State of Idaho
DEPARTMENT OF HEALTH AND WELFARE
Division of Environmental Quality

450 W. State Street
Boise, Idaho 83720

CECIL D. ANDRUS
Governor
RICHARD P. DONOVAN
Director

February 13, 1989

C. Kelley Crossman
New Mexico Health and Environment
Harold Runnels Building
1190 St. Francis Drive
Santa Fe, New Mexico 87503

Dear Kelley:

I have enclosed the information I promised to send you. I hope you find it useful. If you have any questions, please call me at (208) 334-5879.

Sincerely,

Joan M. Meitl

Joan M. Meitl
Hazardous Waste Compliance Officer
Hazardous Materials Bureau

JMM/jd

Enclosure

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HAZARDOUS WASTE SECTION

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Location and Setting

Los Alamos National Laboratory is located in New Mexico, 25 miles northwest of Santa Fe and 60 miles north northeast of Albuquerque. There is a population (resident non-work force) of 19,286 within 5 miles of the laboratory, and some 170,000 inhabitants within a 50-mile radius.

The site borders on the San Ildefonso Pueblo to the east. There are over 450 archaeological and historical resources on Los Alamos Laboratory land.

Generally, the area experiences light winds, but 60 mile per hour gusts are common in spring. "Dust devils" sometimes produce 75 mile per hour winds. Lightning is common, and hail damage occasional.

Geology and Hydrology

The Los Alamos National Laboratory sits on the Pajarito Plateau between the Jemez Mountains to the west and the Rio Grande Valley to the east. The plateau slopes eastward from 7800 feet, along the west to about 6200 to the east, where it stands 300 to 1000 feet above the Rio Grande. Most of the laboratory is on the mesa tops.

Depth to the main aquifer is 1200 feet to the west and 600 feet to the east. There are 16 drainage areas (canyon channels) that either pass through or originate on Los Alamos Laboratory.

Annual precipitation is 15 to 18 inches, with 40 percent as summer storms and the balance mainly as winter snow.

The seismicity of the region is estimated to be one earthquake of magnitude 5 or greater every 100 years.

Function

Los Alamos National Laboratory developed the very first atomic bombs. Today Los Alamos continues to be the major design center for nuclear warheads, though, for security reasons, weapons are no longer constructed on-site. It has been estimated that two-thirds of the present U.S. nuclear arsenal was designed at Los Alamos.

Besides its history of designing and testing various aspects of nuclear weaponry, Los Alamos is also engaged in large scale plutonium operations. These involve converting plutonium into metal form, as well as blending fuel-grade plutonium from Hanford, Washington, with super weapons-grade plutonium from the Savannah River Plant in South Carolina. The blended plutonium is transported to Rocky Flats, Colorado. Los Alamos is involved in this work because a plutonium conversion facility at Rocky Flats has not operated properly.

Los Alamos is also a major research center for high temperature chemistry, non-nuclear explosives technology, laser fusion and chemical enhancement, plutonium processing, neutron experimentation, detonation development, radiobiology, radiochemistry, and a host of other activities associated with sophisticated weaponry.

On its 43 square miles, Los Alamos National Laboratory has an 8-megawatt research reactor, x-ray machines up to 1 million volts in power, a 24-million electron volt Betatron particle accelerator, numerous low power reactors called "critical assemblies" and a linear particle accelerator.

