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TITLE: WASTE MANAGEMENT SITE PLAN

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SUBMITTED TO: U. S. DEPARTMENT OF ENERGY

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WASTE MANAGEMENT

SITE PLAN

MARCH 1986

Los Alamos National Laboratory

Los Alamos, New Mexico 87544

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I. GENERAL SITE INFORMATION

I.A. Organization and Administration

I.A.1 Responsible Office

The Laboratory is operated for the US Department of Energy (DOE) by the University of California under Contract W-7405-ENG-36. The University is under the cognizance of the DOE's Los Alamos Area Office (LAAO), which reports to the DOE Albuquerque Operations Office (AL).

I.A.2 Contractors

The University of California is the prime contractor for those operations involving waste generation and management. The Zia Company provides the major support work for the Laboratory, and also generates waste from its activities.

The current organizational structure of the Laboratory is shown in Fig. 1. Overall responsibility for waste management is under the direction of the Associate Director for Technical Support and the Health, Safety and Environment (HSE) Division (Fig. 2).

The Waste Management Group, HSE-7, is accountable for the operation of all waste management facilities, except those related to high explosives wastes. The preparation of the annual Waste Management Site Plan and authorization of exemptions from site-specific disposal requirements are also the responsibilities of HSE-7. (The Environmental Surveillance Group, HSE-8, and DOE/AL are primary consultants in granting exemptions from site-specific disposal requirements.) Organizations which generate radioactive wastes are responsible for the proper identification, segregation, and documentation of their wastes for disposal. Radioactive waste packaging activities are carried out in large part by Zia Company janitorial personnel, although some effort is required by Laboratory operating groups personnel for certain wastes [e.g., transuranic (TRU) wastes]. On-site waste transport is primarily carried out by Zia personnel under the guidelines established by the Laboratory's waste management and radiation protection groups. Radiation protection personnel provide

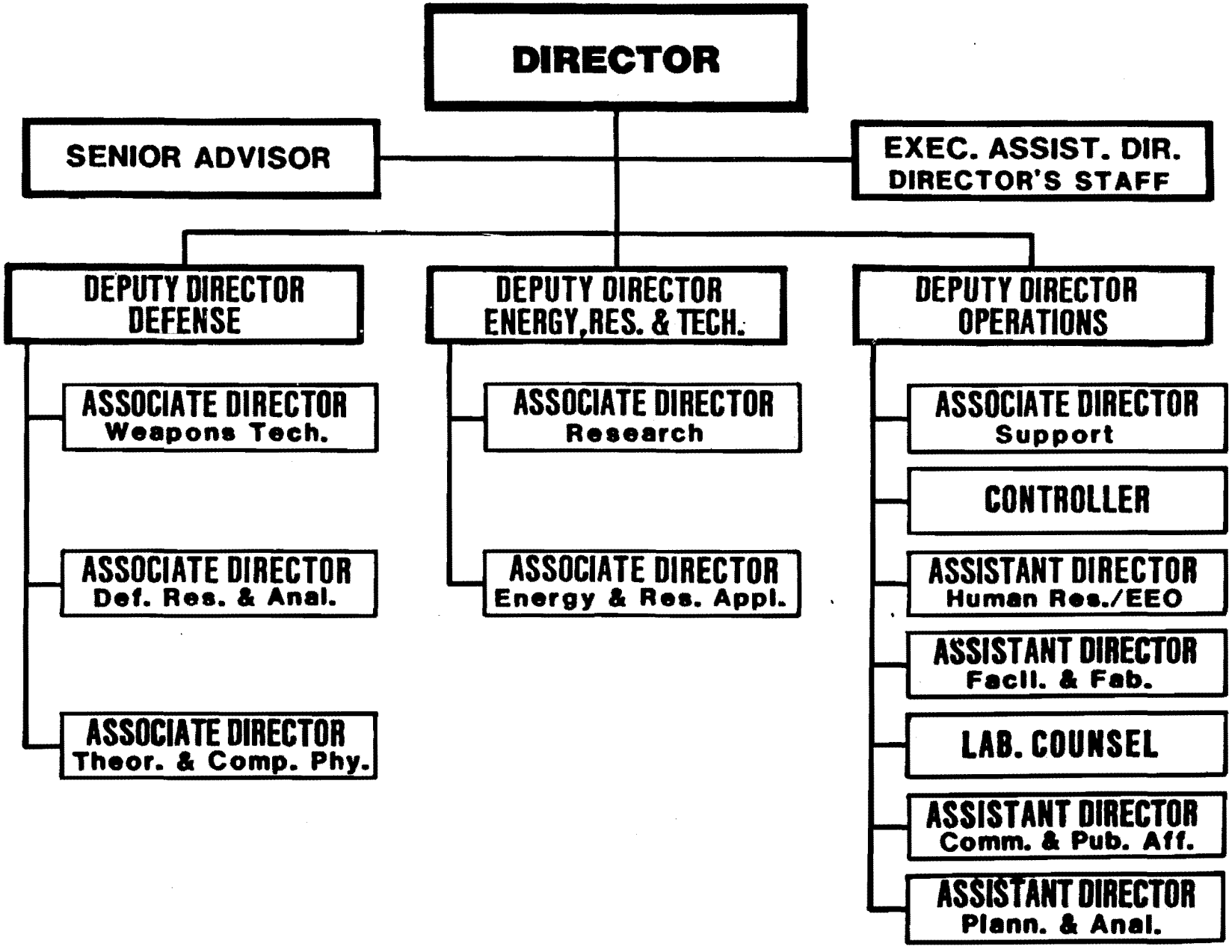
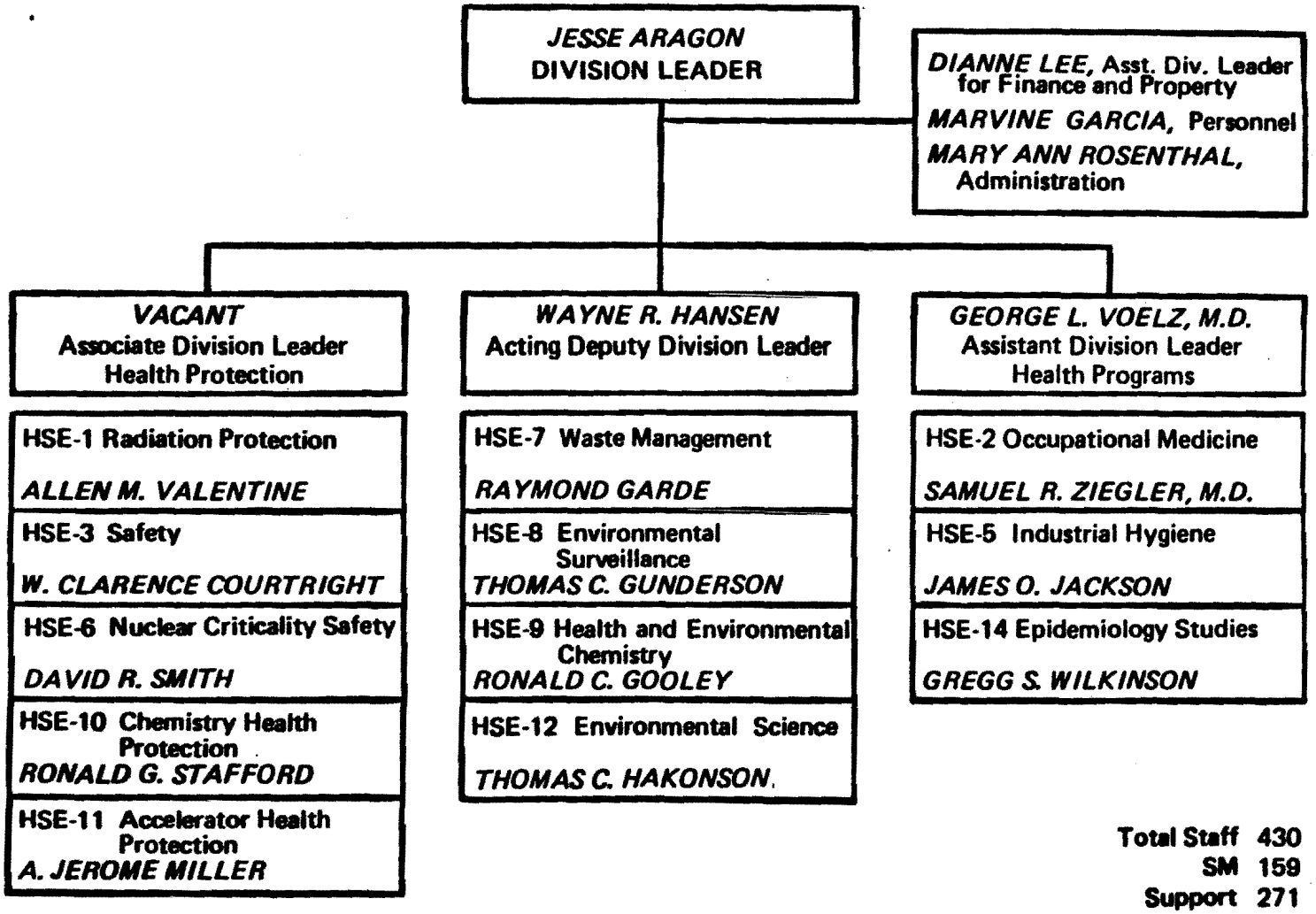


Fig. 1. Los Alamos National Laboratory Organizational Structure

HEALTH, SAFETY, and ENVIRONMENT DIVISION

Los Alamos National Laboratory



Total Staff 430
SM 159
Support 271

January 1, 1986

Fig. 2. HSE Division Structure

general Laboratory support in the areas of monitoring and general waste controls, as well as direct support at the burial/storage site.

Activities within HSE-7 include radioactive liquid and solid waste treatment; hazardous chemical waste packaging, transport, treatment and disposal; and operation of the radioactive and hazardous chemical waste disposal/storage sites. Environmental monitoring at the present and old burial sites is conducted by HSE-8. HSE-8 also ensures overall Laboratory compliance with environmental regulations related to hazardous materials disposal, impact analyses, and NEPA reviews required by the DOE/AL Order 5440.1B.

I.B. General Plant Mission

The principal mission of the Laboratory is the design and development of weapons for the nation's nuclear arsenal; however, considerable research and development (R&D) is directed toward the development of the peaceful uses of nuclear energy including research on controlled thermonuclear reactions, fission reactors, nuclear safeguards, laser fusion, and medium energy physics. Extensive basic research programs in physics, chemistry, metallurgy, mathematics and computers, earth sciences, and electronics support these efforts. Biomedical and environmental research includes programs in molecular biology, radiobiology, radioecology, and industrial hygiene. Expansion into nonnuclear areas is represented by applied technology development of solar and geothermal energy and superconducting power transmission lines.

I.C. Site Description

I.C.1 General Area

The Los Alamos National Laboratory and the resident communities of Los Alamos and White Rock are located in north central New Mexico on the Pajarito Plateau, situated west of the Rio Grande on the eastern slopes of the Jemez Mountains (Fig. 3). The Laboratory was established here during World War II in part because of the mild climate and relative isolation of the loca-

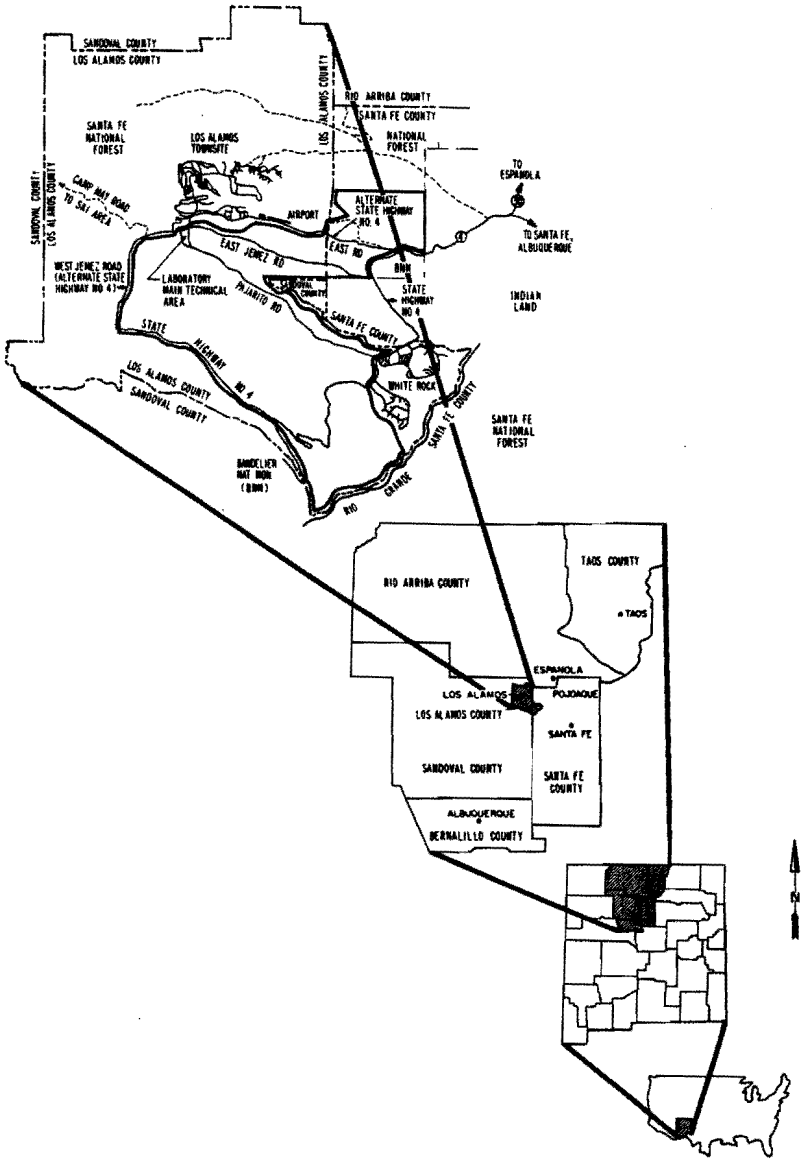


Fig. 3. Location of Los Alamos

tion. The Laboratory site covers about 11 129 hectares* (27 500 acres) in and adjacent to Los Alamos County. The surrounding area, including most of Los Alamos County and portions of Sandoval, Rio Arriba, and Santa Fe Counties, is largely undeveloped except for those areas occupied by Laboratory facilities and the associated communities. Large tracts of land in the Jemez Mountains to the north, west, and south of the Laboratory site are held by the US Forest Service and US National Park Service. This land is largely covered by pine, fir, and aspen forests and supports the usual variety of western mountain wildlife. Agriculture is limited to home gardens and some cattle grazing. In the river valleys to the east, agriculture is limited to the cultivation of relatively small, irrigated plots. Primary crops are corn, chili, tree fruits, and alfalfa. Milk is produced in commercial quantities in the neighboring community of Pojoaque. A more detailed description of the geology, climatology, and economy of the area is given in the Los Alamos Final Environmental Impact Statement.[1]

I.C.2 Waste Management Facilities

Laboratory activities are located in 33 technical areas (TA) widely spread over the site, as shown in Figs. 4 and 5. Radioactive waste management facilities include liquid and solid waste treatment plants with associated effluent control systems, waste storage or burial locations, and airborne contamination release points and their associated effluent control systems, that is, filtration units and monitoring equipment.

The Laboratory is currently utilizing one solid waste disposal site, Area G at TA-54, for radioactive solid waste disposal. Mixed wastes, defined as radioactive wastes that also meet the hazardous chemical waste definition in 40 CFR 261, currently are stored at the TA-54, Area L hazardous waste disposal/storage

*In keeping with Laboratory policy, metric dimensions are used throughout this text with English conversions given in parenthenses.

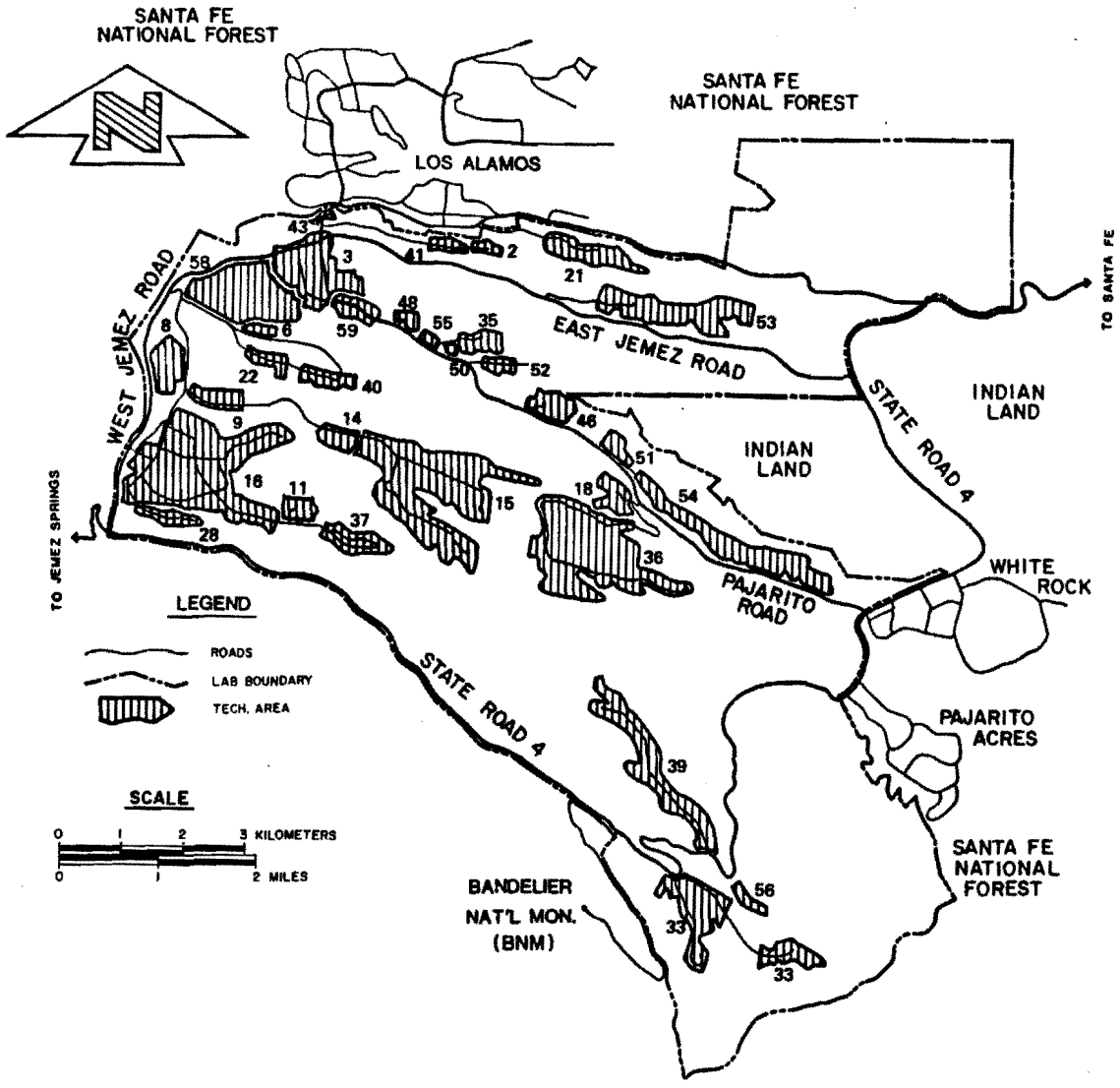


Fig. 4. Los Alamos National Laboratory - technical areas and adjacent communities

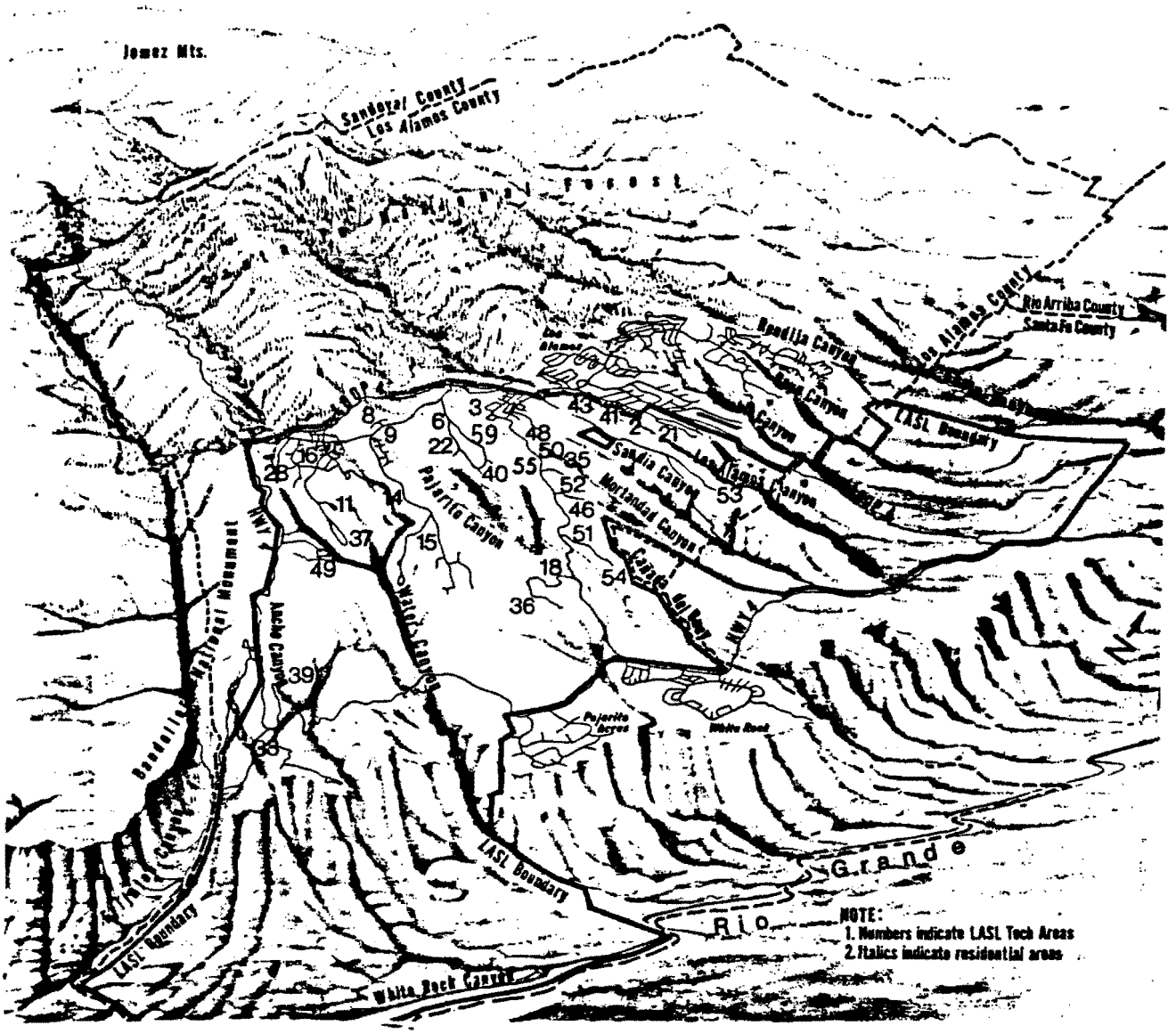


Fig. 5. Topography of the Los Alamos area.

site. High-level, transuranic, and by-product materials are excluded from the definition of mixed wastes. Most of the Laboratory's radioactive and hazardous liquid wastes are treated at TA-50. Similar radioactive liquid wastes are also currently treated at Building 257 at TA-21; the use of this plant is diminishing as generating operations are phased out of TA-21 buildings. Some liquid radioactive wastes are generated at the LAMPF accelerator and are held in lagoons at TA-53. Figures 6 through 10 show the location of these facilities.

Liquid waste treatment processes at TA-21 and TA-50 typically produce a solid waste with small radioactive residuals in the liquid and gaseous effluents. Liquid effluents are treated to DOE Order 5480.1a.II (ERDA Manual Chapter 0524) release limits prior to discharge into Mortandad Canyon north of TA-50 and to DP Canyon north of Building 257. Gaseous effluents at each generation site are managed in compliance with DOE Order 5480.1a.II (ERDA Manual Chapter 0524) release limits prior to release to the atmosphere. Solid radioactive wastes are packaged at the generation site for shipment to Area G, TA-54 where they are buried in pits or shafts if low-level, or stored retrievably if TRU. Chemical wastes are shipped from the generation site to Area L, TA-54 for packaging storage, and treatment.

I.C.3 Geology and Related Disaster Expectations

TA-50 is between 2207 m (7240 ft) and 2213 m (7260 ft) in elevation on a mesa top which slopes southeasterly to an elevation of about 2024 m (6640 ft) at the end of TA-54 (Fig. 5). The axial trend of the mesa is southeast, about 6.7 km (4.2 mi) long and 0.16 km (0.1 mi) to 0.32 km (0.2 mi) wide. The mesa is bounded on the north and south by canyons cut 14-28 m (45-90 ft) below the mesa surface. Numerous small side drainages cut the edges of the mesa. The canyon to the north of TA-50 is Mortandad Canyon while the canyon to the north of TA-54 is Canada del Buey. The canyon to the south of both TA-50 and TA-54 is Pajarito Canyon.

TA-21, often called DP-West, is on a mesa with features

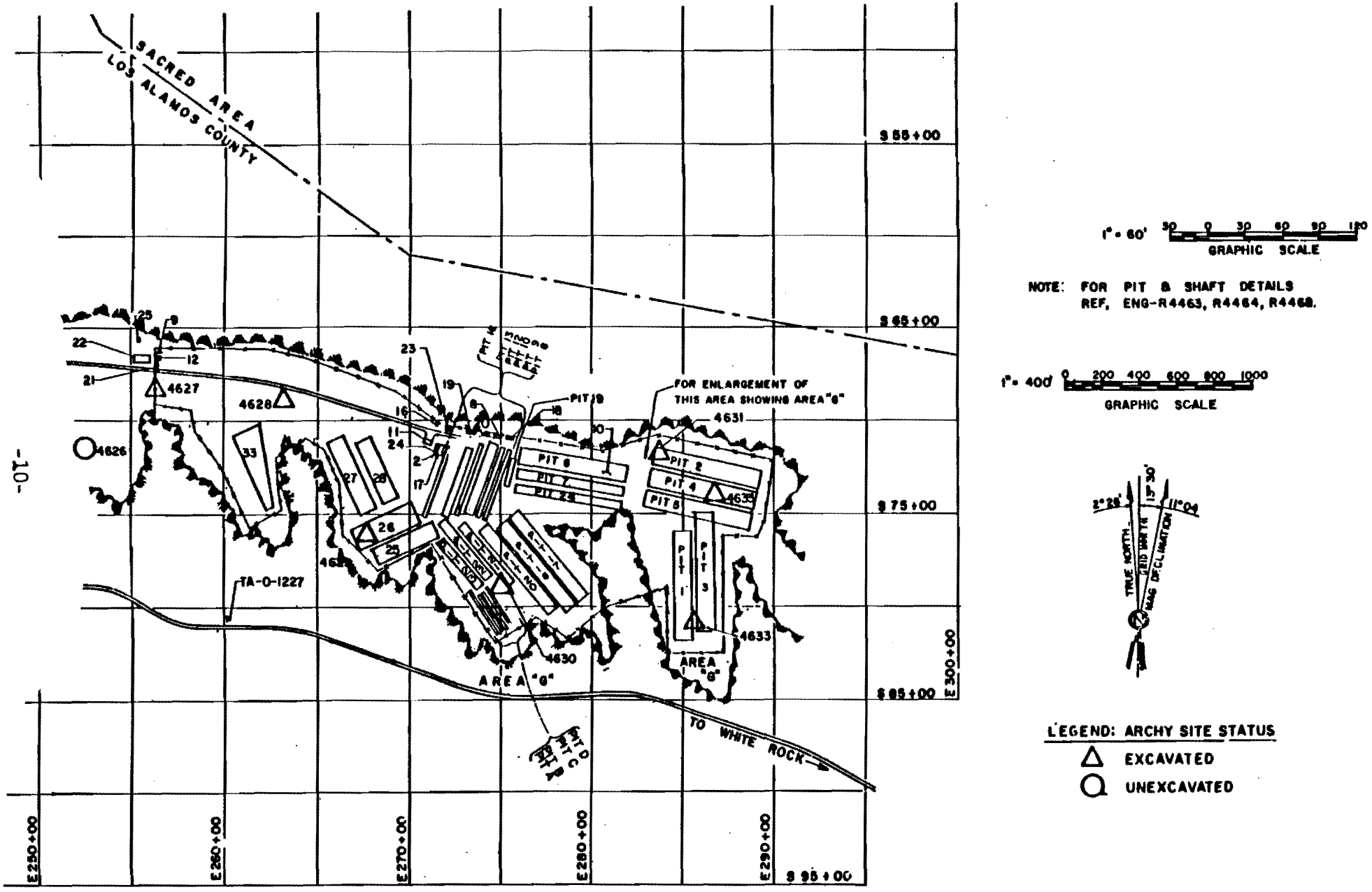
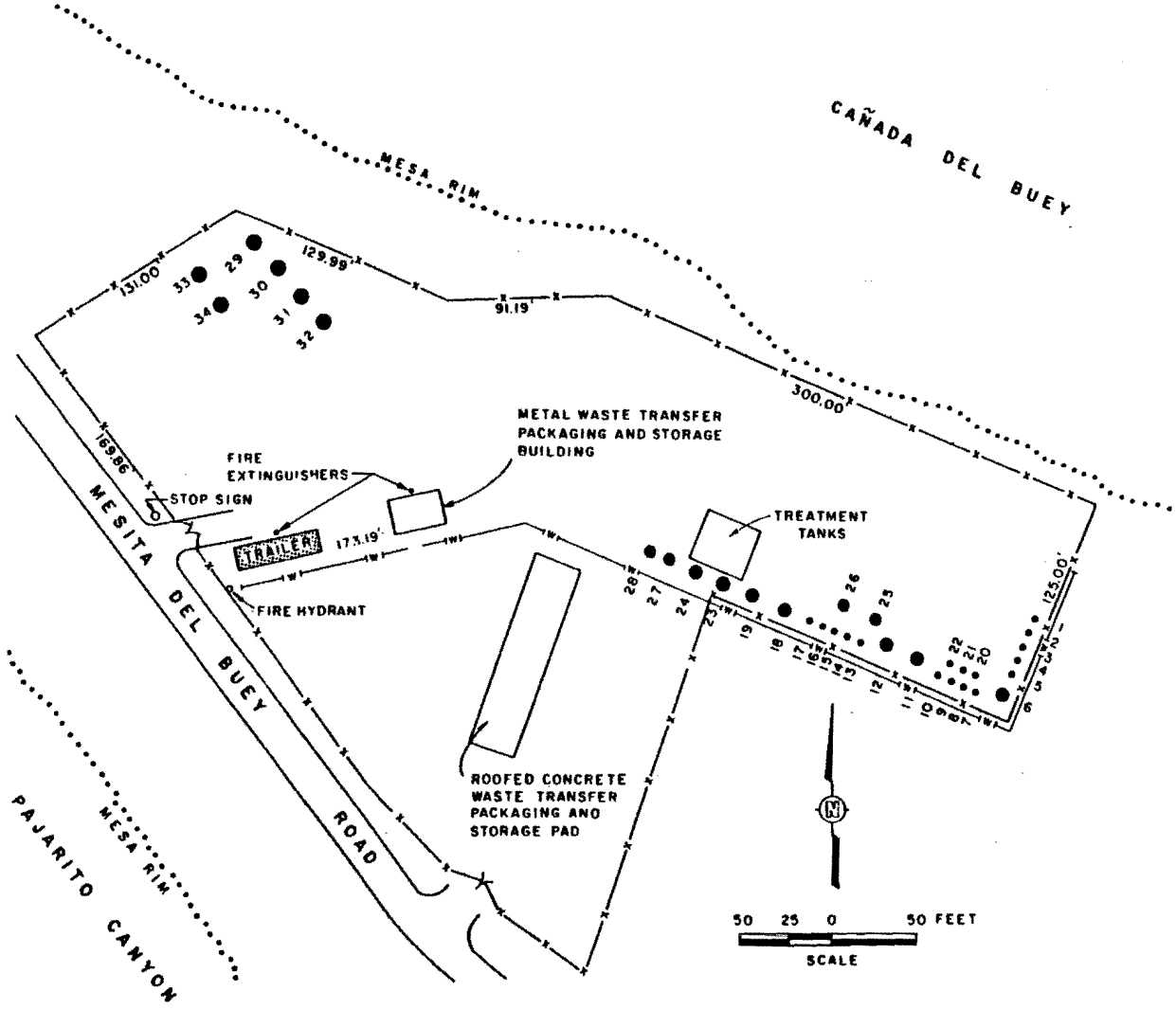


Fig. 6. TA-54, Area G Plot Plan.



AREA L SHAFTS[1]
(INFORMATION CURRENT MARCH 1985)

SHAFT NO.	SHAFT DIAMETER (FEET)	DATE DRILLED	DATE CAPPED	CONTENTS
1	3	4/80	9/83	ORGANICS[2]
2	3	2/75	7/79	ACIDS & BASES
3	3	2/75	11/78	INORGANIC
4	3	2/75	5/80	ORGANIC
5	3	2/75	6/77	WASTE OIL
6	4	6/75	6/79	REACTIVE
7	3	6/75	6/79	REACTIVE
8	3	6/75	6/79	REACTIVE
9	3	6/75	6/79	GAS CYLINDERS
10	3	6/77	6/79	WASTE OIL
11	8	1/78	7/79	WASTE OIL/SOLVENT
12	4	1/78	7/79	WASTE OIL/SOLVENT
13	3	6/79	5/82	INORGANIC
14	3	6/79	5/82	REACTIVE
15	3	6/79	5/82	REACTIVE
16	3	6/79	5/82	GAS CYLINDERS
17	3	6/79	5/82	ORGANIC
18	8	6/79	6/80	WASTE OIL
19	8	4/80	5/82	WASTE OIL
20	3	4/80	9/83	INORGANIC
21	3	4/80	OPEN	GAS CYLINDERS
22	3	4/80	9/83	ORGANIC
23[3]	8	4/82	3/84	WASTE OIL
24[4]	8	4/82	4/84	ORGANIC & WASTE OIL
25	6	9/82	5/85	INORGANIC
26	6	9/82	3/84	ORGANIC
27	4	1/83	2/85	SPECIAL[5]
28	4	1/82	5/85	SPECIAL
29	6	12/83	8/84	ORGANIC
30	6	12/83	8/84	ORGANIC
31	6	12/83	9/84	ORGANIC
32	4	9/84	9/84	ORGANIC
33	6	9/84	2/85	ORGANIC
34	6	2/85	5/85	ORGANIC

NOTES:
(1) ALL SHAFTS ARE APPROXIMATELY 60 FEET DEEP.
(2) SHAFT ONE CONTAINS WASTES NOT IN DRUMS.
(3) PRIOR TO SHAFT 23, LIQUIDS WERE DISPOSED OF IN DRUMS WITHOUT ADDING ABSORBENTS.
(4) MIDDLE SECTION OF THIS SHAFT NOT USED.
(5) USED FOR MISCELLANEOUS WASTE REQUIRING GREATER ISOLATION.

