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QUARTERLY PROGRESS REPORT

to the JOINT COMMITTEE on ATOMIC ENERGY

April - June 1958

UNITED STATES ATOMIC ENERGY COMMISSION

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CONTENTS

*Transmitted as a separate document.

Part I

Raw Materials

U_3O_8 PROCUREMENT

Current Receipts

United States (UNCLASSIFIED). Uranium concentrates received by the United States totaled 26,357 tons of U_3O_8 for fiscal year 1958, an increase of 63 percent over fiscal year 1957. Domestic deliveries of 10,246 tons accounted for 39 percent of the total. (End of UNCLASSIFIED section.)

Table 1—United States Receipts of U_3O_8 (short tons)* ([redacted])

Source	April–June 1958	Total fiscal year 1958
United States	3,227	10,246
Canada	3,187	9,459
North America	6,414	19,705
[redacted]	[redacted]	[redacted]
Belgian Congo	344	1,202
Australia	49	257
[redacted]	[redacted]	[redacted]
Overseas	1,897	6,652
Total	8,311	26,357

* Subject to revision for final assays.

United Kingdom. Deliveries to the United Kingdom by overseas sources under contract to the Combined Development Agency totaled 313 tons during the quarter and 1,470 tons during fiscal year 1958.

Projected Receipts

The projection for United States receipts of U_3O_8 in fiscal years 1959 through 1962 has been increased by 5,700 tons over the forecast shown in the December 1957 Program Status Report. The increase of 8,675 tons in domestic receipts as a result of the limited expansion of domestic uranium procurement will be partially offset by decreases in receipts from Canada and South Africa. Detailed projections for fiscal years 1959 through 1963 are shown in Table 2.

Table 2—Actual 1958 and Projected United States Receipts of U_3O_8
(short tons by fiscal years)

Source	1958*	1959	1960	1961	1962	1963
United States	10,246	14,200	19,400	20,500	20,500	20,500
Canada	9,459	13,700	13,900	13,500	11,300†	1,550‡
North America	19,705	27,900	33,300	34,000	31,800	22,050
[redacted]						
Belgian Cong[redacted]	202	650	330	165	-	[redacted]
Australia	257	265	225	225	175	[redacted]
[redacted]						
Overseas	6,652	4,210	4,960	4,430	4,370	4,200
Total	26,357	32,110	38,260	38,430	36,170	26,250

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*Subject to revision for final assays.

†By exercising options an additional 1,400 tons U_3O_8 could be acquired.

‡By exercising options approximately 9,650 tons additional U_3O_8 could be contracted for in fiscal year 1963 and purchases from Canada maintained at a level of about 11,000 tons per year through December 31, 1966. (End of [redacted] section.)

DOMESTIC OPERATIONS (UNCLASSIFIED)

Production

United States production of U_3O_8 during the April-June quarter was 3,227 tons, 23 percent more than in the preceding quarter and 44 percent more than in the corresponding quarter of fiscal year 1957. June production was at an annual rate of 12,650 tons.

As of June 30, 18 mills having an aggregate processing rate of about 14,000 tons of ore per day were operating, and five new mills with a total estimated capacity of 7,000 tons of ore per day were under construction. Ore fed to process from April 1 through June 30 totaled 1,363,000 tons, an increase of 23 percent over the quantity fed to process in the previous quarter.

Ore receipts during the quarter amounted to 1,328,000 tons, equivalent to an annual delivery rate of 5,312,000 tons. More than 96 percent of this ore was purchased by private buying stations. The AEC continued to operate ore buying stations at Monticello, Utah, and Grants, New Mexico.

Limited Expansion of Uranium Procurement

Pursuant to the Commission's announcement on April 2 of the decision to authorize limited expansion of domestic uranium procurement, a number of meetings were held with representatives of companies interested in constructing new mills in the various areas which the recent survey disclosed had either no market, or an inadequate market, for ore reserves developed prior to November 1, 1957. AEC representatives also attended industry meetings in Albuquerque, New Mexico, Grand Junction, Colorado, and Riverton, Wyoming, to discuss steps taken or contemplated to implement the Commission's action of April 2. It was expected that

[redacted]

contracts covering the major part of the anticipated 3,300 tons of additional daily ore milling capacity would be executed within the next few months.

The recent survey also disclosed that certain areas had adequate milling capacity in relation to total developed reserves but the proportion of this capacity available for ores of independent operators was or might be insufficient because the ore reserves controlled by independent operators had increased since the concentrate procurement contracts were negotiated. During the quarter negotiations were being conducted with several mill operators in such areas for contract extensions to provide a stretchout in the production of company-controlled ores which would result in a greater market at this time for the ores produced by independent operators in the areas affected.

Process Development

The Grand Junction pilot plant has operated continuously since 1955 to test new processes and process improvements for recovery of uranium and to supply engineering and cost data for use in the negotiation of concentrate purchase contracts. The work for which this plant had been constructed was successfully concluded at the end of the quarter, and the facility was closed. The process development work at the Raw Materials Process Development Laboratory at Winchester, Massachusetts, was also being concluded at the end of fiscal year 1958. However, the laboratory will continue to operate on a reduced basis to investigate the possibility of health hazards in connection with mill operation and discharge of waste products.

A comprehensive study of the AEC-owned Monticello mill is being undertaken to determine whether this mill is meeting the standards established by the Division of Licensing and Regulation for uranium milling operations. If any of the standards are not being met, corrective measures will be developed and put into effect. The Division of Biology and Medicine and the Winchester laboratory will participate in the Monticello study. The results of this study should contribute to the development of survey procedures and corrective measures that can be used in privately owned mills.

Ore Reserves

Estimated uranium ore reserves in the United States remained approximately the same as reported for March 31, 1958, about 78,000,000 tons averaging 0.27 percent U_3O_8.

Private Sales of Uranium

On May 8 the AEC announced that domestic producers of uranium ores and concentrates may now make private sales of these materials to domestic and foreign buyers for peaceful uses of atomic energy, subject to AEC licensing regulations.

FOREIGN OPERATIONS

Canada

Six additional mills came into operation during the quarter, completing the installation of Canadian ore processing capacity financed under special price contracts. Two companies which planned mills have been unable to arrange financing, and the possibility of their financing the construction of production facilities appears remote. Nineteen plants with a total milling capacity of approximately 42,000 tons of ore per day were in operation at the end of June. Canadian production is approaching a rate of about 15,000 tons of U_3O_8 per year. This is a maximum figure based on regulation of deliveries after July 1, 1958, limiting the plants to the

monthly rates of delivery specified in their contracts. Beginning in July, the United Kingdom Atomic Energy Authority was to take delivery of 1,500 tons of U_3O_8 a year, to be released from Canadian production under contract to the AEC through March 1962.

The Canadian Government announced on May 7 that Canadian producers would be permitted to make private sales of uranium produced in excess of their Eldorado contract requirements to other buyers for peaceful uses of atomic energy, subject to Canadian licensing regulations. Until this time, Eldorado was the sole buyer and seller of uranium produced in Canada.

Mr. W. J. Bennett resigned as president of Eldorado Mining and Refining, Limited, on April 30. He was succeeded by Mr. R. J. Henry, vice president of Eldorado since 1953.*

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Belgian Congo

A supplement to the agreement with African Metals Corporation was prepared which provides for the delivery of a refined uranium trioxide in lieu of uranium concentrates. Deliveries of uranium trioxide will start in August 1958. The arrangement to accept delivery of refined material is based upon a long standing commitment.

Other countries

Deliveries from Portugal and Australia continued as scheduled. In Portugal, a slightly lower grade of mill feed was offset by maintaining a high rate of mill throughput.

ASSISTANCE TO FOREIGN COUNTRIES

Limited technical assistance in uranium exploration continued in Australia, Brazil, and Peru during the quarter. Similar assistance to Chile began in April.

Two geologists from Pakistan and one from Greece continued their training in uranium exploration, mining, and processing in the western United States. Technicians from Arabia, Japan, Thailand, and Turkey began training in May. (End of UNCLASSIFIED section.)

* Mr. Henry died on July 6. His successor has not been announced.

Part II

Special Nuclear Materials

SUMMARY

The quantities of special nuclear materials and other principal weapon materials produced during the April-June quarter and during the entire fiscal year 1958 are compared with the December 1957 forecast in the following table. In each instance actual production equaled or exceeded the forecast.

Table 1—Production at Annual Rates

Product	April–June 1958		Fiscal year 1958	
	Actual	Forecast	Actual	Forecast
Plutonium separated				
Tritium separated				
Uranium 235 withdrawn		DELETED		
Lithium 6 withdrawn				

REACTOR PRODUCTS

Reactor Operations

The quantities of plutonium and tritium produced in reactors during the last two quarters of fiscal year 1958 are compared in Table 2 in terms of an index, with tritium production expressed in terms of the equivalent amount of plutonium production displaced.

The Savannah River R reactor, the last of the five to be modified, was shut down on April 27 for installation of larger heavy water pumps. It was expected to resume operation in July 1958.

Slug failures. At Hanford, the number of failures occurring in normal and slightly enriched uranium fuel elements increased from 35 in the January-March period to 47 in the April-June period. After reaching a peak of 26 failures in April, the number declined to 14 in May and 8 in

Table 2— Production Reactor Operations

[redacted]

Product and site	January–March 1958	April–June 1958
Plutonium		
Hanford		
Savannah River		
Tritium	DELETED	
Savannah River		
Total		

June. The resulting loss-in-pile operating time doubled in the April-June quarter over the preceding quarter, 6.5 percent compared with 3.1 percent.

At Savannah River, only three failures occurred in the April-June quarter, and they had no significant effect on production. There were no failures in the preceding quarter.

Plutonium

The Hanford Purex plant was shut down in May for equipment modifications to convert the plant process from three cycles to two cycles. The change is expected to reduce substantially the waste losses, the consumption of chemicals, and the need for additional waste storage tanks. The reduction in separations costs will be accompanied by a small increase in production capacity.

Tritium

The quantity of tritium separated during the April-June quarter was 4 percent less than in the preceding quarter because the material processed included a backlog of elements of low tritium concentration.

New Production Reactor Study

A report on preliminary design of a new large-scale production reactor was submitted to the Joint Committee on April 1. The report was based on a study by the General Electric Company in which several alternative cases were considered, ranging from a plutonium-only reactor to a dual-purpose unit capable of producing a large amount of electric power as well as substantial amounts of plutonium. The estimated costs of the reactors considered, together with required auxiliaries, ranged from $126 million for a plutonium-only reactor to $256 million for a large reactor producing plutonium plus 700,000 kilowatts of electric power.

The reactor type on which the study was based was a pressurized-water, graphite-moderated unit fueled with slightly enriched uranium and designed to operate at high temperature. The report concluded that a reactor of this concept is feasible, but that a number of difficult development problems would require solution in order to achieve the predicted performance.

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URANIUM 235

The quantity of uranium 235 produced during the April-June quarter was approximately the same as in the preceding quarter, and slightly greater than forecast.

Fire protection for gaseous diffusion plants. Initial construction contract awards totaling about $7 million were made for portions of the project to reduce fire hazards in the gaseous diffusion plants. Construction began in June. The project, estimated to cost $26.5 million, covers gaseous diffusion cascades and principal auxiliary facilities at Oak Ridge, Paducah, and Portsmouth. The work includes installation of automatic sprinkling equipment, modification of water supply facilities, and improvement of control and fire alarm systems.

LITHIUM 6

Production of lithium 6 continued at about the same rate during the April-June quarter and was slightly greater than forecast.

FEED MATERIALS

Construction of the Weldon Spring feed materials facilities was 99.5 percent complete on June 30. All of the plants were in production.

Production operations at the Destrahan Street plant in St. Louis were shut down and the facilities were being placed in standby.

The Portsmouth hexafluoride feed plant began production in May and was operated at design capacity during June. (End of [redacted] section.)

NUCLEAR ACCIDENT AT OAK RIDGE Y-12 PLANT (UNCLASSIFIED)

A nuclear accident occurred on June 16 in the weapons fabrication facility of the Y-12 plant at Oak Ridge. A critical mass was formed when a solution of highly enriched uranium was inadvertently transferred from a container of "always safe" configuration to one not so designed. The radioactivity thus released set off the alarm system and the plant was evacuated. Except for the immediate area of the accident, the building was reoccupied within 4 hours. Decontamination was completed and all areas were returned to operation by June 23.

Eight employees were exposed to radiation. Five were estimated to have received exposures between 200 and 320 rad.* The other three received less exposure and showed no indications of radiation effect. All eight were under continuing observation at the Medical Division Hospital of the Oak Ridge Institute of Nuclear Studies. (End of UNCLASSIFIED section.)

* These five men were released from the hospital on July 30. By this time, more than 6 weeks after the accident, they had passed through their critical period and were recovering satisfactorily from the acute phase of exposure to this radiation. While there were definite changes in the blood elements of all five men, there were evidences of recovery of the bone marrow such as to warrant a favorable prognosis.

Part III

Weapons

This part of the QUARTERLY PROGRESS REPORT has been transmitted as a separate document.

[redacted]

Part IV

Reactor Development

AIRCRAFT REACTORS [redacted]

Nuclear Propulsion for Manned Aircraft

Direct cycle approach. The immediate objective of the direct cycle approach is to develop and ground test by the fall of 1960 a nuclear propulsion system consisting of a preprototype reactor with associated turbomachinery.

