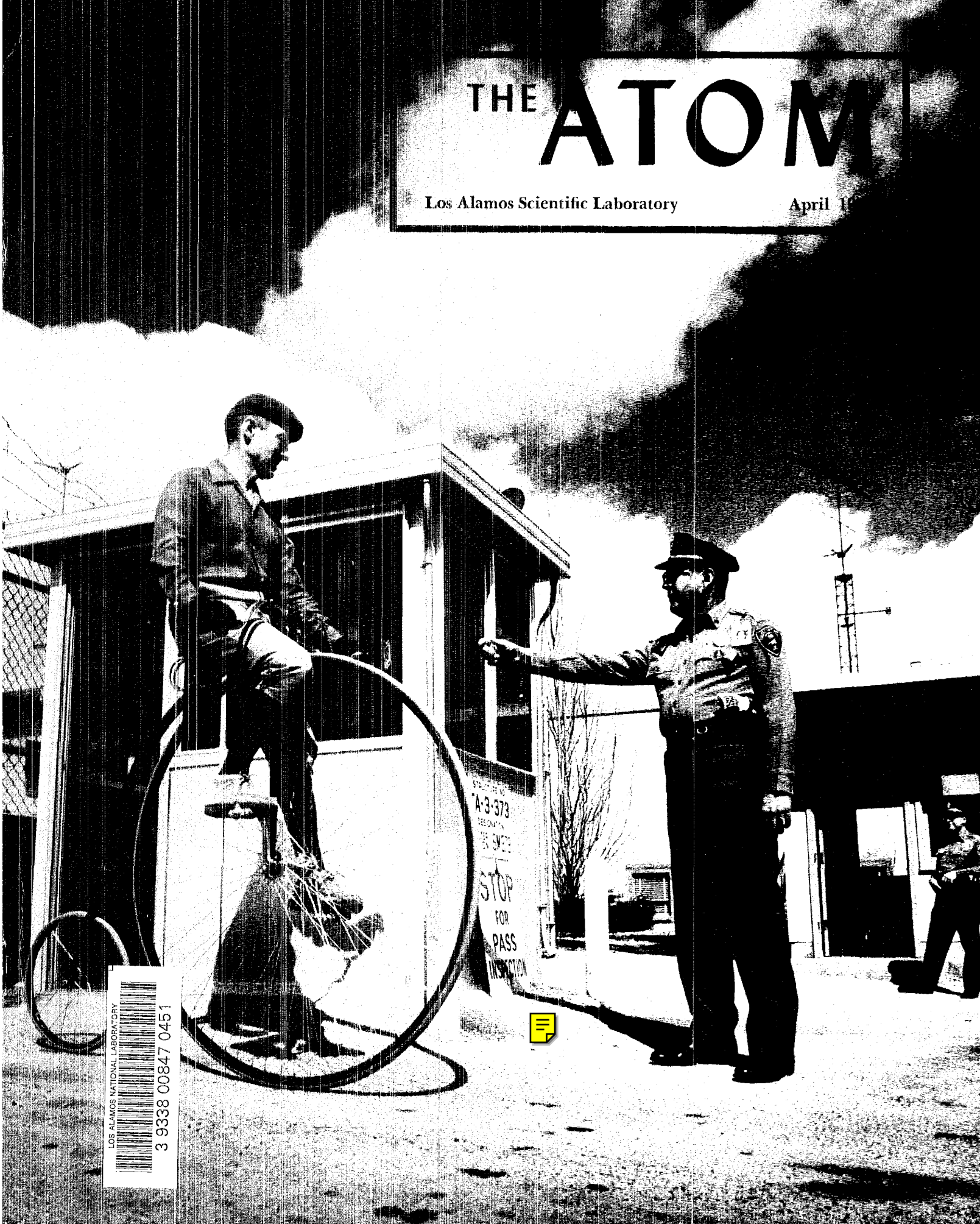
THE ATOM

Los Alamos Scientific Laboratory April 1



Volume 10 Number 3
April 1973

THE ATOM

Published monthly except for July-August and January-February issues by the University of California, Los Alamos Scientific Laboratory, Office of Public Information, P. O. Box 1663, Los Alamos, New Mexico 87544. Second Class Postage Paid at Los Alamos.

CONTENTS:

Editor: Kenneth J. Johnson

Photography: Bill Jack Rodgers, Winfred Headdy and Henry Ortega

Office: D-442-B Administration Building. Telephone: 667-6102. Printed by the University of New Mexico Printing Plant, Albuquerque.

Los Alamos Scientific Laboratory, an equal opportunity employer, is operated by the University of California for the United States Atomic Energy Commission.

COVER:
The high-wheeling, historical and non-polluting "ordinary" bicycle, which decorates the cover, is ridden and owned by Bruce Stewart of Group J-10. The technician's grandfather bought the bike in 1888 and rode it in Lynn, Mass. It was passed down to Stewart's great-uncle, and then to an aunt, and, finally, to Stewart in 1948. The LASL employee stored the bike in Lynn until April of last year when he brought it to Los Alamos and restored it. "It was a rusty mess," Stewart said. "It's one of seven ordinary bikes, that I know of, in this state." At the request of Bill Jack Rodgers, ISD-7 photographer, Stewart rode his ordinary bike through the guard gate at LASL's main technical area for this photograph. Checking Stewart's badge is Percy Tapia. In background is Maniam Royer.

A 27-Year Study of Plutonium in Man

Most of what is known directly about the long-term behavior of plutonium in the human body has been learned through a continuing study of 25 men who were heavily exposed to plutonium during World War II. These men, who were engaged in processing plutonium prior to fabrication and testing of the world's first atomic bombs, at what is now the Los Alamos Scientific Laboratory, have been followed medically for more than 27 years.

"To date, there have never been any radiation-induced effects in man that have been attributed to plutonium," said Chet Richmond, alternate H-Division leader. "These men aren't experiencing any adverse effects from plutonium either, and after 27 years we don't think there will be any. Most of them are successful business executives who lead perfectly normal lives. Except for the ailments you would expect to find in men in their 50's, the early plutonium workers are in remarkably good health."

Richmond is one of three co-authors of a recent report on the study. The others are George Voelz, H-Division leader, and Louis Hempleman who was H-Division leader at the Laboratory during the war years and until 1948. Hempleman is presently a professor of experimental radiology at the University of Rochester, N.Y.

"Statistically, the number of people being studied is probably too small to have any impact on plutonium protection standards. But, the study gives us some reassuring evidence that the standards derived for plutonium probably are correct. One of the early plutonium workers now has a body burden 10 times the present occupational permissible body burden. He's held it for 27 years and he hasn't had any health problems because of it.

"The subjects of this study have given us an early opportunity to learn something about latent effects of plutonium in humans. Information from animal studies has been applied to humans, but data derived from humans themselves is still the most relevant kind of information, even if it involves only a small number of people.

"We're trying to identify other people whose exposure to plutonium has been more recent so that we can improve our statistics. The information that can be obtained from humans becomes more and more useful when you think about it in connection with projections of the amounts of plutonium that will be produced in the future."

Richmond pointed to published projections which show that the amount of plutonium produced and in use, in connection with the production of electrical power, is expected to quadruple by the end of the century, going from approximately 20,000 kilograms a year to 80,000. Other areas in which plutonium use would be expected to multiply are in the medical field and in the development of power sources used in the exploration of space. Considerable amounts of plutonium are already being produced in the production of electrical power and for several research programs by contractors of the Atomic Energy Commission. Included are programs to develop plutonium heat sources to power artificial hearts, cardiac pacemakers, and to improve plutonium heat sources already being used to power generators aboard spacecraft such as the Pioneer satellites, which are being used to study planets within our solar system and phenomena in outer space.

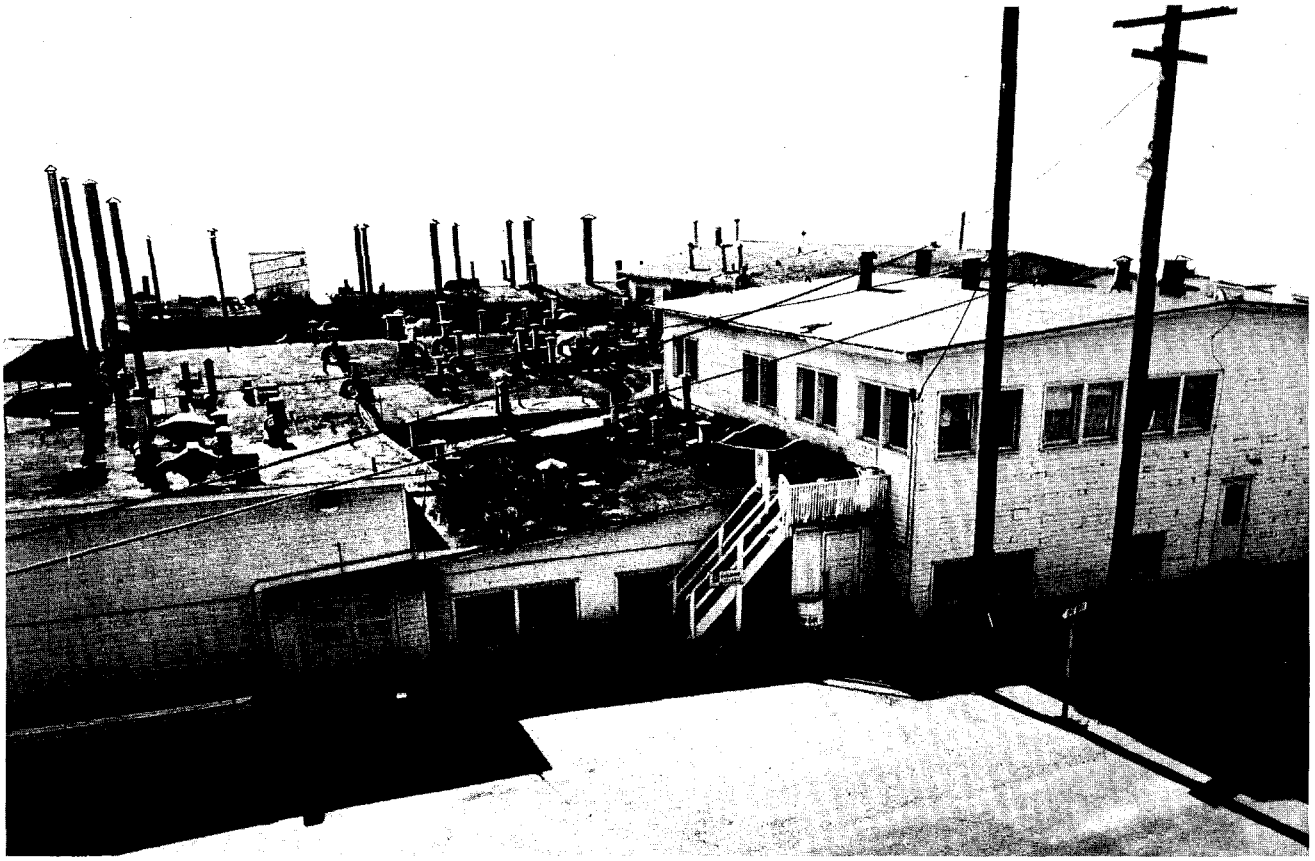
"We've been trying to keep a leading edge on gadgetry to measure plutonium and other transuranium elements in vivo (in place)," said Richmond. "I believe the detection system we have for workers at the Laboratory today, is the best in the country.

"In the early days at Los Alamos, plutonium workers didn't have anywhere near the degree of protection that we have now. Working conditions were deplorable by today's standards. Sophisticated air samplers, radiation counters and other monitoring and protective systems simply hadn't been developed, or they were having their crude beginnings."

Safety regulations established for plutonium workers at Project Y were based on previous experience with radium, and on biological experiments conducted with plutonium. Some of the first plutonium produced had been dedicated to the biological experiments by Glenn Seaborg, one of the element's discoverers, who recognized the similarities of the radioactive properties of plutonium and radium. Radium, an extremely toxic element, had caused bone cancer in many workers in the radium-dial painting industry of the 1920's.

"However, to be aware of the potential biological hazards of plutonium and to protect against

continued on next page



Chemists and metallurgists in CMR-Division did their work in "D Building."

them were two entirely different matters," Hempleman, Richmond and Voelz stated in their recent report. "Safety regulations could be established on the basis of experience in the radium-dial paint plants, but protection problems in the two cases differed by many orders of magnitude. (Milligrams of radium in watch plants were subjected to simple mechanical operations, whereas at Los Alamos, kilogram quantities of plutonium were involved in complex chemical and metallurgical manipulations). All work with plutonium was carried out in the wooden Chemistry and Metallurgy Building called 'D Building.' Stringent safety regulations put into effect included (a) a complete change of street clothing on entrance to contaminated areas with two changes per day of freshly laundered coveralls, canvas bootees, and surgical caps (all persons showered before leaving the building); (b) use of surgical rubber gloves and respirators . . . during all chemical procedures involving plutonium and (c) whenever possible, use of closed systems (at first homemade dryboxes with rubberized canvas sleeves attached to surgical gloves). Sometimes it was impractical to use a closed system and chemical hoods had to be used (not made of stainless steel in the early days). All workers were fully apprised of the hazards of plutonium (as they were then known) and were required to sign a statement saying they would abide by the safety rules. With rare exceptions, the workers cooperated to the best of their ability, although during the tension and feverish activity of developing the first atomic weapons it was difficult to avoid some shortcuts in the observation and enforcement of safety rules.

"When milligram quantities of plutonium first became available to Los Alamos chemists and metallurgists, efforts to live with what was considered to be safe contamination levels was hampered by the fact that portable alpha counters and continuous air samplers had not yet been developed. However, because of the urgency of the times, work with plutonium had to proceed, and improvised methods of monitoring and de-

contamination were unbelievably primitive by today's standards."