Fig. 7. TA-54, Area L Plot Plan

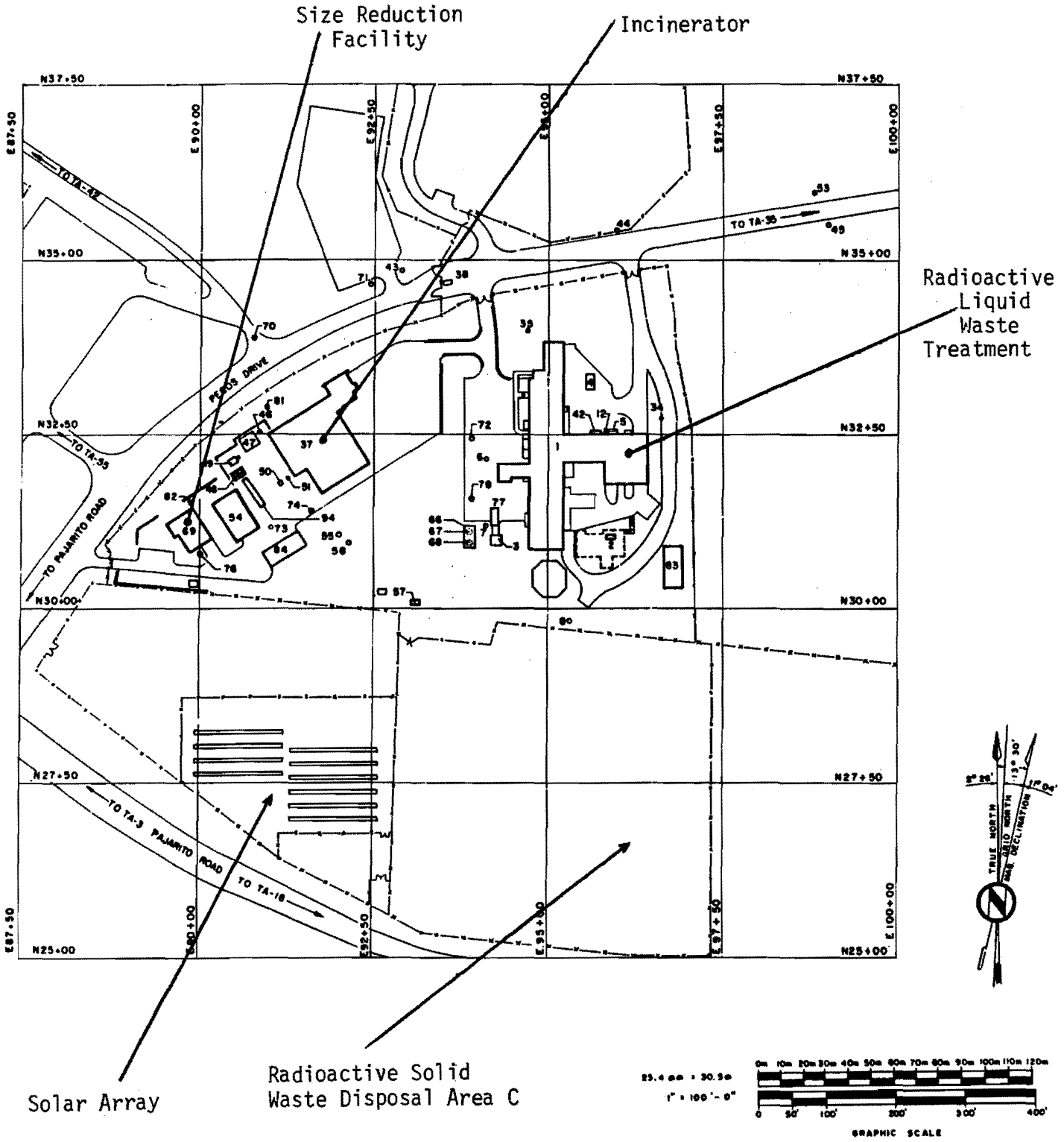


Fig. 8. TA-50 Plot Plan

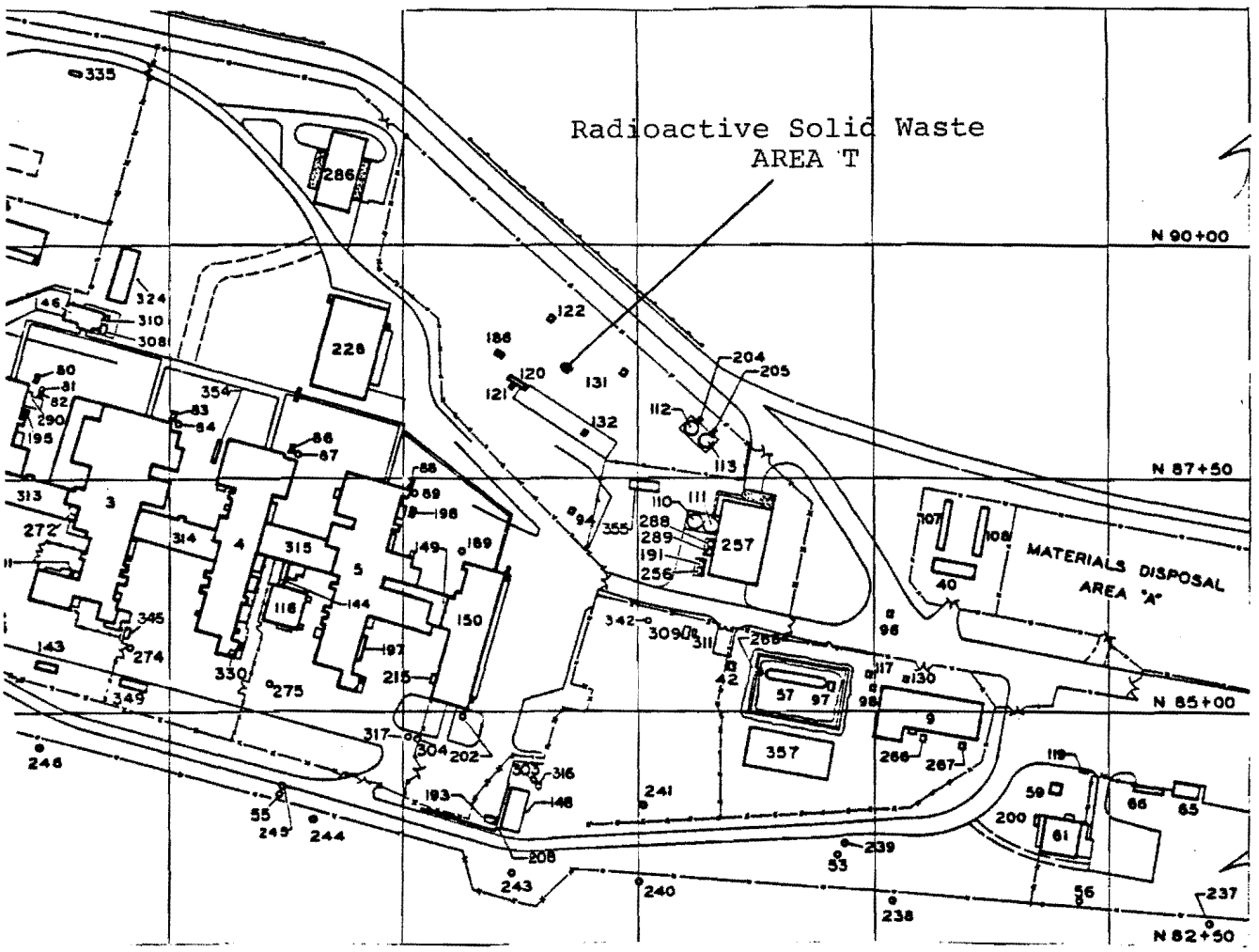


Fig. 9. TA-21, Building 257 Plot Plan

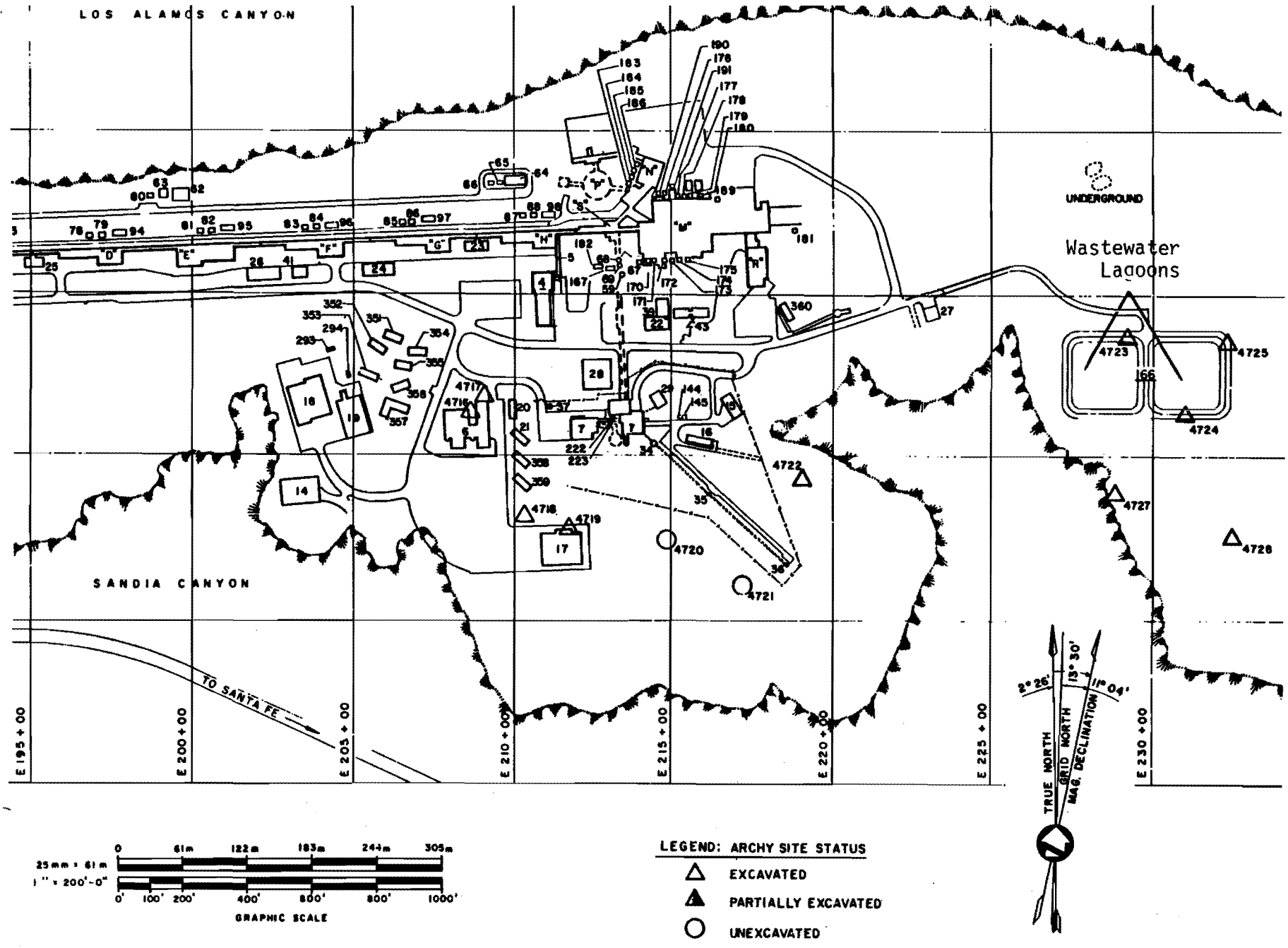


Fig. 10. LAMPF Plat Plan Including Wastewater Lagoons

similar to those of TA-50. However, this mesa is about 3.22 km (2 mi~~les~~) north and west of TA-54 and its axial trend is easterly. TA-21 is bounded on the south by Los Alamos Canyon and on the north by DP Canyon. TA-53, the LAMPF site, is on the mesa just south and east of TA-21 across Los Alamos Canyon. The features of this mesa and its canyons are also similar to those at TA-50.

The surface and underlying rocks of these mesas are ashflows and ashfalls of rhyolite tuff underlain by volcanic basalts interbedded with sediments. The tuff is about 75 m (246 ft.) thick. Floods, earthquakes, or volcanic eruptions sufficient to compromise the integrity of confinement are not likely[1,2].

I.C.4 Climate with Frequency and Types of Severe Weather

Los Alamos has a semiarid, temperate mountain climate characterized by clear skies, light winds, dry atmosphere, warm days, and cool nights. On the whole, the predominant winds are southwesterly over all sites though more southerly over TA-54. A daily wind cycle exists with upslope southeast daytime winds and nighttime drainage winds from the west. Superimposed on the cycle are significant spatial and daily variation of surface winds which are caused by the complex terrain.

Summer maximum temperatures are usually below 32°C (90°F) with overnight temperatures dropping into the 12 to 15°C (54 to 59°F) range. Winter temperatures are typically in the range of -10 to 5°C (17 to 41°F) although occasionally temperatures do drop to near -18°C (0°F) or below.

The average annual precipitation is 41 cm (16 in.). Forty percent or 18 cm (7 in.) is produced by warm-season migratory storms. Warm season precipitation falls primarily during brief afternoon thundershowers, especially during July and August. The balance, about 23 cm (9 in.), is typically cold season migratory snowstorms.

Although winds at Los Alamos are characteristically light, strong wind gusts exceeding 27 m/sec (60 mph) are common during spring months. Historically, no tornadoes have been reported in

Los Alamos County proper, although the potential for them does exist. Tangential wind velocities often exceed 31 m/sec (70 mph). A funnel cloud was sighted and photographed east of the Laboratory boundary in 1982. Dust devils are common during the warm months, and probably do the most storm damage annually of any weather phenomenon.

Lightning is sufficiently common over the Pajarito Plateau that lightning protection is an important consideration applied to each facility at the Laboratory. There is an average of 58 thunderstorm days per year at Los Alamos. Hailstones with diameters up to 0.6 cm (0.25 in.) are common, while 1.3 cm (0.5 in.) hailstones are rather rare. Thundershowers occasionally generate flash floods in local canyons.

I.C.5 Depth of Groundwater, Locations of Onsite Supply Wells or Injection Wells, and Location of Groundwater Monitoring Wells

The main aquifer of the Los Alamos area is the only aquifer in the area capable of serving as a municipal water supply. The surface of the aquifer rises westward from the Rio Grande within the Tesuque Formation into the lower part of the Puye Formation beneath the central and western part of the plateau (Fig. 11). Depth to the aquifer is 360 m (1200 ft.) along the western margin. At TA-21 and TA-53 the aquifer is about 390 m (1280 ft.) deep, whereas at TA-50 it is 335 m (1100 ft.) deep and at TA-54 the aquifer is 250 m (820 ft.) deep. All water used at the Laboratory is piped from DOE-owned and ZIA-operated wells. Drinking water wells are well beyond disposal site boundaries (Fig. 12).

Although perched water can occur ephemerally in local canyons from weather or continuously from manmade sources, there is no known perched water between the surface of the mesa at TA-54 and the main aquifer. Since the main aquifer is isolated from TA-54, there is no hydrologic connection or potential for recharge to it from solid waste disposal. That is, migration of waste constituents through more than 250 m (820 ft.) of unsaturated volcanics and sediments is not likely.

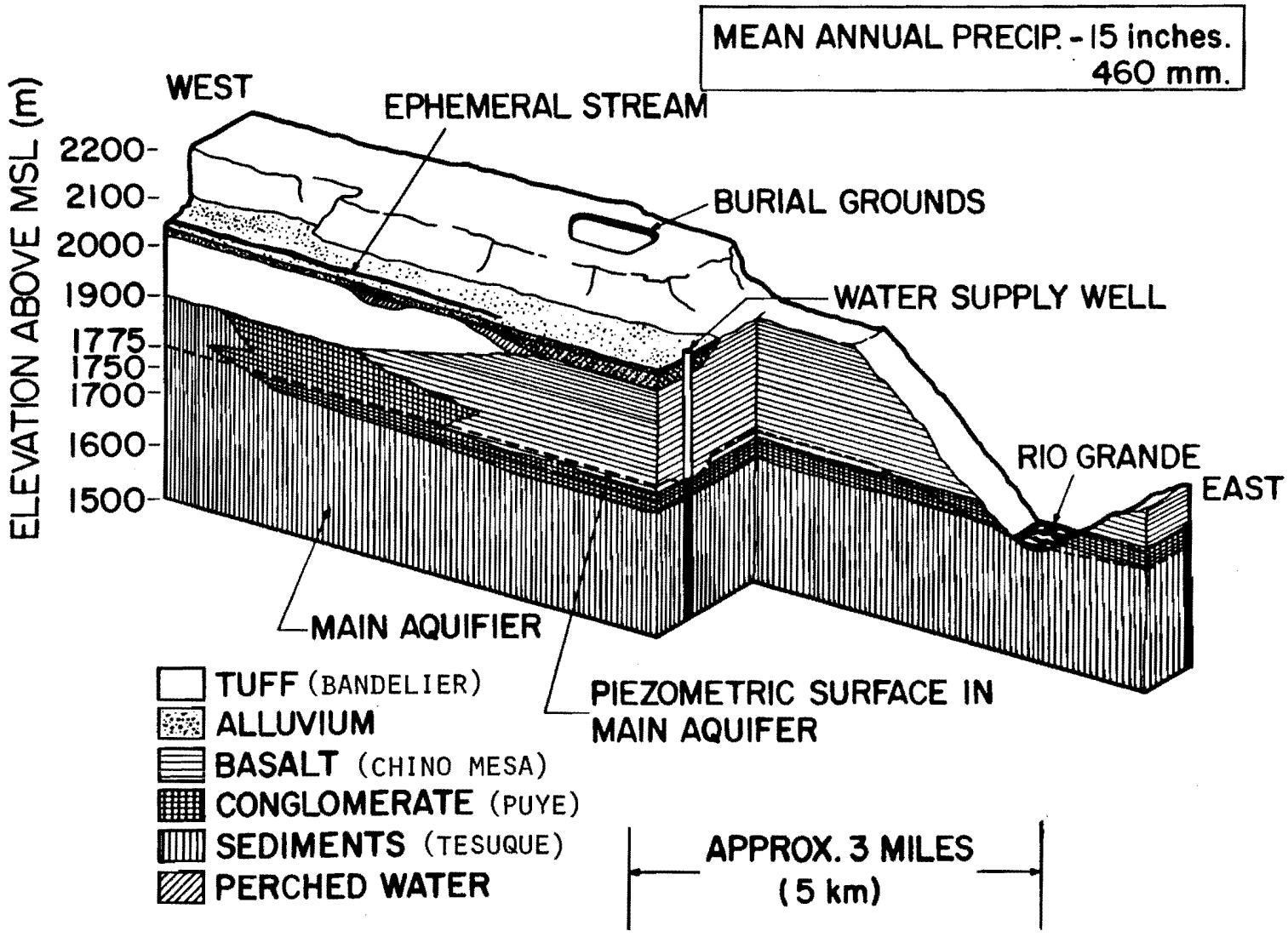
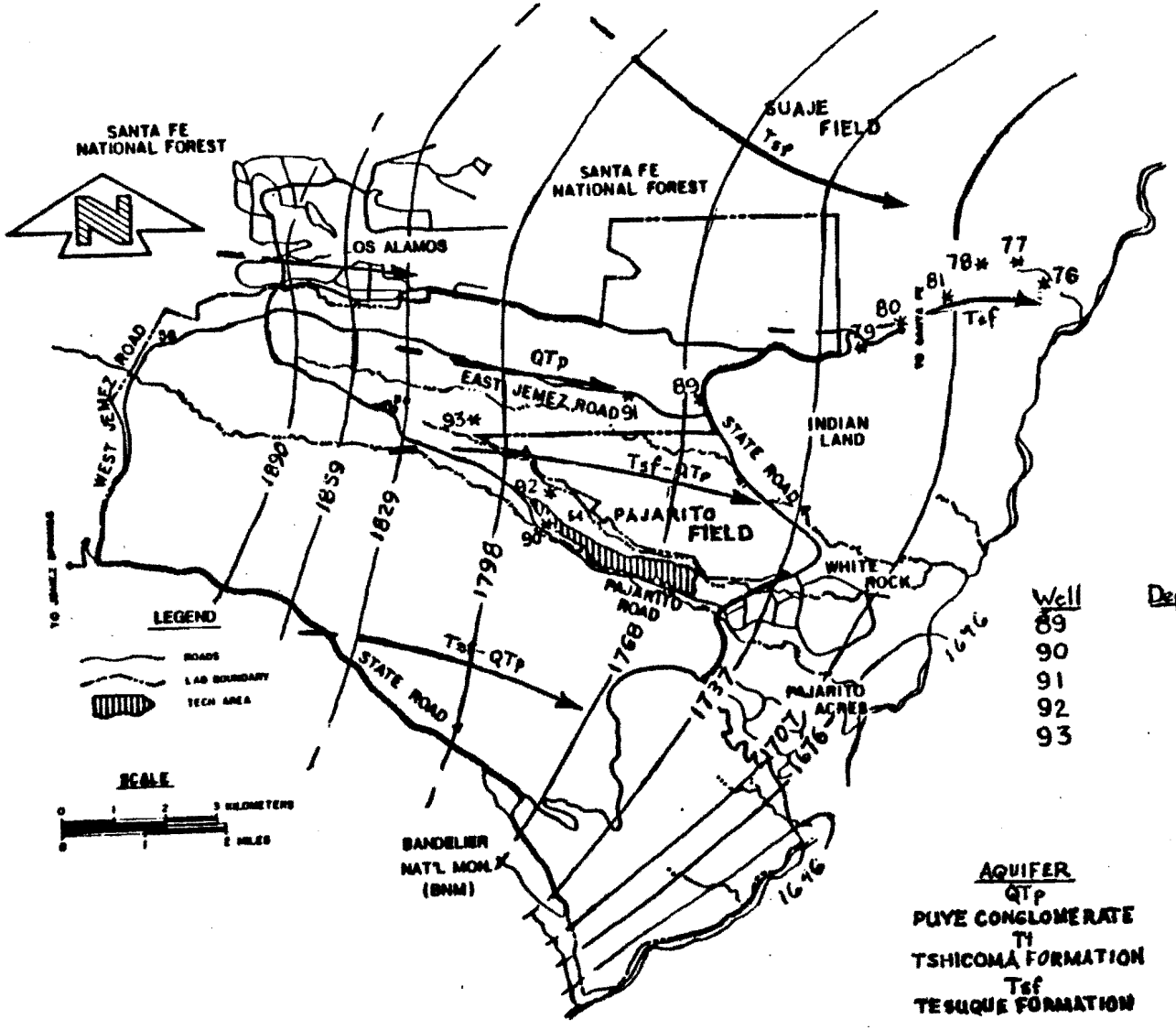


Fig. 11. Conceptual Illustration of Geologic-hydrologic Relationships in the Los Alamos Area



Well	Depth to Water/Elevation of Water (meters)
89	228/1759
90	266/1780
91	232/1792
92	319/1790
93	212/1799

Fig. 12. Groundwater Flow Pattern and Municipal Supply Wells

Perched water in canyon alluvium downstream from liquid effluent discharge areas is monitored with observation holes and test wells shown in Fig. 13. The main aquifer is monitored by taking water samples from municipal supply wells.

I.D. Environmental Monitoring

HSE-8 is responsible for environmental sampling and monitoring at the Los Alamos National Laboratory. The most recent edition of the Laboratory's annual Environmental Surveillance Report states the Laboratory's ongoing commitment to comply with applicable environmental regulations; i.e., "...it [Environmental Monitoring] helps fulfill the Laboratory's policy to protect the general public, employees, and environment from any harm that could be caused by Laboratory activities and to reduce environmental impacts to the greatest degree practicable."[3] The annual environmental reports are prepared in keeping with this policy and DOE requirements to assess and document possible influences of operations on the environment. As part of these reports, HSE-8 provides the DOE with review of environmental surveillance activities at waste management sites to document compliance with appropriate standards, and identify possible undesirable trends.

I.E. Site Safety Assessment

The Los Alamos Final Environmental Impact Statement[1] addressed the impact of waste management activities, including transportation and disposal. Final safety analysis reports have been written for the Size Reduction and Treatment Development facilities. A safety analysis report is being developed for the radioactive and chemical liquid waste treatment systems at TA-50.

I.F. Quality Assurance

Quality assurance has become an integral part of all waste management activities. Specific procedures have been developed for the TRU Waste Certification Plan, the design and construction of new waste management facilities, operation of existing waste management facilities, and the instruments and analysis techniques used for environmental surveillance. These procedures are in compliance with DOE/AL 5700.6A. When nonconformances are found in an area, the appropriate corrective actions are taken.

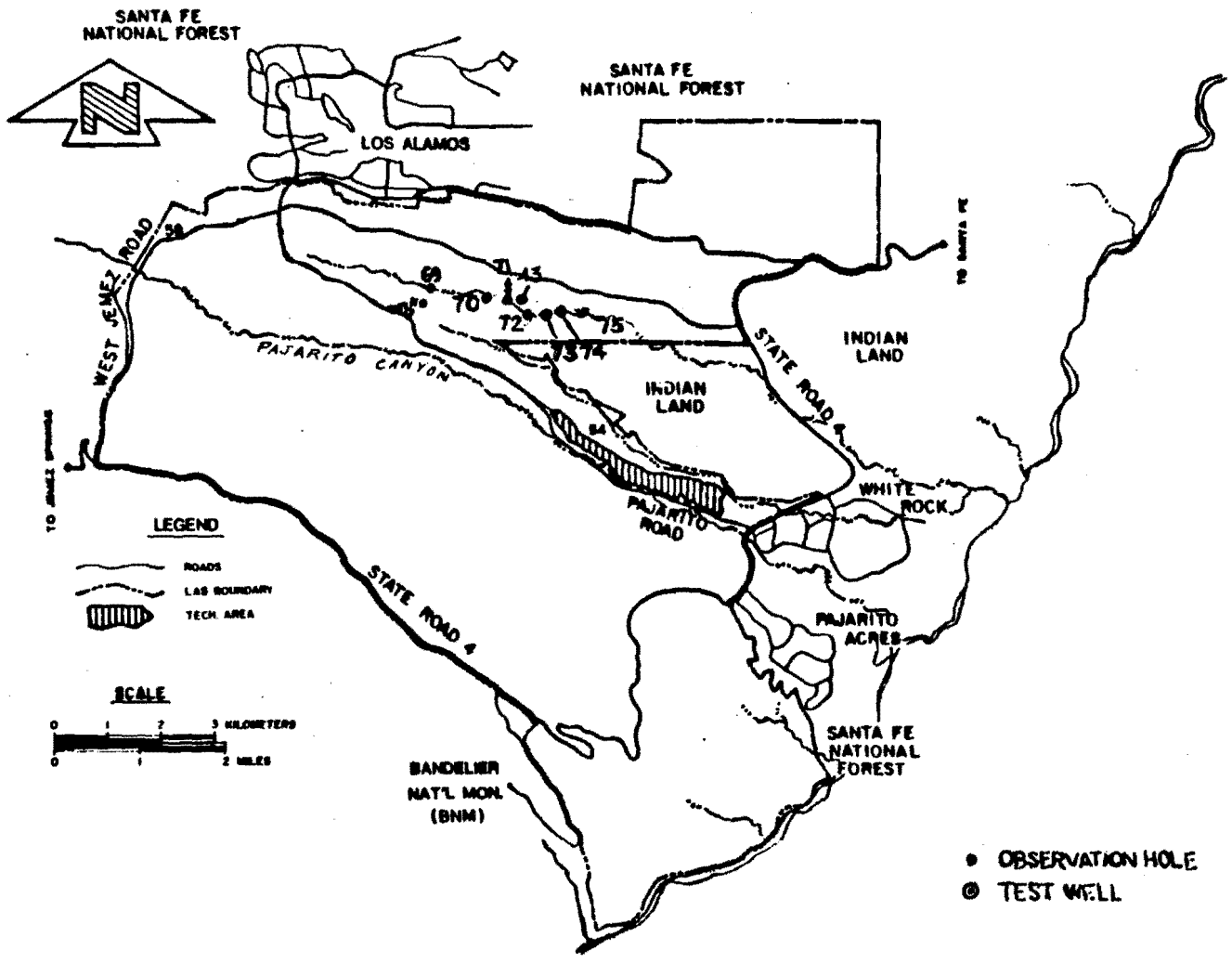


Fig. 13. Perched Water Monitoring System

II. RADIOACTIVE WASTE MANAGEMENT

II.A. Radioactive Waste Management Facilities

II.A.1 Locations

Locations of major radioactive waste management facilities are shown in Fig. 14. Facilities include liquid waste treatment plants with associated effluent control systems, solid waste treatment, storage, and burial locations, and locations of airborne contamination release points and their associated effluent control systems, that is, filtration units and monitoring equipment.

II.A.2 Treatment Facilities

Liquid waste treatment facilities at the Laboratory include a 950-L/min (250-gal./min) chemical-treatment and ion-exchange plant and a 95-L/min (25-gal./min) pretreatment plant at TA-50-1, a 475-L/min (125-gal./min) chemical treatment plant at TA-21-257, and a large number of storage buildings and neutralization and/or pumping stations. Figure 15 indicates the sites served directly by pipeline collection systems and those sites served by loading stations for trucking liquid waste to TA-50.

Three solid waste treatment facilities are in use at the Laboratory. A compactor-baler is located at Area G, TA-54 for the compaction of low-level solid waste. The Size Reduction Facility, at TA-50-69, is designed to repackage and reduce the volume of TRU-metallic waste items such as glove boxes, process equipment, and ductwork. A modified, controlled-air incinerator, housed in the Treatment Development Facility (TDF) at TA-50-37, was designed and constructed to develop methods to reduce volume, stabilize chemical composition, and eliminate combustibility of defense TRU wastes.

II.A.3 Storage Facilities

As of 1971, the disposal of all waste defined as transuranic was modified to twenty-year storage. These storage facilities consist of pads, shafts, and trenches located at Area G, TA-54, and Area T, TA-21.

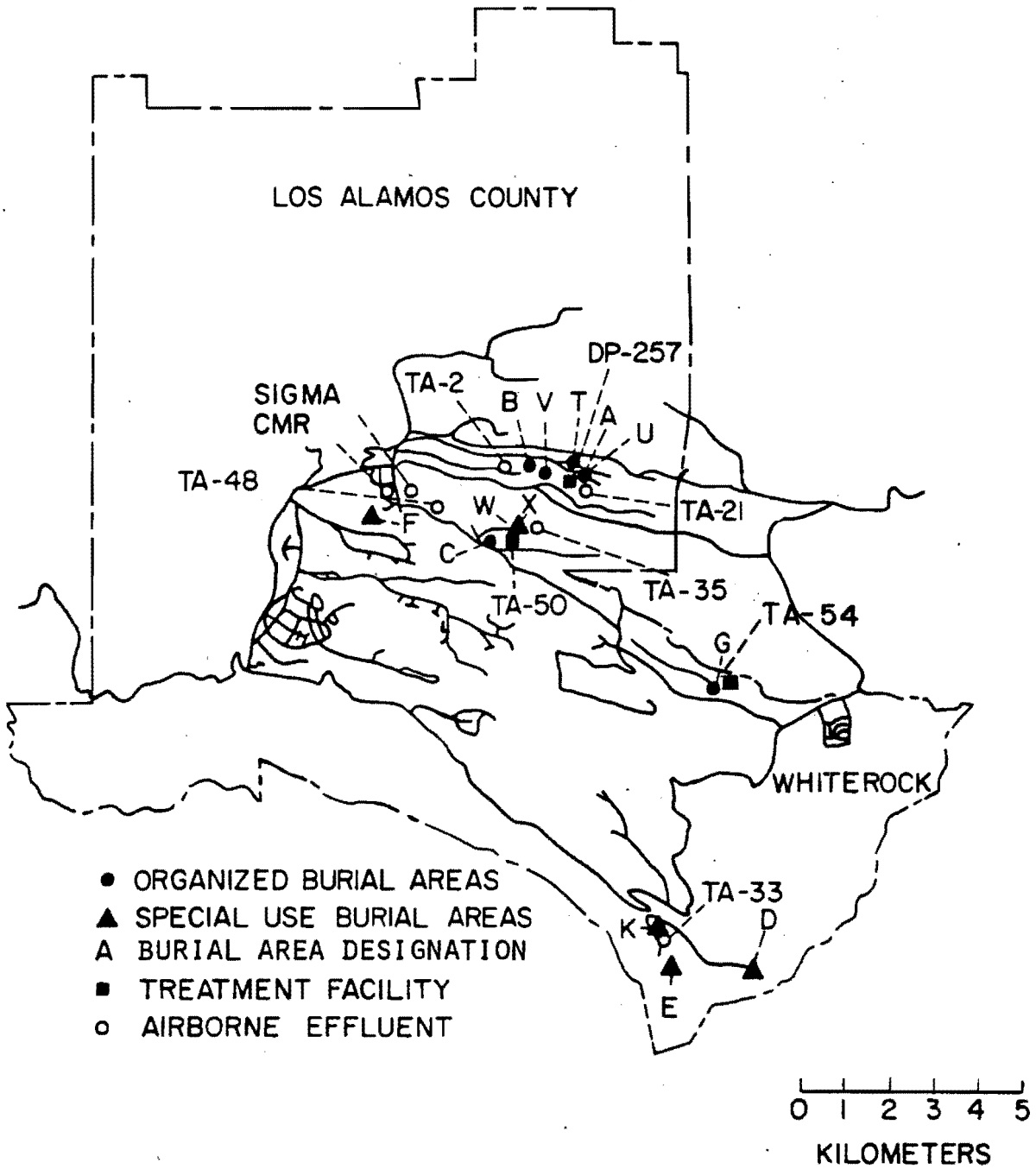


Fig. 14. Radioactive Waste Management facilities

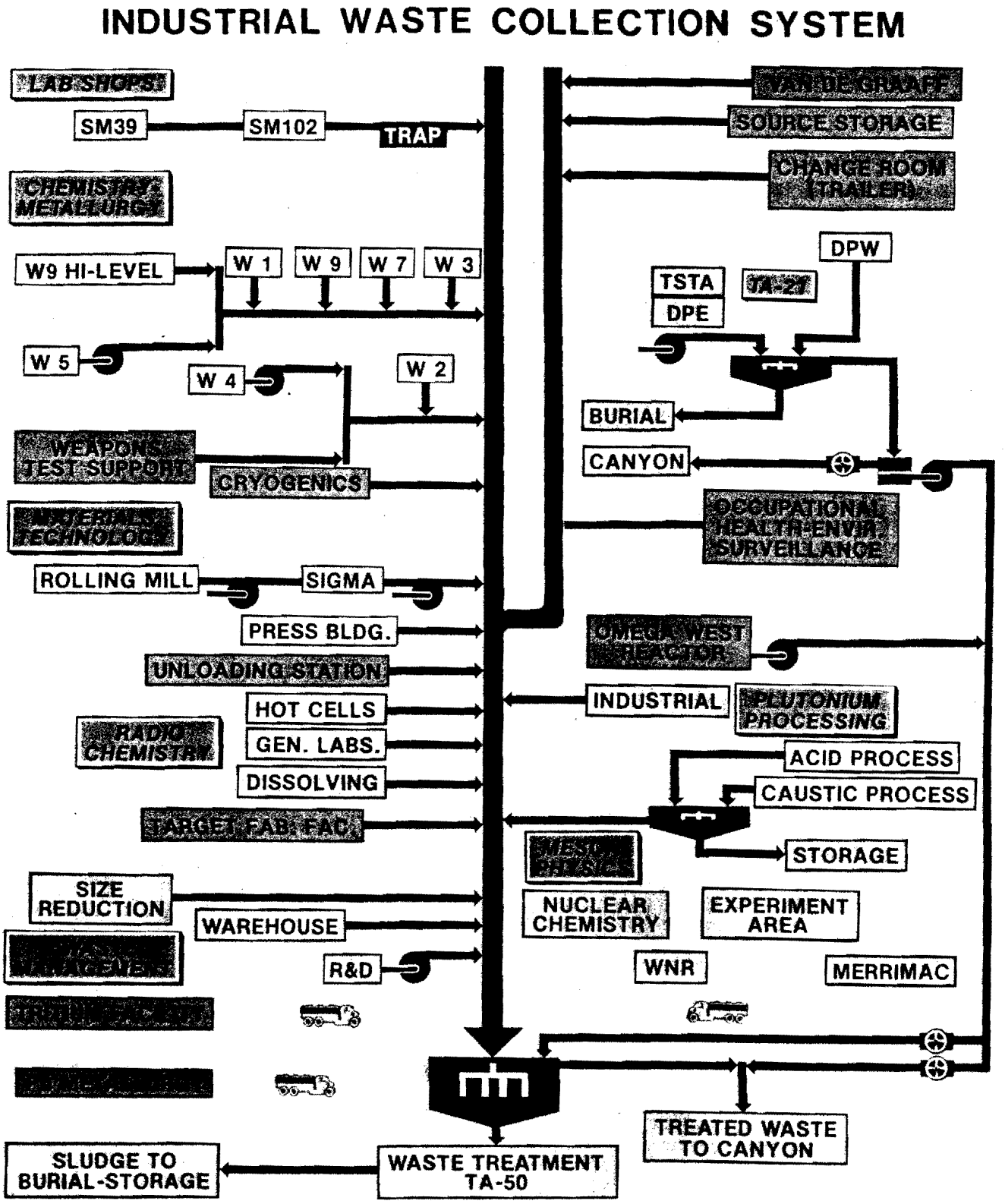


Fig. 15. Central waste collection system discharging to TA-50.

II.A.4 Disposal Facilities

The only currently operating disposal site for radioactive solid waste at Los Alamos is Area G, TA-54. In FY 1977, the active portion of the site was expanded to a total of 25.5 hectares (63 acres); future expansion of this area is anticipated in the next five years. Burial facilities within the area include pits and shafts of varying dimensions.

II.B. Radioactive Waste Management Operations

II.B.1 Treatment Facilities

II.B.1.1 Liquid Waste Treatment, TA-50

The TA-50 facility[4-8] (Fig. 16) provides a neutralization chamber, flash mixers, chemical feeders, flocculator-clarifiers, distributor for CO_2, ion-exchange columns, spent regenerant storage-treatment tank, vacuum filter, and wiped film evaporator. Chemicals used for separation and concentration of alpha emitting radionuclides include ferric sulphate, lime, and coagulant aids.

A wiped-film evaporator has been installed at TA-50 to concentrate high-nitrate waste streams; start up is awaiting redesign of the fire safety system in the oil heater. Operations are expected to begin in mid 1986.

The sludge produced by chemical treatment is dewatered by vacuum filtration to 25-40% solids, placed in lined 210-L (55-gal.) steel drums (if the TRU radionuclide activity is >100 nCi/g, the lined drums from Rocky Flats are used) and forwarded to the solid waste disposal/storage area at Area G. The TRU content of the TA-50 plant vacuum filter sludge declined from about 100 nCi/g in October 1984 to about 30 nCi/g in September 1985. In August 1985, the TA-50 sludge dropped below 100 nCi/g and has remained there.

During FY 1985, liquid process wastes from the Plutonium Facility were pretreated before treatment in the main TA-50 plant. This resulted in the removal of more than 99% of the Am and Pu, which was incorporated in 10 drums, each containing 140 L (36 gal.) of cement paste. For this period, the total $^{238,239,240}Pu$ contained in these drums was 14 Ci while ^{241}Am was 9 Ci.

LIQUID WASTE TREATMENT FACILITY TA-50

Los Alamos National Laboratory

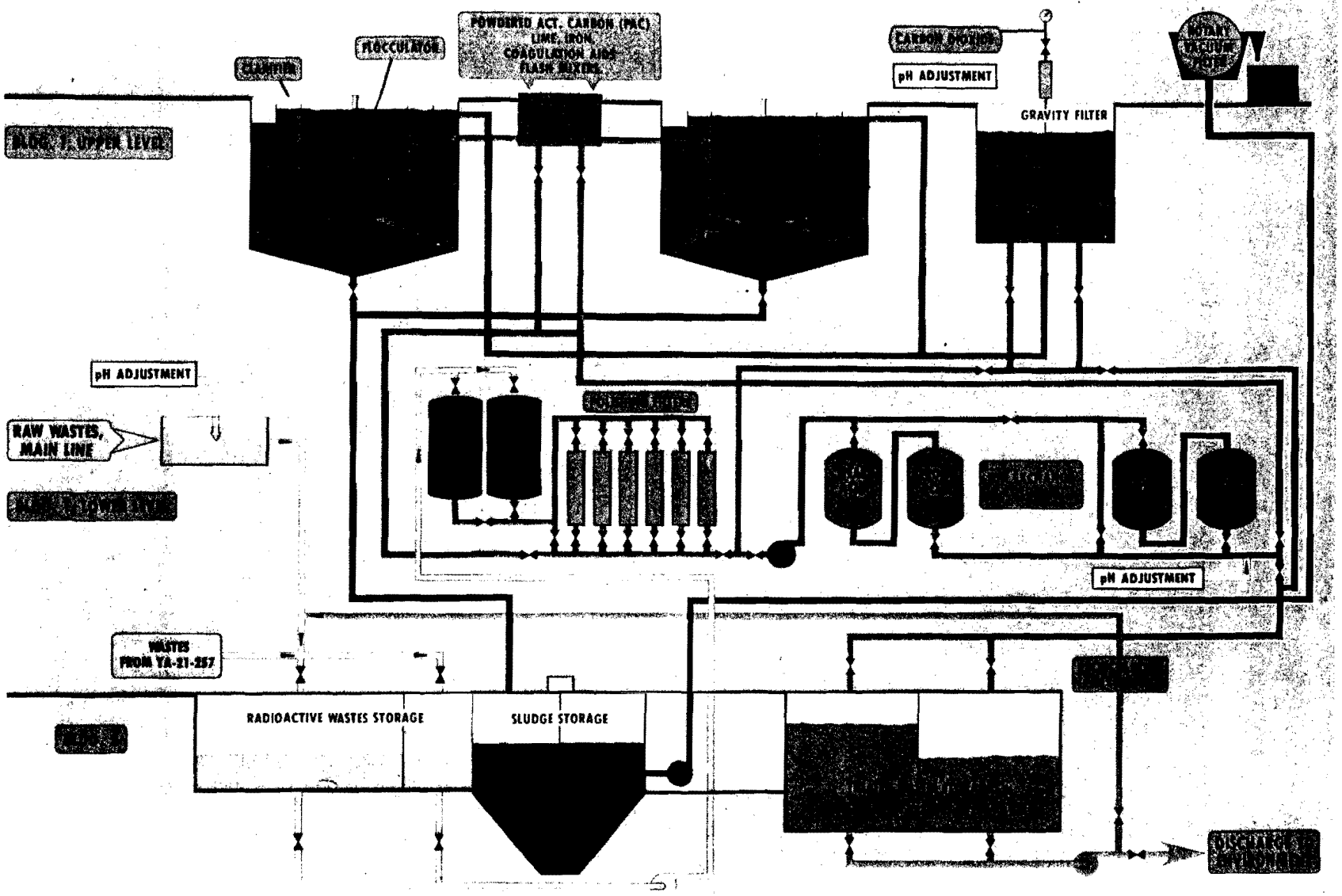


Fig. 16. Contaminated Liquid Waste Treatment Plant, TA-50
Schematic Flow Diagram for Normal Operation.

In FY 1985, the TA-50 plant treated 3.2×10^7 liters (8.5×10^6 gal.) of liquid waste containing 9.4 Ci of Pu and Am. Effluents discharged contained 16.6 mCi of Pu and Am. The uranium content was negligible. The vacuum filter at TA-50 was used to dewater sludge which was placed in 824 drums. This sludge contained 9.9 Ci of Am and 10.5 Ci of Pu. All but 190 of the 824 drums contained over 100 nCi/g of Am and Pu.

II.B.1.2 Liquid Waste Treatment, TA-21-257

This plant[5-9] (Fig. 17) provides a bar screen, grit chamber, raw waste storage, flash mixer, chemical feeders, flocculator, sedimentation tank, filter sump, pressure filter, and treated waste storage tanks for treatment of low-level radioactive wastes. In FY 1985, 3.3×10^6 L (8.7×10^5 gal.) of waste containing about 0.1 Ci of alpha radioactivity were treated. About 2 mCi of gross-alpha activity were discharged from this facility. As of July 1985, the discharge of effluent from TA-21-257 into DP canyon was stopped and the effluent was transferred via pipeline to TA-50 for discharge into Mortandad Canyon. All of the dewatered sludge from the vacuum filter contained less than 100 nCi/g TRU in FY 1985. Sludge in 131 of the 210-L (55-gal.) drums from the vacuum filter contained 0.3 Ci of alpha activity.

