The Atomic Energy Commission

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Introduction

Almost a year after World War II ended, Congress established the United States Atomic Energy Commission to foster and control the peacetime development of atomic science and technology. Reflecting America's postwar optimism, Congress declared that atomic energy should be employed not only in the Nation's defense, but also to promote world peace, improve the public welfare, and strengthen free competition in private enterprise. After long months of intensive debate among politicians, military planners and atomic scientists, President Harry S. Truman confirmed the civilian control of atomic energy by signing the Atomic Energy Act on August 1, 1946.[(1)]

Signing the Atomic Energy Act. On August 1, 1946, President Harry S. Truman signed the bill creating the U.S. Atomic Energy Commission. The members of the Senate Special Committeee on Atomic Energy attended the signing ceremony in the President's oval office at the White House. Ranged around the President are left to right: Senators Tom Connally, Eugene D. Millikin, Edwin C. Johnson, Thomas C. Hart, Brien McMahon, Warren R. Austin, Richard B. Russell.

The provisions of the new Act bore the imprint of the American plan for international control presented to the United Nations Atomic Energy Commission two months earlier by U.S. Representative Bernard Baruch. Although the Baruch proposal for a multinational corporation to develop the peaceful uses of atomic energy failed to win the necessary Soviet support, the concept of combining development, production, and control in one agency found acceptance in the domestic legislation creating the United States Atomic Energy Commission.[(2)] Congress gave the new civilian Commission extraordinary power and independence to carry out its awesome responsibilities. Five Commissioners appointed by the President would exercise authority for the operation of the Commission, while a general manager, also appointed by the President, would serve as chief executive officer. To provide the Commission exceptional freedom in hiring scientists and professionals, Commission employees would be exempt from the Civil Service system. Because of the need for great security, all production facilities and nuclear reactors would be government-owned, while all technical information and research results would be under Commission control, and thereby excluded from the normal application of the patent system.

In addition, the Act provided for three major advisory committees: the Congressional Joint Committee on Atomic Energy, the Military Liaison Committee, and the General Advisory Committee of outstanding scientists.[(3)]

The First Commission

On January 1, l947, the fledgling Atomic Energy Commission took over from the Manhattan Engineer District the massive research and production facilities built during World War II to develop the atomic bomb. The facilities were the product of an extraordinary mission accomplished in three years in almost complete secrecy. Under the direction of General Leslie R. Groves of the Army Corps of Engineers, the laboratory experiments of Enrico Fermi and other American and European scientists had been transformed into operating plants capable of producing a military weapon of devastating power. When the atomic bomb was dropped on Hiroshima on August 6, 1945, and three days later on Nagasaki, not only was a long and costly war brought to an end, but the world also became aware of a completely new and largely unexpected technology.[(4)]

The First Commission. President Truman appointed David E. Lilienthal, former head of the Tennessee Valley Authority, as the first chairmanof the Atomic Energy Commission (center). Serving with Lilienthal on the Commission were left to right: William W. Waymack, Lewis L. Strauss, Robert F. Bacher, and Sumner T. Pike.

As the first chairman of the agency created to control the peacetime development of the new technology, President Harry Truman appointed David E. Lilienthal, a lawyer and former head of the Tennessee Valley Authority. During the preceding year, Lilienthal and Under Secretary of State Dean Acheson had co-authored the well-known Acheson-Lilienthal report which had formed the basis for the American plan for international control of atomic energy. Serving with Lilienthal on the Commission were Summer T. Pike, a businessman from New England, William T. Waymack, a farmer and newspaper editor from Iowa, Lewis L. Strauss, a conservative banker and reserve admiral, and Robert F. Bacher, a physicist from Los Alamos and the only scientist on the Commission. Carroll L. Wilson, a young engineer who had helped Vannevar Bush organize the National Defense Research Committee during the war, was appointed general manager. Two floors of the New War Department Building in Washington provided a temporary home for the Commission. A few months later more permanent headquarters were found at 19th and Constitution Avenue, N.W., in the former wartime offices of the Joint Chiefs of Staff.

Commission Headquarters. The first permanent headquarters for the Atomic Energy Commission stood at Nineteenth and Constitution Avenue, NW, in a building originally constructed in the 1930s for the Public Health Service. During the Second World War, it housed the offices of the Joint Chiefs of Staff.

The new Commission faced a challenging future. World War II was quickly followed by an uneasy international situation commonly referred to as the Cold War, and Lilienthal and his colleagues soon found that most of the Commission's resources had to be devoted to weapon development and production. The requirements of national defense thus quickly obscured their original goal of developing the full potential of the peaceful atom. For two decades military-related programs would command the lion's share of the Commission's time and the major portion of the budget.[5]

The Nuclear Arsenal

To meet the Nation's expanding requirements for fissionable material the Commission set about refurbishing the production and research facilities built during the war. A major overhaul of the original reactors and two new plutonium reactors were authorized for the Hanford, Washington plant. Oak Ridge was scheduled for an addition to the existing K-25 plant and a third gaseous diffusion plant for the production of uranium^{285}. The Commission decided to adopt the Army's practice of hiring private corporations to operate plants and laboratories, thereby extending into peacetime the contractor system previously used by the Government only in times of national emergency.

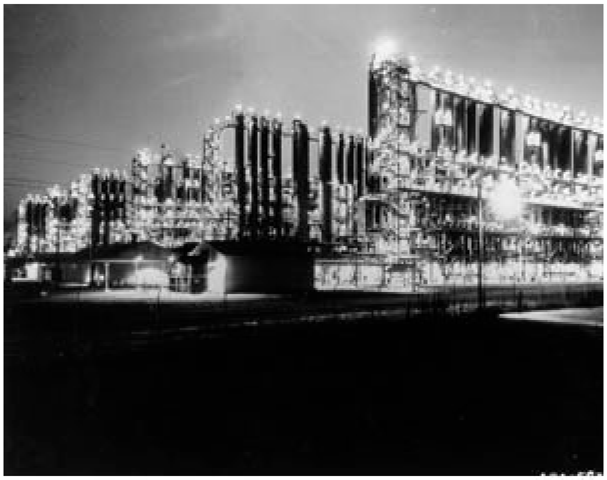
The first test of new weapons was conducted at Enewetak Atoll in April and May 1948. Operation *Sandstone* explored weapon designs and tested a new fission weapon to replace the clumsy tailor-made models used during World War II. By 1948 the Commission had both gun-type and implosion-type non-nuclear and nuclear components in stockpile and was well on the way toward producing an arsenal of nuclear weapons.

In early September 1949 a special Air Force unit detected a large radioactive mass over the Pacific, indicating that the Soviet Union had successfully detonated a nuclear device. The Soviet detonation not only ended the United States monopoly of nuclear weapons, but also had an immediate effect on the Commission's planned expansion program. During the prolonged debate that followed the announcement of the Soviet event, Commissioner Lewis L. Strauss, supported by fellow Commissioner Gordon Dean, urged the Commission to take a “quantum jump” by developing a thermonuclear weapon. Strong support for the Strauss position came from the congressional Joint Committee on Atomic Energy, and from scientists such as Edward Teller, Luis W. Alvarez, and Ernest O. Lawrence, who agreed that the development of the superbomb was absolutely essential to the security of the United States. The members of the General Advisory Committee, however, while concurring in the need for giving high priority to the development of atomic weapons for tactical purposes, recommended against an all-out effort to develop a hydrogen bomb. On January 31, 1950, President Truman settled the issue with his momentous decision that the Commission should expedite work on the thermonuclear weapon.[6]

Production Expansion

David Lilienthal resigned on February 15, 1950, after three years as chairman of the Atomic Energy Commission. Although his dream of developing the full potential of the peaceful atom had not been fulfilled, the Commission under his leadership had become an effective government institution. Indeed, the future held great promise for the peaceful atom, but for the moment at least the military atom would continue to be in the ascendancy.

By mid-July 1950 Gordon Dean had become chairman of the Commission, and the Nation was no longer in a twilight zone between peace and war. Following an attack by North Korean troops across the 38th parallel, President Truman ordered U.S. forces to the aid of South Korea. Suddenly increased military demands, added to the President's decision to develop the hydrogen bomb, threatened to exhaust the Commission's production capacity. Beginning in October 1950 the Commission embarked on a vast expansion program. During the next three years the construction of huge plants increased capacity at each step in the production chain. The new facilities included a feed materials production center at Fernald, Ohio; a plant to produce large quantities of lithium^{6} at Oak Ridge; a gaseous diffusion plant at Paducah, Kentucky; a whole new gaseous diffusion complex at Portsmouth, Ohio; two “Jumbo” reactors and a separation plant for producing plutonium at Hanford; and five heavy-water reactors at the Savannah River site in South Carolina for producing tritium from lithium^{6} as well as plutonium. The three-year three-billion-dollar expansion program represented one of the greatest federal construction projects in peacetime history.



The heavy-water plant at the Savannah River site.

In addition to having an impact on the Commission's expansion program, the Korean War also focused attention on the need for a continental test site. In December 1950, with the approval of the Department of Defense and the General Advisory Committee, the Commission selected the Las Vegas bombing and gunnery range as the site to conduct the January 1951 *Ranger* test series, the first atomic tests in the United States since the *Trinity* detonation at Alamogordo on July 16, 1945.(7)

The gaseous diffusion plant at Paducah, Kentucky.

The United States detonated the world's first thermonuclear device in fall 1952. Code-named *Mike*, the shot was part of the *Ivy* test series conducted at Enewetak. By the end of 1953 more than thirty weapon test devices had been successfully fired at Pacific or Nevada sites, the result of extraordinary efforts by scientists and engineers at the Commission's Los Alamos weapon laboratory. A second weapon laboratory established at Livermore, California, in early 1952 soon became the center of a weapon engineering and production network that included the Sandia Laboratory near Albuquerque, New Mexico, as well as new or expanded facilities in Iowa, Texas, Missouri, Ohio, and Colorado.(8)

Organizing the National Laboratories

Fortunately the concentrated effort on weapon production did not mean a total neglect of the Commission's research laboratories. The Commission recognized the need to maintain the vitality of the national labs, and to encourage the university research teams and industry groups whose research on the peaceful uses of atomic energy would provide the technology of the future. The Metallurgical Laboratory at the University of Chicago had been reorganized by the Army in 1946 as the Argonne National Laboratory. The following year the Commission obtained a new site for the lab at Argonne, Illinois and determined that the laboratory should become a large multi-disciplinary research center for the Midwest. Under the direction of Walter H. Zinn, one of Enrico Fermi's principal assistants in developing the world's first reactor, Argonne very quickly became the Commission's center for reactor development.[(9)]

The Clinton Laboratories, built during World War II at Oak Ridge, Tennessee, became the regional research center for southeastern United States. Reorganized in 1948 as the Oak Ridge National Laboratory, Oak Ridge became the Nation's largest supplier of radioisotopes for medical, industrial and physical research, as well as a regional center for research in chemistry, physics, metallurgy, and biology. The laboratory also conducted the largest radiation genetics program in the world.