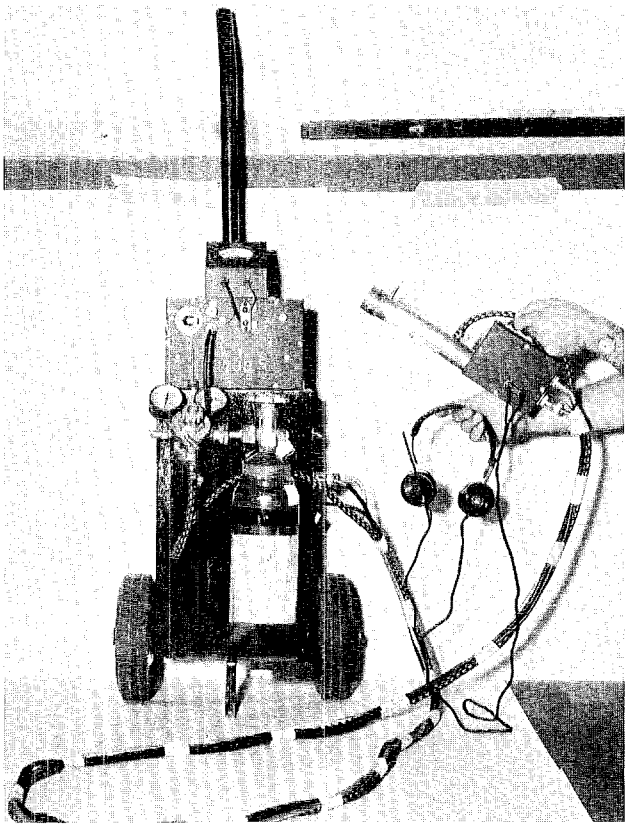
In the absence of portable alpha counters, "swipes" were taken with treated filter paper of laboratory surfaces most likely to be contaminated and of the nostrils of the plutonium workers. The filter papers were taken to stationary counters for counting. Any swiped laboratory area having an activity of more than 500 counts per minute required decontamination, and if a man's nose swipe exceeded 50 counts per minute he was questioned carefully about possible accidental inhalation or breaching of safety regulations.

The next year, in April of 1945, when kilogram quantities of plutonium began to arrive at Los Alamos, portable alpha counters and continuously operating air samplers were being used in certain laboratories. Other equipment, including air lines in some laboratories and specially made positive-pressure masks, had been improved, and a urine assay method had been developed that allowed crude estimates to be made of plutonium body burdens. All work with plutonium was stopped in August of 1946 until the new processing facilities at DP Site were opened the following month.

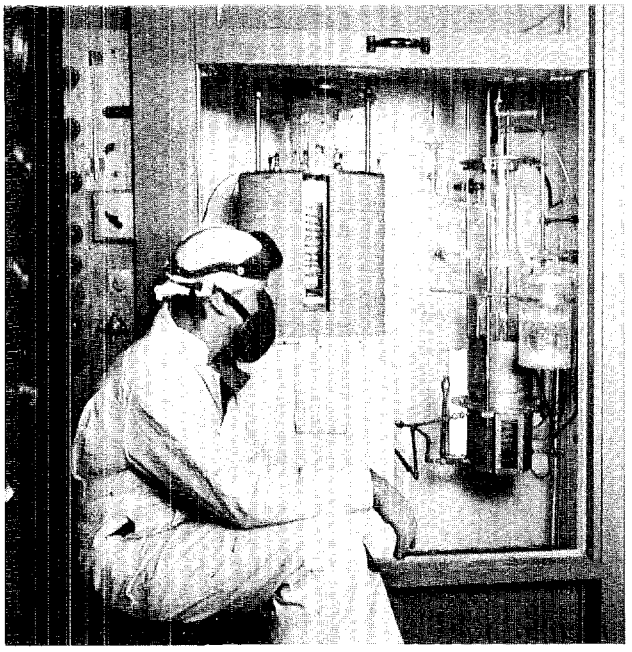
Most of the 25 subjects participating in the long-term study worked in one of four groups between March of 1944 and September of 1946. A majority, 14, worked in what was called the Recovery Group. This group was charged with recovering the then priceless plutonium from a variety of materials, usually related to processing procedures, and then converting it into a state that could be put back into the processing chain. Types of materials from which the group recovered plutonium included analytical residues, washings, metallic scraps, shavings, trimmings, crucibles used in plutonium processing, rags used to wipe up accidental spills, graphite tubes used in oxygen analysis, and drybox and chemical-hood sweepings. The most dramatic of the accidental spills that required the services of the Recovery Group was in May of 1944 when the entire world's supply of plutonium at that time—eight grams—was spilled on the floor. Some of it was recovered by mechanical suction, but the remainder of the plutonium was recovered from the contaminated asphalt tile slabs torn up from the floor.

Groups in which other of the subjects worked were Plutonium Purification, Plutonium Fluorination, and Plutonium Reduction. The Purification Group used wet chemical methods to purify

continued on page 5



This semi-portable alpha counter, called "Supersnoop," was used at the Laboratory in early 1945.



An early plutonium worker, wearing standard protective clothing and respirator, performs one of the steps in the purification operation in an open chemical hood.

The photographs on this page and page five were taken during a social event while a majority of the early plutonium workers, included in the 27-year study, were in Los Alamos for the latest of the series of medical examinations. Above, the late Wright Langham, assistant H-Division leader for biomedical research, second from right, talks with early plutonium workers George Bernstein, Park Forest, Ill.; Theodore Magel, Corapolis, Pa.; and Donald Hirsch, Oklahoma City, Okla. In background are N. S. Dallas, Oak Park, Ill., and Langham's wife, Julie, a member of Group H-4.

In foreground are Phil Dean, H-10, and Chet Richmond, alternate H-Division leader. In background are Harold Long, Avon Lake, Ohio, Bernstein and Donald Klein, Santa Ana, Calif.

plutonium produced at Oak Ridge and Hanford. The Fluoride Group converted plutonium oxalate, prepared by the Purification Group, to oxide and then fluoride. The fluoride was reduced to metal by the Reduction Group and then shaped as required for use in the first atomic bombs.

The late Wright Langham who later became assistant H-Division leader for biomedical research at LASL, organized a kind of exclusive "club" whose eligibility requirements could only be met by the early, heavily-exposed plutonium workers, and under his direction the long-term study of the effects of plutonium began. Its beginning was supported by medical records and reports corresponding to the times when the men worked with plutonium at the Laboratory, and by additional information obtained later from talks with supervisors and health monitors.

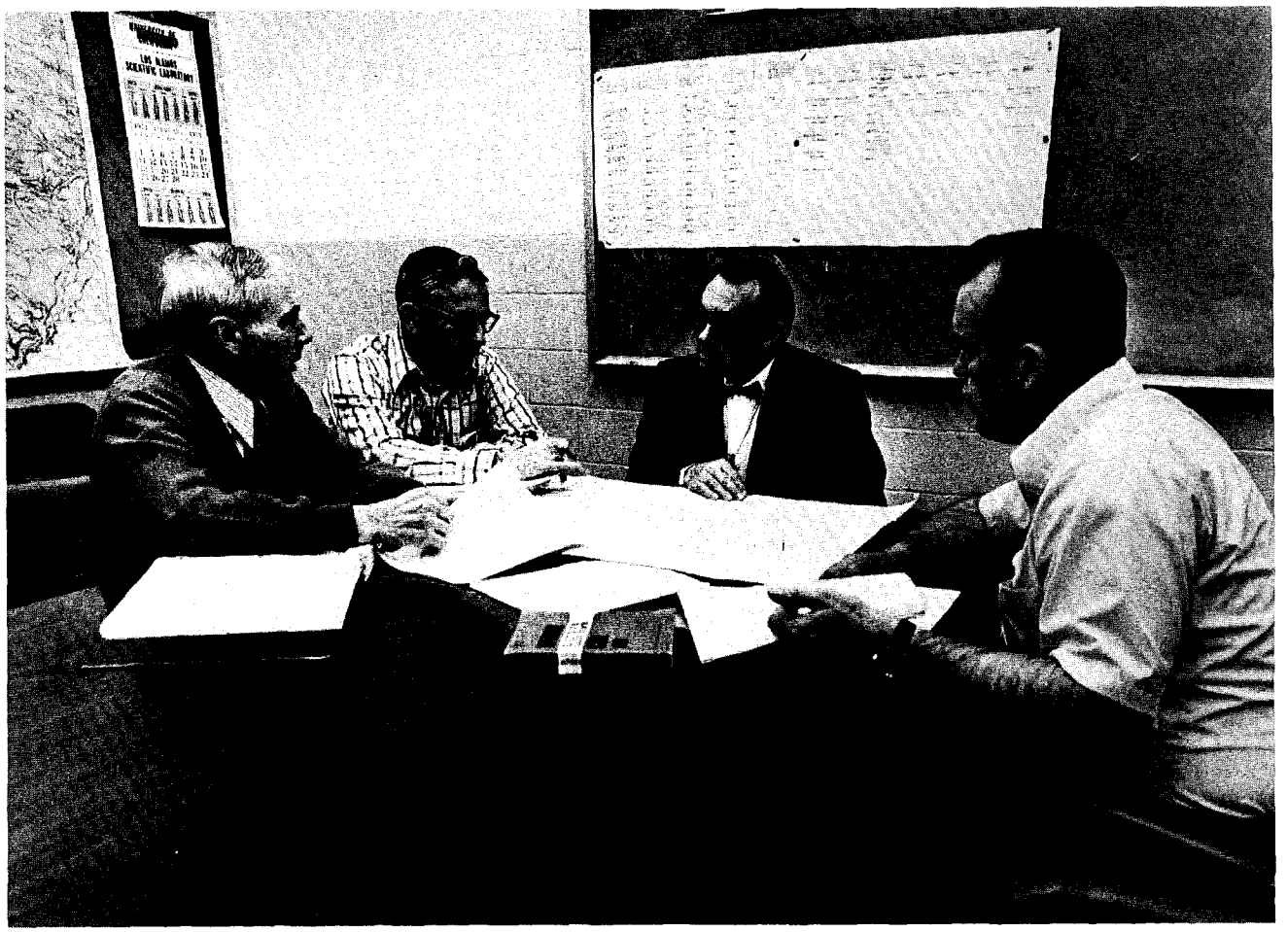
In 1953, the Atomic Energy Commission funded the program to periodically conduct medical examinations. Physicians associated with the Atomic Energy Commission conducted examinations of 22 men in 1953 and all 25 in 1955. Family physicians of the early plutonium workers conducted examinations of all 25 in 1960, 17 in 1966 and 24 in 1970. By far the most comprehensive examination was conducted at Los Alamos in late 1971 through early 1973 when 24 of the men received examinations. These were conducted, for the most part, by technical personnel at the Los Alamos Scientific Laboratory, although, certain technical assistance was received from physicians at other medical facilities, including the Los Alamos Medical Center, the University of Utah and St. Mary's Hospital in Grand Junction, Colo.

In their report, written shortly after the most recent medical examinations of the early plutonium workers, Hempleman, Richmond and Voelz concluded: "Comparing the minute quantities of plutonium deposited in the body (excluding the lungs) with the large amounts to which the subjects had been exposed, we can only conclude that the gastrointestinal tract has a remarkable ability to exclude plutonium from entering the body. Had plutonium been as readily absorbed as radium, all subjects would unquestionably have lethal body burdens of radioactivity."

Louis Hempleman, center, professor of experimental radiology at the University of Rochester, N.Y., talks with George Voelz, H-Division leader, and Ogden Johnson, a plutonium worker during the war years, who still works at the Laboratory in Group H-4.

Recalling early events at Los Alamos are Charles Disney, Gary, Ind., Klein, Long and Bernstein.

Complying with OSHA



OSHA committeemen, headed by ENG-4's Everett Miller, second from right, discuss LASL areas inspected by the more than 140 Laboratory inspectors. Other committee members are Dan Pfaff, ENG-2, Clarence Courtright, H-3, and George Talley, H-5.

The Occupational Safety and Health Act, popularly known by its acronym, OSHA, was enacted by Congress "To assure safe and healthful working conditions for working men and women."

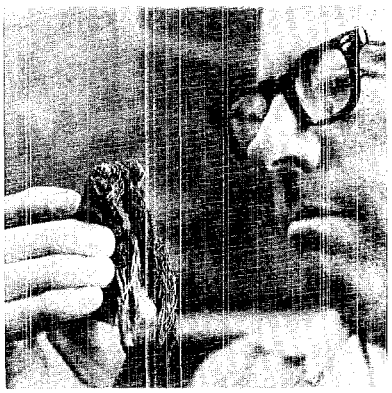
While there were safety and health standards applicable to most types of employment before OSHA came into being, compliance with them was not on a uniform basis. The Occupational Safety and Health Act is a mandate to all employers who are affected by interstate commerce. It brings together several existing safety and health standards and provides for the adoption, modification and development of others necessary to fully implement the intent of the Act.

State and federal government facilities were originally excluded from complying with OSHA. However, federal agencies, including the Atomic Energy Commission, have since been brought under the Act by executive order.