II.B.1.3 Compactor, Area G

Low-level waste at Los Alamos is required to be segregated into compactible and noncompactible categories by generators. Compactible waste is defined as:

> Solid waste consisting of trash-type materials such as paper, plastic, rubber, and small items of glassware up to 1-gallon in size. Small items such as short lengths of pipe or conduit, small pieces of wood or sheet metal, may be included in compactibles; larger wood or metal items are to be excluded. Also excluded are any waste chemicals, free or absorbed liquids, biological waste, pressurized containers, or other hazardous materials.[10]

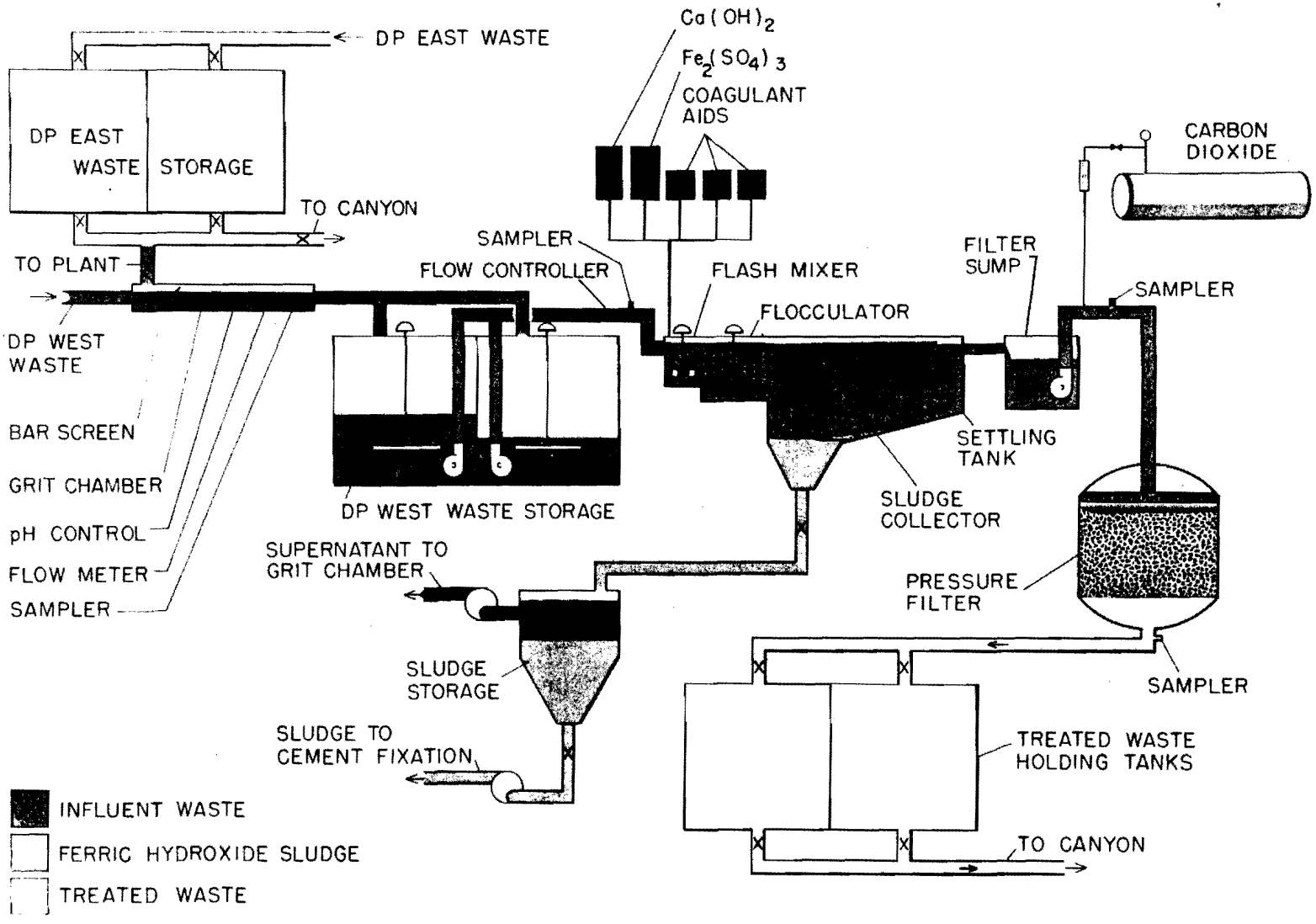


Fig. 17. Contaminated Liquid Waste Treatment Plant TA-21, DP-257.

The majority of this type of waste is received in 0.06 m^3 (2 ft^3) boxes inside dumpsters. Boxes are limited to a maximum weight of 13.6 kg (30 lb). Dumpsters are directed after inspection to the compactor area where they are unloaded into a large bin. The boxes are removed by the operator from the bin and hand fed into the compactor. This process is continued between compacting cycles until a bale 0.4 m^3 (14 ft^3) in size and weighing approximately 200 kg (440 lb) is formed. This bale is banded, wrapped and sealed in plastic, and placed in the disposal pit. An average 5:1 volume reduction ratio is achieved with this type waste. Specific attributes, besides reduced volume, include minimizing the combustibility of the waste and the potential for future pit subsidence. The Los Alamos compactor-baler, acquired in 1977 at a cost of approximately $30,000, through FY 1985 has compacted 6952.5 m^3 (245 424 ft^3) of waste to a burial volume of 1403.0 m^3 (49 526 ft^3), for an overall volume reduction of 5.0:1.

II.B.1.4 <u>Size Reduction Facility, TA-50-69</u>

The Los Alamos TRU Waste Size Reduction Facility (SRF) is a production-oriented prototype designed to repackage and reduce the volume of various types of metallic waste items such as glove boxes, process equipment, and ductwork. The original concept of the SRF was developed in mid-1979 as part of the overall process of decontamination/rehabilitation of an old Los Alamos plutonium-processing facility. In addition to packaging waste in an appropriate container for eventual disposal at the Waste Isolation Pilot Plant (WIPP), SRF treatment reduces waste volume, handling, and disposal costs substantially. Through FY 1985, approximately 2600 m^3 (91 780 ft^3) of various metallic wastes requiring SRF processing had accumulated in storage at the Los Alamos Area G, TA-54, waste disposal site.

The SRF enclosure is divided into four modules according to function. These include an airlock module, a disassembly module, a cutting module, and a packaging/bagout module (Fig. 18).

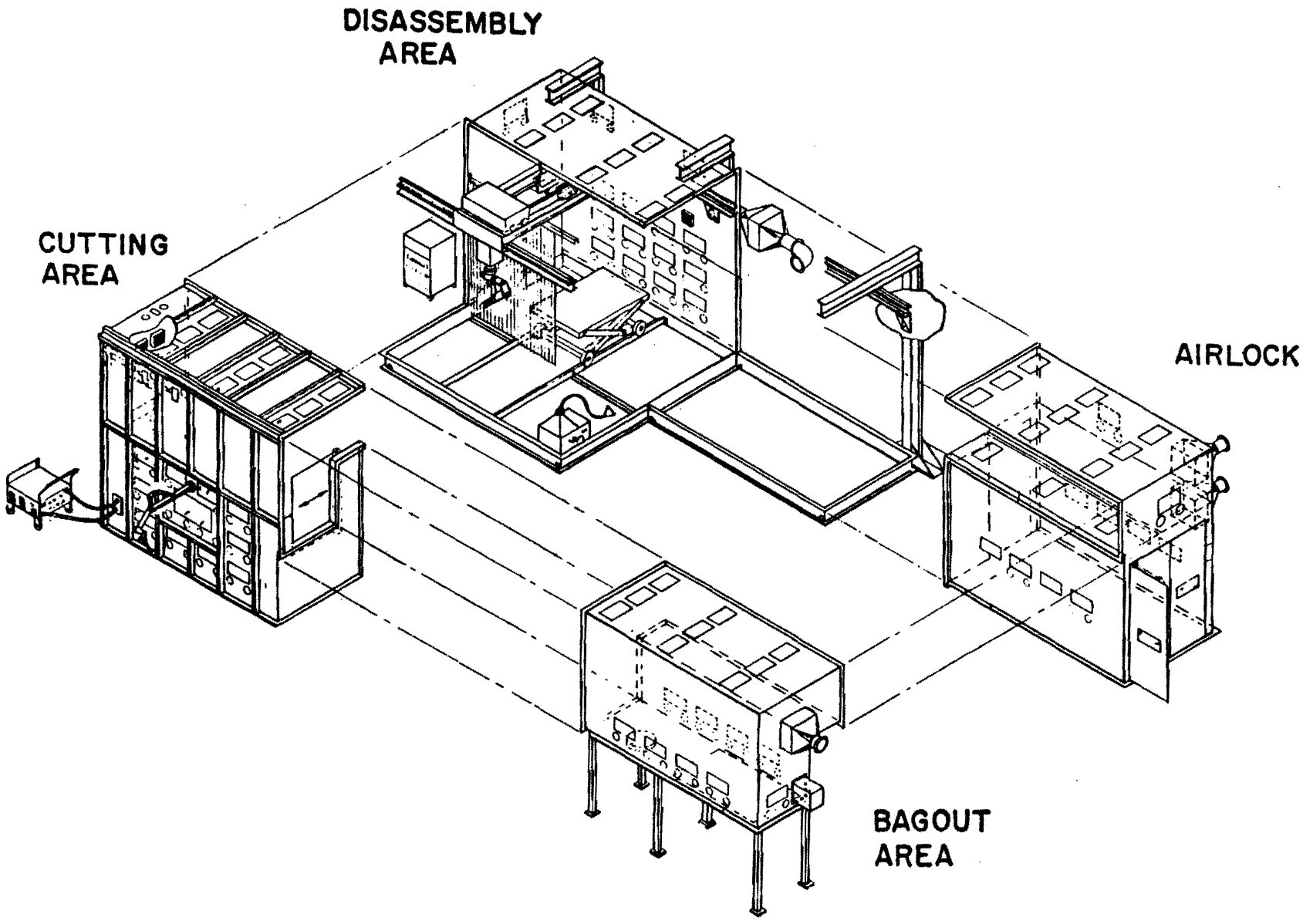


Fig. 18. Size Reduction Facility Enclosure

To process a waste item, the package is placed into the SRF building and the building locked. External packaging is removed and the item is brought into the airlock. The item passes from the airlock to the disassembly area where attached combustible items are removed. It is then moved into the cutting area where a plasma torch cuts it into smaller pieces for packaging. The pieces are placed into accepted WIPP containers in the bagout area. The crate or drum is then sealed for storage at Area G.

Operations with TRU waste in the SRF were initiated in August 1983. Through FY 1985, a total volume of 87.9 m^3 (3106 ft^3) of TRU waste has been processed, resulting in an output volume of 23.8 m^3 (840 ft^3), for an overall volume reduction of approximately 3.7:1. Waste processing in the SRF during this period has been restricted because of the requirements of several special studies, and due to continuing facility modification.

Improvements to the SRF that are in progress include providing additional work space, adding airlocks at all facility access points, and modifying the heating and ventilation systems. This work is an FY 1984 Waste Management GPP funded project, and currently is scheduled for completion in the fourth quarter of FY 1986. Following completion of this work, and the associated Safety Analysis documentation, the TRU inventory limit for the SRF may be raised to 150 g, a level allowing subsequent processing a large portion of the Los Alamos stored and newly generated TRU wastes.

II.B.1.5 Treatment Development Facility, TA-50-37

The Treatment Development Facility (TDF) was designed and constructed for development of incineration methods to reduce volume, stabilize chemical composition and eliminate combustibility of defense TRU wastes. The Controlled-Air Incinerator (CAI) successfully completed the TRU demonstration program and has been subsequently modified to process other wastes. These include beta-gamma radioactive waste, ion exchange resins, carcinogens, and other hazardous chemical wastes in both solid and liquid form. More recently, the CAI was permitted by EPA to burn PCB mixed wastes.

The center of the CAI process is a dual-chamber, commercially available unit modified for TRU service. The Los Alamos modified design accepts a low-density, combustible TRU waste and reduces it by a factor of up to 40:1 by weight and up to 120:1 by volume[11] to produce a chemically stable dry product (Fig. 19). CAI components - a feed preparation and introduction train, an offgas cleanup system, a scrub-solution recycle system, and an ash-removal and packaging station - function as described below.

The feed preparation train assays feed material and removes any materials not suitable for combustion. The offgas cleanup system removes particulates and acid gases from the effluent and conditions the gas stream for passage through HEPA filters before discharge. The scrub-solution recycle system supplies liquids at required pressures to the offgas system and treats these liquids for recycle and discharge. The ash-removal and packaging station transports residue from the incinerator to a hopper and places it in containers for disposal. A more detailed representation of the process without the feed preparation and introduction train is presented in Fig. 20.

Current plans are to utilize the existing CAI to incinerate a substantial fraction of newly generated TRU combustible wastes beginning in FY 1986. The actual percentage will be based on compliance with the current TRU inventory limits specified in the Safety Analysis Report (SAR) for the facility. TRU stored waste work-off plans include incineration of retrieved waste beginning in FY 1988. Experience obtained during the the FY 1986 trial campaigns will determine the operating frequency and the equipment and/or procedural changes needed to meet operating requirements. The ash produced will be immobilized in a new system being developed for installation in the plutonium production facility. Scoping tests have determined that the product will be acceptable at WIPP.

Efforts are currently underway to obtain an EPA permit for the CAI to burn Laboratory waste organic chemicals, including

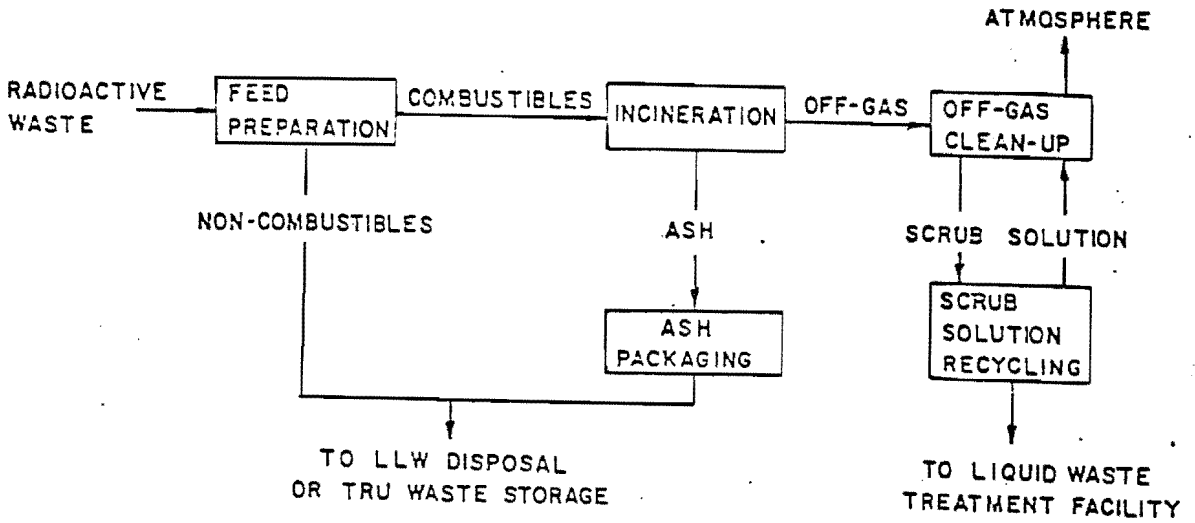


Fig. 19. CAI Process Flow Diagram

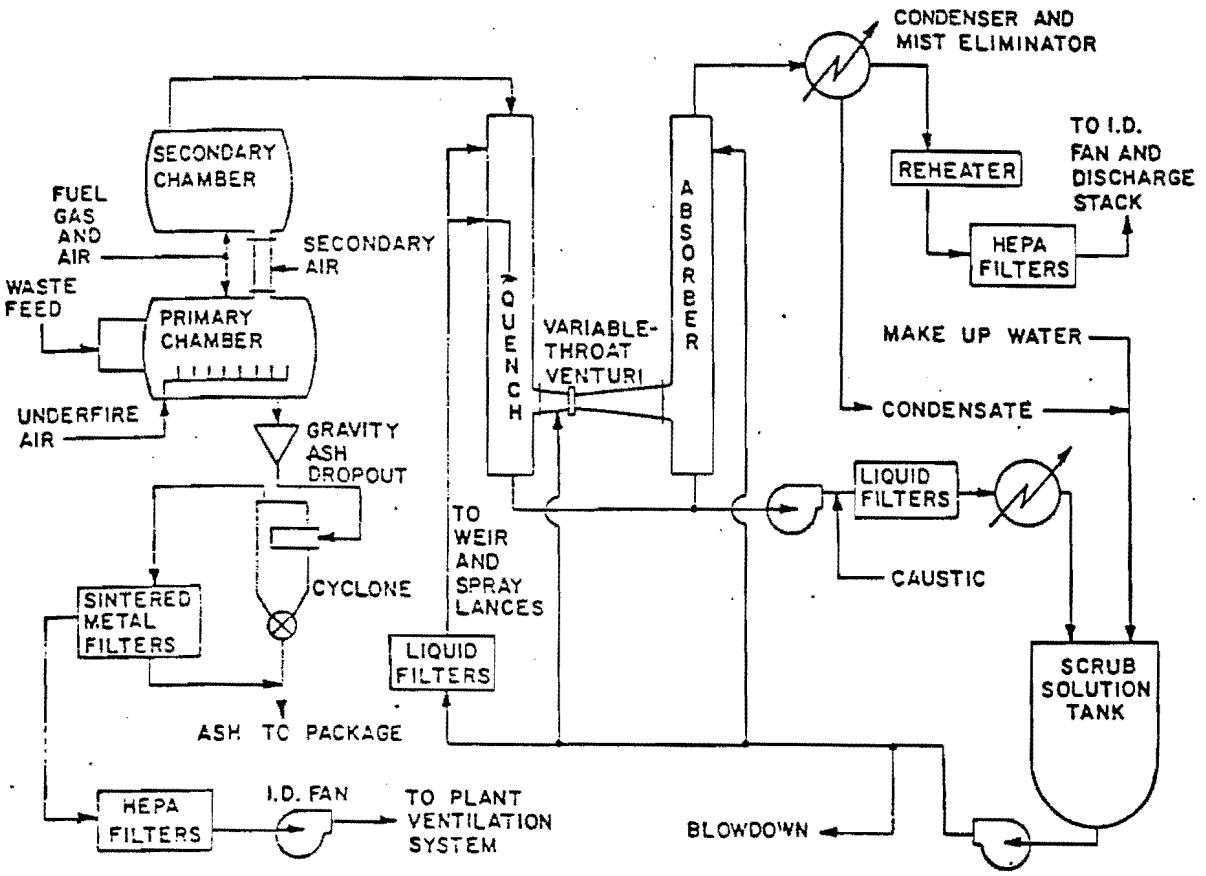


Fig. 20. CAI Process Schematic Without Feed Preparation Line

mixed wastes. The trial burn required for permitting is funded and scheduled for completion in FY 1986.

Other uses for the CAI have been R&D programs performed for the Army and Navy. The completed work established operating conditions necessary to incinerate smoke and flare compounds.

II.B.2. Transuranic Waste Storage

Transuranic wastes are stored in facilities designed from modification of low-level waste burial pits and shafts described below. The bulk of the Laboratory's TRU waste is currently stored on three asphalt pads measuring 12.2 m by 123.4 m (40 ft by 405 ft).

Waste packages, drums and crates, are stacked on the pavement to a height of 3.6 to 4.8 m (12 to 16 ft). As the stack progresses down the pad, the top and sides are covered with 19 mm (0.75 in.) thick plywood, and the entire stack is enclosed with 0.5 mm (0.02 in.) nylon reinforced vinyl sheeting. The stack is then covered with 1 to 2 m (3 to 6 ft) of tuff creating an artificial mound (Fig. 21). One modified pit has also been used for TRU waste storage using much the same procedure.

Special modes have been created for the storage of highly beta-gamma active hot-cell wastes, for wastes containing more than one gram of ^{238}Pu, and the TRU cement paste previously generated at the TA-21-257 liquid waste treatment plant. The hot-cell waste is handled remotely and stored in a modified shaft (Fig. 22). Since the waste is actually below ground during storage, there is little need for additional shielding. The storage array currently employed is compatible with the remote-handled canister now approved for WIPP disposal.

The high activity ^{238}Pu wastes through FY 1985 have been routinely packaged in 114-L (30-gal) drums and placed in concrete casks for storage. Drums of combustible and noncombustible waste are placed in separate casks. The casks are sealed with asphalt and then covered with tuff. (Fig. 23).

A cement paste product previously generated by the TA-21-257 liquid waste treatment plant contained TRU levels of ^{239}Pu

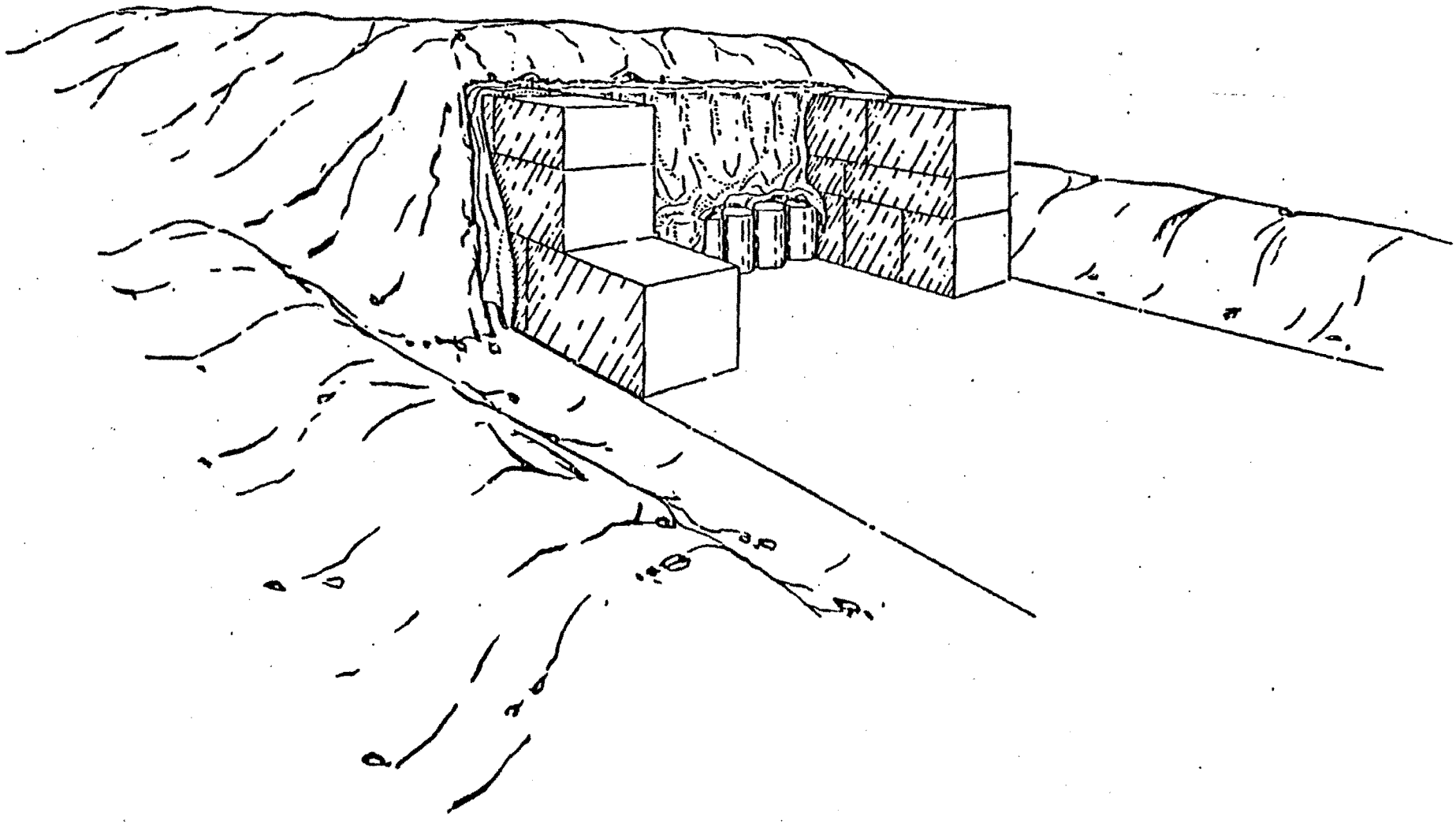
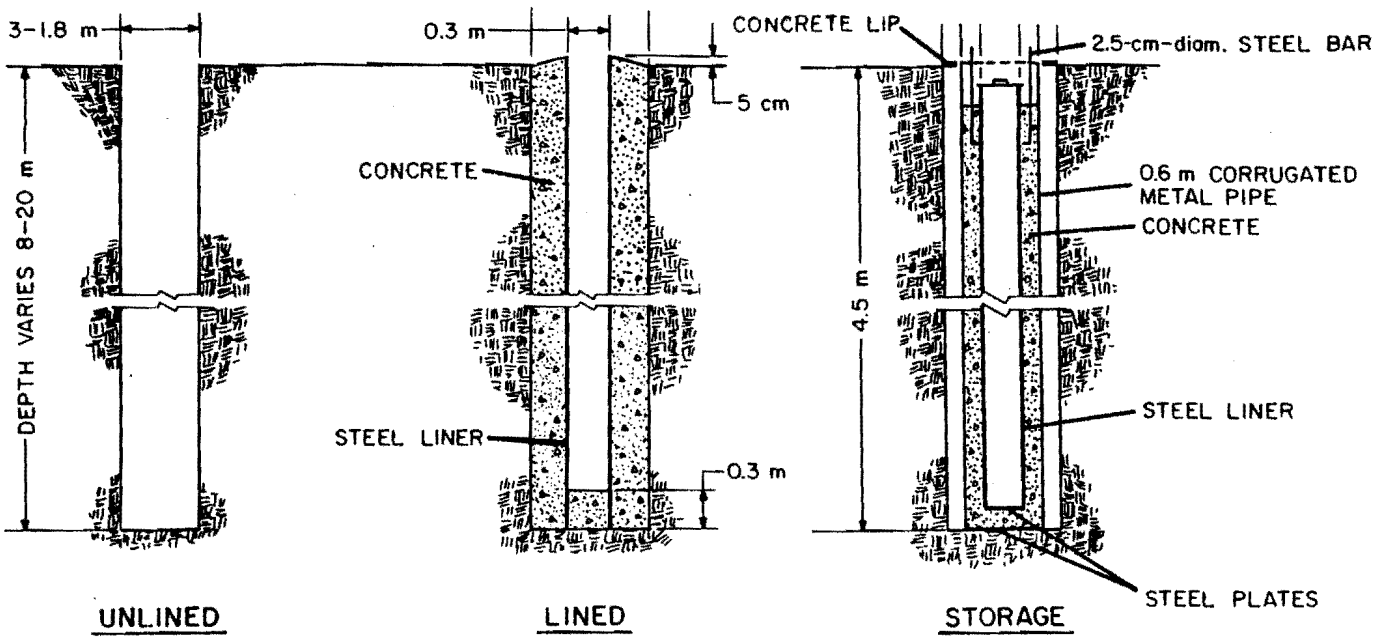
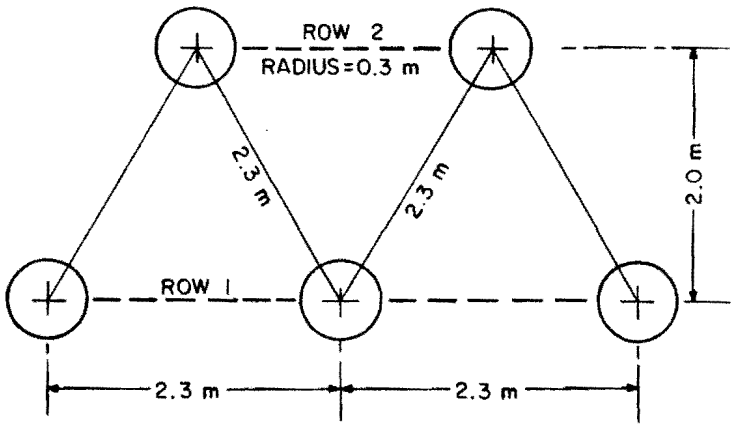


Fig. 21. TRU Waste Storage Pad

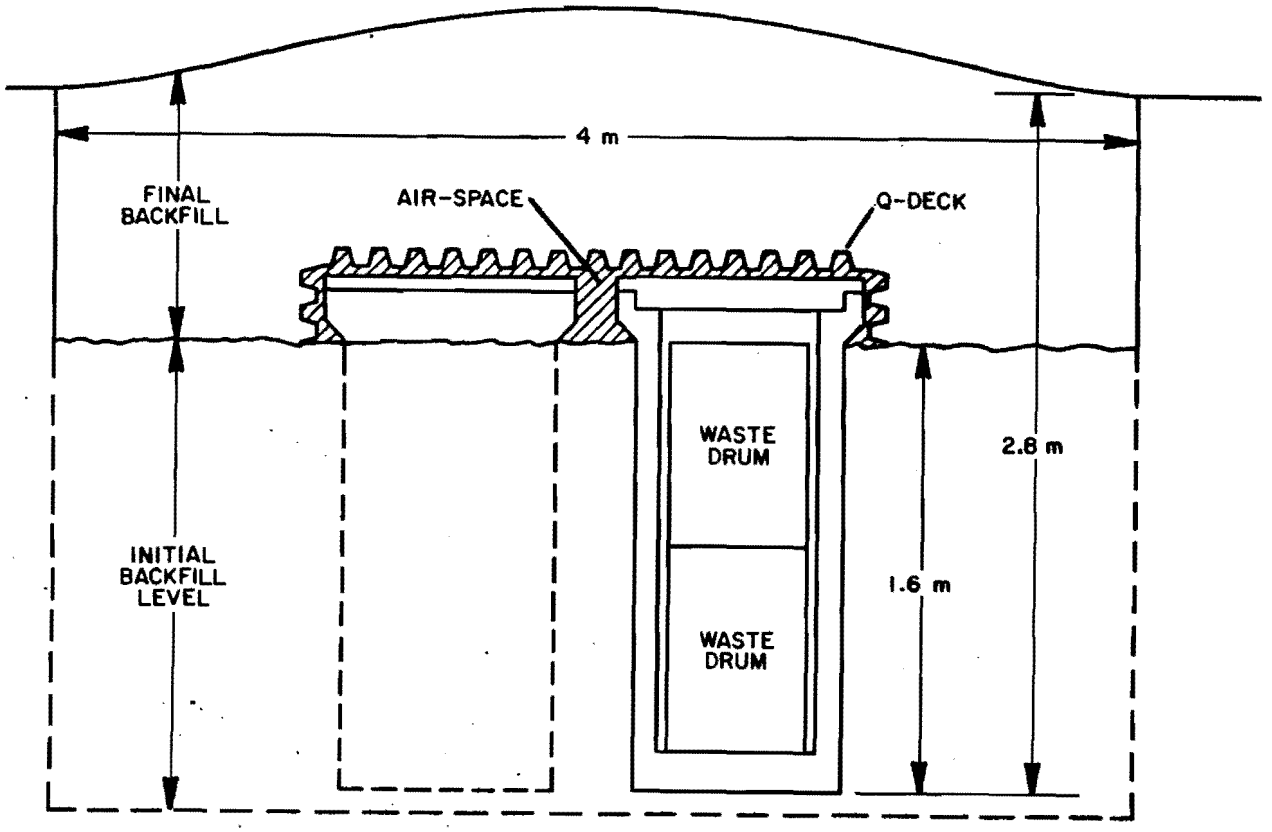


TYPICAL SHAFT DIAGRAM

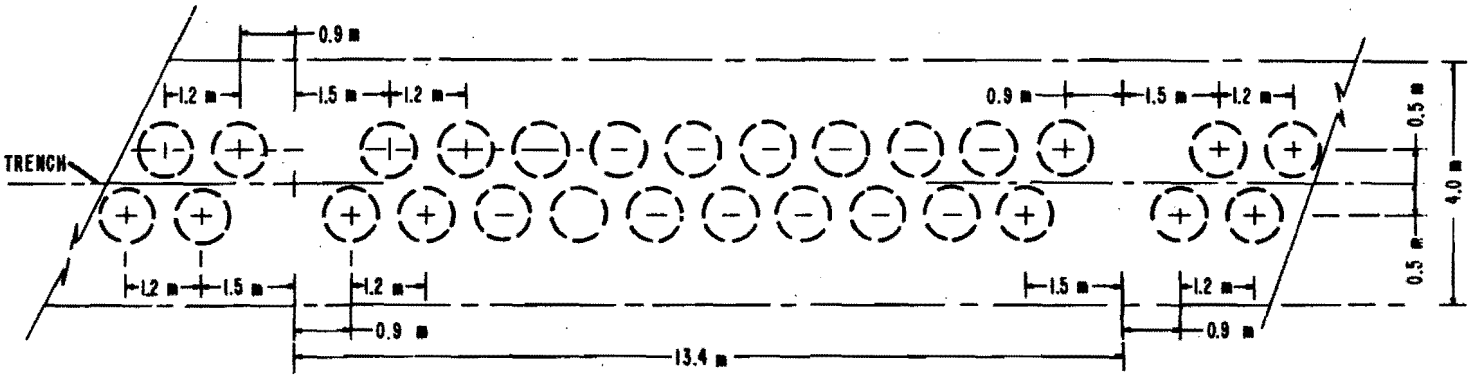


TYPICAL ORIENTATION FOR 0.3-0.9-m-DIAMETER SHAFTS

Fig. 22. Los Alamos Burial/Storage Shafts



TYPICAL CASK BURIAL



CASK LAYOUT DETAIL

Fig. 23. TRU Concrete Storage Cask Usage.

and ^{241}Am. The paste was solidified in 0.75 m (2.5 ft) diameter, 6 m (20 ft) long corrugated metal pipes (CMPs) with a 0.3 m (1 ft) thick uncontaminated concrete plug at the bottom. The pipe was filled to within 0.3 m (1 ft) of the top, then sealed with uncontaminated concrete. The pipes stand vertically in a 6 m (20 ft) deep pit that was backfilled with 1 m (3 ft) of tuff. This waste stream is no longer being generated. Current plans call for the retrieval and movement of the 158 TRU waste-containing CMP's to Area G, TA-54 for storage until a treatment facility for WIPP-processing becomes available.

Planning currently is underway to retrieve all stored TRU wastes to process them such that they meet the requirements of the Los Alamos Certification Plan for WIPP disposal (see Section II.E.2).

II.B.3 Low-Level Waste Disposal, TA-54, Area G

Area G is situated on Mesita del Buey in TA-54 and is the active radioactive solid waste burial/storage site at the Laboratory. The area has been in use since 1957, and is expected to remain active through the foreseeable future. In FY 1977, the active portion of the site was expanded to a total area of 25.5 hectares (63 acres); further expansion of this area is planned within the next five years. Burial/storage facilities within the area include pits, shafts, trenches, and pads, all of varying dimensions. Figures 24 and 25 show the present layout of Area G, including past and future planned use of disposal facilities within the fenced portion of the site, and support facilities at the site. A more detailed description of the use of these facilities and of current waste management operations is contained in the Los Alamos Final Environmental Impact Statement.[1]

Certain "nonreactive" hazardous chemical wastes have been buried in pits and shafts along with the radioactive and mixed wastes at Area G. Such wastes include asbestos, beryllium residues, empty pesticide containers, PCB-contaminated solids (transformers, capacitors, solids (before 1978)), and solid trash-type

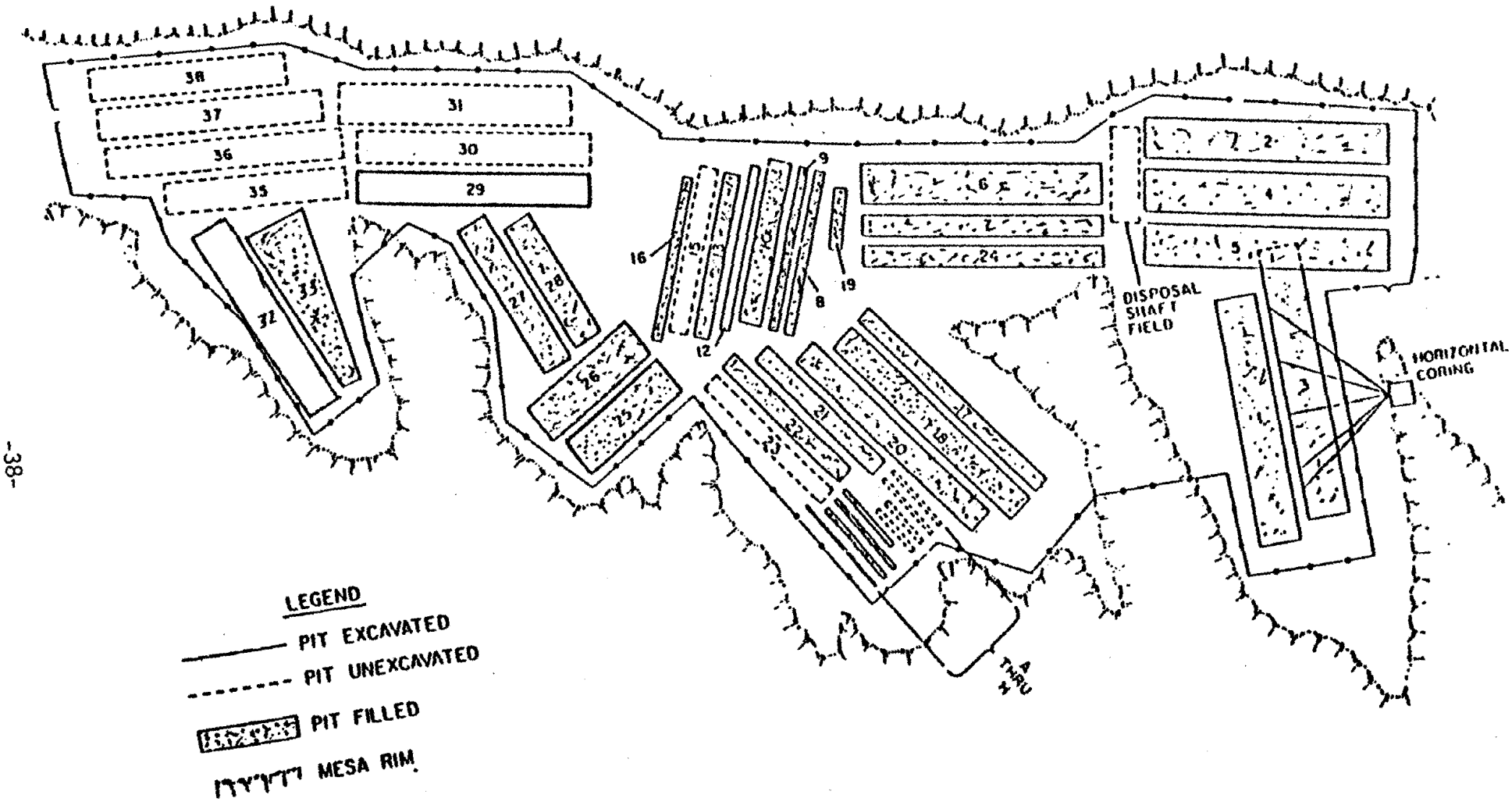
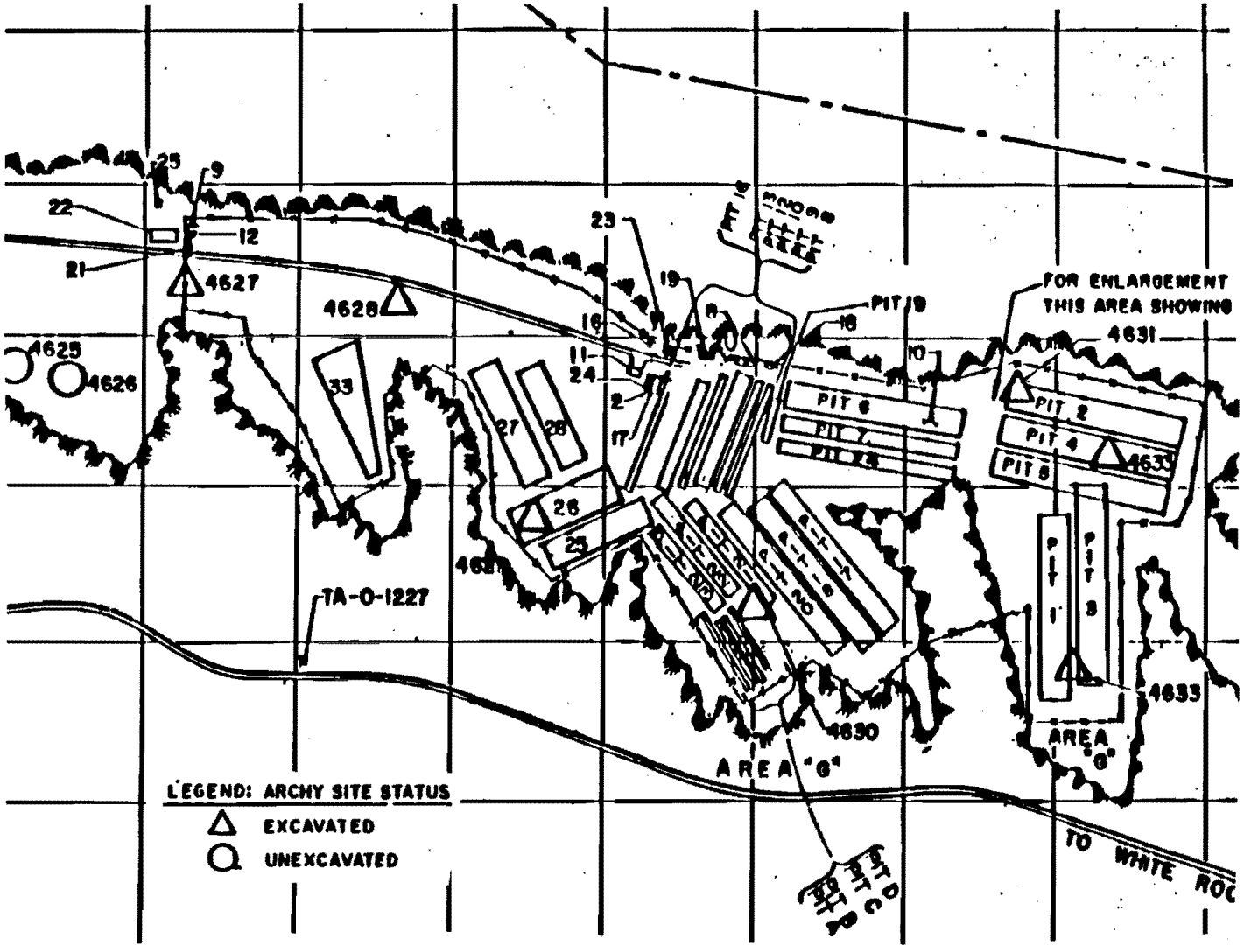


Fig. 24. TA-54, Area G



SITE FACILITIES

2-Compactor/Shop Bldg.
8-TRU Drum Storage Shed
10-Meteorological Sta.
11-Older Office/Change Bldg.
22-Newer Office/Change Bldg.

