UNITED STATES ATOMIC ENERGY COMMISSION

Seventeenth Semiannual Report

OF THE

ATOMIC ENERGY COMMISSION

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LETTER OF SUBMITTAL

WASHINGTON, D. C.,
29 January 1955.

SIRS: We have the honor to submit herewith the Seventeenth Semiannual Report of the United States Atomic Energy Commission, as required by the Atomic Energy Act of 1954.

Respectfully,

UNITED STATES ATOMIC ENERGY COMMISSION,
THOMAS E. MURRAY.
WILLARD F. LIBBY.
LEWIS L. STRAUSS, *Chairman*

The Honorable
The President of the Senate.
The Honorable
The Speaker of the House of Representatives.

CONTENTS

APPENDIXES

FOREWORD

"The development, use, and control of atomic energy shall be directed so as to promote world peace, improve the general welfare, increase the standard of living, and strengthen free competition in private enterprise"—Section 1 of Declaration of Atomic Energy Act of 1954.

The event of the past half year of greatest significance to the program of the Atomic Energy Commission was the enactment of the Atomic Energy Act of 1954 which became law on August 30 when the President signed the Cole-Hickenlooper bill. It is the first complete revision of the statutory charter of the Commission since passage of the original legislation in 1946.

The paramount objective of the AEC was not altered—to make the maximum contribution to the common defense and security. What is new is *added emphasis* on the development of peacetime uses of atomic energy. Workable authority is provided to permit greater international cooperation; to increase the participation by private enterprise; and to assure effective dissemination of both scientific and industrial information.

In its operations under the old law, the Commission in giving priority to its work on nuclear weapons, had not neglected the development of peacetime applications of atomic energy. The progress in development of power and research reactors; the growth of the industrial participation program; the remarkable expansion in the varied uses of radioisotopes and the continuous support of fruitful basic and applied research are evidences of the faith of the agency in the future of benign uses of the atom. The Atomic Energy Act of 1946 recognized that advances in the art would make revision of the basic statute necessary and desirable. The new law reflects the decision that this time has arrived.

Under the new law, the scope and opportunity in these nonmilitary areas are enlarged. The 1954 Act spells out the purposes of the Commission's research activities to include agricultural, medical and industrial uses, generation of usable nuclear power and demonstration of the practical value of using atomic production facilities for industrial and commercial purposes. Additionally, subject to certain provisions, it opens up to some extent the area of patentability of inventions or discoveries other than those in the field of military utilization of nuclear energy.

International Cooperation: The new Act provides, under prudent safeguards, for bilateral agreements with friendly nations which would permit a wide range of activities to be conducted on a mutually beneficial basis. These include the allocation of special nuclear material for power and research reactors; providing assistance in the design and construction of same, and the exchange of certain classified information on nonmilitary utilization of atomic energy after mutually agreeable security controls have been worked out. It also envisages an expansion of international cooperation in the exchange of ideas and unclassified information.

In signing the Act, the President stressed the importance of proceeding with the plan for an international atomic energy agency which would advance peacetime applications. The Commission continues to assist the State Department in the private negotiations with the nations involved. These negotiations have brought wide areas of agreement as to the scope and function of the international agency. One major result was endorsement on December 4, 1954 by the United Nations General Assembly of the United States' proposal for the creation of the agency and for appointment of a special advisory committee to the United Nations Secretary General to plan an international scientific conference. The Commission initiated and also is assisting the State Department in planning this international scientific congress to be held later this year under the auspices of the United Nations.

Pending the establishment of an international atomic energy agency and the negotiation of the bilateral agreements according to Section 123 of the new Act, the AEC is proceeding with a number of interim projects. These include:

(1) Establishment of a reactor training school at the Argonne National Laboratory to be opened in March 1955; (2) a special session for foreign nationals of the four-week course in radioisotope techniques at the Oak Ridge Institute of Nuclear Studies to begin May 2; (3) training courses in the utilization of atomic energy in the fields of biology, medicine and agriculture; (4) training courses in industrial medicine and hygiene; (5) invitations to a number of doctors and surgeons and specialists to spend about two months in the United States visiting the Argonne and Oak Ridge Cancer Hospitals and other research centers; and (6) presentation of a number of AEC technical libraries to countries or regional groups.

The new law also permits the Department of Defense, with Commission assistance, and again under proper security safeguards, to furnish our allies certain data needed for training in the use of and defense against atomic weapons and for evaluating the atomic capabilities of a potential aggressor.

Encouragement of Private Enterprise: The new law also recognizes that the initiative and resources of private industry in the development and use of atomic energy for peaceful purposes should be encouraged and drawn more specifically into the national program. Although the Government retains the title to all special nuclear material, the Commission is empowered under the new statute to license private and public groups to build, own and operate research and power reactors provided the licensees agree to and observe adequate health and security regulations. The AEC will provide the necessary special nuclear material for such facilities. The licensees may sell the power or any byproduct materials such as radioisotopes produced in these reactors. The Commission will continue to bear the burden of basic research and assist the development of nuclear power by the construction of experimental reactors.

Dissemination of Information: The new Act provides flexibility for the Commission to determine the scope and extent of investigations required to be made of persons desiring access to restricted data, thus aiding the dissemination of such information to those interested in the research and industrial phases of the national program. Permission will be granted for this access after completion of a security clearance compatible with the degree of sensitiveness of the information involved.

The Commission also is directed to maintain a continuous review of classified information to determine what data can be declassified without undue risk to the common defense and security. The legislation also greatly simplifies procedures for the dissemination of atomic energy information within the Department of Defense.

The new Act is lengthy and complex. Its implementation requires the careful formulation and promulgation by the Commission of a number of regulations. Management and industry generally have indicated an understanding of the magnitude of this problem.

ADMINISTRATION OF THE 1954 ATOMIC ENERGY ACT

The Commission started preparation for administration of the 1954 Atomic Energy Act even before it became law on August 30. This preliminary work made it possible to take action immediately after signing of the new statute to continue in force the regulations covering the sale and use of isotopes, the export of nuclear equipment, and acquisition of source materials.

Task forces were organized under the direction of the General Manager and are at work on the job of drafting the many types of regulations and licenses required by the new Act. These fall into 15 separate categories and illustrate the complexity of the problem. They are:

(1) Definition of production and utilization facilities and component parts which will be made subject to regulation by the Commission both domestically and for export; regulations governing (2) the distribution of special nuclear materials by the Commission; (3) distribution of source materials; (4) transfer of source materials; (5) manufacture, sale and use of production and utilization facilities; (6) isotopes; (7) reactor operators licenses; (8) security of licensed activities; (9) health and safety of licensed activities; (10) hearing procedures; determining (11) which classes of licensees will be charged for materials and services furnished by the AEC and which classes, if any, will be able to receive materials and services without charge; (12) the amount of charges to be made for materials and services furnished by the AEC to licensees; (13) the fair price to be paid by the Commission for special nuclear material produced by licensees; (14) procedures and rules governing dissemination of classified information; and (15) consideration of downgrading and declassification of certain areas of information.

Before the various licensing regulations are promulgated, the Commission is considering calling one or more industry conferences to discuss various aspects of the licensing program. Management and industry have already furnished valuable assistance through the symposia held in September and October by the Atomic Industrial Forum, Inc., and the National Industrial Conference Board.

Schedules of basic charges for AEC available materials and services needed by private atomic energy developers and of fair prices that the Commission will pay for certain products from privately operated American atomic reactors have been established. These schedules contain classified information and will be made available only to properly cleared persons.

The schedule of basic charges sets the rates which domestic licensees under the Act must pay the Commission for natural uranium, thorium, heavy water, uranium 235, uranium 233, or plutonium as used in nuclear reactors and other enterprises for peacetime applications of atomic energy. The last three items—uranium 235 and 233 and plutonium—may only be leased to licensees. The other materials may be either sold or leased.

The Commission also established the principle that licensees will be charged the full cost of services performed for them by the AEC, such as chemical processing of spent fuel elements from private reactors.

It is the intention of the Commission to maintain the charges as stable as possible. The schedules provide for periodic adjustment of charges if there are substantial changes in the Bureau of Labor Statistics' Wholesale Price Index, Excluding Farm Products and Processed Foods.

Set prices for special nuclear materials produced by the licensees will be guaranteed during a 7-year period beginning July 1, 1955, save for adjustment on the basis of changes in the BLS index.

To encourage further the increased industrial participation in the peacetime program envisioned in the 1954 law, the Commission is developing a Power Demonstration Reactor Program. Under this plan, the Commission has invited proposals from companies or groups that would be willing to assume the risk of construction, ownership and operation of reactors designed to demonstrate the practical value of such facilities for industrial or commercial purposes. One or more proposals might be accepted in any given year and the Commission would consider, within the limits of available funds, providing various types of cooperation such as waiving charges for loan of materials, providing research and development assistance in Commission laboratories and entering into research and development contracts for technical and economic data resulting from work on a demonstration reactor.

The aim of this program is to bring private resources into the development of engineering information on the performance of nuclear power reactors and to advance the time when nuclear power will become economically competitive. The initial proposals for Commission cooperation may be submitted up to April 1, 1955.

In evaluating the proposals to be submitted before April 1, 1955, the Commission will employ the following criteria: Probable contribution of the proposed project toward achieving economically competitive power; cost to AEC in funds and materials; risk to be assumed by the maker of the proposal; competence and responsibility of the maker of the proposal; and assurances given by the maker of the proposal against abandonment of the project.

If the response of industry is favorable and it appears that this procedure will accelerate effective industrial participation in the achievement of practical nuclear power, subsequent dates may be established for receiving additional proposals.

The new law recognizes that industrial development of peacetime uses of atomic energy, particularly nuclear power, would be aided materially by providing access to restricted data of a low degree of sensitivity that is related to these non-military areas of the atomic program. Additionally, economy and efficiency of AEC operations, especially in construction, can be promoted without requiring the complete background investigation for every single worker. Accordingly, under the provisions of the Act, the Commission completed by November 3 the necessary action to set up a new personnel security clearance category known as "L" (for limited access). Following what is known as a "national agency check," persons qualifying will be permitted to use certain data of the lowest category of sensitivity.

An Inspection Division was set up on September 23, 1954, pursuant to provisions of the Act, and an initial assignment of functions was made. Following a detailed staff study, the Commission on January 19, 1955, made a more definitive assignment of duties. Effective February 1, a director of the division was named. (See Appendix 1, p. 78.)

The Commission is working with the U. S. Patent Office to draft procedures for carrying out the several revised patent sections of the new law.

In the field of international cooperation, the Commission is working closely with the State Department and the U. S. Mission to the United Nations. Preliminary work looking toward the establishment of an international atomic energy agency under the auspices of the United Nations is going ahead. The Commission, in collaboration with the State Department, is actively engaged in negotiating bilateral agreements under Section 123 of the new law.

Pending negotiation of these agreements, the Commission is actively putting into effect the several interim actions outlined in the FOREWORD to this report.

Part One

Major Activities in Atomic Energy Programs, July–December 1954

MAJOR ACTIVITIES IN ATOMIC ENERGY PROGRAMS, JULY–DECEMBER 1954

Raw Materials

Production of uranium concentrates by all sources was as scheduled during the latter half of 1954. Anticipated increases in production occurred as new domestic and foreign sources came into production. Construction of new production facilities and expansion of existing facilities moved ahead in this country and abroad. Exploration activity by Government agencies and private industry reached record levels and research and process development studies into more economical and feasible methods of recovering uranium from its ores continued.

Domestic Production

Uranium ore and concentrates production attained new levels. Uranium mining now ranks as a major segment of the domestic nonferrous metal mining industry from the standpoint of dollar value of product produced and the number of persons engaged in the industry. The entrance of many long-established mining companies into the uranium business during the past year or two is evidence of the growing importance of this new industry.

Ore Production

The number of producing uranium mines in the United States greatly increased after mid-1953. The tonnage of ore produced during the last half of 1954 increased substantially over the preceding 6-month period.

The uranium production area was extended also. The Colorado Plateau remains the principal domestic source of uranium ore with some production now being obtained from South Dakota and Wyoming and from primary vein sources in the Marysvale, Utah, area. Occasional ore shipments are made from the Colorado Front Range, the Boulder Batholith region of Montana and from Nevada and California. New mines were opened in Fremont and other counties in western Wyoming and in the vicinity of Globe, Ariz. Uranium ore was also produced at Mauch Chunk (Jim Thorpe), Pa., where the Lehigh Coal and Navigation Co. is operating a small uranium mine.

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Ore Processing

Current ore production is in excess of current processing capacity, resulting in a build-up of large stockpiles of ore at a number of points. This resulted from the Commission's policy of providing ready markets for new areas soon after they are discovered, thereby encouraging the development of the new area. When sufficient ore reserves are developed arrangements are made for local processing facilities. Contracts were completed for a substantial increase in milling capacity through expansion of existing plants and through new construction. Other projected new plants are being designed.

The Commission's effort has continuously been to arrange for privately owned plants for the necessary ore processing. By far the greatest percentage of the ore processing is carried out by private industry.

In November, the Kerr-McGee Oil Industries, Inc., placed a processing mill for the treatment of uranium ores into operation at Shiprock, N. Mex. Mines in the nearby Lukachukai and Carrizo Mountains will provide the bulk of the ore for this plant, which was expanded during construction to provide for a higher production capacity than was originally planned. Expansion of existing mill facilities was completed in October by the Vanadium Corporation of America at Durango, Colo. Additional expansions are now underway at the Grand Junction, Colo., plant of Climax Uranium Co. and the Salt Lake City, Utah, plant of the Vitro Uranium Co. At Bluewater, N. Mex., the Anaconda Copper Mining Co. is constructing a large new plant to treat sandstone type ores. Anaconda's present facilities at Bluewater, N. Mex., also are being expanded. Additional mills or expansions to existing plants are being considered to process ores from other areas such as Monogram Mesa and Gypsum Valley in Colorado, Big Indian Wash and White Canyon in Utah, and the Black Hills area of South Dakota.

The Commission selected the H. K. Ferguson Co. to build a major addition to its mill at Monticello, Utah.

New Ore-Buying Stations

Construction of new uranium ore-buying and sampling stations was completed at White Canyon and Moab, Utah, in October and November, respectively. The American Smelting and Refining Co., operating the Commission's ore-buying and sampling stations at Marysvale and Monticello, Utah, and Edgemont, S. Dak., is also the operator of the new stations. Another new ore-buying and sampling plant is under construction at Riverton, Wyo., scheduled for completion early in 1955, and consideration is being given to erecting a station in the vicinity of Globe, Ariz., to provide a market for ores being produced in that area.

Uranium From Phosphates

Uranium recovery facilities are now in full or limited production at four locations, for byproduct recovery of uranium during treatment of Florida phosphate rock by the phosphate chemical and fertilizer industries. These facilities are: Blockson Chemical Co., Joliet, Ill.; Texas City Chemicals, Inc., Texas City, Tex.; International Minerals and Chemical Corp., Bartow, Fla.; and Virginia-Carolina Chemical Corp., Nichols, Fla. Construction of another plant is to be started early in 1955 by the U. S. Phosphoric Products Division of the Tennessee Corp. at East Tampa, Fla.

Termination of Circular 7

The Commission announced the termination, effective December 12, 1954, of Domestic Uranium Program Circular 7 providing for the issuance of uranium mining leases on certain public lands which at the time of leasing were not subject to the location of mining claims because they were affected by the mineral leasing laws.

The need for Circular 7 was eliminated by the enactment, August 13, 1954, of Public Law 585, amending the mineral leasing laws and the mining laws to provide for multiple mineral development of the same tracts of public lands. Public Law 585 not only permits location of mining claims hereafter on lands affected by the Mineral Leasing Act of 1920, as amended, but also includes provision for the validation of certain mining claims located subsequent to December 31, 1952, and prior to February 10, 1954, on these public lands.

In addition, holders of uranium leases or lease applications under Circular 7 have certain prior rights under the new law during the period of 120 days after its enactment to locate mining claims on the lands covered by the lease or lease applications. Also, as a result of this legislation and the Atomic Energy Act of 1954, the reservation to the Government of uranium found in public lands provided in the Atomic Energy Act of 1946 has been removed.

Access Roads Construction

Under the Defense Highway Act of 1941, as supplemented, nearly 1,000 miles of access roads were built on the Colorado Plateau and in

South Dakota under the general supervision of the Bureau of Public Roads at a cost of approximately $5.5 million. During the current fiscal year 155 miles of access roads construction and improvement is scheduled at a cost of approximately $2.5 million. This program will provide better access to additional production areas and will improve the older roads inadequate to handle the heavy ore traffic.

Sampling Practices on the Colorado Plateau

A study of the sampling practices on the Colorado Plateau by the Colorado School of Mines Research Foundation showed that most of the changes and recommendations in the report of an earlier study made by the group in 1952 were placed into effect. Sampling practices now in effect are at a high level of efficiency and accuracy resulting from remodeling sampling installations during the past 2 years.

Bonus Program

Since the inception in 1951 of the Commission's program for paying a bonus on the production of the initial 10,000 pounds of U_3O_8 in ores produced from new and certain other eligible uranium mining properties, in excess of $4,377,174 was paid out in bonus awards ranging from $1,854 to a maximum of $35,000. There were over 2,680 individual payments on nearly 515 certified mining properties.

Foreign Activities

Belgian Congo

Production from the important Shinkolobwe mine in the Belgian Congo was according to schedule.

South Africa

Production from South Africa increased with the completion of additional new plants. These facilities extract uranium from tailings derived from the gold recovery operations of the various mines.

Canada

Prospecting continued on an intensive scale both in Saskatchewan and in the eastern provinces. Ore tonnages are being developed in the

Pronto and Algom and other properties in the Blind River area of Ontario. Plans were announced for the construction of substantial concentrating facilities on the properties of the Pronto Uranium Co., Ltd.

The Port Radium operation of Eldorado Mining and Refining Co., Ltd., on Great Bear Lake and the company's Ace mine in the Lake Athabaska region of Saskatchewan continued in steady production. A further production increase will result from the recently completed enlargement of Eldorado's Beaverlodge leaching plant at Lake Athabaska. The neighboring Verna property is being extensively explored by Eldorado with encouraging results.

Gunnar Mines, Ltd., in the Lake Athabaska area, is developing its extensive ore body and constructing a leaching plant.

Australia

In the Northern Territory, the processing plant at Rum Jungle was completed and officially opened for trial runs. Ore is now being processed. Widespread exploration activity by private companies continues throughout Australia, and published reports indicate the discovery of a large number of uranium occurrences, some of which may become important sources of uranium.

Domestic Exploration

Further increases in domestic ore reserves resulting from new ore discoveries reflected the intensity of exploration activities by private industry and by Government. Private drilling activity now greatly exceeds that of the Government, and there is increased private effort in all phases of the program. Many of the large ore bodies now being discovered and developed are the direct result of private exploration efforts. Uranium exploration by the Government is carried on by the AEC, the Geological Survey and the Bureau of Mines.

Drilling

Total footage of drilling by AEC, and the Geological Survey and the Bureau of Mines on behalf of the Commission, was approximately 600,000 feet during the second half of 1954. Government drilling in the past 2 years was at the rate of over 1,000,000 feet a year. Private drilling, however, is increasing and is now estimated at more than twice that of the Government's. Accordingly, in the Commission's exploration program more emphasis will be placed on other types of activities such as reconnaissance, geologic and geophysical studies and research which, together with the limited amount of investigative drilling, will be used to develop geologic information and establish the presence of, or favorability for uranium in new areas and in new stratigraphic horizons as a stimulus to private activity.

Airborne Radioactivity Surveying

Airborne radioactivity surveying is an increasingly valuable uranium exploration method used by Government and private exploration groups. The AEC and USGS are engaged in airborne reconnaissance throughout the Western States, particularly the Colorado Plateau and Wyoming, South Dakota, Montana, and Arkansas, and in New York and Pennsylvania in the East. Private airborne exploration in the West exceeds that of the Government.

Dissemination of Information

Geologic information developed through the Commission's exploration program is made available to the mining public through the media of technical reports and publications. Due to the great demand by the mining industry and by the general public for information on the results of the Commission's exploration program, the Commission is making most of its unclassified technical reports on exploration, geology, and mineralogy available for sale through the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C. In addition, unclassified reports are placed on open file in depository libraries for examination by the public. (See Eleventh Semiannual Report, pp. 8–9, for listing of libraries.)

Another means of disseminating information on the Commission's exploration program is the posting of monthly index maps, showing the results of airborne radioactivity surveys, at all AEC exploration offices and at certain offices of the USGS and USBM for examination by the public. There are now 18 such public posting places throughout the country.

These maps show the location of radioactive anomalies, or points where radioactivity is higher than the normal background radioactivity for the particular area. While the anomalies do not necessarily indicate the presence of radioactive mineral deposits, they are likely places for exploration. Arrangements were made with the

Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for the reproduction and sale of these maps to the public. Commercial firms also may sell the maps at prices established by GPO.

Process Development

A number of advances were made recently in processes for recovering uranium from ores and various types of low-grade sources with greater metallurgical efficiency and economy. Work was centered largely in the Raw Materials Development Laboratory at Winchester, Mass., and in the pilot plant at Grand Junction, Colo., both operated for the AEC by National Lead Co., Inc. The U. S. Bureau of Mines Station at Salt Lake City, Utah, also is carrying on under AEC contract a process development program including both laboratory and pilot plant investigation.

In addition, several contractors were engaged in conducting studies which will improve specific process steps that might result in more efficient operations at existing plants on the Colorado Plateau and which may be incorporated into new plants. These include the Battelle Memorial Institute, Arthur D. Little, Inc., Colorado School of Mines Research Foundation, Universities of Nevada and Utah, Dow Chemical Co., Knowles Associates, Inc., Salt Lake City, and the Salt Lake City Station of the U. S. Bureau of Mines.

Studies directed toward developing technically and economically feasible methods for extracting uranium from various low-grade sources were conducted at a number of sites. Pilot plant studies by the Tennessee Valley Authority and laboratory studies by International Minerals & Chemical Corp. on the recovery of uranium and phosphates from the leach zone material overlying the commercial phosphate matrix in Florida are continuing. Process studies are continuing at Columbia University on Chattanooga uraniferous shale.

Production

Production of special nuclear materials continued to equal or exceed established schedules.

Uranium Feed Materials

To meet the projected uranium metal feed requirements, the Commission announced on October 12 an expansion of its facilities at

Fernald, Ohio, and St. Louis, Mo. An estimated $20,100,000 will be expended to expand the Fernald feed material center operated by the National Lead Co. of Ohio. Singmaster and Breyer of New York City were selected architect-engineers for new facilities at Fernald.

Existing refinery and metal plant capacity at St. Louis operated by the Mallinckrodt Chemical Co. will be expanded at a cost of $6,500,000.

In addition to the present St. Louis plants, new facilities will be constructed at a nearby site. A portion of the Government-owned Weldon Spring Ordnance Works, 27 miles west of St. Louis, was selected for the new plants to cost an estimated $33,300,000. The St. Louis area plants will be designed by the Blaw-Knox Construction Co., of Pittsburgh, Pa., and built by the joint venture of the Fruin-Colnon Contracting Co. and the Utah Construction Co., with offices in St. Louis. The Mallinckrodt Chemical Works will operate Weldon Spring facilities in connection with the other AEC facilities at St. Louis.

Capacity for auxiliary gaseous diffusion processing areas also will be increased with the provision of new uranium processing facilities at Paducah, Ky. This expansion, estimated to cost $7 million, will be designed by Giffels and Vallet of Detroit, Mich.

AEC-Mississippi Valley Generating Co. Contract

On November 11, the Commission signed a contract with the Mississippi Valley Generating Co. providing for delivery of 600,000 kilowatts of electric power to or for the account of the Commission. This contract was negotiated in compliance with a directive from the President through the Bureau of the Budget to the Commission to make arrangements for the purchase of power from private sources in order to reduce, by the fall of 1957, existing commitments of the Tennessee Valley Authority to AEC. The power furnished under the contract will be delivered to TVA near Memphis, Tenn., and arrangements are being made with TVA for delivery of an equivalent amount of power to Commission installations at Paducah, Ky., and Oak Ridge, Tenn. As power under this contract becomes available, AEC plans to release TVA from a portion of its commitments under its existing contracts with AEC.

In compliance with the provisions of the Atomic Energy Act of 1954, the contract was submitted to the Joint Committee on Atomic Energy which, after holding public hearings on the question, passed a resolution on November 13, waiving the thirty-day waiting period established under the Act. On December 21 the Arkansas Public Service Commission approved the company's application to issue and sell common stock. The Securities and Exchange Commission conducted hearings on the company's application to issue and sell common stock. After filing of post-hearing briefs, oral arguments were heard on January 19, 1955.

Source and Special Nuclear Materials Accountability

The Division of Source and Special Nuclear Materials Accountability continued to discharge its responsibilities for developing and administering a system of accounting for source and special nuclear materials. The General Manager and the Commission were kept informed of the effectiveness and reliability of control exercised by the contractors and the local operations offices.

Annual audits and reviews of contractor surveys conducted by the operations offices were continued. Upon request survey assistance was furnished operations offices performing such surveys, when division personnel were available. When justified, field problems of accountability received division aid.

A review of AEC's needs for measurement methods development and standard materials preparation and distribution was completed and a report issued. In addition, during the period all contractors evaluated the economic appropriateness of their materials accounting system.

Consistent with the Commission's policy requiring contractor's efforts to be appropriate for dollar value of materials handled, a criterion is being developed to permit operations offices to maintain a routine evaluation of contractor's activities.

Construction and Supply

Capital investment in atomic energy facilities continued its steady growth, largely as a result of progress in construction of new major facilities at Oak Ridge, Paducah, Portsmouth, Savannah River, and Hanford, and as of December 31, 1954, was estimated to have risen to about $6.2 billion before depreciation reserves. Except for production plant facilities at Portsmouth, and expansion of process facilities at Oak Ridge, most of the major construction in the program is nearing completion, and activity has begun to taper off.

Costs incurred for new plant and equipment amounted to $1.22 billion during fiscal year 1954—a new peak for the atomic energy program. During this period AEC construction costs accounted for about 3½ percent of the Nation's total construction dollars.

From July to December 1954 monthly costs incurred averaged about $85 million, a moderate decrease from the $101 million per month for the first half of the calendar year. Monthly construction costs should continue to decline slowly during the next 6 months. It is estimated that costs incurred for new plant and equipment during fiscal year 1955 will total approximately $980 million, an average of about $82 million per month.

Construction Management

It is the policy of AEC to enter into contracts with construction contractors and private architect-engineer firms for required construction and associated engineering services. However, in a few special situations, design and inspection of construction is performed by the experienced engineering organizations organic to certain of the industrial concerns who operate AEC production facilities. As a result, AEC construction and engineering forces, both in Washington and at the field offices, consist of small, primarily administrative groups. During the last half of 1954, these groups administered construction and architect-engineer contracts employing a monthly average of about 58,600 persons. The average cost of these engineering and construction overhead forces amounted to about three-tenths of one percent of the cost of construction during this period.

Radio Communications

Plans for the improvement of two-way radiotelephone communications with scores of scattered AEC exploration camps and radio-equipped motor vehicles within a radius of 350 miles from field headquarters in Grand Junction, Colo., are being completed. The improved radio system will use Frequency Modulated (FM) signals in the Very High Frequency (VHF) band of the radio spectrum. This system will be far more effective in providing dependable and economical communications with these remote working parties than the high frequency system now in service.

Recently conducted field tests demonstrated that the VHF signals (normally considered to travel in a straight line) will be bent over the top of the Uncompahgre Plateau in the first application of this method (diffraction phenomena) in the United States. Due to this bending effect, repeater stations on top of the plateau, which would be largely inaccessible during the winter, are now unnecessary.

Small Business

AEC operations offices and major cost-type contractors continue to maintain small business programs. These programs are consistent with both the Congressional small business policy and the Atomic Energy Commission-Small Business Administration agreement to exchange information between AEC and SBA field offices regarding AEC procurement and other matters. The 1955 edition of "Selling to AEC," a procurement information booklet, is now available to assist small business concerns. (Copies of the publication are on sale by the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for 25 cents.)

Small business continues to receive a substantial volume of AEC procurement dollars. During the April 1 to June 30, 1954, quarter, small business received a record 49.5 percent of $120.8 million subcontract dollars. From July 1, 1951 to September 30, 1954, AEC cost-type contractors awarded subcontracts totaling $2.5 billion. Of this total, $850 million or 34 percent went to small business. Direct contract awards to small business amounted to $156 million or 3 percent of $5.3 billion in contracts awarded during the same period.

Stores Inventories Reduced

The Commission's investment in stores inventories continued downward during fiscal year 1954 to a year-end level of $79 million, despite the start-up of major production facilities. While the level of the operating program and issues are expected to increase considerably, a very nominal increase is planned in total current use stores because of an anticipated increase in turnover rates.

Shipment of Radioactive Materials

A "Handbook of Federal Regulations Applying to the Transportation of Radioactive Materials" was issued for the use of AEC offices. The handbook was designed to be of assistance in locating and understanding Federal regulations for the shipment, packaging, and labeling of materials peculiar to AEC.

Auction Sales to Dispose of AEC Surplus

Whenever the amount, value, type, and location of property justify, AEC is using the auction-sales method rather than the sealed-bid method to dispose of surplus property. Gross returns from seven auctions conducted at Los Alamos, Paducah, Savannah River, Hanford, and Fernald within the past 12 months, ranged from approximately 20 percent to 33.2 percent of the original cost of the property sold. In some cases, this was approximately twice as much as returns from previous sealed-bid sales.

Military Application

Operation CASTLE, conducted in the spring of 1954 at the Pacific Proving Ground, was the most extensive test series yet conducted there. The evaluation of the results during this reporting period confirmed the pre-CASTLE promise of most significant progress in design, development, and proof test of weapons. As a result the weapons program was directed toward new areas of research opened up by the CASTLE information that hold promise of additional major developments, and toward the stockpiling of weapons adding large potential to our defensive power.

Although many contractors and laboratories contributed significantly and earnestly to the thermonuclear weapons program, the contribution of the Los Alamos Scientific Laboratory, whose personnel have for many years worked unstintingly in the weapons field, was outstanding. In recognition of its contributions to the atomic weapons program, the President, on July 8, 1954, awarded a special citation to this laboratory for outstanding achievements in the weapons field.

The Commission's other two principal laboratories in the weapons program, Sandia Corp. and the University of California Radiation Laboratory are also contributing noteworthy accomplishments. Sandia Corp. is primarily concerned with the development and design of the non-nuclear phases of atomic weapons. The major efforts of the UCRL weapons research laboratory at Livermore, Calif., are directed toward research, development, and testing of nuclear systems. Both laboratories, as well as LASL will play major roles in forthcoming test series.

Production of atomic weapons during the last half of calendar year 1954 was in accordance with the President's directive.

New Tests to Protect Free World Security

Preparations are well advanced for the spring 1955 series of nuclear tests at the Nevada Test Site, scheduled to begin in mid-February. The new tests are required to obtain scientific knowledge essential to development and utilization of nuclear weapons for defense of this Nation and the free world. Experiments will again be conducted for the Commission and its contractors, for the Department of Defense, Federal Civil Defense Administration, and other Federal agencies.

THE WHITE HOUSE
WASHINGTON

CITATION

The Los Alamos Scientific Laboratory, as the Nation's principal institution for the development of atomic weapons, has continued to discharge its responsibilities to the people of the United States with highest distinction and by its achievements has rendered invaluable service to the Nation and the free world.

The Laboratory's momentous success in the field of fission weapons has been followed by equal accomplishments in the fusion field. These achievements are the result of a remarkable group endeavor and the devoted and skillful effort of the individuals of the staff of the Laboratory.

In recognition of the outstanding achievements of the Los Alamos Scientific Laboratory and their contribution to the welfare and collective security of this Nation and the free world, this citation is awarded to the Laboratory as a means of expressing to all its members the gratitude of the people of the United States of America.

Dwight D. Eisenhower

8 July 1954

As in the past, the Department of Defense will participate with the Commission in the conduct of the tests by furnishing certain support and conducting programs designed to enhance our knowledge of weapons effects. Civil Defense and the Public Health Service will participate in the tests for purposes of personnel training through observation and field exercises. The series will conform generally with the pattern of the spring 1953 series.

Studies of Continental test site utilization were made following each series in Nevada, with special attention to limitations and procedures required to assure public safety. Each such study resulted in changes in the following series. The study which followed the spring 1953 series in Nevada was an extensive review of each phase of all Continental tests held to date. Special consideration was given to probable future requirements for Continental testing because of AEC, military, and civil defense programs and to limitations of future use in the interest of continued public safety. The committee which conducted this study was composed of members of the Commission, the Department of Defense, the Public Health Service, and the Weather Bureau. The criteria for operating the Test Site recommended by the Committee were reviewed by the Commission's two main advisory bodies, the General Advisory Committee and the AEC Advisory Committee on Biology and Medicine, prior to formulation into policy and adoption by the Commission. The conclusions reached as a result of the study follow.

Acceptable nuclear weapons development progress requires a Continental Test Site. Past experience clearly demonstrated the value of conducting low yield tests at a Continental site in terms of economy of time, manpower, and money as compared with tests conducted outside the Continental limits of the United States. The Continental Test Site should continue to be the Nevada Test Site, which meets the essential criteria of logistics and safety better than any other Continental site known.

Safety Record Set in Tests

An unusual record of on-site and off-site safety was set in the operation of the Continental Test Site. The past low level of public exposure was achieved through close attention to a variety of controls and procedures, each assisting in the final result. Some improvement is possible which will provide increased assurance of public safety and reduce the possibility of undesirable off-site public exposure. The key improvements include improved methods of forecasting wind speed and directions, improved methods of predicting fall-out intensity and location, reducing fall-out by such means as yield limitations under various conditions, using higher towers, and intensified off-site radiological safety operations.

All shots in the forthcoming series will conform with the specifications recommended as a result of the study.

Contracts Entered Into

The contract under which the Dow Chemical Co. of Midland, Mich., operates for the Commission, the AEC Rocky Flats Plant near Denver, Colo., was renewed and now extends to June 30, 1957. Also the contract with the Zia Co. for operation and maintenance of technical area and municipal facilities, including real estate and utilities, at Los Alamos was extended to June 30, 1957. A similar extension to the contract with Los Alamos Constructors, Inc., was made for miscellaneous construction work at Los Alamos. The Holmes and Narver contract for the operation of and construction at the Pacific Proving Ground was extended through June 30, 1956.

Organizational Changes

A number of organizational changes took place to permit more effective administration of the weapons program. The Sandia Field Office was discontinued as a field office and its responsibilities, functions, property, and records transferred to the Santa Fe Operations Office. The Burlington and Pantex Field Offices were redesignated as the Burlington and Amarillo Branch Offices, respectively, and report to the Manager, Kansas City Field Office. The San Francisco Field Office, formerly under the Santa Fe Operations Office, was redesignated the San Francisco Operations Office, reporting directly to the Commission's Division of Military Application.