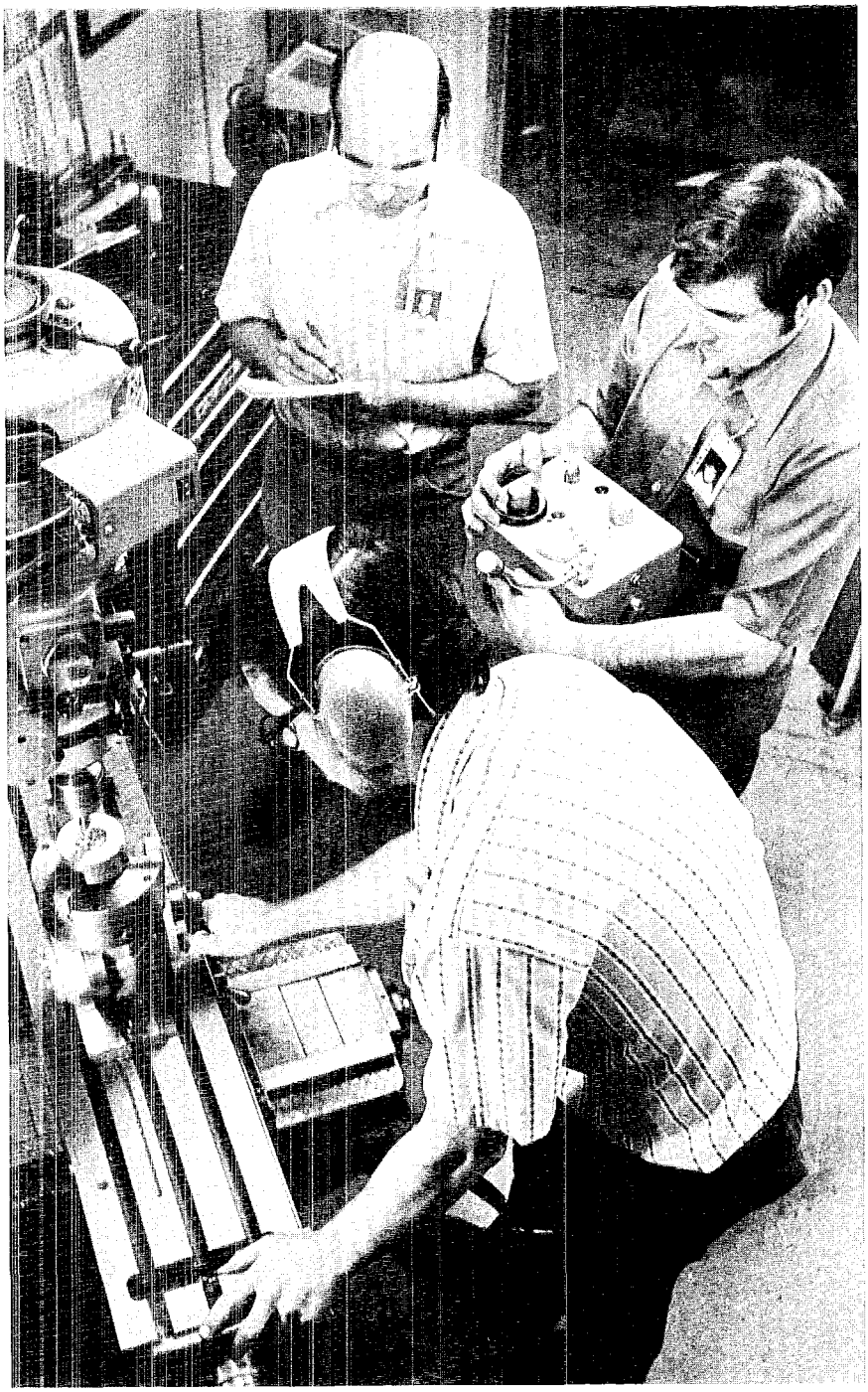
The Atomic Energy Commission has always had an aggressive and competently staffed safety and health program, and it has been instrumental in the formulation of highly specialized radiological standards. OSHA standards, however, vary somewhat from those adhered to by the AEC, and the Commis-

sion is expending considerable manpower to bring its facilities into harmony with the new Act.

In accordance with an AEC directive, an intensive, self-administered program to identify variances from OSHA standards began at the Los Alamos Scientific Laboratory in late August. More than 150 persons from the Laboratory, the AEC and the Zia Company have, so far, devoted a total of 15,000 man hours to it.



There is OSHA, but there is also oshá, points out Bill Davis of Group M-3, and both concern themselves with ". . . safe and healthful working conditions for working men and women." "The same letters, but with an accent, form the name of a plant whose root is considered in local folk medicine to be as universally effective as the other OSHA is by the Congress," Davis noted. "Many laborers will not work outdoors without a little oshá to keep away rattlesnakes. It is also supposed to be good for any kind of infection."

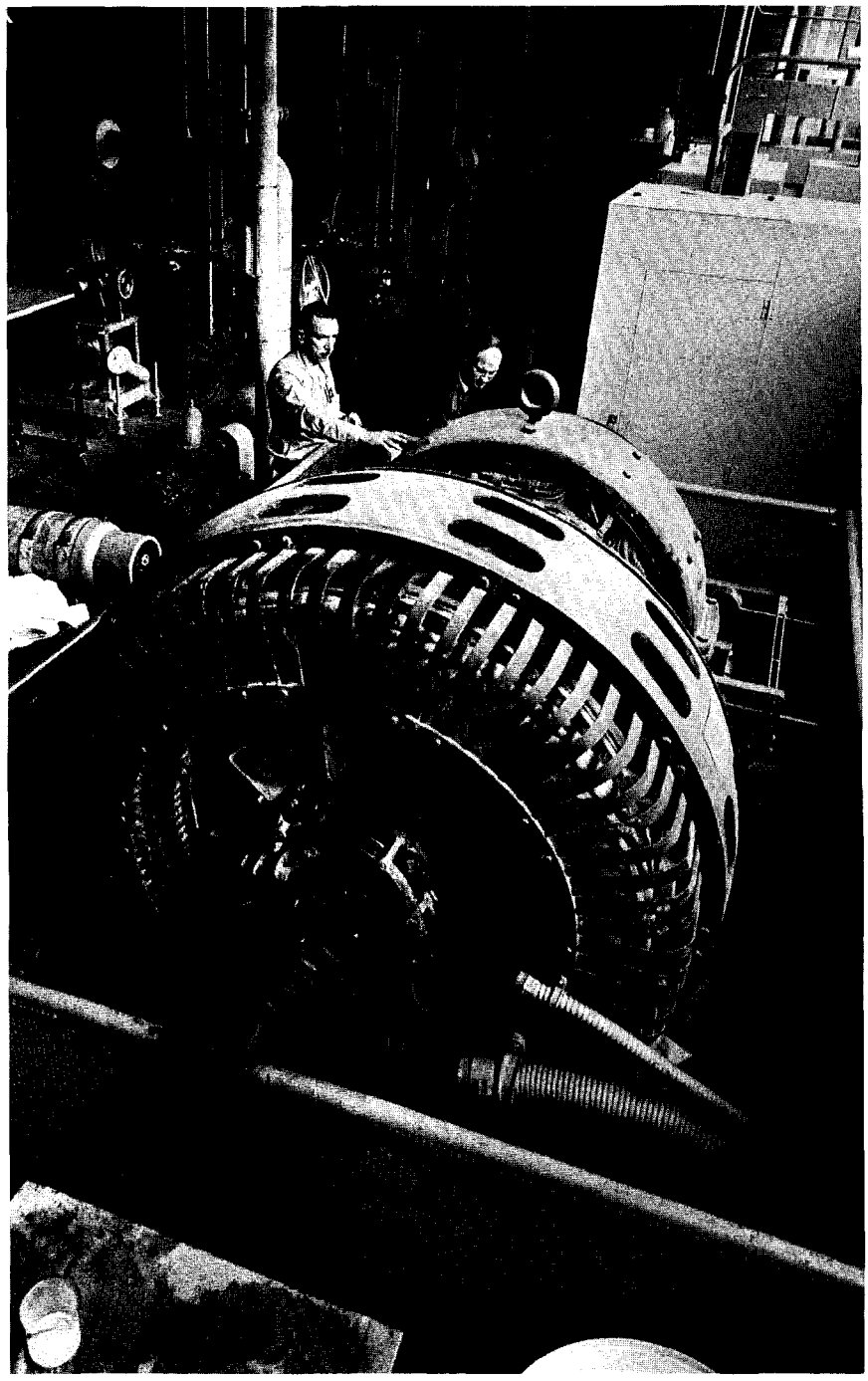


Jose Bustos and John Ortiz, with sound-level meter, measure and record noise level in a machine shop. Bustos, Ortiz and Don Gettemy, operating the milling machine, are all members of H-5.

The OSHA program at the Laboratory was organized under an ad hoc group composed of George Voelz, H-Division leader; Philip Reinig, Engineering Department head; Charles Reynolds, ENG-4 group leader; Roy Reider, H-3 group leader; and Harry Schulte, H-5 group leader.

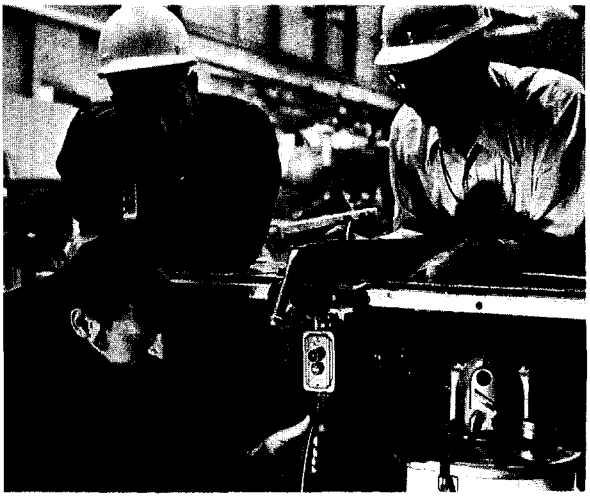
A four-member OSHA Committee was created to provide guide-

continued on next page



Inspectors Harry Williams, ENG-4, and Harry Mydock, the Zia Company, inspect safeguards, including fence, on a synchronous power generator.

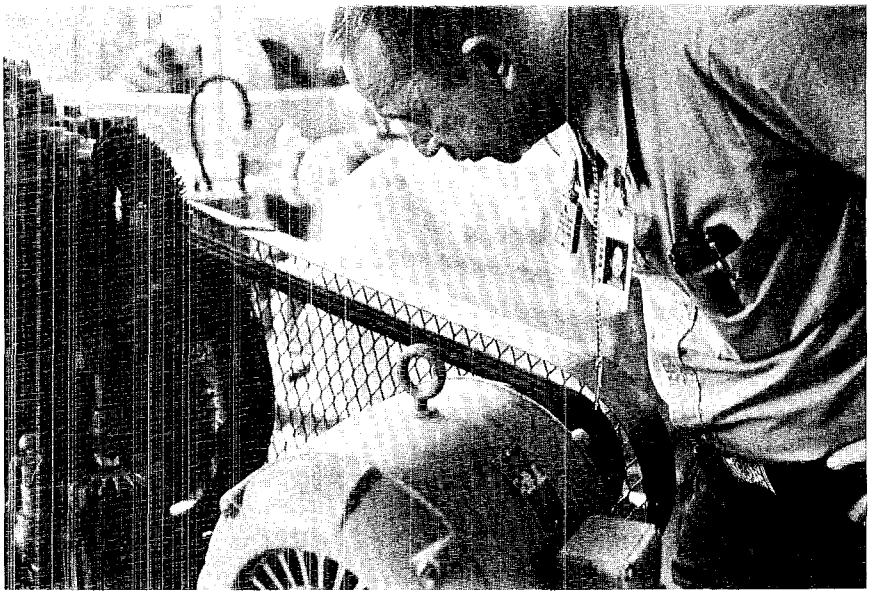
Mydock, Don Williams and Marion Clevenger, all of the Zia Company, inspect safeguards on a table saw. Mydock notes frayed cord.



lines for the inspection, reporting and recording of LASL variances, and to provide overall supervision and administration of inspections. This committee is led by Everett Miller, ENG-4. Other members are Clarence Courtright, H-3, George Talley, H-5, and Dan Pfaff, ENG-2.

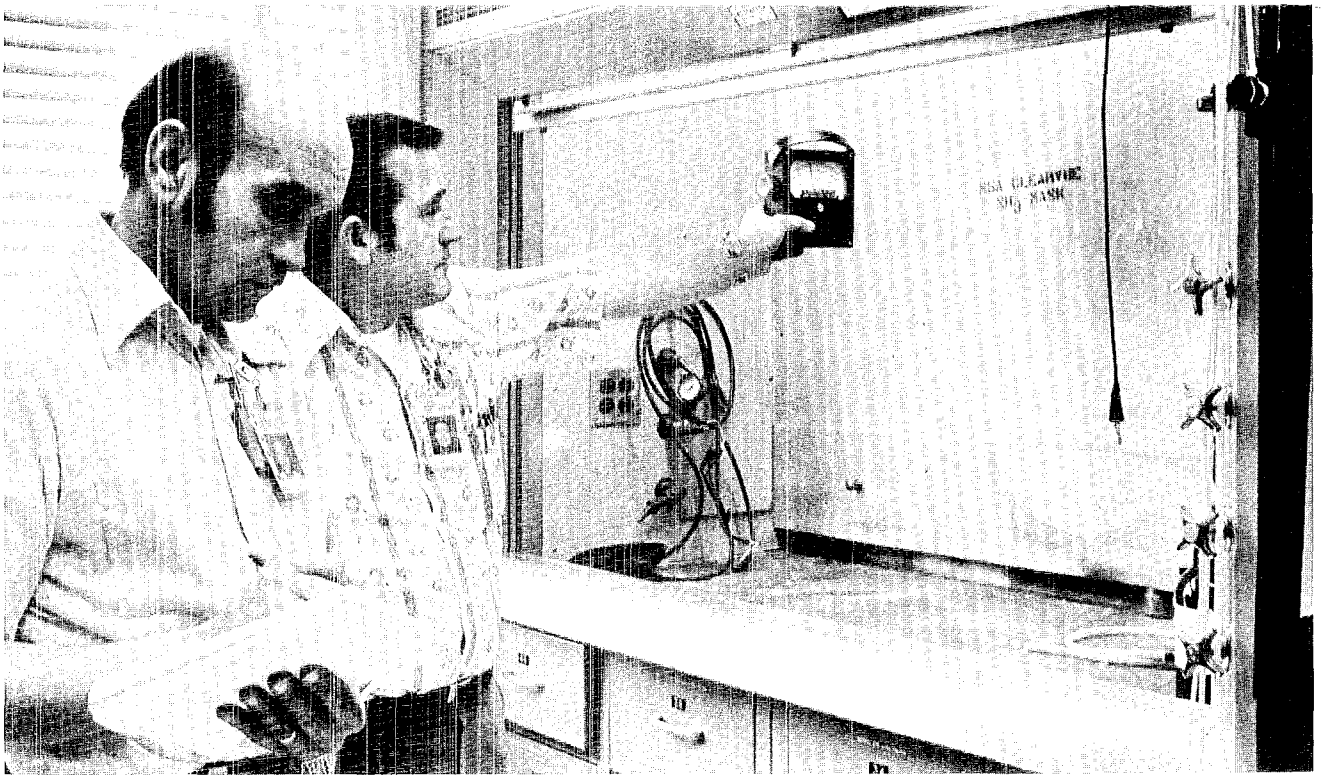
Thirteen coordinators, working under assigned OSHA Committee members were selected to train and direct the actions of field inspectors who physically identified specific OSHA variances, listed their locations and estimated correction costs.

