UNITED
STATES
ATOMIC ENERGY
COMMISSION

LOS ALAMOS SCIENTIFIC LABORATORY

LOS ALAMOS, N. MEX.

APPROVED FOR PUBLIC RELEASE

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Contents

Introduction

The Los Alamos Scientific Laboratory is the American focal point for research and development of the military applications of atomic energy. This has been true since its establishment in 1943. It is operated for the Atomic Energy Commission by the University of California.

Like a number of other atomic energy installations, it was planned and built as an emergency wartime project. A need for its services remained in the postwar period, the plant has been rebuilt, and today the Laboratory is considered one of the finest nuclear energy research centers in the world. Its primary purpose is still the development of atomic weapons, but its work also includes such diverse subjects as medicine, biology, physics, mathematics, chemistry, metallurgy—in brief, almost all the scientific fields related to atomic energy.

Instead of the band of about 30 scientists who were charter members of the Los Alamos scientific group, there was in mid-1951 a working staff of more than 2,300 scientists and assisting personnel; the population of the community that had grown up around the Laboratory had passed the 12,000 mark. Los Alamos is a permanent part of the national defense and of the scientific world.

Los Alamos (locally translated as "The Cottonwoods") lies on the Pajarito Plateau in the Jemez Mountains, in northern New Mexico. It is 35 miles northwest of Santa Fe and about 100 miles north of Albuquerque. Situated in rugged wooded country cut up by canyons and mesas, it is 2,000 feet above the nearby Rio Grande and about 7,300 feet above sea level.

Geographically, the site was selected for its isolation, providing security; its open space, providing wide areas for test and experimental work; and its climate which permits year-round outdoor work. Today, while security is still a vital concern in the life of Los Alamos, the isolation has been markedly reduced by good roads leading to the town, scheduled air connections with the rest of the United States, and communications facilities. Although isolation was desirable before 1945, it is now important that the Laboratory and community have relatively easy contact with the rest of the country both to assist scientific progress and to maintain pleasant living conditions.

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History of the Laboratory

The history of the Los Alamos Scientific Laboratory goes back to June 1942, when enough progress had been made in solving the major difficulties of producing fissionable materials to justify an intensive effort on development of the weapon itself.

Soon after the Manhattan Engineer District took over the atomic energy project, it became apparent that weapons work would require a separate laboratory. Without such a facility, the physical and chemical research required for the design and testing of an atomic bomb could not possibly be carried out. Obviously far more was needed than the complement of technicians required for even the most complex experiment in physics. Eventually nearly every field of science was involved, with hundreds of specialists in supporting roles. As is well known now, their use of scientific apparatus and machinery was on a scale that was impressive even in a mass production age.

Secrecy, ample working space far removed from dense population, and a climate that would favor year-round outdoor work were vitally important for the proposed laboratory. The original director of atomic weapons development, who had a ranch in the isolated canyon area of northern New Mexico, remembered the Los Alamos Ranch School for Boys situated atop the high Los Alamos mesa. In November 1942 this was chosen as the site for the new laboratory.

At first it was thought that only about 30 scientists, their families, and clerical help—not more than 100 persons in all—would be needed. The handful of buildings of the Los Alamos school, mostly of the log cabin type, was believed sufficient to provide housing for such a group. However, there was no laboratory, there were no shops, no adequate power, water, or fire-protection facilities. The sole approach to the mesa was a tortuous, single-lane, gravel mountain road. The nearest railroad was at Santa Fe, 35 miles away. These handicaps were overcome sufficiently to permit successful operation.

Staffing

The Laboratory officially came into being in April 1943. It was then, and still is, operated under contract by the University of California. The University has taken this contract, on a nonprofit basis, as a service to the national defense and security and in the interest of promoting scientific understanding of nuclear energy.

There was no experience in the field of nuclear weapons, and a new laboratory, working in a new and little-known field, had to be created specifically to meet the urgent need for increasing the knowledge of the principles of nuclear fission, and applying them to a weapon which could be used during the war. This called for speedy application of pure science to a precise practical use.

The Laboratory director arrived from the University of California in March 1943. As far as the public was concerned, he and every other person connected with the Laboratory during the war promptly disappeared behind the anonymity of "Post Office Box 1663, Santa Fe, New Mexico." This was the blind address used for all mail and parcel post communications. Even such everyday documents as drivers' licenses identified Los Alamosans by numbers, so that the names of the people on "The Hill" could not be traced through public records.

