Department of Energy
Field Office, Albuquerque
Los Alamos Area Office
Los Alamos, New Mexico 87544

SEP - 2 1994

LANL TA-53

Barbara Hoditschek
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Dear Ms. Hoditschek:

Enclosed are two copies of the Interim Status Closure Plan, Rev. 1.0, for TA-53 Surface Impoundments TA-53-166 Northeast and TA-53-166 Northwest. Please contact me at (505) 665-7203, or Bob Enz, Scientech, at (505) 667-5793 should you have questions.

Sincerely,

Theodore J. Taylor
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LAAMEP:2TT-014

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August 1994
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HAZARDOUS WASTE
PROGRAM

INTERIM STATUS CLOSURE PLAN

SURFACE IMPOUNDMENTS TA-53-166 NORTHEAST AND TA-53-166 NORTHWEST

TECHNICAL AREA 53

Los Alamos National Laboratory
Environmental Restoration Project
Los Alamos, New Mexico 87544

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LIST OF ACRONYMS AND ABBREVIATIONS

AAS	Atomic absorption spectroscopy
ASL	Above sea level
CFR	Code of Federal Regulations
CLP	Contract Laboratory Program
Coliwasa	Composite Liquid Waste Sampler
CPF	Cancer potency factor
CST-9	Los Alamos National Laboratory Environmental Chemistry Group
DOE	US Department of Energy
ECAO	Environmental Criteria and Assessment Office
ER	Environmental Restoration
ESH-1	Los Alamos National Laboratory Health Physics Operations Group
ESH-8	Los Alamos National Laboratory Environmental Protection Group
EPA	Environmental Protection Agency
EQL	Estimated quantitation limit
FIMAD	Facility for Information Management and Display
GC	Gas chromatography
GCEC	Gas chromatography electron capture
GC/MS	Gas chromatography/mass spectroscopy
HEAST	Health Effects Assessment Summary Table
HWMR-7	New Mexico Hazardous Waste Regulations-7
HSP	Health and Safety Plan
ICP-AES	Inductively coupled plasma-atomic emission spectroscopy
ICP-MS	Inductively coupled plasma-mass spectrometer
IRIS	Integrated Risk Information System
IWP	Installation Work Plan for Environmental Restoration
Laboratory	Los Alamos National Laboratory
LAMPF	Los Alamos Meson Physics Facility
MCL	Maximum contaminant level
NESHAP	National Emissions Standards for Hazardous Air Pollutants
NE	Northeast
NMED	New Mexico Environment Department

LIST OF ACRONYMS AND ABBREVIATIONS (Continued)

NPDES	National Pollutant Discharge Elimination System
NW	Northwest
OUPL	Operable Unit Project Leader
PCB	Polychlorinated biphenyl
QA	Quality assurance
QAPP	Quality assurance project plan
QC	Quality control
RCRA	Resource Conservation and Recovery Act
RfD	Reference dose
RPD	Relative percent difference
RPF	Records Processing Facility
SAL	Screening action levels
SOW	Statement of Work
SWSC	Sanitary Wastewater System Consolidation
TA	Technical Area
TCLP	Toxicity Characteristic Leaching Procedure
TIC	Tentatively Identified Compound
VOA	Volatile Organics Analysis

1.0 INTRODUCTION

This closure plan is submitted to the New Mexico Environment Department (NMED) to meet the requirements of the New Mexico Hazardous Waste Regulations-7 (HWMR-7) and the Resource Conservation and Recovery Act (RCRA). This closure plan only addresses closure of two surface impoundments at Technical Area (TA)-53, the TA-53-166 northeast (NE) and Northwest (NW) impoundments at the Los Alamos National Laboratory (Laboratory). These impoundments were identified as mixed waste storage units in the RCRA Part A Permit Application for mixed waste submitted to the NMED on January 25, 1991, and in the RCRA Part B Permit Application for Surface Impoundments at Technical Area 53 submitted to the NMED in July 1991 (LANL, 1992a). These permit applications were submitted because of the possible past discharge of mixed wastes to these impoundments. Mixed waste contains both a hazardous waste, as defined by and regulated under RCRA, and radioactive waste. Records of past discharges to the impoundments are limited and there have been no known discharges of mixed wastes. Prior to 1991 the impoundments were not RCRA-regulated and records of mixed waste discharges were not required to be kept.