There were more than 140 inspectors, working in teams of two each, who were assigned to specific items and specific areas. Of the 19 subparts of the applicable section of the Occupational Safety and Health Act, 14 apply to the Laboratory, and they required the inspection of myriad pieces of equipment and facility components ranging from the most simple to highly complex. The inspectors examined hand tools, electrical cords, power-tool guards, door hinges, air compressors, power generators, exhaust



Williams inspects an air compressor which has no belt guard on back side. "By previous standards, it was all right," said Everett Miller. "By OSHA standards, it's not."

Measuring the air velocity in a chemical hood are Bustos and Gilbert Ferran, both of H-5.



hoods, computer components, floors and sidewalks, fire extinguishers, respirators, protective clothing, medical and first aid supplies, storage areas and a seemingly endless number of other items.

"It was an all-out effort to meet the Dec. 31 deadline imposed by the AEC," said Miller. "We were asked to determine what can be corrected with present funding, what requires additional funding, and in what areas might we apply for exemptions because what we're doing may be as safe as being in compliance with OSHA standards.

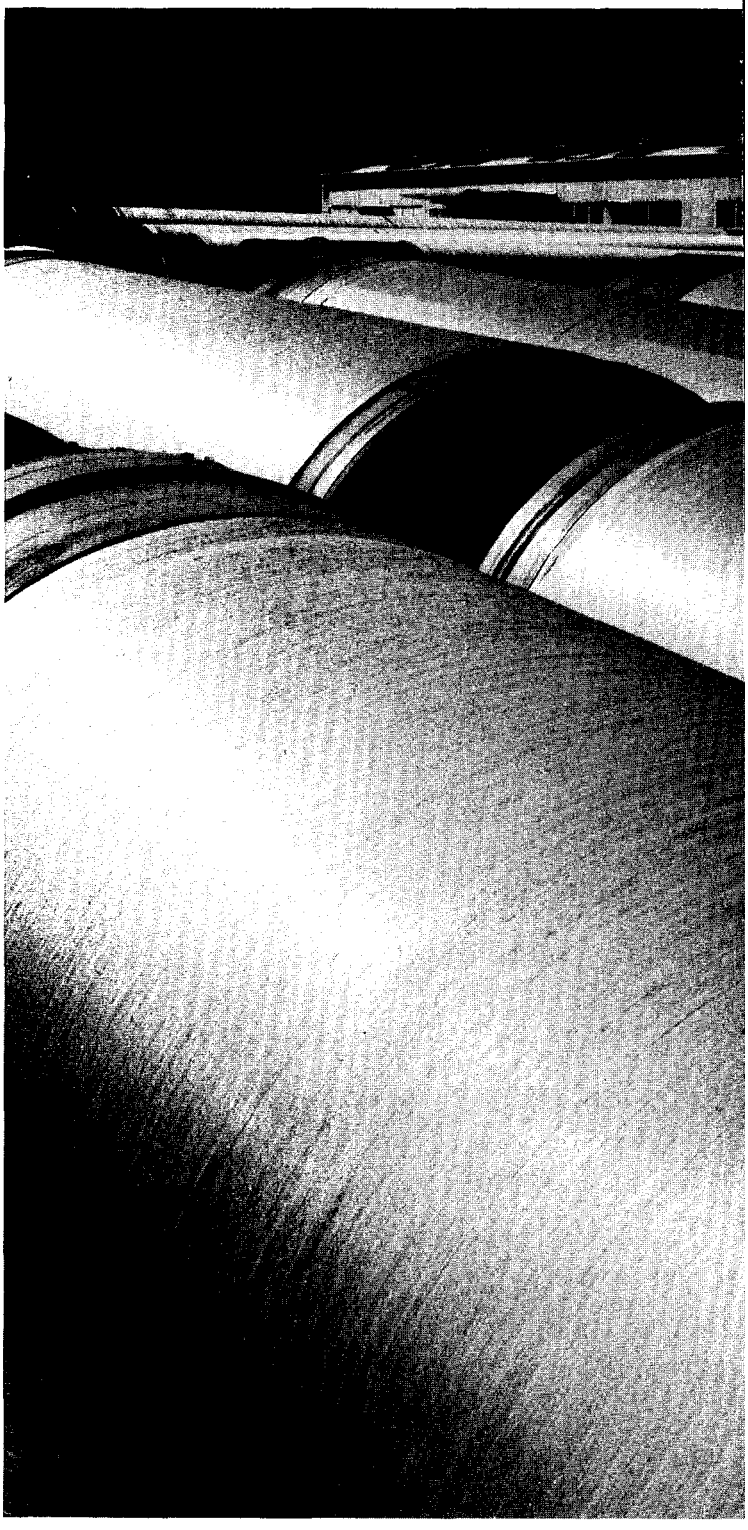
"Other departments and divisions that assisted in the survey included CNC, CMB, E, J, L, M, MP, N, P, WX, Shop, Supply and Property, and, also, the Zia Company and AEC.

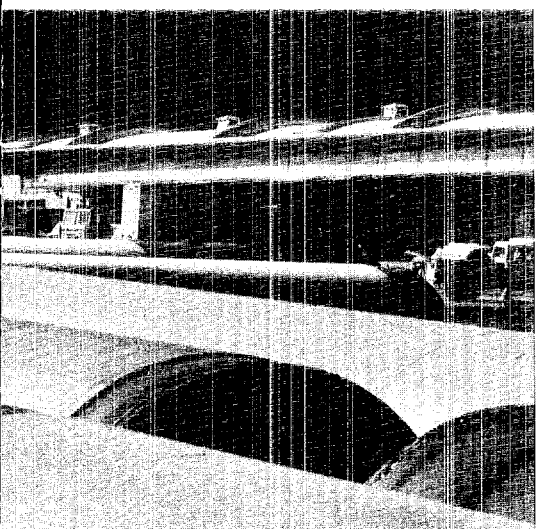
"We met the deadline but it doesn't stop there. We hope to establish a permanent OSHA Committee at the Laboratory to constantly update LASL-facility inspections, and to assure that as standards change, or new ones are added, our inspection procedures are changed accordingly."

Photo Shorts

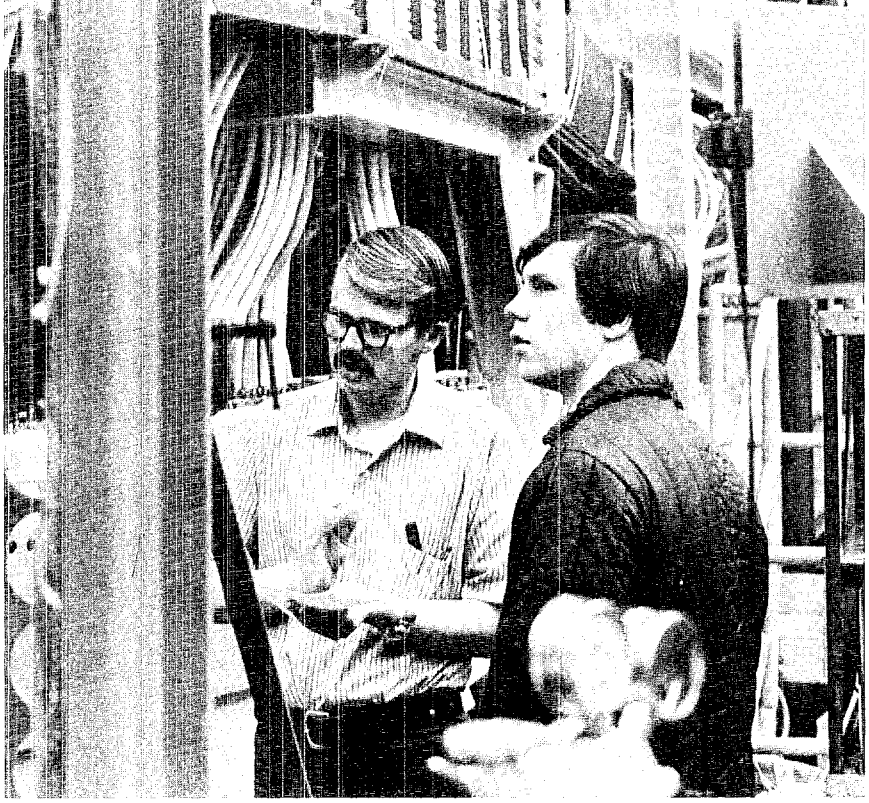
Walter Loridon, Belgian ambassador to the United States, and his wife, toured the Bradbury Science Hall during a recent visit to the Los Alamos Scientific Laboratory. Assistant ISD-2 Group Leader Bob Brashear, who guided the Loridons through the Hall, explains the principle of the subterrene, a rock-melting device being developed at LASL.

Two hogs were recently transferred from the Los Alamos Scientific Laboratory to the Cooperative Extension Service in Albuquerque where they will be used in 4-H projects. Blood samples, occasionally taken from the hogs were used at the Laboratory in a project to develop antibodies for trichinosis. "They were just too big and too cantankerous to work with anymore," said Marty Holland, left, of Group H-4.



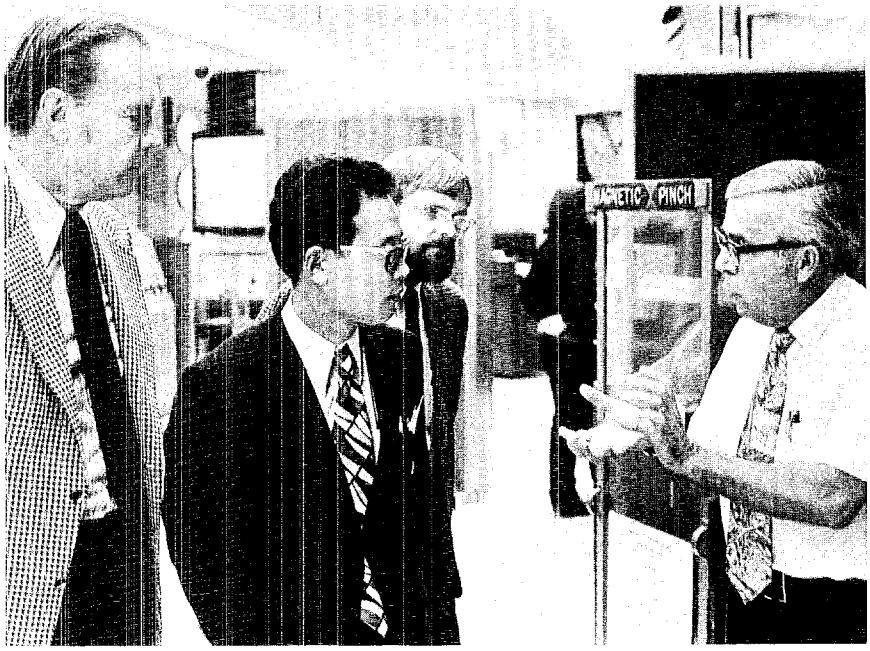


Thirty fiberglass-coated, steel, surplus cylinders have been delivered to the Laboratory from the Nevada Test Site. Each cylinder weighs about 11,000 pounds and is eight feet in diameter and 30 feet long. They will form part of a 200-meter tube to be used in making neutron time-of-flight measurements at the Weapons Neutron Research Facility, which will be built near the Clinton P. Anderson Los Alamos Meson Physics Facility.



Ken Hanks, P-16, guides Douglas Rupp, Belen, N.M., through Scyllac facilities at the Los Alamos Scientific Laboratory. The Scyllac tour was a part of the "Day at the Los Alamos Scientific Laboratory" Award, won by Rupp, a high school student, at the 1972 Northwestern New Mexico Regional Science Fair.