The director soon was joined by groups and individuals from Princeton University, Cornell University, Purdue University, the Universities of Chicago, Illinois, Wisconsin, Minnesota, and California, Rice Institute, the Carnegie Institution, and elsewhere. As the project grew far beyond its original expectations, an extraordinary gathering of scientists assembled on the mesa. Among them were Enrico Fermi, Bruno Rossi, Edward Teller, John von Neumann, Hans Bethe, Niels Bohr, Donald Kerst, Cyril Smith, Joseph Kennedy, Sir James Chadwick, and Sir Geoffrey Taylor. Some were fugitives from the European dictatorships.

Persons of outstanding talent in theoretical and experimental nuclear physics, chemistry, metallurgy, electronics, medicine, ordnance, and engineering were assembled as fast as makeshift facilities to house and service the new laboratory could be completed. Universities, research foundations, private industry, and the Armed Forces provided key personnel. A special mission was made up from the British groups already at work on the problems of atomic weapons. The top atomic scientists from the United Kingdom were integrated into the Los Alamos group. From the original estimate of 30 scientists, the Los Alamos Scientific Laboratory reached a wartime peak of nearly 3,000 workers actually engaged in the technical operation of the project and the supporting services.

RESEARCH EQUIPMENT AT LOS ALAMOS

Scientific equipment was a continuing and difficult problem. At the start, most of it was supplied by universities that had contracts to do experimental and theoretical work on the military use of atomic energy. Three carloads of equipment from the Princeton project filled some of the most urgent needs; Harvard University furnished a cyclotron; two Van de Graaff generators came from the University of Wisconsin; the University of Illinois contributed a Crockcroft-Walton accelerator. It would have taken years to design, manufacture, and assemble this equipment.

Supply nevertheless remained one of the Laboratory's problems. The Manhattan Project had the highest priority obtainable, and had to use it to get new equipment designed and built to order by the Laboratory and its suppliers.

The Reactors

Included in the unique equipment now at Los Alamos are two reactors that have supplied valuable information for use in planning larger developments now under study as part of the Atomic Energy Commission's current reactor program. These are the "water boiler" and the "fast" reactor. Both of these, when first constructed, were the only reactors of their respective types in existence. Much information about the construction and operation of these two reactors has been declassified.

Water boiler. The water boiler does not actually boil water, but takes its name from one of its important constituents, which is water. Externally it resembles the reactors, or piles, at Argonne and Oak Ridge, though it is much smaller. Internally, however, it is quite different. The Argonne and Oak Ridge reactors are essentially lattices of a moderator, such as graphite, with normal uranium rods inserted in them to produce controlled chain reactions. The water boiler is much simpler. It is essentially a spherical container, in which is placed a solution of water and enriched uranium 235 in the form of a water-soluble salt, such as uranyl sulphate or uranyl nitrate. A neutron reflector and a heavy concrete shield surround the container. The rate of reaction in the container is controlled by rods of neutron-absorbing material which can be inserted in the container. Ports in the instrument make it simple to obtain intense neutron irradiations with the reactor. The neutrons can also be funneled through a cadmium-lined tunnel which absorbs stray neutrons and allows particles to escape only in a straight, concentrated beam.

The water boiler supplies a steady, controllable flux of neutrons of known energy which is useful for a variety of purposes. These range from fundamental neutron experiments to a method of weighing minute quantities of fissionable materials by fission-counting a sample in a standard flux.

The water boiler is the only known chain reacting system of the "homogeneous" type—that is, in which the fuel, moderator, and coolant are all in a homogeneous mixture. Because of this, its construction, operation, and performance have contributed knowledge and experience relating to possible future reactor development.

"Fast" reactor. The fast reactor is a critical assembly in which the fissionable material is plutonium metal. This assembly involves no elements which would slow down the neutrons; hence the neutrons which maintain the chain reaction are "fast," much as in a nuclear explosion. The heart of the reactor is cooled with circulating mercury. These three features—use of plutonium, of fast neutrons, and a liquid metal coolant—are novel in reactors.

This reactor has obvious value to the main line of interest of the Laboratory. In addition, its characteristics are important because they are closely related to three trends in the general field of reactor development—toward reactors sustained by fast neutrons, toward reactors using liquid metal as a cooling agent, and toward units operating with plutonium or other concentrated fissionable material as the fuel. The first trend is stimulated by the hope of decreasing the amount of parasitic neutron capture which exists in thermal reactors. Work along this line is being done at Argonne National Laboratory. Specific measurements have been made with the Los Alamos reactor to assist Argonne in the design of reactors under development there.