The series of reactor experiments continued at the National Reactor Testing Station to investigate materials, components, and nuclear aircraft engine operation. Two significant experiments were performed with the Heat Transfer Reactor Experiment No. 2 (HTRE-2) during the quarter. One was the test of an insert, consisting of unclad hydrided zirconium moderator and nichrome fuel elements. The second was a meltdown test of a fuel element to obtain data on the hazards associated with nuclear aircraft operation.

The insert, the third of a series tested in the parent core of the HTRE-2, was designed primarily to determine the operational and engineering characteristics of unclad moderators for use in the first nuclear aircraft power plant. On April 14 this insert completed 100 hours operation with the moderator at the design condition of 1,200 degrees Fahrenheit. The test run was highly successful and the insert materials showed no significant change. Since this moderator material is to be used in the Heat Transfer Reactor Experiment No. 3 (HTRE-3) and is planned for use in the first nuclear aircraft power plant (the XMA), the results are encouraging.

In the meltdown experiment the element melted was of nichrome material in a configuration similar to that used in previous heat transfer reactor experiments. The element was melted in three to five seconds by a rise in temperature caused by restricting the airflow over the element. No interaction with the reactor moderator or other fuel elements occurred. Hazards data were obtained by extensive monitoring of the effluent in the ducting, in the stack, and up to 15 miles downwind, and by taking measurements to determine all applicable meteorological parameters. The diffusion conditions were good and the release cloud followed the centerline of the instrumented test area. In general the experiment was a success. No hazard was incurred, and considerable data were obtained which will be under analysis for the next few months.

The HTRE-3, which is the first of the HTRE series to have a horizontal configuration and to have a solid moderator, became critical in a series of low power experiments. Nuclear power operation with the associated turbojet engines was planned for September 1958.

[redacted]

Modifications to the Initial Engine Test (IET) facility to accommodate the HTRE-3 are to be completed in the late summer of 1958. Construction work continued on the Flight Engine Test (FET) facility and the Shield Test Pool Facility (STPF).

Indirect cycle approach. Primary emphasis in the indirect cycle effort continued on determining the feasibility of a lithium-cooled, liquid cycle reactor. Tests carried out on the compatibility of various reactor materials to lithium continued to indicate that niobium, molybdenum, zirconium, and titanium offer the promise of containing lithium at temperatures required by aircraft reactor operations. However, zirconium and titanium lack structural strength at high temperatures, and will probably be used only as alloying agents. Tests have shown that iron base alloys do not have sufficient promise to justify their consideration as materials for containing lithium in aircraft reactors.

Twelve isostatically pressed, stainless steel-UO_2 fuel pin specimens were examined after they were irradiated in the Materials Testing Reactor at temperatures up to 1,600 degrees Fahrenheit and fuel burnups of approximately 6 percent. Fuel element development work was being converted from stainless steel to niobium as rapidly as possible. Irradiation of the first niobium clad specimens was planned for the summer of 1958.

Nuclear Propulsion for Unmanned Vehicles

Nuclear rocket propulsion (Project ROVER). Fabrication and assembly were on schedule for Kiwi A, the first of a series of experimental reactors designed to provide data for the demonstration of feasibility of nuclear rocket propulsion under realistic operating conditions. Kiwi A is a nonflyable 100,000-kilowatt reactor using graphite plate fuel elements. At the end of the April-June quarter the pressure shell, loaded fuel plates, and other components were completed and were being assembled at the Los Alamos Scientific Laboratory (LASL). Plans called for the following schedule: shipment of Kiwi A, less the control assembly, to the Nevada Test Site (NTS) in July, the shipment of the control assembly to NTS in August; a detailed check of the complete reactor and control system in September and October; the initiation of zero power experiments in mid-November; and the beginning of power experiments in January 1959.

Construction of facilities continued at NTS in preparation for testing Kiwi A and other nuclear rocket devices. Roads, utilities, support facilities, and the control building were completed, and construction of the test cell, propellant tank farm, and the assembly-disassembly building was showing satisfactory progress.

Development of refractory metal fuel elements continued at LASL, and preliminary design work was begun on Dumbo A, the initial refractory metal reactor test device. Dumbo A, the second experimental reactor in the test series, is also to be a nonflyable test reactor with a power level of about 500,000 kilowatts. Molybdenum is to be used as the fuel element base material, zirconium hydride as the moderator, and beryllium as the reflector material.

Nuclear ramjet propulsion (Project PLUTO). Technical work on PLUTO was on schedule at the University of California Radiation Laboratory (UCRL) at Livermore and Atomics International. Construction work was started on the PLUTO facilities at the Nevada Test Site, and on the critical test cell and assembly building at UCRL. Early in May the Marquardt Aircraft Company, at the invitation of the Air Research and Development Command, USAF, briefed those aircraft companies interested in conducting a study of a low altitude nuclear ramjet missile on the parametric aspects of a nuclear ramjet engine. At the end of June the Air Force was evaluating proposals for such a study received from eight companies.

Systems for Nuclear Auxiliary Power (SNAP). Performance specifications for SNAP I (500-watt radioisotope unit) and environmental specifications of SNAP I and SNAP II (3-kilowatt

reactor unit) were revised by the Lockheed Aircraft Corporation, the Air Force prime contractor for the Air Force Advanced Reconnaissance Satellite, Weapons System 117L (WS-117L). The revisions were made in accordance with AEC's recommendations.

Destructive tests of SNAP I cores, less the fuel, were made under conditions simulating launching failures. Complete integrity of molybdenum cores and flame spray coatings was maintained. The availability and use of curium 242 were under investigation as a possible alternative to cerium 144 as a radioisotope fuel for satellite auxiliary power units.

Final design specifications of the SNAP II Power and Environmental Test Facility at Santa Susana, California, were completed on May 5. The Ralph M. Parsons Company was selected as the architect-engineer for the facility.

Direct conversion of heat to electricity was under investigation for use in small, low-power auxiliary power units. The Martin Company negotiated a subcontract with the Westinghouse Electric Corporation for the development of a 1- to 3-watt conversion device. Thermionic conversion techniques of General Electric Company, Atomic Power Equipment Department, and the Thermo Electron Engineering Corporation were also being considered for development. (End of [redacted] section.)

ARMY REACTORS

Army Package Power Reactors (APPR)

APPR-1 (UNCLASSIFIED). The 2,000-electrical kilowatt plant at Fort Belvoir, Virginia, continued in normal operation and had generated approximately 12,000,000 gross electrical kilowatt-hours by the end of June. Core life for the plant passed the halfway mark with 7 thermal megawatt years of its expected 13 megawatt-year life expended.

Alco Products, Inc., the plant operator under a jointly funded Army-AEC operating contract, continued its research and development task of evaluating operating characteristics of the plant and improving component performance. The plant continued to serve as a training facility for military operating crews during the period, in addition to providing operating data.

APPR-1A. Fort Greeley, Alaska, is to be the site of the APPR-1A, the Army's first field model reactor, patterned after the Fort Belvoir prototype. Peter Kiewit Sons, Inc., was selected in May by the Army Corps of Engineers, Alaska District, to construct the plant. (End of UNCLASSIFIED section.)

APPR-1B [redacted]). In response to a Department of Defense requirement, the AEC is developing an improved APPR-type core system, designated as the APPR-1B, capable of producing about 2.5 times the reactor heat of the present APPR-1 core and having a minimum core life of one year at full power. The intended application is to provide electric power for the Nike-Zeus air defense system. (End of [redacted] section.)

APPR-2 (UNCLASSIFIED). The AEC agreed to participate in a 2-year joint development project with the Air Force to develop, procure, and test a second generation APPR-type plant, designated as APPR-2. The design will emphasize the optimum packaging of components in order to reduce construction time and effort at remote sites.

Argonne Low Power Reactor (ALPR)

Construction of the ALPR, a boiling water reactor designed to produce 200 electrical kilowatts and 400 thermal kilowatts for space heating, was essentially completed at the National

Reactor Testing Station (NRTS). Following review of the ALPR hazards summary report by the Advisory Committee on Reactor Safeguards, operation up to 3,000 thermal kilowatts was authorized. Fuel element and core fabrication was completed. Attainment of criticality was expected in August.

Gas-Cooled Reactor Experiment (GCRE)

Fabrication of the nonnuclear portion of the Gas-Cooled Reactor Experiment (GCRE) at NRTS was begun by Farnsworth & Chambers Co., Inc., of Houston, Texas. Completion is scheduled for April 30, 1959.

Final specifications for the fuel elements were established. Fuel plates are to be furnished by M&C Nuclear, Incorporated. Reactor fabrication was under way at Aerojet-General Nucleonics, with completion planned for December 1958. Critical experiment investigations continued at the Battelle Memorial Institute and testing of the reference fuel element was in progress at the Battelle Research Reactor Loop. (End of UNCLASSIFIED section.)

Advanced Reactor Studies [redacted]

The Department of Defense in June requested the AEC to develop a prototype plant to meet military and naval needs which could be satisfied by a compact, lightweight, mobile power plant with a capacity of up to 3,000 electrical kilowatts. Army Compact Reactor studies were being performed in anticipation of this Department of Defense requirement. Task I, which was completed by the Curtiss-Wright Corporation, General Electric Company, and the Nuclear Development Corporation of America, required each of the three contractors to recommend a reactor system which showed the most promise for the above use. The principal concept proposed by each was a version of a liquid-metal-cooled, fast reactor system. Tentative approval of Task I was given by the AEC pending more detailed staff review and evaluation of the proposed concepts. The three contractors were proceeding with Task II—the preliminary design of an initial reactor experiment—with their respective systems.

Investigation of the relative practicability of using barge-mounted or extensible pier-mounted plants to reduce the costs and construction time for a nuclear power plant complex at Thule, Greenland, was completed by Moran, Proctor, Muesser & Rutledge, and Gibbs & Hill, Inc. After considering the unique site and weather conditions at Thule, it was recommended that separate barge-mounted plants, towed to the site, grounded, and interconnected to form a power plant complex, would be the most practicable method of transporting, installing, and maintaining the power plant.

Until such time as a firm requirement is received from the Department of Defense for such a nuclear power plant complex, no further work is planned on this project. (End of [redacted] section.)

NAVAL REACTORS ([redacted])

Naval Reactor Facility (S1W)

Criticality of the second replacement core of the S1W plant was achieved on May 3. Initial power operation began on May 23 and the plant resumed operations for testing and training of personnel on May 30.

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Nuclear Powered Submarines in Operation

Submarine	Miles traveled		Core life consumed (full power hours)
	Total	Submerged	
USS *Nautilus* (SS(N)571)	119,759	84,707	2,178 first core 2,048 second core
USS *Seawolf* (SS(N)575)	50,813	37,647	1,624
USS *Skate* (SS(N)578)	21,845	19,184	895

Naval Reactor Projects Under Development

Submarine Advanced Reactor (S3G and S4G). At West Milton, New York, work on the construction of the prototype plant was 98 percent complete, and was expected to be completed in July 1958. Testing continued in preparation for fuel loading.

Small Submarine Reactor (S1C). Over-all construction of the land prototype plant at Windsor, Connecticut, was 28 percent complete, and installation of machinery in the hull continued.

The keel of the USS *Tullibee* was laid on May 26 at the shipyard of the Electric Boat Division of the General Dynamics Corporation, Groton, Connecticut. The *Tullibee* is to be powered by an S1C-type nuclear propulsion plant.

Large Ship Reactor (A1W). Construction of the A1W prototype at the National Reactor Testing Station was 89 percent complete. Testing of the stainless steel reactor plant, the first of the two reactor systems to be completed, was initiated.

Destroyer Reactor (D1G). In May the Congress authorized the construction of the D1G land-based destroyer reactor prototype at West Milton, New York.* Architect-engineering work continued on the modifications necessary to adapt the West Milton facilities which had been used for the *Seawolf* to the D1G. Knolls Atomic Power Laboratory is carrying out the design and development of the reactor plant, and began the procurement of long lead time equipment. (End of [redacted] section.)

MARITIME REACTORS (UNCLASSIFIED)

NS *Savannah*. The keel of the NS *Savannah* was laid on May 22, National Maritime Day, at the Camden, New Jersey, yard of the New York Shipbuilding Company. Hull fabrication was on schedule and 8.5 percent complete on June 30. Babcock & Wilcox selected a 164-rod brazed bundle boron steel fuel element as the basic power core design. Fuel rod production for the critical experiment at the Lynchburg facility of Babcock & Wilcox was nearly completed. Critical experiments continued and fabrication of power plant components was on schedule.

Development of the second core was begun by the General Electric Company.

Proposals for the ship operator and crew training contractor were evaluated. Westinghouse Electric Corporation began construction of a reactor simulator, based on the *Savannah* control system, to be completed in April 1959. These contracts are with the Maritime Administration (MA).

*A contract was signed with Bethlehem Steel Company on July 7 to fabricate, install, and test the D1G prototype.

Maritime gas-cooled propulsion system. The joint AEC-MA contract with the General Dynamics Corporation was executed on June 26. On the basis of earlier authority, General Dynamics began the study of conceptual design of reference reactor systems, and materials problems associated with gas-metal and graphite-metal reactions.

Boiling water reactor system. The scope of work under the AEC contract with General Electric Company for the design of a boiling water reactor system for use in a T-5 tanker hull was revised to reflect the possibility of using a larger tanker hull. Preliminary design work was to be completed about August 1.