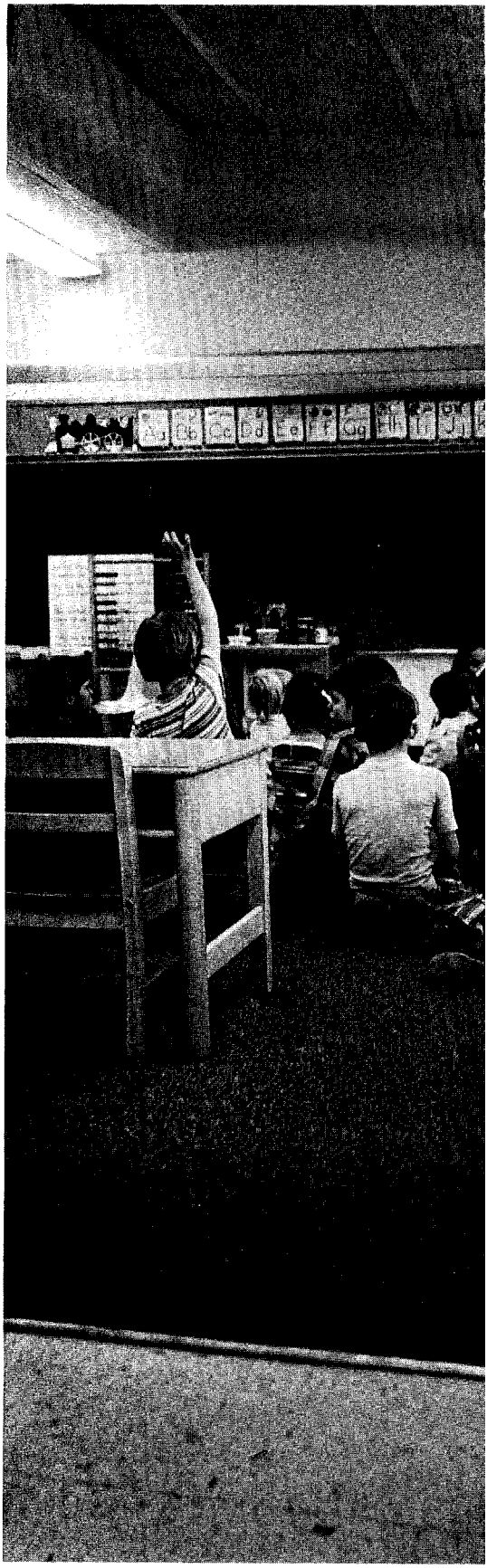
As part of an orientation on activities conducted at the Los Alamos Scientific Laboratory, Maruo Motoyoshi, of the Japanese Atomic Energy Bureau, Tokyo, toured the Bradbury Science Hall. Accompanying him were Delbert Sundberg, head of LASL's Information Services Department, and Bob Masterson, alternate department head. Explaining exhibits of interest is Bob Brashear, assistant ISD-2 group leader.



Los Alamos Daddies Go to First Grade

by Barbara Storms

Mrs. Eleanor Rhea, sitting at the back of her classroom at Pinon School, watches, over the heads of her sixth graders, as a student's father discusses his hobby with the youngsters.



Joe DiMarco, a member of LASL Group P-14, demonstrates the use of camping gear for students in Mrs. Rhea's class.

DiMarco, flanked by his daughter, Donna Marie, shows the first graders his collection of fishing flies.

Uncommon quiet pervades the room. The visitor stands before 25 eager six-year-olds, and beside him, his own child beams with pride.

Daddy has come to first grade.

Mrs. Eleanor Rhea, now at Pinon School in White Rock, has offered this memorable experience to each of her first grade pupils since she began inviting fathers to the classroom 15 years ago.

"The main idea is to get Daddy into the classroom," she said. "It gives the child an opportunity to show off his father, and the father establishes his own special identity with the children."

"Fathers don't participate much in school activities in the early years and the children become accustomed to seeing only teachers and mothers," Mrs. Rhea continued. "When a man comes into the room its a special treat."

Mrs. Rhea, who has been with Los Alamos schools for 26 years, began her program at Canyon School in Los Alamos with the appearance of Frank Harlow, now T-3 group leader at the Los Alamos Scientific Laboratory.

"We had been taking the children down to visit Maria Martinez, the famous potter, at San Ildefonso each year," Mrs. Rhea said. "Then someone mentioned that Mr. Harlow, the father of one of my pupils at the time, had an outstanding collection of old Indian pottery. He invited the entire class to his home to see it, and he did it again for each of his children."

From time to time other parents were invited to share special knowledge or interests with the children. Mrs. Rhea found the contributions so interesting, and the appearance of Daddy at school so exciting, that she eventually asked herself, "Why not invite every father?" and a tradition, unique in the Los Alamos school system, was established.

No second generation father has yet turned up in Mrs. Rhea's class,

continued on next page

The art of making and flying a kite was demonstrated by Don Lauer, a member of WX-3 at the Laboratory. Lauer's son, Greg, framed in hole in kite, helped with the demonstration.

she says, "but I'm watching for them.

"We've had some fantastic Daddies in here," Mrs. Rhea said. "It's hard to think of anything that hasn't been done, and I don't think we've ever had the same thing twice."

The fathers talk about their hobbies—including fishing, hunting, camping, water skiing, ice skating, stamp collecting, rock hunting, trains, boats, cars, folk dancing, skin diving, chess and music. They have demonstrated Ping-Pong, wood working, origami, tricks with string, and they have played all kinds of musical instruments. They show slides of trips and discuss everything from volcanoes in Hawaii to ice tunnels in Switzerland.

"You name it, we've had it," Mrs. Rhea declared.

Many fathers talk about their work. Policemen and firemen have appeared, and even a justice of the peace. Scientific experiments have provided many interesting programs. One Laboratory man's specialty is to startle the wide-eyed children by tossing a bucket of liquid nitrogen into the room only to have it dissipate before their eyes.

Although she has had to settle for grandfathers, uncles, big brothers and an occasional mother, Mrs. Rhea has seldom been turned down by her request for an appearance and, in fact, finds that fathers pitch in with enthusiasm.

"When we started at Canyon," she recalled, "everyone tried to outdo the previous father." But nobody, she claims, has ever topped one father whose work at the Laboratory involved high altitude flying.

"He came in, stripped to his skivvies, donned a space suit and talked to the children through his microphone," Mrs. Rhea said. "It was an unforgettable performance."

Most fathers are pretty apprehensive the first time they're invited, Mrs. Rhea said. "They're never quite sure what to do or how to act, but it's never difficult the second time around."

Mrs. Rhea recalls a particularly reluctant plumber who felt he had nothing to contribute until Mrs. Rhea suggested he explain how the children get a drink of water. "He described the entire process in detail and gave each child a piece of

copper pipe as a souvenir," she said. "The children were fascinated."

Fathers are given free reign in their choice of subjects but sometimes the discussion will expand into a school project. Learning that the first grade had already acquired some raw wheat, one father offered to bring his mill and show how to make stone-ground flour. The next parent, a substituting mother, used the flour to demonstrate bread making in the morning and returned in the afternoon to serve the finished product. Study continued in class and enabled the children to produce a farm-to-table chart for the science fair.

"Having his own dad in school is the high point in every child's school year," Mrs. Rhea said.

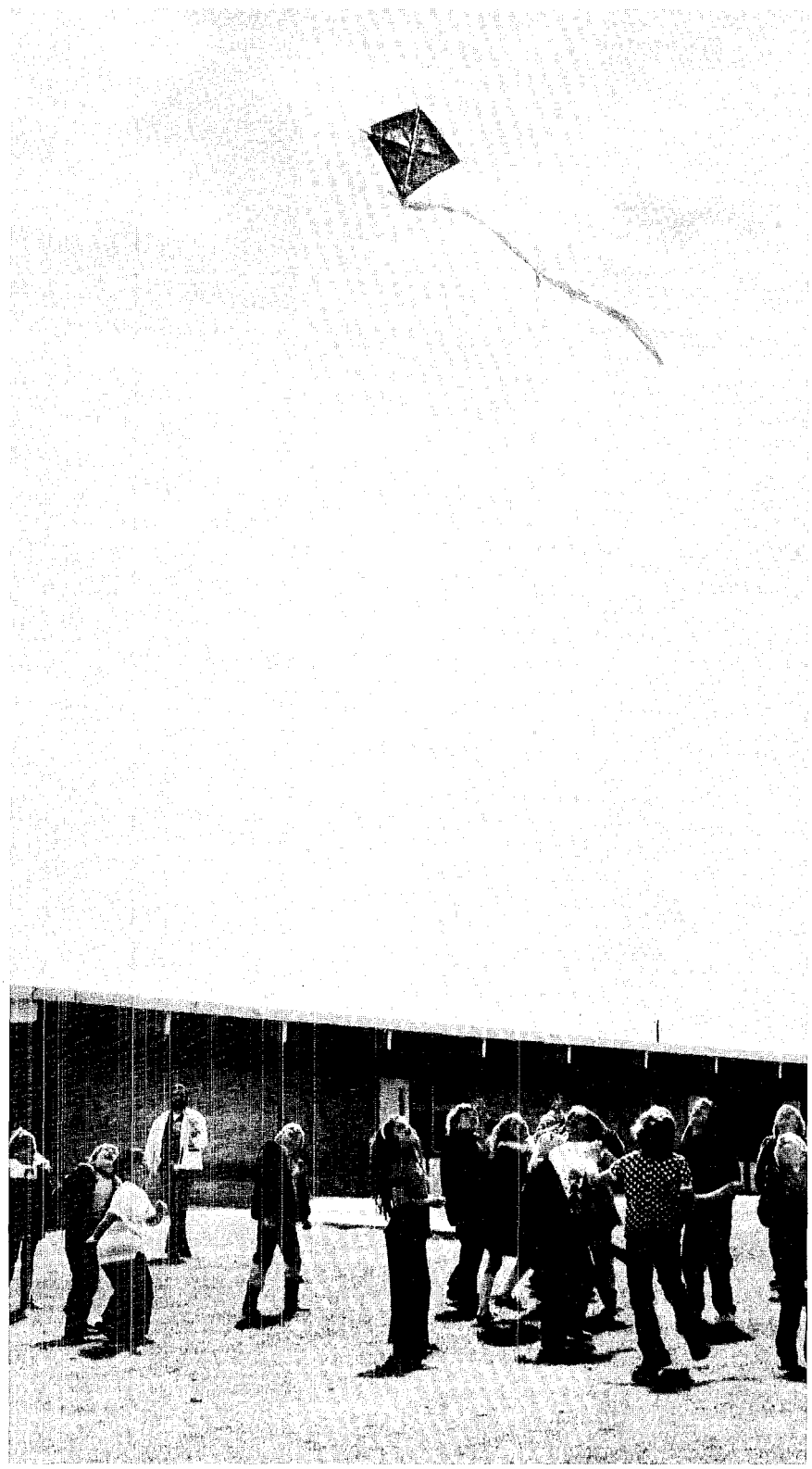
One child was so excited at the prospect of her father's appearance that "she was walking on air for two weeks, getting higher every day," Mrs. Rhea said. "When the big day finally arrived she awoke long before anyone else in her family and even laid out the clothes for her father to wear."

Mrs. Rhea once planned to cancel the appearance of a father whose child had been out with the flu for several days. But disappointment was avoided and the child showed up, pale, rocky and happy, just long enough to help her dad with his program.

"Of course, I would never let a father come to school without his child," Mrs. Rhea said. "That is essential."

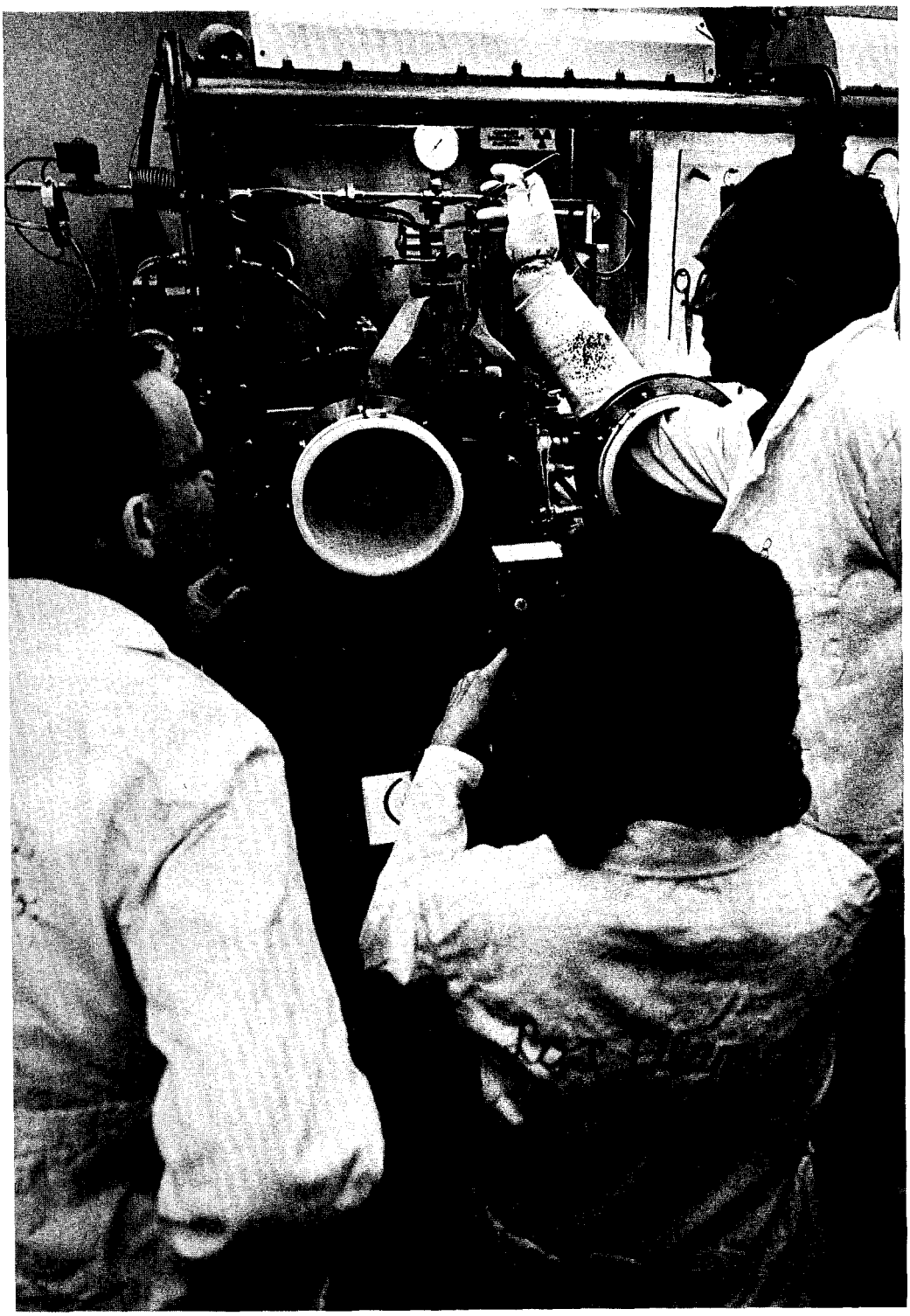
Another time Mrs. Rhea had to juggle her schedule to work in the father of a family who was moving away. "He came in and asked to be scheduled because he felt it was important and didn't want his child to be deprived," Mrs. Rhea said.