Main Research Building, Oak Ridge National Laboratory.

To provide regional research facilities for the northeast, the Commission approved a plan by Associated Universities, Inc., to build and operate a laboratory at Upton, New York. The Brookhaven National Laboratory provided research facilities in reactor physics, high-energy accelerators, and the biomedical sciences. A fourth center in the far west was established by expanding the facilities of the University of California Radiation Laboratory at Berkeley. In addition to the regional centers the Commission continued to support the wartime research laboratories at a number of colleges and universities, and awarded and administered hundreds of contracts with research institutions, universities and nonprofit organizations for basic research in the physical and biological sciences.[(10)]

Reactor Development

Although by 1953 the vast production complex of the Atomic Energy Commission was almost totally dedicated to military purposes, the idea of a civilian nuclear power system based on American industry was very much alive. As early as 1947, Lilienthal had publically encouraged a partnership with industry in developing the peaceful uses of atomic energy. The Commission had supported a modest but coherent plan for developing nuclear power and propulsion and had permitted a few industry committees behind the Commission's security barriers to evaluate the opportunities for commercial development. On December 20, 1951, at the Commission's Idaho Test station, Zinn and a group of engineers from the Argonne National Laboratory succeeded in producing a token amount of electricity from an experimental fast breeder reactor. This historic accomplishment demonstrated in a practical way that the atomic nucleus could serve mankind as a source of power.[(11)]


The SSN Nautilus, the U.S. Navy's first atomic-powered submarine, on its initial sea trials.

Probably the most successful reactor program in the 1950s was the naval reactors project established and directed by Admiral Hyman G. Rickover. On June 14, 1952, at the keel-laying ceremony for the world's first nuclear powered ship, Chairman Gordon Dean noted that the propulsion of the submarine *Nautilus* would be the first practical utilization of atomic power, heretofore used primarily as an explosive. The Navy project later played a significant role in the widespread adoption of pressurized-water reactors by the nuclear power industry in the United States.[(12)]

By the end of 1952, technological developments had generated a broad interest in nuclear power in Congress as well as in industry, and the election of a Republican president brought further encouragement. Indeed, there was soon reason for optimism. Two outstanding accomplishments of the Eisenhower years, the 1953 Atoms-for-Peace plan and the passage of the 1954 Atomic Energy Act were to have a significant impact on the Nation's nuclear program.[(13)]

Atoms for Peace

Speaking before the United Nation's General Assembly on December 8, 1953, President Dwight D. Eisenhower declared that “peaceful power from atomic energy is no dream of the future . . . that capability, already proved, is here today.”[(14)] The President's Atoms-for-Peace proposal became a major pronouncement of America's public policy concerning the international management of nuclear energy. With a sufficient supply of uranium to satisfy its own military needs, by 1954 the United States could turn its attention to the promotion of the peaceful uses of nuclear energy.[(15)]

Lewis Strauss had been President Eisenhower's special assistant for atomic energy prior to his appointment as Commission chairman in July 1953. Strongly committed to national security during his early years as a Commissioner and supportive of Truman's decision to expedite the development of the thermonuclear weapon, Strauss was now in a position to work closely with Eisenhower in promoting the peaceful atom on a world-wide basis.

The Atomic Energy Act of 1954

The President's Atoms-for-Peace speech also focused attention on the need for a fundamental revision of the Atomic Energy Act of 1946 to enable the Commission to share technical and scientific information with foreign governments. On February 17, 1954, the President asked Congress to pass legislation "making it possible for American atomic energy development, public and private, to play a full and effective part in leading mankind into a new era of progress and peace." Exhaustive hearings in the spring of 1954 and congressional debate during the early summer resulted in a new law that opened the door for an exchange of nuclear technology with other nations. Although industry did not gain the right to own fissionable material, liberal licensing provisions, greater access to technical data, and the right to own reactors provided the essential conditions for the private development of nuclear power in the United States.[(16)]

The Five-Year Plan

Even before Congress had passed the Atomic Energy Act of 1954, the Commission had launched a new program for power reactor development. In early 1954 Strauss announced plans to test the basic designs then under study by building five experimental reactors within five years. Of the five reactor prototypes planned, the one with the most immediate impact on nuclear power development was the Pressurized Water Reactor (PWR) at Shippingport, Pennsylvania. Based on the technology developed for nuclear propulsion systems for submarines, Shippingport was completed on schedule in late 1957 as the Nation's first full-scale nuclear generating station.


Shippingport Atomic Power Station, the Nation's first full-scale nuclear generating station.

The other reactor experiments constructed under the five year program included the Sodium Reactor Experiment built by North American Aviation, a Commission contractor in southern California; the Experimental Boiling Water Reactor constructed at the Commission's Argonne National Laboratory; and new models of the fast breeder and homogeneous reactor experiments built in the early 1950s at the National Reactor Testing station in central Idaho, and the Oak Ridge National Laboratory in Tennessee. Of the five experiments in the program, the Shippingport and the Argonne boiling-water reactors encountered fewer technical problems, but each experiment contributed to the development of the technology needed to build full-scale nuclear power plants in the future.

Cooperation with Industry

The terms of the Atomic Energy Act enabled the Commission to encourage private industry to build its own nuclear plants, using fissionable material leased from the Government. Industry responded to the Commission's January 1955 Power Demonstration Reactor Program with four proposals covering all but one of the Commission's five prototypes. Thus by the end of 1957, the Commission had seven experimental reactors in operation and American industry was participating in nine independent or cooperative projects capable of producing almost 800,000 kilowatts of electricity by the mid-1960s. For the moment at least, prospects for the future of the peaceful atom were extremely encouraging.[(17)]

International Participation


The advanced information technology employed in AEC offices and the Fourth United National Conference in the Peaceful Uses of Atomic Energy held in Geneva, Switzerland, September 6 to 16, 1971. Here, a visitor is shown querying by satellite communications a computer data bank in Oak Ridge, Tennessee. Answers to his bibliographic inquiry are displayed on the monitor before him.

In his Atoms-for-Peace proposal of December 8, 1953, President Eisenhower had proposed that the nuclear powers contribute portions of their stockpiles of normal uranium and fissionable materials to an international atomic energy agency, which would then allocate these materials toward peaceful uses. After three years of patient diplomatic negotiations, the International Atomic Energy Agency (IAEA) was formally inaugurated in Vienna, Austria on October 1, 1957. As head of the United States delegation to the first IAEA conference, Lewis Strauss delivered the President's message of hope that the fissioned atom would now be transformed from a symbol of fear to one of hope. The new spirit of international cooperation had been in evidence even earlier when more than 1400 scientists from seventy-three nations attended the first United Nations-sponsored International Conference on the Peaceful Uses of Atomic Energy, held in Geneva, Switzerland in August 1965. Similar conferences were held in 1958, 1964 and 1971.


Commission Chairman John A. McCone (left) and Professor Vasily S. Emelyanov, Head of the USSR Main Administration for Utilization of Atomic Energy, during the Chairman's trip to the Soviet Union in October 1959. The next month, Professor Emelyanov made an exchange visit to the United States.

In addition to sponsoring the International Atomic Energy Agency, the United States gave strong support to Euratom, the European atomic energy community consisting of West Germany, France, Italy, Belgium, the Netherlands and Luxembourg. Formally inaugurated in January 1958, Euratom undertook to establish an integrated program for developing an atomic energy industry in Europe similar to the European Coal and Steel Community. Prior to the establishment of either the International Atomic Energy Agency or Euratom, the Atomic Energy Commission had negotiated a series of bilateral agreements to provide research reactors, power reactor fuel and technical information to friendly nations, as well as training programs for nuclear scientists and technicians. Although no bilateral agreements were made with the Soviet Union, Commission Chairman John A. McCone and his Soviet counterpart, Professor Vasily S. Emelyanov, signed a Memorandum on Cooperation on November 24, 1959, covering exchanges of visits and information on several unclassified areas of peaceful nuclear application. Similar memoranda in the 1960s and early 1970s covered joint experiments in the fields of high energy physics, controlled thermonuclear research and fast breeder reactors.[(18)]

Weapon Testing and Fallout

The detonation of the first shot in the *Castle* weapon test series in the spring of 1954, however, had threatened to cast a shadow over the glowing prospects for the peaceful atom, so recently kindled by Eisenhower's Atoms-for-Peace proposal. At the time of the *Bravo* shot on March 1, a Japanese fishing vessel had been within eighty-two nautical miles of the test area, close enough to receive a heavy dusting of radioactive fallout. By the time the ship, the *Fukuryu Maru* (or *Lucky Dragon*) returned to Japan the effects of the radiation exposure had become evident, and several members of the crew required hospitalization. The American and Japanese press accounts of the incident had made the public aware, probably for the first time, of the worldwide dangers of radiation from fallout.(19)

On February 15, 1955, with the approval of the President, Strauss released a major report on the "Effects of High-Yield Nuclear Explosions." The report did little to calm public apprehension, and mounting concerns found expression in numerous articles on radiation and fallout in scientific journals and other public media. Both the Committee on Armed Services and the Joint Committee on Atomic Energy held hearings in the spring of 1955 on problems associated with radioactive fallout. The following December the United Nations established a Scientific Committee on Radiation with the director of the Commission's Division of Biology and Medicine, Shields Warren, as United States representative.(20)

In January 1956 Commissioner Willard F. Libby revealed the existence of Project Sunshine, a study of global fallout from weapon testing which Libby had initiated in fall 1953 while serving on the General Advisory Committee. Commission laboratories and contractors had been analyzing data collected through a worldwide network monitoring the presence of strontium^{90} in humans, foods and soils. Prior to 1953 public concern with radiation had focused primarily on workers in atomic energy projects. In 1957 the Joint Committee's hearings on the nature of radioactive fallout revealed for the first time the extent of the Commission's radiation research program. Millions of dollars were involved in more than 300 Commission-sponsored projects on various aspects of radiation and fallout.(21)

Testing of nuclear devices by the United States continued throughout the 1950s, although the Eisenhower Administration repeatedly expressed its willingness to suspend nuclear tests as part of a disarmament agreement. When the Conference of Experts convened in Geneva in summer 1958, the President announced that the United States was prepared to negotiate a test ban agreement and would voluntarily suspend all weapon testing after the completion of the *Hardtack* series in the fall. As a result an unpoliced moratorium period began on October 31, 1958, during which both the United States and the Soviet Union refrained from nuclear weapon experiments.(22)

Limited Test Ban Treaty

Commission Chairman John A. McCone (left) and Professor Vasily S. Emelyanov, Head,of the USSR Main Administration for Utilization of Atomic Energy, during the Chairman's trip to the Soviet Union in October 1959. The next month, Professor Emelyanov made an exchange visit to the United States.