CIVILIAN POWER REACTORS

AEC Experimental Power Reactor Projects

Pressurized-water type. Various tests involving nuclear operation of the Shippingport Atomic Power Plant were performed during the April-June quarter. These were on xenon burnout, the calibration and intercomparison of control rods, and plant responses to variations in load and to complete loss of load. These tests were conducted at various power levels up to full power, using three and four loops. Reactor startup tests took place in late June. At the end of June the plant had completed 682 equivalent full power hours of operation and supplied 37,990,000 kilowatt-hours to the Duquesne Light Company system.

Boiling-water type. The Experimental Boiling Water Reactor (EBWR) at the Argonne National Laboratory was operated with a defective fuel element in a test beginning on April 24. The purpose of the test was to measure the radioactive carryover from the reactor to the turbine. During the test a turbine blade failed and the reactor was shut down. Although the EBWR had been operating a week with the defective fuel element, the radiation level at the turbine was sufficiently low to permit the use of standard power plant operating procedures in removing the turbine rotor. After the repaired rotor was reinstalled, the reactor was put back in operation. Operation at 20,000 kilowatts was routine and no unexpected buildup of radioactivity had occurred.

During the routine operation of BORAX IV at the National Reactor Testing Station (NRTS) in February there were indications that one or more of the fuel elements had failed. Since the program of experiments planned for the reactor included operation with a defective fuel element, BORAX IV was not shut down. In spite of the presence of defective fuel elements, no excessive radioactive contamination of the surrounding area occurred. After shutdown, investigations revealed that of the 69 fuel elements in the reactor, 22 of the original 59 elements showed signs of cladding failure.

On May 16 the Joint Committee was informed of the reasons for the suggested rescission of authority for the Argonne Boiling Reactor (ARBOR) facility in the proposed fiscal year 1959 authorization legislation.

Homogeneous type. Shortly after reaching designed power on April 4 the Homogeneous Reactor Experiment No. 2 (HRE-2) at Oak Ridge was shut down because of a leak through which fuel from the reactor core transferred to the heavy water blanket region. Flow measurements indicated a probable leakage area of about one square inch, but efforts to visually locate the leak were unsuccessful. Operation was resumed on June 4 to test a procedure for maintaining the fuel concentration in the blanket region at less than one-third that in the core vessel, despite the interchange of solution permitted by the leak. Operation at lower fuel concentration

will more closely simulate the original design condition for a two-region system. On July 1 the reactor was brought to its design power level of 5,000 thermal kilowatts. Plans called for the reactor to be shut down in early July for modification.

General research and development work on the molten salt reactor concept was under study at the Oak Ridge National Laboratory to investigate technical feasibility and economic promise. Encouraging results were obtained, particularly in the development of a metallurgical alloy with exceptionally high resistance to corrosion and mass transfer at temperatures of interest for civilian power reactors.

Fast-breeder type. In early June the Experimental Breeder Reactor No. 1 (EBR-1) at NRTS reached its full power capacity of 1,156 thermal kilowatts while operating with its third core. No signs were observed of the instabilities which caused the meltdown of the second core in 1955. Successful operation with the third core indicated that these instabilities can be removed by proper engineering design and are not an inherent feature of the reactor type.

The reactor containment vessel for the Experimental Breeder Reactor No. 2 (EBR-2) at NRTS was about 25 percent complete at the end of June. It was estimated that construction of the entire facility, except for the fuel reprocessing plant, would be completed in May 1960. The fuel reprocessing plant is to be completed in November 1960.

The construction of the Transient Reactor Test (TREAT) facility, designed to investigate the effects of extreme operating conditions in fast reactors, was more than 50 percent complete at NRTS. Fuel was being manufactured, and plans called for the Argonne National Laboratory to start installing equipment in October.

Sodium graphite type. Tests showed that modifications made to the Sodium Reactor Experiment (SRE) at Santa Susana, California, to reduce thermal stresses in the coolant during rapid shutdown were successful. The reactor was brought to its design power of 20,000 thermal kilowatts on May 21 and reached 21,000 thermal kilowatts the following day. At the latter figure the electric power was 5,800 kilowatts. The electric power level was lower than expected because of poor heat transfer in the intermediate heat exchanger. On May 28 the reactor was shut down to install experimental fuel elements and reorifice the hot channels. Investigations were in process on fuel elements which had been exposed 100 megawatt days per ton. No distortion was evident from visual inspection. The canning, however, revealed slug bowing such that the tubing had to be cut to remove the slug.

Organic-moderated type. The Organic Moderated Reactor Experiment (OMRE) was operated at NRTS throughout the April-June quarter to study the rate of decomposition of the organic material under various conditions. Preliminary data derived from the operation in the OMRE and extrapolated to the proposed organic moderated reactor for the Piqua project indicated a cost of 0.85 mill per electric kilowatt-hour for organic replenishment.

The OMRE was operated with increasingly higher concentration of decomposed organic in the coolant. As the decomposed organic concentration in the organic coolant was increased from 10 to 30 percent, the heat transfer coefficient did not increase as had been predicted from previous data. This may allow operation of the reactor at a higher concentration of decomposed organic, which will reduce the rate of organic decomposition.

Fabrication was begun of the fuel elements for the second core.

Liquid-metal type. Conceptual design, schedules, and cost estimates of a 5,000 thermal kilowatt Liquid Metal Fuel Reactor Experiment (LMFRE) were submitted by Babcock & Wilcox. Brookhaven National Laboratory (BNL) was recommended as the site.

Different slurries were investigated and corrosion tests were conducted by Babcock & Wilcox and BNL. The testing and construction of in-pile loops continued.

Plutonium-recycle type. Over-all design of the Plutonium Recycle Test Reactor (PRTR) at Hanford was 85 percent complete. Excavation for the containment vessel was finished and concrete work begun. Research and development work continued on fuel elements and components.

Architect-engineering work was under way for the Fuel Technology Center at the Argonne National Laboratory. The center is to be the first facility devoted primarily to research on solid plutonium fuels.

Heavy water type. Preliminary design for the Heavy Water Components Test Reactor (HWCTR) at Savannah River was well under way. Research and development work continued on fuel elements and components.

Gas-cooled type. Preliminary design by Kaiser Engineers-ACF Industries was well advanced for the Gas-Cooled Power Reactor (GCPR), a prototype reactor of 40,000 electric kilowatts capacity and fueled with partially enriched uranium. Supporting research and development continued on fuel fabrication and testing, materials compatibility, and fluid dynamics.

A review of coolant gases for the reactor indicated a relative advantage in performance for helium over carbon dioxide. The change to helium as a coolant will not affect the time for construction.

Power Demonstration Reactor Projects

First invitation. Construction of the pressurized water reactor plant for the Yankee Atomic Electric Company at Rowe, Massachusetts, was on schedule and approximately 4 percent complete. Concrete was poured for the foundation of the generator mat and turbine room. Delivery of the in-pile test loop for the Yankee project to the Materials Testing Reactor (MTR) at the National Reactor Testing Station was scheduled for August.

The reactor vessel for the Power Reactor Development Company fast breeder reactor was installed at the plant site at Monroe, Michigan. An order for fuel was placed, and contracts were let for additional buildings at the site.

Tests on uranium oxide fuel for the Consumers Public Power District sodium graphite reactor project were conducted at the MTR. The preliminary results revealed a thermal conductivity of about half the expected value, indicating a need for increasing the dimensions of the core in the reference design. Groundbreaking ceremonies for the plant were held at the end of June at Hallam, Nebraska. Commissioner Graham represented the AEC.

Second invitation. Contracts were signed with the Rural Cooperative Power Association (RCPA) for plant operation and with ACF Industries, Inc., for the development and design of a boiling water reactor for the RCPA project at Elk River, Minnesota. The Joint Committee had waived the 45-day waiting period.

Conceptual design and testing of components for the organic-moderated reactor proposed by the City of Piqua, Ohio, were being carried out by Atomics International. Contract negotiations were continuing with Atomics International for the fabrication, construction, test operation, and training, and with the City of Piqua for the operation of the reactor.

A feasibility study of the sodium-cooled, heavy-water-moderated reactor for the Chugach Electric Association at Anchorage, Alaska, was being completed by the Nuclear Development Corporation of America (NDA). An agreement was reached with NDA on the scope of work for

an extension of this phase of the contract. NDA is to continue the development and preliminary design of the 10,000-electrical-kilowatt plant for Chugach and, under a contract amendment, is to perform conceptual design for a large-scale, natural uranium, sodium-cooled, heavy-water-moderated reactor in sufficient detail to permit evaluation as to whether the Chugach facility would be suitable as a pilot plant for such a large-scale reactor.

The Joint Committee was informed on May 13 of the decision of the Commission to discontinue any further action on the 10,000-electrical-kilowatt project proposed by the Wolverine Electric Cooperative. Analysis indicated that there is little economic promise for an aqueous homogeneous reactor of such small size.

Third invitation. Research and engineering work continued to establish a reference design for the boiling water reactor of the "Pathfinder Plant" proposed by the Northern States Power Company on the Big Sioux River, about 6 miles northeast of Sioux Falls, South Dakota. Land purchase was substantially completed, and test boring and meteorological investigations at the site were in progress.

The Joint Committee waived the 45-day waiting period for the proposal of Carolinas-Virginia Nuclear Power Associates, Inc., to construct a pressurized heavy water reactor at Parr Shoals, South Carolina. The proposer was reviewing a contract drafted by the AEC.

Special authorization previously requested for the East Central Nuclear Group-Florida West Coast Nuclear Group project was included in the proposed legislation authorizing appropriations for the AEC for fiscal year 1959. Research and development work by the proposer on the gas-cooled, heavy-water-moderated reactor was initiated during the quarter.

Special authorization for an aqueous homogeneous reactor plant proposed by the Pennsylvania Power and Light Company and Westinghouse Electric Corporation was requested in legislation authorizing appropriations for the AEC for fiscal year 1959. Contract negotiations are to begin when the proposed legislation is enacted.

As a preliminary step to a cooperative arrangement proposal, the Water Resources Authority of Puerto Rico submitted to the Commission for evaluation a preliminary design of an advanced boiling water reactor developed by the General Nuclear Engineering Corporation.

GENERAL ENGINEERING AND DEVELOPMENT

Reactor Physics

Engineering Test Reactor (ETR). The ETR operated at its full power of 175,000 kilowatts for the first time on April 19. Operations at full power were successful with separate loadings of two different types of fuel elements, designed to overcome the lack of structural strength which characterized the previous fuel elements. The first capsule irradiations were performed in May. The installation of loop experiments was awaiting further hazards evaluation at the end of June.

Materials Testing Reactor (MTR). Efforts continued at Hanford to fabricate acceptable plutonium fuel and shim elements for a single plutonium loading in the MTR. Several acceptable shim and fuel elements were completed, and the target date for completing a full loading was set for August 1. Efforts will be made to operate the MTR with a plutonium core before the Geneva Conference.

Reactor Materials

Research and development work on materials for improved control rods is to be undertaken by the General Electric Company. The proposal of General Electric was one of 22 responses to an invitation issued by the AEC in March.

Efforts are continuing on the development of aluminum alloys which can be used at higher temperatures in pressurized and boiling water reactors. The Aluminum Company of America agreed to continue participation in the work with the Argonne National Laboratory and Savannah River.

Reactor Safety

In a test on April 14 the Kinetic Experiment on Water Boilers (KEWB) increased its power level from zero to 530,000 thermal kilowatts and shut itself off without sustaining any damage. The rate of power increase was the largest known to have been experienced safely by a reactor, and amounted to tripling the power every two-thousandth of a second. The special test demonstrated the inherent ability of an aqueous homogeneous reactor to shut itself down under abnormal operating conditions without requiring auxiliary control rods.

A series of tests was performed with the Special Power Excursion Reactor Test No. 1 (SPERT-I) on a self-contained, self-actuated safety device for pool-type research reactors. The device is a fuse, consisting of a cylinder containing boron trifluoride gas which is automatically released into the reactor when abnormal operating conditions occur. The gas absorbs the neutrons and brings the reactor under control almost immediately. The fuse prevented the reactor power from rising excessively during a severe transient in which the rate of power was tripling each one-hundredth of a second. Without the fuse the power level would have risen to 25 times the level at which the surge was terminated by the fuse.

Chemical Processing Development

Volatility processing. Processing of fused salt fuel from the Aircraft Reactor Experiment was completed at the Oak Ridge National Laboratory (ORNL). This was the first processing on a significant scale of irradiated fuel using the ORNL adsorption-desorption volatility purification technique. Product recovery was excellent, and no activity in excess of natural background could be detected in the recovered uranium.

Waste Disposal

Salt cavities. As part of the project of investigating the use of salt cavities for the disposal of radioactive wastes, drilling tests were conducted at the Hutchinson Naval Air Station, Hutchinson, Kansas. Drilling was completed to a depth of 722 feet, and through a 300-foot thick salt stratum. Other sites were being examined, including salt outcrop areas in the Middle West.

Deep wells. The American Petroleum Institute appointed a committee to assist the AEC in evaluating the engineering practicality of injecting high-level wastes into deep porous formations. The committee visited the Oak Ridge National Laboratory and Hanford to hold discussion on various aspects of the problem.

Technical Assistance and Training

The fourth of a series of financial grants to educational institutions was announced in June. These grants provided $1.9 million to 41 colleges and universities to enable them to purchase nuclear laboratory equipment for use in physical sciences and engineering. Included in the

equipment to be purchased are six reactors for teaching and nine critical assemblies. With the June awards, a total of $8.7 million had been granted to 95 institutions.