"I wouldn't give up my program for anything," Mrs. Rhea said, although from time to time it has been a temptation. It's a lot of work and I thought I might quit when I changed to Pinon five years ago, but my principal asked Mr. (Jim) Long at Pinon not to let the program drop."



Lauer, in background, shows the first graders that homemade kites, covered with newspapers, really fly.

New Plutonium Alloys by 'Splat Cooling'



The term "quenching" generally refers to the various methods used to rapidly cool materials. These methods are used in both basic research and commercial production to give metals special properties. Ordinary steel, for example, after being heated to a high temperature, is quenched in water, oil or brine to give it extra hardness and strength. The idea is that metals generally exhibit different structures which give them different properties within certain temperature ranges. By quenching, these structures can be locked-in and desirable properties retained at lower temperatures.

Another type of quenching, generally limited to use in basic research, is called "splat-cooling." Its name is derived from the behavior of hot liquid metals which are impacted at high velocity on a cold surface where they splatter and solidify. The splattered material is crudely analogous to drippings from a soldering gun which form irregular shaped foils or splats on the floor.

A modified splat-cooling apparatus has made significant inroads into the development of new plutonium alloys at the Los Alamos Scientific Laboratory. It was built and put into operation by Reed Elliott, CMB-5, and Alan Russell, a former LASL summer employee who is now a graduate student at Iowa State University. B. C. Giessen, a professor at Northeastern Univer-

Vernon Struebing, right, loads a small metal bead into the splat-cooling apparatus while Dana Douglass determines furnace temperature with a pyrometer. Operating power unit, left, is Reed Elliott. All three scientists are members of CMB-5.

Dana Douglass operates the electron-transmission microscope.

This electron-transmission micrograph magnifies the thin edge of a splat 76,000 times. Produced by Dana Douglass, it shows the microstructure of an alloy that is 77½ per cent plutonium and 22½ per cent cerium. Dark circle is a portion of the splat that is too thick to transmit electrons through.

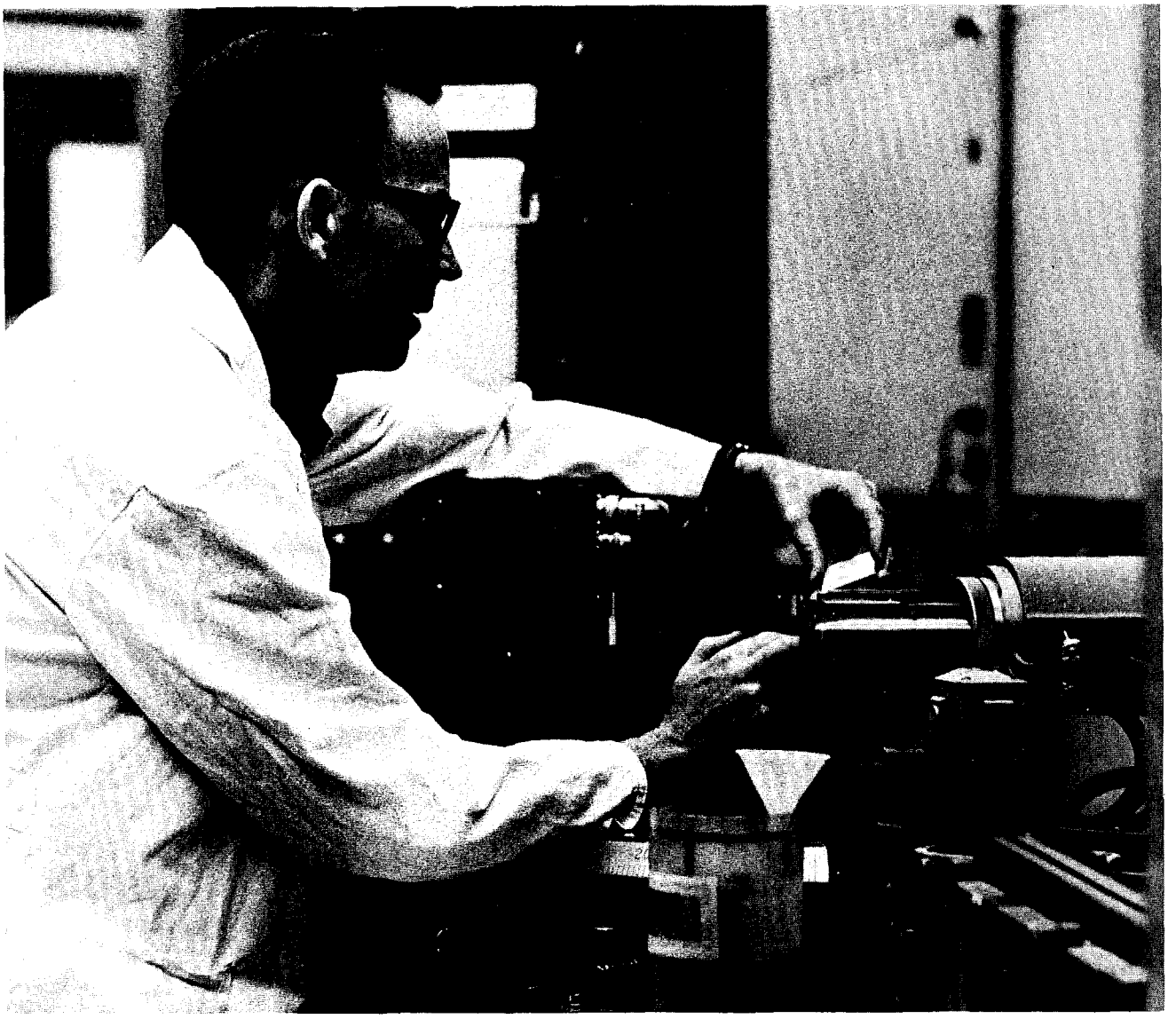
sity in Boston is serving in a consulting capacity on the project.

The apparatus has been used repeatedly to quench a high-temperature phase of plutonium that had never before been retained at room temperature. This was done by splat-cooling molten plutonium-titanium alloys.

The high-temperature phase of plutonium referred to is called "epsilon." It is one of six different crystal structure forms or allotropes of plutonium which occur within certain well-defined temperature ranges. At room temperature, plutonium exists in what is called the alpha phase. When it is heated to about 115 degrees centigrade, its atoms rearrange themselves to form a different crystal structure, the beta phase. Further heating to 185, 310, 452, and 480 degrees centigrade results in gamma, delta, delta-prime and epsilon phases respectively.

These are said to be the equilibrium phases of plutonium, but alloys may exist in so-called "metastable" or non-equilibrium phases.

continued on next page



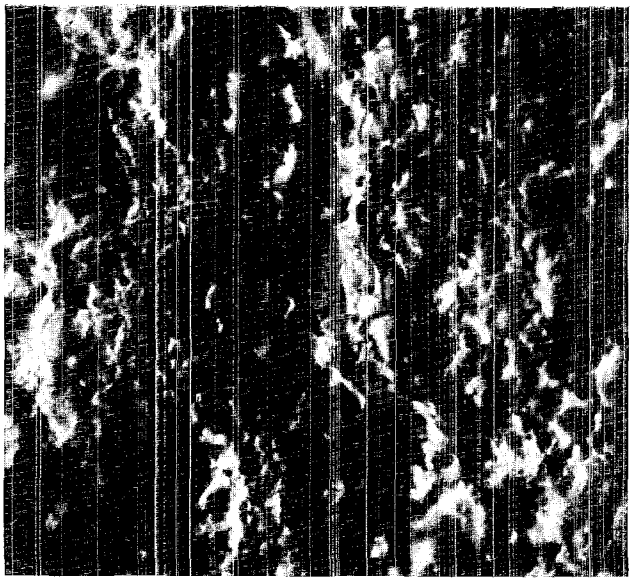
Reed Elliott loads a splat plate into an x-ray diffractometer for analysis of the alloy that is splat-cooled on its surface.

In this category, the splat-cooling apparatus has been used to form, and retain at room temperature, three new phases in plutonium-gallium alloys. In one, the alloy has been retained in a structureless glassy state. Another alloy has a cubic structure in which both the plutonium and gallium atoms occupy ordered positions. The third is a disordered structure that varies slightly from that of the delta phase.

In addition, two elements that are completely soluble only in the liquid state have been retained in solution in solid form at room temperature by the splat-cooling technique. Plutonium and cerium were heated to the liquid state and then cooled so rapidly that separation, which would normally occur, was suppressed.

Alloy foils produced by the apparatus are transparent to the beam of an electron-transmission microscope, an unexpected characteristic that has permitted scientists to actually "see" the internal structure of plutonium and its alloys for the first time. "The edges of the foils," Elliot said, "are thin enough for analysis by an electron-transmission microscope. We've never before had plutonium thin enough for this purpose."

"What this means," according to Dana Douglass, CMB-5 electron-



Scanning-electron micrographs produced by Arnie Hakilla, CMB-5, show surface topography of a plutonium-alloy splat, magnified 500 times, left, and 2,000 times, right. Micrograph at right shows detail in area at bottom center of micrograph at left.

transmission microscopist, "is that we've been able to look at and photograph the microstructure of plutonium for the first time by electron-transmission microscopy. We've never before had any success in looking at plutonium because it is so oxidation-sensitive. We've tried, but oxides have always obscured its fine structural details."

The scientists have been operating the splat-cooling apparatus for about a year. It consists of a high-pressure manifold, a shock tube, a small graphite-tape resistance furnace with integral crucible, and removable copper or silver splat plates. It is contained in a glovebox to protect operators against alpha radiation emitted by plutonium and other materials. The splat plate, furnace and crucible are contained within a cylindrical vacuum chamber.

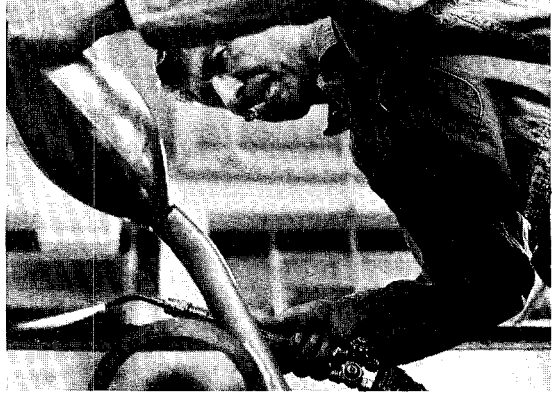
When operated, small metal beads, prepared by Vernon Struebing, CMB-5, are loaded into the furnace through an opening in the vacuum chamber. The beads are melted in the crucible which has a 1/32-inch-diameter hole in its bottom. Surface tension keeps the molten metal from falling through the hole until a shock wave is initiated that ejects the metal through the hole and onto the splat plate directly below the furnace. The shock wave is produced by the release of a small volume of helium at 2,000 pounds per square inch which ruptures a polyethylene diaphragm. The splat plate, cooled by liquid nitrogen, quenches the tiny droplets of metal almost instantaneously. The rate at which quenching occurs, according to Elliott, ". . . is hundreds of millions of degrees centigrade per second."

The splat-cooling apparatus is said to be a "repeater" because three plates can be loaded at one time and exposed individually. They are mounted on a bar-type device that is pushed into the base of the vacuum chamber so that one plate follows another, just as film frames succeed each other with respect to the lens of a camera.