Three years later the Soviet Union abruptly ended the moratorium by announcing, on August 31, 1961, that they intended to resume testing. By now John F. Kennedy was in the White House, and Glenn Seaborg had succeeded John McCone as chairman. One of the original members of the General Advisory Committee and the first scientist appointed as chairman of the Commission, Seaborg served during the entire decade of the 1960s.

Although the Soviet Union tested a large number of high-yield weapons in the atmosphere during autumn 1961, President Kennedy limited the Commission's weapon laboratories to underground tests until April 25, 1962, when the first shot in the *Dominic* series was conducted at Christmas Island in the Pacific. With technical support from Seaborg and the Commission, the President at the same time had been earnestly pursuing a test ban agreement with the Soviet Union. It had been a long and arduous task bearing little fruit. In an address to the Nation on March 2, 1962, Kennedy had explained that he deplored the necessity of beginning atmospheric testing again, but "a nation which is refraining from tests obviously cannot match the gains of a nation conducting tests."(23)

Finally, after months of negotiations, a limited test ban treaty was signed in Moscow on August 5, 1963, prohibiting nuclear explosion tests in the atmosphere, outer space, or under water, but permitting underground detonations provided no radioactive debris crossed the borders of the country in which the test was being conducted.

In the absence of further success in negotiating a comprehensive test ban treaty, President Kennedy, and later Presidents Johnson and Nixon, continued to authorize underground tests in accordance with the 1963 treaty. Although the limitations of the treaty imposed severe technical problems, particularly in testing high-yield warheads, the Commission's laboratories nevertheless were highly successful in devising ways to improve and update nuclear weapons by testing underground.

Civilian Power: The Proliferation of the Peaceful Atom in the Sixties

The signing of the Limited Test Ban Treaty in August 1963 also had an impact on the civilian power program. The cessation of weapon testing in the atmosphere gave new hope that the peaceful atom might soon command as large a share of the Commission's time and budget as the military atom had for so many years.

Although the imminence of economic nuclear power had been a main theme at the 1958 Geneva Conference, recurring technical difficulties in many of the prototype and demonstration plants in several European countries continued in the next few years to frustrate hopes for a practical new source of electrical power. In the United States, however, prospects were somewhat more encouraging. In March 1962 President Kennedy had requested the Atomic Energy Commission to take a “new and hard look at the role of nuclear power” in the Nation's economy. In submitting the Commission's report several months later, Seaborg noted optimistically that the Commission's ten-year civilian power program, adopted in 1958, was on the threshold of attaining its primary objective of competitive nuclear power by 1968. Suggested goals for the future included a concentration of resources in the most promising reactor systems, the early establishment of a self-sufficient and growing nuclear power industry, and increased emphasis on the development of improved converter or breeder reactors which would conserve natural uranium resources. The report was broadly circulated and stimulated public confidence in the economic prospects for civilian nuclear power.[(24)]

On November 22, 1963, Lyndon B. Johnson became President of the United States. One of Johnson's first and probably most significant acts was to order a 25 percent cutback in production of enriched uranium and the shutdown of four plutonium piles, with the expectation that other nations might be challenged to do the same. Although verification was difficult, Chairman Khrushchev later announced production cutbacks in the Soviet Union.

Another milestone in civilian power development occurred on December 12, 1963, when the Jersey Central Power and Light Company announced that it had contracted for a large nuclear power reactor to be built at Oyster Creek near Toms River, New Jersey. According to the company's own evaluation, the plant would be competitive with a fossil fuel plant. For the first time an American utility company had selected a nuclear power plant on purely economic grounds without government assistance and in direct competition with a fossil-fuel plant. In a commencement address at Holy Cross College on June 10, 1964, President Johnson called it an “economic breakthrough.”[(25)] Two months later private industry received further encouragement from Congress in the form of new legislation.

Oyster Creek Nuclear Power Plant Unit 1, Toms River, New Jersey. The Jersey Central Power and Light Company plant reached initial design power in 1969.

Private Ownership Legislation

On August 26, 1964, President Johnson brought to an end an eighteen-year mandatory government monopoly of special nuclear materials by signing into law the Private Ownership of Special Nuclear Materials Act. Enriched uranium for power reactor fuel would no longer have to be leased from the government. Private entities would be permitted to assume title to special nuclear materials. Although the new law provided for a transition period for the changeover from government to private ownership, after June 20, 1973 private ownership of power reactor fuels would become mandatory. The Act also authorized the Commission to offer uranium enriching services to both domestic and foreign customers under long-term contracts, beginning on January 1, 1969. Most of the Atomic Energy Commission's literature on reactor technology had been declassified as early as 1955. With the adoption of the Private Ownership Act in 1964, fissionable materials as well as reactors now entered the public domain, and a full-fledged nuclear industry became a possibility.[(26)]

But how would a full-fledged nuclear industry be regulated? Could one agency continue to regulate a single energy technology in a time of increasing energy needs? In a few years the energy crisis of 1973 would bring these questions into sharp focus.

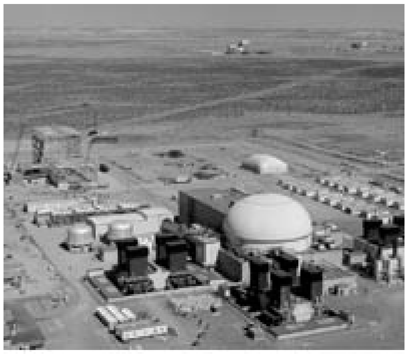
Nuclear Power Capacity

The Commission's 1962 report on civilian power had projected 5,000 megawatts of nuclear power capacity by 1970 and 40,000 by 1980. Within five years the outlook had changed so dramatically that in March 1967 the Commission issued a supplementary report doubling its previous predictions. Within a few years, however, even these revised statistics were exceeded. (By the end of 1974 two hundred and thirty-three nuclear central-station generating units, with a capacity of 232,000 megawatts, were either in operation, under construction, or on order in the United States.)[(27)]

The Breeder Reactor

In addition to predicting dramatic increases in megawatt capacity, the Commission's 1967 report on civilian nuclear power reaffirmed the promise of the breeder reactor for meeting long-term energy needs, and gave the Liquid Metal Fast Breeder Reactor (LMFBR) the highest priority for civilian reactor development. A major boost was given to the program four years later by President Richard Nixon. In his "clean energy" message to Congress on June 4, 1971, the President called for the commercial demonstration of a breeder reactor by 1980, stating that "The breeder reactor could extend the life of our natural uranium fuel supply from decades to centuries, with far less impact on the environment than the power plants which are operating today."[(28)]

The fast breeder project included a demonstration plant in Oak Ridge, Tennessee—the Clinch River Breeder Reactor (CRBR)—and a test reactor in Richland, Washington--the Fast Flux Test Facility (FFTF). Clinch River promised to be a major step in the transition from technology to large-scale demonstration of the fast breeder concept. The project was launched in August 1972 with the signing of a memorandum of understanding between the Commission and the principal utility participants, the Commonwealth Edison Company and the Tennessee Valley Authority. The Commission would be responsible for research and development of the demonstration plant while the Commonwealth Edison Company and the Tennessee Valley Authority would engineer, manufacture and proof test equipment and systems.[(29)]



Aerial view of the Fast Flux Test Facility, Richland, Washington. The FFTF, a 400 megawatt (thermal) sodium cooled fast flux reactor, achieved full power on December 21, 1980.

Licensing and Regulation

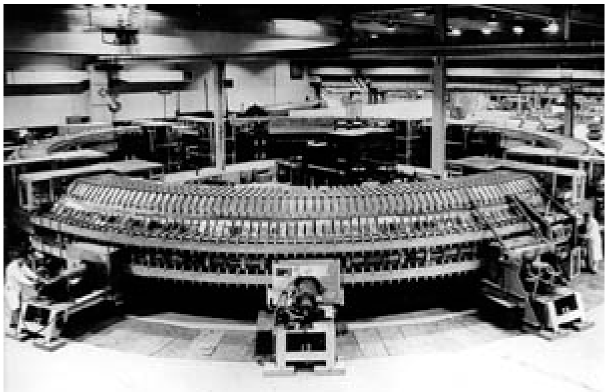
Under the terms of the Atomic Energy Act of 1954, Congress had given the Atomic Energy Commission the responsibility for regulating and licensing commercial atomic activities. As the Nation's electric power industry increasingly turned toward nuclear plants, the Commission found it necessary to modify its organizational structure to separate regulatory from non-regulatory functions. In 1961 the regulatory staff was separated from the general manager's office and placed under a director of regulation who reported directly to the Commissioners. Two years later the regulatory and operational functions were separated physically when the regulatory staff was moved from the headquarters building in Germantown, Maryland, to offices in Bethesda.[(30)]

Headquarters, U.S. Atomic Energy Commission, Germantown, Maryland. A new headquarters building for the AEC was dedicated on November 8, 1957. It was determined the Germantown location(23 miles from Washington) would afford reasonableprotection against blast effects of a thermonuclear weapon in the event of an attack on the Nation's capital.

Licensing procedures involved a series of technical reviews and public hearings, including an independent technical safety evaluation by the Advisory Committee on Reactor Safeguards. The Commission itself served as a final review board for all licenses granted, and maintained continuous surveillance of licensed reactors throughout their operating lifetime.

Research

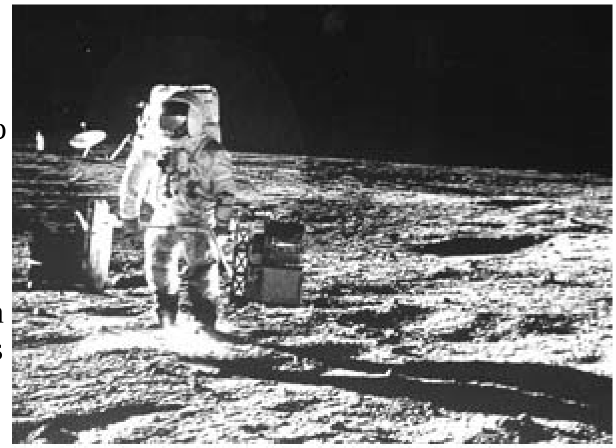
The weapon requirements for national defense in the early years had forced the Commission to postpone goals for an all-out program of research on the peaceful atom. As seen in the development of the power reactor, however, there was a gradual shift in emphasis during the Eisenhower era, and the trend continued to gain momentum during the Kennedy and Johnson Years. In 1966 the AEC budget for the first time was divided about equally between weapons and peaceful uses.



The Cosmotron, Brookhaven National Laboratory, Upton, New York. A 3.0 Bev proton synchrotron that accelerated protons in a circular path to speeds approaching the velocity of light. When in operation, the Cosmotron was surrounded by heavy concrete shielding blocks to protect personnel from radiation hazards.