Fig. 25. TA-54, Layout of Area G Site Facilities

wastes contaminated with known or suspected carcinogens. Between 1976 and 1979 much of this waste was buried in a separate pit (Pit 19) at the site, although there were exceptions due to very large volumes (e.g., PCB-contaminated transformers). In 1980, approval was granted by the EPA for disposal of PCB-solid waste in special facilities at Area G. Landfill of material regulated under the Resource Conservation and Recovery Act (RCRA) was discontinued May 1, 1985.

Mixed wastes have been buried as low-level waste at Area G through April 1985. In accord with the anticipated DOE/EPA regulations and due to the small volume of this waste, the Laboratory discontinued this practice on May 1, 1985. Since that time mixed wastes have been placed in storage at Area L until they can be treated/disposed.

Procedures and facilities have been developed at Los Alamos to assure proper management and disposal of radioactive solid waste. Key areas of management are packaging and transportation, waste acceptance, site design, and disposal activities. Once approved by DOE-AL, all shipments received from off-site facilities are required to meet the same guidelines established for onsite waste generators. No off-site shipments were received for burial in FY 1985.

Standard waste packaging is described in the Laboratory's Administrative Requirement 10-2, "Radioactive Solid Waste." It also details which wastes, such as untreated reactive material and free liquids, are unacceptable for disposal. The criteria for the transportation of radioactive material are contained in Laboratory Administrative Requirement 3-5, "Shipment of Radioactive Materials." These two AR's were developed with input from both Health Physics and Waste Management personnel.

Goals for operation of a waste receiving and acceptance area include the control of radiation and contamination, compliance with appropriate transportation requirements, and proper documentation. A related and extremely important aspect of waste receiving and acceptance is the monitoring of procedures devel-

oped by Laboratory waste generators for the preparation of waste for disposal, and assuring that these procedures have been met when waste is accepted at the disposal site.

Standard operating procedures (SOP) are developed to cover specific operations as assurance that all necessary health and safety precautions have been considered. At the Laboratory, an SOP for any operation that creates radioactive solid waste must have Waste Management approval. Waste management segments of the SOP must clearly address the operation, and packaging and transportation of the waste. These SOP's are reviewed annually by waste management personnel, a process which includes an on-site inspection of a generator's facilities to determine whether procedures are being properly implemented. The SOP and documented on-site inspection serve as quality assurance and control measures on the form the waste is in when it arrives at the disposal site.

At the disposal site, vehicles containing waste are initially stopped at a barrier gate for documentation review. A Radioactive Solid Waste Disposal form must accompany each shipment (Fig. 26). The waste generator signature certifies compliance with all applicable disposal requirements and the health physics signature certifies that packaging and transportation requirements have been met. The vehicle is then moved just beyond the barrier for physical inspection. Radiation levels are checked and contamination swipes are taken. Verification that all aspects of the waste packaging and transportation were conducted in accordance with proper procedures is performed. If only waste transportation discrepancies are noted, they are documented prior to proceeding with disposal operations. Situations involving improper waste form, packaging, or documentation require the shipment to be moved to a holding area until corrective action can be determined. In all cases, personnel at the waste generator site are contacted to assist in determining corrective action and to initiate action to prevent recurrence. When all disposal criteria have been satisfied, the shipment is directed to the

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

RADIOACTIVE SOLID WASTE DISPOSAL RECORD

NOTE: Read instructions on back carefully before completing this form.

HSE-7 Waste Management
Ext. 6095, MS J592

1. Form Number
S 8 6 0928

2. Date M M D D Y Y

3. Retrievable Serial Number

4. Origin of Waste

Group	TA	Building	Wing	Room

5. Waste Code

6. Waste Description

7. Numbers of Waste Packages

Plastic Bags	Card-Board Boxes	Drums No.	Drums Gal.	Wooden Crates No.	Wooden Crates Volume-ft³

8. Gross Volume

Amount	Units (M = meter³, F = foot³, G = gallon)

9. Package Radiation at

Surface (mr/hr)	1 Meter (mr/hr)

10. Gross Weight

Amount	Units (K = kilogram, P = pound, T = ton)

11. Additional Description of Packaging and Packaging Materials

12. Radionuclide Content

Nuclide	Amount	±	Units (C = curie, M = gram)	Error on Amount	±	Amount Determined By: A = analysis, M = measurement, E = estimate	SS Materials Write-Off Account	SS Materials Write-Off Project Code
	E			E				
	E			E				
	E			E				
	E			E				
	E			E				
	E			E				

APPROVALS

Waste Generator *(Print Name Here)*	HSE-1/-10/-11 Area Representative *(Print Name Here)*	Group Leader *(Optional)*
Signature certifies that waste is in accordance with all applicable disposal requirements. *(Signature)*	Signature certifies that waste package or shipment is safe to handle and transport. *(Signature)*	

13. Date Disposed M M D D Y Y

14. Disposal/Storage Location

Area	Shaft	Pit	Post(s)	Layer	Pos.

15. Shaft Surface Dose mr/hr

HSE-7 Waste Management Representative *(Print Name Here)*

Signature certifies that waste acceptance criteria and all disposal requirements were met. *(Signature)*

Form Number HS 10-2A (12/85)

Fig. 26. Radioactive Solid Waste Disposal (RSWD) Form

appropriate storage, treatment, or disposal location.

Disposal site operations must involve adequate procedures and/or facilities for proper waste segregation, disposal, and contamination and pollution control. The type of disposal facility used, the waste form and packaging, the application of cover material, and site restoration are all items that must be considered in achieving these goals. The method and location of disposal of waste is dependent upon the physical, chemical, and radiological properties of the waste.

The bulk of waste generated at the Laboratory is buried in large pits ranging in size from 120 to 180 m (400 to 600 ft) long, 8 to 30 m (26 to 100 ft) wide, and 8 to 14 m (26 to 46 ft) deep. Pits are oriented with the long dimension as parallel as possible to the area surface contours to minimize surface erosion. The ends of pits are excavated with slopes that allow access by vehicles and equipment. As a final step, tuff is ground and compacted in the pit bottom to a depth of 0.15 to 0.30 m (0.5 to 1 ft) to provide a seal for any fractures in the pit bottom, and an absorption medium for precipitation that enters the pit prior to waste burial. A set of guidelines have been developed to document the design criteria of a waste disposal unit. Greater confinement disposal in a pit is practiced for those wastes with TRU contamination between 10 nCi/g and 100 nCi/g.

To provide better isolation following burial and/or to increase worker safety, certain Los Alamos wastes are buried in augered shafts measuring 0.3 to 1.8 m (1 to 6 ft) in diameter by up to 20 m (65 ft) deep. Several oversize shafts, 1.8 x 3.6 x 13.7 m (5.9 x 11.8 x 45 ft), have been drilled for disposal of large, highly-activated metal wastes from the LAMPF accelerator. While most shafts are unlined, a few are lined with concrete or metal primarily for additional containment.

To prevent possible interaction between buried waste and perched water which exists in alluvial material in the floors of

adjacent canyons, no burial facilities may be deeper than the adjacent canyon floor which is 23 m (75 ft) deep. Both pits and shafts are located no closer than 15 m (50 ft) to a canyon wall and all topsoil is removed and stockpiled for future site revegetation. All burial facilities are surveyed, recorded, and approved for use by the Laboratory Environmental Surveillance Group prior to use. Pits and shafts are filled to a level 1 m (3 ft) below the "spill point", defined as the lowest point on the facility rim, thus ensuring complete containment of waste by undisturbed tuff. Pits are then covered with tuff, a layer of topsoil, and revegetated. Shafts are capped with concrete the entire final meter (three feet). During FY 1985, Pit 32 was excavated and approved for use. This pit measured approximately 26m (85 ft) wide, 158.5 m (520 ft) long, and 14 m (46 ft) deep. Six shafts of varying dimensions were also excavated.

As stated earlier, the bulk of Los Alamos waste is placed in pits. This includes large equipment, most decommissioning wastes, all compactible waste bales, and most routine non-compactible waste. Items such as radioactive "mixed" waste (through April 1985), biological waste, and highly activated materials are routinely placed in unlined shafts (Fig. 22).

Waste packaging is provided in most instances primarily for contamination and radiation control during transportation as the disposal site environment is the primary containment following burial. In some instances, however, disposal facility liners or special packages are utilized to supplement containment. The waste that this occurs with most frequently is contaminated with tritium. Tritium waste >20 mCi/m^3 must be placed in asphalt lined or encapsulated drums and then placed in lined shafts (Fig. 22). This type of containment is being evaluated to determine its effectiveness against tritium migration.[12]

The immediate cover on all waste disposed of at Los Alamos is excavated tuff. In the shafts, this material is used to cover packages for better isolation of individual packages and to fill voids. In pits, all waste is covered daily. This is accomplish-

ed using a layered-landfill approach with additional compaction achieved during the covering by the weight of the heavy equipment. Operation in this manner has proven effective in preventing pit subsidence.

Efficient site utilization is achieved through a combination of disposal facility design, operations, and closure. Maximum land use is accomplished by leaving minimal space between pits and shafts and by having TRU waste storage areas located on top of old pits. Operationally, waste volume reduction by compaction is encouraged wherever possible to minimize land usage. Disposal facility closure incorporates revegetation with native grasses, appropriate surface drainage control by restoration of natural gradients, and monument installation for permanent identification.

II.C Description of Radioactive Waste Generating Process

Low-level waste is the largest volume of radioactive waste generated at Los Alamos. Averages from the last several years indicate that approximately eighty-nine percent of the total radioactive solid waste volume is low-level waste, ten percent is TRU, and one percent is mixed waste. The volume of decontamination and decommissioning (D&D) waste varies from project to project and has been incorporated into the low-level and TRU waste volumes. High-level wastes are not generated at the Laboratory. Flow diagrams of the generation and disposition of radioactive solid waste at the Laboratory are presented in Fig. 27.

Mixed waste has been defined in general terms as that waste which is both radioactively and chemically contaminated. The waste streams that meet this criterion at Los Alamos are scintillation vials, uranium-contaminated lithium hydride, and miscellaneous reagent chemicals. Through April 1985, this waste has been buried or stored at Area G as radioactive waste. The packaging, treatment and disposal/storage of these wastes meets the hazardous waste regulations. The contaminated lithium hydride, for example, will be rendered nonreactive before disposal. (EPA and DOE regulations ban land disposal of reactive materials.) The

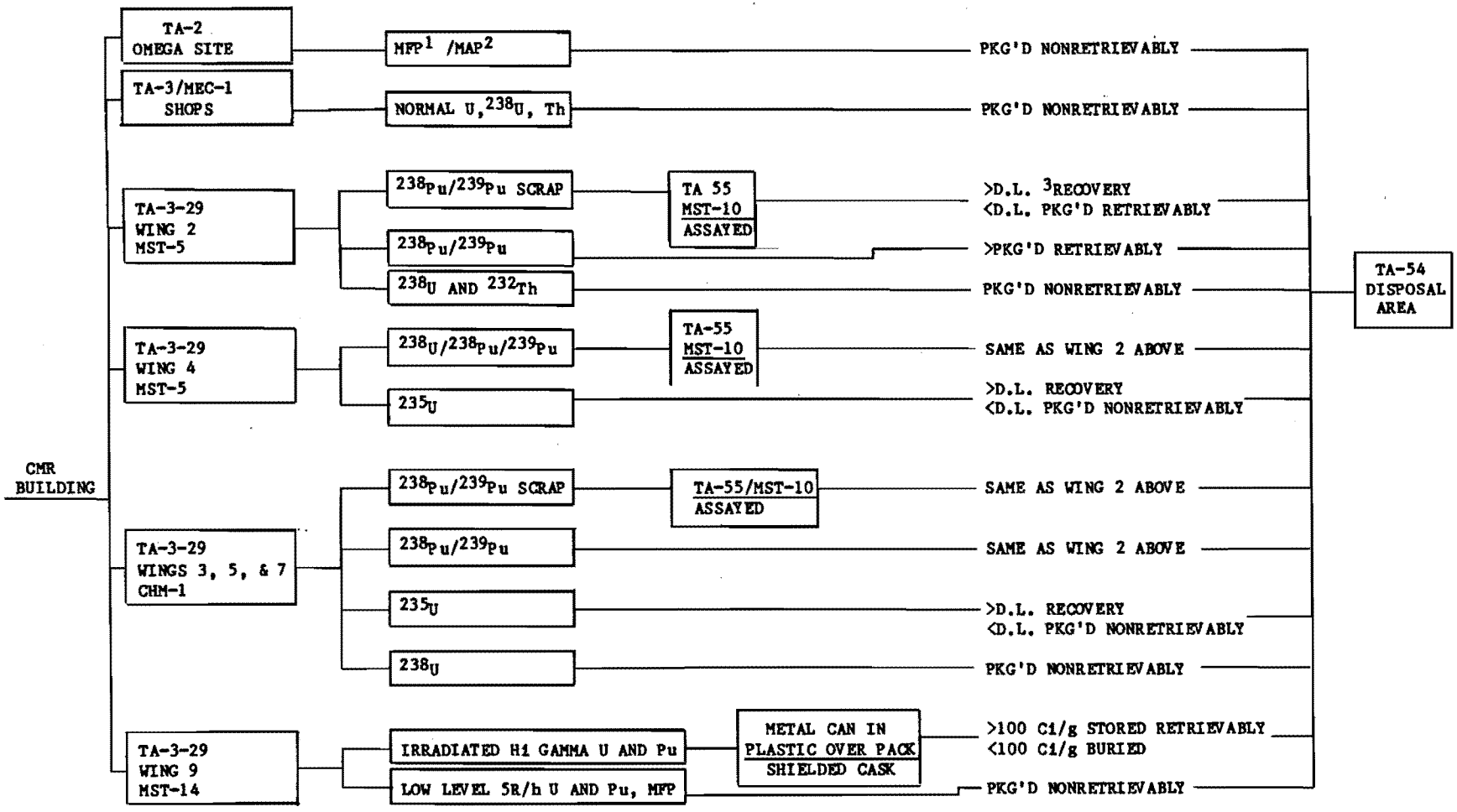


Fig. 27. Flow Sheet for Los Alamos Radioactively Contaminated Solid Waste (Continued on next 3 pages)

[1]MAP=Mixed Activation Products
[2]MFP=Mixed Fission Products
[3]D.L. = Discard Limit

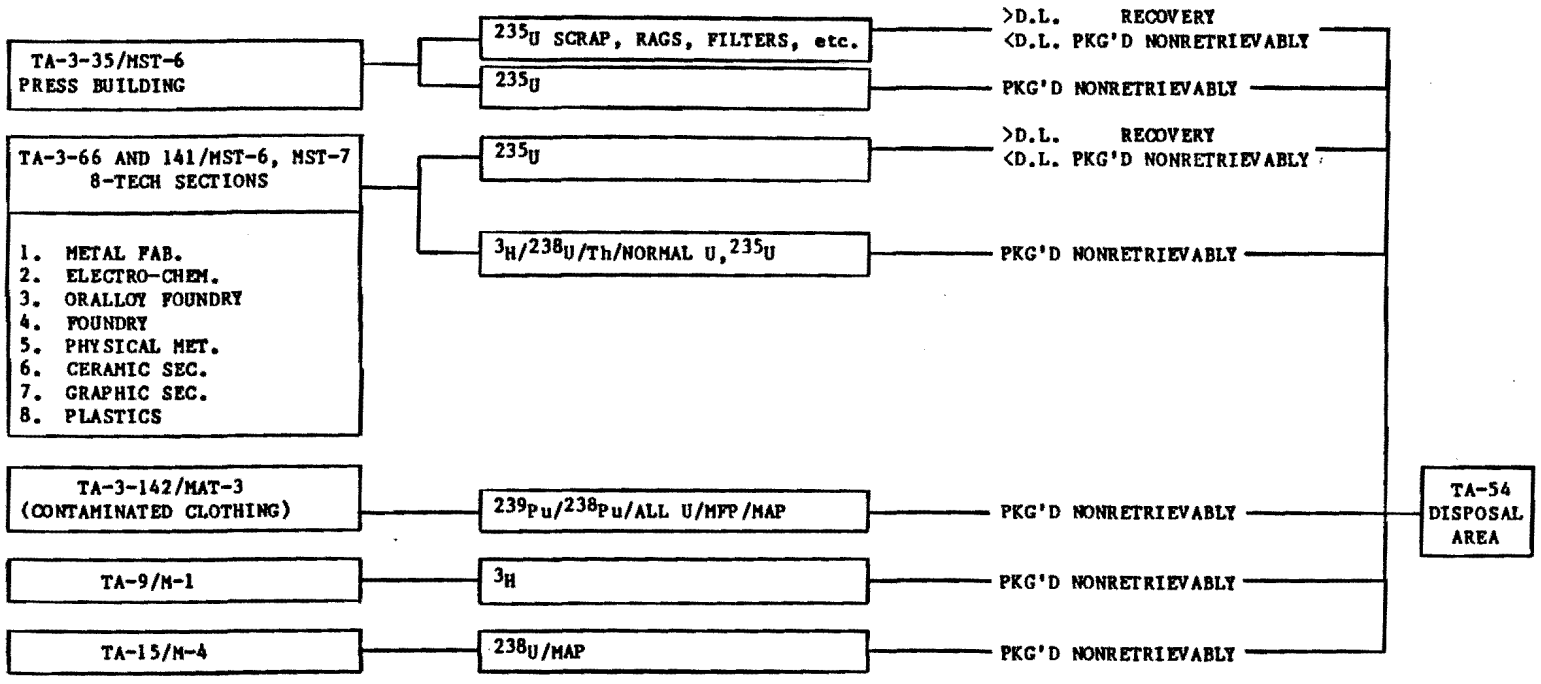

TA-3-35/MST-6
PRESS BUILDING
235U SCRAP, RAGS, FILTERS, etc.
235U
>D.L. RECOVERY
<D.L. PKG'D NONRETRIEVABLY
PKG'D NONRETRIEVABLY
TA-3-66 AND 141/MST-6, MST-7
8-TECH SECTIONS
1. METAL FAB.
2. ELECTRO-CHEM.
3. ORALLOY FOUNDRY
4. FOUNDRY
5. PHYSICAL MET.
6. CERAMIC SEC.
7. GRAPHIC SEC.
8. PLASTICS
235U
3H/238U/Th/NORMAL U, 235U
>D.L. RECOVERY
<D.L. PKG'D NONRETRIEVABLY
PKG'D NONRETRIEVABLY
TA-3-142/MAT-3
(CONTAMINATED CLOTHING)
239Pu/238Pu/ALL U/MFP/MAP
PKG'D NONRETRIEVABLY
TA-9/M-1
3H
PKG'D NONRETRIEVABLY
TA-15/M-4
238U/MAP
PKG'D NONRETRIEVABLY
TA-54
DISPOSAL
AREA

Fig. 27. (cont)

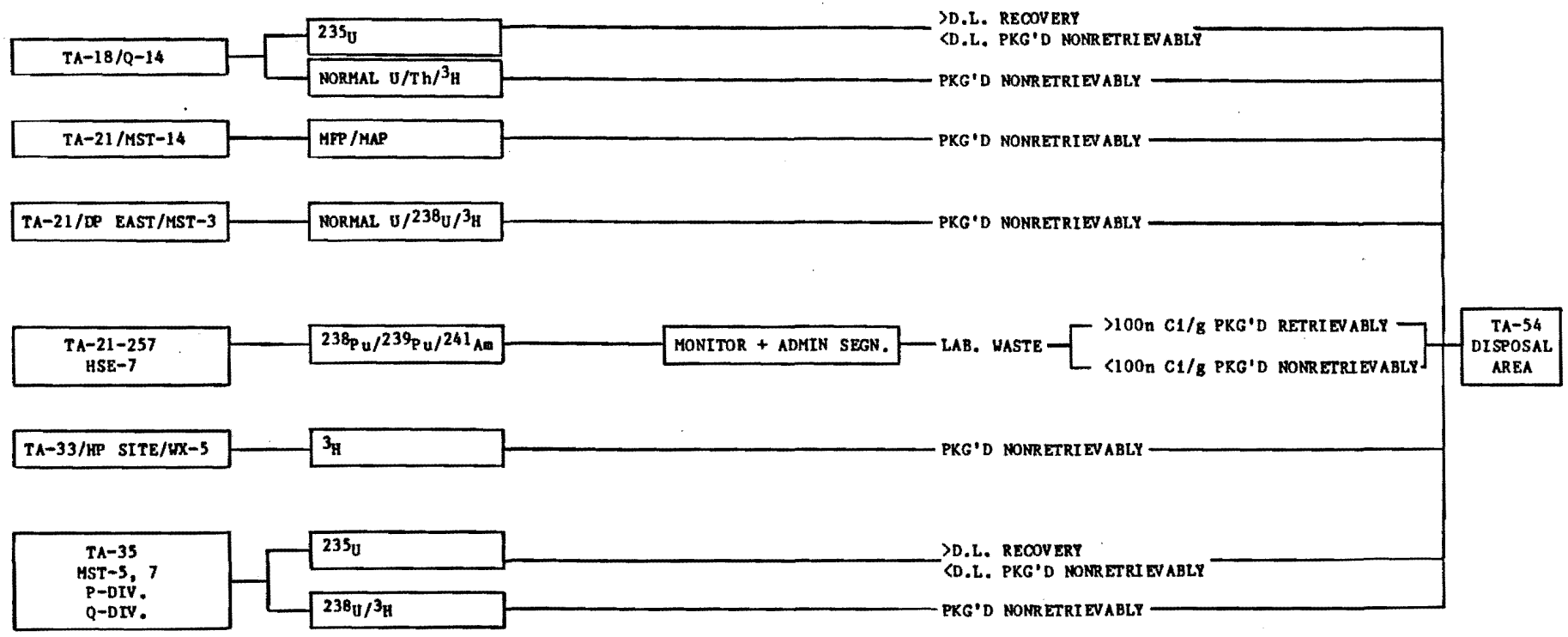

TA-18/Q-14
235U
NORMAL U/Th/3H
>D.L. RECOVERY
<D.L. PKG'D NONRETRIEVABLY
PKG'D NONRETRIEVABLY
TA-21/MST-14
MFP/MAP
PKG'D NONRETRIEVABLY
TA-21/DP EAST/MST-3
NORMAL U/238U/3H
PKG'D NONRETRIEVABLY
TA-21-257
HSE-7
238Pu/239Pu/241Am
MONITOR + ADMIN SEGN.
LAB. WASTE
>100n Ci/g PKG'D RETRIEVABLY
<100n Ci/g PKG'D NONRETRIEVABLY
TA-54
DISPOSAL
AREA
TA-33/HP SITE/WX-5
3H
PKG'D NONRETRIEVABLY
TA-35
MST-5, 7
P-DIV.
Q-DIV.
235U
238U/3H
>D.L. RECOVERY
<D.L. PKG'D NONRETRIEVABLY
PKG'D NONRETRIEVABLY

Fig. 27. (cont)

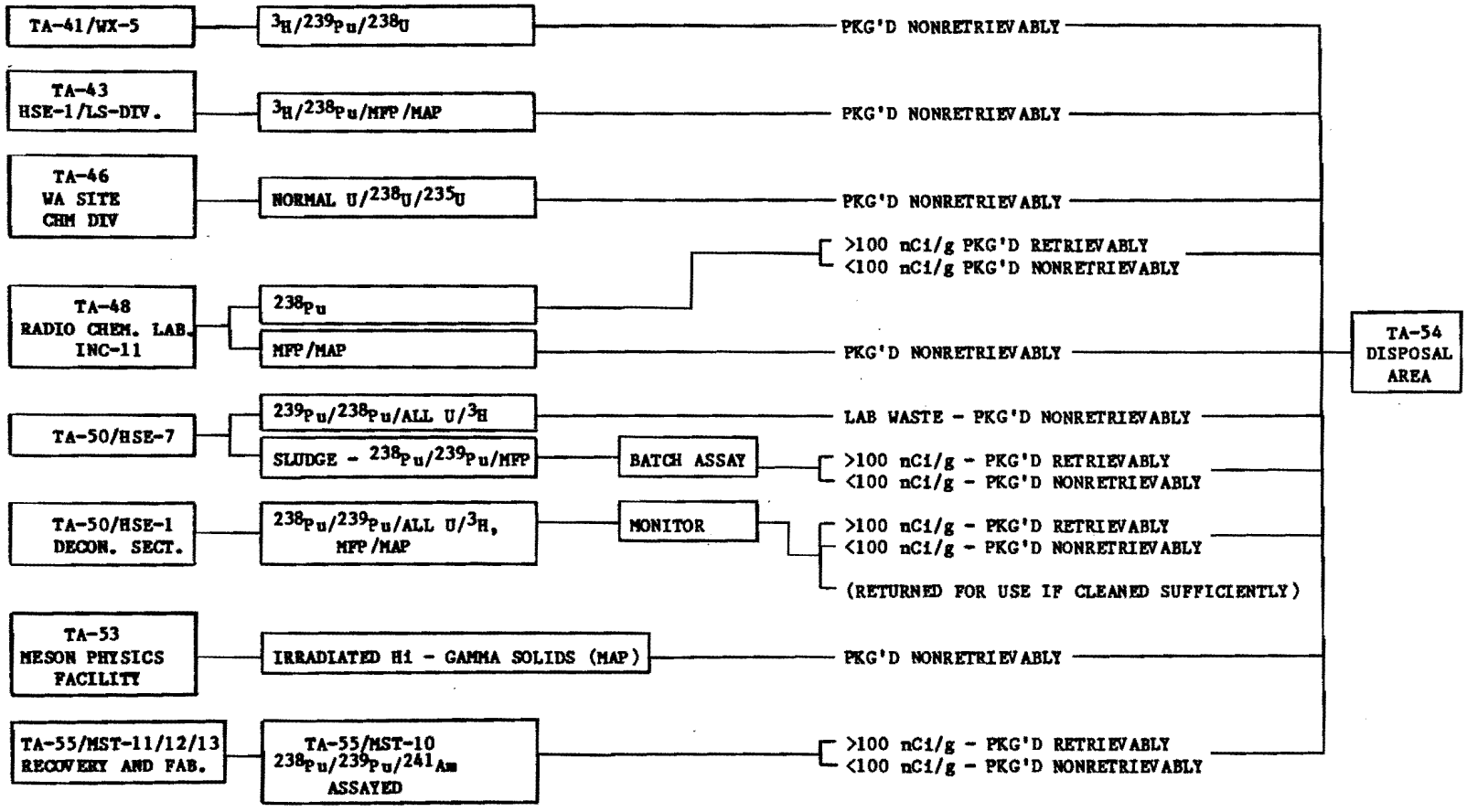

TA-41/WX-5
$^{3}H/^{239}Pu/^{238}U$
PKG'D NONRETRIEVABLY
TA-43
HSE-1/LS-DIV.
$^{3}H/^{238}Pu$/MFP/MAP
PKG'D NONRETRIEVABLY
TA-46
WA SITE
CHM DIV
NORMAL U/$^{238}U/^{235}U$
PKG'D NONRETRIEVABLY
TA-48
RADIO CHEM. LAB.
INC-11
^{238}Pu
>100 nCi/g PKG'D RETRIEVABLY
<100 nCi/g PKG'D NONRETRIEVABLY
MFP/MAP
PKG'D NONRETRIEVABLY
TA-50/HSE-7
$^{239}Pu/^{238}Pu$/ALL U/^{3}H
LAB WASTE - PKG'D NONRETRIEVABLY
SLUDGE - $^{238}Pu/^{239}Pu$/MFP
BATCH ASSAY
>100 nCi/g - PKG'D RETRIEVABLY
<100 nCi/g - PKG'D NONRETRIEVABLY
TA-50/HSE-1
DECON. SECT.
$^{238}Pu/^{239}Pu$/ALL U/^{3}H,
MFP/MAP
MONITOR
>100 nCi/g - PKG'D RETRIEVABLY
<100 nCi/g - PKG'D NONRETRIEVABLY
(RETURNED FOR USE IF CLEANED SUFFICIENTLY)
TA-53
MESON PHYSICS
FACILITY
IRRADIATED Hi - GAMMA SOLIDS (MAP)
PKG'D NONRETRIEVABLY
TA-55/MST-11/12/13
RECOVERY AND FAB.
TA-55/MST-10
$^{238}Pu/^{239}Pu/^{241}Am$
ASSAYED
>100 nCi/g - PKG'D RETRIEVABLY
<100 nCi/g - PKG'D NONRETRIEVABLY
TA-54
DISPOSAL
AREA

Fig. 27. (cont)

future management of other mixed waste streams is anticipated to be storage and incineration, but will depend upon the guidance expected to be issued in the coming year.

II.D Solid Radioactive Waste Inventories

Actual volumes and activities of low-level solid waste generated and disposed of at Los Alamos are submitted as part of the DOE Solid Waste Information Management System (SWIMS). Inventory and projection data on TRU waste are submitted annually to the DOE Integrated Data Base System. A summary of the waste buried during FY 1985 is presented in Table I and projections for burial volume for FY 1986 are presented in Table II. The large variations in waste volumes and radioactive content result primarily from program changes, facility D&D activities, and general Laboratory area cleanup programs.

During FY 1985, one D&D project funded by the surplus facilities program was completed. Phase I of the TA-2 Water Boiler Reactor was completed with a low-level waste volume generated of 116 m^3 (4095 ft^3). Other D&D projects generated a low-level waste volume of 2417 m^3 (85 320 ft^3). These projects included major cleanups at TA-4, -5, and -20 and the ongoing removal of the old industrial waste line.

Low-level mixed waste is generated at the Laboratory. The type of waste involved and the volume disposed of in FY 1985 are summarized in Table III.

II.E High-Level Program

No high-level waste is generated at Los Alamos.

II.F TRU Waste Certification Program and Activities

II.F.1 Newly Generated Waste Certification Development

In the plutonium recovery operations, where the concentration of TRU nuclides in the waste may be economically recoverable, waste is assayed before packaging to assure segregation of TRU from low-level waste. Solid wastes from liquid waste treatment are analyzed radiochemically before packaging for the same purpose. Where remote-handled TRU waste is generated, the TRU concentration is determined by inventory control and mechanical measurement. This waste is never recoverable scrap because it is residue from the examination of irradiated fuel. Radium 226

TABLE I
WASTE BURIED/STORED REPORTED
FY 1985

Waste Category	Buried (B) Stored (S)	Volume (m^3)	Radio-activity (Ci)[a]	Radionuclide Content (g) Pu	Am	U/Th
1 - CH-TRU	S	572.7	51167.1	85523.3	9.5	3063098.4
2 - U/Th	B	1710.1	3.4			9110151.2
3 - MFP	B	1635.0	462.7			
4 - MAP	B	505.3	531.7			
5 - H-3	B	115.6	73839.6			
6 - RH-TRU	S	0.6	113.0	119.9		346.5
7 - Alpha	B	2552.5	12.0	41.4	0.1	2443.0
	TOTALS	7091.8	126129.5	85684.6	9.6	12176039.1

a Total activity of all contaminants.

TABLE II
PROJECTIONS OF WASTE BURIED/STORED AT LOS ALAMOS
FY 1986

Waste Category	Buried (B) Stored (S)	Volume (m^3)
1 - CH-TRU	S	400
2 - U/Th	B	1200
3 - MFP	B	400
4 - MAP	B	500
5 - H-3	B	200
6 - RH-TRU	S	1
7 - Alpha	B	2300

TABLE III
LOW-LEVEL MIXED WASTE BURIED AT LOS ALAMOS
(11/84 - 5/85)

Description	Chemical Composition Including Radioactive Constituents	Volume (m^3)
Scintillation Vials	Benzene, Toluene, Xylene; Pu, ^{3}H, ^{14}C ^{32}P	10.0
Miscellaneous Chemicals	Variable Chemical Composition and Radioactive Contamination	0.3

sources and uranium 233 are managed as TRU, which is consistent with DOE 5820.2, Chapter IV, and with earlier definitions of TRU waste.

Administrative requirements for reducing TRU waste generation are defined in the Los Alamos Health and Safety Manual.[10] These address office wastes, packaging materials, housekeeping wastes, and facilities design.

A TRU Waste Certification Plan for newly generated waste has received final DOE approval. A modified plan currently is being prepared for submission to the Waste Acceptance Criteria Certification Committee (WACCC), which incorporates criteria changes and provision for remote handled wastes. This document, supplemented by attachments from each TRU waste generating organization, defines the Los Alamos plan for assuring the WIPP operators that waste shipped to them from Los Alamos complies with the WIPP Waste Acceptance Criteria (WAC) and associated requirements. At present, eight attachments are planned, covering ten identified TRU waste streams. Of these, one (SRF wastes) has received preliminary WACCC approval, and five others have been submitted for comments. No waste can be fully certified until the plan and the attachment appropriate to that waste are approved by the WACCC, and comments from the State of New Mexico Environmental Evaluation Group (EEG) have been resolved. However, none of the current waste streams appear to be impractical to certify. Classified TRU waste is not accepted at the TA-54 storage site and all such waste must be rendered nonclassified by the generator prior to storage. All newly-generated TRU waste is scheduled to be certifiable by the end of FY 1986.

The TRU Waste Certification Plan specifies the containers that are permitted for TRU waste packaging. All of these are DOT-7A containers. Waste requiring processing before certification may be stored on-site in nonspecification containers that are suitable for health and safety purposes. Los Alamos TRU waste has never been shipped off-site.

Shipment of newly generated TRU Waste to the WIPP is cur-

rently scheduled to begin in FY 1989. Until that time, newly generated certified waste will be stored above-ground, on an asphalt-paved pad, protected from the elements by a plastic cover topped with at least 1 m (3 ft) of soil, in much the same manner in which waste has been stored since 1971.

II.F.2 Stored Waste Work-Off

Through FY 1985, approximately 7000 m^3 (247 100 ft^3) of uncertified TRU waste have been accumulated in storage at two Los Alamos sites. Of this, approximately 27 m^3 (953 ft^3) are remote-handled wastes stored in concrete casks at TA-54; approximately 80 m^3 (2824 ft^3) U-233 and Pu-238 wastes packaged in 114-L (30-gal.) drums stored in concrete casks at TA-54, and 442 m^3 (15 600 ft^3) are cemented sludge in CMPs stored at TA-21. The balance is stored at TA-54, primarily in 210-L (55-gal.) drums and fiber-glass-coated plywood crates. These are placed on asphalt pads, protected from the elements by plywood and a plastic cover, topped with a minimum of 1 m (3 ft) of tuff.

TRU waste withdrawn from retrievable storage for transfer to the WIPP will be certified before shipment. A draft plan for retrieval, processing, and certification was prepared in FY 1983; a final Inventory Work-Off Plan is being prepared during FY 1986. Planned methods of meeting the WIPP criteria include visual inspection, real-time x-ray radiography, active/passive radionuclide analysis, sorting and repackaging, cementing, and volume reduction by sectioning or incineration.

Certification of stored waste (except that processed in the TDF and SRF) is dependent upon construction of several new facilities. Four facilities are currently in varying stages of design. Retrieved waste packages will be taken to the Waste Preparation Facility for initial sorting, cleaning, verification of package integrity, and any overpacking required. From here packages will be staged for shipment to other facilities for additional processing/certification. A Non-Destructive Examination and Analysis (NDE-NDA) Facility for certification of wastes that need no processing is scheduled to begin operation in FY 1988.

Associated with the NDE-NDA Facility will be the Transportation Facility where the TRUPACT will be loaded and prepared for shipment to WIPP. A CMP-Saw Facility for processing the cement paste filled CMPs is scheduled for operation in FY 1991. Once the CMPs have been treated, the interior of the facility will be redesigned to process (immobilize) the remaining volume of uncertifiable waste. Funding for the Waste Preparation Facility, $300K, was received in FY 1985. Funding for the first phase of construction on the NDE-NDA/Transportation Facility, $600K, will be received in FY 1986. The balance of $970K for project completion was requested for FY 1987. Funding for the Waste Processing Facility was requested for FY 1988.

A small amount of the currently stored waste appears to be impractical to certify, generally because it is too massive or unsuitable for processing in current or planned facilities. The final design of the facilities to be built for processing and certifying stored waste will largely determine the quantity of waste in this category. Disposal of this waste in the greater confinement mode at Los Alamos is an alternative means of handling uncertifiable waste.

II.F.3 Certification Documentation Systems

A documentation system providing the information required for the TRU section of the DOE Integrated Data Base (DOE/NE-0017-1) is currently in operation at Los Alamos. All information on certifiable/certified TRU waste that is required for transportation, for completion of the WIPP data package, and for certification will be supplied by the waste generator on a standard form (Fig. 28). The data will be reviewed for completeness and compliance with the WIPP WAC before the waste is accepted by HSE-7. The completed form will be stored on microfilm or hard copy. Portions of the data package will also be maintained in a readily retrievable form in the HSE-7 group computer. These records will be destroyed after the retention/removal decision has been made at the WIPP.

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

CERTIFIED WASTE STORAGE RECORD

WASTE PACKAGE SERIAL NUMBER
LA 8 4

I. GENERATOR'S PACKAGE INFORMATION

ORIGIN OF WASTE	PN Items C&D No.	Additional Information
Group		
TA		
Building		
Room		

CONTAINER	CODE	SS MATERIALS WRITE-OFF		RADIONUCLIDE CONTENT		C = Curie M = Gram
		Account	Project Code	Nuclide	Amount	
☐ Steel Drum (55 gal.)	01					
☐ Steel Overpack (Drums)	02					
☐ Steel Box (68 in. X 54 in. X 38.5 in.)	03					
☐ Steel Overpack (FRP Box)	04					
☐ Other *(Describe)*						
Drum Lot Code / Year of Mfr.						
Manufacturer's Box Serial Number						

Process Batch Code	
Gross Wt. (kg)	
Organic Mat'l Wt. (kg)	
Organic Mat'l Vol (%)	
Content Code	
Date Closed (MMDDYY)	

TOXIC OR CORROSIVE MATERIALS		
Name	Code	Quantity (g)

The data in this section were collected, and the waste described herein was packaged and labeled according to the procedures defined in the Los Alamos TRU Waste Certification Plan and its appropriate attachment(s). The data are correct and complete to the best of my knowledge.

Printed Name	Signature	Date

II. GENERATOR-SITE HEALTH PHYSICS INFORMATION

Surface Dose Rate (mrem/h)	The data in this section were collected as prescribed in approved procedures. The package is properly closed and is safe to handle and transport.
Survey Meter Model	
Survey Meter Serial No.	
Alpha Contamination (dpm/100cm2)	Printed Name / Date
Beta-Gamma Cont. (dpm/100cm2)	Signature

III. HSE-7 SOLID-WASTE RECORDS OFFICE INFORMATION

The data package for this waste has been reviewed by HSE-7. The generator is authorized to arrange transportation to TA-54 per AR 10-2.	Printed Name / Date
	Signature

IV. STORAGE-SITE HEALTH PHYSICS INFORMATION

Surface Dose Rate (mrem/h)	The data in this section were collected at the TA-54 waste storage/disposal site as defined in approved procedures. The package is acceptable for handling and storage.
Survey Meter Model	
Survey Meter Serial No.	
Alpha Contamination (dpm/100cm2)	Printed Name / Date
Beta-Gamma Cont. (dpm/100cm2)	Signature

V. STORAGE SITE INFORMATION

This package was visually inspected when received and was found to be properly labeled and in good condition. It was accepted according to approved procedures.		Pad No. / Layer	☐E ☐C ☐W
		Post No. / Date Stacked	
		This waste package was stored at this location according to approved procedures.	
Printed Name	Date	Printed Name	Date
Signature		Signature	

HS Form Number 10-28 (12/83)

Fig. 28. Certified Waste Storage Record (CWSR)

II.G Low-Level Waste Program

Disposal site operations are discussed in detail in Section II.B.3. The description includes acceptable waste forms, disposal methods, and current packaging and transportation requirements. In FY 1986, current packaging and transportation practices will undergo intensive review for compliance with the new DOE Order on transportation.