Community Operations

Community Disposal

On June 18 and 19, a subcommittee of the Joint Committee on Atomic Energy conducted a public hearing in Richland, Wash., on proposed legislation to facilitate the establishment of local self-government and to provide for disposal of Federally-owned property at Oak Ridge, Tenn., and Richland.

The Commission proposes to resubmit proposed legislation for disposal of the communities of Oak Ridge and Richland for consideration by the 84th Congress.

Housing and Community Facilities

Oak Ridge

All of the 900 privately-financed Title VIII and Title IX housing units in Oak Ridge were occupied as of December 31. The trend of increasing vacancies in Government-owned housing with the completion of privately-financed housing stopped, and occupancy of Government units is increasing.

In accordance with the Oak Ridge housing policy to retire and dispose of the temporary dwellings that require excessive maintenance, 125 such units were sold for off-site removal during the past 6 months. The last trailer park in Oak Ridge was closed August 31.

Oak Ridge Properties, Inc., completed arrangements for leasing a substantial amount of space in buildings to be constructed for the new commercial center. Construction of the center has not yet begun.

Richland

As of December 31, 54 of the 1,000 Title VIII housing units were unoccupied. It is anticipated that vacancies will increase during the next few months as the construction program approaches completion. Vacancies in Government-owned housing also are increasing.

A Catholic parochial school was completed in Richland, and the enrollment of 285 pupils slightly relieved the heavy opening day enrollment of the public schools. Enrollment in Richland schools was 784 higher than a year ago.

Los Alamos

The program to replace substandard housing at Los Alamos was started. The first phase of this program, 120 replacement units, is scheduled for completion in February 1955. The first of these units was completed in September 1954. The second phase of the replacement program, consisting of 96 units, is under design.

Other Areas

The remaining trailer park at Augusta, Ga., was closed on November 13, 1954, and all of the original 4,000 trailers sold. This ends AEC participation in housing activities in the Savannah River area.

In the Portsmouth, Ohio, area a total of 1,400 temporary housing units and trailers were completed and all but 14 were occupied as of

December 31. Most of the 925 Title IX units completed in the area were occupied at the end of December.

At the end of December there were 157 vacancies in the 500 Title VIII housing units at Paducah, Ky., and 117 vacancies in the remaining 420 Title IX units. Twenty-eight of the Title IX units were sold, and additional units are being advertised for sale.

Reactor Development

The Commission's program of developing reactors for industrial and military power and for naval and aircraft propulsion progressed in several phases during the last 6 months of 1954. Expenditures of approximately $141 million for reactor development are expected during the fiscal year ending June 30.

Extensive material progress was made in the field of reactor development during the past 6 months. Ground was broken for the Nation's first nuclear powerplant, its first atomic submarine began its sea trials, and industry took an active interest in the field by investing private funds in study of the peaceful applications of atomic energy.

With the need and feasibility of nuclear power already established, the Commission evolved a pattern for research and development from which it believes will come nuclear power plants that will compete with other sources of energy. (The Commission's program was outlined in the Sixteenth Semiannual Report.) Five types of plants believed to be the most likely to lead to economic nuclear power were chosen for the program and three as this is written are in the construction phase. One, the Pressurized Water Reactor, will be the Nation's first full scale civilian atomic powerplant. The remaining four types are experimental in size.

During the past 6 months an increasing number of industrial firms invested their money in Commission-approved studies in the field of reactor technology. Several have shown an intense interest in the Commission's Power Demonstration Reactor Program under which AEC will consider bearing a portion of the expense of reactor plants "leading to the demonstration of the practical value of such facilities for industrial or commercial purposes." Each proposal from industry to build and operate power demonstration reactors under this program will be evaluated on the basis of its contribution toward the development of economically competitive nuclear power, cost to AEC in funds and materials, relative risk assumed by the licensee in proportion to the amount of assistance requested of the AEC, competence and responsibility of the licensee, and adequate assurances given by the licensee against abandonment of the project.

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In a program to apply nuclear powerplants to land-based military operations, industry will for the first time design and construct at a fixed price a complete reactor powerplant and guarantee its operation.

The first nuclear-powered submarine, the USS *Nautilus*, launched at Groton, Conn., was commissioned this past September and began its sea trials on January 17. In addition to work on several reactors for underwater craft, plans are now under way for a nuclear powerplant for a large surface vessel.

The following tabulation outlines AEC's program of industrial nuclear power development:

DEVELOPMENT PROGRAM FOR CIVILIAN POWER REACTORS

Reactor Concept	Name	Location	Scheduled Completion Date	Moderator	Coolant	Fue	Heat Output (KW)	Electrical Output (KW)
Pressurized Water	Pressurized Water Reactor (PWR).	Shippingport, Pa	1957	Ordinary Water	Ordinary Water	Slightly Enriched Uranium.	264,000	60,000
Boiling Water	Experimental Boiling Water Reactor (EBWR).	Argonne National Laboratory near Chicago, Ill.	1956	Ordinary Water	Ordinary Water	Natural and Highly Enriched Uranium.	20,000	5,000
Sodium Graphite	Sodium Reactor Experiment (SRE).	Near Santa Susana, Calif.	1955	Graphite	Sodium	Slightly Enriched Uranium.	20,000	None
Fast Breeder	Experimental Breeder Reactor No. 2 (EBR No. 2).	Not Selected	1958	None	Sodium	Uranium Plutonium Alloy.	62,500	15,000
Homogeneous	Homogeneous Reactor Experiment No. 2 (HRE No. 2).	Oak Ridge National Laboratory, Tenn.	1955	Heavy Water	Heavy Water	Highly Enriched Uranium in UO_2SO_4 Solution.	5,000	300
	Homogeneous Thorium Reactor (HTR).	Not Selected	1959	Heavy Water	Heavy Water	Highly Enriched Uranium in UO_2SO_4 Solution.	65,000	16,000

Power Reactors

Pressurized Water Reactor

Ground was broken for construction of the Nation's first civilian nuclear powerplant at ceremonies held at Shippingport, Pa., near Pittsburgh, on September 6. Symbolizing the use of the atom for peaceful purposes, President Eisenhower in Denver, Colo., placed a wand containing a source of neutrons close to a fission detector. The resulting current, flowing through wires across the country, started a remote-controlled bulldozer at the Shippingport site.

Prior to the groundbreaking, engineering evaluation of the site for construction purposes was completed by the Duquesne Light Co. and surveys preparatory to construction are in progress. A definitive contract between the Commission and Duquesne was concluded on November 3. This contract contains provisions expected to reduce considerably the expenditures the Government would have had to make had it undertaken the full cost of construction and of five years operation.

The Westinghouse Electric Corp. as principal contractor to the Commission for the design, development, and construction of the nuclear portion of the plant, placed orders for many of the principal components, such as the steam generators. Fixed-price competitive bidding was used wherever possible. The same principle will be followed in awarding construction contracts for the reactor plant buildings and facilities. Plans and specifications for these are being prepared by the Stone & Webster Engineering Corp. under subcontract to Westinghouse.

Consistent with its policy of making available to authorized groups and individuals the classified technical information developed under the PWR project, the Commission held the second of a series of classified seminars at Bettis Plant, Pittsburgh, Pa., on August 27. This seminar was attended by some 250 representatives of private and public utilities, industrial study groups, and Government agencies.

Experimental Boiling Water Reactor

The boiling experiments conducted by the Argonne National Laboratory at the National Reactor Testing Station in 1953, described in the Sixteenth Semiannual Report (pp. 22–23), were resumed in June 1954 after some modification and reconditioning of the facility. One final short period excursion was performed on July 22. In this test the power was allowed to rise well over a million kilowatts in a tenth of a second. This excursion resulted in destruction of the reactor core and some associated equipment, a result which was recognized as a distinct possibility in planning this test. The conditions imposed for this excursion were much more severe than are expected to occur in any reasonably conceivable accident.

During the summer of 1954 a second boiling reactor experiment installation was constructed at NRTS a short distance from the original installation. This reactor which began operation on October 19, was built to demonstrate the operational reliability of a boiling water system and is similar in construction but operates at a higher power (6,000 kw. of heat) and pressure (300 p. s. i.) than the previous experiment.

The prototype boiling water power reactor (EBWR) is proposed for construction at the Argonne National Laboratory. The reactor and power generating equipment will be housed in a gas-tight steel shell having a volume of about 400,000 cubic feet. The reactor, which will operate at a power of about 20,000 kilwatts and generate 5,000 kilowatts of electricity, will be light-water-moderated and -cooled. The fuel elements are mostly natural uranium, with a few enriched elements necessary to obtain criticality.

Architect-engineer work on the power plant facility is being performed by Sargent and Lundy Co. on a lump-sum basis. Allis-Chalmers Manufacturing Co. was awarded a contract on a lump-sum basis to design, develop, construct, and install the power generating, heat transfer, and special equipment for the power cycle. The contract specifies that the power system components to be developed will be leak-proof, which is desirable from an operating standpoint. Leak-proof systems are particularly important to the technology of boiling reactors using expensive heavy water instead of light water. It is hoped that this reactor power system will be producing experimental amounts of power by the end of the calendar year 1956.

Sodium Graphite Reactor

America's first sodium-cooled, graphite-moderated reactor (SRE) went into the construction phase. Ground was cleared and foundations are being laid at the reactor's site near Santa Susana, Calif. Engineering-design work is nearing completion and procurement of components through fixed-priced contracts is well advanced. North American Aviation, Inc., is contributing 25 percent of the estimated $10 million required for the project in accordance with a contract between the company and the Commission covering the period 1954–58.

The Sodium Reactor Experiment is being built to advance the technology of sodium-graphite systems and to aid in evaluating the economics of this type reactor for power production. The SRE will be constructed underground in a tank filled with liquid sodium, into which columns of zirconium-canned graphite blocks will be placed to act as moderator. This design uses metallic fuel elements of either slightly enriched uranium or a combination of thorium and uranium.

As preliminaries to the actual construction, system components were mocked-up and tested. These include the fuel loading and unloading equipment, the pumps required for circulating liquid sodium, fuel element assemblies, and zirconium-canned moderator assemblies.

Homogeneous Reactors

The Commission entered the second phase in its development of homogeneous type reactors with construction of the Homogeneous Reactor Experiment No. 2 (HRE No. 2) at Oak Ridge National Laboratory. Phase one of the development program was HRE No. 1, which was dismantled in the spring of 1954.

In a homogeneous reactor the fuel is dissolved in a liquid moderator with the entire solution circulated as the coolant. Thus, this type of reactor more closely resembles a modern chemical plant than heterogeneous type reactors in which fuel and moderator are separate.

The HRE No. 2 is so designed that several homogeneous systems may be tested with comparatively minor modifications of the original reactor installation. The first experiment is intended to prove the basic component design, as well as over-all long-term operational reliability and ease of maintenance. Evaluation of the concept of continuous chemical processing will also be included.

The HRE No. 2 is to be placed underground in a steel-lined reactor tank. The construction of this tank, housed in the original HRE No. 1 building, was completed and installation of the "low pressure system" begun. Contracts were awarded and fabrication started on all major equipment, including the heat exchangers, core tank, pressure vessel and circulating pumps. Experiments using an "in-pile loop" of circulating fuel simulating the conditions to be encountered in HRE No. 2 were successfully conducted in the Low Intensity Test Reactor at Oak Ridge.

The third phase of the homogeneous program is the medium sized Homogeneous Thorium Reactor (HTR). Development work on components for this reactor is now underway. Preliminary design work on intermediate size and large scale power reactors was directed toward determining the economics and optimum plant arrangement for varying design power levels.

Fast Breeder Reactors

The development of reactors capable of producing more fissionable material than they consume remains an important objective of the reactor development program.

Operation of the Experimental Breeder Reactor No. 1 (EBR No. 1), which went critical at the National Reactor Station in Idaho in 1951, continues to contribute to the fast breeder program. The first core of the EBR No. 1, consisting of enriched uranium, produced over three million kilowatt-hours of heat. The reactor is presently operating on a second uranium core installed during the early months of 1954. A third core, this time of plutonium, is scheduled to be loaded into the reactor during the first part of 1955. Breeding occurs in the blanket of natural uranium surrounding the core.

The program leading to the construction of a second considerably larger experimental breeder reactor (EBR No. 2) is now well underway. The EBR No. 2, which is being developed and designed by ANL, will produce 62,500 kilowatts of heat and generate 15,000 kilowatts of electricity. The reactor will eventually be fueled with a uranium-plutonium alloy with a blanket consisting of natural or depleted uranium. The schedule calls for construction to start in 1955 and operation to begin in 1958.

During the past 6 months experimental studies of subcritical core assemblies for a fast breeder were carried on at ANL. Several hundred sets of measurements were made of the distribution of neutrons to be found in such subcritical arrays of various compositions when neutrons from a source reactor are fed into them.

At the testing station in Idaho the building to house the zero power fast reactor was completed. The critical assembly will begin operation soon and will provide information on such factors as critical mass, breeding ratio, and power distribution in the core of EBR No. 2.

A half-scale working model of EBR No. 2 was constructed at the Argonne National Laboratory to demonstrate the engineering feasibility of the design. The model is scheduled to begin operation during March 1955.

An essential requirement for the development of a fast breeder reactor powerplant is a facility for the fabrication of fuel elements containing plutonium. The design of the fuel fabrication building is nearing completion and its construction at ANL is scheduled to begin in 1955.

Industrial Participation

An Industrial Liaison Branch was established in the Division of Reactor Development. This branch is charged with the responsibility of encouraging wider participation by industry in the peaceful applications of atomic energy.

The program for industrial participation through study groups was broadened to allow a wider segment of industry to take advantage of the available technology. In order to expedite the peaceful uses of atomic energy, a new program of access agreements permits industrial concerns to have individuals cleared to receive limited categories of information. Programs of commercial activity and licensing are being developed to permit new companies and companies currently in the program to design, construct, and operate reactors or related facilities.

A comprehensive unclassified training program in reactor technology is being developed. Present plans call for the establishment of an international school at the Argonne National Laboratory. The school will begin in March 1955 with a 4-month unclassified training program in the broad fields of reactor technology, followed by a 3-month session of applied engineering projects. This first session will be limited to about 30 students, 20 of whom may come from other countries. In the fall of 1955, the curriculum will be given to 80 students, 50 of whom may come from other nations.

The Oak Ridge School of Reactor Technology will continue with its classified training program for recent college graduates and men from industry and Government.

New Study Groups

The Commission approved six new study group agreements during the last 6 months of the year, bringing to 18 the number of participating study teams, each of which represents one or more contractors. In all, 11 new teams entered the industrial participation program during 1954—the greatest number to enter in a single year since the program's inception in 1951.

The six new industrial study groups [1] are:

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[1] In addition to the new industrial participation teams, there are the following: (1) Nuclear Power Group including American Gas and Electric Co., Bechtel Corp., Commonwealth Edison, Pacific Gas & Electric Co., and Union Electric Co.; (2) Westinghouse Electric Corp.; (3) General Electric Co.; (4) Newports News Shipbuilding and Dry Dock Co.; (5) Tennessee Valley Authority; (6) Monsanto Chemical Co.; (7) Dow Chemical Co.-Detroit Edison Co., including: Allis-Chalmers Manufacturing Co., Atlantic City Electric Co., Babcock & Wilcox Co., Bendix Aviation Corp., Cincinnati Gas & Electric Co., Cleveland Electric Illuminating Co., Consolidated Edison Co. of N. Y., Consolidated Gas Electric Light & Power Co., Consumers Power Co., The Detroit Edison Co., the Dow Chemical Co., the Ford Motor Co., General Public Utilities Corp., Gibbs & Cox, Inc., Hartford Electric Light Co., New England Electric System, Niagara Mohawk Power Corp., Philadelphia Electric Co., Potomac Electric Power Co., Public Service Electric & Gas Co., and Rochester Gas & Electric Corp., Southern Services, Inc., Toledo Edison Co., United Engineers & Constructors, Inc., Vitro Corporation of America, and Wisconsin Electric Power Co.; and (8) Foster Wheeler-Pioneer Service & Engineering Co.-Diamond Alkali Co., including: California-Oregon Power Co., Louisville Gas & Electric Co., Northern States Power Co., Oklahoma Gas & Electric Co., San Diego Gas & Electric, and Wisconsin Public Service Corp.; (9) Babcock and Wilcox Co.; (10) American Machine and Foundry Co.; (11) Bendix Aviation Corp.; and (12) Pacific Northwest Power Co., including the Montana Power Co., Washington Water Power Co., Pacific Power and Light Co., Portland General Electric Co., and Mountain States Power Co.

Bethlehem Steel Co., which will conduct a study on the application of atomic power to the propulsion of commercial ships.

Consumers Public Power District of Nebraska, which will study the engineering, economic, and technical feasibility of constructing a nuclear power reactor for the production of electric power.

Kaiser Engineers, which will study the engineering, economic, and technical feasibility of constructing and operating a power-producing reactor.

Pennsylvania Power and Light Co., which will make a detailed study of the economic and engineering feasibility of a large-scale nuclear-fueled powerplant in its own system.

Rocky Mountain Nuclear Power Study Group, which will conduct a study of the Commission's reactor development activities to determine the engineering, technical, and economic aspects of peacetime applications of atomic power. The group includes Arizona Public Service Co., Phoenix, Ariz.; Ebasco Services, Inc., New York; Fluor Corp., Ltd., Los Angeles, Calif.; Idaho Power Co., Boise, Idaho; Minnesota Mining and Manufacturing Co., St. Paul, Minn.; Phillips Petroleum Co., Bartlesville, Okla.; Public Service Co. of Denver, Colo.; Riley Stoker Co., Worcester, Mass., and Utah Power and Light Co., Salt Lake City, Utah.

Vitro Corp. of America, which will make a study of chemical and metallurgical problems associated with nuclear power systems.

Army Power Reactors Program

In December a lump-sum contract to design, build, and test operate a prototype "package" nuclear power plant for military use was awarded the American Locomotive Co. The plant—known as the Army Package Power Reactor (APPR)—will be built at Fort Belvoir, Va., site of the Army Corps of Engineers Training Center. It will be based on a conceptual engineering design by the Oak Ridge National Laboratory of a pressurized light water reactor using enriched uranium fuel.

Studies by the Army and the Commission established that such plants at remote bases would be technically feasible and have strong military advantages. For example, use of a power reactor plant, with components transportable by air, could reduce the amount of bulky conventional fuels that must be transported to support a military operation. In addition, a plant of this type, which could be transported and erected anywhere in the world, should contribute to the objective of utilizing atomic energy commercially.

Of 18 proposals submitted by various industrial firms, the proposal by the American Locomotive Co. was the most favorable to the Government from the standpoint of price, excellence of design, and responsiveness to other terms of AEC's invitation. The contract price of $2,096,753 is to be shared by the AEC and the Department of the Army on an approximately equal basis.

Naval Reactors Program

Submarine Reactors

Experimental operation of the prototype *Submarine Thermal Reactor* (*STR*), Mark I, at the National Reactor Testing Station in Idaho was continued by the Westinghouse Electric Corp. as a part of the program for testing this type of reactor.

Power for the USS *Nautilus*, constructed by the Electric Boat Division of General Dynamic Corp., and commissioned at Groton, Conn., on September 30, is being furnished by the STR, Mark II.

Construction of the second nuclear-powered submarine, the USS *Sea Wolf*, continued at the Electric Boat Division of General Dynamics Corp., Groton, Conn. The ship will be powered by *Submarine Intermediate Reactor* (*SIR*), Mark B.

The prototype powerplant, SIR Mark A, was completed at West Milton, N. Y., and the Electric Boat Division installed machinery in the hull section. Defective piping in the propulsion part of the plant is being replaced. This work may put the project about a month behind schedule.

Research and development on the (SIR) Mark A and Mark B plants continued at the Knolls Atomic Power Laboratory, near Schenectady.

The Knolls Atomic Power Laboratory continued work on the development of another nuclear powerplant suitable for a high performance submarine, the *Submarine Advanced Reactor* (*SAR*).

Large Ship Reactor (*LSR*)

The Westinghouse Electric Corp. was assigned the research and development work required by the new AEC-Navy project in the development of nuclear propulsion for large naval vessels. The pressurized water reactor type was selected for this project. Development work will be done at the AEC's Bettis Plant, Pittsburgh, Pa.

Separate design studies of large nuclear-powered ships were undertaken by the Newport News Shipbuilding and Dry Dock Co., Newport News, Va., and the Shipbuilding Division, Bethlehem Steel Co. at Quincy, Mass., under contracts with the Bureau of Ships, Navy Department.

Aircraft Reactors Program

The AEC-Air Force program of research and development for aircraft nuclear propulsion continued. Principal AEC contractors in the program are: General Electric Co. (through its Aircraft Nuclear Propulsion Department, Evendale, Ohio); Carbide and Carbon Chemicals Co. (through the Oak Ridge National Laboratory) and United Aircraft Corp. (through Pratt and Whitney Aircraft Division, East Hartford, Conn.).

The General Electric-Aircraft Nuclear Propulsion Dept.-AEC definitive contract was signed in July.

A $294,000 contract was awarded in September to the Jackson Construction Co. of Salt Lake City for work at the National Reactor Testing Station. The agreement calls for completion of the exhaust system of the Initial Engine Test Area at the Aircraft Nuclear Propulsion Area by July 1955.

New Facility for Pratt & Whitney Aircraft Division

A research and development facility for use by the Pratt & Whitney Aircraft Division of United Aircraft Corp., in connection with a portion of the Aircraft Nuclear Propulsion Program, is to be constructed in the same general area as Pratt & Whitney's existing plant in East Hartford, Conn.

The Charles T. Main Co. of Boston is under contract to develop design criteria and site requirements. The project is being financed by the U. S. Air Force.

General Engineering and Development

Materials Testing Reactor Serves Public

Since the Commission made available to the public the specialized irradiation facilities of the high intensity 30,000-kilowatt Materials Testing Reactor at the NRTS in Idaho, 6 industrial firms have taken advantage of its facilities.

Because of its high flux, the MTR can produce isotopes of higher specific radioactivity than the Argonne, Brookhaven, and Oak Ridge reactors currently offering irradiation services to the public.

Irradiation Facilities Available to Industry

The first irradiation facility designed to use the gamma radiations from spent reactor fuel elements is being constructed by the AEC adjacent to the MTR for an estimated cost of $90,000.

The facility can be used for unclassified work. The radioactive fuel elements can furnish about 10,000 times more intense irradiations than the largest cobalt 60 sources now used.

The AEC provided the Army Quartermaster Corps with radioactive fuel elements for use in its study of the use of gamma rays for food preservation. The AEC also provides an irradiation service to industry [2] similar to that it now supplies with the MTR.

Another gamma radiation facility is being constructed at the Argonne National Laboratory by Fred Berglund and Son, Inc. at an estimated cost of $91,550. This facility will be used by the Army Quartermaster Corps and its contractors in the study of food preservation. In addition, it will be available to ANL research projects and outside industrial concerns.

Potato Irradiation Facility

The University of Michigan under contract to AEC completed a design of a facility capable of irradiating 20 tons of potatoes in an hour and giving them a shelf life of 2 years. Such a facility could make use of MTR fuel elements, gross fission products or cesium 137 as a radiation source. Potatoes exposed to mild doses of gamma irradiation could be held at storage temperature of 50° F. for several years without spoiling or sprouting. Present cost estimates indicate that this could be done for approximately $3.60 a ton. The cost of such a facility is estimated at $50,000.

Sanitary Engineering

The Mohawk River below the Knolls Atomic Power Laboratory was the scene of three radioactive tracer runs. The purpose of these runs was to obtain quantitative information on the ability of the river to receive safely certain low-level radioactive wastes from KAPL. In general, the tests provided an evaluation of the capacity of surface waterways to receive safely certain wastes from nuclear energy operations.

The technique used consisted of the injection of known, controlled amounts of radioactive tracer into the river through the KAPL sewer outfall and then, by spot measurements with highly sensitive radiological instruments and analysis of river water and bottom samples, determination of the dilution of the tracer as it moved downstream.

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[2] Inquiries should be addressed to Phillips Petroleum Co., Atomic Energy Division, Idaho Falls, Idaho.

In the most recent test, 4.5 curies of phosphorus 32 were injected into the river in a little over three hours.

Preliminary analyses indicated that, under the test conditions, in roughly 5,000 feet of stream travel, the radioactivity concentration at the outfall was diluted to essentially background or harmless levels.

Field tests were under the general direction of the Geological Survey, with active participation of the New York State Department of Health, General Electric Co. (KAPL), and Harvard University.

Two conferences of experts were held to consider the capabilities of two special environments for disposition of high-level wastes—the ocean and deep geologic structures. One was held at Woods Hole Oceanographic Institution on the oceanographic aspects of the problem and the other in Washington on the geologic problems involved. Although each has its advantages and disadvantages, extensive research and development work will be necessary before engineering conclusions can be reached.

The coordination of such information is under the Department of Sanitary Engineering and Water Resources, Johns Hopkins University.

Physical Research

Physical research in the atomic energy program continued to result in significant scientific and technical accomplishments. Moreover, the prospect of rewards from further investigations seemed ever increasing. Essentially every advance in atomic knowledge can be attributed to laboratory research of the type being conducted in the physical research program. The program is designed to develop and utilize adequate scientific talent and facilities for tackling the most urgent and promising problems of atomic energy, under conditions affording imaginative scientists freedom for creative effort.

In addition to conducting research in its own laboratories, the AEC also sponsors work in university laboratories where both research and training are accomplished in sciences pertaining to atomic energy. Although emphasis in this report is given to accomplishments in Commission facilities, outstanding contributions from universities and other off-site contractors have appeared in the scientific journals.

The listing of current unclassified research contracts in the physical sciences (pp. 106–115) is indicative of the scope of these scientific studies. However, in addition to such studies, the research programs of the national laboratories are diversified and extensive, covering work of all classifications. National laboratories are primarily responsible for the rapid solution of problems rising in the production and development programs, and for on-the-job training of scientists and engineers using complex, and often unique, nuclear machines and equipment.

The past 6 months witnessed a number of important advances resulting from research in atomic capabilities.

In chemistry, an isotope of cesium (cesium 137) was separated in sufficient quantity to provide a large radiation source (1,540 curies) for a new teletherapy unit for cancer research. A new pilot plant approved for construction at Oak Ridge National Laboratory will greatly expand facilities for separating and purifying cesium and other useful fission products, such as strontium 90. Technetium, a metallic element not yet found in nature, was isolated and found to have properties of interest to the atomic program.

In metallurgy and ceramics, significant findings were made in investigations of radiation damage to plastics and in corrosion studies.

In physics, a new type of ion source was developed and successfully used in electromagnetically separating isotopes of refractory metals in greater amounts than was possible previously.

The bevatron at University of California Radiation Laboratory attained a proton beam energy of 6.1 Bev, the highest energy yet realized in the laboratory. At Brookhaven National Laboratory, design of the alternating gradient synchrotron, expected to develop proton energies of 25 to 35 Bev, was studied with a smaller scale device.

Further details of these studies, and additional examples of research progress follow.

Chemistry

Production of Large Cesium 137 Source

Cesium 137—a long-lived, gamma-ray-emitting fission product—was separated from irradiated reactor fuel at ORNL and made into a large radiation source for a new teletherapy unit. The source, to be used for cancer research by the Medical Division of the Oak Ridge Institute of Nuclear Studies, is in the form of two small pellets about the diameter of a half dollar, half an inch thick and weighing a little more than an ounce. Nevertheless, the source which cost several thousand dollars to prepare contains 1,540 curies, equivalent to more than $20 million worth of radium.

The pellets of compressed cesium chloride are sealed inside double jackets of stainless steel to insure against leakage.

Multicurie Fission Products Plant

A new facility capable of separating and purifying fission products for production of large radioactive sources for industrial, medical and other uses was approved for construction at ORNL. The new plant will greatly expand the "hot chemistry" facilities in the radioisotope program. It will provide equipment for separating and purifying kilocurie quantities of important long-lived fission products and for fabricating them into large radiation sources.

The plant will have the capacity for separation of 200,000 curies per year of cesium 137, an important long-lived gamma-ray-emitting isotope, as well as large quantities of strontium 90, a valuable source of beta radiation.

The fabrication facilities will be capable of producing single radiation sources containing approximately 2,000 curies each, with provisions for combining two or more 2,000-curie units into larger sources.

The plant is also designed for the separation of a wide variety of the less abundant radioisotopes. It is expected to fill only the initial needs for fission products, and is designed as a pilot plant for possible future industrial models.

Properties of Technetium

Among the fission products of uranium are two elements not yet found in the earth's crust. These are promethium, a rare earth having an atomic number of 61, and technetium, an element resembling manganese and rhenium, with atomic number of 43. All of the isotopes of promethium and technetium produced by uranium fission are radioactive. Fortunately, in one case each, the half-lives for their decay are long enough so that weighable amounts of them remain in process waste solutions. Gram quantities of both elements were isolated from these intensely radioactive wastes in the hot laboratories in Oak Ridge.

The chemical and physical properties of the synthetic element technetium are of particular interest. Pure metallic technetium is silver-gray in appearance and shows a very high melting point. Its density is approximately the same as that of silver, and it is slightly magnetic. Technetium dioxide occurs as a black solid resembling manganese dioxide. Elemental technetium is of reactor interest because of its moderately large ability to soak up slow neutrons.

Mass Spectrometry

At ORNL, an improved method was developed for determining the isotopic composition of elements in extremely small amounts of solid samples. The basic method involves vaporizing the sample inside a mass spectrometer and then ionizing (charging) the vapor by electron bombardment or by surface ionization. The isotopic ratios of interest can then be determined.

Introduction of iridium heater strips, on which the sample is placed and subsequently vaporized, simplified and improved the technique. It was found possible to load several types of samples on a single heater strip and vaporize them separately at increasing temperatures, thus conducting several isotope assays in succession. This resulted in saving time and money per analysis.

The chemical inertness of iridium makes possible the isotopic assay of most elements in the form of any solid compound, thus simplifying the chemical pretreatment of the samples. The surface ionization characteristics of iridium were found to be at least equal to those of other materials presently used.

Chemical Structure Determination by Neutron Diffraction

An unusual opportunity for research is afforded by the abundant supply of neutrons as beams from several AEC reactors. Diffraction (scattering) of such neutrons by crystalline substances constitutes a valuable method of determining the chemical structure of the material. Neutron diffraction is similar to X-ray diffraction in that a pattern is observed either from a single crystal or from a powdered sample, in which each spot or line of the pattern corresponds to a logical scattering of the neutrons or X-rays from a recurring unit of the crystal structure. Interpretation consists in assuming a structure and in calculating from it the diffraction pattern to be expected. The calculated pattern is then compared with the observed pattern. Calculations are repeated for successive modifications of the assumed structure until the patterns match.

Neutron and X-ray diffraction are complementary, in that some problems are better attacked by one than by the other. Of great chemical interest is the fact that neutron diffraction can be used to investigate the positions of hydrogen atoms in crystals, whereas X-rays usually cannot. Details of atomic structure in crystals, such as motion of atoms caused by heating, the extent of free movement (rotation) of atoms, and the identification and exact location of hydrogen atoms are revealed by neutron diffraction, thus supplementing information obtained from X-ray work.

It is apparent that neutron diffraction will be a valuable complement to X-ray diffraction, and that further studies will solve many problems in crystal structure, including several of classical chemical interest.

Stable Isotope Chemistry

The process of separating the rare earth elements by liquid-liquid extraction (tributyl phosphate-nitric acid), which previously produced kilogram quantities (2.2 pounds) of gadolinium, was extended to other rare earth elements. This process was developed on a laboratory scale at ANL and modified and adapted to larger scale rare earth extraction by ORNL.

Recently special attention was given to dysprosium and europium. Kilogram quantities of dysprosium were enriched to more than 90 percent purity. More than a kilogram of the much rarer element, europium, originally contained in 100 kilograms of mixed rare earths, was concentrated in 10 kilograms of material. The chemical nature of europium makes it readily separable from this concentrate.

Some of the residues from these operations are now greatly enriched in other rare earths that were initially extremely scarce. Application of a newly developed process for the separation of rare earth elements from unwanted elements in rare earth ores made rare earth mixtures more readily available for the liquid-liquid extraction process that separated the rare earth elements themselves.

Rare earths have many practical applications. Among these are use in cigarette lighter flints; in cored graphite rods for searchlights; in motion picture projectors; in waterproofing textiles; in paint driers—especially for baked finishes; in glass decolorization; in colored glasses and sun glasses; in high-grade camera lenses; and in polishing optical glass.

Melting Curves

The relationship between pressure and melting of low-boiling gases in the solid state was investigated at Los Alamos Scientific Laboratory with improved apparatus and techniques. The freezing and melting transitions of helium 3, helium 4, neon, nitrogen, and oxygen were studied, with temperatures as low as −458.1° F. and pressures as high as 54,000 pounds per square inch being used. In this work a phenomenon analogous to supercooling was observed—termed "superpressuring" at the laboratory.

For example, it was found possible to apply to liquid oxygen a pressure of some 7,000 pounds per square inch above the normal equilibrium freezing pressure before solidification took place. It was also found possible to apply shear forces across solidified gases without appreciably changing the melting point. A further matter of interest was that dilution of oxygen with a small amount of argon raised the melting point.

Scintillation Detectors

Further progress was made at Los Alamos Scientific Laboratory on the synthesis of organic scintillators and their application to the de-

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velopment of large volume radiation detectors. Progress resulted in a continuation of the program to develop a liquid scintillation detector large enough to surround the entire human body as a means of assaying its total gamma radiation activity.

The detector was constructed and ready for testing in January 1955. The program resulted in the synthesis of 37 new organic compounds, all having scintillation characteristics. An additional 40 compounds that were previously known were also tested for their scintillation properties. All compounds were members of the oxazole family and studies are under way to synthesize and test compounds of other families including pyridines and furans.

Radiochemical Processing Costs

Cost studies of radiochemical processes showed that radiochemical processing plants cost approximately 12 times as much to build as similar plants processing nonradioactive materials. The total annual operating cost of a radiochemical plant may be almost three times that of a conventional plant. A long range program being carried out at ORNL is designed to reduce the capital investment required for radiochemical processing plants and to reduce operating costs.

Preliminary studies indicate that significant savings might be realized by simplifying remote control maintenance operations. For example, by placing processing equipment in a pit, flooded with water to provide necessary shielding during periods when maintenance is required, it should be possible for workmen using long-handled tools to perform maintenance operations directly. These cost studies are expected to be of considerable interest to groups studying and designing radiochemical plants for processing power reactor fuels.

Metallurgy and Materials

Irradiation of Plastics

Changes in physical and chemical properties of a material caused by irradiation present additional difficulties over those normally encountered in conventional powerplants for builders and operators of nuclear powerplants. Such changes in a material are termed "radiation damage." Radiation damage is being studied by subjecting classes of materials having similar chemical structure to a definite amount of irradiation, using gamma or neutron sources, and correlating the final properties of the material with its chemical structure.