Research and development programs in the 1960s and early 1970s produced a significant fund of knowledge about radiation and its effects, and provided basic data needed to determine radiation protection standards and to assess the environmental impact of nuclear technology. Advances in medical diagnostic techniques based on the use of radioisotopes and radiation machines added to the skills of the medical profession, while immunological research provided the knowledge needed for successful transplants. Other medical breakthroughs included the treatment of Parkinson's disease, the preservation of cells for transfusion, and the introduction of small accelerators to produce short-lived radioisotopes for immediate use in patients. Although Oak Ridge produced virtually all of the radioisotopes available for physical and biomedical research as well as for industrial applications, the Commission gradually transferred production, packaging, and shipping to commercial suppliers, while continuing to support research on new applications.[31]

During the 1960s the Commission produced a series of radioisotope-powered and reactor-powered electrical-generating units for space applications. The first such unit was launched into space from Vandenberg Air Force Base in California on April 3, 1965, under the Systems for Nuclear Auxiliary Power (SNAP) program. Newly discovered heavy isotopes, such as californium^{252}, were found useful in both research and industry. In addition, significant progress was made in developing cardiac pacemakers for human use and ultimately artificial hearts using radioisotopic power sources.[32]



Nuclear electric power arrived on the Moon for the first time on November 19, 1969, when the Apollo 12 astronauts deployed the AEC's SNAP-27on the lunar surface. Commander Alan Bean is shown carrying the SNAP-27 (left).

Major research facilities such as high energy accelerators were constructed and operated by the AEC. Building on the accomplishments of the Berkeley Bevatron and the Brookhaven Cosmotron in the 1950s, the Commission supported even larger accelerators in the 1960s and 1970s, including the Alternating Gradient Synchrotron at Brookhaven, the Zero Gradient Synchrotron at Argonne, and the two-mile-long Stanford Linear Accelerator. The Fermi National Accelerator Laboratory, completed in 1972, contained the world's most powerful proton synchrotron. The principal centers for research on controlled thermonuclear (fusion) reactors were Oak Ridge, Los Alamos, Livermore, and Princeton, although many universities and industrial facilities were involved on a smaller scale.

Applied Technology

As nuclear technology developed, the Commission perfected special applications of nuclear power, such as nuclear explosives for earth moving and for extracting resources deep underground. *Gnome*, the first experiment in the *Plowshare* series, was conducted in December 1961 in a thick salt bed deposit near Carlsbad, New Mexico, while the first nuclear cratering experiment, Project *Sedan*, was completed the following July at the Nevada Test Site. Project *Gasbuggy* in 1967, *Rulison* in 1969, and *Rio Blanco* in 1973, tested methods for extracting natural gas from impermeable rock. In the early 1970s, the Commission directed applied technology projects toward environmental research, energy storage and transmission systems, synthetic fuels, and nonnuclear energy.

As part of the U.S.-Soviet technical talks on Peaceful Nuclear Explosions held in Washington, D.C., in July 1971, a Soviet group toured the Plowshare program sites. Here, members of the Soviet delegation stand atop the lip of the crater formed by the 1962 Sedan Plowshare program cratering experiment at the Nevada Test Site.

Non-Nuclear Research

The scientific and technological expertise gained by the national laboratories in developing nuclear energy made the Commission a logical contender for a strong role in developing new energy options. The doors of the national labs first opened to non-nuclear research in 1960 when the Commission, in a special report to the Joint Committee on Atomic Energy, acknowledged "that the strong capabilities of the laboratories are not the exclusive resources of the atomic energy field; they are held in trust for the Nation as a whole." Accordingly, work from other federal agencies would be accommodated whenever the skills of the national laboratories were needed.(33)

On August 11, 1971, largely in response to President Nixon's energy message of June 4, Congress authorized the Atomic Energy Commission to undertake research and development projects geared to providing a variety of alternatives for meeting the Nation's energy needs. As a result the Commission's industrial contractors and national laboratories became involved in the areas of superconducting power transmission systems, energy storage, solar energy, geothermal resources, and coal gasification.(34)

Reorganization

James R. Schlesinger took over the helm of the Atomic Energy Commission in August 1971 as its twenty-fifth year as an agency was drawing to a close. American troops were still in Vietnam and anti-war protests were widespread. The Nation faced increasing demands for energy, a leveling out of domestic oil production, limitations on coal use due to environmental concerns, inadequate natural gas supplies, and field delays in the licensing and construction of nuclear power plants. The rapid growth in atomic energy activities in the previous decade and changing perspectives in nuclear technology clearly pointed to the need for a substantial reorganization of the Commission's operational and regulatory functions. For nearly a quarter of a century the Commission had focused research and development toward responding to national defense requirements, funding and developing new uses for atomic energy, and fostering the growth of a competitive and viable nuclear industry. The next few years would see increasing attacks on the Commission's role as a regulatory overseer of the nuclear industry, particularly in the areas of quality of product and public safety.(35)

The Commission in August 1972: Seated left to right: James T. Ramey, James R. Schlesinger (Chairman), Clarence E. Larson. Standing left to right: Dixy Lee Ray, and William O. Doub. In 1973, Dr. Ray became the first woman chairman of the Atomic Energy Commission. Chairman Schlesinger became the first Secretary of Energy in 1977.

As a first order of business, Schlesinger led the Commission in a comprehensive review of the agency's functions and organization. An economist and former assistant director of the Bureau of the Budget, Schlesinger announced the results of the review in December 1971. The first broad reorganization in ten years would bring together various related programs previously scattered throughout the agency. Developmental and operational functions formerly under the jurisdiction of the general manager would now be under six assistant general managers for Energy and Development Programs, Research, Production and Management of Nuclear Materials, Environment and Safety Programs, National Security, and Administration. Reflecting expanding areas of Commission involvement were new divisions of Controlled Thermonuclear Research, International Security Affairs, and Applied Technology.[(36)] The second half of 1971 also saw a major revamping of the regulatory organization and functions.

Calvert Cliffs Decision

Aerial view of Baltimore Gas and Electric Company's Calvert Cliffs Nuclear Power Plant on the Chesapeake Bay near Lusby, Maryland.

The Nixon Administration believed that nuclear power, as an environmentally “clean” fuel, could help the Nation produce the increasing supply of energy needed for the future. On the other hand ponderous licensing procedures and increasing environmental considerations lengthened the time necessary to bring nuclear power plants on line, and increased costs to the industry, and ultimately to the consumer. As Commissioner Doub informed the Atomic Industrial Forum in October 1971, the Commission harbored no illusions as to the magnitude of the task of trying to match “the capabilities of a dynamic and complex technology to the urgent energy and environmental needs of the country.”[(37)]

The Federal Court of Appeals August 4, 1971, landmark decision concerning the Calvert Cliffs nuclear power plant became a pivot point for a major revamping of the Commission's licensing procedures. The Court ruled that the Atomic Energy Commission's regulations for implementing the National Environmental Policy Act of 1969 in licensing procedures did not comply in several respects with the Act, and that the Commission should make an independent review and evaluation of all environmental effects at every decision point in the nuclear power plant licensing process.

Moving swiftly to implement the Court's ruling, the Commission made substantive changes in environmental review procedures. Both the Commission and the license applicant would now be required to consider the total impact of the proposed plant on the environment, including water quality. In addition, a cost-benefit analysis would balance the benefits of building the facility against a variety of alternatives.[(38)] These changes in procedures affected virtually all nuclear power plants whether licensed for operation or under review.

To expedite the additional procedures which the Calvert Cliff's decision required, Schlesinger made significant changes in the Commission's regulatory organization, and added additional personnel to the staff to help with the expanded reactor licensing workload. Additional changes in 1972 further streamlined the regulatory staff. Three directorates consolidated the functions previously performed by seven divisions. All licensing activities were centered in the largest of the three, the Directorate of Licensing, headed by John F. O'Leary, former director of the Bureau of Mines.[(39)]

The Commission's Last Days

Ghillie, a Scottish deerhound, and Jacques, a gray poodle, often accompanied Dr. Dixy Lee Ray as she went about her duties as AEC Chairman. Both dogs wore AEC photo identification tags on their collars, a gift when Dr. Ray visited the AEC Hanford plant. Here, Thomas Nemzek, affixes the tag to Ghillie's collar.

Schlesinger left the Atomic Energy Commission in January 1973 to become head of the Central Intelligence Agency. He was succeeded as chairman by Dr. Dixy Lee Ray, a marine biologist from the state of Washington who had been appointed to the Commission by President Nixon in August 1972. The first woman to be chairman of the Atomic Energy Commission, Ray took over at a time when the Nation was faced with the monumental task of reconciling energy needs, environmental concerns and economic goals. More importantly for the Commission, criticism had begun to mount against an agency that regulated the very same energy source that it helped to produce and operate.

In June 1973, President Nixon directed the chairman of the Atomic Energy Commission to undertake an immediate review of federal and private energy research and development activities and to recommend an integrated program for the Nation.[(40)] The President's energy proposals to Congress the following January reflected the recommendations submitted by Chairman Ray in the December 1, 1973, report on “The Nation's Energy Future.” Because of the energy crisis resulting from the October Arab oil embargo, the President had chosen to break tradition and present his energy request to Congress before delivering his State of the Union address. Both his proposal for a five-year $10 billion energy research and development program, and his determination to double the total federal commitment to energy research and development for fiscal year 1975, were in line with the recommendations made by the Commission chairman. The Ray report also supported the President's recommendation to establish an Energy Research and Development Administration.[(41)]

Reactor Safety

In December 1973 the Commission announced new requirements for the performance of the emergency core cooling systems installed in light-water-cooled power reactors. Such systems provided the capability for emergency removal of heat from the reactor core in the event of a loss of the normal reactor coolant water. The Commission's action concluded a two-year public rulemaking hearing which had served as a focal point for public discussion of opposing viewpoints on the safety of nuclear power plants. Six months of hearing sessions, between January 27, 1972, and July 25, 1973, had produced a voluminous transcript, a clear witness to the complexity of the technical issues involved in nuclear safety. A constant advocate of the public's right to know and fully understand the possible dangers of radiation, the Joint Committee on Atomic Energy had also held a hearing in early 1973 on the safety of nuclear power plants.

Clearly the handwriting on the wall was spelling out the numbered days of the AEC in 1973. Although nuclear power constituted a significant part of the answer to the Nation's need for additional sources of energy, it was by no means the only answer as had been predicted in the early decades of the Commission's existence.

Summary

When President Ford signed the Energy Reorganization Act of 1974 on October 11, the Atomic Energy Commission's twenty-eight-year stewardship of the Nation's nuclear energy program came to an end. On January 19, 1975, the Commission's research and development responsibilities were assumed by the Energy Research and Development Administration, and the regulatory and licensing functions by the Nuclear Regulatory Commission. Six thousand, three hundred twenty Commission employees went to ERDA while one thousand nine hundred seventy former regulatory personnel became part of the new Nuclear Regulatory Commission.