During FY 1985, surface stabilization of past radioactive disposal areas continued. Areas A, U, and V were regraded and surface-stabilized during FY 1985. Included in this work was the removal of undesirable vegetation, debris, and surface contamination, the addition of new cover material, correction of area drainage, and revegetation. Work at Area U involved the removal of 230 m^3 (8119 ft^3) of material to Area G for disposal. Areas F and T will be investigated and stabilized as necessary in FY 1986.

II.H. Radioactive Mixed Waste

Mixed waste has been defined in general terms as that waste which is both radioactively and chemically contaminated. The waste streams that meet this criterion at Los Alamos are listed in Table III. Through April 1985, this waste has been buried at Area G as radioactive waste. The packaging, treatment and disposal/storage of these wastes adequately meets the intent of the hazardous waste regulations. The contaminated lithium hydride, for example, is rendered nonreactive before disposal. (EPA and DOE regulations ban land disposal of reactive materials.) The current management of these waste streams is storage at Area L.

II.I Description of Decontamination and Decommissioning

II.I.1 Identification and Description of Contaminated Facilities

A 10-year Decontamination/Decommissioning (D&D) Site Plan was prepared for the Laboratory during 1977. From FY 1978 through 1985, the following D&D work was accomplished.

TA-42	Plutonium Incinerator Facility	- Decommissioned
TA-21-153	Filter Building	- Decommissioned
TA-35-2	Room 12A Tritium Laboratory	- Decontaminated

TA-35-7	Filter Building	- Decontaminated
TA-35-43	Contaminated Sodium Tanks	- Entombed
TA-35-2	LAMPRE Reactor Vessel	- Decontaminated
TA-21-2,-3,	-4, and -150 Plutonium Facilities	- Decontaminated
TA-3	Portions of Liquid Waste Collection System from TA-3 to TA-50	- Decommissioned
TA-2	Water Boiler Vent Line	- Decommissioned

Currently excess contaminated facilities that are available for decommissioning and/or decontamination include the following.

II.I.1.1 TA-35, LAPRE Reactor Vessel

The vessel that housed the Los Alamos Power Reactor Experiment (LAPRE) II Reactor is buried under a paved area south of TA-35-2. It is activated and contains small amounts of uranium. It is excess and should be removed and buried at the Laboratory radioactive waste disposal site when office trailers now in the area are relocated. The location has been marked and no detectable radiation levels exist at the pavement surface. This site also is identified as radioactive waste burial Area X.

II.I.1.2 TA-2, Water Boiler Reactor Facilities

This experimental water boiling reactor was defueled in 1974, making the reactor and associated liquid and gaseous waste systems available for decommissioning. The reactor fuel form was enriched uranium-uranyl-nitrate solution, and the reactor vessel is highly contaminated with uranium, induced activity, and long-lived fission products. Gaseous waste transfer systems are moderately contaminated with fission products and the massive concrete biological radiation shields have low levels of induced activity.

Phase I, the decommissioning of the external structures, effluent stack lines and delay tanks was effected in FY 1985-1986. Phase II, the removal of the reactor vessel, biological shield, and interior equipment is currently scheduled for the FY 1989-1990 time frame.

II.I.1.3 TA-52, UHTREX Reactor Facility

The Ultra-High-Temperature Reactor Experiment (UHTREX) is located at TA-52. The site is in limited use by the Energy Division. There are two main buildings. Building RD-1 is a composite, rectangular building with maximum dimensions of 40 m (132 ft) x 26 m (85 ft). It consists of the containment area and the areas outside the containment, which are the ground floor level, the operations level and the basement level. The reactor was defueled around 1970 and there are no plans for reactivation. The building has hot-water heating, evaporative cooling and ventilation, electric, water, and sewer services, sanitary facilities, a fire detection system, a telephone conduit system, and a paging system. A vacuum cleaning system, breathing-air system, compressed-air system, and air sampling system are also provided in certain areas. Portions of the reactor (fuel has been removed) are highly contaminated with fission products and induced radioactivity. Removal of the reactor vessel and components and decontamination of the facility are planned.

Building RD-11, the Mechanical Assembly building, is a prefabricated, rigid-frame metal building set on reinforced concrete foundations. The outside dimensions are 10 m (33 ft) x 19 m (61 ft). The wall height is 8 m (27 ft); the table height is 10 m (32 ft). The building has toilet and washroom facilities, heat, power, lightning protection, and a fire detection system.

Decommissioning operations on this facility are currently scheduled to begin in FY 1987 and be completed in FY 1989 with DOE Surplus Facilities Management Program funding.

II.I.1.4 Liquid Waste Collection System

This twenty-year old collection system became excess in FY 1982. Partial removal was accomplished in FY 1981 and 1982. Decommissioning work resumed in November 1983, and will continue into FY 1986. All of this removal work is being funded by the new system line construction project funds.

II.I.1.5 TA-21, South End of Buildings 3 and 4

These two areas of TA-21, consisting of about 1000 m^2

(10 760 ft^2) of usable floor space, became available for decontamination in late FY 1984. The uranium contaminated structures may be decontaminated as early as FY 1986-1987 if funding becomes available.

II.I.1.6 **Considered to be Standby**

There are no facilities considered standby.

II.I.1.7 **In Use**

Radioactively contaminated facilities currently in use at Los Alamos are given in Table IV. Other Los Alamos land areas contaminated with radioactivity are listed in Table V.

II.I.2 **Projection of Waste Volumes from D&D Activities**

Waste buried from D&D projects in recent years has amounted to about 50% of the total buried radioactive waste during this period, as indicated in Table VI.

The volume of D&D wastes during FY 1985 was 2533 m^3 (89 415 ft^3) generated primarily by the collection system project. Other work included the Phase I removal of the TA-2 Water Boiler Reactor and cleanup work at TA-4, -5, and -20. In FY 1986 removal of the liquid waste collection system from TA-3 to TA-50 will continue, generating wastes as shown in Table VII.

II.I.3 **D&D Plans and Priorities**

The Decontamination/Decommissioning Site Plan, mentioned earlier, describes facilities that are either surplus or expected to become programmatically inactive. It identifies, describes and justifies these as projects, addresses project alternatives, estimates D&D costs, and ranks projects according to priority. Entire surplus buildings with or without surplus equipment items, on-site land areas and building portions are considered as facilities. In FY 1982, the present underground industrial liquid waste collection system became excess, and parts of this system and SM-700 were removed as part of the radioactive liquid waste system improvement construction project. Work will continue on this priority project into FY 1986. Funding in FY 1985 and 1986 for partial decommissioning of the TA-2 Water Boiler Reactor also was received. Funding in 1987 through 1989 for the TA-52 UHTREX Reactor Facility is anticipated.

TABLE IV

CONTAMINATED FACILITIES CURRENTLY IN USE

Tech Area (Fig. 2)	Description	Location Bldg #	Location Dwg.#	Contamination Category[a]	Radioactive Contaminant(s)
TA-2	Omega Reactors	1	ENG-R 2409	M	FP, IA
TA-2	Stack Gas Valve	19	" " "	M	FP, IA
TA-2	Equipment Building	44	" " "	M	FP, IA
TA-2	Cooling Tower	49	" " "	M	FP, IA
TA-3	Van de Graaff Lab	16	ENG-R 2414	L	T, IA
TA-3	CMR Building	29	" " "	M	TRU, U, FP, IA, T
TA-3	Cryogenics Building "B"	34	" " "	L	T
TA-3	Press Building	35	" " "	M	U
TA-3	Tech Shop, Rm 42	39	" " "	L	U
TA-3	Physics Laboratories	40	" " "	L	T, TRU, FP, IA
TA-3	Source Storage Building	65	" " "	L	Ra
TA-3	Sigma Building	66	" " "	L	U
TA-3	Tech Shops	102	" " "	L	U
TA-3	Rolling Mill Building	141	" " "	L	U
TA-3	Liquid Waste Storage Facility	154	" " "	M	TRU, U, FP, IA
TA-3	Shop Storage Building	164	" " "	S	TRU, U
TA-8	Betatron Building	23	ENG-R 2422	M	IA, FP, TRU, U
TA-8	Isotope Building	24	" " "	S	IA
TA-8	Radiation Laboratory	26	" " "	S	IA
TA-8	Nondestruct. Test Facil.	70	" " "	L	U
TA-9	Lab.Bldg. (Rms 119 & 120)	21	ENG-R 2424	L	T
TA-16	Assembly Building	410	ENG-R 2441	S	TRU, U, T
TA-16	Rest House	411	" " "	S	TRU, U, T
TA-18	Assembly Bldg. (Kiva 1)	23	ENG-R 2446	M	U, IA
TA-18	Vault	26	" " "	M	U, TRU
TA-18	Assembly Bldg. (Kiva 2)	32	" " "	M	TRU, U, IA
TA-18	Assembly Bldg. (Kiva 3)	116	" " "	M	TRU, U, IA
TA-18	Reactor Subassembly Bldg	129	" " "	L	U
TA-18	Dynam. Crit. Assay Facil.	168	" " "	M	U, FP, IA
TA-21	All Laboratory Buildings	-	ENG-R 5113	S-H	U, Pu, T, FP
TA-35	Laboratory Buildings	2	ENG-R 2462	S-H	FP, Pu, T
TA-46	Lab Bldg. (Ducts & Drains)	1	ENG-R 2480	M	U
TA-46	Test Cell No. 1 & 2	16	" " "	M	U
TA-48	Laboratory Building	1	ENG-R 2483	H	TRU, U, FP, IA, T
TA-50	Waste Management Facilities	-	ENG-R 2493	M	TRU, U, FP, IA, T
TA-53	Accelerator Building	3	ENG-R 2500	L	IA
TA-54	Waste Disposal Site	-	ENG-R 5131	M	All
TA-55	Plutonium Facility	4		M	TRU
TA-59	Occupational Health	1		L	All

[a] DOE recommended classification criteria applied with addition of Suspect (S) category for facilities where health physics surveys do not indicate contamination; however, a more intensive survey is advisable if facility is removed or used for other purposes. H, M, L indicates high, medium, low levels of contamination.

TABLE V

OTHER CONTAMINATED AREAS

Identification/Description (Fig. 2)	Surface Area (acres)	Estimated Radio-activity[a]	Principle Radio-(nuclides
A. Underground pits used for liquid disposal:			
1. Near TA-21-164 (Area U)	0.3	H	Po, Ac, Ra
2. TA-21-20 (dismantled laundry) between TA-21-14 and Waste Disposal Area B (Area V)	1.0	M	Pu, U
3. Near TA-33-86 (Area K)	0.003	L	H-3
4. At TA-49	1.0	M	Pu
B. Outfall and disposal areas for liquid effluent:			
1. TA-21 and DP-Los Alamos Canyon	11.1 (est.)	L	Pu
2. TA-50, Mortandad Canyon, and Ten Site Canyon	2.2 (est.)	L	Pu
3. TA-53 Lagoons	2.0	L	H-3
C. Septic tanks:			
TA-2, TA-21, TA-33, TA-41, TA-46	Unknown	L	Pu, U, H-3
D. Underground contaminated drainlines: (Ref: Dwg. ENG-R 2404 and others in Ref. 12)			
1. TA-3-700 to ULR-33 manhole	Unknown	M	Pu, U, FP
2. HRL to ULR-60	Unknown	L	Pu, FP
3. Under Canyon Rd. near Diamond Dr.	Unknown	M	Pu, U, FP
4. ULR-62 to north side Central Ave.	Unknown	M	Pu, U
5. Under Rose St. near Central Ave.	Unknown	M	Pu, U
6. Under Canyon Rd. near Central Ave.	Unknown	M	Pu, U
7. Miscellaneous lines at TA-21	Unknown	H	Pu, Am, U
E. Miscellaneous			
1. Dirt bunkers (4) at TA-15-44, 45, E, and I-J firing points	Unknown	L	U
2. Underground chamber TA-33-29	0.7	L	Po (decayed)

[a] H, M, L indicate high, medium, low levels of contamination.

TABLE VI
LOS ALAMOS WASTE VOLUMES BURIED
(Volume - m^3)

Year (CY)	Routine	D&D	Total volume
1974-1975			143002
1976	2830	5990	8820
1977	2358	1352	3710
1978	2003	5501	7504
1979	2214	2656	4870
1980	2588	2167	4755
1981	2883	2656	5539
1982	2489	2046	4535
1983	2958	198	3156
1984	4264	1112	5376
TOTAL	24587 (51%)	23678 (49%)	191267

TABLE VII
PRESENT AND FUTURE LOS ALAMOS D&D WASTES

Tech Area	Project	FY	TRU	LLW	Type
TA-3	Liquid Waste Collection System	84-86	0	3000-4000	Soil, pipe, concrete, and concrete manholes
TA-21-1	Decommissioning of Water Boiler Reactor (Phase 1)	85-86	0	500-1000	Steel bldg. material and piping
TA-33-86	Decontamination of High Pressure Tritium Facility	87	0	100-200	Line removal, septic tank, and room equipment
TA-52	Decontamination of UHTREX Reactor Area	87-88	0	200-400	Steel vessels, piping, soil
TA-35	LAPRE Reactor	89	0	100-200	Steel vessels, piping, soil
TA-2-1	Decommissioning of Water Boiler Reactor (Phase II)	90	0	500-1000	Biological shield piping, concrete

II.J Environmental Monitoring Programs[3]

II.J.1 Environmental Surveillance of Radioactive Waste Disposal Areas

II.J.1.1 Introduction

Environmental surveillance of radioactive waste management areas at Los Alamos documents compliance with appropriate standards, identifies undesirable trends that may require remedial actions, and monitors the performance of waste confinement. Radioactivity concentrations in air (particulates and moisture), water, soil, and sediment samples are measured, along with the levels of external penetrating radiation. Eleven radioactive waste management sites are monitored (Fig. 29). The general public is excluded from these waste management areas because they are controlled-access areas. One (Area G at TA-54) is currently active and the remainder (Areas A, B, C, E, F, T, U, V, W, and X) are closed or decommissioned. They are described in the next paragraphs.

II.J.1.2 Descriptions of Active and Inactive Radioactive Waste Disposal Areas

II.J.1.2.1 Area A

Area A was used from 1945 to 1946. It is on the north side of TA-21 between DP-East and DP-West and covers 5000 m^2 (53 800 ft^2). Pits were excavated in volcanic tuff for burial of polonium contaminated wastes, which has now almost completely decayed, and possibly plutonium, uranium, and thorium contaminated waste from TA-21. Two tanks, designated the "General's Tanks", are buried on the west side of Area A. These tanks were used for storing plutonium solutions. Liquids from the tanks have been pumped to a nearby liquid waste plant for treatment. However, a thin layer (several centimeters) of gelatinous residue still remains in each tank.

Area A was reactivated in April 1969. An additional pit was excavated for disposal of low-level radioactively contaminated debris from demolition work at TA-21. This pit remained active thru September 1977 and was backfilled in May 1978.

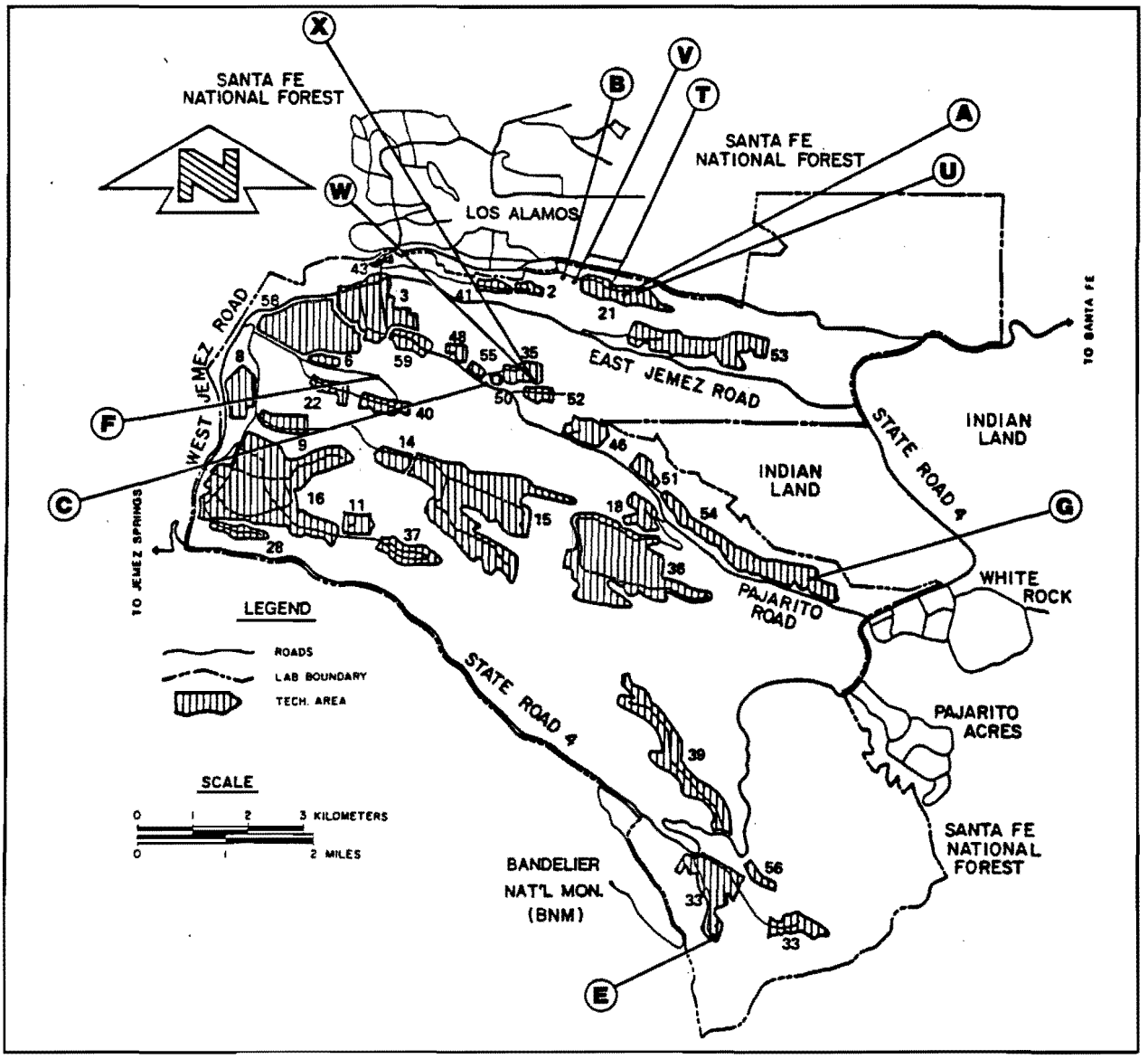


Fig. 29. Locations of active (Area G) and inactive radioactive waste disposal areas.

Surface stabilization work was completed at Area A during FY 1985. However, future work at the site is needed to address the residual TRU contamination in the "General's Tanks."

II.J.1.2.2 Area B

Area B is on the south side of DP Road, about 490 m (1607 ft) east of the intersection of DP Road and Trinity Drive and about 130 m (426 ft) west of TA-21. It covers 24 000 m^2 (258 240 ft^2) and is divided into three sections. The larger section is paved with asphalt and is leased by Los Alamos County for storing privately owned boats and trailers.

Area B was used from 1946 through 1948 for disposal of wastes contaminated with radioactive materials used at Los Alamos. It is estimated to contain no more than 100 g of ^{239}Pu. The ground surface of the eastern section (about one third of the total area) was decontaminated and stabilized during FY 1982. New cover material was compacted over the section and topsoil seeded with a mixture of native grasses placed over the cover layer. In September 1984, the smaller southwest corner section received the same remedial treatment.

II.J.1.2.3 Area C

Area C, near Pajarito Road and south of TA-50, covers 48 000 m^2(516 480 ft^2). It contains 7 pits, one of which has been designated a hazardous chemical waste pit, and 108 disposal shafts. These pits and shafts contain alpha and beta-gamma contaminated wastes. Wastes with relativity higher concentrations of radioactivity were disposed in the vertical shafts. Some of the shafts were lined with corrugated metal pipe or cement. One of the shafts was used for disposal of ^{90}Sr waste.

In FY 1983, remedial action was started at Area C to stabilize and cover surface contamination, remove debris, modify the fence line, and add drainage channels for preventing soil erosion. In September 1983, a can containing ^{137}Cs was removed from Area C and disposed at Area G. In November 1983, nine gas cylinders found at the site were vented and detonated. In early January 1984, the nine cylinders were removed from Area C and

disposed at Area L. Remedial work on the eastern end of the site was completed in early 1984.

II.J.1.2.4 **Area E**

Area E is on the extreme south end of TA-33. It covers about 307 m^2 (3303 ft^2) and contains six pits and an underground chamber. The underground chamber was destroyed by experimentation in 1950 and was probably contaminated with polonium (now decayed) and perhaps used through the middle 1960s for disposal of waste contaminated with polonium, uranium, and beryllium. In October 1983 an old barbed-wire fence was replaced with a chain link fence.

II.J.1.2.5 **Area F**

Area F is on Two Mile Mesa east of TA-6 and was used from 1946 through the early 1950s for disposal of Laboratory wastes. It consists of two burial pits. The smaller pit has an estimated volume of 740 m^3 (26 122 ft^3). It may contain wastes contaminated with ^{90}Sr, ^{137}Cs, alpha emitters, and high explosives. The larger waste pit has an estimated volume of 2020 m^3 (71 306 ft^3) and contains only high explosive wastes. In September 1983 a chain-link fence was installed around the disposal pits.

II.J.1.2.6 **Area G**

Area G is the primary radioactive solid waste disposal and storage facility for the Laboratory. It is on Mesita del Buey at TA-54 and occupies an area of 2.55×10^5 m^2 (2.74×10^6 ft^2) and consists of pits, shafts, trenches, and storage pads. This facility started operation in 1957 and is expected to remain active into the forseeable future.

From 90 to 95% of the total volume of radioactively contaminated solid waste from the Laboratory is disposed of by burial at Area G. The remaining 5 to 10% is classed as TRU waste and is stored retrievably at Area G. The pits, shafts, and trenches contain mixed fission products, tritium, uranium, activation products, and small amounts of transuranic elements. Other types of radioactive waste materials buried at this facility include: contaminated demolition debris, process

waste, paper, plastic, clothing, and equipment. The main groundwater aquifer is about 260 m (853 ft) below the ground surface of Area G.

Buried waste are confined from the environment by placing packaged wastes in pits or shafts excavated in the dry geologic formation of Area G. Burial pits range in size from 9 to 30 m (30 to 98 ft) wide, 45 to 180 m (148 to 590 ft) long, and 4 to 10 m (13 to 33 ft) deep and each layer is covered with about 0.5 m (1.5 ft) of crushed volcanic tuff. Filled burial pits are covered with top soil that is slightly mounded to encourage surface runoff. Packaged wastes are also disposed of in vertical shafts that range from 0.6 to 1.8 m (2 to 6 ft) in diameter and up to 20 m (65 ft) deep. The layering and mounded cover techniques are again used.

Stored TRU wastes are packaged in steel drums or fiberglass reinforced, plastic-coated, wooden crates. These packages are then placed in crushed tuff berms or in concrete casks, which in turn are placed in trenches.

Guidelines for pit construction were specified in 1965 by the US Geological Survey[13]. These specifications were revised and reissued in 1980 by the Laboratory's Waste Management Group, HSE-7, and the Environmental Surveillance Group, HSE-8 [14]. Each newly constructed pit is inspected to assure it complies with the Laboratory's guidelines.

II.J.1.2.7 **Area T**

Area T is on the north side of TA-21 and west of Area A. From 1945 to 1967 absorption beds were used for subsurface disposal of liquid wastes generated from the recovery process of plutonium. The absorption beds consisted of trenches excavated into volcanic tuff and backfilled with three different layers of materials (from bottom to top: about 20-cm (0.7 ft) diameter boulders, gravel, fine sand). Liquid wastes containing plutonium and americium from the recovery process were discharged into the beds. This practice was done from 1945 to 1952. The absorption beds also received effluent from the Laboratory's liquid waste

treatment facility from the early 1950s to 1967.

Operation of the TA-21 liquid waste treatment facility generated sludge residue contaminated with plutonium and americium. For years the residue was placed in steel drums and the drums buried at Areas C and G. In 1968, a pug mill operation was started to mix the sludge with cement. The resulting cement paste was pumped directly into asphalt coated vertical shafts augered between the absorption beds. This procedure continued through 1974.

In late 1974, a new disposal technique was implemented. A storage pit was dug beyond the shaft field area. Corrugated metal pipes were filled with TRU cement paste and placed in the pit. Low-level cement paste continued to be pumped into shafts at the site through April, 1983.

In August 1984, 70 CMP's were relocated from Area T to Area G. They contained TRU contamination below 100 nCi/g.

II.J.1.2.8 **Area U**

Area U is on the northeast side of DP-East at TA-21. It covers an area of 1200 m^2 (12 912 ft) and contains two absorption beds excavated in volcanic tuff. These beds were used for subsurface disposal of radioactively contaminated liquid wastes from 1948 to 1968. The amounts of liquid wastes discharged are unknown, because documentation is lacking. However, there are records that indicate about 2.5 Ci of ^{227}Ac were discharged into these beds in 1953. In December 1984 a gate was installed in the wast fence of the site. During FY 1985, surface stabilization was conducted at the site. Several drainage problems were corrected.

II.J.1.2.9 **Area V**

Area V is southwest of TA-21 and east of Area B and covers about 4000 m^2 (43 040 ft^2). Its primary purpose was for disposal of liquid wastes from laundry operations. It consists of three absorption beds excavated into volcanic tuff. They were used from 1945 to 1964. The beds received wastes containing an estimated total of 3 Ci (^{89}Sr, ^{140}Ba, and ^{140}La), which have decayed

over the years. In addition, small quantities of ^{90}Sr and ^{239}Pu were contained in the liquid wastes. In January 1984 a chain-link fence was constructed around the waste area. Surface stabilization work at the site was completed during FY 1985.

II.J.1.2.10 **Area W**

Area W is at TA-35, southwest of Building TSL-116, and about 5 m (16 ft) north of the rim of a tributary canyon to Mortandad Canyon. This site consists of two stainless steel tanks that are in separate vertical shafts containing irradiated sodium contaminated with ^{137}Cs, ^{22}Na, and ^{239}Pu. In 1979 the tops of the tanks, which are at ground level, were entombed in a reinforced concrete structure.

II.J.1.2.11 **Area X**

Area X is at TA-35 north of Building TSL-110 and was used for subsurface storage of the Los Alamos Molten Plutonium Reactor Experiment (LAMPRE) reactor vessel. The vessel was buried in 1964. It contains some of the longer lived activation products and some residual ^{235}U. This site has now been paved with asphalt.

II.J.1.3 **External Penetrating Radiation Measurements**

Levels of external penetrating radiation, including x and gamma rays and charged particle contributions from cosmic, terrestrial, and manmade sources, are measured at 9 of the 11 waste management areas. Areas W and X were not monitored with thermoluminescent dosimeters (TLDs), because they consist only of buried vessels that offer little opportunity for radiation exposure at the ground surface. Surface measurements with field instruments have confirmed this fact. The TLDs are attached to the areas' perimeter fences to measure radiation from both natural background and manmade sources.

The annual TLD measurements for the waste management areas are in Table VIII. For comparison, natural background radiation varied from 80 to 151 mrem/yr during 1984 in the Los Alamos region (Table IX). A holding tank for radioactive liquid waste from current operations and buried wastes from past operations at Area T caused this area's relatively higher measurement.

Table VIII

External Penetrating Radiation Measurements at

Waste Management Areas During 1984

Area	No. of Sampling Locations	No. of Quarterly Measurements	Annual Measurement (mrem)		
			Maximum	Minimum	Mean
Inactive					
A	5	20	133.1 ± 9.3	127.1 ± 9.3	130.6 ± 4.7
B	23	88	138.4 ± 9.3	117.5 ± 9.3	127.6 ± 12.5
C	18	64	145.9 ± 9.4	116.1 ± 9.4	131.1 ± 19.0
E	4	0	—	—	—
F	2	4	114.1 ± 9.3	114.1 ± 9.3	114.1 ± 9.3
T	7	20	280.9 ± 10.1	135.8 ± 9.3	167.9 ± 126.6
U	2	8	151.5 ± 9.3	148.5 ± 9.3	150.0 ± 4.2
V	4	0	—	—	—
Active					
G	27	92	246.8 ± 8.8	130.7 ± 8.4	158.9 ± 49.1

Table IX

Thermoluminescent Dosimeter Measurements

Station Location	Coordinates	Annual Measurement (mrem)
Regional Stations (28-44 km)—Uncontrolled Areas		
1. Espanõla	—	80 ± 4
2. Pojoaque	—	122 ± 4
3. Santa Fe	—	90 ± 4
4. Fenton Hill	—	118 ± 4
Perimeter Stations (0-4)—Uncontrolled Areas		
5. Barranca School	N180 E130	103 ± 4
6. Arkansas Avenue	N170 E030	103 ± 4
7. Cumbres School	N150 E090	114 ± 4
8. 48th Street	N110 W010	125 ± 4
9. LA Airport	N110 E170	135 ± 4
10. Bayo Canyon	N120 E250	151 ± 5
11. Gulf Station	N090 E120	115 ± 4
12. Royal Crest	N080 E080	117 ± 5
13. White Rock	S080 E420	113 ± 4
14. Pajarito Acres	S210 E380	97 ± 4
15. Bandelier	S280 E200	130 ± 4
16. Pajarito Ski Area	N150 W200	115 ± 4
Onsite Stations—Controlled Areas		
17. TA-21 (DP West)	N095 E140	140 ± 4
18. TA-6 (Two-Mile Mesa)	N025 E030	121 ± 4
19. TA-53 (LAMPF)	N070 E090	161 ± 4
20. Well PM-1	N030 E305	135 ± 4
21. TA-16 (S-Site)	S035 W025	122 ± 4
22. Booster P-2	S030 E220	135 ± 4
23. TA-54 (Area G)	S080 E290	135 ± 5
24. State Hwy 4	N070 E350	182 ± 4
25. TA-49 (Frijoles Mesa)	S165 E085	119 ± 4
26. TA-2 (Omega Stack)	N075 E120	127 ± 4
27. TA-2 (Omega Canyon)	N085 E120	157 ± 4
28. TA-18 (Pajarito Site)	S040 E205	183 ± 4
29. TA-35 (Ten Site A)	N040 E105	128 ± 4
30. TA-35 (Ten Site B)	N040 E110	128 ± 4
31. TA-59 (Occupational Health Lab)	N050 E040	137 ± 5
32. TA-3 (Van de Graaff)	N050 E020	130 ± 4
33. TA-3 (Guard Station)	N050 E020	138 ± 4
34. TA-3 (Alarm Building)	N050 E020	189 ± 4
35. TA-3 (Guard Building)	N050 E020	118 ± 5
36. TA-3 (Shops)	N050 E020	119 ± 4
37. Pistol Range	N040 E240	127 ± 4
38. TA-55 (Plutonium Facility South)	N040 E240	127 ± 4
39. TA-55 (Plutonium Facility West)	N040 E080	136 ± 5
40. TA-55 (Plutonium Facility North)	N040 E080	145 ± 5

Several transient elevated TLD measurements at Area G were due to handling and storing of the wastes before their burial.

II.J.1.4 **Air Sampling Results**

Air sampling is done at the one active waste management area, Area G at TA-54. During the later part of 1984 four new air sampling stations were placed around the perimeter of Area G to supplement the one existing air sampler (Fig. 30). Moisture samples from these stations are analyzed for ^{3}H monthly and air particulate samples for $^{239,240}Pu$ and total U quarterly.

Air sampling data for the last quarter of 1984 are in Table X. The highest mean tritium concentration of 1290 X 10^{-12} µCi/ml (0.3% of Department of Energy's Concentration Guide for Controlled Areas) occurred at Station G-2. This station is near burial shafts that are used for disposal of liquid scintillation vials, which contain trace amounts of tritium. The uranium concentration was above the minimum detectable limit of 3 X 10^{-18} µCi/ml. A concentration of 7.7 X 10^{-18} µCi/ml (0.0004% of the Department of Energy's Concentration Guide for Controlled Areas) was measured at Station G-1. This station is downwind from handling and storing operations at the TRU waste storage pads.

II.J.1.5 **Monitoring Results for Areas B and C**

Environmental Monitoring of Areas B and C was completed during 1984. Soil and vegetation samples were collected from three perimeter locations around Area B and four perimeter locations around Area C. Samples were analyzed for ^{3}H, ^{238}Pu, $^{239,240}Pu$, and total U, because these radionuclides are likely to be in the buried wastes. Gamma spectra analyses were also done to identify other radionuclides that might be present.

Results of the sampling are in Table XI. For comparison, concentrations in regional (background) soil samples range from about 1 to 4 X 10^{-6} µCi/ml for ^{3}H, about 2 to 3 µg/g for total U, and about 0.000 to 0.015 pCi/g for $^{239,240}Pu$. Although prior years' samples contained traces of ^{3}H, these samples showed no

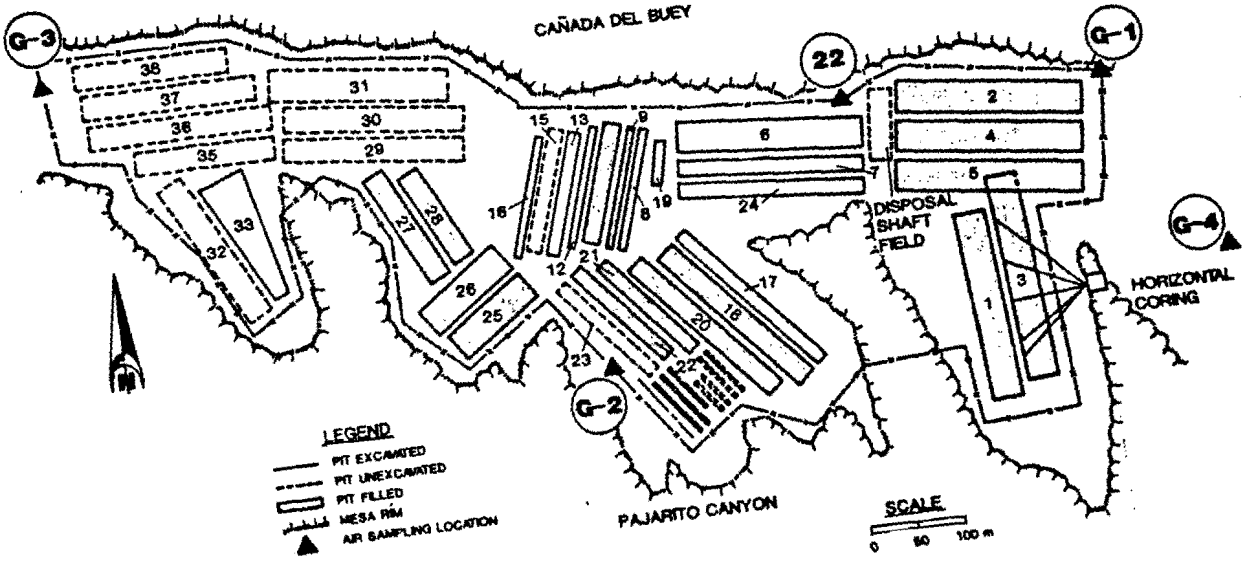


Fig. 30. Air Sampler locations at Area G

Table X

Air Sampling Results for Fourth Quarter at Area G (TA-54)

Station Location[a]	^{3}H pCi/m^{3} (10^{-12} μCi/ml)					Total U (pg/m^{3})			$^{239,240}Pu$ aCi/m^{3} (10^{-18} μCi/ml)		
	Number of Samples	Max	Min	Mean	Mean as % CG[b]	Number of Samples	Mean	Mean as % CG[b]	Number of Samples	Mean	Mean as % CG[b]
Station 22	3	80 ± 20	25 ± 5	62 ± 64	0.0012	1	12 ± 1.3	0.00001	1	0.5 ± 0.3	0.00005
G-1	3	80 ± 10	17 ± 3	45 ± 64	0.0009	1	24 ± 2.7	0.00001	1	7.7 ± 1.0	0.0004
G-2	3	2100 ± 400	280 ± 50	1290 ± 1850	0.03	1	6.4 ± 0.7	0.00000	1	0.2 ± 0.2	0.00001
G-3	3	21 ± 4	6 ± 1	13 ± 15	0.0003	1	12 ± 1.2	0.00001	1	0.3 ± 0.2	0.00002
G-4	3	34 ± 7	15 ± 3	24 ± 19	0.0005	1	5.0 ± 0.6	0.00000	1	0.1 ± 0.2	0.00000

[a]See Fig. 10 for map of station locations.
[b]Controlled Area Concentration Guides: $^{3}H = 2 \times 10^{-6}$ μCi/ml, Total U = 1.8×10^{8} pg/m^{3}, and $^{239,240}Pu = 2 \times 10^{-12}$ μCi/ml.

Table XI

Radionuclide Concentrations in Soil Samples from Waste Management Areas B and C

	Area B		
	^{3}H (10^{-6} μCi/mℓ)	Total U (μg/g)	$^{239,240}Pu$ (pCi/g)
Depth: 0-1 cm			
Range	2.4 - 4.8	4.9 - 5.7	0.5 - 3.1
$\bar{x} \pm 2s$	3.2 ± 2.7	5.3 ± 0.7	1.7 ± 2.6
No. of Samples	3	3	3
Depth: 1-10 cm			
Range	1.8 - 2.7	5.2 - 6.0	0.6 - 7.4
$\bar{x} \pm 2s$	2.3 ± 0.9	5.5 ± 0.9	3.0 ± 7.6
No. of Samples	3	3	3
Depth: 10-30 cm			
Range	1.8 - 2.4	4.0 - 4.8	0.39 - 1.2
$\bar{x} \pm 2s$	2.2 ± 0.7	4.5 ± 0.8	0.65 ± 0.91
No. of Samples	3	3	3
	Area C		
Depth 0-1 cm			
Range	9.9 - 20	3.7 - 5.6	0.05 - 5.9
$\bar{x} \pm 2s$	15 ± 8.3	4.4 ± 1.9	1.8 ± 5.6
No. of Samples	4	4	4
Depth: 1-10 cm			
Range	6.6 - 11	3.6 - 6.1	0.09 - 2.6
$\bar{x} \pm 2s$	9.2 ± 3.9	4.7 ± 2.4	0.99 ± 2.2
No. of Samples		4	4
Depth: 10-30			
Range	7.9 - 22	3.6 - 5.6	0.33 - 8.5
$\bar{x} \pm 2s$	14 ± 13	4.4 ± 1.8	2.5 ± 8.1
No. of Samples	4	4	4

evidence of ^{3}H contamination at Area B and little at Area C. Uranium concentrations in the Area B and C soil samples, although slightly higher than regional values, were within the range of variability in the natural crustal abundance of uranium.

Plutonium concentrations in the soil samples from Areas B and C evidenced low level contamination. This contamination is about 30 times below the Department of Energy's remedial action guidelines[15]. Surface runoff from Area B empties into Small Canyon, a tributary to Los Alamos Canyon. Soil and sediment samples from these two canyons do not show any evidence of plutonium contamination from Area B.

Surface runoff from Area C flows into Mortandad Canyon, which receives effluents from a radioactive waste liquid treatment plant at TA-50. Therefore, any contamination from Area C that might have been transported into the canyon is not distinguishable from the known contamination from TA-50 operations.

II.J.1.6 Radionuclide Transport in Sediments and Runoff at Area G

Radionuclides transported by surface runoff have an affinity for attachment to sediment particles by ion exchange or adsorption. Thus, radionuclides in surface runoff tend to concentrate on sediments in stream channels. Nine sampling stations were established in 1982 outside the perimeter fence at Area G to monitor any possible transport of radionuclides by storm runoff (Fig. 31). These stations are sampled annually.

The average concentrations of ^{137}Cs (0.46 pCi/g) and total uranium (4.6 μg/g) in sediments from the nine sediment stations were below regional back ground levels from 1978 through 1982 (Tables XII and XIII). Additional analyses of the sediments for ^{3}H and gross gamma in 1984 indicated these concentrations were low when compared to the regional sediments in 1984 (^{3}H regional 3.9×10^{-6} μCi/l; gross gamma regional, 9.0 counts/min/g).