In June the AEC awarded assistance to the University of Virginia for operation of its research reactor. The assistance consists of the loan of fabricated fuel elements and neutron sources without charge, and the waiver of burnup and use charges on the contained special nuclear material. Other educational institutions receiving similar assistance are North Carolina State College, Pennsylvania State University, University of Michigan, and the Massachusetts Institute of Technology.

The Commission approved the loan, without charge, of source, special nuclear, and by-product materials to ten educational institutions, bringing to 60 the number of educational institutions which had received such loans at the end of June.

The Summer Institute Program, sponsored by the AEC and the American Society for Engineering Education, has as its purpose the training of faculty members teaching engineering. The program is divided into three levels: basic instruction to faculty members of technical institutes which do not offer advanced degrees, basic instruction to faculty members of engineering schools offering higher degrees, and advanced instruction to highly qualified personnel on specific areas of nuclear engineering.

A basic institute for faculty members from technical institutes is to be held at Pennsylvania State University. Acceptances in this group totaled 30.

Basic institutes for faculty from engineering schools are to be held at Cornell University, University of California at Berkeley, Purdue University, and North Carolina State College. A total of 140 are to attend.

Areas of instruction, location, and acceptances for the advanced institutes are as follows:

Chemical processing	Hanford Works	10
Nuclear metallurgy	Research laboratory at Iowa State College	10
Instrumentation and control	Argonne National Laboratory	17
Reactor physics	University of Michigan	20

Those participating in the summer program represent 91 colleges and universities, 23 technical institutes, and three service academies.

This summer's attendance will bring the total number, who have participated in the 3 years during which the program has been functioning, to 330 faculty members from 120 universities in 42 states, the District of Columbia, and Puerto Rico, and 30 faculty members from 23 technical institutes in 15 states. (End of UNCLASSIFIED section.)

Part V

Licensing and Regulation

LICENSING (UNCLASSIFIED)

Licensing actions and applications received during the April-June quarter are summarized below for each type of facility and material. A statistical summary of licensing actions during the quarter and of cumulative licensing actions through June 30, 1958, is shown in Table 1.

Power and Test Reactors

With respect to the Power Reactor Development Company hearing, the Commission on May 29, 1958, heard oral argument by the parties regarding the conditional construction permit issued to the company on August 4, 1956.

The General Electric Company was granted an amended facility license authorizing changes in the core configuration and the operating procedures for the Vallecitos Boiling Water Reactor. The company also requested further amendment of its facility license to permit greater flexibility with respect to the operating procedures for this reactor.

The National Advisory Committee for Aeronautics hearing with respect to the proposed construction of a 60,000-kilowatt testing reactor at Sandusky, Ohio, was concluded and the Hearing Examiner on June 28, 1958, ordered that a construction permit be issued, effective July 21, unless exceptions to his decision were filed on or before July 18, or the Commission reviewed his decision on its own motion.

Research Reactors

Aerojet-General Nucleonics was issued facility licenses authorizing operation of three additional AGN-201 100-milliwatt reactors at San Ramon, California.

The American Radiator & Standard Sanitary Corporation was granted a license to operate a 1-watt Argonaut-type research and training reactor at Mountain View, California.

A license was issued the Curtiss-Wright Corporation authorizing operation of its 1,000-kilowatt pool-type research reactor at Quehanna, Pennsylvania.

A construction permit, and later a facility license, were issued to the General Dynamics Corporation authorizing construction and operation of a 10-kilowatt reactor at Torrey Pines Mesa, California. The company was subsequently granted an amendment to its license authorizing performance of the "transient reactivity compensation experiments" described in its application.

Table 1—Summary of Licensing Actions

	April–June 1958			
	Applications received	Permits or licenses issued	Total issued through June 1958	Permits or licenses in effect June 30, 1958
Facilities*				
Power Reactors				
Construction permits	0	0	5	4
Licenses to operate	-	0	1	1
Test Reactors				
Construction permits	0	0	2	2
Licenses to operate	-	0	0	0
Research Reactors				
Construction permits	2	2	25†	8‡
Licenses to operate	-	8	29	19
Licenses to acquire, possess, and operate	1	0	9	9
Reactor Exports				
Research reactors	6	2	19	§
Test reactors	0	1	2	§
Critical Experiment Facilities				
Construction permits	1	1	12	1
Licenses to operate	-	1	10	9¶
Operators' Licenses	34	42	259	251
Special Nuclear Material Licenses	29	34	214	192
Source Material Licenses issued or renewed				
To raw material producers		141	4,239	371
To source material processors		6	164	58
To domestic distributors		44	674	113
To consumers		189	4,335	601
For export		208	3,896	§

* Applications to construct and operate are filed simultaneously; conversions from construction permits to licenses to operate are made upon satisfactory completion of construction.

† Permits authorize construction of 59 reactors and modification of 2 reactors.

‡ Permits authorize construction of 31 reactors.

§ Export licenses terminate upon completion of shipment.

¶ Two of the licenses authorize possession only.

A construction permit previously issued to the American Machine & Foundry Company for the construction of a 5,000-kilowatt pool-type reactor at Plainsboro, New Jersey, was amended at the applicant's request to transfer right, title, and interest in the construction permit and the proposed facility being built from the American Machine & Foundry Company to Industrial Reactor Laboratories, Incorporated.

A license was issued the Massachusetts Institute of Technology authorizing operation of its 1,000-kilowatt heavy-water-cooled and -moderated reactor at Cambridge, Massachusetts. This reactor will be used for medical research and therapy as well as general research.

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North American Aviation, Inc., was issued a construction permit, and subsequently a facility license, authorizing construction and operation of a 10-watt Model L-77 laboratory reactor at Canoga Park, California. The company reported that its 5-watt L-47 reactor (a prototype of the Model L-77 reactor) had been dismantled, and requested that its license to operate that reactor be terminated. The requested action was taken on June 30.

Aerojet-General Nucleonics (AGN) applied for a license to construct and operate ten 1-watt pool-type nuclear reactors at San Ramon. AGN subsequently amended its application to increase the operating level to 15 watts.

Nuclear Development Corporation of America applied for a license to construct and operate a 5-watt, heavy-water-moderated and -reflected reactor at Pawling, New York. This reactor is a low-power prototype of a research and training reactor which the company plans to produce in quantity for sale.

Oregon State College applied for a license to acquire and operate on its campus at Corvallis, Oregon, a 100-milliwatt reactor built by Aerojet-General Nucleonics.

Reactor Export Licenses

Three export licenses were granted. ACF Industries, Inc., was issued a license to export a 30,000-kilowatt materials testing and research reactor to Aktiebolaget Atomenergi, Tystberga, Sweden. Licenses were also issued authorizing the export of two 1,000-kilowatt pool-type research reactors, one by the American Machine & Foundry Company to the Israeli Atomic Energy Commission, Tel-Aviv, Israel, and the other by General Electric Company to National Tsing-Hua University, Taipei, Taiwan, China.

Applications were filed by Aerojet-General Nucleonics for the export of two 100-milliwatt nuclear reactors, one destined for the University of Geneva, Geneva, Switzerland, and the other for the University of Palermo, Palermo, Sicily. The company subsequently withdrew its application for export of a reactor to the University of Geneva, since the reactor was exported by Aerojet-General Nucleonics under AEC contract for exhibit at the Fifth International Electronics and Nuclear Congress and Exposition at Rome, Italy, and the Second International Conference on the Peaceful Uses of Atomic Energy at Geneva, Switzerland.

The American Machine & Foundry Company requested a license to export a 5,000-kilowatt tank-type research reactor to the Osterreichische Studiengesellschaft fur Atomenergie Gesellschaft m.b.h., Vienna, Austria.

S. A. Innocente Mangili Adriatica, Inc., applied for a license to export a 50-kilowatt solution-type reactor (Atomics International Model L-54) to Politecnico di Milano, Milan, Italy.

Aerojet-General Nucleonics withdrew its applications for licenses to export research reactors to Laboratoire R. Derveaux, Boulogne, France, and to the Brussels World's Fair. (The AGN reactor for exhibition at the World's Fair in Belgium was exported by AGN as an AEC contractor.)

ACF Industries, Inc., also withdrew its request for a license to export a research reactor to Tecnicas Hispano Americanas, S. A., Madrid, Spain.

Critical Experiment Facilities

A construction permit, and subsequently a facility license, were issued Westinghouse Electric Corporation authorizing construction and operation of a critical experiment facility at Waltz Mill, Pennsylvania, to conduct experiments relating to the Westinghouse Test Reactor.

Westinghouse was also issued an amendment to a previously issued license, authorizing the performance at Waltz Mill of a second series of critical experiments relating to the Yankee power reactor.

The Babcock & Wilcox Company was granted an amendment authorizing B&W to perform critical experiments which employ boric acid in the moderator for the Consolidated Edison Reactor.

General Dynamics Corporation was issued an amended facility license to conduct additional experiments and to modify the water filling system of its critical experiment facility located at Torrey Pines Mesa, San Diego, California.

The Martin Company was issued an amended license authorizing the company to conduct, in addition to the Martin Power Reactor critical experiments, the Engineering Research and Development Laboratory experiments (previously known as the U. S. Army Package Power Reactor experiments).

Allis-Chalmers Manufacturing Company applied for a license to construct and operate a critical experiment facility at Greendale, Wisconsin, to perform experiments relating to a power reactor which the applicant proposes to build for the Northern States Power Company.

Materials Licenses

Special nuclear material licenses issued during the quarter included allocations of 3,502 grams of plutonium, 18,192 grams of uranium 235, and 25 grams of uranium 233. Most of the uranium 235, 17,564 grams, was allocated for use as reactor fuel; the remainder was for research and development.

During the quarter 203 initial byproduct material licenses were issued. On June 30, there were 5,649 licenses in effect, held by 3,691 licensees. New licensees during the quarter and the number of licensees on June 30, are classified as follows:

	New licensees April–June 1958	Licensees on June 30, 1958
Medical institutions and physicians	75	1,723
Colleges and universities	4	232
Industrial companies	68	1,298
Federal and state laboratories	49	350
Foundations and institutions	1	42
Other	6	46
Total	203	3,691

There were reported 917 shipments to non-Soviet bloc countries during the second quarter. The Oak Ridge National Laboratory (the AEC's primary distributor of radioisotopes) made 3,855 shipments of radioisotopes; at June 30 ORNL had made a total of 112,084 shipments.

Four new applications for licenses to dispose of radioactive wastes at sea were received during the quarter, indicating a growing interest by commercial firms in providing waste disposal service.

A final order was issued on May 22, revoking the license of Radiation Products Company of Dallas, Texas, for violations by the company of its license and AEC regulations in trans-

ferring licensed material to persons not licensed to receive it. The company had waived a hearing.

A temporary order to show cause why its license should not be suspended was issued to Advanced Industrial X-Ray Laboratories, Los Angeles, on June 13 as the result of apparent violations of license conditions and regulations involving a radiation incident and the loss of a 28-curie iridium-192 source. A hearing was scheduled at Los Angeles for July 8.

Reactor Safety

Safety reviews were conducted by the AEC staff on a number of licensed and Government-owned reactors. The staff also provided advisory service to the Governments of Israel and Puerto Rico with respect to the hazards analysis of reactors planned by the governments of those countries.

The Advisory Committee on Reactor Safeguards met in May to discuss various projects referred to it by AEC for review and advice. The committee also met in June at Hanford to consider the Wahluke Slope problem.

Cooperation with States and Other Agencies

States and local public bodies continue to exhibit growing interest in regulation of atomic energy activities. Current information indicates that the legislatures of a number of states will be considering atomic energy legislation at their 1959 sessions.

A series of meetings is continuing with representatives of the Civil Aeronautics Board, the Interstate Commerce Commission, the Coast Guard, and the Post Office Department to review existing transportation regulations and to develop amendments, where needed, to assure public health and safety in the transportation of radioactive materials.

Financial Protection and Indemnity

A number of state-owned educational institutions have expressed concern that they are unable to comply with the financial protection requirements of Public Law 85-256 (the Price-Anderson Act). All of these assert that they are immune from tort liability and now lack authority to waive that immunity. Most of them also lack authority to purchase nuclear energy liability insurance policies. As the Joint Committee has previously been informed, the Commission has not exercised the authority granted under the Price-Anderson Act to require waiver of immunity or to enforce the financial protection requirement as to these institutions since to do so would result in shutting down their research reactors.

The AEC is currently examining various means to deal with the immunity problem. These include possible state legislation or, as an alternative, Federal legislation amending the Price-Anderson Act to remove the requirement of financial protection.

Three proposed amendments to the temporary indemnity regulation (10 CFR Part 140) are in the final stages of development. They concern (1) fixing the amount of financial protection which reactor licensees must have and maintain, (2) the proposed form of indemnity agreement to be entered into with licensees, and (3) whether or not the standard nuclear liability insurance policy issued by Nuclear Energy Liability Insurance Association (NELIA) and Mutual Atomic Energy Liability Underwriters (MAELU) constitutes financial protection as that term is defined in the Act. These proposed amendments will be published as notices of proposed rules and public comment will be invited. (End of UNCLASSIFIED section.)

Part VI

Industrial Development

INDUSTRIAL PARTICIPATION (UNCLASSIFIED)

Foreign Liability

In April the AEC requested about 20 American companies engaged in the foreign sale of reactors, reactor components, and reactor fuels to submit their views concerning the nature and extent of the foreign liability problem. The majority of the companies replied that the question of foreign liability was a major problem. Most of the power reactor manufacturers thought that the supplier should be indemnified, while manufacturers of small research reactors thought that their risk might be insurable. The problem continues under study.