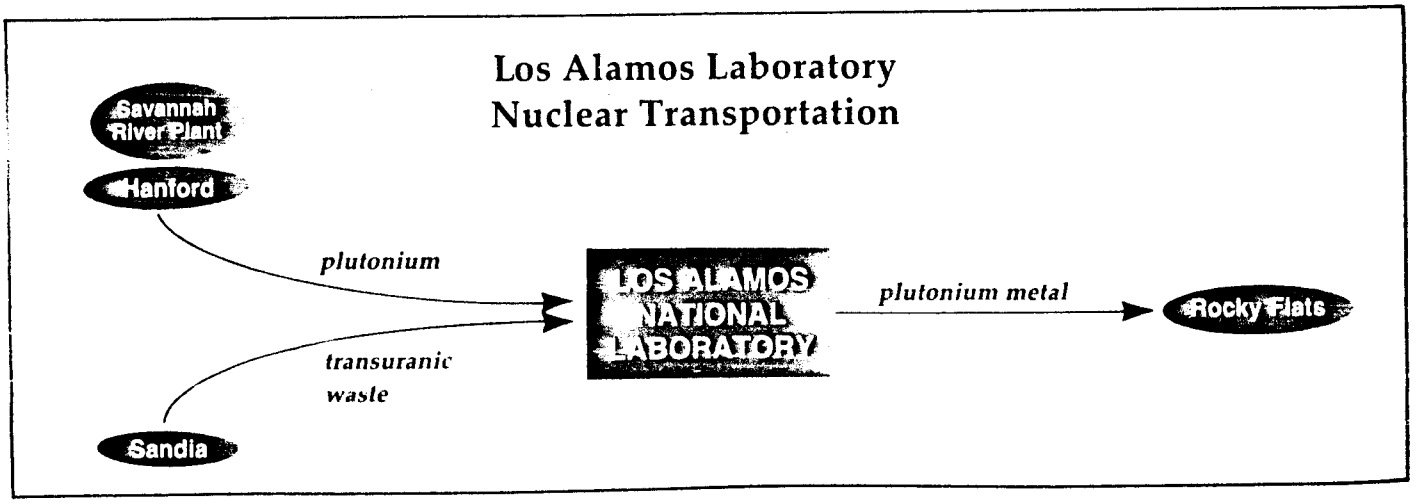
Los Alamos also conducts some solar energy and geothermal research.

Radioactive Waste

Waste Management

There are 14 known solid waste disposal sites at Los Alamos. Records for some sites have been lost.

Waste is buried or stored in pits, trenches and shafts. Since 1971, transuranic wastes have been segregated and retrievably stored. Los Alamos contains the second largest volume of plutonium-238, after the Savannah River Plant. Plutonium-238 has a 90-year half-life, high activity and is extremely dangerous, so much so that it has prevented a plutonium shipping container, the TRUPAC, from being licensed. Without the TRUPAC, transuranic waste from Los Alamos cannot be shipped to the underground repository



at Carlsbad, New Mexico.

Effluents from two liquid radioactive waste treatment plants and one sanitary sewage lagoon system are discharged into the Los Alamos and Mortanded Canyons.

There is also waste in the form of decommissioned sites.

Finally, other areas have been used for non-radioactive hazardous waste.

What Is Buried or Stored

A wide variety of radioactive waste is handled at Los Alamos, including transuranics, "low-level" wastes, mixed fission products, mixed activation products, uranium and tritium.

Solid Waste. Solid radioactive wastes include tools, instruments, equipment, building materials, sludge, cement, and general refuse. Area G is currently the active waste site. There are an additional 5 major and 8 smaller solid waste sites. Los Alamos projections of how much waste will be stored at just the major areas by 1990 is staggering: 12 million cubic feet. As of Dec. 31, 1986, there were an estimated 6.7 million cubic feet of "low-level" waste.

The solid waste areas contain an enormous amount of highly radioactive material. Further, much of the waste is mixed with flammable material. To make matters even worse, in some areas the amount, nature, and location of the waste is unknown. Area B is a drastic example. The area was used for alpha-contaminated wastes from 1944 to 1948. The eastern half of the area was then left to overgrow during the next 30 years. Now samples of plants in the area show plutonium-239, uranium and cesium-137 concentrations ranging widely—over six orders of magnitude depending on the sample.