The average concentrations of ^{238}Pu at Stations 3, 4, 6, 7, 8, and 9 were above regional background concentrations. The average ^{238}Pu and $^{239,240}Pu$ concentrations at Stations 6, 7, and

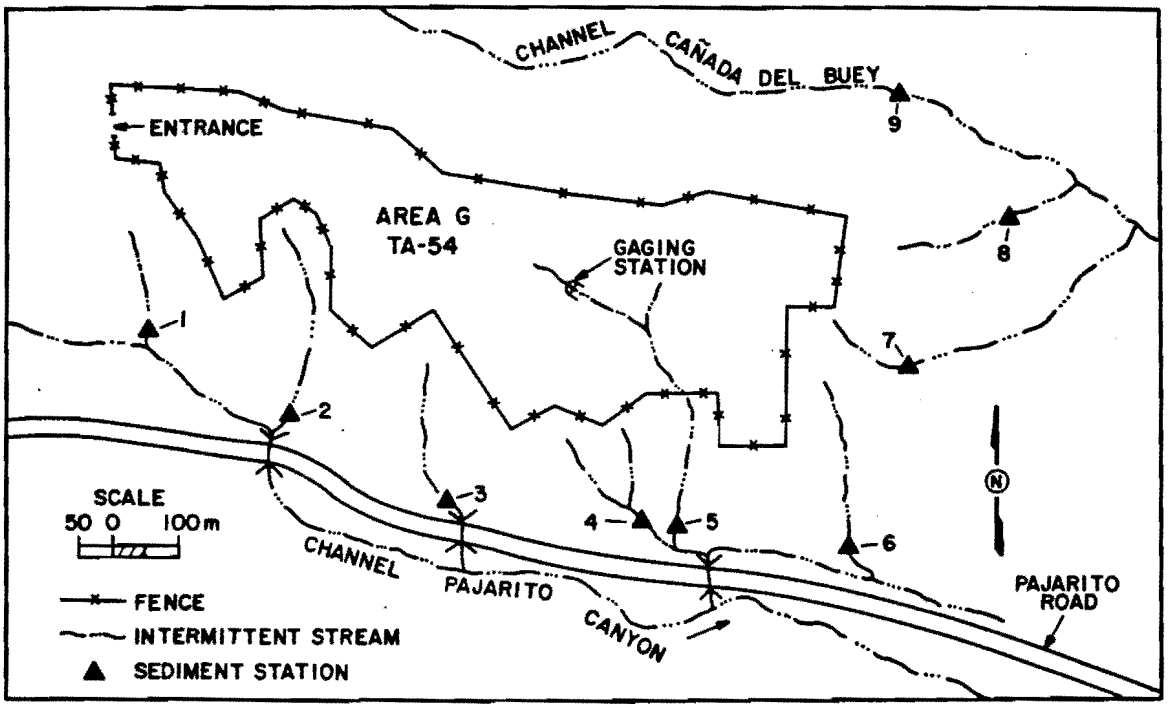


Fig. 31. Surface water gaging station in Area G (TA-54) and sediment sampling adjacent to Area G.

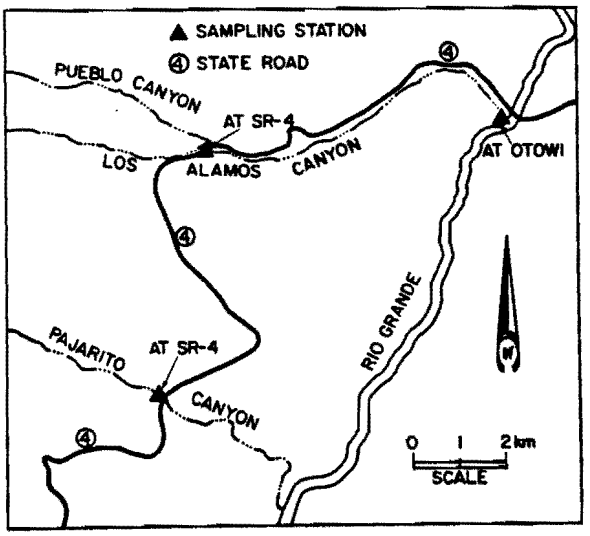


Fig. 32. Locations of surface runoff sampling Stations at State Road 4 (SR-4)

Table XII

Radiochemical Analyses of Sediments and Runoff at Area G (TA-54)

Analysis	Units	1982 ($\bar{x} \pm 2s$)	1983 ($\bar{x} \pm 2s$)	1984 ($\bar{x} \pm 2s$)	Regional Stations 1978-1982 ($\bar{x} + 2s$)[a]
		Sediment Stations			
^{137}Cs	pCi/g	0.30 ± 0.41	0.23 ± 0.20	0.2 ± 21	0.46
^{238}Pu	pCi/g	0.110 ± 0.025	0.033 ± 0.107	0.023 ± 0.016	0.006
$^{239,240}Pu$	pCi/g	0.032 ± 0.104	0.034 ± 0.160	0.088 ± 0.295	0.042
^{3}H	10^{-6} μCi/mℓ	—	—	2.9 ± 2.1	3.9[b]
Total U	μg/g	3.2 ± 1.9	3.7 ± 2.3	3.3 ± 1.7	4.6
Gross gamma	counts/min/g	—	5.9 ± 4.1	6.8 ± 3.9	9.0[b]
		Runoff at Gaging Station			
					Pajarito Canyon 1983 ($\bar{x} + 2s$)[c]
Solution					
^{238}Pu	10^{-9} μCi/mℓ	0.027 ± 0.051	0.001 ± 0.001	–0.012 ± 0.024	0.014
$^{239,240}Pu$	10^{-9} μCi/mℓ	0.013 ± 0.056	0.002 ± 0.002	0.012 ± 0.024	–0.002
Suspended Sediments					
^{238}Pu	pCi/g	1.1 ± 0.28	3.2 ± 0.32	–0.008 ± 0.010	0.79
$^{239,240}Pu$	pCi/g	1.3 ± 0.24	5.0 ± 0.12	–0.003 ± 0.012	0.71

[a]Reference (Purtymun 1983D).
[b]Regional sediments (1984).
[c]Pajarito Canyon snowmelt (1983).

Table XIII

Radiochemical Analyses of Sediment and Runoff Samples from Area G (TA-54)

	Sediments (October 1, 1984)					
Station	^{137}Cs (pCi/g)	^{238}Pu (pCi/g)	$^{239,240}Pu$ (pCi/g)	^{3}H (pCi/g)	Total Uranium (μg/g)	Gross Gamma (counts/min/g)
1	0.10 ± 0.16	0.002 ± 0.004	0.004 ± 0.004	1.9 ± 0.8	4.1 ± 0.6	8.2 ± 0.6
2	0.17 ± 0.13	0.004 ± 0.004	0.005 ± 0.003	2.1 ± 0.8	2.7 ± 0.4	5.9 ± 0.6
3	0.34 ± 0.18	0.014 ± 0.007	0.011 ± 0.006	2.1 ± 0.8	3.5 ± 0.5	8.0 ± 0.6
4	0.42 ± 0.26	0.015 ± 0.006	0.037 ± 0.009	3.8 ± 1.0	4.2 ± 0.6	9.0 ± 0.6
5	0.16 ± 0.18	0.002 ± 0.005	0.002 ± 0.003	4.7 ± 1.2	2.2 ± 0.4	3.9 ± 0.3
6	0.23 ± 0.15	0.029 ± 0.010	0.440 ± 0.045	3.0 ± 1.0	4.2 ± 0.6	8.9 ± 0.3
7	0.21 ± 0.14	0.073 ± 0.007	0.214 ± 0.024	4.1 ± 1.0	2.2 ± 0.4	5.4 ± 0.6
8	0.17 ± 0.14	0.036 ± 0.009	0.051 ± 0.005	1.8 ± 0.8	3.9 ± 0.5	7.9 ± 0.6
9	0.11 ± 0.18	0.032 ± 0.008	0.030 ± 0.007	2.7 ± 0.8	2.8 ± 0.4	4.4 ± 0.6
$\bar{x} \pm 2s$	0.21 ± 0.21	0.023 ± 0.046	0.088 ± 0.295	2.9 ± 2.1	3.3 ± 1.7	6.8 ± 3.9

Runoff in Area G at Gaging Station (August 24, 1984)			
Solution		Suspended Sediments	
^{238}Pu (10^{-9} μCi/mℓ)	$^{239,240}Pu$ (10^{-9} μCi/mℓ)	^{238}Pu (pCi/g)	$^{239,240}Pu$ (pCi/g)
−0.012 ± 0.024	0.012 ± 0.024	−0.008 ± 0.010	−0.003 ± 0.012

Note: The ± value represents twice the standard deviation of the distribution of observed values. If only one analysis is reported, then the value represents twice the uncertainty term for the analysis.

8 also exceeded regional background concentrations (^{238}Pu regional, 0.006 pCi/g; $^{239,240}Pu$ regional, 0.0042 pCi/g). These above background concentrations of ^{238}Pu and $^{239,240}Pu$ in the sediments are similar to what was found in 1982 and 1983 and indicate some transport of surface contamination by runoff from Area G. Any contaminated sediments transported into adjacent canyons are dispersed by storm runoff transport.

The maximum concentration of ^{238}Pu was 0.73 pCi/g or about 12 times greater than regional background concentrations or fallout levels. The $^{239,240}Pu$ maximum concentration was 0.44 pCi/g or about 10 times greater than regional background concentrations. Sampling in Canada del Buey at State Road-4 (SR-4) below Stations 7, 8, and 9 and in Pajarito Canyon at SR-4 below Stations 1 through 6 (Area G) detected no concentrations above regional background levels (Fig. 32).

One sample was collected of runoff in the center of Area G during 1984 (Fig. 31). The sample was analyzed for plutonium in solution and in suspended sediments (Tables XII and XIII). Radioactivity in solution is defined as filtrate passing through a 0.45 pore-size filter, while radioactivity in suspended sediments is defined as the residue on the filter. The single runoff event contained no plutonium in solution or in suspended sediments when compared to snowmelt runoff for 1983[16]. During 1984 there was no snowmelt runoff at SR-4 in Pajarito Canyon.

II.J.2 Radioactive Airborne Emissions

Radioactive airborne emissions are monitored and discharged at the Laboratory from 86 stacks. These emissions consist principally of filtered exhausts from glove boxes, experimental facilities, operational facilities (such as liquid waste treatment plants), a research nuclear reactor, and a linear particle accelerator at the Los Alamos Meson Physics Facility (LAMPF). The emissions receive appropriate treatment before discharge, such as filtration for particulates, catalytic conversion and adsorption for tritium, or temporary holdup to permit decay of short-lived activation gases. Quantities of airborne radio

activity released depend on the kinds of research being done, so can vary significantly from year to year (Figs. 33-35, Tables XIV and XV).

During 1984, the most significant apparent increase was in airborne activation products (gases, particulates, and vapors) from the linear particle accelerator at LAMPF. A total of 463 751 Ci of activation products was reported for 1983[16]. The total is 736,618 Ci for 1984 (Fig. 34, Table XIV, and Table XV). Most of this apparent increase is due to an error in calibration of the stack sampling instrumentation at LAMPF. The instrumentation was calibrated incorrectly for an undetermined period of time, so stack emission data have been reported about 40% low. Consequently, the 1983 total should have been 40% higher or about 640,000 Ci. The real increase from 640 000 Ci, 1983, to 736,618 Ci 1984, is due to increased operating levels and times at LAMPF.

The principal airborne activation products, half-lives in parentheses, were ^{11}C (20 min), ^{13}N (10 min), ^{14}O (71 sec), ^{15}O (123 sec), ^{41}Ar (1.83 h), ^{192}Au (4.1 h), and ^{195}Hg (9.5 h). Over 95% of the radioactivity was from the ^{11}C, ^{13}N, ^{14}O, and ^{15}O radioisotopes, which have half-lives that range from 2 to 20 minutes. Therefore, the radioactivity from these radionuclides decays very rapidly. Engineering design improvements to the beam stop area were begun in 1984 to help reduce generation of activation products.

Tritium emissions from TA-33 and TA-41 contributed to the approximate doubling of total Laboratory tritium emissions in 1984 compared with 1983 (Tables XIV and XV). This increase is due primarily to changing research and development programs and operational problems (see Section IV.H).

In addition to releases from facilities, some depleted uranium (uranium consisting primarily of ^{238}U) is dispersed by experiments that use conventional high explosives. About 840 kg (1848 lb) of depleted uranium were used in such experiments in 1984 (Table XVI). This mass contains about 0.29 Ci of activity.

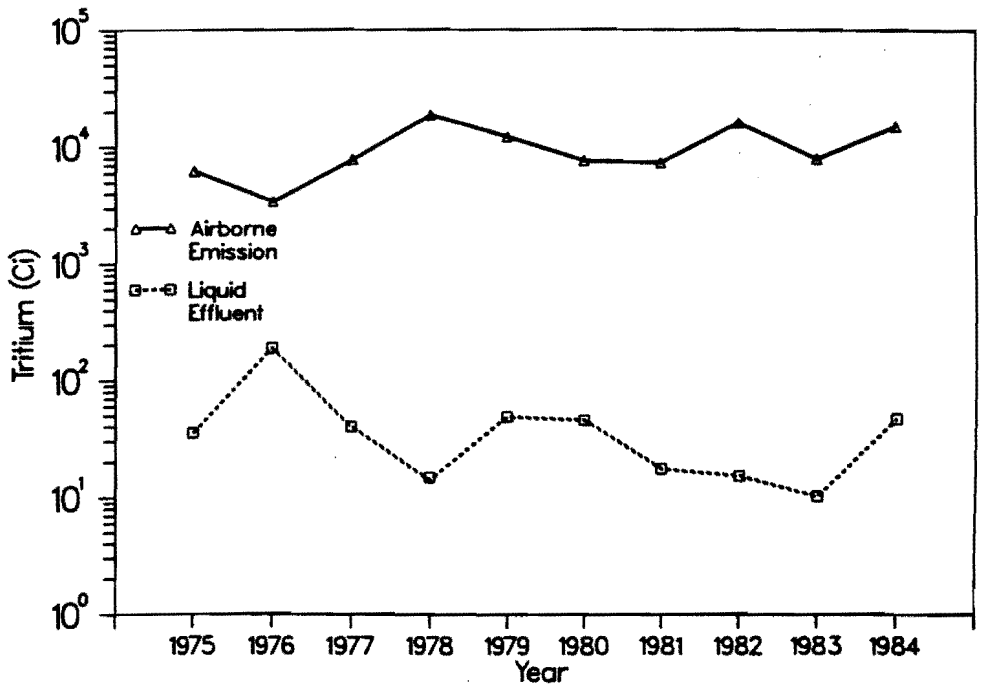


Fig. 33. Summary of tritium releases (airborne emissions and liquid effluents).

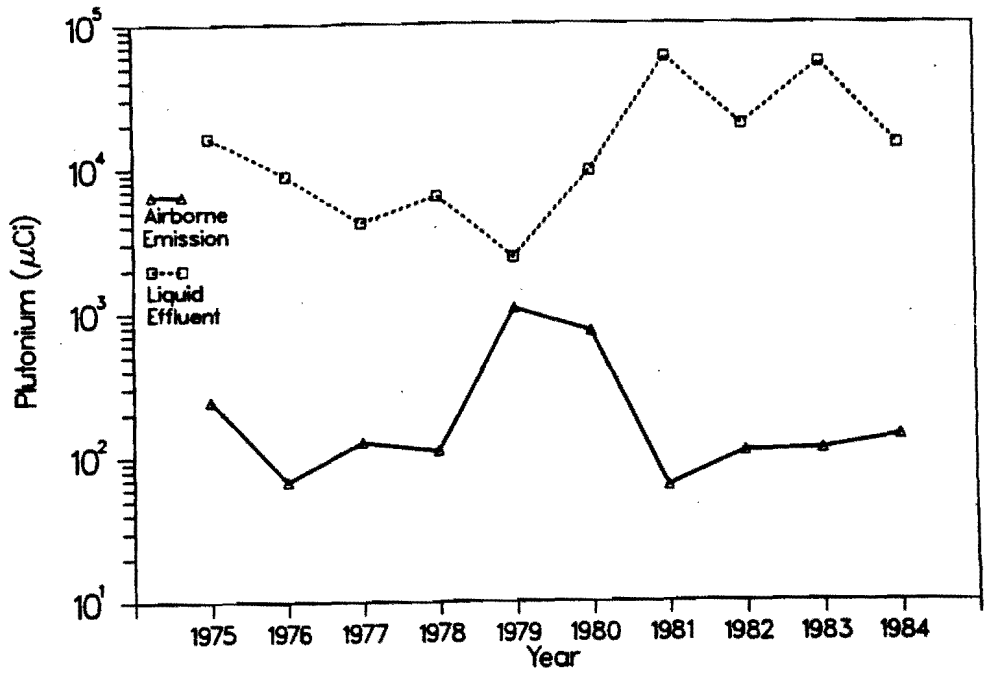


Fig. 34. Summary of plutonium releases (airborne emissions and liquid effluents).

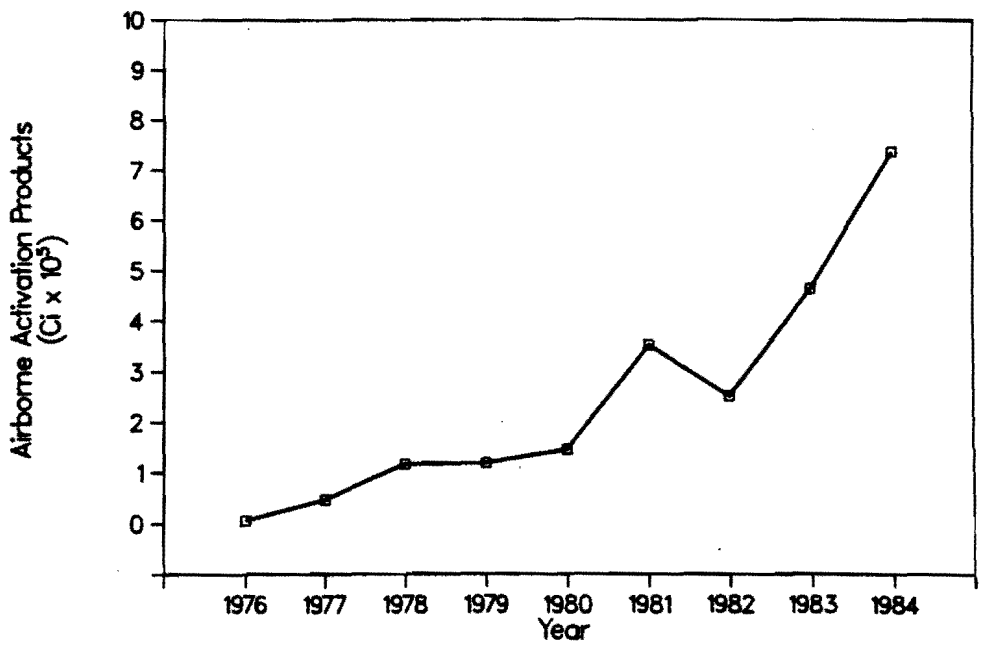


Fig. 35. Airborne activation product emissions (^{11}C, ^{13}N, ^{14}O, ^{15}O, ^{41}Ar, ^{192}Au, ^{195}Hg) from the Los Alamos Meson Physics Facility (TA-53).

Table XIV

Comparison of 1983 and 1984 Radioactive Releases from the Laboratory

Airborne Stack Emissions

Radioactive Constituent	Units	Activity Released 1983	Activity Released 1984	Ratio [1984/1983]
^{241}Am	µCi	0.095	0	0.4
^{41}Ar	Ci	418	335	0.8
^{3}H	Ci	7 847	14 869	1.9
^{131}I	µCi	83	73	0.9
^{32}P	µCi	2.7	33	12.2
$^{238,239,240}Pu$	µCi	113	140	1.2
U	µCi	888	1 205	1.4
Gaseous Mixed Activation Products	Ci	461 111	734 111	1.6
Mixed Fission Products	µCi	1 580	1 617	1.0
Particulate/Vapor Activation Products	Ci	2 640	2 500	0.9
Total	Ci	472 753	751 815	

Liquid Effluents

Radioisotopes	Activity Released (mCi) 1983	Activity Released (mCi) 1984	Ratio [1984/1983]
$^{238,239,240}Pu$	53.3	14.4	0.3
^{241}Am	38.4	9.0	0.2
$^{89,90}Sr$	59.3	269	4.5
^{3}H	10 350	46 942	4.5
^{137}Cs	45	19.7	0.4
^{234}U	2.1	7.4	3.5
Total	10 548	47 262	

Table XV

Atmospheric Radioactive Emission Totals

Location	^{238}Pu $^{239,240}Pu$ (μCi)	^{241}Am (μCi)	^{235}U ^{238}U[a] (μCi)	MFP[b] (μCi)	^{131}I (μCi)	^{41}Ar[c] (Ci)	^{32}P (μCi)	^{3}H (Ci)	G/MAP (Ci)[d]	P/VAP (Ci)[e]
TA-2	---	---	---	---	---	335	---	---	---	---
TA-3	114	---	214	42	73	---	---	1 792	---	---
TA-9	---	---	---	---	---	---	---	---	---	---
TA-15	---	---	---	---	---	---	---	---	---	---
TA-18	---	---	---	---	---	---	---	---	---	---
TA-21	17	---	990	0.3	---	---	---	802	---	---
TA-33	---	---	---	---	---	---	---	7 110	---	---
TA-35	0.4	---	---	---	---	---	---	206	---	---
TA-41	---	---	---	---	---	---	---	4 780	---	---
TA-43	1.0	--	---	---	---	---	33	---	---	---
TA-46	---	---	0.05	---	---	---	---	---	---	---
TA-48	2.6	---	1.3	1566	---	---	---	---	---	---
TA-50	3.7	---	---	8.9	---	---	---	---	---	---
TA-53	---	---	---	---	---	---	---	27	734 118	2500
TA-54	0.02	---	---	---	---	---	---	---	---	---
TA-55	1.0	---	---	---	---	---	---	152	---	---
Totals	140	---	1205	1617	73	335	33	14 869	734 118	2500

[a]Does not include aerosolized uranium from explosives testing. See Table E-XXXII.
[b]Mixed fission products.
[c]Another source of ^{41}Ar (3080 Ci) is the G/MAP from TA-53.
[d]G/MAP = Gaseous Mixed Activation Products. Main contaminants are ^{11}C (16%), ^{13}N (4.2%), ^{14}O (2.1%), ^{15}O (71.8%), and ^{41}Ar (0.42%). The half-lives of ^{11}C, ^{13}N, ^{14}O, and ^{15}O range from about 2 to 20 minutes; the half-life of ^{41}Ar is 1.83 hours.
[e]P/VAP = Particulate or Vapor Activation Products. Main contaminants are ^{195}Hg for vapor and ^{192}Au for particulates.

Note: --- means no discharge of that radionuclide at that location.

Table XVI

Estimated Concentrations of Toxic Elements
Aerosolized by Dynamic Experiments

Element	1984 Total Usage (kg)	Fraction Aerosolized (%)	Annual Average Concentration (ng/m^3) 4 km	8 km	Applicable Standard (ng/m^3
Uranium	840.5	10	0.08	0.03	9000[a]
Be	17.5	2	0.0005	0.0001	10[b]
Pb	81.8	100[c]	0.09	0.04	1500[d]

[a]Reference (DOE 1981).
[b]Thirty-day average. New Mexico Air Quality Control Regulation 201.
[c]Assumed percentage aerosolized.
[d]Three-month average. 40 CFR 50.12.

Most debris from these experiments is deposited on the ground in the vicinity of the firing sites. Limited experimental data indicate that no more than about 10% of the depleted uranium becomes airborne. Dispersion calculations indicate that resulting airborne concentrations are in the same range as attributable to natural crustal abundance uranium in resuspended dust.

II.J.3 Radioactive Liquid Effluents

Treated liquid effluents containing low levels of radioactivity are released from the Central Liquid Waste Treatment Plant at TA-50, a smaller plant serving processing facility (TA-21), and a sanitary sewage lagoon system serving the Los Alamos Meson Physics Facility at TA-53. Detailed results of the effluent radioactivity monitoring are in Tables XIV, XVII, XVIII, and Figs. 33, 34, and 36.

The quality of effluents from the larger radioactive liquid waste treatment plant, TA-50, was well below the Department of Energy's Concentration Guides for onsite releases (Table XVIII). There was no significant trend in the comparison of the 1983 and 1984 data. The effluents are discharged into a normally dry stream channel in Mortandad Canyon where surface flow has not passed beyond the Laboratory boundary since before the plant began operation.

All radionuclide concentrations in effluents from the smaller plant, TA-21, were well within the Department of Energy's Concentration Guides for onsite releases (Table XVIII). No significant trends were noted when radionuclide releases for 1984 were compared with those for 1983. Discharges from TA-21 are into DP Canyon, a tributary of Los Alamos Canyon. Runoff in DP Canyon does at times flow past the Laboratory boundary and transports some residual radionuclides that have adsorbed on sediments.

All radionuclide concentrations found in the TA-53 lagoon effluent in 1984 were higher than those found in 1983. This is due to the increase in radionuclide production, because of

Table XVII

Quality of Effluents from Liquid
Radioactive Waste Treatment Plants for 1984

	Waste Treatment Plant Location					
	TA-50			TA-21		
Radioactive Isotopes	Activity Released (mCi)	Mean Concentration (μCi/mℓ)	Mean as % CG[a]	Activity Released (mCi)	Mean Concentration (μCi/mℓ)	Mean as %CG[a]
^{238}Pu	6.1	1.7×10^{-7}	0.17	0.09	2.1×10^{-8}	0.02
$^{239,240}Pu$	8.1	2.3×10^{-7}	0.23	0.13	3.1×10^{-8}	0.03
^{241}Am	8.2	2.3×10^{-7}	0.23	0.84	2.0×10^{-7}	0.20
^{89}Sr	262	7.5×10^{-6}	2.5	0.16	3.8×10^{-8}	0.01
^{90}Fr	6.8	1.9×10^{-7}	1.9	0.23	5.5×10^{-8}	0.55
^{3}H	12,700	3.6×10^{-4}	0.36	542	1.3×10^{-4}	0.13
^{137}Cs	19.5	5.6×10^{-7}	0.14	0.16	3.8×10^{-8}	0.01
^{234}U	3.8	1.1×10^{-7}	0.11	3.6	8.6×10^{-7}	0.86
Total Effluent Volume:	3.503×10^{7} ℓ			4.198×10^{6} ℓ		

	Waste Treatment Plant Location	
	TA-50	TA-21
Nonradioactive Constituent	Mean Concentration (mg/ℓ)	Mean Concentration (mg/ℓ)
Cd[b]	0.003	0.005
Ca	120	16
Cl	84	27
Cr (total)[b]	0.13	0.07
Cu[b]	0.44	0.022
F	12	79
Hg[b]	0.0013	0.0006
Mg	4	3.6
Na	972	908
Pb[b]	0.029	0.03
Zn[b]	0.24	0.25
CN	0.082	0.022
COD[b]	73	60
$NO_3(N)$	331	159
PO_4	0.62	0.86
TDS	3400	2820
pH[b]	7.0-12.8	8.6-12.5
Total Effluent Volume	3.5×10^{7} ℓ	4.2×10^{6} ℓ

[a]Department of Energy's Concentration Guide for Controlled Areas.
[b]Constituents regulated by National Pollutant Discharge Elimination System permit.

Table XVIII

Quality of Effluent from the Los Alamos Meson Physics Facility's (TA-53) Lagoons

Radioactive Isotope	Activity Released (mCi)	Mean Concentration (μCi/mℓ)	Mean as % CG[a]
^{7}Be	7630	4.3×10^{-4}	0.86
^{57}Co	258	1.5×10^{-5}	0.15
^{60}Co	36	2.0×10^{-6}	0.20
^{134}Cs	125	7.1×10^{-6}	2.4
^{3}H	33,700	1.9×10^{-3}	1.9
^{54}Mn	80	4.5×10^{-6}	0.15
^{22}Na	170	9.6×10^{-6}	1.1
Total Effluent Volume Released	1.77×10^{7} ℓ		

[a]Department of Energy's Concentration Guide for Controlled Areas.

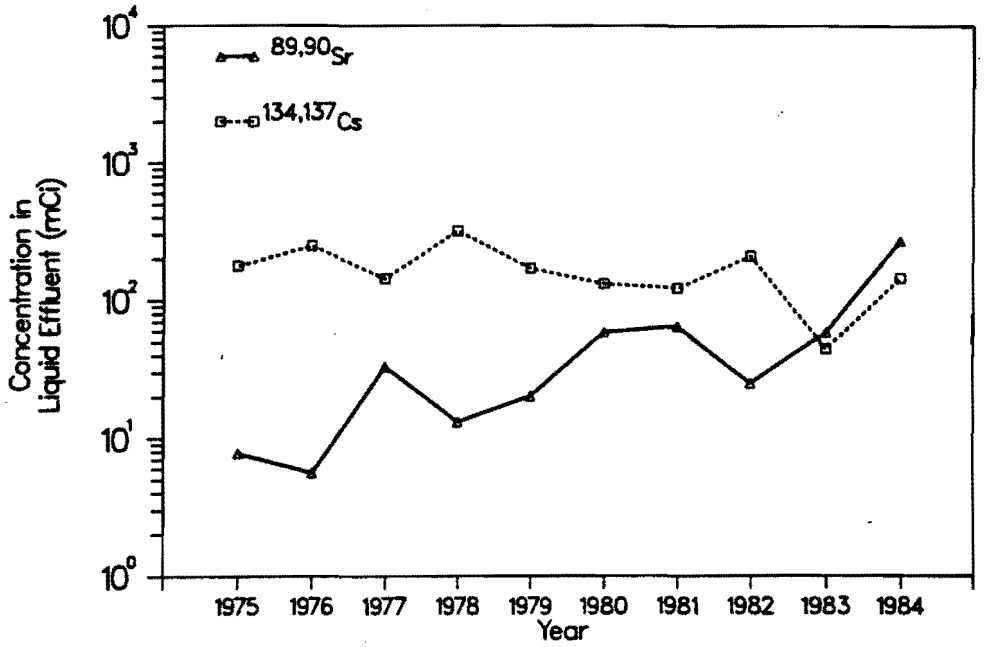


Fig. 36. Summary of strontium and cesium liquid effluent releases.

higher accelerator beam strength. The source of the radioactivity was activated water from the beam-stop cooling systems. All radionuclide concentrations were well below the Department of Energy's Concentration Guides for onsite effluents (Table XVII). The effluent sinks into alluvium of Los Alamos Canyon within the Laboratory's boundary.

III. CHEMICAL WASTE MANAGEMENT

III.A Description of Hazardous Waste Management Facilities

Laboratory facilities in which nonradioactive hazardous wastes have been or are being treated, stored, or disposed of are shown in Fig. 37. The following waste management facilities located, as noted are addressed in the Resource Conservation and Recovery Act (RCRA) Part B permit application. This application for permitted facilities was filed with EPA in May, 1985.

- o Technical Areas 14, 15, 16, 36, and 39
  - thermal treatment facilities, used to burn or detonate waste high explosives, high explosives-contaminated material and reactives

- o Technical Area 50
  - batch treatment system and associated waste container storage area
  - chemical waste incinerator

- o Technical Area 54, Area L
  - waste transfer, packaging and storage facilities, used for accumulation, packaging and storage of chemical wastes
  - treatment tanks, used for the neutralization, oxidation and evaporation of various wastes.
  - land disposal facility, Los Alamos' primary chemical waste landfill operation where wastes are buried within shafts.

All of the above facilities have interim authority status, with the exception of the TA-50 waste incinerator. Additional facilities include the PCB storage building at TA-21-61, the Zia motor oil storage tanks at Area J, TA-0, TA-54, and Area P, TA-16.

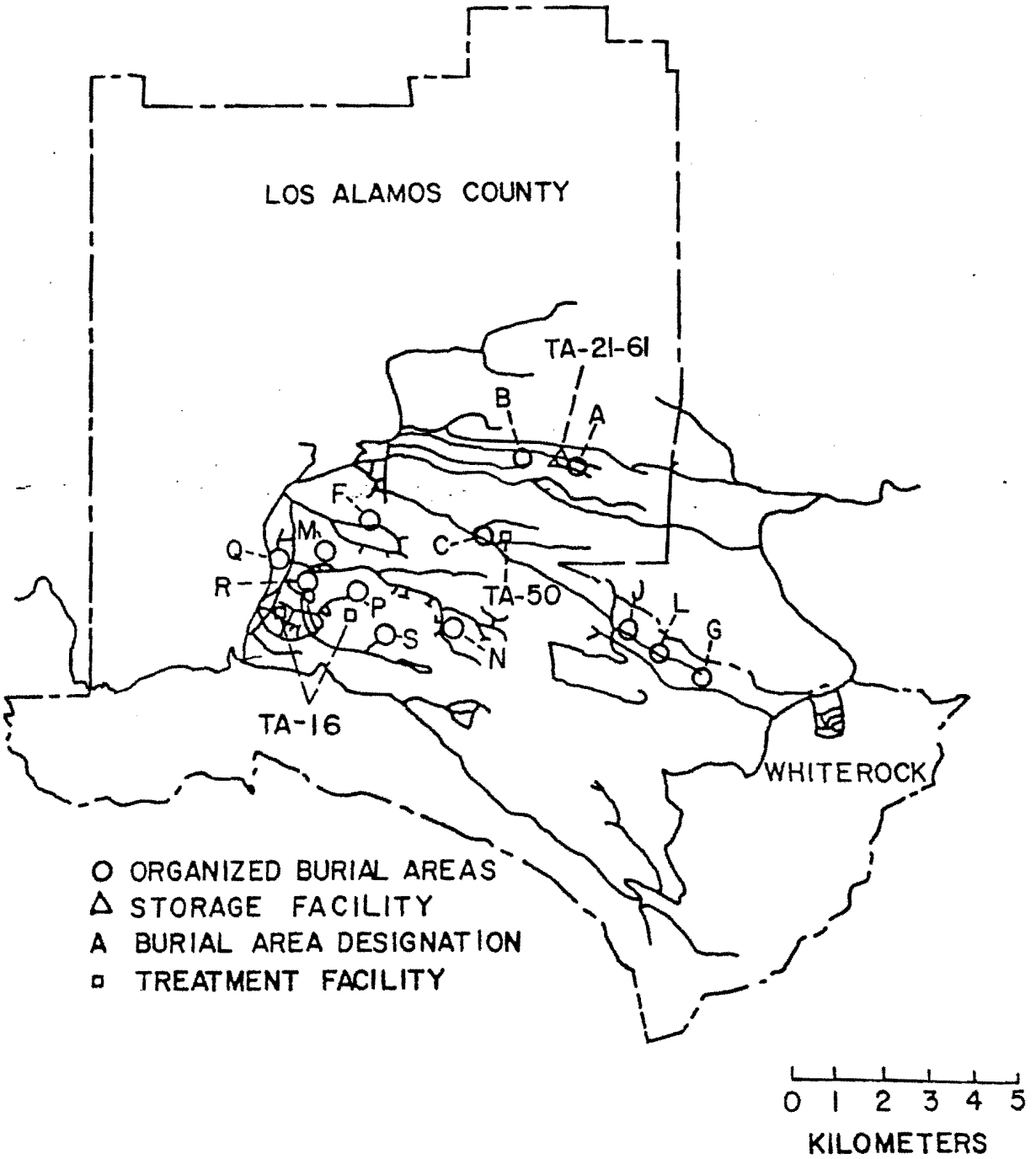


Fig. 37 Locations of Hazardous/Chemical Waste Management Facilities

III.B Chemical Waste Management Operations

III.B.1 Waste Storage Facilities

III.B.1.1 PCB Storage, TA-21-61

Building 61 at TA-21, dedicated to storage of PCB materials generated by the Laboratory, meets the requirements of Annex III of the February 17, 1980, Federal Register (PCB Disposal and Marking) for PCB storage facilities. PCB materials requiring incineration are accumulated during the year. Within the year, shipment of these materials is made to an EPA approved incinerator facility.

A temporary curbed asphalt holding pad was constructed behind Building 61. This pad can serve as a storage area for oil awaiting results from analysis. If the data indicate >500 ppm PCB in the oil, the drum is moved into the building. If <500 ppm but >50ppm PCB are found, the oil is solidified and transferred for disposal or recycle to Area G. If the oil is <50 ppm PCB, it is stored at Area L for recycle.

III.B.1.2 Zia Motor Oil Tanks, TA-0

Two 2120-L (560-gal.) tanks are used at the Zia motor pool for storage of spent motor oil. A pipeline from the shop building transfers oil to the tanks. When one tank is full, the oil recyler is contacted to remove the contents. This occurs at approximately ninety day intervals.

III.B.1.3 Chemical Storage, TA-50-1

Within the chemical treatment room in Building 1 at TA-50 is a 1.4-m^2 (16-ft^2) bermed area for storage. The area is designed to accommodate four 210-L (55-gal.) drums of liquid waste requiring treatment prior to disposal. Cyanide waste and sulfuric acid waste are two typical wastes that might be stored in the area. Only compatible chemicals can be stored at this facility at the same time. Residence time of the wastes would typically be thirty to sixty days.

III.B.1.4 Waste Transfer, Packaging and Storage Facilities, TA-54, Area L

A single-story metal building encompassing 18.2 m^2 (196 ft^2) and a roofed concrete storage pad encompassing 148.2 m^2

(1595 ft^2) are located in Area L.

These facilities are used for the accumulation, packaging and storage of waste containers generated from throughout the Laboratory. The metal building has a concrete floor having a design standard load-bearing capacity of 250 pounds per square foot. Three shallow sumps covered by fiberglass grates are located within the floor of the building (Fig. 38). The storage pad has a concrete floor having design standard load-bearing capacity of 700 pounds per square foot.

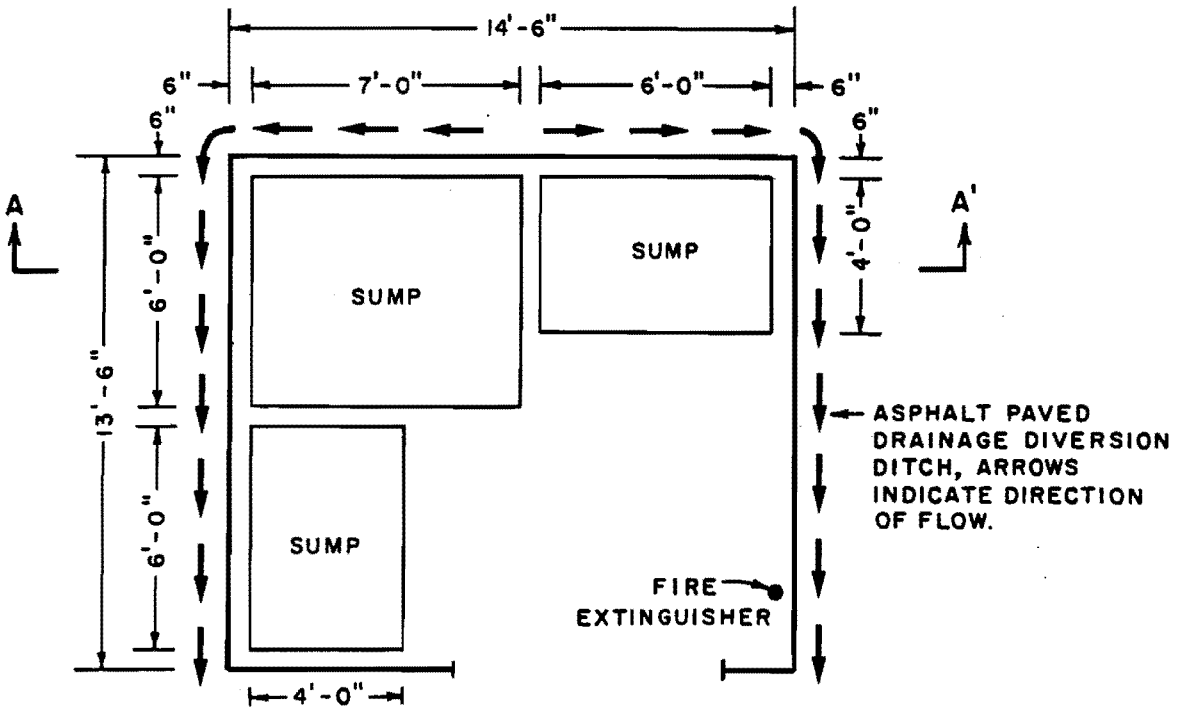
Hazardous waste containers generated at the various Los Alamos laboratories are delivered to the waste transfer, packaging and storage facilities on a routine basis. Wastes are segregated into compatible types and placed upon the three fiberglass grates located in the metal building or within one of the six storage cells on the roofed concrete pad. Wastes packaged in small containers are placed into lab packs. Waste suitable for recycling or incineration are consolidated into drums and any damaged or leaking drums are repackaged into larger drums in these facilities.