Establishment of Charges for Depleted Uranium

In June the Commission removed the prohibition on nonnuclear uses of uranium source material, and made depleted uranium available for sale on an unclassified basis. The price schedule and general terms and conditions for the sale of depleted uranium as uranium hexafluoride (UF_6) were published in the Federal Register of June 28. The sale of these materials continues to be subject to the AEC licensing regulations. Those purchasers who do not specify a particular assay will be sold depleted uranium assaying 0.0022 (±0.002) weight fraction uranium 235 at $5.00 per kilogram of uranium in the form of UF_6.

Technical Information Meetings with Industry

Four technical information meetings and one workshop meeting were held in the April-June quarter.

1. A symposium on the industrial uses of radioisotopes held in Baltimore on April 7–8 was sponsored by the AEC, the Baltimore Applied Nucleonics Society, the Baltimore Association of Commerce, and Loyola University.

2. A seminar on the utilization of radioisotopes in the textile industry was held April 24–25 at Clemson College, Clemson, South Carolina.

3. A meeting between industry and AEC contractors on nuclear process instrumentation and control, sponsored by the AEC and Oak Ridge National Laboratory, was held at Gatlinburg, Tennessee, on May 20–22.

4. A meeting on reactor fuel measurement techniques was held by the AEC on June 18–20 at East Lansing, Michigan.

5. The third of a series of workshop meetings on the use of AEC scientific and technical information material was held in New York City on June 26–27.

A technical information meeting on the gas-cooled reactor project was under consideration for the fall of 1958 at San Francisco.

Access Permit Program

During the April-June quarter 55 new applications for access permits were received, compared with 66 in the preceding quarter. On June 30 there were 1,417 access permits in effect. About 58 percent of the permits were for access to Secret–Restricted Data. Of the 827 permits due to expire by June 30, 83 percent had been renewed.

ISOTOPE DEVELOPMENT

Isotope Development Program

In May the AEC established the Isotope Development Program to accelerate the industrial uses of radioisotopes and high-level radiation in the United States, and to encourage the production of radioisotopes in privately owned reactors. To achieve these purposes the Isotope Development Program will:

1. Include projects intended to develop new industrial applications of radioisotopes and improve existing techniques,

2. Greatly increase opportunities for training in industrial isotope technology,

3. Make available to industry increased quantities of AEC-produced radioisotopes at prices which are attractive to purchasers and of interest to potential private producers, and

4. Increase efforts to develop high-level radiation for industrial processes.

Industrial Radiation Study

The AEC contracted with the Emerson Radio and Phonograph Corporation, of the CEM group, for a study evaluating the current technical and economic status and the future prospects for industrial applications of high-level radiation. The study was expected to be completed by the summer of 1959. The CEM group (chemicals, electronics, and metallurgy) is composed of the Emerson Radio and Phonograph Corporation, General Aniline and Film Corporation, and Revere Copper and Brass, Incorporated.

Economic Study of Radioisotope Application

The National Industrial Conference Board signed a contract in May with the AEC to perform a study of the contribution made to the national economy through the industrial use of radioisotopes. The study, to be completed by the fall of 1958, is to update previous investigations of the economic impact of radioisotopes in industry.

Food Irradiation Program

At the end of June the AEC was negotiating a contract with Curtiss-Wright for the construction of a large gamma food irradiation facility to become part of the U. S. Army Ionizing Radiation Center at Sharpe General Depot, Lathrop, California. The proposed contract covered the development, design, construction, and test operation of the High Intensity Food Irradiator (HI-FI) which is to be completed by mid-1960.

Under agreement with the Department of Defense, the AEC had nearly completed the construction of a food irradiation assembly at Savannah River as part of the development work for the HI-FI. The assembly, using spent fuel elements, is to process about 1,500 number 10 cans of food per month beginning July 1. About 4,000 cases, containing a total of 24,000 cans, and 160,000 pounds of various frozen food items were received at Savannah River.

Project PLOWSHARE

The possible use of nuclear explosives for nonmilitary applications continues under investigation at the University of California Radiation Laboratory at Livermore. Attention is focused on determination of useful and economic applications, and on the technical development of special nuclear explosive devices which would be most suitable for particular uses.

A survey to investigate the practicality of using nuclear explosives to excavate an Alaskan harbor was announced on June 9. Probably the first full-scale PLOWSHARE experiment will be a 10-kiloton shot in a salt formation, tentatively planned for the summer of 1959, to obtain data concerning power and isotope production. Other applications being investigated are the recovery of oil from oil shales and tar sands, the mining of low grade ore, the creating of aquifers for replenishing water tables and flood control, and scientific studies in seismology, geology, and special chemical reactions. AEC will work with industry and other interested government agencies to explore the industrial applications being investigated under PLOWSHARE. (End of UNCLASSIFIED section.)

Part VII

Physical Research

PHYSICS (UNCLASSIFIED)

Improvement of the CP-5 Research Reactor

Additional top shielding was installed on the CP-5 reactor in April, as part of the modification authorized for fiscal year 1958. To test the reactor's operating characteristics at higher power, it was subsequently operated for 2 hours at 5,000 kilowatts and performed satisfactorily in all respects.

The reactor was originally operated in 1954 at a power level of 1,000 kilowatts. This level was increased to 2,000 kilowatts in 1957, and improvements to permit operation at 4,000 kilowatts were authorized by Congress a year ago. Authority for additional modifications to permit operation at 10,000 kilowatts was included in the fiscal year 1959 authorization request.

Bevatron Breakdown

On April 23 one of the two motor generators which power the magnet coils of the Bevatron at Berkeley broke down when the head of a retaining bolt sheared off. Repair of the generator at a cost of $150,000 was expected to be completed in July.

Following inspection of the other generator, routine operation of the Bevatron was resumed, 24 hours a day and 7 days a week, but at less than the normal pulse rate of 10 pulses per minute and at proton energies less than the 6.3 billion electron volts (Bev) usually attained. The reduced energy level of the machine did not permit simultaneous research operation at both target stations.

Before the breakdown occurred, an unusually large number of antiproton events had been observed with the new 15-inch hydrogen bubble chamber. At the reduced pulse rate and energy, it was necessary to undertake other types of experiments, pending resumption of normal operation.*

72-Inch Bubble Chamber

Development continued of the 72-inch bubble chamber for the Bevatron. In early May, the magnet for the device was "walked" into its new building. Because of its great weight, more than 200 tons, the magnet is equipped with hydraulically operated pads to move the system in a step-by-step fashion at a rate of about one foot per minute. In this way the bubble chamber can be moved from one beam of the Bevatron to another.

* All generator repairs were completed and the Bevatron resumed full power operation on July 18.

Cosmotron Repair

Design of coil clamp hardware and accessories was substantially completed. The delays which occurred in the shipment of bare extruded copper conductors to Westinghouse, the fabricator of the new copper coils, makes it unlikely that coil installation can be completed before mid-November.

Because of deviations from the specifications contained in the March invitation, the bids for shielding were rejected and new bids were invited and received on the basis of an increase in scope to include shielding for an external beam catcher. Despite these delays, it still appears possible to complete the coil repair and the installation of the shielding by the end of December 1958.

COMPUTER RESEARCH AND DEVELOPMENT

University of Chicago

A contract was awarded to the recently established Institute for Computer Research of the University of Chicago for the fabrication of a new transistor-type computer, and for related research and development. The institute is directed by Dr. Nicholas Metropolis, who designed the Los Alamos "Maniac" machines.

CHEMISTRY

Element 102

The nuclide of element 102 having an atomic weight of 254 was produced at the University of California Radiation Laboratory through use of the Heavy Ion Linear Accelerator (HILAC). This nuclide has a half-life of three seconds.

Bombardment of curium 246 with highly ionized carbon 13 from the HILAC produced 5 neutrons and the nuclide 102^{254}. The latter was identified by the fact that it decayed into fermium 250 and an alpha particle. Fermium 250 emits an alpha particle of 7.43 million electron volts (Mev) and has a 30-minute half life.

Ion Exchange

Chemical compounds capable of exchanging ions have recently become available which are soluble in organic solvents but insoluble in water. Solutions of these compounds in organic media have been found to extract ions selectively from aqueous solutions. Thus, liquids may serve in a manner analogous to the more commonly used solid ion exchangers such as Dowex 50. The possibilities of this new method for selective extraction of various ions are being further explored. (End of UNCLASSIFIED section.)

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METALLURGY AND MATERIALS (UNCLASSIFIED)

General results in the fields of solid-state and metallurgical research include acquisition of basic information about uranium compounds for possible fuel applications, and the beginnings of an understanding of the fundamental processes operative in surface oxidation and film formation.

Solid-state theory as currently developed indicates that the mechanical properties of crystalline solids are altered in a major way by the presence of various types of imperfections in the lattice. These imperfections are present in different degree in every solid, perfection never having been observed in any crystalline material. An understanding of these lattice defects, the conditions under which they are stable, and the influence of each type upon the properties and behavior of the crystalline solid is of fundamental importance in materials research.

Bombardment with energetic radiation of various types under selected conditions permits the concentration of one type of defect relative to another to be altered in a controlled manner. In contrast to earlier research directed broadly at determining "radiation damage," the AEC now supports considerable solid-state research based on the principle of producing particular types of lattice defects and measuring associated changes in the properties of the material. As a result, great strides are being made in understanding the properties of solids.

Solid State–Metallurgy Meeting

The annual meeting of scientists engaged in AEC-sponsored research in solid-state physics and metallurgy was held at the University of Pennsylvania, June 5–7. The discussions dealt with research progress on imperfections, the structures of liquids, radiation effects, diffusion, and the general properties of solids. Such meetings have made a major contribution to the exchange of ideas between scientists engaged in research on related problems.

CONTROLLED THERMONUCLEAR RESEARCH

The four major laboratories engaged in research on controlled thermonuclear reactions continued to focus their efforts on obtaining favorable results which could be announced at the Geneva Conference in September and on preparing impressive exhibits for that conference.

Princeton University

At Princeton, research was continued on an improved method of plasma heating, a form of magnetic pumping involving the use of frequencies close to the ion cyclotron resonance. The heating effect has been observed when the method was tried at low power. Equipment for higher power will be used soon to increase this heating effect.

Detailed engineering for the Model C Stellarator is on schedule.

Oak Ridge National Laboratory

At Oak Ridge, the DCX (Direct Current Experiment) equipment has contained a circulating atomic ion beam with an average number of turns of about 100,000 and a confinement time of 10 milliseconds. The number of turns in the trapped ion beam must be increased by a factor of about 15 before a desirable condition called burnout is achieved in hydrogen gas. To achieve this condition in deuterium gas will be somewhat more difficult. Measures to achieve burnout include improving vacuum conditions and increasing the output of ion sources. At burnout in deuterium a large neutron production should be suddenly observed.

University of California Radiation Laboratory (UCRL)

When Dr. Teller became director of UCRL activities at Livermore, he arranged for a review of all controlled thermonuclear research being performed by the laboratory. As a result of the review, completed in May, planning for a large pinch tube was rearranged. Several months will be devoted to diagnosis of the difficulties in operating pinch tubes of more modest size before proceeding with detailed engineering plans for a larger tube.

It is now certain that a small fraction of the deuterium ions squeezed out from the multiple compression mirror machine called Toy Top have a high energy, of the order of one thousand electron volts (Kev). While this fact is encouraging, the difficulty lies in the low density of these ions. Extensive remodeling of the machine was undertaken to permit continuation of these experiments.

A building estimated to cost $900,000 is under construction at Livermore to house future thermonuclear devices.

Los Alamos Scientific Laboratory

Chief interest continued to be centered on three matters:

1. A toroidal pinch tube about 5 inches in diameter, called the Perhapsatron S-4, is believed to have been producing more neutrons than any other toroidal pinch device in the world. Diagnostic work on this machine was proceeding on nearly a double-shift basis.

2. Refined diagnostic measurements are being made on a straight pinch tube about 5 inches in diameter. These measurements reveal for the first time the existence of a sheath of electric current around the pinch, which sheath had been masked in measurements on smaller tubes.

3. There was excellent progress on producing hotter plasmas by shock injection into a very rapidly rising mirror field. The device employed is called Scylla. It produces an interesting number of neutrons.

Ground was broken for a $600,000 building to house fast condensers with a capacity of at least 12 megajoules. The probable completion date is November 1959.

Public Disclosure of Experimental Approaches

Information released in January 1958 on controlled thermonuclear research dealt largely with work conducted at Los Alamos on pinch devices. Papers delivered at the May 2 meeting of the American Physical Society described the stellarator approach undertaken at Princeton University, the magnetic mirror approach being studied by the University of California Radiation Laboratory, and the technique for injecting high energy ions into a steady magnetic field, being explored by Oak Ridge National Laboratory. Scientific details of these approaches will be released for the first time at the Geneva Conference in September. (End of UNCLASSIFIED section.)

Part VIII

Biology and Medicine

PROJECT SUNSHINE (UNCLASSIFIED)

Monitoring and sampling of worldwide radioactive fallout continued throughout the quarter. The Health and Safety Laboratory of the New York Operations Office prepared a report which brings together all the data that have been obtained on the deposition and uptake of fallout since systematic monitoring and sampling began.* The data on gummed film, surface air monitoring, Pacific Ocean water, and human bone sampling are only summarized in the report because they comprise hundreds of thousands of individual listings. However, the detailed information is unclassified and available to anyone.