Qualitatively, the changes produced by gamma radiation and neutron (reactor) radiation are the same. Also, equivalent changes are produced in many properties for the same energy absorption by both types of radiation.

An unusual effect is obtained when irradiating one type of plastic material (polyethylene). Here, the long-chain molecules appear to add to one another in three dimensions to form larger molecules by a process known as "cross-linking." This results in an increase in hardness, tensile strength, and density of the irradiated plastic. Many other plastics are observed to lose strength and become soft or brittle when subjected to radiation exposures too short to produce much change in polyethylene. The hardness is either decreased or little changed, and there is a small change in density. In these instances, the most pronounced change is a decrease in tensile strength. It is felt that these results are due to rupture of the molecule resulting in fragments with inferior physical properties.

In an extension of these studies it was found that materials having nylon-type structures show the same order of stability toward irradiation as polyethylene. In material having dacron-type structure, the predominant effect was embrittlement.

Evaluation of available data indicates that there is a large variation in the ability of plastics to withstand decomposition by nuclear radiation. Resistance to radiation is closely related to chemical structure of the plastic. Short-time exposure may result in an improvement of certain desirable properties, such as strength. However, when strength is improved, it is usually accompanied by a decrease in some other property, such as ductility. Heavy doses of irradiation appear to produce harmful effects in all plastics.

Corrosion of Aluminum in Water

Corrosion of aluminum in water at high temperatures is being studied at the Argonne National Laboratory. When testing the behavior of aluminum in water at high temperature, serious corrosion was observed. However, corrosion resistance was remarkably improved when small quantities of certain inorganic salts were added to the water.

The same effect was observed in neutral solution and in slightly acid solution, sulfuric acid being used to render the solution acidic. These corrosion inhibitors prevented blistering of the metal during a 48-hour test period, and there was evidence to indicate that no blistering would occur even if the test period was extended for 24 days.

Corrosion of Steel

At Brookhaven National Laboratory the behavior of materials of construction for reactors (such as steel) when in contact with molten bismuth are under investigation. It was shown that the mode of corrosion is by the dissolution of the steel in the hot molten metal. If the molten metal is cooled, a large fraction of the iron that is dissolved in the hot bismuth is precipitated out. Thus, in a closed circuit, such as is used in transferring heat from the reactor to a heat exchanger, the iron is transferred by the fluid from the hot region to the colder sections. It was shown that the addition of small quantities of metallic zirconium to bismuth (250 parts per million) markedly reduced this transfer.

In experiments in which radioactive zirconium was used, it was shown that the zirconium deposits on the steel surfaces.

Zirconium Alloy Systems

Zirconium is one of the few metals with a low cross section and good resistance to high-temperature aqueous corrosion. The strength of the pure metal can presumably be much improved by alloying. It is furthermore possible that alloying might alleviate certain unfortunate properties, such as its tendency to become brittle when exposed to atmospheres containing hydrogen. Thus, a program was initiated at ORNL aimed at an understanding of the effect of various elements on alloy structure and behavior.

Physics and Research Tools

"Fermi Prize" Established

On November 16 Dr. Enrico Fermi became the first to receive the Commission's award for outstanding contributions in the development of atomic energy. The $25,000 award was accompanied by a citation (pp. 40–41) describing his contribution to nuclear science, the development of the theory of the chain reaction and demonstration of the practicality of the nuclear reactor. Similar awards—to be known hereafter as the "Fermi Prize"—will be made to others for noteworthy accomplishments in the field of atomic energy.

Dr. Fermi's achievements in physics, especially in the field of atomic energy, have been of inestimable value. As much as any individual he is responsible for achieving the release of atomic energy. He was a Nobel Prize winner and past president of the American Physical Society. After the war he served for several years as advisor to the

AEC while a member of its General Advisory Committee. A professor of physics at the Institute for Nuclear Studies, University of Chicago, at the time of his death on November 28, Dr. Fermi's recent research efforts were concerned with the theory of nuclear forces and the interpretation of meson experiments.

Isotope Separation

In the electromagnetic separation of stable isotopes at ORNL a new type of ion source operating in the 1,800° to 2,800° C. temperature range was developed and used in obtaining for the first time gram quantities of the isotopes of the refractory metals—ruthenium, palladium, iridium, and platinum. The successful processing of these elements brings to 48 the number of elements whose isotopes have been separated.

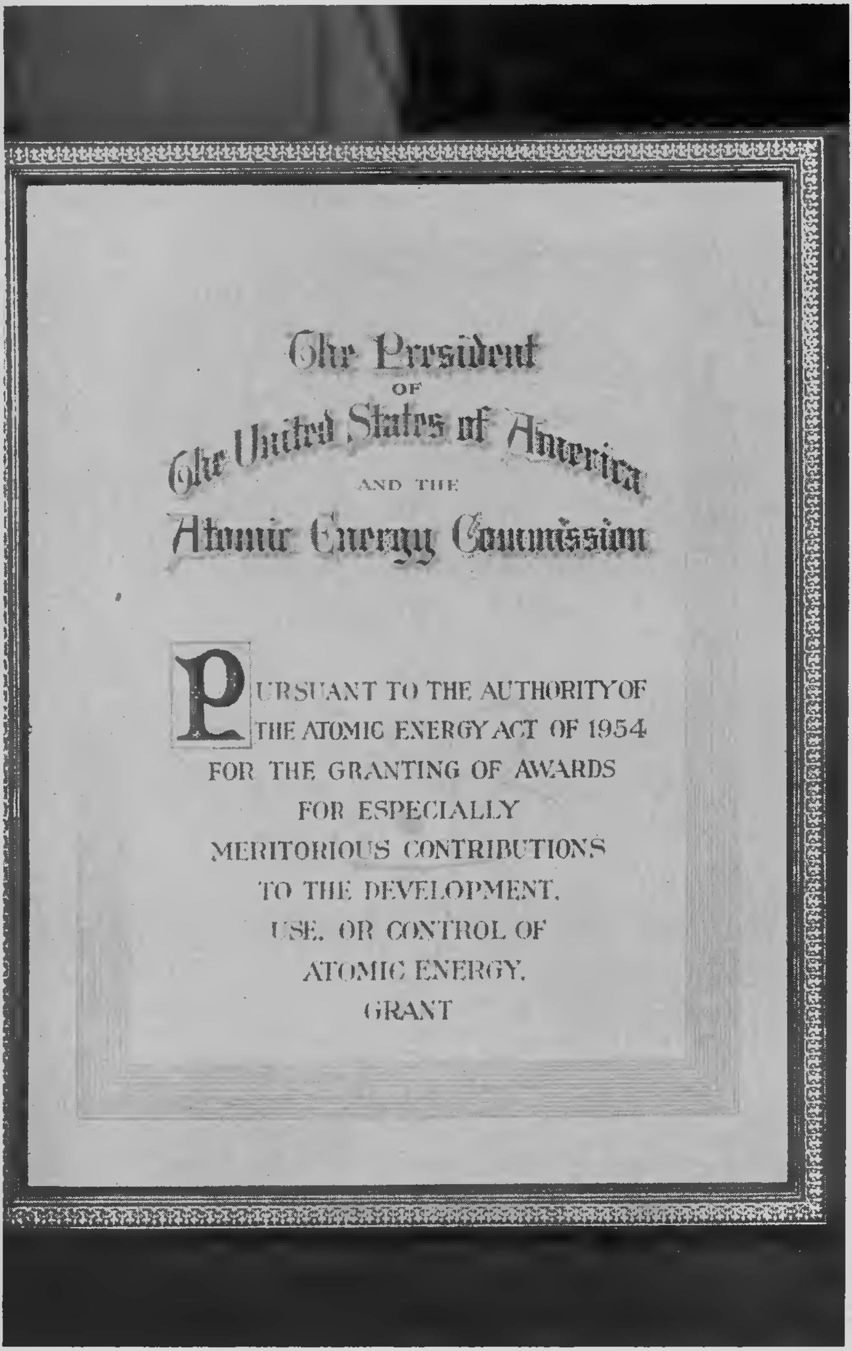
Progress was also made in developing ion sources and isotope collectors for production of multigram quantities of enriched isotopes. Gram quantities of separated isotopes are used especially in neutron cross-section measurements and in the preparation of cyclotron targets for the production of essential radioactive isotopes. Many of these radioactive isotopes have important applications and cannot be obtained satisfactorily by any other means. Calcium 46, manganese 54, and iodine 130 are examples of isotopes being investigated for medical research.

The Gas Counter

At Argonne National Laboratory it was found that alpha particles shot into helium or argon or mixtures of these gases with nitrogen give pulses readily measurable with photomultipliers, thus making possible a new type of scintillation counter. The principal advantages over other types are high speed and insensitivity to gamma rays. At Los Alamos such counters using krypton were found to be useful under circumstances in which the large number of pulses would clog or choke other types of counters.

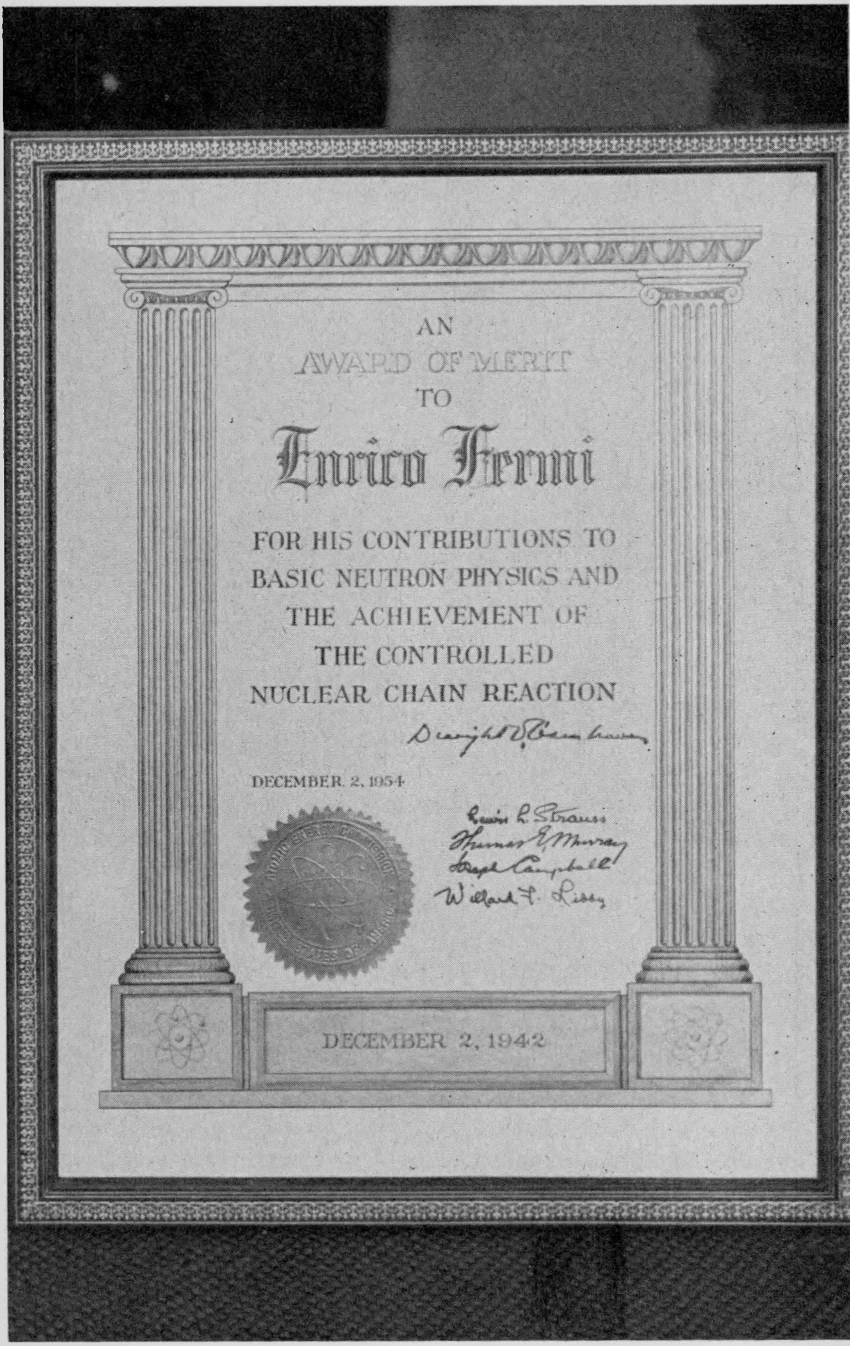
Geophysical Research by Mass Spectrometric Analysis

An age of 4.6 billion years was determined for two famous stony meteorites (the "Forest City meteorite" of Winnebago Co. Iowa and the "Beardsley meteorite" of Rawlins Co. Kansas) by measuring the small amounts of potassium 40 and argon 40 in them. Since the rate of radioactive disintegration of the potassium into argon is known,



The President
OF
The United States of America
AND THE
Atomic Energy Commission

PURSUANT TO THE AUTHORITY OF
THE ATOMIC ENERGY ACT OF 1954
FOR THE GRANTING OF AWARDS
FOR ESPECIALLY
MERITORIOUS CONTRIBUTIONS
TO THE DEVELOPMENT,
USE, OR CONTROL OF
ATOMIC ENERGY,
GRANT


AN
AWARD OF MERIT
TO
Enrico Fermi
FOR HIS CONTRIBUTIONS TO
BASIC NEUTRON PHYSICS AND
THE ACHIEVEMENT OF
THE CONTROLLED
NUCLEAR CHAIN REACTION
DECEMBER 2, 1954
DECEMBER 2, 1942

the relative amounts present give a measure of the time that has elapsed since the meteorite solidified so that it could retain argon.

It is striking that this age agrees with the one obtained for the age of the earth's crust. By comparing the relative abundance of lead isotopes in the earth's crust with those in meteorites that contain negligible quantities of uranium, it is possible to determine how long radioactive disintegration of uranium 238 and uranium 235 must have been going on to account for the observed proportions of lead 236 and 237 in the earth's crust. These measurements and calculations give a value of about 4.5 billion years. Both the age of the meteorites and the age of the earth's crust were determined by physicists of the University of Chicago using, in part, the facilities of the Argonne National Laboratory.

UCRL Bevatron

Initial operation of the bevatron at the University of California Radiation Laboratory began in February, when protons were accelerated to an energy of about 5 Bev (billion electron volts). Performance continued to improve, and by April a proton beam energy of 6.1 Bev was attained—the highest energy yet realized with protons. Bombardment of targets with 6 Bev protons is expected to produce an abundance of many particles previously undetected in a laboratory.

There is particular interest in the use of the bevatron to create and study mesons (elementary particles having a mass intermediate between that of an electron and that of a proton). Mesons have been found in a bewildering variety in cosmic rays and have been produced by other high energy accelerators. However, the higher energy from the bevatron is expected to open up a new range in the spectrum of these particles not previously available for laboratory study. Experiments are also planned with protons, neutrons, and mesons using a great many target materials to study their absorption and their scattering.

BNL Cosmotron

During operation of the cosmotron on November 5 at Brookhaven National Laboratory a short circuit developed in the main magnet winding in the southeast quadrant near the south straight section, as a result of a water leak in a cooling tube. It was tentatively estimated that 3 to 6 months shutdown time will be required for repairs. This affords an opportunity for incorporating improvements in the machine, and ejection magnets are being installed to facilitate getting the beam out of the cosmotron, thereby substantially increasing its effectiveness.

BNL Alternating Gradient Synchrotron

Use of the alternating gradient (strong focusing) principle in the synchrotron to be constructed at BNL is expected to permit proton energies of 25 to 35 Bev to be attained—about 10 times those realized in the laboratory's cosmotron. The Brookhaven staff will explore design problems with a smaller-scale experimental device, known as an electron analogue that will accelerate electrons.

ORNL Research Reactor

In August 1954, the AEC authorized the design and construction of a reactor facility at the Oak Ridge National Laboratory, specifically designed to carry out the laboratory's research programs. The reactor installation, designated as the ORR, is a simplified version of the Materials Testing Reactor (MTR) at Idaho Falls, Idaho, and will operate at a power level of 5 megawatts.

The design work is being carried on by ORNL and the McPherson Co. of Greenville, S. C., and is expected to be completed by March 1, 1955. A lump-sum contract will be let for the construction of the building, reactor, and cooling system by February 1, 1955. Operation of the reactor is scheduled by August 1, 1956.

Biology and Medicine

In order to minimize the hazards associated with the use of radioactive materials and to protect against overexposures to radiation, broad research activities in biology and medicine are necessary. Laboratory and field investigations continued in the past 6 months to be projected toward studies of the effects of radiation on living things, understanding the mechanisms by which these effects are produced, and developing controls and methods of protection against damaging effects.

Current progress is reported here on activities which describe the broad scope of this program at research installations. Brief developments are described in the instrumentation field, and recent participation in civil defense activities.

Residents of Marshall Islands

The first medical follow-up study on the Marshallese from the islands of Rongelap and Utirik accidentally exposed to the March 1 detonation was completed recently. In September the AEC arranged to have the study made by a team from the technical staffs of the Naval

Radiological Defense Laboratory and the Naval Medical Research Institute. The people continue in excellent health. Blood counts are now approximately normal, skin lesions have entirely healed, and a regrowth of hair has occurred.

Radiobiology Conference in Japan

An unclassified scientific conference on radiobiology attended by scientists from Japan and the United States was held November 15–20, in Tokyo, Japan. The invitation to participate in this conference was received from the Japanese Science Council. Representatives from the Commission and the Department of Agriculture were selected to attend.

The agenda covered such items as detection and measurement of radioactivity, decontamination of radioactive substances, movement of fission materials in soils and uptake by plants and animals, and the application and utilization of radioisotopes in agricultural and biological research.

The meeting, an outgrowth of preliminary discussions on marine biology with Japanese scientists early this year, provided an excellent opportunity for the mutual exchange of technical data, and stimulated interest for future cooperation and exchange of information on the general subject of radiobiology.

Civil Defense Activities

The Commission made arrangements to include a Civil Effects Program in the coming Continental Test Operations at the Nevada Test Site in 1955. Ten specific programs were established under the Civil Effects Test Group of the Continental Test Operation. These programs embrace 44 individual experimental and training projects involving participation of various AEC research groups, Federal Civil Defense Administration, Housing and Home Finance Agency, Public Buildings Service, Food and Drug Administration, and the Department of Agriculture.

During the current period assistance to FCDA was given also in the following area: approximately 270 weapons test reports (primarily classified) were transmitted to date since the start of the cooperative program of AEC and the Department of Defense to furnish specific categories of effects information relevant to civil defense planning and operations; in cooperation with the U. S. Weather Bureau, a number of briefings and conferences were arranged to consider the problem of radioactive fall-out; and cobalt 60 radiation sources were loaned the Oregon State Civil Defense Agency, upon endorsement of FCDA, for training and educational use in the State civil defense program.

Current data were provided the Office of Defense Mobilization on the effects of high-yield weapons for use in reevaluation of the national industrial dispersal policy.

The Civil Defense Committee of the Life Insurance Association of America prepared a comprehensive unclassified report of the civil defense problem—with recommendations for industry action—on the basis of information obtained in classified briefings by AEC and other agencies early this year. The report, a product of considerable deliberation over a period of several months, was reviewed by the AEC and should serve as a basic civil defense guide to the insurance industry. The report is to be released by the LIAA.

First International Instrument Congress and Exposition

In furtherance of the Commission's program of working with industrial and technical groups, an exhibit was presented at the First International Instrument Congress and Exposition in Philadelphia, Pa., September 13–24. The exhibit illustrated the role played by nuclear instrumentation within the atomic energy program. It employed photographs, a short movie and actual operating instruments to show how instrumentation is required in nearly all AEC operations, such as uranium mining, production, research and radiological safety.

Twenty-three thousand people, including 755 foreign representatives, attended the conference and exposition sponsored by the Instrument Society of America. More than 250 technical papers were presented and about 500 American and foreign instrument manufacturers exhibited their products.

The Congress and Exposition was an important event in the growth and recognition of instrumentation as a major specialized branch of science and technology.

Training and Health Protection

Specialized training courses offered by AEC in the fields of health continued. Candidates were selected for such training during the current year as follows:

Industrial Hygiene

Eight out of 75 applicants were selected for study at Harvard and the University of Pittsburgh during the 1954–55 academic year. The purpose of the program—administered by the Oak Ridge Institute of Nuclear Studies and now in its third year—is to provide training in industrial hygiene with particular reference to the needs of the atomic energy industry.

Industrial Medicine

Seven candidates were approved for advanced training and on-the-job experience in industrial medicine. This program was established in 1950 to train physicians in special medical problems of the atomic energy industry. It is administered by the Atomic Energy Project at the University of Rochester, New York.

Radiological Physics

Forty-three fellows were chosen for studies dealing with health problems associated with handling radioactive materials and with the release of atomic energy. They will report to one of the three training schools of the Commission as follows: University of Washington at Seattle, 5; Vanderbilt University, 21; and the University of Rochester, 17.

The 41 trainees who completed the academic courses last year reported to the cooperating laboratories (Hanford, Oak Ridge, and Brookhaven, respectively) for field training and experience. Eleven renewals were granted to enable exceptional students to complete studies for the Master's Degree in this field.

Industrial Health Award

On behalf of the Commission, the Division of Biology and Medicine was presented an award by the Houston Chamber of Commerce during the Seventh Industrial Health Conference held in September in Houston, Tex. The award was in recognition of achievements in the field of radiation protection and industrial health by the many contractors who built and operate the production facilities of the AEC.

Research Investigations

Specific accomplishments at some of the Commission's major research centers are reported herein for the current period. The biomedical work of the Commission includes many varied and complicated studies on the direct and indirect effects of radiation on living material. These studies are essential to the protection against radiation exposure of the many workers in the atomic energy program, and other citizens who might experience radiation exposure from atomic energy operations.

Oak Ridge National Laboratory

Biomedical investigations at ORNL deal with effects of radiation on plant and animal life, ranging from the long-time effects of low-level radiation to those of levels sufficient to produce injury or death. In general, the effects on living cells are being examined, since it is known that radiations induce changes both in their chemical makeup (genes) and in their chromosome structure. In these studies observations are being made of the relationship between the metabolic processes of the cell and such phenomena as the production of mutations, chromosome breaks, chromosome recombinations, and cell death.

In these studies the experimental materials include plants and microorganisms, animals, and their germ cells and tissues. In a long-range genetic study concerned with X-rays as a cause of mutations in the mouse, many thousands of mice and their offspring are being studied. The results of these large experiments are providing a basis for predicting the effects of ionizing radiation on mammals generally.

Experiments to date on X-irradiation at 300, 600 and 1,000 roentgens (r) indicate that the effect of radiation on the mutation rate in the mouse is ten times as great as that observed in fruit flies in previous experiments. Estimates of the genetic hazards of radiation in man based on fruit fly mutations were revised in the light of this new knowledge. It is now planned to gather further data, particularly as to the effect of lower doses of radiation on the mutation rate in mice.

Genetic research is also in progress using bacteriophage (a bacteria-destroying agent), virus, yeast, mold, and flowering plants, such as *Tradescantia* (spiderwort), and corn. Studies with corn show that oxygen decreases the recombination of chromosomes broken by X-ray exposure. Exposure of the spiderwort to infrared radiation in combination with X-rays indicated that both temperature and ion density are important factors in determining chromosome breakage. Recent experiments with the same plant indicate that respiratory enzymes also play an important role in determining chromosome breakage. Studies with the broad bean plant showed that a respiratory enzyme aids the rejoining of broken chromosomes. Studies on the amount of hydrogen peroxide formed within the cell nucleus during irradiation provided additional evidence that this substance is not the agent through which X-rays produce chromosome damage.

The work with the fruit fly *Drosophila* produced data relating to chromosome breakage by radiation. The number of chromosome aberrations induced was found to be a function of the wave length of the X- or gamma-rays used. This finding is of significance in formulating theories as to how radiation damages the genetic material of a cell. In addition, it was found that less chromosome damage occurs when irradiation is carried out in low oxygen concentrations. Apparently, this does not mean that low-oxygen concentration offers protection against chromosome breakage, but rather that it increases the ability of broken chromosomes to rejoin. This illustrates the complexities of interaction between absorption of radioactive energy and genetic changes.

In the field of plant physiology and biochemistry, a number of tracer studies with radioisotopes provided data on intermediary metabolism and on physical interactions within the cell. Studies on the structure of nucleic acids and nucleoproteins were emphasized, since these materials are basic components of living cells and are related to their normal functions. Since radiation produces damage mainly to these materials, these studies give one of the best approaches to understanding radiation effects on living things.

Methods developed at ORNL led to the discovery of ten new components of one of the nucleic acids. This gives a new concept of the structure of nucleic acids and broadens the approach to the problem of cell structure and components. These methods were recently applied in studies of sugars and sugar phosphates in work being done at other laboratories.

University of Tenn.—AEC Agricultural Research Program

Extensive research effort is underway for the purpose of developing beneficial uses of radioisotopes and atomic energy application in the field of agriculture. Facilities are available for studies under controlled conditions with both laboratory and domestic animals.

An important segment of the work is the intake of radioactive materials by agriculturally important livestock. The problem is to determine how much of these radioactive materials is taken in by the animals and how much is retained in those portions utilized by man for food. To obtain these data, some key radioisotopes such as strontium, yttrium, barium-lanthanum, cesium, ruthenium, protactinium, and others, are used. Studies are made of tissue distribution, absorption, retention and excretion levels of these radioactive elements by the animal body. It is also possible from these studies to make reasonable estimates on permissible exposure values.

Some recent findings were reported on intake by rats, sheep, pigs, and cattle of protactinium—a chemical element occurring along with radium in pitchblende. The preliminary work indicates that the very low absorption of this element from the digestive tract tends to minimize the hazards in two ways. The amount of the ingested protactinium reaching the muscle tissue of the animal will be low. In addition, the amount remaining in the body of the person eating the contaminated tissues will be low, if it can be assumed that the absorption by man is similar to that in the animals studied. The following facts are of interest: About 0.5 percent of the protactinium reaching the blood is firmly retained; protactinium is a bone-seeker—about 40 percent of the amount entering the circulation system will be deposited and retained in the skeleton; and protactinium is transferred across the placenta for deposition in the fetus. Further research is necessary to clarify the conditions under which protactinium constitutes a hazard.

Oak Ridge Institute of Nuclear Studies—Medical Division

These studies are directed toward developing new applications of radioactive substances to cancer and related diseases. The program is divided about equally between external and internal therapy, with increasing emphasis on internal use of isotopes in diagnostic procedures. One-third of the program involves the study and care of human patients. Construction was completed on a cobalt 60 teletherapy machine designed to take a cobalt source from about 100 to 400 curies, and clinical testing is under way. Physical testing began on the recently completed 1,000-curie cesium 137 unit.

It is hoped that development of standardized and tested methods for teletherapy will lead to more efficient operation of such machines in hospitals and medical schools, and to more standardized and accurate measuring procedures.

Primary emphasis in regard to internally administered isotopes continued to be on dosage distribution in tissues, and the metabolic fate of and reactions to the isotope. Current tests concern particularly yttrium, lutecium, colloidal gold, and various insoluble compounds.

Argonne National Laboratory

Experimental data are being obtained at ANL on the metabolism and toxicity of internally deposited radioelements, as well as externally applied radiation exposures. The principal emphasis is on biological research and the application of this knowledge to the prevention of toxic effects of radiation on living systems. Laboratory animals are used to parallel metabolic studies in humans to provide a basis for the prediction of biologic damage, and to establish maximum permissible levels of radiation exposure.

In cooperation with the Argonne Cancer Research Hospital, clinical studies are carried out to obtain data on the body content of individuals exposed to doses of radium, on the metabolism of radium, and on the incidence of disease in such persons.

Considerable effort is given to the practical problems of measuring doses and health control, since more accurate measurement is essential for the final interpretation of biological data. Instrumentation to detect and measure radiations of all types requires constant development and improvement. The large scale neutron toxicity program reported in the Sixteenth Semiannual Report to Congress (pp. 60–63) continued. Specific accomplishments during the current period were as follows:

Radiation effects on tumors. Certain mammalian tumors are invaluable in studies of radiation effects, since their growth is easily measured and their irradiation response well known. Experiments were developed in which the growth of a mouse tumor, which causes accumulation of large amounts of fluid in the abdomen, was measured by the use of a dye dilution method. Irradiation of 13 types of rodent tumors with implanted sources is underway. In this study results of chemical protective agents will be observed, and cell recovery measured.

Radium studies. Radium is known to be present in drinking water and foods although the amounts have never been found to be more than a small fraction of that deemed safe for lifetime consumption.

This radioisotope is a bone seeker somewhat like calcium and once deposited is difficult to remove. The question is whether a direct relationship exists between the amount of radium in the water and the amount of radium retained in the body. At Argonne National Laboratory a study has been underway for several years analyzing the amount of radon (radioactive gas evolved by radium) in breath samples of volunteers at Stateville Penitentiary in Illinois. In this area the drinking water is from deep underground sources and has a higher concentration of radium than ordinarily found in water obtained from surface sources such as lakes and rivers.

Studies show that volunteers at Stateville over a period of 15 years accumulated in their bodies only twice the amount of radium found in those who drank the water during a period of three to six months. It must be pointed out, however, that for those subjects in the longer period groups, the total body content of radium is measurably but not significantly higher than found by other investigations in residents of New York State where the radium concentrations in drinking water are about average for the United States.

Related work is being done to determine natural levels of radium contained in drinking water obtained from deep wells of approximately 1,500 feet near Chicago. The water from the deep wells was found to have the highest observed concentration of radium for any drinking water supplied to a large population in the United States. The amounts of radium deposited in the body from water and food in this area are not regarded as hazardous. However, these data are being used in studies of statistical variations in the occurrence of bone cancers from one area to another to determine whether radium in the body may be a factor in the natural occurrence of bone cancer.

As a part of a general effort to locate radium in potable water supplied to large populations, drinking water from Frankfurt, Germany, and Pittsburgh, Pa., was assayed and found to contain about the same amount of radioactivity as Lake Michigan and surface water around Chicago.

Biosynthesis of carbon 14-labeled compounds. Various plant species (Jerusalem artichoke, soybean, red kidney bean, Brazilian rubber) are being grown in atmospheres of radiocarbon dioxide in order to label all of the carbon containing compounds of the plant. Many of these compounds are of interest as metabolic intermediates or tracers. Labeled inulin (carbohydrate), isolated from the Jerusalem artichoke, can be used to measure the extent to which this compound is metabolized in man. The widely used inulin test for kidney function is based on the assumption that inulin is not metabolized.

Emulsions of labeled soybean oil are being used to study the usefulness of fatty emulsions given intravenously to patients unable to take food. Tissues of the red kidney bean plant are a good source of protein and provide amino acids for study of plant and animal metabolism. Labeling of tissues of the rubber tree will not only provide carbon 14-tagged natural rubber, but also help in understanding rubber synthesis in the plant by demonstrating the organic precursors of the rubber molecule.

Argonne Cancer Research Hospital

The hospital is equipped to accommodate 54 patients for treatment with isotopes and high energy radiations. Studies are in progress to obtain further information on therapeutic applications and basic clinical research problems. A long term program for utilization of the high energy machines for cancer therapy has just begun.

325448—55——5

Use of implants of plastic tubing, which contains radioiodine for localized irradiation of pancreatic malignancy, has proved therapeutically feasible. Attempts are now being made to implant plastic envelopes containing cesium in the brain and chest.

Compounds labeled with radioactive carbon and tritium are being administered to normal subjects and to those with neoplastic diseases in an effort to learn more of the metabolism of steroid hormones (sex, growth, and regulating hormones), and of the total turnover of such important precursors to general metabolism as glucose and acetate. For instance, the biologically important compound, cholesterol, is being chemically labeled with deuterium as well as with tritium. The exposure of cholesterol mixed with lithium carbonate in the Argonne National Laboratory pile is also being explored as a possible alternative technique for tritium labeling.

Health and Safety Laboratory (New York)

The work of the Health and Safety Laboratory is designed to assist the AEC and its contractors in solving problems involving health and safety of personnel and the protection of property. This includes routine industrial surveys at a number of the production facilities, as well as frequent consultations on special hygiene problems, and instrumentation research and development in the field of health protection.

With the widespread utilization of particle accelerators in nuclear research at laboratories and universities throughout the country, there is a need for constant reevaluation of the radiation safety problems involved in their operation. The Health and Safety Laboratory undertook the problem of surveying a wide variety of particle accelerators (cyclotrons, betatrons, synchrotrons, synchrocyclotrons, Van de Graaff generators, etc.). Such information will provide a fund of knowledge regarding accelerator produced radiations as well as experience in safe and economical personnel protection. Development of particle accelerators over recent years has produced machines yielding beams of increasingly higher energies permitting a greater variety of experiments and targets. As a consequence, stray radiations assume a new complexity both in type and intensity. The interpretation of measured radiation levels and the translation of these data into permissible periods of working time for personnel poses a highly specialized problem.

To date, radiation survey teams from the Health and Safety Laboratory have been sent to approximately 25 accelerator sites. Results of recommendations after the surveys led to important shielding modifications at two synchrocyclotron sites, certain changes in safety procedures, and stimulated the development of instrumentation required for this special type of radiation monitoring. The study is being expanded to include detailed measurements of radiation levels produced by accelerators located in populated areas to assure thorough protection of the general public as well as the operating personnel.

Surveys were also made on surface contamination. A recent study of fifteen plants handling relatively large quantities of radium and uranium indicated that levels of surface contamination presently considered acceptable are excessively restrictive and that surface contamination measurements do not in themselves form good criteria for judging whether or not a health hazard exists in a work area.

Data gathered at radium-dial painting establishments, uranium-processing plants and chemical manufacturing operations using radium salts show that sampling of in-plant dust, breath concentrations or urinary excretion of workers are more reliable indicators of possible hazardous conditions. In addition, it was found unsound to establish a maximum permissible level of surface contamination because the acceptable level depends, in any given situation, on such factors as the physical state of the contamination, the amount of traffic in the area and the ventilation.

As a result of the study it was recommended that time-consuming surface monitoring be deemphasized in relation to air sampling and bioassay. Costly decontamination procedures and replacement of surfaces are not considered necessary, unless the contamination is so great that it is reflected in excessive atmospheric dustiness or external radiation levels.

The disposal of radioactive waste is a major problem in the atomic energy program. Present methods for the disposal of contaminated scrap include storage, burial, sea disposal and incineration. In an effort to reduce the cost of disposal, consideration was given to the feasibility of burning low-level contaminated materials out of doors at isolated areas. Preliminary results indicated that this type of volume reduction can be accomplished without health hazard at a considerable reduction in cost over that of other types of incineration.

A study made in 1952 to determine whether surface contaminated steel could be released as scrap into normal commercial channels was expanded to include other contaminated metals such as nickel, stainless steel, copper, and aluminum. An analysis of surface-uranium-contaminated copper withdrawn from the electromagnetic separation plant at Oak Ridge showed that when the metal is melted all the detectable contamination rises to the surface with the slag which can be easily skimmed off. The findings of this study are now being considered to determine under what conditions such scraps could be released for commercial use.