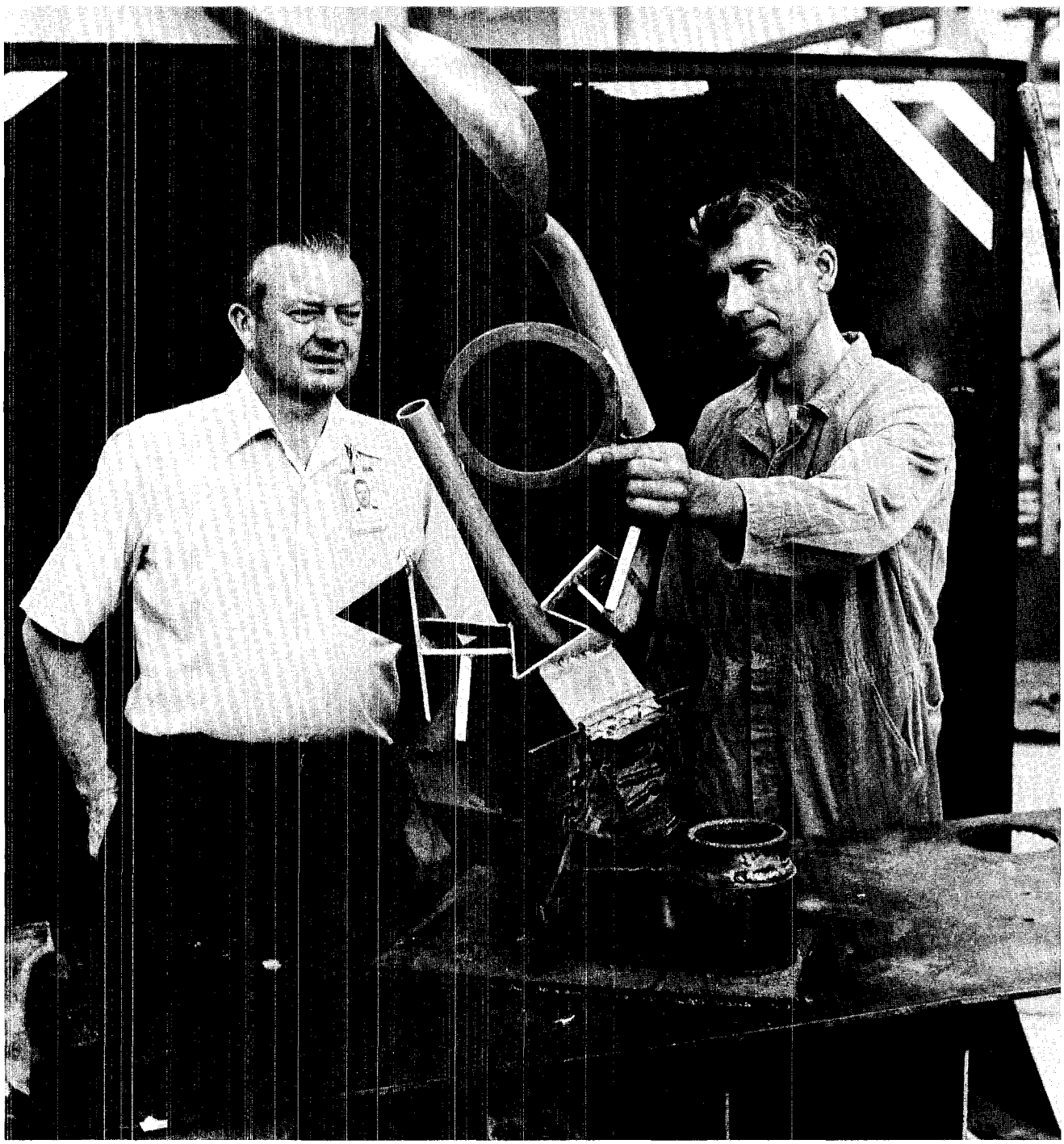
Following exposure, the plates are removed and sealed in polyethylene bags to prevent the spread of alpha radiation. The deposits are then analyzed by electron-transmission microscopy and x-ray diffraction. X-ray diffraction methods, used in the identification and solution of crystal structures through interpretation of diffraction patterns, are applied by Elliott.

"We believe that with the splat-cooling apparatus and our analytical procedures, we can determine methods for preparing plutonium alloys that will have unusual structures and strikingly improved properties," said Elliott.

The 'Welding Tree'



Below, the welding tree is "made up of pieces of scrap metal," according to Leo Crisler, CMB-6 Fabrication Section, shown with Section Leader Gale Hanks, left. Right, "We've kept it around to test new materials and joining techniques," said Crisler.

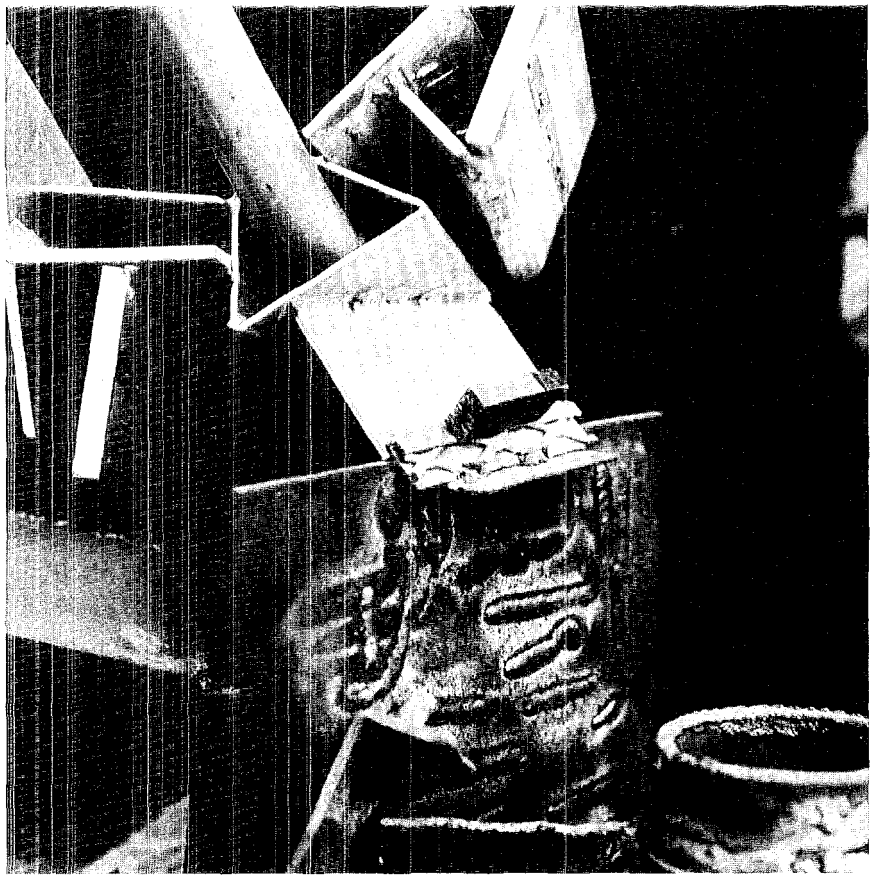


It's not an automatic football launcher and it wasn't intended to be an abstract sculpture. A better name for it might be the "welding tree."

The assemblage has been a fixture in the CMB-6 Fabrication Section for several years. "It's made up of pieces of scrap metal," said Leo Crisler, a member of the section. "When we had students working here during the summer, we taught them welding, soldering and other joining techniques on pieces of scrap metal rather than on something expensive that we were developing for the Laboratory. It's made up of several different metals—aluminum, steel, copper, brass—that are put together with different joining techniques.

"The students put it together several years ago. Since then, we've kept it around to test new materials and joining techniques. I read in an article a while back that welding steel to aluminum was being done. I tried it on this and it turned out to be a pretty good weld."

To Crisler, the welding tree is "just a pile of scrap" that's handy to have around when he needs it. But, to some who enjoy abstract sculptures—that's art.



Crisler tried joining steel (with x-pattern) to flat sheets of aluminum ". . . and it turned out to be a pretty good weld."

short subjects

Joe Trujillo, CMB-14, died March 7 at his home in Los Alamos. He is survived by his wife, Theresita, H-4, and three sons, Miguel, Patricio, and Carlo.

Jim Kearns, M-2, is one of 14 students pioneering in a new variation of an independent studies program offered by the University of Oklahoma.

The coursework, which leads to the bachelor of liberal studies degree, is the equivalent of a four-year college program designed especially for non-resident junior college graduates. Through independent study, students can complete coursework at their own pace under the guidance of an advisor.

Indexes for the 1972 issues of "The Atom" are available at ISD-1. There is no charge.

For Reporting Change of Address

If your address has changed please inform THE ATOM by clipping and filling out this coupon. Print or type your name and both your old and new addresses.
Mail to: The Atom
Los Alamos Scientific Laboratory
Box 1663
Los Alamos, N.M. 87544

Previous Address

name

address

city state zip code

New Address

address

city state zip code

the technical side

Taken from LASL Technical Information Reports submitted through ISD-6

Sixth LAMPF Users Meeting, Los Alamos, Nov. 13-14:
"The Neutron Irradiation Damage Facility at LAMPF" by W. V. Green, CMB-13

Rand Corporation, Santa Monica, Calif., Nov. 17:
"Conjectures on the nature of Ball Lightning" by J. L. Tuck, P-CTR

Colloquium, Institute for Theoretical Physics, Justus-Liebig University, Giessen, Germany, Jan. 11:
"The Los Alamos Approach to the Calculation of Fission Barriers" by J. R. Nix, T-9

Colloquium, Institute for Nuclear Chemistry, University of Marburg, Marburg, Germany, Jan. 15:
"Theory of Superheavy Nuclei" by J. R. Nix, T-9

Seminar, Heavy-Ion Laboratory, Wixhausen, Germany, Jan. 16:
"Superheavy Nuclei" by J. R. Nix, T-9

Colloquium, Institute for Theoretical Nuclear Physics, Technical University, Darmstadt, Germany, Jan. 17:
"Calculation of the Nuclear Potential Energy of Deformation" by J. R. Nix, T-9

Colloquium, Physics Institute, Johann Wolfgang Goethe University, Frankfurt, Germany, Jan. 18:
"Calculation of Fission Barriers" by J. R. Nix, T-9

Colloquium, Physics Institute, University of Basel, Switzerland, Jan. 19:
"Calculation of Fission Barriers and half-lives for Superheavy Nuclei" by J. R. Nix, T-9

Eleventh International Winter Meeting on Nuclear Physics, Villars, Switzerland, Jan. 22-27:
"Recent Calculations on the Fission of Heavy Elements" by J. R. Nix, T-9

Colloquium, Max Planck Institute, Heidelberg, Germany, Jan. 31:
"Calculation of Fission Barriers for Heavy and Superheavy Nuclei" by J. R. Nix, T-9

Colloquium, Physics Institute, University of Mainz, Germany, Feb. 1:
"Calculation of Single-Particle Effects on the Fission Barrier" by J. R. Nix, T-9

Seminar, United States Department of Agriculture Plum Island Animal Disease Laboratory, Greenport, N. Y., Feb. 1:
"The USDA Program on Flow Microfluorometry at the Los Alamos Scientific Laboratory" by L. S. Cram, H-10 (invited)

Symposium, Society of Photographic Scientists and Engineers, New Orleans, La., Feb. 1-2:
"Computer Microfilm Color Generation" by D. C. Buckner, formerly E-1

"New Developments in COM: Computer Generated Optical Sound Tracks" by L. H. Baker, Jr., TD-7, D. C. Buckner, formerly E-1, and E. K. Tucker, ENG-7

Yale University, New Haven, Conn., Feb. 2:
"Experiments, Proposed and In Progress, at Low and Intermediate Energies at Los Alamos" by N. Stein, P-DOR

Seminar, San Francisco Medical Center, Calif., Feb. 2:
"Current Status of Pion Radiotherapy" by M. R. Raju, H-10 (invited)

Creative Conversation Program, Santa Fe Public Library, Feb. 5:
"Peaceful Uses of Atomic Energy" by G. A. Graves, ADRG

Colloquium, Department of Physics, University of North Carolina, Chapel Hill, Feb. 5:
"Ferromagnetic Superconductors" by J. D. Erickson, P-8

Symposium on Metallurgical Effects at High Strain Rates, Sandia Corporation, Albuquerque, Feb. 5-8:
"Relation between Dynamic and Static Phase Transformation Studies" by W. J. Carter, M-6 (invited)

"Experimental Methods in Shock Wave Physics" by J. W. Taylor, M-2 (invited)

Department of Chemistry, Texas Technological College, Lubbock, Feb. 7:
"Actinide Oxidation-Reduction Reactions, Kinetics and Mechanisms in Aqueous Solutions" by T. W. Newton, CNC-2 (invited)

Seminars, University of Alberta, Edmonton, Canada, Feb. 6; and University of Manitoba, Winnipeg, Canada, Feb. 7:
"Polarization Program at the LASL Tandem Van de Graaff" by G. G. Ohlsen, P-DOR (invited)

Sandia Laboratories at Livermore, Calif., Feb. 6-7:
"Surface Areas of Uranium and Uranium Hydride Powders" by R. M. Alire, WX-2

"Exchange Reactions" by T. E. Larson, WX-2

Defense Nuclear Agency Mid-Year Laser Review Meeting, Naval Research Laboratory, Washington, D. C., Feb. 8-9:
"Review of Laser-Produced Plasma Interaction Experiments at Los Alamos" by R. P. Godwin, L-4

Colloquium, University of Colorado Department of Astro-Geophysics, Boulder, Feb. 12:
"Anomalous Absorption of Large Amplitude Microwaves near the

Electron Plasma Frequency" by H. Dreicer, Q-1

Northern Illinois University, DeKalb, Feb. 12, and Harvard University, Cambridge, Mass., Feb. 14:

"The Birth and Care of Triborane Intermediates" by R. T. Paine, CNC-4 (invited)

Chemistry Seminar, University of New Mexico, Albuquerque, Feb. 13:

"New Techniques in Precision Gamma Scanning; Application to Fast Breeder Reactor Fuel Pins" by J. R. Phillips, CMB-1

National Bureau of Standards, Washington, D. C., Feb. 15:

"Radiotherapy with High LET Radiations" by M. R. Raju, H-10 (invited)

Naval Research Laboratory, Washington, D.C., Feb. 16:

"Radiotherapy with Pions" by M. R. Raju, H-10 (invited)

New Mexico Section, American Society of Civil Engineers, Las Cruces, N.M., Feb. 16:

"A Preliminary Study of Electroprecipitation of Phosphate from Secondary Sewage Effluent" by E. I. Onstott, CMB-8, W. S. Gregory, ENG-7, E. F. Thode and K. L. Holman, both New Mexico State University, Las Cruces

Central New Mexico Section, American Institute of Mining, Metallurgy and Engineers, Grants, N.M., Feb. 17:

"Review of LASL Subterrene and Geothermal Energy Programs" by J. C. Rowley, Q-23 (invited)

Seminar, Engineering College, University of Illinois, Urbana, Feb. 19:

