ENTERED

ERID#: 8404	LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION (RRES-R) Records Processing Facility ER Records Index Form

Date Received: 8/12/1992 ***Processor:*** GAA ***Page Count:*** 151

Privileged: (Y/N) N ***Record Category:*** R ***Administrative Record: (Y/N)*** Y

FileFolder: N/A

Miscellaneous Comments: N/A

Record Documents:

Start Pg	Doc Type	Doc Date	Title	Box	Package
2	REPORT	4/1/1985	IMPLEMENTATION PLAN FOR RADIOACTIVE WASTE MANAGEMENT AT LOS ALAMOS NATIONAL LABORATORY	19	

36787

Los Alamos Environmental Restoration Records Processing Facility
ER Record I.D.# 0008404

IMPLEMENTATION PLAN FOR RADIOACTIVE WASTE MANAGEMENT AT LOS ALAMOS NATIONAL LABORATORY

APRIL 1985

TABLE OF CONTENTS

I. General Site Information 1
- A. Organization and Administration 1
- B. General Plant Mission 4
- C. Site Description 4
- D. Quality Assurance 20
- E. Site Safety Assessment. 20
- F. Emergency Preparedness. 20
- G. Training 20
- H. Records 21
- I. Inspections 21
- J. Environmental Monitoring 21
- K. Closure/Post-Closure 22

II. Radioactive Waste Management 26
- A. Radioactive Waste Management Facilities 26
- B. Description of Radioactive Waste Generating Process 29
- C. Solid Radioactive Waste Inventories 29
- D. Radioactive Waste Management Operations 35
- E. Mixed Waste 60
- F. Description of Decontamination and Decommissioning. 61
- G. Budget 63

References
- Appendix A - Accidental Oil, Chemical, and Airborne Releases
- Appendix B - Inspection Forms
- Appendix C - Environmental Sampling and Monitoring Program
- Appendix D - Ground Water Monitoring Exemption Request
- Appendix E - Vadoze Zone Monitoring System
- Appendix F - Radioactive Solid Waste
- Appendix G - Shipment of Radioactive Materials
- Appendix H - Waste Disposal Facility Construction Guidelines
- Appendix I - Greater Confinement Disposal Guidelines
- Appendix J - Radioactive Liquid Waste Collection System Improvements - Project Management Plan

I. GENERAL SITE INFORMATION

I.A. Organization and Administration

I.A.1 Responsible Office

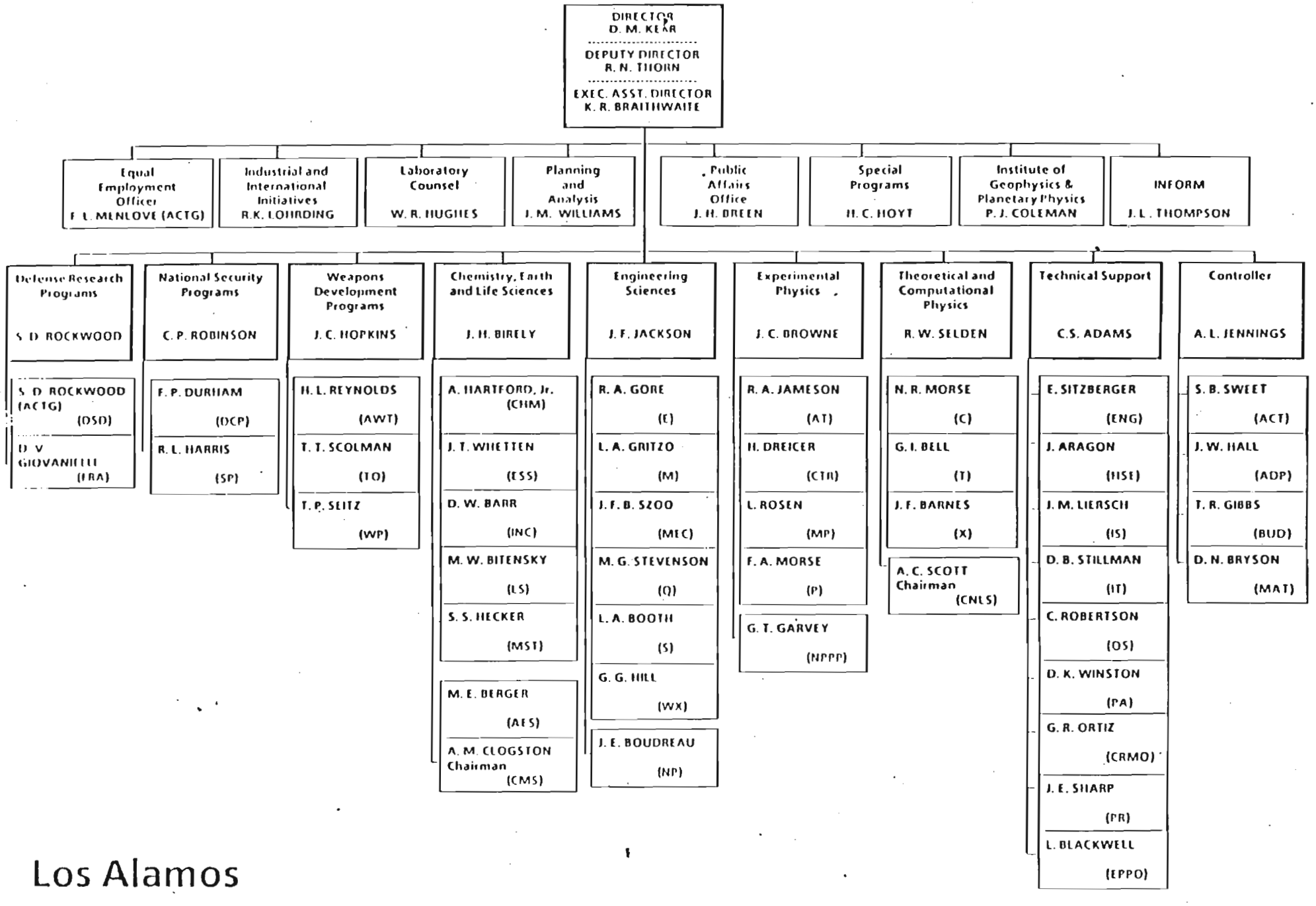
The Laboratory is operated for the US Department of Energy (DOE) by the University of California under Contract W-7405-ENG-36. The University is under the cognizance of the DOE's Los Alamos Area Office (LAAO), which reports to the DOE Albuquerque Operations Office (AL).

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 radioactive waste management facilities, the preparation of the annual Waste Management Site Plan, and initiating, and sometimes granting, exemptions from site-specific disposal requirements. (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. 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 general Laboratory support in the areas of monitoring and general



Los Alamos

1/1/85 Fig. 1. Los Alamos National Laboratory organizational structure.

HEALTH, SAFETY, and ENVIRONMENT DIVISION

Los Alamos National Laboratory

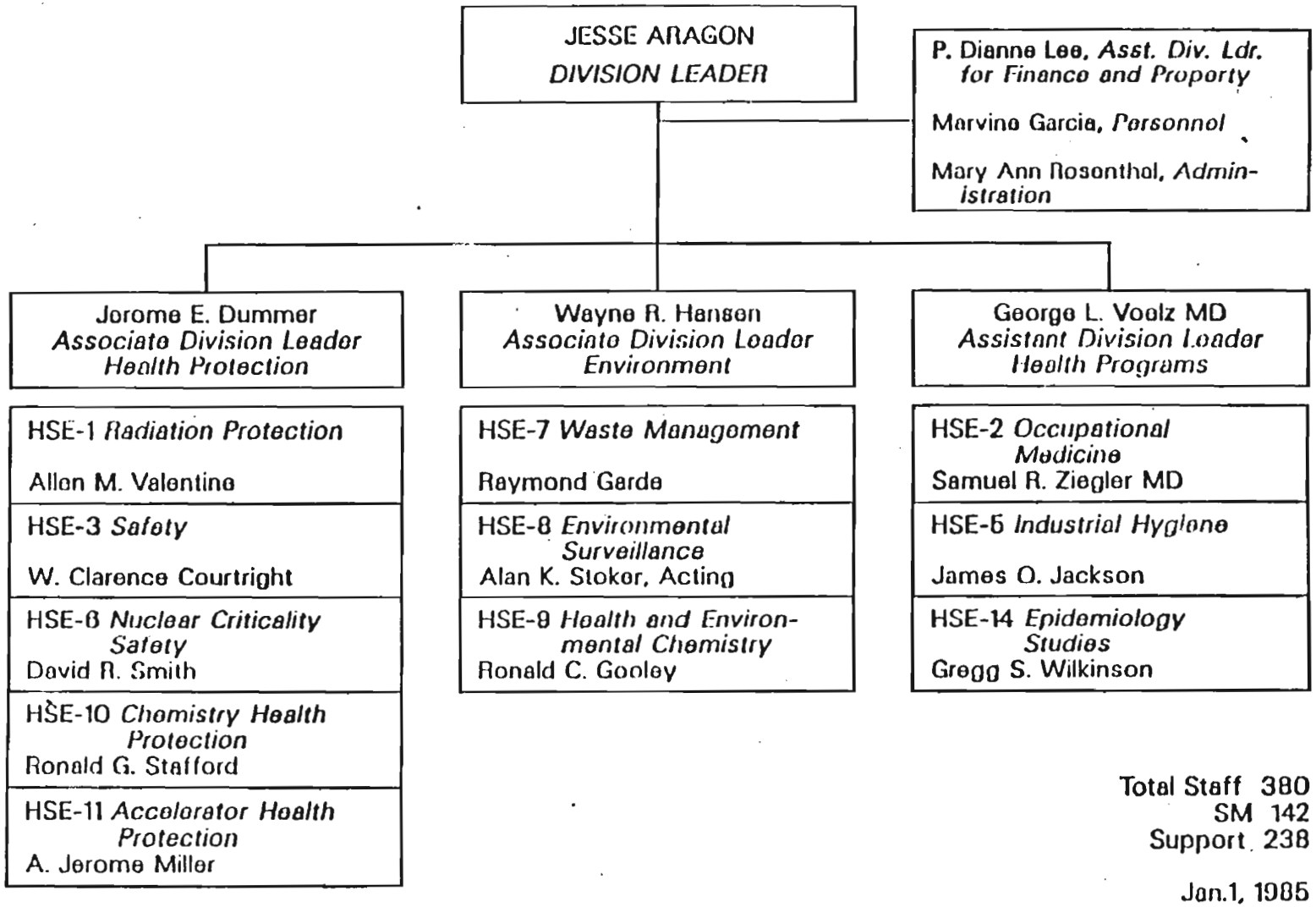


Fig. 2. Health, Safety, and Environment Division Organization Chart

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 the environmental surveillance group, 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 Orders 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 location. The Laboratory site covers about 11 129 hectares* (27 500 acres) in and adjacent to Los Alamos County. The surrounding

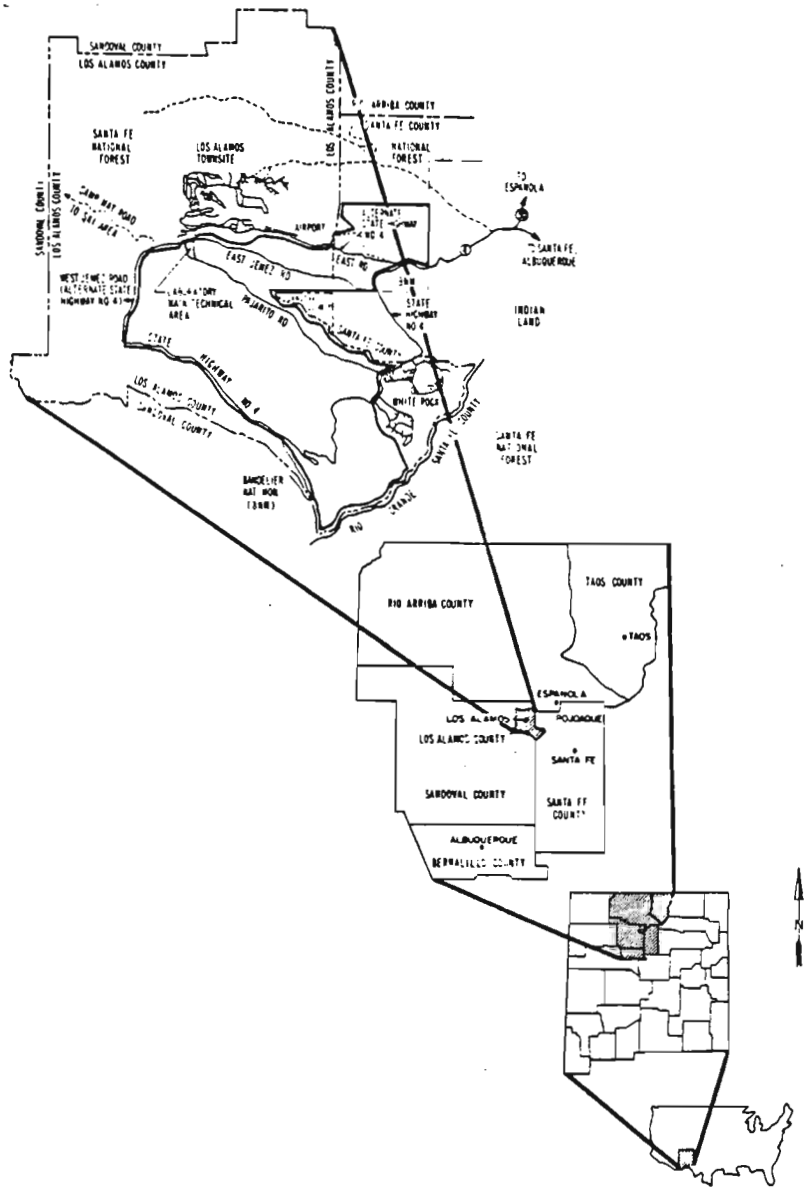


Fig. 3. Location of Los Alamos

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, are disposed of at the TA-54, Area L hazardous waste disposal site. High-level, transuranic, and by-product materials are excluded

---

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

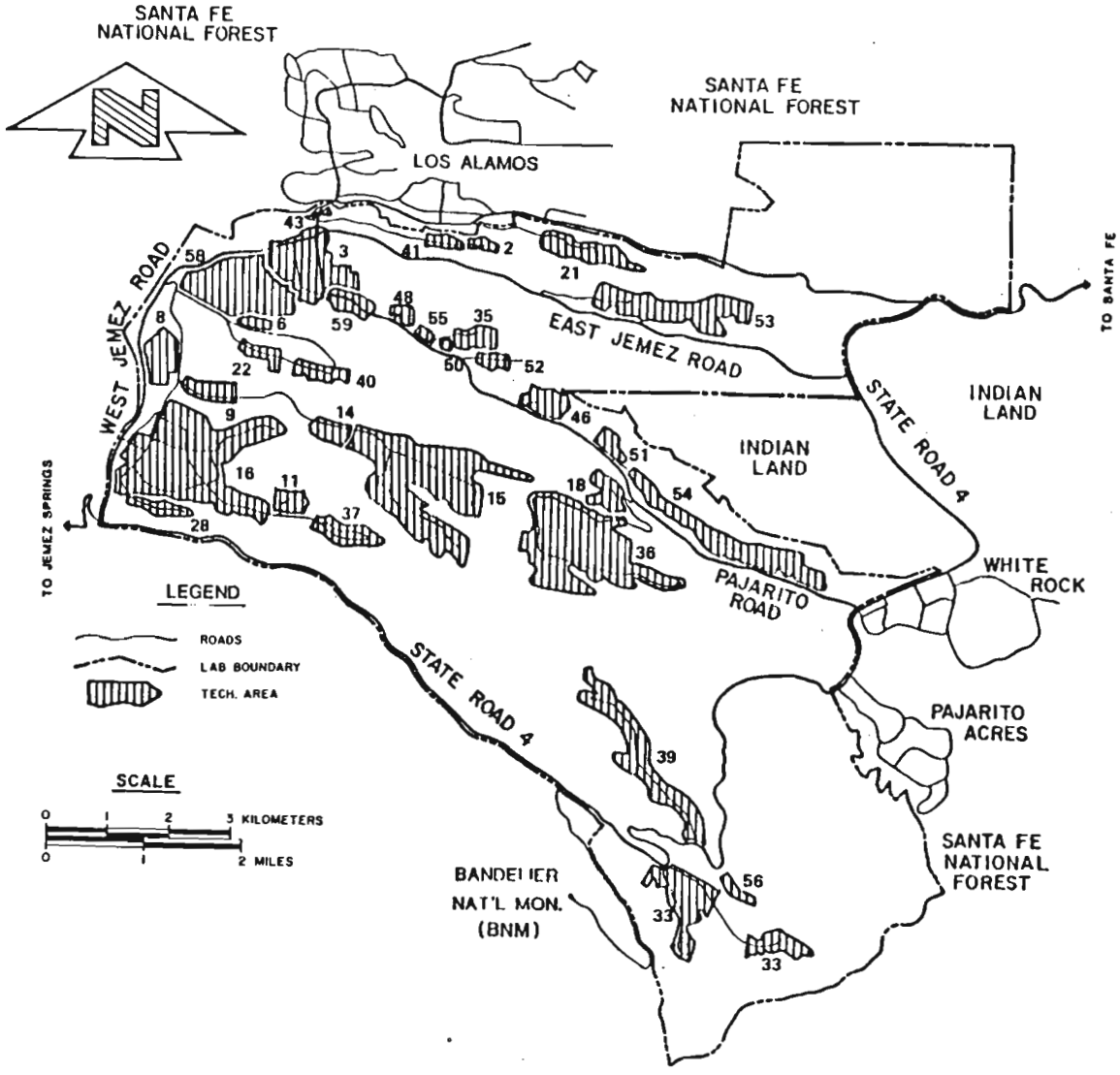


Fig. 4. Los Alamos National Laboratory-Technical Areas and Adjacent Communities

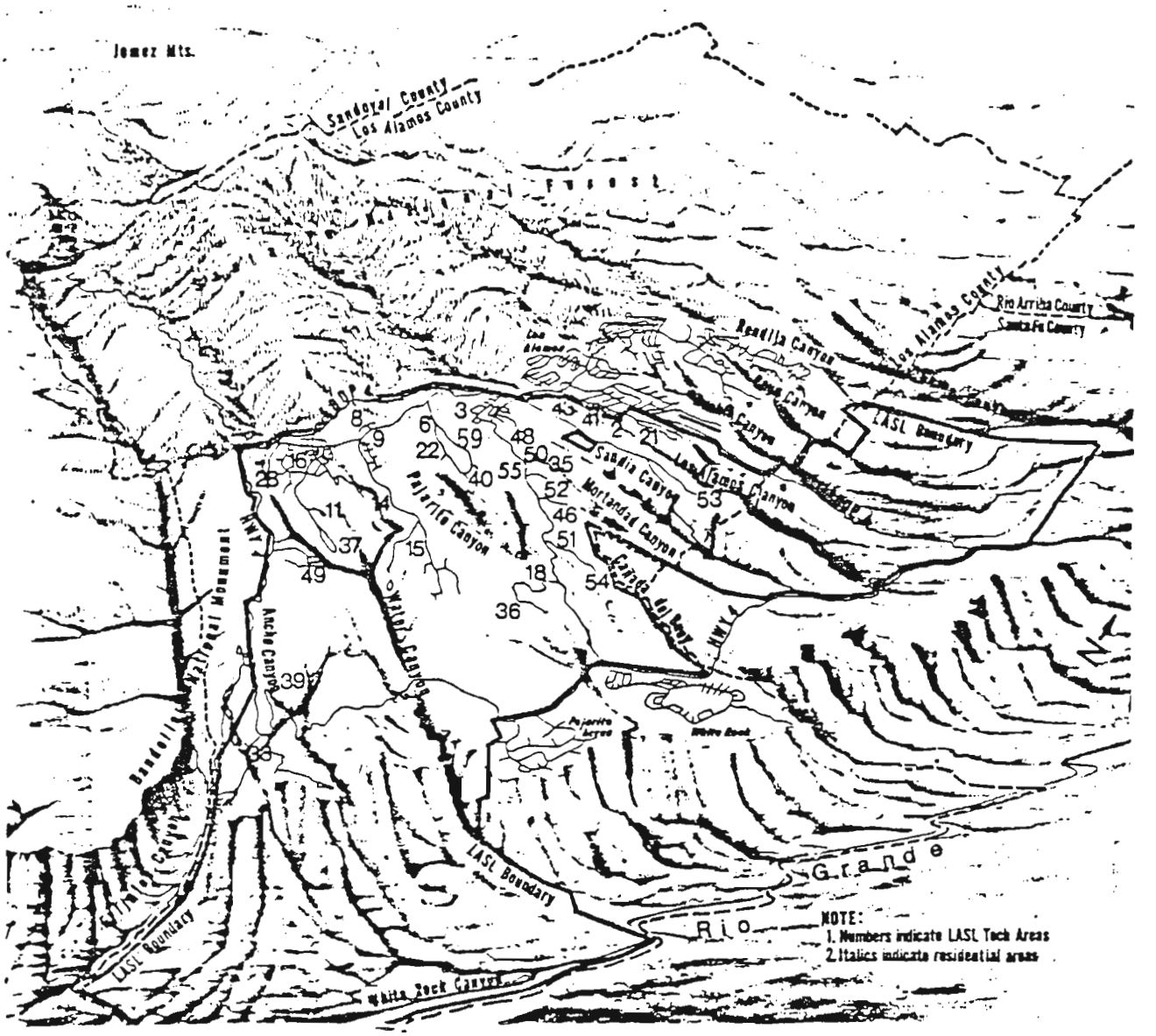


Fig. 5. Topography of the Los Alamos Area

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 9 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 wastes are packaged at the generation site for shipment to Area G at TA-54 where they are buried in pits or shafts if low-level, or stored retrievably if TRU.

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. 10). 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 similar to those of TA-50. However, this mesa is about 2 miles 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

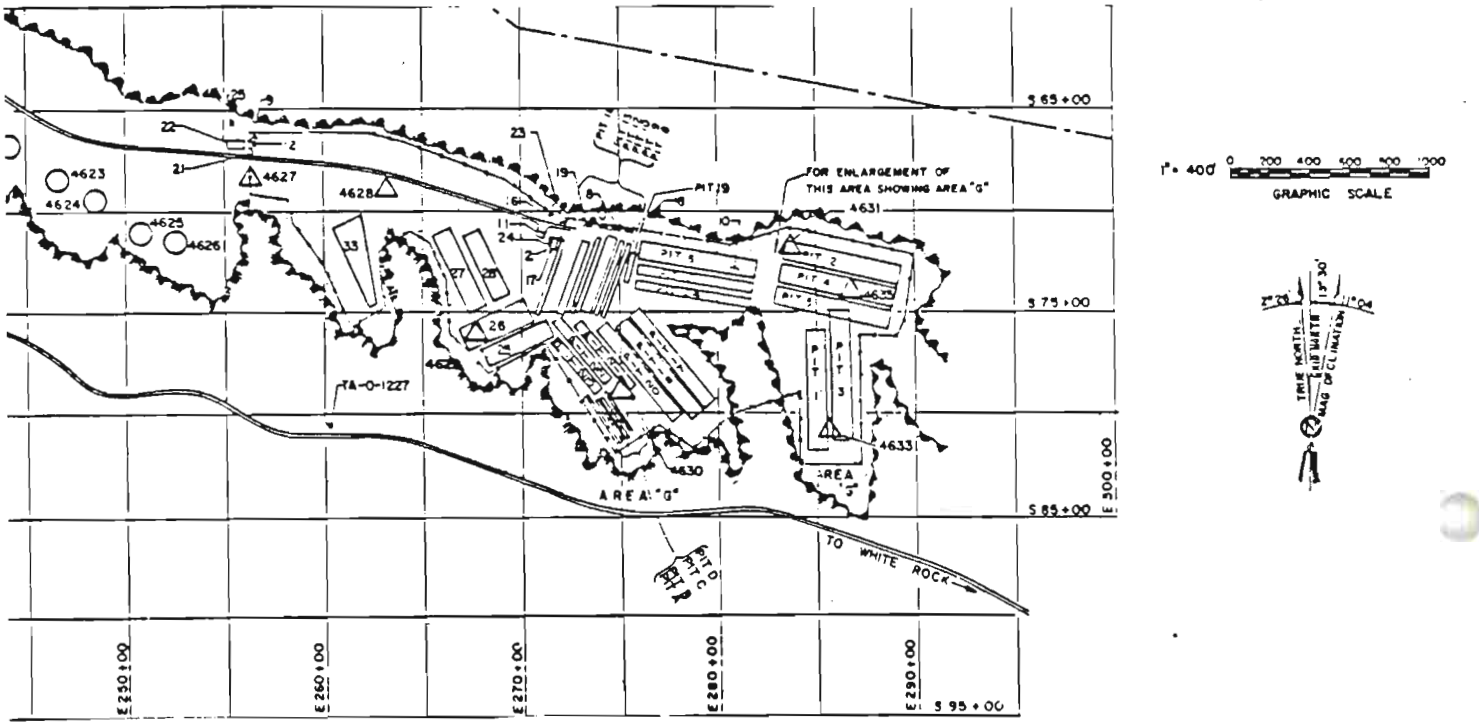


Fig. 6. TA-54, Area G Plot Plan

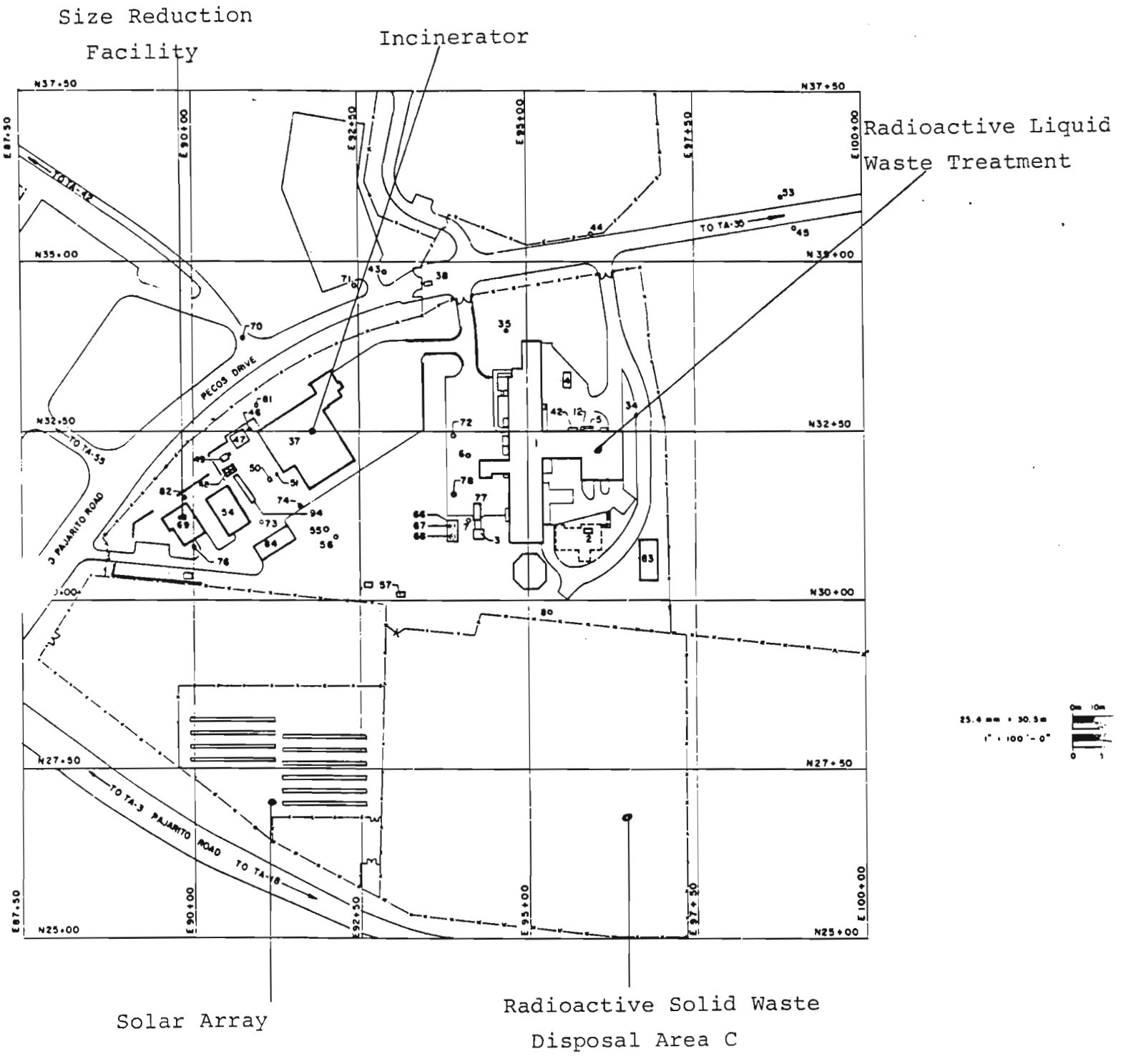


Fig. 7. TA-50 Plot Plan

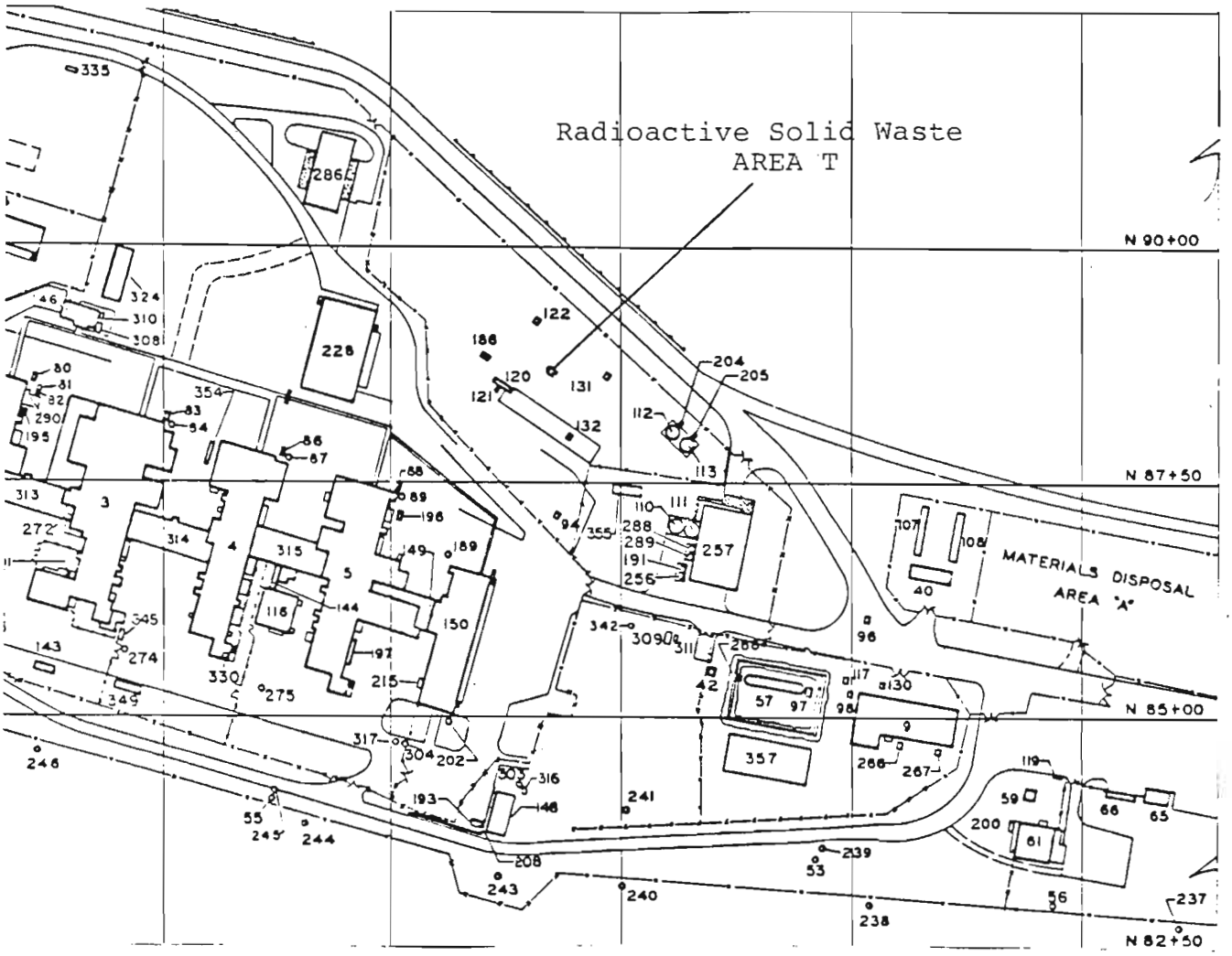


Fig. 8. TA-21, Building 257 Plot Plan

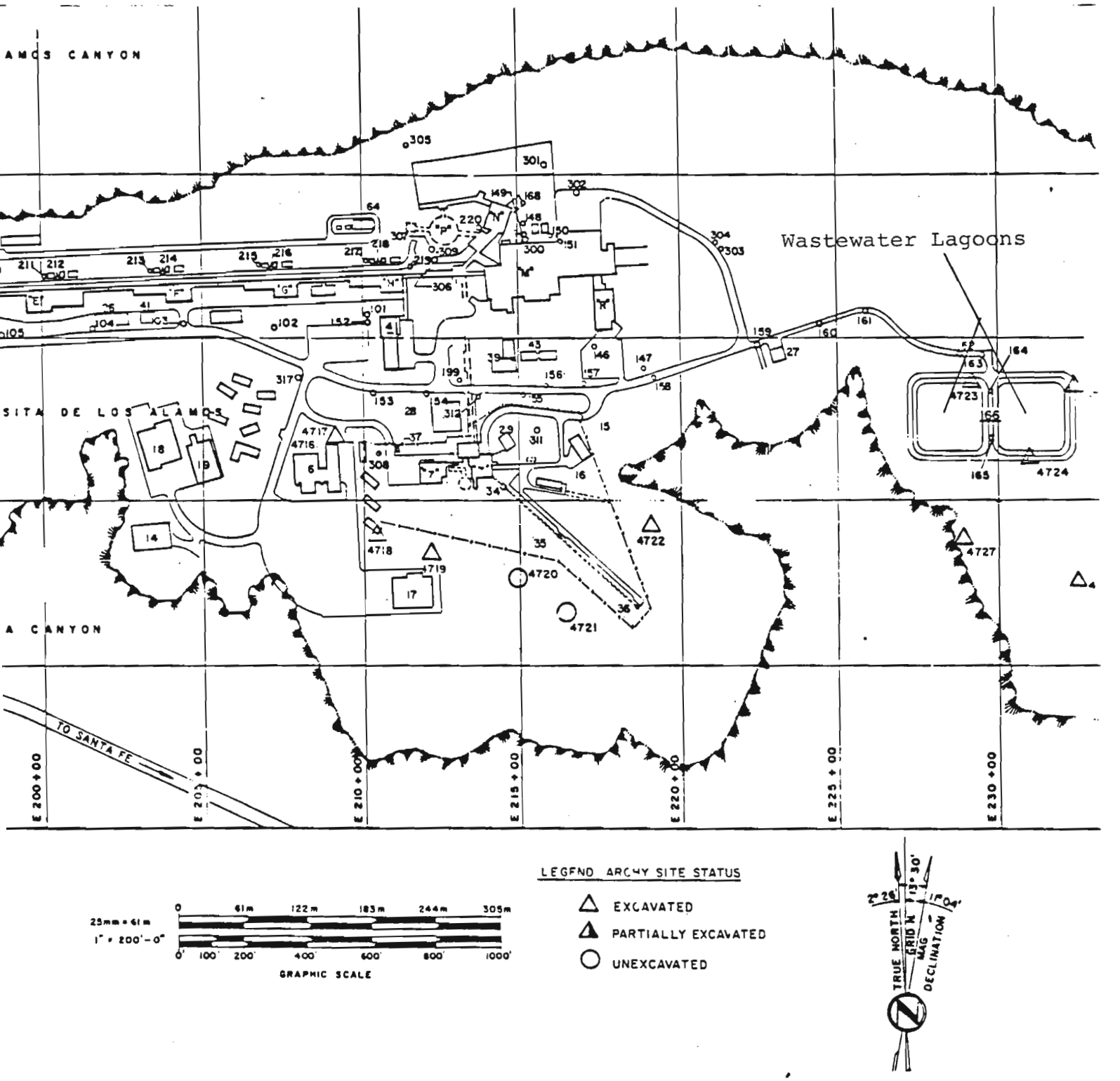


Fig. 9. LAMPF Plot Plan including Wastewater Lagoons

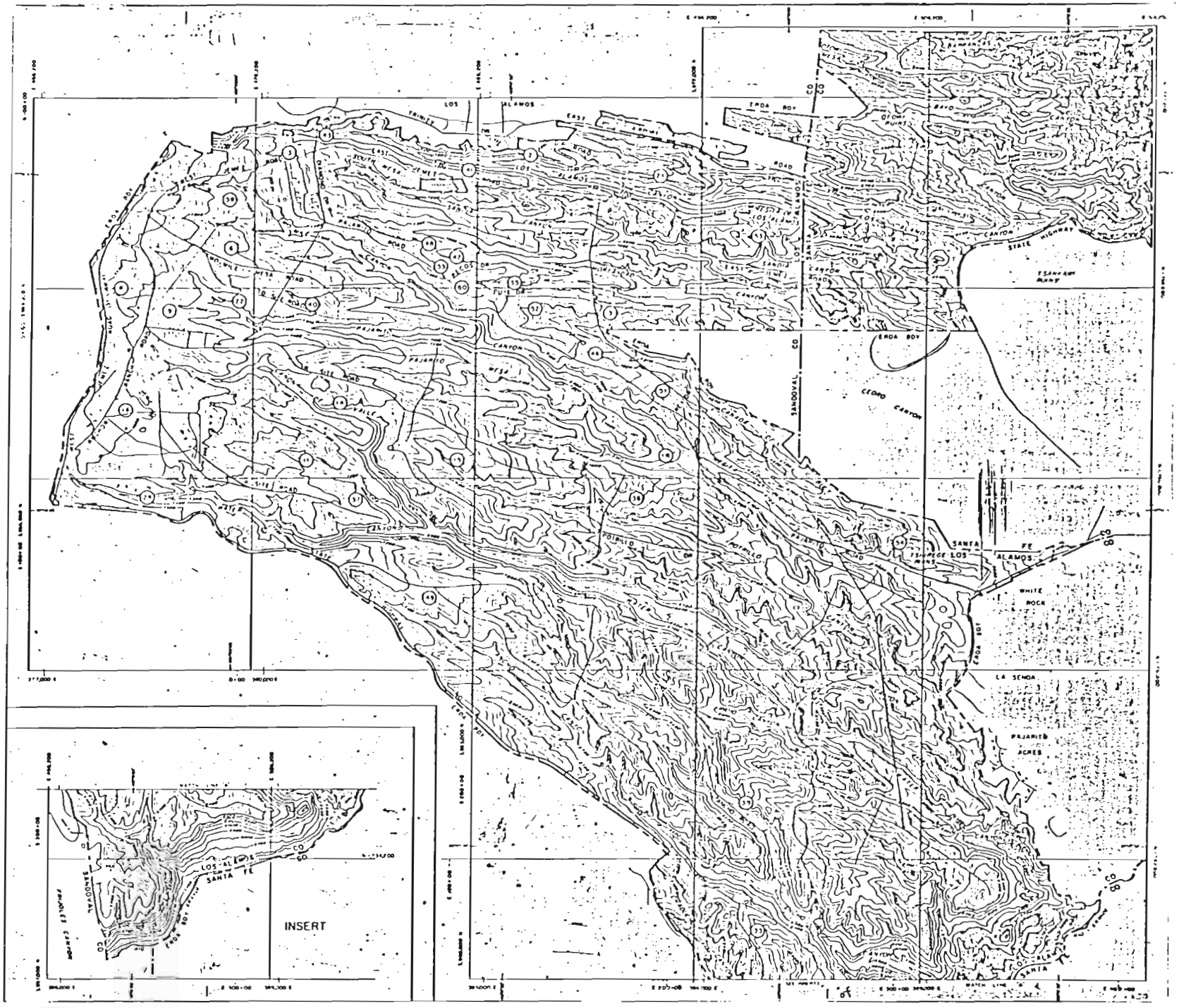


Fig. 10. Topogra of Los Alamos

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 a high 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.

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.

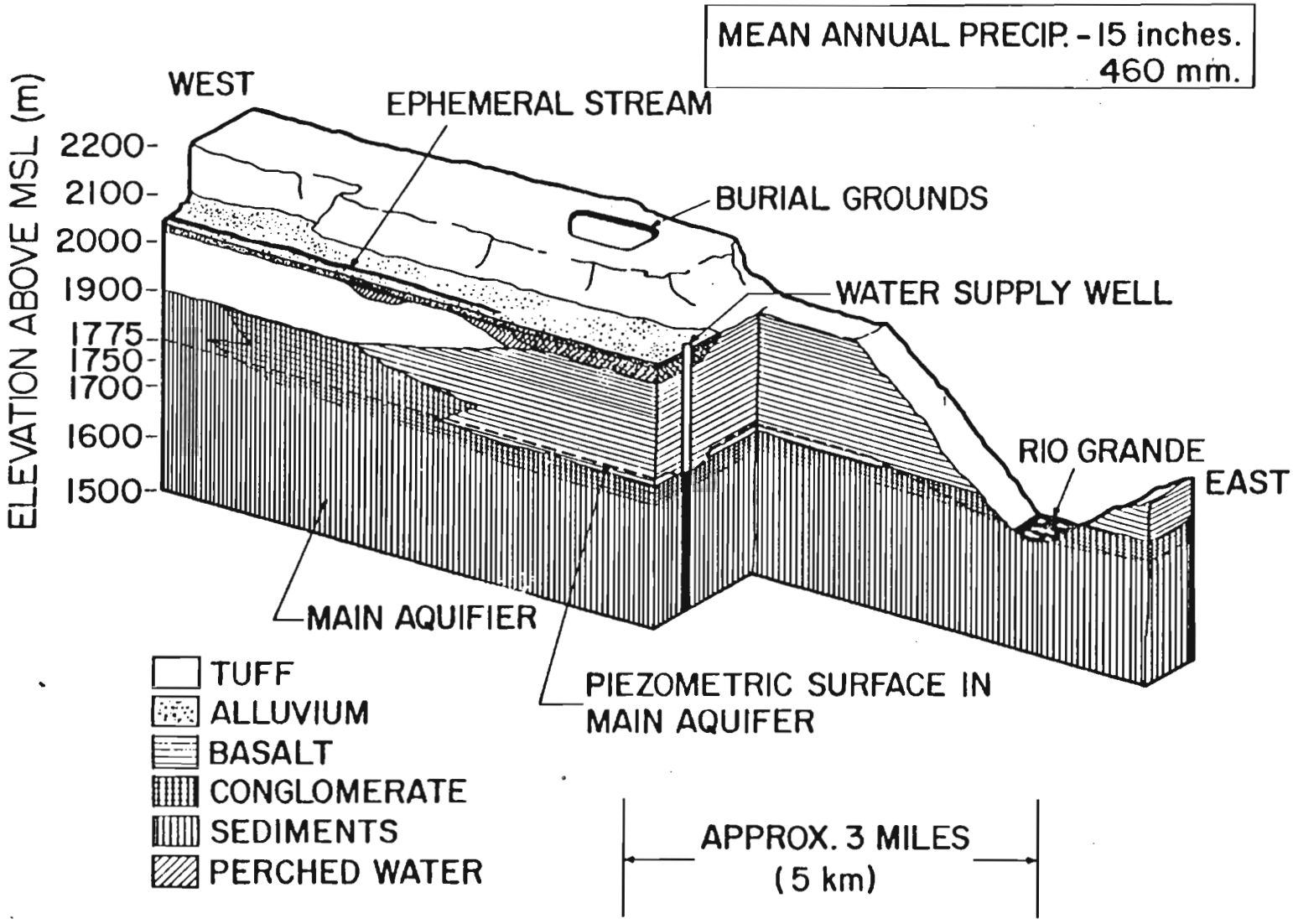


Fig. 11. Conceptual Illustration of Geologic-Hydrologic Relationships in the Los Alamos Area

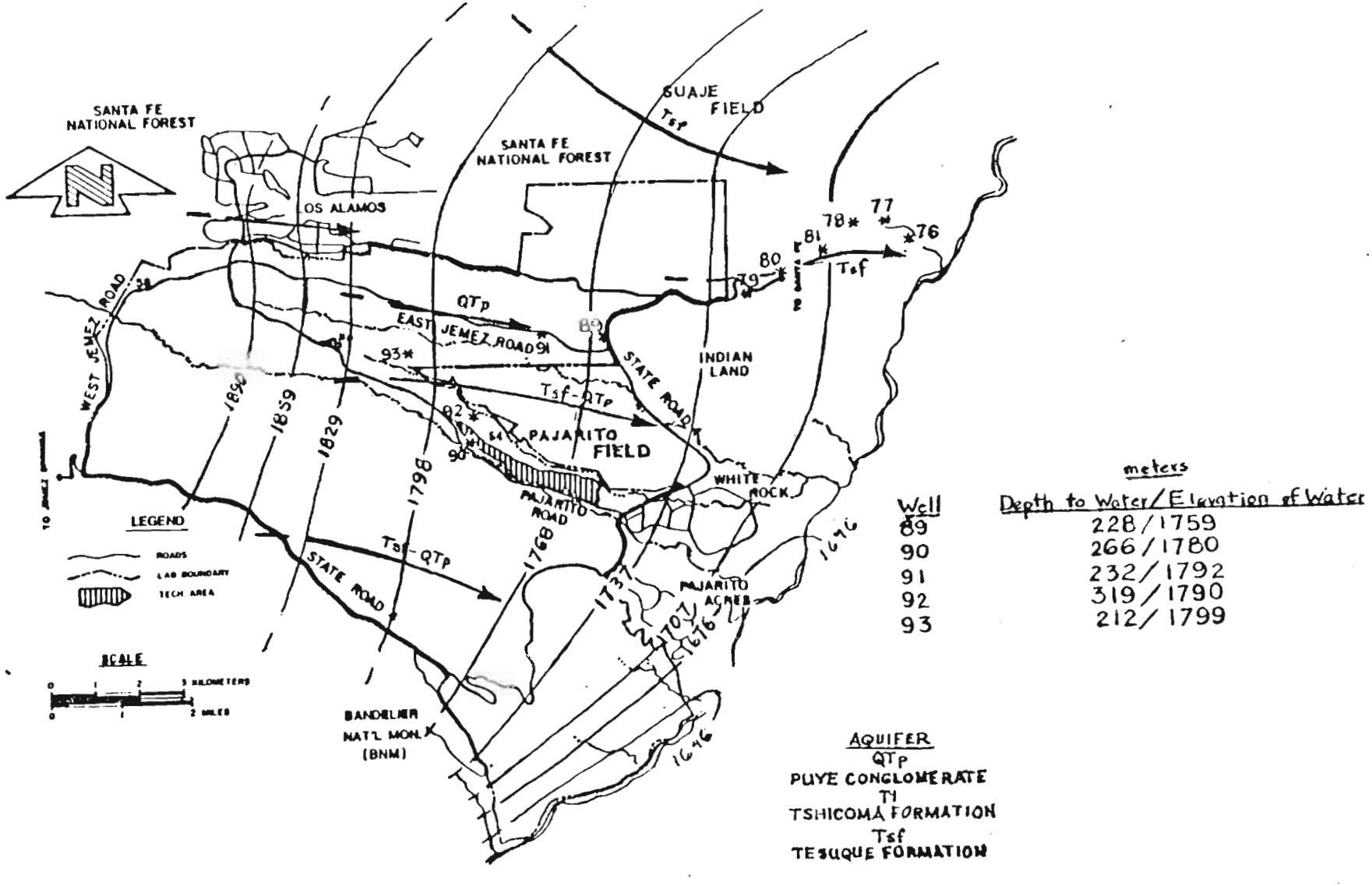


Fig. 12. Groundwater Flow Pattern and Municipal Supply Wells

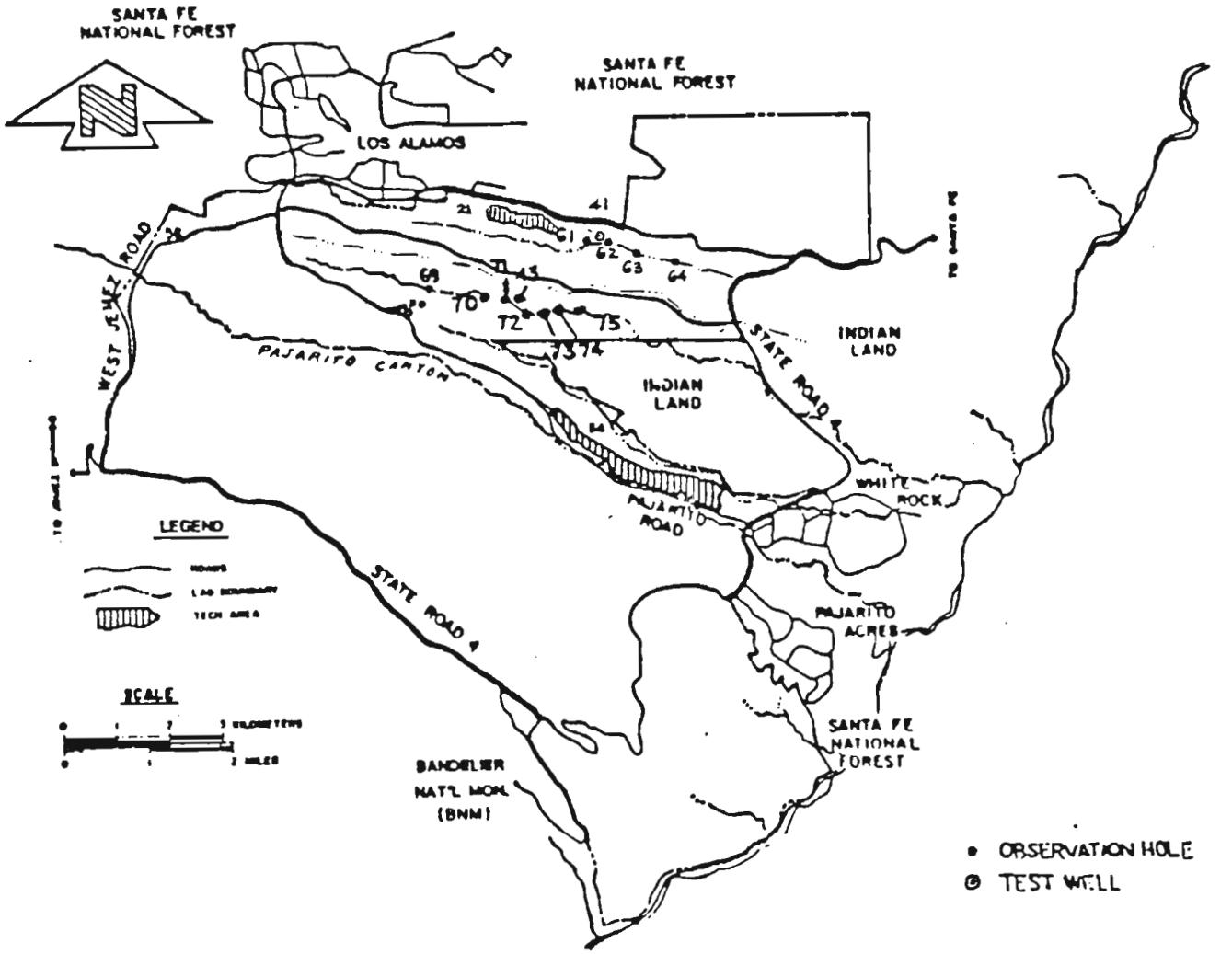


Fig. 13. Perched Water Monitoring System

I.D. 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.

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 Liquid Waste Treatment system at TA-50.

I.F. 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. An Administrative Requirement (AR) contained in the Health and Safety Manual, AR 9-4, Accidental Oil, Chemical, and Airborne Releases (Appendix A), requires a spill coordinator be designated for each working area. As well, 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. Together, these measures meet the requirements of DOE/AL 5500.2 and DOE/AL 5500.3.

I.G. 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 and radioactive waste transportation and packaging classes as applicable. Safety films/lectures are also provided on a quarterly basis. Training records are maintained in the group files.

I.H. Records

Day-to-day operating records are generated and maintained in accordance with DOE/AL Order 5820.2. 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 (Radioactive Solid Waste Disposal Record form and the Certified Waste Storage Record form, Fig. 25 and 26).
- Reports and results of inspections and audits.
- Reports of unusual occurrences.
- Monitoring, testing, and analytical data.

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

I.I. 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. Appendix B provides a copy of the general forms used at waste management facilities. 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.

I.J. 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, the 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. Details of the monitoring program are contained in Appendix C.

I.K Closure/Post-Closure

I.K.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. Radioactive waste treatment, storage, and disposal facilities at the Los Alamos National Laboratory consist of chemical treatment, compaction, size reduction, controlled air incineration, TRU storage, and landfill disposal.

I.K.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

I.K.3 Partial and Final Closure

The Laboratory's radioactive waste facilities are to be closed in the year 2100. All radioactive wastes will be recycled, 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. No such partial closures are now anticipated.

Closure of individual landfill shafts or pits located at TA-54 is ongoing and performed as they are filled.

I.K.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, both of which are at TA-54. 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. Therefore, ground water monitoring at the disposal sites is only as described in Appendix D. Vadose zone monitoring at Area L is to be performed as described in Appendix E.

I.K.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. Contaminated protective clothing and protection equipment shall be treated as radioactive and either decontaminated or disposed of in compliance with appropriate regulations.

I.K.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

I.K.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.

I.K.8 Individual Closure Plans

Details of the closure plans for individual Los Alamos radioactive waste facilities will be developed at the time the facility is declared to be a surplus facility. The closure plan that will be developed for Area G is further complicated pending the results of environmental studies that still must be performed. The study of buried TRU waste and what to do with it (funded in FY 1987) is one such study.

I.K.9 Post-Closure

Post-closure activities would include the following items:

1. The site shall be inspected semiannually or more frequently as determined necessary, checking:

    (a) the cover system for integrity, settlement, and erosion,

    (b) the site drainage system for any blockages or evidence of poor function,

    (c) the integrity of the fence, gate and lock, and

    (d) the condition of surveyed benchmarks.

2. Repairs shall be made to any of the items mentioned in activity No. 1 should the inspection reveal conditions requiring further attention for the proper function of the closure system.
3. Environmental sampling and monitoring programs at Area L will be consistent with key contaminants relative to environmental surveillance of the Laboratory waste

management activities (see Appendices C, D, and E for details of present and proposed monitoring).

4. Records shall be kept of inspections, repairs, sampling, and analytical results for the duration of post-closure care activities.

The design of the closure and post-closure plans will be based in large part on data developed for Los Alamos National Laboratory's Ground Water Monitoring Waiver Request. To date, conclusions have been made that the site has a low infiltration rate, under worst case conditions, and that past storage of free liquids was of insufficient volume to have a potential impact on the main aquifer 250 m (820 ft) below the site.

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 ofair-borne 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 building 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, stablize 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.

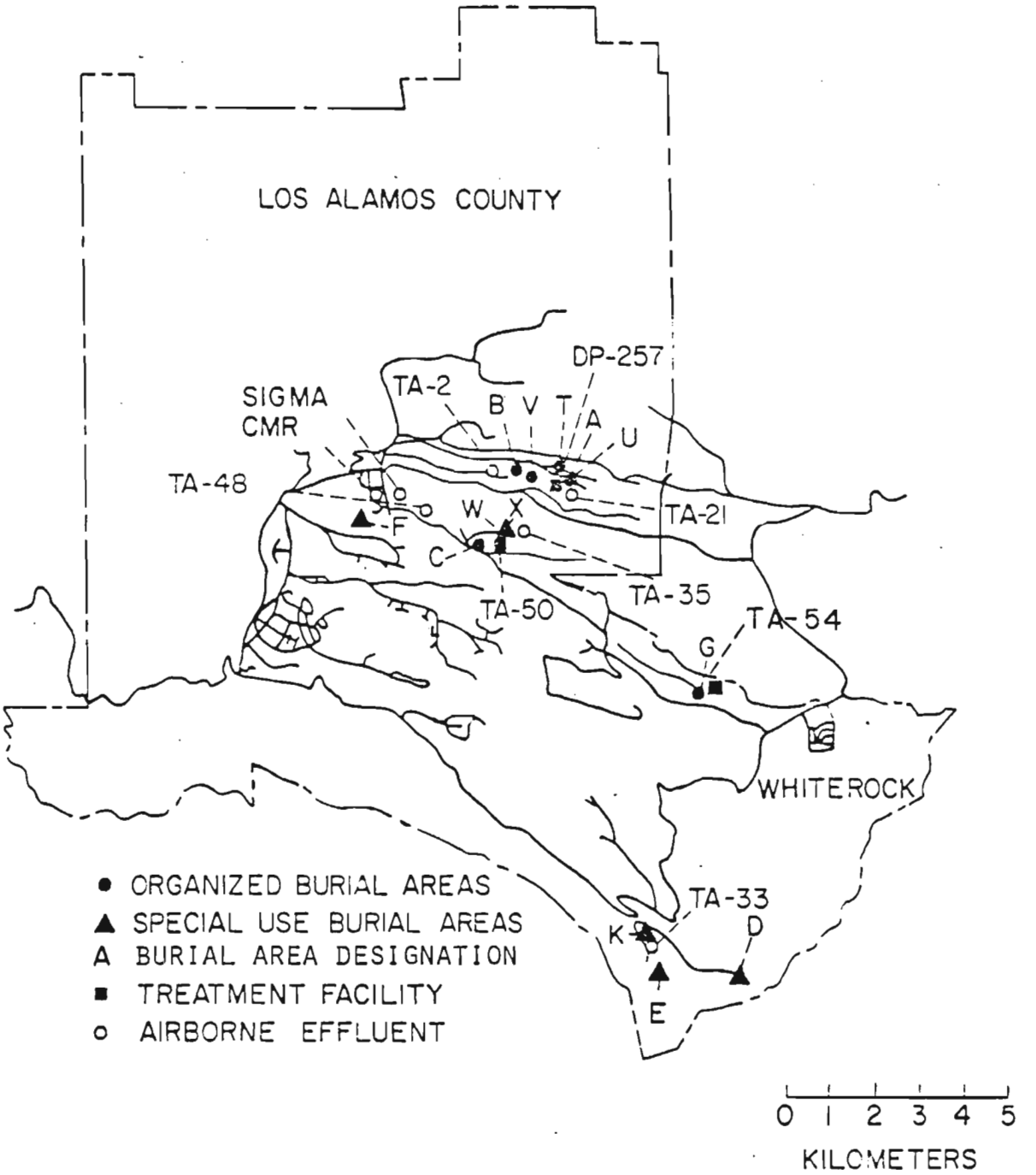


Fig. 14. Radioactive Waste Management Facilities

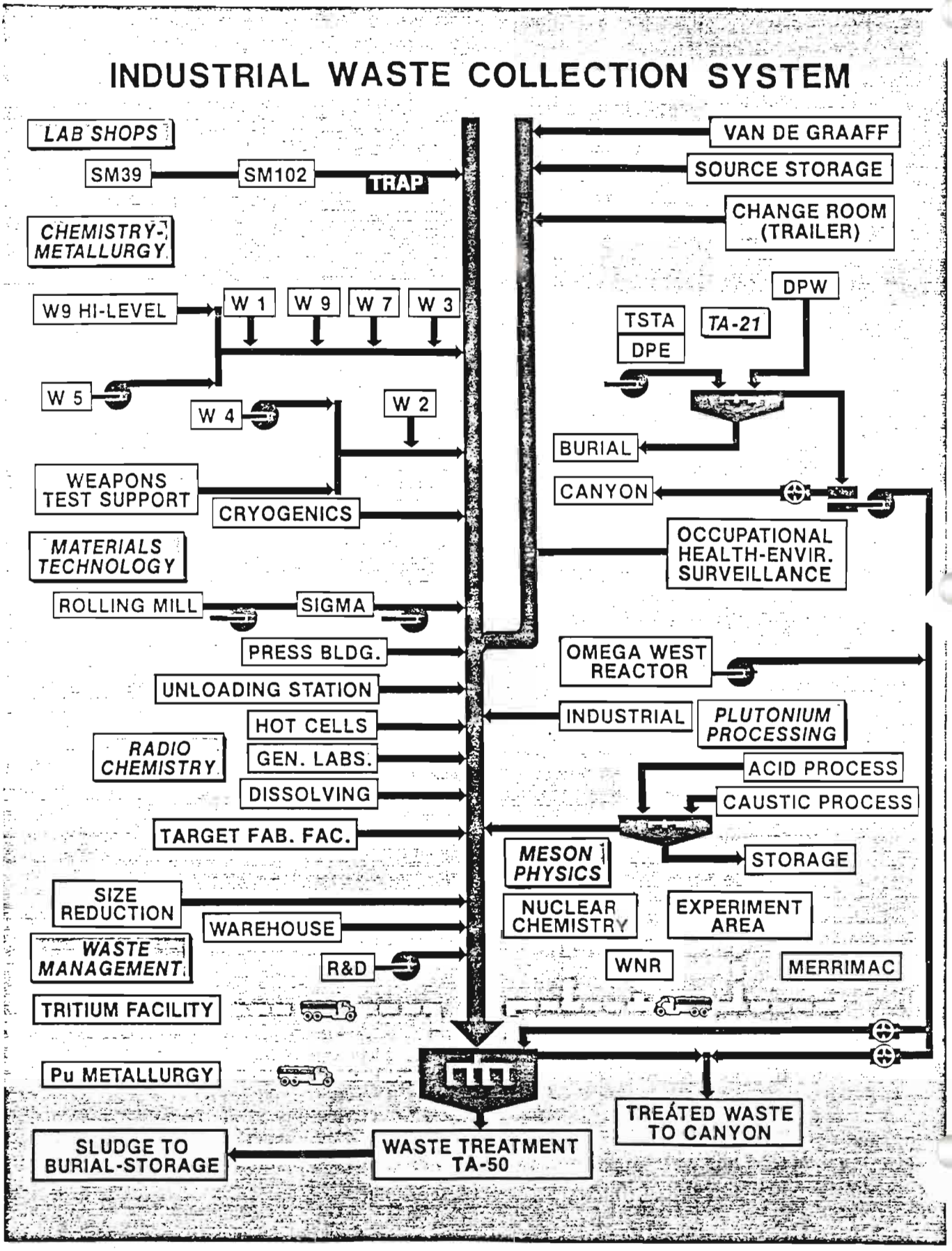


Fig. 15. Central Waste Collection System Discharging to TA-50

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 expansions of this area are planned. Burial facilities within the area include pits and shafts of varying dimensions.

II.B. 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. 16.

II.C. Solid Radioactive Waste Inventories

Actual volumes and acitivities 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 information submitted for FY 1984 is presented in Table I and projections for FY 1985 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.

In recent years, there has been no D & D waste generated at the Laboratory that has been funded through the surplus facilities program. In FY 1985, the generation of 375 m^3 (13 238 ft^3) of low-level waste is projected from the program-funded decommissioning of the TA-2 Water Boiler Reactor.

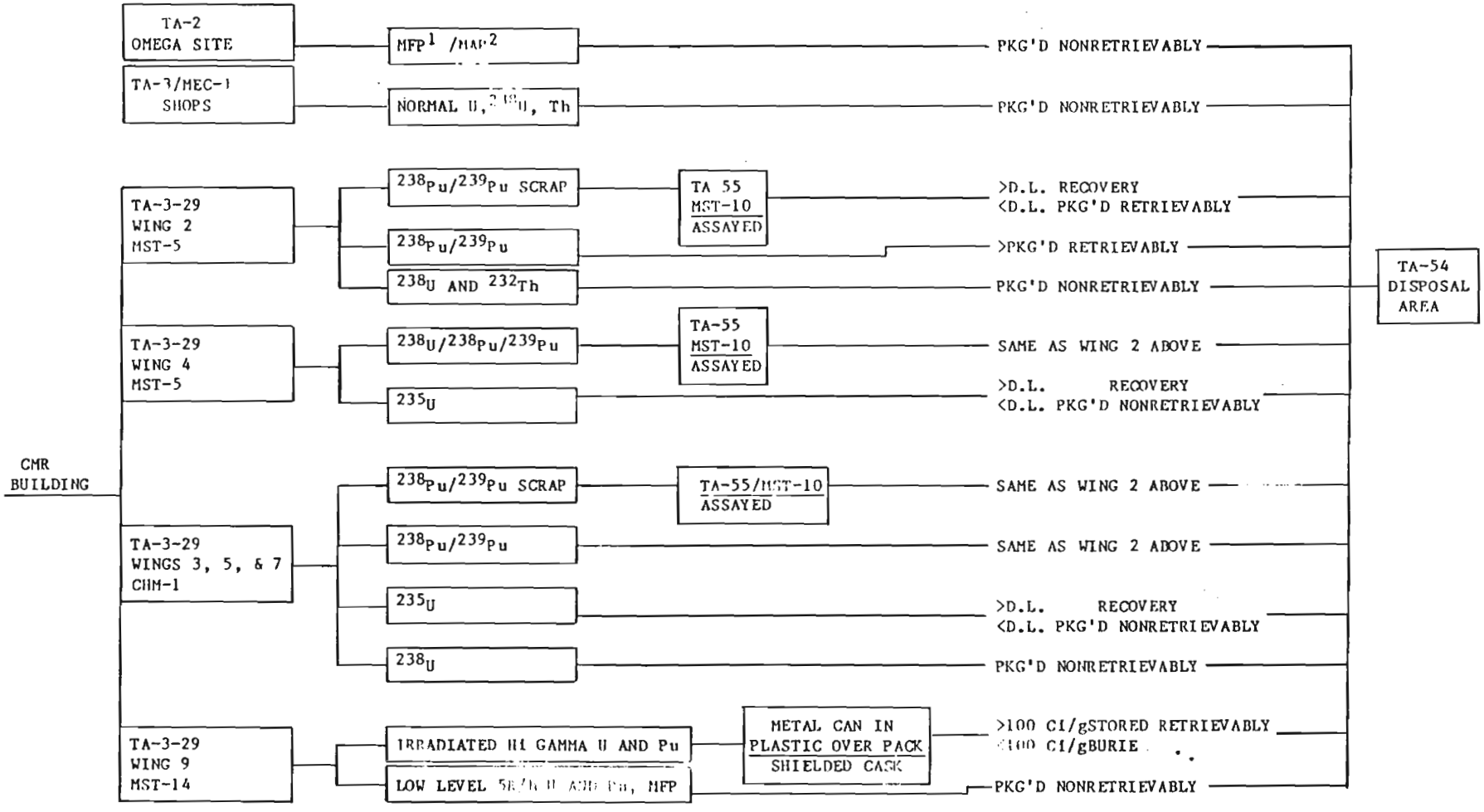


Fig. 16. Flow Sheet for Los Alamos Radioactively Contaminated Solid Waste (continued on next 3 pages)

[1]MAP=Mixed Activation Products

[2]MFP=Mixed Fission Products

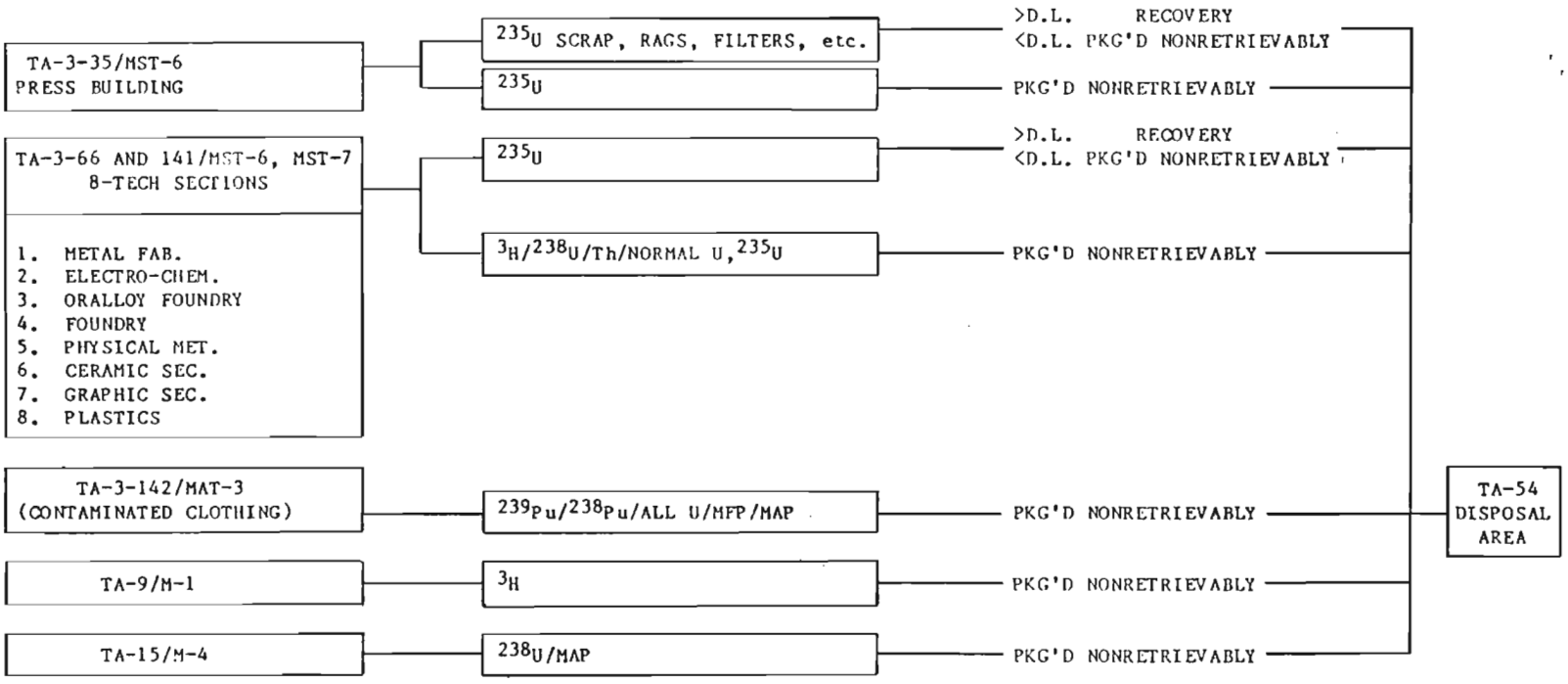

TA-3-35/MST-6
PRESS BUILDING
235U SCRAP, RAGS, FILTERS, etc.
235U
>D.L. RECOVERY
<D.L. PKG'D NONRETRIEVABLY
PKG'D NONRETRIEVABLY
TA-3-66 AND 141/MST-6, MST-7
8-TECH SECTIONS
1. METAL FAB.
2. ELECTRO-CHEM.
3. ORALLOY FOUNDRY
4. FOUNDRY
5. PHYSICAL MET.
6. CERAMIC SEC.
7. GRAPHIC SEC.
8. PLASTICS
235U
>D.L. RECOVERY
<D.L. PKG'D NONRETRIEVABLY
3H/238U/Th/NORMAL U,235U
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. 16. (cont)

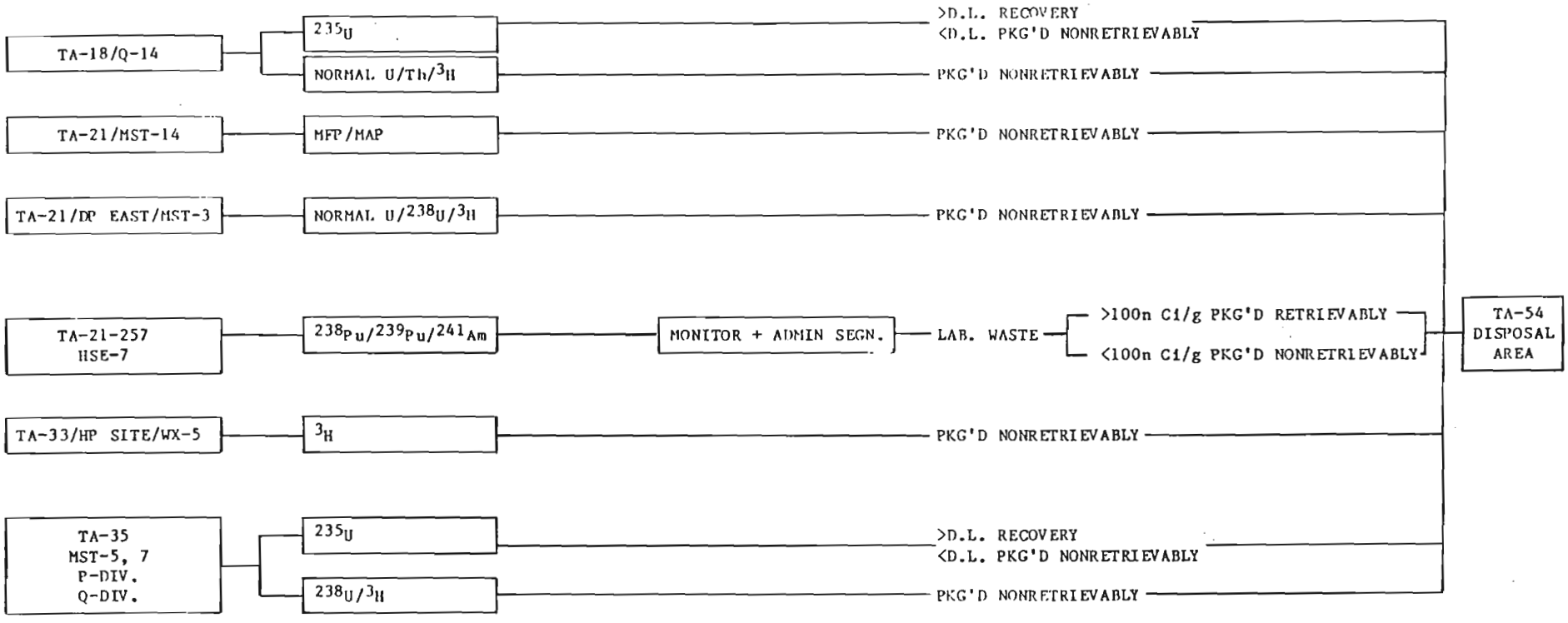

TA-18/Q-14
235U
NORMAL U/Th/3H
>D.L. RECOVERY
<D.L. PKG'D NONRETRIEVABLY
PKG'D NONRETRIEVABLY
TA-21/MST-14
MFP/MAP
PKG'D NONRETRIEVABLY
TA-21/DP EAST/MST-3
NORMAL U/238U/3H
PKG'D NONRETRIEVABLY
TA-21-257
HSE-7
238Pu/239Pu/241Am
MONITOR + ADMIN SEGN.
LAB. WASTE
>100n Ci/g PKG'D RETRIEVABLY
<100n Ci/g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

Fig. 16. (cont)

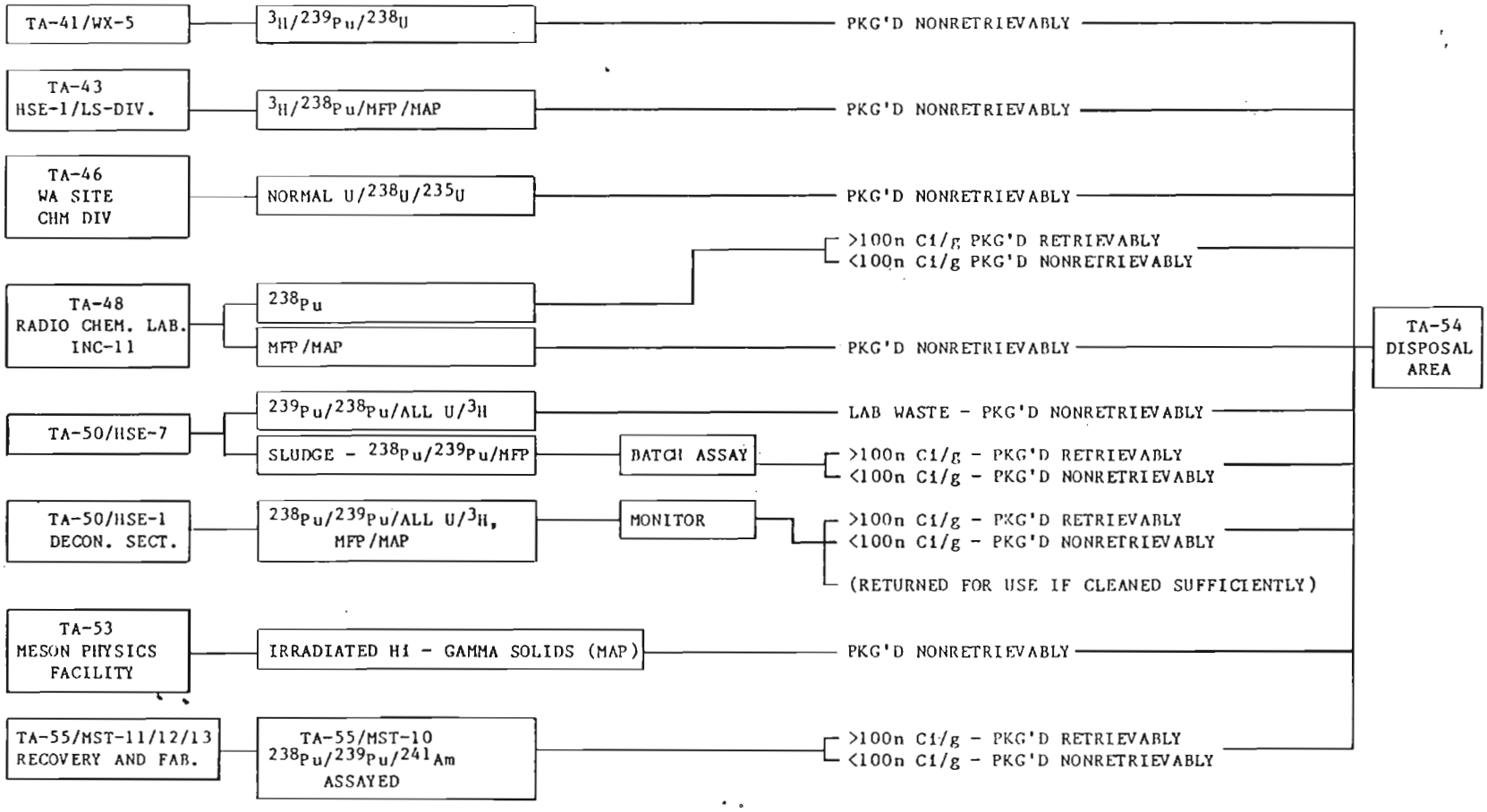

TA-41/WX-5
$^{3}H/^{239}Pu/^{238}U$
PKG'D NONRETRIEVABLY
TA-43
HSE-1/LS-DIV.
$^{3}H/^{238}Pu$/MFP/MAP
PKG'D NONRETRIEVABLY
TA-46
WA SITE
CHM DIV
NORMAL U/$^{238}U/^{235}U$
PKG'D NONRETRIEVABLY
>100n Ci/g PKG'D RETRIEVABLY
<100n Ci/g PKG'D NONRETRIEVABLY
TA-48
RADIO CHEM. LAB.
INC-11
^{238}Pu
MFP/MAP
PKG'D NONRETRIEVABLY
TA-54
DISPOSAL
AREA
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
>100n Ci/g - PKG'D RETRIEVABLY
<100n Ci/g - PKG'D NONRETRIEVABLY
TA-50/HSE-1
DECON. SECT.
$^{238}Pu/^{239}Pu$/ALL U/^{3}H,
MFP/MAP
MONITOR
>100n Ci/g - PKG'D RETRIEVABLY
<100n Ci/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
>100n Ci/g - PKG'D RETRIEVABLY
<100n Ci/g - PKG'D NONRETRIEVABLY

Fig. 16. (cont)

TABLE I

WASTE BURIED/STORED REPORTED

FY 1984

Waste Category	Buried (B) Stored (S)	Volume (m^3)	Radio-activity (Ci)[a]	Radionuclide Content (g) Pu	Am	U/Th
1 - CH-TRU	S	376.4	57148.6	77885.4	34.6	350929.9
2 - U/Th	B	1913.6	2.5			7092110
3 - MFP	B	129.4	269.1			
4 - MAP	B	274.7	6367.2			
5 - H-3	B	312.8	150804			
6 - RH-TRU	S	1.7	360.6	4.9		19.7
7 - Alpha	B	2362.7	34.0	35.2	5.1	6.2
	TOTALS	5371.3	214986	77925.5	39.7	7443055.8

a Total activity of all contaminants.