The Laboratory is a multidisciplinary laboratory whose mission is to apply science and technology to solve national problems. Basic scientific research complements and strengthens the Laboratory's fundamental technical capabilities in such areas as weapons development, energy supply, and conservation programs. The Laboratory is owned by the US Department of Energy (DOE), and is jointly operated by DOE and the University of California (LANL, 1992a).

This closure plan provides a description of the surface impoundments and the actions that will be implemented during closure. The impoundments will undergo closure by removal or decontamination (i.e., "clean closure"). Regulatory requirements for clean closure will be met by removal or decontamination of wastes and/or environmental media that exhibit the characteristics of hazardous waste or that contain RCRA-regulated hazardous constituents above health-risk-based cleanup levels. Removal or decontamination of non-RCRA-regulated radioactive constituents will not be addressed by this closure plan. Chapter 2.0 provides descriptive information on TA-53 and on the design and operation of the surface impoundments. Chapter 3.0 summarizes existing information concerning the chemical and

physical characteristics of the water and sludge in the surface impoundment and also provides a plan for further sampling and analysis to be conducted as part of closure. Chapter 4.0 discusses the status of the groundwater monitoring waiver for the site. Chapter 5.0 provides a detailed description of closure activities and the decision process that will be used to demonstrate that clean closure requirements have been met. Chapter 6.0 describes the reports that will be prepared to document closure.

Compliance with specific regulatory requirements for closure are addressed in Chapter 5.0. The HWMR-7 have incorporated the Code of Federal Regulations (CFR), Title 40, Parts 260 to 270, through July 1, 1992. All regulatory citations in this closure plan will, therefore, be referenced to the 1992 40 CFR. Table 1-1 lists the regulations applicable for closure of these surface impoundments and identifies which sections of Chapter 5.0 address compliance with these regulations.

Table 1-1. Applicable Closure Regulations and Associated Closure Plan Sections

HWMR-7 Regulation	Closure Plan Section
264.228(a)(1)	5.1.1.2
264.228(b)	5.4
265.111	5.1.1.1
265.112(b)	5.1.1.3
265.112(b)(1)	5.2.1
265.112(b)(2)	5.2.2, 5.2.3
265.112(b)(3)	5.2.4, 5.2.5
265.112(b)(4)	5.2.6, 5.3.1, 5.3.3, 5.3.4
265.112(b)(5)	5.2.7
265.112(b)(6)	5.2.8
265.112(c)	5.1.1.4
265.112(d)	5.1.1.5
265.112(e)	5.1.1.6
265.113(a)	5.1.2.1
265.113(b)	5.1.2.1
265.113(c)	5.1.2.2
265.114	5.1.3, 5.2.6, 5.3.2
265.115	5.1.4
265.116	5.1.5
265.117 - 265.120	5.4
265.142	5.1.6
265.143	5.1.7
265.144 - 265.145	5.4
265.147	5.1.8
270.1(c)(5)	5.1.1.2

2.0 FACILITY DESCRIPTION

This chapter contains a general description of Los Alamos National Laboratory (Laboratory), Technical Area (TA)-53, and the surface impoundments undergoing closure.

2.1 General Description

The Laboratory is in Los Alamos County in north-central New Mexico, approximately 60 miles (mi) north-northeast of Albuquerque and 25 mi northwest of Santa Fe (Figure 2-1). The Laboratory, which occupies an area of 43 mi^2, and the associated residential areas of Los Alamos and White Rock are situated on the Pajarito Plateau. The plateau consists of a series of fingerlike mesas separated by deep east-west-trending canyons; intermittent streams lie at the bottoms of all of the canyons. The mesa tops range in elevation from approximately 7,800 ft at the flank of the Jemez Mountains (west of Los Alamos) to about 6,200 ft at their eastern extent, where they terminate above the Rio Grande Valley (LANL, 1992a).

The Laboratory is divided into 51 TAs; 34 of these TAs are developed (Figure 2-2). The waste management units addressed in this closure plan are two surface impoundments at TA-53 (LANL, 1992a).

The main activity at TA-53 centers around the Los Alamos Meson Physics Facility (LAMPF) and its associated experimental areas. The LAMPF is a half-mi-long proton accelerator that produces secondary nuclear particles for various experimental programs, including basic research in nuclear physics, production of isotopes, and other work in radiochemistry, solid state physics research, and accelerator technology. In addition to the LAMPF and its associated experimental areas, TA-53 includes shops, warehouses, trailers for instruments and data logging, an office, and facilities for accelerator technology research (DOE, 1987).