University of California Radiation Laboratory (Berkeley)

Some of the activities at UCRL are directed toward applications of radioisotopes in the study and treatment of disease in a variety of biomedical research projects. In addition, emphasis is given to the eventual use of high energy beams from such devices as cyclotrons for human therapy.

Human studies on the effect of pituitary irradiation are now in progress to ascertain whether any retardation of cancerous growth can be achieved. The first use of the 184-inch cyclotron at the radiation laboratory on human patients was made in September. All other known treatments, except the removal of the pituitary gland, were attempted. Since the surgical removal of the pituitary gland to arrest cancerous growth is difficult, the cyclotron was used as a surgeon's scalpel in an attempt to retard or completely destroy the action of the gland.

Previous work with animals led to the development of the irradiation techniques being used. The effects of irradiation of the pituitary in animals with certain types of advanced carcinomas were sufficiently encouraging to warrant the use on patients.

Radiosensitivity of the Developing Embryo

A recent study by the New England Deaconess Hospital Laboratory stressed an analysis of vital factors determining the degree of damage that cell destruction immediately following irradiation produces in the later development of the embryo. When pregnant rats and mice are subjected to single doses of as little as 25 *r* of X-rays at various periods during gestation, the embryo often undergoes a series of abnormalities in its development. During the earliest stages the embryos are rather radioresistant. However, at the time when the various organs of the body begin to differentiate, the embryos are more sensitive and the organs tend to become malformed if irradiated at that time. Severe deficiencies in the brain, eyes, and face, and deformities in the spinal cord and bones often result.

It was previously established that the cells are unusually sensitive to radiation at the time when the vital organs of the body are forming. It was therefore thought that any structure caught in this stage at the time of exposure to radiation might be lacking or deformed in the resulting fetus. This idea must now be modified as a result of the work described in the following.

Embryos removed four hours after irradiation were compared with others in the same litters left in place for several days after irradiation. The comparison showed that extensive destruction of cells in the sensitive stage may be followed by apparently complete repair from adjacent primitive dividing cells which are less sensitive to radiation. Certain parts (such as the optic pits and the neural part of the pituitary gland) were not repaired in this manner, although the cells bordering them appeared the same under the microscope as the cells adjacent to repairable areas. It was noted, however, that these areas involved local development of an outward-growing pocket to form a new structural unit on the embryo and an adjacent cluster of especially radiosensitive cells. Further data are needed to establish whether damage to these cells is of primary importance in the loss of the ability of the embryo to repair certain structures.

Radiation Effects in Large Animals

Fundamental studies are needed on the effects produced in large animals by whole-body ionizing irradiation, in order to understand clearly the mechanisms involved in radiation damage. At the present time there are only a few reports available concerning the effects of whole-body irradiation on large animals such as swine, goats, and burros. Information on the effect of chronic daily exposures of large animals to whole-body irradiation is even more limited.

Studies undertaken by the AEC-University of Tennessee program, and through collaboration with the AEC project at UCLA, were aimed at measuring the relation of chronic radiation dose and the detectable physiological changes, in burros exposed to 100 roentgens daily of cobalt 60 gamma rays. The general symptoms of radiation injury are similar to but slower in developing than the symptoms when the daily dose of radiation is higher. A pronounced fall in blood lymphocyte count occurred one hour after the first 100 *r* dose of irradiation. The blood platelets followed the pattern of response obtained when either 200 *r* fractional or a single dose sufficient to kill half the animals was given. However, generalized bleeding from small wounds did not occur until the 21st day, whereas in the 200 *r* series it occurred on the ninth day.

A significant increase in the level of iron in the blood was observed when the total irradiation reached 400 *r*. Two maximal responses were obtained, one after 800 *r* and the other after 1500 *r*. Plasma iron was significantly elevated at the time of death. A primary drop in the blood iron level was observed in one animal associated with a pronounced increase in the white cell count, followed by a secondary drop. The origin of the increased plasma iron is uncertain, but since there was no significant decrease in the red cell count or the hemoglobin concentration, it appears that the iron must be released from body stores rather than from hemoglobin destruction.

Mechanisms of Post-Irradiation Fever

At the AEC project at the University of California (Los Angeles) recent studies suggest that the elevated temperatures observed in rabbits following exposure to X-rays is a result of a direct action of the radiation on the central nervous system. It was formerly believed that the fever might be due to absorption of certain chemical substances (pyrogens) through the injured intestinal lining. However, it was impossible to demonstrate that repeated pyrogen injections before irradiation prevented the fever, although such treatment is known to render the rabbits tolerant to the pyrogens.

Localized irradiation of abdominal regions or of the hindquarters failed to cause the fever, whereas an exposure of 800 roentgens to the head only (with the rest of the body shielded) produced the fever. Since the temperature-regulating centers are known to be principally in a certain part of the brain (hypothalamus), a direct reaction of this part of the brain to the head irradiation is the most obvious explanation. Furthermore, the drug aminopyrine—believed to act directly on these temperature-regulating centers of the brain—was shown to be effective against the fever reaction when given just prior to irradiation.

Further studies are in progress to demonstrate the effects of radiation administered directly to this part of the brain. The investigators think that the so-called "acute shock deaths", occurring in some rabbits within a few hours after whole-body irradiation, may be due in large part to the high fevers developed at this stage.

Organization and Personnel

Outside Training for Employees

Plans were completed to administer Section 161 n. of the Atomic Energy Act of 1954, authorizing the Commission to "assign scientific, technical, professional, and administrative employees for instruction, education, or training by public or private agencies, institutions of learning, laboratories, or industrial or commercial organizations. . . ." This authority will be used when such training assignments are determined to be the effective and economical method of imparting skills and knowledge necessary for best performance of employees' duties.

In view of the limitation on the use of this authority, central control will assure that no more than one percent of the eligible employees will be so assigned at any one time.

Incentive Awards Program

An incentive awards program was established by the Commission in conformity with the Government-wide awards program provided for by Public Law 763 (83d Cong., 2d Sess.). Cash awards will be made to employees for superior accomplishment, suggestions, and inventions resulting in economies or improvements in operations, and special acts or services in the interest of the Government. Honorary awards will also be granted for exceptionally meritorious service to the atomic energy program.

In line with this new program, a Distinguished Service Award was presented to Dr. Lawrence R. Hafstad, Director of the Division of Reactor Development, on December 21. The award cited his "exceptional ability, sound judgment, and extraordinary devotion to duty in planning and directing the many activities which comprise the Commission's program for the development of nuclear reactors."

Personnel and Organizational Changes

The following personnel and organizational changes took place in Washington Headquarters, effective October 1, 1954, or as indicated:

Commissioner Henry D. Smyth resigned as of September 30, to return to Princeton where he will serve as Chairman of the Board of Scientific Engineering and Research. Dr. Willard F. Libby was appointed on October 1 to fill the remainder of Dr. Smyth's term of office.

Dr. John von Neumann was named by the President to a vacancy on the Commission, and his name was submitted to the Senate for confirmation on January 10, 1955.

Commissioner Joseph Campbell resigned his appointment as a member of the Commission effective November 30, and was appointed by the President as Comptroller General.

Appointment of R. W. Cook, former Assistant General Manager for manufacturing, to the position of Deputy General Manager. In addition, Mr. Cook continues to act as Assistant General Manager for Manufacturing.

Establishment of the position of Assistant General Manager and the appointment of Harry S. Traynor, former Special Assistant to the General Manager, to this position. Mr. Traynor provides overall coordination and assistance to the General Manager in directing the activities of the following components: Division of Organization and Personnel; Division of Security; Division of Information Services; Division of Intelligence (formerly Office of Intelligence), with C. H. Reichardt as Director, effective February 1, 1955; Division of

Classification (formerly Office of Classification); and Division of Source and Special Nuclear Materials Accountability (formerly the Source and Fissionable Materials Accountability Branch, Division of Production), with Donald F. Musser as Director.

Establishment of an Inspection Division with Elbert B. Johnson, formerly Chief, Controller's Investigative Staff, as Acting Director. Curtis A. Nelson has been designated Director of the Inspection Division, effective February 1, 1955. Section 25c of the AEC Act of 1954 provides that the Inspection Division "shall be responsible for gathering information to show whether or not the contractors, licensees, and officers and employees of the Commission are complying with the provisions of this Act (except those provisions for which the FBI is responsible) and the appropriate rules and regulations of the Commission." The former Controller's Investigative Staff was transferred to the new division, and studies are being made with respect to the assignment of other AEC inspection activities to the Division.

Appointment of Paul F. Foster as Special Assistant to the General Manager for Liaison to coordinate the Office of International Affairs (formerly Office of Special Projects) and the Congressional Liaison staff.

Designation of Harold L. Price, Deputy General Counsel, to act also as Special Assistant to the General Manager for Licensing to coordinate necessary planning and studies of the Commission's licensing functions under the Atomic Energy Act of 1954, and the development of licensing regulations and procedures.

Effective December 31, Dr. Lawrence R. Hafstad resigned as Director of the Division of Reactor Development to enter private industry as an atomic energy consultant.

Total AEC employment declined by over 300, largely as a result of the reorganization of the New York Operations Office during the period of February 28 through September 30. The New York office was reorganized early in 1954, resulting in the transfer of its production functions to the Oak Ridge Operations Office; shortly thereafter the exploration office of the Raw Materials Division was transferred from New York to Washington, D. C.

Atomic Energy Labor-Management Relations Panel

The Labor-Management Relations Panel issued recommendations in four disputes during this report period. Two of these involved operations contractors and two involved construction contractors. Except in one case, discussed under "National Emergency Dispute at Oak Ridge and Paducah," the parties accepted these recommendations as bases for settlement of their disputes without interruption of the work. In one other dispute, involving construction contractors and building trades unions, the Panel returned the dispute to the parties for further negotiations.

National Emergency Dispute at Oak Ridge and Paducah

Production and maintenance employees of Carbide and Carbon Chemicals Co. were on strike at the gaseous diffusion plants in Oak Ridge, Tenn., and Paducah, Ky., from July 7–9. This dispute arose out of negotiation of wage reopeners between the contractor and United Gas, Coke and Chemical Workers, CIO, and Atomic Trades & Labor Council, AFL. The Atomic Energy Labor-Management Relations Panel had recommended in June that the dispute be settled by an across-the-board wage increase of 6 cents per hour. Carbide accepted, but the unions rejected these recommendations.

The president created a board of inquiry on July 6, pursuant to the Labor-Management Relations Act, 1947. The board, composed of T. Keith Glennan, chairman; John F. Floberg, and Paul H. Sanders, members, heard the issues in dispute between Carbide and the CIO Union on July 8 in Washington and reported to the President on July 10. The board's report on the AFL dispute was submitted to the President on July 19, 1954.

On July 10, CIO employees returned to work pursuant to an understanding between Secretary of Labor James P. Mitchell and CIO officials that AEC would discuss "matters of housing, health and community facilities" in AEC communities with union leaders and that a study would be initiated "to seek to improve labor-management relations and to strengthen collective bargaining in the atomic energy field." The Commission met with representatives of CIO and AFL, and officials of the United Gas, Coke and Chemical Workers to discuss the first matter and subsequently Mr. Mitchell appointed David Cole to head a committee to study atomic energy labor-management relations.

Early in August the Atomic Trades and Labor Council, AFL—representing employees at the X–10 and Y–12 plants in Oak Ridge—voted to reverse its previous action and accept the 6-cent per hour wage increase retroactive to April 15. The CIO, however, continued in disagreement with Carbide and threatened a second strike to enforce its demands. The President instructed the Attorney General to seek an injunction under the emergency provisions of the Taft-Hartley Act on the ground that strikes at the affected plants in Oak Ridge and Paducah would imperil the security of the nation. The injunction was issued by the U. S. District Court in Knoxville on August 11.

Thereafter the parties met in several negotiating sessions with the assistance of the Federal Mediation and Conciliation Service. These efforts were unsuccessful, however, and on October 11 the Board of

Inquiry made a final report to the President advising that the dispute was still unresolved. The National Labor Relations Board, pursuant to the national emergency provisions of the Taft-Hartley law, conducted a secret ballot election on October 21 and 22 among employees as to whether the employees wished to accept the employer's last offer. Employees at both plants voted to reject Carbide's offer of a 6-cent general increase retroactive to April 15. This "last offer" was identical with the terms recommended by the Atomic Energy Labor-Management Relations Panel for settlement of the dispute on June 14.

The injunction was dissolved as required by law on October 30. At the request of union leaders employees remained at work while negotiations continued and a settlement was reached on November 7 providing for a 6-cent increase effective April 15, a 4-cent increase effective January 15, 1955, and revisions in holiday pay practices.

This settlement adopted the Panel recommendations and anticipated the January 1955 reopener in the existing contract. The labor agreement now assures stability of employment conditions until October 1955 when the present contract expires.

Work Stoppages

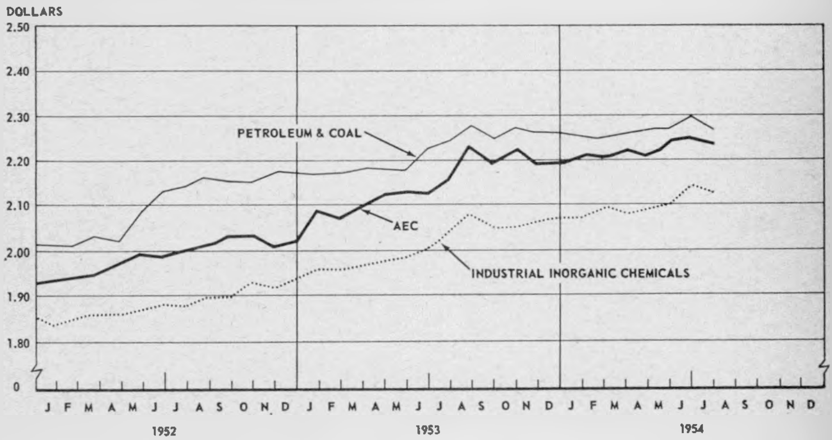
Work stoppages in gaseous diffusion plants at Oak Ridge and Paducah—discussed under "National Emergency Dispute at Oak Ridge and Paducah"—were the most serious in the Commission's history from the standpoint of time lost in production activities. However, despite these losses total time lost through work stoppages amounted to 0.15 of one percent of total working time scheduled for production, research and development activities during the 6-month period through November 1954. Of the 0.15 percent, 0.12 percent was incurred through the Carbide stoppages at Oak Ridge and Paducah, discussed previously, and the remaining 0.03 percent is attributable to stoppages at Monsanto and Berkeley. Maintenance and service activities lost 0.02 percent of scheduled working time. Construction and design contractors lost 2.39 percent of total scheduled working time because of work stoppages, most of which occurred at the Oak Ridge and Portsmouth projects.

The outstanding record of the Savannah River project continued. Project construction employees have now worked 56 million man-hours without a work stoppage, since May 1953. In operations at Savannah River, employees continue to maintain an unblemished work record. The Paducah project lost only 0.28 percent of scheduled construction working time due to one stoppage during this reporting period.

Hours and Earnings

Gross earnings (including overtime and other premium pay) of atomic energy production and maintenance workers were high at $2.303 per hour in September, the latest month for which data are available, because of premium pay for the Labor Day holiday. The more representative August average of $2.238 reflected an increase of 2 cents per hour over the April average. Throughout the entire 6-month period earnings of AEC workers continued to fall in a position between earnings of workers in the petroleum and coal products and the industrial inorganic chemicals industries (industries most nearly comparable in process and equipment).

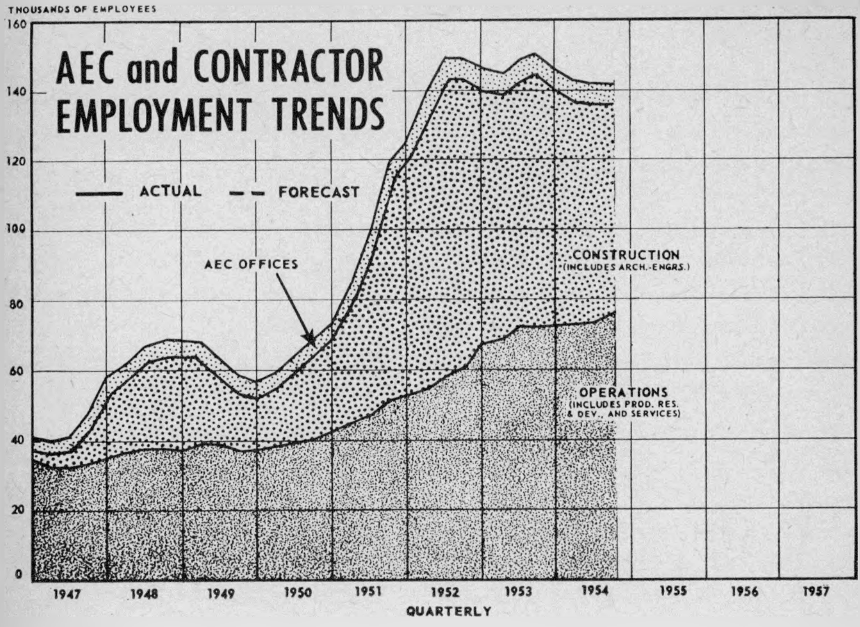
GROSS AVERAGE HOURLY EARNINGS - OF PRODUCTION WORKERS OF AEC OPERATIONS CONTRACTORS COMPARED WITH THOSE OF EMPLOYEES OF SELECTED INDUSTRIES



AEC and Contractor Employment Trends

Employment by AEC and its contractors totaled 141,886 in September 1954. Of this total, 5,946 were AEC employees and 135,940 contractor employees—60,403 in construction and design, and 75,537 in operations.

While overall employment remained fairly constant during the past 6 months, there was an increase in operating employment of 3,221, which was more than offset by a decline of 3,624 in construction employment and 312 in AEC employment. As new plants and facilities now under construction are placed in operation, the trend of total employment in AEC activities will be downward. At the same time, however, employment in AEC plants of operating contractors will continue to increase, while construction employment drops off.



Scientific and Engineering Employment Trends

Scientific and engineering staffs of the AEC and its operating contractors totaled 14,269 in September 1954, consisting of the following occupational categories:

Biological and medical scientists	1, 722
Chemists	2, 574
Physicists	1, 702
Geologists	196
Other physical scientists	626
Chemical engineers	1, 735
Civil engineers	485
Electrical engineers	1, 380
Mechanical engineers	1, 854
Metallurgical engineers	501
Mining engineers	163
Other engineers	1, 331
Total	14, 269

The total represented an increase of about 5 percent during the past 6 months. Unfilled vacancies in contractor scientific and engineering staffs totaled 689 as of September 1954.

Labor Turnover

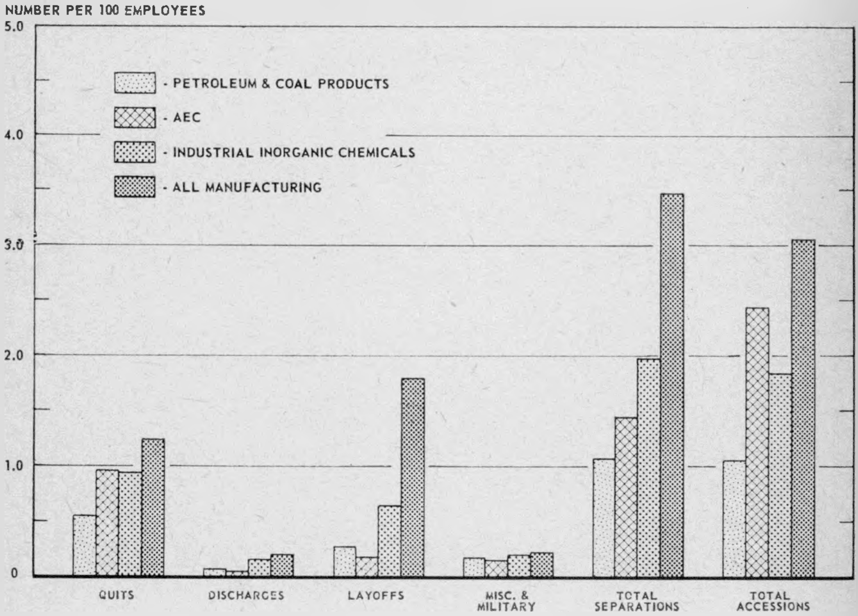
The following chart compares monthly turnover rates per 100 employees in atomic energy contractor operations (excluding construction contractors) with those of related industries during the 6-month period ending September 1954.

Accessions by AEC operations contractors increased more rapidly from April through September than during the previous 6-month period. This increase was due to expanding operations at Goodyear, du Pont, and National Lead, and to the employment of students at many installations during the summer months.

The increase in rates for total separations is largely attributable to students returning to school in September.

LABOR TURNOVER RATE

AVERAGE FOR 6 MONTH PERIOD APRIL - SEPTEMBER, 1954



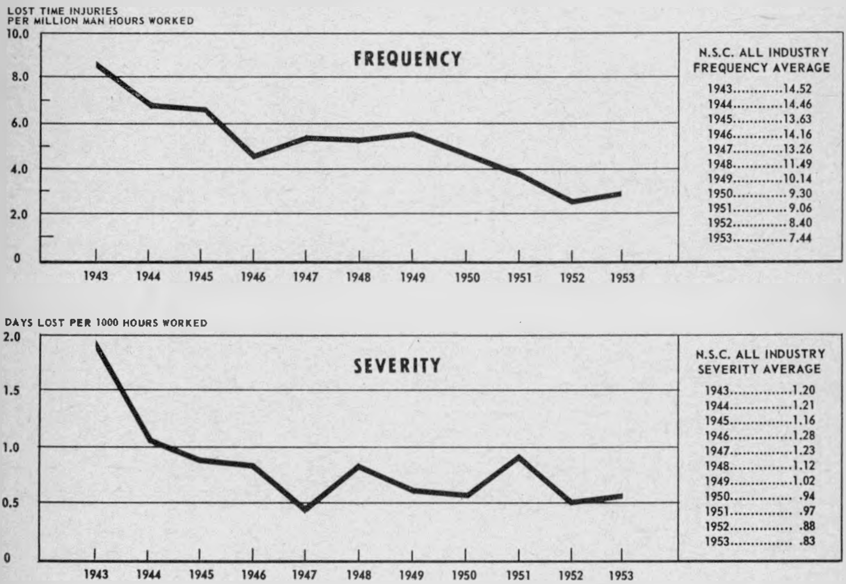
Safety and Fire Protection

The frequency of injuries incurred in all the Commission's activities continued to decline through November 1954. The graph on page 64 shows that there has been improvement since 1949, with the exception of 1953. The drop in new construction in that year, normally accompanied by a disproportionate increase in injuries, raised the rate over 1952. This long downward trend follows a similar trend in the national industrial experience in the postwar years, but AEC's record is relatively lower.

AEC experienced 2.42 injuries per million man-hours for 11 months during 1954, a 16 percent reduction from the 1953 rate of 2.89, and 9 percent below the 2.66 of 1952. There were no radiation injuries during the first 11 months of 1954. However, there were 18 fatal accidents, more than the annual average for the previous 11 years. The lowest number of fatalities (8) in construction activities since 1950 was offset by an increased number (10) in operations.

In the AEC program, fatalities up to November 30 were incurred at a rate of 13 per 100,000 employees, compared to the all-industry average of 26 reported by the National Safety Council for 1953. A graph showing frequency and severity of injuries during the period from 1943 through 1953 follows.

10 YEAR TOTAL EXPERIENCE COMPARED WITH NATIONAL AVERAGE **ALL AEC**
FREQUENCY & SEVERITY OF INJURIES MED-AEC 1943-1953



In order to reduce the number of fatalities through the safety program, emphasis during 1955 will be on prevention of falls and electrocutions—the two largest causes of accidental death.

Accidents in motor vehicles improved through November, as compared with the same period in 1953—0.98 accidents per 100,000 miles in 1954 compared to 1.05 in 1953.

Industrial fire losses through November were above those experienced during the same months of 1953 ($172,944 as compared with $143,076), and the projected fire loss ratio of $.00350 per $100 of property evaluation is below the 1953 rate of $.00451. As usual, the bulk of the fire losses occurred in a few large fires.

Compared with average cost of injuries in selected industries and Federal agencies, the frequency and severity record in the atomic energy program indicates estimated savings of $4,500,000 in workmen's compensation and medical costs during 1954. If the usual factor of 4 to 1 is applied for related costs of accidents in which injuries occur, the estimated savings would be $18 million.

Revision and reissuance of AEC safety and fire protection standards, development of preventive measures and compilation of information on new hazards were special staff activities during the past 6 months. A number of awards and citations were conferred upon AEC contractors by the National Safety Council, National Fire Protection Association, State industrial commissions, and parent contractor companies. Similarly, promotion of the Commission's incentive awards to contractors and AEC offices has had a beneficial influence on the safety program.

The following have qualified for AEC safety awards:

AWARD OF HONOR

	Employee man-hours without injury
E. I. du Pont de Nemours & Co., Inc., Savannah River Project Construction, Augusta, Ga	3, 760, 361
Carbide and Carbon Chemicals Co., Y-12 Plant, Oak Ridge, Tenn	3, 126, 787
Sandia Corp., Albuquerque, N. Mex	3, 057, 441

AWARD OF MERIT

E. I. du Pont de Nemours & Co., Inc., Dana Plant, Terre Haute, Ind	1, 653, 986
Monsanto Chemical Co., Mound Laboratory, Miamisburg, Ohio	1, 605, 884
Maxon Construction Co., Inc., Oak Ridge, Tenn	1, 422, 981
U. S. AEC Field Office, Los Alamos, N. Mex	1, 396, 093
Phillips Petroleum Co., National Reactor Testing Station, Idaho Falls, Idaho	1, 298, 406
National Lead Co., Fernald Feed Materials Plant, Fernald, Ohio	1, 280, 282
Peter Kiewit Sons' Co., Portsmouth, Ohio	1, 092, 349
Dow Chemical Co., Rocky Flats Plant, Rocky Flats, Colo	1, 070, 604

Part Two

Condensed AEC Annual Financial Report Fiscal Year 1954

325448—55——6

Condensed AEC Annual Financial Report, Fiscal Year 1954

Appropriations for fiscal year 1954 amounted to approximately $1.0 billion. This brings the total amount appropriated to the atomic energy program to $13.2 billion. Of this amount $8.5 billion was expended prior to June 30, 1953, $1.9 billion expended during fiscal year 1954, and $2.8 billion remained unexpended at June 30, 1954.

Of the $13.2 billion appropriated to the atomic energy program $7.7 billion is now in the form of plant, equipment, stores inventories and other assets held by AEC. For security reasons net assets of AEC as shown here are understated by the value of inventories of source and special nuclear materials and weapons components on hand.

The Commission's progress in the plant expansion program authorized in 1953 is illustrated by the increase in plant and equipment to $5.7 billion at June 30, 1954, from $4.6 billion at June 30, 1953. Completed facilities increased to $4.1 billion at June 30, 1954, from $3.1 billion at June 30, 1953. Construction work in progress increased to $1.6 billion at June 30, 1954, from $1.4 billion at June 30, 1953.

The statement of operations further indicates the extent of expansion of the atomic energy program. Operating costs—including the cost of procuring and producing source and special nuclear materials and weapons components—increased $100 million, totaling $1.0 billion for fiscal year 1954.

Income from communities exceeded community costs, excluding depreciation, for the first time in fiscal year 1954, when community revenue amounted to $1.2 million more than such costs, an improvement of $2.5 million over fiscal year 1953.

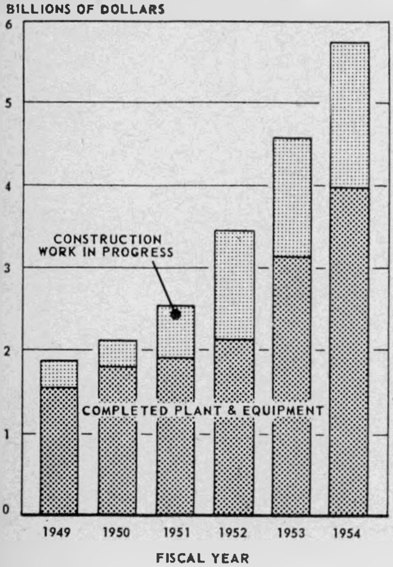
AEC administrative expenses decreased to $33.6 million in 1954 from $34.4 million in 1953, in spite of an increase in total operating costs.

Cash with contractors decreased to $49 million at June 30, 1954, from $119 million at June 30, 1953. This resulted from implementation of a policy under which advances are made to cover daily, weekly, or biweekly cash requirements rather than monthly or quarterly requirements. This decrease in cash with contractors will result in interest savings to the Government of approximately $1.6 million a year.

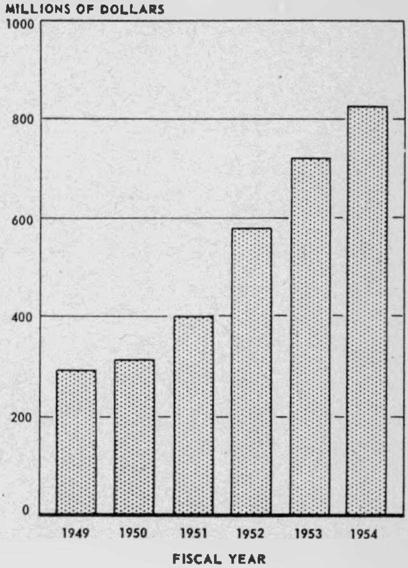
A Condensed Comparative Balance Sheet, Statement of Operations, and Summary of the Government's investment in the atomic energy program follow on pages 72–75. The chart (p. 70) illustrates the increase in AEC plant and program costs for fiscal years 1949–1954.

AEC GROWTH

PLANT & EQUIPMENT



OPERATIONS (Program Costs)



COMPARATIVE BALANCE SHEET AS

Assets	1954	1953
Cash and working funds:		
U. S. Treasury	$2, 896, 999, 252	$3, 747, 313, 554
Contractors	49, 226, 669	118, 847, 778
Other Federal agencies	100, 924, 142	73, 871, 429
	3, 047, 150, 063	3, 940, 032, 761
Accounts receivable, less allowance for uncollectible accounts	7, 084, 337	13, 408, 396
Inventories, less allowance for loss	88, 514, 158	91, 965, 528
Prepayments and deferred charges	22, 467, 004	19, 789, 126
Plant and equipment at cost:		
Production facilities	2, 957, 784, 473	2, 132, 869, 167
Research facilities	616, 548, 525	548, 010, 157
Community facilities	300, 247, 479	298, 453, 569
General facilities	215, 690, 669	170, 179, 801
Construction work in progress	1, 615, 134, 076	1, 429, 576, 436
	5, 705, 405, 222	4, 579, 089, 130
Less accumulated depreciation	860, 148, 022	755, 149, 196
	4, 845, 257, 200	3, 823, 939, 934
Collateral funds and other deposits	30, 225, 302	44, 525, 235
Total assets	$8, 040, 698, 064	$7, 933, 660, 980

NOTES:

Inventories of raw source materials, special nuclear materials, and weapons parts and assemblies are excluded from the balance sheet.

The balance sheet does not include the market value of 247,886,447 troy ounces of silver at June 30, 1954, and 350,924,917 troy ounces of silver at June 30, 1953, provided by the Treasurer of the United States for use in the Y-12 Oak Ridge plant in the form of electrical connections. Its market value was $211,323,000 at June 30, 1954 and $299,163,000 at June 30, 1953. This silver is returnable in bullion form to the Treasurer of the United States for processing into commercial bars.

OF JUNE 30, 1954, AND JUNE 30, 1953

LIABILITIES AND AEC EQUITY

	1954	1953
Liabilities:		
Accounts payable and accrued expenses	$203, 258, 426	$168, 407, 193
Working funds from other Federal agencies	86, 914, 981	48, 976, 742
Employees' and other funds on deposit	9, 014, 668	9, 903, 069
Deferred credits	387, 993	354, 444
Total liabilities	299, 576, 068	227, 641, 448
AEC equity:		
Equity, beginning of year	7, 706, 019, 532	4, 475, 883, 210
Additions:		
Appropriated funds (net)	1, 042, 492, 000	4, 136, 475, 500
Transfers from other Federal agencies without reimbursement	1, 985, 284	7, 278
	8, 750, 496, 816	8, 612, 365, 988
Deductions:		
Net cost of operations and prior years' adjustments (See Comparative Statement of Operations)	1, 001, 305, 246	900, 555, 265
Funds returned to U. S. Treasury	8, 069, 574	5, 791, 191
	1, 009, 374, 820	906, 346, 456
Equity, end of year	7, 741, 121, 996	7, 706, 019, 532
Total liabilities and AEC equity	$8, 040, 698, 064	$7, 933, 660, 980

NOTES: (Cont'd.)

As part of the uranium procurement program, the Commission has guaranteed minimum prices through March 1962, for domestic ores and concentrates. In addition, bonuses are payable under certain specified circumstances to encourage the discovery of new uranium resources. The Commission also has long-term commitments for the procurement of foreign ores, the development of foreign ore sources, and for the return of residues of ores processed in this country.

In addition to the liabilities shown on the balance sheet, AEC had at June 30, 1954; (a) a commitment for unfunded accrued annual leave of AEC employees of $4,644,580; (b) known commitments represented by unpaid obligations of $2,364,503,714; and (c) contingent liabilities for claims filed against the Government or AEC contractors of approximately $25,000,000.

COMPARATIVE STATEMENT OF OPERATIONS FOR THE YEARS ENDED JUNE 30, 1954 AND JUNE 30, 1953

	1954	1953
Production, research and development:		
Source and special nuclear materials	$415, 931, 022	$281, 039, 542
Weapons	218, 811, 230	236, 385, 273
Reactor development	84, 852, 074	91, 129, 087
Physical research (net)[1]	39, 312, 424	38, 401, 571
Biology and medicine	24, 936, 611	24, 813, 806
	783, 843, 361	671, 769, 279
Community operations:		
Operating costs	19, 040, 999	19, 648, 386
Less revenue	20, 290, 801	18, 382, 224
	(1, 249, 802)	1, 266, 162
AEC administrative expenses	33, 614, 211	34, 426, 151
Security investigations	12, 592, 903	12, 547, 537
Total program costs and expenses	828, 800, 673	720, 009, 129
Other expenses and income:		
Depreciation and obsolescence	205, 162, 436	176, 972, 295
Projects abandoned	5, 467, 189	713, 414
Other charges	3, 560, 549	10, 280, 492
	214, 190, 174	187, 966, 201
Other income	(3, 813, 095)	(3, 379, 052)
	210, 377, 079	184, 587, 149
Net cost of operations for the year [2]	1, 039, 177, 752	904, 596, 278
Prior years' adjustments (net)	(37, 872, 506)	(4, 041, 013)
Net cost of operations and prior years' adjustments	1, 001, 305, 246	900, 555, 265

[1] Costs have been reduced by proceeds from sales of isotopes aggregating $1,200,176 for the fiscal year ended June 30, 1954, and $866,273 for the fiscal year ended June 30, 1953.