These trends in reactor development may aid in developing a reactor which will generate power and at the same time create more fissionable material than is consumed. Creation of fissionable material in this manner is called breeding. One "breeder" reactor using fast neutrons and liquid metal coolant is being constructed for the AEC's Reactor Testing Station in Idaho.

The lighter side of the work at Los Alamos is illustrated by a bronze plaque set into one side of the concrete shield of the fast reactor. This labels the machine as "Clementine." The story behind the name is this. In 1947, when the reactor was still classified, one of the scientists who had worked on the project left Los Alamos. Since he had been involved in the design and construction of the device, he was understandably interested in its progress. But since it was not "in the clear," he could neither inquire specifically about it, nor receive any direct answer. So he sent a telegram to the crew working on the reactor at Los Alamos. The wire read:

"In a cavern, in a canyon, extrapolating must be fine; since you're the miners, 49er's, tell me how is Clementine?"

Since the reactor was being built in a canyon, and the code word for plutonium was "forty-nine," the reactor crew had no difficulty in figuring out what he was querying them about. And Clementine was promptly adopted as the name for the reactor.

The Accelerators

Other equipment in operation at Los Alamos includes a 40-inch cyclotron, a 20-Mev betatron, a 2-Mev Van de Graaff electrostatic generator, and three Cockcroft-Walton accelerators. A new and larger Van de Graaff was completed in 1951. It accelerates particles to energies of 8 to 12 million electron volts—one of the most powerful accelerators of this kind in existence.

GROWTH OF THE LABORATORY

Almost from the beginning, the Laboratory outgrew the limited facilities of the former ranch school and spread into the canyons and mesas surrounding the Los Alamos mesa. The emphasis had to be on temporary construction because the future of the entire project was unknown.

Living and working conditions, of course, were on a level that would be considered completely impossible in peacetime. At times residents of Los Alamos were not allowed to travel further from "The Hill" than Santa Fe without special dispensation, and even there they were unpopular with many of the Santa Feans who were annoyed by the nearby secret area that was completely closed to them. Los Alamos residents could not tell their families and friends where they were, much less what they were doing.

The war work finally reached its climax in the successful explosion of an experimental bomb at Alamogordo on July 16, 1945, and the production of the atomic weapons which were used against Hiroshima and Nagasaki in August 1945.

Uncertainties and difficulties did not end with the war. The Laboratory director resigned in October 1945, believing, as did many of the scientists at Los Alamos, that his job was completed. The Laboratory had been built to build bombs to hasten the end of the war, and the war was over. There was complete uncertainty as to the future of the project, and many of the key personnel followed Dr. Oppenheimer's example and went back to universities and industry.

Sandia Laboratory

In 1945, it was decided to establish a special unit at Sandia, N. Mex., just outside of Albuquerque and near an Air Force base, for ballistics studies and work on problems directly concerned with atomic weapon production and handling. The task of this unit was to carry out some aspects of the engineering work on the bomb, and to do general research in its nonnuclear aspects, such as ordnance engineering.

The Sandia Laboratory was set up in the fall of 1947 as a branch of Los Alamos. The Laboratory proper is located on AEC owned land within the Sandia Military Base.

As more and more engineering aspects of weapons were transferred to Sandia, the University of California decided it should concentrate on nuclear research at Los Alamos. As a result, operation of the Sandia Laboratory was transferred in November 1949 to the Sandia Corp., a subsidiary of the Western Electric Co. created to take over this project. This arrangement provides for use of the research and development services of the Bell Telephone Laboratories in the work done at Sandia. Sandia continues to work closely with Los Alamos and with the Armed Forces.

Present Status of Los Alamos

When the Atomic Energy Act was passed in 1946, the responsibilities it assigned to the new Atomic Energy Commission included improvement and production of atomic weapons. This national endorsement of the program which the Laboratory had been following up to that time initiated a program of revitalizing and expansion for the Laboratory and its community.

Today this program is far from completed, but great improvements have been made. The Laboratory in 1951 had a staff of more than 2,300 scientists, technicians, craftsmen, and engineers. Complete reconstruction of the wartime technical facilities on a permanent basis is under way on a mesa adjacent to the one on which the town is built.