In the preceding twenty-eight years the Atomic Energy Commission had accomplished a large portion of the mission established by the Congress in 1946. First, through its weapon laboratories and production contractors, it had developed and stockpiled an array of sophisticated nuclear weapons, which for nearly three decades had served as an important element in national defense. Also in the area of defense, the Commission had supported the development of nuclear propulsion reactors which made possible the creation of a fleet of reliable nuclear submarines and surface ships.

Although for many years military related programs commanded the major portion of the budget, the Commission had initiated and supported extensive research in the nuclear sciences. The research contract and the national laboratory had become key instruments in the widespread development and application of nuclear technology for scientific, medical, and industrial purposes. Through participation in the International Atomic Energy Agency, international conferences and bilateral agreements, the United States shared the new technology with other nations.

The congressional mandate of 1946 also called for the use of atomic energy in a way that would strengthen free competition in private enterprise. Although the severe restrictions of the 1946 Act made atomic energy virtually a government monopoly, the Commission in less than a decade advanced nuclear technology to the point where industrial participation was feasible, and then encouraged the passage of new legislation in 1954, which made a nuclear industry possible. By the early 1970s nuclear power offered a promising option for meeting national and world energy needs.

In carrying out the congressional mandate of 1946, the Atomic Energy Commission essentially worked its way out of existence. After concentrating on defense commitments in the early years, the Commission then focused on the development of a viable nuclear industry, only to come under fire in the late 1960s and 1970s for being in the position of regulating the same industry it helped to create.

This difficulty had been foreseen in 1961 when the functions of the agency were divided between the General Manager and the Director of Regulation. Then in 1963 the two functions were physically separated by being housed in different geographical locations. Finally, the legal separation of the developmental and regulatory functions, requested in 1973 by the Commission itself, was accomplished by the Energy Reorganization Act of 1974. The regulatory and licensing responsibilities became the exclusive focus of a new agency headed by a five-member board, the Nuclear Regulatory Commission, while the developmental functions were placed under a single administrator in a second agency, the Energy Research and Development Administration.

In the preceding decade the Atomic Energy Commission had lost much of its privileged status with Congress and the American public. The exclusive monopoly and the mantle of secrecy had been largely removed, and no longer did atomic energy seemingly provide the perfect formula for both military defense and civilian energy needs. Regulatory restrictions and environmental concerns were a large part of the reason for the demise of the AEC, but more important was the recognition that a single technology should not be the exclusive focus of one agency. The energy crisis would now require the coordination of all major energy programs in a new research and development agency, whose primary purpose would be to assist the Nation in achieving energy independence.

As a legacy to the new agency, the Atomic Energy Commission passed on its unique production facilities, its valuable network of national laboratories, and the proven technological skills, resourcefulness, and experience of its personnel. Three years later the Energy Research and Development Administration, like the Atomic Energy Commission before it, became part of an even larger organization. The U.S. Congress passed the Department of Energy Organization Act (Public Law 95-91) on August 4, 1977, and the Department opened for business on October 1, 1977.

Endnotes: The Atomic Energy Commission

1. Sect. 1(a), Atomic Energy Act of 1946 (Public Law 585) 78th Cong. 1st sess.

2. Corbin Allardice and Edward R. Trapnell, *The Atomic Energy Commission* (New York: Praeger Publishers, 1974), pp. 31-32 (hereafter cited as Allardice and Trapnell, *The AEC*).

3. Dr. Richard G. Hewlett, former Chief Historian of the AEC, believes that the most influential group in the early years was not the Commission itself but its General Advisory Committee, consisting of such famous scientists as J. Robert Oppenheimer, James B. Conant, Enrico Fermi, and Isador I. Rabi. Richard G. Hewlett, “The Advent of Nuclear Power, 1945-1968,” (paper delivered before the American Association for the Advancement of Science, Dallas, TX, Dec. 28, 1968), p. 4 (hereafter cited as Hewlett, “The Advent of Nuclear Power”).

4. Richard G. Hewlett, “Nuclear Power in the Public Interest: The Atomic Energy Act of 1954” (Paper delivered before the American Historical Association, Dallas, TX, December 1977), pp. 1-3.

5. Richard G. Hewlett, “The AEC in Retrospect” (unpublished ms., Department of Energy Historian's Office, February 10, 1976), p. 12 (hereafter cited as Hewlett, “The AEC in Retrospect”).

6. *Public Papers of the Presidents of the United States: Harry S. Truman 1950* (Washington: Government Printing Office, 1965), p. 138. For a detailed presentation of the decision on the hydrogen bomb, see Richard G. Hewlett and Francis Duncan, *Atomic Shield, 1947-1952, Vol. II of A History of the United States Atomic Energy Commission* (University Park: Pennsylvania State University Press, 1969), pp. 362-409 (hereafter cited as Hewlett and Duncan, *Atomic Shield*).

7. Hewlett and Duncan, *Atomic Shield*, pp. 534-35, 563-64.

8. Hewlett and Duncan, *Atomic Shield*, pp. 411, 424-30, 441; “The Eisenhower Imprint,” unpublished ms., Department of Energy Historian's Office, pp. 3-4; “A History of the Expansion of AEC Production Facilities,” Report by the General Manager, August 16, 1963, pp. 13-20.

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12. Hewlett and Duncan, *Nuclear Navy*, pp. 178-79, 235-57; Dean Diary, June 14, 1952.

13. Hewlett, “The Advent of Nuclear Power,” p. 12.

14. *Public Papers of the Presidents of the United States, 1953, Dwight D. Eisenhower* (Washington: Government Printing Office, 1960), pp. 813-22.

15. For a discussion of Atoms for Peace as an instrument of foreign policy, see Jack M. Holl, “Eisenhower's Peaceful Atomic Diplomacy: Atoms for Peace in the Public Interest” (Paper delivered before the American Historical Association, Dallas, TX, December 23-30, 1977), p. 1 (hereafter cited as Holl, “Eisenhower's Peaceful Diplomacy”).

16. “Message from the President of the United States,” House Document, 83 Cong., 2 sess., no. 328 (February 17, 1954); Richard G. Hewlett, “Industry and the Atomic Energy Commission, 1947-1954” (Paper delivered at a joint session of the Society for the History of Technology and the Organization of American Historians, Chicago, IL, April 27, 1967), pp. 21-22.

17. Joint Committee on Atomic Energy, *Current Statement of the Atomic Energy Commission on the Five-Year Reactor Development Program*, May 4, 1955 (Washington: Government Printing Office, 1958) .

18. Holl, “Eisenhower's Peaceful Diplomacy,” pp. 9-18; AEC, *Twenty-third Semiannual Report, January 1958* (Washington: Government Printing Office, 1955) pp. 189-221.

19. Robert A. Divine, *Blowing on the Wind, the Nuclear Test Ban Debate 1954-1960* (New York: Oxford University Press, 1978), pp. 3-18; AEC, *Sixteenth Semiannual Report, July 1954* (Washington: Government Printing Office, 1958), pp.51-5; Richard G. Hewlett and Jack M. Holl, “Nuclear Weapons: A New Reality” (unpublished ms., Department of Energy Historian's Office, 1981), pp. 61-63.

20. “A Report by United States Atomic Energy Commission on Effect of High-Yield Nuclear Explosions,” Appendix 7, *Eighteenth Semiannual Report of the Atomic Energy Commission July 1955* (Washington: Government Printing Office, 1955), pp. 147-54; Senate Committee on Armed Services, *Civil Defense Program*, 84th Cong., 1st sess., February 22, 1965, p. 2; Joint Committee on Atomic Energy, *Health and Safety Problems Associated with Atomic Explosions*, April 15, 1955; AEC, *Major Activities in the Atomic Energy Programs, January-June 1956*, p. 16.

21. Willard F. Libby, “Radioactive Fallout and Radioactive Strontium,” Northwestern University, Evanston, IL, January 19, 1956; Joint Committee on Atomic Energy Press Release No. 80, April 18, 1957.

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23. *Major Activities in the Atomic Energy Program, January-December 1961* (Washington: Government Printing Office, 1962), pp. 161-62; AEC, *Major Activities in the Atomic Energy Programs, January-December 1962* (Washington: Government Printing Office), p. 234; *Public Papers of Presidents of the United States: John F. Kennedy 1962* (Washington: Government Printing Office, 1963), pp. 186-92.

24. AEC, *Civilian Nuclear Power—A Report to the President—1962*, November 20, 1962.

25. “Annual Message to the Congress on the State of the Union,” January 8, 1964, and “Commencement Address at Holy Cross College,” June 10, 1964, both in *Public Papers of the Presidents: Lyndon B. Johnson 1964* (Washington: Government Printing Office, 1965), pp. 117, 763-64.

26. AEC, *Annual Report to Congress for 1964* (Washington: Government Printing Office, 1965), pp. 12-14; Hewlett, “The AEC in Retrospect,” p. 18; “Remarks Upon Signing Bill Permitting Private Ownership of Nuclear Materials,” *Public Papers of the Presidents: Lyndon B. Johnson 1964* (Washington: Government Printing Office, 1965), p. 1006.

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28. Richard M. Nixon, “A Program to Insure an Adequate Supply of Clean Energy in the Future,” June 4, 1971, as reprinted in *Executive Energy Documents*, published by the Senate Committee on Energy and Natural Resources, July 1978, pp. 1-12 (hereafter cited as *Executive Energy Documents*).

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30. AEC, *Major Activities in the Atomic Energy Programs, January-December 1961* (Washington: Government Printing Office, 1962), pp. 337-38; Richard G. Hewlett, “The Development of the Nuclear Power Industry,” unpublished ms., Department of Energy Historian's Office, 1974), pp. 13-14.

31. AEC, *1974 Annual Report to Congress* (Washington: Government Printing Office, 1974), pp. 24-26.

32. AEC, *Annual Report to Congress for 1965* (Washington: Government Printing Office, 1966), p. 151; AEC, *Annual Report to Congress for 1966* (Washington: Government Printing Office, 1967), p. 211; AEC, *1974 Annual Report to Congress* (Washington: Government Printing Office, 1975), p. 114.

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Office, 1961); AEC *Annual Report to Congress for 1960* (Washington: Government Printing Office, 1961), pp. 156-57.

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36. “Reorganization of Atomic Energy Operating Functions,” AEC Announcement 216, December 7, 1971.

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41. *The Nation's Energy Future*, A Report to President Richard M. Nixon, December 1973 (Washington: Government Printing Office, 1973), p. ix; “Proposals to Deal with the Energy Crisis,” January 23, 1974, in *Executive Energy Documents*, pp. 119-134; White House Fact Sheet, “ Energy Research and Development,” October 11, 1973.