III.B.2 Waste Treatment Facilities

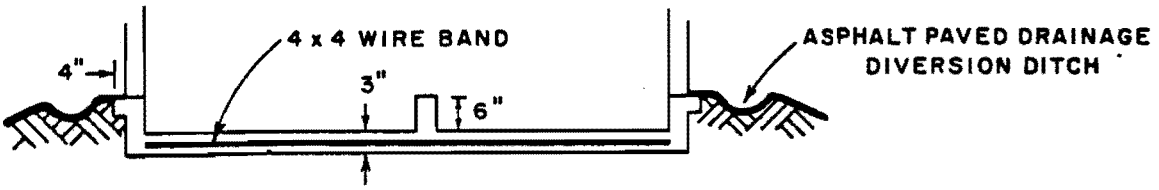
Facilities used for both the open burning and the detonation of waste high explosives (HE) are located at the Laboratory. Although these facilities are included in the Part A submission, they are not included in the Part B Permit Application because 40 CFR regulations for facilities of this nature have not been promulgated. The Part B Application will be amended when such regulations are in place. These facilities are described in the following sections.

III.B.2.1 Thermal Treatment Facilities TA-16

The thermal treatment facilities located at TA-16 include three general types. One type consists of a sand pad which is surrounded on at least two sides by a berm or natural hillside. Waste explosives or explosives-contaminated equipment are placed on these pads and remotely burned using an "electric match" firing device. There are three facilities of this type at TA-16. A second type of thermal treatment facility present at



FLOOR PLAN



FOUNDATION AND SUMP

(Section A-A')

Fig. 38. TA-54, Area L Waste Transfer, Packaging and Storage Building

TA-16 consists of a sand-filled metal pan on which five smaller shallow pans lined with fire brick are located. Waste HE fluids are poured into these pans and the HE is remotely ignited with an "electric match". There is one facility of this type at the Laboratory. About 200 L (55 gal.) of waste are burned approximately once a month. The third type of facility present at TA-16 is used to burn sludges containing waste HE. These facilities consist of steel cone-shaped vessels having a diameter of about 1.5 m (5 ft) buried with only the upper 0.9-1.2 m (3-4 ft) of the vessel above ground. The steel vessels are filled with sand and gravel and an open fluids drain is located at the bottom of the cone. Sludge HE is gravity fed into the top of the cone, onto the sand and gravel bed. A heavy steel cap is then placed over the top of the cone and hot air is forced into the cone through air ducts. The hot air dries the waste sludge and liquids from the sludge migrate downward through the sand and gravel bed and through the fluids drain. Effluent from these drains is regulated by NPDES permit (NM 0028355). When the remaining explosive material is relatively free of moisture, the steel cap is removed from the cone and the explosive is ignited remotely with an "electric match". There are two facilities of this type at Los Alamos; both of these are located in TA-16. Explosives are burned at these two facilities at a rate of about one burn per week. Each burn consists of about 341 kg (750 lbs) of waste explosive sludge.

In some cases, the burn pad sand or surface is contaminated by barium (RCRA waste code D005), which is a constituent of some HE, prior to flashing or burning. Since the burn pad sand contains EP Toxic barium, it is drummed, stored and treated as a hazardous waste.

III.B.2.2 Thermal Treatment Facilities, TA-14, 15, 36, and 39

Waste HE detonation sites are located at Los Alamos in Technical Areas 14, 15, 36, and 39. These sites are used routinely to detonate scrap HE, failed experimental detonations, unneeded classified explosives shapes, other HE determined to be

excess, and small quantities of reactive chemicals. These sites consist of firing pads often located within a small canyon. Associated facilities at these sites include bunkers which are occupied by technical personnel during detonations. Prior to all firings, nearby roads are checked and kept clear.

III.B.2.3 Batch Treatment System and Container Storage Area, TA-50-1

Chromic acid never stored all waste

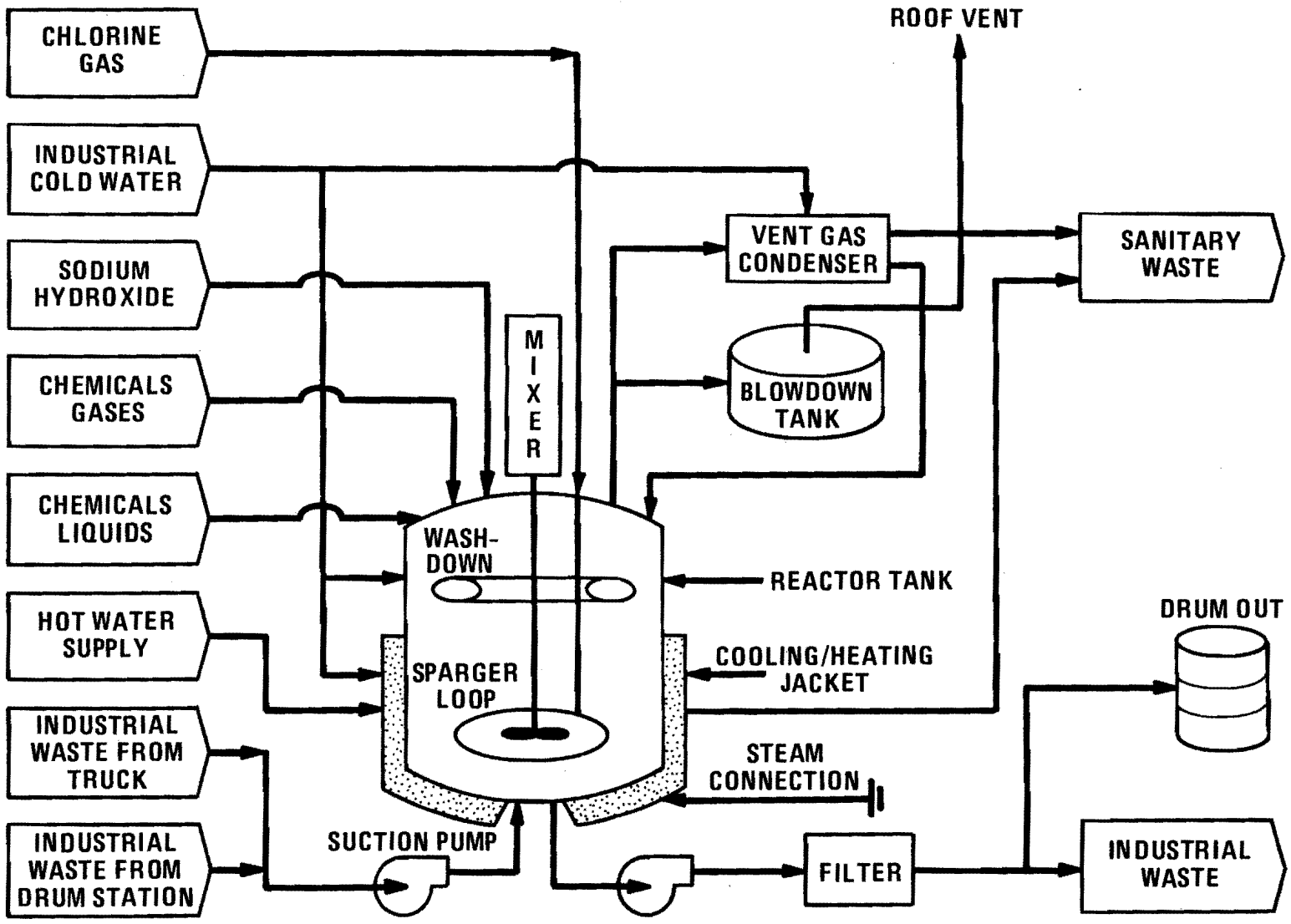
The Batch Treatment System is located in Building 1 at TA-50. The system consists of a totally enclosed, vented, 1893-L (500 gal.) pressure vessel equipped with a filtering system, condenser, and vacuum transfer lines (Fig. 39). Total system washdown between batches allows for the treatment of incompatible wastes in the facility. Wastes treated in the Batch Treatment System include cyanide, chromate plating solutions, and solutions of acids, bases and heavy metals. stored.

Three waste streams comprise the bulk of the waste treated in the Batch Treatment System, although the system is flexible enough to allow treatment of other wastes that may be generated through new Laboratory projects. These streams are an acid/base waste which contains TA-50 copper, chromate plating waste, and waste cyanide plating solutions. not operational last two years

Dec Chromate

III.B.2.4 Chemical Waste Incinerator

The waste incinerator is located in Building 37 at TA-50. The highly modified, controlled-air incinerator is rated at a nominal 45 kg (90 lbs.) per hour waste feed thoughput. The incinerator was developed as part of a continuing incinerator study and demonstration program being conducted by Los Alamos and is currently permitted to burn PCB-contaminated liquid materials. Modifications to the incinerator include additions of liquid and solid waste feed preparation lines, a continuous ash removal system, a high-efficiency off gas cleanup system, and backup utility systems. Standard combustion equipment has been modified to permit effective incineration of waste in solid, liquid, slurry, or gaseous form (Fig. 19 and 20). Particular attention has been given to engineering for proper waste



FLOW DIAGRAM OF BATCH CHEMICAL TREATMENT SYSTEM

Fig. 39.

containment, resulting in a system that is safe for evaluating the incineration of hazardous chemicals and certian radioactive waste forms. Once Los Alamos receives approval to operate the incinerator for the destruction of RCRA wastes, many wastes that are currently stored will be incinerated.

III.B.2.5 Treatment Tanks, Area L, TA-54

Four 6347-liter (1665-gal.) ten-gauge carbon steel tanks are located at Area L, TA-54. The tanks are lined with plastic. These tanks are used to neutralize, oxidize and evaporate wastes. The tanks will be located on a bermed concrete pad as shown in Fig. 40. The waste most commonly oxidized in these tanks is lithium hydride. Ammonium biflouride (a "non-RCRA" waste) is the waste most commonly evaporated in the tanks.

III.B.3 Waste Disposal Facilities

III.B.3.1 Area G

Area G description is in Section II.2.4.

III.B.3.2 Area J

Area J, approximately 1.1 hectares (2.65 acres), is located at TA-54 (Mesita del Buey) and has been used since the early 1960s for burial of equipment wastes potentially contaminated with HE. One pit in this area was filled in 1966, and a second used since that time was filled and covered at the end of FY 1984. A third pit and two 1.8 m (6 ft) diameter by 20 m (65 ft) deep shafts were excavated at the site in late FY 1984, and since have been utilized for disposal. Operation of Area J was transferred to the Waste Management Group at the beginning of FY 1985. All materials currently disposed at Area J are certified by the generating group to be non-RCRA wastes.

III.B.3.3 Area L

Area L, 0.8 hectares (3.0 acres) as shown in Fig. 41, is located on Mesita del Buey in TA-54, and since 1964, has been the main active chemical waste disposal site at Los Alamos. From 1964 through May 1975, all chemical wastes were disposed of in one pit at the site. Beginning in June 1975, with the transfer of responsibility for disposal operations to HSE-7, this pit was

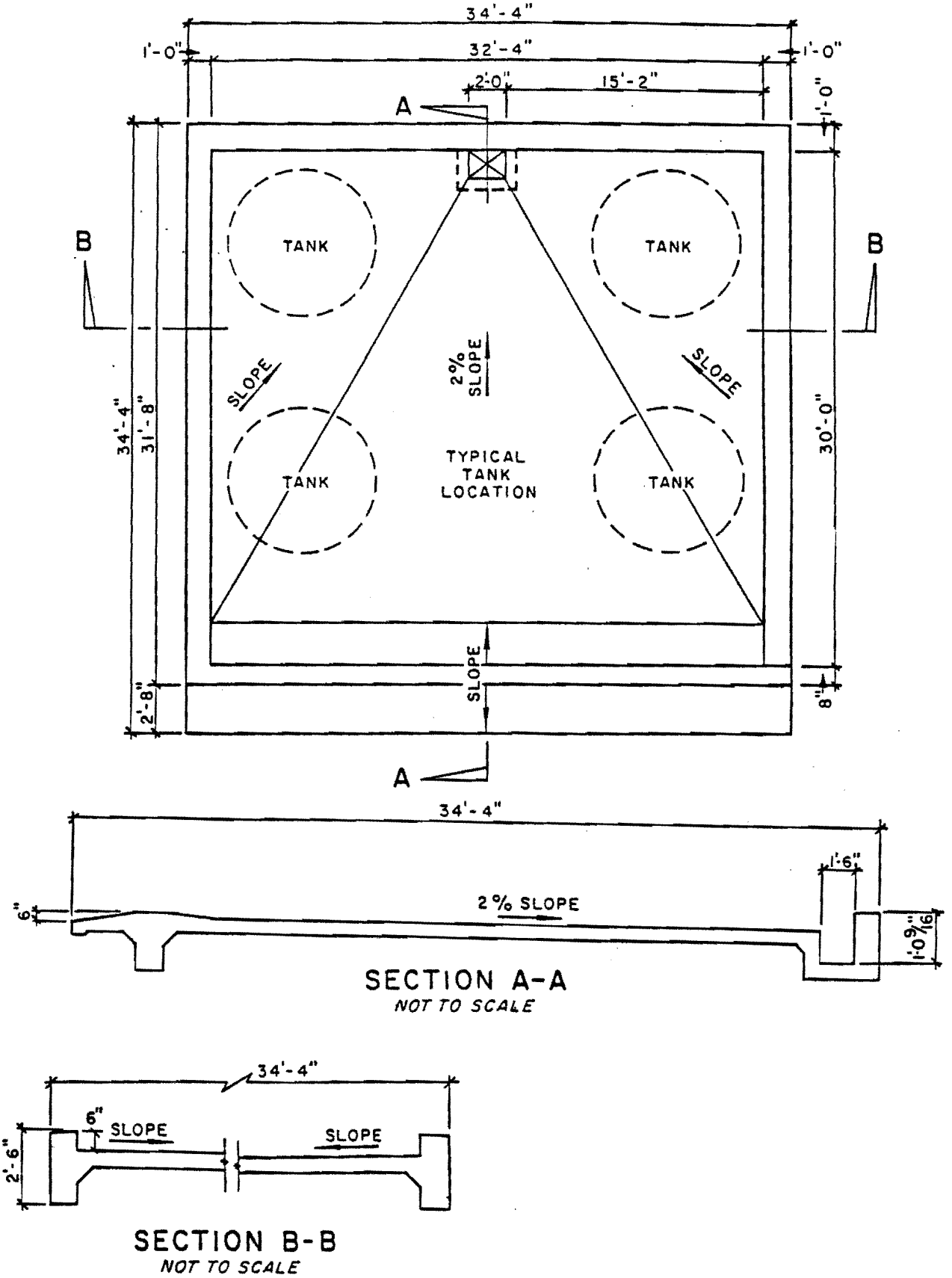
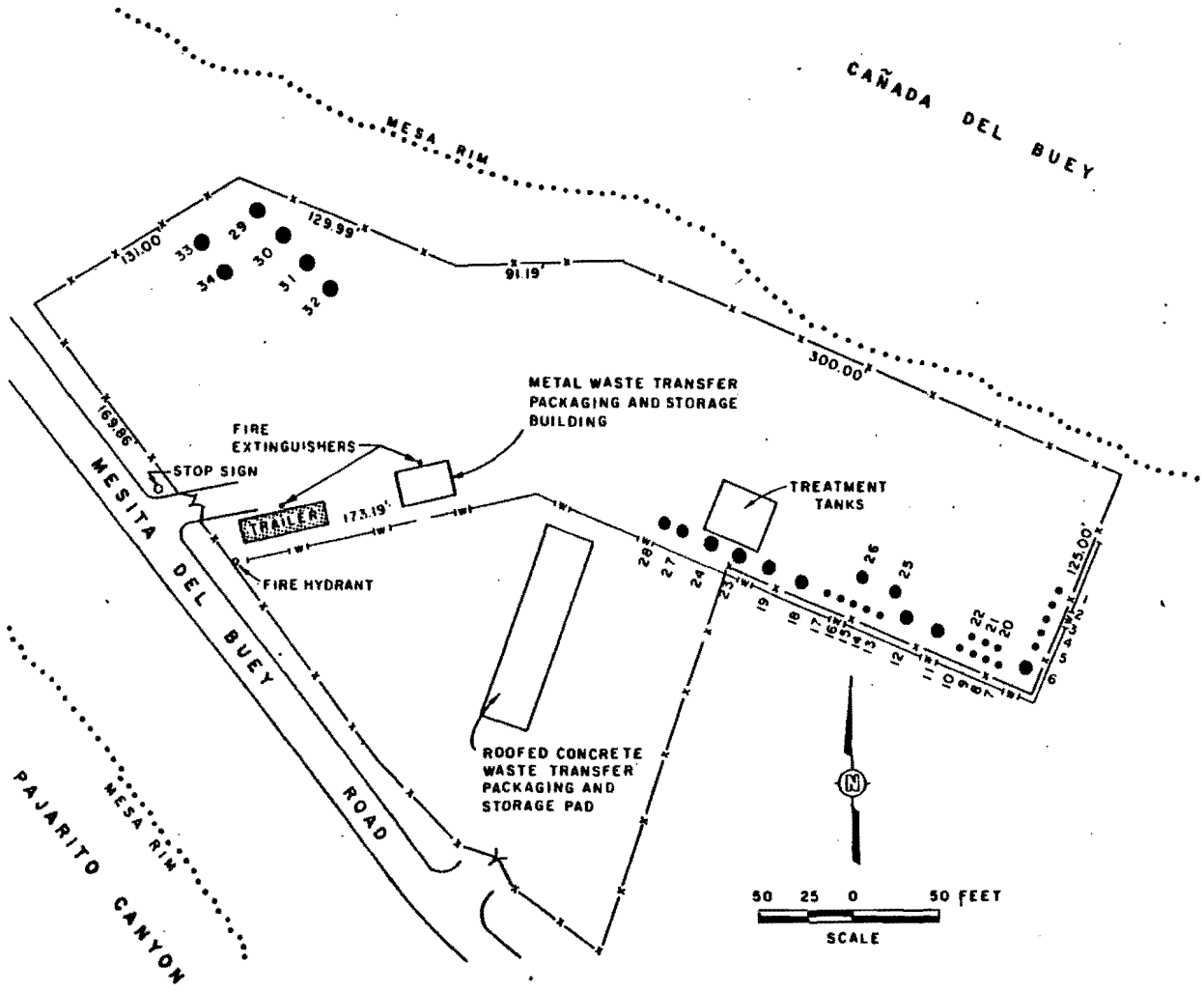


Fig. 40. TA-54, Area L Treatment Tanks Plan



AREA L SHAFTS[1]
(INFORMATION CURRENT MARCH 1985)

SHAFT NO.	SHAFT DIAMETER (FEET)	DATE DRILLED	DATE CAPPED	CONTENTS
1	3	4/80	9/83	ORGANICS[2]
2	3	2/75	7/79	ACIDS & BASES
3	3	2/75	11/78	INORGANIC
4	3	2/75	5/80	ORGANIC
5	3	2/75	6/77	WASTE OIL
6	4	6/75	6/79	REACTIVE
7	3	6/75	6/79	REACTIVE
8	3	6/75	6/79	REACTIVE
9	3	6/75	6/79	GAS CYLINDERS
10	3	6/77	6/79	WASTE OIL
11	8	1/78	7/79	WASTE OIL/SOLVENT
12	4	1/78	7/79	WASTE OIL/SOLVENT
13	3	6/79	5/82	INORGANIC
14	3	6/79	5/82	REACTIVE
15	3	6/79	5/82	REACTIVE
16	3	6/79	5/82	GAS CYLINDERS
17	3	6/79	5/82	ORGANIC
18	8	6/79	6/80	WASTE OIL
19	8	4/80	5/82	WASTE OIL
20	3	4/80	9/83	INORGANIC
21	3	4/80	OPEN	GAS CYLINDERS
22	3	4/80	9/83	ORGANIC
23[3]	8	4/82	3/84	WASTE OIL
24[4]	8	4/82	4/84	ORGANIC & WASTE OIL
25	6	9/82	5/85	INORGANIC
26	6	9/82	3/84	ORGANIC
27	4	1/83	2/85	SPECIAL[5]
28	4	1/82	5/85	SPECIAL
29	6	12/83	8/84	ORGANIC
30	6	12/83	8/84	ORGANIC
31	6	12/83	9/84	ORGANIC
32	4	9/84	9/84	ORGANIC
33	6	9/84	2/85	ORGANIC
34	6	2/85	5/85	ORGANIC

NOTES:
(1) ALL SHAFTS ARE APPROXIMATELY 60 FEET DEEP.
(2) SHAFT ONE CONTAINS WASTES NOT IN DRUMS.
(3) PRIOR TO SHAFT 23, LIQUIDS WERE DISPOSED OF IN DRUMS WITHOUT ADDING ABSORBENTS.
(4) MIDDLE SECTION OF THIS SHAFT NOT USED.
(5) USED FOR MISCELLANEOUS WASTE REQUIRING GREATER ISOLATION.

Fig. 41. TA-54, Area L Waste Management Facilities

covered and shafts were used for waste chemical disposal.

Chemical disposal shafts measured 0.6 m (2 ft) to 2.4 m (8 ft) in diameter by up to 20 m (65 ft) deep. Different shafts were used for different categories of waste chemical (e.g., organics, inorganics, oil, etc.) to assure that incompatible chemicals would not mix and react. With the new RCRA requirements for double-lined, double leachate collection landfill units and for ground water monitoring certification, all land fill activities ceased on Nov. 8, 1985. Future landfill designs and locations are being evaluated.

In addition, two small pits at the site were used for disposal of bulk quantities of treated aqueous waste. The water quickly evaporated from these wastes leaving a "salt cake" in the pit bottom. When this salt cake was within 1 m (3 ft) of the top, the pit is backfilled. One of these pits in the area was filled between June 1975 and July 1978. This operation was stopped in FY 1984 at the request of the State of New Mexico Environmental Improvement Division (NMEID).

III.B.3.4 Area P

Area P has been used since the 1950's as an industrial landfill to dispose of residues resulting from burning HE-contaminated equipment and trash. The landfill is regulated under NMEID Hazardous Waste Management Regulations (HWMR) because residues containing barium in excess of EP toxicity limits (RCRA waste code D005) have been placed in the landfill since 1980.

Area P is regulated under a Resource Conservation and Recovery Act (RCRA) Part A Permit. A Part B Permit is not being sought and the landfill will be closed under interim authority.

The recognition that Area P was a regulated hazardous waste landfill occurred in September, 1984, when two of six samples of the TA-16 thermal treatment residues showed excesses of the EP toxicity limit for barium. Waste disposal at Area P has been discontinued. The late discovery of the regulatory status and its existence prior to RCRA regulations have complicated compli-

ance with interim status regulations. The Laboratory has conducted a detailed land survey of Area P and compared the survey to the previous land survey to determine the extent of the landfill. The probability of the presence of hazardous constituents in the landfill was assessed by determining the use of regulated chemicals at the site. The geology and hydrology of Area P have been investigated by conducting surface surveys and by consulting literature.

TA-16, Area P is located in a saddle of a short, eastern-trending, narrow mesa. The saddle is near the south rim of Canon de Valle, just north of the TA-16 thermal treatment area's pad number 387. The general area impacted is a half-ellipse, roughly 51.8 m (170 ft) in north-south dimension and 122 m (400 ft) in the east-west dimension. Within this area are two areas of fill, one to the west and the second to the east. The estimated landfill volume is 9940 m^3 (35 1000 ft^3).

Landfilling progressed from west to east. The west portion was closed by leveling the landfill and covering with dirt. The leveling overflowed the rim in the northwest quadrant of Area P, as witnessed by the elevation changes determined by the survey. Most of the wastes are located on the steep canyon slope. The landfill depth at the rim is 3.7-4.3 m (12-14 ft), thinning both to the south and down the slope to the north. The cross-section indicates that deposition of wastes reaches only 9.1-12.2 m (30-40 ft) back from the rim, extends down the slope, and does not reach the canyon floor. Large items, such as blocks of foundation concrete and pieces of structural steel, did roll to the canyon floor. A few empty cans were found on the canyon floor. These and other metal items on the canyon floor have probably been there for a number of years because they are rusted and weathered.

The west portion of the landfill has been revegetated with grasses, wild rose, wormwood, and oak brush. Based on a visual survey, the slope is stable. There are occasional protrusions of concrete rubble, pipe, and steel, which aid in binding the mass.

The site shows no evidence of slippage or significant erosion, as would be shown by gully formation or silt deposition at the canyon floor.

The east landfill area was the active portion of the site. Fill has progressed from south to north with cover dirt being spread as the fill advanced. Wastes on the north face are exposed. The covered portion has no appreciable vegetation, and surface drainage cuts through this portion of the landfill. The cross-section indicates that the wastes in the east portion of the landfill are on a bench and have not overflowed the bench rim.

III.C Description of Waste Generating Processes

Various types of nonradioactive hazardous waste are generated in Laboratory operations. Because of the R&D nature of the Laboratory's work and the varied origin of these wastes, it is not considered practical to provide process flow sheets for the entire Laboratory. Instead, Figure 42 provides a process flow sheet for the major waste streams produced.

III.C.1 Basic and Applied Chemistry Research and Applied Chemistry Research and Development Programs

Primary Laboratory sites for basic and applied chemistry R&D include the Chemistry and Metallurgy Research (CMR) Building (TA-3-29), Radiochemistry Laboratory (TA-48), Sigma Building (TA-3-66), and the Health Research Laboratory (TA-43). Typical nonradioactive chemical wastes consist primarily of laboratory reagent chemicals, pump oil, solvents, test samples, and miscellaneous laboratory wastes. Overall, up to several hundred relatively small containers of different acids, bases, organics, inorganics, reactive metals, and other chemicals require disposal per year.

Occasionally, an entire laboratory or research area will require cleanup and disposal of reagent chemicals. In these instances, waste management personnel go to the laboratory and sort, package, and prepare for disposal of all waste materials. Generally, the wastes in small bottles, jars, and cans are pack-

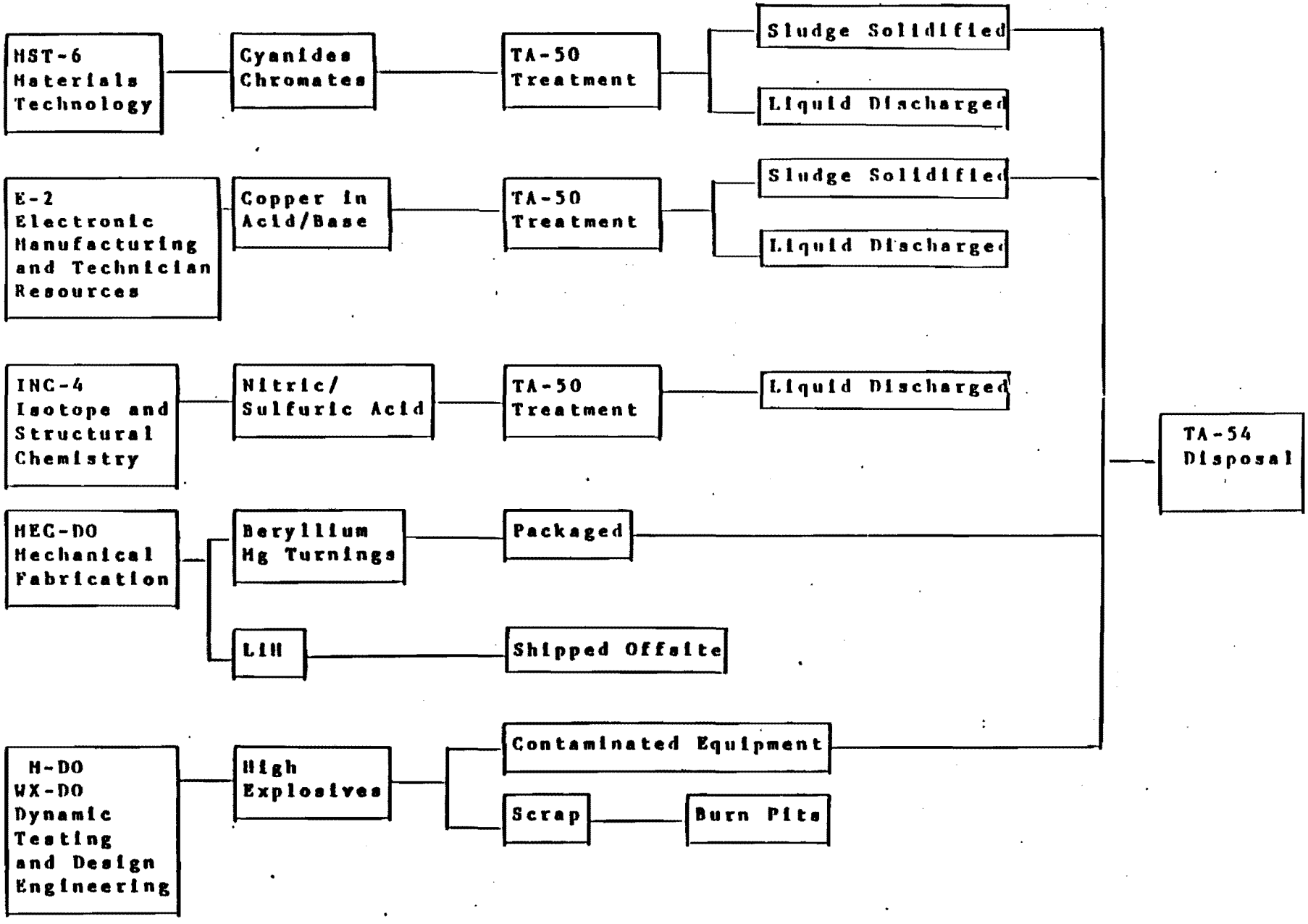


Fig. 42. Flow Sheet for Los Alamos Hazardous Chemical Waste

aged with vermiculite in metal drums for disposal. Wastes are sorted to assure that incompatible chemicals are not packaged in the same storage/disposal container.

III.C.2 Electrochemistry Wastes

The Electrochemistry Section of the MST-7 Group, located at TA-3-66, generates plating solutions containing chromates and cyanides. The Print Circuit Board Shop of the E-2 Electronic Manufacturing and Technicians Resources Group, located at TA-3-40, generates significant quantities of acid/base wastes heavily contaminated with copper.

All electrochemistry wastes require neutralization prior to final disposal. If the wastes contain cyanide, alkaline chlorination is performed to destroy the cyanide. In either case, a heavy metal hydroxide sludge is formed during treatment. This is solidified with cement and stored at Area L for future disposal. The liquid fraction meets discharge limits and is released to the radioactive liquid waste treatment plant's effluent tank.

III.C.3 Isotope Separation Wastes

The Isotope and Structural Chemistry Group, INC-4, generates nitric and sulfuric acid wastes. The concentration is generally 7N or higher. Neutralization is performed at TA-50. Discharge will be to either the radioactive liquid waste plant's effluent tank or the wiped film evaporator feed tank to eliminate any liquid discharge.

III.C.4 Shops Department Waste

The Main Shops Department, Building TA-3-39, houses most of the extremely versatile machine shop capability at the Laboratory. Parts can be machined from almost any metal, alloy, or other material. These operations generate significant volumes of nonradioactive hazardous wastes including beryllium, lithium hydride, and magnesium turnings. Toxic wastes, such as the beryllium, are packaged in drums and stored/disposed of at either Area L or G. Reactive wastes, such as the lithium hydride, are packaged, manifested and shipped off-site for treatment and disposal.

III.C.5 Explosives Wastes

High-explosives (HE) waste is generated by Dynamic Testing (M) and Design Engineering (WX) Division groups in the course of processing and testing various HE materials. Processing embraces pressing, machining, and casting HE. Waste occurs as discrete pieces of HE, as well as chips, machine cuttings, and powder. The chips, cuttings, and powder usually are in the form of water-borne suspensions, collected in specially designed accumulating/settling sump tanks. Wastes also consist of materials contaminated with HE. These may include paper, oils, solvents, wood, etc., as well as contaminated machine tools, fixtures, etc. Chemically the wastes consist of HMX, RDX, TNT, PETN, ammonium nitrate, barium nitrate, boric acid, TATB (triaminotrintitrobenzene), nitrocellulose, tetryl, introguanidine, and various plastic binders.

Most HE wastes are burned on the pressure filters or sand beds of the burn pits at S-Site, TA-16. Discrete pieces of "scrap" HE are detonated at other controlled sites. Large items with possible trace quantities of HE contamination, such as milling machines, are disposed of at Area J.

III.C.6 Asbestos wastes

Asbestos wastes originate from a wide variety of sources including old pipe insulation, transite board, ceiling insulation, welding curtains, and welders' gloves. The largest generators at the present time are the Zia Company and the Maintenance and Operations Group, ENG-4, at the Laboratory. Asbestos wastes are packaged in plastic bags or plastic-lined cardboard boxes. They are collected and transported to Area G for disposal.

II.C.7 Chemically Contaminated Equipment

Items that contain chemical residuals may be hazardous wastes unless the residual is removed. Empty drums, tanks, and gas cylinders are but a few such items. Generation of this waste occurs Laboratory-wide and is extremely sporadic and difficult to predict. Chemically contaminated equipment is packaged and stabilized as necessary for disposal. The items are then buried

at Area G. Reusable empty 210-L (55-gal.) drums are retained for recyling.

III.C.8 Waste Oil

Oil is used throughout the Laboratory in items ranging in size from several thousand gallon size transformers to several liter size pumps. Some of the oil is PCB-contaminated; much of the oil is free of PCB's.

Dependent on the level of PCB's present in waste oil, different disposal locations are used. Oil free of PCB's, (<50 ppm) is stored for recycle. That with PCB levels between 50 and 500 ppm, is absorbed into vermiculite and disposed of at Area G. Oil with PCB levels greater than 500 ppm is stored at TA-21-61 until shipment to an approved incineration facility. All soil, equipment, and other solid materials contaminated with PCB oil are disposed of at Area G.

III.D Hazardous Waste Treated/Disposed

Table XIX summarizes chemical waste activities for FY 1985. All corrosive and reactive waste was treated to destroy the hazardous property. Potentially recyclable oil has been stored for future recycle to a vendor. As of May 1985, most chemical or mixed waste was placed in storage at Area L. Since disposal of RCRA-regulated waste was completely discontinued in November, inventories during FY 1986 will reflect only storage and treatment.

Volumes of waste handled have increased again this year. This is primarily attributable to an increased Laboratory awareness of the proper disposal procedure for waste chemicals.

In the future, volume increases are expected for asbestos and recycled wastes. An ongoing program for the removal of asbestos insulation will continue to generate large amouts of waste during FY 1986. The regulations under RCRA encourage recycling of waste materials in place of disposal. As the Laboratory moves in this direction, the recycled waste volume will increase.

TABLE XIX
CHEMICALS TREATED/DISPOSED OF DURING FY 1985

Waste Type	Volume, m^3	Weight, kg
Inorganic	31.88	19808
Organic	29.60	20751
Corrosive	64.13	62994
Reactive	3.82	1804
Oxidizer	0.91	1179
Oil	25.20	21633
PCB (50-500 ppm)	42.31	12542
Gas Cylinders	1.50	490
Asbestos	692.45	75213
HE Waste	55.00	23345
Recycle	0.08	161
Other	70.40	16406
	1017.28	256326

CHEMICALS STORED DURING FY 1985

Waste Type	Volume, m^3	Weight, kg
Inorganic	0.23	108
Organic	1.91	1041
Corrosives	1.14	50
Ignitables	0.45	145
	3.73	1344

III.E Environmental Monitoring

III.E.1 RCRA Area L and Area G Geohydrological Investigation

The Resource Conservation and Recovery Act (RCRA) requires that hazardous waste disposal facilities such as Los Alamos National Laboratory either (1) perform groundwater monitoring or (2) obtain a ground water monitoring waiver. To evaluate whether or not the Laboratory can obtain a groundwater monitoring waiver, the State of New Mexico (which has legal authority to enforce RCRA) has defined a vadose characterization program that the Laboratory must complete at waste disposal Areas L and G. The tasks are defined in a Compliance Order/Schedule (Docket Number 001007) issued by the NMEID on May 7, 1985 under the New Mexico Hazardous Waste Management Act. Bendix Field Engineering Corporation assisted the Laboratory in performing the required geohydrological investigation.

The overall objective of this study at Areas G and L is two fold: to characterize the hydrogeology of the vadose zone and evaluate the potential for contaminant migration from these two waste disposal areas. Figure 43 shows the approximate locations of the 18 drill holes drilled in and around Areas L and G. Major areas of field data collection at or near Areas L and G are: (1) determination of soil physical properties (i.e., intrinsic permeability, moisture characteristic curve and unsaturated hydraulic conductivity) of five 38 m (125 ft) deep holes (three at Area L, two at Area G); (2) core and pore gas analyses of seven 30.5 m (100 ft) deep holes (2 at Area G, 4 near Area L, and one background hole); (3) moisture distribution with neutron probe and soil psychrometer installations, respectively two 30.5m (100 ft) holes at Area L and two 15.2 m (50 ft) holes at Area G.

The Laboratory's November 20, 1985 response to the Compliance Order/Schedule provided the EID with results of core analyses and perched water analyses. The Laboratory is required to submit the results of tuff soil physical properties by March 31, 1986. A thorough interpretation of all field data will be presented in a comprehensive final report on this study, to be

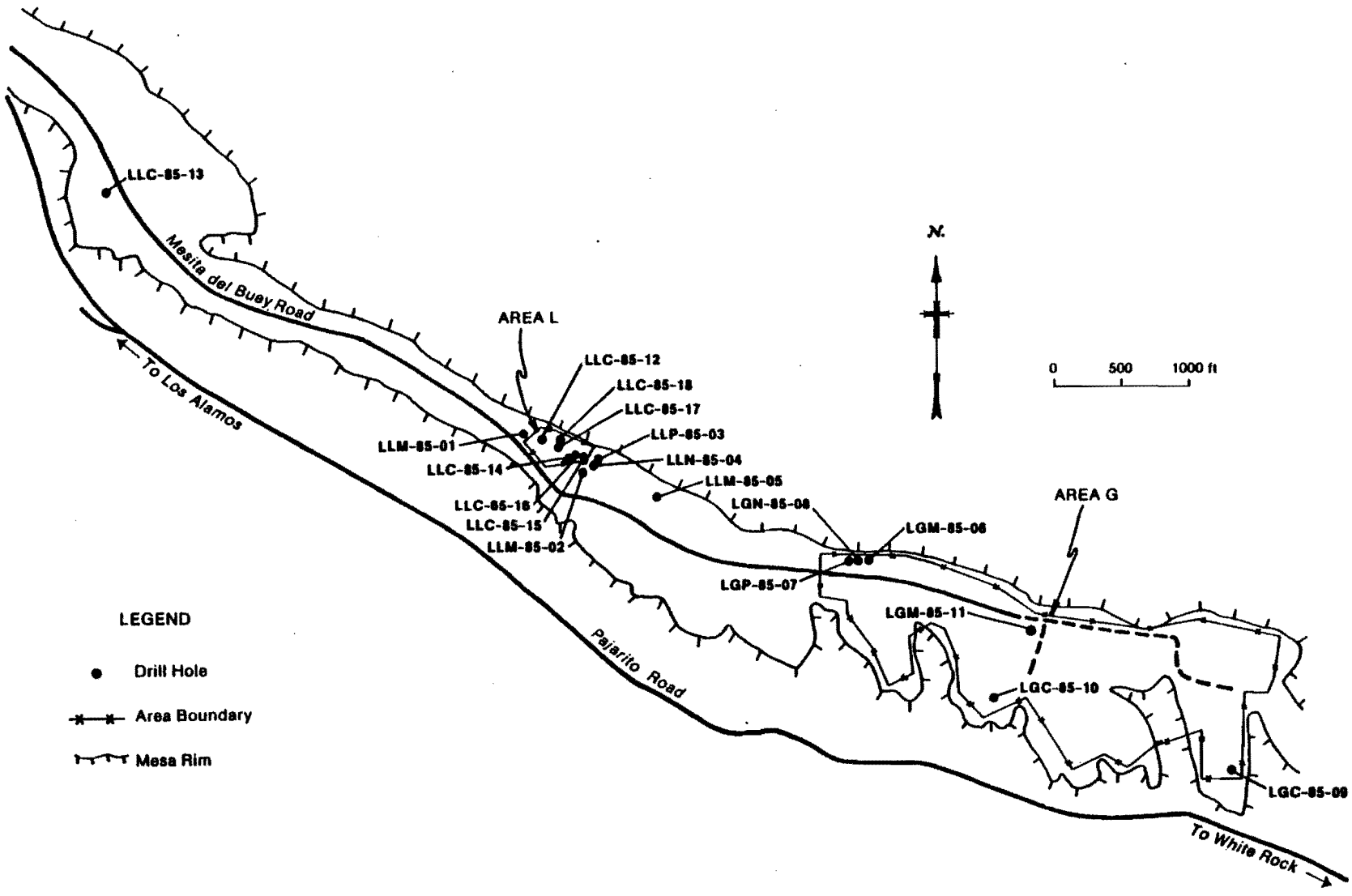


Figure 43. Locations of Drill Holes in Areas G and L, Technical Area 54, Los Alamos National Laboratory, New Mexico

submitted to the state March 31, 1987.