LOS ALAMOS COMMUNITY

Because security at Los Alamos is of great importance, Los Alamos is still a "closed" town. Inside the fence surrounding the community, however, a new, modern city has sprung up. It has a permanent community center with adequate shopping facilities. There are theaters, bowling alleys, meeting halls, a radio station, and a large gymnasium with a swimming pool for the adult community and school children. New schools have been built, and much of the housing is permanent.

This modernization of the community has been a valuable asset to the operation of the Laboratory. The attractiveness of the community contributes directly to the caliber of the personnel employed in its basic industry. Scientists and engineers, like people everywhere, desire an adequate standard of living for themselves and their families no matter what their work may be.

Although the conversion of Los Alamos to a modern, comfortable community is well under way, much remains to be done. A portion of the housing in use in 1951, six years after the war's end, still was temporary, and inadequate and expensive to maintain. Additional housing, over and above replacement of wartime buildings, will be required to meet the needs of the community as the Laboratory staff increases to meet the demands of the work assigned to it.

A new highway from the Rio Grande Valley to the mesa top was finished before the end of the war, with the worst grades eliminated. Thirty-minute connections with Albuquerque are provided by an airline, which operates a fleet of small planes over the rugged canyon area.

One of the first moves at Los Alamos during the war was to set up an elective advisory town council which served as a "safety valve" during the many hardships and various crises over living conditions. This advisory group has been continued by the AEC. In addition, on June 10, 1949, the AEC-owned area became a county as a result of Federal legislation which returned jurisdiction of the Los Alamos area to the state of New Mexico. This clarified a number of legal problems that previously had plagued the town. Residents now have the right to vote, and they have access to the New Mexico courts.

As a political unit, Los Alamos County is unique. It is the only county in the United States with boundaries identical to those of a Federal reservation, which can be entered only by a Federal permit, which has no real estate levy, and with officials serving for nominal $1-a-year salaries.

THE RESEARCH PROGRAM

Los Alamos concentrates its resources on fundamental problems relating to the use of nuclear energy for military purposes, but does not limit its work to these problems. Its program has three major objectives—improving present atomic weapons, developing new ones, and carrying on basic research.

Such a program provides the basis not only for weapon development, but also the foundation for advances in the peacetime uses of atomic energy. The Laboratory thus occupies a key position in the execution of national policy—that of maintaining preeminence in all fields of atomic research and application. Its work covers several special fields of knowledge defined roughly as follows: (*a*) Nuclear characteristics of materials; (*b*) Physical, chemical, and metallurgical characteristics of these materials; (*c*) Mechanics and dynamics of methods of initiating nuclear energy release; and (*d*) Behavior of nuclear energy release systems (bombs, for example).

Weapons Research and Development

Theoretical physics. The Theoretical Physics Division is concerned especially with supercritical systems, or quantities of fissionable material which will release energy (bombs). Experimentation with these quantities is obviously impossible, and so theories of detonation, design, etc., must be worked out with paper, pencil, and with a battery of computing machines. Problems range from fundamental theoretical nuclear physics and particle interactions to the behavior of gross matter under extremely high temperatures and pressures. A new high-speed electronic computer, the "Maniac," is now under construction to help solve such problems.

Experimental physics. The Experimental Physics Division operates the particle accelerating equipment and the two reactors. Its responsibilities rest largely in determining the nuclear characteristics of materials—nuclear constants, for example. This group is also studying the reactions between light elements.

Chemistry and metallurgy. Physical, chemical, metallurgical, and extranuclear physical properties of materials used at Los Alamos are covered largely by the Chemistry and Metallurgy Division. It is also responsible for carrying out pilot plant operations on a scale large enough to bring continual improvement in methods of manufacture and assembly.

The production processes of Oak Ridge and of Hanford were set up during the war before complete specifications regarding size, shape, and purity of active material for explosive purposes were known. Consequently, the task of establishing purification and fabrication methods was given to Los Alamos as a continuing responsibility.

As new materials become more plentiful, the range of possible physical and chemical measurements of their properties and of their compounds and alloys increases. Therefore, the work in chemistry and metallurgy is not limited to process improvement in a narrow sense, but includes a wide range of fundamental research. As an example of this range, the Division operates a cryogenic laboratory that has proved useful in extending the temperature range of measurements on ordinary materials. It has also done valuable work in investigating fundamental properties of new materials such as liquid helium 3.

Weapons research. The mechanics and dynamics of nuclear energy release are the responsibility of the Weapons Research Division. Although much of the research and techniques of this unit are of great interest, security requirements prevent any discussion of them here.