[2] Costs of operations include total costs incurred during the year for procurement and production, i. e., total input, with no adjustment for costs of completed product or for costs of production in process.

U. S. GOVERNMENT INVESTMENT IN THE ATOMIC ENERGY PROGRAM FROM JUNE 1940 THROUGH JUNE 1954

Appropriated funds disbursed, net of reimbursements:		
National Defense Research Council		[1] $468, 000
Office of Scientific Research and Development		[1] 14, 624, 810
War Department (Manhattan Engineer District):		
Fiscal Year 1943	$77, 098, 355	
Fiscal Year 1944	730, 321, 470	
Fiscal Year 1945	858, 571, 646	
Fiscal Year 1946	366, 355, 447	
Fiscal Year 1947 (part)	185, 975, 321	
		2, 218, 322, 239
Atomic Energy Commission:		
Fiscal Year 1947 (part)	146, 108, 325	
Fiscal Year 1948	477, 557, 826	
Fiscal Year 1949	627, 347, 271	
Fiscal Year 1950	534, 308, 839	
Fiscal Year 1951	920, 467, 872	
Fiscal Year 1952	1, 669, 386, 036	
Fiscal Year 1953	1, 812, 672, 917	
Fiscal Year 1954	1, 930, 514, 183	
		8, 118, 363, 269
Total payments (net)		10, 351, 778, 318
Unexpended balance of appropriation, June 30, 1954		2, 806, 753, 039
Total appropriated funds		13, 158, 531, 357
Less:		
Collections paid to U. S. Treasury	[2] $30, 233, 317	
Property and services transferred to other Federal agencies without reimbursement, net of such transfers received from other Federal agencies	[3] 126, 576	
		30, 359, 893
Total investment through June 30, 1954		[4] 13, 128, 171, 464
Less:		
Cost of operations and cost of inventories of source and special nuclear materials and weapons components on hand at June 30, 1954:		
June 1940 through June 30, 1953	$4,385,744, 222	
July 1, 1953 through June 30, 1954 per statement of operations	1,001,305, 246	5, 387, 049, 468
AEC equity at June 30, 1954		[5] $7, 741, 121, 996

[1] Based on published reports.
[2] From January 1, 1947, to date. Prior data not available.
[3] For fiscal years 1949 through 1954. Prior data not available.
[4] The total investment through June 30, 1954, represents only the funds appropriated to agencies that have been charged specifically with the responsibility of administering the atomic energy program.
[5] Understated by the cost of inventories of source and special nuclear materials and weapons components on hand at June 30, 1954.

APPENDIX 1

Organization and Principal Staff of U. S. Atomic Energy Commission

Atomic Energy Commission	Lewis L. Strauss, *Chairman.*
	Willard F. Libby.
	Thomas E. Murray.
Assistant to the Chairman	John MacKenzie, Jr.
Assistant to the Chairman	McKay Donkin.
Assistant to the Chairman	Roy B. Snapp.
Assistant to the Chairman	Everett Holles.
General Manager	K. D. Nichols.
Deputy General Manager	R. W. Cook.
Special Assistant to General Manager (Liaison)	Paul F. Foster.
Special Assistant to General Manager for Licensing	Harold L. Price.
Special Assistant to General Manager	Charles Vanden Bulck.
Assistant General Manager	Harry S. Traynor.
Assistant General Manager for Administration	James L. Kelehan.
Assistant General Manager for Manufacturing	R. W. Cook, *Acting.*
Assistant General Manager for Research and Industrial Development	A. Tammaro.
Controller	Don S. Burrows.
General Counsel	William Mitchell.
Secretary to Commission	W. B. McCool.
Chief, Office of Operations Analysis	C. D. W. Thornton.
Director, Office of International Affairs	John A. Hall.
Director, Division of Biology and Medicine	Dr. John C. Bugher.
Director, Division of Construction and Supply	John A. Derry.
Director, Division of Military Application	Brig. Gen. K. E. Fields, U. S. A.
Director, Division of Production	E. J. Bloch.
Director, Division of Raw Materials	Jesse C. Johnson.

Director, Division of Reactor Development	W. Kenneth Davis, *Acting.*
Director, Division of Research	Thomas H. Johnson.
Director, Division of Classification	Charles D. Luke.
Director, Division of Information Services	Morse Salisbury.
Director, Division of Inspection	E. B. Johnson, *Acting.*[1]
Director, Division of Intelligence	C. H. Reichardt, *Acting.*[2]
Director, Division of Organization and Personnel	Oscar S. Smith.
Director, Division of Security	John A. Waters, Jr.
Director, Division of Source and Special Nuclear Materials Accountability	D. F. Musser.
Managers of Operations Offices and Areas:	
Chicago (Ill.) Operations Office	J. J. Flaherty.
Lockland (Ohio) Area	E. M. Velten.
Pittsburgh (Pa.) Area	Lawton D. Geiger.
Grand Junction (Colo.) Operations Office	Sheldon P. Wimpfen.
Hanford (Wash.) Operations Office	David F. Shaw.
Idaho (Idaho Falls) Operations Office	Allan C. Johnson.
New York (N. Y.) Operations Office	Merril Eisenbud.
Brookhaven (Long Island, N. Y.) Area	E. L. Van Horn.
Oak Ridge (Tenn.) Operations Office	S. R. Sapirie.
Dayton (Miamisburg, Ohio) Area	John H. Roberson.
Fernald (Cincinnati, Ohio) Area	Clarence L. Karl.
New Brunswick (N. J.) Area	C. J. Rodden.
Paducah (Ky.) Area	Kennedy C. Brooks.
Portsmouth (Ohio) Area	Kenneth A. Dunbar.
St. Louis (Mo.) Area	Fred H. Belcher.
San Francisco (Calif.) Operations Office	Harold A. Fidler.
Santa Fe (Albuquerque, N. Mex.) Operations Office	Donald J. Leehey.
Eniwetok (Albuquerque, N. Mex.) Field Office	Paul W. Spain.

[1] Curtis A. Nelson has been designated Director, Division of Inspection, effective February 1, 1955.

[2] Dr. Reichardt has been designated Director, Division of Intelligence, effective February 1, 1955.

Managers of Operations Offices and Areas—Continued	
Santa Fe (Albuquerque, N. Mex.) Operations Office—Continued	
Kansas City (Mo.) Field Office	JAMES C. STOWERS.
Las Vegas (Nev.) Field Office	SETH R. WOODRUFF, Jr.
Los Alamos (N. Mex.) Field Office	FRANK C. DILUZIO.
Rocky Flats (Colo.) Field Office	GILBERT C. HOOVER.
Savannah River (Augusta, Ga.) Operations Office	CURTIS A. NELSON.[3]
Dana (Terre Taute, Ind.) Area	CHARLES W. REILLY.
Wilmington (Del.) Area	S. D. CHITTENDEN.
Schenectady (N. Y.) Operations Office	JON D. ANDERSON.

[3] Robert C. Blair has been designated Director, Savannah River Operations Office, February 1, 1955.

APPENDIX 2

Membership of Committees

STATUTORY COMMITTEES

Joint Committee on Atomic Energy—Eighty-fourth Congress

This committee was established by the Atomic Energy Act of 1946, and continued under the Atomic Energy Act of 1954, 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 is 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 Clinton P. Anderson (New Mexico), *Chairman.*
Senator Richard B. Russell (Georgia).
Senator John O. Pastore (Rhode Island).
Senator Albert Gore (Tennessee).
Senator Henry M. Jackson (Washington).
Senator Bourke B. Hickenlooper (Iowa).
Senator Eugene D. Millikin (Colorado).
Senator William F. Knowland (California).
Senator John W. Bricker (Ohio).
Representative Carl T. Durham (North Carolina).
Representative Chet Holifield (California).
Representative Melvin Price (Illinois).
Representative Paul J. Kilday (Texas).
Representative W. Sterling Cole (New York).
Representative John J. Dempsey (New Mexico).
Representative Carl Hinshaw (California).
Representative James E. Van Zandt (Pennsylvania).
Representative James T. Patterson (Connecticut).

Military Liaison Committee

Under Sec. 27 of the Atomic Energy Act of 1954, "there is hereby established a Military Liaison Committee consisting of—a. a Chairman, who shall be the head thereof and who shall be appointed by the President, by and with the advice and consent of the Senate, who shall serve at the pleasure of the President, and who shall receive compensation at the rate prescribed for an Assistant Secretary of Defense; and b. a representative or representatives from each of the Departments of the Army, Navy, and Air Force, in equal numbers, as determined by the Secretary of Defense, to be assigned from each Department by the Secretary thereof, and who will serve without additional compensation. The Chairman of the Committee may designate one of the members of the Committee as Acting Chairman to act during his absence. The Commission shall advise and consult with the Department of Defense, through the Committee, on all atomic energy matters which the Department of Defense deems to relate to military applications of atomic weapons or atomic energy including the development, manufacture, use, and storage of atomic weapons, the allocation of special nuclear material for military research, and the control of information relating to the manufacture or utilization of atomic weapons; and shall keep the Department of Defense, through the Committee, fully and currently informed of all such matters before the Commission. The Department of Defense, through the Committee, shall keep the Commission fully and currently informed on all matters within the Department of Defense which the Commission deems to relate to the development or application of atomic energy. The Department of Defense, through the Committee, shall have the authority to make written recommendations to the Commission from time to time on matters relating to military applications of atomic energy as the Department of Defense may deem appropriate. If the Department of Defense at any time concludes that any request, action, proposed action, or failure to act on the part of the Commission is adverse to the responsibilities of the Department of Defense, the Secretary of Defense shall refer the matter to the President whose decision shall be final."

Hon. HERBERT B. LOPER, *Chairman.*
Brig. Gen. KENNER F. HERTFORD, United States Army.
Brig. Gen. HARRY McK. ROPER, United States Army.
Rear Adm. GEORGE C. WRIGHT, United States Navy.
Rear Adm. PAUL H. RAMSEY, United States Navy.
Maj. Gen. HERBERT B. THATCHER, United States Air Force.
Brig. Gen. RICHARD T. COINER, Jr., United States Air Force.

General Advisory Committee

This committee was established by the Atomic Energy Act of 1946 (sec. 2 (b)), and is continued by Sec. 26 of the Atomic Energy Act of 1954. 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.

Dr. I. I. RABI, chairman; professor of physics, Columbia University, New York, N. Y.
Dr. JESSE W. BEAMS, professor of physics, University of Virginia, Charlottesville, Va.
Dr. J. B. FISK, vice president—research, Bell Telephone Laboratories, Murray Hill, N. Y.
Dr. WARREN C. JOHNSON, chairman, department of chemistry, University of Chicago, Chicago, Ill.
Dr. EDWIN M. McMILLAN, professor of physics, UCRL, Berkeley, Calif.
EGER V. MURPHREE, president, Standard Oil Development Co., New York, N. Y.
Dr. J. C. WARNER, president, Carnegie Institute of Technology, Pittsburgh, Pa.
WALTER G. WHITMAN, head, department of chemical engineering, Massachusetts Institute of Technology, Cambridge, Mass.
Dr. EUGENE P. WIGNER, professor of physics, Princeton University, Princeton, N. J.
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, and is the Board designated under Section 157a of the Atomic Energy Act of 1954. Section 157 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.

Casper W. Ooms, chairman; firm of Casper W. Ooms, Chicago, Ill.
Isaac Harter, of Babcock & Wilcox Tube Co., Beaver Falls, Pa.
John V. L. Hogan, consulting engineer, Hogan Laboratories, Inc., New York, N. Y.

COMMITTEE OF SENIOR REVIEWERS

The Committee of Senior Reviewers studies the major technical activities of the Atomic Energy Commission program and advises the Commission on classification and declassification matters, making recommendations with respect to the rules and guides for the control of scientific and technical information. The committee consists of six members appointed for a term of 5 years on a rotating basis.

Dr. Warren C. Johnson, chairman; associate dean of physical sciences, University of Chicago, Chicago, Ill.
Dr. Thomas B. Drew, head, department of chemical engineering, Columbia University, New York, N. Y.
Dr. Alvin C. Graves, J division leader, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.
Dr. John P. Howe, section chief, reactor materials, North American Aviation, Inc., Downey, Calif.
Dr. Winston M. Manning, director, chemistry division, ANL, Lemont, Ill.
Dr. J. R. Richardson, associate professor of physics, University of California, Los Angeles, Calif.

ADVISORY BODIES TO THE ATOMIC ENERGY COMMISSION

Advisory Committee on Biology and Medicine

The Advisory Committee on Biology and Medicine was created in September 1947, on the recommendation of the Commission's Medical Board of Review. The committee reviews the AEC programs in medical and biological research and health and recommends to the Commission general policies in these fields.

Dr. Gioacchino Failla, chairman; director, department of radiology, Columbia University Medical School, New York, N. Y.
Dr. Charles H. Burnett, professor of medicine, University of North Carolina, Chapel Hill, N. C.
Dr. Simeon T. Cantril, director, Tumor Institute of Swedish Hospital, Seattle, Wash.
Dr. Edward A. Doisy, director, department of biochemistry, St. Louis University School of Medicine, St. Louis, Mo.
Dr. Curt Stern, professor of zoology, University of California, Berkeley, Calif.
Dr. Shields Warren, vice chairman; pathologist, New England Deaconess Hospital, Boston, Mass.

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.

HENRY P. BRANDIS, Jr., dean of the law school, University of North Carolina, Chapel Hill, N. C.

SHELDON D. ELLIOTT, director of institute for judical administration, New York University, New York, N. Y.

ROBERT KINGSLEY, dean, school of law, University of Southern California, Los Angeles, Calif.

EDMUND R. PURVES, executive director, American Institute of Architects, Washington, D. C.

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

Advisory Committee on Brazing

This committee was formed at AEC request by the Welding Research Council of the Engineering Foundation to serve in an advisory capacity on problems involving fabrication by brazing.

F. W. DAVIS, chairman; U. S. Atomic Energy Commission, Washington, D. C.

CHARLES D. COXE, assistant manager, metallurgical department, Handy and Harman, Bridgeport, Conn.

A. E. FOCKE, manager, materials development, Aircraft Nuclear Propulsion Project, General Electric, Cincinnati, Ohio.

FRANK G. HARKINS, chief welding engineer, Solar Aircraft Co., San Diego, Calif.

Lt. T. HIKIDO, Wright Air Development Center, Wright Patterson Air Force Base, Dayton, Ohio.

G. O. HOGLUND, welding engineer, process and development laboratories, Aluminum Company of America, New Kensington, Pa.

T. E. KIHLGREN, welding section, research laboratory, International Nickel Co., Bayonne, N. J.

W. D. MANLY, head metallurgist, ANP division, ORNL, Oak Ridge, Tenn.

ROBERT L. PEASLEE, development engineeer, Wall Colmonoy Corp., Detroit, Mich.

H. R. SPENDELOW, Jr., assistant director of research, Metals Research Laboratories, Electric Metallurgical Co., New York, N. Y.

W. SPRARAGEN, secretary; director, Welding Research Council, New York, N. Y.

LYALL ZICKRICK, supervisor, materials application unit, Knolls Atomic Power Laboratory, Schenectady, N. Y.

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.

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

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

Dr. Joseph E. Mayer, professor of chemistry, University of Chicago, Chicago, Ill.

Dr. Don M. Yost, professor of chemistry, California Institute of Technology, Pasadena, Calif.

Advisory Committee on Industrial Information

This committee was reconstituted and expanded in April 1952 to replace an ad hoc committee appointed in 1949 to advise the AEC on disseminating unclassified technological information to industry. The members are visiting AEC sites to identify information of use to industry which should be submitted for declassification and recommending arrangements for the widest possible publication and distribution of such declassifiable information.

Sidney D. Kirkpatrick, chairman; vice president and director of editorial development, McGraw-Hill Book Co., Inc., New York, N. Y.

Dr. Allan G. Gray, editor, Steel, Penton Publishing Co., Cleveland, Ohio.

Eugene Hardy, National Association of Manufacturers, Washington, D. C.

Keith Henney, editor, Nucleonics and Electronics, McGraw-Hill Publishing Co., Inc., American Institute of Radio Engineers, New York, N. Y.

Dr. Elmer Hutchisson, editor, Journal of Applied Physics, American Institute of Physics, New York, N. Y.

Norman H. Jacobson, editor, market issue, Electric Light and Power, Haywood Publishing Co., New York, N. Y.

Walter E. Jessup, editor, Civil Engineering, The American Society of Civil Engineers, New York, N. Y.

Andrew W. Kramer, editor, Power Engineering, The Technical Publishing Co., Chicago, Ill.

Everett S. Lee, American Institute of Electrical Engineers, New York, N. Y.

Dr. Walter J. Murphy, editor, Chemical and Engineering News, American Chemical Society, Washington, D. C.

Frederick A. Pawley, research secretary, American Institute of Architects, Washington, D. C.

Edward H. Robie, secretary, American Institute of Mining and Metallurgical Engineers, New York, N. Y.

Karl T. Schwartzwalder, The American Ceramic Society, Inc., Columbus, Ohio.

George F. Sullivan, managing editor, The Iron Age, Chilton Publication, Inc., New York, N. Y.

E. E. Thum, editor, Metal Progress, American Society for Metals, Cleveland, Ohio.

Oliver H. Townsend, secretary, Atomic Industrial Forum, Inc., New York, N. Y.

S. A. Tucker, publications manager, American Society of Mechanical Engineers, New York, N. Y.

F. J. Van Antwerpen, 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.

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. Samuel E. Eaton, chairman; A. D. Little, Inc., Cambridge, Mass.

Dr. Richard Chamberlain, University of Pennsylvania Medical School, Philadelphia, Pa.

Dr. John E. Christian, associate professor, department of pharmaceutical chemistry, Purdue University, Lafayette, Ind.

Dr. Leon O. Jacobson, associate dean, division of biological sciences, University of Chicago, Chicago, Ill.

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

Dr. Howard E. Skipper, associate director, Southern Research Institute, Birmingham, Ala.

Dr. John E. Willard, professor of chemistry, University of Wisconsin, Madison, Wis.

Dr. Paul C. Aebersold, secretary; chief, isotopes division, AEC, Oak Ridge, Tenn.

Advisory Committee on Reactor Safeguards

The committee, formed in 1953 from the former Reactor Safeguard Committee and the Industrial Committee on Reactor Location Problems, serves in an advisory capacity to the AEC with regard to the hazards associated with the operation of reactor facilities. The committee reviews safety studies prepared by organizations planning to build or operate reactor facilities and appraises proposed reactor locations in terms of accepted industrial safety standards.

Dr. C. Rogers McCullough, chairman; general development department, Monsanto Chemical Co., St. Louis, Mo.

Dr. Manson Benedict, professor of chemical engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Dr. Harvey Brooks, professor of physics, Harvard University, Cambridge, Mass.

Dr. Willard P. Conner, manager, physics division, research department, Hercules Powder Co., Wilmington, Del.

Dr. R. L. Doan, manager, atomic energy division, Phillips Petroleum Co., Idaho Falls, Idaho.

Dr. Hymer Friedell, director, department of radiology, Lakeside Hospital, Western Reserve University, Cleveland, Ohio.

Dr. I. B. Johns, Monsanto Chemical Co., Everett, Mass.

Dr. Mark M. Mills, radiation laboratory, University of California, Livermore, Calif.

K. R. Osborn, manager of industrial development, general chemical division, Allied Chemical and Dye Corp., New York, N. Y.

D. A. Rogers, manager, central engineering, Allied Chemical and Dye Corp., Morristown, N. J.

Reuel C. Stratton, supervising chemical engineer, engineering and loss control division, the Travelers Insurance Co., Hartford, Conn.

Dr. Edward Teller, professor of physics, University of California, Berkeley, Calif.

Dr. Abel Wolman, head, department of sanitary engineering and water resources, Johns Hopkins University, Baltimore, Md.

Dr. HARRY WEXLER, chief, scientific services division, U. S. Weather Bureau, Department of Commerce, Washington, D. C.

Dr. C. R. RUSSELL, secretary; U. S. Atomic Energy Commission, Washington, D. C.

Advisory Committee on Stainless Steel

This committee, formed in 1950, by the Welding Research Council of the Engineering Foundation, in July 1951 at AEC request became advisory to the Commission in regard to research and development to improve the welding of type 347 stainless steel. All data resulting from these investigations are being made public. In October 1953 the scope of the Committee's services was enlarged to include the manufacture, fabrication, and use of all stainless steels.

Dr. V. N. KRIVOBOK, chairman; development and research division, International Nickel Co., Inc., New York, N. Y.

W. O. BINDER, research laboratory, Union Carbide and Carbon Co., Niagara Falls, N. Y.

F. W. DAVIS, U. S. Atomic Energy Commission, Washington, D. C.

W. B. DELONG, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del.

R. B. GUNIA, Carnegie Illinois Steel Corp., Pittsburgh, Pa.

LORIN K. POOLE, project engineer, Arcos Corp., Philadelphia, Pa.

Dr. M. A. SCHEIL, director, metallurgical research, A. O. Smith Corp., Milwaukee, Wis.

R. DAVID THOMAS, Jr., vice president & director, research & engineering, Arcos Corp., Philadelphia, Pa.

AEC Computer Council

This group is appointed on a yearly basis to make a continuing review of the AEC computing requirements and facilities and to recommend the most advantageous apportionment of computer time on the AEC Computer at New York University. The following members were appointed to serve from July 1954 to July 1955.

Dr. EDWARD TELLER, chairman; professor of physics, University of California, Berkeley, Calif.

Dr. ALSTON S. HOUSEHOLDER, mathematics panel, Oak Ridge National Laboratory, Oak Ridge, Tenn.

Dr. HENRY HURWITZ, Jr., supervisor theoretical physics division, Knolls Atomic Power Laboratory, Schenectady, N. Y.

Dr. GEORGE A. KOLSTAD, vice chairman; physics branch, division of research, AEC, Washington, D. C.

Dr. N. C. METROPOLIS, group leader, theoretical division, LASL, Los Alamos, N. Mex.

Dr. ROBERT D. RICHTMYER, secretary; theoretical division, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.

Dr. BERNARD SPINRAD, physics division, Argonne National Laboratory, Chicago, Ill.

Dr. IRA F. ZARTMAN, U. S. Atomic Energy Commission, Washington, D. C.

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.

Chairmanship (vacant).

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

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

FRANCIS C. FRARY, technical advisor, aluminum research laboratory, Aluminum Company of America, New Kensington, Pa.

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

ERNEST H. ROSE, staff metallurgist, materials advisory board, National Research Council, Washington, D. C.

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.

Nuclear Cross Sections Advisory Group

This group is appointed on a yearly basis to make a continuing review of the AEC program of nuclear cross section measurements, and to evaluate the needs for cross section information in the various activities of the AEC. The following members were appointed to serve from July 1954 to July 1955.

Dr. RICHARD F. TASCHEK, chairman; department of physics, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.

Dr. LOWELL M. BOLLINGER, department of physics, ANL, Lemont, Ill.

Dr. TOM W. BONNER, department of physics, Rice Institute, Houston, Tex.

Dr. JOSEPH L. FOWLER, physics division, Oak Ridge National Laboratory, Oak Ridge, Tenn.

Dr. HERBERT GOLDSTEIN, Nuclear Development Associates, Inc., White Plains, N. Y.

Dr. WILLIAM W. HAVENS, Jr., department of physics, Columbia University, New York, N. Y.

Dr. DONALD J. HUGHES, department of physics, Brookhaven National Laboratory, Upton, Long Island, N. Y.

Dr. ALEXANDER S. LANGSDORF, physics division, Argonne National Laboratory, Chicago, Ill.

Dr. CARL O. MUEHLHAUSE, department of physics, Brookhaven National Laboratory, Upton, Long Island, N. Y.

Dr. HENRY W. NEWSON, professor of physics, Duke University, Durham, N. C.

Dr. JACK M. PETERSON, cyclotron group, University of California Radiation Laboratory, Livermore, Calif.

Dr. HERBERT S. POMERANCE, physics division, Oak Ridge National Laboratory, Oak Ridge, Tenn.

Dr. THOMA M. SNYDER, manager, nuclear physics section, Knolls Atomic Power Laboratory, Schenectady, N. Y.

Dr. LOUIS A. TURNER, physics division, Argonne National Laboratory, Chicago, Ill.

Dr. GEORGE A. KOLSTAD, vice chairman; physics branch, division of research, AEC, Washington, D. C.

Dr. IRA F. ZARTMAN, U. S. Atomic Energy Commission, Washington, D. C.

Dr. CARROLL W. ZABEL, secretary; department of physics, Los Alamos Scientific Laboratory, Los Alamos, N. Mex.

Patent Advisory Panel

This panel was appointed in January 1947. 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, Washington, D. C.
William H. Davis; of Davis, Hoxie & Faithfull, New York, N. Y.
John A. Dienner; of Brown, Jackson, Boettcher & Dienner, Chicago, Ill.
Casper W. Ooms; firm of Casper W. Ooms, Chicago, Ill.

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 to 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 Purcell & Nelson, Washington, D. C.
Dr. Paul E. Klopsteg, associate director, National Science Foundation, Washington, D. C.
William E. Leahy, president, Columbus University, Washington, D. C.

Stack Gas Problem Working Group

The appointment of this group was authorized in May 1948 to advise the Atomic Energy Commission and its contractors on problems in the treatment and control of gaseous effluents. The group meets formally at irregular intervals but renders continuing assistance in the field of air cleaning through specific research and development work directed by individual members and by individual consulting advice.

Dr. Abel Wolman, chairman; head, department of sanitary engineering and water resources, Johns Hopkins University, Baltimore, Md.
Dr. Philip Drinker, professor of industrial hygiene, Harvard University School of Public Health, Boston, Mass.
Dr. Lyle I. Gilbertson, director, research and engineering department, Air Reduction Co., Inc., Murray Hill, N. J.
Dr. H. Fraser Johnstone, professor of chemical engineering, University of Illinois, Urbana, Ill.
Dr. Charles E. Lapple, professor of chemical engineering, Ohio State University, Columbus, Ohio.
Dr. Moyer D. Thomas, department of agricultural research, American Smelting & Refining Co., Salt Lake City, Utah.
Dr. William P. Yant, director of research, Mine Safety Appliances Co., Pittsburgh, Pa.

APPENDIX 3

Major Research and Development Installations 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. Adolph F. Voigt

Argonne Cancer Research Hospital (University of Chicago, contractor), Chicago, Ill.

The participating institutions associated with Argonne National Laboratory (listed immediately below) are also affiliated with the Argonne Cancer Research Hospital.

Director	Dr. Leon O. Jacobson
Associate Director	Dr. Robert J. Hasterlik

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
- Ohio State University
- Oklahoma Agricultural and Mechanical College
- Purdue University
- St. Louis University
- State University of Iowa
- Washington University (St. Louis, Mo.)
- Wayne University
- Western Reserve University
- University of Chicago
- University of Cincinnati
- University of Illinois
- University of Kansas
- University of Michigan
- University of Minnesota
- University of Missouri
- University of Nebraska
- University of Notre Dame
- University of Pittsburgh
- University of Wisconsin

Director	Dr. Walter H. Zinn
Deputy Director	Dr. Norman Hilberry
Business Manager	John H. McKinley
Associate Director, University Relationships	Dr. Joseph C. Boyce
Assistant Director, Technical Services	John T. Bobbitt

Bettis Plant (Westinghouse Electric Corp., Atomic Power Division, contractor), Pittsburgh, Pa.

Division Manager, Westinghouse Atomic Power Division	CHARLES H. WEAVER
Assistant Division Manager	EDMUND T. MORRIS
Reactor Project Manager	JOSEPH C. GENGEL
Reactor Project Manager	JOHN W. SIMPSON
Reactor Project Manager	ALEXANDER SQUIRE
Reactor Project Manager	JOHN T. STIEFEL

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

Chairman, Board of Trustees	EDWARD REYNOLDS
President, AUI	LLOYD V. BERKNER
Vice President, AUI and Laboratory Director	Dr. LELAND J. HAWORTH
Deputy Laboratory Director	Dr. GERALD F. TAPE
Assistant Director, University Liaison	Dr. ROBERT A. PATTERSON

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

General Manager	K. R. VAN TASSEL
Manager, SIR Project	F. E. CREVER
Manager, SAR Project	F. B. HORNBY
Manager, Technical Department	Dr. R. D. BENNETT
Manager, Reactor Operations Department	E. P. LEE
Manager, Auxiliary Operations Department	W. W. SMITH

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

Director	Dr. NORRIS E. BRADBURY
Technical Associate Director	Dr. DAROL K. FROMAN

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

Project Director	Dr. N. N. T. SAMARAS
Laboratory Director	Dr. JOSEPH J. BURBAGE

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
- Clemson Agricultural College
- Duke University
- Emory University
- Florida State University
- Georgia Institute of Technology
- Louisiana State University
- Mississippi State College
- North Carolina State College
- Rice Institute
- Southern Methodist University
- Tulane University of Louisiana
- Tuskegee Institute
- Virginia Polytechnic Institute
- University of Alabama
- University of Arkansas
- University of Florida
- University of Georgia
- University of Kentucky
- University of Louisville
- University of Maryland
- University of Mississippi
- University of North Carolina
- University of Oklahoma
- University of Puerto Rico
- University of South Carolina
- University of Tennessee
- University of Texas
- University of Virginia

Chairman of Council — Dr. George H. Boyd
Vice Chairman of Council — Dr. T. W. Bonner
President of Institute — Dr. Paul M. Gross
Vice President of Institute — Dr. C. K. Beck
Scientific and Educational Consultant — Dr. George B. Pegram
Executive Director of Institute — Dr. William G. Pollard

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

Director — Dr. C. E. Larson
Research Director — Dr. A. M. Weinberg
Deputy Research Director — Dr. J. A. Swartout
Assistant Research Director — Dr. G. E. Boyd
Assistant Research Director — Dr. R. A. Charpie
Assistant Research Director — Dr. E. D. Shipley
Assistant Research Director — Dr. C. E. Winters

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

Director — Dr. Ernest O. Lawrence
Associate Director — Dr. Donald Cooksey
Business Manager and Managing Engineer — Wallace B. Reynolds
Assistant Director — William M. Brobeck
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

Raw Materials Development Laboratory (National Lead Co., contractor), Winchester, Mass.

Technical Director and Manager .... JOHN BREITENSTEIN

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

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

President .... JAMES W. MCRAE

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

Director .... DR. STAFFORD WARREN
Project Manager .... ROBERT J. BUETTNER

University of California, Medical Center, Radiological Laboratory (University of California, contractor), San Francisco, Calif.

Director .... DR. ROBERT S. STONE

National Reactor Testing Station, Idaho Falls, Idaho

Nevada Test Site, Las Vegas, Nev.

Pacific Proving Ground, Marshall Islands

APPENDIX 4

Isotope Distribution Data [1]

Isotope	Aug. 2, 1946, Dec. 31, 1953		Jan. 1, 1954, Nov. 30, 1954 [2]		Total to Nov. 30, 1954	
	Activity (Curies)	Shipments	Activity (Curies)	Shipments	Activity (Curies)	Shipments
Radioactive isotopes:						
Iodine 131	1,863.4	17,036	498.0	4,485	2,361.4	21,521
Phosphorus 32	531.0	11,073	128.0	2,102	659.0	13,175
Carbon 14	19.0	1,832	4.0	267	23.0	2,099
Sodium 24	39.1	1,589	7.0	406	46.1	1,995
Sulfur 35	24.3	860	4.4	230	28.7	1,090
Gold 198	154.4	1,533	58.0	585	212.4	2,118
Calcium 45	3.3	559	4.0	89	7.3	648
Iron 55, 59	1.1	546	.3	154	1.4	700
Cobalt 60	8,717.2	789	13,145.0	137	21,862.2	926
Potassium 42	16.3	656	5.0	193	21.3	849
Strontium 89, 90	103.0	364	108.4	90	211.4	454
Other	690.1	5,915	736.0	1,695	1,426.1	7,610
Total	12,162.2	42,752	14,698.1	10,433	26,860.3	53,185
Stable isotopes:						
Deuterium oxide		649		139		788
Deuterium		705		117		822
Boron		205		52		257
Helium 3		33		8		41
Oxygen 18		299		42		341
Electromagnetically concentrated		799		171		970
Argon 38		4		0		4
Total		2,694		529		3,223
Shipments to AEC installations:						
Radioactive		7,250		935		8,185
Stable		1,667		151		1,818

[1] Domestic shipments from Oak Ridge National Laboratory.
[2] November figures estimated.

LOCATION AND TYPE OF NEW USERS [1]

JANUARY 1, 1954–NOVEMBER 30, 1954

States and Territories	Medical Institutions and Physicians		Colleges and Universities		Industrial Firms		Federal and State Laboratories		Foundations and Institutions		Other		Total	
	Radio	Stable	Radio	Stable	Radio	Stable	Radio	Stable	Radio	Stable	Radio	Stable	Radio	Stable
Alaska														
Alabama	4				1								5	
Arizona	1												1	
Arkansas	2												2	
California	17	2			25	4	6						48	6
Colorado	5	1			1				1				7	1
Connecticut					7			1					7	1
Delaware					1		1						2	
District of Columbia	1				2		4	2					7	2
Florida	5			1	2		1						8	1
Georgia	3				1								4	
Hawaii							1						1	
Idaho	1				1		4				1		3	
Illinois	18	1	1	1	14	1		1	2				35	4
Indiana	2				1								3	
Iowa	4				2								6	
Kansas	1												1	
Kentucky	1		1		1								3	
Louisiana	4		2	1	2		2						10	1
Maine	1				3								4	
Maryland	1	1			3		1						5	1
Massachusetts	1		2	4	15	2	1		1				20	6
Michigan	2				3						1		6	
Minnesota	2				1								3	
Mississippi				1	2								2	1
Missouri	9				5								14	
Montana									1				1	
Nebraska	3						2						5	
Nevada					1								1	
New Hampshire														
New Jersey	14				13	2	1	1					28	3
New Mexico	1			1									1	1
New York	26		1	2	26	2	6		1		1		61	4
North Carolina	3		1		4								8	
North Dakota														
Ohio	10	1	1	1	14		1						26	2

Oklahoma	4				4								8	
Oregon	4				1		2				1		8	
Panama	1												1	
Pennsylvania	10	3		1	15		2	1					27	5
Puerto Rico	1												1	
Rhode Island	3												3	
South Carolina			1	1	1		1						3	1
South Dakota	1												1	
Tennessee	2				1								3	
Texas	8				13								21	
Utah	1			1									1	1
Vermont														
Virginia	3	1		1	5	1							8	3
Washington	2				3		2						7	
West Virginia	4				1								5	
Wisconsin	4		1	2	8								13	2
Wyoming														
Total	190	10	11	18	203	12	34	6	6		4		448	46

[1] Users are either institutions or individuals receiving isotopes authorized through the Commission's distribution program.