TABLE II

PROJECTIONS OF WASTE BURIED/STORED AT LOS ALAMOS[a]

FY 1985

Waste Category	Buried (B) Stored (S)	Volume m^3
1 - CH-TRU[b]	S	338
2 - U/Th	B	1200
3 - MFP	B	975
4 - MAP	B	350
5 - H-3	B	300
6 - RH-TRU	S	5
7 - Alpha	B	3000

a Exclusive of any major D&D project(s) that may be added, but which are not currently planned, and of any significant volume of off-site waste.

b ^{226}Ra and ^{233}U are treated as TRU waste at concentrations >100 nCi/g.

Low-level mixed waste is generated at the Laboratory. The type of waste involved and projected annual generation rates are summarized in Table III.

TABLE III

LOW-LEVEL MIXED WASTE GENERATED AT LOS ALAMOS

Description	Chemical Composition Including Radioactive Constituents	Annual Generation Rate (m^3)
Scintillation Vials	Benzene, Toluene, Xylene; Pu, ^3H, ^{14}C, ^{32}P	10
Lithium Hydride	Pieces/Fragments of LiH; ^{238}U	1
Miscellaneous Chemicals	Variable Chemical Composition and Radioactive Contamination	1

II.D. Radioactive Waste Management Operations

II.D.1 Treatment Facilities

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

The TA-50 facility[4-8] (Fig. 17) 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 late FY 1985 or early FY 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) and forwarded to the solid waste disposal/storage area at Area G. (At this time, all the sludge is >100n Ci/g.) The

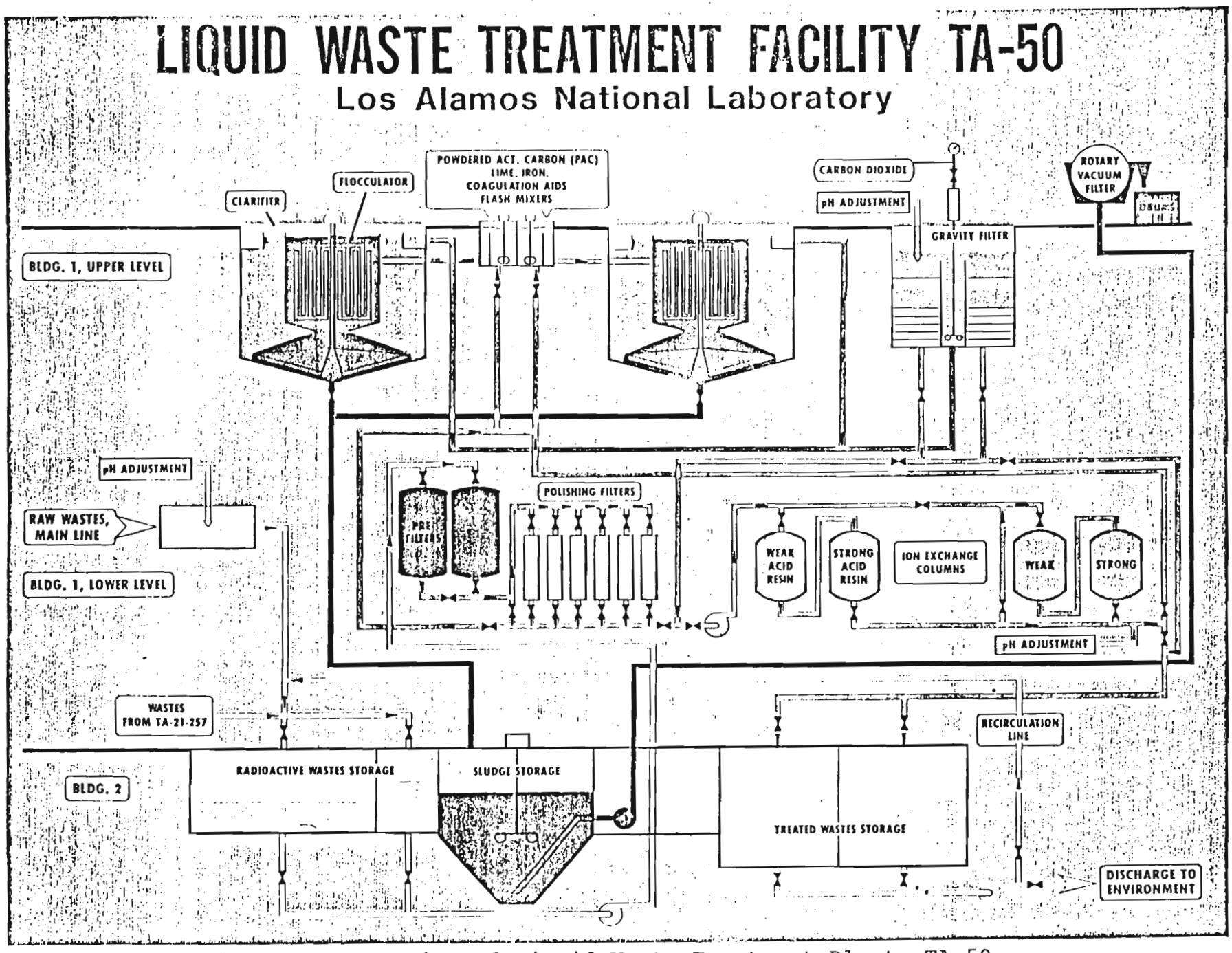


Fig. 17. Contaminated Liquid Waste Treatment Plant, TA-50
Schematic Flow Diagram for Normal Operation

sludge looks like wet clay, with no free water. To further insure the absence of free water, some 10 pounds of Portland cement powder is placed in the bottom of the drum liner before the sludge is added and another 10 pounds of cement is placed on top of the sludge after the drum is filled. Drum liners are 2.3-mm (90-mil) black, cross-linked, high-density polyethylene units that provide, with the steel overpack, a package expected to maintain its integrity in storage for a minimum of 20 years.

During the period April 1983 through December 1984, liquid process wastes from the Plutonium Facility have been 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 83 drums, each containing 140 L (36 gal.) of cement paste. cement paste. For this period, the total $^{238,239,240}Pu$ contained in these drums was 103 Ci while ^{241}Am was 121 Ci.

The TRU content of the TA-50 plant vacuum filter sludge declined from about 2700 nCi/g in January of 1983 to about 100 nCi/g in October 1983. Cleanup operations and an extensive shut down period (while the vacuum filter was being replaced) have kept the vacuum filter sludge slightly above 100 nCi/g. It is expected that in 1985, this value will drop below 100 nCi/g, allowing this waste to be buried as low-level.

In CY 1984, the TA-50 plant treated 3.49×10^7 liters (9.18×10^6 gal.) of liquid waste containing 9.8 Ci of Pu and Am. Effluents discharged contained 22.4 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 387 drums. This sludge contained 4.35 Ci of Am and 4.8 Ci of Pu. All but 62 of the 809 drums contained over 100 nCi/g of Am and Pu.

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

This plant[5-9] (Fig. 18) 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 CY 1984, 3.46×10^6 L (9.1×10^5 gal.) of waste containing about 0.1 Ci of alpha radioactivity were treated. About

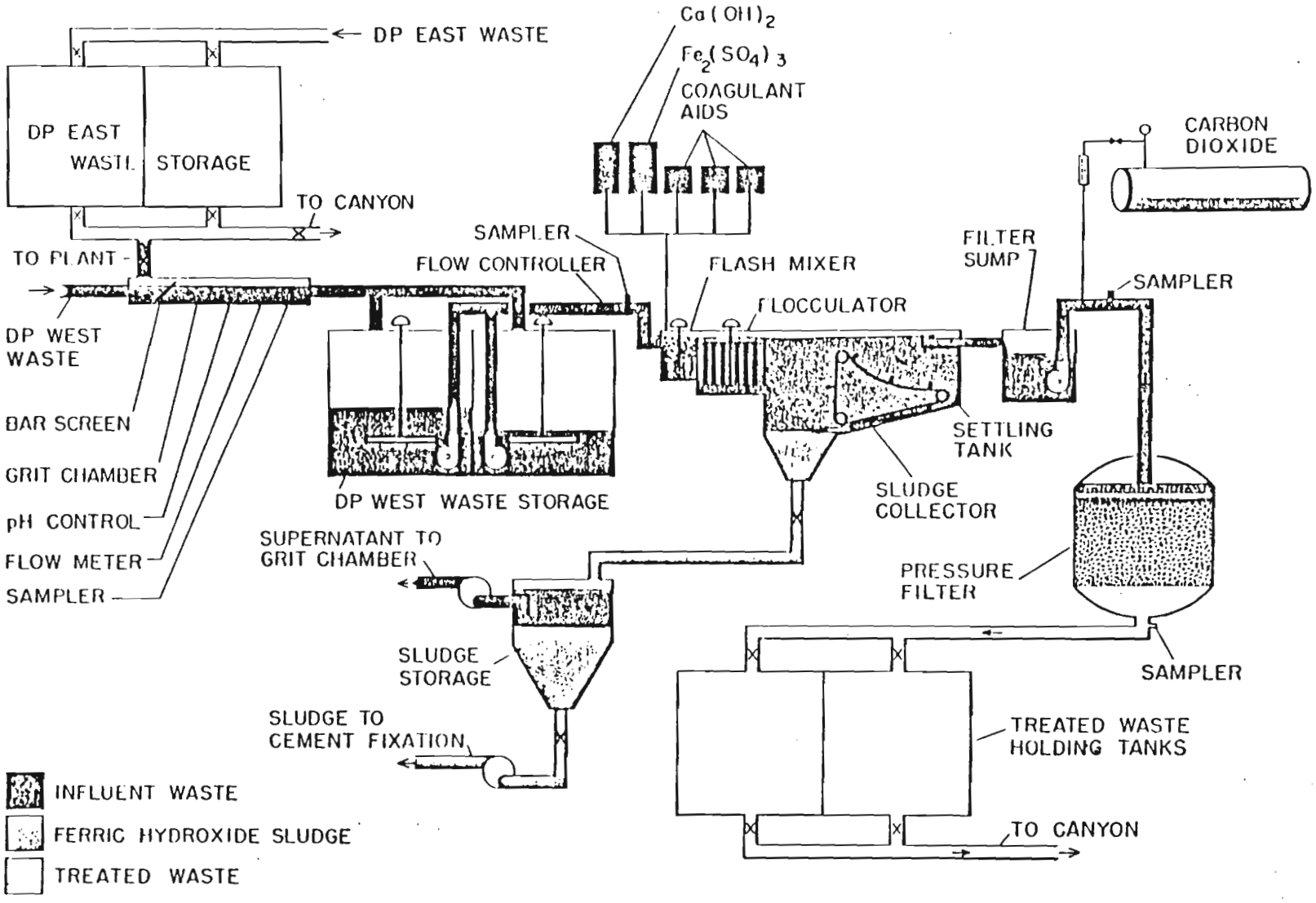


Fig. 18. Contaminated Liquid Waste Treatment Plant TA-21-257

3.9 mCi of gross-alpha activity were discharged from this facility.

During CY 1983, a pug mill which had been used to make cement paste from the chemical sludge from this plant was replaced with a vacuum filter. All of the dewatered sludge from the vacuum filter contained less than 100 nCi/g TRU in CY 1984. Sludge in 130 of the 210-L (55-gal.) drums from the vacuum filter amounted to 27 300 L (12 480 gal.) and 0.5 Ci of alpha activity.

All uranium processing at TA-21 has stopped. After clean-up and processing of the sludge backlog, operations of the TA-21-257 plant will be reduced.

II.D.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]

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 1984 has compacted 8321 m^3 (293 731 ft^3) of waste to a burial volume of 1270.0 m^3 (44 831 ft^3), for an overall volume reduction of 5.0:1.

II.D.1.4 Size Reduction Facility, TA-50-69

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 1983, approximately 2560 m^3 (90 400 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. 19).

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 September 1984, a total volume of 76 m^3 (2684 ft^3) of TRU waste has been processed, resulting in an output volume of 21.4 m^3 (756 ft^3), for an overall volume reduction of approximately 3.6:1. 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.

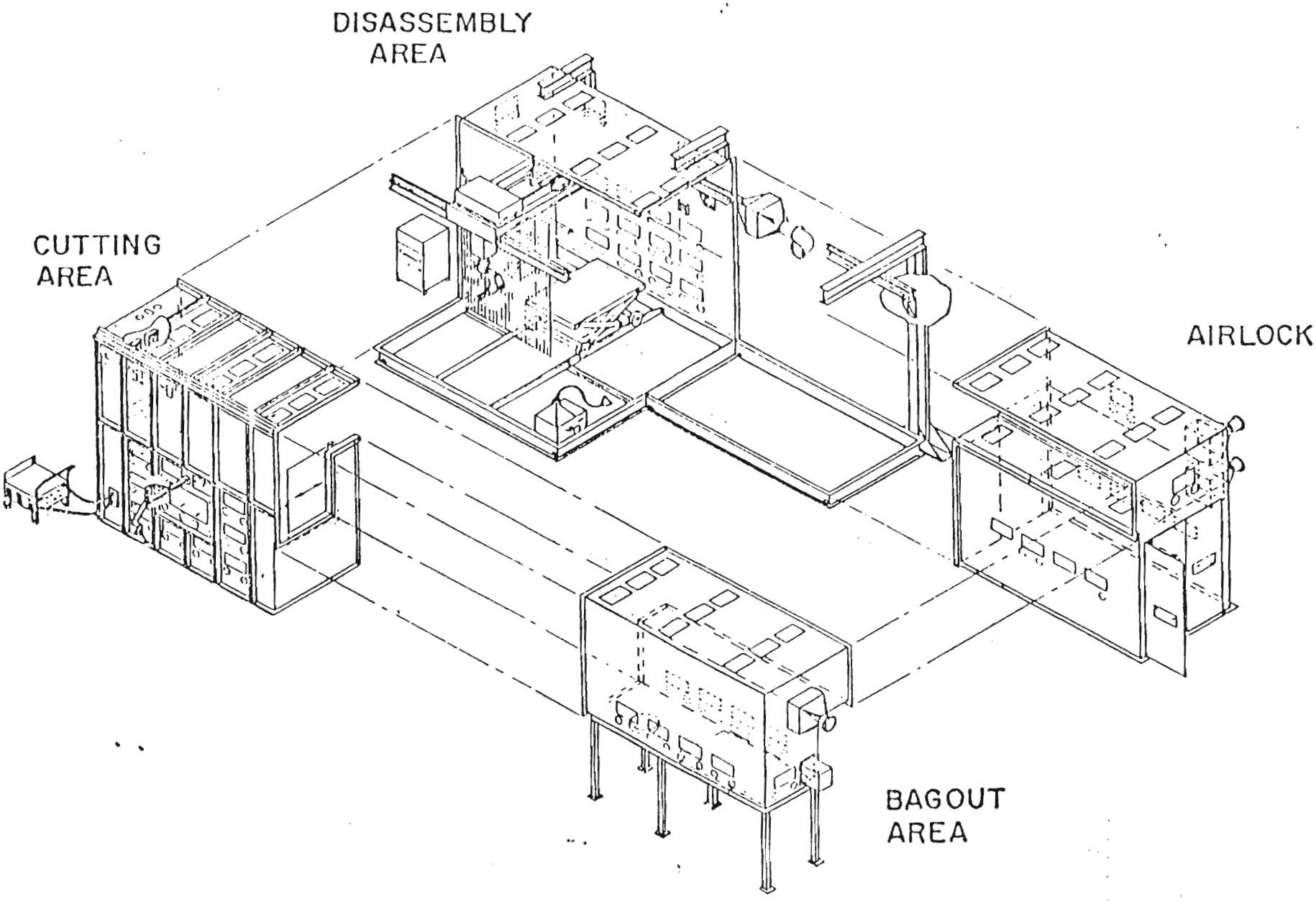


Fig. 19. Glove Box Module

Currently planned improvements to the SRF 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 1985. Following completion of this work, successful operational experience at the 50 gram level, and the associated Safety Analysis documentation, the TRU inventory limit for the SRF may be raised to 400 g, a level allowing subsequent processing of all appropriate Los Alamos stored and newly generated TRU wastes.

II.D.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. 20). 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

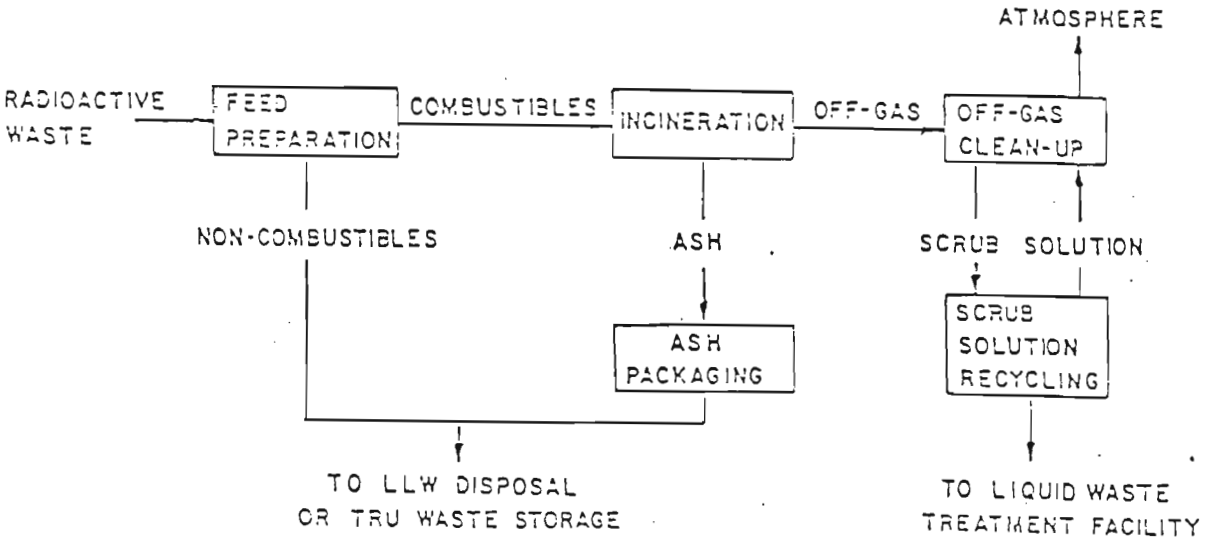


Fig. 20. CAI Process Flow Diagram

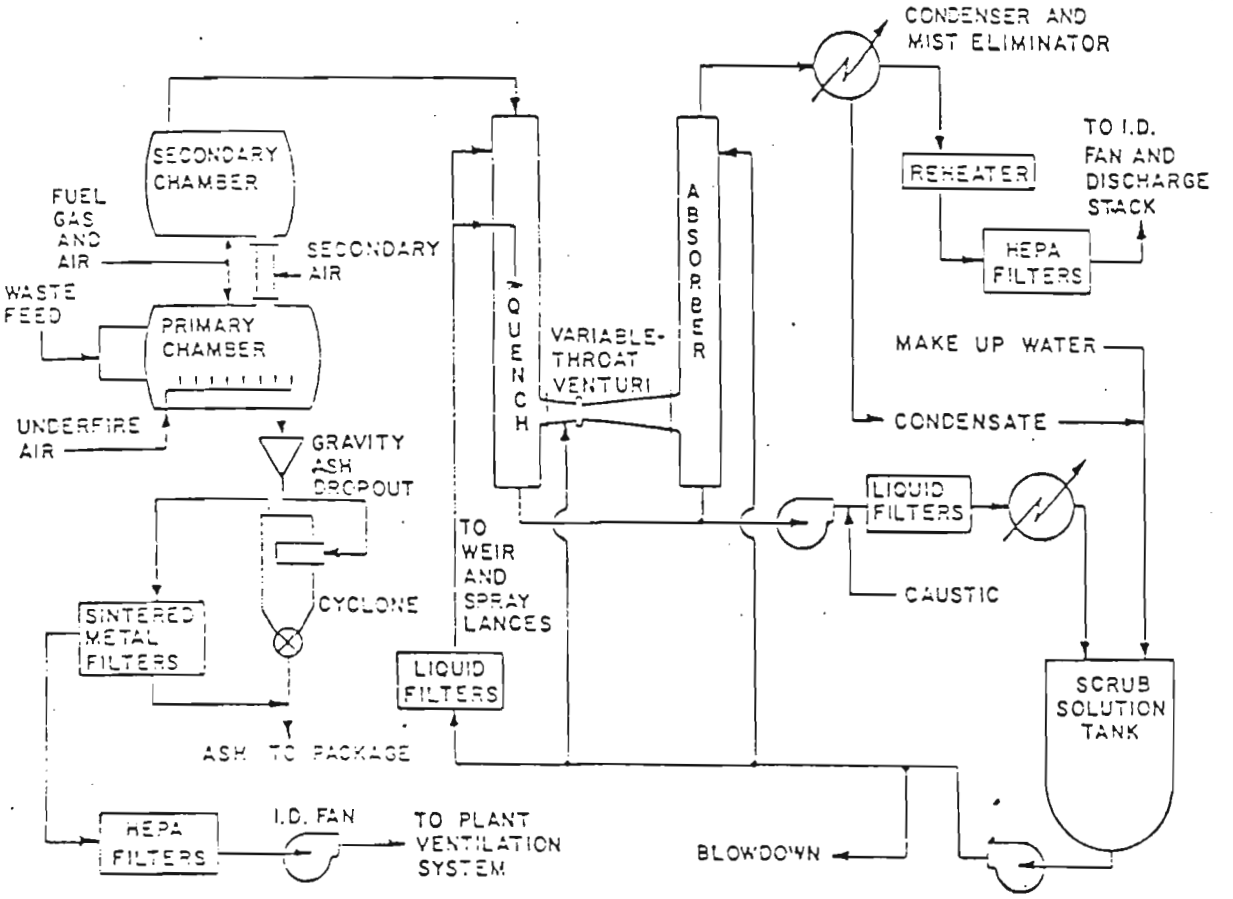


Fig. 21. CAI Process Schematic Without Feed Preparation Line

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. 21.

Current plans are to utilize the existing CAI to incinerate approximately 65% of newly generated TRU combustible wastes beginning in FY 1985. This percentage is based upon 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 a similar percentage of retrieved waste beginning in FY 1988. Approximately two 2-week operating campaigns per year will be required for newly generated wastes, and one 2-week campaign will be required per year for stored wastes. An ash immobilization system will be installed so that the product will be acceptable at WIPP.

Work currently is underway to obtain an EPA permit for the CAI to burn Laboratory waste organic chemicals, including 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. This work is done primarily to test the operational conditions necessary to incinerate smoke compounds.

II.D.2.6 Transuranic Waste Storage, and Certification

II.D.2.1 Waste Storage Operations, TA-54, Area G

Transuranic wastes are stored in facilities designed from modification of low-level waste buriel 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 encased 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. 22). One modified pit has also been used for TRU waste storage using much of 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. 23). Since the waste is actually below ground during storage, there is little need for additional shielding.

The ^{238}Pu wastes are 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. 24).

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

Planning currently is underway to retrieve these stored wastes to process them such that they meet the requirements of the Los Alamos Certification Plan for WIPP disposal.

II.D.2.2 TRU Waste Certification Program and Activities

II.D.2.2.1 Newly Generated Waste Certification Development

In the plutonium recovery operations, where the concentration of TRU nuclides in the waste may be economically recoverable, the waste is assayed before packaging to assure segregation of recoverable scrap from TRU waste. In most other facilities the waste is assayed after packaging to assure segregation of TRU from low-level waste. Solid wastes from liquid waste treatment

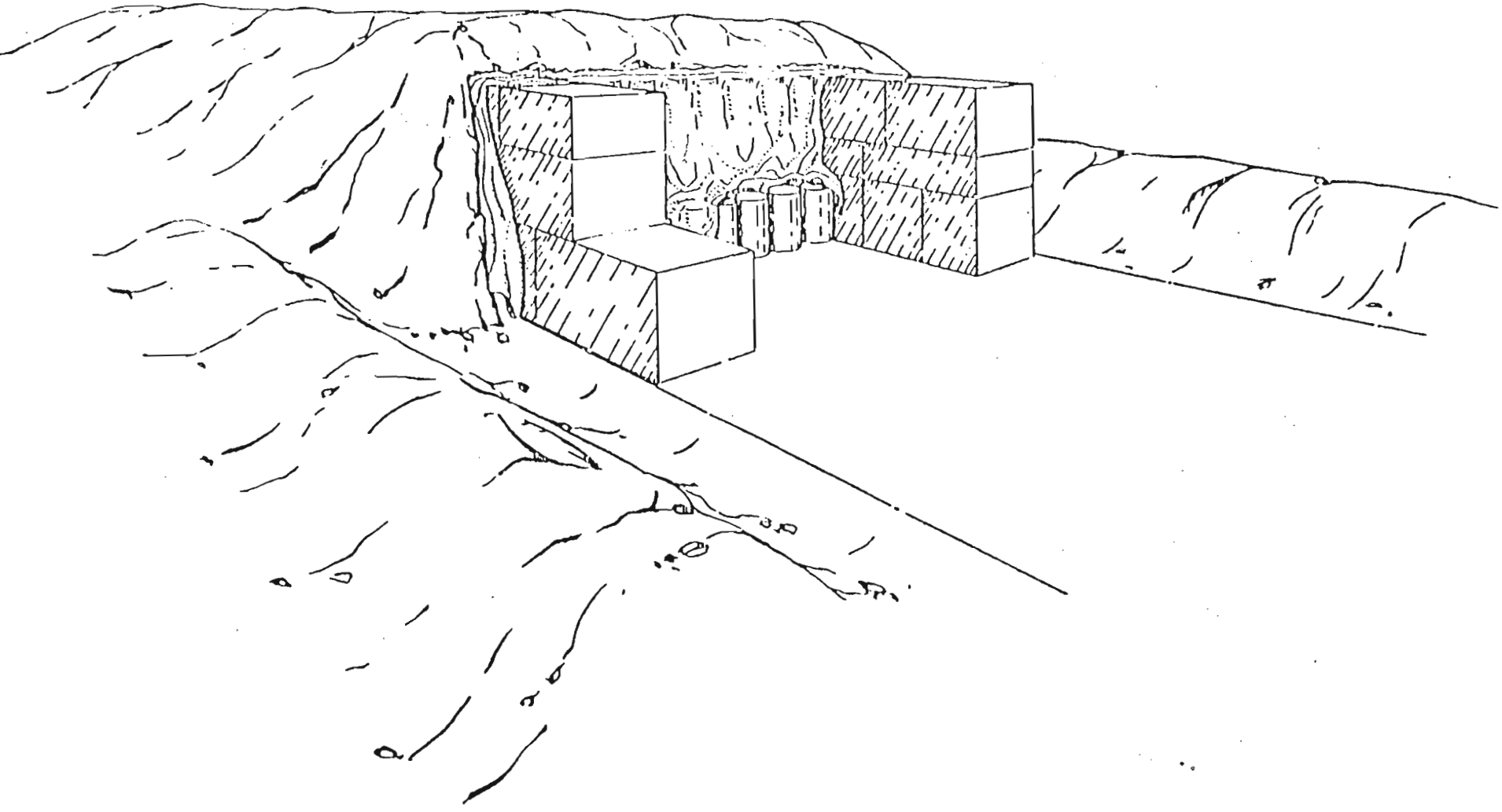
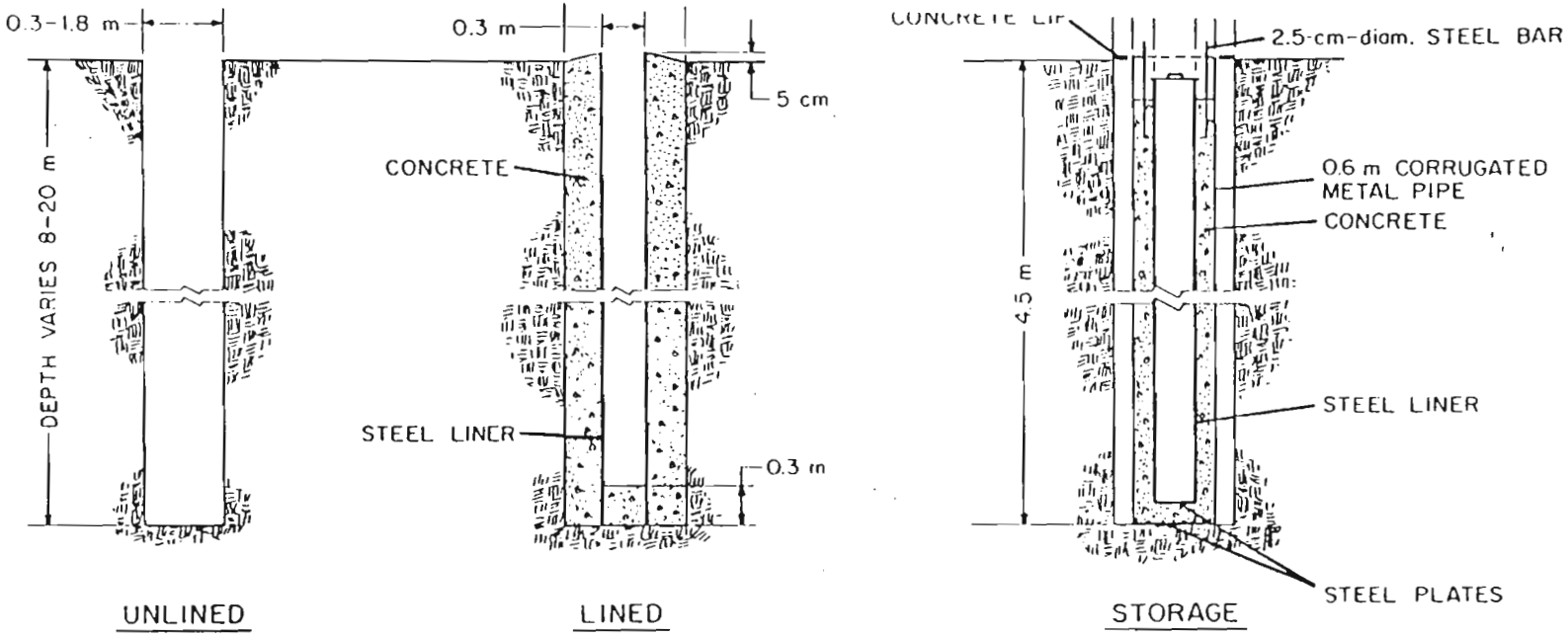
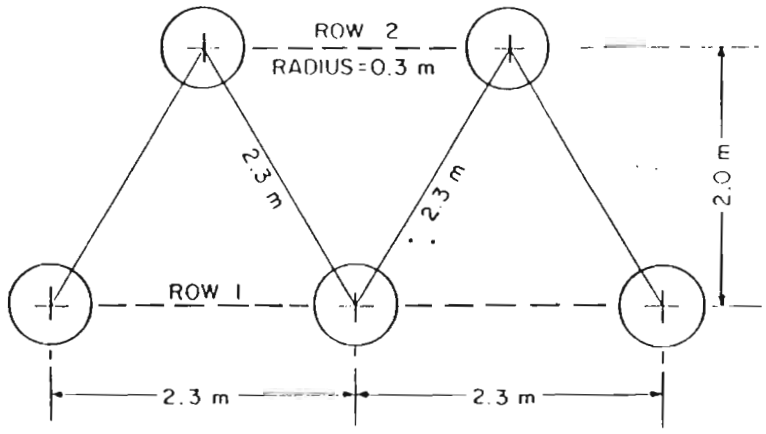


Fig. 22. TRU Waste Storage Pad

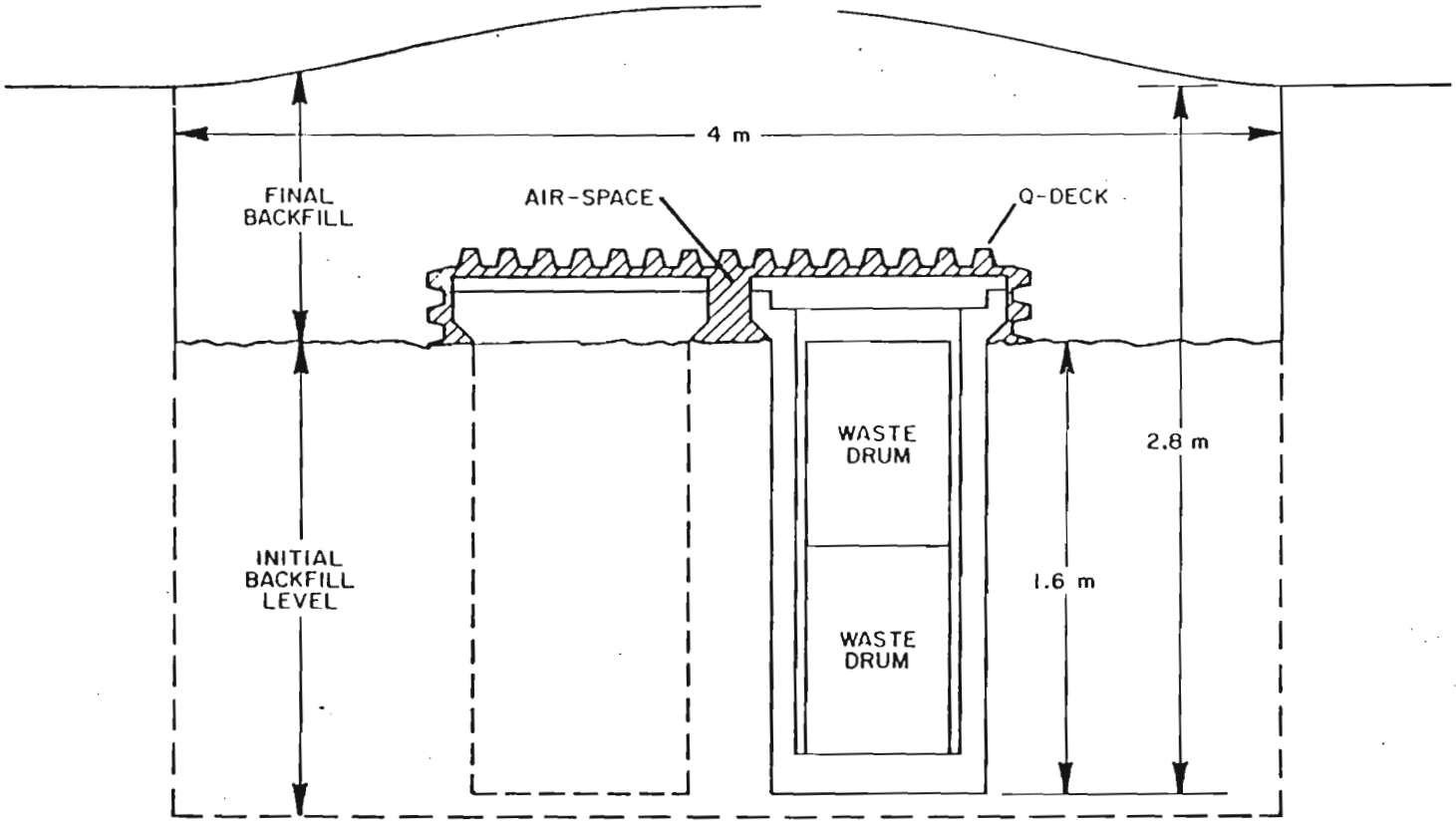


TYPICAL SHAFT DIAGRAM

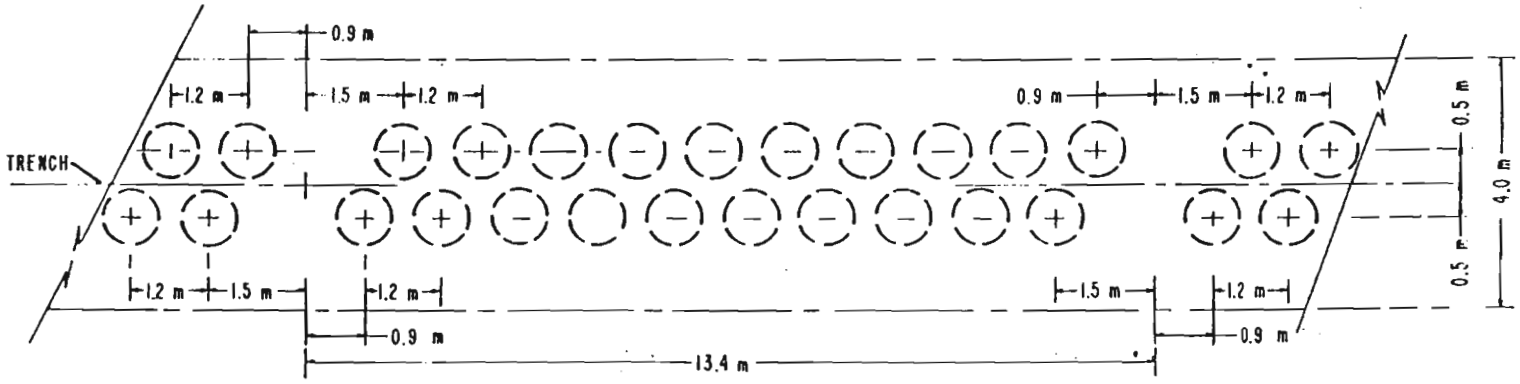


TYPICAL ORIENTATION FOR 0.3-0.9-m-DIAMETER SHAFTS

Fig. 23. LANL Burial Storage Shafts



TYPICAL CASK BURIAL



CASK LAYOUT DETAIL

Fig. 24. TRU Concrete Storage Cask Usage

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 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, packagng materials, housekeeping wastes, and facilities design.

A TRU Waste Certification Plan for newly generated waste has received preliminary approval from the Waste Acceptance Criteria Certification Committee (WACCC). 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, ten attachments are planned, covering eleven identified TRU waste streams. Of these, one (SRF wastes) has received preliminary WACCC approval, five others have been submitted for comments, and two exist in draft form. 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 1985.

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 non-specification containers that

are suitable for health and safety purposes. Los Alamos TRU waste has never been shipped off-site.

Shipment to the WIPP is currently 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 successfully stored since 1971.

II.D.2.2.2 **Stored Waste Work-Off**

Through FY 1984, approximately 6500 m^3 of uncertified TRU wastes are 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) are U-233 and Pu-238 wastes packaged in 114-L (30-gal.) drums stored in concrete casks at TA-54, and 426 m^3 (15 03 ft^3) are cemented sludge in CMPs stored at TA-21. The balance is stored at TA-54 in 210-liter (55-gal.) drums and fiberglass-coated plywood crates on asphalt pads, protected from the elements by 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. Planned methods of meeting the WIPP criteria include visual inspection, real-time x-ray radiography, active/passive examination, radionuclide assay, 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 being designed. 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 (NDE/A) Facility for certification of wastes that need no processing is scheduled to

begin operation in FY 1988. Associated with the NDE/A Facility will be the Transportation Facility where the TRUPACT will be loaded and prepared for shipment to WIPP. A 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. Preconceptual design of the two facilities is progressing, and will be complete in FY 1985.

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.D.2.2.3 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. 25). 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 needed for waste retrieval, transportation documentation, and the WIPP 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.

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

Area G is situated on Mesita del Buey in TA-54 and is the main active radioactive solid waste burial/storage site at the

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
☐ 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)*	

SS MATERIALS WRITE-OFF		RADIONUCLIDE CONTENT		C = Curie M = Gram
Account	Project Code	Nuclide	Amount	
			0 E ±	
			0 E ±	
			0 E ±	
			0 E ±	
			0 E ±	
			0 E ±	

Drum Lot Code | Year of Mfr.

Manufacturer's Box Serial Number

Process Batch Code

Gross Wt. (kg) 0 E ±

Organic Mat'l Wt. (kg) 0 E ±

Organic Mat'l Vol (%)

Content Code

Date Closed (MMDDYY)

TOXIC OR CORROSIVE MATERIALS		
Name	Code	Quantity (g)
		0 E ±
		0 E ±
		0 E ±
		0 E ±

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) 0 E ±

Survey Meter Model

Survey Meter Serial No.

Alpha Contamination (dpm/100cm2) 0 E ±

Beta-Gamma Cont. (dpm/100cm2) 0 E ±

The data in this section were collected as prescribed in approved procedures. The package is properly closed and is safe to handle and transport.

Printed Name	Date
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) 0 E ±

Survey Meter Model

Survey Meter Serial No.

Alpha Contamination (dpm/100cm2) 0 E ±

Beta-Gamma Cont. (dpm/100cm2) 0 E ±

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.

Printed Name	Date
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.

Printed Name	Date
Signature	

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
Signature	

HS Form Number 10-2B (12/83)

Fig. 25. Certified Waste Storage Record

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); future expansions of this area are planned. Burial/storage facilities within the area include pits, shafts, trenches, and pads, all of varying dimensions. Figures 26 and 27 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 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 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.

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 will discontinue this practice on May 1, 1985. At that time mixed wastes will be 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.

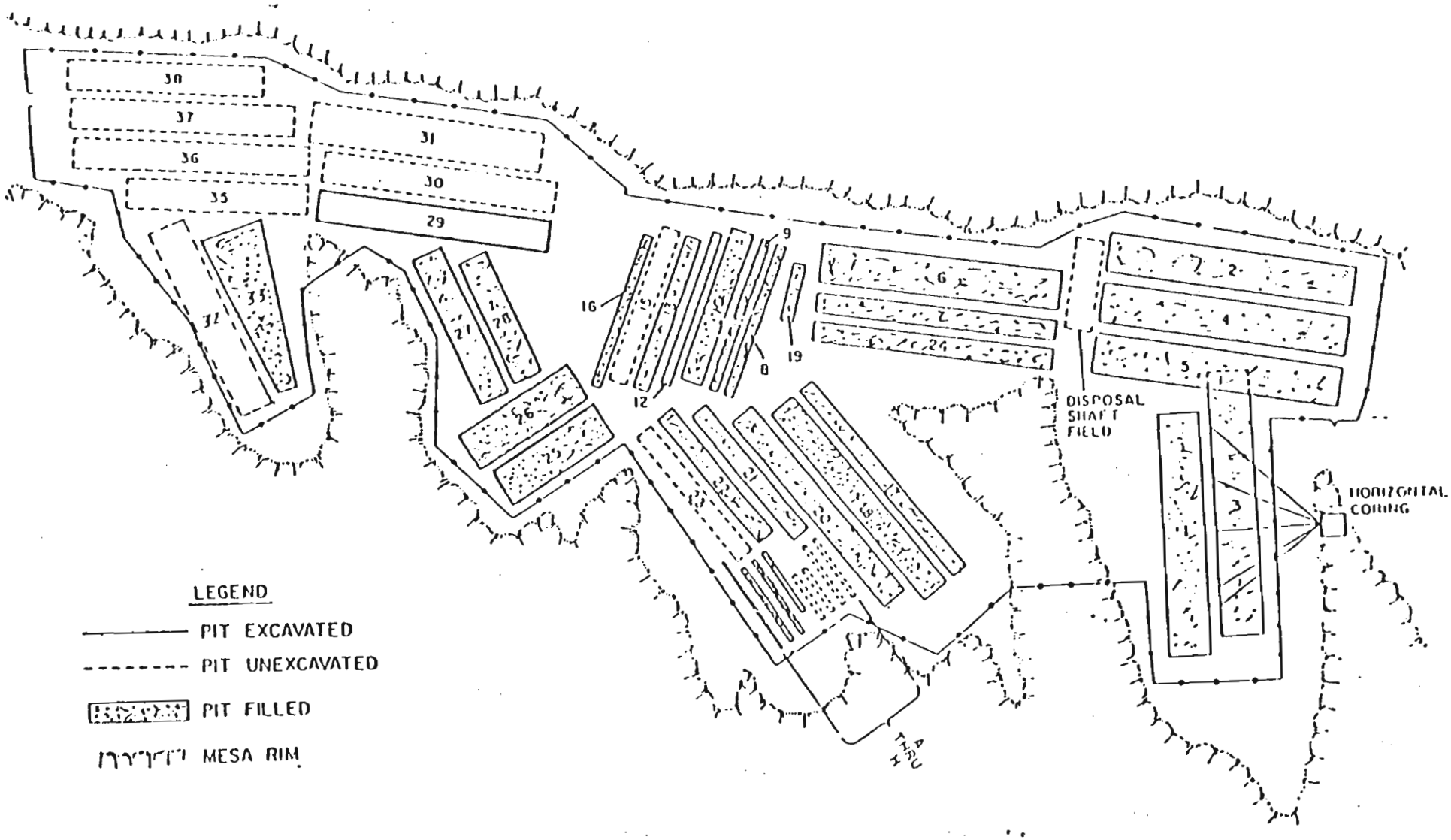
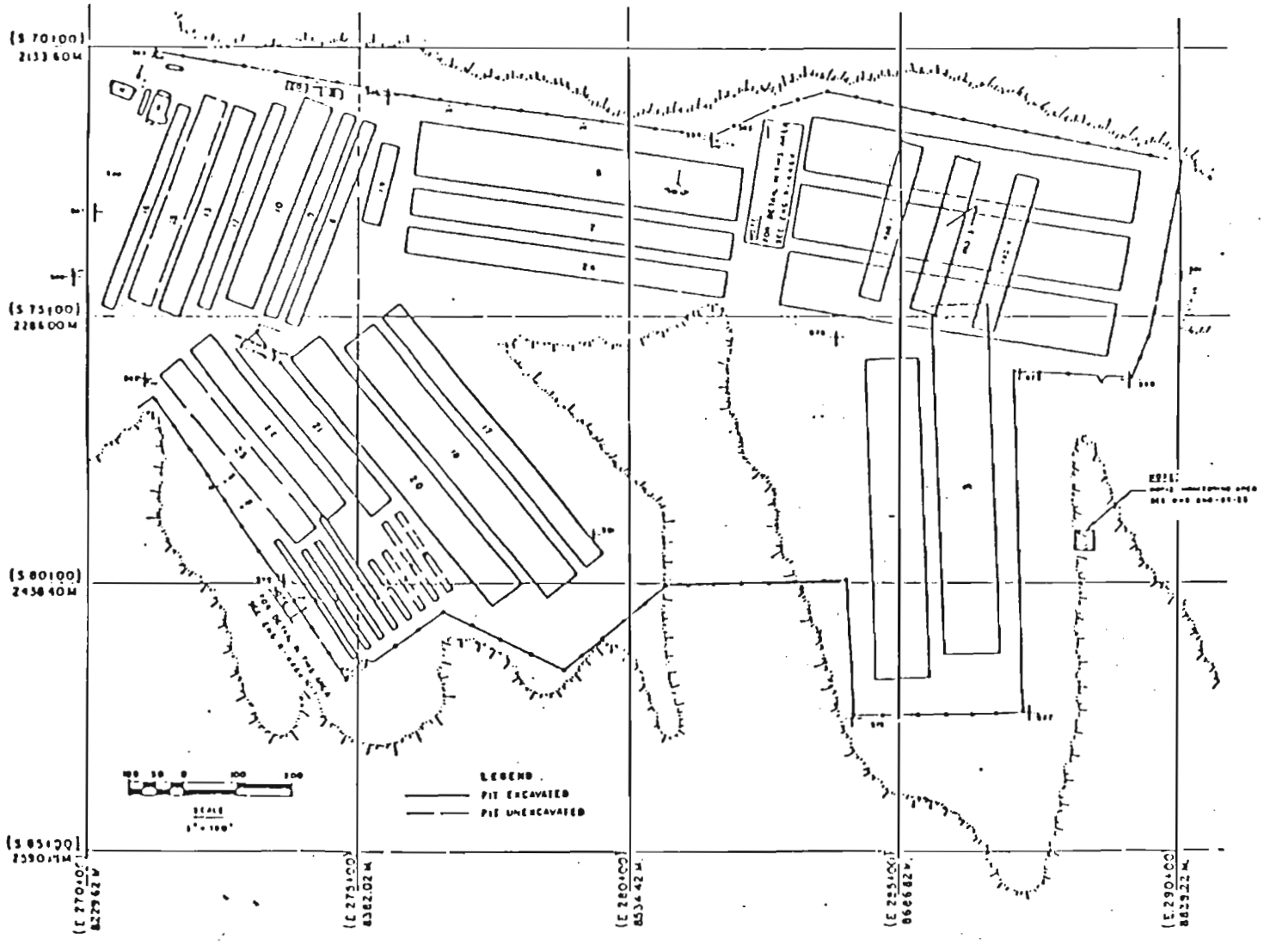


Fig. 26. TA-54, Area G



SITE FACILITIES

2-Compactor/Shop bldg.

8-TRU drum storage shed

10-Meteorological station

11-Office/change bldg.

PP-Power pole

Fig. 27. TA-54, Layout of Older Portion of Area G and Site Facilities

Standard waste packaging is described in the Laboratory's Administrative Requirement 10-2, "Radioactive Solid Waste" (Appendix F). It also details which wastes, such as untreated reactive material, are unacceptable for disposal. The criteria for the transportation of radioactive material are also contained in a Laboratory Administrative Requirement (AR 3-5, "Shipment of Radioactive Materials," Appendix G). 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 aspects of waste receiving and acceptance is the monitoring of procedures developed 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. 28). The waste generator signature certifies compliance with all applicable disposal requirements and the health physics

PLEASE READ INSTRUCTIONS ON BACK CAREFULLY

1. FORM NUMBER
S 8 5 2045

LOS ALAMOS RADIOACTIVE SOLID WASTE DISPOSAL RECORD

HSE-7 Waste Management
Ext 6095 MS J592

2. DATE
M M D D Y Y

3. RETRIEVABLE SERIAL NO.

4. ORIGIN OF WASTE

GROUP	TA	BLDG.	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-ft^3

8. GROSS VOLUME — UNITS: M = METER^3, F = FEET^3, G = GALLON

9. PACKAGE RADIATION AT:

SURFACE MR/HR	1 METER MR/HR

10. GROSS WEIGHT — UNITS: K = KILOGRAM, P = POUND, T = TON

11. ADDITIONAL DESCRIPTION OF PACKAGING AND PACKAGING MATERIALS

12. RADIONUCLIDE CONTENT — UNITS: C = CURIE, M = GRAM

NUCLIDE	AMOUNT	±	UNITS	ERROR ON AMOUNT	±	AMOUNT DETERMINED BY: A = ANALYSIS, M = MEASUREMENT, E = ESTIMATE	SS MATERIALS WRITEOFF ACCOUNT	PROJECT CODE
	E			E				
	E			E				
	E			E				
	E			E				
	E			E				
	E			E				

WASTE GENERATOR
Signature certifies that waste is in accordance with all applicable disposal requirements.

HSE-1 AREA REPRESENTATIVE
Signature certifies that waste package or shipment is safe to handle and transport.

GROUP LEADER (AS NECESSARY)

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
Signature certifies waste met acceptance criteria, and all disposal requirements were met.

HS Form Number 10-2A (12/83)

Fig. 28. Radioactive Solid Waste Disposal Form

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 actioncan 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 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 (Appendix H). Greater confinement disposal in a pit is practiced for those wastes with TRU contamination between 10 nCi/g and 100 nCi/g (Appendix I).

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 wastes. While most shafts are unlined, a few are lined with concrete or metal primarily for additional contamination control.

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 23 m (75 ft). 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).

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, biological waste, and highly activated materials have been routinely placed in unlined shafts (Fig. 24).
Shafts are capped with concrete the entire final meter.

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-compac-

tible waste. Items such as radioactive "mixed" waste, biological waste, and highly activated materials are routinely placed in unlined shafts (Fig. 24).

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 >20mCi/m^3 must be placed in asphalt lined or encapsulated drums and them placed in lined shafts (Fig. 24). 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 accomplished 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.E. 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 or stored 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 future management of these waste streams is anticipated to be storage and incineration, but will depend upon the guidance expected to be issued in the coming year.

II.F. Description of Decontamination and Decommissioning

II.F.1 General Project Plan

All major D&D projects at the Laboratory are planned in accordance with the DOE Manual Chapter 6101 and the "Handbook for ALO Project Development and Management". These plans set forth a plan of action for the design, procurement, construction, and management of a project. Appendix J, the project management plan for the radioactive liquid waste collection system improvements, provides an example of this plan. Final reports are written for all major D&D projects.

Procedures for smaller D&D projects, such as glove box removal from a laboratory, are provided by a special work permit (SWP) or an SOP. These documents would address how items would be cleaned, assayed, and removed, as well as the personal protection equipment required to perform the project.

II.F.2 Decommissioning Projects

Two Laboratory facilities have been identified as decommissioning candidates by the DOE's Surplus Facilities Management Program, the TA-2 Water Boiler Reactor, and the TA-52 UHTREX Reactor. One major on-going project is the removal of the old industrial liquid waste line. Funding for this latter project is derived from construction funds for the new liquid waste line.

The Water Boiler Reactor, located in Los Alamos Canyon, was a low power homogeneous reactor fueled with enriched uranyl nitrate solution. The fuel, removed in 1974, was contained in a stainless steel sphere with a volume of approximately 13 liters

(3.4 gal.). The reactor vessel with its associated recombiner and plumbing is contained in a concrete, graphite-lined biological shield structure that has an approximate volume of 73 m^3 (2577 ft^3). The reactor and its biological shield structure and control room are housed in a frame building approximately 18 m x 18 m x 18 m (59 ft x 59 ft x 59 ft). Gaseous effluents from the reactor were released via a small enclosure underground and proceeded through two underground concrete chambers and a valve house. The effluent line continued to a condensing trap and two 3 m^3 (106 ft^3) stainless steel delay tanks before terminating at a stack.

Decommissioning of the exterior structures is planned for FY 1985. Dismantling of the reactor structure is scheduled to begin the last quarter of FY 1988 and be completed in FY 1989. Forecast volumes of LLW are 375 m^3 (13 238 ft^3) in FY 1985 and 125 m^3 (4413 ft^3) total in FY 1988/89.

The UHTREX Reactor Facility is located south of Puye Road approximately 300 m (985 ft) east of Pajarito Road. This 3 MeV reactor was a gas-cooled, high-temperature research reactor which utilized enriched uranium impregnated in graphite rods for fuel elements. In addition to the reactor there are numerous large equipment items, such as heat exchangers, gas cleanup systems, pumps, filters, and a stack that require removal. The irradiated fuel elements have been removed; however, an undetermined quantit remain in the graphite liner of the reactor vessel along with a ^{238}Pu neutron source.

Decommissioning planning will begin work is planned to begin in FY 1987 and be completed in FY 1988. An estimated 125 m^3 (4413 ft^3) of LLW will in FY 1987 and FY 1988. The ^{238}Pu source will require special packaging but the volume of waste will be minimal. A model used during the planning and construction of UHTREX will be used to help plan the decommissioning.

A 1978 Line Item Project provided $12.5M to replace the Laboratory's Industrial Liquid Waste Collection System and to remove all abandoned lines throughout the Laboratory's technical

areas and Los Alamos County. The allocation was $8.35M for the new line and $4.15M for removal of the old lines. Installation of the new line was completed in October 1982.[13] General locations of the new systems are shown in Figures 29 and 30.

Removal of abandoned lines began in July 1981, concentrating on inactive lines that could be removed prior to completion of the new line. A transfer of $3.5M from project funds by DOE caused the removal to stop in December 1981. During those six months, 3900 m (12 796 ft) of line were removed and 2500 m^3 (88 250 ft^3) of low-level waste were sent to TA-54.

In October 1983, the $3.5M were returned to Los Alamos; removal operations resumed in December. The volumes of LLW forecast from this project since December 1983 are 1000 m^3 (35 300 ft^3) in FY 1984 and 2500 m^3 (88 250 ft^3) in FY 1985. The general location and descriptions for each line are shown in Figures 31 thru 36.

II.G. Budget

II.G.1 Liquid Waste Operations

Budget projections for management of low and intermediate-level liquid wastes are summarized below.

Year	Operating Costs	Capital Equipment	Construction	Total
FY 1984	1390	25	1000	2415
FY 1985	1500	40	300	1840
FY 1986	1650	25	50	1725

Much of the funding indicated for capital equipment and construction for FY 1984-85 is related to finishing major modifications and improvements in the liquid waste management collection system and at TA-50.