Stratospheric Monitoring

Table 1 summarizes the results of analysis for strontium 90 of stratospheric samples collected during the period November 1956 through January 1958, based on data available

Table 1—Average Concentrations of Strontium 90 in Stratospheric Samples Collected November 1956 through January 1958*

(Strontium 90 content expressed in micromicrocuries per 1,000 cubic feet of air, reduced to standard conditions.)

	Minneapolis, Minnesota		San Angelo, Texas		Panama Canal Zone France Air Force Base		Sao Paulo, Brazil	
Altitude (feet)	Average strontium 90 content	Number of samples	Average strontium 90 content	Number of samples	Average strontium 90 content	Number of samples	Average strontium 90 content	Number of samples
90,000	7 ± 10†	10	5 ± 5	14	7 ± 5	2	9 ± 9	11
80,000	10 ± 7	8	15 ± 10	11	14 ± 11	5	12 ± 8	14
65,000	24 ± 15	17	29 ± 12	10	29 ± 26	6	17 ± 13	11
50,000	9 ± 5	19	2 ± 2	10	-	0	1 ± 1	5‡

*Based on data available through June 26, 1958. Analyses had not been completed on all samples collected during this period. The program calls for one sample a month from each altitude at each location. In some instances the sample was not recovered.

†Range shows one standard deviation above and below average. Standard deviations shown include both errors of measurement and variations in strontium 90 content from month to month.

‡These samples were collected in the vicinity of the tropopause and probably do not represent stratospheric concentrations. The 50,000-foot sampling level is usually below the stratosphere at this location.

*Copies of this report, "Environmental Contamination from Weapons Tests—A Compilation of Data Concerning Transport, Deposition, Distribution, and Biological Uptake of Worldwide Radioactive Fallout," HASL-42, were provided to the Joint Committee. The report will be sold by the Office of Technical Services, Department of Commerce.

through June 26. It will not be possible to give these data their final interpretation in terms of strontium 90 concentrations in the stratosphere until the question of the efficiency of air filters can be resolved.

Foreign Food Collection

Food samples were collected in Spain by a nutrition team of the Interdepartmental Committee on Nutrition for National Defense and will be analyzed for their strontium 90 and calcium content. (End of UNCLASSIFIED section.)

RADIOBIOLOGICAL SURVEYS IN THE PACIFIC ([redacted])

A number of radiobiological surveys were under way in the Pacific to monitor the radioactivity in the water and marine organisms resulting from the current test series, Operation HARDTACK. In addition, ecological studies at Rongelap Atoll will continue. Each of these programs is described briefly below.

Surveys in Connection with HARDTACK

Informal arrangements were made with a radiochemist of the National Institute of Health, Tokyo, for the collection of tuna samples at a port of landing in Japan. A total of 2,600 samples will be collected at the rate of 20 samples per day 5 days a week for 6 months and sent to the Laboratory of Radiation Biology of the University of Washington. All samples will be counted for total beta and gamma activity, and a limited number will be selected for radiochemical analysis. The Japanese will retain duplicate samples, and it is expected that information on sample analyses will be exchanged with them.

In connection with the WAHOO underwater detonation on May 15, which was only the third underwater detonation since the beginning of testing in the Pacific, the University of Washington and the Office of Naval Research joined forces to observe the physical and biological dispersal in the water of radioactivity from that event. The Hydrographic Office Vessel USS *Rehoboth* was used for the observation of water structure and the collection of water, plankton, and fish, both before and after the event.

A limited number of biological samples were collected at Eniwetok, Bikini, and a few nearby atolls prior to Operation HARDTACK and will also be collected following the test series. Personnel were to be available during the operation for other radiobiological surveys that might be needed.

Immediately following the conclusion of the current test series a survey similar to the post-REDWING survey of 1956 will be conducted to measure the contamination of water in the restricted area preparatory to removing the boundaries of the area. The survey will go beyond the restricted area and in general, will include the area between Bikini, Eniwetok, and Guam. Water, plankton, and fish will be collected. Gross beta and gamma counts will be made of all samples and radiochemical analyses of a limited number of selected samples.

Beginning in July, four radiobiological surveys were to be made during the year at Guam, in the Palau Islands, and in the Gulf of Siam by the Vanderbilt Foundation of Stanford University. The ocean transport of contamination from the test site to these areas requires several months. Those organisms will be collected that are most likely to concentrate radioisotopes from weapons tests (commonly called indicator species) and that correspond most closely to species sampled in other radiobiological surveys. Indicator species include fish, giant clams, lobster, plankton, and land crabs. The samples will be sent to the University of Washington for counting and radiochemical analysis.

Rongelap Ecological Studies

The first phase of a long-term ecological survey of Rongelap Atoll was carried out during February and March. The object of the initial study was to determine the types of soil on the atoll, their approximate distribution, their chemical and physical properties, their relation to plant distribution, and the distribution of radioactive materials in soils, plants, and ground water. Field work consisted of reconnaissance surveys of Rongelap, Eniaetok, and Kabelle Islands, followed by detailed examination of soil profiles and collection of soil samples.

An integral part of the Rongelap ecology study is the continuing program of monitoring the foodstuffs of the natives. This serves as a check on the radioisotopes ingested by the natives and also provides information required for food chain studies.

Thirteen field rats collected on Rongelap Island during this trip were assayed for strontium 90 content of bone. The values obtained ranged from 268 to 926 strontium units, with an average value of 443. One pig bone was obtained, which gave an assay of 480 strontium units.

A second field trip is planned for September 1958. (End of [redacted] section.)

TREATMENT OF RADIATION DAMAGE (UNCLASSIFIED)

Studies continued at the Oak Ridge National Laboratory on the treatment of radiation injury by bone marrow transplants. In an experiment conducted on bone marrow cells in suspension the cells were protected from a dose of 800 roentgens of X irradiation by removing most of the oxygen in the cell suspension just before irradiation. Protection was judged by the ability of the irradiated marrow cells to promote recovery in mice exposed to a lethal dose of radiation.

Various chemical compounds were administered to mice in an effort to suppress the reaction which prevents the successful transplant of foreign bone marrow. None of these compounds proved to be effective, nor did diets deficient in specific vitamins have any effect on this reaction.

RADIOLOGICAL ASSISTANCE PLAN

Procedures coordinating the capabilities of the AEC and the Department of Defense for handling all types of radiation incidents were established during the quarter. As reported in the Program Status Report for December 31, 1957, the AEC had certain capabilities for handling both onsite and offsite incidents, and joint AEC-Department of Defense procedures were already in existence for handling incidents involving nuclear weapons. The new radiological assistance plan applies to both weapon and nonweapon incidents arising in onsite contractor operations, offsite contractor or licensee establishments, or in other places as reported by either military or civil authorities. The plan provides for rapid response to a request for assistance at the scene of an incident by a team from the responsible AEC regional office, with assistance from the AEC-DOD Coordination Center at Sandia Base, New Mexico, if requested.

The AEC issued a press release on June 10 describing the services available in the event of a radiation incident. Each AEC regional office sent letters describing the radiological assistance plan to contractors, licensees, and state and local government officials in the geographical area under its jurisdiction.

CIVIL EFFECTS ACTIVITIES

Civil Effects Exercise 58-1

A civil effects exercise was conducted at the Nevada Test Site (NTS) during May under the technical leadership of the Oak Ridge National Laboratory to determine shielding characteristics of typical structures remaining at NTS and the value of simple modifications and other methods of improving the shielding. The objective of this exercise was to develop data useful in the preparation of standards for fallout protection and to find inexpensive means of improving or improvizing shelters. Another important phase of the exercise was the collection of data on which to base specifications for a vehicle equipped with radiation sources and instruments for evaluating the shelter characteristics of homes.

Civil Effects Exercise 58-2

A brief but intense temperature rise at the time of nuclear detonation was noted in certain large shelters at NTS, particularly during Operation TEAPOT experiments in 1955. A civil effects exercise was scheduled for a 2-week period during August at NTS to determine the attenuation of light by the configuration of these shelters in an effort to determine the physical basis for the temperature rise. Data on temperature rises in shelters is essential to the development of acceptable criteria for protective construction.

Civil Effects Exercise 58-3

During June personnel of the Atomic Energy Project of the University of California at Los Angeles initiated a resurvey of the radiation levels in and around the Nevada Test Site. A detailed survey of the Jackass Flats area, which was to be completed prior to the commencement of reactor testing activities in that area, was to include sampling of soil, plants, and animals as well as monitoring of radiation levels. This information may be useful to projected ecological studies.

Planning for Future Civil Effects Tests

In order to lay a firm foundation for participation in future test operations, task units were established to review existing information on various subjects and to determine the types of field experiments that would furnish the most urgently needed data and the preliminary laboratory work that would complement these experiments. These groups, each composed of six or more specialists, are conducting studies of radiobiology, fallout, ecology, genetics, blast biology, thermal biology and effects, physical damage to structures, countermeasures and decontamination, and radiation dosimetry and other instrumentation.

A group of 15 ecologists met May 27–29 at the Nevada Test Site to consider research needs and opportunities in this area. This survey of NTS was only a part of the group's total program; its recommendations for ecological research were expected to cover all aspects of interest to the AEC.

BACKGROUND RADIATION SURVEY OF ATOMIC ENERGY INSTALLATIONS

Arrangements were made with the U. S. Geological Survey for airborne background radiation surveys of sizable portions of the United States, including all major AEC production sites, licensee reactor sites, and the Nevada Test Site. The data obtained by the Geological Survey and maps prepared from these data should provide a basis for appraisal of changes in levels of radiation in the environment brought about by the testing program, reactor operation, AEC plants, and radiation accidents.

EDUCATION AND TRAINING

Training Equipment Grants

In June the AEC awarded 38 grants totaling $453,883 to 34 colleges and universities to assist these institutions in expanding their facilities for training in radiation biology and in the use of radioisotopes in the fields of medicine, biology, agriculture, and health physics. This is the fourth series of such grants and brings the total awards since the start of the program in October 1957 to 90 grants totaling $1,167,480.

OCCUPATIONAL RADIATION EXPOSURE INFORMATION

Policy and procedures were established in May for informing AEC and AEC contractor employees concerning occupational radiation exposure which has been recorded as having been received by them during the period of their employment. This information will be made available to any employee upon request. In addition, the employee will be notified if his recorded accumulated radiation exposure exceeds any of the permissible levels of radiation exposure. (End of UNCLASSIFIED section.)

Part IX

International Activities

INTERNATIONAL COOPERATION (UNCLASSIFIED)

International Atomic Energy Agency

One of the first projects undertaken by the International Atomic Energy Agency (IAEA) was a survey of nuclear energy training needs and capabilities in Latin America. During May and June an international team of scientists, engineers, and administrators headed by Dr. Norman Hilberry, Director of Argonne National Laboratory, and including representatives from the Organization of American States, visited Caribbean, Central American, and South American countries.

During the quarter the IAEA Board of Governors discussed at length the agency's program and budget for calendar year 1959. Although no decision had been reached by the end of June, the initial $12 million budget proposal had been tentatively scaled down to $7 million.

An agreement for cooperation between the United States and the IAEA was in the final stages of negotiation at the end of the quarter. A draft agreement had been approved by the AEC and the Department of State and was being considered by the IAEA.

As of June 30 a total of 67 nations were participating members of the IAEA.

European Atomic Energy Community

The European Atomic Energy Community (Euratom) and the United States reached agreement during the quarter on a joint program of nuclear power development.* The aim of this program is to bring into operation in the Community, by 1963, about 1,000,000 electrical kilowatts of installed nuclear capacity, in reactors of proven types developed in the United States, and to initiate immediately a joint research and development program centered on these types of reactors.

Work was completed on a memorandum of understanding, an international agreement under section 124 of the Atomic Energy Act, and an agreement for cooperation under section 123 of the Act. With the approval of the Euratom Council of Ministers, the Euratom Commission signed the memorandum of understanding and the international agreement and initialed the agreement for cooperation. The President submitted the international agreement to Congress for approval on June 23. Following approval of this agreement, the agreement for cooperation with Euratom was to be placed formally before the Joint Committee on Atomic Energy. Congressional approval of authorization and appropriation of funds and certain other enabling

*The joint program and the necessary legislation were described in detail in a letter to the Joint Committee dated June 23.

legislation were also required before the United States could carry out its share of the joint program.

The United Kingdom and Euratom have opened negotiations looking toward a program of cooperation.

Organization for European Economic Cooperation

The AEC informed the Organization for European Economic Cooperation (OEEC) that it is prepared to undertake a long-term program of cooperation with the European Company for the Chemical Processing of Irradiated Fuel (Eurochemic) in connection with the processing plant to be constructed by Eurochemic at Mol, Belgium, and offered to provide a small group of experts for consultation and plant design review. The OEEC hoped that the Mol plant could eventually be designated by the AEC as an acceptable facility for the reprocessing of fuel originating from the United States.

Several meetings were held by the OEEC experimental reactors group and attended by AEC scientists. General agreement was reached on a proposal for a $30 million experimental high-temperature gas-cooled reactor project at Winfrith Heath, United Kingdom. The Netherlands proposed a long-term research and development program on homogeneous reactors by the United States, the United Kingdom, France, and the Netherlands, involving exchange of information and personnel. Plans were made for a 3-year international research and experimental program under OEEC auspices on the Halden, Norway, boiling water reactor project. At Norway's request, the AEC assigned three reactor safety and operating engineers to Halden for 3 to 6 months during the next year.