Each of the storage areas has numerous shafts, trenches, or pits full of waste, and the list of nuclides runs the gamut: uranium-233, uranium-234, uranium-235, uranium-236, uranium-238, strontium-90, barium-140, lanthanum-140, lead-210, cesium-137, actinium-22, sodium-22, americium-238, plutonium-239, plutonium-240, plutonium-241 and plutonium-242. In general, the shafts are reserved for plutonium-238 and remote-handled transuranic waste.

The activity levels vary. For example, in parts of area C they range from 100 to 5000 nanocuries per gram. Current wastes from the plutonium facility are lower: 98 percent contain under 10 nanocuries per gram, 1 percent 10 to 100 nanocuries per gram, and 1 percent greater than 100 nanocuries per gram.

In area G (Technical Area 54), in use since 1957, the larger pits are typically 100 by 600 feet, with depths ranging from 25 to 45 feet deep. The smaller pits are of varying dimensions. Pits 1 through 6 (large or small) probably contain transuranic wastes mixed with "low-level" waste. (Before 1971 all solid wastes were buried in common pits, shafts, and trenches.) Pit 1 is known to contain about 600 grams of plutonium. Pits 2 and 8 contain transuranics. Other pits and trenches contain "low-level" waste. In changing the definition of transuranic waste from activity greater than 10 to activity greater than 100 nanocuries per gram, much of this pit waste is now classed as "low-level" waste rather than transuranic waste.

About 120 vertical shafts are also located in area G. Some of the shafts contain mixed transuranics, assorted fission products, mixed activation products and other "low-level" waste. Pits and shafts also contain plutonium-239, americium-241, tritium, uranium, and smaller amounts of nuclides like plutonium-238, neptunium-237, thorium-230, thorium-232 and isotopes of curium.

Liquid Waste. The Central Liquid Waste Treatment Plant (Technical Area 50) is a large facility with waste being pumped to it from many laboratory areas. Effluents are discharged into a normally dry stream channel in Mortandad Canyon.

There is also a smaller plant for treating liquid radioactive waste at the Technical Area 21 laboratories. Prior to June 1985, these effluents were discharged from the plant into a nearby canyon.

Technical Area 53 is a lagoon system serving the linear accelerator. It contains radioactivity from activated water used in beam-stop cooling systems. The effluent sinks into the alluvium of Los Alamos Canyon within the laboratory boundary.

Decommissioning Waste. Beyond the solid and liquid radioactive waste sites at Los Alamos, there are various areas that have been decommissioned. Bayo Canyon, for

Radioactive Waste
LOS ALAMOS NATIONAL LABORATORY
1943 - 1986

"LOW-LEVEL" WASTE (buried)

volume	6,700,000 cubic feet
mass of uranium	190,000 pounds
radioactivity	980,000 curies (at burial)

TRANSURANIC WASTE

volume	500,000 cubic feet (buried)*
	250,000 cubic feet (stored)
radioactivity	9,000 curies (buried)
	170,000 curies (stored)

* in addition, there are almost 40,000 cubic feet of soil contaminated with transuranic waste

Source: Integrated Data Base for 1987, U.S. Department of Energy, Sept. 1987 (DOE/RW-0006)

Radioactive Waste Burial/Storage Sites

site	volume (cubic feet)	partial inventory of contents
A	500,000	possible transuranic waste
B	750,000	100 grams transuranic waste; hazardous waste
C	3,700,000	various radionuclides
	5,000	transuranic waste stored in 107 shafts (reserved for plutonium-238 and remote-handled wastes)
G	6,000,000	600 grams of plutonium-239; other transuranic waste
	(1500 drums)	10 drums of transuranic waste
	8,400	uranium-233; transuranic waste (plutonium-238)
	15,000	mixed remote-handled transuranic waste in 120 shafts
	47,000	unknown
E	unknown	uranium-238 and polonium-210
F *	unknown	strontium-90; cesium-137; possibly high explosives
H	unknown	tritium contamination
K	unknown	tritium; uranium-235; uranium-238; plutonium
T	96,000	10 curies plutonium-239; americium, other transuranic wastes
	250,000	remote-handled transuranic wastes in 237 shafts
U	unknown	actinium-227
V	150,000	plutonium, strontium-90, barium-140, lanthanum-140
W	unknown	buried cooling tanks of Lampre reactor containing cesium-137, sodium-22, plutonium-239
X	unknown	Lampre vessel containing uranium-235
Y	unknown	disposal of wastes from dynamic testing operations; some uranium-238 may be present