II.G.2 Airborne Waste Management

The only clearly identifiable operational cost associated with the Laboratory's airborne waste management program is for the routine monitoring of exhaust stacks. In FY 1984, this cost totaled approximately $170K. This level is expected to remain

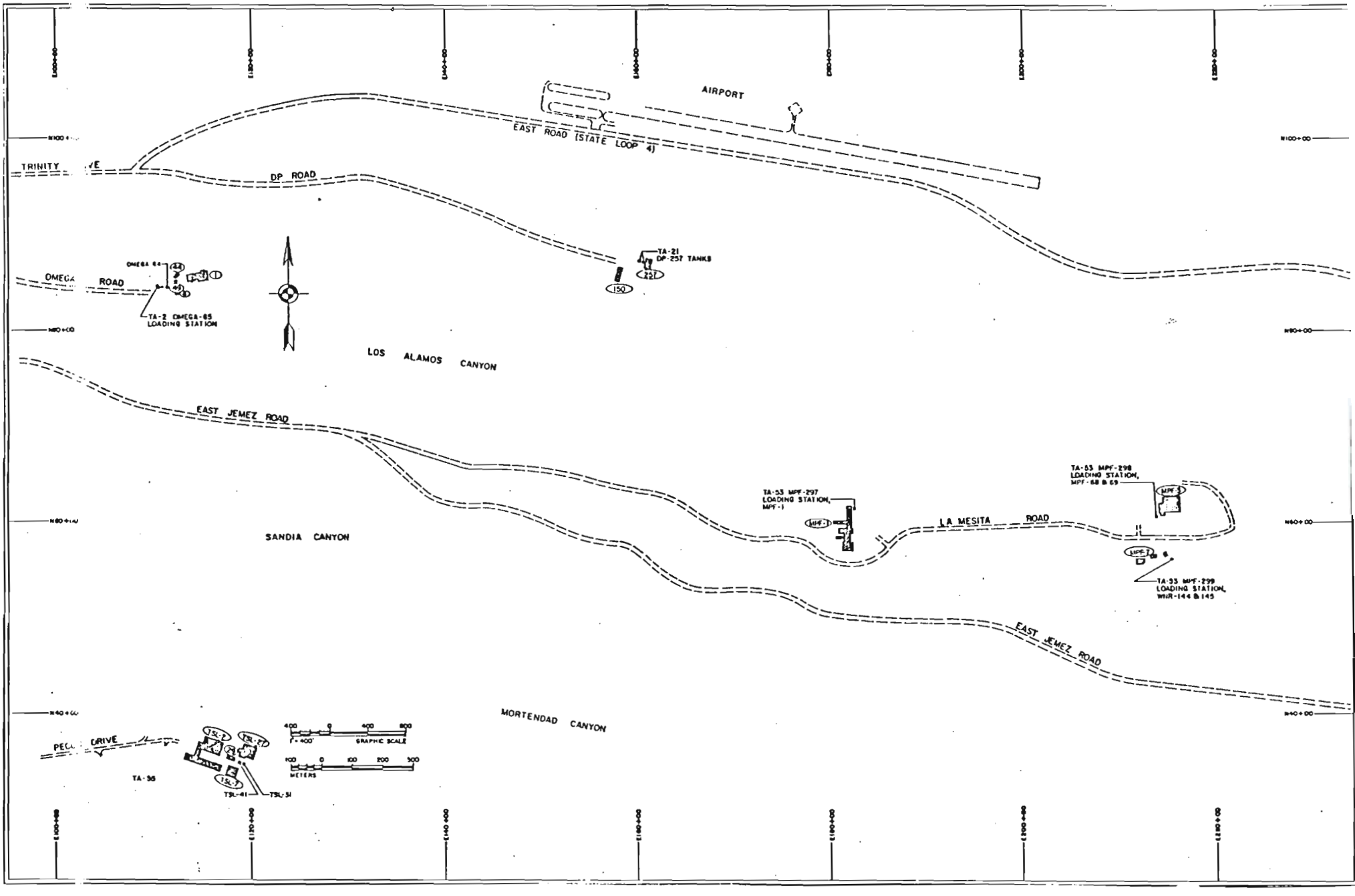


Fig. 30. New Industrial Waste Line

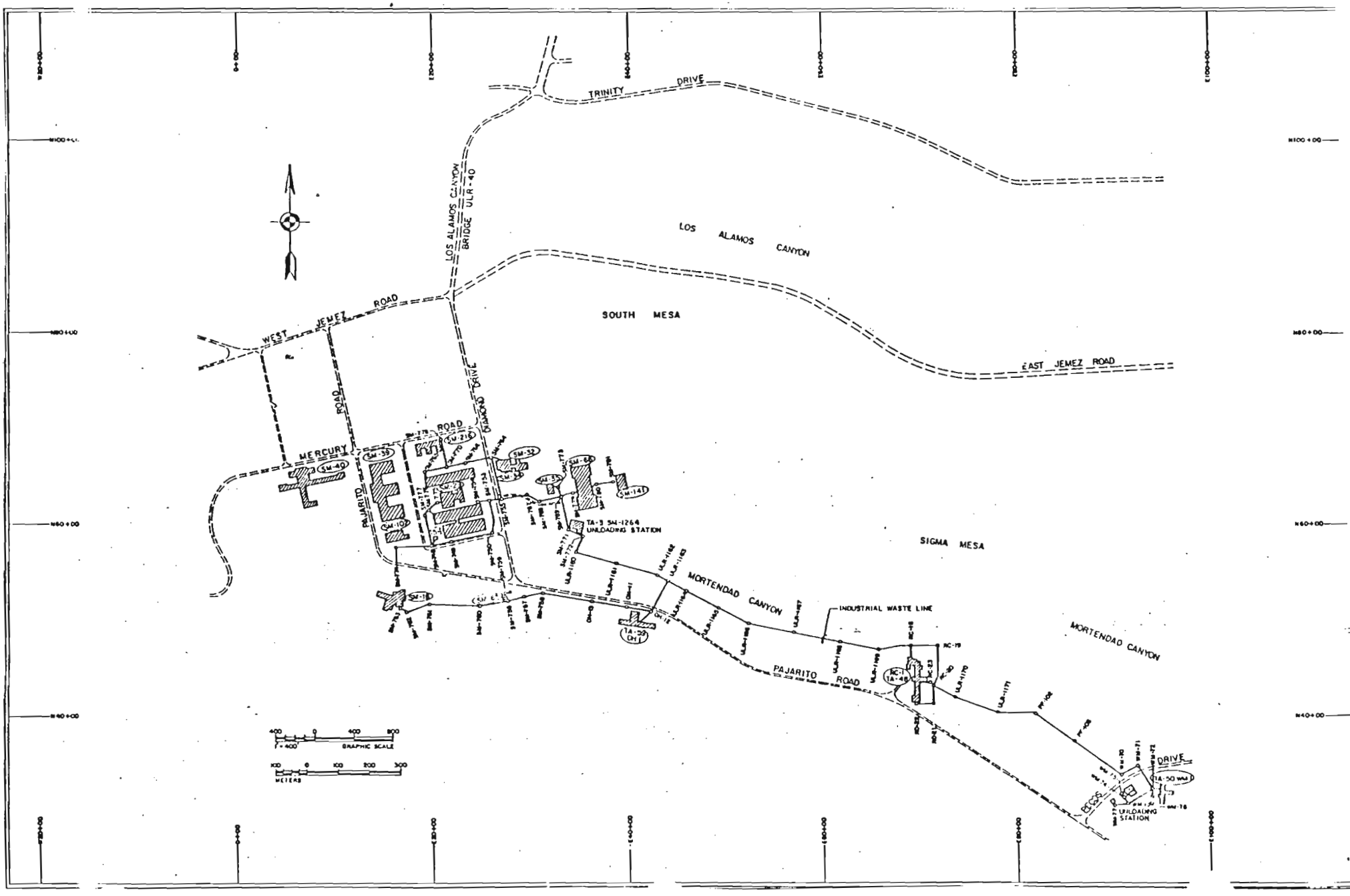


Fig. 29. New Industrial Waste Line

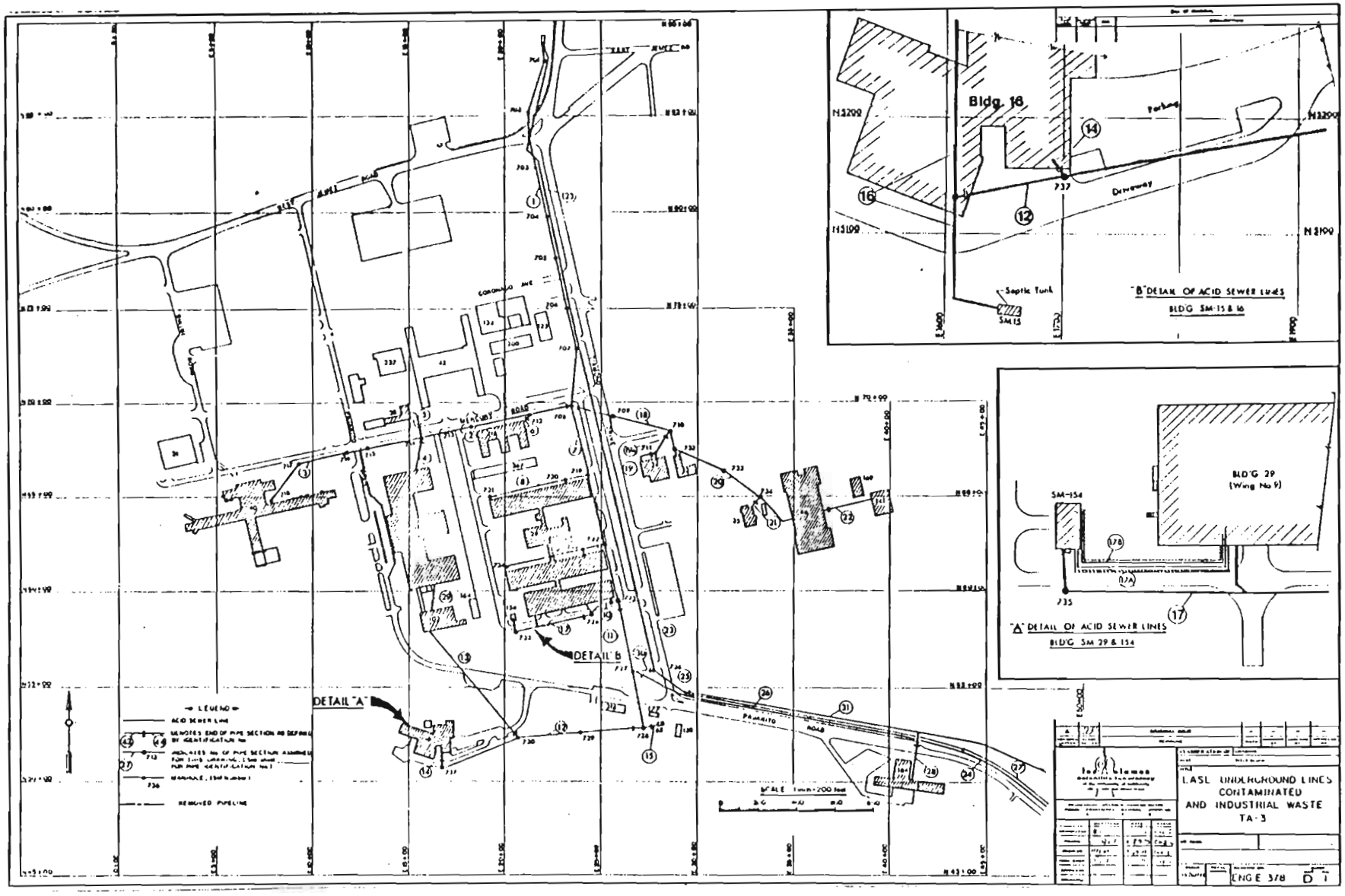


Fig. 31. Old Industrial Waste Line, TA-3

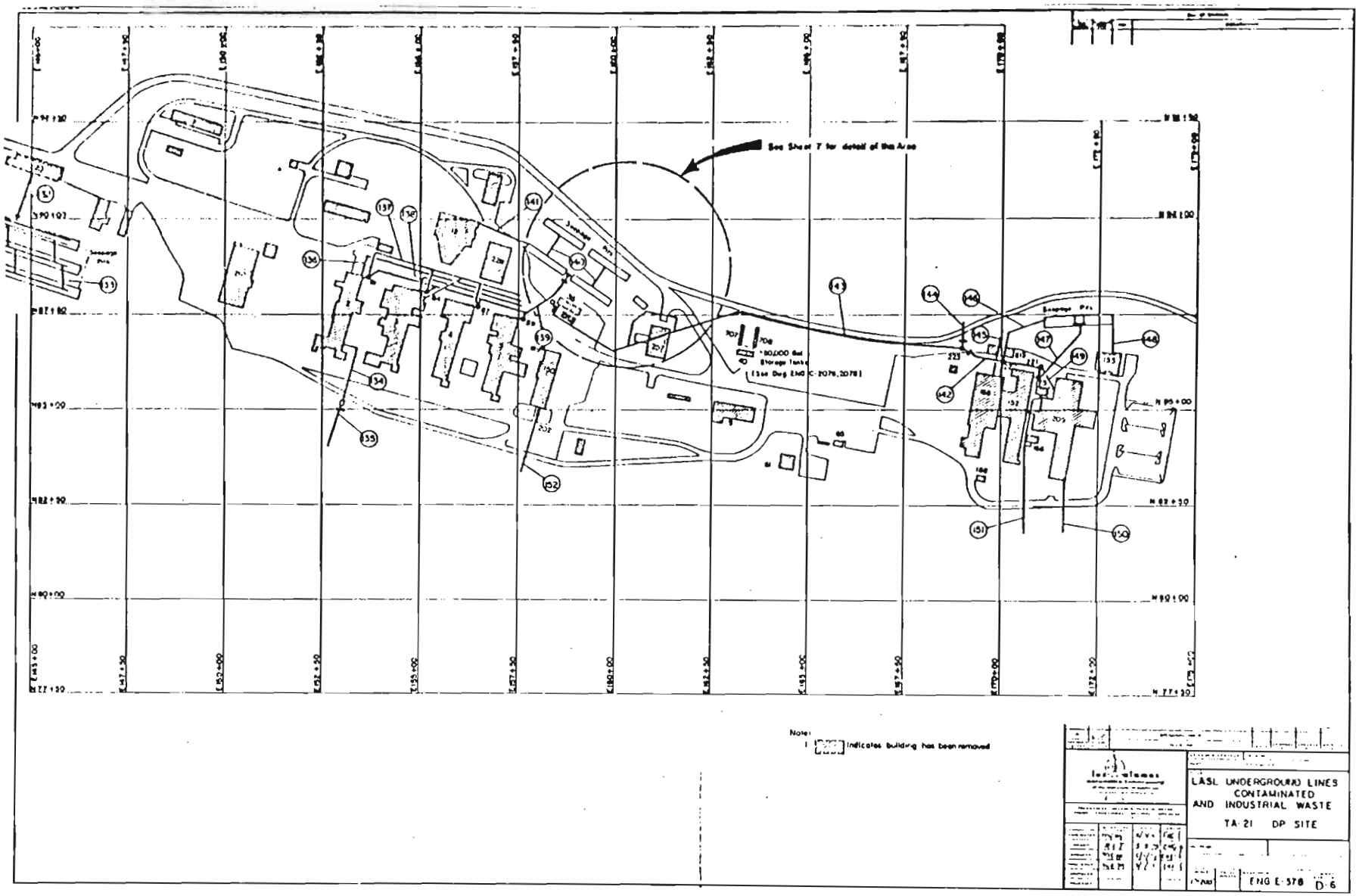


Fig. 32. Old Industrial Waste Line, TA-21

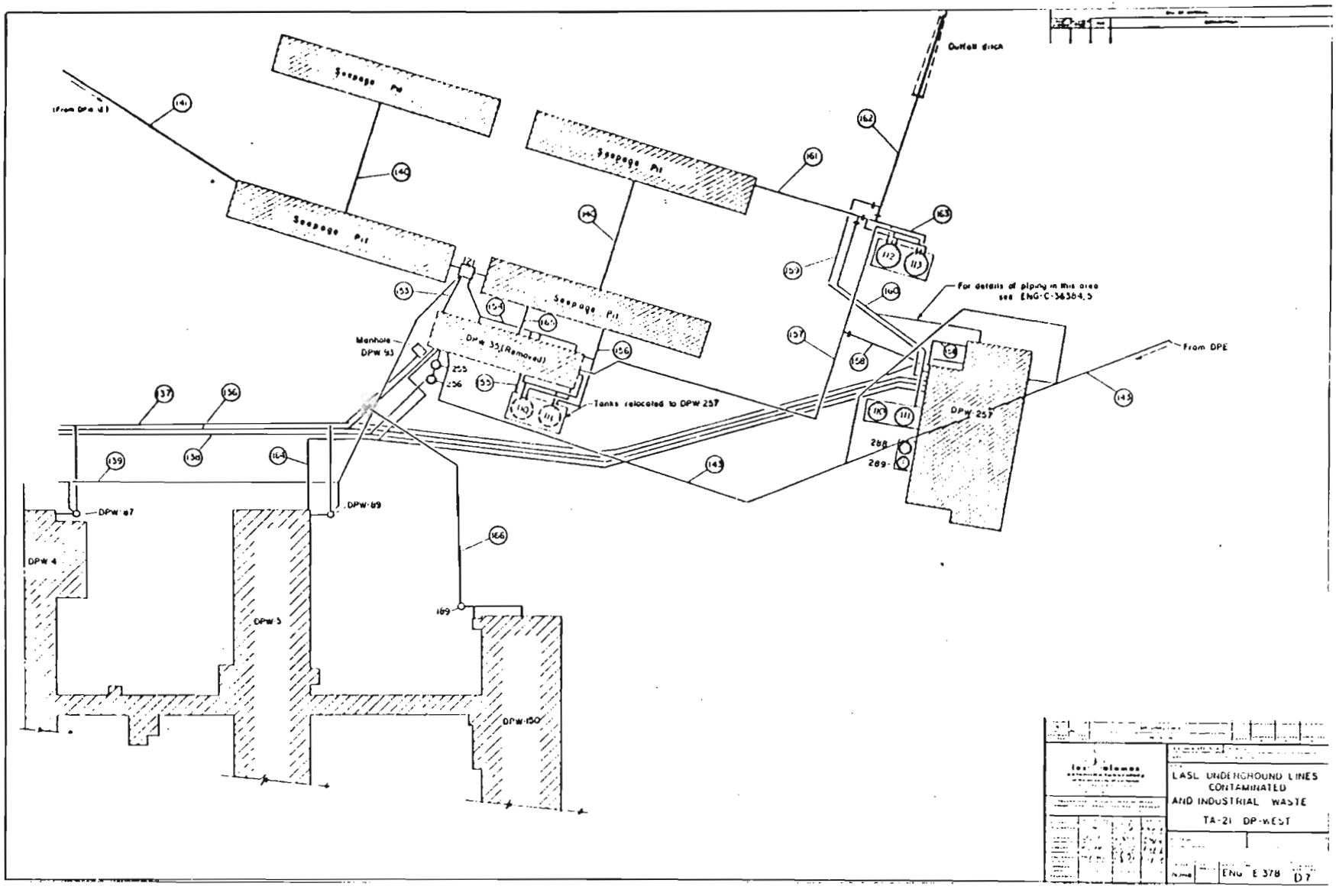


Fig. 33. Old Industrial Waste Line, TA-21, DP-West

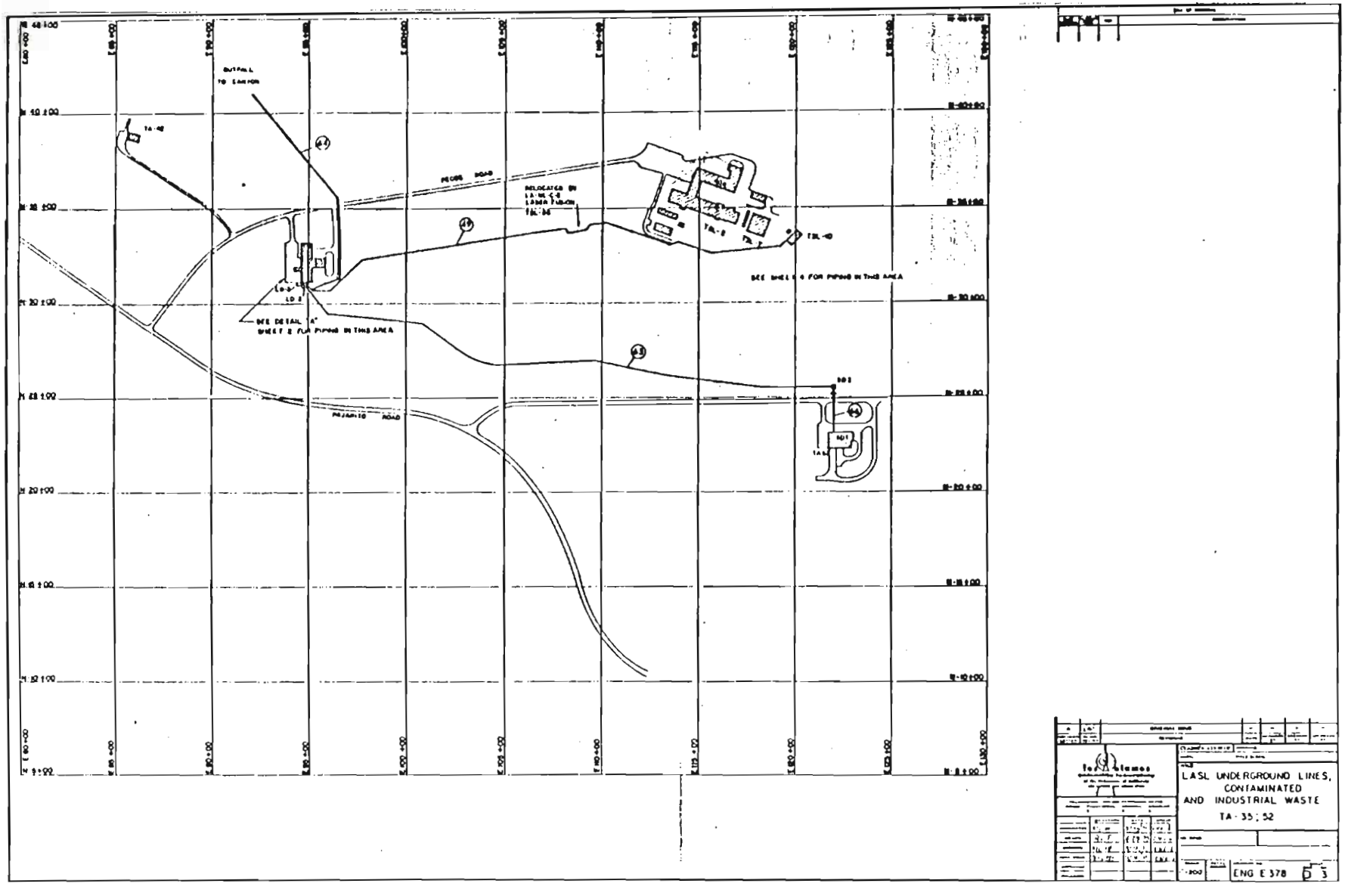


Fig. 34. Old Industrial Waste Line, TA-35 and -52

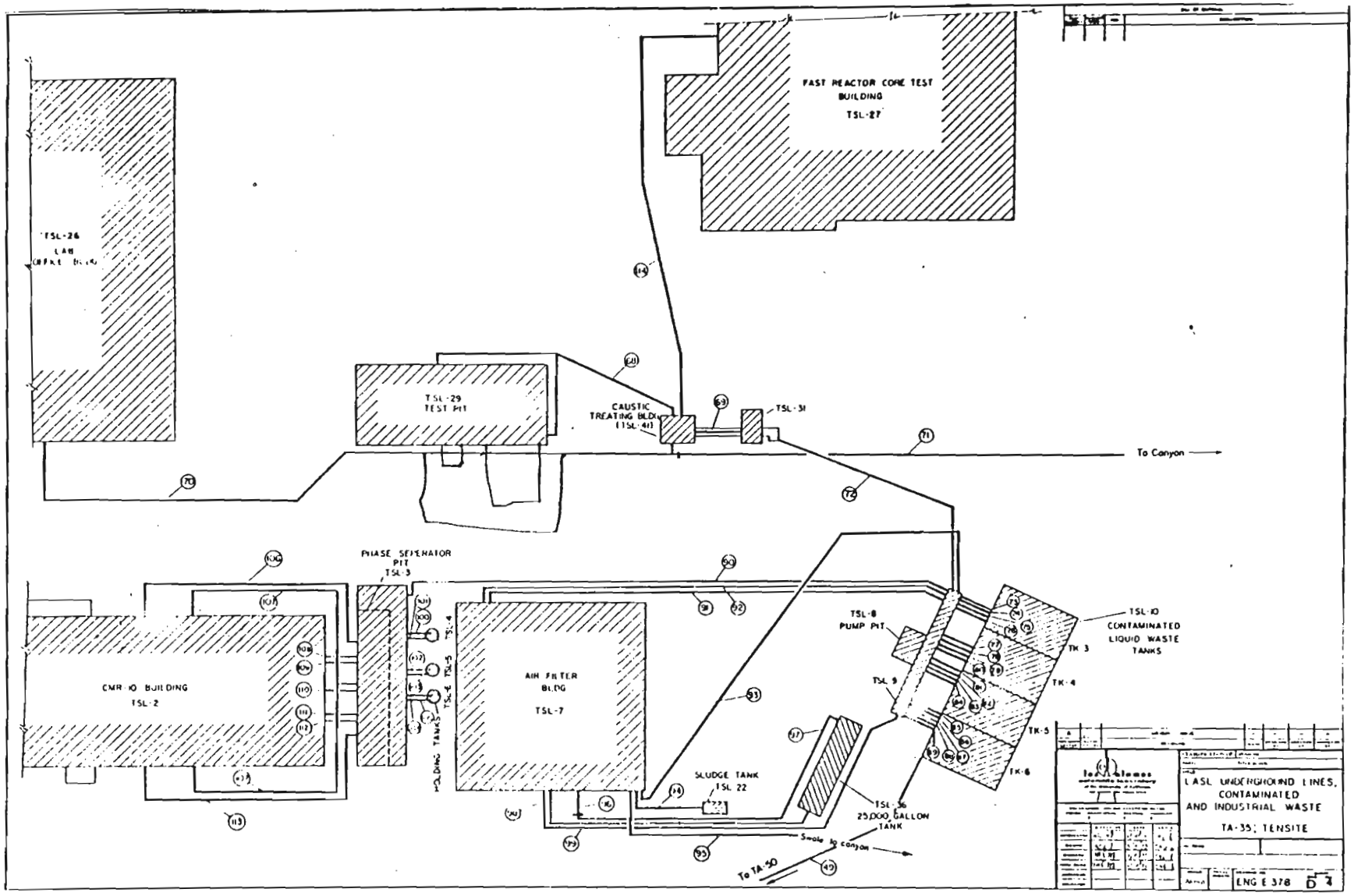


Fig. 35. Old Industrial Waste Line, TA-35

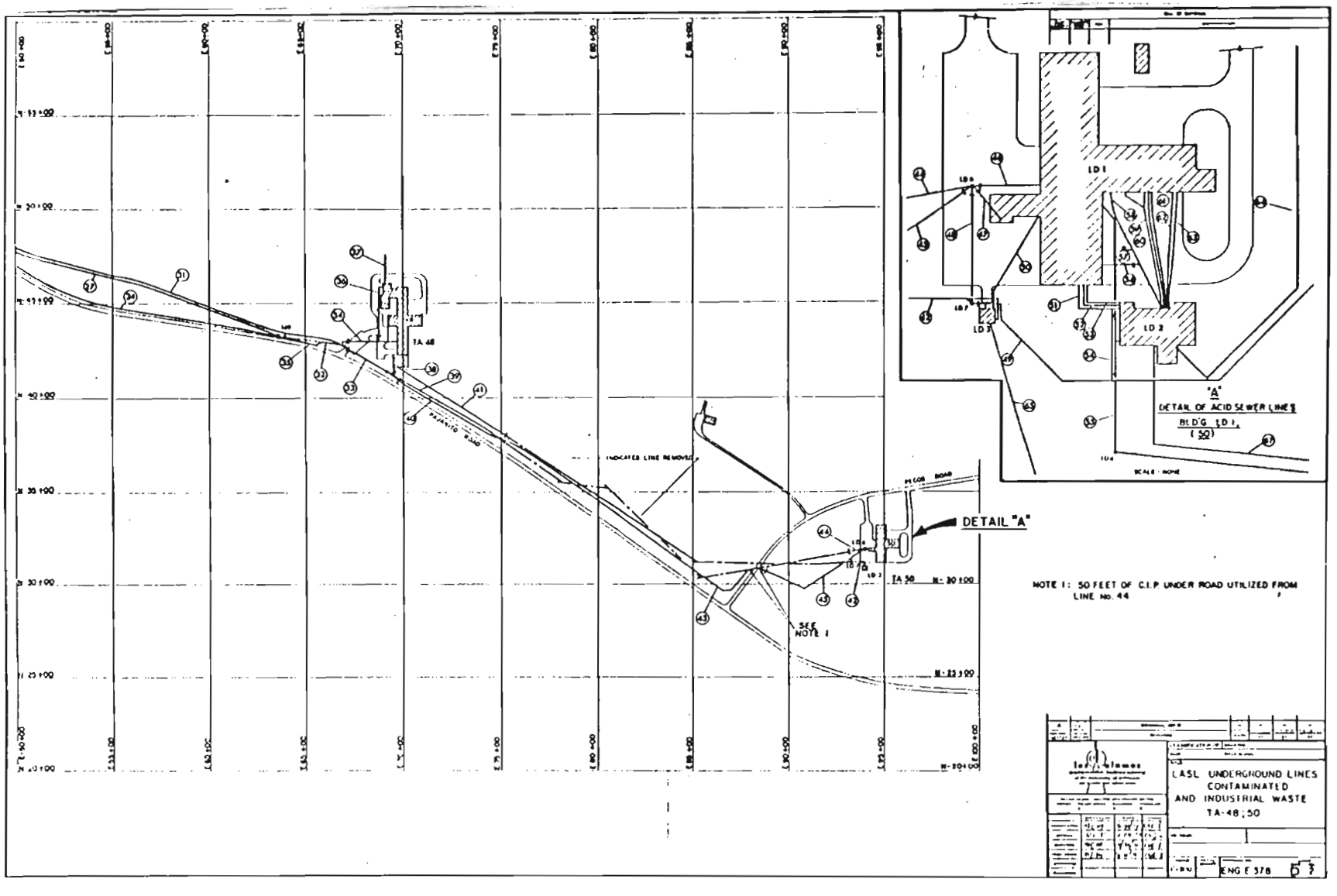


Fig. 36. Old Industrial Waste Line, TA-48 and -50

relatively constant through the forseeable future, with cost increases resulting from inflation and increased stack flow measurement programs. Projected costs for FY 1985 and FY 1986 are thus $180K and $191K, respectively.

II.G.3 Solid Waste Management

II.G.3.1 Transuranic Waste

Projections of operating costs for the management of TRU wastes at Los Alamos are listed in Table IV. 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 through FY 1985 is 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 Surveilance (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 is required for the TRU waste program to assure that Los Alamos TRU waste handling and storage 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.

As identified in the "Inventory Work-Off Plan," $500K of capital equipment funding is required for FY 1986 to obtain approximately half of the equipment essential for operations in the NDE/A Facility. The two major equipment items identified are a real time x-ray radiograph and a nuclear assay system. Supporting equipment for the NDE/A Facility includes a forklift and related waste handling equipment. The total anticipated cost of equipment for this facility is approximately $1100K. Due to the long lead times required to obtain some major equipment items, procurement of those having the longest lead time must be initi-

TABLE IV
LOS ALAMOS TRU WASTE OPERATING COSTS
FY 1984 through FY 1986

	Task	FY 1984	($K) FY 1985	FY 1986
1.	TRU Waste Storage	220	270	285
2.	Facilities Maintenance, Restoration	20	25	27
3.	Environmental Monitoring	130	140	150
4.	Records Management	60	70	80
5.	Size Reduction	290	330	400
6.	Certification Development	519	455	-
7.	Certification Verification	-	80	150
8.	Stored Waste Work-Off	100	120	350
	Subtotal	1339	1490	1442
9.	Modification of CAI for Operations	-	220	120
10.	Incineration Operations	-	150	500
	Total	1339	2000	2342

ated in FY 1986. This action is essential to assure a startup of operations on schedule as indicated in workoff planning documents.

For FY 1985, a Waste Management GPP-funded project totaling $300K is the TRU Waste Preparation Facility. 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.

An estimated $210K of capital equipment funding (P&S, ONMP) will be expended in FY 1985 to achieve upgrade and refurbishment of the existing CAI process. Also in FY 1985, some $500K of capital equipment funding (P&S, ONMP) will be committed for securing components of the new system to be installed. An additional $180K of capital equipment funds are required in FY 1986 for support of continuing CAI operations. FY 1986 requests for $1860K capital and $1800K GPP have been submitted to P&S and ONMP as needed support for the new system installation.

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

Year	Operations Costs	Capital Equipment	Construction	Total
FY 1984	1339	280	400	2019
FY 1985	2000	730	300	3030
FY 1986	2342	2540	2400	7282

II.G.3.2 Low-Level Waste

Projections of operating costs for the management of low-level waste at Los Alamos are listed in Table V. 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 such as packaging, handling, and on-site transportation, or the costs of waste management R&D programs.

TABLE V

LOS ALAMOS LOW-LEVEL WASTE OPERATING COSTS

FY 1984 THROUGH FY 1986

	Task	FY 1984	($K) FY 1985	FY 1986
1.	Burial Operations	400	485	515
2.	Facilities Maintenance, Restoration	200	225	238
3.	Environmental Monitoring	130	145	150
4.	Records Management	60	80	80
5.	Compaction	40	45	50
6.	Generation Control	220	240	360
7.	Mixed Waste Incineration*	-	-	-
8.	LLW Incineration Study*	-	-	85
	TOTAL	1050	1220	1540

*Added to DOE-IWO Budget request

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.

Waste management GPP funding in the amount of $30K has been requested in FY 1986 to fund those small jobs that are unknown or of an emergency nature involving capital repairs or additions at the waste disposal site. Typically, work covered under this general category includes: correction of routinely identified health and safety defects; minor fire protection improvements and small alarm and sprinkler installations; fencing and other minor safeguard improvements; replacements or improvements to utility systems; and modifications and improvements to other facilities at the site.

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 1984	1050	60	----	1110
FY 1985	1220	60	----	1280
FY 1986	1540	85	----	1625

II.G.4 Summary of Budget

Projected radioactive waste management costs (in thousands of dollars) for the Los Alamos National Laboratory are summarized below.

Year	Operating Costs	Capital Equipment	Construction	Total
FY 1984	3949	365	1400	5714
FY 1985	4900	830	600	6330
FY 1986	5723	2650	2450	10823

REFERENCES

1. US Department of Energy, Final Environmental Impact Statement, Los Alamos Scientific Laboratory Site, Los Alamos, New Mexico, DOE/EIS-0018 (December 1979).

2. B. W. Burton, "Geologic Evolution of the Jemez Mountains and Their Potential for Future Volcanic Activity," Los Alamos National Laboratory Report LA-8795-GEOL (June, 1981).

3. Environmental Surveillance Group, "Environmental Surveillance at Los Alamos During 1983," Los Alamos National Laboratory Report LA-10100-ENV (1984).

4. L. A. Emelity, C. W. Christenson, and W. H. Kline, "Operational Practices in the Treatment of Low- and Intermediate-Level Radioactive Wastes: Argonne and Los Alamos Laboratories, United States of America," Proceedings of Symp. on Practices in the Treatment of Low- and Intermediate-Level Radioactive Wastes 187, (IAEA, Vienna, 1966).

5. L. A. Emelity and C. W. Christenson, "Program and Procedures for Control of Radioactive Wastes at Los Alamos," Health Phys. 12, 1170 (1966).

6. L. A. Emelity and C. W. Christenson, " Processing of Plutonium Contaminated Liquid Wastes at Los Alamos," Symp. on Safety in Plutonium Handling Facilities, Rocky Flats Div., Dow Chemical Company Golden, Colorado, 1971.

7. L. A. Emelity, J. R. Buchholz, and P. E. McGinnis, "Review of Radioactive Liquid Waste Management at Los Alamos," Symp. on Management of Low-Level Radioactive Waste, Atlanta, Georgia, 1977.

8. C. W. Christenson and L. A. Emelity, "Chemical Treatment and Cement Fixation of Radioactive Waste," 42nd Annual Conf. on the WPCA, Dallas, Texas, 1969.

9. L. A. Emelity and C. W. Christenson, "Replacement of an Old Treatment Plant, a Design Based on Experience," Symp. on Developments in the Management of Low- and Intermediate-Level Radioactive Wastes, IAEA, Aix en Provence, France, 1970.

10. Health and Safety Manual, "Radioactive Solid Waste," Administrative Requirement 10-2, Los Alamos National Laboratory Manual.

11. L. A. Stretz, L. C. Borduin, W. E. Draper, R A. Koenig, and J. M. Newmyer, "Radioactive Waste Incinerator Studies at the Los Alamos Scientific Laboratory," American Nuclear Society Annual Meeting, Las Vegas, Nevada, 1980.

REFERENCES (cont.)

12. M. L. Wheeler and J. L. Warren, "Tritium Containment After Burial of Contaminated Solid Waste," 23rd Conference on Remote Systems Technology, 1975.

13 L. A. Emelity, W. M. Sanders, R. Garde, and J. R. Buchholz, "A New Continuously Monitored Collection System for Liquid Industrial Wastes," Los Alamos National Laboratory, Report LA-UR-83-571, 56th Annual Water Pollution Control Federation, October 1983.

APPENDIX A

Accidental Oil, Chemical, and Airborne Releases

Introduction

The many different chemicals used in the Laboratory today, including solvents, acids, caustics, and gases, range from being moderately inert in biological systems to being highly toxic, corrosive, reactive, or flammable. The inadvertent discharge of many of these materials can lead to personal injury, death, and/or can result in long-term degradation of the environment. Because of these potential dangers, Congress has passed Federal laws dealing with spills and releases, including the Clean Water Act, the Clean Air Act, the Resource Conservation and Recovery Act, and the Toxic Substances Control Act.

Oil is of particular interest because it is used at the Laboratory in a variety of applications, such as heat transfer media, hydraulic fluids, diesel fuel, and motor oil. Thousands of gallons are used in transformers, capacitors, electromagnets, power supplies, and other electrical equipment. Some oils contain hazardous constitutents, such as polychlorinated biphenyls (PCBs), heavy metals, or radioactive substances.

This administrative requirement outlines the Laboratory's requirements for handling accidental oil spills, chemical spills, and atmospheric discharges in accordance with Laboratory policy, applicable regulations, and Department of Energy Orders.

Definitions

Ambient Air - that portion of the atmosphere that is external to buildings and to which the general public has access.

Discharge (Atmospheric) - the release of gaseous or particulate air pollutants into the ambient air.

Hazardous Chemical - any chemical substance that, because of its quantity, concentration, or chemical characteristics, may cause human injury or environmental degradation.

Leak or Spill - the unintentional and/or unauthorized discharge or release of a fluid to the environment.

Oil - oil of any kind or in any form, including petroleum, fuel oil, sludge, oil refuse, and oil mixed with wastes other than dredged spoil, as defined by 40 CFR 110.1(a).

Identification of Hazardous Wastes

Guidance in identifying hazardous chemicals is provided by the health physics staff (HSE-1, -10, and -11), the Industrial Hygiene Group (HSE-5), and the Waste Management Group (HSE-7), as well as by the following sources:

- 40 CFR 712 (as proposed), which defines toxic substances under the terms of the Toxic Substances Control Act,
- 40 CFR 261, which defines the characteristics and provides a listing of hazardous wastes under the terms of the Resource Conservation and Recovery Act,
- 40 CFR 116, which defines hazardous substances under the terms of the Clean Water Act, and
- 40 CFR 117, which defines reportable quantities for hazardous substances under the terms of the Clean Water Act.

Planned Discharges

Planned atmospheric or liquid discharges must be in accordance with applicable administrative requirements. (Contact the Environmental Surveillance Group, HSE-8, for further information on *atmospheric discharges*; contact Waste Management for further information on *liquid discharges.)*

Standard Operating Procedures

Standard operating procedures (SOPs) are required for all operations involving the use of substantial quantities of hazardous chemicals or oil. (Contact Industrial Hygiene, Waste Management, or Environmental Surveillance for further information.) Group leaders must ensure that SOPs are prepared, reviewed, and approved in accordance with Administrative Requirement 1-3, "Standard Operating Procedures and Special Work Permits. SOPs must identify potential spills and/or accidental atmospheric discharges along with the necessary steps to be taken after a spill, leak, or discharge. The SOP also must identify a Group Spill Coordinator, his/her level of authority, the proper people for the coordinator to call, and other needed information. (Contact Waste Management for guidance.)

Preventive Measures

Precautionary measures must be taken wherever possible to prevent or contain a spill, leak, or accidental atmospheric discharge. Group leaders must ensure that employees are properly trained in handling chemicals and oil.

Large Quantities of Hazardous Chemicals or Oil. Where large quantities of hazardous chemicals or oil are used, proper pre-spill containment structures must be constructed, including tanks with corrosion inhibition, leak-detection systems, and/or containment dikes.

Small Quantities of Hazardous Chemicals or Oil. For small quantities of hazardous chemicals or oil, immediate containment of the spill must be possible; necessary supplies and equipment must be readily available.

NOTE: "Large versus small" definitions are a function of the intrinsic hazard of the chemical substance. For example, in 40 CFR 117, DDT or Kepone must be reported when leaks or spills exceed 1-pound quantities; in contrast, leaks or spills of aluminum sulfate must exceed 5000 pounds before reporting is required.

Notification of Spill

Employees must notify their group leader or the group's Spill Coordinator as soon as a spill, leak, or accidental atmospheric discharge has occurred. The group leader or Spill Coordinator must notify the

- Health, Safety, and Environment Division (7-7878; 7-4437 after normal work hours)
- Waste Management Group for information on disposal methods and regulatory considerations, and
- Environmental Surveillance Group if accidental environmental discharge occurs.

As appropriate, the following also must be notified:

- the Laboratory Emergency Coordinator;
- the Occupational Medicine Group (HSE-2) to report injuries, illnesses, or toxic exposures;
- the health physics staff to report radioactive contamination;
- the Safety Group (HSE-3) to report fire, explosive, or electrical hazards;
- the Industrial Hygiene Group to report toxic chemical hazards.

The notifier must provide the following information:

- site name or number,
- time of spill or discharge,
- composition of spilled or discharged material,
- amount spilled or discharged, and
- other pertinent information.

The Health, Safety, and Environment Division determines the appropriate notification procedures for outside agencies in accordance with Federal regulations. The Laboratory Emergency Coordinator ensures that the proper local, state, and Federal emergency resources are called in when needed.

Cleanup

The operating group must clean up the spill as soon as all warranted health/safety precautions have been taken. The group's Spill Coordinator must supervise all activities connected with containment and cleanup of the spill. The Health, Safety, and Environment Division determines whether the spill has been properly cleaned up.

Disposal

For information on disposal of

- nonradioactive wastes, refer to Administrative Requirement 10-3, "Nonradioactive Chemical Waste," and for
- radioactive wastes, refer to Administrative Requirements 10-1, "Radioactive Liquid Waste," and 10-2, "Radioactive Solid Waste."

Health, Safety, and Environment Division Assistance

In addition to providing assistance when notified of a spill or discharge, groups from the Health, Safety, and Environment Division provide advice, procedural review/approval, and studies appropriate to handling oil and chemicals.

The health physics staff approves procedures for handling spills of radioactive materials and, with Industrial Hygiene and Waste Management, works on oil and hazardous chemical spills that involve radioactive substances.

The *Safety Group* reviews and approves fire protection procedures.

Industrial Hygiene approves procedures for handling oil and hazardous chemical spills in the workplace and determines airborne exposure levels.

Waste Management provides advice on cleanup operations and proper disposal of spilled oil, chemicals, rags, soil, or other contaminated debris, and ensures compliance with Federal and state regulations.

Environmental Surveillance ascertains the potential environmental impact of the chemicals released to the ambient air and the potential dose to the general public. In connection with the necessary reporting to Federal and state officials, Environmental Surveillance monitors the material released and carries out meteorological modeling to determine dispersion patterns and doses.

References

"Air Programs," 40 CFR 50-99 (latest edition).

"Chemical Information Rules," 40 CFR 712 (most recent).

Clean Water Act, Public Law 95-217, Sec. 311 (latest edition).

"Designation of Hazardous Substances," 40 CFR 116 (most recent).

"Determination of Reportable Quantities for Hazardous Substances," 40 CFR 117 (most recent).

"Environmental Protection, Safety, and Health Protection Program for DOE Operations," Department of Energy Order 5480.1A, Chapters XI and XII (latest edition).

"General Design Criteria Manual," Department of Energy Order 6430.1 (latest edition).

"Hazardous and Radioactive Mixed Waste Management," Department of Energy Order 5480.2 (latest edition).

"Hazardous, Toxic, and Radioactive Waste Management," AL 5480.2 (latest edition).

"Identification and Listing of Hazardous Waste," 40 CFR 261 (most recent).

"Los Alamos National Laboratory Site Emergency Preparedness Plan," Los Alamos National Laboratory (May 1983).

"New Mexico Air Quality Control Act and Air Quality Control Regulation" (latest edition).

"Nonradioactive Chemical Waste," Administrative Requirement 10-3, in *Health and Safety*, Los Alamos National Laboratory Manual, Chapter 1 (August 1984).

"Oil Pollution Prevention," 40 CFR 112 (latest edition).

"Pesticide Programs," 40 CFR 162-180 (latest edition).

"Polychlorinated Biphenyls," Administrative Requirement 10-4, in *Health and Safety*, Los Alamos National Laboratory Manual, Chapter 1 (August 1984).

"Radioactive Solid Waste," Administrative Requirement 10-2, in *Health and Safety*, Los Alamos National Laboratory Manual, Chapter 1 (August 1984).

Resource Conservation and Recovery Act, Public Law 94-580 (latest edition).

"Standard Operating Procedures and Special Work Permits," Administrative Requirement 1-3, in *Health and Safety*, Los Alamos National Laboratory Manual, Chapter 1 (August 1984).

"Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment," American Conference of Governmental Industrial Hygienists, Cincinnati, Ohio (latest edition).

Referrals

Health, Safety, and Environment Division Emergency Assistance, 7-7878 (7-4437 after normal work hours)

Radiation Protection Group (HSE-1), 7-5296

Occupational Medicine Group (HSE-2), 7-7251

Safety Group (HSE-3), 7-4644

Industrial Hygiene Group (HSE-5), 7-5231

Waste Management Group (HSE-7), 7-4301

Regulatory Compliance Section of HSE-7, 7-7957

Solid Waste Section of HSE-7, 7-5397

Environmental Surveillance Group (HSE-8), 7-5021

Chemistry Health Protection Group (HSE-10), 7-7218

Accelerator Health Protection Group (HSE-11), 7-5890

APPENDIX B

MONTHLY INSPECTION

VEHICLES

VEHICLE:_____ BLDG/LOCATION:_____ AREA:_____

LICENSE NO:_____ DATE INSPECTED:_____ INSPECTOR:_____

SUPERVISOR:_____

Check for Proper Operation as appropriate, wear, leaks, damage, etc.	Condition: Operates Properly	Condition: Needs Repair	Condition: Not Operating	Problems/Actions
Brakes, Foot and Park				
Windshield, Window Glass				
Wipers and Washer				
Mirrors				
Seat Belts				
Sun Visors				
Door Locks				
Horn				
Tires				
Headlights, High, Low Beams				
Side or Special Lights				
Parking Lights				
Emergency Flashers				
Turn Signals				
Tail and Stop Lights				
Back-up Lights				
License Lights				
Steering				
Engine				
Clutch, Transmission				
Body Condition				
Special Equipment				
Fire Extinguisher				
Housekeeping, Interior				
Other:_____				

Date Vehicle Maint. Shop notified of any deficiencies, above:_____

Date repairs scheduled:_____

by:_____

MONTHLY INSPECTION
SPECIAL VEHICLES

SPECIAL VEHICLE: _____ LOCATION: _____ AREA: _____

.: _____ DATE INSPECTED: _____ INSPECTOR: _____

Check for Proper Operation as appropriate, wear, leaks, damage, etc.	Condition: Operates Properly	Condition: Needs Repair	Condition: Not Operating	Problems/Actions
Brakes, Foot and Park				
Horn				
Back-up Alarm				
Steering				
Tires				
Lights, Front and Rear				
Lubrication				
Engine, Drive Motors				
Clutch/Transmission				
Body/Structural Condition				
Housekeeping				
Extinguisher				
Batteries, Charge Level				
Batteries, Electrolyte Level				
Hydraulic Hoses, Cylinders				
Hydraulic Fluid Reservoir Level				
Chains, Other Linkages				
Other:				

Date Maintenance notified of any deficiencies, above, not correctable by user group: _____

by: _____

Date deficiencies, above, corrected by user group: _____

by: _____

HS&E PROGRAM
F&E INSP. FORM 3

QUARTERLY INSPECTION

BUILDING SAFETY INSPECTION

BUILDING:_____ AREA:_____ BUILDING MANAGER: _____

Check for Proper Operation as appropriate, wear, leaks, damage, etc.	FY:_____			
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Structural (ceilings, walls, floors)				
Roof (condition, drainage)				
Walks and Drives				
Doors and Windows				
Electrical (panels, receptacles, switches, lights, etc.)				
Emergency Lighting, Exit Signs				
Phones, PA, Intercom				
Alarm Systems, Fire, Evacuation, Radiation				
Fire Protection Systems, Sprinklers, Extinguishers, etc.				
Plumbing (water, gas, air, drains)				
Heating, Ventilation Systems				
Special Equipment, Filters, etc.				
Safety Showers				
Housekeeping				
Stored Equipment, Materials				
Other:_____				
Inspection Completed (Date and Initial)				

COMMENTS: Problems/Actions

1st Quarter:_____

2nd Quarter:_____

3rd Quarter:_____

4th Quarter:_____

FY: _____

QUARTER: _____

INSPECTION DATE: _____

HS&E PROGRAM

F&E INSP. FORM 4A

QUARTERLY INSPECTION

EQUIPMENT SAFETY INSPECTION

AREA: _____ BUILDING: _____ ROOM(S): _____ INSPECTOR: _____ SUPERVISOR: _____

MECHANICAL EQUIPMENT, PROCESS EQUIPMENT, MACHINE TOOLS, POWER SOURCES, STORED ENERGY SOURCES, AND EQUIPMENT CONTAINING SAFETY INTERLOCKS AND/OR THE POTENTIAL OF PERSONNEL HAZARD OR ENVIRONMENTAL DAMAGE.

EQUIPMENT ITEM/DESCRIPTION	PROPERTY NUMBER	Structural Condition (inc. mounts, frame, case, etc.)	Mechanical Condition (inc. belts, drives, lubrication, etc.)	Electrical (starters, panels, switches, power cables, etc.)	Safety Equipment (shields, guards, etc.)	Electrical, Mechanical Interlock Function	Operation (performance, vibration, noise, etc.)	OTHER: Determined by Operator or Inspector			COMMENTS: Problems/Actions

USE ADDITIONAL SHEETS (FORMS 4B) AS REQUIRED

HS&E PROGRAM

F&E INSP. FORM 4B

QUARTERLY EQUIPMENT SAFETY INSPECTION FY:_____ QUARTER:_____ DATE:_____

AREA:_____ BUILDING:_____ ROOM(S):_____ INSPECTOR:_____ SUPERVISOR:_____

MECHANICAL EQUIPMENT, PROCESS EQUIPMENT, MACHINE TOOLS, POWER SOURCES, STORED ENERGY SOURCES, AND EQUIPMENT CONTAINING SAFETY INTERLOCKS AND/OR THE POTENITAL FOR PERSONNEL HAZARD OR ENVIRONMENTAL DAMAGE.

EQUIPMENT ITEM/DESCRIPTION	PROPERTY NUMBER	Structural Condition	Mechnical Condition	Electrical Systems	Safety Equipment	Electric, Mech. Interlocks	Operation	OTHER: Determined by Operator or Inspector			COMMENTS: Problems/Actions

USE ADDITIONAL SHEETS (FORMS 4B) AS REQUIRED Page_____ of _____

FY: _____

QUARTER: _____

QUARTERLY INSPECTION
OVERHEAD BRIDGE CRANES

CRANE: _____ AREA/LOCATION: _____ PN: _____

DATE INSPECTED: _____ INSPECTOR: _____

SUPERVISOR: _____

Check for Proper Operation:	Condition: Operates Properly	Needs Repair	Not Operating	Problems/Actions
Control Pendant:				
Pendant OFF Switch				
Hoist UP Switch				
Speed Control				
Brake/Clutch Operation				
Hoist DOWN Switch				
Speed Control				
Brake/Clutch Operation				
Trolley Travel East Switch				
Travel West Switch				
Brake/Clutch Operation				
Bridge Travel North Switch				
Travel South Switch				
Brake/Clutch Operation				

Check visually for excessive wear, binding, broken wires, kinks, leaks, stretch or deformation. Describe any defects:

Wire Rope Hoist Line: _____

Control Pendant Cable: _____

Trolley Travel Cable: _____

Bridge Travel Cable: _____

Bridge Travel Cable Take-up Reel: _____

Hoist Hook: _____

Hoist Drum: _____

Hoist Gear Box, Motor: _____

Trolley Gear Box, Motor: _____

Trolley Drive, Wheels, and Rails: _____

Bridge Gear Box, Motor: _____

Bridge Drive, Wheels, and Rails: _____

Date Work Order Submitted for any deficiencies, above: _____

by: _____

GROUP H-7
HS&E PROGRAM
F&E INSP. FORM 6

QUARTERLY INSPECTION
WORK PLACE SAFETY INSPECTION

ROOM/AREA: _____ BUILDING: _____ AREA: _____

INSPECTOR: _____

SUPERVISOR: _____

Check for Proper Operation as appropriate, wear, leaks, damage, etc.	FY: _____			
	1st Qtr.	2nd Qtr.	3rd Qtr.	4th Qtr.
Structural (ceilings, walls, floor)				
Electrical (panels, receptacles, switches, lights, etc.)				
Extension, Power cords				
Plumbing (water, gas, air, drains)				
Fire Protection (				
Heating, Ventilation				
Fume Hoods				
Lab Equipment				
Phones, PA, Intercom				
Safety Showers				
Emergency Lighting				
Furnishings				
Appliances				
Housekeeping				
Other:				
Inspection Completed (Date and Initial)				

COMMENTS: Problems/Actions

1st Quarter: _____

2nd Quarter: _____

3rd Quarter: _____

4th Quarter: _____

MSA INSPECTION FORM

GROUP_____ TA_____ BLDG._____ SERIAL NUMBER_____ DATE_____

Place a check mark in appropriate space and note any defects.

INSPECTION POINTS:	SATISFACTORY	UNSATISFACTORY	COMMENTS
1. STRAPS AND BUCKLES			
2. BACK PLATE AND CYLINDER LOCK			
3. PRESSURE GAUGE			
4. SUFFICIENT CYLINDER PRESSURE			
5. CYLINDER VALVE LOCK			
6. HIGH PRESSURE HOSE			
7. HIGH PRESSURE HOSE CONNECTOR			
BY PASS VALVE			
9. MAIN LINE VALVE			
10. MODE SELECT LEVER			
11. PRESZURE GAUGE			
12. PAK-ALARM			
13. BREATHING TUBE			
14. BREATHING TUBE CONNECTOR			
15. BREATHING TUBE "O" RING			
16. FACEPIECE BODY			
17. HEAD HARNESS			
18. LENS			
19. EXHALATION VALVE			

INSPECTED BY:_____

Forward one (1) copy of completed form to: Tom Moore, H-5, MS-K496

APPENDIX C

APPENDIX C

ENVIRONMENTAL SAMPLING AND MONITORING PROGRAM

The objective of the monitoring program is to reveal loss of confinement of radioactive materials from waste disposal sites, should loss of confinement occur, and to characterize emissions of radioactive materials from waste treatment processes. The survey scheme would (1) document environmental conditions relative to waste management operations and key contaminants, and (2) trigger more detailed investigations and/or corrective action in the event of loss of confinement. Key contaminants relative to environmental surveillance of Laboratory waste management activities are listed in Table C.1. Table C.2 relates suspect radionuclides to monitored liquid and gaseous effluent release points from Laboratory structures. Table C.3 shows which radionuclides are monitored in surface and ground waters. Table C.4 lists analyses commonly performed for environmental surveillance relative to the environmental matrix materials sampled.

Soil

Surface soil sampling locations have been selected primarily on the basis of surface runoff impoundment. Existing locations are from environmental surveillance work that monitors radionuclide migration from old waste disposal sites at TA-21, Areas A and T; TA-50, Area C; and from the currently active site at TA-54, Area G. Figure C.1 shows the distribution of existing and proposed sampling locations at TA-21. Proposed locations

TABLE C.1

SOURCE TERMS:

Dynamic Testing Aerosols: U

Radioactive Gas and Aerosol Emissions

^{3}H	MAP (L+S)[b]	^{238}U
^{32}P	^{131}I	^{241}Am
^{41}Ar	MFP[c]	^{230}Pu
MAP(g)[a]	^{235}U	$^{239,240}Pu$

Liquid Effluents

^{3}H	^{60}Co	^{234}U
^{7}Be	^{89}Sr	^{238}Pu
^{22}Na	^{90}Sr	$^{239,240}Pu$
^{54}Mn	^{134}Cs	^{241}Am
^{57}Co	^{137}Cs	

a. Mixed activation products - as vapors i.e., gaseous phase

b. Mixed activation products - as aerosols i.e., liquid and solid phase

c. Mixed fission products

TABLE C.2
RADWASTE EFFLUENT MONITORING PROFILES

GASEOUS EFFLUENT					LIQUID EFFLUENT		
TA No.	BLDG No.	FE No.	I.D./ LOCATION	RADIONUCLIDES MONITORED	MODE OF TRANSPORT	LOC OF TREATMENT	RADIONUCLIDES MONITORED
2	99	-	Omega Stack	^{41}Ar	Truck	TA-50-1	Gross α, Gross β, $^{238,239}Pu$, ^{241}Am, ^{137}Cs, ^{3}H, and ^{234}U
3	16	14	Van De Graaf (S)	^{3}H	Acid Waste Line	TA-50-1	
	29	16	Van De Graaf (SW)	^{3}H			
		14	(N) Stack Wg2	$^{238,239}Pu$			
		15	(S) Stack Wg2	$^{238,239}Pu$			
		17	(S) Stack Wg2	$^{238,239}Pu$			
		18	(N) Office Wg2	$^{238,239}Pu$			
		19	(S) Stack Wg3	$^{238,239}Pu$			
		20	(N) Stack Wg3	$^{235,238}U$			
		21	(S) Office Wg3	$^{238,239}Pu$, $^{235,238}U$			
		22	(N) Offices Wg3	$^{238,239}Pu$, $^{235,238}U$			
		23	(N) Stack Wg4	$^{235,238}U$, ^{238}D	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, and ^{234}U
		24	(S) Labs Wg4	$^{235,238}U$, ^{238}D			
		26	(N) Offices Wg4	$^{235,238}U$, ^{238}D			
		27	(S) Offices Wg4	$^{235,238}U$, ^{238}D			
		28	(S) Stack Wg5	$^{238,239}Pu$			
		29	(N) Stack Wg5	$^{238,239}Pu$			
		30	(N) Offices Wg5	$^{238,239}Pu$			
		31	(S) Offices Wg5	$^{238,239}Pu$			
		32	(N) Stack Wg7	$^{238,239}Pu$, ^{241}Am $^{235,238}U$			
		33	(S) Stack Wg7	$^{238,239}Pu$, ^{238}U			
		34	(S) Offices Wg7	$^{238,239}Pu$			
		35	(N) Offices Wg7	$^{238,239}Pu$			

TABLE C.2 (cont'd)
RADWASTE EFFLUENT MONITORING PROFILES

GASEOUS EFFLUENT					LIQUID EFFLUENT		
TA No.	BLDG No.	FE No.	I.D./ LOCATION	RADIONUCLIDES MONITORED	MODE OF TRANSPORT	LOC OF TREATMENT	RADIONUCLIDES MONITORED
(cont'd)							
	29	44 45 46	Stack Wg[9]	MFP, ^{235}U, ^{239}Pu	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	34	52	Cryogenics Stack	^{3}H	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	35	1 2	West Stack	^{235}U, ^{238}U	Acid Waste Line	TA-50-1	^{238}Pu, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	66	8 9 10	N W Stack N E Stack S W Stack	^{238}U ^{238}U ^{235}U	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{3}H, and ^{234}U
	102	13 24 26 20	N Stack W Central Stack N W Cor. Stack Main Stack	^{238}U ^{238}U, $^{232}ThO_2$ ^{238}U ^{235}U, ^{238}U	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	141	6 9 10	N Stack N W Stack S W Stack	^{238}U ^{238}U ^{238}U	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U

TABLE C.2 (cont'd)
RADWASTE EFFLUENT MONITORING PROFILES

GASEOUS EFFLUENT					LIQUID EFFLUENT		
TA No.	BLDG No.	FE No.	I.D./ LOCATION	RADIONUCLIDES MONITORED	MODE OF TRANSPORT	LOC OF TREATMENT	RADIONUCLIES MONITORED
21	2E	2	(E) Stk. Rm Air	$^{238,239}Pu$, U			
	2W	1	Room Air Stack	^{239}Pu			
	3 Main	6(1)	Main Stack	$^{235,238}U$			
	3 (Incin)	1	Process Area 313	^{235}U			
	3E	2	E Stk. Rm Air	$^{235,238}U$, ^{239}Pu			
	3W	1	W Stk. Rm Air	^{238}U, ^{239}Pu, TRPU	Acid Waste Line	TA-21-257	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs ^{3}H, ^{234}U
	4 Main	1	Main Stack	^{235}U			
	4W	2	West Stack	^{239}Pu			
	4HC	1	Hot Cell Stack	^{239}Pu	Acid Waste Line	TA-21-257	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	5W	2	West Stack	^{239}Pu			
	150	1	Room Air	$^{238,239}Pu$	Acid Waste Line	TA-21-257	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	257	4	Process Ex	^{239}Pu, ^{241}Am	Acid Waste Line	TA-21-257	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	209DPE	10	Stack	^{3}H	Acid Waste Line	TA-21-257	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	324	1	Process Ex	$^{235,238}U$, ^{239}Pu, ^{231}Pa, ^{242}Pu, ^{237}Np, $^{241,243}Am$, ^{249}Bk, $^{244,248}Cm$	Acid Waste Line	TA-21-257	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U

TABLE C.2 (cont'd)
RADWASTE EFFLUENT MONITORING PROFILES

GASEOUS EFFLUENT					LIQUID EFFLUENT		
TA No.	BLDG No.	FE No.	I.D./ LOCATION	RADIONUCLIDES MONITORED	MODE OF TRANSPORT	LOC OF TREATMENT	RADIONUCLIDES MONITORED
33	86	6,11	Stack	^{3}H	Truck	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
35	2	H-1	C106,TSL-2	^{3}H	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs, ^{3}H, ^{234}U
	7	2	S Stack	^{239}Pu			
	7	7	S E Stack	$^{238,239}Pu$			
	7	8	Central Stk.	^{239}Pu			
41	4	17	Main Stack	^{3}H	San. Waste Line	Septic Tank	Gross α, Gross β, Gross γ, ^{3}H
43	1	9	E Penthouse	^{239}Pu			
		10	W Penthouse	^{239}Pu, ^{125}I, other			
		12	W Penthouse	^{239}Pu			
		14	S E Stack	^{239}Pu	Truck	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{137}Cs,
		16	S E Stack				
		24	S W Stack	^{239}Pu			
		34	W Penthouse	^{239}Pu			
46	31	41		^{238}U	San. Waste Line	Sanitary Lagoon	Gross α, Gross β, Gross γ, ^{3}H
48	1	11					
		12	S Stack	MFP			
		13					
		15	N End Radio-				
		16	Chem Labs	MFP			
		18	Old Hot Cell Stk.	MFP			

TABLE C.2 (cont'd)
RADWASTE EFFLUENT MONITORING PROFILES

GASEOUS EFFLUENT					LIQUID EFFLUENT		
TA No.	BLDG No.	FE No.	I.D./ LOCATION	RADIONUCLIDES MONITORED	MODE OF TRANSPORT	LOC OF TREATMENT	RADIONUCLIDES MONITORED
(con't)							
48	1	38	Hot Cell Stk.	MFP	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, Gross α, ^{3}H, Gross β, Gross γ
		40					
		45	Core Wind Stk.	MFP			
		46	One Stack				
		51	Alpha Wing Stk.	^{252}Cf, ^{241}Am, ^{238}Pu, ^{239}Pu, ^{233}U			
		54	N E Stack	^{252}Cf, ^{241}Am, ^{238}Pu, ^{239}Pu, ^{233}U			
50	1	1	N E Stack	^{239}Pu, $^{235,238}U$			
		2	S E Stack	^{239}Pu			
		3	S Stack	$^{238,239}Pu$, ^{241}Am $^{235,238}U$, ^{137}Cs			
		4	Caustic Waste Line	$^{238,239}Pu$, ^{241}Am, $^{235,238}U$	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{3}H, ^{234}U, ^{137}Cs
		6	Rm 60	^{241}Am, $^{238,239}Pu$			
		17		$^{238,239}Pu$, ^{241}Am			
		27		$^{238,239}Pu$, ^{241}Am			
	37	1	TDF Stack	^{239}Pu, MFP			
	69	1	SRF Rm.	^{239}Pu			
	69	3	SRF Process	^{239}Pu			
53	WNR	2	Accel. Areas	^{11}C, ^{13}N, ^{15}O ^{41}Ar, MAP	Truck	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{3}H ^{137}Cs, ^{234}U

TABLE C.2 (cont'd)
RADWASTE EFFLUENT MONITORING PROFILES

GASEOUS EFFLUENT					LIQUID EFFLUENT		
TA No.	BLDG No.	FE No.	I.D./ LOCATION	RADIONUCLIDES MONITORED	MODE OF TRANSPORT	LOC OF TREATMENT	RADIONUCLIDES MONITORED
(con't)							
53	LAMPF	3	W Exp Area A	^{11}C, ^{13}N, ^{15}O ^{41}Ar, MAP	Truck	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{3}H, ^{137}Cs, ^{234}U
		16	Hot Chem Hoods	MAP	Sanitary Sewer	Local Sanitary Lagoon	^{22}Na, ^{7}Be, ^{3}H, $^{57,60}Co$, ^{134}Cs, ^{54}Mn
54		1	Compactor Rm.	MFP, MAP, U, TRU	Truck	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{3}H, ^{137}Cs, ^{234}U
		2	Compactor	MFP, MAP, U, TRU			
		15	North	$^{238,239,242}Pu$, ^{241}Am	Acid Waste Line	TA-50-1	$^{238,239}Pu$, ^{241}Am, $^{89,90}Sr$, ^{3}H ^{137}Cs, ^{234}U
		16	South	$^{239,240,242}Pu$, ^{241}Am, ^{3}H			

NOTE: Sludge samples and liquid samples from sanitary system sewage treatment plants, septic tanks, and sanitary lagoons, are routinely monitored for gross , gross , gross , and ^{3}H.

TABLE C.3
WATER RESOURCE MONITORING - 1983

	^{3}H	^{137}Cs	Gross Beta	Gross Gamma	Total U	^{238}Pu	$^{239,240}Pu$	^{241}Am	Gross Alpha
Regional:									
Surface Water	X	X		X	X	X	X		
Perimeter:									
Surface Water	X	X		X	X	X	X		
Main Aquifer	X	X	X	X	X	X	X		X
Surface Water (W. R. Canyon)	X	X		X	X	X	X		
Main Aquifer (W. R. Canyon)	X	X		X	X	X	X		
Perimeter & Onsite:									
Surface Water (Effluent Release Areas)	X	X		X	X	X	X	X	
Perched Water (Effluent Release Areas)	X	X		X	X	X	X		
Main Aquifer (Municipal Supply and Distribution)	X	X	X	X	X	X	X		X
Onsite:									
Surface Water	X	X		X	X	X	X		
Main Aquifer	X	X		X	X	X	X		

TABL 4

ANALYSES COMMONLY PERFORMED

LISTED BY MATRIX MATERIAL

RADIONUCLIDE	SOIL/SEDIMENT/TUFF	AIR	WATER	VEGETATION	BEES	HONEY	FISH
^{3}H[a]	+	+	+	+	+	+	--
^{7}Be[c]	+	+[b]	+	+	+	+	--
^{22}Na[c]	--	--	+	--	+	+	--
^{41}Ar[d]	--	+	--	--	--	--	--
^{54}Mn[c]	--	--	+	--	+	+	--
^{57}Co[c]	--	--	+	--	+	+	--
^{60}Co[c]	+	--	+	--	--	--	--
^{83}Rb[c]	--	--	--	--	+	+	--
^{89}Sr[c]	--	--	+	--	--	--	--
^{90}Sr	+	+	+	+	--	--	+
^{134}Cs[c]	--	--	+	--	+	+	--
^{137}Cs	+	+	+	+	+	+	+
^{234}U	+	+	+	+	--	--	--
^{235}U	+	+	+	+	--	--	--
^{238}U	+	+	+	+	--	--	--
TOTAL U	+	+	+	+	+	+	+
^{238}Pu	+	+	+	+	--	--	+
$^{239,240}Pu$	+	+	+	+	+	+	+
^{241}Am	+	+	+	--	--	--	--
MAP	--	+	+	--	--	--	--
MFP	--	+	+	--	--	--	--
Gross α	+	+	+	+	--	--	--
Gross β	+	+	+	+	--	--	--

a. As ^{3}HOH liquid or vapor phase

b. As particulate

c. LAMPF effluents

d. Omega Reactor Stack

would monitor fallout from the indicated stacks of the treatment plant, TA-21-257. Existing and proposed sampling locations for TA-50-1 and Area G are shown in Figures C.2 and C.3, respectively.

Since sediments also contain materials transported by surface runoff, sediment sampling stations supplement those for surface soil. Figure C.4 delineates drainage systems 5, 6, 7, 9, and 10, which are Los Alamos, Sandia, Mortandad, Canada del Buey, and Pajarito Canyons, respectively. Sediment sampling stations are located in these major drainage systems as shown in Figure C.5. Stations 15 and 41 through 45 monitor the liquid waste outfall from TA-50 in Mortandad Canyon. Pajarito Canyon south of TA-54 is monitored by stations 17 and 1 through 6 (inset) while Canada del buey north of TA-54 is monitored by stations 16 and 7 through 9 (inset). These latter sets of stations thus oversee the disposal sites activities. One additional sampling station is proposed between Area L and Area G to help clarify from which site any observed contaminants might be coming. Station L1 through L8 and 34 and 35 monitor the drainage channel from the lagoons at TA-53. Stations 29 and 33 through 35 monitor drainage from TA-21-257 in DP Canyon and in Los Alamos Canyon.

Subsurface soil and bedrock (tuff) are also monitored for migrating contaminants. Analytical laboratory personnel anticipate that downhole monitoring instrumentation can be used to monitor for both liquid phase and vapor phase soil moisture, and for soil density, to indicate advancing fronts which might bear contaminants from waste repositories. Studies are now being considered to see if specific and generic contaminants can be

monitored by extracting appropriate sampling media from test holes. Organic vapors are expected to be the most mobile soil constituents, followed by soil moisture vapor, soil moisture, and soluble pollutants. Sampling holes would be closer to the waste repository than the monitoring holes. Routine downhole instrument readings would be taken annually and routine samples would be taken on a three year cycle. Figures C.6, C.7, and C.8 show the proposed and existing distribution of monitoring and sampling holes for Area C, Area T, and Area G, respectively. Figure 9 in the text shows observation holes and a test well in Mortandad Canyon downstream from the TA-50 outfall and observation holes downstream from the TA-21-257 outfall. The well in Mortandad monitors a local body of perched water. These holes and the well may become additional monitoring/sampling locations if found adaptable to the techniques described above.

Air

Requirements for airborne radioactivity are presently met by monitoring (1) stack effluent and (2) sampling ambient air (a) onsite, (b) at the site perimeter, and (c) remote from the site but within the region. This implementation plan would add air sampling results from Area G, TA-54, to evaluate performance of confinement there. Such measurements have proven to be good indicators of surface contamination where resuspension of surface-desposited or exposed contaminants is the sole source of airborne-radioactivity. However, if the stack emissions of like pollutants are present, correlation with air sampling results are confounded. Since confounding stack emissions have been generated around Area T and are generated at LAMPF, ambient air

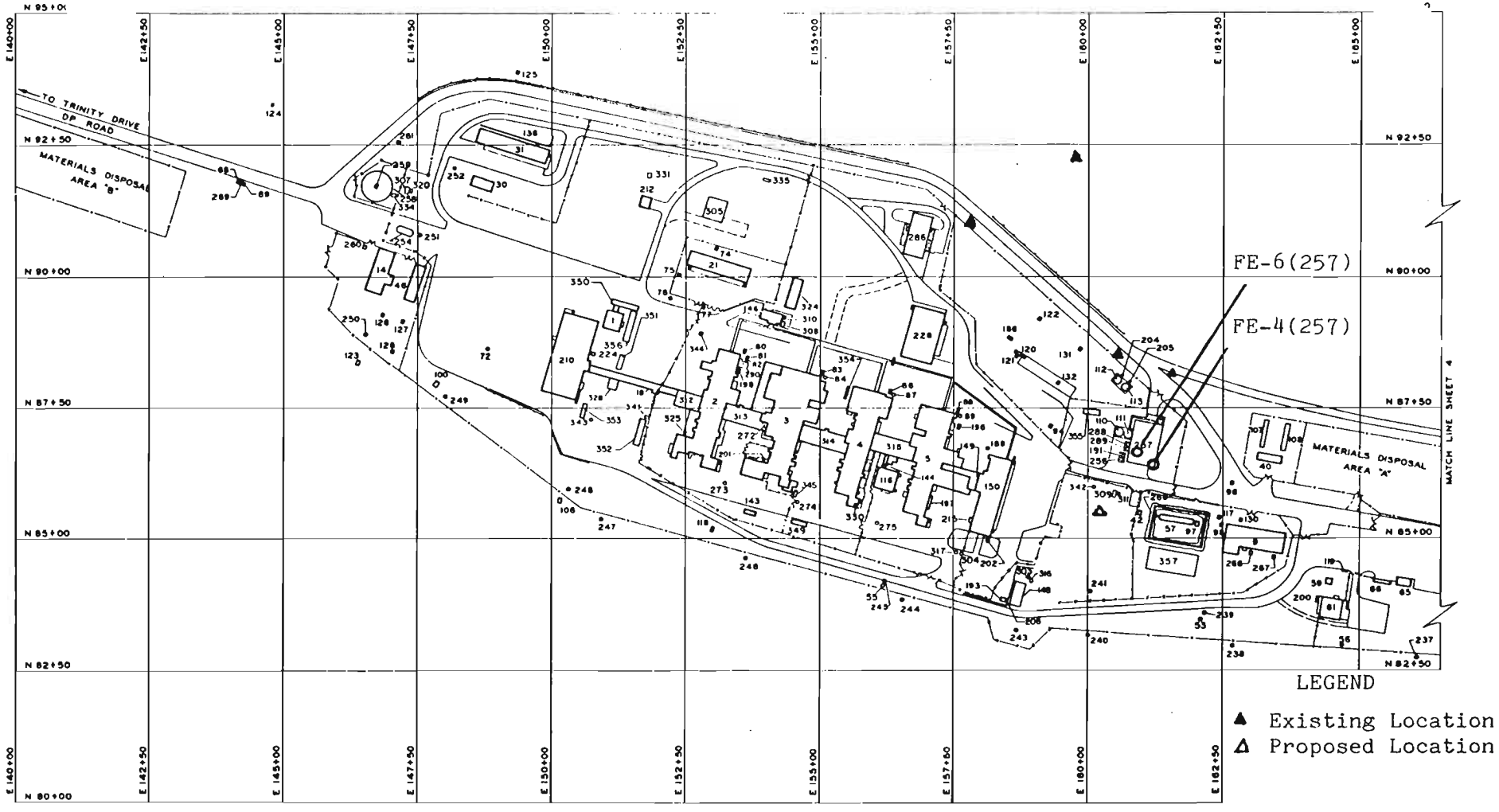
samples are not planned at either location. Vents from the compactor building at TA-54 are monitored, but to date they have not generated enough Pu to confound the resuspension measurements.

Predominant winds at TA-54 are out of the west. This pattern is altered somewhat by complex terrain which causes upslope daytime winds in the canyons and night time drainage winds. Air sampling locations are presently operating at Area G as shown in Figure C.9.

Figure C.10 shows the existing on-site and perimeter air sample locations which might be used to interpret contaminants borne by upslope and downslope winds across TA-21, TA-50, TA-53, and TA-54. Figure C.11 shows two air sampling locations to cover effluents from buildings TA-50-1, 37, 54, and 69 and resuspension from the Area C surface. Figures C.12 through C.25 show the location of stacks monitored at Los Alamos. (See also Table C.2 for radionuclides monitored at each stack).

Biota

Vegetation samples are taken at the surface soil sampling locations shown in Figures C.1, C.2, and C.3. Beehives are located in the canyons below TA-21 and TA-50 and another on TA-54. Honey and bees from these hives are sampled as part of the annual monitoring effort.