III.E.2 Nonradioactive Air Emissions

III.E.2.1 Particulate Air Quality

Total suspended particulate (TSP) concentrations in the communities of Los Alamos and White Rock are routinely measured by the NMEID. Table XX summarizes these data for 1984 and the appicable state and federal standards. The primary standards are designed to protect human health and the secondary standards are designed to protect general welfare (for example, preventing soiling).

The New Mexico standard and federal secondary 24-hour standard were exceeded once in White Rock on May 6. High winds on this day caused an excessive amount of wind blown dust of natural origin. The highest TSP concentrations were measured in the spring (Table XX), which is the windiest season of the year.

III.E.2.2 TA-21 Steam Plant

New Mexico Air Quality Control Regulation (AQCR) 703 requires registration of emission sources that emit greater than 909 kg (2000 lbs) of any air contaminant per year. The purpose of this regulation is to allow for development and maintenance of a state air quality emission inventory. Prior to construction, emissions from the new steam plant at TA-21 were estimated to be greater than 909 kg/y (2000 lb/yr) for nitrogen oxides and carbon monoxide. Therefore, it was registered with the State of New Mexico in 1984. Emissions from the plant during 1984 were estimated using the Environmental Protection Agency's emission factors[17,18] and are shown in Table XXI.

III.E.2.3 TA-3 Power Plant

The TA-3 power plant was not required to meet New Mexico AQCR 604 in 1984 because each of its boilers consumed less than 1 X 10^{12} Btu/yr of natural gas. Boilers 1, 2, and 3 consumed 0.544, 0.612, and 0.533 X 10^{12} Btu of natural gas in 1984, respectively.

The AQCR 604 requires gas burning equipment built before Januray 10, 1973, like the TA-3 plant, to meet an emission standard for nitrogen oxides of 0.3 lb/10^6 Btu if its natural gas

Table XX

Particulate Air Quality (g/m^3)

Federal and State Ambient Air Quality Standards		Measurements	
Type	**Concentration**	**Los Alamos**	**White Rock**
24-hour average[a]			
State[b]	150	69[c] (72)[d]	157[c] (202)[d]
Federal			
Primary	260		
Secondary	150		
7-day average[b]	110		
30-day average[b]	90		
Annual geometric mean		31	36
Primary	75		
Secondary[b]	60		
Seasonal arithmetic mean			
Winter		36	34
Spring		41	84
Summer		28	36
Fall		31	28

[a]Not to be exceeded more than once per year.
[b]New Mexico State standard only.
[c]Second highest.
[d]Highest.

Table XXI

Estimated Emissions and Fuel Consumption for the TA-3 Power Plant and Steam Plants for 1984

Pollutant	TA-3	TA-16	TA-21
Particulates (tons)	2.4	0.4	0.2
Oxides of nitrogen (tons)	31.2	20.3	8.1
Carbon monoxide (tons)	31.4	5.1	2.0
Hydrocarbons (tons)	1.3	0.8	0.3
Fuel consumption ($1000\ ft^3$)	1 571 634	290 613	116 124

consumption exceeds 1 X 10^{12} Btu/yr/unit. This emission standard is equivalent to a flue gas concentration of 248 ppm. The TA-3 boilers meet this standard with measured flue gas concentrations from 14 to 45 ppm.

Sulfur dioxide analyses of the flue gas indicate that sulfur dioxide emissions are negligible. Estimated emissions from the plant for 1984 are in Table XXI. The nitrogen oxides emissions were estimated based on exhaust gas measurements. The Environmental Protection Agency's emission factors were used in estimating the other emission requirements for particulates as specified in New Mexico AQCR 501. According to AQCR 501, the asphalt plant, which has a 68 182 kg/h (75 ton/h) capacity, is required to meet a particulate emission limit of 15.9 kg/h (35 lb/h). A stack test of the asphalt plant in 1977 indicated an average emission rate of 0.8 kg/h (1.8 lb/h) and a maximum rate of 1 kg/h (2.2 lb/h) over 3 tests[19].

Though the plant is an old plant and it not required to meet the federal New Source Performance Standards for asphalt plants, it could also easily meet these standards (Kramer 1977). The plant was found to have fugitive emission problems from leaks at six locations on the equipment. These leaks will be repaired as soon as possible. In 1984 the plant produced 1.25 x 10^7 kg (13 773 tons) of asphalt and 1.11 x 10^7 kg (12 171 tons) in 1983.

III.E.2.5 Environmental Audits

There were two air quality audits in 1984. The first was done by the NMEID on October 2, 1984. The second was a joint audit by the NMEID and the Environmental Protection Agency (EPA), Region 6, on November 14, 1984. Normally, only an annual audit is conducted by the NMEID. However, the Laboratory was EPA's "targeted federal facility" in New Mexico for fiscal year 1985. This designation caused the second audit. No significant air pollution problems were found during the audits.

III.E.2.6 Beryllium Shop

The Laboratory's beryllium shop is required to comply with the New Mexico Ambient Air Quality Standard (AAQS) for Be of 0.01

$\mu g/m^3$ averaged over 30 days (AQCR 201). Under the National Emission Standards for Hazardous Air Pollutants (NESHAP), beryllium shops are required to meet either an emission standard of 10 gm/day or an AAQS of 10 $\mu g/m^3$ averaged over 30 days. The beryllium shop easily meets all these requirements with emissions of less than 2 gm for a period exceeding 9 months and stack concentrations of between 0.00016 - 0.0016 $\mu g/m^3$ (Table XXII).

III.E.2.7 Asbestos

The National Emission Standards for Hazardous Air Pollutants (NESHAP) have notification, emission control and disposal requirements for friable asbestos renovation/demolition activities. The NMEID was delegated authority by the EPA for the New Mexico NESHAP program. Friable asbestos material means any material containing more than 1% asbestos by weight that hand pressure can crumble, pulverize or reduce to powder when dry.

Friable asbestos wastes are buried at TA-54 (Area G) and the disposal practices meet NESHAP requirements. The notification requirements are shown in Table XXIII. Nine notifications were made to the EID in 1984 (Table XXIV). One of these was a blanket estimate for small renovation jobs for 1985.

One late notification was made when it was discovered at TA-21 that an outside contractor was not meeting NESHAP emission control and disposal requirements. The contractor corrected his removal procedures to comply with the regulations. One of the buildings the contractor demolished. In addition, the debris from this demolition were improperly disposed of at San Ildefonso Pueblo. The demolition debris was removed from the Pueblo land and buried at TA-54, Area G. The Pueblo land and TA-21 demolition site were cleaned of asbestos contamination. The cleanup was verified by analysis of soil samples. Air sampling during removal operations at the two sites showed very low levels, less than 0.01 fibers/cm^3

Table XXII

Stack Gas Sampling Results from Beryllium Shop for 1984

Sample Date	Be on Filter (μg)	Hours Operated	Stack Concentration (μg/m³)	Emissions (g)
01-20-84	0.23	51.7	0.00119	0.185
01-30-84	0.17	36.9	0.00123	0.137
02-15-84	0.24	51.2	0.00125	0.193
02-3-84	0.06	43.3	0.00037	0.048
03-20-84	0.05	61.0	0.00022	0.040
03-30-84	0.21	52.4	0.00107	0.169
07-06-84	0.11	68.0	0.00043	0.089
08-07-84	0.32	137.5	0.00062	0.258
08-24-84	0.12	57.4	0.00056	0.097
09-21-84	0.42	72.0	0.00156	0.338
10-05-84	0.07	60.2	0.00031	0.056
10-26-84	0.07	53.7	0.00035	0.056
11-08-84	0.03	50.0	0.00016	0.024
12-05-84	0.05	45.7	0.00029	0.040
12-28-84	0.18	49.1	0.00098	0.145
			Total	1.877

Table XXIII

Asbestos Notification Times

Limit Exceeded[a]	Activity: Renovation	Activity: Demolition[b]
Yes	As early as possible	10 days
No	Notification not[c] required on an individual basis	20 days

[a]Limit is 260 feet on pipe or 160 square feet on other components of friable asbestos material.
[b]Demolition means the wrecking or taking out of any load supporting structural member of a facility together with any related handling operations.
[c]For small jobs, a prediction of the total friable asbestos material to be removed over a maximum period of 1 year is required.

Table XXIV

Asbestos Removal Notifications

Facility	Dates			Amount	
	Notice	Start	Completion	Pipe Components (ft)	Other (ft^2)
TA-22-5, -34, -52	01-26-84	01-23-84	02-17-84	—	—
Small renovation jobs, 1984	06-14-84	07-01-84	12-30-84	1410	404
TA-9-21	07-30-84	08-06-84	08-17-84	300	640
TA-16-207	08-13-84	09-10-84	11-02-84	660	0
TA-22-1	09-17-84	10-09-84	11-09-84	3100	0
TA-3-34	09-20-84	09-19-84	09-30-84	300	100 valves
Small renovation jobs, 1985	12-10-84	01-02-85	12-31-85	2620	810
TA-21-46	12-12-84	03-04-85	03-15-85	300	0
TA-21-14	12-12-84	03-04-85	03-15-85	300	0
TA-15-20	12-19-84	12-20-84	12-23-84	380	0

III.E.2.8 Burning and Detonation of Explosives

A total of 19 045 kg (41 899 lb) of high-explosive wastes was disposed of by open burning at the Laboratory during 1984. This reduced the 1984 estimated airborne emissions by about 9% when compared with 1983. The 1984 emissions were 149 kg (328 lb) of hydrocarbons, and 575 kg (1265 lb) of nitrogen oxides. These estimates were made by using data from previous experimental work[20]. Open burning of high-explosive wastes is permitted under New Mexico Air Quality Control regulation 301.

Dynamic tests using conventional explosives are routinely conducted at the Laboratory and may contain quantities of potentially toxic metals, including beryllium, lead, and uranium. Estimates of average concentrations of these toxic metals downwind from the detonations are reported in Table XXV. These estimates are based upon information concerning the proportion of material aerosolized provided from limited field experiments involving aircraft sampling and the amounts of toxic metals used in the 1984 experiments. The estimated average concentrations of uranium, beryllium, and lead are all less than 0.006% of applicable standards.

III.E.2.9 Emissions from Vehicles

A large fleet of cars and trucks is maintained for the Laboratory complex by the Zia Company. A total of 3.2×10^6 L (8.5×10^5 gal.) of gasoline was used by this fleet to cover 10.4×10^6 km (6.5×10^6 mi) during 1984.

Carbon monoxide, hydrocarbons, nitrogen oxides, sulfur oxides, and particulates are emitted during vehicle operations. There also are gasoline evaporative losses associated with gasoline storage and vehicle fueling. Air emissions from operation of this fleet during 1984 were estimated using the appropriate EPA emission factors[18] and are shown in Table XXVI.

III.E.2.10 Chemical Usage

The Laboratory complex uses large quantities of various volatile chemicals and gases, some of which are released into the

Table XXV

Estimated Concentrations of Toxic Elements
Aerosolized by Dynamic Experiments

Element	1984 Total Usage (kg)	Fraction Aerosolized (%)	Annual Average Concentration (ng/m^3) 4 km	8 km	Applicable Standard (ng/m^3
Uranium	840.5	10	0.08	0.03	9000[a]
Be	17.5	2	0.0005	0.0001	10[b]
Pb	81.8	100[c]	0.09	0.04	1500[d]

[a]Reference (DOE 1981).
[b]Thirty-day average. New Mexico Air Quality Control Regulation 201.
[c]Assumed percentage aerosolized.
[d]Three-month average. 40 CFR 50.12.

Table XXVI

Estimates of Air Polutant
Emissions Associated with the
Operation of the Vehicle Fleet
(metric tons)

Fuel storage evaporative losses	5.7
Hydrocarbons	16
Carbon monoxide	197
Nitrogen oxides	24
Sulfur oxides	2.3
Particulates	
Exhaust	1.0
Tire Wear	1.4

atmosphere by evaporation or exhaust. Using data from stock records, a table of chemical usage over the years has been compiled (Table XXVII).

III.E.3 Clean Water Act (Nonradioactive Liquid Effluents)

III.E.3.1 National Pollutant Discharge Elimination System

The NPDES requires permits for nonradioactive constituents at all point source discharges. A single NPDES permit (NM 0028355) for the Laboratory sets liquid effluent limits at 99 industrial outfalls in 10 categories and at 11 sanitary sewage treatment plant outfalls. The permit was issued in April 1982 and it expires in September 1986. The industrial categories are: power plant effluent (1 location), boiler blowdown (1), treated cooling water (30), noncontact cooling water (30), industrial waste treatment plant effluent (2), high explosive waste effluent (20), photo waste effluent (14), and printed circuit board waste effluent (1).

Tables XXVIII and XXIX summarize the effluent quality of the industrial and sanitary outfalls. The Laboratory was in compliance with the NPDES permit in about 94% of all samples collected for compliance monitoring (Table XXX).

The two radioactive waste treatment plants have the largest number of NPDES limits. About 99% of all analyses done on samples collected for compliance monitoring were in compliance. Details of the effluent quality from these two plants are in Table XXXI.

III.E.3.2 Federal Facility Compliance Agreement

In March 1983 the Los Alamos Area Office of the Department of Energy signed a Federal Facility Compliance Agreement (FFCA) that contained an abatement schedule with compliance dates ranging from 1983 to 1985. The FFCA called for abatement efforts to be completed at three high explosive treatment plants and one sanitary sewage treatment plant in 1984. Improved administrative procedures at two of the high explosive waste treatment plants were responsible for achieving compliance. Compliance at the

Table XXVII

Quantities of Volatile Chemicals and Compressed Gases Used at Los Alamosa
(all amounts in kg)

	1982	1983	1984
Acids			
Acetic Acid	170	—	99
Hydrochloric Acid	6 000	1 400	1 655
Hydrofluoric Acid	270	640	191
Nitric Acid	70 500	52 100	55 976
Perchloric Acid	180	60	321
Phosphoric Acid	490	30	111
Sulfuric Acid	2 200	2 600	692
Gases			
Ammonia	1 800	2 400	2 177
Carbon Monoxide	9 600	—	2 965
Chlorine	610	140	1 238
Freon 12	1 600	2 600	4 137
Hydrogen Fluoride	1 600	1 600	1 134
Nitrogen Oxides	330	410	354
Sulfur Dioxide	210	30	0
Sulfur Hexafluroide	8 800	14 200	9 507
Inorganic Chemicals			
Ammonium Hydroxide	1 200	2 100	797
Mercury	210	60	24
Sodium Hydroxide	—	39 500	73 539
Organic Chemicals			
Acetone	10 700	10 900	10 118
Benzene	—	70	12
Carbon Tetrachloride	190	60	103
Chloroform	320	500	177
Ethanol	12 800	13 500	7 024
Freons	32 200	28 400	22 006
Kerosene	5 500	2 800	1 315
Methanol	3 100	730	3 298
Methylene Chloride	430	100	1 876
Methyl Ethyl Ketone	400	6 200	5 805
Perchloroethylene	340	—	2
Tetrahydrofuran	—	—	30
Toluene	60	190	337
Trichloroethane	25 600	31 100	27 674
Trichloroethylene	390	4 200	2 204
Xylene	—	70	59

[a]This table does not include chemicals received under special orders.

Table XXVIII

Effluent Quality Summary of Sanitary Sewage Treatment Facilities

Discharge Location	Permit Constituents	Number of Deviations	Range of: Deviation / Limiting Standard or pH
TA-3	BOD[b]	4	1.0 - 3.4
	TSS[c]	2	1.06 - 1.13
	Fecal Coliform[d]	4	1.1 - 2.5
	pH[e]	1	3.2
TA-8	BOD	3	1.1
	TSS (90)[c]	1	1.2
	pH	3	9.4 - 9.9
TA-9	BOD	0	---
	TSS	0	---
	pH	0	---
TA-16	BOD	1	1.1
	TSS	1	1.2
	pH	0	---
TA-18	BOD	0	---
	TSS (90)[c]	0	---
	pH	0	---
TA-21	BOD	3	1.0 - 2.1
	TSS	3	1.1 - 2.28
	pH	5	9.2 - 10.9
TA-35	BOD	13	1.0- 3.6
	TSS (90)[c]	0	---
	pH	2	9.1 - 10.0
TA-41	BOD	0	---
	TSS	0	---
	Fecal Coliform[d]	8	1.1 - 25.0
	pH	0	---
TA-46	BOD	0	---
	TSS	0	---
	pH	0	---
TA-48	BOD	0	---
	TSS	1	---
	pH	0	---
TA-53	BOD	3	1.2 - 1.3
	TSS (90)[c]	3	1.2 - 1.5
	pH	13	9.1 - 10.1

[a]Single NPDES Permit NM 0028355.
[b]The BOD_5 limits are 30 mg/ℓ (20-day avg), 45 mg/ℓ (7-day avg).
[c]The TSS limits are 30 mgℓ (20-day avg), 45 mg/ℓ (7-day avg) at some outfalls, and 90 mg/ℓ (7-day avg) at other outfalls.
[d]Fecal coliform limits are 2000/100 mℓ (daily max) and 1000/100 mℓ (geometric mean).
[e]The pH range limit is not less than 6.0 or greater than 9.0 standard units.

Table XXIX

Effluent Quality Summary of Industrial Outfalls

Discharge Category	Number of Outfalls	Permit Constituents	Number of Deviations	Range of: [Deviation / Limiting Standards] or pH[b]	Number of Outfalls Causing Deviations
Power Plant	1	TSS	0	—	0
		Free Cl	0	—	0
		pH	0	—	1
Blower Blowdown	1	TSS	2	1.0 - 455.0	1
		Fe	0	—	0
		Cu	3	1.8 - 4.3	1
		P	1	1.0	1
		pH	4	9.8 - 10.8	1
Treated Cooling Water	30	TSS	3	1.2 - 1.8	3
		Free Cl	7	1.8 - 22.8	5
		P	0	—	0
		pH	2	9.18 - 9.31	1
Noncontact Cooling Water	30	pH	0	—	0
Radioactive Waste Treatment Plant Discharges	2	H_3	0	—	0
		COD	0	—	0
		TSS	0	—	0
		Cd	0	—	0
		Cr	3	1.5 - 2.8	2
		Cu	1	2.1	1
		Fe	6	1.1 - 9.5	1
		Pb	4	1.1 - 1.9	2
		Hg	0	—	0
		Zn	0	—	0
		pH	0	—	0
High Explosives Waste Discharges	20	COD	19	1.0 - 8.1	7
		TSS	3	1.4 - 2.4	3
		pH	8	2.0 - 9.5	5
Photo Waste Discharges	14	Cn	0	—	0
		TSS	0	—	0
		pH	1	5.5	1
		Ag	2	1.1 - 3.2	2
Printed Circuit Board Development Wastes	1	COD	0	—	0
		Cu	0	—	0
		Fe	0	—	0
		Ni	0	—	0
		P	0	—	0
		pH	0	—	0

[a]Summary of reports to EPA or NPDES Permit NM 0028355.
[b]The pH range limit on all outfalls is not less than 6.0 or greater than 9.0 standard units.

Table XXX

Summary of National Pollutant Discharge Elimination System (NPDES) Compliance in 1984

Parameter Measured	Number of Samples	
	Domestic Discharges	Industrial Discharges
pH		
Taken	228	275
Out of compliance	24	15
Per cent compliance	89.5	94.5
Other[a]		
Taken	511	1383
Out of compliance	51	54
Per cent compliance	90.0	96.1
Flow[b]		
Taken	2573	275
Summary: Domestic and Industrial		
Taken	2397	
Out of compliance	144	
Per cent compliance	94.0	

[a]Chemical parameters such as chemical oxygen demand (COD), total suspended solids (TSS), etc.
[b]Flow is monitored but there is not limit under the Laboratory's NPDES permit.

Table XXXI

Quality of Effluents from Liquid
Radioactive Waste Treatment Plants for 1984

	Waste Treatment Plant Location					
	TA-50			TA-21		
Radioactive Isotopes	Activity Released (mCi)	Mean Concentration (μCi/mℓ)	Mean as % CG[a]	Activity Released (mCi)	Mean Concentration (μCi/mℓ)	Mean as %CG[a]
^{238}Pu	6.1	1.7×10^{-7}	0.17	0.09	2.1×10^{-8}	0.02
$^{239,240}Pu$	8.1	2.3×10^{-7}	0.23	0.13	3.1×10^{-8}	0.03
^{241}Am	8.2	2.3×10^{-7}	0.23	0.84	2.0×10^{-7}	0.20
^{89}Sr	262	7.5×10^{-6}	2.5	0.16	3.8×10^{-8}	0.01
^{90}Fr	6.8	1.9×10^{-7}	1.9	0.23	5.5×10^{-8}	0.55
^{3}H	12,700	3.6×10^{-4}	0.36	542	1.3×10^{-4}	0.13
^{137}Cs	19.5	5.6×10^{-7}	0.14	0.16	3.8×10^{-8}	0.01
^{234}U	3.8	1.1×10^{-7}	0.11	3.6	8.6×10^{-7}	0.86
Total Effluent Volume:	3.503×10^{7} ℓ			4.198×10^{6} ℓ		

	Waste Treatment Plant Location	
	TA-50	TA-21
Nonradioactive Constituent	Mean Concentration (mg/ℓ)	Mean Concentration (mg/ℓ)
Cd[b]	0.003	0.005
Ca	120	16
Cl	84	27
Cr (total)[b]	0.13	0.07
Cu[b]	0.44	0.022
F	12	79
Hg[b]	0.0013	0.0006
Mg	4	3.6
Na	972	908
Pb[b]	0.029	0.03
Zn[b]	0.24	0.25
CN	0.082	0.022
COD[b]	73	60
$NO_3(N)$	331	159
PO_4	0.62	0.86
TDS	3400	2820
pH[b]	7.0-12.8	8.6-12.5
Total Effluent Volume	3.5×10^{7} ℓ	4.2×10^{6} ℓ

[a]Department of Energy's Concentration Guide for Controlled Areas.
[b]Constituents regulated by National Pollutant Discharge Elimination System permit.

third location was achieved by constructing a lined evaporation pit. Reconstruction of a sand filter at the TA-35 sanitary sewage treatment plant was to put the plant in compliance in 1984. The sand filter was completed in 1985.

III.E.3.3 Clean Water Act Audits

The EPA conducted three audits under the Clean Water Act in 1984. A compliance inspection reviewed the status of the FFCA and the NPDES permit. All schedules calling for compliance in 1984 or later were reviewed.

A second inspection by the EPA focused primarily on analytical procedures. The inspector noted some minor deficiencies that have been corrected.

The last inspection by the EPA covered the Spill Prevention, Controls and Countermeasures (SPCC) part of the Clean Water Act. The SPCC provides for cleanup of spills and requires preparation of a SPCC plan. The Laboratory has many elements that are required in a SPCC plan and is currently assembling an official SPCC plan.

IV. RELATED SUBJECTS

IV.A Training

On-the-job training and orientation is provided to all personnel in the areas of facility operations, equipment usage, safety equipment, and emergency plans. This training is supplemented by radiation protection classes, radioactive waste transportation and packaging classes, and RCRA training as applicable. Safety films/lectures are also provided on a quarterly basis. Training records are maintained in the HSE Division Training Coordinator's files.

IV.B Emergency Preparedness

Emergency plans exist for each waste facility either as a stand-alone document or as part of a Standard Operating Procedure. HSE Division and Laboratory-wide plans have also been prepared for the larger scale accidents. These plans include the agreements made with external agencies, such as the local police department and hospital, and notification procedures for reporting an unusual occurrence as defined by DOE. The Laboratory has a Lab-wide Emergency Coordinator for the larger scale incident. An HSE-Division coordinator and on-call group personnel are also available during non-working hours. HSE-7 personnel currently serve as the required Hazardous Waste Emergency Coordinator under RCRA.

IV.C Inspections

Inspections are conducted on a routine basis for all equipment used in waste activities. At Area G and L, all pits, shafts, and fences are also inspected for any signs of damage or site intrusion. The program for the liquid waste treatment facility is under development and will be activated in the next year. All other facilities have an active inspection program.

IV.D Records

Day-to-day operating records are generated and maintained in accordance with DOE/AL Orders 5820.2 and 5480.2. The following information is recorded as it becomes available:

- Description and quantity of each waste received and the method and date of storage or disposal.
- Reports and results of inspections and audits.
- Reports of unusual occurrences.
- Monitoring, testing, and analytical data.

All records, with the exeption of inspection and audit reports, will be retained permanently. Inspection and audit records will be held for three years.

IV.E Unusual Occurences

Those events classified as unusual occurrences are reported to DOE according to the existing notification shedule.

IV.F Closure/Post-Closure

IV.F.1 General Closure/Post-Closure Information

This plan identifies all steps that will be necessary to close a facility at the end of its operating life or to partially close a facility at any point during its intended operating life. Waste treatment, storage, and disposal facilities at the Los Alamos National Laboratory consist of chemical treatment, compaction, size reduction, controlled air incineration, storage, and landfill disposal.

IV.F.2 Closure Performance Standard

The closure plans are designed to meet the following performance standards:

- Protect human health and the environment
- Prevent the escape of waste, waste constituents, leachate, contaminated rainfall, or waste decomposition products to the ground, surface waters, or atmosphere

IV.F.3 Partial and Final Closure

The Laboratory's radioactive waste facilities are to be closed in the year 2100. All radioactive wastes will be recyled, treated, and/or disposed of prior to closure.

Partial closure of treatment facilities may occur to accommodate upgrading of facilities to handle new wastes or to use new technology. The closure of individual landfill shafts or pits located at Area G for radioactive waste is ongoing and is performed as they are filled. Closure plans have been submitted to the EPA and NMEID for the following areas.

TA-3-102-Closure of >90 day storage facility
TA-16-Area P-Closure of chemical landfill facility
TA-22-24-Closure of >90 day storage facility
TA-40-2-Closure of >90 day storage facility
TA-40-SDS-Closure of thermal treatment facility
TA-54, Area L-Closure of chemical landfill facility
TA-54, Area G-Closure of chemical landfill facility
(Area G will continue as a radioactive landfill.)

These closures will be effected within the next five years. All other closure plans for chemical facilities are provided in the RCRA Part B permit application.

IV.F.4 Groundwater Monitoring

In accordance with the provisions of hazardous chemical waste regulations, Los Alamos National Laboratory has applied for a ground water monitoring waiver for TA-54. Ground water monitoring is only applicable to the Laboratory's landfill operations. The waiver request is based on the determination that average annual precipitation is equaled or exceeded by runoff and evapotranspiration resulting in negative percolation rates.

IV.F.5 Personal Protection

Good industrial hygiene practices shall be followed during all phases of closure and post-closure to protect employees from exposure to waste constituents. Normal Los Alamos National Laboratory operating procedures require that the Laboratory's Industrial Hygiene Group (HSE-5) and Radiation Protection Group (HSE-1) survey a site prior to personnel entry and specify protective clothing and respiratory protection equipment.

IV.F.6 Post-Closure Care Office

The following is the office to which contact may be made concerning the facility during the post-closure care period.

Area Manager
Los Alamos Area Office
U.S. Department of Energy
Los Alamos, New Mexico 87544
(505) 667-5105

IV.F.7 Security

Low-level radioactive wastes have been handled and buried at TA-54. TA-54 will therefore be under the permanent care of the DOE or other authorized federal agency. Fences and site security will be maintained in perpetuity to prohibit public access and to meet DOE requirements for radiation protection.

V. BUDGET DATA

V.A Radioactive Liquid Waste Program

During the next 10 years, the emphasis will continue to be on reduction of liquid discharges and improvement of radionuclide removals from waste streams.

Construction is about 99% complete for the treatment plant upgrading. This was an FY 1981 project with a total cost of $8M; it provided additions to the TA-50-1 building and treatment plant.

Additional processes, process improvements and additional storage capacity for influent liquid were included. Emphasis on treatment plant improvements is directed toward minimizing release of radioactivity to the environment and compliance with the effluent guidelines established by the DOE and EPA. Specific items that will result in better quality effluents include:

- Additional influent storage capacity
- Prefiltration
- Weak acid cation exchange
- Dual media postfiltration
- Concentration of high nitrate wastes by wiped film evaporation.

In the longer term, zero discharge of all radioactive liquid effluents is being sought. A small contract will be awarded to an A-E firm during FY 1986 to study feasible methods of attaining zero discharge of liquid wastes.

The dewatered sludge from the TA-50-1 vacuum filter should remain non-TRU in 1986. Fifty to one hundred drums/year of TRU waste are expected in the future from in-drum cementing of the pretreatment plant sludge.

The processess added to the TA-50 treatment plant should be brought into operation during FY 1986. Improvements in both chemical and radiochemical quality are expected for the TA-50 treatment plant effluents in FY 1986.

Budget projections for management of low- and intermediate-level liquid wastes follow (in thousands of dollars):

Year	Operating Costs	Capital Equipment	Construction
FY 1985	1286	0	100
FY 1986	1400	0	70
FY 1987	1550	0	80

V.B Transuranic Waste Program

Projections of operating costs for the management of TRU wastes at Los Alamos are listed in Table XXXII. Tasks 1 through 8 are those costs borne by the DOE-funded Interim Waste Operations Program. As such, these costs are primarily for operation of the storage area and work-off-related facilities, and do not include costs borne by waste generators, such as packaging, handling, and on-site transportation, or the costs of waste management R&D programs. Also included in FY 1985 was funding for developing and implementing TRU waste certification procedures for newly generated wastes. Funding shown for tasks 9 through 11 for operations involving the CAI is derived from the Production and Surveillance (P&S) and Office of Nuclear Materials Production (ONMP) operating funds of the waste generator.

Capital equipment funding in the amount of $20K in FY 1985 was provided for the TRU waste program to assure that Los Alamos TRU waste handling and storage needs were met. As identified in the "Inventory Work-Off Plan," $500K of capital equipment funding is required in FY 1986 and $525K in FY 1987 to obtain the equipment essential for operations in the NDE-NDA Facility. The two major equipment items identified are a real-time x-ray radiograph and a nuclear assay system. Supporting equipment for the NDE-NDA Facility includes a forklift and related waste handling equipment. The total anticipated costs of equipment for this facility is approximately $1100K. Due to the long lead times required, procurement of the assay system for drums of TRU waste was anticipated in FY 1986. This action is essential to assure a startup of operations on schedule as indicated in workoff planning documents. Procurement of the radiography system will be initiated with FY 1987 funding.

TABLE XXXII

LOS ALAMOS TRU WASTE OPERATING COSTS
FY 1985 through FY 1987

	Task	FY 1985	($K) FY 1986	FY 1987
1.	TRU Waste Storage	270	285	305
2.	Facilities Maintenance, Restoration	25	27	30
3.	Environmental Monitoring	140	150	160
4.	Records Management	70	80	85
5.	Size Reduction	330	400	425
6.	Certification Development	455	-	-
7.	Certification Verification	80	150	160
8.	Stored Waste Work-Off	120	350	280
	Subtotal	1490	1442	1445
9.	Modification of CAI for operations	390	125	-
10.	Incineration Operations	-	250	375
	Total	1880	1817	1820

In FY 1985, a Waste Management GPP-funded project totaling $300K was the TRU Waste Preparation Facility. Completion of this facility is scheduled for the third quarter of FY 1986. Over the period FY 1986-1992, a total of $5.65M (FY-1984 dollars) is estimated to be required to provide facilities and equipment to evaluate, certify, process, and eventually ship stored TRU wastes to the WIPP. In FY 1986, $600K of Waste Management GPP funding was provided to initiate work on the NDE-NDA/Transportation Facility. The balance of funding required for this facility, $970K, is requested for FY 1987.

Approximately $390K operations and $350K of capital equipment funding (P&S, ONMP) was expended in FY 1985 to initiate upgrade and refurbishment of the existing CAI process. Specific activities include replacement of obsolete instrumentation, construction of an ash assay system, retrieval of refractory samples in the lower incinerator chamber, replacement of all FRP piping with Hastelloy, upgrade of the liquid filter configuration, installation of a HEPA filter bypass system, enhancement of superheater capabilities, and modification of the feed prep line to improve throughput. Actual burning of TRU waste is slated for the final quarter of FY 1986 and will continue in subsequent years, constrained only by nuclide limits in effect for the TDF facility. Funding provided in FY 1986 to complete the upgrades and initiate incineration are $375K operation and $650K capital equipment. Estimated operations costs in FY 1987 is $375K.

A summary of the budget projection for the management of TRU wastes at Los Alamos is presented below (in thousands of dollars).

Year	Operations Costs	Capital Equipment	Construction	Total
FY 1985	1880	370	300	2550
FY 1986	1817	1150	600	3567
FY 1987	1820	525	970	3315

V.C Low-Level Waste Program

Projections of operating costs for the management of low-level waste at Los Alamos are listed in Table XXXIII. Note that these are operating costs only, and are also only those costs

borne by the DOE-funded Interim Waste Operations Program. As such, these costs are primarily for operation of the burial area and waste disposal related functions and do not include costs borne by waste generators for packaging, handling, anc on-site transportation, or the costs of waste management R&D programs.

TABLE XXXIII

LOS ALAMOS LOW-LEVEL WASTE OPERATING COSTS

FY 1985 THROUGH FY 1987

	Task	($K) FY 1985	FY 1986	FY 1987
1.	Burial Operations	485	515	550
2.	Facilities Maintenance, Restoration	225	238	255
3.	Environmental Monitoring	145	150	160
4.	Records Management	80	80	85
5.	Compaction	45	50	55
6.	Generation Control	240	255	330
7.	Mixed Waste Incineration	-	-	65
	TOTAL	1220	1288	1500

Funding for low-level waste buried includes all operations at the TA-54, Area G, burial site including waste acceptance and proper emplacement and burial in appropriate disposal facilities and locations. Waste burial pits and shafts will continue to be provided each year as required.

Work involving removal of surface contamination followed by surface restabilization at the old burial Areas T and F should be completed in FY 1986. Projects currently identified for FY 1987 completion include Areas E and K. In addition, Area X (buried LAPRE reactor shell) will be evaluated in FY 1987 to determine what, if any, action is appropriate. This work will complete Los Alamos efforts to meet the milestone of stabilizing surface conditions at all identified radioactive waste disposal areas.

A significant portion of the environmental monitoring effort will continue to be in direct support of the surface stabilization work. Routine burial site monitoring and other special studies also will be continued.

All reporting requirements will continue to be met, and work to transfer historic log book waste disposal records into the computer system also will continue.

Compaction of nonretrievable trash-type waste prior to burial will continue. At current generation rates, approximately 900 m^3 of waste will be compacted to a burial volume of approximately 180 m^3.

Interaction with Laboratory waste generators to better control waste generation processes is the "cornerstone" of an enhanced volume reduction program effort. Emphasis will be placed on assuring proper segregation and handling of all waste materials to reduce radioactive waste volumes. Laboratory employee training/education in areas of waste segregation, materials control, waste handling procedures, and overall waste management-volume reduction philosophy will be utilized.

Incineration of scintillation vials and other appropriate mixed wastes, as possible, will begin in FY 1987. An evaluation of actual mixed waste incineration costs subsequently will be completed.

Capital equipment funding is required for this program to assure that Los Alamos waste handling and disposal needs can be met. Equipment needed includes replacement items and new equipment to modify operations to meet DOE criteria and to satisfy new waste handling requirements. Specific items include new and replacement equipment for waste handling, facilities maintenance, site/waste security, environmental monitoring, personnel safety, waste treatment, and records keeping.

Through FY 1987, because of the extensive needs of the TRU waste work-off effort, no GPP funding has been requested in support of the low-level waste disposal effort.

A summary of the budget projections for the management of low-level wastes at Los Alamos is presented below (in thousands of dollars):

Year	Operating Costs	Capital Equipment	Construction	Total
FY 1985	1220	60	----	1280
FY 1986	1288	85	----	1373
FY 1987	1500	85	----	1585

V.D Chemical Waste Program

The primary effort of the Los Alamos nonradioactive hazardous waste treatment/disposal program will be to assure compliance with applicable Federal and State regulations governing the handling and disposal of these wastes. These include regulations promulgated under RCRA 1976, Toxic Substances Control Act (TOSCA) (1976), the New Mexico Hazardous Waste Act (1978), and the RCRA Reauthorization Bill (1984).

Los Alamos initiated a Site Characterization Program (SCP) in 1983 and combined it with the Albuquerque Operations Office (AL) Comprehensive Environmental Assessment and Response Program (CEARP) when it was started in 1984. The purpose of these phase programs is to take a detailed look at the environmental history of the Laboratory, to document current conditions, and eventually to assess and correct existing or potential environmental problems. In FY 1986 efforts are being concentrated on report preparation in accord with DOE order 5480.14 (Comprehensive Environmental Response, Compensation, and Liability Act Program) and AL direction to have a Phase I (Installation Assessment) report completed in FY 1986. Additional FY 1986 efforts will concentrate on environmental sampling and geophysical exploration to confirm or deny potential problems that were identfied in Phase I. These latter efforts will continue into FY 1987. From

these data and additional problem investigations some assessment of the potential hazards and possible options to correct the hazards will be done.

Program activities this FY will include the continuation of treatment/disposal operations in the safest and most effective manner possible to remain consistent with applicable regulations. To comply with upcoming regulations and the Laboratory's Part B RCRA application, an extensive evaluation of the hazardous waste management program will be continued. Emphasis will be placed on treatment options available to replace landfill practices for the appropriate waste streams. Permitting and usage of the CAI will be stressed during this evaluation.

The RCRA Part B permit application for operation of the Laboratory's chemical waste facilities was submitted May 1, 1985. A separate volume addressed the use of these same facilities for radioactive mixed waste. Two major revisions have already occurred to the document, the most current change being the deletion of chemical waste landfill operations. As previously mentioned, closure plans have been submitted for the landfills and several storage and treatment facilities. Modifications and reviews of the Part B will continue into FY 1987.

Construction was started in FY 1985 on a covered storage pad at Area L. This will be the primary storage location for the Laboratory in an effort to reduce the number of permitted storage areas. Construction will be completed in FY 1986.

Another concrete bermed pad will be constructed during FY 1986. It will hold the four treatment tanks at Area L. Exact location within the area is being negotiated.

Indirect funding has been provided to support RCRA permitting activities with the goal of establishing on-site incineration capability for Lab-generated chemical wastes. Specific activities to date have included preparation of a trial burn permit application (included in the Laboratory's Part B Submittal to EPA), responses to EPA/NMEID comments on the incineration subsection, providing input for an interim status request for CAI,

preparing an addendum to the TDF FSAR, and designing needed modifications to the feed preparation area to permit receipt, storage and blending of volatile organic chemicals with fuel oil.

A major drilling effort at Areas L and G was negotiated with the State in FY 1985. It will provide data to support the Laboratory's request for a groundwater monitoring waiver. The drilling was performed in late FY 1985-early FY 1986. Analysis of the data will occur during FY 1986 followed by a report to the state in FY 1987.

The construction of a new PCB storage facility to replace building TA-21-61 is planned for FY 1987. The building 21-61 was originally built in the 1940's and is in need of major repairs if prolonged PCB storage continues there.

Passage of new regulations under the Hazardous and Solid Waste Amendments will surface new problem areas that will need to be addressed. Because the full impact of these regulations is not known, many other projects will continue to be added to the FY 1986 and 1987 lists.

A summary of the budget projections for the management of chemical wastes at Los Alamos is presented below by subtask (in thousands of dollars):

	FY 1985	FY 1986	FY 1987
Storage, Treatment, Disposal			
Operations	425	600	550
Incineration	100	340	280
HE Treatment	70	160	170
CEARP	280	560	1150
Regulatory Compliance/Monitoring	2285	3840	3500
Total	3160	5500	5650

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