* site at 2-mile mesa

Source: Los Alamos Low-Level Waste Performance Assessment Status, *W.J. Wenzel et al., Department of Energy, June 1986 (LA-10768-MS).*

example, was once used for high explosive research. Using conventional explosives, nuclides like uranium, strontium-90 and lanthanum-140 were in effect blown up and spread in the atmosphere and on the ground. Radiochemistry experiments added to the contamination, with waste being dumped into pits and leaching fields. In 1963, Bayo Canyon was supposedly cleaned up. Those contaminated wastes that could easily be excavated were excavated, and the Los Alamos officials decided that the site was sufficiently decontaminated to release it from federal control. Nevertheless, a 1978 resurvey showed contamination both on the surface and subsurface.

A former liquid waste treatment plant was decommissioned, and some of the land was transferred to Los Alamos County in 1967. A 1980 resurvey showed residual radioactivity in soils and sediments at the former site and in channels of the Pueblo, Los Alamos and Acid Canyons.

The Technical Area 1 research area was demolished and decommissioned. Beginning in 1966 the land was given to Los Alamos County or sold to private interests. A 1974 survey disclosed contamination, and 530,000 cubic feet of soil and debris were subsequently removed to area G.

Pathways By Which Radioactivity Is Escaping

There are indications that radioactive elements are escaping from the waste sites. When eight inactive "low-level" waste areas were tested in 1983, the tests confirmed migration of tritium and uranium. Low levels of subsurface plutonium contamination were also found in three of the samples. A study in 1984 of areas B and C showed "low-level" plutonium contamination.

Sampling stations outside area G, the current solid waste site, have shown plutonium-238, plutonium-239 and plutonium-240 concentrations to be above background, indicating movement of these radionuclides outside the area.

Effluents from the liquid treatment plants are released into various canyons. Plutonium has been transported from the Upper Los Alamos Canyon into the Lower. Plutonium has been found in the banks as well as in the active and inactive channels of the Canyon. Acid-Pueblo, DP-Los Alamos, and Mortandad canyons all now contain surface and shallow groundwater with measurable amounts of radioactivity. Suspended sediments in Los Alamos Canyon water at Otawi, at the Rio Grande, showed plutonium-238,

plutonium-239, and plutonium-[illegible] concentrations above background during snow meltoff. Storm runoff from summer thunderstorms showed similar levels, indicating movement of plutonium radionuclides out of DP and Acid Pueblo Canyons into the Rio Grande.

Effluents from Technical Area-50's industrial liquid wastes are dumped into Mortandad Canyon. In addition to effluents from the liquid treatment plants, cooling water from the Omega reactor at Technical Area-2 has been dumped into the upper reaches of Los Alamos Canyon. Further, cooling tower blowdown from Technical Area-3 has been released into Sandia Canyon, and untreated radioactive wastes were dumped into Acid-Pueblo from 1944 to 1964. To make matters worse, in the early days of Los Alamos Laboratory very limited records were kept on the quantities of wastes released into the canyons. Today these canyons present potential sources of contamination for the surrounding area and for the Rio Grande.

Animals, principally gophers, are a serious problem at Los Alamos. Burial pits and landfills are honeycombed by gophers, who eat radioactive waste. Gopher tunnels open rainwater pathways to the wastes. Also, gophers physically move waste to the surface. Rocks and rip-rap are a partial solution. Desert brush is also a problem. Growing in the waste areas, contaminated tumbleweed blows off-site.