1" = 100'

GRAPHIC SCALE

Fig. C.1 Surface Soil and Vegetation Sampling Locations at TA-21-257

REV	DATE	REVISION	BY	CKD
10	8-5-83	REVISED TITLE BLOCK & DWG. TO STATUS OF 8-1-83	H.S.	[illegible]

UNIVERSITY OF CALIFORNIA
Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

FACILITIES ENGINEERING DIVISION

STRUCTURE LOCATION PLAN
TA-21 DP-SITE

SEC. CLASSIFICATION
CLASS U
REVIEWER
DATE

DRAWN	CHECKED	RECOMMENDED	DATE	SHEET NO.	APPROVED	DRAWING NO.
[illegible]	[illegible]	[illegible]	8-8-83	3 of 4	[illegible]	ENG-R5113

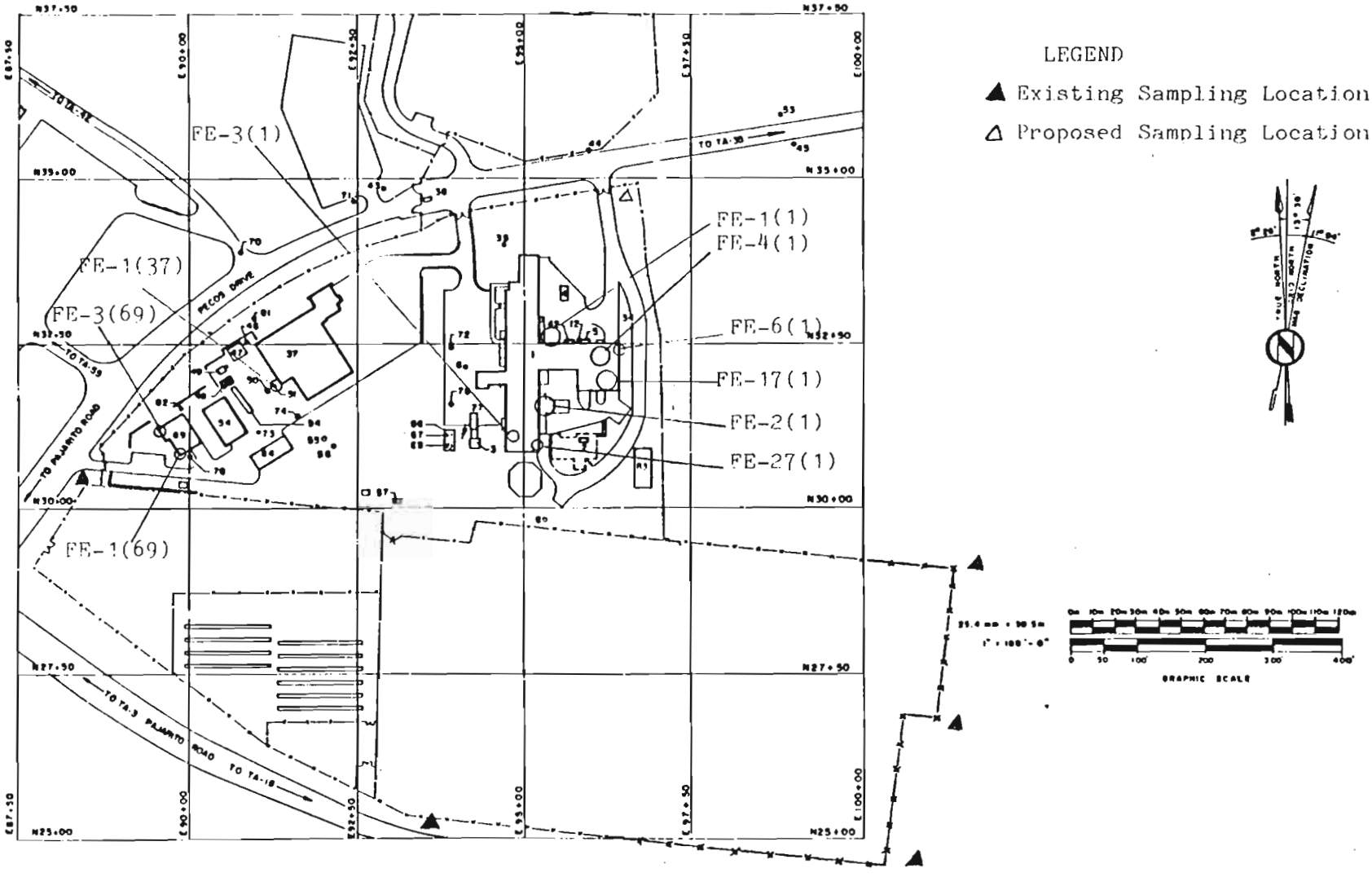


Fig. C.2 Surface Soil and Vegetation Sampling Locations at TA-50

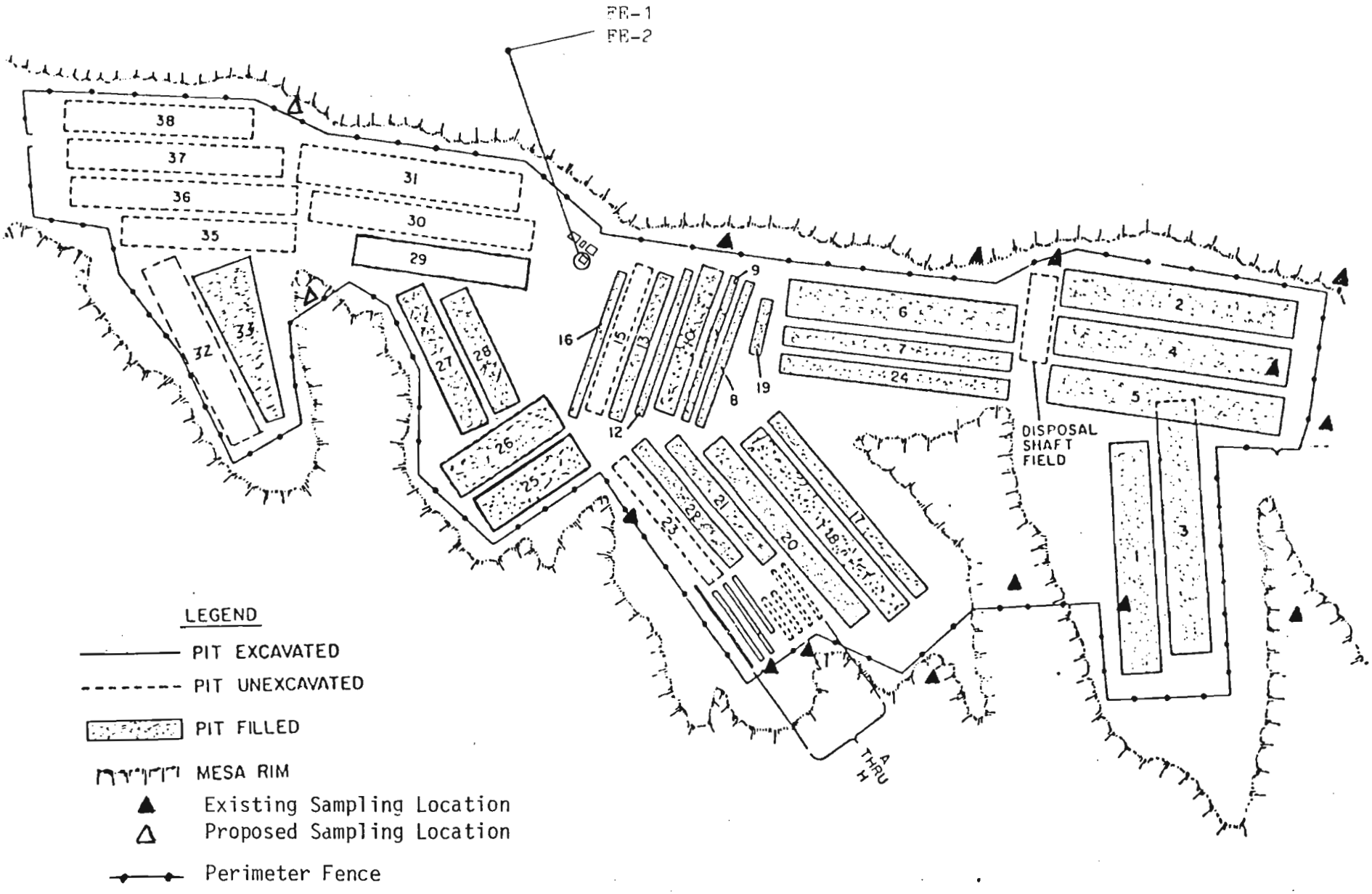
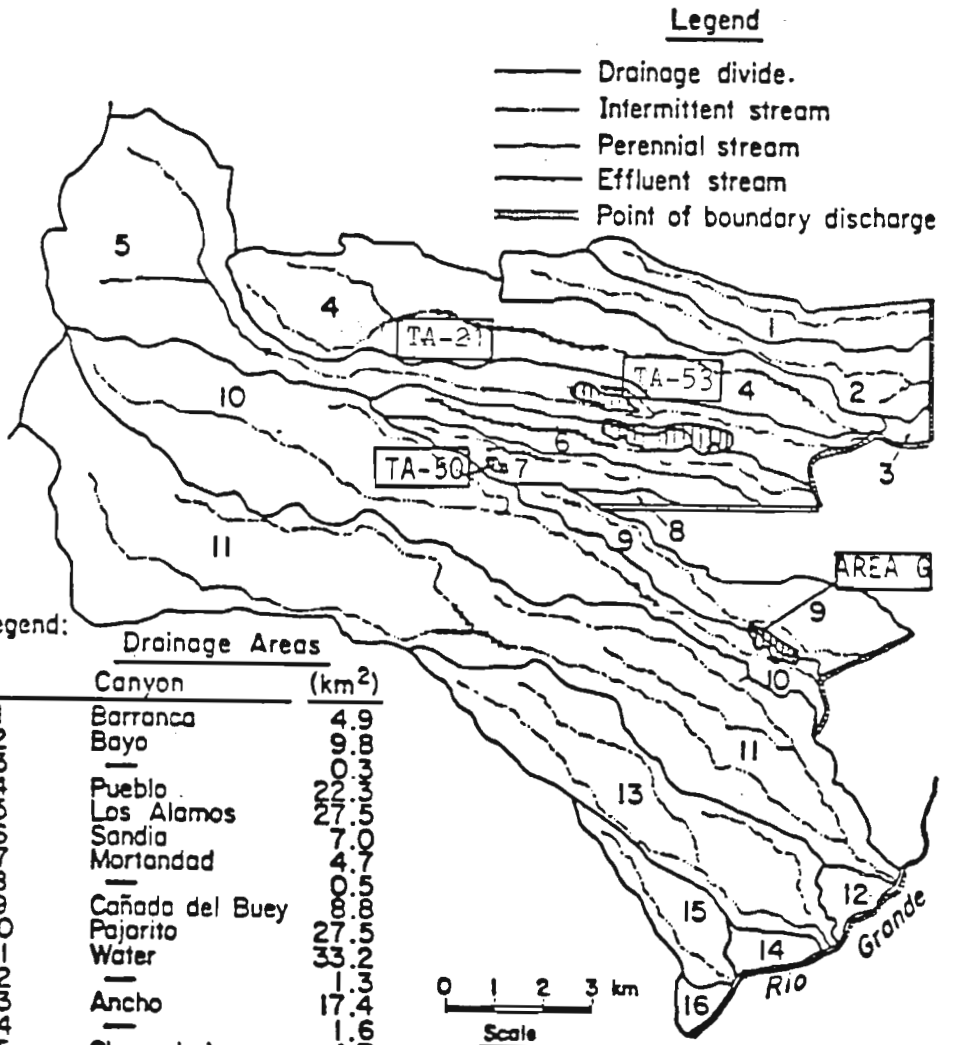


Fig. C.3 Surface Soil and Vegetation Sampling Locations at Area G.



Legend:

Drainage Areas

		Canyon	(km^2)
	1	Barranca	4.9
	2	Bayo	9.8
	3	—	0.3
	4	Pueblo	22.3
	5	Los Alamos	27.5
	6	Sandia	7.0
*	7	Mortandad	4.7
	8	—	0.5
**	9	Cañada del Buey	8.8
*	10	Pajarito	27.5
	11	Water	33.2
	12	—	1.3
	13	Ancho	17.4
	14	—	1.6
	15	Chaquehui	4.7
	16	—	1.0

Fig. C.4 Surface Water Drainage Areas

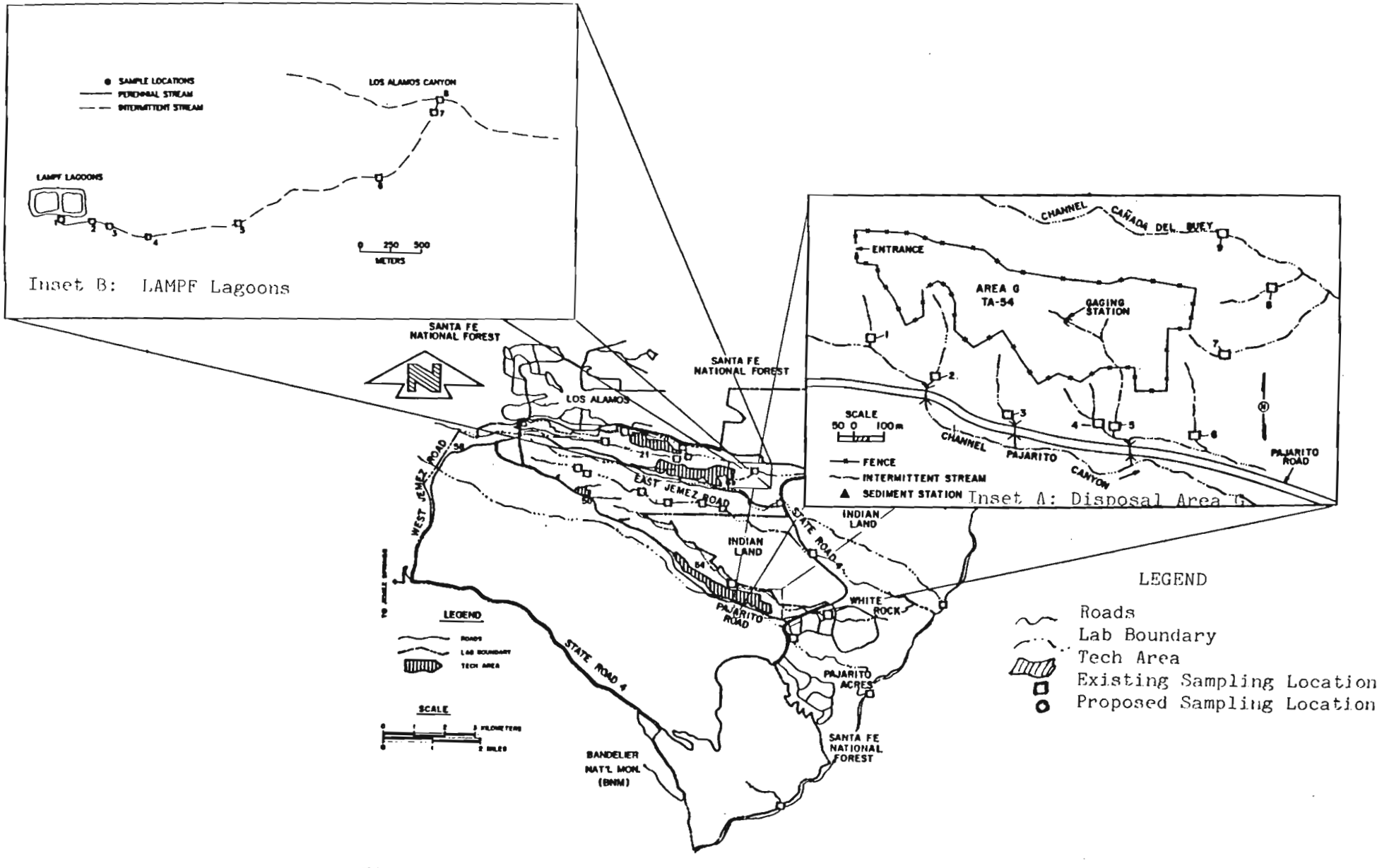


Fig. C.5 Sediment Sampling Locations for TA-21, TA-50, TA-53 and TA-54

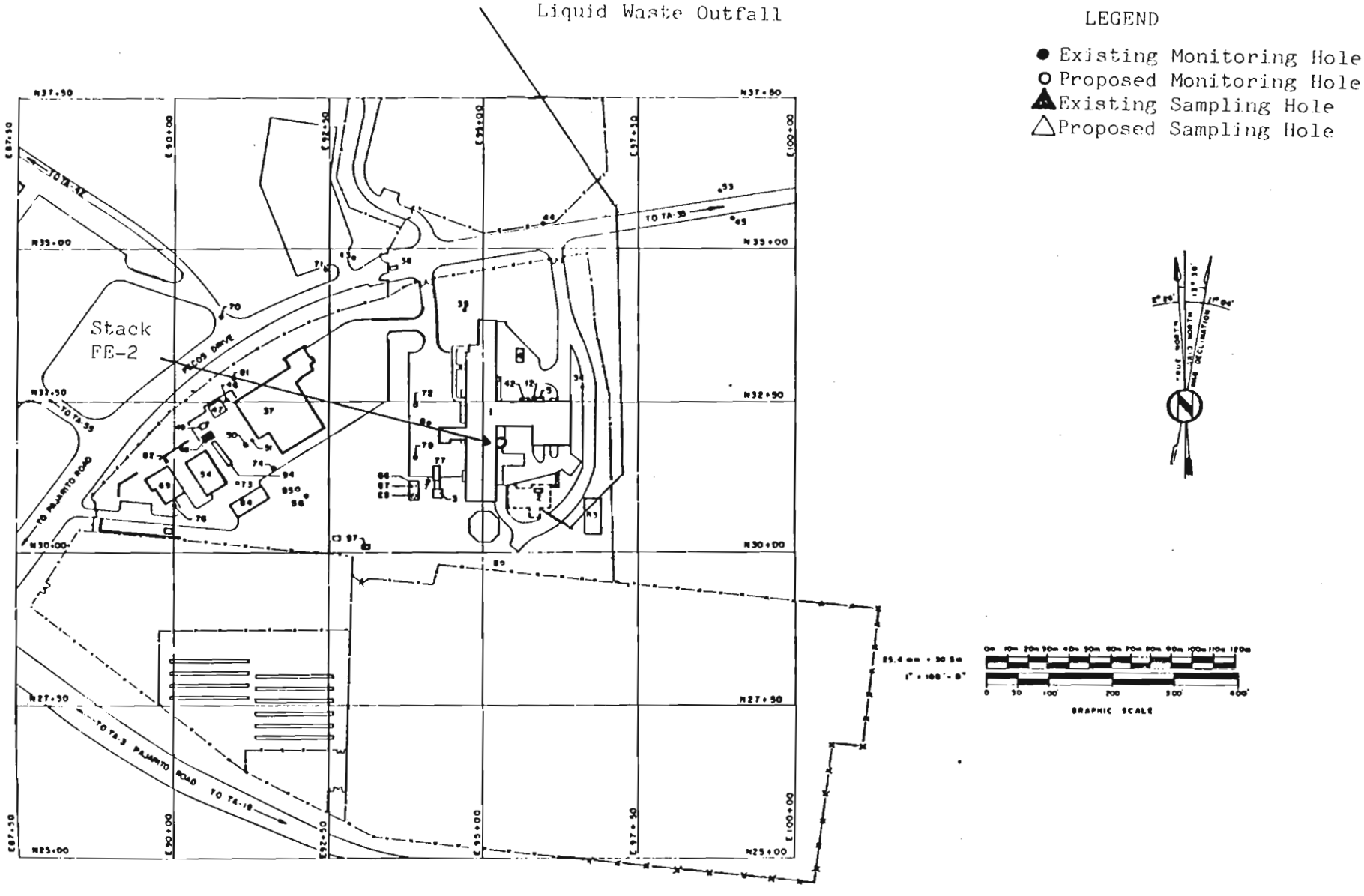
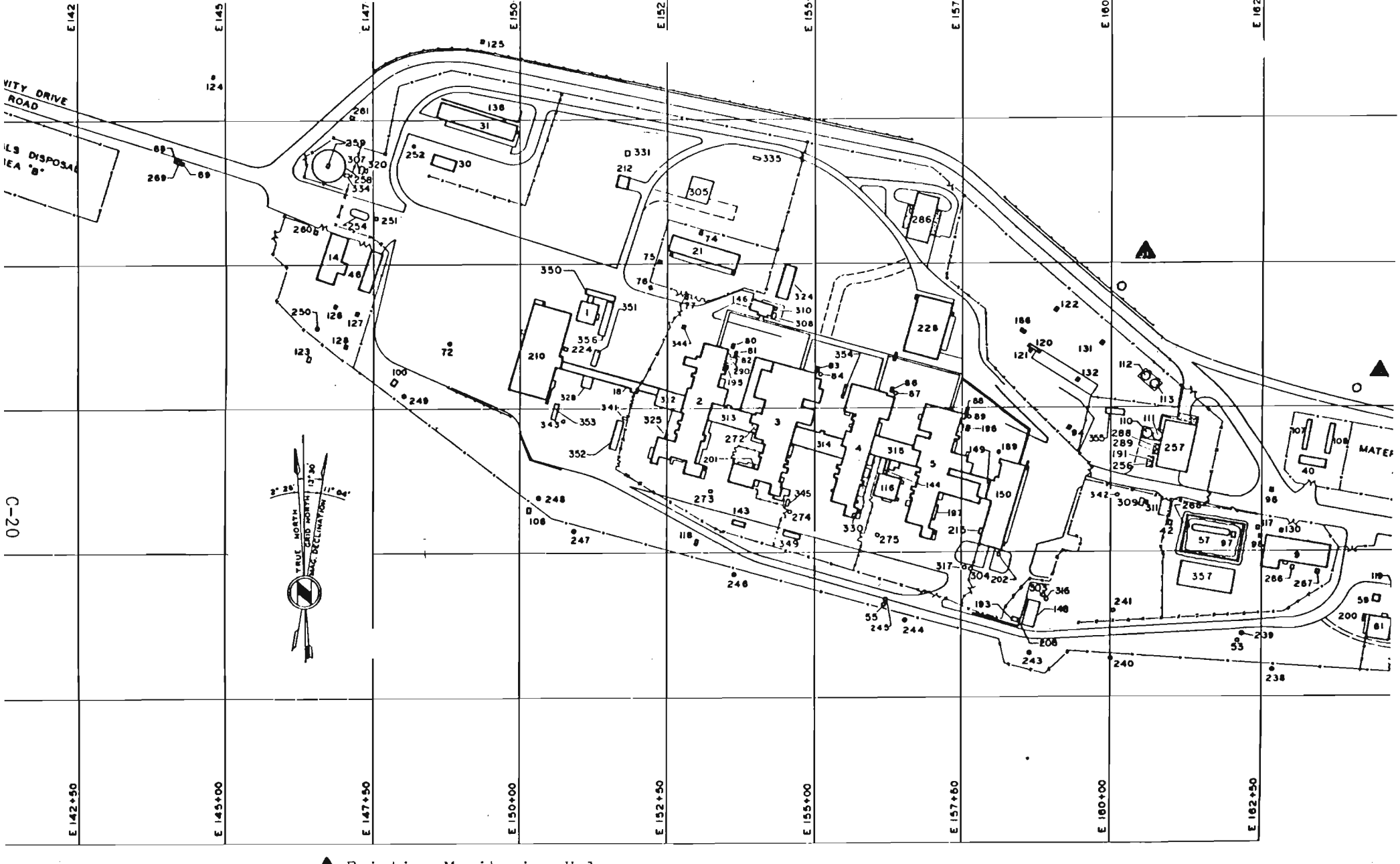


Fig. C.6 Subsurface Soil Monitoring and Sampling Holes for TA-50



▲ Existing Monitoring Hole

o Proposed Sampling Hole

1" = 100'

100' 50' 0 100' 200' 300' 400'

GRAPHIC SCALE

Fig. C.7 Subsurface Soil Monitoring and Sampling Holes at Area T

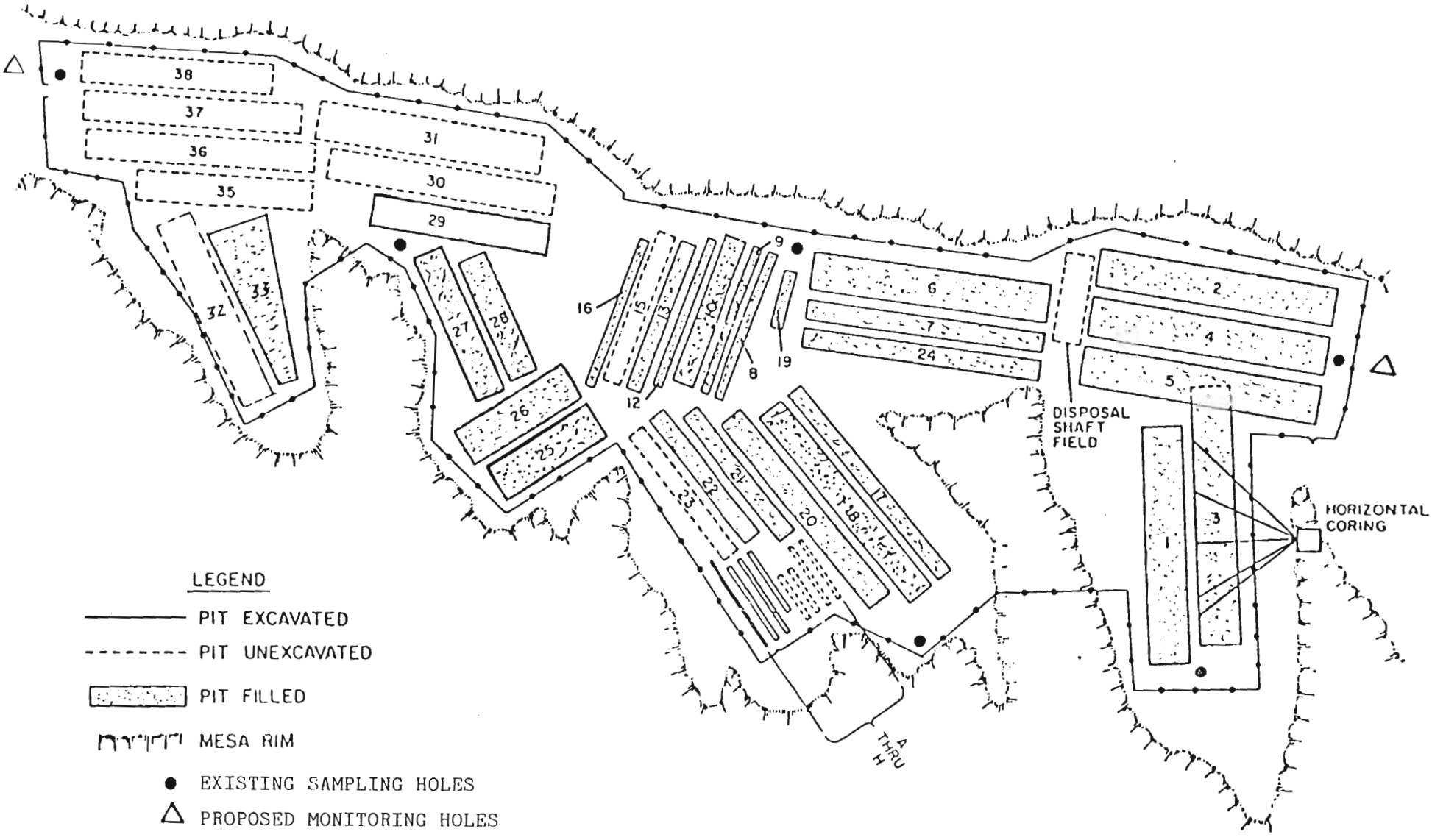


Fig. C.8 Subsurface Sc Monitoring and Sampling Holes at Area G

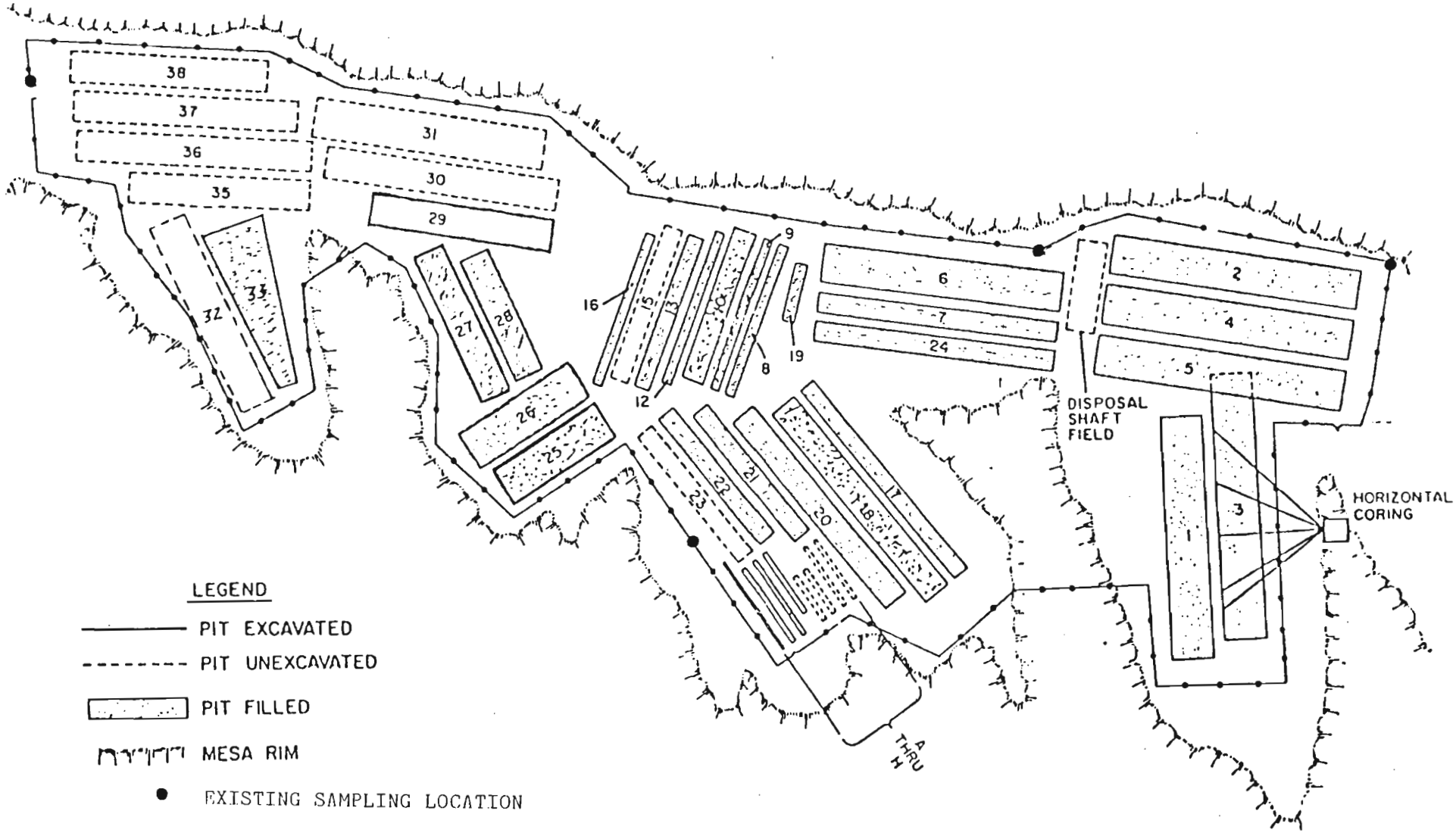


Fig. C.9 Air Sampling Locations at Area G

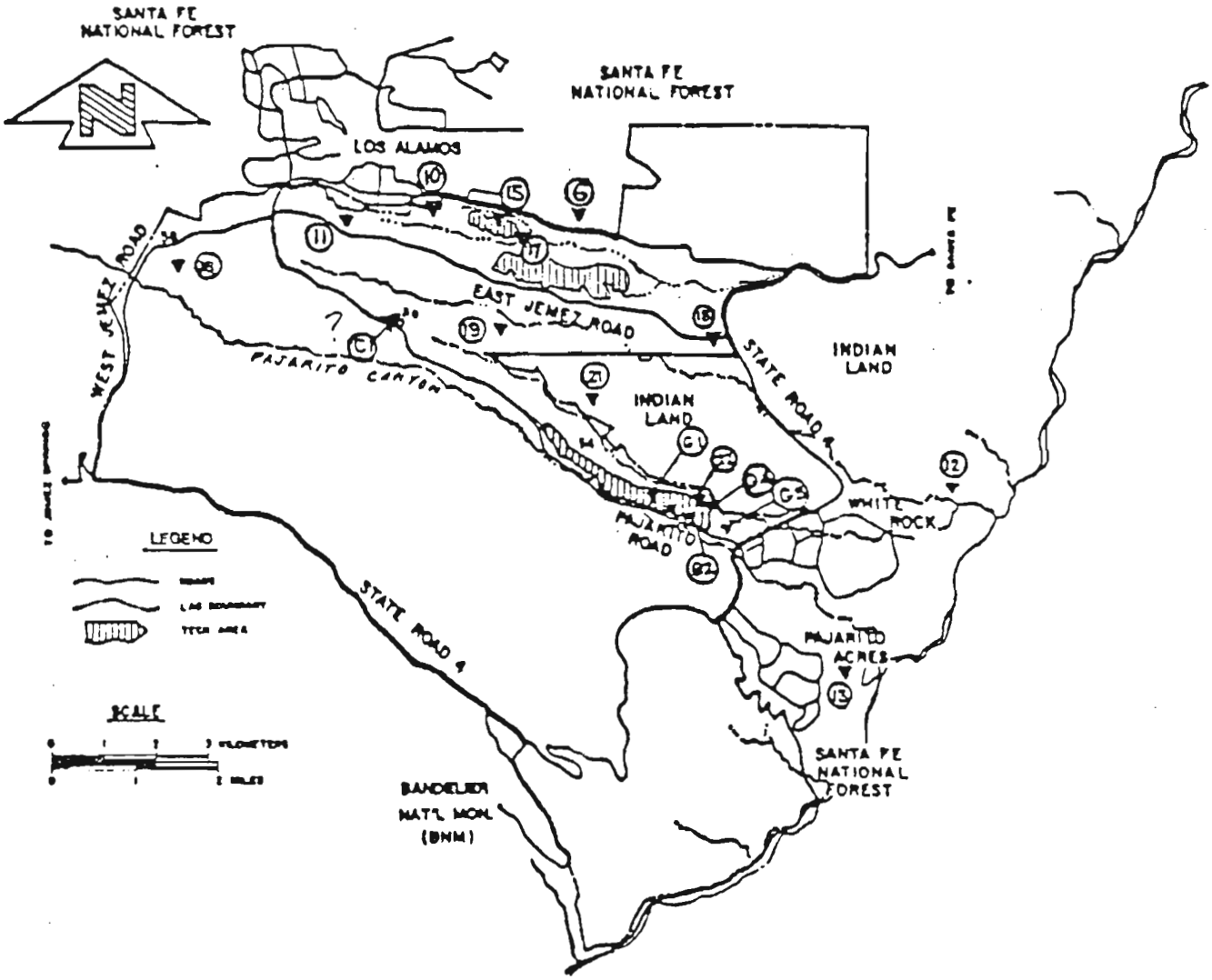


Fig. C.10 Existing Air Sampling Locations Pertinent to TA-21, TA-50, TA-53, and TA-54

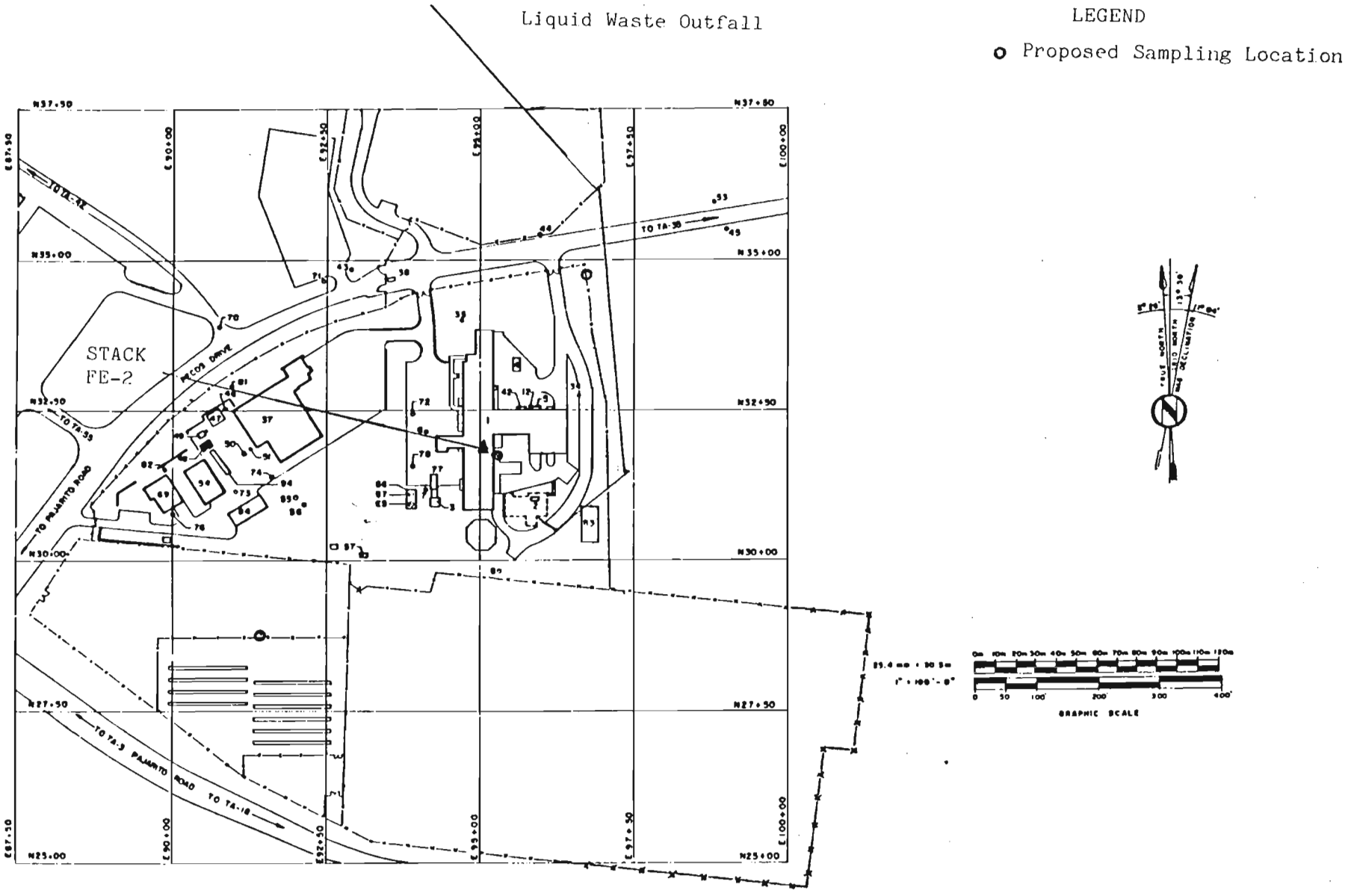


Fig. C.11 Air Sampling Locations at TA-50

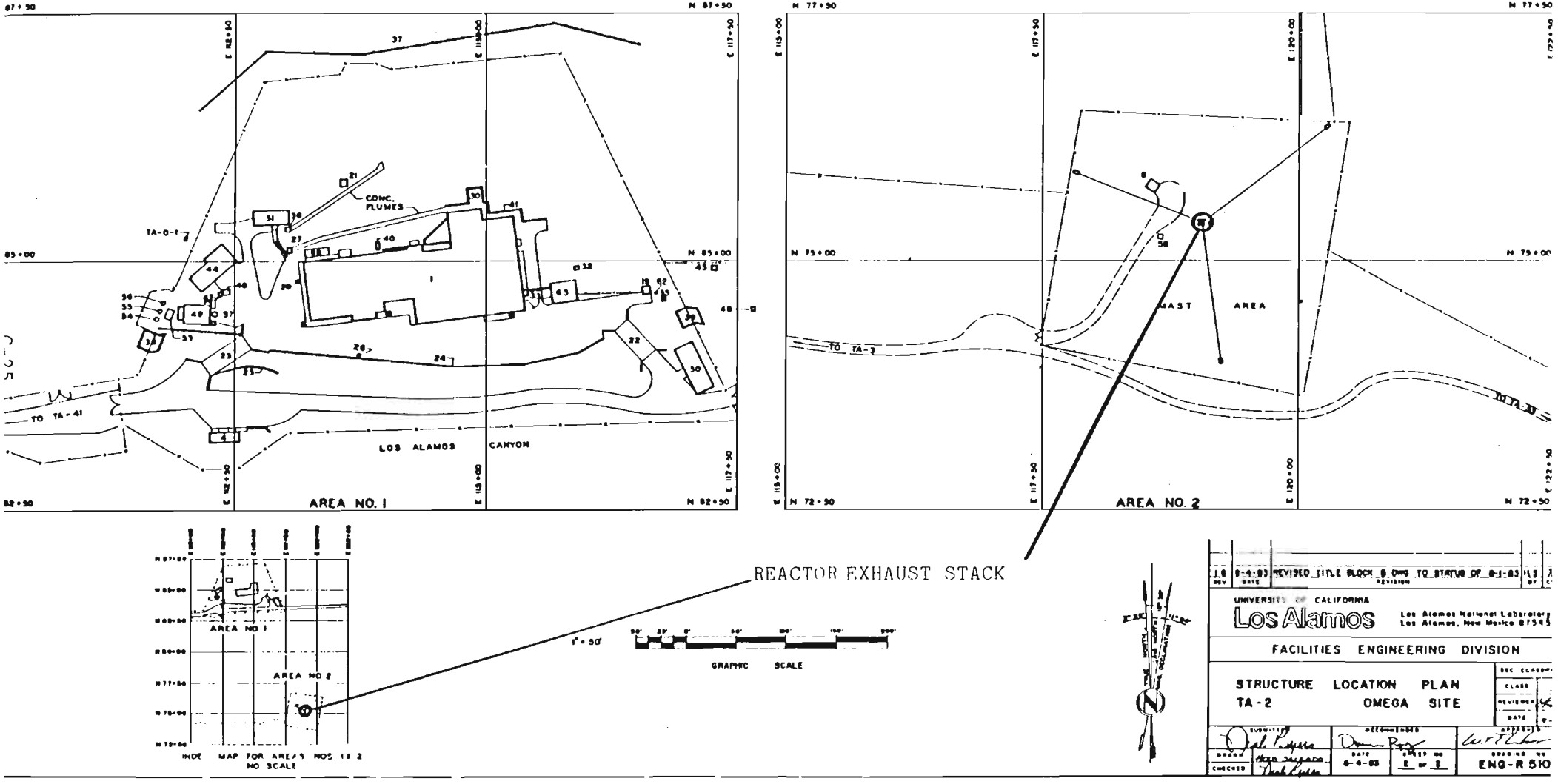


Fig. C.12 TA-2 Stack Monitor Location

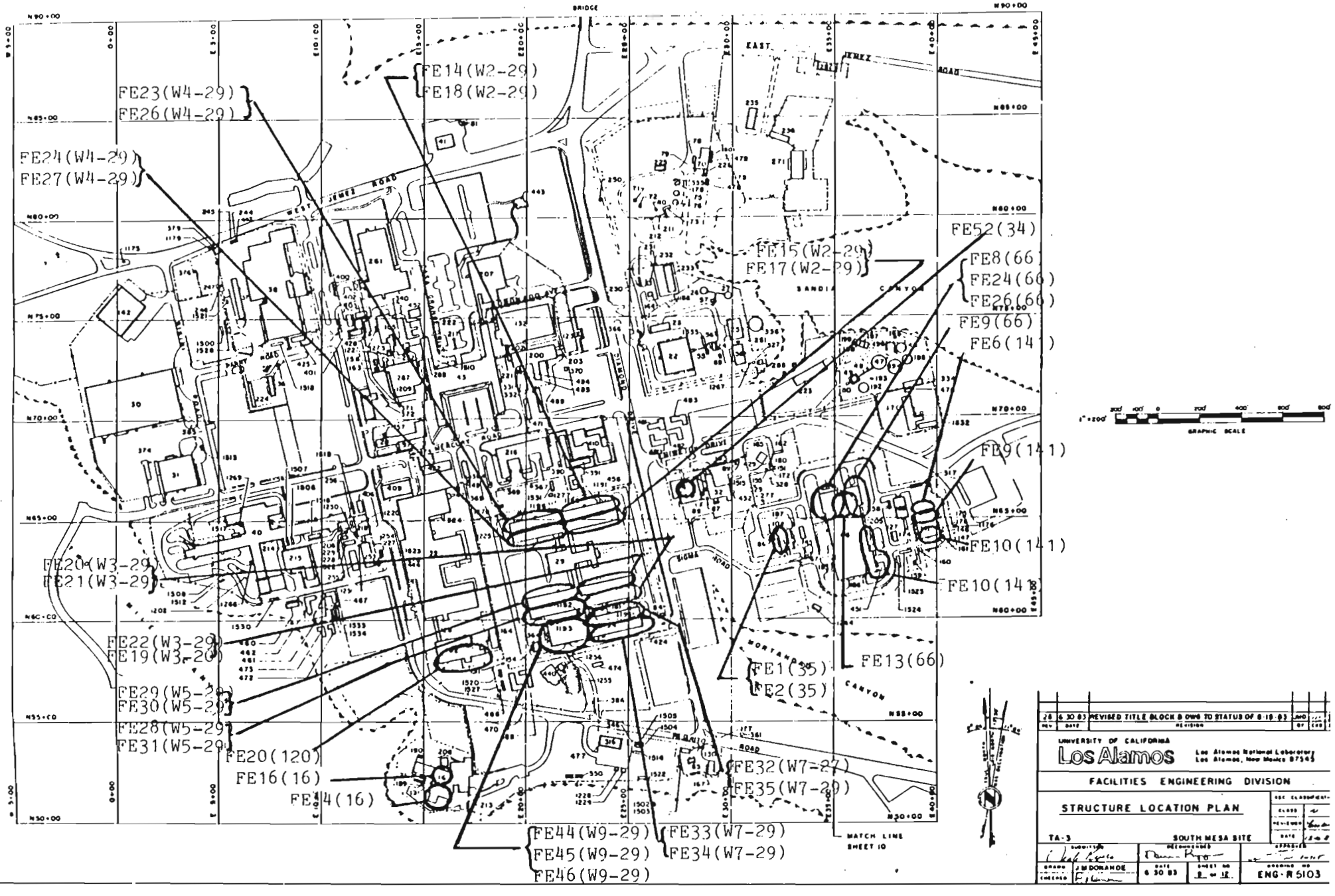
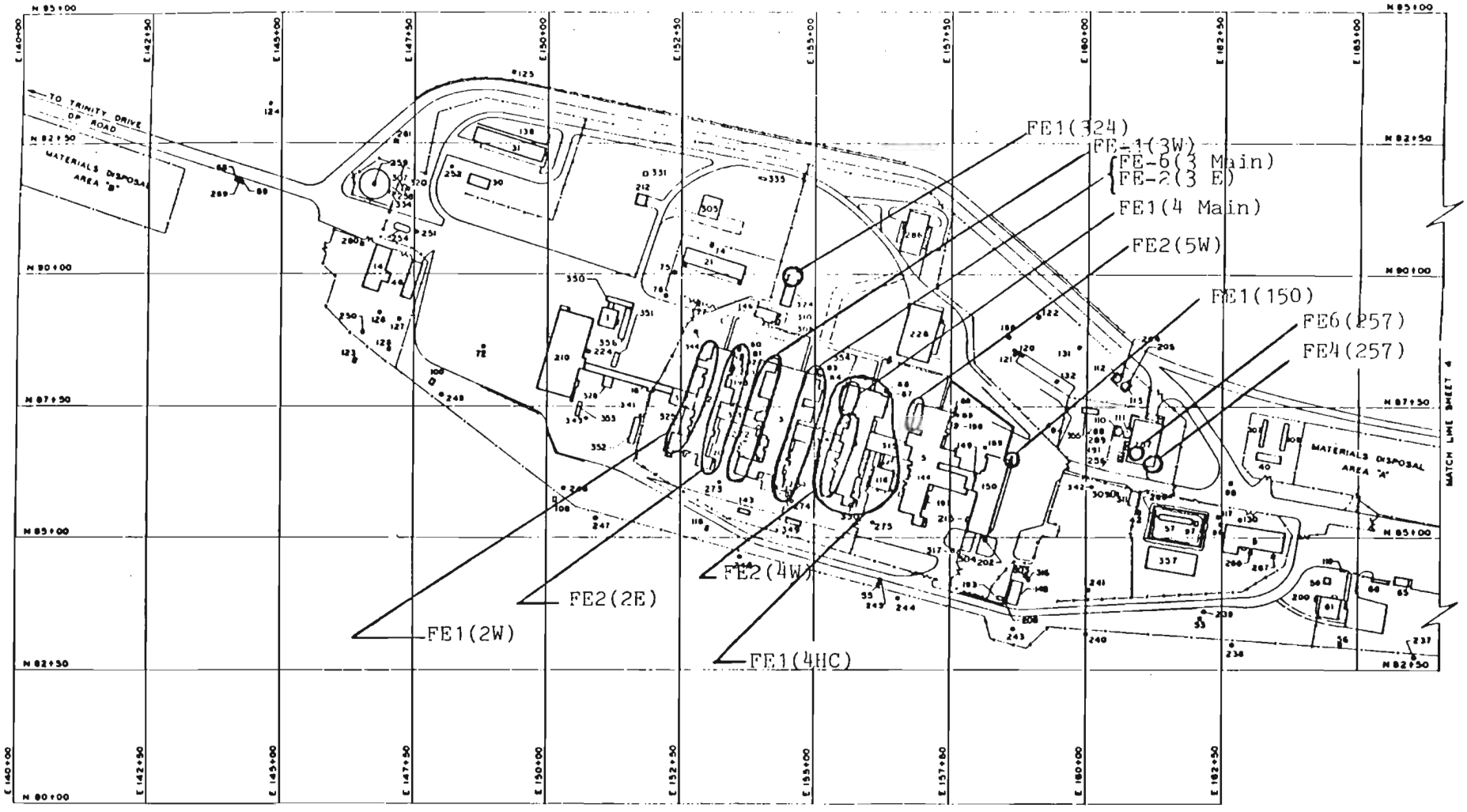


Fig. C.13 TA-3 Stack Monitor Locations



1" = 100'

GRAPHIC SCALE

10 REV	8-5-83 DATE	REVISED TITLE BLOCK & DWG TO STATUS OF 8-1-83 REVISION

UNIVERSITY OF CALIFORNIA
Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87544

FACILITIES ENGINEERING DIVISION

STRUCTURE LOCATION PLAN
TA-21 DP-SITE

DRAWN
CHECKED
RECOMMENDED
DATE
SHEET NO 3 OF 4
APPROVED
DRAWING NO ENG-R511

Fig. C.14 TA-21 West Stack Monitoring Locations

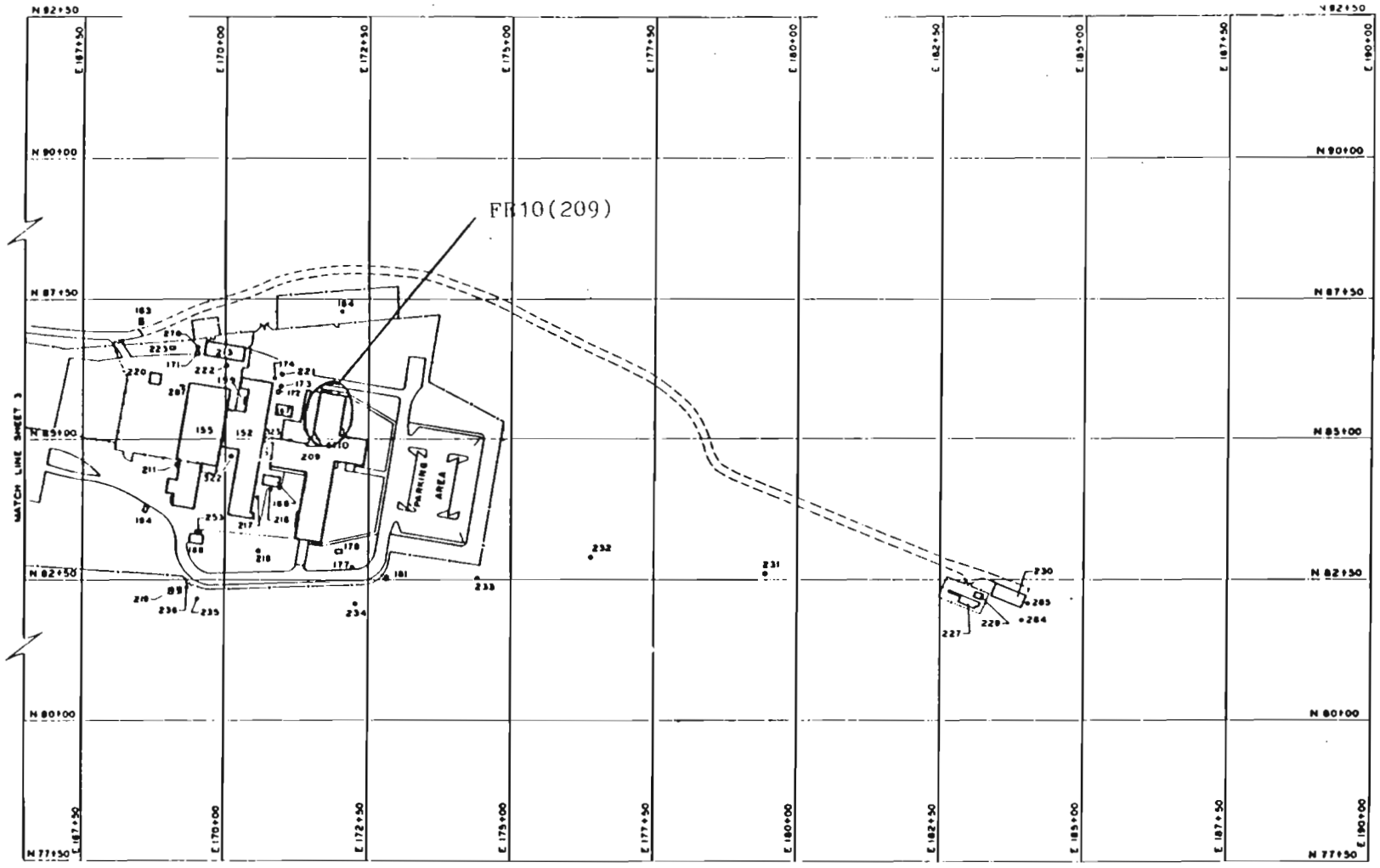


Fig C.15 TA-21 East Stack Monitoring Locations

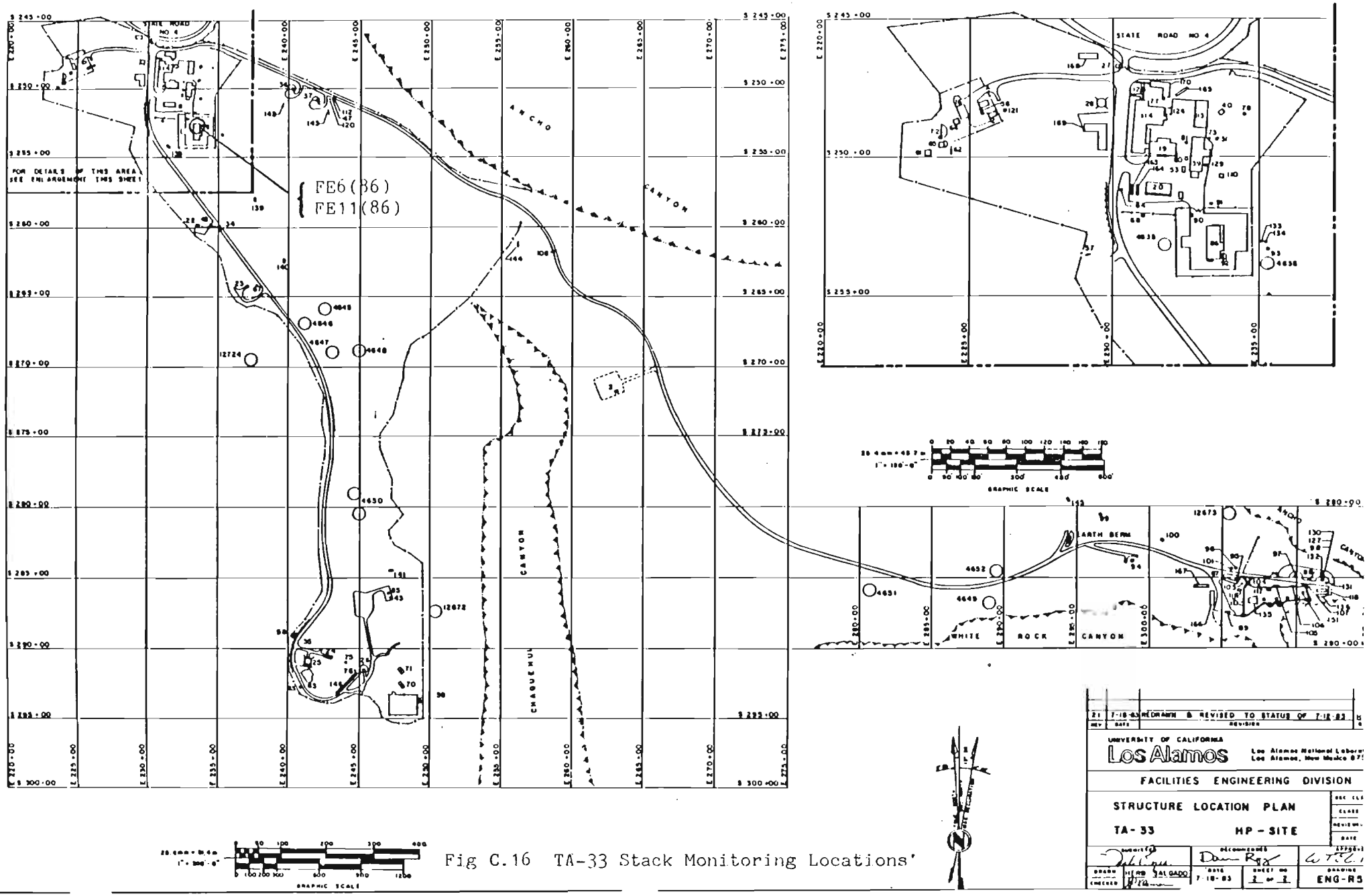


Fig C.16 TA-33 Stack Monitoring Locations'

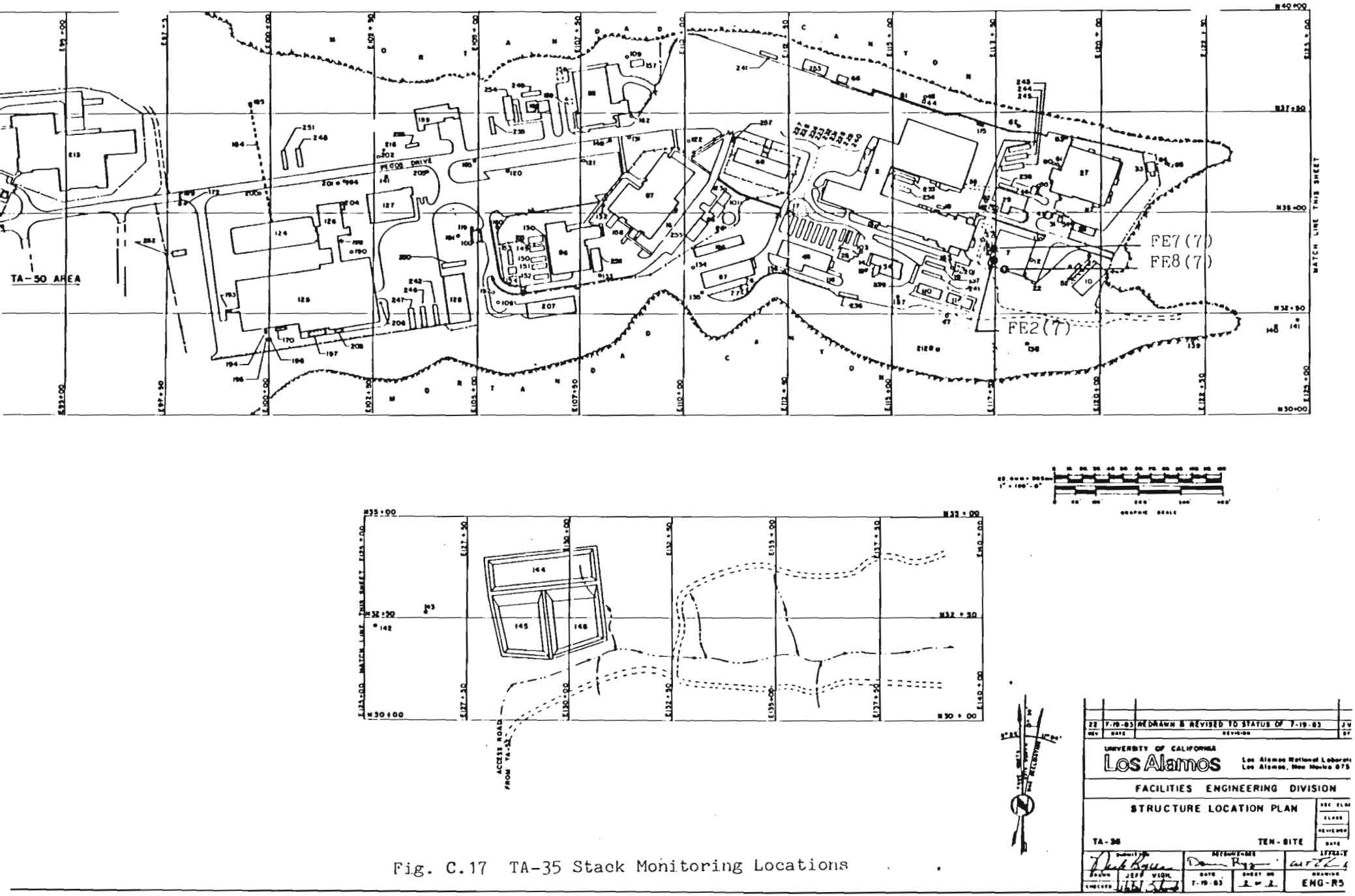
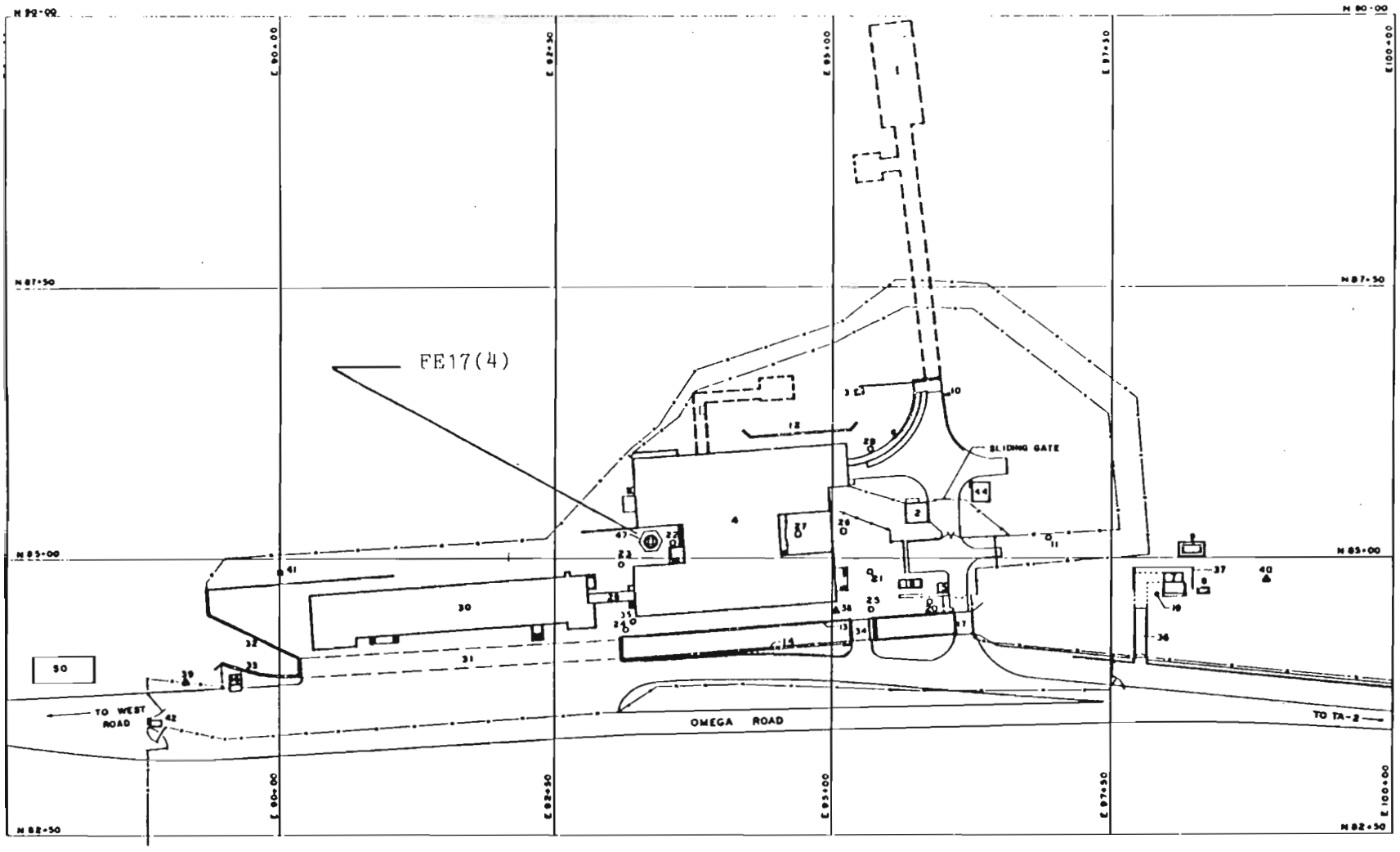


Fig. C.17 TA-35 Stack Monitoring Locations



13 REV	8-5-83 DATE	REVISED TITLE BLOCK & DWG TO STATUS OF 8-1-83 REVISION

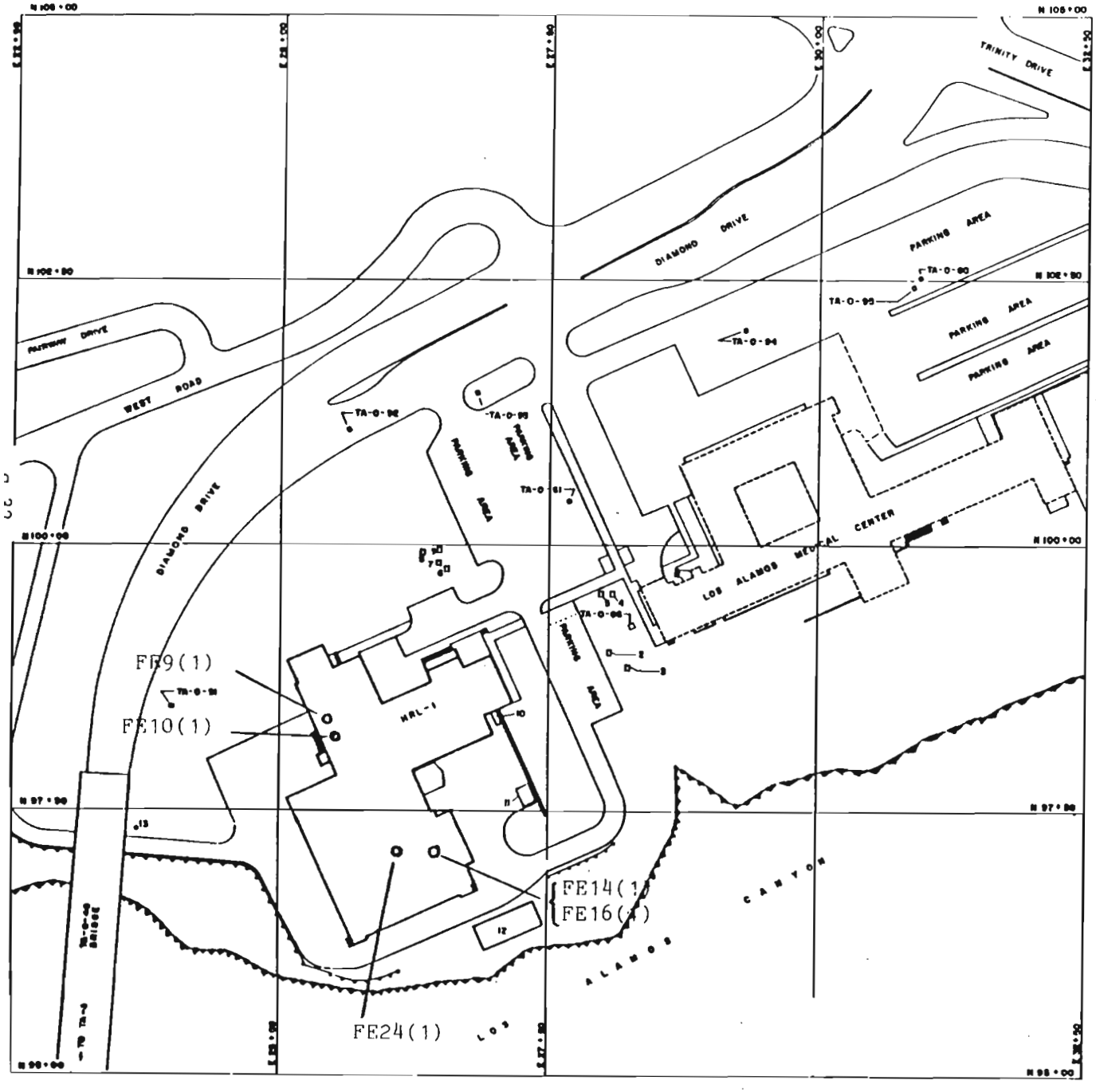
UNIVERSITY OF CALIFORNIA
Los Alamos
Los Alamos National Labo
Los Alamos, New Mexico 8

FACILITIES ENGINEERING DIVISION

STRUCTURE LOCATION PLAN
TA-41 W-SITE

SUBMITTED	RECOMMENDED		APPR
DRAWN / CHECKED	DATE 8-4-83	SHEET NO 1 OF 1	DRAWING ENG-1

Fig. C.18 TA-41 Stack Monitoring Locations



STRUCTURE NUMBER	STRUCTURE DESIGNATION	STRUCTURE NOMENCLATURE	REMARKS	APPROXIMA GRID LOC
TA-43-1	HRL-1	HEALTH RESEARCH LAB		N97+50 E2
TA-43-2	HRL-2	MANHOLE	WATER P.I.V.	N100+00 E2
TA-43-3	HRL-3	MANHOLE	WATER	N100+00 E2
TA-43-4	HRL-4	MANHOLE	WATER	N100+00 E2
TA-43-5	HRL-5	MANHOLE	WATER	N100+00 E2
TA-43-6	HRL-6	MANHOLE	WATER	N100+00 E2
TA-43-7	HRL-7	MANHOLE	WATER	N100+00 E2
TA-43-8	HRL-8	MANHOLE	WATER	N100+00 E2
TA-43-9	HRL-9	MANHOLE	WATER	N100+00 E2
TA-43-10	HRL-10	SEWAGE LIFT STATION	TRANSFERRED TO ZIA AUG '70	N97+50 E2
TA-43-11	HRL-11	METAL LAWN BUILDING		N97+50 E2
TA-43-12	HRL-12	WAREHOUSE		N97+50 E2
TA-43-13	HRL-13	MANHOLE, TELEPHONE		N97+50 E

STRUCTURE NUMBER	STRUCTURE DESIGNATION	STRUCTURE NOMENCLATURE	REMARKS	APPROXIM GRID LOC
TA-0-84	ULR-84	MANHOLE, ACID	REMOVED 1967	
TA-0-85	ULR-85	MANHOLE, ACID	REMOVED 1967	
TA-0-90	ULR-90	BRIDGE	TRANSFERRED TO ZIA 1968	N97+50 E2
TA-0-90	ULR-90	MANHOLE, ACID	ABANDONED 1955	N102+50 E2
TA-0-91	ULR-91	MANHOLE, ACID	ABANDONED 1959	N100+00 E2
TA-0-88	ULR-88	MANHOLE, ELECTRICAL	ABANDONED 1960	N100+00 E2
TA-0-91	ULR-91	MANHOLE, STEAM		N97+50 E2
TA-0-92	ULR-92	MANHOLE, STEAM		N100+00 E2
TA-0-93	ULR-93	MANHOLE, STEAM		N102+50 E2
TA-0-94	ULR-94	MANHOLE, STEAM		N102+50 E2
TA-0-95	ULR-95	MANHOLE, STEAM		N102+50 E2

1" = 50'

GRAPHIC SCALE

REV.	DATE	REVISION
14	7-8-83	REVISED TITLE BLOCK & DWG. TO STATUS OF 6-29-83

UNIVERSITY OF CALIFORNIA
Los Alamos
Los Alamos National Labor
Los Alamos, New Mexico 87

FACILITIES ENGINEERING DIVISION

STRUCTURE LOCATION PLAN
TA-43
HEALTH RESEARCH LABORATORY

SUBMITTED: Del Gross
DRAWN: HERB SALAZAR
CHECKED:
RECOMMENDED: Doug Rose
DATE: 7-8-83
SHEET NO: 1 of 1
APPROVED: W. T. K.
DRAWING: ENG-R