Chronology of the Atomic Energy Commission

DATE	EVENTS
August 1, 1946	Atomic Energy Act of 1946 signed by President Truman.
January 1, 1947	Atomic energy program transferred from the Manhattan Engineer District to the Atomic Energy Commission.
September 1947	Start of construction on first of two new Hanford reactors.
March 1, 1948	Oak Ridge National Laboratory officially established to continue work of Clinton Laboratories established in 1943.
April-May 1948	Operation *Sandstone*, the first AEC nuclear test series conducted at Enewetak Atoll.
March 1, 1949	Announcement by AEC of selection of a site for the National Reactor Testing Station in Idaho.
August 29, 1949	Soviet Union detonated nuclear device.
January 31, 1950	President Truman directs Commission "to continue work on all forms of weapons, including the so-called hydrogen or super-bomb."
June 27, 1950	Truman orders U.S. forces to aid of South Korea.
December 20, 1951	Experimental Breeder Reactor No. 1 (EBR-1) first reactor to produce electric power from nuclear energy.
June 14, 1952	Keel of the world's first nuclear-powered ship, the submarine *Nautilus*, laid at Groton, Connecticut.
November 1952	World's first thermonuclear device detonated by U.S. at Enewetak.
December 8, 1953	Announcement by President Eisenhower of the Atoms-for-Peace program and proposal to establish an international agency to promote peaceful applications of atomic energy.
March 1, 1954	First shot in *Castle* weapon test series fired in Pacific.
August 30, 1954	President Eisenhower signed the Atomic Energy Act of 1954, a major revision of the 1946 Act. The new law made possible greater participation by private industry and more cooperation with other countries in developing the peaceful uses of nuclear energy.
January 10, 1955	Announcement by the AEC of the Power Demonstration Reactor Program, under which the AEC and industry would cooperate in the construction and operation of experimental power reactors.

August 8-20, 1955	First United Nations International Conference on the Peaceful Uses of Atomic Energy, in Geneva, Switzerland.
October 1, 1957	International Atomic Energy Agency inaugurated in Vienna, Austria. AEC Chairman Lewis Strauss announced U.S. offer to make 5,000 kilograms of uranium^{235} available to the agency.
December 23, 1957	Full-power operation of the Shippingport Atomic Power Station, the world's first full-scale nuclear power plant, at Shippingport, Pennsylvania.
August 22, 1958	President Eisenhower announced moratorium on weapon testing to begin on October 31.
March 1961	Regulatory functions separated from General Manager's Office and placed under a Director of Regulation.
August 31, 1961	Soviet Union broke moratorium and began testing nuclear weapons.
December 10, 1961	Project *Gnome*, the first Plowshare nuclear detonation, conducted in New Mexico.
April 25, 1962	First shot in *Dominic* series conducted at Christmas Island in the Pacific.
August 5, 1963	Limited test ban treaty between U.S., U.K., and U.S.S.R. signed in Moscow.
August 26, 1964	President Johnson signed Private Ownership of Special Nuclear Materials Act.
October 1964	The nuclear-powered surface ships, *Enterprise*, *Long Beach* and *Bainbridge*, completed "Operation Sea Orbit," a round- the-world cruise without logistic support of any kind.
December 16, 1964	AEC issued a permit to Jersey Central Power and Light Company for the construction of a nuclear power plant at Oyster Creek, New Jersey. This was the first civilian power reactor to be built on a competitive basis with conventional plants and without government assistance.
April 3, 1965	The first launching and operation of a nuclear reactor in space (SNAP-10a).
March 5, 1970	Ratification of the Treaty for the Nonproliferation of Nuclear Weapons by the United States, the United Kingdom, and the Soviet Union and forty-five other nations.
June 4, 1971	President Nixon announced as a national goal a commitment to

	complete LMFBR demonstration plant by 1980.
July 23, 1971	Calvert Cliffs decision regarding AEC licensing procedures for nuclear power plants.
March 1972	Completion of National Accelerator Laboratory at Batavia, Illinois, world's most powerful proton synchrotron.
October 17, 1973	Organization of Arab Petroleum Exporting Countries embargoed oil to the United States.
October 11, 1974	Energy Reorganization Act of 1974 signed by President Ford.
August 4, 1977	Department of Energy Reorganization Act signed by President Carter.

Atomic Energy Commission Commissioners

	From	To
Sumner T. Pike	October 31, 1946	December 15, 1951
David E. Lilienthal, *Chairman*	November 1, 1946	February 15, 1950
Robert F. Bacher	November 1, 1946	May 10, 1949
William W. Waymack	November 5, 1946	December 21, 1948
Lewis L. Strauss	November 12, 1946	April 15, 1950
Chairman	July 2, 1953	June 30, 1958
Gordon Dean	May 24, 1949	June 30, 1953
Chairman	July 11, 1950	June 30, 1953
Henry DeWolf Smyth	May 30, 1949	September 30, 1954
Thomas E. Murray	May 9, 1950	June 30, 1957
Thomas Keith Glennan	October 2, 1950	November 1, 1952
Eugene M. Zuckert	February 25, 1952	June 30, 1954
Joseph Campbell	July 27, 1953	November 30, 1954
Willard F. Libby	October 5, 1954	June 30, 1959
John Von Neumann	March 15, 1955	February 8, 1957
Harold S. Vance	October 31, 1955	August 31, 1959
John S. Graham	September 12, 1957	June 30, 1962
John Forrest Floberg	October 1, 1957	June 23, 1960
John A. McCone, *Chairman*	July 14, 1958	January 20, 1961
John H. Williams	August 13, 1959	June 30, 1960
Robert E. Wilson	March 22, 1960	January 31, 1964
Loren K. Olson	June 23, 1960	June 30, 1962
Glenn T. Seaborg, *Chairman*	March 1, 1961	August 16, 1971
Leland J. Haworth	April 17, 1961	June 30, 1963
John G. Palfrey	August 31, 1962	June 30, 1966
James T. Ramey	August 31, 1962	June 30, 1973
Gerald F. Tape	July 15, 1963	April 30, 1969
Mary I. Bunting	June 29, 1964	June 30, 1965
Wilfred E. Johnson	August 1, 1966	June 30, 1972

Samuel M. Nabrit	August 1, 1966	August 1, 1967
Francesco Costagliola	October 1, 1968	June 30, 1969
Theos J. Thompson	June 12, 1969	November 25, 1970
Clarence E. Larson	September 2, 1969	June 30, 1974
James R. Schlesinger, *Chairman*	August 17, 1971	January 26, 1973
William O. Doub	August 17, 1971	August 17, 1974
Dixy Lee Ray	August 8, 1972	
Chairman	February 6, 1973	January 18, 1975
William E. Kriegsman	June 12, 1973	January 18, 1975
William A. Anders	August 6, 1973	January 18, 1975

Atomic Energy Commission General Managers

	From	To
Carroll Wilson	December 31, 1946	August 15, 1950
Marion Boyer	November 1, 1950	October 31, 1953
Kenneth D. Nichols	November 1, 1953	April 30, 1955
Kenneth F. Fields	May 1, 1955	June 30, 1958
Paul F. Foster	July 1, 1958	November 30, 1958
A. R. Luedecke	December 1, 1958	July 31, 1964
R. E. Hollingsworth	August 11, 1974	December 31, 1973
John A. Erlewine	February 15, 1974	December 31, 1974

Joint Committee on Atomic Energy

Chairmen	Dates of Service
Brien McMahon	1946
Burke B. Hickenlooper	1947-1948
Brien McMahon	1949-1952 (d. 7/28/52)
Carl T. Durham (Acting)	1952
W. Sterling Cole	1953-1954
Clinton P. Anderson	1954-1956
Carl T. Durham	1956-1958
Clinton P. Anderson	1959
Chet Holifield	1960-1961
John O. Pastore	1962-1964
Chet Holifield	1965-1966
John O. Pastore	1967-1968
Chet Holifield	1969-1970
John O. Pastore	1970-1972
Melvin Price	1973-1975

Military Liaison Committee

Chairmen	Dates of Service
Lt. Gen. Lewis H. Brereton, USAF	1946-1948
Donald F. Carpenter	1948
William Webster	1948-1949
Robert F. LeBaron	1949-1954
Herbert B. Loper	1954-1960
Gerald W. Johnson	1961-1962
W. J. Howard	1963-1965
Carl Walske	1966-1969
Chet Holifield	1970
Carl Walske	1971-1972
Donald R. Cotter	1973

General Advisory Committee

Chairmen	Dates of Service
J. Robert Oppenheimer	1946-1952
Isidor I. Rabi	1952-1956
Warren C. Johnson	1956-1959
Kenneth S. Pitzer	1960-1961
Manson Benedict	1962-1963
L. R. Hafstad	1964-1967
Norman F. Ramsey	1968
Howard G. Vesper	1969-1972
Lombard Squires	1973

United States Announced Nuclear Detonations and Early Stockpile Data 1974-1975

Event or Series Name	Description	Dates
Trinity	First test of an atomic bomb	July 16, 1945
Hiroshima	First use in combat	August 6, 1945
Nagasaki	Second use in combat	August 9, 1945
Crossroads	Bikini in the Pacific	June-July 1946
Sandstone	Enewetak in the Pacific	April-May 1948
Ranger	First test series in Nevada	January-February 1951
Greenhouse	Enewetak	April-May 1951
Buster-Jangle	Nevada Test Site (NTS)	October-November 1951
Tumbler-Snapper	NTS	April-June 1952
Ivy	Enewetak	October-November 1952
	Mike, experimental thermonuclear device	October 31, 1952
Upshot-Knothole	NTS	March-June 1953
Castle	Bikini and Enewetak	February-May 1954
	Bravo, experimental thermonuclear device	February 28, 1954
Teapot	NTS	February-May 1955
Wigwam	Underwater in the Pacific	May 14, 1955
Redwing	Bikini and Enewetak	May-July 1956
Plumbbob	NTS	May-October 1957
Hardtack	Bikini, Enewetak, Johnston Is	April-August 1958
Argus	High altitude, South Atlantic	August-September 1958
Hardtack	NTS	September-October 1958
	NO TESTS CONDUCTED FROM OCTOBER 30, 1958 to SEPTEMBER 1961	
Nougat	NTS	September 1961-June 1962
Dominic I	Christmas Island area	April-June 1962
Storax	NTS	July 1962-June 1963
	Sedan, excavation experiment	July 6, 1962
Dominic II	Three above-ground tests	July 1962

LIMITED TEST BAN TREATY, AUGUST 5, 1963, PROHIBITED NUCLEAR DETONATIONS IN ATMOSPHERE, OUTER SPACE AND UNDER WATER

Niblck	NTS	August 1963-June 1964
Whetstone	NTS	July 1964-June 1965
Flintlock	NTS, Amchitka	July 1965-June 1966
Latchkey	NTS	July 1966-June 1967
Crosstie	NTS	July 1967-June 1968
Bowline	NTS	July 1968-June 1969
Mandrel	NTS, Amchitka	July 1969-June 1970
Emery	NTS	October 1970-June 1971
Grommet	NTS, Amchitka	July 1971-May 1972
Toggle	NTS	July 1972-June 1973
Arbor	NTS	October 1973-June 1974
Bedrock	NTS	July 1974-June 1975