LOCATION AND TYPE OF USERS

AUGUST 1946–NOVEMBER 30, 1954

States and Territories	Medical Institutions and Physicians		Colleges and Universities		Industrial Firms		Federal and State Laboratories		Foundations and Institutions		Other		Total	
	Radio	Stable	Radio	Stable	Radio	Stable	Radio	Stable	Radio	Stable	Radio	Stable	Radio	Stable
Alaska	1		1				1						3	
Alabama	9		2	1	10	1	3	1	2	1			26	4
Arizona	3		1	1			2						6	1
Arkansas	7		1	1	2		1						11	1
California	108	6	15	11	102	17	41	4	10	1	1		277	39
Colorado	21	1	3	2	6	1	4		2		2		38	4
Connecticut	11	1	5	3	34	3	2	1					52	8
Delaware	1		1	1	9	3	1		1	1			13	5
District of Columbia	9	4	3	4	6		17	7			1		36	15
Florida	15		6	2	3		4				1		29	2
Georgia	9		4	3	4		6						23	3
Hawaii	3		1				2		2				8	
Idaho	3		1		2						1		7	
Illinois	57	4	8	7	66	9	13	2	4	1	2		150	23
Indiana	13		3	4	23	4					1		40	8
Iowa	7	1	3	2	7								17	3
Kansas	12		2	2	3								17	2
Kentucky	6		2	1	8		2		1		1		20	1
Louisiana	12	1	5	3	8	2	3						28	6
Maine	4		3	1	11		1						19	1
Maryland	13	5	5	3	16	3	13	5					47	16
Massachusetts	29	7	15	11	70	11	7	2	3	1	1		125	32
Michigan	19	1	7	3	29	5	1				1		57	9
Minnesota	10	2	5	2	9		1						25	4
Mississippi	2		1	1	4	1	3	1					10	3
Missouri	32	2	4	4	10		1			1			47	7
Montana	6	2	1	1			1		1				9	3
Nebraska	6		3				3						12	
Nevada	2				3		1						6	
New Hampshire	2		2	2	3		2						9	2
New Jersey	24		4	2	77	14	7	2	6	1	1	2	119	21
New Mexico	6		2	2	1		3						12	2
New York	124	12	27	20	124	15	18	2	8		3		304	49
North Carolina	11	1	6	3	8		5						30	4
North Dakota	6		2				1						9	
Ohio	38	3	9	8	85	6	10	2	3	2	1		146	21

Oklahoma	10		1	1	20	6	1		3				35	7
Oregon	7	1	3	3	3		5				1		19	4
Panama	1						1						2	
Pennsylvania	49	8	11	7	97	13	11	3	4	2	1		173	33
Puerto Rico	4						2						6	
Rhode Island	4		2	1	7		1						14	1
South Carolina	3		3	2	2		2						10	2
South Dakota	3		2										5	
Tennessee	21	1	4	3	8	1	5	1					38	6
Texas	47	6	5	4	58	6	5		3	1		1	118	18
Utah	4	1	3	2	2		2						11	3
Vermont	3				1								4	
Virginia	9	1	4	2	13	2	8						34	5
Washington	12		4	3	10	1	6						32	4
West Virginia	11		2	1	3	1	2						18	2
Wisconsin	13	1	3	3	31		4						51	4
Wyoming	1		1	1			1						3	1
Total	843	72	211	144	998	125	236	33	53	12	19	3	2,360	389

SHIPMENTS OF RADIOACTIVE AND STABLE ISOTOPES TO FOREIGN COUNTRIES

Country	Jan. 1, 1954–Nov. 30, 1954		Total Jan. 1947, to Nov. 30, 1954	
	Radio	Stable	Radio	Stable [1]
Argentina	18	0	123	0
Australia	4	0	107	0
Austria	0	0	1	0
Belgian Congo	1	0	1	0
Belgium	13	2	144	2
Bermuda	0	0	16	0
Bolivia [2]	0	0	0	0
Brazil	42	0	253	0
British West Africa	0	0	1	0
Canada	240	5	660	5
Chile	18	0	97	0
Colombia	3	0	8	0
Costa Rica [2]	0	0	0	0
Cuba	95	0	228	0
Denmark	16	0	223	0
Dominican Republic	0	0	1	0
Egypt	1	0	2	0
El Salvador [2]	0	0	0	0
England	12	0	143	0
Finland	1	0	14	0
France	21	7	111	7
Germany	16	0	22	0
Gold Coast	0	0	1	0
Greece	1	0	1	0
Guatemala	9	0	12	0
Honduras [2]	0	0	0	0
Iceland	0	0	5	0
India	10	0	22	0
Indonesia	0	0	3	0
Ireland [2]	0	0	0	0
Israel	0	0	6	0
Italy	6	1	34	1
Japan	101	0	328	0
Lebanon	0	0	6	0
Mexico	45	0	92	0
Netherlands	2	0	55	0
New Zealand	1	0	12	0
Norway	1	0	43	0
Pakistan	2	0	7	0
Paraguay [2]	0	0	0	0
Peru	6	0	19	0
Philippines	2	0	2	0
Portugal	0	0	5	0
Spain	4	0	9	0
Sweden	5	0	187	0
Switzerland	12	1	63	1
Syria [2]	0	0	0	0
Thailand [2]	0	0	0	0
Trieste	0	0	3	0
Turkey	0	0	5	0
Union of South Africa	1	0	29	0
Uruguay	0	0	10	0
Yugoslavia	0	0	1	0
Venezuela	7	0	7	0
Total	716	16	3,122	16

[1] Stable isotopes became available for export July 1, 1954.
[2] Authorized to receive isotopes; no shipments made.

KIND OF ISOTOPE	JAN. 1, 1954–NOV. 30, 1954	TOTAL JAN. 1947, TO NOV. 30, 1954
RADIOACTIVE ISOTOPES		
Phosphorus 32	80	853
Iodine 131	302	937
Carbon 14	47	298
Sulfur 35	17	120
Iron 55, 59	23	107
Cobalt 60	41	179
Strontium 89, 90	25	78
Calcium 45	18	96
Other	160	451
Rare earths	3	3
Total	716	3,122
STABLE ISOTOPES		
Deuterium oxide	1	1
Boron	8	8
Electromagnetically concentrated	7	7
TOTAL	16	16
TOTAL FOREIGN ISOTOPE SHIPMENTS	732	3,138

325448—55 ——8

APPENDIX 5

AEC Owned Patents

PATENTS ISSUED TO THE COMMISSION WHICH ARE AVAILABLE FOR LICENSING [1]

The following 66 U. S. Letters Patents owned by the United States Government as represented by the Atomic Energy Commission are in addition to the 37 patents listed in the 16th Semiannual Report. The patents listed have been made available for licensing at periodic intervals. Licenses are granted on a non-exclusive, royalty-free basis.

PATENT NO.	TITLE	PATENTEE
2, 677, 592	Process of Producing Uranium Tetrachloride.	J. M. Carter, Berkeley, Calif.
2, 677, 668	Stabilization of Reduced Metal Catalyst.	J. E. Ahlberg, Chicago, Ill.
2, 677, 669	Stepwise Stabiliztion of Reduced Metal Calalysts.	J. E. Ahlberg, Chicago, Ill.
2, 677, 759	Coincidence Circuit	R. Madey, Berkeley, Calif.
2, 677, 770	Ion Source	H. D. Smyth, Washington, D. C.; L. G. Smith, E. Moriches, N. Y., and J. E. Mack, Madison, Wis.
2, 677, 771	Ion Source	C. M. Turner, Stony Brook, N. Y.
2, 677, 772	Neutron Thermometer	R. J. Moon, Chicago, Ill.
2, 677, 778	Linear Cathode	W. R. Baker, Berkeley and D. A. Vance, Lafayette, Calif.
2, 678, 014	Head Seaming Device	M. B. Hawkins, Richmond, Calif.
2, 678, 257	Activated Uranium Dioxide and Processes of Producing the Same.	M. J. Polissar, San Francisco, Calif.
2, 678, 300	Means for Controlling Flow of Electrolyte to an Electrolytic Cell.	J. M. Sturtevant, Branford, Conn.
2, 678, 773	Mechanical Register	W. E. Glenn, Jr., Berkeley, Calif.
2, 679, 597	Ion Source	C. M. Turner, Stony Brook, N. Y.
2, 679, 783	Shielded, Explosively Released Fastener.	P. P. Smith, San Antonio, Tex.
2, 679, 940	Electrical Manipulator	R. C. Goertz and D. F. Uecker, Elmhurst, Ill.
2, 680, 071	Low Melting Alloy	L. F. Epstein, Schenectady, W. H. Howland, Waterford, and M. D. Powers, Schenectady, N. Y.
2, 680, 212	Protective Circuit	P. E. Frazier, Berkeley, Calif.
2, 680, 227	Polaroscope	Q. A. Kerns, Berkeley, Calif.

[1] Patents listed as of November 1, 1954. Applicants for licenses should apply to Chief, Patent Branch, Office of the General Counsel, U. S. AEC, Washington 25, D. C., identifying the subject matter by patent number and title.

PATENT NO.	TITLE	PATENTEE
2,681,416	Neutron Scintillation Counter	B. W. Thompson, Walnut Creek Calif.
2,681,883	Recovery of Heavy Water from Reacted Solutions Thereof.	C. F. Hiskey, New York, N. Y.
2,681,907	Isolation of Flavonoid Compounds.	S. H. Wender, Norman, Okla.
2,681,923	Compounds of the Element Americium.	L. B. Asprey, R. A. Penneman and S. E. Stephanou, Los Alamos, N. Mex.
2,682,352	Shipping Container for Radioactive Material.	M. B. Hawkins and E. R. Tompkins, Oak Ridge, Tenn.
2,682,364	Electronic Controlled Pumping System.	D. S. Schover, Chicago, Ill.
2,682,451	Still	R. J. Schmidt, Oakland, Calif. S. Rosenfeld, Berkeley, Calif.
2,682,452	Extraction Apparatus	L. Wainwright, Brooklyn, N. Y.
2,682,510	Gamma and X-Ray Dosimetric Method.	G. V. Taplin, Los Angeles, and C. H. Douglas, Alhambra, Calif.
2,682,583	Contacting Device	F. R. Shonka, Riverside, and R. F. Selman, Chicago, Ill.
2,682,611	Ion Source	W. M. Woodward, Ithaca, and L. G. Smith, E. Moriches, N. Y.
2,682,785	Control Rod Drive Mechanism	B. C. Cerutti and H. V. Lichtenberger, Idaho Falls, Idaho
2,683,221	Particle and Gamma Ray Energy Spectrometer.	B. R. Gossick, Lafayette, Ind.
2,683,222	Radiation Meter	G. Failla, New York, and H. H. Rossi, Orangeburg, N. Y.
2,683,650	Shielding Window Against Radioactivity and Composition Therefor.	W. B. Doe, LaGrange, Ill.
2,683,655	Separation of Americium and Curium from Aqueous Solutions.	D. F. Peppard, Chicago, and P. R. Gray, Worth, Ill.
2,683,807	Variable Voltage Wave Form Generator.	G. D. Paxson, El Cerrito, Calif.
2,683,814	Ion Beam Measuring Device	R. L. Mather, Berkeley, Calif.
2,684,825	Shock or Vibration Isolating Means.	E. K. Arnold, D. W. Laviana, Kansas City, Mo. G. L. Cooper, Overland Park, Kans.
2,685,027	Radioactivity Measurement	L. W. Alvarez, Berkeley, Calif.
2,685,501	Process for Preparing Boron	J. S. Spevack, New York, N. Y.
2,685,670	Speed Regulating Circuit for Generators.	M. W. Horrell, Detroit, Mich.
2,686,427	Resonant Type Shake Table	D. M. Ellett, New Haven, Conn., and W. E. Baker, Waldwick, N. J.
2,686,827	Water Cooled Insulator	B. H. Roffee, Oak Ridge, Tenn.
2,686,880	Isotope Separator	W. E. Glenn, Jr., Berkeley, Calif.
2,686,946	Refining Beryllium in the Presence of a Flux.	J. H. Jackson, Columbus, Ohio

PATENT NO.	TITLE	PATENTEE
2, 687, 480	Radiation Measuring Device	F. R. Shonka, Riverside, A. J. Okleshen, Lemont, Ill., and R. F. Selman, Chicago, Ill.
2, 688, 529	Method of Preparing Uranium Tetrachloride.	E. L. Wagner and L. B. Dean Providence, R. I. and Columbus, Ohio
2, 688, 530	Method of Preparing Uranium Tetrachloride	E. L. Wagner, Providence, R. I., and B. M. Pitt, Evanston, Ill.
2, 688, 703	Radioactive Logging Apparatus.	H. J. DiGiovanni, New York, R. T. Graveson, Yonkers, and A. H. Yoli, New York, N. Y.
2, 689, 309	Discharge Device Responsive to Molecular Density.	J. R. Mahoney, Oak Ridge, Tenn.
2, 689, 318	Load Torque Responsive Follow-Up System.	R. C. Goertz, Elmhurst, and F. Bevilacqua, Downers Grove, Ill.
2, 689, 753	Translating, Rotating Bearing Device.	J. J. Wechsler, Los Alamos, N. Mex
2, 689, 782	Process for Producing Deuterium Oxide.	E. V. Murphree, Summit, N. J.
2, 689, 949	Telemetering System	J. F. Kalbach, Pasadena, Calif., and C. W. Johnstone, Los Alamos, N. Mex.
2, 690, 376	Recovery of Pure Uranium Compounds from Ores.	J. I. Hoffman, Chevy Chase, Md.
2, 690, 379	Process for the Production of Deuterium Oxide as a Source of Deuterium.	H. C. Urey, Leonia, N. J. and A. V. Grosse, Bronxville, N. Y,
2, 690, 380	Production of Deuterium Oxide.	H. S. Taylor, Princeton, N. J.
2, 690, 381	Isotope Exchange Process for Concentrating Deuterium.	H. S. Taylor, Princeton, N. J.
2, 690, 382	Dual Temperature Isotope Exchange Process.	G. G. Joris, Princeton, N. J.
2, 690, 421	Electrolytic Production of Uranium Powder.	W. C. Lilliendahl, Mountain Lakes, R. Nagy, E. Orange, D Wroughton, Bloomfield, N. J., and J. W. Marden, E. Orange, N. J.
2, 690, 468	Drill Hole Logging Probe	H. Faul, Middlesex County, Mass., and R. J. Smith, Elmhurst, Ill.
2, 690, 515	Method and Apparatus for Producing Ions.	J. E. Mack, Madison, Wis.
2, 690, 521	Ion Source Units	C. M. Turner, Stony Brook, N. Y.
2, 691, 481	Vacuum Pumping Apparatus	K. M. Simpson, Santa Barbara, Calif.
2, 691, 773	Valve Leak Detector	H. V. Lichtenberger, Idaho Falls, Idaho.
2, 692, 297	High-Voltage Bushing	H. M. Owren, Oakland, Calif.
2, 692, 823	Uranium-Nickel Metal Alloy	M. E. Cieslicki, Mt. Lebanon, and B. J. Nelson, New Kensington, Pa.

APPENDIX 6

Regulations of the U. S. Atomic Energy Commission [1]

Part 30—Radioisotope Distribution

MISCELLANEOUS AMENDMENTS

Pursuant to the Atomic Energy Act of 1946, as amended (Pub. Law 585, 79th Cong.; 60 Stat. 755ff) and the Administrative Procedure Act of 1946, as amended (Pub. Law 404, 79th Cong.) additional amendments to Title 10, Chapter I, Part 30, Code of Federal Regulations, entitled "Radioisotope Distribution," promulgated April 9, 1951, and published in 16 F. R. 3251 et seq. of the Federal Register are set forth hereunder to be effective upon publication.

1. Amend § 30.1 to read as follows:

§ 30.1 *Scope.* The regulations in this part establish instructions and standards governing the procurement, delivery, possession, use, transfer (including export), and disposal of radioisotopes (a) originating in or procured from the facilities of the Commission or a distributor, or (b) originating in domestic facilities not owned by the Commission, but distributed by or through the Commission or a distributor, or (c) originating in any nuclear reactor located in the United States, its Territories or possessions, or (d) originating in any foreign nuclear reactor for shipment into the United States. The regulations in this part do not apply to source and fissionable materials as defined in this part.

2. Amend § 30.60 to read as follows:

§ 30.60 *Withholding or disposition of radioisotopes.* The Commission may withhold radioisotopes from any person or require any person to deliver to the Commission, or otherwise dispose of, any or all radioisotopes in his possession, as directed by the Commission, when it is determined by the Commission that such person (a) is not equipped to observe, or has failed to observe, the health and safety standards established by the Commission; or (b) has used radioisotopes in a manner other than as disclosed in the application therefor; or (c) has used radioisotopes in violation of any law or of any regulation of the Commission.

3. Amend § 30.61 to read as follows:

§ 30.61 *Other action.* Any person who violates any provision of these regulations in this part, or who, in connection with the regulations in this part, willfully conceals a material fact or furnishes false information to the Commission, may be prohibited by the Commission from making or obtaining further deliveries of radioisotopes or using, possessing or storing them; and may be required to deliver to the Commission, or otherwise dispose of, any or all radioisotopes in his possession as directed by the Commission. Violation of the regulations contained in this part or the furnishing of false information in connection with applications, statements, and reports thereunder may also be a crime under the provisions of the Atomic Energy Act of 1946 or of 18 U. S. C. 1001, act of June 25, 1948, 62 Stat. 749.

(60 Stat. 755–775, as amended; 42 U. S. C. 1801–1819)

Dated at Washington, D. C., this 16th day of July 1954.

K. D. Nichols,
General Manager.

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[1] Policies and regulations of the U. S. AEC announced prior to December 1954 can be found in the following: Fifth Semiannual Report, Sixth Semiannual Report, Ninth Semiannual Report, Tenth Semiannual Report, Eleventh Semiannual Report, Twelfth Semiannual Report, Thirteenth Semiannual Report, Fourteenth Semiannual Report, Fifteenth and Sixteenth Semiannual Reports; and in the Federal Register.

CONTINUATION IN EFFECT OF EXISTING CONTROLS CONSISTENT WITH ATOMIC ENERGY ACT, 1954

Pursuant to the Atomic Energy Act of 1954 (Public Law 703, 83d Congress) and section 4 (a) of the Administrative Procedure Act of 1946, as amended (Public Law 404, 79th Congress), the following note affecting Title 10, Chapter I, Code of Federal Regulations, entitled "Atomic Energy Commission," is promulgated as a rule of the Atomic Energy Commission.

NOTE: Until further order of the Atomic Energy Commission, all provisions of rules, regulations and notices, published by the Atomic Energy Commission in the FEDERAL REGISTER under the authority of the Atomic Energy Act of 1946, and in effect immediately prior to the effective date of the Atomic Energy Act of 1954, are continued in force and effect to the extent that they are not inconsistent with the Atomic Energy Act of 1954. The term "fissionable material," as used in such rules, regulations, and notices, means special nuclear material as defined in the Atomic Energy Act of 1954.

Effective date. This rule is effective as of the effective date of the Atomic Energy Act of 1954. Notice and public procedure is omitted for good cause found by the Atomic Energy Commission on the ground that such would be contrary to the public interest by reason of the fact that the public health and safety and the national defense necessitate the uninterrupted continuation of the effectiveness of all existing controls. However, the provisions hereof are considered as interim provisions by the Commission and comments by all interested parties are invited.

Dated at Washington, D. C., this 30th day of August 1954.

K. D. NICHOLS,
General Manager.

PART 50—CONTROL OF FACILITIES FOR THE PRODUCTION OF FISSIONABLE MATERIAL

DEFINITION OF PRODUCTION FACILITY

Pursuant to the Atomic Energy Act of 1954 (Public Law 703, 83d Congress) and section 4 (a) of the Administrative Procedure Act of 1946, as amended, Public Law 404, 79th Congress, Title 10, Chapter I, Part 50, Code of Federal Regulations, entitled "Control of Facilities for the Production of Fissionable Material," is amended as set forth hereunder.

1. Amend § 50.2 by adding the following new paragraph (g).

(g) The Commission has determined pursuant to section 11p of the Atomic Energy Act of 1954 that the term "production facility" includes all facilities for the production of fissionable material as defined in this part. The Commission has also determined that the general licensing of items in Schedule B pursuant to § 50.12 (b) will not constitute an unreasonable risk to the common defense and security.

2. Amend § 50.12 by deleting paragraph (c) thereof.

(Pub. Law 703, 83d Cong.)

Effective date. This order is effective as of the effective date of the Atomic Energy Act of 1954. Notice and public procedure is omitted for good cause found by the Commission on the ground that such are impracticable by reason of the fact that due and timely execution of the Commission's functions in giving effect to the Atomic Energy Act of 1954 would be impeded by such notice and procedure. However, the provisions hereof are considered as interim provisions by the Commission and comments by all interested parties are invited.

Dated at Washington, D. C., this 30th day of August 1954.

K. D. NICHOLS,
General Manager.

PART 60—DOMESTIC URANIUM PROGRAM

TERMINATION OF DOMESTIC URANIUM PROGRAM CIRCULAR 7

Pursuant to the Atomic Energy Act of 1954 (Public Law 703, 83d Congress), the following action is taken affecting Domestic Uranium Program Circular 7

(Title 10, Chapter I, Part 60, 60.7, Code of Federal Regulations).

1. Domestic Uranium Program Circular 7 is terminated effective as of December 12, 1954, without prejudice to the rights of leaseholders established under existing Circular 7 leases.

2. All Circular 7 lease applications pending on December 12, 1954, will be considered rejected as of that date and rental payments submitted with such applications will be returned.

Dated at Washington, D. C., this 8th day of November 1954.

K. D. NICHOLS,
General Manager.

APPENDIX 7

CURRENT AEC UNCLASSIFIED RESEARCH CONTRACTS IN PHYSICAL AND BIOLOGICAL SCIENCES, RAW MATERIALS, AND REACTOR DEVELOPMENT [1]

PHYSICAL RESEARCH CONTRACTS

Chemistry

Alabama, University of. J. L. Kassner and E. L. Grove, A Study of the Principles, Theory and Practice of High Frequency Titrimetry.

Arizona, University of. E. B. Kurtz, Jr., Study of Uranium Accumulation in Plants.

Arkansas, University of. R. R. Edwards, Chemical Effects of Nuclear Transformation.

Arkansas, University of. R. R. Edwards, Investigation of the Radioactivity of Thermal Waters and Its Relationship to the Geology and Geochemistry of Uranium.

Brooklyn, Polytechnic Institute of. R. B. Mesrobian and H. Morawetz, Study of Radiation Induced Solid State Polymerization.

Buffalo, University of. G. M. Harris, Applications of Isotopes in Chemical Kinetics.

California Institute of Technology. Norman Davidson, Complex Ions and Reaction Mechanisms in Solution.

California Institute of Technology. Harrison Brown, Study of Fundamental Geochemistry of Critical Materials and Development of Economic Processes for Their Isolation.

California, University of. J. H. Hildebrand, Studies in Intermolecular Forces and Solubility.

California, University of. C. S. Garner, Isotopic Exchange Reactions.

California, University of. R. A. James, Nuclear Chemistry Research.

California, University of. R. L. Scott, Fluorocarbons Solutions.

Carnegie Institute of Technology. T. P. Kohman, Nuclear Chemistry Research.

Catholic University of America. F. O. Rice, The Thermal Production and Identification of Free Radicals.

Chicago, University of. H. C. Urey, Natural Abundance of Deuterium and Other Isotopes.

Chicago, University of. Nathan Sugarman and Anthony Turkevich, Nuclear Chemical Research.

Chicago, University of. C. A. Hutchinson, Paramagnetic Resonance Absorption.

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[1] Contracts listed as of November 30, 1954.

Clarkson College of Technology. H. L. Shulman, The Determination of Interfacial Area in Packed Absorption and Distillation Columns.

Colorado, University of. J. R. Lacher and J. D. Park, Thermochemical Studies of Organic Fluorine Compounds.

Colorado, University of. R. N. Keller, The Scintillation Properties of Coordination Compounds.

Columbia University. J. L. Kulp, Helium in the Atmosphere and Lithosphere.

Columbia University. J. L. Kulp, U-Pb Method of Age Determination.

Columbia University. V. K. LaMer, Fundamental Investigation of Phosphate Slimes.

Columbia University. J. M. Miller, Research in the Field of Radiochemistry.

Columbia University. R. M. Noyes, Photochemical Reactions of Iodine.

Columbia University. W. A. Selke, Ion Exchange Chromatography.

Columbia University. T. I. Taylor, Separation of Isotopes by Chemical Exchange.

Connecticut, University of. R. Ward, Tracer Element Distribution between Melt and Solid.

Cornell University. F. A. Long, *et al*, Gradient of the Electric Field in Ionic Crystals.

Cornell University. J. L. Hoard, Structure of Fluorocarbons, Elementary Boron and Boron Compounds.

Cornell University. F. A. Long, Kinetic and Equilibrium Salt Effects.

Delaware, University of. R. L. Pigford, Thermal Diffusion in Liquids.

Duke University. D. G. Hill, A Study of Some Chemical Reactions at High Temperatures.

Emory University. R. A. Day, Study of the Stability of Complex Ions of Uranium.

Emory University. W. H. Jones, Mass Distribution in Proton-Induced Fission.

Florida State University. R. E. Johnson, Exchange Between Labelled Halogens and Certain Inorganic Halides.

Florida State University. Raymond Sheline, Search for Long-Lived Radioactivities; Theoretical Nuclear Studies.

Florida, University of. G. B. Butler and A. H. Gropp, Studies in the Preparation and Properties of Quaternary Ammonium Ion Exchange Resins.

Fordham University. Michael Cefola, Studies on Formation of Complexes by Thenoyltrifluoroacetate and Other Chelating Agents.

George Washington University. Theodore Perros, Studies of Fluorides of the Rare Earth Elements.

Harvard University. E. S. Barghoorn, Radioactivity in Uraniferous Plant Fossils.

Harvard University. R. M. Diamond and Geoffrey Wilkinson, Nuclear and Inorganic Chemistry of the Transitional Elements.

Howard College. John Xan, Cyclotron Research.

Hunter College. G. R. Burns, Mechanism of the Oxo Reaction Using Carbon 14.

Illinois Institute of Technology. M. L. Bender, Correlation of Isotopic Effect on Reaction Rate with Reaction Mechanism.

Illinois Institute of Technology. H. E. Gunning, Studies in the Field of Stable Isotopes.

Illinois Institute of Technology. George Gibson, Fundamental Chemistry of Uranium.

Illinois Institute of Technology. H. E. Gunning, Decomposition of Molecules by Metal-Photosensitization.

Illinois, University of. E. A. Alperovitch, Occurrence of Technetium in Nature.

Illinois, University of. P. E. Yankwich, Studies in Radiochemistry.

Illinois, University of. H. G. Drickamer, The Mechanism of Molecular Motion as Determined from Diffusion and Thermal Diffusion Measurements.

Indiana University. L. L. Merritt, Studies with Radioactive Tracers.

Indiana University. W. J. Moore, Rate Processes in Inorganic Solids at High Temperatures.

Indiana University. W. B. Schaap and F. C. Schmidt, Electrochemical Research in Amine Solvents.

Iowa, State University of. LeRoy Eyring, Preparation of Rare Earth Oxides.

Iowa, State University of. Karl Kammermeyer, Separation of Gases by Diffusion Thru Permeable Membranes.

Johns Hopkins University. W. S. Koski, Nuclear Chemistry Studies.

Kansas, University of. P. W. Gilles, High Temperature Research.

Little, Inc., Arthur D. G. A. Bleyle, Study of Deuterium Separation.

Louisville, University of. R. H. Wiley, The Synthesis and Properties of Ion-Exchange Resins.

Massachusetts Institute of Technology. Manson Benedict, Transfer of Deuterium from Steam to Hydrogen.

Massachusetts Institute of Technology. C. D. Coryell, D. N. Hume, J. D. Sheehan, C. G. Swain, Nuclear Chemistry Research.

Massachusetts Institute of Technology. T. K. Sherwood, Mechanism of Mass Transfer to Drops.

Massachusetts Institute of Technology. P. M. Hurley, Investigations of Isotopic Abundances of Strontium, Calcium and Argon in Certain Minerals.

Massachusetts Institute of Technology. A. M. Gaudin, Techniques in Mineral Engineering.

Michigan, University of. E. F. Westrum, Low Temperature Chemical Thermodynamics.

Michigan, University of. W. W. Meinke, Nuclear Chemical Research.

Michigan, University of. P. J. Elving, Polarographic Behavior of Organic Compounds.

Michigan, University of. R. B. Bernstein, Fundamental Research on Isotopic Reactions.

Michigan State College M. T. Rogers, A Physico-Chemical Investigation of Interhalogen Compounds.

Michigan State College. C. H. Brubaker, Investigations into Aperiodic Oxidation States.

Michigan State College. James L. Dye, Thermodynamic Investigation of Dilute Solutions of the Alkali Metals in Liquid Ammonia.

New Hampshire, University of. H. M. Haendler, Infra-red Spectroscopy of Inorganic Fluorides.

New York State College for Teachers. O. E. Lanford, Concentration of Nitrogen 15 by Chemical Exchange.

North Carolina State College. F. P. Pike, Performance of Contactors for Liquid-Liquid Extraction.

North Carolina, University of. Kerro Knox, The Preparation and Properties of Compounds of Technetium and Rhenium.

Northwestern University. Fred Basolo and R. G. Pearson, Mechanism of Substitution Reactions of Inorganic Complexes.

Notre Dame, University of. Milton Burton, Radiation Chemistry Studies.

Oklahoma, University of. J. R. Nielsen, Spectroscopic Properties of Fluorocarbons and Fluorinated Hydrocarbons.

Oklahoma A & M College. T. E. Moore, The Separation of Inorganic Salts by Liquid-Liquid Extraction.

Oklahoma A & M College. E. M. Hodnett, The Isotope Effect in the Study of Chemical Reactions.

Oregon State College. T. H. Norris, A Study of Generalized Acid-base Phenomena with Radioactive Tracers.

Oregon, University of. D. F. Swinehart, Study of Gaseous Chemical Reaction Kinetics Using a Mass Spectrometer.

Pennsylvania State University. W. C. Fernelius, Stabilities of Coordination Compounds and Related Problems.

Pennsylvania State University. T. F. Bates, Investigation of the Mineralogy and Petrography of Uranium-Bearing Shales and Lignites.

Pennsylvania State University. B. F. Howell, Jr., Studies of the Dielectric Constant of Rocks and Minerals.

Pennsylvania State University. C. R. Kinney, An Investigation of the Chemical Nature of the Organic Matter of Uraniferious Shales.

Pennsylvania State University. W. W. Miller, Chemical Reactions Induced in Condensed Systems by Beta-decay.

Pennsylvania State University. H. D. Wright, Mineralogy of Uranium-Bearing Deposits in the Boulder Batholith, Montana.

Pittsburgh, University of. Robert Levine, Synthesis of Beta-Diketones and Beta-Ketoesters with Heterocyclic Nuclei.

Pittsburgh, University of. Henry Freiser, The Developent and Testing of Organic Reagents for Use in Inorganic Analysis.

Princeton University. John Turkevich, Temporary and Permanent Effects Produced by Radiation on Solids.

Princeton University. John Turkevich, Study of Nucleation Processes.

Providence College. M. A. Fineman, The Nature of Gaseous Negative Ions Formed by Electron Impact.

Purdue University. Thomas DeVries, Polarographic Studies in Non-Aqueous Solvents.

Purdue University. W. F. Edgell, Studies in Molecular Spectroscopy.

Purdue University. W. H. Johnston, Gas Phase Exchange Reactions.

Purdue University. H. C. Brown, Chemistry of Polyvalent Metal Halides.

Rensselaer Polytechnic Institute. H. M. Clark, Extraction of Inorganic Substances by Organic Solvent.

Rochester, University of. E. O. Wiig, Radiochemistry.

Rutgers University. E. R. Allen, Polar Inorganic Molecules.

Rutgers University. William Rieman, Analytical Chemistry of the Polyphosphates.

Southern California, University of. H. L. Friedman, Solutions of Inorganic Electrolytes in Solvents of Low Dielectric Constant.

Southern California, University of. W. K. Wilmarth, The Mechanism of the Base Catalyzed Exchange of Hydrogen Gas and Protonic Solvents.

South Carolina, University of. O. D. Bonner, Fundamental Studies of Ion Exchange Equilibria.

Syracuse University. Henry Linschitz, Photochemical Reactions of Complex Molecules in Condensed Phase.

Syracuse University. B. P. Burtt, Mechanism of Gaseous Radiation Chemical Reactions and the Chemical Reactions of Electrons.

Syracuse University. Louis Gordon, Coprecipitation Studies.

Tennessee, University of. G. K. Schweitzer, Study of Radiocolloids.

Tennessee, University of. H. A. Smith, Catalytic Reactions Involving Deuterium and Vapor Pressure Studies of H_2O–D_2O Mixtures.

Tennessee, University of. P. B. Stockdale, Investigation of the Chattanooga Black Shale of Tennessee as a Source of Uranium.

Texas, University of. G. W. Watt, Unusual Oxidation States of Transitional Elements.

Texas, University of. E. F. Gloyna, Effects of Biological Slimes on Sea Water.

Tufts College. T. R. P. Gibb, Research on Hydrides.

Utah, University of. Henry Eyring, Studies on Surface Chemistry.

Utah, University of. R. B. Parlin, 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.

Vanderbilt University. E. A. Jones, Raman Spectra of Some Inorganic Fluorine Compounds.

Vanderbilt University. M. D. Peterson, Radiation Stability and Inorganic Radiochemistry.

Virginia Polytechnic Institute. N. F. Murphy, Mass Transfer Studies in Liquid-Liquid Extraction.

Washington State College. H. W. Dodgen, The Formulae and Stability of Complex Ions in Solution.

Washington University. J. W. Kennedy, Study of Reaction Kinetics Using Stable Isotope Tracers.

Washington University. J. W. Kennedy, Generation of High Voltages by Means of Nuclear Radiations.

Washington, University of. G. H. Cady, Preparation of Compounds Containing O–F or N–F Bonds.

Wayne University. K. H. Gayer, Solubility of Uranium and Thorium Oxides in Dilute Acid and Base.

Western Reserve University. E. L. Pace, Thermodynamic Properties of Gases Adsorbed on Solids.

Wisconsin, University of. J. E. Willard, Application of Radioisotopes to Chemical Problems.

Wisconsin, University of. E. L. King, Studies of Rates and Equilibria in Inorganic Reactions in Solution.

Wisconsin, University of. Farrington Daniels, Studies on the Geochemistry of Uranium and the Recovery of Uranium from Low Grade Ores.

Wisconsin, University of. J. O. Hirschfelder, Quantum Mechanical and Semiempirical Determination of Intermolecular Forces.

Yale University. H. S. Harned, Diffusion Coefficients of Electrolytes and Molecules.