Fig. C.19 TA-43 Stack Monitoring Locations

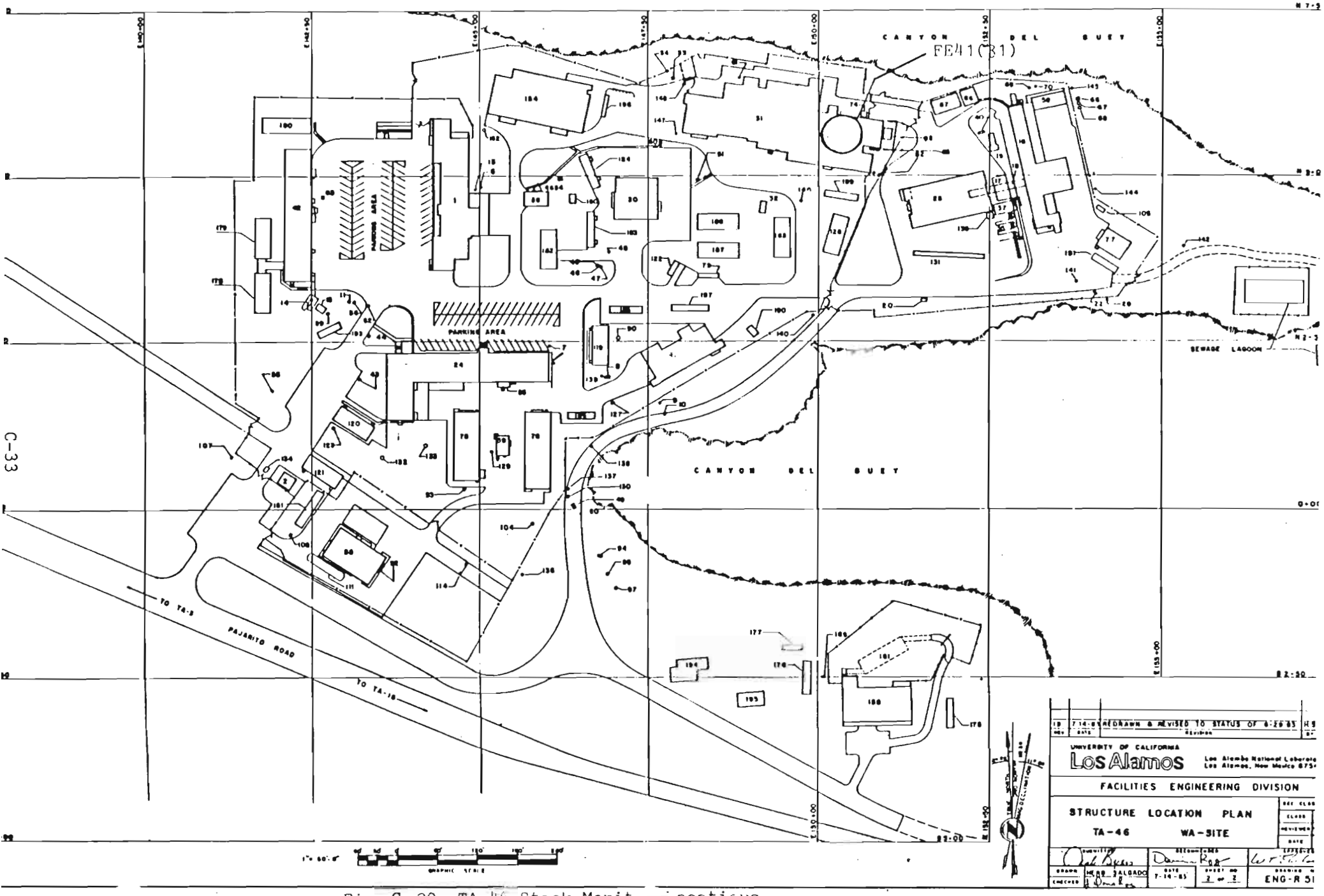


Fig. C .20 TA-46 Stack Monit locations

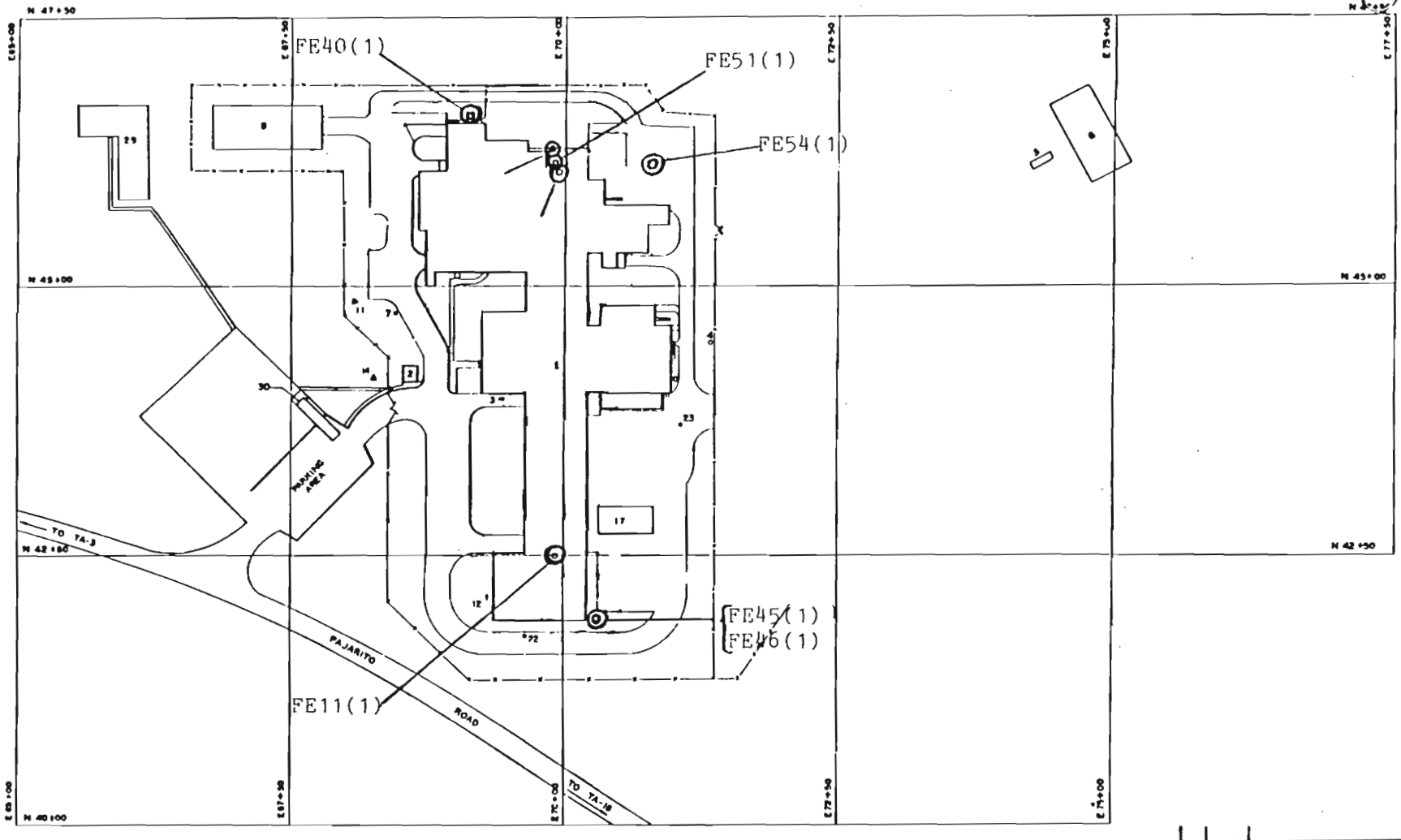
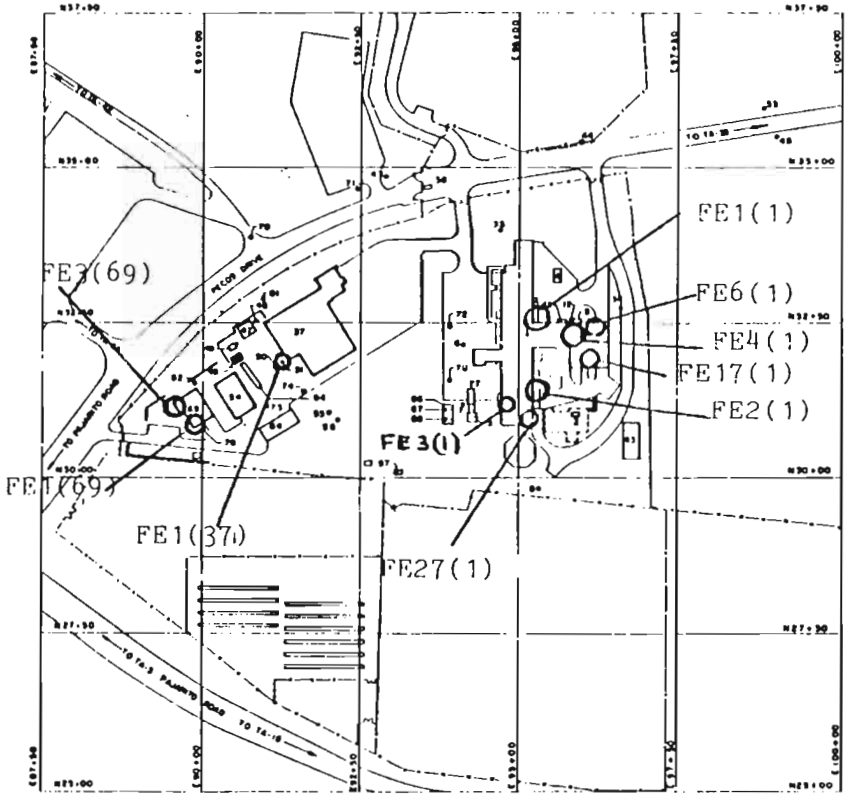


Fig. C.21 TA-48 Stack Monitor Locations



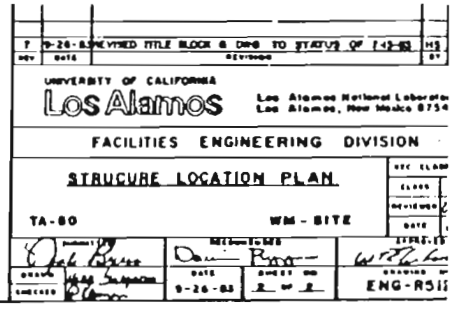


Fig. C.22 TA-50 Stack Monitor Locations

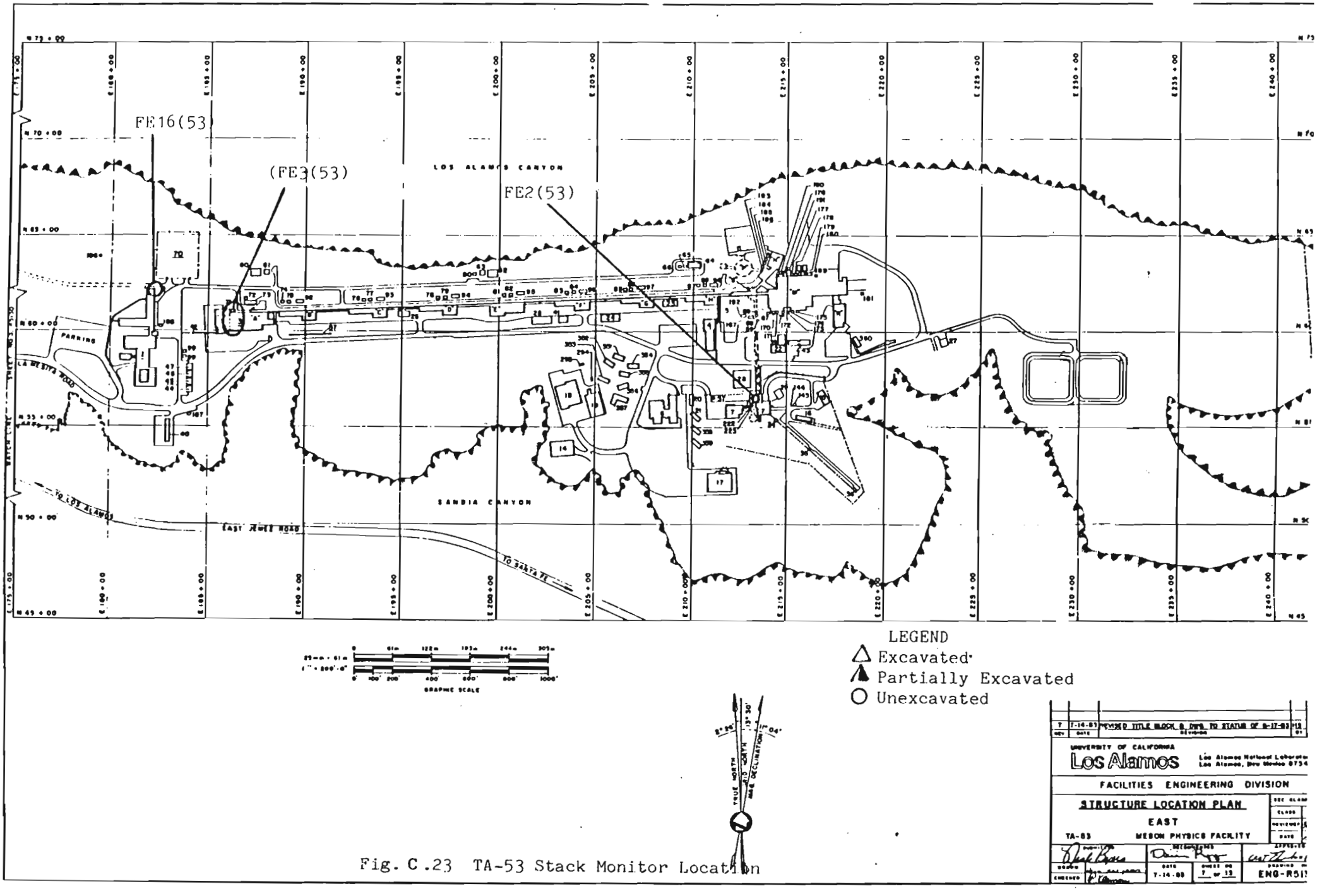
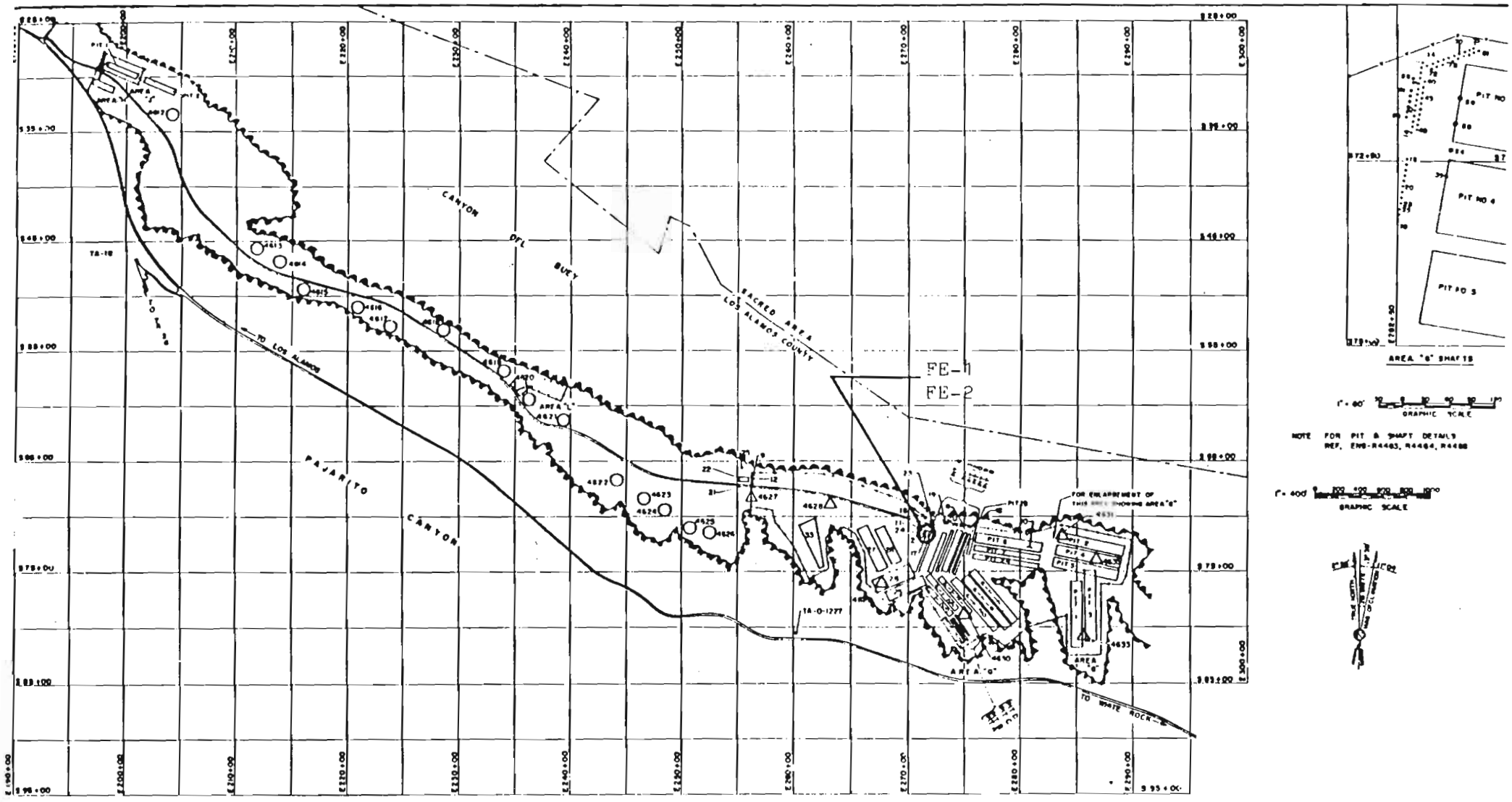


Fig. C.23 TA-53 Stack Monitor Location



STRUCTURE NUMBER	STRUCTURE DESIGNATION	STRUCTURE NOMENCLATURE	REMARKS	APPROXIMATE GRID LOCATION
TA-54-1	MD-1	OPERATIONS BLDG		S70+00 E270+00
TA-54-2	MD-2	TRANSFORMER STATION	NOT SHOWN	
TA-54-3	MD-3	TRANSFORMER STATION		S70+00 E270+00
TA-54-4	MD-4	TRANSFORMER STATION		S70+00 E270+00
TA-54-5	MD-5	TRANSFORMER STATION		S70+00 E275+00
TA-54-6	MD-6	TRANSFORMER STATION		S70+00 E280+00
TA-54-7	MD-7	TRANSFORMER STATION		S70+00 E280+00
TA-54-8	MD-8	CONTAMINATED DRUM STORAGE		S70+00 E275+00
TA-54-9	MD-9	TRANSFORMER STATION		S65+00 E255+00
TA-54-10	MD-10	METEOROLOGICAL TOWER		S75+00 E280+00
TA-54-11	MD-11	WASTE MANAGEMENT CTRL FAC		S70+00 E270+00
TA-54-12	MD-12	CONSTRUCTION SHACK		S65+00 E295+00
TA-54-16	MD-16	SEPTIC TANK		S70+00 E270+00
TA-54-17	MD-17	HOT LIQUID HOLDING TANK		S70+00 E270+00
TA-54-18	MD-18	TANK, WATER		S70+00 E275+00
TA-54-19	MD-19	TANK, WATER U-8		S70+00 E275+00

STRUCTURE NUMBER	STRUCTURE DESIGNATION	STRUCTURE NOMENCLATURE	REMARKS	APPROXIMATE GRID LOCATION
TA-54-20	MD-20	EQUIPMENT SHELTER		S75+00 E275+00
TA-54-21	MD-21	SECURITY GATE		S70+00 E255+00
TA-54-22	MD-22	TRANSPORTABLE OFFICE BLDG		S65+00 E260+00
TA-54-23	MD-23	TRAILER STORAGE	FORMERLY TA-0-383	S75+00 E270+00
TA-54-24	MD-24	TRAILER, CHANGE ROOMS	FORMERLY TA-0-670	S75+00 E270+00
TA-54-25	MD-25	BACKFLOW PREVENTER BLDG		S70+00 E260+00
TA-0-1277	UL-R-1277	BACKFLOW PREVENTER BLDG		S80+00 E260+00

REV	DATE	REVISION
7	8-8-83	REVISED TITLE BLOCK & DWG TO STATUS OF 8-2-83

UNIVERSITY OF CALIFORNIA
Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87

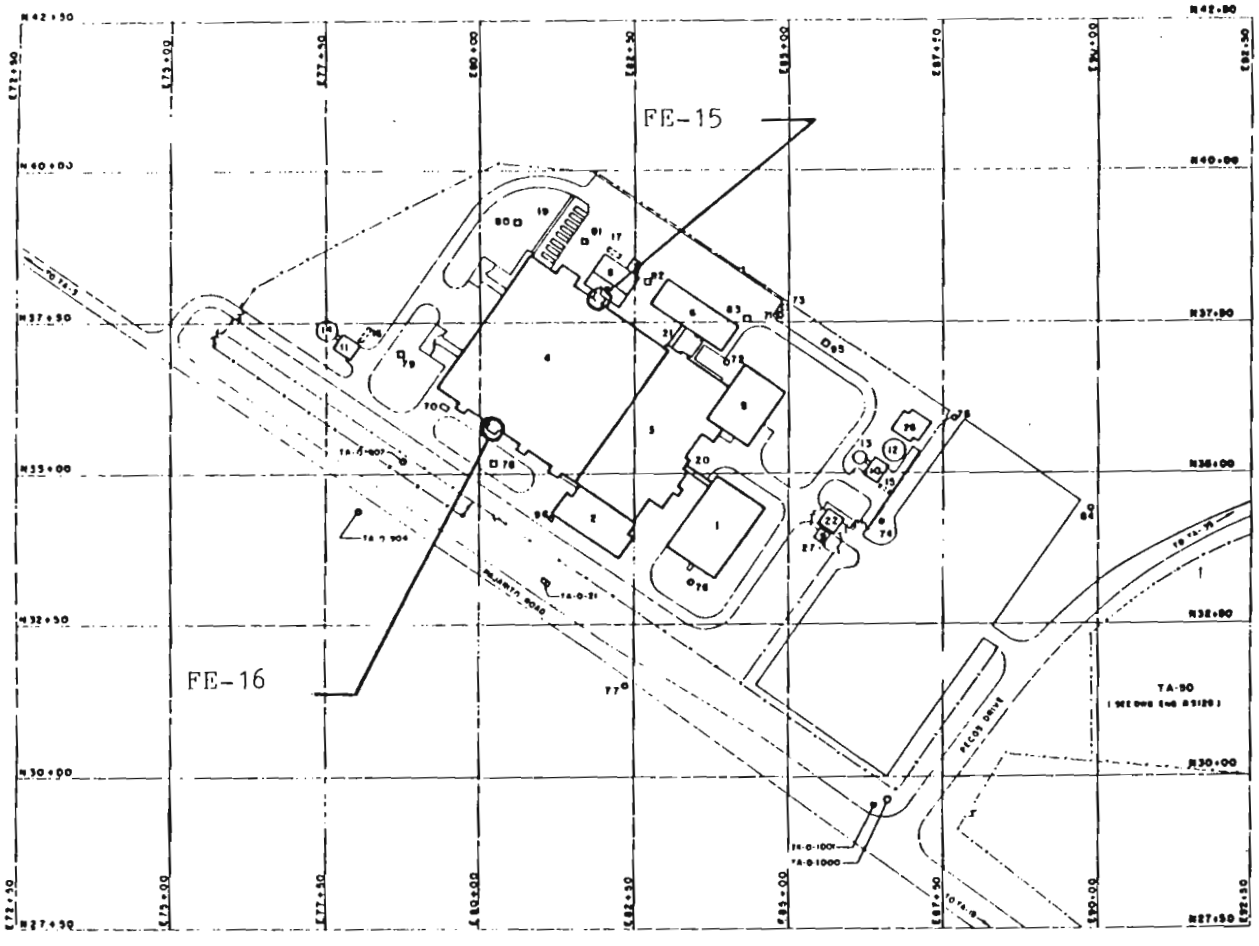
FACILITIES ENGINEERING DIVISION

STRUCTURE LOCATION PLAN

TA-54 WASTE DISPOSAL SITE

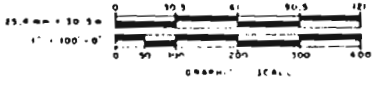
DRAWN: [illegible] DATE: 8-8-83 SHEET NO 1 OF 1 DRAWING ENG-R5

Fig. C.24 TA-54, Area [illegible]ack Monitor Locations



LEGEND

Excavated
Partially Excavated
Unexcavated



UNIVERSITY OF CALIFORNIA
Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87

FACILITIES ENGINEERING DIVISION

STRUCTURE LOCATION PLAN
TA-55 PLUTONIUM PROCESSING FACILITY

DRAWN J. DONAHOE
DATE 7-27-83
SHEET NO 2 OF 2
ENG-R

Fig. C.25 TA-55 Stack Monitor Locations

APPENDIX D

GROUND WATER MONITORING EXEMPTION REQUEST

Pursuant to: 40 CFR 264.90 (b) (4) and

40 CFR 265.90 (c)

November 1, 1984

I. PURPOSE

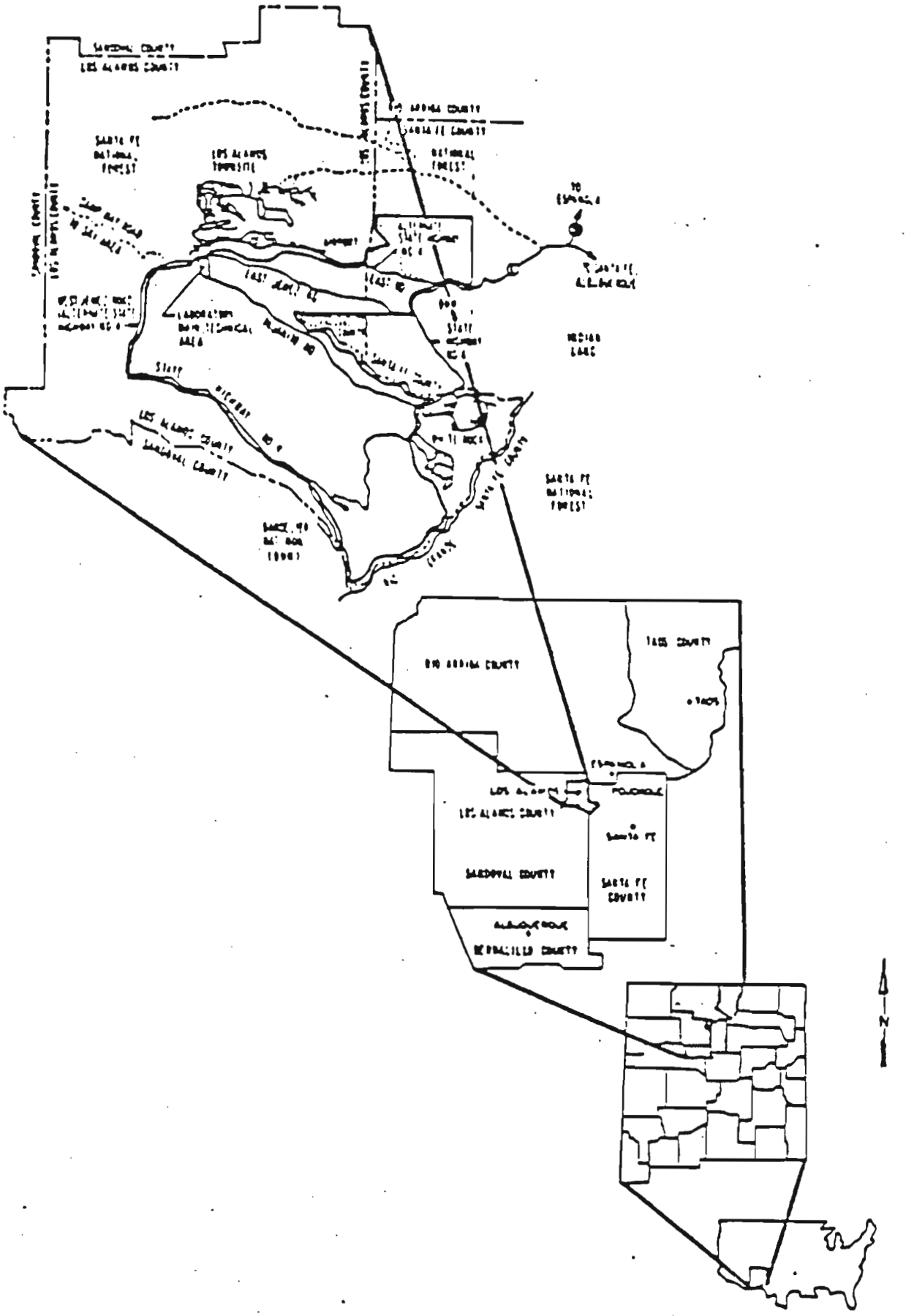
The purpose of this document is to provide information necessary to obtain a variance from 40 CFR 264, Subpart F in accordance with 40 CFR 264.90 (b)(4). Subpart F requires groundwater monitoring unless it can be demonstrated there is no potential for migration of liquids from the regulated unit to the uppermost aquifer. Data presented here demonstrates that the annual evapotranspiration equals or exceeds the annual precipitation resulting in a negative percolation rate. Current disposal practices prohibit the disposal of free liquids. Past disposal of volumes of free liquids are insufficient to contaminate ground water. Depth to the first aquifer is 950 ft. (Area L) to 850 ft. (Area G). There is no potential for waste leachate to migrate to the top of the first aquifer.

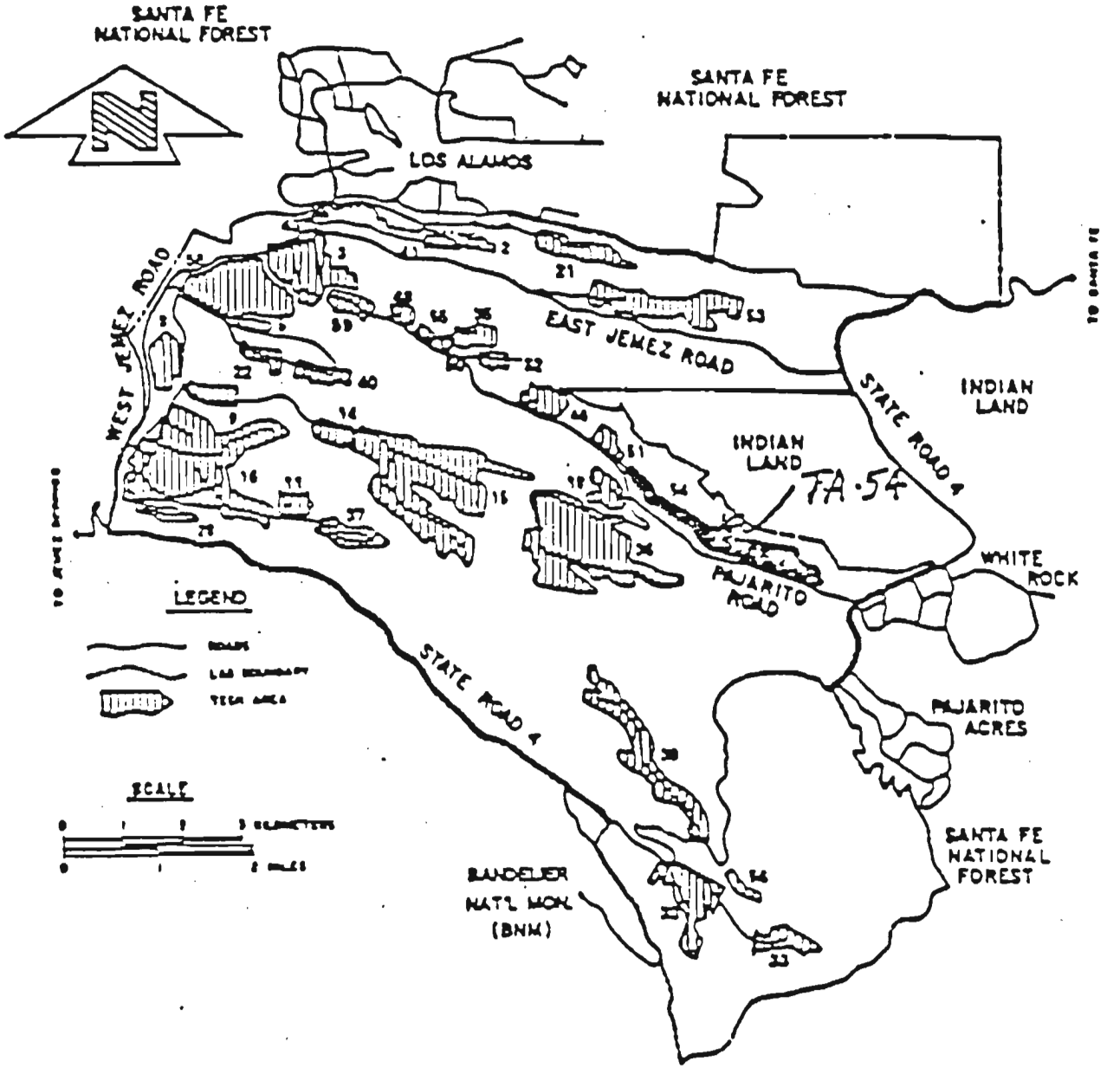
II. LOCATION

A. General

The waste disposal area within the bounderies of Los Alamos National Laboratory is located in north central New Mexico about 50 miles north of Albuquerque (Los Alamos Scientific Laboratory, 1979). The Laboratory is located on the Pajarito Plateau, a series of ashflow and ashfall tuffs that form an apron around the eastern flanks of the Sierra de Los Valles. The eastern edge of the Plateau terminates above the Rio Grande.

The Plateau has been dissected by southeast trending canyons into a number of finger-like mesas. The waste disposal area, TA-54, is located on Mesita del Buey, beginning at the junction of Rex Drive and Pajarito Road and extending approximately 2 mi. It is located at S 1/2, Section 31, T. 19 N., R7E., N.M.P.M. A general location map of Los Alamos is shown on figure 1. The layout of Los Alamos National Laboratory facilities relative to adjacent communities is shown on figure 2.


SANDOVAL COUNTY
LOS ALAMOS COUNTY
SANTA FE NATIONAL FOREST
LOS ALAMOS TOWNSITE
TO ESPAÑOLA
TO SANTA FE ALBUQUERQUE
EAST JEMEZ RD
PUEBLO
SANTA FE NATIONAL FOREST
RIO ARRIBA COUNTY
TAOS COUNTY
TAOS
ESPAÑOLA
LOS ALAMOS COUNTY
POJOAQUE
SANTA FE
SANDOVAL COUNTY
SANTA FE COUNTY
ALBUQUERQUE
BERNALILLO COUNTY
N


SANTA FE
NATIONAL FOREST
SANTA FE
NATIONAL FOREST
LOS ALAMOS
WEST JEMEZ ROAD
EAST JEMEZ ROAD
STATE ROAD 4
INDIAN
LAND
INDIAN
LAND
TA-54
WHITE
ROCK
PAJARITO
ROAD
PAJARITO
ACRES
SANTA FE
NATIONAL
FOREST
BANDELIER
NAT'L MON.
(BNM)
LEGEND
SCALE

B. Proximity to Residential Areas

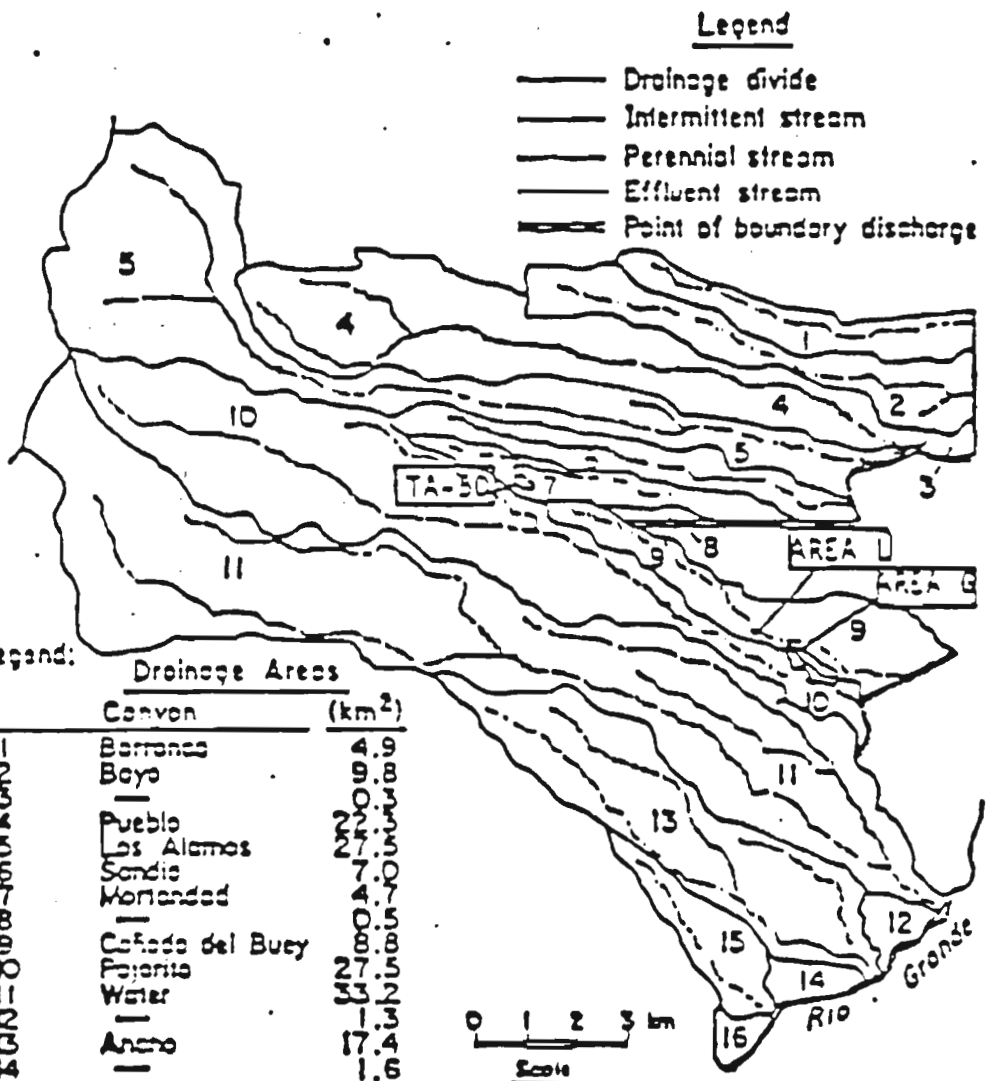
The nearest residential community is White Rock, New Mexico, located approximately 1.15 mi. to the SE of TA-54. A second residential community is Los Alamos, New Mexico, located approximately 4.4 mi. to the NW of TA-54. The total population of Los Alamos County, New Mexico is 19,000 to 20,000.

C. Proximity to Surface Waters

The nearest perennial navigable stream, as defined by the Clean Water Act, is the Rio Grande, located 4.5 mi. to the SE of TA-54. Surface water drainage areas are shown on figure 3. The disposal area is bordered on the north by Canada del Buey and on the south by Pajarito Canyon. Both canyons have intermittent streams. Canada del Buey has a small drainage area and flows only during high intensity, localized summer thunderstorms. The channel alluvium in Canada del Buey is 3 to 4 feet thick. Pajarito Canyon has a larger drainage area and thicker alluvium, 20 to 30 feet thick (Purtymun, 1971). Approximately one-half mile southeast of the disposal area, the Pajarito Canyon alluvium fans out to the top of a basalt deposit. Stream flow in both canyons is insufficient to recharge an alluvial aquifer which would be capable of yielding sufficient amounts of groundwater to supply wells and springs.

D. Flooding Potential in the Vicinity of the Landfill

The disposal Areas L and G are located on a mesa top. The disposal areas are not subject to flooding as drainage is into deep canyons adjacent to the mesas. The mesa at Area L is at an elevation of 6800 ft., and the adjacent canyon floor is at an elevation of 6650 ft. At Area G, the elevation is 6700 ft., while the canyon floor is at 6600 ft.



Legend: Drainage Areas

	Canyon	(km²)
1	Barranca	4.9
2	Bayo	9.8
3	—	0.3
4	Pueblo	22.5
5	Los Alamos	27.5
6	Sandia	7.0
7	Mortandad	4.7
8	—	0.5
9	Cañada del Buey	8.8
10	Pajarito	27.5
11	Water	33.2
12	—	1.3
13	Ancho	17.4
14	—	1.6
15	Chaquehui	4.7
16	—	1.0

III. DESCRIPTION

A. Size of Facility

1. Site. Currently the main hazardous waste disposal facility Area L, is located in TA-54 and has an area of 0.88 acres (figure 4). Area G, a low level radioactive waste disposal area, is also located in TA-54, comprising an area of 63 acres (figure 5). Area G receives a relatively small amount of nonradioactive hazardous waste, such as asbestos insulation and PCBs (regulated under the Toxic Substances Control Act). This area has received an exemption from ground water monitoring and leachate collection systems under TSCA by virtue of a letter (June 5, 1980) from Adlene Harrison to Kenneth R. Braziel. (Appendix I). An additional 36 acres of Mesita del Buey is dedicated to future expansion of Areas L & G.

2. Area L. 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 the Waste Management Group, this pit was covered and shafts were used for waste chemical disposal.

Chemical disposal shafts measure 2 ft to 8 ft in diameter by up to 65 ft deep. Different shafts are used for different categories of waste chemical (e.g., organics, inorganics, oils, etc.), to assure that incompatible chemicals will not mix and react. In addition, two small pits, approximately 10 ft. wide, 20 ft. long and 10 ft. deep, are used intermittantly for disposal of small bulk quantities of treated non-hazardous aqueous waste. The water quickly evaporates from these wastes leaving a "salt cake" in the pit bottom. Pit disposal volumes and frequencies are not adequate to form a permanent pool. When the salt cake is within 3 ft of the top, the pit is backfilled and covered.

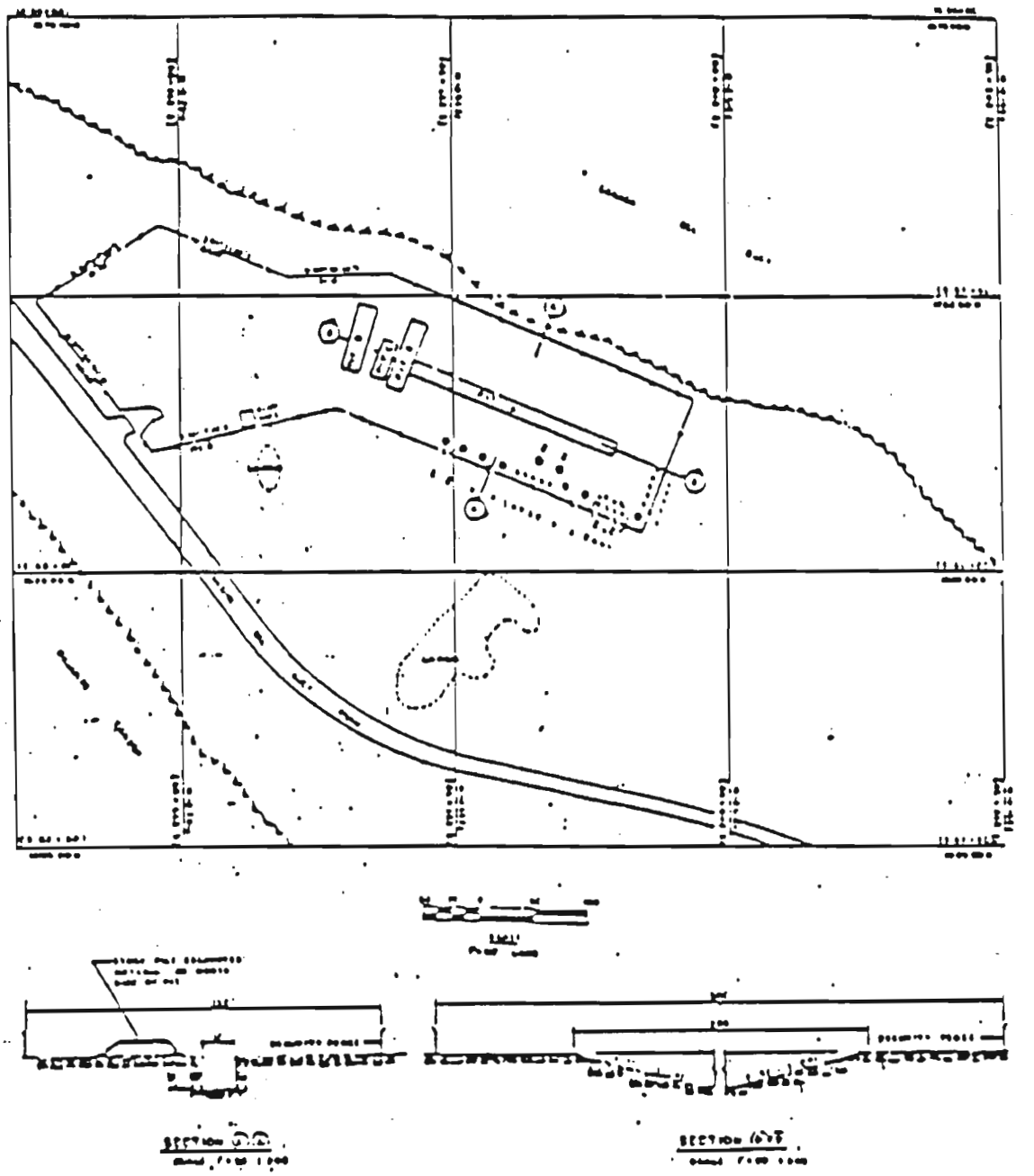


Figure 4.-Disposal Area For Chemical Wastes, Area L, TA-54
(Pit A and C Closed)

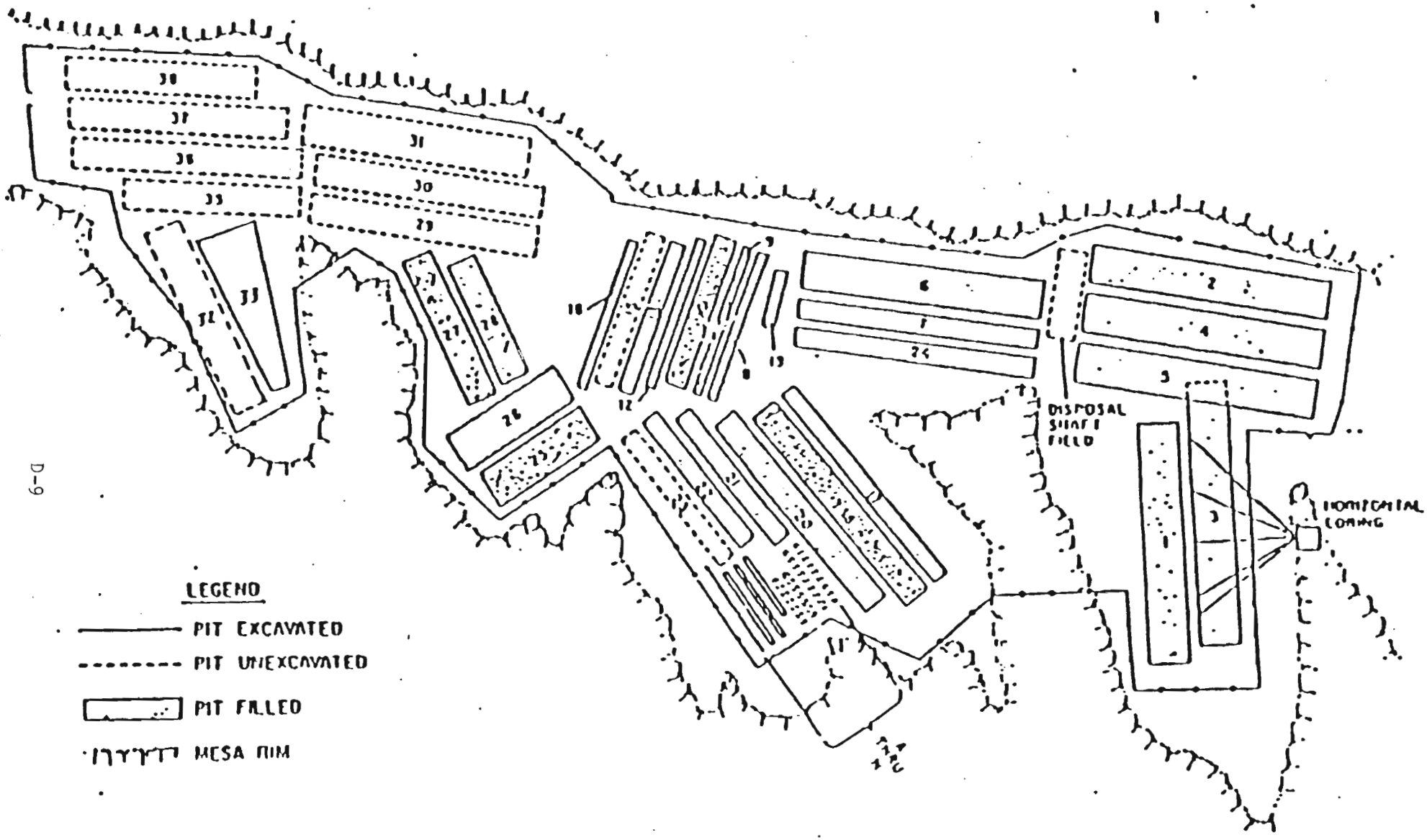


Figure 5.-Disposal Area for Radioactive Wastes (Solids) Area G, TA-54

Current disposal practices are phasing out the use of pit disposal. Liquid hazardous wastes are packed in vermiculite and containerized prior to shaft disposal in accordance with 40 CFR 264.314 and 40 CFR 264.316 to prevent the fromation of free liquids. Past practice, however, allowed the disposal of quantities of free liquid in several shafts. The impact of these liquids is discussed later in this document. Shafts are filled to within three feet from the top then covered with a cement cap to prevent direct infiltration.

3. Area G. Area G is the current low level 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 63 acres; future expansions of this area are planned. Burial/storage facilities within the area include pits, shafts, trenches, and pads, all of varying dimensions. Figure 5 shows the present layout of Area G, including past and future planned use of disposal and support facilities within the fenced portion of the site.

Certain "nonradioactive" hazardous solid chemical wastes have been buried in pits and shafts along with radioactive wastes at Area G. Such wastes include asbestos, beryllium residues, empty pesticides containers, PCB-contaminated solids (transformers, capacitors, solids (before 1978)), and solid trash-type 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., drained PCB-contaminated transformers). In 1980, approval was granted by the EPA for disposal of PCB-solid waste in special facilities at Area G.

Shafts and pits are filled to within 3 feet of the rim of the shaft or pit, then covered. Pits are covered with tuff, then topsoil followed

by revegetation. The upper 3 ft. of the shafts are capped with cement to prevent infiltration.

B. Hazardous Waste Migration

1. Potential Migration Due to Precipitation.

Calculations were performed to determine the degree of infiltration from precipitation using a worst case scenario in a water balance, Appendix II. Precipitation data from TA-59, which is 133% greater than TA-54, was used and then only the largest recorded in the 33 years of available records. Potential evapotranspiration was calculated using the Blaney-Criddle Method.

When runoff alone was considered in the calculation, infiltration amounts of less than 1 inch were shown to occur during 4 months, less than 2 inches during 1 month, and about 3.3 inches during 1 month. When runoff, interception, and depression storage were considered as part of the calculation, which is a more accurate hydrologic description of the water balance, an infiltration was seen to occur of about 1.3 inches during only 1 month, and a trace (0.04 inch) amount during two other months. Assumptions were conservative in nature.

2. Potential Migration Due to Past Disposal Practices

Currently, non hazardous aqueous wastes are evaporated in a 10 ft wide, 20 ft long, 10 ft deep pit. This method of disposal is periodic and being phased out as a disposal method. Dumping rates are not adequate to maintain a standing pool. In FY 84 an estimated 1500 gallons will be disposed of in this manner. Assuming the wastes to be entirely aqueous, spread over the pit floor, and no direct evaporation, the pit disposal locally adds 12 inches equivalent precipitation to the pit floor. This produces a positive infiltration rate only when the more

conservative evapotranspiration rates are assumed. Further the above analysis is conservative in that it assumes no pan evaporation, the wastes is entirely water, and there is no lateral movement of water which significantly increases the evapotranspiration area. This conservative analysis indicates that the pit disposal is not a significant moisture head source.

Prior to 1982, shaft disposal of liquid chemicals was conducted without the addition of absorbents. It is possible that leakage could create liquid head causing migration of waste. There are ten shafts containing drummed organic liquids and waste oil. Accounting for the arrangement of drums in the shafts and assuming all drums are filled with only liquid, the maximum total possible organic liquid volume is 3750 ft^3 There are four shafts containing inorganic chemicals with a maximum possible inorganic liquid volume of 1125 ft^3 (calculations shown in Appendix III).

Assuming complete, instantanious failure of the containers of organics and waste oil, the maximum depth of penetration can be estimated from the formula (Baradat, 1979).

$$D = \frac{V}{A \times R \times K}$$

where

D = Maximum depth of penetration, ft.
V = Volume of infiltrated oil, ft^3
A = Area of infiltration at surface, ft^2
R = Retention capacity of soil in cubic feet per cubic foot (ft^3/ft^3)
K = Approximate correction factor for various oil viscosities

The retention capacity of soils vary from 0.005 ft^3/ft^3 for stone and coarse gravel to 0.04 ft^3/ft^3 for fine sand and silt.[8] While the formation is discribed as fine silt, a value of 0.025 ft^3/ft^3 for medium to fine sand is assumed to be conservative. The viscosity correction factors vary from 0.5 for light hydrocarbons to 2.0 for viscous oils.[8] Even though the bulk of organics stored are lubricating oils, a value of 0.5 is assumed. The area of infiltration, 3594 ft^2, is the surface area associated with the L shaped configuration of the disposal shafts. The calculation takes no credit for lateral migration thus predicting a worst case. For the stored volume of oil, 3750 ft^3, the maximum hydrocarbon penetration, assuming complete and instantaneous container failure, is 83 ft below the shaft floor. Actual penetration will of course be less due to lateral plume migration. Container failure will not be instantaneous and offset by biodegradation. Ultimately the organics will be decomposed by either aerobic or anaerobic biofilm degradation, the rate of degradation limited by nutrient supply (American Petroleum Institute, 1972; McCarty, 1981). These organic wastes are therefore no potential threat to the main aquifer.

Failure of the aqueous containers, likewise, is no potential threat. For the moderately welded Bandalier Tuff, moisture contents below 4 per cent by volume result in no migration; from 4 to 8 per cent moisture is redistributed by diffusion; from 8 to 23 per cent distribution is by capillary action, and above 23 per cent the movement is by capillary and gravity drainage (Purtymun, 1979).

Moisture contents of the site tuff below 10 feet vary from 0.2 to 2 per cent by weight (Purtymun, 1971) (0.3 to 3.2 percent by volume). Complete and instantaneous failure of the aqueous storage containers releasing 1125 ft^3 of liquid over the 3594 ft^2 storage area would increase the moisture content of the tuff to 8 per cent to a maximum depth of 6.5 ft. Further moisture migration would be by diffusion. Diffusion of the moisture in of the waste would trap the metal and salt content of the waste in the tuff.

Gases evolving from wastes placed in shafts are diffused through the tuff in open joints or along contacts between ashflows. The soil on the mesa top and weathering characteristics of the tuff outcrops along the canyon wall restrict the movement of air into and out of the tuff; however, the tuff responds to atmospheric pressure changes around shafts that penetrate the soil zone. The movement of gases or volatiles in the vapor phase would be localized around the shaft disposal area, as has occurred with tritium in the vapor phase at Area G (Purtymun, 1973).

C. Security Measures

Both Areas L and G are completely fenced with a 8 ft high chain-link security fence, topped by standard three-strand barbed wire 45° standoffs to discourage unauthorized entry.

D. Proximity to Drinking Water Sources

Stream flow in Canada del Buey, north of Area L and G and in Pajarito Canyon south of Area L and G, is intermittent. The intermittent streams in the canyon recharge water in the alluvium, which is perched on the underlying tuff. The alluvium in Canada del Buey is thin and contains no perennial water due to the small drainage area and small amount of runoff (Purtymun, 1971).

The intermittent stream in Pajarito Canyon recharges a body of water in the alluvium. As is typical of stream-connected aquifers, the water table is highest during the spring from snowmelt and in late summer from showers. In the fall and early summer the water table declines. The decline in the water table is due to high evapotranspiration, especially in areas of old gravel pits, which are near the top of the stream-connected aquifer in Pajarito Canyon (Purtymun,1971). Water in the alluvium in Canada del Buey and in Pajarito Canyon is not in sufficient quantity to be a source of water supply.

There are no perched aquifers in the vicinity of Areas L and G between the mesa top and the upper surface of the main aquifer. This is based on data collected during construction of two supply wells drilled into the main aquifer (located 1 mile to the west, and the other two miles to the northwest) (Purtymun, 1984; Cooper, 1965). Three test holes (two in Pajarito Canyon and one in Area G) were completed dry into the basalts (Table I) (Griggs, 1964; Purtymun, 1978). Lithologic logs of supply wells PM-2, PM-3 and PM-4 are furnished in Appendix Y.

The only aquifer at Los Alamos capable of Water Supply is the main aquifer. The main aquifer lies at a depth of about 950 feet at Area L and 850 feet at Area G. Overlying the main aquifer at Area L are about 340 feet of dry rhyolite tuff and 610 feet of volcanic flow rocks and sediments (Fig. 6).

The major recharge area for the main aquifer is the intermountain basin formed by the Valles Caldera and deep canyon cut into the flanks of the mountains west of Pajarito Plateau (Area L and G are located on the eastern third of the Plateau). The depth to the aquifer ranges from about 1200 feet along the western edge of the plateau, decreasing to 600 feet along the eastern edge. Movement of water in the aquifer is to the southeast toward the Rio Grande where there is discharge into the river through seeps and springs (Fig. 7) (Cushman, 1965; Purtymun, 1980A, 1980B). Movement in the upper 1740 feet of the aquifer in the area is about 95 feet/year (Purtymun, 1984).

E. Geological Discription

The disposal area is located on Mesita del Buey, a narrow south-eastern trending mesa about two miles long and a quarter of a mile wide. The mesa surface slopes gently from an elevation of 6900 feet near its western margin to about 6,600 feet near its eastern end. The mesa is bounded on the north by Canada del Buey and on the south by Pajarito Canyon. Both canyons have cut 50 to 100 feet below the mesa surface.

TABLE I - DISPOSAL SITE STRATIGRAPHY

		Approximate Thickness Feet	Description
DLIER TUFF			
Ishirege Member	Unit 2b	60	Rhyolite tuff, light gray to brown, moderately welded, forms upper surface of Mesita del Buey.
	Unit 2a	30-85	Rhyolite tuff, light gray pumiceous, moderately welded, outcrops on walls of Mesita del Buey, thin from west to east.
	Unit 1b	25	Rhyolite tuff, grayish brown, moderately welded, outcrop on wall of Mesita del Buey.
	Unit 1a	10-30	Rhyolite tuff, light orange to light brown pumiceous tuff, nonwelded to moderately welded, outcrops in lower slopes of Mesita del Buey, thin west to east.
Otowi Member		120	Rhyolite Tuff, light gray, nonwelded, pumiceous, does not outcrop at Mesita del Buey but is found in subsurface.
Guaje Member		10-30	Rhyolite pumice, light gray, nonwelded, an ashfall pumice.
TA FE GROUP			
Chino Mesa Basalt		250-300	Composed of basalt flow rocks and interbedded sediments.
Puye Conglomerate		700-750	Upper 600-650 feet is volcanic debris, lower 70 feet is poorly consolidated channel-fill.
Tesuque Formation		+1200	Silty sandstones, sandstones with lenses of clay & pebbly conglomerate, many contain interbedded basalts.

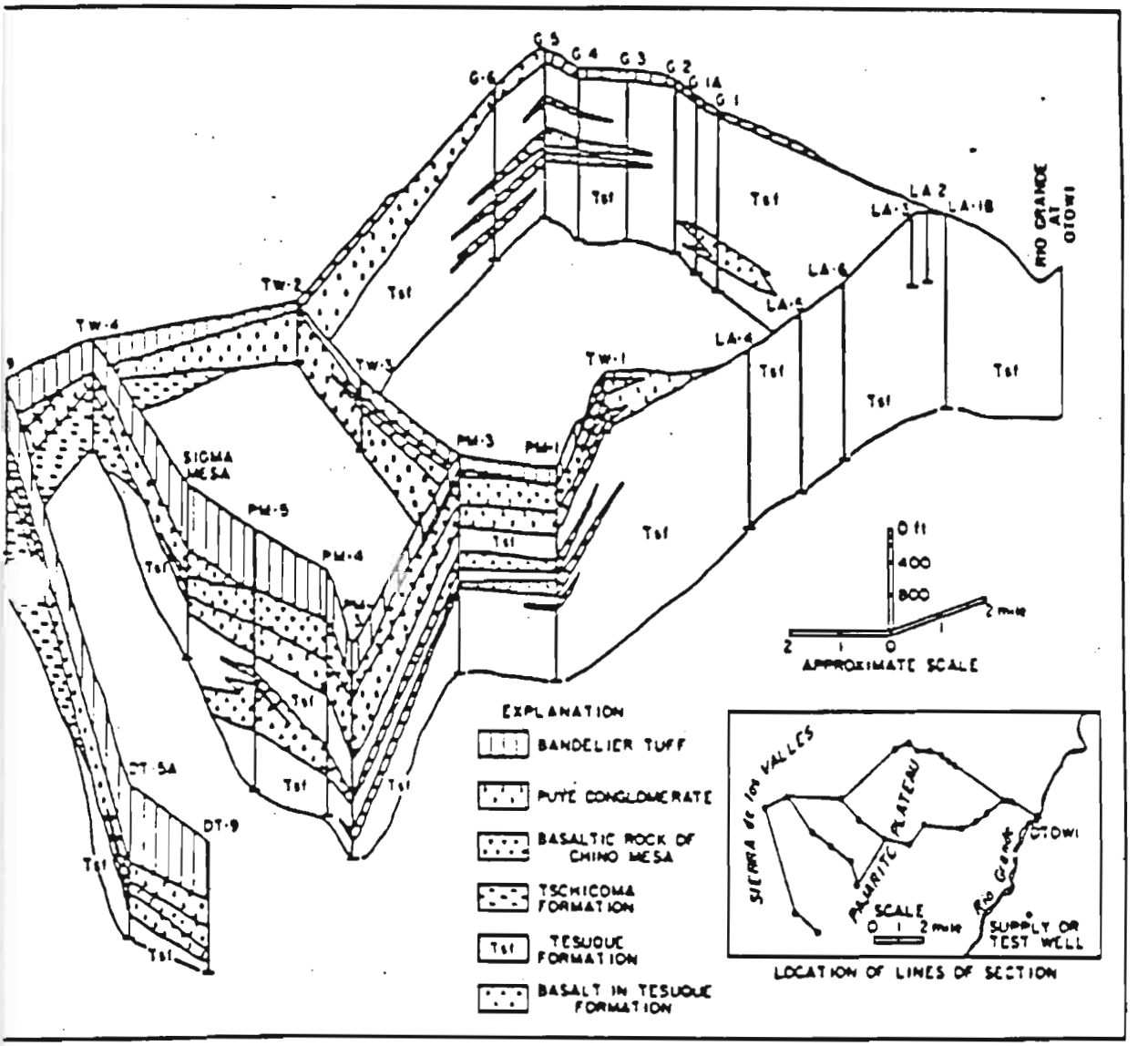


Fig. 6A. Detailed geologic section based on test holes and supply wells completed into the main aquifer.

Mesita del Buey is part of the Pajarito Plateau which forms a topographic high area along the western part of the Rio Grande depression in North Central New Mexico. The Pajarito Plateau is formed by a series of Pleistocene/Ashfalls and ashflows of Bandelier Tuff. In the subsurface are the sediments and basalts of the Santa Fe Group of Middle Miocene to Pleistocene Age (Griggs 1964). The formation in the Santa Fe Group from oldest to youngest are the Tesuque and Puye with interbedded Chino Mesa basalts. The stratigraphy of the Mesita del Buey is summarized on Table I and shown on Fig. 6. A detailed geologic section based on data from supply and test wells is shown in Fig. 6A. Detailed geologic mapping of the units on Mesita del Buey failed to find any evidence of faulting (Purtymun, 1971). Inspection of pits and shacks have also failed to find any evidence of faulting on the mesa.

1. Disposal Area Formation Thickness. The top of the main aquifer is 950 ft at Area L and 850 ft. at Area G. At area L there are 340 ft. of tuff underlain by 610 ft. of volcanic rock and sediments above the main aquifer. At Area G, there is 220 ft. of tuff underlain by 630 ft. of volcanic rocks and sediments above the main aquifer

2. Permeability. Laboratory measurements of saturated permeabilities range from 0.8 gpd/ft^2 for a welded tuff to 22 gpd/ft^2 for a nonwelded tuff. Permeabilities are not applicable as the tuff is not saturated. The porosity ranges from 15% by volume for a welded tuff to 60% by volume for a nonwelded tuff. Generally the effective porosity is 15 to 25% less than the porosity indicated. The pores in the tuff are generally of capillary size so that any movement of fluid that occurs is mainly capillary movement. These capillary-size pores also tend to restrict movement of fluids as well as retain fluids.

3. Main Aquifer and Surface Water Monitoring. The quality of water (chemical and radiochemical) of the main aquifer is monitored at the two nearby supply wells and springs in White Rock Canyon of the Rio Grande. Also monitored is the quality of surface flow, if it occurs, in canyons

adjacent to Area L. Monitoring of these sources has shown no chemical contamination from disposal of chemical wastes (Environmental Surveillance Group, 1984). Surface water sampling stations in the vicinity of the disposal area are shown in figure 8. The non radioactive chemical analyses performed on surface and main aquifer waters are shown on Table II. Results of water sampling are published annually in the Laboratory's environmental surveillance report. Copies are routinely supplied to the New Mexico Environmental Improvement Division (NMEID). An example of a special study of vadose zone monitoring was made in 1976. Radiochemical analyses of cores taken from beneath a solid waste pit at Area G indicated no migration or movement of radionuclides from wastes in the pit (Purtymun, 1980).

4. Additional Monitoring. Current operating practice includes air, soil, and biota sampling programs directly related to disposal site activity. The objective of the monitoring program is to reveal loss of confinement of hazardous material from waste disposal sites, and to characterize emissions of hazardous materials from waste treatment processess. Key contaminants relative to environmental surveillance of Laboratory waste management activities are listed in Table III. Existing air, soil (including sediment) and biota sampling sites related to the disposal site are shown on figures 9 thru 14. Results are published in the Laboratory's annual environmental surveillance report. Additional investigations and constructions to establish a system to monitor shallow ground water in the alluvium adjacent to Area L and vadose zone monitoring at Area L are found in Appendix IV.

F. EPA Based Assumptions

The Federal Register (47 FR 32293) of July 26, 1982, lists eight criteria/assumptions that are to be used by owners of disposal facilities in making travel time predictions of contaminants. These assumptions are intended to maximize the estimated rate of leachate migration. Two of the assumptions (i.e., assuming unit is full of liquid and assuming the

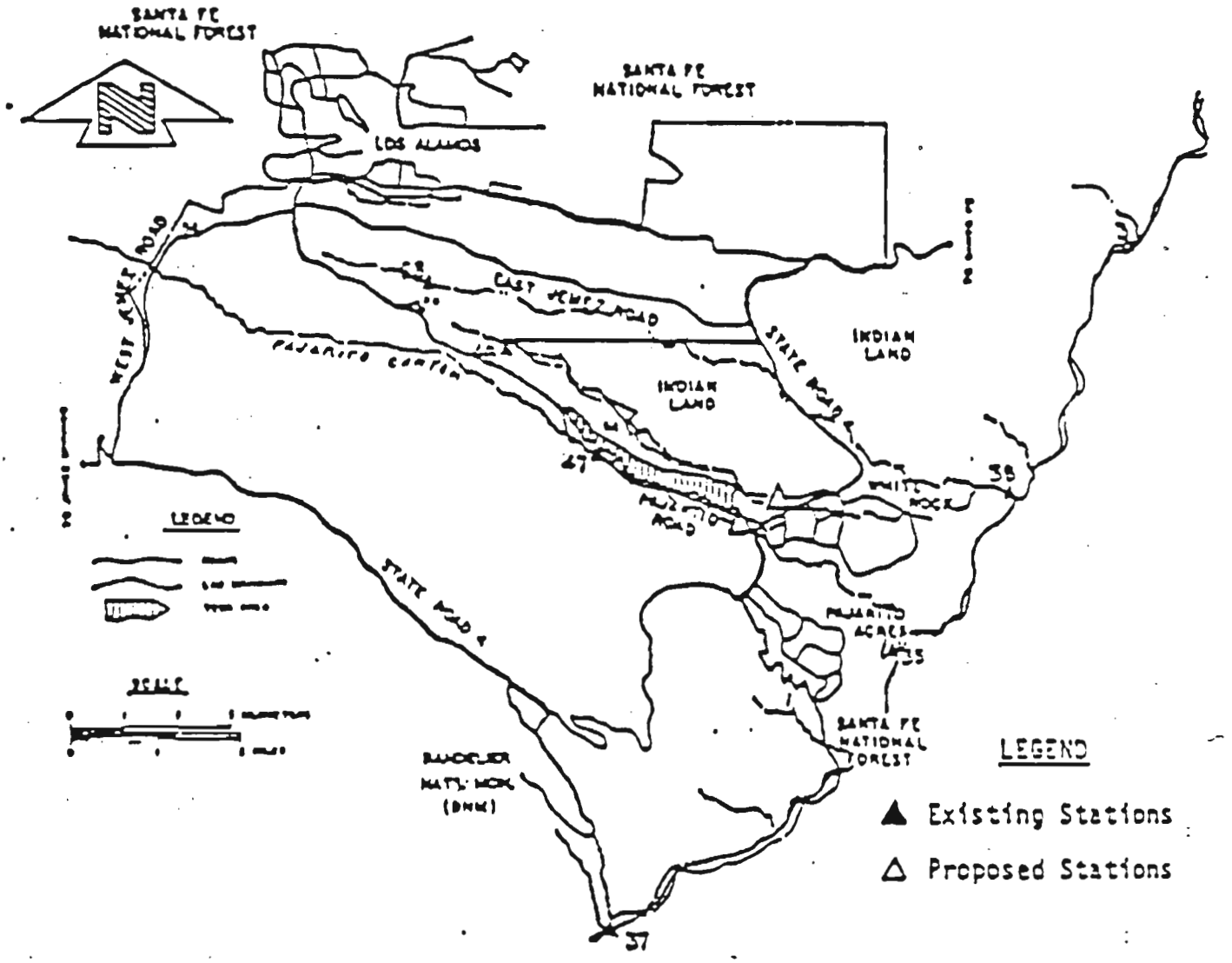


Fig. 8 Surface Water Sampling Stations in the Vicinity of TA-50 and TA-54

		Zinc Zn	Sulfate SO_4	Sodium Na	Silver Ag	Silica SiO_2	Selenium Se	Potassium K	Phosphate PO_4	Nitrogen N	Nitrate NO_3	Mercury Hg	Manganese Mn	Magnesium Mg	Lithium Li	Lead Pb	Iron Fe	Fluorine F	Cyanide CN	Copper Cu	Chromium Cr	Chlorine Cl	Carbonate CO_3	Carbondioxide CO_2	Calcium Carbonate $CaCO_3$	Calcium Ca	Cadmium Cd	Boron B	Bicarbonate HCO_3	Barium Ba	Arsenic As	Ammonium NH_4	Suspended Solids SS	Total Dissolved Solids TDS	Conductivity/Conductance	Chemical Oxygen Demand COD	Acidity/Alkalinity pH	Hardness
Regional	: Surface Water										x							x				x															x	
Perimeter	: Surface Water		x	x	x			x			x			x				x				x			x				x					x			x	x
	Main Aquifer		x	x	x			x			x			x				x				x			x				x					x	x		x	x
White Rock Canyon (Perimeter)	: Surface Water		x	x		x		x	x		x			x				x				x		x		x			x					x	x		x	x
	Main Aquifer		x	x		x		x	x		x			x				x				x		x		x			x					x	x		x	x
Onsite	: Surface Water		x	x	x			x			x			x				x				x			x				x					x		x	x	x
	Main Aquifer		x	x	x			x			x			x				x				x			x				x					x		x	x	x
Effluent Release Areas (onsite & perimeter)	: Surface Water	x	x	x		x		x	x	x	x	x		x	x	x		x		x	x	x	x			x	x	x	x			x	x	x	x	x	x	x
	Perched Water	x	x	x		x		x	x	x	x	x		x	x	x		x		x	x	x	x			x	x	x	x			x	x	x	x	x	x	x
Waste Treatment Plants (onsite)	:	x		x					x		x	x		x		x		x	x	x	x	x			x		x							x		x	x	
Municipal Supply Onsite & Perimeter (Main Aqf)	: Main Aquifer and Distribution System	b	b		a	a	a				a	a	b			a	b	a		b	a	b					a			a	a			b			b	

a. Primary Chemical Quality for Municipal Use.

b. Secondary Chemical Quality for Municipal Use.