Dangers

Who Is at Risk

Laboratory studies clearly demonstrate off-site radioactive contamination emanating from Los Alamos. There is also definite evidence of plutonium reaching the Rio Grande. Thus, downstream communities and Rio Grande water users are at risk.

Eventual serious contamination of groundwater is a possibility. According to one Los Alamos report, "both the long-lived uranium and thorium daughters of the plutonium and the long-lived uraniums (uranium-238 and uranium-235), if buried along with transuranic wastes, would be discharged into the aquifer eventually. Clearly, large well water concentrations and correspondingly large critical organ doses could result at maximum discharge."

Radioactive contamination in the arroyos threatens those immediately downgradient, particularly the San Ildefonso Pueblo. Plutonium has already moved onto Indian lands. There is flashflood potential in arroyos. In times of heavy summer rain, much erosion, movement of soil takes place, particularly if waste sites are dug up by gophers. This quickly dries up. Dust storms can easily make plutonium airborne, where plutonium danger is greatest.

Further, the contamination downstream is only part of the Indian plight. The Los Alamos site was carved out of previous Indian land. The Indians have certain claims to the land. Should they win some of their land back it will be contaminated—a dubious victory indeed.

In addition to the contamination of parts of the San Ildefonso Pueblo, other downstream communities, White Rock and Pajarito Acres in particular, also risk the possibility of increased radioactive pollution.

Other Dangers

Long term dangers due to earthquakes and volcanic eruption are of concern. One Los Alamos study suggests that the earthquake possibility for the area is one earthquake of magnitude 5 or greater on the Richter scale every 100 years. Elsewhere, Los Alamos Labs suggests that a quake of this magnitude would be sufficient to crack open containers of radioactive waste, thus greatly accelerating the transport of such wastes. The Jemez Mountains were formed as a result of volcanic activity.

Large amounts of plutonium are being shipped into Los Alamos National Laboratory from Hanford and Savannah River, and being shipped, in metal form, to Rocky Flats. In case of a severe accident, plutonium metal can oxidize and be dispersed and inhaled by residents along major highways near Los Alamos. In addition, processing of plutonium in conversion facilities puts trace amounts of plutonium in the air during normal operations.

Other studies have shown that Los Alamos has cleaned up areas, only later to find that the areas continue to be radioactively contaminated.

Finally, it is not clear what will be the disposition of plutonium-238 and remote-handled transuranic wastes since the present Department of Energy shipping container, TRUPACT, is not licensed to carry this material to an underground repository.