Metallurgy and Materials

Alfred University. V. D. Frechette, Graphitization of Carbon.

Armour Research Foundation. D. J. McPherson, Heat Treatment of Zirconium Base Alloys.

Bausch and Lomb Optical Co. J. J. Kreidl, Irradiation Damage to Glass.

Buffalo, University of. Stanislaw Morzowski, Basic Principles of Manufacture of Carbons.

California, University of. E. R. Parker, Creep of Alloys.

California, University of. J. A. Pask, The Mechanics of Metal-Ceramic Bonding.

Carnegie Institute of Technology. Roman Smoluchowski, Study of Grain Boundaries; and Lattice Imperfections.

Carnegie Institute of Technology. Gerhard Derge, Electrochemical Studies of Non-Aqueous Melts.

Carnegie Institute of Technology. Roman Smoluchowski, Radiation Effects in Materials.

Carnegie Institute of Technology. J. E. Goldman, Research on Properties of Rare Metals.

Case Institute of Technology. W. J. Baldwin, Scaling of Zirconium in Air at Elevated Temperatures.

Chicago, University of. Lothar Meyer, Research on the Structure and Properties of Graphite.

Columbia University. H. H. Kellogg, Electrolytic Production of Zirconium Metal.

Columbia University. G. L. Kehl, A Study of Inclusions in Uranium.

Franklin Institute. R. L. Smith and F. E. Jaumot, Basic Research on Solid State Physics.

General Electric Company. W. R. Hibbard, Developing of Zirconium Base Alloys.

General Electric Company. D. Turnbull, Fundamental Metallurgical Research.

Illinois Institute of Technology. T. J. Neubert, Imperfections in Solids.

Illinois, University of. Frederick Seitz and D. Lazarus, Mechanism and Substitutional Diffusion in Metals.

Illinois, University of. P. A. Beck, Annealing of Cold Worked Metals.

Illinois, University of. T. A. Read, Diffusionless Phase Changes in Non-Ferrous Metals and Alloys.

Illinois, University of. Frederick Seitz, Experimental and Theoretical Investigation of Radiation Damage in Solid Materials.

Iowa, State University of. N. C. Baenziger, Structures and Properties of Intermetallic Compounds.

Massachusetts Institute of Technology. B. E. Warren, Studies of Radiation Damage.

Massachusetts Institute of Technology. F. H. Norton, The Measurement of Thermal Conductivity of Refractory Materials.

Massachusetts Institute of Technology. M. B. Bever, Thermodynamics of Metal Solution.

Massachusetts Institute of Technology. M. Cohen, Solid Solutions and Grain Boundaries.

Massachusetts Institute of Technology. B. Averbeck, Fundamentals of Cold Work and Recrystallization.

Massachusetts Institute of Technology. F. H. Norton and W. D. Kingergy, Metal-Ceramic Interactions.

Massachusetts Institute of Technology. S. C. Collins, Mechanical Properties of Metals at Low Temperatures.

Massachusetts Institute of Technology. A. R. Kaufmann, The Physical Metallurgy of Uncommon Metals.

New York University. J. P. Nielsen, Origin of Secondary Recrystallization Nuclei.

North Carolina State College. K. O. Beatty, Jr., Thermal Properties of Non-Metallic Materials at High Temperatures.

Ohio State University. C. H. Shaw, Soft X-ray Absorption and Emission Spectra.

Ohio State University. Edward Mack, Jr., Investigation of Separative Processes.

Oregon, University of. Pierre Van Rysselberghe, Polarographic Studies on the Corrosion of Zirconium.

Pennsylvania State University. C. R. Kinney, Factors Affecting the Mechanism of Graphitization and the Heterogeneous Gas Reactions of Graphites.

Pittsburgh, University of. W. E. Wallace, Thermochemistry of Alloys.

Purdue University. Karl Lark-Horovitz, Radiation Damage Studies.

Rensselaer Polytechnic Institute. H. B. Huntington, Anistropic Self-Diffusion in Metals.

Rutgers University. Sigmund Weissmann, Radiation Damage of Metals and Alloys.

Tennessee, University of. E. E. Stansbury, Energy Changes from Plastic Deformation.

Utah, University of. I. V. Cutler, Recrystallation and Sintering of Oxides.

Virginia, University of. A. T. Gwathney, Growth and Chemical Properties of Nearly Perfect Crystals.

Wichita, University of. Luther Lyon, The Permeability Method of Determining Surface Areas of Finely Divided Materials.

Physics

Alabama Polytechnic Institute. Howard E. Carr, Research with Mass Spectrometer.

Bartol Research Foundation of the Franklin Institute. C. E. Mandeville, Neutron Scattering Measurements.

Brown University. R. A. Peck, Precision Measurements of Neutron Interactions.

California Institute of Technology. J. W. DuMond, Precision Nuclear Spectroscopy.

California Institute of Technology. R. F. Bacher, High Energy Physics.

California, University of. W. F. Giauque, Low Temperature Physics.

California, University of. C. D. Jeffries, Nuclear Moments.

Carnegie Institute of Technology. Edward Creutz, 400 Mev Synchrocyclotron and Associated Research.

Case Institute of Technology. E. F. Shrader, Electron and Gamma Interactions with 26–Mev Betatron.

Case Institute of Technology. E. F. Shrader, Reactor Studies.

Chicago, University of. S. K. Allison, Reactions of the Light Nuclei and the Penetration of Charged Particles Through Matter.

Columbia University. W. W. Havens, Neutron Spectroscopy and Nuclear Physics Research.

Columbia University. C. H. Townes, Microwave Spectroscopy.

Connecticut, University of. S. S. Friedland, Inelastic Scattering of Neutrons.

Duke University. H. W. Newson, Shell Structure and Fast Neutron Cross Section.

Florida, University of. D. C. Swanson, Electrostatic Generator Program.

Florida State University. A. E. S. Green and M. A. Melvin, Analysis of Nuclear Forces.

Iowa, State University of. J. A. Jacobs, Research in Nuclear Structure.

Johns Hopkins University. S. S. Hanna, Fast Neutron Cross-Section Measurements.

Johns Hopkins University. G. H. Dieke, Absorption and Fluorescent Spectra of Solid Uranium Compounds.

Johns Hopkins University. G. H. Dieke, Properties of Nuclei.

Kansas State College. C. M. Fowler, Precision Beta-ray Spectrometry.

Massachusetts Institute of Technology. G. R. Harrison, Echelle Spectroscopy.

Michigan, University of. H. R. Crane, Nuclear Research with 300-Mev Synchrotron.

Michigan, University of. H. T. Gomberg, Research Reactor Studies.

Michigan, University of. W. C. Parkinson, 42″ Cyclotron Program.

Minnesota, University of. J. H. Williams, 60 Mev Proton Linac.

National Academy of Sciences. Kay Way, Preparation of Tables of Nuclear Data.

National Bureau of Standards. H. W. Koch, Neutron Yield and Neutron Energy Distribution Studies.

Nebraska, University of. Theodore Jorgensen, Jr., Mechanism of Energy Transfer of Slow Ions.

New York University. R. Richtmyer and E. Bromberg, AEC Computing Facility.

North Carolina State College. Clifford Beck, Studies for the Development of a Low-Powered Nuclear Reactor.

North Carolina, University of. A. V. Masket, Measurement of Inelastic Neutron Scattering.

Northwestern University. Edward N. Strait, Completion of 5 Mev Electrostatic Generator.

Notre Dame University. Bernard Waldman, Assistance in Remodeling of Electrostatic Generator.

Ohio State University. J. G. Daunt, Nuclear Paramagnetism and Low Temperature Physics.

Ohio State University. J. N. Cooper, Nuclear Spectroscopy with Van de Graaff.

Oregon State College. E. A. Yunker, 37″ Cyclotron.

Pennsylvania, University of. K. B. Atkins, Solid State Physics at Low Temperatures.

Pennsylvania State University. Ray Pepinsky, Neutron Single Crystal Structure Analysis.

Pennsylvania State University. William Breazeale, Construction and Operations of Research Reactor.

Princeton University. M. G. White, Nuclear Research Using 18-Mev Cyclotron.

Purdue University. K. Lark-Horovitz, Linear Electron Accelerator.

Purdue University. Ernst Bleuler, Research With Cyclotron.

Purdue University. R. M. Whaley, Research With Synchrotron.

Purdue University. Karl Lark-Horovitz and R. M. Whaley, Modification of the Purdue Cyclotron.

Rice Institute. T. W. Bonner, Nuclear Physics Research.

Rochester, University of. R. E. Marshak, High Energy Nuclear Physics.

Stanford University. E. L. Ginzton, Limitations of Electron Linear Accelerators.

Syracuse University. Kurt Sitte, Nuclear Interactions of Cosmic Rays.

Texas, University of. E. L. Hudspeth, Fast Neutron Interactions.

Vanderbilt University. S. K. Haynes, Precision Beta-Ray Spectroscopy.

Vanderbilt University. Cyril Curtis, Nuclear Research With Ranger.

Vanderbilt University. Cyril Curtis, Transfer of ORNL Cockcroft-Walton to Vanderbilt University and Related Research.

Virginia, University of. Frank L. Hereford, Interaction of Polarized Photons With Matter and Other Research with a 1 Mev Van de Graaff.

Washington, State College of. S. T. Stephenson and S. E. Hazlet, Design Study and Development of Research Reactor.

Washington University. J. H. Manley, 60'' Cyclotron Program.

Wisconsin, University of. R. G. Herb, Nuclear Research With Electrostatic Generator.

Wisconsin, University of. R. G. Sachs, Theory of Light Nuclei.

Wisconsin, University of. C. K. McLane and J. R. Dillinger, Low Temperature Research.

Wisconsin, University of. D. A. Lind, Inelastic Scattering of Fast Neutrons.

Yale University. W. W. Watson, Isotope Separation of Radioactive Studies.

Yale University. H. L. Schultz, Electron Linac Neutron Velocity Selector.

Yale University. H. L. Kraybill and E. C. Fowler, High Energy Physics.

Yale University. Franklin Hutchinson, Stopping Power of Water.

Yale University. E. R. Beringer, Heavy Particle Linear Accelerator.

325448—55——9

Biology, Biophysics, Medicine, and Radiation Instrumentation Research Contracts

Biology

Agriculture, Department of, Agricultural Research Administration. R. M. Salter and C. H. Wadleigh, Isotopes in Ion Absorption by Plants and Reaction in Soils and Related Activities.

Agriculture, Department of, Agricultural Research Administration. Berley Winton, Study of the Effects of Radiation on Chickens.

Agriculture, Department of, Bureau of Animal Industry. The Intermediary Metabolism of Proteins and Amino Acids in Avian and Mammalian Species.

Alabama Polytechnic Institute, Agriculture Experiment Station. H. E. Sauberlich, Radioisotope Studies on Amino Acid Imbalances and Other Factors Affecting the Metabolism of Amino Acids in Microorganisms and Animals.

American Meat Institute Foundation (Chicago). B. S. Schweigert, Relation of Vitamin B–12 to Nucleic Acid Metabolism.

Amherst College. G. W. Kidder, Studies on Nucleic Acid and Free Nucleotide Synthesis in Normal Tissue and in Tumor Tissue, Using Carbon 14.

Amherst College. H. H. Plough, Genetic Effects of Acute and Chronic Low Level Irradiation with Cobalt 60.

Arizona, University of. W. H. Fuller and W. T. McGeorge, Utilization of Phosphorus from Biological Material and Uptake of Strontium by Various Type Crops.

Arizona, University of. E. B. Kurtz, The Synthesis of Fatty Acids in Higher Plants.

Arkansas, University of. P. M. Johnson, The Utilization of Radioisotopes by Vertebrate Embryos.

Arkansas, University of. Jacob Sacks, Studies on the Phosphorylation Cycle in the Intact Animal Using Radioactive Phosphorus.

Arkansas, University of. J. M. Seigel, Investigation of Intermediary Metabolism of the Photosynthetic Bacteria.

Battelle Memorial Institute. K. S. Chester, The Use of Radioactive Indicators in the Study of Mode of Action of Fungicides.

Boston University School of Medicine. W. C. Boyd, Blood-Group-Specific Hemagglutinins from Plant Sources.

Boyce Thompson Institute. G. L. McNew, Use of Tracer Fungicides in Determining the Mechanics of Protecting Plants from Fungus Diseases.

Brown University. J. W. Wilson, The Role of the Intestinal Flora in Radiation Injury.

California Institute of Technology (Pasadena). G. W. Beadle, The Genetic and Cytological Effects of High Energy Radiation.

California Institute of Technology. Henry Borsook, The Biological Synthesis of Protein.

California, University of (Berkeley). E. A. Adelberg, Enzymatic Changes Associated with Radiation Induced Mutations.

California, University of (Davis). A. C. Anderson and G. H. Hart, The Effect of Radiation on Work Capacity and Longevity of the Dog.

California, University of (Berkeley). H. A. Barker, W. Z. Hassid, and C. C. Delwiche, Tracer and Enzymatic Studies on the Metabolism of Plants and Bacteria.

California, University of (Davis). A. S. Crafts, The Use of Radioactive Isotopes and Other Indicators to Study Absorption and Distribution of Herbicidal Chemicals in Plants.

California, University of (Berkeley). W. G. Dauben, Mechanism of Biosynthesis of Polycyclic Compounds.

California, University of (Berkeley). Louis Jacobson and Roy Overstreet, Study of the Internal or Metabolic Factors and the External or Environmental Factors Affecting Ion Absorption by Plants.

California, University of (Davis). Max Kleiber, Intermediary Metabolism of Organic Compounds and Biological Synthesis in Farm Animals.

California, University of (Davis). A. H. Smith, Radiosensitivity of the Hen's Oviduct.

California, University of (Berkeley). P. R. Stout, Micronutrient Element Nutrition of Plants as Determined by Essential and Non-Essential Soil Borne Heavy Metals of Importance in Plant Nutrition.

California, University of (Riverside). F. M. Turrell, *et al.* Use of Radioactive Tracers in Studies of the Mode of Action of Organic Insecticides.

California, University of (Los Angeles). T. A. Geissman, The Sites and Mechanisms of Action of Physiologically Active Substances, with Particular Application to Drugs Acting upon the Autonomic Nervous System.

California, University of (Los Angeles). S. G. Wildman, The Study of Plant Virus as Approached by the Study of the Normal Plant Proteins.

Chicago, University of. Hans Gaffron, Effect of Blue and Dark Red Light upon Reactivation of Ultraviolet Treated Photosynthetic Microorganisms.

Chicago, University of. E. M. K. Geiling, Biosynthesis of Radioactive Drug Compounds.

Chicago, University of. J. O. Hutchens, The Entropy of Amino Acids and Proteins.

Chicago, University of. B. L. Strehler, Studies in Photobiochemistry and Bioenergetic Problems.

Clemson Agricultural College. J. G. Dinwiddie, Jr., Investigation of the Mode of Action of Maleic Hydrazide as a Plant Growth Regulator.

Clemson Agricultural College. J. B. Whitney, Jr., Overwintering of *Xanthomonas pruni*, The Causal Organism of Bacterial Spot of Peaches.

Columbia University. Theodore Dobzhansky, The Population Genetics of Species of Drosophila.

Columbia University. C. G. King and H. B. Burch, To Identify Precursors and End-Products Containing Radiocarbon, in Studies of the Role of Glucose, Ascorbic Acid, etc., in Metabolism.

Columbia University. F. J. Ryan, Radiation Induced Genetic Instability.

Columbia University. J. H. Taylor, Nucleic Acid and Protein Synthesis in Individual Cells and Chromosomes Studied by Radioactive Tracers and Autoradiographs.

Connecticut Agricultural Experiment Station. P. E. Waggoner and A. E. Dimond, Therapy of Plant Disease by Nuclear Radiations.

Connecticut, University of. A. E. Schwarting, A Study of Alkaloidal Synthesis in *Claviceps purpurea.*

Cornell University—New York State Agricultural Experiment Station. John Einset, The Induction and Testing of Somatic Mutations in Apples, Grapes and Other Economic Plants.

Cornell University. M. R. Zelle, Cytological and Genetic Studies of Bacteria as Related to Effects of Radiation.

Delaware, University of. A. M. Clark, The Relation of Genome Number to Radiosensitivity in Habrobracon.

Duke University. P. J. Kramer, A Study of the Absorption of Radioisotopes by Roots of Plants.

Duke University. K. M. Wilbur and Frederick Bernheim, The Effects of Ultraviolet Light and Gamma Rays on Cell Lipids and the Physiological Action of Irradiated Lipids.

Emory University. A. V. Beatty, Studies of the Influence of Oxygen Level and Temperature on the Effects of Ionizing Radiation.

Florida, University of. G. K. Davis, R. L. Shirley and A. M. Pearson, Concentration of Mineral Elements in the Fetus and the Relationship to Placental Transfer of These Elements.

Fordham University. L. R. Cerecedo, Fate of Thiamine and Thiamine Analogs in the Animal Body. Mechanism of Thiamine Inhibition by Thiamine Analogs.

Fordham University. F. F. Nord, Investigation on Enzymatic Degradation of Native and Chemically Modified Proteins.

Georgia, University of. E. P. Odum, J. J. Paul and D. C. Scott, (1) An Ecological Study of Land-Use, Succession, and Invertebrate and Vertebrate Populations of the Savannah River Operations Areas; (2) Studies on the Productivity of Coral Reef Atolls.

Harvard University, Bussey Institution. Karl Sax, The Biological Effect of Radiation.

Hawaii, University of. M. S. Doty, (1) The Utilization and Evaluation of Isotope Techniques for the Determination of Algal Productivity in the Tropical Pacific; (2) The Role of Benthic Algae in the Central Pacific.

Hawaii, University of. R. W. Hiatt, Technical and Administrative Functions of Eniwetok Marine Biological Laboratory Operations.

Hawaii, University of. R. W. Hiatt, Radioisotope Uptake in Marine Organisms with Special Reference to the Passage of Such Isotopes as Are Liberated from Atomic Weapons through Food Chains Leading to Organisms Utilized as Food by Man.

Howard University. W. M. Booker, The Relation of Ascorbic Acid to Cholesterol.

Howard University. L. A. Hansborough, The Effect on Fertilization and Development of Labeling the Germ Cells.

Howard University. Nathan Lavenda, The Influence of Radioiodine and Radiophosphorus on the Hematopoietic Systems of Leukemia-Resistant and Susceptible Strains of Mice.

Idaho, University of. W. K. Ferrell and E. E. Hubert, A Study of Absorption and Translocation of Mineral Elements in Diseased and Healthy Western White Pine by the Use of Radioactive Materials.

Illinois Institute of Technology. L. R. Hedrick, Studies on Yeast Agglutination Using Labeled Antigen.

Illinois, University of. I. C. Gunsalus, Intermediary Metabolism of Carbohydrates.

Illinois, University of. R. G. Hansen, Utilization of Carbon 14 in Studies of the Metabolism of Lactose.

Illinois, University of. B. C. Johnson, Nutritional Biochemistry on the Metabolism of Vitamins and Amino Acids.

Illinois, University of. H. H. Mitchell, Content in Human Tissues of Eleven Trace Elements.

Illinois, University of. George Wolf, Metabolism of Amino Acids Labeled with Radioactive Carbon.

Indiana University Foundation. Felix Haurowitz, The Mechanism of the Combination of Antigen and Antibody.

Indiana University Foundation. H. J. Muller, The Influence of Radiation in Altering the Incidence of Mutations in Drosophila.

Indiana University Foundation. Roy Repaske, Energy Transport in Bacterial Cell-Free Extracts.

Indiana University Foundation. T. M. Sonneborn, Specific Immobilization Substances (Antigens) of *Paramecium aurelia.*

Interior, Department of, Fish and Wildlife Service. W. A. Chipman, (1) Survey of Accumulation of Radioactivity in Marine Invertebrate Animals; (2) Uptake of Fissionable Materials by Oceanic Fish.

Iowa State College. P. A. Dahm, A Mode of Action Study of Radioisotope-Labeled Organic Insecticides with Emphasis on the Problem of Insecticide Resistance.

Iowa State College. J. W. Gowen and Janice Stadler, Quantitative Study of Lifetime Sickness and Mortality and Progeny Effects Resulting from Exposure of Animals to Penetrating Irradiation.

Johns Hopkins University. Robert Ballentine and W. D. McElroy, Metabolism and Functional Significance of Cobalto-Protein.

Johns Hopkins University. B. F. Chow, Purification of Intrinsic Factor in Gastric Juice.

Johns Hopkins University, School of Medicine. Theodore Enns and Francis Chinard, A Study of Relative Diffusion Rates of Isotopes from Capillaries.

Johns Hopkins University. H. B. Glass, The Action of Radiation and Other Mutagenic Agents; (1) in Inducing Mutation in Drosophila Females, and (2) in Controlling the Action of a Specific Gene Responsible for Suppressing Uncontrolled Growth.

Johns Hopkins University. R. M. Herriott, (1) The Transformation of E. coli B from Virus Sensitive to Virus Resistant or vice versa; (2) Chemical and Nutritional Studies of Bacterial Viruses.

Johns Hopkins University. W. D. McElroy, Biochemical Changes Resulting from Mutations Induced by X-rays, Ultraviolet, and Nitrogen Mustard.

Johns Hopkins University—Medical School. C. P. Richter, Part Played by the Adrenals in the Ability of Rats to Withstand Radiation Effects.

Johns Hopkins University. C. P. Swanson, Modification of the Rates of Induced Chromosomes and Gene Changes by Supplementary Agents.

Kansas State College of Agriculture and Applied Science. R. E. Clegg, Phosphoproteins of the Embryonated Egg.

Kansas State College of Agriculture and Applied Science. M. F. Hansen, Mode of Action of Anthelmintics. I. Carbon Disulfide.

Kansas State College of Agriculture and Applied Science. C. C. Roan, Use of Radioactive Tracers in Investigations of the Mode of Action of Insecticides with Emphasis on Potential Systematic or Chemotherapeutic Action.

Kansas, University of. C. A. Leone, The Effect of Radiation on the Proteins of Organs and Tissues by Means of Serological Techniques.

Kentucky, University of. H. P. Riley, The Protective Effect of Certain Chemicals on the Sensitivity of Plant Chromosomes to Ionizing Radiation.

Long Island Biological Association, Inc. Bruce Wallace, Adaptive Value of Experimental Populations Exposed to Radiations.

Longwood College. R. T. Brumfield, Effects of Radiation on Root Growth of Higher Plants.

Louisiana State University. H. E Wheeler, Investigations of the Toxin Theory of Plant Disease Using Labeled Plant Pathogens.

Maine, University of—Agricultural Experiment Station. K. F. Nielsen, A Study of the Translocation and Accumulation of Certain Anions and Cations within the Potato Plant.

Marine Biological Laboratory. P. B. Armstrong, Studies on the Physiology of Marine Organisms Using Radioisotopes.

Marine Biological Laboratory. P. B. Armstrong, Investigation of the Biochemistry of Cell Nuclei Using Radioisotopes.

Marquette University School of Medicine. Michael Laskowski, Studies on the Specificity of Nucleolytic Enzymes.

Marquette University. J. P. O'Brien, Temperature Prevailing During Exposure as a Modifying Factor in the Dose-Response Relationship of X-rayed Mammalian Skin.

Maryland, University of. W. M. Dugger and H. G. Gauch, The Influence of Inorganic Nutrients on the Translocation of Organic Materials in Plants.

Maryland, University of. J. C. Shaw, The Metabolism of Radioactive Carbon Compounds in Lactating Ruminants.

Maryland, University of. Edward Steers, A Study of the Metabolic Precursors of the Benzenoid Carbons of Tryptophan.

Massachusetts Institute of Technology. B. E. Proctor, Fundamental Studies on the Effects of Ionizing Radiations on Bacteria.

Massachusetts, University of. P. A. Swenson, Effects of Ultraviolet Radiations on Phosphate Turnover of Yeast Cells in the Presence of Galactose.

Michigan State College. R. U. Byerrum and C. D. Ball, A Study of Transmethylation in Plants Using Carbon 14 as a Tracer.

Michigan State College. J. L. Fairley, The Role of Various Aliphatic Acids in Pyrimidine Biosynthesis.

Michigan State College. L. W. Mericle, Effects of Irradiation on Developing Plant Embryos.

Michigan State College. H. B. Tukey, (1) The Absorption and Utilization of Radioactive Minerals Applied to the Leaves of Plants; (2) The Absorption and Utilization of Ruthenium by Plants; (3) The Leaching of Nutrients from Leaves of Plants.

Michigan State College. L. F. Wolterink, Hormonal and Nutritional Factors Which Influence the Biological Half Lives of Calcium and Strontium in Animals (Including Studies of Intestinal Absorption).

Michigan, University of. J. V. Neel, (1) The Estimation of the Rate of Mutation of Certain Human Genes; (2) The Estimation of the Genetic Effects of Radiation on Man.

Minnesota, University of. J. J. Christensen and E. C. Stakman, Effects of Radioactive Substances on Plant Pathogens and Other Microorganisms.

Minnesota, University of, Hormel Institute. R. T. Holman and Herman Schlenk, Studies in Lipid Metabolism by Means of Radioactive Tracers.

Minnesota, University of. W. E. Petersen, *et al.*, Study of Milk Formation by the Use of Radioactive Carbon Compounds.

Missouri, University of. Samuel Brody, Determination of Thyroid Activity in Farm Animals by the Use of Radioactive Tracers.

Missouri, University of. J. R. Laughnan, The Genetic Nature of Induced Mutations.

Missouri, University of. C. W. Turner, Study of the Inheritance of Productive Processes in Domestic Animals by Endocrine Methods Using Radioactive Isotopes as Tracers.

Morehouse College (Atlanta, Ga.). J. H. Birnie, The Correlation of Histological Differentiation in the Thyroid Gland of Fetal Rats with the Beginning of Function.

Nebraska, University of. E. F. Frolik and Rosalind Morris, The Genetic Effects of Thermal Neutron Irradiation of Crop Seeds.

Nevada, University of. V. R. Bohman, Range Livestock Production Adjacent to Nevada Test Site.

New York Medical College. Carl Neuberg, Factors Influencing the Solubility of Heavy Metal Compounds and Their Metabolism.

New York University. B. W. Zweifach and B. P. Sonnenblick, Histochemical Studies of Metabolic Alterations in Rats Receiving Lethal and Sublethal Doses of Radiation, with Emphasis on Terminal Vascular Bed.

North Carolina State College of Agriculture and Engineering. L. A. Dean, (1) A Project to Characterize the Phosphorus Complexes of Soils of the Red-Yellow Podsolic Group; (2) The Effect of Root Interaction.

North Carolina State College of Agriculture and Engineering. W. C. Gregory, The Comparative Effect of Irradiation upon Mutation Frequency, Total Genetic Variance, and Progress from Selection in Different Genotypes of Peanuts and Their Hybrids.

North Carolina State College of Agriculture and Engineering. D. S. Grosch, The Genetic and Developmental Effects of Ingested Radioactives in Habrobracon.

North Carolina State College of Agriculture and Engineering. S. B. Tove, A Study of the Effect of the Diet on Lipid Metabolism Using Carbon 14.

North Carolina, University of. Maurice Whittinghill, A Study of Genetic Recombination as Influenced by Mutagenic and Non-mutagenic Environmental Agents.

Northwestern University. G. H. Mickey, Comparison of the Delayed Effects Produced by Chemical Mutagens and by X-rays.

Notre Dame, University of. C. S. Bachofer, Study of Protection of Virus Systems Against Irradiation.

Oberlin College. G. T. Scott, Studies on the Physiology of Ion Accumulation and Electrolyte Balance in Living Cells.

Ohio Agricultural Experiment Station. O. G. Bentley and A. L. Moxon, Investigations of Vitamin B–12 and Vitamin B–12-like Substances Produced in Ruminants, Using Radioactive Cobalt.

Oklahoma Agricultural and Mechanical College. Robert MacVicar, Isotope Investigation of the Mechanism of Nitrate Reduction in Bacteria.

Oklahoma Research Institute, University of. Lawrence 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. S. B. Apple, Jr., The Effects of Soil Temperature and Morphological Age of Plants on the Uptake and Assimilation of Radioactive Phosphorus.

Oregon State College. J. S. Butts, The Mode of Action of Labeled 2, 4-Dichlorophenoxyacetic Acid and Similar Agents.

Oregon State College. V. H. Cheldelin and B. E. Christensen, Carbohydrate-Amino Acid Interrelationships, Using Isotopic Tracers.

Oregon State College. B. E. Christensen and Elmer Hansen, Intermediary Metabolism of Organic Acids and Proteins in Certain Fruits Using Isotopic Tracers.

Oregon, University of. F. J. Reithel, An Investigation of Lactose Synthesis in Mammary Gland Homogenates.

Pennsylvania, University of. E. D. DeLamater, Studies on the Cytology and Cytochemistry of Microorganisms Following Irradiation.

Pennsylvania, University of. D. R. Goddard and William Stepka, A Study of Sulfate Reduction and the Biosynthesis of Organic Sulfur Derivatives in Higher Plants.

Pennsylvania, University of. L. V. Heilbrunn, Radiation-Induced Colloidal Changes and Releases of Bound Materials in Protoplasm.

Pennsylvania, University of. Stuart Mudd, The Internal Organization of Normal and Phage-Infected Cells as Influenced by Radiation.

Pennsylvania, University of. P. W. Whiting, Mutation Rates in Mormoniella.

Pennsylvania, University of. D. W. Wilson and Samuel Gurin, Synthesis of Isotopic Carbon Compounds Used in Biochemistry.

Pittsburgh, University of. M. A. Lauffer, Study of the Correlation of Radiation Effects with Physical and Chemical Changes in Viruses.

Puerto Rico, University of, Agricultural Experiment Station. J. A. Bonnet, and A. R. Riera, The Absorption of Potassium by Tropical Crops.

Purdue Research Foundation. Henry Koffler and P. A. Tetrault, Use of Radioactive Isotopes in Studying Mold Metabolism with Emphasis on the Assimilatory Mechanisms of Penicillium Chrysogenum and Other Representative Molds.

Purdue Research Foundation. Henry Koffler and D. M. Powelson, The Physiology of Hydrogen Bacteria.

Reed College. A. H. Livermore, The Biochemical Synthesis of Peptide Bonds.

Reed College. A. F. Scott and A. H. Livermore, The Effect of Ionizing Radiation on Biochemical Compounds.

Rice Institute. R. V. Talmage, Endocrine and Metabolic Studies Utilizing Radioisotopes and Labeled Hormones.

Rochester General Hospital. H. L. Rosenthal, A Study of the Uptake, Turnover, and Metabolism of the Chemical Constituents of Bone.

Roscoe B. Jackson Memorial Laboratory (Bar Harbor). C. C. Little, Study of Endemic and Epidemic Diseases in Mice.

Roscoe B. Jackson Memorial Laboratory (Bar Harbor). E. S. Russell and W. S. Murray, The Maintenance of a Genetically Controlled Colony of Mice to Insure the Availability of Strains of Known Constitution to AEC Institutions and Contractors.

Rutgers University. N. F. Childers, L. F. Hough and J. E. Gunckel, Growth, Flowering and Fruiting Effects of Irradiation on Important Fruit Plants, Particularly Blueberry and Peach.

Rutgers University. J. E. Gunckel, Histological and Physiological Effects of Irradiation of Plant Tissues.

Smith College, Genetics Experiment Station. Sophie Satin, Studies to Determine the Effects of Different Types of Radiations on Plants.

Smithsonian Institution. R. B. Withrow, A Biochemical Investigation of Radiant Energy as it Affects Photomaturation in Green Plants.

Smithsonian Institution. R. B. Withrow, Specific Biological Indicators of Ionizing Radiation and the Mechanism of Its Action.

South Carolina, University of. W. E. Hoy, An Ecological Study of the Land Plants and Cold-Blooded Vertebrates of the Savannah River Project Area Before and After Installations Have Been Completed.

325448—55——10

South Dakota State College. E. I. Whitehead and O. E. Olson, Metabolism of Selenium and Radioactive Sulfur in Plants.

Southern California, University of. H. J. Deuel, Jr., and A. L. S. Cheng, The Effect of Radiation on Intestinal Absorption and Metabolism of Fats and Carbohydrates.

Southern California, University of. W. E. Martin, The Action of Ultraviolet Light on Purine and Protein Metabolism in Echinoderm Embryos.

Southern California, University of. M. G. Morehouse, A Study of the Effect of X-Radiation on the Absorption of Glycerides Utilizing Tracer Technique.

Southern Illinois University. C. C. Lindegren, The Effect of X-Irradiation on a Polypoid Series of Yeast Cultures Containing Determined Amounts of DNA.

Southern Research Institute. H. E. Skipper, Body Retention of Carbon 14.

Southern Research Institute. H. E. Skipper and L. L. Bennett, Jr., Use of Radioactive Isotopes for Study of Certain Chromosome-Coenzyme Relationships.

Stanford University. A. C. Giese, Studies on Photoreactivation Following Ultraviolet Irradiation Injury.

Syracuse University. B. S. Strauss, The Study of Intermediate Carbohydrate Metabolism in Neurospora Using Radioactive Carbon and Biochemical Mutants.

Tennessee, University of. Metabolism of Radioisotopes in Domestic Animals and Their Deposition in Various Organs.

Tennessee, University of. A. W. Jones and Honorico Ciordia, A Survey of the Effects of Radiation on Animals Parasitized with *Taenia pisiformis*, on the Parasites on the Irradiated Animals, and on the Parasites *per se*.

Texas A & M College, Agricultural Experiment Station. J. L. Liverman, Biosynthesis, Metabolism and Mechanism of Action of Plant Growth Substances.

Texas A & M College, Agricultural Experiment Station. J. H. Quisenberry, Effects of X-ray Irradiation on Reproduction of the Domestic Fowl (*Gallus Domesticus*).

Texas, University of. W. F. Blair, Direct and Indirect Effects of Radiation on Genetic and Developmental Systems of Vertebrates.

Texas, University of. J. W. Foster, Studies of the Metabolic Processes in Molds and Fungi with Carbon 14.

Texas, University of. A. R. Schrank, Effects of Various Types of Irradiation on Growth Responses, Metabolism and Electrical Pattern of the *Avena* coleoptile and Earthworms.

Texas, University of. W. S. Stone, Research on Direct and Indirect Effects of Radiations on the Genetic Systems of Organisms.

Texas, University of. Orville Wyss, The Genetic and Biochemical Effects of Radiation on Bacteria.

Utah State Agricultural College. G. W. Cochran, The Use of Radioactive Phosphorus, P–32, in Labeling Plant Viruses to Facilitate Their Isolation by Means of Paper Electrochromatography.

Utah State Agricultural College. L. E. Harris, Effect of Radioactive Elements and Radiation on Ewes Maintained on Different Levels of Nutrition.

Utah State Agricultural College. D. W. Thorne, Use of Radioisotopes in Studying Lime-Induced Chlorosis.

Utah, University of. J. D. Spikes and R. W. Lumry, Studies of Photosynthetic Processes in Cell-Free Preparations Using Radiation.