TABLE II Water Monitoring Status-1983

TABLE III

CURRENT KEY CONTAMINANT ANALYSIS[2]

Soil/Sediment/Tuff	Air	Bees	Honey
Radiochemical			
^{241}Am	^{241}Am	^{7}Be	^{7}Be
^{238}Pu	^{238}Pu	^{134}Cs	^{134}Cs
^{239}Pu	$^{239+240}Pu$	^{137}Cs	^{137}Cs
Total U	Total U	^{57}Co	^{57}Co
^{90}Sr	^{3}H	^{54}Mn	^{54}Mn
^{137}Cs	Gross α		
	Gross B	^{83}Rb	
Gross α			^{22}Na
Gross B		^{22}Na	
		Total U	Total U
		^{3}H	
Chemical			
	TSP	As	Cd
		B	F
		Cr	Hg
		F	
		Hg	

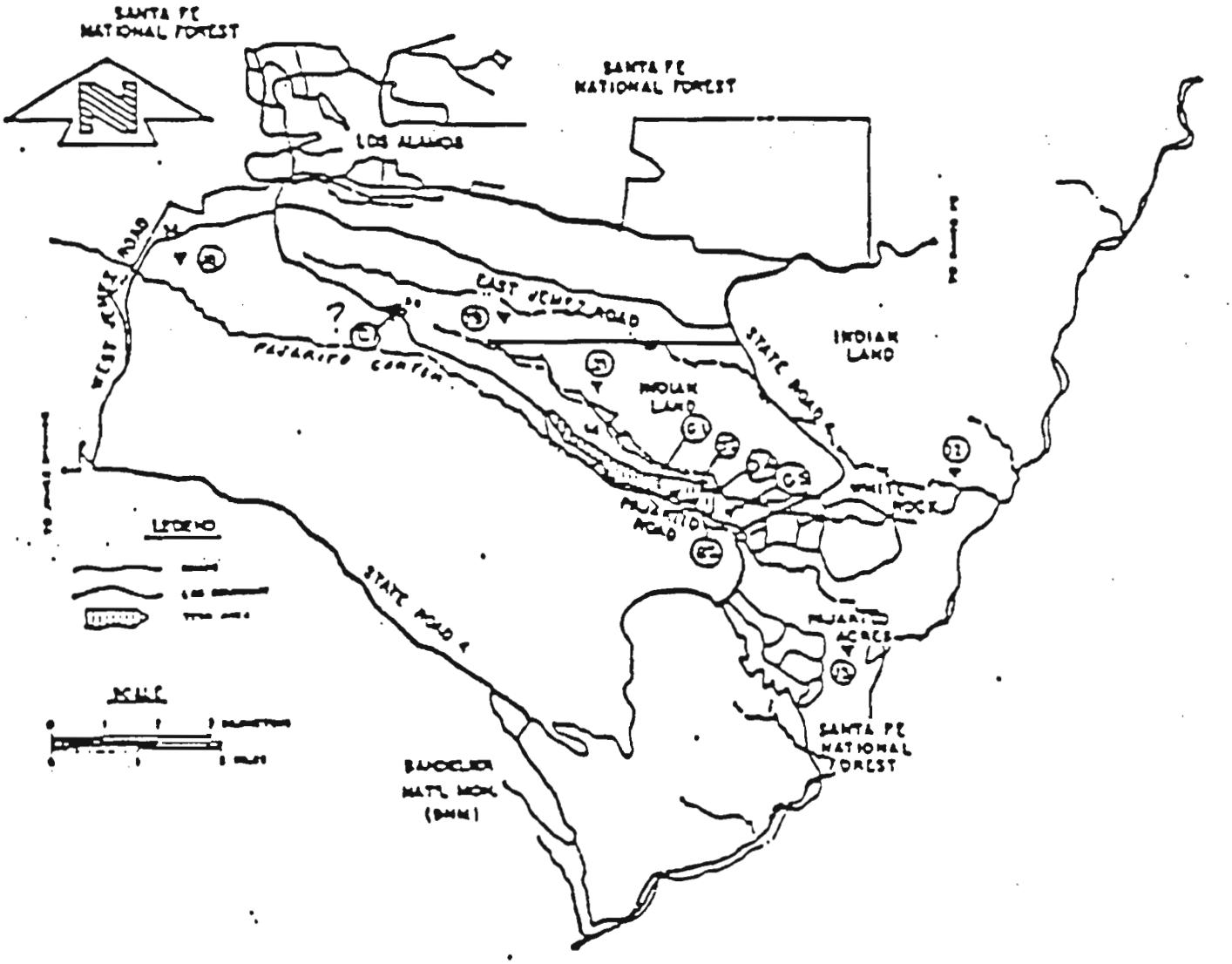


Fig. 9 Existing Air Sampling Locations Pertinent to TA-50 and TA-54

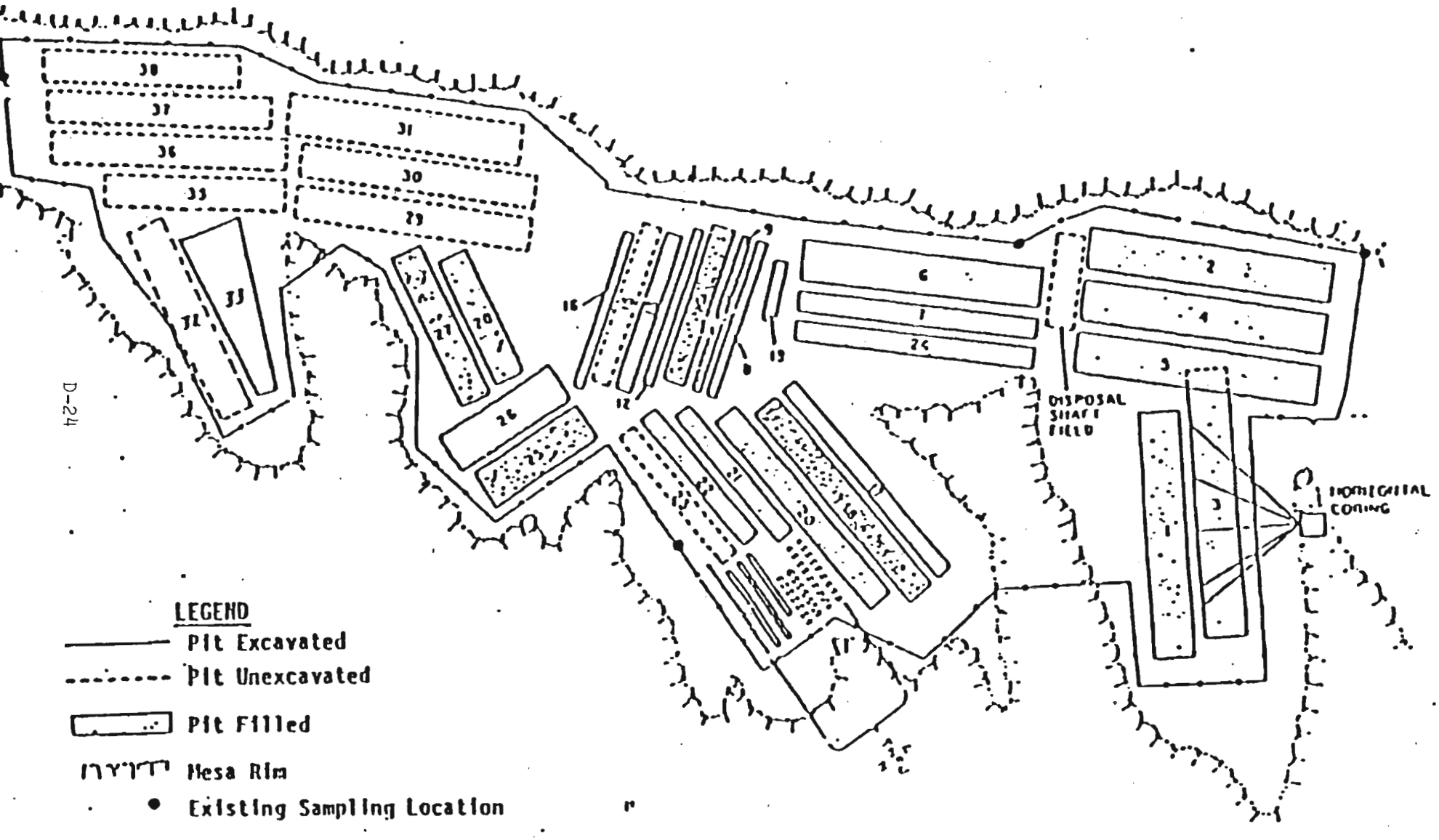


Fig. 10 Air Sampling Locations at Area G

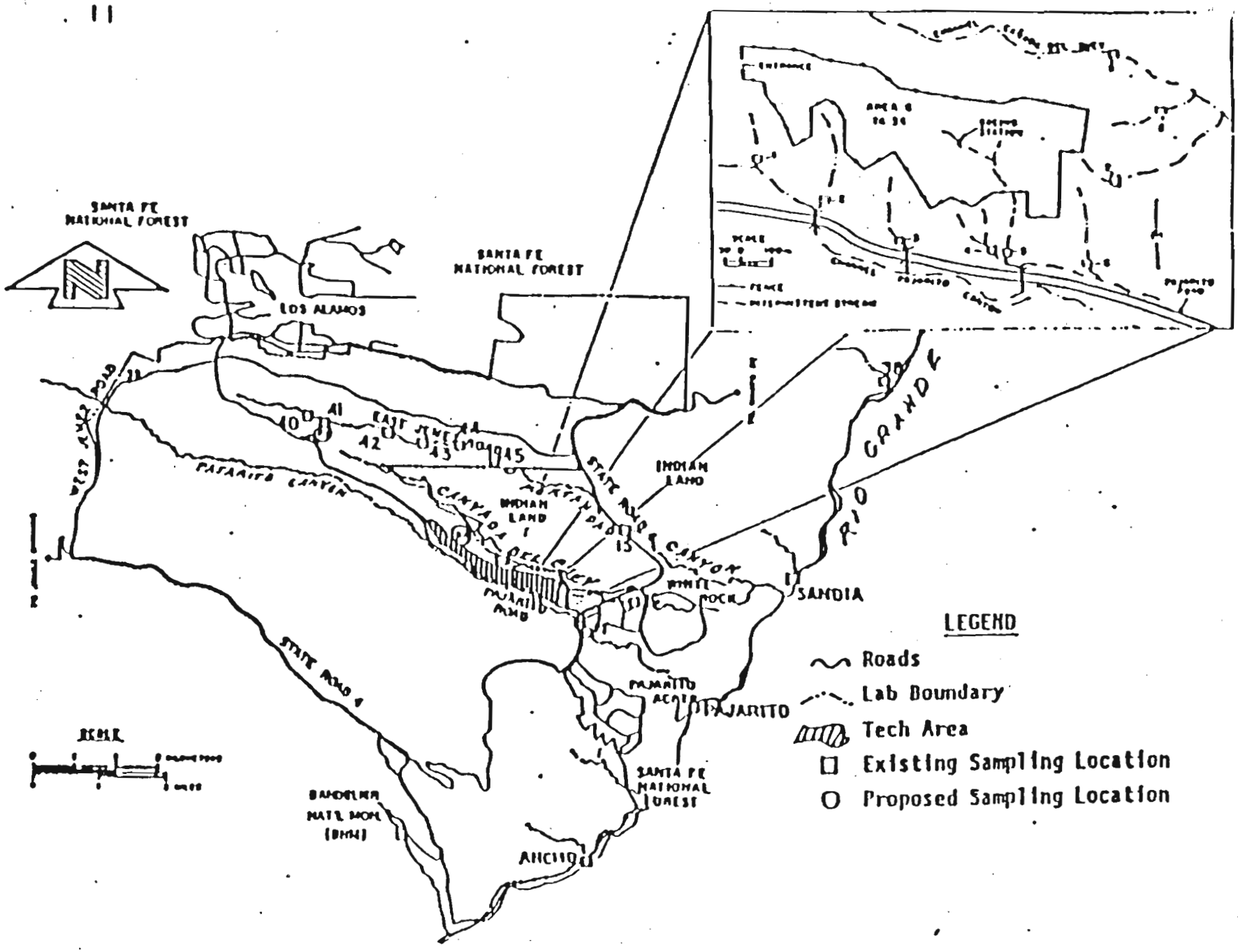


Fig. 11 Sediment Sampling Locations for TA-50 and TA-54

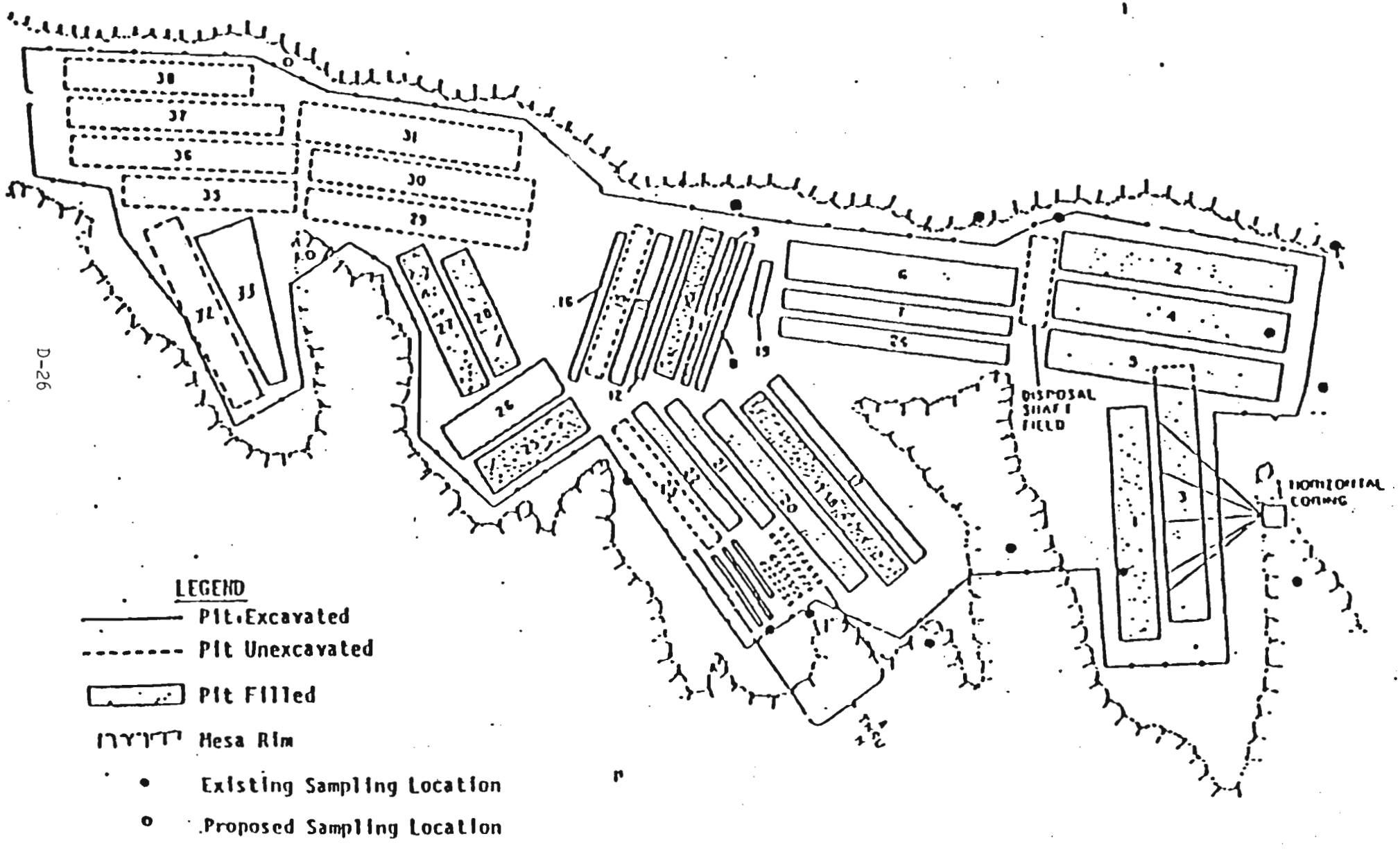


Fig. 12 Surface Soil and Vegetation Sampling Locations at Area G

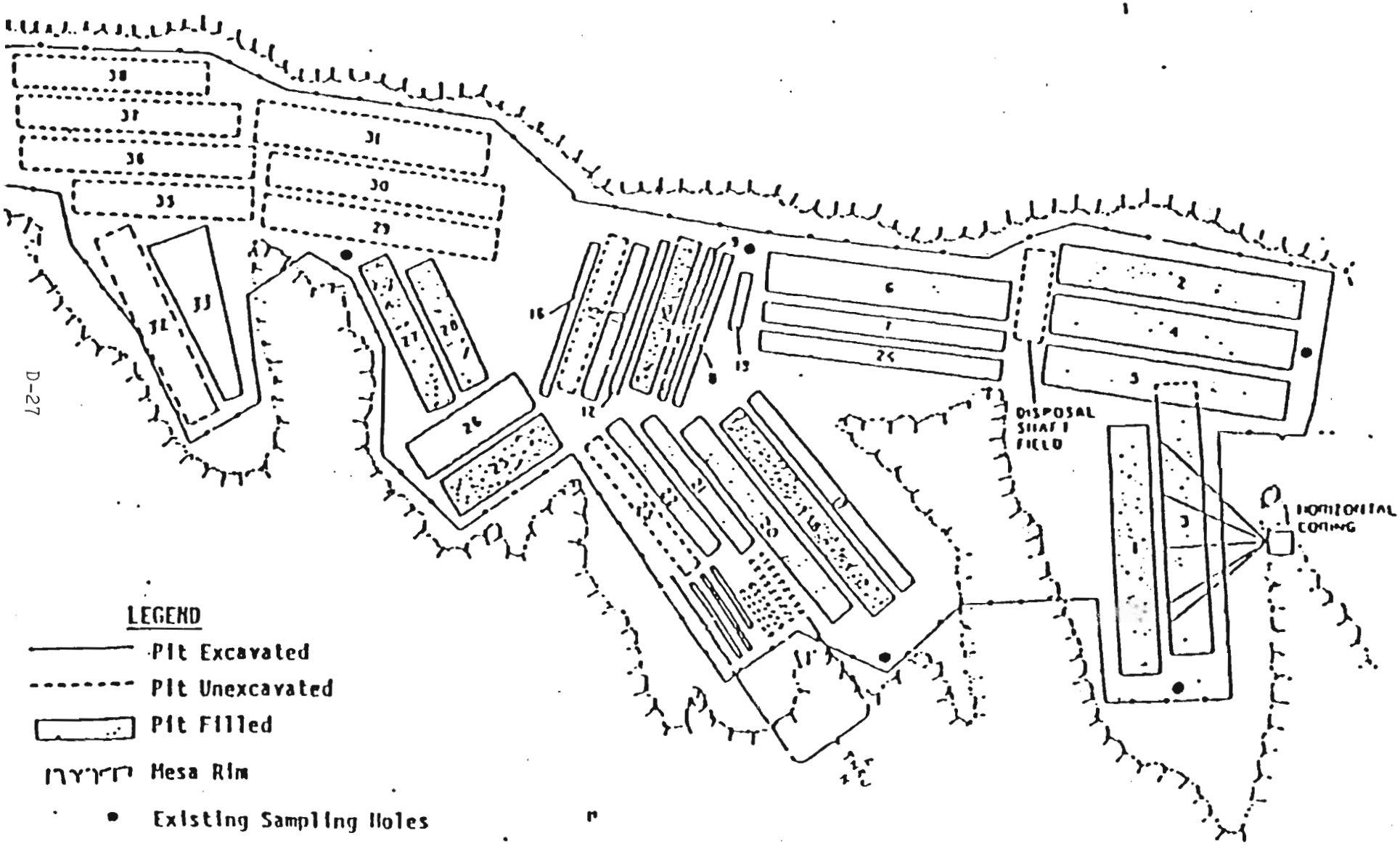


Fig. 13 Subsurface Soil Monitoring and Sampling Holes at Area G

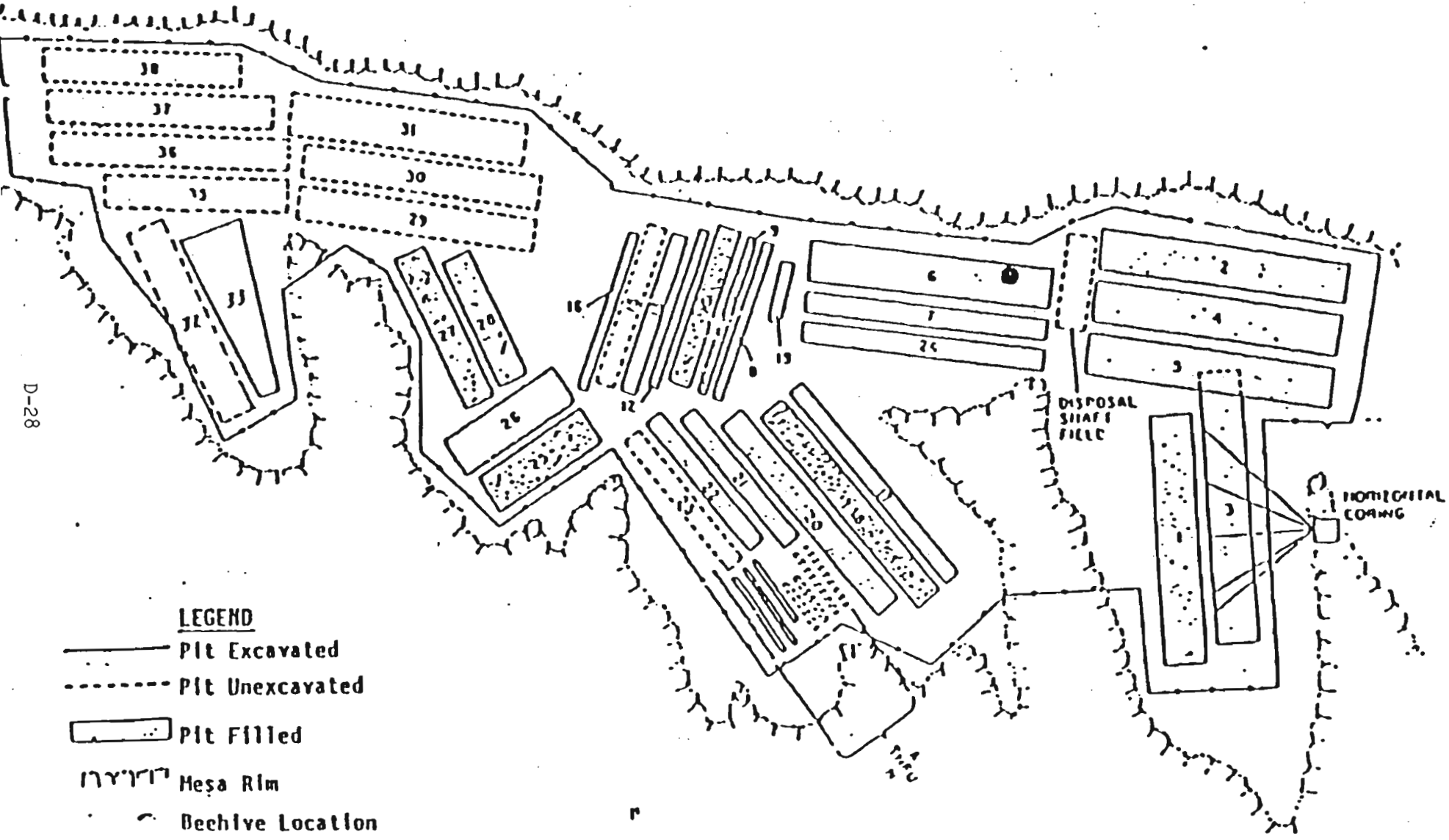


Fig. 14 Beehive Location at Area G

soil is saturated) are completely inappropriate in regard to the TA-54 landfill area. First, the landfill will never be full of liquid since no free liquid is deposited into the shafts and all liquids in the pits are evaporated. Second, the tuff has not been saturated since it was deposited about 1.1 million years ago. There is no recharge to the main aquifer through the mesa tops (Cushman, 1963). To saturate the section of tuff, volcanics, and sediments above the main aquifer would require the mesas to be covered by about 285 ft of water. Taking these factors into account, there is no driving force to carry waste constituents to the aquifers. The required assumptions are discussed here as compared to conditions at the site.

1. Criteria/Assumptions (47FR32293).

a. Thickness or depth of geologic units underlying the regulated unit - See Cestion III(E)(1). Area L is 885 ft. and Area G is 785 ft.

b. Calculation of travel time based on:

(1) Natural Soil Properties. Saturated permeabilities range from 0.8 to 22 gpd/ft^2 with an average of 11 gpd/ft^2 (Purtymun, 1979). The volcanics and sediments underlying the disposal area are not saturated; natural moisture content is less than 5% by volume (Purtymun, 1971).

(2) Least Viscous Fluid in the Regulated Unit. The least viscous fluid in the regulated unit is probably freon 113, which makes up less than 5% of wastes received; however, due to the high vapor pressure of freon 113 which will cause the fluid to evaporate at normal temperature and pressure, little if any of this fluid remains in the waste. Calculations for rate of

movement were made using viscosity of water (permeability) as freon 113 can not be contained as liquid in the wastewater, if present, would be the main driving force at these areas.

(3) Assumption That Unit is Full of Fluids. The unit is not full of fluids. Current practice dictates that liquids are absorbed into vermiculite in 30 or 55 gal drums to immobilize the fluids. The impact of past free liquids in the storage shafts has been previously discussed, and shown to have very little movement within the unsaturated zone.

(4) Assumption That Soil is Saturated. The volcanics and sediments underlying the disposal areas are not saturated. About 950 ft of unsaturated material overlies the main aquifer in the area at Area G. The area (on a mesa) is not in the recharge area to the aquifer. The area is well drained by adjacent canyons, thus there is no ponding of any water. There is little, or no infiltration of water from precipitation into the waste due to the high level of evapotranspiration. Based upon the effective porosity (30%) and thickness of unsaturated volcanics and sediments, it would take 285 ft of precipitation with no runoff or evapotranspiration to saturate the material between the mesa surface and top of the aquifer.

(5) Effective Porosity of 10%. Effective porosity is estimated at 30% by volume.

(6) Soil Attenuation Mechanisms. Soil Attenuation Mechanisms are not considered.

(7) Assumption that Migration of Fluids Through the Soil Began When the Unit Commenced Operation. This assumption is not necessary because prior calculations are based on the maximum volume of free liquids previously stored. There is no on-going storage of free liquid to contribute additional hydraulic head.

G. Field Conditions

Field conditions at the site indicate the tuff, volcanics, and sediments are not saturated above the main aquifer. There is no driving force (water) to facilitate infiltration or leaching of chemical from the disposal shaft. The chemical wastes are now packaged so that there is no liquid available to set up even a minor driving force for infiltration or movements of chemicals from the shafts or pits. Based on the above discussion, there is no hydraulic gradient, thus the hydraulic gradient is zero (0).

$$\text{Velocity} = \frac{\text{Permeability} \times \text{gradient}}{\text{porosity}}$$

$$= \frac{11 \text{ gpd/ft}^2 \times 0}{7.48 \text{ g/ft}^3 \times 0.10}$$

$$= 0 \text{ ft/day}$$

For all practicable purposes the time to reach the water table cannot be calculated, but is infinitely long.

H. Geologist Qualifications/Certification Statement

W. D. Purtymun

BA Major Geology - Minor Engineering 1958
University of New Mexico
Registered Geologist - State of California
Certificate No. 796 (April 8, 1970).

US Geological Survey 1955-1969
Los Alamos National Laboratory - 1969 to Present

Major Projects: Waste disposal studies (liquids and solid) related to monitoring movement of waste contaminates in the environment. Water Supply Studies related to location and development of water for municipal and industrial use.

REFERENCES

American Petroleum Institute, 1972: American Petroleum Institute, "The Migration of Petroleum Products in Soil and Ground Water," API Publication 4149, Washington, D. C. (1972).

Baradat 1979: Y. Baradat, R. Barthel, A. Chiarelli, D. R. Fussell, T. L. de Pastrovich, "Protection of Groundwater from Oil Pollution," CONCAWE, Special Task Force No. 11, Report No. 3/79 (April 1979).

Cooper 1965: J. B. Cooper, W. D. Purtymun, and E. C. John, "Records of Water Supply Wells Guaje Canyon 6, Pajarito Mesa 1, and Pajarito Mesa 2, Los Alamos, New Mexico Basic Data Report," U.S. Geol. Survey Open-File Report (July 1965).

Cushman 1965: R. L. Cushman, "An Evaluation of the Aquifer and Well Characteristics of the Municipal Well Fields in Los Alamos and Guaje Canyons near Los Alamos, New Mexico," U.S. Geological Survey Water Supply Paper 1809-D (1965).

nvironmental Surveillance Group 1984: Environmental Surveillance Group, "Environmental Surveillance at Los Alamos During 1983," Los Alamos Scientific Laboratory Report LA-10100-ENV (April 1984).

Griggs 1964: R. L. Griggs, "Geology and Ground Water Resources of the Los Alamos Area, NM," U.S. Geological Survey Water Supply Paper 1753 (1964).

Los Alamos Scientific Laboratory 1979: "Los Alamos Scientific Laboratory Final Environmental Impact Statement" (December 1979).

McCarty 1981: P. L. McCarty, B. E. Rittmann, "Trace Organics in Ground Water," Environmental Science and Technology, Vol. 15, No. 1, pages 40-49 (January 1981).

Purtymun 1971: W. D. Purtymun and W. R. Kennedy, "Geology and Hydrology of Mesita del Buey," Los Alamos Scientific Laboratory Report LA-4660 (1971).

Purtymun 1973: W. D. Purtymun, "Underground Movement of Tritium from Solid Waste Storage Shafts," Los Alamos Scientific Laboratory LA-5286-MS (May 1973).

Purtymun 1978: W. D. Purtymun, M. L. Wheeler, and M. A. Rogers, "Geologic Description of Cores from Holes P-3 MH-1 through P-3 MH-5, Area G, Technical Area 54," Los Alamos Scientific Laboratory report LA-7308-MS (May 1978).

Purtymun 1979: W. D. Purtymun, "Geohydrology of the Pajarito Plateau with Reference to Quality of Water: 1949-1972," Los Alamos National Laboratory Informal Report (December 1979).

Purtymun 1980: W. D. Purtymun, M. A. Rogers, M. L. Wheeler, "Radiochemical Analyses of Samples from Beneath a Solid Radioactive Waste Disposal Pits at Los Alamos, New Mexico," Los Alamos Scientific Report LA-8422-MS (June 1980).

Purtymun 1980A: W. D. Purtymun and H. Adams, "Geohydrology of Bandelier National Monument, New Mexico," Los Alamos Scientific Laboratory Report LA-8461-MS (July 1980).

Purtymun 1980B: W. D. Purtymun, R. J. Peters, and J. W. Owens, "Geohydrology of White Rock Canyon of the Rio Grande from Otowi to Frijoles Canyon," Los Alamos Scientific Laboratory report LA-8635-MS (December 1980).

Purtymun 1984: W. D. Purtymun, "Hydrology of the Main Aquifer with Reference to Location of Additional Water Supply Wells," Los Alamos National Laboratory report LA-9957-MS (January 1984).

APPENDIX I

TSCA GROUND WATER MONITORING EXEMPTION

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION VI
1201 ELM STREET
DALLAS, TEXAS 75270

5 June 1980

Mr. Kenneth R. Braziel, Area Manager
Department of Energy
Albuquerque Operations
Los Alamos Area Office
Los Alamos, New Mexico 87544

Dear Mr. Braziel:

On May 31, 1979, the United States Environmental Protection Agency published final regulations in the Federal Register (43 FR 7150 - 7164) on Polychlorinated Biphenyls (PCBs), Disposal and Marking. These regulations prohibit the disposal of PCBs at any site not approved by EPA after July 2, 1979. The regulations also require that the owner and/or operator of a chemical waste landfill used for the disposal of PCBs submit information in accordance with Section 761.41, "Chemical Waste Landfills," to the Regional Administrator for review.

On January 25, 1979, we received your formal application for a PCB landfill at the Los Alamos Scientific Laboratory (LASL). The application was for disposal of DOE/LASL generated PCB solid waste and would not be a commercial operation. The application was distributed to Regional, Headquarters, and State personnel for comment. A March 26, 1979, news release concerning EPA's receipt of the application generated several local news stories and three written responses to the Regional Office. One letter was in favor of the site, one opposed, and one brought attention to the nearness of the LASL site to Indian lands and requested the careful review of the facility plan. The New Mexico Environmental Improvement Division and the U. S. Fish and Wildlife Service reviewed the application and indicated to EPA in writing that they had no objection to the application.

After a review of all the information, I made a tentative decision to approve your facility as an Annex II chemical landfill for PCB articles. This tentative decision was sent to you in my letter of April 14, 1980, and we solicited public comment by placing an announcement in the April 19, 1980, issue of the Albuquerque Journal. No letters were received commenting on the tentative approval.

The proposed PCB disposal site is located on top of the Misita del Buey, which is on LASL property and is the present location of the ongoing, low-level radioactive disposal site. The proposed site meets all the technical requirements for a chemical waste landfill as required in Section 761.41 (b), except "Groundwater Monitor Wells" and "Leachate

Collection Systems." These systems are not considered feasible due to arid climate conditions, and soil characteristics and conditions. The Groundwater Monitor Wells and Leachate Collection System requirements are hereby waived as provided in Section 761.41, and the attached conditions are required as substitutes. These waivers will not present an unreasonable risk of injury to health or environment from PCBs.

The DOE/LASL chemical waste landfill for disposal of PCB articles is hereby approved. Conditions for the operation of your PCB chemical waste landfill are listed in Enclosure 1 of this letter.

Approval for the DOE/LASL landfill may be revoked, modified, or otherwise altered at any time evidence indicates a violation of the conditions of this approval letter, 40 CFR Part 761, or other applicable rules and regulations. Also this approval is for disposal of PCBs in a chemical waste landfill and is not to be construed to be approval for PCB incineration or for PCB liquids. The approval applies only to the Department of Energy, Los Alamos Scientific Laboratory Landfill, Los Alamos, New Mexico. This designation is non-transferrable.

Sincerely,

Francis E. Phillips, for

...ene Harrison
Regional Administrator

Enclosures

cc: Thomas E. Baca, M.P.H. Director
Environmental Improvement Division
New Mexico Health Environment
Department

Conditions for Disposal of PCBs at the Department of Energy/Los Alamos Scientific Laboratory Chemical Waste Landfill, Los Alamos, New Mexico

1. Maintain records as specified in 40 CFR 761.45 (b), "Records and Monitoring."

2. Advise EPA immediately of any changes, alternations, or divergencies in the operational managerial policies and procedures as outlined in the documents submitted in support of the application.

3. Report immediately to the Regional Administrator, EPA Region 6, any detection of PCBs in stormwater runoff or in groundwater samples.

4. Monitor the two springs currently monitored for the Safe Drinking Water Act at least once each year (during and after site operation) for PCBs, pH, specific conductance, and chlorinated organics.

5. Install onsite cumulative samplers for rainfall runoff collection. Water samples collected in the cumulative samplers after rainfall of sufficient volume for analysis must be analyzed for PCBs, pH, specific conductance, and chlorinated organics.

6. Report to the EPA Regional Administrator, attention Chief, Solid Waste Branch, every six months the following information:

    a. Types and quantities of PCB articles disposed.

    b. A summary of analytical data which must be developed under 40 CFR 761.41 (b) (6) (iii) "Water Analysis," and for conditions 4 and 5 listed above.

    c. A summary of shaft or trench construction activities for PCB articles disposal and corrective maintenance work required for PCB shaft or trench stormwater diversion structures.

APPENDIX II

POTENTIAL FOR MIGRATION FROM INFILTRATION AND PRECIPITATION - CALCULATIONS

APPENDIX II

POTENTIAL FOR MIGRATION FROM INFILTRATION OF PRECIPITATION - CALCULATIONS

I. INTRODUCTION

Calculations were made to investigate the possibility of infiltration of precipitation into waste disposal pits and shafts and provide a means for waste to migrate outward. It was specified that a worst-case scenario be considered.

A. Precipitation

Although a weather station exists at Area G, it has been collecting data for less than 5 full years. Because the length of record is so short, it cannot provide a statistically meaningful data base. Tree-ring data cannot be used because methods do not exist to remove CO_2 effects (Bower, 1984).

Weather data has been collected at either TA-3 or TA-59 for the last 33 years. The TA-3 and TA-59 collection locations are close together, so that stationarity is not significant. Previous to 1952, weather data has been collected at other locations within Los Alamos County, and stationarity does become an issue. For this reason, only data collected between 1952 and the present is considered a stationary data set.

The Area G weather station is located about 5.2 miles southeast of TA-59. In general, precipitation diminishes to the southeast, and specifically, Area G receives annually only about 75% of the precipitation amount measured at TA-59 (Bowen 1984). Due to the paucity of data at Area G, it was decided to use unadjusted TA-59 data, which represents data, on the average, 133% greater. The largest monthly precipitation recorded in the 33-year record was used to represent a worst-case scenario for Area G. Monthly rainfall statistics are presented in Table II-1.

TABLE I

LOS ALAMOS RAINFALL 1952-1984
(Inches)

	January	February	March	April	May	June	July	August	September	October	November	December
Minimum	0.05	0.00	0.02	0.00	0.05	0.00	0.35	1.07	0.00	0.00	0.00	0.01
Maximum	2.81	1.87	4.11	3.23	3.50	3.40	6.60	11.18	4.55	6.77	6.60	2.85
Average	0.82	0.67	1.14	0.82	1.16	1.10	3.20	3.86	1.73	1.47	0.99	0.97

B. Evapotranspiration

There are many methods available to calculate potential evapotranspiration. The method employed was the Blaney-Criddle Method, as recommended in Cruff (1967), which was shown to be practical in arid and subhumid environments. Calculations are shown on Calculation Sheet No. 1.

The calculation calls for the use of the mean monthly temperature. The relationship between monthly average temperature and monthly total rainfall was investigated for the month of January to determine if a case could be made to use the minimum temperature, Fig. II-1. It is evident that no obvious relationship exists, and so that low temperature does not correlate with high rainfall. Therefore, the mean temperature was used, as the method dictates.

C. Soil Moisture

Soil moisture was determined from the available water capacity, Calculation Sheet No. 2. The available water capacity was calculated for both a native soil cover, using the characteristics of the Hackroy sandy loam that covers the top of Mesita del Buey, and for crushed volcanic tuff, which is used as a cap and fill in waste disposal pits and shafts. The available water capacity for these two covers does not differ greatly, 138 mm for the Hackroy sandy loam compared to 126 mm for crushed volcanic tuff.

D. Water Balance

A water balance was constructed to determine the amount of water available for infiltration. The method used was the Thornthwaite Method, as described in Dunne (1978). Water balances were calculated using (1) largest monthly rainfall data recorded at TA-59, (2) potential

CALCULATION SHEET #1

CALCULATION OF EVAPOTRANSPIRATION USING THE BLANEY-CRIDDLE METHOD

$$u = k \sum_{i=1}^{m} p_i t_i$$

after Chow (1964)

where u = evapotranspiration in inches
m = months
p = per cent of daytime hours of the year occurring during the period divided by 100
t = mean monthly temperature °F
k = monthly consumptive use coefficient

It is recommended that for a subhumid environment, where mean precipitation ranges from 5-20 inches, that k = 0.90 during the growing season and k = 0.75 during the entire year. (Cruff and Thompson, 1967).
Growing season will be assumed to extend from May through September.

Latitude of Los Alamos = 35° 52.5 min = 35.88° N.
p will be adjusted for this latitude.

Month	k	Daytime Hour p	p/100	Avg. Temp °F	Monthly (in.)	Evapotranspiration (mm)
January	0.75	7.00	0.070	29.1	1.53	38.80
February	0.75	6.85	0.0685	32.3	1.66	42.15
March	0.75	8.35	0.0835	37.6	2.35	59.81
April	0.75	8.85	0.0885	45.6	3.03	76.88
May	0.90	9.81	0.0981	54.8	4.84	122.89
June	0.90	9.82	0.0982	65.0	5.74	145.92
July	0.90	9.98	0.0998	68.2	6.13	155.59
August	0.90	9.40	0.0940	65.9	5.58	141.61
September	0.90	8.37	0.0837	60.2	4.53	115.19
October	0.75	7.85	0.0785	50.2	2.96	75.07
November	0.75	6.93	0.0693	37.9	1.97	50.03
December	0.75	6.80	0.0680	30.8	1.57	39.90
				Total	41.89	

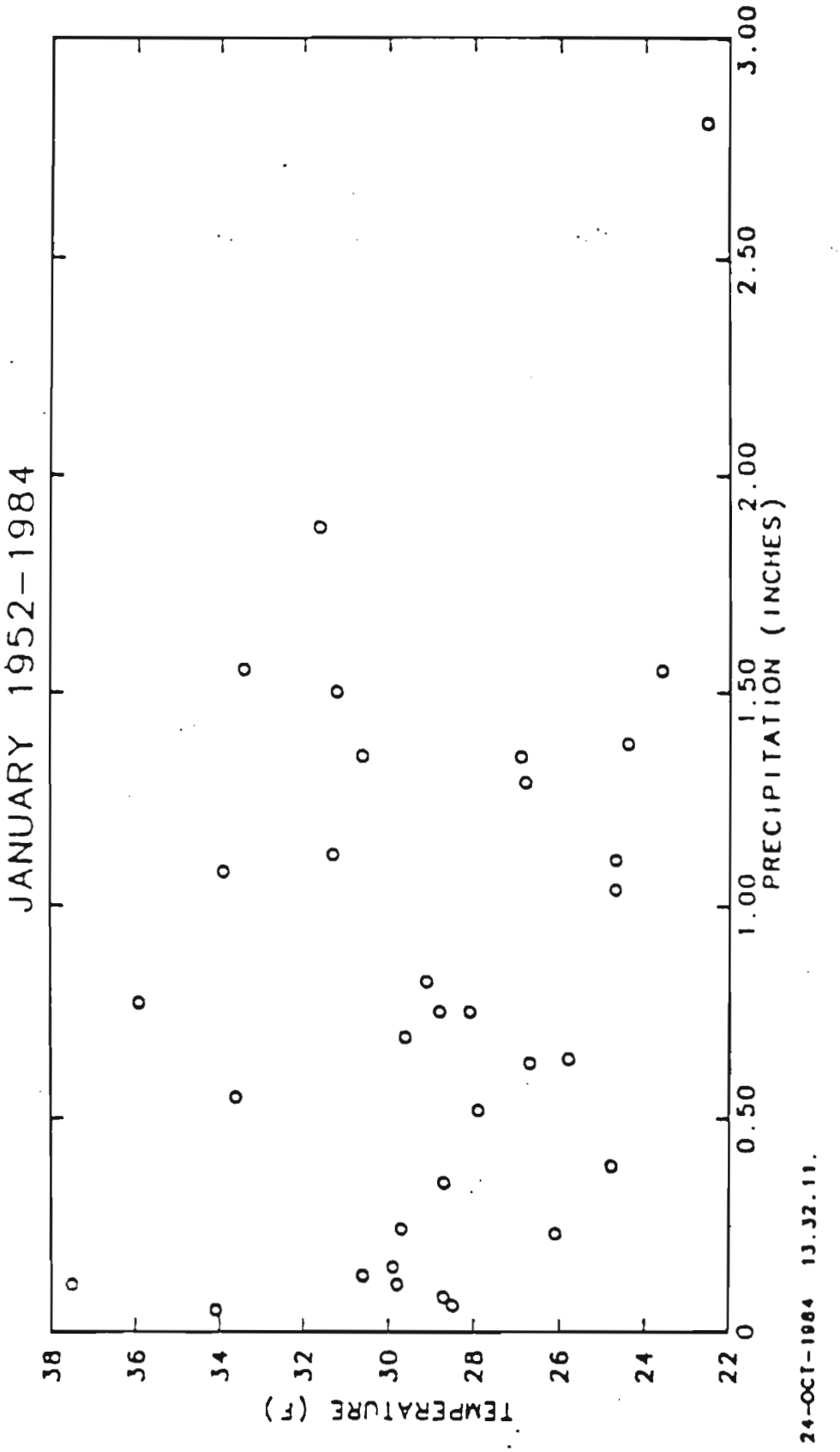

JANUARY 1952-1984
TEMPERATURE (F)
38
36
34
32
30
28
26
24
22
0
0.50
1.00
1.50
2.00
2.50
3.00
PRECIPITATION (INCHES)
24-OCT-1984 13.32.11.

Fig. II-1

CALCULATION SHEET #2

Soil Moisture Calculations

Available water capacity (AWC) AWC = (field capacity - wilting point)* (rooting depth)

Rooting Depth: The four most common species as determined by importance value, a measure of relative abundance, relative dominance, and relative frequency, found on revegetated low-level radioactive waste disposal areas are:

1) sand dropseed - Sporobolus cryptandrus
2) sweet clover - melilotus spp.
3) fescue - festuca spp.
4) Bigelow aster - aster bigelovii

(Foxx, Tierney and Williams, in press)

Rooting depths as summarized from the literature are summarized below:

Species	Average Rooting Depth (cm)
Sand dropseed	99
Sweet clover	130
Fescue	78
Bigelow aster	154

(From Tierney & Foxx, 1982)

Assuming that each of these is equally represented, one may obtain an average rooting depth by averaging. This result is reasonable when examining their respective importance values (19, 19, 18, 16) (Foxx, Tierney and Williams, in press).

$$\text{Average rooting depth} = \frac{(99 + 130 + 78 + 154)\ \text{cm}}{4}$$

$$= 115\ \text{cm}$$

Available water capacity:

	Field Capacity	Wilting Point	Rooting Depth(cm)	Available Water Capacity(%)	Available WC (mm)
Native soil cover*			115	12	138
Crushed tuff**	0.19	0.08	115		126

*Soil is a Hackroy sandy loam, data in Nyhan, et al. (1978).
**Data from Lane (1984).

evapotranspiration according to the Blancy-Criddle Method, and (3) available water capacities for both native soil and crushed volcanic tuff. The results are shown in Tables II-2 and II-3.

The water balance method, as described, accounts for runoff only after soil moisture needs have been satisfied. This assumption on the timing of runoff is probably not valid for the local hydrogeologic conditions in Los Alamos. Rainfall events in Los Alamos are usually of short duration and relatively high intensity. This, combined with the relative impermeability of the soils (Hydrologic Soils Groups C and D) develops a rapid runoff. Therefore, it is appropriate to subtract off the runoff from the precipitation before soil moisture deficits are considered, Table II-4. This technique is also described as being appropriate (Dunne 1978).

Using the SCS Curve Number Method (SCS 1972), a rainfall-runoff relationship was developed for a curve number of 82, which corresponds to a 40% cover of herbaceous plants, brush and grasses (Lane 1984), which would develop over a revegetated waste area, Table II-5. Because most individual rainfall events do not produce over 1-1/2 inches, a value of 20% was chosen to represent the amount of rainfall that becomes runoff. Note that this is conservative compared to the 50% figure recommended in the Thornthwaite Method. Then, this 20% is subtracted from the precipitation before continiung the water balance, Table II-4.

E. Discussion

Comparing the values for monthly detection (last line) on Tables II-2 and II-3 shows that there is not much difference in the soil moisture characteristics of the crushed volcanic tuff or Hackroy sandy loam native soil covers. However, Tables II-2 and II-3 do not accurately portray hydrologic and hydrogeologic conditions at Los Alamos because runoff is not considered rapid in these instances. Table II-4 does consider a

TABLE

WATER BALANCE - NATIVE SOIL COVER
(units are millimeters)

	January	February	March	April	May	June	July	August	September	October	November	December
Precipitation P	71	48	104	82	89	86	168	284	116	172	168	72
Potential E-T (PET)	39	42	60	77	123	146	156	142	115	75	50	40
P-PET	32	6	44	5	-34	-60	12	142	1	97	118	32
Accum. Potential Waterless	-	-	-	-	-34	-94	-	-	-	-	-	-
Soil Moisture	138	138	138	138	120	75	87	138	138	138	138	138
Δ in Soil Moisture	0	0	0	0	-18	-45	+12	+51	0	0	0	0
Actual E-T	39	42	60	77	107	131	156	142	115	75	50	40
Soil Moisture Deficit	0	0	0	0	16	15	0	0	0	0	0	0
Soil Moisture Surplus	32	6	44	5	0	0	0	91	1	97	118	32
Total Available for Runoff	92	52	70	40	20	10	5	91	46	120	178	121
Runoff	46	26	35	20	10	5	3	46	23	60	89	61
Detention	46	26	35	20	10	5	2	45	23	60	89	60

TABLE II-3

WATER BALANCE - CRUSHED TUFF COVER
(units are millimeters)

	January	February	March	April	May	June	July	August	September	October	November	December
Precipitation P	71	48	104	82	89	86	168	284	116	172	168	72
Potential E-T (PET)	39	42	60	77	123	146	156	142	115	75	50	40
P-PET	32	6	44	5	-34	-60	12	142	1	97	118	32
Accum. Potential Water Loss	-	-	-	-	-34	-94	-	-	-	-	-	-
Soil Moisture	126	126	126	126	105	72	84	126	126	126	126	126
Change in Soil Moisture	0	0	0	0	-21	-33	12	42	0	0	0	0
Actual E-T	39	42	60	77	110	119	156	142	115	75	50	40
Soil Moisture Deficit	0	0	0	0	13	27	0	0	0	0	0	0
Soil Moisture Surplus	32	6	44	5	0	0	0	100	1	97	118	32
Total Available for Runoff	92	52	70	40	20	10	5	100	51	122	179	121
Runoff	46	26	35	20	10	5	3	50	26	61	90	61
Detention	46	26	35	20	10	5	2	50	25	61	89	60

TABLE II-4

Water Balance - Native Vegetation Cover With Runoff

(Units Are Millimeters)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Precipitation P	71	48	104	82	89	86	168	284	116	172	168	72
20% P	14	10	21	16	18	17	34	57	23	34	34	14
P-20% P=P*	57	38	83	66	71	69	134	227	93	138	134	58
Potential E-T (PET)	39	42	60	77	123	146	156	142	115	75	50	40
P*-PET	18	-4	23	-11	-52	-77	-22	85	-22	63	84	18
Accumulated Potential Water Loss		-4		-11	-63	-140	-162	-77	-99			
Soil Moisture	138	135	138	128	100	55	50	85	80	138	138	138
Change In Soil Moisture	0	-3	3	-10	-28	-45	-5	35	-5	58	0	0
Actual E-T	39	42	60	77	117	131	156	142	115	75	50	40
Soil Moisture Deficit	0	0	0	0	6	15	0	0	0	0	0	0
Soil Moisture Surplus	18	0	20	0	0	0	0	50	0	5	84	18

TABLE II-5

VARIATION OF RAINFALL/RUNOFF FOR CN=82, USING THE SCS CURVE NUMBER METERED CN=82 CORRESPONDS TO = 40% COVER OF HERBACEOUS PLANTS, BRUSH and GRASS (LANE, 1984)

Rainfall (in)	Direct Runoff (in)	% Rainfall Which Becomes Runoff
0.5	0.	0
1.0	0.15	15
1.5	0.35	23
2.0	0.65	33
2.5	1.05	42
3.0	1.45	48
3.5	1.8	51
4.0	2.25	56
4.5	2.7	60
5.0	3.15	63

apid runoff, which is in most instances what is physically observed in field conditions and studies, and should be considered an appropriate representation for field conditions.

The last row on Table II-4, Soil Moisture Surplus, represents that water that is available for infiltration. There is no surplus water available during the months of February, April, May, June, July, and September. The amount of surplus water available during the months of January, March, October, and December is less than 1 inch per month. August has a surplus of just under 2 inches and November has a surplus of 3.3 inches.

This method of water balance calculation is deficient in the respect that there is no accounting for that amount of rainfall that is taken up by interception and depression storage. Interception is that portion of the total precipitation that wets and adheres to above ground objects until it is returned to the atmosphere. Interception storage may account for anywhere from 5 to 40% of the rainfall (Viessman 1977). Depression storage is that portion of the total precipitation detained in and evaporated from surface depressions and does not contribute to either runoff or infiltration. Measurements of depression storage for intense storms vary with cover composition, and is less than 1/2 inch (Viessman 1977). If these constituents of the hydrologic cycle are considered, calculations would show inconsequential soil moisture surpluses for the months of January, March, and December, and about 1.3 inches for August, Table II-6.

It should be stressed that all assumptions used in these calculations are very conservative and present an extreme worst case.

TABLE II-6

Water Balance - Native Vegetation With Runoff, Interception, And Depression Storage

(Units Are Millimeters)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Precipitation P	71	48	104	82	89	86	168	284	116	172	168	72
Runoff (20% P) R	14	10	21	16	18	17	34	57	23	34	34	14
Interception (15% P) I	11	7	16	12	13	13	25	43	17	26	25	11
Depression Storage D	6	6	6	6	6	6	6	6	6	6	6	6
Potential E-T (PET)	39	42	60	77	123	146	156	142	115	75	50	40
P-R-I-D-PET	1	-17	1	-29	-71	-96	-53	36	-45	31	53	1
Accumulated Potential Water Loss		-17	-16	-45	-116	-212	-265	-229	-274			
Soil Moisture	104	130	130	105	55	30	23	25	18	49	102	103
Change In Soil Moisture	1	26	0	-25	-50	-25	-7	2	-7	31	53	1
Actual E-T	39	42	60	77	123	111	156	142	115	75	50	40
Soil Moisture Deficit	0	0	0	0	0	35	0	0	0	0	0	0
Soil Moisture Surplus	1	0	1	0	0	0	0	34	0	0	0	0

REFERENCES

Bower 1984: B. Bower, "CO_2 Rises Stretch Tree-Ring Sizes," Science News, V. 126, No. 10, p.156. September 8, 1984.

Bowen 1984: B. Bowen, "TA-54 (Area G) Precipitation," Los Alamos National Laboratory Memorandum to Naomi M. Becker dated October 25, 1984, HSE-8-951.

Chow 1964: V. T. Chow, Handbook of Applied Hydrology McGraw-Hill Book Company, New York (1964).

Cruff 1967: R. W. Cruff and T. H. Thompson, "A Comparison of Methods of Estimating Potential Evapotranspiration from Climatological Data in Arid and Subhumid Environments," US Geological Survey Water-Supply Paper 1839-M (1967).

Dunne 1978: T. Dunne and L. B. Leopold, Water in Environmental Planning, W. H. Freeman and Company, San Francisco (1978).

Foxx 1984: T. S. Foxx, G. D. Tierney, and J. M. Williams, "Rooting Depths of Plants on Low-Level Waste Disposal Sites," Los Alamos National Laboratory report LA-10253-MS.

Lane (to be published): L. J. Lane, "Surface Water Management: A User's Guide to Calculate a Water Balance Using the CREAMS model," A Technology Transfer Document prepared for the US Department of Energy, National Low-Level Waste Management Program, Shallow Land Burial Technology, Arid, Los Alamos National Laboratory LA-10177 (to be published).

Nyhan 1978: J. W. Nyhan, L. W. Hacker, T. E. Calhoun, and D. L. Young, "Soil Survey of Los Alamos County, New Mexico," Los Alamos National Laboratory report LA-6779-MS (June 1978).

Tierney 1982: G. D. Tierney and T. S. Foxx, "Floristic Composition and Plant Succession on Near-Surface Radioactive Waste Disposal Facilities in the Los Alamos National Laboratory," Los Alamos National Laboratory report LA-9219-MS (March 1982).

US Department of Agriculture 1972: US Department of Agriculture Soil Conservation Service, NEH-4 Hydrology, US Government Printing Office (August 1972).

Viessman 1977: W. Viessman, J. W. Knapp, G. L. Lewis, and T. E. Harbaugh, Introduction to Hydrology (Harper and Row, New York, 1977).

APPENDIX III

POTENTIAL MIGRATION DUE TO PAST PRACTICES (CALCULATIONS)

PROBLEM: ESTIMATE VOLUME OF FREE LIQUID WASTE POSSIBLE IN WASTE SHAFTS FILLED PRIOR TO 1982.

Break Down of Shafts:

SHAFT NO.	DATE OPEN	DATE CLOSED	DIA. FT.
Organic-Waste Oil			
1 Organic	1980	Sept. 1983	3
4 Organic	Feb. 1975	May 1980	3
5 Waste Oil	Feb. 1975	June 1977	3
10 Waste Oil	June 1977	June 1979	3
11 WO-Solvent	Jan. 1978	July 1979	8
12 WO-Solvent	Jan. 1978	July 1979	8
17 Organic	June 1979	May 1982	3
18 Waste Oil	June 1979	June 1980	8
19 Waste Oil	April 1980	Sept. 1980	8
22 Organic			3
Acids & Bases			
2*	Feb. 1975	July 1979	3
Inorganic			
3	Feb. 1975	Nov. 1978	3
13	June 1979	May 1982	8
20	April 1980	Sept. 1983	3

Shafts filled after 1983 include vermiculite so 100 free liquid occurs.

* Chemicals not containerized.

Source of Data: Area L Waste Log Book and DWG ENG-4-4468 "Materials Disposal Areas, Area L".

MAXIMUM LIQUID VOLUMES

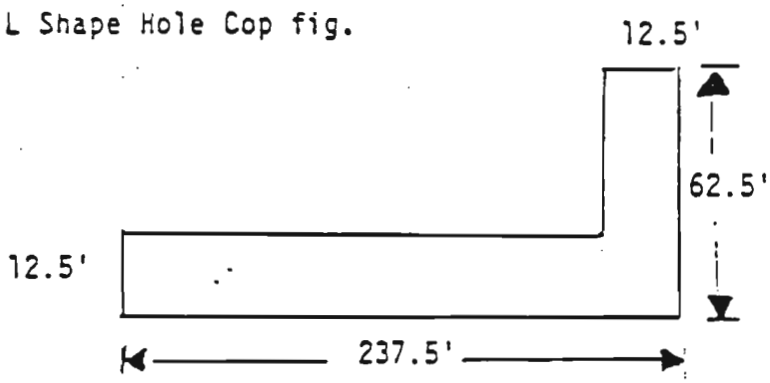
Organic & Waste Oil

6 (3') shafts x 125 cu. ft./shaft	=	750 cu. ft.
4 (8') shafts x 125 cu. ft./shaft	=	3000 cu. ft.
		3750 cu. ft.

Acid & Base	1 (3') Shaft x 125 cu. ft./shaft	=	125 cu. ft.
10 Organic	2 (3') shaft x 125 cu. ft./shaft	=	250 cu. ft.
	1 (8') shaft x 750 cu. ft./shaft	=	75[illegible] cu. ft.
			112[illegible] cu. ft.

APPROXIMATE STORAGE AREA

L Shape Hole Cop fig.



Area = 62.5' x 12.5' x (237.5225 - 12.5') x 12.5' = 3593.75 ft.^{2}

Calc. max. depth of oil penetration assumed total failure of organic storage.

Source: T.L. de Pastrovich, "Protection of Groundwater from Water from Oil Pollution", Concowe Report Nr.3/79.

FORMULA Page 13

$$D = \frac{1000\ V}{A \times R \times K}$$

Where D = Maximum Depth of Penertration, m

V = Volume of infiltrated oil M^3

A = Area of infiltration

R = Retention Capacity of Soil

k = Approx. viscosity correction factor

K = 0.5 for Low Vis, Eg. Gasoline
1.0 for Kerosene, Gas, Oil, etc.
2.0 for Fuel Oil, No. 1 & Heavier

VALUES FOR R

Soil	R L/M³ Oil Retention Capacity
Stone/Coarse Gravel	5
Gravel, Coarse Sand	8
Coarse Sand	15
Medium - Fine Sand	25
Fine Sand, Silt	40

V M^3 Oil $= \frac{3750 \text{ cu.ft.} \quad M^3}{35.31 \text{ cu.ft.}} = 106.2 \text{ m}^3$

A Area In M^2 $= \frac{3593.75 \text{ ft}^2 \quad M^2}{10.76 \text{ ft}^2} = 333.99 \text{ m}^2$

$= 334 \text{ M}^2$

Log indicates that waste is mainly waste oil; to be conservative, assume low vis.: k = 0.5

Subsurface soil closest to fine sand R = 25

$$D = \frac{1000 \ (106.2 \text{ M}^3)}{334 \text{ M}^2 \times 25 \text{ L/M}^3 \times 0.5} = 25.4 \text{ m } (83.3 \text{ ft})$$

Sensitivity

Assume R = 5 Coarse Gravel

$$D = \frac{1000 \ (106.2 \text{ m}^3)}{334 \text{ m}^2 \times 5 \text{ L/M}^3 \times 0.5} = 127.2 \text{ m } (417.3 \text{ ft.})$$

CALCULATE SHAFT VOLUMES

3'Ø H 60'

$Vol = \pi R^2 (H)$

$= 3.141 (3/2')^2 (60')$

$= 424 \ Ft^3$

8'Ø H 60'

$Vol = \pi R^2 (H)$

$= 3.141 (8/2)^2 (60')$

$= 3015 \ Ft^3$

Gross Shaft Volumes

Organic and Waste Oil

6 (3') Shafts x 424 ft^3/Shaft	=	2544 ft^3
4 (8') Shafts x 3015 ft^3/Shaft	=	12060 ft^3
SUBTOTAL	=	14604 ft^3

Acid and Base

1 (3') Shaft x 424 ft^3/Shaft	=	424 ft^3

Inorganic

2 (3') Shafts x 424 ft^3/Shaft	=	848 ft^3
1 (8') Shaft x 3015 ft^3/Shaft	=	3015 ft^3
SUBTOTAL	=	4287 ft^3

TOTAL = 18891 ft^3

PACKING PROCEDURE: In an 8 ft. Ø shaft 5-6 55 gal. drums are placed in a layer with 6 inches of crushed tuff between layers.

In a three ft. Ø shaft 1-55 gal. drums forms a layer with 6 inches of crushed tuff.

To maximize volume prediction, assume 6 drums per layer.

Drum Dimension: 22 1/4" Ø x 33 1/4" Ht. Vol. 55 Gal.
(By Measurement)

A Layer = 33 1/4" + 6" Dirt = 39 1/4"

Assume 60 ft. shaft less 3 ft. topfill.

$$\text{Possible Layers} = \frac{60\text{ ft.} - 3\text{ ft.}}{39\ 1/4\ \ 11/12\ \ 11/1} = 17.4 - 17$$

Vol. per 8'Ø Shaft

$$\text{Cubic ft.} = \frac{6\text{ Drums}}{\text{Layer}} \quad \frac{55\text{ Gal.}}{\text{Drum}} \quad \frac{\text{Cu. Ft.}}{7.481\text{ Gal.}} \quad \frac{17\text{ Layers}}{\text{Shaft}}$$

= 749.9 Cu. Ft.

= 750 Cu. Ft.

Vol. per 3'Ø Shaft

$$\text{Cubic Ft.} = \frac{1\text{ Drum}}{\text{Layer}} \quad \frac{55\text{ Gal.}}{\text{Drum}} \quad \frac{\text{Cu. Ft.}}{7.481\text{ Gal.}} \quad \frac{17\text{ Layers}}{\text{Shaft}}$$

= 124.9 Cu. Ft.

= 125 Cu. Ft.

Ref. J.H. Abrahams, Jr., "Physical Properties of and Movement of Water in Bandelier Tuff"

USGS, Open File Report 1963, Albuquerque, NM.

From 0-8% Vol. H_2O is Redistributed by Diffusion
8-22% By Capillary and Gravity
22-41% Gravity by Drainage

Below 10 ft. moisture content is 0.2 - 3.2% Vol.

Calculate depth of rock associated with 4.8% increase in moisture to 8%.

∴ 1125 cu. ft. = 8-3.2% of Total Volume.

$$\text{Depth} = \frac{1125 \text{ cu. ft.} \quad 1.0 \text{ Total}}{0.048\ H_2O \quad 3593.75\ ft^2} = 6.5 \text{ ft.}$$

Calculated 1% Change.

$$\text{Depth} = \frac{1125 \text{ cu. ft.} \quad 1.0 \text{ Total}}{0.01\ H_2O \quad 3593.75\ ft^2} = 31.3 \text{ ft.}$$

Calculated 100 ft. = % Moisture Change.

$$\% = \frac{1125 \text{ cu. ft.}}{3593.7\ ft^2 \times 100 \text{ ft.}} \times 100\% = 0.3\%$$

Calculated @ 950 ft. % Moisture Change.

$$\% = \frac{1125 \text{ cu. ft.}}{3593.7\ ft.^2 \times 950} \times 100\% = 0.325\%$$

Ultimate Fate of Oil

Ref. 1. American Petroleum Institute, 1972, "The Migration of Petroleum Products in Soil and Ground Water": API Publication 4149, Washington, D.C.,

Ref. 2. P.L. McCarty, M. Reinhard, B.E. Rittman, "Trace Organics in Ground Water".

Ref. 3 Biodegradation producers Microbial Cells, H_2O, CO_2 & H_2O.

Aerobic Bacteria - Need Oxygen, have been found in pourous (permiable) formations several thousand feet down.

Anaerobic Bacteria - Found in subsurface but results in slower decomposition rates.

Ref. 4. Mechanism Biofilm degradation or biofilm kenetics - nutrients rate limiting.

Consider Aqueous Liquids

Volume 1125 cu. ft.

$$LB\ H_2O = \frac{1125\ \text{cu. ft.} \quad 62.4\ \text{lb}}{\text{cu. ft.}} = 70{,}200\ \text{lbs}$$

Consider Rock Density 72 - 115#/cu. ft.
Moderately Welded (Source: Purtymun)

Surface Area 3593.75 ft.

APPENDIX E

INVESTIGATION AND CONSTRUCTION TO ESTABLISH A MONITORING SYSTEM

I. INTRODUCTION

The proposed investigation and construction is to be performed to establish a monitoring system at Area L (Chemical Waste Disposal Area). Area L is located on Mesita del Buey, a narrow southeast trending mesa bounded on the north by Canada del Buey and on the south by Pajarito Canyon (Fig IV-1). The surface of the mesa is underlain by about 250 ft of ashflow and ashfall of rhyolite tuff (depth to top of aquifer 950 ft).

The study will (1) establish observation wells in adjacent canyon; (2) establish a system to monitor possible infiltration of water from precipitation (possible transport mechanism for contaminants) and (3) establish through test drilling, sample collection, and analyses of samples of transport of oils or chemicals has occurred from existing pits or shafts.

A. Observation Wells

Six observation wells are scheduled for construction, three in Canada del Buey and three in Pajarito Canyon. In each canyon, there will be one well upgradient from Area L, one opposite Area L, and one below Area G (Fig IV-1). Effort will be made to locate the wells in the thickest section of alluvium. Thickness of alluvium in Canada del Buey ranges from 3 to 4 feet, while in Pajarito Canyon the thickness is less than 25 ft. Water in the alluvium is seasonal and occurs only after prolonged runoff from snowmelt. The wells will be drilled with an rig using a 7-inch auger. The wells are to be completed at the alluvium-bedrock contact, and will be cased with 4-inch PVC casing. The lower 8 ft of the

casing is perforated with 1/2-inch diameter (drilled) holes and wrapped with stainless steel screen. The annular space between the casing and the hole wall is to be filled with 1/4 to 1/2 inch gravel to within 3 ft of land-surface. The upper 3 ft of the annular space will be filled with cement. The well head will be completed with a locking cap.

B. Moisture Access Holes

Five moisture access holes will be constructed (four within Area L and one on the mesa outside of the area) to measure the distribution and possible movement of moisture in the tuff (Fig IV-2). The holes will be constructed using a 3-inch auger and cased to a depth of about 23 ft (depth of hole) with aluminum tubing. The holes are to be monitored using moisture/density equipment (Campbell Pacific Nuclear Corp., 501 Depthprobe Moisture/density gauge). The use of moisture/density equipment has been used in the past at Los Alamos to determine distribution and movement of moisture and density in the tuff.

C. Test Drilling

Four core holes are to be drilled as part of the investigation to determine possible movement of contaminants from pits or shafts. One core hole (~20 ft deep) will be drilled to obtain cores for background data out side Area L. The remaining three holes are to be drilled in Area L (Fig IV-2). Locations are : (1) adjacent to seepage pit B (liquid lithium hydroxide release), (2) adjacent to shaft 12 (oil in drums), and (3) adjacent to shaft 24 (vermiculite-oil mixture in drums). Holes are to be drilled using a hollow stem auger to a depth of about 100 ft. Drive split spoon or auger cores will be collected at about a 10 ft. interval.

Cores are to be analyzed to determine if migration of chemicals or oils has occurred. Initial core analyses will be determined as described

below; however, unused portions of the cores will be retained if further analyses are necessary.

1. Moisture content shall be determined of all cores.

2. Cores taken from near the seepage pit will be analyzed for Li, Cr, Cu, NH_4F_2, F, and TDS (Total Dissolved Solids).

3. Cores taken near shafts will be analyzed for total organic carbon.

4. The set of cores collected outside of Area L and analyzed for the above constituents or compounds to provide background for comparison of analyses from within Area L.

Upon completion of drilling and sampling, the holes will be used to determine if vapor migration (vapor from organic compounds) of organics from the shafts or pits exists in the tuff. Samples will collected by pumping air from the holes or through the use of packers to pump air from selected depths within the holes. The methods employed will depend on results of analyses of cores.