Weapons physics. The Weapons Physics Division operates at times in the fields of both nuclear characteristics and supercritical systems. Much can be learned about the techniques of the nuclear physics of supercritical systems by appropriate over-all measurements of neutron distribution in space and energy. The results obtained provide a valuable confirmation of fundamental data and theory.

During the war, when many risks had to be taken to speed the work of Los Alamos, experiments with critical and supercritical assemblies were done by hand. All work of this nature is now performed by remote control. The actual building in which active material is assembled into a critical mass is about one-fifth of a mile from the control room. There are elaborate warning signals and safety devices. These devices automatically disassemble any dangerous assemblies if anything goes wrong with the remote-control system. As a further control, television cameras are focused on the active material, and receivers in the control room give the operators a detailed picture of what is going on.

Such elaborate methods are obviously expensive, and they are often not as fast as if the work were done by hand. But direct handling is hazardous to the personnel involved, and the remote control system provides the maximum possible safety.

Weapons tests. The Weapons Test Division is responsible for nuclear measurements in actual tests. A nuclear explosion offers an exceptional opportunity to study basic phenomena under conditions of temperature and pressure unattainable elsewhere. This group is also responsible for the Laboratory's test operations in Nevada and at the AEC Pacific Proving Ground on Eniwetok Atoll.

Because the duration of explosive reactions is very short, and the number of repetitions limited, extensive techniques of observation have been developed. The activities of the Test Division include laboratory preparation followed by an intricate setup of field instruments for observation of light, blast, and nuclear radiations accompanying a nuclear explosion.

Typical Operation at Los Alamos

A small group of senior scientists at Los Alamos is responsible for originating and exploring the various ways of developing a nuclear explosive arrangement. When it has been decided to try a new idea, the paper work comes first. Questions requiring experimental answers soon arise. Nearly every division of the Laboratory plays a part in determining whether or not the proposed scheme is feasible in principle.

If the idea passes this stage, more extensive and intensive investigation follows in which the idea is developed, not to the stage of an actual military weapon, but to that of a workable nuclear explosive system. This phase again may involve nearly all of the Laboratory.

If results continue to be fruitful, the device is exploded under carefully planned conditions and appropriate measurements of its behavior are made. Such a flow of work involves maximum participation of each laboratory division, yet at each stage there is a clear definition of primary responsibility.

Health Safety and Biomedical Research

The safety of the entire Laboratory staff with respect to the special hazards associated with atomic energy is the responsibility of the Health Division. It operates in three main fields: (*a*) Adequate control of the hazards themselves; (*b*) Detection of incipient overexposure; and (*c*) The study of therapeutic procedures for treating radiation damage to living tissue. This program requires an active research program as well as the continuous, routine monitoring of radiation levels.

It was realized from the outset that a number of workers at Los Alamos would be engaged in handling plutonium. Methods had to be developed quickly for establishing permissible concentrations of this material in air, for carrying out air sampling procedures, and for determining the amount of this material which a worker might actually have taken into his system. Because of the difficulty of getting the necessary information from other sources, some chemists from the Los Alamos staff were assigned to this essential work. This was the birth of biomedical research at Los Alamos. From this small beginning has grown the Laboratory's Health Division which in mid-1951 consisted of approximately 125 workers divided into 5 groups. The work of these groups is described below.

Occupational medicine. The occupational medicine group performs the tasks of the industrial medical department in any industry, such as physical examinations and first aid for injuries and minor illnesses. It is necessary, however, to carry this industrial medical work considerably further than is necessary in most industries. The atomic energy industry is dealing with a vast number of new materials, new methods, and even new forces. Little is known, for example, about the long-term effects of exposures to certain types of radiation. This group makes the necessary observations and records as a basis for safety recommendations for future uses of radioactive materials.

Radiological safety. Protecting laboratory workers against the harmful effects of radiation is the responsibility of the radiological safety group. Los Alamos has workers who may be exposed to alpha and beta particles, gamma rays, X-rays, and neutrons; there are workers who are handling radioactive sources of every conceivable type and of every degree of potency. The monitors, the biophysicists, and the electronic experts in this group must not only be prepared to offer protection against dangers which are reasonably well understood; they must also anticipate new difficulties before they arise.

Industrial hygiene. The industrial hygiene engineers and their co-workers in the industrial hygiene laboratory must determine the existence of all toxic hazards, estimate their magnitudes, calculate possible exposures, and devise methods of control. To keep abreast of new developments at Los Alamos, a substantial part of this group's time must be devoted to research and development.