The AEC also was cooperating with other OEEC groups who were studying problems relating to health and safety and third party liability.

Organization of American States

The preparatory committee appointed last November by the Council of the Organization of American States (OAS) to draft a statute for an Inter-American Nuclear Energy Commission (IANEC) completed its work and submitted a draft for Council consideration.

Discussions continued between the AEC and the Department of State on the possibility of holding additional Inter-American symposia on the peaceful uses of atomic energy, similar to the one held in May 1957 at the Brookhaven National Laboratory. It was anticipated that OAS would take the initiative in proposing the symposia and that they would be conducted in South America under the aegis of IANEC. Full participation by the United States is planned if these symposia are held.

AGREEMENTS FOR COOPERATION

On April 15 notes were exchanged to bring into effect the comprehensive power agreement with Italy. Including this agreement, there were 41 agreements in effect with 39 countries as of June 30; 29 of these were for research and 12 were for power. There were, in addition, four research and three power agreements awaiting ratification.

The research agreements with Venezuela and the Republic of Korea were amended during the April-June quarter to provide for the transfer of limited quantities of special nuclear material for use in defined research projects.

The Commission announced in April a liberalization of conditions under which uranium reactor fuel enriched to more than 20 percent in uranium 235 may be made available to

friendly nations. Highly enriched fuel may be made available for research reactors using up to 8 kilograms of uranium 235 per core loading, as well as for materials testing reactors, provided that the requesting nation has in effect an appropriate agreement for cooperation with the United States containing comprehensive safeguards and controls against diversion of nuclear material to military uses. The Commission will consider requests for amendments to present agreements that do not contain the necessary provisions. An amendment to the Danish research agreement permitting transfer of uranium 235 at 90 percent enrichment for use in Denmark's DR-2 research reactor was being negotiated at the end of June and was expected to be the first action under the new policy.

Activities Pertaining to Agreements for Cooperation

Italy. The comprehensive agreement for cooperation with Italy provides for the transfer to Italy of 7,000 kilograms of uranium 235 over a 20-year period for use in research and power reactors. A question has arisen as to the relationship of this agreement to Euratom since the exchange of notes bringing the agreement into effect occurred subsequent to the date upon which the Euratom treaty entered into force. This question was under study by the Department of State and appropriate authorities of the Italian Government and Euratom.

Japan. A comprehensive agreement for cooperation with Japan was signed on June 16 and will supersede the 1955 research agreement when it has been ratified by the Japanese Diet. The new agreement provides for the transfer to Japan of 2,700 kilograms of uranium 235 over a 10-year period for use as fuel in research and power reactors. Among the projects planned by the Japanese are a 15,000- to 20,000-electrical-kilowatt experimental power reactor scheduled for operation in 1961, and a full-scale 150,000-electrical-kilowatt power reactor scheduled for operation in 1964. Both of these reactors are tentatively planned as enriched-uranium, water-cooled types.

Research reactor grants. Formal letters of commitment for $350,000 research reactor grants were presented to seven countries during the April-June quarter.

Country	Reactor Project
Austria	5,000-kilowatt, tank-type research reactor to be constructed by AMF Atomics for the Austrian Study Company for Atomic Energy at a site in the vicinity of Vienna
Belgium	25,000-kilowatt, high-flux testing reactor being built at the Mol nuclear research center by Belgian industry with the assistance of the Nuclear Development Corporation of America
China	1,000-kilowatt, pool-type research reactor to be constructed by the General Electric Company at the National Tsing Hua University, Hsinchu, Taiwan
Germany	1,000-kilowatt, pool-type research reactor at the Technical University of Munich, built by AMF Atomics and in operation since the fall of 1957
Israel	1,000-kilowatt, pool-type research reactor to be built by AMF Atomics at Nebi-Rubin near Rehovoth
Norway	Zero-power, pool-type research reactor to be built largely by Norwegian industry at Kjeller
Sweden	30,000-kilowatt, research and materials testing reactor being built by ACF Industries at Studsvik nuclear research center

These new grants bring to 16 the total number of research reactor grants approved by the AEC. The grants approved previously were for research reactor projects in Brazil, Denmark, Greece, Italy, Japan, the Netherlands, Portugal, Spain, and Venezuela.

OTHER FOREIGN ACTIVITIES

Belgium. The Belgian parliament approved a radiation protection law providing government control over the production, utilization, transportation, and importation of radioactive materials. Responsibility for the enforcement of this law was assigned to the Ministry of Public Health.

Canada. On May 24 the NRU reactor building at Chalk River became severely contaminated with radioactive materials as the result of an accident which occurred during the removal of a defective fuel element. The contamination was confined largely to the NRU building, and cleanup operations were initiated immediately. All planned United States experiments in the NRU facilities were to be delayed for an indefinite period.

Early in April Eldorado Mining and Refining, Limited, achieved its first production of uranium metal, about two and one-half years after Canada announced her intention to produce metal. Production was scheduled to be at a rate of about 300 tons of uranium per year, approximately twice the requirements for the Chalk River reactors. Canada hoped to sell the rest abroad and had made commitments to Switzerland for about 12 tons a year.

Paralleling the AEC's announcement that it would permit private sales of uranium ores and concentrates, the Canadian Government announced on May 7 that it would permit private Canadian producers to make their own sales arrangements. Individual sales of up to 250 pounds will be authorized, with total sales to any one country not to exceed 2,500 pounds. Sales of larger quantities will be made only to countries with which Canada has agreements for cooperation. Canada will attempt to market uranium in as finished a form as possible and will encourage foreign sales of concentrates, uranium metal, and fuel elements. (End of UNCLASSIFIED section.)

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France. (UNCLASSIFIED) On May 2 a ceremony was held at Malvezy, near the Spanish border, inaugurating the construction of a new uranium metal extraction plant. The production from this plant, 500 tons of uranium per year, is intended primarily for the power and plutonium production reactors at Marcoule. Completion of the plant is scheduled for early 1959.

Germany. The Brown Boveri-Krupp group announced that construction was scheduled to begin at the end of 1958 on a 15,000-electrical-kilowatt advanced type gas-cooled experimental power reactor. The project is being sponsored by a nine-city utility group in northwest Germany.

Israel. The new Institute of Nuclear Science at the Weizmann Institute in Rehovoth was dedicated on May 20. It is expected that there will be close cooperation between the institute and the staff of the Israeli Atomic Energy Commission in the use of the latter's research reactor, to be built by AMF Atomics at nearby Nebi-Rubin.

Italy. Ratification of the United Kingdom–Italy power bilateral agreement was completed in May. The British Nuclear Power Plant Company and AGIP Nucleare, a publicly owned

utility, were expected to agree shortly on a contract for the construction of a 200,000-electrical-kilowatt power reactor at Latina, near Rome, as well as a 7-year agreement for cooperation providing for technical information exchange.

Japan. The United Kingdom–Japan power bilateral agreement, long stalemated on the third party liability issue, was signed on June 16, the same day as the agreement with the United States. It was reported that there was considerable public criticism in Japan of the Japanese Government's decision to purchase a Calder Hall–type power reactor from the United Kingdom.

A Kyoto University meteorology professor has written a paper titled "A Dynamical Theory of the Microbarographic Oscillations Produced by Explosions of Hydrogen Bombs," dealing with studies of air wave recordings in connection with 29 nuclear tests from 1952 to 1957. The shock waves are categorized by four types of test explosions and related to specific detonations.

Sweden. Negotiations were reportedly in progress between Swedish and Finnish atomic energy companies concerning possible sale to Sweden of all uranium ore mined in Finland. Sweden's own production was expected to yield about 100 metric tons of uranium per year after completion of a new processing plant under construction.

United Kingdom. A white paper issued by the United Kingdom in April revealed that the target date for completion of the 5,000,000- to 6,000,000-kilowatt nuclear power program had been delayed one year, to 1966 instead of 1965, and that a higher proportion of the total new generating capacity required between 1958 and 1966 would be in the form of coal-fired stations with lower capital costs.

The Dounreay Materials Testing Reactor (DMTR) went critical May 24. When fully operative it will run at 10,000 kilowatts. DMTR is the first of three reactors at Dounreay; the other two are a fast breeder reactor housed in a giant sphere and the Admiralty's land-based submarine propulsion reactor prototype.

At a press conference the United Kingdom Atomic Energy Authority gave details of the latest experiments with their Zero Energy Thermonuclear Assembly (ZETA) at Harwell, showing that at least 95 percent of the neutrons produced by ZETA were not thermonuclear in origin. This refuted general public assumption that true thermonuclear neutrons had been achieved in ZETA. However, Harwell did not plan to change the direction of its controlled thermonuclear research program.

Yugoslavia. Yugoslavia's first nuclear reactor, a zero power facility using natural uranium and heavy water acquired from the Soviet Union but otherwise built by the Yugoslavs themselves, was officially dedicated May 17, after having achieved initial criticality in April. The reactor is located at the Boris Kidric Institute for Nuclear Sciences at Vinca. A larger reactor of 10,000 kilowatts was being built with Soviet assistance, with completion scheduled for late 1958. There were indications, however, that this project was behind schedule.

TECHNICAL EXCHANGE AND ASSISTANCE

Australian Symposium

A seven-man AEC delegation participated in the Australian Symposium on the Peaceful Uses of Atomic Energy held at Sydney, June 2–6, and presented seven papers. The group remained in Australia for an additional week as an AEC technical mission and conferred with Australian atomic energy personnel on legal and administrative aspects of nuclear energy, experimental power reactor technology, uranium fabrication, chemical processing, and radioactive waste disposal.

Spanish Conference and Exhibition

A conference and an exhibition on atomic energy were held in Madrid in May. Two AEC scientists represented the United States at the conference and also discussed local nuclear energy problems with Spanish officials.

Equipment Grants

During the April-June quarter the AEC established a grant program to assist foreign countries in acquiring equipment, other than research reactors, for nuclear training and research. Grants will be considered for many types of equipment ranging from "package" research laboratories and subcritical assemblies to relatively minor items of equipment which would advance a nation's nuclear training and research programs. These grants will not be limited to countries with which the United States has agreements for cooperation. Listed below are the countries and equipment for which grants were committed during the quarter, for a total cost of $168,000.

Greece	Equipment for a nuclear engineering laboratory, including a subcritical assembly with necessary uranium
Italy	A cobalt 60 gamma ray irradiation unit for agricultural uses
Uruguay	A biochemical laboratory, a medical diagnostic laboratory, and a cobalt 60 teletherapy unit

United States–United Kingdom Cooperation

The United Kingdom Atomic Energy Agency (UKAEA) and the AEC continued their cooperation in controlled thermonuclear research and graphite research during the April-June quarter.

Representatives from the United Kingdom Atomic Weapons Research Establishment at Aldermaston visited the Nevada Test Site and the Armed Forces Special Weapons Project headquarters for discussions on blast effects of nuclear weapons.

Following agreement by the United Kingdom in June 1957 to furnish the United States with design information on the Calder Hall reactors, useful information was given to the AEC on many aspects of these reactors. Differences in interpretation of the scope of the exchange were resolved in June 1958, and detailed data on manufacture and performance of standard Calder Hall fuel elements will be added to the information available.

Two Brookhaven scientists were assigned to Harwell for extended periods for work on reactor physics, including liquid-metal-fuel reactor research.

The United Kingdom informally expressed interest in exchanging data on chemical reprocessing plant technology in connection with handling irradiated uranium from their nuclear power reactors. An amendment to the present agreement for cooperation would be required before full exchange of information in this area could be accomplished.

Tripartite United States–United Kingdom–Canada Programs

Meetings and discussions continued under the tripartite hot loop and nuclear cross sections programs. The fourth meeting of the Tripartite Nuclear Cross Sections Committee was held at Chalk River, Canada, May 20–22.

Technical Documents Exchange

During the April-June quarter, 54 classified and official use only documents were received from cooperating countries, while the United States transmitted 167. The latter figure includes identical reports submitted to two or more countries in some cases. The United States exchanged classified information as specified in agreements for cooperation with Australia, Belgium, Canada, the Netherlands, Switzerland, and the United Kingdom.

Visit Summary

During the April-June quarter, 23 United States visitors participated in nine classified conferences in the United Kingdom, Canada, and Australia, while 11 United Kingdom and Canadian representatives visited the United States to attend nine classified meetings.

On an unclassified basis, arrangements were made during the quarter for 248 individuals from 33 foreign countries to visit AEC field installations.

TRAINING AND EDUCATION

Puerto Rico Nuclear Center

Architect and design work progressed on the $3.5 million construction project for the nuclear center in Puerto Rico. Dr. Carlos Bonilla, on leave from Columbia University, accepted the post as director of the center. The University of Puerto Rico is providing temporary facilities and space pending completion of permanent buildings.

A contract was signed with AMF Atomics for the design, fabrication, installation, and testing of the 1,000-kilowatt, pool-type research and training reactor, scheduled for operation on the Mayaguez campus by late 1959. The Southern Construction Company of Augusta, Georgia, was awarded the contract for construction of the reactor building, the laboratory building, and various other auxiliary facilities.

The University of Puerto Rico, with the assistance of the AEC, has been conducting a 4-week radioisotope techniques training course on a bimonthly basis since August 1957.

Puerto Rico Health Physics Symposium

In cooperation with the University of Puerto Rico Medical School, the AEC sponsored a health physics symposium held May 26–28 in Puerto Rico. The symposium was attended by 65 physicians and scientists from the United States and nine Latin American countries. Information was exchanged on health physics, and future Latin American needs for training and research in the use and handling of radioactive materials were discussed. There were favorable comments from the participants, and the attitudes and statements of the Latin American representatives were considered particularly encouraging in view of the recent political events in South America.

Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica

The nuclear research project at the Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica, was inaugurated in April with the official dedication of the gamma field and radioisotopes laboratory supplied by the United States.

Technical Libraries

Representatives from 13 countries and six international organizations attended a library workshop and conference held by the AEC at Geneva, Switzerland, May 26–30, to demonstrate

with actual materials at hand how an AEC technical library should be organized and administered to provide maximum service. The workshop and conference, held in response to requests for assistance from many countries to which libraries had been given, were well received and appeared to have been highly useful. Workshops may be held in other areas of the world if the need arises.

During the quarter, an unclassified technical library was approved for presentation to Iran, bringing to 54 the total number of countries for which libraries have been authorized.

Training Courses

Graduation of 56 foreign and 11 United States participants in the sixth session of the International School of Nuclear Science and Engineering brought the total number who have completed this course to 272 foreign and 87 United States students.

A total of 268 foreign participants from 49 countries had completed the 4-week radioisotope training course at the Oak Ridge Institute of Nuclear Studies through June. Increasing numbers of applications for this course resulted in the establishment in May of facilities to accommodate 30 additional foreign students per year.

Plans were made and information distributed through State Department channels for a new 6-week course in fallout monitoring techniques, scheduled to start in October 1958 at the Health and Safety Laboratory of the New York Operations Office.

INTERNATIONAL MEETINGS

United Nations Scientific Committee on the Effects of Atomic Radiation

The fifth session of the United Nations Scientific Committee on the Effects of Atomic Radiation, held in New York June 9–13, unanimously approved adoption of a report to the General Assembly which had been requested by the 1955 resolution which established the committee. The report discusses the biological effects of radiation arising from natural background, medical radiography, industrial use of radioisotopes, and fallout from nuclear explosions. The committee concluded that "all steps designed to minimize irradiation of human populations will act to the benefit of human health" but that "considerations involving effective control of all these sources of radiation involve national and international decisions which lie outside the scope of its work." The committee voted down a Soviet proposal which would have put the committee on record as favoring immediate cessation of nuclear weapons testing. The Soviet proposal and an Indian proposal relating to testing will appear as footnotes in the report. It was expected that the report of the committee would be released to the public in August.

The Secretary General of the United Nations informed the committee that he would recommend to the next General Assembly the indefinite continuance of the committee under suitably broadened terms of reference. The United States representative on the committee, Dr. Shields Warren, advised the Secretary General that while a broad charter was desirable, the future work of the committee should be deliberative rather than operational.

Fifth International Electronic and Nuclear Exposition and Congress, 1958

United States participation in the Fifth International Electronic and Nuclear Exposition and Congress, held in Rome June 16–July 1, consisted of a nuclear energy exhibit and a delegation of ten AEC and AEC contractor personnel who presented papers at the congress.

Extensive and complimentary news coverage was given to the United States exhibit, which was attended by more than 83,000. An operating low-power research and training reactor proved to be the most popular item in the exhibit. The United States won a prize cup for having the best exhibit at the exposition.

Topical Conferences

Under the AEC's program of financial support for international conferences on special scientific subjects relating to atomic energy, aid was given to the Symposium on Health Physics in Biology and Medicine held in Puerto Rico under the auspices of the University of Puerto Rico, May 26–28.

Second International Conference on the Peaceful Uses of Atomic Energy, 1958

Details of United States preparation for the International Conference on the Peaceful Uses of Atomic Energy to be held in Geneva, Switzerland, September 1–13, will be found in the Commission's Twenty-fourth Semiannual Report to the Congress.

Trend of conference preparations. The worldwide trend of preparations for the 1958 Conference as reported by the United Nations is clearly in the direction of broader, more complete, and more elaborate participation by more countries. The United Nations announced that on May 2 it had received 2,325 abstracts of papers from all nations, compared with 1,070 for the 1955 conference. Of the 45 countries and four intergovernmental agencies submitting abstracts, the smaller nations showed the greatest increases. Mexico and Hungary, which submitted no papers in 1955, submitted 5 and 28 abstracts, respectively. Yugoslavia increased its submission from 7 to 56 and West Germany from 2 to 65. The United States total of 831 abstracts submitted by April 22 had been increased to 910 by the middle of June. The number of abstracts submitted by May 2 by other leading nations, as reported by the United Nations, were:

United Kingdom	199
U.S.S.R.	189
France	162
Belgium	69
West Germany	65
India	63
Yugoslavia	56
Sweden	51
Italy	47

Summary of United States preparations. Preparations by the United States have more than kept pace with the increased efforts of other nations. United States participation in the 1958 conference is expected to be greater than in 1955 in many respects, as indicated in the following table:

	1958	1955
Number of abstracts received and processed by AEC review committees	1,499	1,067
Number of papers submitted to the United Nations for oral presentation or publication in the proceedings	700	391
Films prepared by the United States for showing by the United Nations	17	8

	1958	1955
Short films to be shown by the United States	27	0
United States exhibit space (square feet)	40,000	7,000
United States staff*		
Conference representatives and advisors	207	210
Exhibit staff	180	51
Information staff	16	14
Secretariat	128	100
Local hires	118	43
Total United States staff	649	418

More significantly, United States participation will be of higher quality than was possible in 1955:

Technical exhibits. The emphasis of United States technical exhibits has been placed on authentic laboratory equipment, instruments, components, and reactors in actual operation. Highlights of the United States exhibit are expected to be the Argonaut research and training reactor, which will be constructed by personnel from Argonne National Laboratory during the first week of the conference; the TRIGA reactor, manufactured by General Atomics, Inc., which will produce radioisotopes for the isotope laboratory to be operated in the exhibits building; and the special area containing nine operating laboratory devices representing the major approaches of the United States in research on controlled thermonuclear reactions.

Technical films. The United States will present a comprehensive set of technical films of high quality, which are designed especially for the high technical competence of the conference delegates. A special sound system which permits simultaneous narration in four languages was developed for the United States exhibit and has been adopted by the United Nations for the presentation of films from many nations.

Technical papers. A larger and more comprehensive organization of review committees representing outstanding United States scientists in all fields was established to assure the highest possible quality in technical papers to be presented by the United States.

Commercial exhibit. AEC is offering direct assistance to United States industry in preparations for the commercial exhibition in downtown Geneva. The central exhibit in the United States area will be sponsored by AEC and will dramatize the close cooperation between Government and industry in the United States in the development of the peaceful uses of atomic energy.

Technical information. In the technical information area, stress will be laid on the wide variety and high quality of information and assistance available from the AEC and private industry in the United States.

United Nations advisory committee. United Nations plans for the Conference were reviewed in Geneva on May 7 and 8 by the Secretary-General's advisory committee, on which Dr. I. I. Rabi is the official United States representative. The committee reviewed the agenda submitted by Dr. Sigvard Eklund of Sweden, the Conference Secretary-General, and increased the number of technical sessions to about 70, to be presented in five parallel series of sessions

*1958 personnel figures are estimated.

rather than four as originally planned. The additional sessions were not confined to any particular area of interest but represented the increased activity on the part of most nations in all aspects of the Conference. The committee gave Dr. Eklund rather broad discretion in completing details for the Conference, which will receive the committee's final approval at a meeting on August 29 in Geneva.

The committee approved the Conference schedule. The exhibit building being constructed by the United Nations will be open to the general public August 31 to September 15, from 10:00 a.m. to 3:00 p.m.

It was also agreed that six evening lectures would be delivered on three nights during the Conference by prominent scientists. Although the program was not announced in detail, the following were expected to be invited by the United Nations to deliver evening lectures: Glenn T. Seaborg and Lloyd V. Berkner of the United States, I. Y. Tamm and V. A. Engel'gardt of the U.S.S.R., Sir John Cockcroft of the United Kingdom, and Homi J. Bhabha of India. (End of UNCLASSIFIED section.)

Appendix A

CONSTRUCTION PROGRESS SCHEDULES

CONSTRUCTION STATUS OF PRINCIPAL FACILITIES

Project name and location	Percent construction completion						Construction dates		Current estimated cost (in millions of dollars)
	Actual		*Scheduled*				Start	*Scheduled* or actual completion	
	Mar. 31, 1958	June 30, 1958	Sept. 30, 1958	Dec. 31, 1958	Mar. 31, 1959	June 30, 1959			
SPECIAL NUCLEAR MATERIALS									
OAK RIDGE									
Reduction in fire hazards, gaseous diffusion plants, Oak Ridge, Paducah, and Portsmouth (Phase I)		1	*Schedule being developed*				June 1958	*Sept. 1959*	14.6
PORTSMOUTH									
Feed plant	99	100					Sept. 1955	June 1958	9.4
ST. LOUIS									
Feed materials expansion	98	99	*99*	*100*			Mar. 1955	*Oct. 1958*	51.6
SAVANNAH RIVER									
Productivity improvement and tritium facilities expansion programs	56	66	*70*	*77*	*84*	*91*	Dec. 1955	*June 1960*	104.0
Reactor areas	71	86	*90*	*92*	*94*	*95*	Dec. 1955	*June 1960*	28.8
Separation areas	53	60	*67*	*75*	*80*	*87*	Dec. 1955	*June 1960*	47.2
Feed materials	53	54	*56*	*61*	*71*	*84*	June 1956	*Dec. 1959*	14.2
Process development facilities	96	100					Feb. 1956	June 1958*	3.1
General site	29	58	*71*	*81*	*90*	*98*	May 1956	*July 1959*	10.9
WEAPONS									
BURLINGTON-PANTEX [redacted] plants	98	100					Oct. 1956	May 1958*	7.4
LIVERMORE									
Weapons development and engineering facilities	23	42	66	83	92	96	Jan. 1957	*Nov. 1959*	12.7
OAK RIDGE [redacted] plant	71	78	*84*	*90*	*93*	*97*	Aug. 1956	*Nov. 1959*	20.9
SAVANNAH RIVER									
Gas packaging plant	99	100					May 1956	June 1958*	6.3
REACTOR DEVELOPMENT									
CAMDEN									
Merchant ship reactor—NS *Savannah* propulsion system	2	13	*24*	*43*	*62*	*75*	Feb. 1956	*Jan. 1960*	22.3
CHICAGO									
Fuels technology center		1	*Schedule being developed*				June 1958	*Oct. 1960*	12.0
ELK RIVER									
Elk River reactor—RCPA			*Schedule being developed*				*Sept. 1958*	*Dec. 1960*	9.3

HANFORD									
Plutonium recycle test reactor	1	1	8	10	16	28	Mar. 1958	*Aug. 1960*	15.0
IDAHO									
Large ship reactor	81	89	96	99	100		Apr. 1956	*Jan. 1959*	35.0
Modifications and expansion, ANP-OF	48	49	53	59	63	70	Oct. 1956	*Apr. 1960*	15.0
Flight engine test facility, ANP-GE	14	34	50	60	76	90	Sept. 1957	*Dec. 1959**	13.0
Experimental breeder reactor—II	1	3	8	20	40	59	Dec. 1957	*Sept. 1960**	29.1
NEVADA TEST SITE									
Nuclear rocket propulsion test facilities—Project ROVER	56	64	98	100			May 1957	*Nov. 1958*	9.7
Nuclear ramjet propulsion test facilities—Project PLUTO		2	*Schedule being developed*				May 1958	*June 1960*	9.0
PRINCETON									
Model "C" stellarator buildings	1	3	*Schedule being developed*				Feb. 1958	*June 1959*	6.6
SCHENECTADY									
Submarine advanced reactor	82	98	100				Oct. 1955	July 1958	23.5
Destroyer reactor plant			*Schedule being developed*				*Sept. 1958*	*Dec. 1960*	35.0
WINDSOR									
Small submarine reactor	21	28	67	85	97	100	Feb. 1957	*June 1959*	13.5
PHYSICAL RESEARCH									
BROOKHAVEN									
Alternating gradient proton-synchrotron	39	42	52	61	72	81	Mar. 1954	*July 1960*	26.0
CAMBRIDGE									
Cambridge electron accelerator	13	21	31	54	73	84	Nov. 1956	*Mar. 1960**	8.3
PRINCETON									
Princeton proton accelerator	8	16	32	46	62	73	Sept. 1957	*Jan. 1960**	11.3
BIOLOGY AND MEDICINE									
BROOKHAVEN									
Medical research center	85	96	99	100			June 1956	*Oct. 1958**	6.6
ADMINISTRATIVE AND OTHER									
GERMANTOWN									
Headquarters building addition	42	77	100				Sept. 1957	*Sept. 1958*	3.3
PUERTO RICO									
Puerto Rico Nuclear Center			*Schedule being developed*				July 1958	*May 1960*	3.0

*Completion date revised since previous report.

NOTE: In four instances projects shown are parts of larger budgeted items: (1) the feed plant at Portsmouth is the incompleted part of the Portsmouth gaseous diffusion plant project; (2) the productivity improvement and tritium facilities expansion programs are incompleted parts of the $1,284.3 million total project at Savannah River; (3) the thin-shell assembly plants at Burlington and Pantex cover two-thirds of the proposed assembly cells; and (4) the stellarator buildings are the major part of the $10.0 million 1958 Project SHERWOOD construction project.

Costs shown are those accruing to AEC. Princeton and Pennsylvania universities are contributing $0.5 million to the Princeton proton accelerator project.