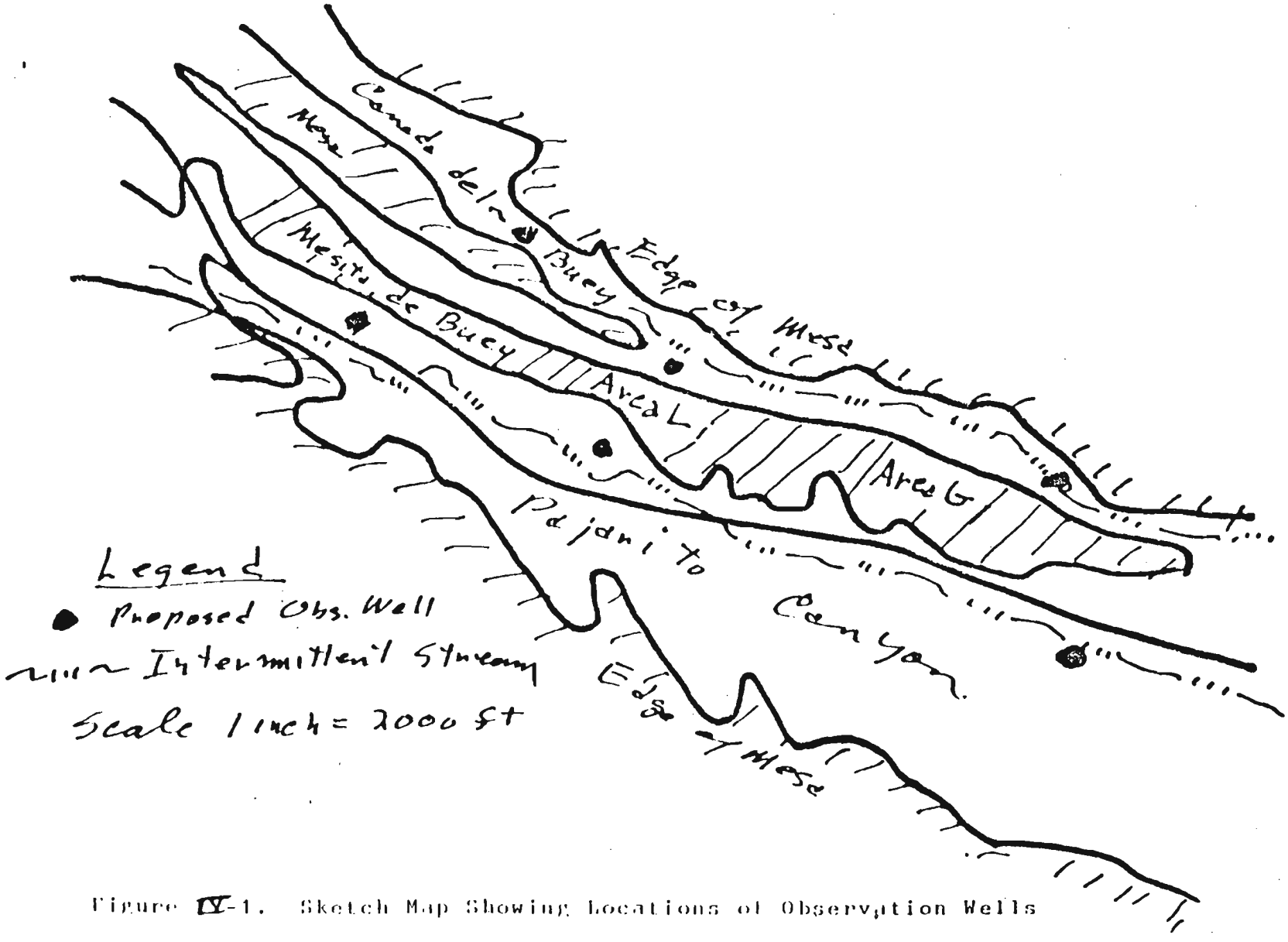
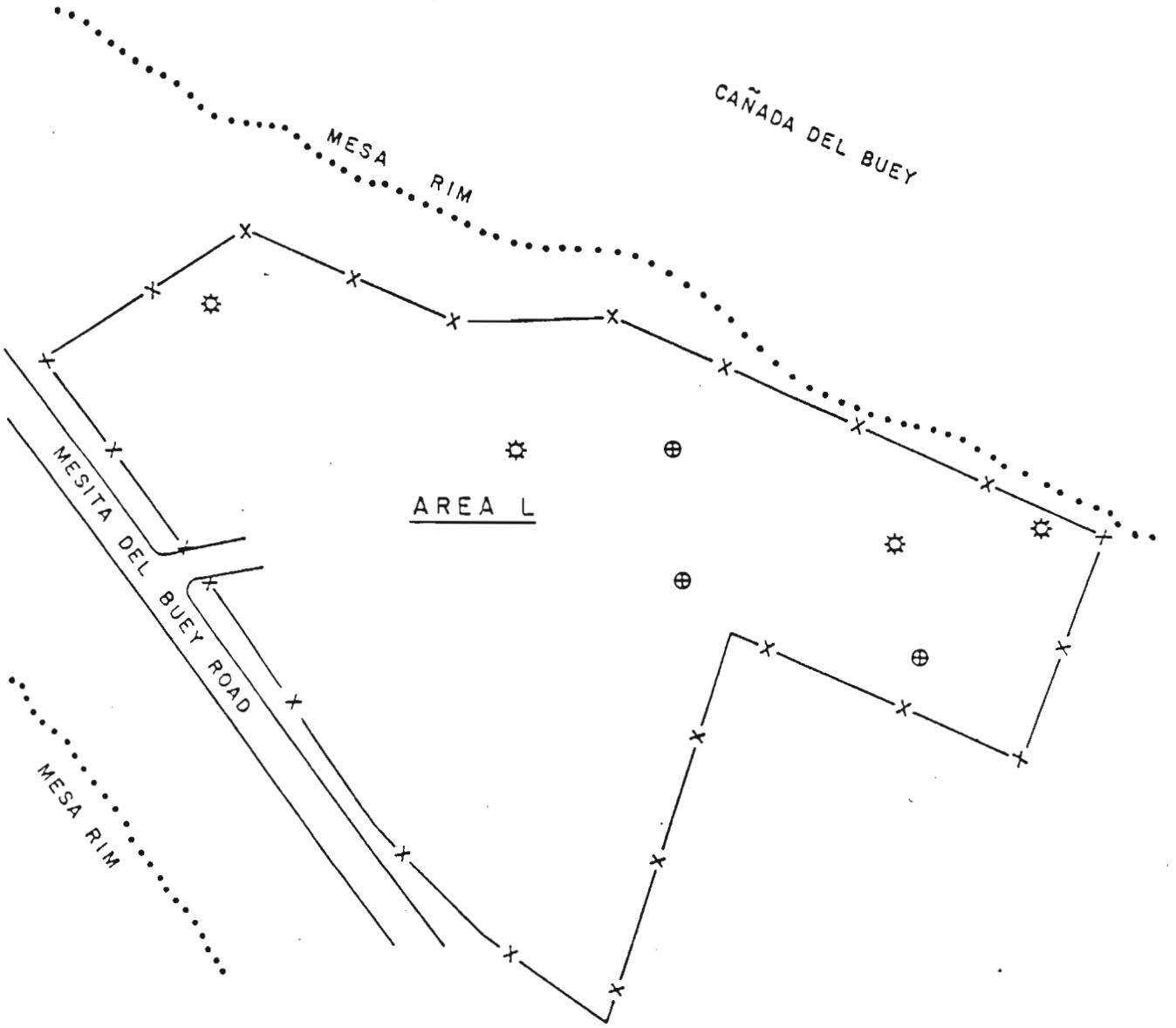


Figure IV-1. Sketch Map Showing Locations of Observation Wells



⊕ COREHOLES

✡ MOISTURE ACCESS HOLES

50 0 100 FEET

SCALE

FIGURE IV-2

LOCATION OF
VADOSE ZONE MONITORING
AND CORE HOLES AT AREA L

PREPARED FOR

LOS ALAMOS NATIONAL LABORATORY
LOS ALAMOS, NEW MEXICO

DRAWING NUMBER

CHECKED BY / APPROVED BY

MJG 2/27/83

L WN BY

© 1984 IT CORPORATION
ALL COPYRIGHTS RESERVED

...Creating a Safer Tomorrow

"Do Not Scale This Drawing"

65360

APPENDIX F

Radioactive Solid Waste

Introduction

This administrative requirement specifies the rules and general procedures for radioactive solid waste disposal at the Laboratory, including segregation, packaging, labeling, documentation, and transportation.

Definitions

Combustible Waste - solid waste that will sustain a flame if ignited. Examples include paper, plastic, rubber, wood, and rags.

Compactible Waste - solid waste that consists of trash-type materials such as paper, plastic, rubber, and small items of glassware up to a 1-gal. size; and small items such as short lengths of pipe conduit and small pieces of wood or sheet metal. Excluded are larger noncompactible items, waste chemicals, free or absorbed liquids, biological waste, pressurized containers, powders, and other particularly hazardous materials.

Hazardous Chemical Waste - any waste chemical or mixture of chemicals that is corrosive to living tissue, is toxic, carcinogenic, teratogenic, mutagenic, or infectious; or in any way poses a present or potential hazard to human health or the environment.

Low-Level Waste - solid radioactive waste that is not classified as transuranic waste.

Mixed-Stream Waste - a combination of radioactive waste and hazardous chemical waste. Included are oils, solvents, pyrophoric substances, spray cans, and any other chemically contaminated items.

Noncombustible Waste - solid waste that will not sustain a flame if ignited. Examples include metals (scrap, equipment, pipe, trimmings), cement, building rubble, soil, leached residues, and HEPA filters.

Noncompactible Waste - large or bulky waste exceeding the maximum dimensions for compactible packages (16 in. by 19 in. by 36 in.) or other obvious noncompactible "common" waste such as heavy pipe, angle iron, equipment, lumber, building rubble, and soil. Also included are mixed-stream and tritium wastes.

Packaging - the waste container; refers to the device(s), including liners and closures, used in the packaging of waste. The waste *package* is the final configuration of the waste in its container ready for transport to the disposal site. *NOTE: Neither the packaging nor the package refers to any special overpack required solely to meet transport criteria.*

Sanitary Landfill Waste - waste material that does not contain radioactive materials, hazardous chemicals, or explosives. Noncontaminated waste

originates from areas and facilities where no radioactive/hazardous materials are handled or from radiation/hazardous materials work areas under controlled conditions.

Tritium Waste - solid waste that is contaminated with tritium in excess of 20 mCi/m^5 (for example, 1 mCi/cardboard box measuring . ft by 1 ft by 2 ft).

Transuranic Radionuclides - alpha-emitting radionuclides of atomic number greater than 92 and half-lives greater than 20 years.

Transuranic (TRU) Waste - solid waste that is contaminated with transuranium radionuclides to levels greater than 100 nCi/g. Also included are wastes that are contaminated with ^{233}U and its daughter products, and ^{226}Ra sources at levels in excess of the above.

Burial of Low-Level Waste

The only approved Laboratory disposal site for burial of low-level solid radioactive waste is at TA-54, Area G. No other disposal means may be used without prior Waste Management (HSE-7) approval.

Reduction of Waste Volume

Waste-generating groups must make every reasonable effort to reduce the volume of radioactive waste at the source by controlling the movement of materials through identified radioactive material work areas. Specific procedures are detailed below.

Office-Type Wastes. To the extent practicable, office-type wastes shall be excluded from radiation areas.

Facilities Design. When designing new facilities or modifying existing facilities, management must separate offices from radiation areas.

Number of Radiation Work Areas. The number of areas where radioactive material is handled must be kept to a minimum and like areas concentrated.

Packaging Materials. Group leaders shall establish and enforce administrative controls to keep large quantities of packaging material and other waste materials from becoming known or suspected radioactive waste. A staging area for unpacking incoming materials must be established for routine operations at facilities that handle radioactive materials. When *large items* are unpacked in a radiation area, special procedures must be implemented to keep packaging materials from becoming radioactively contaminated.

Housekeeping. Special care must be taken during general cleanup campaigns in and around Laboratory facilities to ensure that uncontaminated wastes are kept segregated from contaminated items.

Standard Operating Procedures

Standard operating procedures (SOPs) are required for operations that generate radioactive solid waste. The SOPs must be prepared, reviewed, and approved as specified in Administrative Requirement 1-3, "Standard Operating Procedures and Special Work Permits."

Inclusions. The SOPs must include the following information:

- a description of the waste-generating processes and operations,
- identification of the wastes, including physical, chemical, and radionuclide characteristics,
- identification of waste-reduction procedures, and
- a description of how waste segregation, preparation, packaging, and transportation will be handled in accordance with the requirements defined in this administrative requirement.

Waste Management Review. In addition to the review procedures specified in Administrative Requirement 1-3, SOPs involving the generation of radioactive solid waste must be reviewed and approved by Waste Management before implementation. To ensure compliance with the SOP and appropriate regulations as well as to determine where program improvements are needed, Waste Management also annually reviews the SOP, operation, and facility with the waste generators, area health physics personnel (HSE-1, -10, and -11), and other Laboratory personnel.

Waste Management Coordinator

Group leaders must identify a Waste Management Coordinator for each facility or area. This coordinator will be the primary contact for Waste Management personnel and must have approval authority on waste management matters for that waste-generating site.

Nonroutine Waste

Nonroutine waste is handled on an individual basis. Sufficient leadtime must be allowed for adequate planning. Proposed solutions and funding considerations for unusual problems are the responsibility of the waste generator.

To initiate planning, contact Waste Management's Solid Waste Disposal Section (7-5397) with the following information:

- number, size, type, and condition of containers (if applicable);
- waste matrix;
- identity and quantity of radionuclides (in each container, if applicable); and
- Department of Energy authorization to dispose of wastes by burial/storage (if disposal involves special nuclear materials).

Waste Management will work with the operating group and provide the appropriate assistance.

Waste Segregation and Special Handling

Radioactive wastes must be segregated as shown in Fig. 1 to ensure their safe and efficient treatment and disposal.

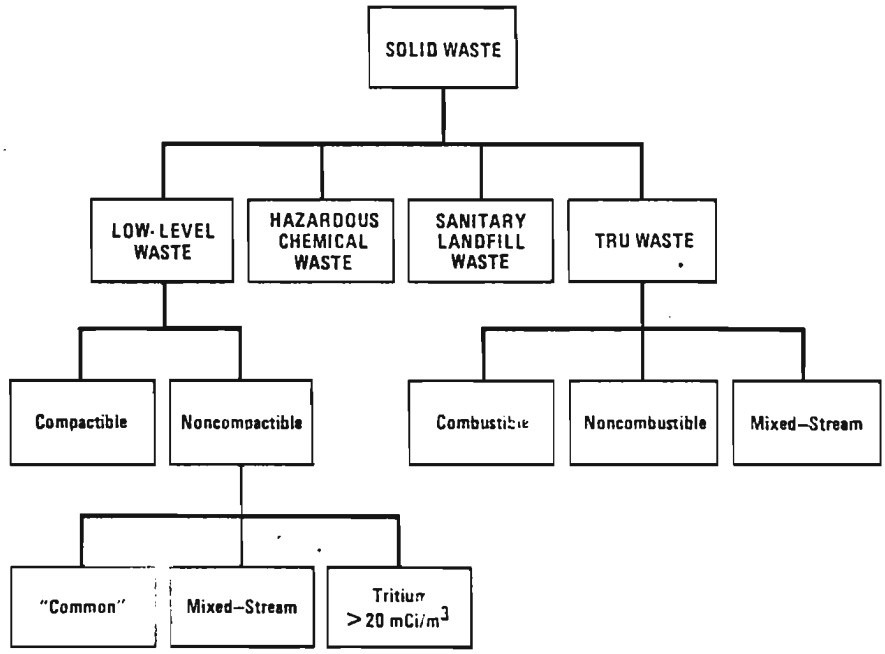


Fig. 1. Waste clasifications.

Sanitary Landfill (Nonradioactive) Waste. Sanitary landfill waste shall be placed in dumpsters for disposal in the Los Alamos County Landfill. There are no special handling requirements for this type of waste.

Nonradioactive Hazardous Chemical Waste. See Administrative Requirement 10-3, "Nonradioactive Chemical Waste," for disposal requirements.

Low-Level Waste. Solid waste generated in a radiation work area, as defined by the health physics staff, shall, at a minimum, be considered low-level waste. Under approved standard operating procedures or special work permits, such work areas may produce uncontaminated sanitary landfill waste.

Low-level waste must be segregated as either *compactible or noncompactible.* Compactible and noncompactible low-level waste must be segregated for separate packaging and placed in separate dumpsters for treatment and burial.

Low-level waste from a *tritium work area* (less than 20 mCi/m^3) does not require special packaging or handling. However, compactibles must be segregated from noncompactibles.

All *mixed-stream* wastes require separation for special handling and packaging.

Transuranic Waste. Transuranic (TRU) waste is designated as such through monitoring, assay, or approved administrative segregation. Administrative segregation requires that all solid waste removed from a TRU glovebox or hood be designated as TRU waste. Exceptions to this rule may be granted by Waste Management but only with documentation based on assay that waste from a specific TRU glove box or hood is below the retrievable level.

Documentation of measured contamination levels and information on previous uses are required to classify *large, excess TRU-contaminated items* (for example, equipment, glove boxes, hoods, and ductwork) as low-level or transuranic waste.

Measurements can be averaged for the individual waste package, although *transuranic waste must not be deliberately diluted to make it low level.* Procedures must be established for the segregation of small batches so that transuranic portions can be handled separately.

Transuranic waste must be segregated as

- combustible,
- noncombustible, or
- mixed stream.

Combustible TRU fractions require packaging in containers separate from TRU noncombustible fractions. This requirement must be met unless specific exemption is granted by Waste Management, based on the operating group's inability to accomplish the segregation. Mixed-stream wastes require separation from all other TRU waste for special handling and packaging.

Packaging of Low-Level Waste

The waste packaging guidelines for the materials described below must be followed unless prior approval has been granted by Waste Management or unless special procedures are described in an approved SOP.

Room Trash. Low-level room trash (for example, paper, plastic, and glassware) must be packaged in cardboard boxes that have an inner plastic bag liner. Compactible waste boxes must be identified with a large "C." Noncompactible waste is identified by an "N" when placed in the same dumpster. Compactible packages shall not exceed the dimensions 16 in. by 19 in. by 36 in. (Also see "Large/Heavy Wastes.").

Where possible, low-level *noncompactibles* must be packaged in cardboard boxes whenever any of the following situations apply:

- external contamination has been detected,
- the waste consists of glass, metal pieces, or other materials that are potentially dangerous to handle, or
- after being unloaded, the waste could be easily dispersed by the wind.

Mixed-Stream Waste. Special handling is required for mixed-stream waste in accordance with either an approved SOP or established

procedures for a nonroutine waste. Mixed-stream waste must not be packaged with other low-level waste except with prior approval from Waste Management.

Waste Oils. The waste generator must ensure that low-level waste oils are absorbed in an approved manner. (See "Solidifying Liquids.")

Large/Heavy Wastes. Items that are large or heavy (for example, pipe, equipment, and other bulky objects) must be packaged in wooden crates and/or plastic bags or wrap unless other disposal procedures are covered in an approved SOP. Metal and fiber drums are also acceptable packages. *NOTE: Additional packaging may not be required if all contamination is fully contained within the waste material (for example, pumps and electrical motors).*

Large Volumes. Large volumes of certain bulky waste (for example, slightly contaminated soil, building rubble, pavement, and area cleanup debris) shall be contained in an enclosed transport vehicle such as a plastic-lined, tarp-covered dump truck.

Tritium Waste. As detailed in the following, special packaging with asphalt is required for tritium waste (greater than 20 mCi/m^3).

Waste contaminated with activity levels

- up to 100 Ci/m^3 must be packaged in asphalt-lined metal drums, the lids of which are also sealed with asphalt. Approved containers are 55-gal. and 30-gal. drums with locking rings.
- greater than 100 Ci/m^3 must be completely encapsulated in asphalt. Typically, this entails a 30-gal. drum within a 55-gal. drum, with asphalt filling the void space between the two.

Under the procedures for nonroutine waste, exceptions to these packaging specifications (for example, large waste items) may be considered.

Packaging of Transuranic Waste

Transuranic waste packages must maintain their integrity throughout a required 20-year storage period. These wastes must be stable solid or solidified materials that meet the Waste Isolation Pilot Project's (WIPP) waste acceptance requirements. Wastes with the following types of materials or properties must be treated before packaging to remove such materials/properties:

- free liquids or wastes from which free liquids can form during storage,
- fine particulates,
- reactive chemicals (for example, pyrophorics, explosives, water reactives, incompatible chemicals), and
- pressurized containers or those wastes that could create a pressure buildup in the container during storage.

Drum. The only drum approved for TRU waste is the Stock LG-1115, white-painted, 55-gal., DOT 17-C drum. When filled, the drums are limited to having a *maximum surface radiation dose rate of 200 mrem/h.* The radionuclide content of a drum is limited to 14.6 curies of alpha activity; the fissile material content is limited to 200 g.

Drums must have *protective liners* as specified below. Plastic bag liners must be sealed with plastic tape (Stock GS-3862) before the drum is sealed. Polyethylene (2.3-mm) liner lids must be snap-sealed and clamped (no sealant is required). The drum lid shall be secured by wrapping three layers of yellow plastic tape around the drum-lid joint. The ring clamp is then installed, and the bolt torqued to 40-45 ft-lbs.

Specific requirements (including liner specifications) for packaging the various types of TRU waste in drums are as follows.

- TRU *dry waste* must be packaged in approved drums containing a 0.25-mm-thick polyethylene liner.
- TRU *corrosive or wet waste* must be packaged in approved drums with a 2.3-mm polyethylene liner.
- TRU *waste oils* must be solidified (see "Solidifying Liquids") and packaged in approved drums with a 2.3-mm polyethylene liner.
- For *TRU wastes that are gamma active,* shielding materials must be used wherever practical in a drum to reduce surface radiation to below 200 mrem/h.
- *Higher activity wastes* containing greater than 14.6 curies of alpha activity (greater than 1 g ^{238}Pu, greater than 4 g ^{241}Am) require special handling, packaging, and storing. (See "Nonroutine Waste.")

Box. If drums are not suitable, TRU dry, large, or bulky waste that is noncombustible shall be packaged in WIPP-approved metal boxes measuring 68 in. by 54 in. by 38.5 in. Other sizes of boxes may be used if prior approval is obtained from Waste Management. When filled, boxes are limited to a maximum gross weight of 6000 lbs unless another value is approved by waste management. The amount of fissile material allowed in a box is limited to 5 g/ft^3 to a maximum of 350 g per box.

Steel boxes are suitable only for *dry waste.* If a plastic liner is used, neither its installation nor closure shall obstruct the box vent.

In *sealing the box*, the lid shall be seal-welded to the box with the ridges of the corrugations protruding up. The surfaces to be welded shall be clean, dry, and free of paint. No sealant shall be used. The weld shall be leak-tested with liquid leak detector (Stock GS-2946 or equivalent) while the box is under approximately 0.25 psi pressure. Allow at least 1 minute for bubbles to become visible. The weld shall be free of spatter, slag, and leak detector fluid before refinishing with a primer and paint compatible with the original paint on the box.

If the box requires *transportation to another Laboratory site* before the final seal-welding of the lid can be completed, the box must have an approved temporary cover (including a hold-down device).

Solidifying Liquids

Solidification is required before disposal of low-level liquid wastes that cannot be handled according to Administrative Requirement 10-1, "Radioactive Liquid Waste." Contact Waste Management for further guidance on solidification procedures.

Absorption onto an approved sorbent material such that the resulting mass is a nonflowing semisolid is a currently approved solidification method. Other solidification technologies may be used with prior Waste Management approval.

Absorption Mixture. For waste oils, the approved and preferred sorbent is *ground (60 mesh or finer) exfoliated vermiculite* (Stock CI-6617). Oil shall be mixed with this vermiculite in the following proportions:

- by volume: 0.6 part waste oil to 1.0 part vermiculite. *NOTE: the oil will occupy void space only (total volume = volume of vermiculite)*; and
- by weight: 3.3 parts waste oil to 1.0 part vermiculite.

Also approved is the use of *coarse-ground vermiculite* (industrial type No. 1, Stock CI-6616). Oil shall be mixed with this vermiculite as follows:

- by volume: 0.5 part waste oil to 1.0 part vermiculite (total volume = volume of vermiculite only);
- by weight: 2.6 parts waste oil to 1.0 part vermiculite.

These portions of oil/vermiculite are based on SAE 10/40-weight oils. The above ratios of waste to vermiculite will have to be adjusted by the generator if much heavier or lighter oils or other liquids will be disposed of.

Contact Waste Management for guidance on acceptably solidifying TRU waste oils and other liquids.

Layered Procedure. The recommended procedure for the absorption of contaminated liquids in an appropriate container with the required liner is to alternately add vermiculite and oil in a layered fashion. Proper absorption is ensured by mixing while the liquid is being added.

Dumpsters

Disposal procedures other than those specified below are acceptable only if they are covered in an approved SOP.

All waste placed in dumpsters must be packaged, surveyed before loading, and free of removable external contamination. Unless otherwise approved, the maximum beta/gamma reading at the surface of any package is limited to 200 mrem/h. *NOTE: Even if packaged, radioactive waste must never be left outside a dumpster.*

Allowed Wastes. Only low-level waste shall be placed in dumpsters labeled for radioactive waste.

Disallowed Wastes. Wastes that are *never* disposed of in dumpsters include

- unpackaged wastes,
- free liquids,
- mixed-stream waste (such as oils, chemicals, spray cans), and
- TRU wastes.

Weight Limitation. A waste package placed in a dumpster for compactible waste must not exceed 30 lbs.

Compactibles/Noncompactibles. Major waste generators possessing separate dumpsters for compactibles and noncompactibles must not mix such wastes in the same dumpster.

Box-Type Dumpsters. Box-type dumpsters for radioactive waste must be kept locked at all times. If a dumpster for sanitary landfill waste is closer than 100 feet to a radioactive waste dumpster, the sanitary landfill dumpster also must be locked. Health physics personnel issue and control the keys. Any dumpster with missing locks or broken clasps must be sealed and posted to ensure that waste is not placed in that dumpster. Notify Waste Management immediately to have the dumpster picked up, emptied, and repaired as necessary.

Skip-Type Dumpsters. Although normal loads consist of metal and/or fiber drums, other packages such as boxes may be transported only with Waste Management/Health Physics approval. The waste generator shall load or arrange for the loading of the packages. *Maximum load is 5000 lbs*. Drums or other packages must be secured with a chain and must not be stacked in a skip-type dumpster.

Labeling

General Requirements. Packages of waste destined for disposal or storage must be clearly labeled as containing radioactive material. Tape and signs appropriate for this purpose are obtainable through Safety Stock and should be used as indicated below.

Cardboard Boxes and Bags. "CAUTION-RADIOACTIVE WASTE" tape (Stock CM-3262) must be used to mark all boxes and bags to be disposed of by burial. The building and room number of the waste's origin shall be marked on all cardboard boxes.

Drums. Whether destined for burial or retrievable storage, drums must have a Radioactive Material Transfer tag properly filled out and securely attached. Contact the health physics staff for assistance.

Additional Labeling for TRU Waste. In addition to the above, all TRU waste packages must have the following:

- *a unique identification number.* Drums and boxes must have a serially numbered tag attached (available from Waste Management). Only the Waste Management tag is acceptable.
- *proper color coding.* WIPP certification requires the use of color-coded bands to identify packages (1) having surface radiation doses above 10 mrem/h, (2) containing reportable quantities of toxic chemicals, or (3) having a combustible waste content exceeding 25% by volume. Contact Waste Management for specific color-coding requirements.

Documentation

To properly maintain the required records for waste disposal, each consignment of low-level waste or package of uncertified TRU waste must be accompanied by a Los Alamos Radioactive Solid Waste Disposal Record (HS Form 10-2A). Waste will not be accepted at the disposal site without this form properly completed.

Certified TRU waste must be accompanied by a Certified Waste Storage Record (CWSR) form (HS Form 10-2B) that has been approved by Waste Management before shipment to the disposal site.

Property (and Classified Waste) Disposal. Disposal of a property-numbered item or classified contaminated item requires an additional form, 252-R, "Disposal of Contaminated and/or Classified Property." The waste-generating group initiates this form, which is obtainable from Stock (ST-2623) or from the Property Management Group (MAT-2).

Transportation

Described here are the procedures required to transport radioactive solid waste from waste-generating sites to the disposal/storage area (TA-54, Area G). Any deviation from the following must be in accordance with Administrative Requirement 3-5, "Shipment of Radioactive Materials." *NOTE: This section does not address shipments made outside of Los Alamos County.*

Transport by Waste Generators. Radioactive waste must not be transported to Area G by a waste generator unless the generator has an approved SOP for the operation or approval from the health physics personnel and the Waste Management staff.

The following rules apply for transport by waste generators.

- Unless otherwise authorized, use pickup trucks only; do not use enclosed vans or passenger cars. *No private vehicle shall be used for transport at any time.*
- The health physics monitor at the generator site shall verify that all waste packaging, labeling, and documentation requirements are met.
- Loads shall be positively secured with chains or other tiedown means, and/or covered with a secured tarp. The truck shall not leave the generator site until the health physics monitor has approved the load and signed the required accompanying documentation.

Transport by Others. The waste generators must initiate arrangements for waste transport to Area G through contact with, as necessary, the health physics staff, the Waste Management Group's Area G site supervisor, and the generator site representative from the Maintenance and Operations Group (ENG-4).

ENG-4 will contact health physics personnel and the Waste Management staff regarding specific transport and handling requirements. ENG-4 will write individual work orders as required for Zia transport of waste (except for dumpsters) and arrange the necessary Zia support at the generating site and at Area G for disposal/storage. The Waste Management's Area G site supervisor notifies Zia directly of a required dumpster pickup and coordinates the operation with the appropriate health physics supervisor.

Escort Requirements. If the shipment involves any of the following, specially trained health physics personnel shall escort the waste shipment from the originating site to Area G:

- >200 mrem/h beta-gamma radiation at the vehicle's (or dumpster's) outer surface, or >10 mrem/h at 6 ft from the vehicle's (or dumpster's) surface.
- drums containing uranium chips and turnings (potential fire hazard);
- TRU wastes, *unless* packaged with an approved Type B overpack as defined in Administrative Requirement 3-5, "Shipment of Radioactive Materials," in which case the escort may be waived;
- other wastes containing DOT Type B quantities of contaminants, *unless* an approved Type B overpack is used; or
- any other waste as deemed necessary by health physics staff and/or Waste Management personnel.

Vehicle Breakdown. If a transport vehicle becomes inoperative during the transportation of waste, the driver must contact his/her supervisor and request assistance without leaving the vehicle unattended. If the vehicle must be taken to the repair shop, it first must be towed to an appropriate Laboratory-secured area where the waste must be either transferred to another truck or stored at the approved site until the next workday. If the vehicle cannot be moved, the waste must be transferred to another vehicle for transport to Area G. The disabled vehicle, after being emptied, must be monitored by health physics personnel before the vehicle is moved.

Transportation Accident. Any accident involving a vehicle carrying radioactive waste must be reported immediately by calling the Health, Safety, and Environment Division's assistance number (7-7878).

In the event or possibility of fire, the Fire Department (9-911) must be notified immediately. Vehicle accidents occurring offsite also must be reported immediately to the Los Alamos Police Department.

WIPP Storage of Transuranic Waste

Defense TRU wastes generated at Los Alamos are placed into retrievable storage at the Laboratory until they can be sent to WIPP for permanent disposal.

Compliance Requirements. Waste acceptance criteria for WIPP were developed and interpretations and clarifications of these criteria, in operational terms, were issued as Compliance Requirements. Certification that these Compliance Requirements are satisfied is required before shipment to WIPP and, thus, before TRU waste is accepted for storage by Waste Management.

Certification Procedure. To ensure that waste meets the WIPP criteria for disposal, each generator of TRU waste shall prepare and implement a certification procedure(s) to supplement the Laboratory's TRU Waste Certification Plan. Certification procedures require both Waste Management and DOE-ALO approval. Certified TRU waste, together with the proper documentation, shall be delivered to Waste Management for onsite "retrievable" storage.

References

"Certification Plan for TRU Waste to be Shipped to the WIPP," Los Alamos National Laboratory (Draft, February 1984).

"Hazardous and Radioactive Mixed Waste Management," Department of Energy Order 5480.2 (most recent).

"Management of Transuranic Contaminated Material," Department of Energy Order 5820.1 (most recent).

"Nonradioactive Chemical Waste," Administrative Requirement 10-3, in *Health and Safety*, Los Alamos National Laboratory Manual, Chapter 1 (August 1984).

"Quality Assurance Measures for Certification of TRU Wastes for Shipment to the WIPP," WIPP-DOE-120 (April 1982).

"Radioactive Liquid Waste," Administrative Requirement 10-1, in *Health and Safety*, Los Alamos National Laboratory Manual, Chapter 1 (August 1984).

"Shipment of Radioactive Materials," Administrative Requirement 3-5, in *Health and Safety*, Los Alamos National Laboratory Manual, Chapter 1 (August 1984).

"Standard Operating Procedures and Special Work Permits," Administrative Requirement 1-3, in *Health and Safety*, Los Alamos National Laboratory Manual, Chapter 1 (August 1984).

"TRU Waste Certification Compliance Requirements for Newly-Generated Contact-Handled Wastes for Shipment to the WIPP," WIPP-DOE-114 (October 1981).

Referrals

Radiation Protection Group (HSE-1), 7-7137

Solid Waste Disposal Section of Waste Management Group (HSE-7), 7-5397

Radioactive Solid Waste Disposal/Storage Area of HSE-7, 7-6095, (TA-54, Area G, for routine disposal/storage arrangements)

Maintenance and Operations Group (ENG-4), 7-4657

Chemistry Health Protection Group (HSE-10), 7-7218

Accelerator Health Protection Group (HSE-11), 7-5890

Property Management Group (MAT-2), 7-7802

Forms

HS Form 10-2A, Los Alamos Radioactive Solid Waste Disposal Record

HS Form 10-2B, Certified Waste Storage Record 252-R, Disposal of Contaminated and/or Classified Property

Tag

Radioactive Material Transfer tag

PLEASE READ INSTRUCTIONS ON BACK CAREFULLY

1. FORM NUMBER S 8 5 2945

LOS ALAMOS RADIOACTIVE SOLID WASTE DISPOSAL RECORD

HSE-7 Waste Management
Ext 6095 MS J592

2. DATE	3. RETRIEVABLE SERIAL NO.	4. ORIGIN OF WASTE					5. WASTE CODE
MM DD YY		GROUP	TA	BLDG.	WING	ROOM	

6. WASTE DESCRIPTION

7. NUMBERS OF WASTE PACKAGES					
PLASTIC BAGS	CARD-BOARD BOXES	DRUMS NO.	DRUMS GAL.	WOODEN CRATES NO.	WOODEN CRATES VOLUME-ft^3

8. GROSS VOLUME	UNITS

M = METER^3
F = FEET^3
G = GALLON

9. PACKAGE RADIATION AT:	
SURFACE MR/HR	1 METER MR/HR

10. GROSS WEIGHT	UNITS

K = KILOGRAM
P = POUND
T = TON

11. ADDITIONAL DESCRIPTION OF PACKAGING AND PACKAGING MATERIALS

12. RADIONUCLIDE CONTENT NUCLIDE	AMOUNT	±	UNITS	ERROR ON AMOUNT	±	AMOUNT DETERMINED BY: A = ANALYSIS M = MEASUREMENT E = ESTIMATE	SS MATERIALS WRITEOFF ACCOUNT	PROJECT CODE
	E			E				
	E			E				
	E			E				
	E			E				
	E			E				
	E			E				

C = CURIE
M = GRAM

WASTE GENERATOR
Signature certifies that waste is in accordance with all applicable disposal requirements.

HSE-1 AREA REPRESENTATIVE
Signature certifies that waste package or shipment is safe to handle and transport.

GROUP LEADER (AS NECESSARY)

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 ____________
Signature certifies waste met acceptance criteria, and all disposal requirements were met.

HS Form Number 10-2A (12/83)

GENERAL INSTRUCTIONS

The waste generator must complete this form to document all waste buried or retrievably stored at the Laboratory's TA-54, Area G, site. It is important to complete each section before proceeding to the next section.

Waste Generator:

1. Do not use more than the allotted spaces on the form (one letter or number per space).
2. Ensure that all data recorded is printed and legible.
3. Note positions of indicated decimal points accurately in all pertinent entries.
4. Use the number zero (0) on the form only on entries requiring that numerical designation. Do not use the number zero to fill blank spaces.
5. Where the amount of information available does not allow recording all data on one form, use additional forms for different portions of the waste.

Signatures Required: The Waste Generator signs the form to indicate compliance with disposal requirements. The area HSE-1 Health Physics Representative signs the form to indicate that the package or shipment is safe to handle and to transport.

When the Form is Complete: The Waste Generator must ensure that a properly completed form accompanies each shipment of waste for burial and each package of retrievable transuranic (TRU) waste delivered to the site. The Waste Generator must keep a copy of the completed form for the files.

SPECIFIC INSTRUCTIONS

SECTION

5 **WASTE CODE**

Identify all waste by a 3-digit description code, as given in Waste Disposal Record Form-Attachment I.

6 **WASTE DESCRIPTION**

If radiation levels exceed that which can be listed, leave blank and record data in the Section 11 Additional Description entry. Do not use symbols indicating greater than or less than. Round off fractional numbers to the nearest whole unit.

11 **ADDITIONAL DESCRIPTION OF PACKAGING AND PACKAGING MATERIALS**

Use this space to provide property number, C&D form numbers, etc.

12 **RADIONUCLIDE CONTENT (A) NUCLIDE**

List radionuclides by using either the normally accepted notations (for example, U235, Pu239, Co60, H3, etc.) or, for accountable materials, by using the element identification plus the SS Material Type Code (for example, Pu52 for plutonium code 52, U38 for uranium code 38). Acceptable codes include MFP for Mixed Fission Products and MAP for Mixed Activation Products. For chemical or hazardous waste not containing radioactive contamination, contact HSE-7 at 7-5397 for information regarding the entry. In cases where more than one contaminant is identifiable, each contaminant should be listed (with all appropriate data) on a separate line in section 12. Where there are more than six (6) radionuclides, contact HSE-7 at 7-5397 for information regarding the entry.

12 **RADIONUCLIDE CONTENT (B) AMOUNT/ERROR ON AMOUNT**

Use scientific notation to record all entries, for example, record 0.012 as 1.200 E-2; 1.2 as 1.200 E-0; 1200 as 1.200 E+3. Every effort must be made to identify units, that is, M = gram, C = curie. Identify Amount Determined By. If AMOUNT and/or ERROR ON AMOUNT values are unknown, leave spaces blank; do not use a numerical entry of 0.0 (this infers absolutely no contamination).

Distribution:
Original - HSE-7 Waste Management (accompanies waste to disposal/storage area)
Copy - Waste Generator

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
☐ 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)*	

SS MATERIALS WRITE-OFF		RADIONUCLIDE CONTENT		C = Curie M = Gram
Account	Project Code	Nuclide	Amount	
			E	
			E	
			E	
			E	
			E	
			E	

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)
		E +
		E +
		E +
		E +

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) E +

Survey Meter Model

Survey Meter Serial No.

Alpha Contamination (dpm/100cm2) E +

Beta-Gamma Cont. (dpm/100cm2) E +

The data in this section were collected as prescribed in approved procedures. The package is properly closed and is safe to handle and transport.

Printed Name	Date
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) E +

Survey Meter Model

Survey Meter Serial No.

Alpha Contamination (dpm/100cm2) E +

Beta-Gamma Cont. (dpm/100cm2) E +

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.

Printed Name	Date
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.

Printed Name	Date
Signature	

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
Signature	

HS Form Number 10-28 (12/83)

PROCEDURES AND INSTRUCTIONS

This form must be used to document packages of TRU waste that have been generated according to the Los Alamos TRU Waste Certification Plan. Complete each section thoroughly in the order given on the form before proceeding to the next section. Accompany all signatures with a printed or typed name.

Use scientific notation. Whenever the notation E plus or minus is given in a data block, enter the plus or minus as appropriate. Examples: Record 0.012 as 1.2E-2; 1.2 as 1.2E+0; and 1200.0 as 1.2E+3. Where E+ appears in a data block, enter values less than E-0 as 0.0E-0.

I. GENERATOR'S PACKAGE INFORMATION

Waste Generator: Complete the entire section as follows; then send the form to the area HSE-1 Health Physics Representative.

Waste Package Serial Number. Use the full 13-digit number beginning with "LA" as marked on the waste package.

Origin of Waste. Give the data for the organization offering the waste to HSE-7.

PN Items. Enter the C&D (Form 252-R, Disposal of Contaminated and/or Classified Property) number(s) in the space provided. Enter the associated property number(s) in the space marked "ADDITIONAL INFORMATION."

Additional Information. Use this space to enter any information about the waste that may be useful later, such as property numbers or the specific origin of the waste. Use of this space is optional except for listing property numbers when a C&D number has been entered.

Container. Check the correct box. Drum lot number is a code of one or more characters stamped or painted on the outside of the drum between the upper rolling hoop and the top curl. Year of manufacture is the last two digits in the code stamped in the bottom head of the drum. Example: 16-55-82, enter 82. Manufacturer's serial number is the manufacturer's number for containers other than drums.

SS Materials Write-Off. Provide the account and project codes. (This is for the waste generator's use only.)

Radionuclide Content. List the radionuclides by using either the normally accepted notations (for example, U235, Pu239, Co60, H3, etc.) or, for accountable materials, by using the element identification plus the SS Material Type Code (for example, Pu52 for plutonium code 52, U38 for uranium code 38, etc.). The acceptable code for Mixed Fission Products is MFP. In cases where more than one contaminant is identifiable, list each (with appropriate data) on a separate line. Where there are more than six (6) radionuclides, contact Group HSE-7 at 7-5397 for information about this entry. Identify units, that is M = Grams, C = Curies.

Process Batch Code. Use this code only when a homogeneous batch of waste fills more than one container; otherwise, enter "N/A."

Gross Weight. Enter the weight of the complete package in kilograms (kg).

Organic Mat'l Weight. Enter the total weight of organic material in the package, including the packaging, in kilograms (kg).

Organic Mat'l Volume. Round off to the nearest 10% and enter.

Content Code. Enter the number assigned by the Certification Plan attachment.

Date Closed. Enter as MMDDYY without spaces or punctuation.

Toxic or Corrosive Materials. Use name and code number as given in 49 CFR 172.101. Enter only if the amount in the package exceeds the reportable quantity (RQ) value; otherwise, enter "NONE." An amount is required for each code listed.

II. GENERATOR SITE HEALTH PHYSICS INFORMATION

The area HSE-1 Health Physics Representative at the Generator's site completes and signs this section. The Waste Generator then sends the form to the HSE-7 Solid Waste Records Office (MS E516) for review and approval.

III. HSE-7 SOLID WASTE RECORDS OFFICE INFORMATION

The HSE-7 Solid Waste Records Office Representative completes and signs this section. This represents authorization to transport. The Waste Generator must arrange for transportation ONLY AFTER RECEIVING SUCH AUTHORIZATION FROM THE HSE-7 SOLID WASTE RECORDS OFFICE. Refer to Administrative Requirement 10-2. Ensure that the CWSR accompanies the waste to the TA-54 storage site.

IV. STORAGE SITE HEALTH PHYSICS INFORMATION

The HSE-1 Health Physics Representative at TA-54 must complete and sign the Storage Site Health Physics Information section.

V. STORAGE SITE INFORMATION

The HSE-7 Storage Site Personnel must complete this section and sign (1) when the waste is accepted and (2) after the waste is stacked.

APPENDIX G

Shipment of Radioactive Materials

Introduction

The Laboratory requires that radioactive materials be packaged, marked, labeled, certified, and transported in accordance with appropriate regulations. This administrative requirement outlines the necessary procedures for onsite transfers and offsite shipments of radioactive materials.

Definitions

Approved Containers - a Department of Transportation specification container or a Certificate of Compliance container approved by either the Department of Energy or the Nuclear Regulatory Commission.

Empty Radioactive Materials Packaging - any packaging that previously contained radioactive materials, has been emptied of contents as far as practicable, and meets the criteria of Part 173.427 of Title 49, Code of Federal Regulations.

Limited Quantity - a quantity of radioactive material that meets the requirements of Parts 173.421 through 173.423 in Title 49, Code of Federal Regulations.

Offsite Shipment - a shipment of radioactive material to a destination outside the Los Alamos project.

Onsite Transfers - movement of radioactive material between technical areas and/or major facilities located within the Los Alamos project.

Radioactive Material - materials containing a specific activity greater than 0.002 μCi/g are considered to be radioactive for *offsite shipments*. For *onsite transfers*, the 0.002 μCi/g value normally applies; however, materials with less than a specific activity of 0.002 μCi/g may be considered radioactive for the purpose of local radioactive contamination control. Radioactive material is categorized as follows:

- **Normal Form Radioactive Material** - any radioactive material that does not meet the criteria for special form.
- **Special Form Radioactive Material** - radioactive material that is (1) a single, solid piece or (2) contained in a sealed capsule that can be opened only by destroying the capsule. The piece or capsule has at least one dimension not less than 5 mm and satisfies the test requirements of Part 173.469 in Title 49, Code of Federal Regulations.

Radioactive Material Package Transport Index - a number placed on a package by health physics personnel to designate the degree of control to be taken by the carrier during transportation. The transport index is based

on the degree of external radiation or on fissile material criticality considerations.

Incoming Shipments

The health physics staff, in compliance with Department of Energy (DOE) regulations, monitors all incoming radioactive packages and the transport vehicles to ensure that there is no significant removable contamination. In addition to the DOE regulations, the Radiation Protection Group (HSE-1) has established procedures for monitoring incoming "empty" radioactive material packages. Radioactive material received at TA-3, SM-30 is distributed by the Supply and Distribution Group (MAT-14) or the Nuclear Materials Accountability Group (OS-2), dependent on the type and quantity of the material.

The operating group shall open radioactive material shipping containers at their own work location in the presence of the health physics representative, who will then perform the required monitoring of the internal surfaces.

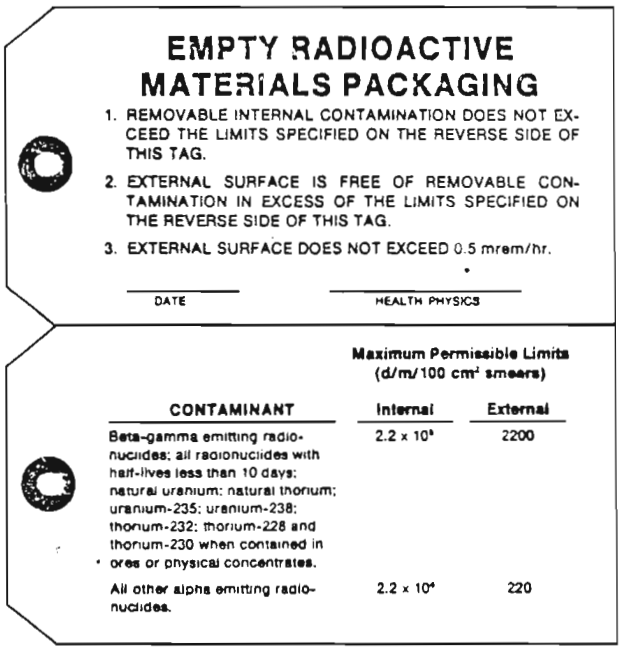
Offsite Shipments

Initial Contact. Upon notification by an operating group, the Radioactive Materials Shipping Advisor in HSE-1 prepares a Radioactive Shipment Advance Information form (HS Form 3-5A), describing the required packaging and the applicable Department of Transportation (DOT) regulations. The originator must identify and describe the material on the Laboratory's Shipping Request (Form 796).

Shipping Container Requirements. Shipments of radioactive material in excess of "limited quantities" (see "Definitions") require an approved shipping container. For shipments using or requiring a Type B shipping container, the operating group must complete a Quality Control form (HS Form 3-5C) and either the general Certification of Packaging form (HS Form 3-5D) or a specific certification of packaging form (contact the Radioactive Materials Shipping Advisor for details).

Labeling the Containers. In general, shipments of radioactive material must have a Radioactive White I, a Radioactive Yellow II, or a Radioactive Yellow III label affixed to them. (Labels are affixed by the health physics staff.) An exception to this rule is made for limited quantity shipments of radioactive material, which are exempted from specification packaging, marking, and labeling requirements. Each empty radioactive material shipping container that meets the applicable definition of "empty" must be labeled with the approved DOT label. *NOTE: The Empty Radioactive Materials Packaging tag (Fig. 1) is for internal use only.* The operating group must complete a Certification for Empty Radioactive Material Packaging form (HS Form 3-5E) when shipping such containers offsite.

Approving the Shipment. The health physics staff, in cooperation with the operating group, ensures that offsite shipments are properly packaged and that a completed Radioactive Materials Shipping Data Sheet (HS Form 3-5B) accompanies the shipment. The Traffic Office of



EMPTY RADIOACTIVE MATERIALS PACKAGING

1. REMOVABLE INTERNAL CONTAMINATION DOES NOT EXCEED THE LIMITS SPECIFIED ON THE REVERSE SIDE OF THIS TAG.
2. EXTERNAL SURFACE IS FREE OF REMOVABLE CONTAMINATION IN EXCESS OF THE LIMITS SPECIFIED ON THE REVERSE SIDE OF THIS TAG.
3. EXTERNAL SURFACE DOES NOT EXCEED 0.5 mrem/hr.

DATE _____ HEALTH PHYSICS _____

CONTAMINANT	Maximum Permissible Limits (d/m/100 cm² smears) Internal	External
Beta-gamma emitting radionuclides; all radionuclides with half-lives less than 10 days; natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical concentrates.	2.2×10^5	2200
All other alpha emitting radionuclides.	2.2×10^4	220

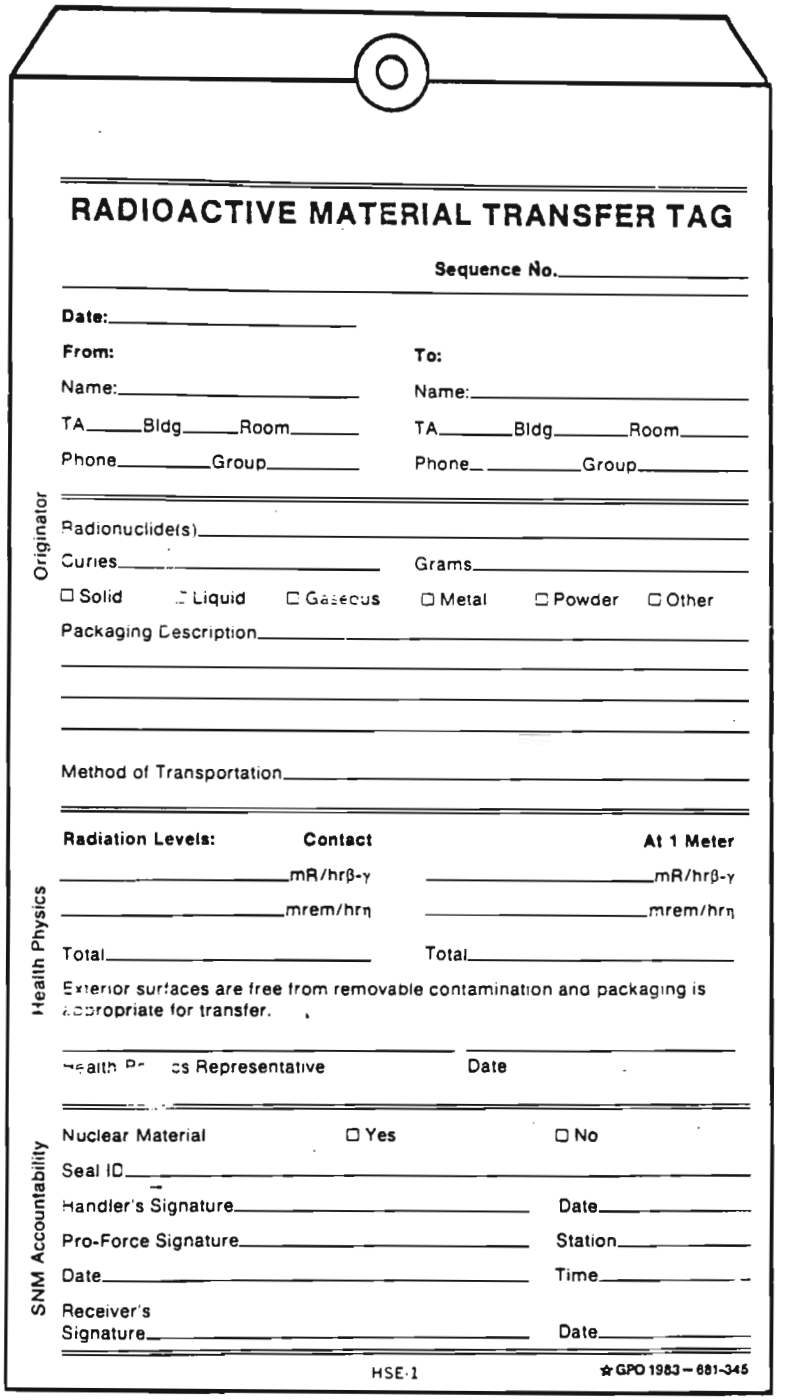
Fig. 1. Empty radioactive material packaging tag.

MAT-14 determines the applicable transport regulations based on the information supplied by the health physics staff and the shipping request, and then approves the shipping methods.

Safety Analysis. If special form radioactive material is involved, the operating group must prepare a safety analysis and ensure that criteria stated for "Special Form Radioactive Material" are met. The Radioactive Materials Shipping Advisor must concur and documented evidence must be furnished to MAT-14 by the operating group.

Onsite Transfers

Onsite transfers must be made in a manner that provides comparable protection to that provided for offsite shipments. This may be achieved by use of approved containers (see "Definitions"), locally approved containers (approved by the Radioactive Materials Shipping Advisor), or a combination of locally approved containers and additional administrative controls such as escorts. The Radioactive Materials Shipping Advisor determines whether a container is approved for local use and approves transport methods used for all onsite transfers. The container must be securely fastened to the vehicle, as determined appropriate by the health physics representative. An onsite Radioactive Material Transfer tag (Fig. 2) must be completed for all transfers. These tags are available from the Radioactive Materials Shipping Advisor (either the shipper or the health physics staff affixes these labels).



RADIOACTIVE MATERIAL TRANSFER TAG

Sequence No._____

Date:_____

From:

Name:_____

TA_____Bldg_____Room_____

Phone_____Group_____

To:

Name:_____

TA_____Bldg_____Room_____

Phone_____Group_____

Originator

Radionuclide(s)_____

Curies_____ Grams_____

☐ Solid ☐ Liquid ☐ Gaseous ☐ Metal ☐ Powder ☐ Other

Packaging Description_____

Method of Transportation_____

Health Physics

Radiation Levels: **Contact** **At 1 Meter**

_____mR/hrβ-γ _____mR/hrβ-γ

_____mrem/hrη _____mrem/hrη

Total_____ Total_____

Exterior surfaces are free from removable contamination and packaging is appropriate for transfer.

Health Physics Representative Date

SNM Accountability

Nuclear Material ☐ Yes ☐ No

Seal ID_____

Handler's Signature_____ Date_____

Pro-Force Signature_____ Station_____

Date_____ Time_____

Receiver's Signature_____ Date_____

HSE-1 ☆GPO 1983—681-345

Fig. 2. Radioactive material transfer tag.

Waste	Waste items must be properly packaged and must comply with Administrative Requirements 10-1, "Radioactive Liquid Waste," and 10-2, "Radioactive Solid Waste."
Transportation Accident	If a transport vehicle becomes involved in an accident, the driver or escort must ensure radiation control and immediately notify the appropriate managers and the Health, Safety, and Environment Division (7-7878). In the event or possibility of a fire, the Fire Department (9-911) must be notified immediately. Vehicle accidents occurring offsite also must be reported immediately to the Los Alamos Police Department.
References	"Safety Requirements for the Packaging of Fissile and Other Radioactive Material," Department of Energy Order 5480.1, Chapter III (May 1, 1981). "Transportation," 49 CFR 100-199, Department of Transportation Regulations (most recent).
Referrals	Radioactive Materials Shipping Advisor (HSE-1), 7-4127 Radiation Protection Group (HSE-1), 7-5296 Waste Management Group (HSE-7), 7-4301 Chemistry Health Protection Group (HSE-10), 7-7218 Accelerator Health Protection Group (HSE-11), 7-5890 Supply/Distribution Group of the Materials Management Division (MAT-14), 7-5115
Forms	HS Form 3-5A, Radioactive Shipment Advance Information HS Form 3-5B, Radioactive Materials Shipping Data Sheet HS Form 3-5C, Quality Control HS Form 3-5D, Certification of Packaging HS Form 3-5E, Certification for Empty Radioactive Material Packaging Los Alamos Form 796, Shipping Request
Tags	Empty Radioactive Material Packaging tag Radioactive Material Transfer tag

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

RADIOACTIVE SHIPMENT ADVANCE INFORMATION

SR Number			Date
Group Shipping	Person	Telephone Number	Mail Stop
Destination			
Radionuclide			
Form	Chemical Form		
Amount			

☐ A1 ☐ A1 Exceeded ☐ LSA ☐ Limited ☐ Instruments and Articles

☐ A_2 ☐ A_2 Exceeded ☐ Highway Route Controlled Quantity

Fissile Class	Transport Index
Markings	
Container Provided	
Certification of Packaging Form ☐ Not Required ☐ Required	Quality Control Form ☐ Not Required ☐ Required
Internal Packaging	
Remarks	

HS Form Number 3-5A (6/84)

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

RADIOACTIVE MATERIALS SHIPPING DATA SHEET

SR No.: _____ Group Shipping: _____ Date: _____

Destination: _____ Transport Method: _____

Material (radionuclide): _____

FORM OF MATERIAL:

Physical: _____ Liquid _____ Solid _____ Powder _____ Gas _____ Metal

_____ Special form* _____ Normal form _____ Acid _____ Instrument and articles

_____ Fissile (excepted) _____ Fissile _____ Nonfissile

QUANTITY OF MATERIAL: _____ Limited _____ LSA _____ Highway route controlled quantity

PACKAGING:

INTERNAL: _____ Shock or liquid absorbing material _____ Pipe nipple and caps

_____ Secured lead, polyethylene _____ Poly bottle or glass _____ Metal can

EXTERNAL: Size _____

Requirements for limited quantity met: ☐ YES ☐ NO

Requirements for instruments and articles met: ☐ YES ☐ NO

Nonfixed radioactive contamination limit not exceeded: _____ (initials)

Limit of specification or certificate not exceeded: _____ (initials)

_____ Strong, tight package _____ Type A _____ Type B _____ Type B(U) _____ Type B(M)

Tamper Seal: ☐ YES ☐ NO Gross Weight: _____

MARKING REQUIRED: _____

ORIGIN OF CRITICALITY EVALUATION: _____

Fissile Class: _____ Criticality Transport Index: _____

Container No. (if any)	☐ g ☐ mg	☐ μg	☐ Ci ☐ mCi	☐ μCi	mRem/hr Contact	1 meter	Fissile Class	Transport Index Used	Type Label I, II, III**

Trefoil used on Type B(U) and Type B(M): _____ (initials)

*Basis for and approved by: _____

**Vehicle placard required: _____

REMARKS: _____

_____
Health Physics Surveyor's Signature

HS Form Number 3-5B (7/83)

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

QUALITY CONTROL

Certificate of Compliance Number	DOT Specification Number	Date of Expiration

The container(s) designated above and prepared for shipment on SR Number have been inspected and comply with the following requirements:

	Initials
1. The packaging is in unimpaired physical condition, except for superficial marks.	_____
2. Each closure device of the packaging, including any required gasket, is properly installed, secured, and free of defects.	_____
3. For fissile material, each moderator and neutron absorber, if required, is present and in proper condition.	_____
4. Each closure, valve, or other opening of the containment system through which the radioactive content might escape is properly closed and sealed.	_____
5. Each packaging containing liquid in excess of an A_2 quantity and intended for air shipment has been tested to show that it will not leak under ambient atmospheric pressure of not more than 0.25 atmosphere, absolute (0.25 kilogram per square centimeter or 3.6 psia). The test must be conducted on the entire containment system or on any receptacle or vessel within the containment system to determine compliance with this requirement.	_____
6. The internal pressure of the containment system will not exceed the design pressure during transportation.	_____

Group Leader or Designated Alternate *(Signature)*	Date

Comments

Distribution
MAT-14, MS P274
HSE-1, MS P229
Group Shipping

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

CERTIFICATION OF PACKAGING

From	Group	Date

The package(s) covered by SR Number_____ was prepared and packaged according to the detailed requirements of Certificate of Compliance Number_____.

Signed: Group Leader or Designated Alternate

COPIES: TRAFFIC OFFICE, MAT-14, Mail Stop P274
RAM SHIPPING ADVISOR, HSE-1, Mail Stop P229

NOTE: The original and HSE-1 copy can accompany the SR.

HS Form Number 3-5D (6/84)

Los Alamos

Los Alamos National Laboratory
Los Alamos, New Mexico 87545

CERTIFICATION FOR "EMPTY" RADIOACTIVE MATERIAL PACKAGING

SR No._____ Date_____

Group_____

The containers listed below are offered for shipment and have been emptied of contents as far as practicable. The internal contamination does not exceed the specified limits, determined by removable means, as indicated on the reverse side of this form.

Description of Numerical Designation of Container

_____ _____

_____ _____

_____ _____

The packaging (1) is in an unimpaired condition, (2) is securely closed so that there will be no leakage of radioactive material under conditions normally incident to transportation, and (3) does not contain more than 15 g of ^{235}U. *EXCEPTION: The packaging may contain more than 15 g of ^{235}U only in the case of manufactured articles in which the sole radioactive material content is (a) natural uranium, (b) depleted uranium, or (c) natural thorium.* In addition, old labels have been removed, obliterated, or covered. After the monitoring requirements are met, the HSE-1 representative applies the EMPTY RADIOACTIVE MATERIALS PACKAGING *tag.* For shipments leaving the Laboratory, MAT-14 will then apply the official "EMPTY" *label.*

Signed:_____
Inspector

_____
Group Leader or Designated Alternate

HSE-1 has monitored the exterior surfaces of the container(s) and has found them to comply with the requirements of 49 CFR 173.421(b) and (c). The HSE-1 "EMPTY" tag has been attached to each container.

Signed:_____
Health Physics Surveyor

HS Form Number 3-5E (6/84)

CONTAMINANT	Maximum Permissible Limits (100 cm^2) Internal	External
Beta-gamma emitting radionuclides; all radionuclides with half-lives less than 10 days; natural uranium; natural thorium; uranium-235; uranium-238; thorium-232; thorium-228 and thorium-230 when contained in ores or physical concentrates.	2.22×10^5	2200
All other alpha emitting radionuclides.	2.22×10^4	220

COPY NO 1 SHIPPING OFFICE FILE

FORM 796 (11/81)

SHIPPING REQUEST

SR _____

(No. P.O. Box for Address) (Entire Form To Be Completed By Author, Except Where Indicated) DATE _____

Consignee _____ Telephone: _____

Street Address _____

City / State _____ Zip Code _____

ITEM	QUAN.	DESCRIPTION	PROPERTY NO. OR STOCK NO.	UNIT COST	TOTAL COST
		REQUESTED ROUTING			
		SPECIAL INSTRUCTIONS			
REASON FOR SHIPMENT				TOTAL	

WARNING: It is a Federal offense to knowingly or unknowingly violate hazardous materials shipping regulations.

IF SHIPMENT IS COLLECT, PLEASE CALL VENDOR FOR SHIPPING INSTRUCTIONS.

U. OF C. LABORATORY P.O. No. _____

CONSIGNEE'S P.O. # _____

PREPAID _____ COLLECT _____ FOLLOW UP _____

LOAN _____ HOW LONG _____ RETURN OF LOAN _____

REPAIR _____ OTHER _____ PERMANENT TRANSFER _____

IF NOT SURE, PUT A "?"

COMPLETE ALL OF THE FOLLOWING, IF ANWER IS YES, DESCRIBE ABOVE

RADIOACTIVITY _____

EXPLOSIVES A ____ B ____ C ____

COMBUSTIBLE LIQUID _____

BLASTING AGENT _____

POISON A ____ B _____

FLAMMABLE LIQUID _____

FLAMMABLE SOLID _____

OXIDIZER _____

CORROSIVE LIQUID _____

COMPRESSED GASES _____

FLAMMABLE _____

COMPRESSED GASES – NON-FLAMMABLE _____

ETIOLOGICAL AGENTS _____

MAGNETIZED MATERIAL _____

IRRITATING MATERIAL _____

ORGANIC PEROXIDE _____

SECURITY CLASSIFICATION OF MATERIAL _____

SECURITY CLASSIFICATION OF THIS SR _____

COMPLETE THE FOLLOWING:

PICK UP ABOVE MATERIAL FROM: PHONE _____

PERSON _____ GROUP OR STOCKROOM _____

SITE _____ BLDG. _____ ROOM NO. _____

PICK UP DATE _____ TIME _____ DELIVERY DATE REQUIRED _____

CREDIT

GROUP NAME	ACCOUNT CODE

VALUE _____

PROGRAM NO. _____

APPROVED

AUTHORIZED GROUP SIGNATURE _____

PROPERTY REPRESENTATIVE _____

PROPERTY MANAGEMENT GROUP MAT - 2 _____

PROCUREMENT _____

INFORMATION BELOW TO BE COMPLETED BY GROUP MAT-14 ONLY

S.M. NO.	DATE	NO. PKGS.	WT.	DIMENSIONS	PACKED BY

APPENDIX H

LOS ALAMOS SCIENTIFIC LABORATORY
UNIVERSITY OF CALIFORNIA
LOS ALAMOS, NEW MEXICO 87545
Telephone Ext: 4301

OFFICE MEMORANDUM

TO : Distribution

DATE: 10 December 1980

THRU: Harry Jordan, H-DO

FROM : W. D. Purtymun, H-8
M. Wheeler, LS-6
J. L. Warren, H-7

SUBJECT : GUIDELINES FOR CONSTRUCTION AND USE OF SOLID WASTE DISPOSAL FACILITIES AT AREA G, TA-54

SYMBOL : H7-80-660

MAIL STOP : 518

The final version of the guidelines, revised after review by the Operational Waste Management Committee, is being submitted for your information. Groups H-7 and H-8 plan to implement the guidelines immediately.

WDP,MLW,JLW/HSJ/rmb

Enc. a/s

Distribution:
- J. W. Healy, H-DO, MS-400
- W. J. Maraman, CMB-DO, MS-756
- R. J. Bard, CMB-8, MS-734
- M. M. Thorpe, NM-DO, MS 324
- D. R. Smith, Q-14, MS 560
- E. M. Sitzberger, ENG-DO, MS 624
- T. K. Keenan, H-7, MS 518
- J. Steger, LS-6, MS 495
- M. A. Rogers, LS-6 MS 495
- W. R. Hansen, H-8, MS 490

LASL GUIDELINES FOR CONSTRUCTION AND USE OF SOLID WASTE DISPOSAL FACILITIES AT AREA G, TA-54

I. INTRODUCTION

These recommended practices for the location, construction, and operation of the LASL TA-54, Area G waste disposal/storage site have been prepared to document procedures that will minimize and control releases from the site, and to provide a continuing documentation of site control. The overall responsibility for ensuring compliance with these guidelines rests with the H-7 Solid Waste Disposal Section Leader. Other LASL groups, as required, will be called on to provide special assistance in providing necessary information.

Deviations from these criteria in specific instances will be necessary, and will be allowed when justified and properly documented. Approval for such deviations will be obtained from the Waste Management (H-7) and Environmental Surveillance (H-8) Group Leaders. Additional approval from the LASL Waste Management Operations Advisory Committee may also be required if requested by either Group Leader.

In all instances the LASL criteria and operations will be consistent with established DOE Burial Site Criteria (Appendix A).

II. RESPONSIBILITY AND DOCUMENTATION

A. Documentation of site suitability studies, current maps and engineering drawings, copies of site and individual pit/shaft inspections, and other related information will be maintained in the files by Group H-7.

B. The Area G Site Engineer is responsible for notifying the H-8 office, in writing, of each activity requiring their attention.

C. Following the completion of all required facility inspections, site studies, and site evaluations, written notification including approvals, results, and recommendations shall be provided to the Area G Site Engineer by the Environmental Surveillance Group Office (H-8).

C. The Site Engineer will call upon the Engineering Department to provide the required topographic maps, engineering drawings, pit surveys, etc., as described in Sections IV, V, and VI.

III. SITE EXPANSION

TA-54, the location of Area G, includes all of Mesita del Buey. This site is of sufficient size that all LASL radioactive solid waste can be buried/stored at this location through the foreseeable future. Consequently, these criteria do not address new site selection. It is assumed that all appropriate DOE and other Federal Agency criteria, as well as the NEPA process, would be followed should any new site ever be required.

Presently, approximately 63 acres of the TA-54 site are fenced, and future expansion of this fenced area will eventually be required. During any such site expansion the following criteria will apply:

A. Prior to the expansion of the useable portion of Area G, notification will be provided to the Environmental Surveillance Group (H-8). The Group will perform the required environmental and archaeological studies, and will provide the necessary documentation.

B. The ecology of the expanded area will be considered in relation to plants and animal communities that are classified as rare or endangered. Any such entities observed will be preserved and protected as specified in the "Endangered Species Act of 1973" (50 CFR-Part 17).

C. Prior to the use of an expanded portion of the disposal site, a thorough site evaluation will be performed by H-8 to determine the suitability of the area for its intended use.

D. Appropriate review and evaluation of the expansion area for archaeological ruins must be conducted as prescribed in Federal Regulations (36 CFR Part 800, as amended March 1, 1979).

IV. GENERAL SITE CRITERIA

A. The use of the TA-54 site is restricted to the top of Mesita del Buey and must be consistent with these Guidelines.

B. A topographic contour map of the fenced portion of Area G will be developed and kept current. Topography will be shown at contour intervals of 5' or less. Filled and proposed burial/storage facilities will be designated. The map will also indicate the final grade contours of the filled portion of Area G.

C. Engineering drawings will be developed, and maintained, which locate the position of site facilities (buildings, retrievable storage areas, disposal pits and shafts, permanent and significant monitoring installations, fence lines, bench marks, etc.).

V. BURIAL PIT/SHAFT CONSTRUCTION

Several weeks prior to clearing and excavation of a pit or shaft, notification will be provided to H-8. At the discretion of H-8, samples may be collected during the construction of a pit or shaft. Following completion of the construction, and before a facility is placed into use, H-8 will be responsible for preparing a geologic/hydrologic description of the pit (and shaft to the extent possible). Upon completion of this inspection, written notification will be provided to the Site Engineer by the H-8 Group Office. This notification will identify any features in the pit or shaft requiring the attention of the Site Engineer. If any additional documentation is necessary the ESG will provide it to the Site Engineer at a later time.

A. Location (see Fig. 1)

1. The "spill point" (the lowest elevation of the undisturbed rock surrounding the pit or shaft) determines the maximum utilization volume of the pit or shaft (Section VI-D). Thus, the layout of the pit will be with the long dimension more or less parallel to the topographic contours.
2. As protection against lateral erosion of the mesa, leading to possible eventual exposure of waste material, the nominal design distance between the edge of a pit or shaft and the canyon rim will be 50 feet. The "rim" is interpreted to be the significant break in slope between the surface and the side of the mesa. The position of this rim will be physically identified by suitable markers

as established by the Engineering Department, and identified on a designated topographic map of the site (Section IV-B). Some variation in this 50-foot separation can be expected over the length of a pit due to localized topographic or pit edge variabilities. These variations should not reduce the separation distance to less than about 45 feet.

3. The nominal design surface distance between the edges of adjacent pits will be 15 feet but in no case less than 10 feet.

B. Burial Pit/Shaft Excavation

1. To the extent possible, natural vegetation and topsoil in the area will remain undisturbed (see Fig. 2).
2. Topsoil from an area to be excavated will be removed either for immediate use elsewhere in revegetation or for stockpiling for future use. Any stockpiling will be done in a manner as to minimize erosion.
3. Tuff removed during construction of the pits will be separately stockpiled in the same manner as the topsoil. No stockpiling will be done on top of rehabilitated or undisturbed areas.
4. In order to protect against water movement from saturated alluvium into the waste, the deepest point in a pit or shaft shall be no deeper than 65', which has been determined as being at least 10' above the adjacent canyon floors.

5. The floors of the pits do not need to be level.
6. Horizontal dimensions (length, width) and shape of pits or shafts are not restricted.
7. The walls and access ramps of the pit will be constructed at a slope deemed to be safe by the Site Engineer and Group H-3.
8. Crushed tuff 0.5 to 1 ft deep will be compacted on the floor of each pit before emplacement of wastes.
9. Upon completion of a pit, excavation engineering drawings will be prepared showing lengthwise profiles at walls ~~and~~ or centerline, and crosswise profiles at significant breaks in bottom slope and every 100 ft length. At the time of this survey, the location of the first and last reference posts (for waste disposal location) will be established and recorded on the drawings.

VI. BURIAL PIT/SHAFT USE

A goal of the LASL Waste Disposal Facility is to conduct waste management operations in accordance with DOE and LASL criteria and in a manner that will restrict the release of radioactive materials to the environment to levels below existing standards, and further, to levels that are as low as reasonably achievable. The primary release mechanisms of concern are transport by moving soil moisture (either towards the surface or towards ground water aquifers); erosion of the cover material overlying buried waste; or intrusion into the waste by plants, animals, or man.

A. Only wastes in solid or solidified form will be accepted for burial.

B. As much as possible, wastes will be layered in pits with each layer covered with a minimum of at least 0.5 ft of compacted crushed tuff.

C. Loose combustible wastes subject to wind dispersal will be covered by the end of the day of disposal.

D. Pits and shafts will be filled with wastes to a level no higher than 3 ft below the "spill point" (lowest point on pit rim, Fig. 2.)

E. As a pit is filled, care will be taken to ensure that sufficient room is allowed between waste and large open fractures in the walls and access ramps to allow crushed tuff to fill these fractures.

F. Open joints or fractures are difficult or impossible to identify, inspect, or fill in vertical shafts. Special measures may be required to insure containment of some wastes within disposal shafts. These measures may include the use of shaft liners and/or special waste containers.

G. Surface drainage will be constructed and maintained so that surface runoff does not enter the waste storage or disposal facilities.

VII. FINAL PIT/SHAFT COVER

A. The final cover of a pit will be crushed tuff (minimum of 3') overlain by topsoil (approximately 4").

B. The final cover of a pit will be at or above the original land-surface, as required for contouring to provide the desired drainage within the area.

C. The final cover of a shaft will be noncontaminated cement, a minimum of 3 ft thick, slightly rounded, and extending about 0.5 ft above land surface.

D. Provisions will be made to control runoff in the disposal area to minimize infiltration and erosion of the final cover of pits or shafts.

E. Turf-forming grasses and bunch grasses will be planted in the final cover to prevent wind and sheet wash erosion.

F. Identifying engineering type markers will be placed at two diagonal corners (surveyed) of each pit, and in the final pour of seal cement in the shafts. For pits the markers, at least 12 in. in diameter, will be set approximately 2-3 ft deep in undisturbed tuff and will extend about 0.5 to 1 ft above the ground surface. This marker will be a single brass cap set in concrete as illustrated in Fig. 3. Information on the cap shall include the wording "Buried Radioactive Waste" along with the pit number, corner, radionuclides buried, and dates of use.

Shaft markers will contain information (along with the above wording) including shaft number, radionuclides buried, total curies, and dates of use.

G. Prior to site closure, criteria will be developed for construction and placement of permanent site identifying markers. Site decommissioning will include placement of these markers.