Utah, University of. F. E. Stephens, Study of the Frequency of Human Consanguineous Marriages and Its Relation to the Appearance of Recessive Gene Mutations.

Washington, State College of. Orlin Biddulph, Absorption, Translocation and Deposition of Radioactive Elements in Plants.

Washington, State College of. H. B. Milne, The Effect of Ionizing Radiations on the Activator Requirements of SH Enzymes.

Washington, State College of. R. A. Nilan, A Study of Factors Influencing the Biological Effects of X-rays.

Washington, University of, Applied Fisheries Laboratory (Seattle). L. R. Donaldson, The Deposition and Accumulation of Radioactive Materials on Aquatic Organisms.

Washington, University of (Seattle). E. J. Ordal. The Metabolism of Molecular Hydrogen, Deuterium and Tritium.

Western Biological Laboratories (Culver City, Calif.). B. H. Ershoff, Further Studies of an Unidentified Factor in Liver which Prolongs Survival of Animals Administered Multiple Sublethal Doses of X-Irradiation.

Western Reserve University. H. G. Wood and L. O. Krampitz, Intermediary Metabolism of Carbohydrates by Bacteria.

Wisconsin, University of. R. H. Burris, M. J. Johnson and P. W. Wilson, Metabolism of Organic Acids in Higher Plants and Microorganisms.

Wisconsin, University of. R. H. Burris and P. W. Wilson, Biological Nitrogen Fixation with Isotope Tracers.

Wisconsin, University of. D. E. Green, Effect of Radiation on Enzymes in the Cyclophorase System.

Wisconsin, University of. A. D. Hasler, Radioisotope Exchange Studies in Lakes.

Wisconsin, University of. J. C. Nees, The Iron, Manganese and Copper Cycles in Aquatic Insect Populations.

Wisconsin, University of. P. H. Phillips, Long Time Effects of Intermittent Radiation on Dogs.

Wyoming, University of. Irene Rosenfeld and O. A. Beath, Investigations of the Interrelationship of Sulphur, Phosphorus and Calcium in Selenium Metabolism in Plants and Animals.

Yale University. D. M. Bonner, Relationship of Genes to Biochemical Reactions in Neurospora.

Yale University. M. I. Bunting, The Genetics of Serratia as Revealed by Radiation.

Yale University. N. H. Giles, Jr., Investigations on the Cytogenetic Effects of Radiations.

Yale University. E. C. Pollard, Irradiation of Viruses and Large Molecules.

Biophysics

Chicago, University of. R. E. Zirkle, Proton and Ultraviolet Microbeam.

Columbia University. C. B. Braestrup, Attenuation of Scattered Cobalt 60 Radiation in Lead and Building Materials.

Columbia University. Gioachino Failla, Biological Action of Ionizing Radiation. Instrumentation for Research.

Columbia University. V. K. LaMer, Filtration of Monodisperse Radioactive Solid Aerosols (Dusts).

Columbia University, Lamont Geological Observatory. J. L. Kulp, Distribution of Certain Fission Product Activities.

Commerce, U. S. Department of, National Bureau of Standards. Radiation Physics as Related to Dosimetry and Radiation Protection.

Emory University. H. D. Bruner, Biological Studies on the Distribution of Radioactive Metals with Special Reference to Damaging Levels of Tissue Concentration.

Health, Education, and Welfare, U. S. Department of. R. L. Cleere, Study of Methods for the Control of Radioactive Dusts and Gases in Mines.

Howard University. Herman Branson, Kinetic and Mass Spectrometric Studies of Biophysical Systems with Radioactive and Stable Isotopes.

Idaho State College. A. E. Taylor, Development of Analytical Methods for the Determination of Small Amounts of Strontium, Uranium and Fluoride.

Kansas, University of. F. E. Hoecker, Study of Deposition and Excretion of Bone-Seeking Radioisotopes.

Marquette University, School of Medicine. J. F. Kuzma, The Pathological Effects of Radioactive Isotopes of Calcium and Strontium on Bone and Soft Tissue.

Massachusetts Institute of Technology. R. D. Evans, Radium and Mesothorium Poisoning, and Dosimetry and Instrumentation Techniques.

Michigan, University of. H. J. Gomberg, High Resolution Detection of Nuclear Radiations.

Navy, U. S. Department of, Office of Naval Research. Rocket Instrumentation.

Northwestern University Medical School, Rheumatic Fever Research Institute. E. L. Hess, Radiation Sensitivity of Lymphoid Proteins.

Pittsburgh, University of. T. F. Hatch, Hazard from Inhaled Radioactive Particulate Matter.

Sloan Kettering Institute for Cancer Research, Memorial Center for Cancer and Allied Diseases. J. S. Laughlin, Equivalence of Absorbed Radiation Energy and Cavity Ionization.

Utah, University of. J. Z. Bowers, Toxicity Studies of Plutonium and Other Radioactive Substances in Animals.

Vanderbilt University. J. I. Hopkins, Nuclear Physics Studies on Instrumentation Problems.

Washington University School of Medicine (St. Louis). W. M. Allen, W. B. Seaman, and Michel Ter-Pogossian, Comparative Biological Effects of X-rays and Ionizing Radiation from Radioisotopes.

Washington, University of (Seattle). F. I. Badgley, Determination of Relationships Between Temperature Lapse Rate, Wind Speed and Wind Shear (Atmospheric Turbulence Study).

Wisconsin, University of. D. M. Angevine and J. J. Lalich, Biological Applications of Historadiography.

Medicine

Albany Medical College. Arthur Knudson and Pradisth Cheosakul, The Mechanism of Urea Metabolism.

Albert Einstein Medical Center. Charles Weiss, Comparative Enzymatic and Biochemical Studies of Animal Skin Irradiated with Alpha and Beta Particles.

Arkansas, University of, School of Medicine. P. L. Day and Isadore Meschan, Studies on the Biochemical and Nutritional Aspects of X-Radiation Injury.

Arkansas, University of, School of Medicine. Isadore Meschan, To Investigate, Develop and Evaluate Radioisotopes for Teletherapy.

Beth Israel Hospital Association, Inc. H. L. Blumgart, The Use of Iodine 131 in Treatment of Heart Diseases and Follow-up Studies on Biological Effects of Radiation.

Boston University. G. P. Fulton, The Effect of Irradiation on the Functions of Small Blood Vessels of the Hamster and the Frog.

Boston University. L. C. Wyman, The Effect of Irradiation on the Growth and Functioning of Transplanted or Regenerated Adrenocortical Tissue in the Rat.

Boston University School of Medicine. Isaac Asimov, Radiation-Induced Changes in Nucleic Acids and Their Hydrolysis Products.

California, University of, School of Medicine (Berkeley). I. L. Chaikoff, Studies on the Induction of Thyroid Cancer Following Administration of Radioactive Iodine.

California, University of (Berkeley). I. L. Chaikoff, Carbohydrate Metabolism as Studied with Carbon 14 Labeled Compounds.

Cedars of Lebanon Hospital (Los Angeles). H. L. Jaffe, To Investigate, Develop and Evaluate Radioisotopes for Teletherapy.

Chicago Medical School. Harold Koenig, A Study of Phosphorus Metabolism in Normal, Degenerating and Regenerating Nerve Cells Employing P–32.

Chicago Medical School. Philippe Shubik, A Study of the Latent Tumor Cells as Produced by Beta Radiation and a Comparison of the Latent Tumor State with That Produced by Chemical Carcinogens.

Chicago, University of. H. S. Anker, Investigation of the Mechanism of Antibody Synthesis by the Tracer Technique.

Chicago, University of. E. S. G. Barron, Studies on the Mechanism of Action of Ionizing Radiations.

Chicago, University of. P. P. H. DeBruyn, Radiosensitivity of the Lymphocytes.

Chicago, University of. C. P. Miller, Bacteriological Aspects of Radiation Sickness.

Chicago, University of. W. L. Palmer, A Study of the Effect on Gastric Tissues of Irradiation Therapy in Peptic Ulcer.

Chicago, University of. W. H. Taliaferro, The Effect of Localized X-Irradiation on Antibody Formation and Antigen Localization. The Site of Antibody Formation.

Children's Hospital of Buffalo. C. U. Lowe, Nucleic Acid Metabolism in the Liver and Effects of Radiation.

Children's Medical Center (Boston). Sidney Farber, The Nature of Bleeding in Pancytopenia with Special Regard for Thrombocytopenia and the Vascular Defect.

Children's Medical Center. Jacob Furth, The Effect of Irradiation on the Adrenal-Pituitary Axis from the Time of Irradiation to the Development of the Pituitary Tumor.

Cincinnati, University of, Kettering Laboratory. F. F. Heyroth and J. S. Cass, Research on the Biological Effects of Beryllium and Its Compounds.

Colorado, University of. J. K. Aikawa, A Study of the Abnormal Physiology of Immune Reactions (Immunophysiology).

Colorado, University of. T. T. Puck, Bacteriophage Mechanisms and Radiation.

Columbia University, College of Physicians and Surgeons. P. B. Hudson, The Turnover of Specific Proteins, Protein Fractions, and Nucleic Acids in Normal and Malignant Human Testis and Kidney.

Columbia University. Seymour Lieberman, Turnover of Nucleic Acids in Human Ovarian and Endometrial Carcinomas.

Columbia University. David Nachmansohn, Effect of Exposure to Radioactive Material and to X-ray Irradiation on Nerve Tissue.

Duke University. Philip Handler, Metabolic Studies with Tracer Techniques.

Duke University. J. S. Harris, (1) Metabolism and Physiological Role of Potassium, (2) Metabolism of Renal Insufficiency.

Emory University. A. J. Riopelle, Effect of Radiation on Learned Behavior, Problem-Solving Ability and Neural Mechanisms of Rhesus Monkeys.

Emory University. H. S. Weens, To Investigate and Evaluate Radioisotopes for Teletherapy.

Florida, University of, Cancer Research Laboratory. F. E. Ray, The Use of Isotopes in the Study of the Metabolism of Aromatic Amines.

George Washington University. P. K. Smith, Studies of the Effects of Radiation on the Biosynthesis and Degradation of Nucleoproteins and Its Modification by Various Agents.

Georgetown University School of Medicine. W. C. Hess, Source of the Liver Glycogen Resulting from the Administration of Cortisone.

Georgetown University, Chemo-Medical Research Institute. M. X. Sullivan, A Study of Intermediary Carbohydrate Metabolism by Means of Labeled Compounds.

Georgia, University of, School of Medicine. S. A. Singal, The Effects of Nutritritional Deficiencies on the Synthesis of Phospholipids and Nucleoproteins in the Rat.

Hahnemann Medical College and Hospital. H. J. Eichel, Effects of Irradiation on the Enzymatic Activities of Cell Nuclei.

Harvard University. J. C. Aub, Study of Metabolic Activities of Living Organisms by Means of Suitable Isotopes.

Harvard University. D. G. Cogan, R. D. Evans, Production of Cataracts by Neutrons and Other Radiations.

Harvard University. A. B. Hastings, Research on the Use of Isotopes in Study of Metabolism of Organic Substances in Mammalian Tissues.

Harvard University. A. K. Solomon, Research on Biological, Medical and Biophysical Problems in Isotope Techniques, and on the Use of Isotopes in Medical Problems.

Harvard University. Shields Warren, Research on the Use of Isotopes as Therapeutic and Diagnostic Agents.

Harvard University Medical School. E. L. Gasteiger, The Effect of Ionizing Radiations on Peripheral Nerve.

Illinois, University of. Percival Bailey, The Effects of Betatron 23 MEV X-rays upon Tumors of the Central Nervous System of Man and upon the Normal Nervous System of Man.

Illinois, University of. P. G. Kruger, Experimental Research on Synthesis of Boron-Containing Dyes.

Illinois, University of, College of Medicine. S. B. Binkley, The Chemistry and Biological Significance of Carbohydrate Containing Nucleotides and Polynucleotides.

Illinois, University of, College of Medicine. S. R. Rosenthal, A Reevaluation of Radiation Injury (B Rays) of the Skin by a Direct Method Approach.

Institute for Cancer Research, Lankenau Hospital. J. A. Stekol, Metabolic Studies on Ethionine and Derivatives.

Institute for Cancer Research, Lankenau Hospital. Sidney Weinhouse, Origin and Fate of Amino Acids in Plants and Animals.

Iowa State College. Henry Gilman, Synthesis of Organic Compounds for Neutron Capture Studies.

Iowa, State University of. T. C. Evans, R. E. Hodges and J. T. Bradbury, Radioiodine Studies of Fetal, and Other Thyroids.

Iowa, State University of. T. C. Evans and P. G. Leinfelder, A Quantitative and Morphologic Study of Radiation Induced Cataracts.

Jefferson Medical College of Philadelphia. F. W. Sunderman, Metabolic and Cytologic Changes Induced by Metallic Carbonyls.

Johns Hopkins University-School of Medicine. C. L. Conley, (1) Absorption, Utilization, and Excretion of Vitamin B–12, (2) Blood Coagulation, Hemorrhagic Disease.

Johns Hopkins University. J. E. Howard, Investigation of the Mechanism of Bone Deposition and Related Physiological Studies.

Johns Hopkins University. W. H. Price, The Mechanism of the Activation of Latent Epidemic Typhus Infections in the Laboratory Animals and in Humans by Cortisone and X-ray.

Kansas, University of. F. E. Hoecker, Investigation of Organic Substances Tagged with I–131 by Human Thyroid Gland *in Vivo.*

Kansas, University of. R. E. Stowell, Effects of Ischemia, Irradiation and Chemical Irritation on Cytochemistry of Mammalian Tissues.

Kresge Eye Institute (Detroit). V. E. Kinsey, Effects of Neutrons and Other Radiations on the Ocular Lens.

Lovelace Foundation for Medical Education and Research. W. R. Lovelace II, Indirect Blast Injuries.

Maryland, University of, School of Medicine. T. E. Woodward, Host Parasite Relationships of Schistosomiasis Infestation as Affected by Exposure of the Host Mammal to Whole-Body Irradiation.

Massachusetts Eye and Ear Infirmary, Howe Laboratory of Ophthalmology. D. G. Cogan and J. H. Kinoshita, A Study of the Metabolism of the Ocular Lens with the Use of Radioactive Compounds.

Massachusetts General Hospital. J. C. Aub, I. T. Nathanson and P. C. Zamecnik, A Biochemical Study of the Effects of Radiation on Cells.

Massachusetts General Hospital. Oliver Cope, Effects of Radioactive Iodine on Biology of the Thyroid Gland.

Massachusetts General Hospital. H. L. Hardy, Establishment of a Beryllium Case Registry.

Massachusetts General Hospital. W. H. Sweet, External Localization of Brain Tumors Employing Positron Emitting Isotopes.

Massachusetts General Hospital. W. H. Sweet, The Use of Thermal and Epithermal Neutrons in the Treatment of Neoplasms.

Massachusetts Memorial Hospitals. Charles Emerson, Physiological and Therapeutic Investigations and Fundamental Blood Studies Using Radioactive Isotopes.

May Institute for Medical Research (Cincinnati). Sol Sherry, Studies on the Hemorrhagic State Following Exposure to Radiation.

Meharry Medical College. P. F. Hahn, Use of Radioactive Gold in Treatment of Tumors.

Miami, University of. G. C. Ring, Test of an Isotopic Method for Estimation of Pulmonary Circulatory Changes.

Michigan, University of. F. H. Bethell, Hematological and Biochemical Effects of Ionizing Radiations.

Michigan, University of. F. J. Hodges and Isadore Lampe, Clinical Evaluation of Teletherapy.

Michigan, University of. W. J. Nungester, Immunological Study of Tumors.

Minnesota, University of. W. D. Armstrong and W. O. Caster, Effects of Ionizing Radiations on Electrolyte and Water Metabolism.

Minnesota, University of. L. A. French and S. N. Chou, Study of Mechanisms of Radioactive Isotopic Localization in Tissues of the Central Nervous System.

Minnesota, University of. J. F. Marvin, E. L. Brackney and C. W. Lillehei, Toxic Effects of Irradiation.

Minnesota, University of. Samuel Schwartz, 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.

Montefiore Hospital for Chronic Diseases. Daniel Laszlo, A Study of the Distribution and Excretion of Lanthanum and the Rare Earth Elements.

Nebraska, University of. W. J. Arnold, Effects of Cranial X-Irradiation on Psychological Processes in Rats.

New England Center Hospital. William Dameshek, Physiopathology of Platelets and Development of Platelet Substitutes.

New England Deaconess Hospital. S. P. Hicks, The Effects of Ionizing Radiation on the Developing Mammalian Nervous System.

New England Deaconess Hospital. Shields Warren, Acute and Chronic Radiation Injury.

New York, State University of, Research Foundation (Albany). J. H. Ferguson and M. F. Hilfinger, Experimental Transfusion of Bone Marrow into Rabbits after Total Body Irradiation.

New York, State University of, Upstate Medical Center (Syracuse). Alfred Farah, Method for the Quantitative Determination of Sulfhydryl and Disulfide in Cells and Factors Influencing these Substances.

New York University, Bellevue Medical Center. J. M. Converse and Mario Gaudino, The Transfer of Cellular Antibodies in Relation to the Immunological Aspects of the Homograft Rejection Reaction.

New York University, Bellevue Medical Center. Norton Nelson, Immunochemical Studies on Beryllium.

New York University, Bellevue Medical Center. W. E. Smith, Investigation of Factors which may Modify Neoplastic Changes Induced by Irradiation.

New York University, Bellevue Medical Center. M. B. Sulzberger, Study of the Biological Effects of Ionizing Radiation (Alpha and Beta) on Human Skin.

New York University. Norton Nelson, Aerosol Retention Studies; Radiation Pellet Implantation in the Lung.

New York University. W. S. Tillett and Robert Soberman, The Influence of Ionizing Radiation on Enzyme Systems.

New York University, College of Medicine. H. W. Smith, Body Fluid and Electrolyte Distribution, and Collateral Physiological Studies.

North Dakota, University of. W. E. Cornatzer, The Effect of Whole-Body Radiation on Various Enzyme Systems in the Liver, Kidney and Other Tissues.

Northwestern University. J. A. D. Cooper and H. L. Alt, The Diagnostic and Therapeutic Use of Radioisotopes in Experimental Medicine.

Northwestern University. Loyal Davis, Further Development and Utilization of Radioactive Dyes in the Diagnosis and Localization of Brain Tumors.

Northwestern University. Smith Freeman, Studies on Radiation-Induced Cataracts.

Northwestern University, Rheumatic Fever Research Institute. R. W. Schayer, Metabolism of Biologically Active Amines.

Oklahoma Medical Research Foundation. C. D. Kochakian, Androgen Regulation of the Incorporation of Radioactively Labeled Amino Acids into Tissues.

Oklahoma Medical Research Institute and Hospital. C. D. Kochakian, Metabolism of Radioactive Sex Hormones.

Oregon, University of, Medical School. E. E. Osgood and A. J. Seaman, Studies of Hemic Effects of Radioisotopes, X-rays and of Adrenocortical Hormones.

Oregon, University of, Medical School. J. T. Van Bruggen, Studies on the Metabolism of Cholesterol and Ketone Bodies.

Pack Medical Foundation (New York). I. M. Ariel, Investigation of Pick-up and Effects of Radioactive Phosphorus in Primary and Metastatic Tumors of the Lung, Alone and in Conjunction with Nitrogen Mustard and Terramycin.

Parke, Davis and Company, Detroit, Michigan. J. K. Weston, Factors Elaborated by Animal Tissues which Stimulate Rate of Regeneration of Hematopoietic Organs of Animals Exposed to Total Body Irradiation with Gamma Rays.

Pennsylvania, University of. T. F. Anderson, Biophysical Studies of Bacteriophages and Their Synthesis.

Pennsylvania, University of. F. C. Grant and G. M. Austin, Investigation of Use of Na-24 in the Diagnosis of Brain Tumors and Focal Epileptic Lesions.

Peter Bent Brigham Hospital. F. D. Moore, Intracellular Changes in Trauma, Depletion and Repair; Biochemical Studies on the Human Being with the Aid of Isotopes.

Philadelphia General Hospital. H. P. Schwarz, The Effect of X-ray Radiation on the Infra Red Spectra of Neural and Radiosensitive Visceral Tissue.

Pittsburgh, University of. L. V. Beck, Dietary Sulphur-Containing Amino Acids in Relation to Resistance to Irradiation and Other Trauma in the Mouse.

Pittsburgh, University of. F. S. Cheever, The Effect of Radiation on the Virus-Host Cell Relationship.

Pittsburgh, University of. M. A. Fischer, Effects of Radiation on Spleen Succinoxidase and Serum Proteins.

Pittsburgh, University of, School of Medicine. T. S. Danowski, Neoplasia and the Disposal of Exogenous Thyroxin.

Pittsburgh, University of, School of Medicine. F. J. Dixon, The Study of the Effects of Radiation on the Immune Response.

Rochester, University of, School of Medicine and Dentistry. L. H. Hempelmann, Individual Response to Ionizing Radiation in Animals and Patients.

Seton Hall University (South Orange, N. J.). E. V. Brown, Metabolism of a New Carcinogen Using Radioactive Carbon.

Sloan Kettering Institute for Cancer Research, Memorial Hospital. C. P. Rhoads, *et al.*, Biological Effect of Radiation, and Related Biochemical and Physical Studies.

Southern California, University of. Eloise Jameson, Electrophoretic Studies on X-Irradiated Rats on High Fat and Fat Deficient Diets.

South Carolina, Medical College of. M. H. Knisely, Methods for Demineralization of Bone Maintaining Soft Tissue Histological Qualities.

Southwest Foundation for Research and Education (San Antonio). N. T. Werthessen, Investigation of *in vitro* Organ Maintenance Technique for Production and Isolation of Post-Irradiation Recovery Factors.

Stanford University. H. S. Kaplan and E. L. Ginzton, Biological and Medical Investigations with the 70 MEV Linear Electron Accelerator.

St. Louis University. Henry Pinkerton, Study of the Relation of Rickettsial and Viral Infections to Radiation Injury.

St. Louis University, School of Medicine. E. A. Smolik, The Blood Volume and Blood Turnover in Cases of Head Injury as Determined by Isotope Labeled Red Blood Cells.

St. Lukes Hospital (New York). E. H. Reisner, Jr., Studies on the Life Span and Behavior of Mammalian Platelets *in vitro* and *in vivo* Using Chromium 51.

Tennessee, University of. Aaron Ganz, Factors Influencing the Distribution of Intravenously Administered Radiogold Colloids.

Tennessee, University of. Lester Van Middlesworth, Thyroid Metabolism and Study of the Metabolism of Radioactive Methionine in Tissue.

Tennessee, University of. R. R. Overman, Mechanism of Ionic Imbalance and Pathophysiologic States.

Tennessee, University of. J. D. Perkinson, Jr., Effect of Internal Irradiation on Cellular Metabolism.

Tennessee, University of. J. L. Wood, The Origin and Fate of Thiocyanate Ion in Metabolism.

Tennessee, University of, College of Medicine. W. M. Hale, A Study of the Effects of Cobalt 60 Gamma Irradiation on Infection and Immunity.

Tennessee, University of, College of Medicine. R. R. Overman, Physiology of Water and Ionic Balance in Monkeys Subjected to Whole Body Radiation.

Trudeau-Saranac Institute. P. C. Pratt, Studies in Experimental Pathology of Pulmonary Granulomatosis of Beryllium Workers.

Trudeau-Saranac Institute. L. D. Scheel, Biochemical Aspects of Pulmonary Granulomatosis.

Tufts College. David Rapport, Study of the Relation of Radiation on Reactions Associated with Growth.

Tufts College. Richard Wagner, Enzyme Studies on White Blood Cells and Blood Platelets.

Tulane University of Louisiana. R. H. Turner, The Influence of Radiation Injury upon Physiology of Serum Lipids with Particular Reference to the Function of the Liver.

Tulane University of Louisiana, School of Medicine. W. S. Wilde, The Metabolic Exchange of Tissue Electrolytes.

Utah, University of, College of Medicine. S. R. Dickman, The Pathways of Glucose Oxidation in the Pancreas.

Utah, University of. M. M. Wintrobe and G. E. Cartwright, Metabolism of Trace Elements in Animals and Man with Special Reference to Their Role in Erythropoiesis.

Vanderbilt University, School of Medicine. M. T. Bush, Metabolic Fate of Barbituric Acid Anesthetics with Special Reference to Evipal.

Vanderbilt University, School of Medicine. W. J. Darby, Study of the Absorption and Metabolism of Lipids and the Alterations which Occur in Acute Radiation Injury.

Virginia Medical School, University of. C. L. Gemmill, The Metabolic Exchange of Radioactive Phosphorus and Potassium in Isolated Cell Systems.

Virginia, Medical College of. H. G. Kupfer and N. F. Young, An Investigation of Certain Tissue Protein Changes in Irradiated Animals.

Wake Forest College, Bowman Gray School of Medicine. Camillo Artom, Formation of Tissue Phospholipides and Toxicity of P–32 as Related to Dietary Factors.

Washington University (St. Louis). G. T. Cori, Enzymatic Mechanisms of Glycogen Synthesis.

Washington University (St. Louis). David Lipkin, Synthesis of Nucleotides and Related Compounds.

Washington University (St. Louis). I. L. Shechmeister, Investigations of the Relationship Between Radiation Damage and the Immune State.

Washington, University of (Seattle). C. A. Finch, Isotope Study of Hematopoiesis in Man.

Washington, University of (Seattle). C. A. Finch, Erythrocyte Metabolism.

Washington, University of (Seattle). R. D. Ray, Mobilization of Radioactive Emitters from Bone.

Washington, University of (Seattle). R. H. Williams and H. H. Tomizawa, Studies of Isotopically Labeled Hormones.

Wayne University College of Medicine (Detroit). J. E. Lofstrom, Evaluation of Radioactive Isotope Gamma Ray Source for Medical Teletherapy.

Western Reserve University, School of Medicine. B. M. Dobyns, A Study of the Physiological Function and Histological Changes of Thyroids Irradiated with Radioactive Iodine.

Western Reserve University. H. L. Friedell, Investigations of the Biological Effects of Internally Deposited Radioisotopes and Related Radiobiology Studies.

Western Reserve University. L. O. Krampitz, Synthesis of Nucleic Acids by *Escherichia coli* and Bacteriophage Systems.

Western Reserve University. A. R. Moritz, Louis Pillemer and O. A. Ross, An Investigation of a Recently Isolated Serum Factor (Properdin) in Relation to Its Role in Protecting Against Early Death Following Exposure to Ionizing Radiation.

Western Reserve University. H. G. Wood, A Study of Intermediary Metabolism with Isotopically Labeled Compounds in Perfused Organs, Whole Animals and Humans.

West Virginia University, School of Medicine. R. F. Krause, The Synthesis of C–14 Labeled Carotene and A Study of Its Physiological Functions.

Wisconsin, University of. H. F. Harlow and P. H. Settlage, The Effect of Various Forms of Irradiation of the Brain on Learned and Unlearned Behavior of Monkeys and Chimpanzees.

Worcester Foundation for Experimental Biology. Gregory Pincus, Investigation of the Effects of Radiation on the Biosynthesis and Metabolism of Adrenocortical Steroids.

Yale University. C. E. Carter, Phosphorylation Mechanisms of Nucleic Acid Synthesis in Hematopoietic Tissue.

Yale University School of Medicine. J. H. Heller, Factors Increasing the Radiosensitivity of Malignant Neoplasms.

Yerkes Laboratory of Primate Biology, Inc. (Orange Park, Fla.). H. W. Nissen, Behavioral Effects of Ionizing Radiation on Chimpanzees of Various Ages.

Radiation Instrumentation

Commerce, U. S. Department of, National Bureau of Standards. Louis Costrell, Radiation Monitoring Telemetering System.

Commerce, U. S. Department of, National Bureau of Standards. W. A. Wildhack, Basic Instrumentation Program.

Dumont Laboratories, Inc., Allen B. Stanley Koch, Photomultiplier Tube Development.

Naval Research Laboratory. J. H. Schulman, Dosimetry Systems Employing Radiation-Sensitive Solids.

New England Center Hospital, Pratt Diagnostic Clinic. C. V. Robinson, Small GM and Proportional Counters for Medical Research.

New York University, Washington Square College. M. H. Shamos, and Seymour Z. Lewin, Investigation of Certain Physical and Chemical Dosimetric Techniques.

Notre Dame, University of. E. A. Coomes, Fundamental Research on Photoemission.

Radio Corporation of America. Multiplier Phototube Development.

St. Procopius College (Lisle, Ill.). F. R. Shonka, Special Problems in Nuclear Instrumentation.

RAW MATERIALS RESEARCH CONTRACTS

Colorado School of Mines Research Foundation. V. L. Mattson, Application of Flotation Methods to Recovery of Uranium Values from Ore.

Columbia University. C. H. Behre, Jr., Examination and Evaluation of Bird Spring Mining District, Southern Nevada.

Columbia University. W. H. Bucher, Fracture Pattern Studies of Uranium Occurrences Within the Colorado Plateau to Determine Their Relationship to Control of Uranium Distribution.

Columbia University. H. D. Hassialis, Recovery of Uranium from the Chattanooga Shale.

Columbia University. Paul F. Kerr, Alteration Studies of Uranium Deposition at Temple Mountain and on the San Rafael Swell.

Harvard University. Clifford Frondel, Mineralogical Research on the Synthesis of Secondary Uranium Minerals.

Mining Research Corporation. C. W. Livingston, Leaching of Uranium Ores in Place.

Minnesota, University of. J. W. Gruner, Mineralogic and Petrographic Nature and Genesis of "Black Ores" of the Colorado Plateau.

Nevada, University of. V. E. Scheid, Development Studies on the Beneficiation of Uranium Ores, and Extractive Metallurgy for Recovery of Uranium from Ores.

Pennsylvania State University. D. R. Mitchell and H. B. Charmbury, Concentration of Uranium and other Values from Phosphatic Materials by Dry Methods of Beneficiation.

Pennsylvania State University. Harold Wright, Study of Primary Uranium Deposits in the Boulder Batholith Area.

Princeton University. H. D. Holland, Investigation of Known Uranium Ore Bodies in Dry Valley, Utah and Other areas to Delineate Geochemical Halos.

Utah, University of. W. M. Fassell, Jr., and M. E. Wadsworth, Kinetics of Leaching of Uranium Minerals.

REACTOR DEVELOPMENT RESEARCH CONTRACTS

Arcos Corp. R. D. Thomas, Welding of Austenitic Stainless Steel. Study of micro-fissuring and other characteristics, with the objective of improving structural usefulness of these steels.

California, University of. H. B. Gotaas, Research and Development on the Use of Sewage Treatment Processes on Radioactive Wastes. Investigating use of sanitary engineering methods for disposal of high-volume, low-level radioactive wastes.

California, University of. H. A. Johnson, Heat Transfer Characteristics of Liquid-Lead Bismuth.

Carnegie Institute of Technology. Gerhard Derge, Electrochemical Separations in Nonaqueous Solutions.

Chicago, University of. L. S. Skaggs, Utilization of Fission Products. Study of food preservation.

Columbia University. Charles F. Bonilla, (1) Mass Transfer in Liquid Metal and Fused Salt Systems, (2) Boiling and Condensing of Liquid Metals.

Columbia University. W. A. Selke, Utilization of Fission Products. Research and development on the effect of radiations from fission products, particularly the effect of gamma radiation on chemical reactions.

Commerce, Department of, National Bureau of Standards. Franz Alt, Shielding Calculations. Detailed calculations of gamma ray attenuation in various media, covering a wide range of gamma energies.

Commerce, Department of, National Bureau of Standards. Ugo Fano, Penetration and Diffusion of High-Energy Gamma Rays. Analytical and experimental studies to provide knowledge basic to design of gamma ray shields.[2]

Commerce, Department of, National Bureau of Standards. W. A. Wildhack, Basic Instrumentation.

Harvard University. Philip Drinker, Air Cleaning. Research and development on air cleaning, including improved methods and equipment, sampling methods, and training of personnel.

Harvard University. H. A. Thomas, Waste Disposal. Determination of distribution and disposition of radioactive material introduced into fresh water reservoir and streams.

Illinois, University of. B. B. Babbitt, Effects of Radioactive Elements on Anaerobic Digestion of Sewage Sludges. Investigation of feasibility of concentrating radioactivity using sludge digestion process.

Illinois, University of. H. F. Johnstone, Aerosol Research and Development. Investigation of fundamental properties of aerosols as related to air cleaning.

Interior, Department of, U. S. Bureau of Mines. R. C. Corey, Incineration of Radioactive Wastes. To develop a practical incinerator for disposal of solid combustible radioactive wastes.

Johns Hopkins University. Abel Wolman, Disposal of Liquid and Solid Radioactive Wastes. Adsorption of radioactive material on natural waterborne silts; circulation of estuarial waters; distribution of radioactivity charged into institutional incinerators; and treatment of contaminated laundry wastes.

Little, Arthur D., Inc. Earl Stafford and W. J. Smith, Filter Research and Development. Development of high-efficiency, high-temperature, acid-resistant filters for removal of aerosols from gaseous effluents.

Massachusetts Institute of Technology. Rolf Eliassen, Water Decontamination. Removal of radioactivity from water supplies by modified water-treatment methods.

Massachusetts Institute of Technology. B. E. Proctor, Utilization of Fission Products. An investigation of uses for fission products in the sterilization of foods, pharmaceuticals, and tissues.

Michigan, University of. L. E. Brownell, Industrial Utilization of Fission Products. Investigate possible use of fission products and identify areas within which (1) industrial uses of such products are technically and economically feasible, and (2) further research and development would be useful.

Minnesota, University of. H. S. Isbin and N. R. Amundson, Reactor Cooling Investigations to Study Pressure Drop and Transient Flow Characteristics in Two Phase, Water-steam Systems.

National Canners Association. Dr. E. J. Cameron, Fission Product Utilization.

New York University. Gail P. Edwards and William E. Dobbins, Waste Disposal. Feasibility of trickling filter for treatment of dilute radioactive wastes.

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[2] Contract administered through Office of Naval Research, Washington, D. C.

Nuclear Development Associates. Herbert Goldstein, Shielding Studies. Broad review of field, including evaluation of sensitiveness of calculated attenuations to physical data employed, comparison of theoretical methods, collation of experimental results, and development of engineering formulae.

Rensselaer Polytechnic Institute. J. O. Hougen, Liquid-Liquid Extraction Studies. Research in liquid-liquid extraction; experimentation with pilot plant size extraction column.

Texas, University of. E. W. Steel, Disposal of Low-Level Radioactive Wastes by Algae Concentration. Studies of practicality of handling low-level wastes through concentration capacities of algae.

Tufts College. T. R. P. Gibb, Research on Light Metal Hydrides as Shielding Components for Nuclear Reactors.

Yale University. R. H. Bretton, Utilization of Fission Products. Research on effect of radiations from fission products, particularly gamma radiation on chemical reactions.

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