Total Announced Detonations by Year

1945	3	1961	10
1946	2	1962	98
1947	0	1963	47
1948	3	1964	47
1949	0	1965	39
1950	0	1966	48
1951	16	1967	42
1952	10	1968	55
1953	11	1969	46
1954	6	1970	38
1955	18	1971	24
1956	18	1972	26
1957	32	1973	24
1958	77	1974	23
1959	0		
1960	0		
		TOTAL	763

Early Nuclear Weapon Stockpile Data

	Fiscal Year			
	1945	*1946*	*1947*	*1948*
Number of nonnuclear Components				
1.Gun-type	0	0	0*	2*
2. Implosion-type	2	9	29*	53*
Number of nuclear Components				
1. Gun-type	0	0	0	0
2. Implosion-type	2	9	13	50

*Numbers declassified in 1976

Atomic Energy Commission
Financial Statistics

U.S. Government Investment in the Atomic Energy Program

(From June 1940 Through January 18, 1975)

(in millions)

Appropriation Expenditures:		
National Defense Research Council	$	.5
Office of Scientific Research and Development		14.6
War Department (including Manhattan Engineer District)		2,218.3
Total		2,233.4
Atomic Energy Commission:		
Fiscal years prior to 1966		34,643.8
Fiscal year 1966		2,402.9
Fiscal year 1967		2,263.7
Fiscal year 1968		2,466.6
Fiscal year 1969		2,450.4
Fiscal year 1970		2,455.0
Fiscal year 1971		2,274.7
Fiscal year 1972		2,392.1
Fiscal year 1973		2,393.1
Fiscal year 1974		2,307.5
Fiscal year 1975 (through January 18)		1,512.6
Total AEC		57,562.4
Total Appropriation Expenditures		59, 795.8
Unexpended Balance of Funds in U.S. Treasury		
January 18, 1975		3,439.9
Total Funds Appropriated		63,235.7
Less:		
Collections paid to U.S. Treasury		58.0
Property and services transferred to other Federal agencies without reimbursement,		462.0

net of such transfers received from other federal agencies	
Cost of operations from June 1940 through January 18, 1975	46,562.2
AEC Equity at January 18, 1975 as shown on Balance Sheet	$16,153.5

Atomic Energy Commission
Laboratory and Production Facilities

AEC Facility	*Location*	*Contractor-operator*
Multiprogram Laboratories		
Argonne National Laboratory	Chicago, IL	Univ.of Chicago/Argonne Universities Assn.
Brookhaven National Laboratory	Upton, NY	Associated Universities, Inc.
Lawrence Berkeley Laboratory	Berkeley, CA	University of California
Lawrence Livermore Laboratory	Livermore, CA	University of California
Los Alamos Scientific Laboratory	Los Alamos, NM	University of California
Oak Ridge National Laboratory	Oak Ridge, TN	Nuclear Div., Union Carbide Corporation
Pacific Northwest laboratory	Richland, WA	Pacific Northwest Div., Battelle Memorial Institute
Engineering Development		
Bettis Atomic Power Laboratory	Pittsburgh PA	Westinghouse Electric Corporation
Hanford Engineering Development		
Laboratory	Richland, WA.	Westinghouse Electric Corporation
Knolls Atomic Power Laboratory	Schenectady, NY	General Electric Company
Liquid Metal Engineering Center	Santa Susana, CA	Atomics Int'l Div., Rockwell Int'l Corporation
Idaho National Engineering Laboratory	Idaho Falls, ID	Aerojet Nuclear Company
Naval Reactors Facility, INEL	Idaho Falls, ID	Westinghouse Electric Corporation
Sandia Laboratories	Albuquerque, NM/	Sandia Corporation (Western Electric-Bell System)
	Livermore, CA	
Savannah River Laboratory	Aiken, SC	E.I. du Pont de Nemours & Company
Shippingport Atomic Power Station	Shippingport, PA	Duquesne Light Company

Specialized Physical Research Laboratories

Ames Laboratory	Ames, IA	Iowa State University of Science and Technology
Fermi National Accelerator Laboratory	Batavia, IL	Universities Research Association
Notre Dame Radiation Laboratory	South Bend, IN	University of Notre Dame
Princeton Plasma Physics Laboratory	Princeton, NJ	Princeton University
Stanford Linear Accelerator Center	Palo Alto, CA	Stanford University

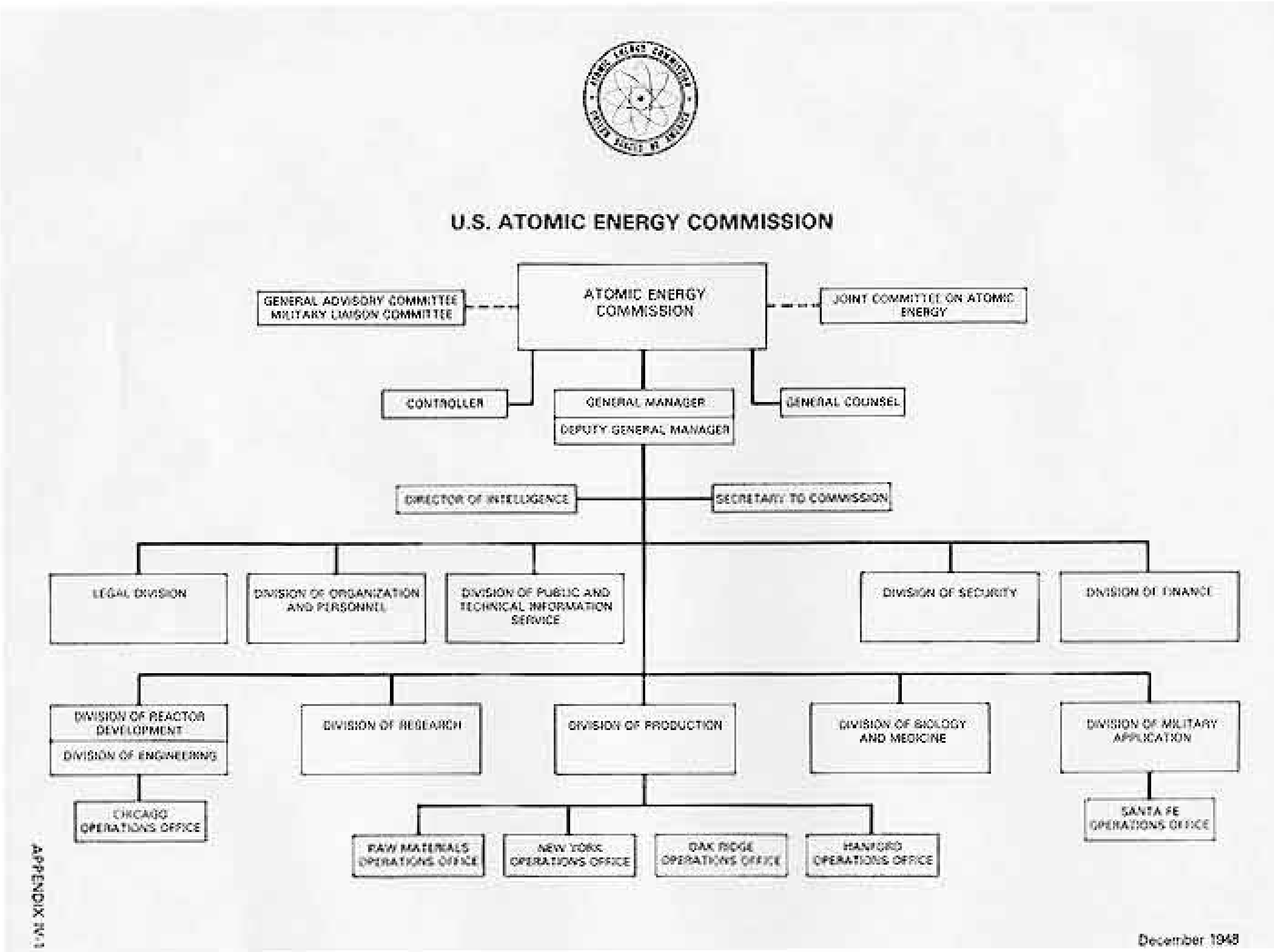
Specialized Biomedical Research Laboratories