Primary References

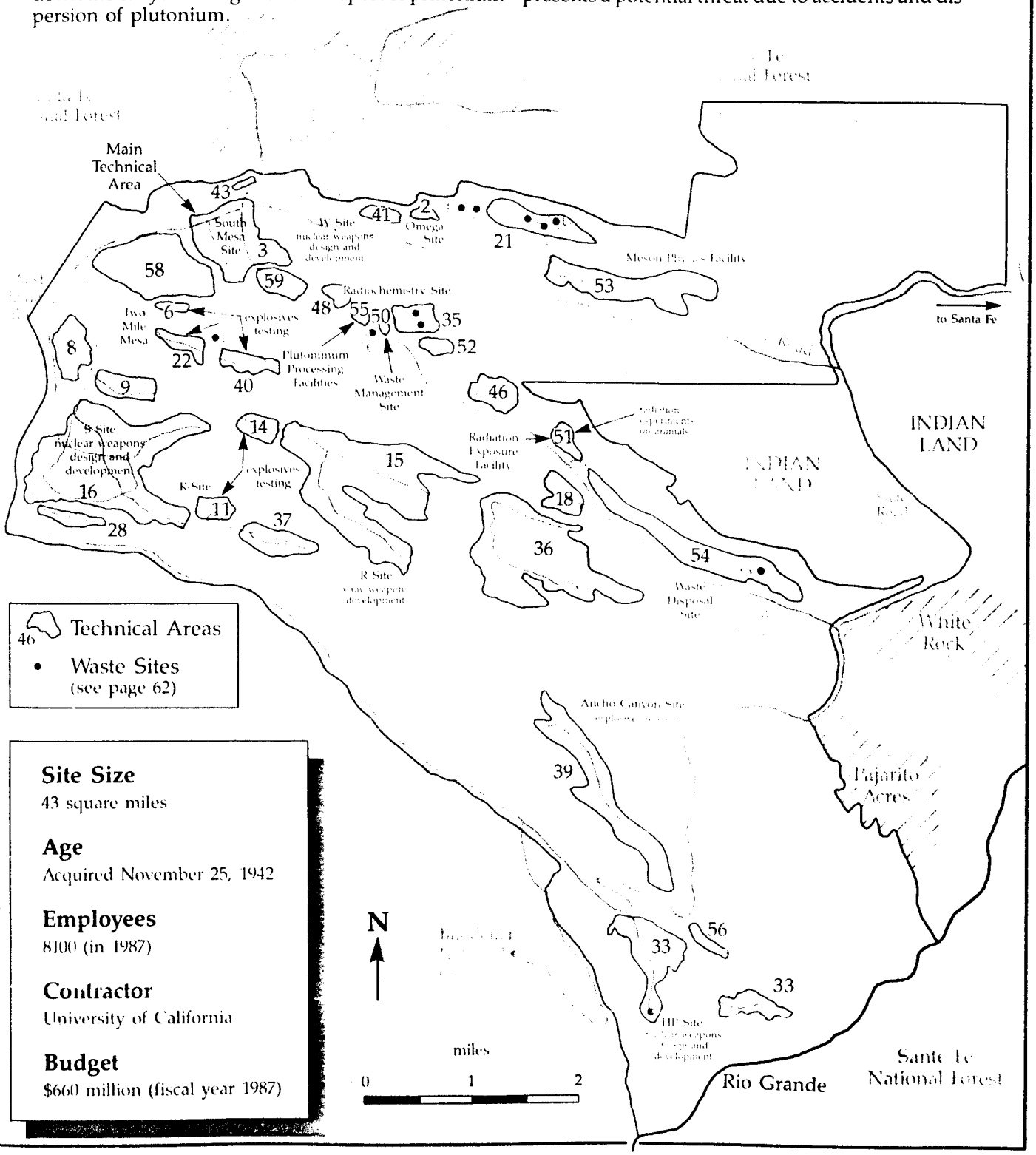
Missile Envy, Helen Caldicott, Bantam, New York, 1986.

Environmental Surveillance at Los Alamos During 1985, Los Alamos National Laboratory, April 1986 (LA-12721-ENV).

Los Alamos Low-Level Waste Performance Assessment Status, W.J. Wenzel, et al., Department of Energy, Los Alamos, June 1986 (LA-10768-MS).

Los Alamos National Laboratory

Los Alamos National Laboratory is located 25 miles northwest of Santa Fe and 60 miles north of Albuquerque, New Mexico. There are 170,000 inhabitants within a 50-mile radius. The Lab sits on a plateau between a mountain range to the west and a valley to the east. Los Alamos continues to be the major design center for nuclear warheads. The Lab is now engaged in large scale blending operation, combining fuel grade plutonium from Hanford with super weapons grade plutonium from Savannah River Plant. This blend is then transported to Rocky Flats. During flashfloods, plutonium and other radionuclides move down the canyons. Large-scale transport of plutonium presents a potential threat due to accidents and dispersion of plutonium.



Site Size
43 square miles

Age
Acquired November 25, 1942

Employees
8100 (in 1987)

Contractor
University of California

Budget
$660 million (fiscal year 1987)