Safety. Los Alamos has machine shops, sheet metal shops, carpenter shops; it has internal traffic problems; and being partly housed in temporary frame buildings constructed during the war, it has a fire protection problem. It is the task of the safety group to cope with these problems.

Biomedical research. It has already been pointed out that the biomedical group started in the search for a laboratory method of detecting the presence of plutonium in the body. This group, while it has grown, remains essentially a service agency to solve the programmatic problems that arise in the Laboratory. In the research group of approximately 30 people are physicists, biologists, biochemists, organic chemists, pathologists, and others. The group works on such subjects as the ability of different materials to penetrate the enamel of teeth; the effect of radiation on a particular nucleic acid produced by the pneumococcus; and the toxicology of dicoumarol, a new drug with the ability to delay the clotting of blood. Studies on the effects of various types of radiation on tumors produced artificially in laboratory animals may one day contribute to the control of cancer.

In general the members of the research group have largely been involved in one of two programs. The first of these concerns the toxicology and toxicity of various radioactive materials to which Laboratory workers are or may be exposed. In the second program, organic chemical compounds are synthesized in such a way that they contain one or more "labeled" atoms. The tracer most commonly used is carbon 14. Biochemists and biologists use these labeled materials to study their behavior after injection into mice or rats. They seek to learn how the materials are broken down in the body, in what organs they may be stored in high concentrations, and also how the body ultimately eliminates them. After preliminary studies of this nature, the compound is usually turned over to the AEC Isotopes Division at Oak Ridge, where it is available for distribution to research laboratories throughout the country. A few of the materials which have been synthesized, studied, and made available for distribution are urea, thiourea, pentobarbital, nicotinic acid, and dicoumarol.

Los Alamos, like other AEC installations, has attained an enviable safety record. This means a constant vigilance by every person employed, proper training, and elaborate equipment. Every worker concerned with potentially dangerous tests must guard against mistakes which might endanger himself or his fellow workers. Every operation in this field, whether a daily routine or some new technique being carried out for the first time, must be thought through to anticipate and eliminate any possibility of injury. Considered risks which are a part of a wartime philosophy cannot be taken in a peacetime operation.

SCIENTIFIC POLICY

Free Exchange of Ideas

Every attempt is made, within the limits of security, to preserve academic freedom. Seminars, colloquia, and free discussion throughout the Laboratory contribute to the staff's continued interest in the work.

The sound wartime policy of "no compartmentalization" within the technical sections of the Laboratory has been continued. In this new and strange field, ideas of value may not always come from the individual who is expected to have them. So the free flow of problems and information among the senior scientists not only contributes to their professional knowledge and accomplishments; it also aids the national defense.

The recognized need for outside contacts brings an impressive list of visiting consultants. These contribute data in their special fields, and knowledge of interest to the scientific world at large.

Isolation Minimized

The in-and-out flow of ideas and people minimizes the isolated location. Laboratory personnel are encouraged to attend scientific meetings. Laboratory business being rather widespread, the opportunity for consultations in academic, industrial, and governmental fields are utilized. It is also possible for a staff member to secure a leave of absence to pursue scientific or professional work at other locations.

Publication of papers is encouraged whenever the material may be declassified. More than 500 papers on Los Alamos have been declassified for publication. This gives recognition to staff members' work in basic research, while at the same time following the AEC policy of encouraging, wherever possible, the dissemination of scientific information.

Training

In addition to the consultants who visit Los Alamos for periods of a few days to several months, the Laboratory employs a number of cleared predoctoral students in the summer period; 69 students representing 33 colleges spent the summer of 1949 at Los Alamos. This brings the staff in contact with fresh young minds and gives the students opportunity to gain research experience in their respective fields by working under skilled leaders. There are no formal arrangements with any institution. The Laboratory, however, under some conditions does employ students recommended by various colleges for doctoral thesis work. This benefits the institution, which may not possess the required facilities. It benefits Los Alamos through the student's contribution to the work of the Laboratory and his possible interest in a permanent connection.

As knowledge of nuclear energy advances, it seems apparent that an establishment such as Los Alamos will contribute to peaceful uses of the atom. Even if its prime effort must be devoted to military applications for some time to come, much of value to science and humanity may also grow out of the work. History has shown that things learned by scientists in wartime or military efforts also contribute to the progress of civilization.

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