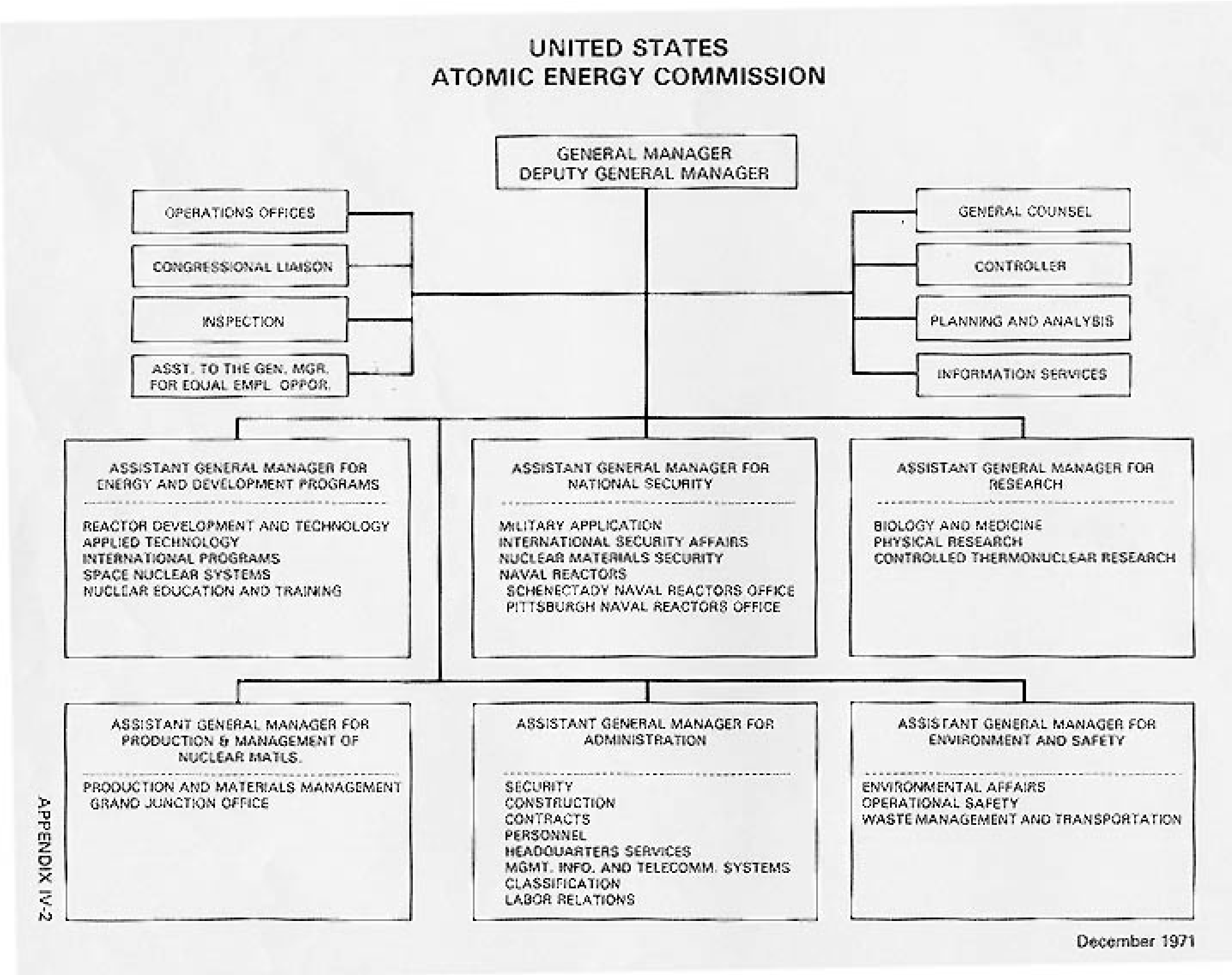
Comparative Animal Research Laboratory	Oak Ridge, TN	University of Tennessee
Franklin McLean Memorial Research Institute (formerly Argonne Cancer Research Hospital)	Chicago, IL	University of Chicago
Inhalation Toxicology Research Institute	Albuquerque, NM	Lovelace Foundation of Med'l Educ. and Research
Laboratory of Nuclear Medicine and Radiobiology	Los Angeles, CA	University of California, Los Angeles
Laboratory of Radiobiology	San Francisco, CA	University of California Medical Center
MSU/AEC Plant Research Laboratory	E. Lansing, MI	Michigan State University
ORAU Research Facilities	Oak Ridge, TN	Oak Ridge Associated Universities
Puerto Rico Nuclear Center	Mayaguez and Rio Piedras, PR	University of Puerto Rico
Radiobiology Laboratory	Davis, CA	University of California, Davis
Radiobiology Laboratory	Salt Lake City, UT	University of Utah
Savannah River Ecology Laboratory	Aiken, SC	University of Georgia
University of Rochester Medical Laboratory	Rochester, NY	University of Rochester

Production, Development, and Fabrication Centers

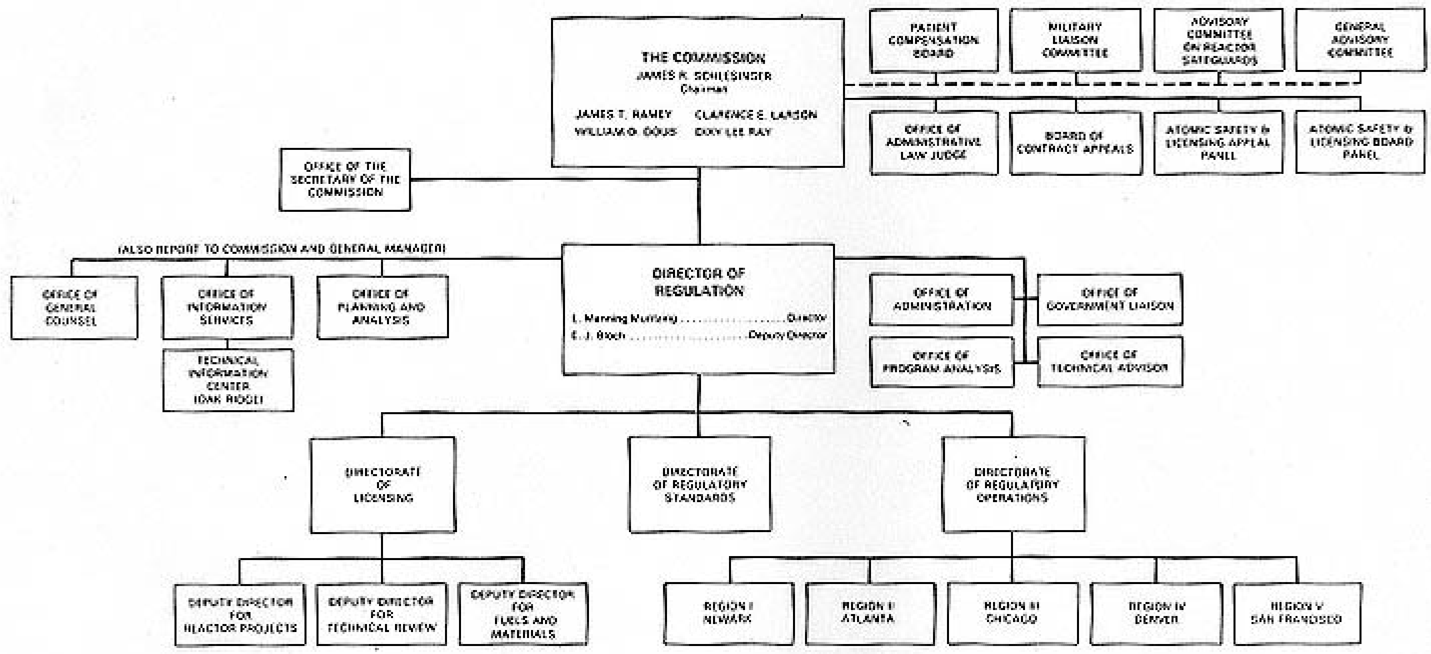
Burlington-AEC Plant	Burlington, IA	Mason & Hanger-Silas Mason Co., Inc.

Feed Materials Plant	Ashtabula, OH	Reactive Metals, Inc.
Feed Materials Plant	Fernald, OH	National Lead Company
Feed Materials Plant	Paducah, KY	Nuclear Division, Union Carbide Corporation
Hanford Works	Fichland, WA	Atlantic-Richfield Hanford Company and
		United Nuclear, Inc.
Idaho Chemical Processing Plant	INEL, ID	Allied Chemical Corporation
Kansas City Plant	Kansas City, MO	Bendix Corporation
Mound Laboratory	Miamisburg, OH	Monsanto Research Corporation
Nevada Test Site	Mercury, NV	Reynolds Electrical & Engineering Co.; EG&G, Inc,;
		Holmes & Narver, Inc.
Oak Ridge Gaseous Diffusion Plant	Oak Ridge, TN	Nuclear Division, Union Carbide Corporation
Paducah Gaseous Diffusion Plant	Paducah, KY	Nuclear Division, Union Carbide Corporation
Portsmouth Gaseous Diffusion Plant	Portsmouth, OH	Goodyear Atomic Corporation
Pantex Plant	Amarillo, TX	Mason & Hanger-Silas Mason Co., Inc.
Pinellas Plant	Clearwater, FL	General Electric Company
Rocky Flats Plant	Golden, CO	Atomics Int'l Div., Rockwell Int'l Corporation
Savannah River Plant	Aiken, SC	E. I. du Pont de Nemours & Company
Y-12 Plant	Oak Ridge, TN	Nuclear Division, Union Carbide Corporation


U.S. ATOMIC ENERGY COMMISSION
ATOMIC ENERGY COMMISSION
GENERAL ADVISORY COMMITTEE
MILITARY LIAISON COMMITTEE
JOINT COMMITTEE ON ATOMIC ENERGY
CONTROLLER
GENERAL MANAGER
DEPUTY GENERAL MANAGER
GENERAL COUNSEL
DIRECTOR OF INTELLIGENCE
SECRETARY TO COMMISSION
LEGAL DIVISION
DIVISION OF ORGANIZATION AND PERSONNEL
DIVISION OF PUBLIC AND TECHNICAL INFORMATION SERVICE
DIVISION OF SECURITY
DIVISION OF FINANCE
DIVISION OF REACTOR DEVELOPMENT
DIVISION OF ENGINEERING
DIVISION OF RESEARCH
DIVISION OF PRODUCTION
DIVISION OF BIOLOGY AND MEDICINE
DIVISION OF MILITARY APPLICATION
CHICAGO OPERATIONS OFFICE
RAW MATERIALS OPERATIONS OFFICE
NEW YORK OPERATIONS OFFICE
OAK RIDGE OPERATIONS OFFICE
HANFORD OPERATIONS OFFICE
SANTA FE OPERATIONS OFFICE
APPENDIX IV-1
December 1948


UNITED STATES
ATOMIC ENERGY COMMISSION
GENERAL MANAGER
DEPUTY GENERAL MANAGER
OPERATIONS OFFICES
CONGRESSIONAL LIAISON
INSPECTION
ASST. TO THE GEN. MGR. FOR EQUAL EMPL. OPPOR.
GENERAL COUNSEL
CONTROLLER
PLANNING AND ANALYSIS
INFORMATION SERVICES
ASSISTANT GENERAL MANAGER FOR ENERGY AND DEVELOPMENT PROGRAMS
REACTOR DEVELOPMENT AND TECHNOLOGY
APPLIED TECHNOLOGY
INTERNATIONAL PROGRAMS
SPACE NUCLEAR SYSTEMS
NUCLEAR EDUCATION AND TRAINING
ASSISTANT GENERAL MANAGER FOR NATIONAL SECURITY
MILITARY APPLICATION
INTERNATIONAL SECURITY AFFAIRS
NUCLEAR MATERIALS SECURITY
NAVAL REACTORS
SCHENECTADY NAVAL REACTORS OFFICE
PITTSBURGH NAVAL REACTORS OFFICE
ASSISTANT GENERAL MANAGER FOR RESEARCH
BIOLOGY AND MEDICINE
PHYSICAL RESEARCH
CONTROLLED THERMONUCLEAR RESEARCH
ASSISTANT GENERAL MANAGER FOR PRODUCTION & MANAGEMENT OF NUCLEAR MATLS.
PRODUCTION AND MATERIALS MANAGEMENT
GRAND JUNCTION OFFICE
ASSISTANT GENERAL MANAGER FOR ADMINISTRATION
SECURITY
CONSTRUCTION
CONTRACTS
PERSONNEL
HEADQUARTERS SERVICES
MGMT. INFO. AND TELECOMM. SYSTEMS
CLASSIFICATION
LABOR RELATIONS
ASSISTANT GENERAL MANAGER FOR ENVIRONMENT AND SAFETY
ENVIRONMENTAL AFFAIRS
OPERATIONAL SAFETY
WASTE MANAGEMENT AND TRANSPORTATION
APPENDIX IV-2
December 1971

ATOMIC ENERGY COMMISSION
REGULATORY ORGANIZATION



March, 1974