"Computational Methods in Fluid Dynamics" by J. U. Brackbill, T-3

Laser Division Colloquium, Lawrence Livermore Laboratory, Calif., Feb. 20:

"Observation of Parametric Instabilities, Supra-Thermal Electron Production, and Strong Field AC Electrical Resistivity near the Critical Plasma Density" by H. Dreicer, Q-1

University of Illinois, Urbana, Feb. 20:

"Calculation of Fission Barriers for Heavy and Superheavy Nuclei" by M. Bolsterli, T-9

Branch Seminar, Whiteshell Nuclear Research Establishment, Pinawa, Manitoba, Canada, Feb. 20-22:

"Gamma Scanning Capabilities and Applications at LASL" by J. R. Phillips, CMB-1

"Analytical Chemistry Facilities and Capabilities Necessary to LASL Programmatic Needs" by G. R. Waterbury, CMB-1

National Science Foundation Computer Science Conference, Ohio State University, Columbus, Feb. 20-22:

"Semantic Refinement Using Madcap VI" by J. B. Morris, C-7

"Better Relations between Users and Systems Programmers" by R. A. Stutz, TD-3

Sigma Chi Club, Highlands University, Las Vegas, N.M., Feb. 21:

"Geothermal Resources Created by Hydraulic Fracturing in Hot Dry Rock" by R. M. Potter, CNC-4 (invited)

University of Notre Dame, South Bend, Ind., Feb. 21:

"Extracting Physical Parameters from Low Energy Scattering Data" by M. Bolsterli, T-9

Phi Sigma Biological Honorary Seminar, Biology Department, University of New Mexico, Albuquerque, Feb. 23:

"Biomedical Research Activities at the Los Alamos Scientific Laboratory" by C. R. Richmond, H-DO (invited)

Seminar, Department of Chemistry, University of New Mexico, Albuquerque, Feb. 23:

"Nitrogen-15 Nuclear Magnetic Resonance Spectroscopy" by M. Alei, Jr., CNC-2 (invited)

Albuquerque Veterinary Association Meeting, Albuquerque, Feb. 27:

"RF Tumor Therapy; Animal Experiments" by J. D. Doss, MP-3, and S. Edwards, University of New Mexico School of Medicine.

University of British Columbia, Vancouver, Canada, Feb. 27:

"Terrestrial and Extraterrestrial Limits on the Photon Mass" by M. M. Nieto, T-5

First Task Force Meeting on Nuclear Data for Fission Product Decay Heat and Burnup Calculations, Hanford Engineering Development Laboratory, Richland, Wash., Feb. 27-28:

"Changes in Some Thesis Results Following Cinder and Data Corrections" by T. R. England, T-2

Institute of Electrical and Electronic Engineers Computer Society International Conference, San Francisco, Calif., Feb. 27-March 1:

"Development of the LASL Computer Network" by R. D. Christman, C-2

"Communication with Uncontrolled Remote Terminals" by H. B. Demuth, C-2

Biophysical Society's Seventeenth Annual Meeting, Columbus, Ohio, Feb. 27-March 2:

"Effects of Temperature on the Mitotic Cycle of CHO Cells" by L. S. Cram, H-10, and C. E. Hildebrand, H-9

"A Coulter Volume Spectrometer Employing a Potential Sensing Technique" by G. C. Salzman, P-DOR, P. F. Mullaney, H-10, and J. R. Coulter, SD-5

"Specific Effects of X-Irradiation on RNA Metabolism of Cultured Chinese Hamster Cells" by M. D. Enger, E. W. Campbell and R. A. Walters, all H-9

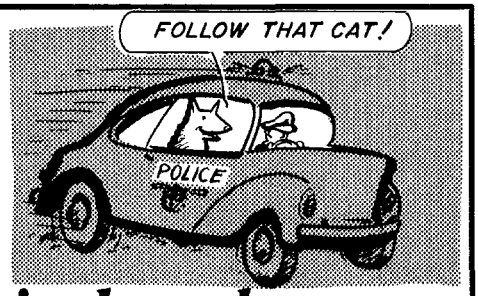
"Effects of Caffeine on X-Ray-Induced Radiation Responses of Chinese Hamster Cells" by R. A. Walters, L. R. Gurley and R. A. Tobey, all H-9

"Multiparameter Cell Sorting and Analysis" by P. F. Mullaney and J. A. Steinkamp, both H-10

University of Washington, Seattle, Feb. 28:

"Particle Physics at LAMPF" by M. M. Nieto, T-5

10 years ago in los alamos



Culled from the April, 1963, files of the LASL News and the Los Alamos Monitor by Robert Porton

J. Robert Oppenheimer Wins Fermi Award

J. Robert Oppenheimer, who converted the isolated Los Alamos Ranch School into the physics laboratory that changed the course of history, was named the 1963 winner of the Enrico Fermi Award. Oppenheimer was director of the Los Alamos Laboratory from its establishment in 1943 until late 1945. He has headed the Institute for Advanced Studies at Princeton University since 1947. The Fermi Award, which carries a gold medal, a citation and $50,000 in cash, is the highest single scientific prize in the United States. It was created in 1956 by the Atomic Energy Commission to honor the late Enrico Fermi, Nobel Prize winner and wartime colleague of Oppenheimer's at Los Alamos.

Four Selected for LASL's Advanced Study Program

Four LASL staff members have been selected to do full-time graduate study at the university or college of their choice next year under the Laboratory's Advanced Study Program. Charles Anderson, GMX-3, will study at Brown University in Providence, Rhode Island. W. Doyle Evans, P-4, Raymond Pollock, T-2, and Mahlon Wilson, CMB-14, will study at the University of New Mexico in Albuquerque.

Only Dog in State with Car and Chauffeur

"Badge," the Los Alamos Police Department's trained police dog, probably is the only canine in New Mexico to rate his own private automobile and uniformed chauffeur. A patrol car has been converted, both to accommodate the big, pedigreed German shepherd, and to protect the uniforms of the men with whom Badge works. The dog regularly makes night patrols with a police officer and investigates the dark areas.

British Scientists Visit LASL

Sir William Penney, deputy chairman of the United Kingdom's Atomic Energy Authority and F. A. Vick, director of the Atomic Energy Research Establishment, Harwell, England, visited LASL. They discussed the work being done as part of Project Sherwood with Laboratory officials. "We're laying the foundation for the future," Sir William said. "The generation of power for peaceful uses should be possible within 30 years and a large proportion of the power stations in the world will be nuclear powered." Penney was a member of the British Mission at Project Y during the war years.

what's doing

BIEN DICHO TOASTMASTERS CLUB: Luncheon meeting, 12:05 p.m., Mondays, South Mesa Cafeteria. For information call Beverly Wellnitz, 662-4982.

SIERRA CLUB: Luncheon meeting at noon, first Tuesday of each month, South Mesa Cafeteria. For information call Brant Calkin, 455-2468, Santa Fe.

RIO GRANDE RIVER RUNNERS: Meetings scheduled for noon, second Friday of each month at South Mesa Cafeteria. For information call Jon Cross, 662-9462.

LOS ALAMOS SAILORS: Meetings at noon, South Mesa Cafeteria, first Friday of each month. For information call Dick Young, 983-9770.

SPORTS CAR CLUB DEL VALLE RIO GRANDE: Meetings, 7:30 p.m., Hospitality Room, Los Alamos National Bank, first Tuesday of each month. For information call Hunter Hill, 672-9550, or Wayne Fullerton, 662-4171.

PUBLIC SWIMMING: High School Pool — Monday through Wednesday, 7:30 to 9 p.m.; Saturday and Sunday, 1 to 6 p.m. Adult swim club, Sunday, 7 to 9 p.m.

LOS ALAMOS VOLLEYBALL CLUB: Monday, girls' gym, High School. Men—6-7:30 p.m. women—8-9:30 p.m. For information call Don Shepard, 662-7865.

LOS ALAMOS BADMINTON CLUB: Tuesday, 8 p.m. 9:30 p.m., girls gym, High School. For information call Art or Jane Sherwood, 662-2966.

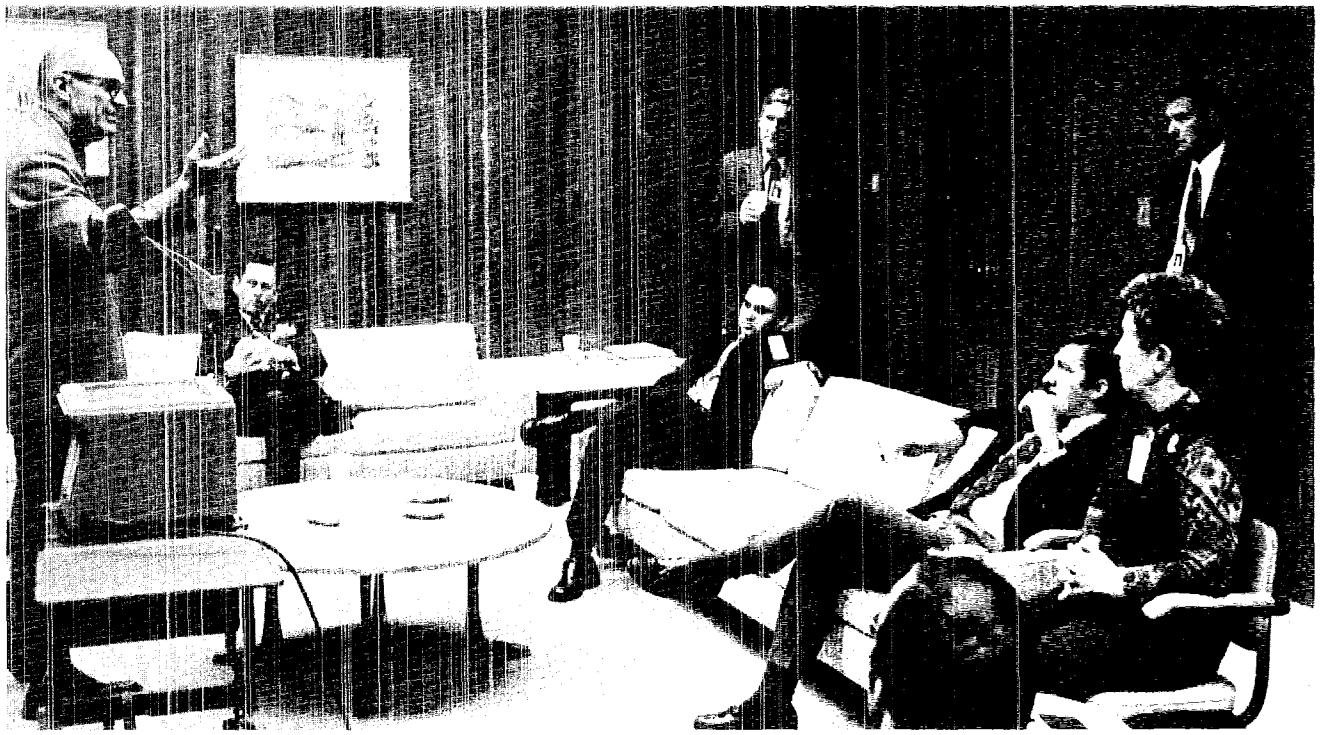
WHITE ROCK KARATE CLUB: Workouts, 8 p.m., Monday and Wednesday, Pinon School gym. For information call Tom Cook, 672-9426.

MOUNTAIN MIXERS SQUARE DANCING CLUB: Mesa School, 8 p.m. For information call Ruth Maier, 662-3843.
April 7—Dick Parrish, Hobbs
April 21—Ray Rogers, Albuquerque

LOS ALAMOS OUTDOOR ASSOCIATION: No charge, open to the public. Contact leaders for information.
April 5—Noon meeting, South Mesa Cafeteria, election of officers, Reed Elliott, 662-4515
April 7-8—San Juan River*, Walt Green, 672-3203
April 14—County line to Velarde*, LaVerne Pollat, 672-3280
April 14—Virgin Canyon and Ruin, Reed Elliott, 662-4515
April 15—Pilar Race Course*, Jon Cross, 662-9462
April 21—Ashley Pond Boat Show, Stretch Fretwell, 662-6477
April 22—Lyden to San Juan*, Jon Cross, 662-9462
April 28—Pedernal Mesa, Dave Brown, 662-2185
April 28-29—Chama River*, Les Redman, 455-2943
*River Trip

MESA PUBLIC LIBRARY:
April 18—Book discussion, Winifred Amsden, "The World Was My Garden," by D. G. Fairchild

NEWCOMERS CLUB: April 25, talk on Los Alamos Family Council, Los Alamos National Bank Hospitality Room, 7:30 p.m. For information call Pat Astel, 662-4709



Robert Shreffler, Dir. Off., briefs representatives from various government agencies on technical activities conducted at the Los Alamos Scientific Laboratory. Seated are U.S. Air Force Colonel William Vlach, Legislative Liaison; Richard Perle, a member of the staff of Washington Senator Henry Jackson; John Lehman, Jr., staff member, National Security Council; and Dorothy Fosdick, a member of Senator Jackson's staff. In background are LASL Director Harold Agnew and Robert Gattis, ADWP-1 group leader.

Henry T. Motz
3187 Woodland
Los Alamos, New Mexico
87544

William Gardner, director of systems development at Sandia Laboratories, and Morgan Sparks, recently appointed president of Sandia Laboratories, talk with Benjamin Moore, associate WX-Division leader at the Los Alamos Scientific Laboratory, and LASL Director Harold Agnew. In addition to briefings on LASL scientific activities, officials from the two laboratories discussed functions of the TX Committee, a LASL-Sandia group established to recognize and arrange solutions for problems of mutual interest, arising in the design, development and production of weapons. Gardner was appointed chairman of the TX Committee, succeeding Moore, chairman for the past three years, who will leave the Laboratory prior to July 1.