H. Access roads to pits or shafts will be laid out so that vehicles do not transverse rehabilitated areas.

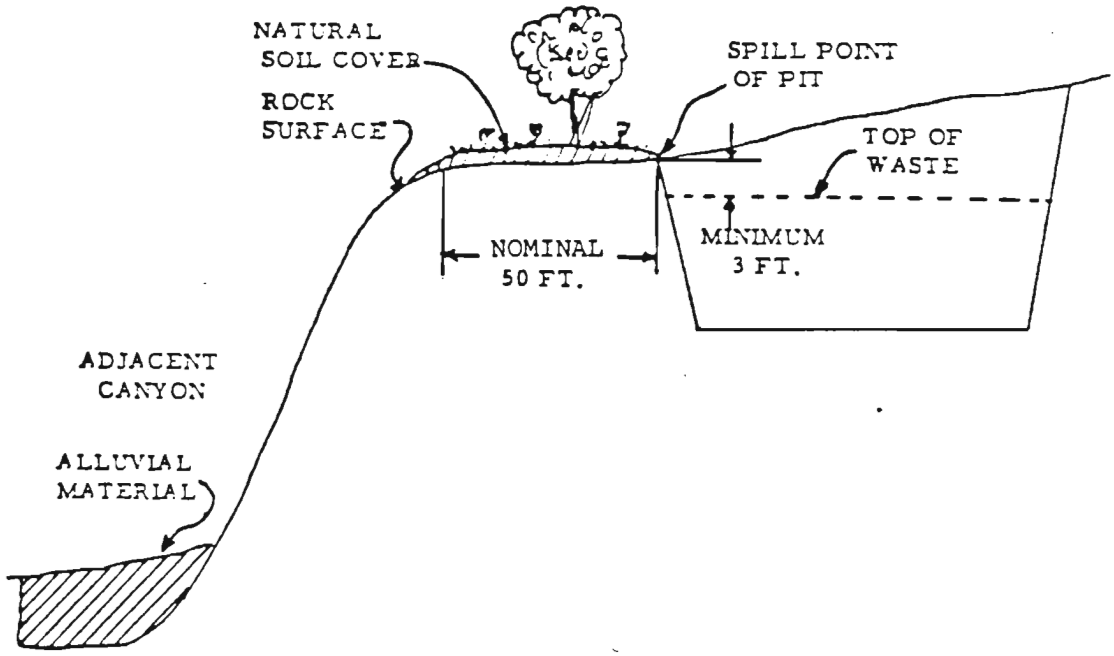
VII. ENVIRONMENTAL MONITORING

The disposal site is a potential source of radionuclides in the environment. There should be no routine release of effluents containing radionuclides from either site operations or site facilities. Further, all releases, whether from operations or through migration of disposed radionuclides, should be as low as reasonably achievable.

A. A routine environmental surveillance program will be conducted by Group H-8, to identify and monitor for any contaminant releases from the site.

B. The monitoring data should be sufficient to allow identification of the processes responsible for contaminant release, and to assess the significance of any releases.

C. The operations of the site will be conducted in a manner consistent with these monitoring programs.



1A

Fig. 1. Cross-section showing details of pit location and placement of wastes.

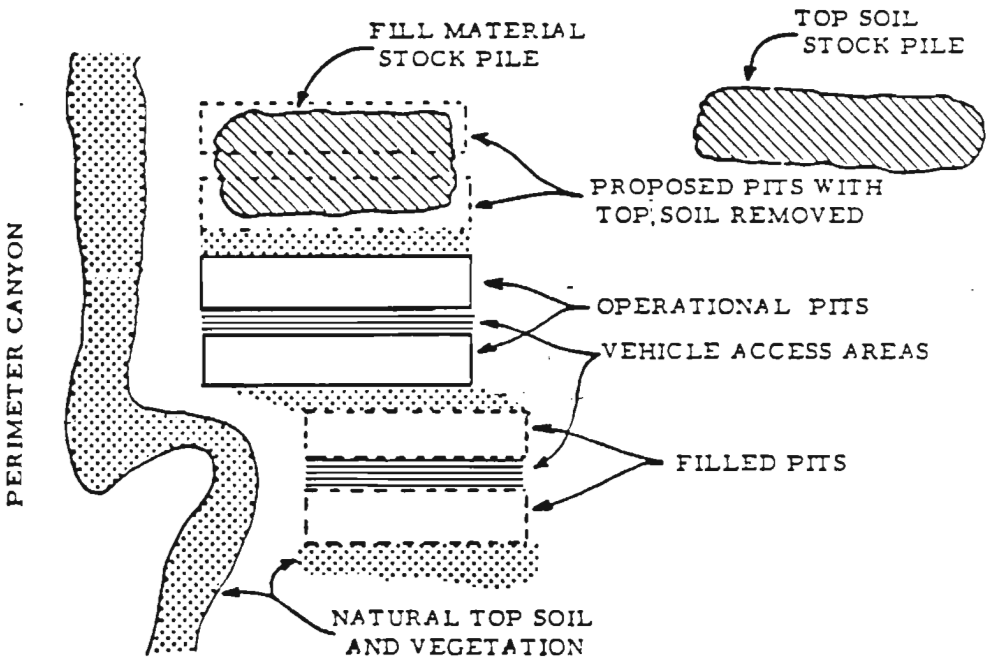
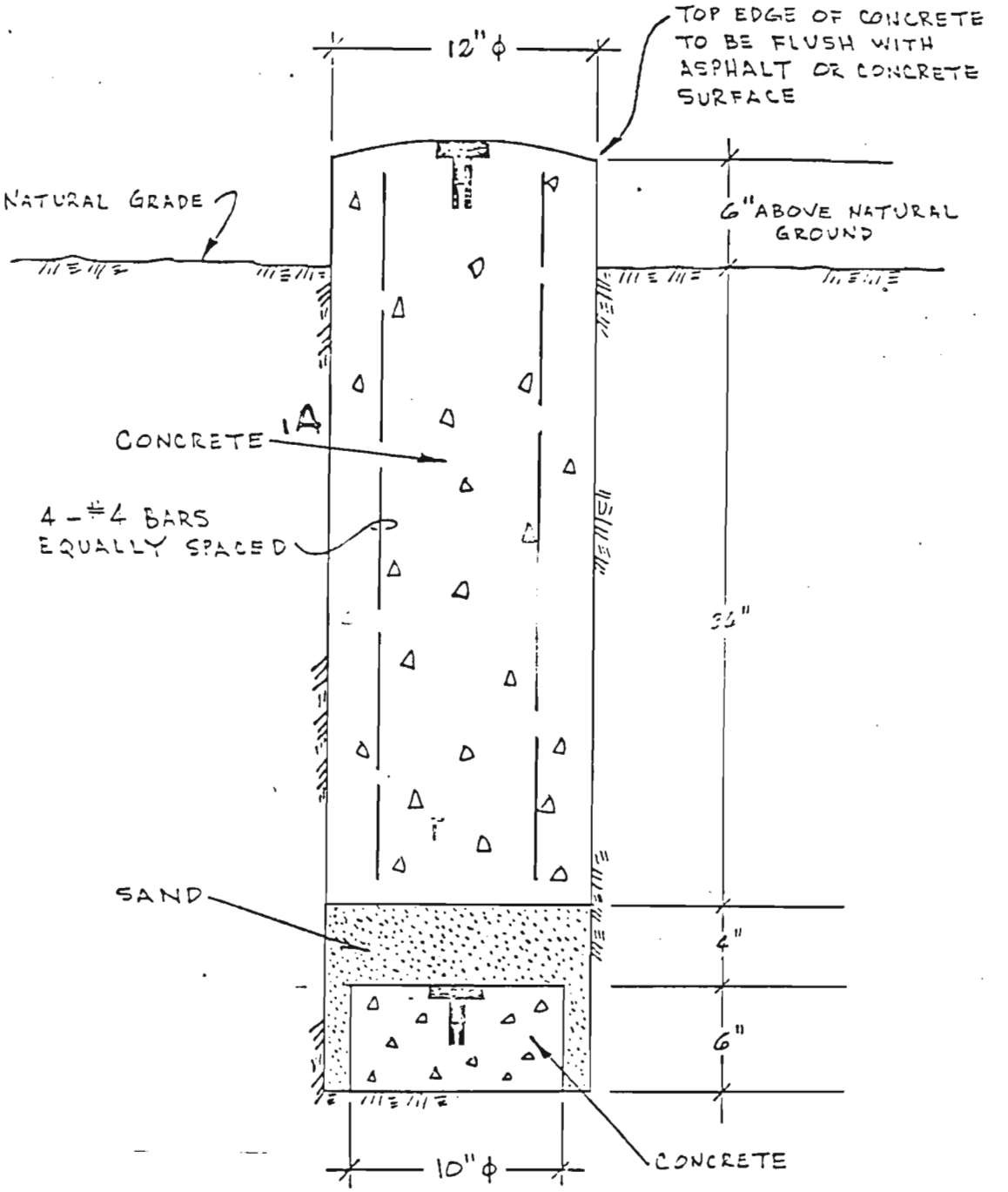


Fig. 2. Example layout of disposal pit, stockpile areas, and biotic sanctuaries.



TYPICAL MONUMENT INSTALLATION

TA-54, H-7, S.P.

Fig. 3. Typical Monument to Identify Pit or Shaft

Initial Disposal Criteria for DOE Solid Low-Level Waste

Purpose

The purpose of these criteria is to provide that DOE solid low-level waste (LLW) is disposed of (1) in a safe and economical manner, (2) with an acceptable environmental impact, (3) with minimum reliance on long-term surveillance and/or maintenance activities, (4) with acceptable risk to future generations, and (5) with minimum land usage. It is recognized that the general and preliminary nature of these initial criteria will lead to substantive changes in order to provide system-wide, quantified final criteria in FY 1980.

Goals

Disposal site operations should:

1. Encourage minimum waste generation and minimum land usage by applying good housekeeping practices, volume-reduction techniques, better landfill designs and improved disposal methods consistent with operational, health and safety requirements.

2. Use disposal methods and waste conditioning techniques which minimize long-term environmental impact, dependence upon long-term surveillance and/or maintenance, and potential risks to future generations.

3. Generate a properly recorded operating experience data base reflecting environmental and health and safety results of the disposal method(s) in use.

4. Operate, and interpret results of existing and improved site performance surveillance system(s) to assist in the evaluation of the performance of the disposal site and practices.

Criteria

1. General

   a. Good housekeeping and industrial operating practices shall be employed.

   b. Occupational health and safety, environmental and security standards shall be met in all operations.

   c. Land usage for disposal shall be minimized without compromising health and safety.

   d. Emergency response systems should be tested routinely.

e. Technology should be assessed periodically to upgrade practices (volume reduction, containment, surveillance).

f. Plans shall be made for the long-term control and ultimate disposition of the site using the latest technical and land use information.

g. A quality assurance program shall be maintained.

II. Administrative

a. An individual responsible for all disposal site operations shall be specified. The responsibilities and authorities shall be documented and shall include (but not be limited to):

(1) Documenting compliance with appropriate directives, standards and procedures.

(2) Developing and implementing standard operating procedures.

(3) Establishing waste acceptance criteria and, where appropriate, determining the acceptability of input waste.

(4) Providing estimates of resources necessary to assure that site and operations meet standards.

(5) Providing waste volume projections.

b. Generators shall be encouraged to minimize waste generation. Consideration should be given to charging a portion of disposal costs to the generator, such as a sliding charge scale that discourages generation.

c. An independent review system shall be established.

d. Anomalous occurrences at the waste disposal area shall be reviewed and analyzed, and corrective measures implemented and documented as required.

III. Site Selection

a. The site shall have suitable geological, hydrological and climatological properties which are tested, documented, reviewed and accepted by competent authorities to avoid excessive dose to man from radioactive and nonradioactive contaminants.

b. Impact on ecological and archaeological conditions shall be minimized.

c. Transportation of waste, population distribution, and availability of utilities and other site support factors should be considered.

d. Recognized potential uses should be considered for an area prior to its being dedicated for waste disposal so as to minimize the impact of land withdrawal.

IV. Site Operation

a. Approved standard operating procedures shall be centrally documented, implemented, reviewed annually and revised as necessary. Procedures shall include:

(1) Waste acceptance requirements including contents and labeling

(2) Disposal method and location

(3) Criticality, radiation and occupational safety

(4) Method of handling unacceptable waste or packaging

(5) Proper handling equipment and techniques to be used

(6) Decontamination of personnel, vehicles, equipment and facilities

(7) Fire prevention methods

(8) Segregation of TRU waste for retrievable storage

(9) Emergency response plans

(10) Consideration of potential future discovery of artifacts

(11) Quality assurance program

(12) Site surveillance program

b. Methods should be established to control:

(1) Wind dispersion of waste or contamination

(2) Water intrusion

(3) Dust

(4) Chemical hazards

(5) Vehicle and personnel traffic

(6) Materials with the potential of mobilizing waste (solvents, organics, etc.)

(7) Intrusion by vegetation or animals

c. Specifications for containment designs and construction shall be developed and implemented for all packaging and disposal techniques.

d. Measurement methods will be implemented, documented and updated as appropriate for.

(1) Radiological conditions in and around the disposal area

(2) Migration of contaminants (radioactive and nonradioactive) in surface and ground water

(3) Uptake of radionuclides by vegetation and animals

(4) Release of airborne contaminants

e. Exposures to site operating personnel and off-site population shall be kept as low as practicable.

V. Site Maintenance

a. Adequate site drainage systems shall be maintained.

b. Final cover shall be maintained to control surface accumulation of water.

c. Adequate erosion control measures shall be employed.

d. Corrective action shall be taken when maximum authorized levels of radiation are approached or predicted to occur.

e. A method to identify the location of disposed waste shall be maintained.

f. Conceptual hydrological model shall be developed utilizing local geohydrological and radiological data, and surveillance systems shall be maintained to aid in detecting and evaluating subsurface migration.

VI. Support

a. Adequate fire suppression shall be available.

b. Security shall be adequate to prevent unauthorized access to waste.

c. Operators shall be qualified for their duties, and an adequate training program should be implemented.

d. Permanent records shall be maintained on:

(1) Waste volume, content, properties and location

(2) Interpreted results of surveillance and monitoring programs

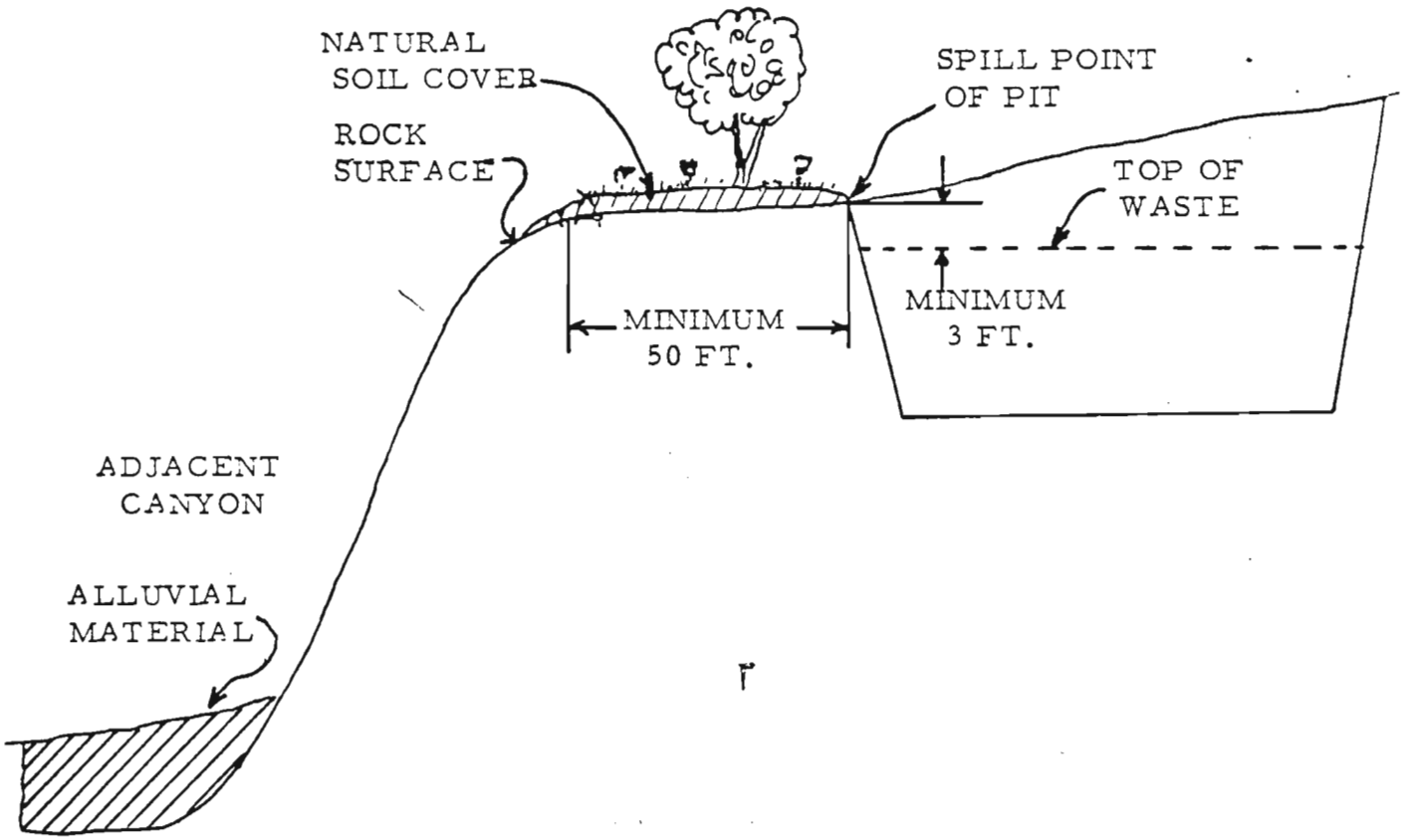
(3) Routine and significant nonroutine events

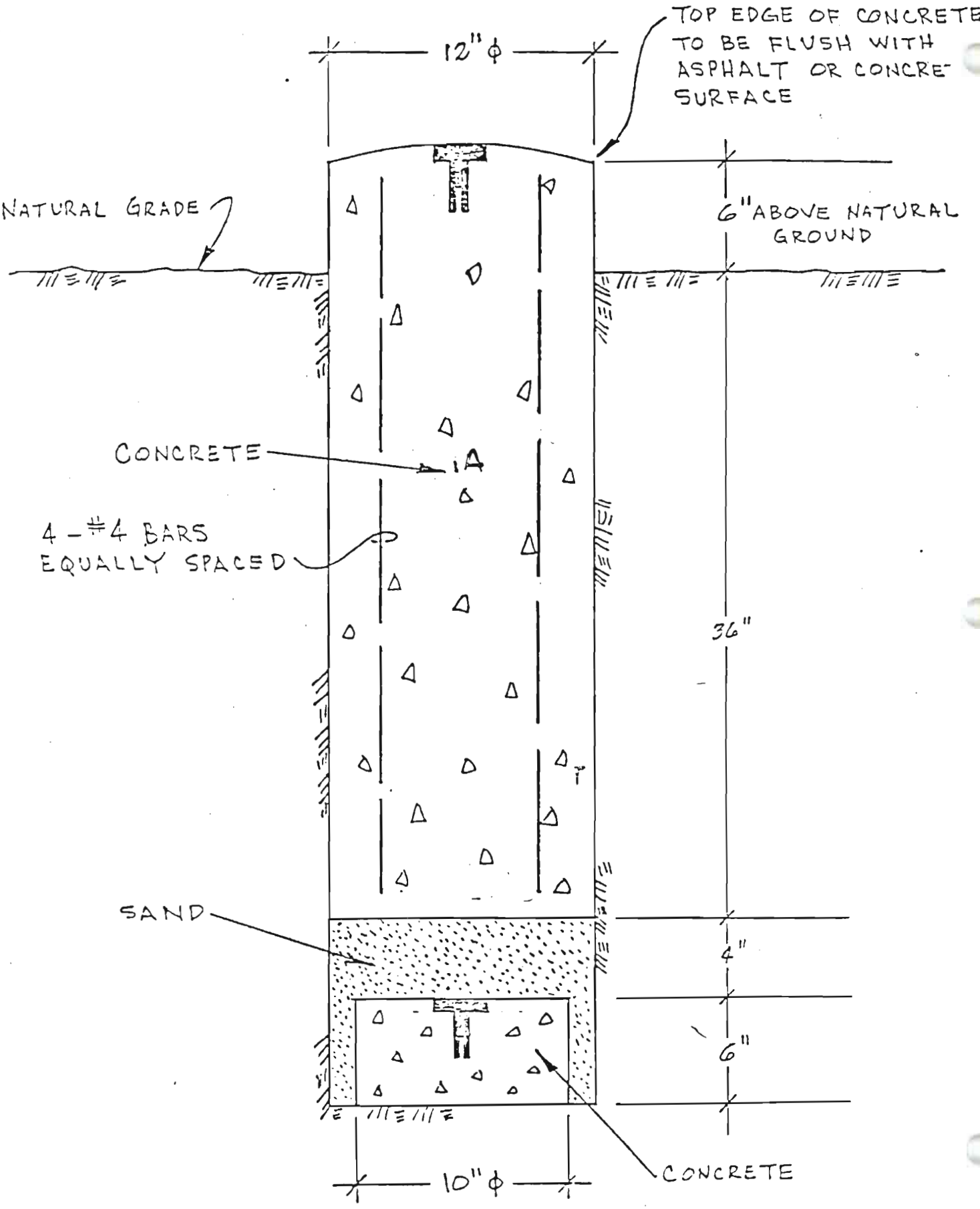
(4) Results of periodic independent evaluation of operations

(5) Results of emergency response tests

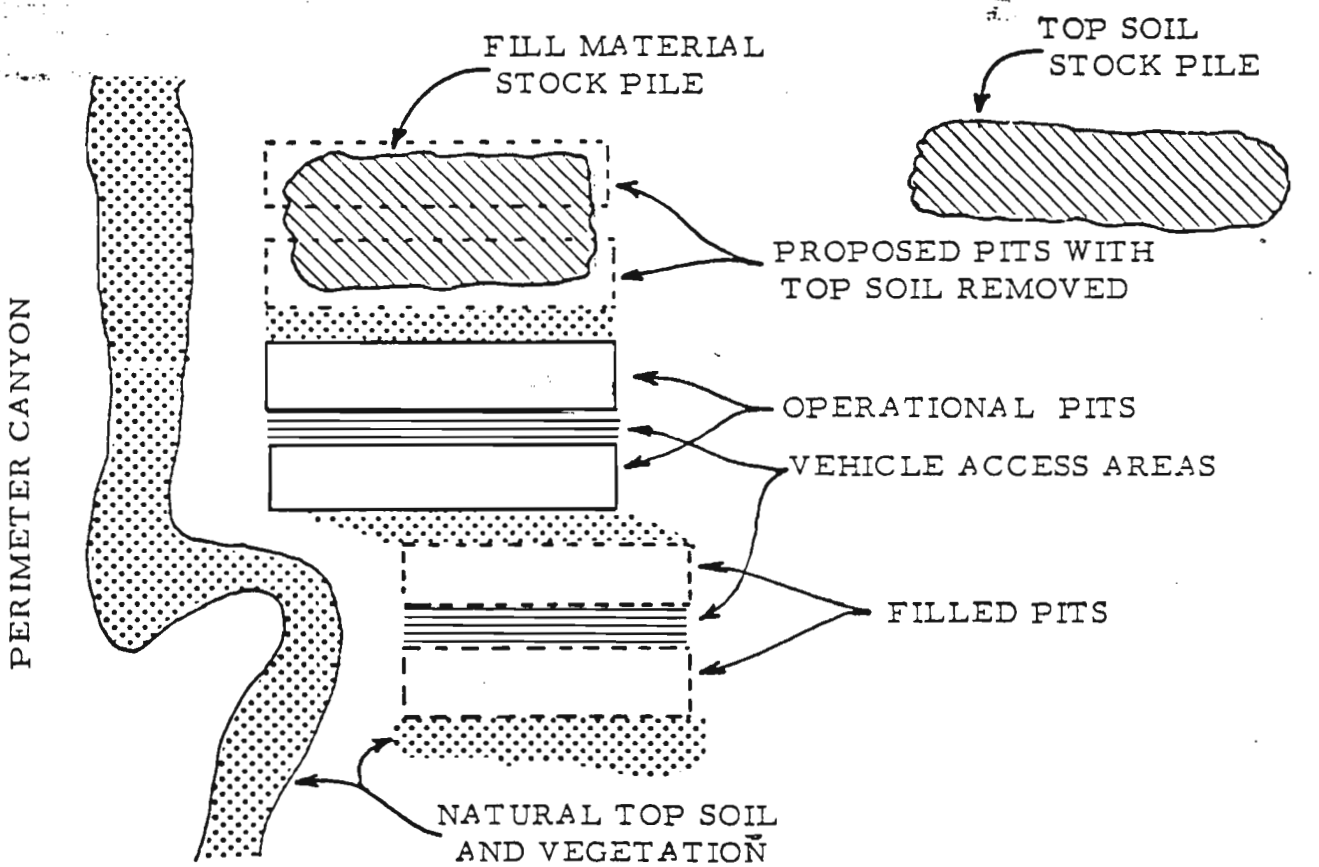
(6) Site geological, hydrological and climatological properties

(7) Operating personnel and dose accumulation


NATURAL
SOIL COVER
ROCK
SURFACE
SPILL POINT
OF PIT
TOP OF
WASTE
MINIMUM
50 FT.
MINIMUM
3 FT.
ADJACENT
CANYON
ALLUVIAL
MATERIAL



TYPICAL MONUMENT INSTALLATION


FILL MATERIAL
STOCK PILE
TOP SOIL
STOCK PILE
PROPOSED PITS WITH
TOP SOIL REMOVED
PERIMETER CANYON
OPERATIONAL PITS
VEHICLE ACCESS AREAS
FILLED PITS
NATURAL TOP SOIL
AND VEGETATION

APPENDIX I

Los Alamos
Los Alamos National Laboratory
Los Alamos, New Mexico 87545

memorandum

TO: Lee Borduin, HSE-7, MS E518

DATE: February 17, 1984

FROM: Wayne R. Hansen, HSE-8 Group Leader by McSlover

MAIL STOP/TELEPHONE: K490/5021

SYMBOL: HSE8-84-109

SUBJECT: DISPOSAL OF CEMENT CULVERTS CONTAINING TRU WASTE AT 10-100 nCi/g

On February 15, I discussed disposal of cement culverts in TRU storage from Area T on DP site with Karen Balo of your group. She requested advice on the acceptability of disposing of those culverts in Area G, TA-54.

As you are aware, past studies have indicated that for the best containment of TRU elements in Area G we need to bury waste with TRU concentrations greater than 10 nCi/g deeper and further back from the mesa edges than we do our normal low-level waste. In keeping with the findings of several modeling efforts in HSE-8, and with the help of LS-6, we have a general guidance that if TRU waste were buried at offsets greater than 75 ft back from the mesa edge and at least 15 ft below the surface of the trench at closure, adequate confinement of TRU elements would be assured. This assurance is based on the best geological modeling currently available, which indicates confinement should last a minimum of 200,000 to 250,000 years plus or minus 50,000 years (I'm not so sure about the uncertainty number, it may be larger). If we do pursue burial in this manner, we will be practicing greater confinement and I believe can make arguments that we are safely containing the waste.

If you wish reprints or copies of reports that have resulted in these recommendations, I will be glad to forward them to you.

WRH/mlk

Cy: Jesse Aragon, HSE-DO, MS P228
Karen Balo, HSE-7, MS E516
John Warren, HSE-7, MS E516
Don Mayfield, HSE-8, MS K490

APPENDIX J

RADIOACTIVE LIQUID WASTE COLLECTION SYSTEM IMPROVEMENTS

AT THE

LOS ALAMOS SCIENTIFIC LABORATORY

PROJECT
MANAGEMENT
PLAN

ISSUED BY THE

UNITED STATES
DEPARTMENT OF ENERGY

ALBUQUERQUE OPERATIONS OFFICE
LOS ALAMOS AREA OFFICE
LOS ALAMOS, NEW MEXICO

L. J, 5253-(

PROJECT MANAGEMENT PLAN

RADIOACTIVE LIQUID WASTE COLLECTION

SYSTEM IMPROVEMENTS

RECOMMENDED FOR APPROVAL:

R. Bradshaw
Engineering Department Head, LASL

4/18/79
Date

Kenneth R. Braziel, LAAO
Area Manager

4-20-79
Date

APPROVED:

Herman E. Roser, Manager
Albuquerque Operations Office

May 18, 1979
Date

TABLE OF CONTENTS

		Page
I.	Introduction	1
II.	Project Scope	2
III.	Organization	4
IV.	Project Control System	16
Appendix A - Project Organization Chart		19
Appendix B - Construction Project Data Sheet		20
Appendix C - Cost Estimate		26
Appendix D - Project Schedule		27
Appendix E - Project Logic Diagram		28

I. INTRODUCTION

1.1 Purpose

This plan describes the project management procedures that will be followed by all project participants in the management of the Radioactive Liquid Waste Collection System Improvements (RLWCSI) project. The plan identifies the various Department of Energy (DOE) and Los Alamos Scientific Laboratory (LASL) organizations and personnel, including responsibilities and authorities, and the organizational relationships between the Office of Military Application (OMA), Albuquerque Operations Office (ALO), Los Alamos Area Office (LAAO), and LASL.

The plan has been developed in accordance with the DOE Manual Chapter 6101 and the "Handbook for ALO Project Development and Management" to set forth a plan of action for the design, procurement and construction (including removal of existing waste lines) of this project. The plan was developed by representatives from LAAO, ALO and LASL.

II. PROJECT SCOPE

2.1 Function

The purpose of this project is: (1) to install a Radioactive Liquid Waste Collection System that will facilitate the safe, reliable collection and transport of these wastes to the central treatment plant at the LASL; and (2) to remove and dispose of the existing system and previously abandoned lines in a manner consistent with requirements for disposal of contaminated materials.

Containment reliability for the existing system cannot be verified. The original specifications under which the line was installed did not require a leak-tight system, an approach that was acceptable at that time.

The Radioactive Liquid Waste Collection System Improvements project will consist of the following:

a. Installation of buried sewer line in the collection grid of the main technical area (TA-3), and the trasnport line from TA-3 and TA-48 to the treatment plant (TA-50). The total length of line to be installed is approximately 22,000 lineal feet. The construction will be line-in-line type to provide primary and secondary encasement of the waste-carrying lines. The annular space between the inner and outer lines will provide a collection space for any leak developing in the inner line. T liquid will flow to transmitting detectors located in manhole along the line that will signal alarm at monitored points in the event of a system leak. The manholes, as secondary containment, will also be the location of expansion joints or loops, air relief vents where required, and plumbing connections for minimum effort maintenance during stoppages due to loss of primary (inner) line integrity.

b. A dual inverted siphon with a dosing system for flow velocity will be considered, with possible alternates, for one canyon crossing. The balance of the system will be controlled slope gravity flow, with force mains and lift stations only as required for topographical and/or economic reasons.

c. Six truck loading stations will be provided at remote waste collection and temporary storage locations. The loading station design will provide for storage, pumping to tank trailers, spill protection, freeze protection and construction on concrete pads with hard surface access from and egress to main roads. One primary truck unloading station will be provided in an area remote from public access at a location along the line routing. A back-up unloading station will be provided at TA-50. Design will be similar to the loading station design. Two tank trailers will be procured for use with truck tractors presentl used on plant, and complying with Department of Transportatic requirements.

d. A number of existing storage tanks presently in use will be upgraded to meet the criteria of this project. The upgrading will include cleaning, repairing where necessary, relining, sealing, structural inspection, new primary inner tanks, and providing for monitoring for leakage.

e. A new data acquisition, control, and alarm system will be designed and procured by LASL for installation by the contractor at TA-50-1. Details of this design will be furnished to the A-E by LASL for incorporation in the overall design by the A-E during Titles I and II. Description of the DAS is detailed in document entitled "Specification E-5-0109 - H-7 Radioactive Liquid Waste Management Data Acquisition System", which is by reference, part of the Project Management Plan.

f. Existing contaminated sewers (including sections of line previously abandoned), associated manholes, valves, valve boxes, etc., will be removed and disposed of at the LASL radioactive disposal site. Contaminated earth in the vicinity of the lines and equipment will also be removed for disposal. A Standard Operating Procedure (SOP) to accomplish the removal and disposal of the existing system is being prepared. Generally, removal of presently abandoned lines will begin prior to completion of the new system. Removal of the remaining contaminated system will begin after completion of the new system. The SOP will be completed and approved prior to start of removal.

g. The existing main pumping station SM-700, TA-3, with associated tanks and equipment and any contaminated earth will be dismantled, removed, and disposed of at the LASL managed disposal site, TA-54.

III. ORGANIZATION

3.1 Philosophy

The project management organization will follow the basic ALO management philosophy outlined in the "Handbook for ALO Project Development and Management" whereby selected individuals have been selected from existing functional organizations of ALO, LAAO and LASL for specific management responsibilities with functional support provided by designated individuals within the existing aforementioned organizations.

3.2 Project Management Organization

Utilizing the basic single-site organization structure set forth in the ALO Handbook, the management team individuals are as identified in Appendix A. Responsibilities and authorities of the various individuals and organizations are described in the following paragraphs:

3.3 Department of Energy (DOE) Organization

3.3.1 DOE Headquarters

3.3.1.1 Office of Military Application (OMA)

OMA is the Headquarters division having programmatic responsibility. As such, OMA will provide programmatic and funding advice and guidance, will monitor and assess project scope, costs and schedules within current reporting requirements and will ensure that all required Headquarters activities in support of the project are coordinated with other Headquarters divisions for responsive actions towards project accomplishment.

3.3.1.2 DOE Headquarters Support Organizations

Headquarters support organizations, e.g., Office of the Controller and the Division of Operational and Environmental Safety, provide advice and guidance necessary for performance of projects in compliance with DOE and/or Congressional requirements. Headquarters support organizations may perform independent assessments of a project's progress, problems, and resource needs or safety documentation and relate their findings, via established reporting channels, to the OMA and ALO management.

3.3.3 Albuquerque Operations Office (ALO)

Albuquerque Operations Office (ALO) has DOE responsibility for management overview of the project. In response to OMA programmatic and technical direction and within approved Congressional authorizations and budgetary limitations, ALO will monitor all project activities to ensure successful construction of this project within the approved cost, schedule and

technical performance envelope. This effort, through the ALO Project Coordinator, includes performance in the following major areas:

1. Monitor performance of cost, schedule and technical progress and activities against approved project baselines. Ensure implementation of adequate procedures for controlling changes and timely corrective action on nonconforming performance.

2. Maintain an awareness of and control for applicability for use of contingency funds in conjunction with the Project Manager.

3. Assure adequate planning for project accomplishment.

4. Assure implementation of project management concepts per approved PMP. Assure periodic update of PMP, as required, to reflect current major changes to cost, schedule, management approach or procurement strategy.

5. Provides ALO staff reviews, coordination and comment to project documentation, as required.

6. Reviews QA Program activities as related to construction program.

7. Issues project directives and modifications following staff reviews.

8. Assists in selection and negotiation of major contracts for design of major project systems or components as required.

9. Supports availability of funding and program guidance on as needed basis.

10. Review and approve all project health and safety documentation. Make submissions to HQ of pertinent safety documentation as required.

3.3.2.1 ALO Manager

The ALO Manager has the ultimate authority and responsibility for ensuring the successful execution of projects under his administration.

3.3.2.2 ALO Project Coordinator

The ALO Project Coordinator, J. R. D'Antonio, FCMD, will serve as the focal point of contact within ALO for all communications and will be responsible for:

1. Maintaining constant awareness of all project activities.

2. Maintaining a central documented project file in ALO.

3. Monitoring the planning, review and control procedures, total and incremental funding requirements, and work progress for (a) facility engineering and construction, and (b) capital equipm design, acquisition, and installation.

4. Providing the ALO Manager with periodic reports and problem/solution/performance assessments as required on the current status of the project.

5. Consolidating responses to Headquarters inquiries and Project Manager requests requiring ALO Divisions' interaction.

6. Providing coordinated ALO Management guidance and assistance to the PM in the resolution of problems including those requiring funding evaluations or changes.

3.3.2.3 ALO Project Support Team (PST)

The PST will be responsible for:

1. Assisting the PM, TM and EM in the formulation of design criteria and performing a review of these documents to assure that all aspects of the technical requirements are delineated, simply stated, and consistent with the established parameters and functional objectives, thus establishing a total comprehensive project scope that can be utilized as the "Project Baseline" for the PM's "Change Control" or "Configuration Control" systems.

2. Assisting in the analysis of changes to the Project Management Plan.

3. Reviewing the Request for Directive for compliance with manual and technical requirements and recommending approval/disapproval.

4. Determining if the engineering effort is in compliance with the Design Criteria, manual requirements, budget constraints, codes, standards, and schedules.

5. Periodically visiting the construction site to analyze and critique the work progress and attending periodic work status review meetings to discuss, in depth problem conditions related to time schedules and budget considerations, changes and their impact, and work element interactions.

6. Monitoring the design, acquisition, and installation activities to determine if this effort is consistent with the established "Project Baseline."

7. Analyzing the various project status reports to determine their adequacy and accuracy.

8. Reviewing request for project directives and recommending approval/disapproval to FC&M Division.

9. Resolving budgetary and funding problems relating to the project.

10. Determining if the various submittals, including Design Criteria, comply with and conform to Health and Safety (H&S) manual requirements as well as other regulatory codes and standards.

11. Reviewing Titles I/II submittals to verify the correctness and applicability of the design effort.

12. Assure preparation, submission and approval of interim and final safety documentation and acceptance of system operational tests prior to facility becoming functionally operational.

13. Determining that the Final Safety Analysis Report (FSAR) has been submitted to and approved by ALO prior to the facility becoming functionally operational.

3.3.3 Los Alamos Area Office (LAAO)

The LAAO will have the day-to-day management responsibility of the project.

3.3.3.1 Los Alamos Area Manager

The Los Alamos Area Manager (LAAM), as set forth in ALO Manual Chapter 0180, Part II, reports directly to the ALO Manager and is responsible for administration of contracts with (LASL), The Zia Company (ZIA), Los Alamos Constructors, Inc. (LACI) and fixed-price contracts awarded by DOE in support of the project. As set forth in AL Appendix 0180 Contracting Officer authority for contractual matters is delegated to the LAAM from the ALO Manager.

3.3.3.1.1 Assistant Area Manager for Engineering (AAME)

The AAME is responsible for the administration and management of the overall engineering and construction programs at the LASL with contracting officer authority as set forth in AL Appendix 0180.

3.3.3.1.2 Project Manager (PM)

D. Trujillo has been designated as Project Manager and as such will be the authorized representative of the LAAM for this project. As a member of the Project Engineering Branch, guidance and assistance will be solicited from the AAME and other LAAO staff on basis of need and other support identified hereinafter.

As the authorized representative of the LAAM, the PM has the (1) management responsibility for planning, organizing, and coordinating all project activity functional elements, obtaining dedicated support and assistance from the LASL organization through the Engineering Manager and Technical Manager, the ALO Project Support Team through the ALO Project coordinator, LAAO Site Support Team, Architect-Engineer and Construction organizations as required (2) authority to approve all decisions (consistent with established DOE policies) relative to administrative, fiscal and technical matters (3) responsibility to oversee the administration of fixed-price DOE construction contracts related to this project, (4) responsibility for the preparation of the Project Management Plan, and (5) responsibility for report updating in accordance with DOE Manual Chapter 6101.

During the engineering and construction phases of the project the PM will:

1) Establish a change control system including a Change Review Board, which will formalize the evaluation and approval process regarding changes in the "Project Baseline" (specific facility and capital equipment design criteria). The "Change Review Board" will be composed of the Technical Manager, the Engineering Manager, the ALO Project Coordinator and the PM as chairman. All actions/determinations will be documented and retained to support direction to the design effort and construction participants.

2) Coordinate the preparation of, review and staff for ALO approval of the Preliminary Proposal, Preliminary and Final Safety Analysis Reports.

3) Chair all project status reviews.

4) On a regularly scheduled basis monitor the progress, schedule and cost estimates for the design, procurement and construction phases of the entire project. Monthly, or as needed, meetings will be held to evaluate the LASL facility and equipment design activities monitoring their progress, identifying and resolving problems, reviewing current and/or projected costs and schedules, and insuring the proper interface between the two. During construction, frequent site visits will occur during which progress and problem conditions will be discussed with the key LASL, and contractor(s) personnel.

5) In the administration of A-E and construction contracts, be responsible for making all decisions, issuing all official contractual correspondence and recommending approval of all contract documents in accordance with authorities delegated under AL Appendix 0180.

6) Conduct formal design reviews to assure and verify that the design (a) satisfies the design criteria and meets the functional requirements (b) is technically correct, and (c) is consistent with the incremental and/or total allocated funds for construction.

7) Coordinate the Quality Assurance Program (LASL Technical Manual LA-5220-M) and approve deviations from established criteria.

8) Participate in final inspections of construction and officially accept the completed work for the Government.

9) Coordinate, consolidate and issue construction and other progress reports as specified in this plan.

10) Have full access to information concerning the performance and control of all project activities.

3.3.3.1.3 Los Alamos Area Office (LAAO) Support Team

LAAO support will be provided to the PM by the following:

1) Assistant Area Manager for Engineering

(a) Facilities Engineering Branch - A Facilities Engineer from this branch will be assigned to administer all cost-type contracts awarded to the ZIA/LACI for this project. Responsibilities will include the administration, of the contract(s) for compliance with all technical, financial, safety, schedule, costs and changes as set forth in the contract documents.

2) Assistant Area Manager for Operations

(a) Technical Programs Branch - This branch will provide the PM technical support in fire protection, construction and industrial safety areas related to the overall project.

(b) Financial Management and Contracts Branch - This office will be responsible for the financial aspects of the project and as such will issue monthly notice of obligational limitation plans to LASL, and in general assure that funding for proposed obligations is available. In addition, all LASL procurements over $100,000 and Zia procurements over $25,0000 will be reviewed to assure compliance with DOE regulations.

(c) Counsel - This office will provide the PM legal review and support on all contractual matters, e.g., LASL, procurement actions, construction contracts, claims, etc.

3.4 LASL Project Organization

The RLWCSI project will be managed as a part of LASL's Engineering Department (ENG) and the Health Research Division. Specifically, the project will be part of the LASL Health Research program that has responsibility for waste management aspects of the program. Technical management of the project is assigned to the Technical Manager, P. M. Stanley, H-7. L. J. Finley, ENG-DO/FD is the LASL Engineering Manager for the project.

3.4.1 Technical Manager (TM)

The Technical Manager will be responsible for coordinating the technical requirements of the project. Responsibilities will include:

1. Maintaining a close coordinated relationship with the Engineering Manager, especially in providing assistance in planning, organizing, directing and controlling the project activities so that the objectives can be attained effectively and within schedules and budget restrictions.

2. Formulating and interpreting the technical requirements of the process and monitoring systems.

3. Keeping the Engineering Manager advised of technical developments that will have an impact on project scope, cost or schedule.

4. Delegating responsibility, in concert with the Engineering Manager, for the varied support activities to other Divisions/Departments within the Laboratory organization.

5. Coordinating and analyzing in concert with the Engineering Manager any input to be considered for project incorporation, throughout the project evolution, by providing, to the Project Manager, an evaluation that addresses design elements, or changes thereto, cost impacts, and schedule considerations.

6. Serving as the Laboratory technical representative in the decision making process.

3.4.2 Engineering Manager (EM)

The Engineering Manager will be involved in the day-to-day direction and decision making in support of the Project Manager and the Technical Manager. The areas of involvement include design, budgeting, scheduling, construction, reporting, and records keeping.

The Engineering Manager will be responsible for reviewing the project design to assure that project requirements are obtained within budgets and schedules, and that construction cost estimates are verified. He will be

responsible for determining the impact on the project by changes in funding, participate in funding decisions, obtain information to answer funding questions, and in seeing that project Final Cost Reports are prepared in accordance with DOE requirements.

The Engineering Manager will assist in the establishment of project design, construction and procurement schedules and milestones, the re-establishment of schedules and milestones due to funding changes as well as assist in the determination of the effect of change orders on schedules. The Engineering Manager will monitor design, construction and procurement schedules and milestones, and will assist the Project Manager and the Technical Manager in maintaining the project on schedule.

The Engineering Manager will oversee the integrated construction contractor effort and will initiate construction change orders and monitor construction progress as related to budgets and schedules. He will provide input to Project Status Reports and all other reports required by DOE Manual chapters and requested by DOE management, and will be responsible for the maintenance of project files and records. The Engineering Manager is included on the key personnel list in the Quality Assurance Program.

3.4.3 LASL Project Support

3.4.3.1 ENG-1 Construction

The LASL ENG-1 group will serve as inspection observers during the construction of the new collection system. The group will serve as inspectors to assure quality control during the existing collection system removal and decontamination phase of the project.

3.4.3.2 ENG-3 - Records Management

The ENG-3 group maintains the Quality Assurance documentation files and the up-to-date central file on the project. The Group Leader serves on the QA Design Review Board as records management administrator.

3.4.3.3 ENG-4 - Wirerun Section

This section of ENG-4 is responsible for the "Wire-X" computer program to determine cable routes and terminal identifications.

3.4.3.4 ENG-8 - Cost Engineering

The responsibilities of the Cost Engineering Group is to provide estimating, scheduling and cost projection and analysis services in an efficient and timely manner to meet the needs of this project. This Group will review estimates and proposed construction schedules as well as assist in developing cost projections of equipment and installation costs.

3.4.3.5 ENG-DO/QA - Quality Assurance

The Engineering Department Office of Quality Assurance is respons for management of the quality-related activities for construction projects LASL. The Quality Assurance Program is documented in LASL Quality Assurance Manual for Engineering and Construction (LASL Technical Manual LA-5220-M), which includes supplemental quality assurance procedure specifications.

Quality Assurance activities begin during conceptual design phase and continue through final acceptance and beneficial use of the facility or product. Quality administration of each project is performed by the individual Engineering Manager with the assistance of facility operating group personnel.

3.4.3.6 Supply and Property Department (SP)

The Supply and Property Department, working in conjunction with Engineering and E-Division personnel, will be responsible for procurement of all special equipment purchased from outside vendors for the project. The function of the various entities within SP will be as described below.

3.4.3.7 SP-DO - Procurement Audit Section

One function of this section is to audit all purchase orders in excess of $2,500 to ensure compliance with DOE and University of California regulations. The procurement auditor serves as Chairman of the SP Contract Review Board that reviews all fixed-price orders in excess of $25,000 and a cost-type orders in excess of $5,000. This section has the responsibility expedite procurements for various special and high urgency LASL projects.

3.4.3.8 SP-DO - Traffic Management Section

The primary function of this section is assurance of compliance with all packing, marking, labeling, and descriptive regulations; and the efficient economical and expeditious routing of all incoming and outgoing LASL shipments.

3.4.3.9 SP-DO - Associate Department Head for Procurement

Acts for the Alternate/Department Head in procurement matters and directly oversees the SP-10 and SP-11 Procurement Groups and the SP-12 Service Group.

3.4.3.10 SP-2 Property Management

This group's primary function is insuring that all LASL property is identified, classified, and used in conformance with the University's Prime Contract with the DOE. All shipping requests are processed through SP-2.

3.4.3.11 SP-3 -Stores Inventory

The primary function of this group is administrative and physical control of materials, supplies and equipment. Other functions include establishing and maintaining inventories at an optimum level considering the necessity for not being out of stock. SP-3 places low dollar value orders directly with vendors for certain requirements and expedites these deliveries. They also utilize an ADP system in the various inventory control functions.

3.4.3.12 SP-4 - Shipping, Receiving, and Warehousing

This group's function is the shipping, receiving, picking up, and distribution of all materials and supplies for the Laboratory. Other functions are the packing and crating of outgoing shipments and working with the Traffic Management Section on all damage claims for incoming shipments.

3.4.3.13 SP-10 and SP-11 - Procurement

The primary function of these groups is the procurement of and the contracting for, all supplies, equipment, and services required by the LASL. SP-10 is primarily responsible for purchasing electronic and electrical commodities; SP-11 is primarily responsible for purchasing mechanical and chemical commodities.

Additionally, the procurement function entails the administering of purchase orders for lost and damaged materials, return of equipment for repair or replacement, arranging for loans of equipment for engineering evaluation, issuance of modifications to contracts or cancellations as may be necessary and expediting contractual performance as required by regulation.

3.4.3.14 SP-12 - Procurement Services

The primary function of this group is the administrative support of the two procurement groups. Included in this function are the receipt, logging, and distribution to SP-10 or SP-11 of all incoming purchase requests. Some low dollar value procurements are typed by SP-10 and SP-11, but SP-12 reviews, approves, and signs all orders for LASL.

All management reports for SP, Laboratory management, and DOE are the responsibility of this group.

3.4.3.15 E-Division - Electronics

E-Division will provide a high level, broad based electronics engineering capability for the dual purposes of performing quality research and development in the field of electronics, and of supporting the electronics engineering activities in other divisions.

3.4.3.16 E-5 - Computer Systems

Group E-5 will provide computer and data acquisition systems desig support for the project. This includes specifications and design of the control and data acquisition hardware, specification and design of the computer and software system. In addition, the group will assist in the coordination of the procurement effort.

3.4.3.17 E-9 - Telecommunications

Group E-9 administers the contract with the Telephone Company. The Group will assist Group E-5 in determining where telephone lines are available to use in transmitting information to the data acquisition system.

3.4.3.18 Health Division

The Health Division will be responsible for all aspects of health and safety of the project. They will also review plans and specifications to assure that the design complies with all applicable health and safety codes and standards. After construction is complete, the facility will be surveyed for any conditions related to health and safety of personnel and protection of the environment.

3.4.3.19 H-1 Health Physics

H-1 will be responsible for providing the field coordinator for the decontamination and removal phase, and for providing health physics coverag when required. H-1 will make recommendation to the Technical Manager on ALA levels.

3.4.3.20 H-3 Safety and Fire Protection

H-3 will monitor the decontamination and removal phase as required in order to provide the necessary physical and construction safety advice.

3.4.3.21 H-7 Waste Management

H-7 will provide the Technical Manager for the project, establish the design criteria and identify the facilities subject to removal. In addition, H-7 will direct the TA-54 disposal operation.

3.4.3.22 H-8 Environmental Surveillance

H-8 will provide a surveillance network to measure and document release to the environment or exposure of the general public. In addition, H-8 will make recommendations on ALAP levels and document final soil decontamination levels.

3.4.3.23 Coordinator for Automatic Data Processing - CADP

The Coordinator for Automatic Data Processing (CADP), reviews all procurement requests for automatic data processing (ADP) equipment, software, and related ADP services throughout the Laboratory in compliance with DOE regulations. CADP assists requestors in the development of DOECM-1801 Studies for review and approval by the DOE as may be necessary. Among its duties, CADP is required to make reviews and evaluations of equipment installations, to prepare DOE-required reports, and to maintain a current inventory of all ADP equipment in the Laboratory.

3.5 The Zia Company and/or Los Alamos Constructors, Inc. (LACI)

3.5.1 The Technical Division of The Zia Company will be responsible for organizing the work crews necessary to perform the removal and disposal of the existing collection system. They will be responsible for meeting the standard procedures, schedules and budgets established to perform the work assigned.

IV. PROJECT CONTROL SYSTEM

4.1 Control Philosophy

The overall objective of the Project Control System can be summarized as follows:

1. Monitor performance and measure progress by comparison against established baselines.

2. Identify significant deviations from the baselines, as well as identify trends and forecast potential deviations.

3. React to these changes or trends by making decisions based on thorough analysis of the deviation ramifications and taking timely and positive action that is consistent with project objectives.

4. Provide other project participants and higher authority with status data including information regarding deviation resolution and impact.

4.2 Baselines

1. In the Construction Budget Data Sheet, Appendix B, the general summaries of the (a) scope of work (project description) defi to meet functional objectives (b) time frame for work performance, and (c) specific budget (TEC) all constitute the primary baselines for project accomplishments. Appendices C and D represent comparison listing of cost and schedules between the Data Sheet and current cost and schedule estimates, respectively.

2. Based on the data resulting from the comprehensive development and planning effort prerequisite to the Data Sheet, the following secondary baselines are established:

   a. Technical - design criteria for the Radioactive Liquid Waste Collection System Improvements specifies how the functional objectives are to be achieved.

   b. Time - logical schedules for accomplishment of the project elements, including milestones, are developed, taking into consideration the various interacting components and appropriation assumptions. See Appendix E.

   c. Cost - cost estimates are applied to each of the various elements of the project, including escalation factors based on time schedules presented for work activity accomplishment.

d. Contingency - amounts applied to the various work element breakdowns are derived from a comprehensive analysis of the following:

(1) project elements complexity, and

(2) concepts for which the definition has not been totally resolved (uncertainties).

3. Facility Design Criteria is by reference, part of the project management plan.

4.3 Control System

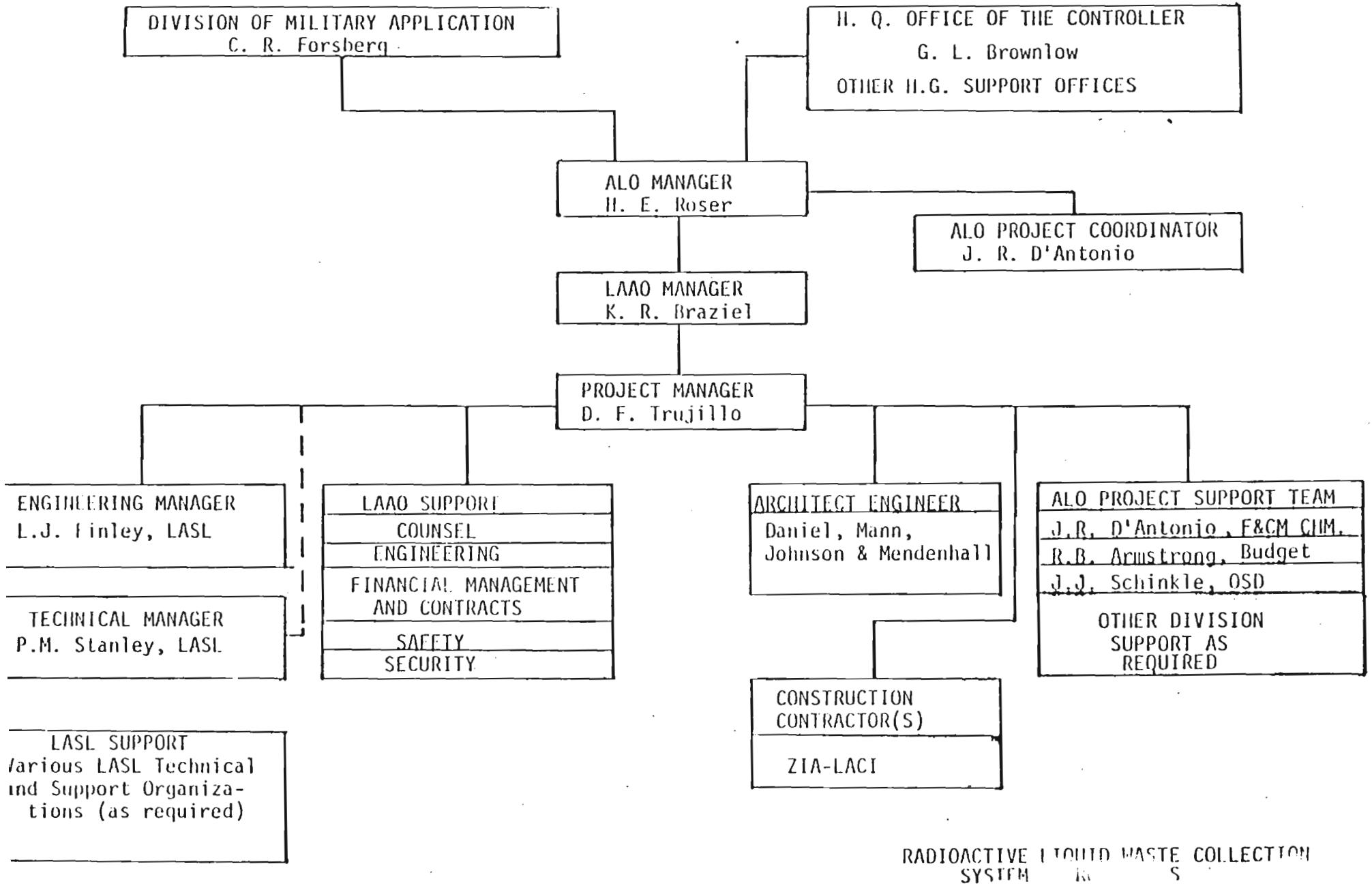
1. The Project Manager will establish a system by which changes in the secondary baselines can be monitored, evaluated, resolved and reported. This system will require the Engineering Manager and the Technical Manager to be responsible for technical, cost and schedule control of the facility design and construction activities and the process systems design, acquisition and installation, respectively. Whenever technical changes are anticipated or proposed, the Engineering Manager and the Technical Manager will evaluate all ramifications and fully document (including consideration of alternatives and schedule, cost and interrelated work impact statements) their conclusions for all project participants edification. If the impact statement(s) concludes that the change would adversely affect any of the primary baselines, the Project Manager, ALO Project Coordinator, and the Headquarters Program Office, when appropriate, will be contacted for consultation, evaluation and approval prior to work incorporation. The use of contingency will be monitored closely, especially that dedicated to design uncertainties, and the status reported to key project participants so that the project will not be jeopardized because of cost overrun.

2. The Project Manager will establish a Change Review Board composed of, at a minimum, himself, the Engineering Manager and the Technical Manager, to evaluate the credibility of work deviations and take positive and timely action in the resolution process.

3. Cost and schedule control will, to the maximum extent possible, utilize existing computer based program capabilities and resources in the organization, complemented by various network printouts, Gantt type bar charts, cost/time analysis reports and related project cost and schedule data.

4. At a minimum, monthly meetings, attended by the Project Manager, Engineering Manager and others, as appropriate, will be held to discuss the project status and resolve problems. A documente meeting summarization will be distributed to all project participants.

5. The Project Manager will be responsible for the compilation of cost and schedule data to be utilized in the preparation of all status reports required periodically.



RADIOACTIVE LIQUID WASTE COLLECTION SYSTEM

DEPARTMENT OF ENERGY
ATOMIC ENERGY DEFENSE ACTIVITIES
FY 1979 CONGRESSIONAL BUDGET REQUEST
(Tabular dollars in thousands. Narrative material in whole dollars.)

Construction Project Data Sheet

Los Alamos Scientific Laboratory

Mission Name: Atomic Energy Defense Activity
Resource Name: Weapons Activities
Activity Name: Research and Development

1. Title and location of project: Radioactive liquid waste improvement, Los Alamos Scientific Laboratory, New Mexico

2. Project No. 78-16-g

3. Date A-E work initiated: 2nd Qtr. FY 1978

3a. Date physical construction starts: 3rd Qtr. FY 1979

4. Date construction ends: 3rd Qtr. FY 1981

5. Previous cost estimate:
Date: 12/76 $12,500

6. Current cost estimate:
Date: 12/77 $12,500

7. Financial schedule

Fiscal Year	Authorizations	Appropriations	Obligations	Costs
1978	$ 600	$2,800	$2,800 a/	$ 700 a/
1979	11,900	9,700	5,700	3,600
1980	0	0	4,000	5,200
1981	0	0	0	3,000

8. Brief physical description of project

This project is required to improve the radioactive liquid waste collection and transportation systems at the Los Alamos Scientific Laboratory.

Approximately 22,000 feet of encased sewer line (pipe in pipe) will be installed complete with manholes at critical points and instrumentation to detect leakage. The system will include gravity main sections and a section of inverted siphon. Also included will be installation of a dosing system to provide for high velocity flow from the siphon through the balance of the system to the treatment plant.

An electronic multiplexing and display system will be installed and will provide approximately 100 signals necessary for the operation, monitoring, and reliability assurance of the entire waste collection and transportation system.

a/ [illegible]tions and costs for FY 1978 will not exceed the [illegible] authorized.

Construction Project Data Sheet

Los Alamos Scientific Laboratory

Mission Name: Atomic Energy Defense Activity
Resource Name: Weapons Activities
Activity Name: Research and Development

1. Title and location of project: Radioactive liquid waste improvement, Los Alamos Scientific Laboratory, New Mexico

2. Project No. 78-16-g

Four tank trailer loading stations will be constructed complete with storage tanks for waste accumulation pumps and concrete pads. A truck unloading station will be incorporated into one of the junction boxes in the transport line at a location remote from heavily traveled thoroughfares.

This project will also provide for additional work on components of the existing radioactive waste collection system such as upgrading existing storage tanks by cleaning, repairing, sealing and structural inspection, installing leakage monitoring wells, and providing instrumentation for transmission of liquid level data. This effort will include reclassifying a number of subsystems presently receiving nonradioactive and chemically insignificant wastes, and rerouting these subsystems from the industrial system to the sanitary sewer system.

In addition to the work outlined above, the system components no longer required will be disposed of in an acceptable manner. This will include removal and disposal of all contaminated sewers (including sections of line previously abandoned) associated manholes, valves, valve boxes, tanks, the existing pumping station, other equipment, and contaminated earth.

The requested FY 1979 funds will be used for construction of the new radioactive waste improvement system and removal and disposal of existing sewers and related materials and equipment.

9. Purpose, justification of need for, and scope of project

This project is required to upgrade the radioactive liquid waste collection and transportation systems at Los Alamos and to reduce the probability of release of such wastes to the environment.

The existing system has developed leaks and has deteriorated to such an extent that reliability of containment is questionable. Some elements of the existing system are as much as 25 years old. A leak recently developed in a section of the line, resulting in an uncontrolled release of radioactive substance to the local environment. Subsequent cleanup and inspection revealed numerous leaks from joints in the line and a general deterioration of the system. The original specifications under which the line was installed did not require a leak-tight system, an approach which was acceptable at the time of original installation. Upon discovery of leaky joints in the line currently in service, immediate action was taken to install a temporary line to provide an alternate flow route bypassing the section of major concern. This project provides for a permanent solution to the overall problem. Existing sewer lines and associated equipment to be abandoned by this project, as well as lines abandoned in the past by operational changes, are contaminated and will require removal and disposal as contaminated waste.

Construction Project Data Sheet

Los Alamos Scientific Laboratory

Mission Name: Atomic Energy Defense Activity
Resource Name: Weapons Activities
Activity Name: Research and Development

1. Title and location of project: Radioactive liquid waste improvement, Los Alamos Scientific Laboratory, New Mexico

2. Project No. 78-16-g

The resulting improved systems to be constructed under this project will provide practical assurance that radioactive waste material will not leak into the environment. Additionally, in the event of system or component failure, such failure will be immediately detected. The function of the system is to provide for collection and transport to the waste treatment facility of low level radioactive and acidic industrial wastes generated in various facilities at the general Los Alamos plant site. This is presently accomplished principally by a collection system of gravity acid waste piping to the terminal point at the waste treatment plant. At remote facilities, transport is accomplished by tank truck hauling from collection points to the treatment plant. The new system will be similar. However, components will be of much more reliable design, and the force main feature has been eliminated. In addition to the new line collection system, facilities remote from the line collection area will be provided with improved holding tanks and tank truck filling stations. A special liquid waste tank trailer will be provided for hauling waste to the treatment plant.

It is not anticipated that annual operating costs of the new waste collection and transportation system will vary significantly from those associated with the existing system. Some cost savings may be realized from more efficient waste handling at remote points (i.e., transfer of wastes from bulk storage to truck), but design has not been developed to the point where such savings can be accurately quantified.

Construction Project Data Sheet

Los Alamos Scientific Laboratory

Mission Name: Atomic Energy Defense Activity
Resource Name: Weapons Activities
Activity Name: Research and Development

1. Title and location of project: Radioactive liquid waste improvement, Los Alamos Scientific Laboratory, New Mexico

2. Project No. 78-16-g

10. Details of cost estimate a/

a. Engineering, design, and inspection at approximately 15% of construction costs, Item b		$ 750
b. Construction costs		4,900
(1) Utilities		
(a) Grading and site preparation	$ 50	
(b) Trailer stations and trailers	430	
(c) Equipment rehabilitation and reclassification	320	
(d) Piping systems	3,420	
(e) Instrumentation	680	
c. Removal cost less salvage (removal and disposition of existing piping systems)		4,350
Subtotal		10,000
d. Contingency at approximately 25% of above costs		2,500
Total project cost		$12,500

a/ Estimate is based upon completed conceptual design.

11. Method of performance

Design and inspection will be accomplished by a negotiated architect-engineer contract and by the operating contractor. To the extent feasible, construction and procurement will be accomplished by fixed-price contracts and subcontracts awarded on the basis of competitive bids.

Construction Project Data Sheet

Los Alamos Scientific Laborator,

Mission Name: Atomic Energy Defense Activity
Resource Name: Weapons Activities
Activity Name: Research and Development

1. Title and location of project: Radioactive liquid waste improvement, Los Alamos Scientific Laboratory, New Mexico

2. Project No. 78-16-8

12. Funding schedule of project funding and other related funding requirements

	Prior Yrs.	FY 1979	FY 1980	FY 1981	Total
a. Total project funding					
1. Total facility costs					
(a) Construction line item	$700	$3,600	$5,200	$3,000	$12,500
(b) CP&D	0	0	0	0	0
(c) Expense-funded equipment	0	0	0	0	0
(d) Inventories	0	0	0	0	0
Total facility costs	700	3,600	5,200	3,000	12,500
2. Other project funding					
(a) Conceptual design	40	0	0	0	40
(b) Other project-related costs	0	0	0	0	0
Total other project funding	40	0	0	0	40
Total project funding (item 1 and item 2)	$740	$3,600	$5,200	$3,000	$12,540

13. Narrative explanation of total project funding and other related funding requirements

a. Total project funding

1. Total facility costs

(a) Construction line item
No narrative required.

(b) CP&D
No narrative required.

(c) Expense-funded equipment
No narrative required.

(d) Inventories
No narrative required.

2. Other project funding

(a) Conceptual design cost

Conceptual design was completed in FY 1976 at a cost of $40,000.

(b) Other project-related costs
No narrative required.

b. Total related funding requirements

1. Facility operating costs
No narrative required.

2. Programmatic operating expenses directly related to the facility
No narrative required.

3. Capital equipment not related to construction but related to the programmatic effort in the facility
No narrative required.

4. GPP or other construction related to programmatic effort
No narrative required.

5. Other costs
No narrative required.

APPENDIX C

Cost Estimate

	Construction Project Data sheet dated 12/77 TEC ($ in Thousands)	Present Estimate TEC ($ in Thousands)
Engineering	$ 750	$ 1,000*
Construction	4,900	4,900
(1) Grading & site preparation	(50)	(50)
(2) Trailer stations & trailers	(430)	(425)
(3) Equip. rehab. & reclassification	(320)	(325)
(4) Piping systems	(3420)	(3425)
(5) Instrumentation	(680)	(675)
Removal & disposal of existing system	4,350	4,150
Subtotal	10,000	10,050
Contingency @ 24%	2,500	2,450
Total Project Cost	$ 12,500	$12,500

*Includes $250K for establishing Standard Operating Procedures (SOP) and for providing field coordination and monitoring of removal and disposal of existing system. The Construction Project Data Sheet includes this amount under "Removal and Disposal of Existing System."

APPENDIX D

Project Schedule

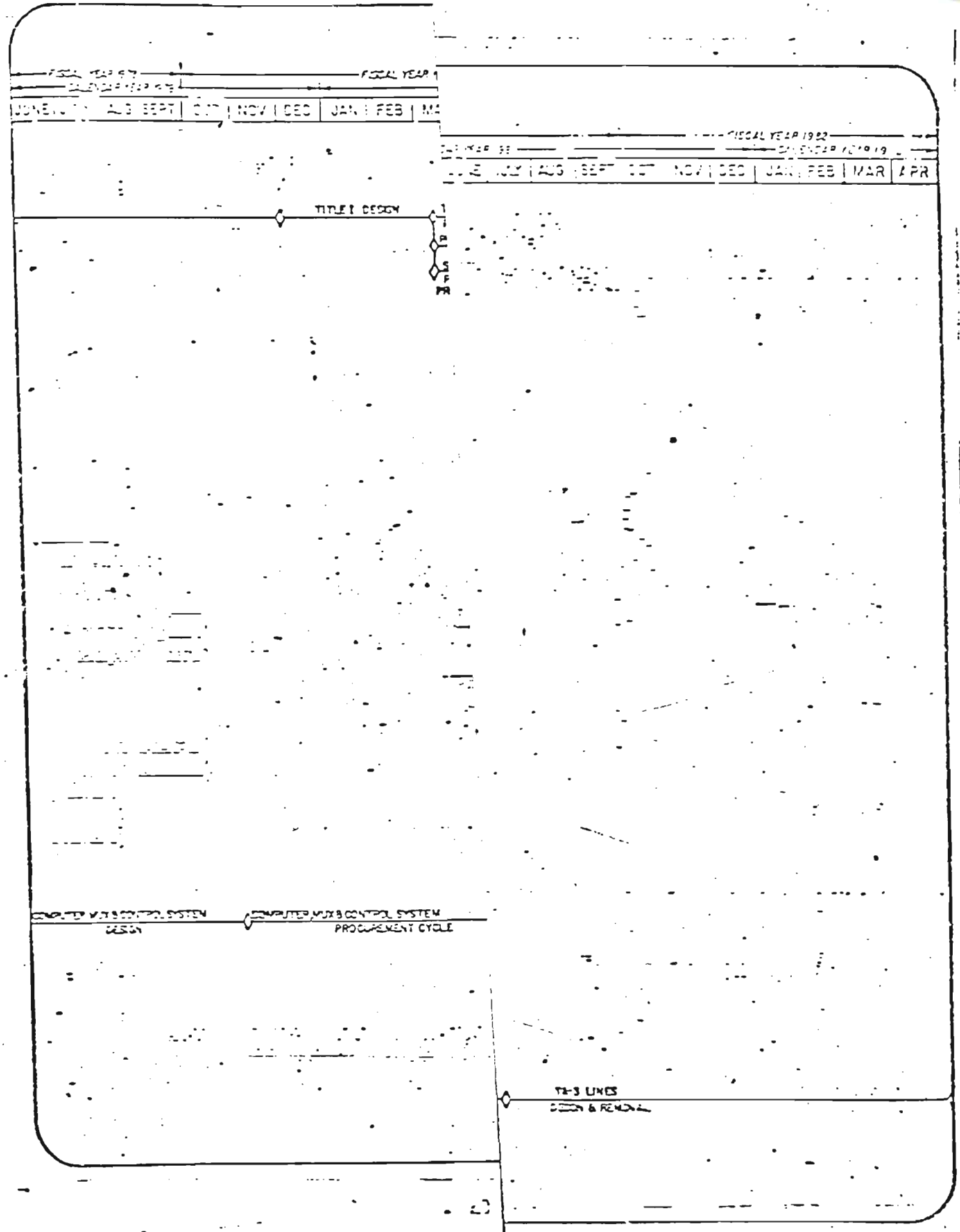
The following represents a comparison listing of the project schedule between that listed in the Construction Project Data Sheet and the current schedule. For more detail refer to the Logic Diagram in Appendix E.

	Baseline Construction Project Data sheet dated 12/77		Current Schedule 3/79	
	Start	Complete	Start	Complete
Engineering	2nd Qtr FY 1978	-	7/78*	9/79
Procurement	-		6/79	2/80
Construction	3rd Qtr FY 1979	3rd Qtr FY 1981	11/79	5/82**

*Design of the Data Acquisition, Control and Alarm System (DAS) by LASL started on 7/78. Design of the new collection system started 12/78.

**Completion of the removal and disposal of the presently abandoned and existing system is the only item that is currently scheduled to deviate appreciably from the Construction Project Data Sheet schedule. This schedule can possibly be shortened by employing more than one removal crew, if the situation lends itself to be economically feasible. This can only be evaluated when it is better known what portions of the system will become available for removal.

APPENDIX E


FISCAL YEAR 1982
JUNE
AUG
SEPT
OCT
NOV
DEC
JAN
FEB
MAR
APR
TITLE I DESIGN
COMPUTER MUX & CONTROL SYSTEM
DESIGN
COMPUTER MUX & CONTROL SYSTEM
PROCUREMENT CYCLE
T2-3 LINES
DESIGN & REMOVAL