2.1.1 TA-53 Surface Impoundments

This section provides a description of the TA-53 surface impoundments. This description addresses design and construction, operation and maintenance, overtopping controls, erosion controls, and sources and types of wastes.

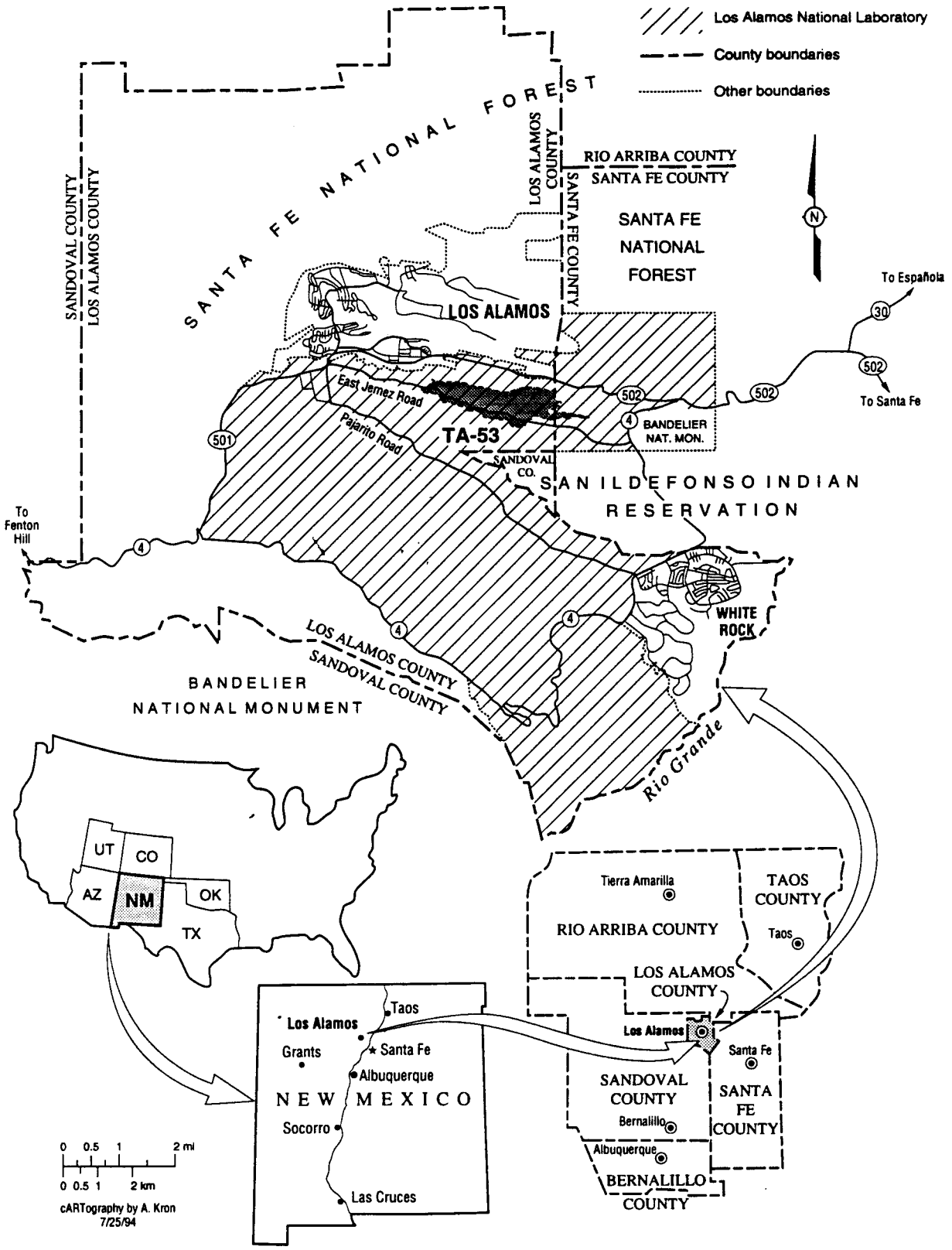


Figure 2-1. Regional Map of Los Alamos National Laboratory

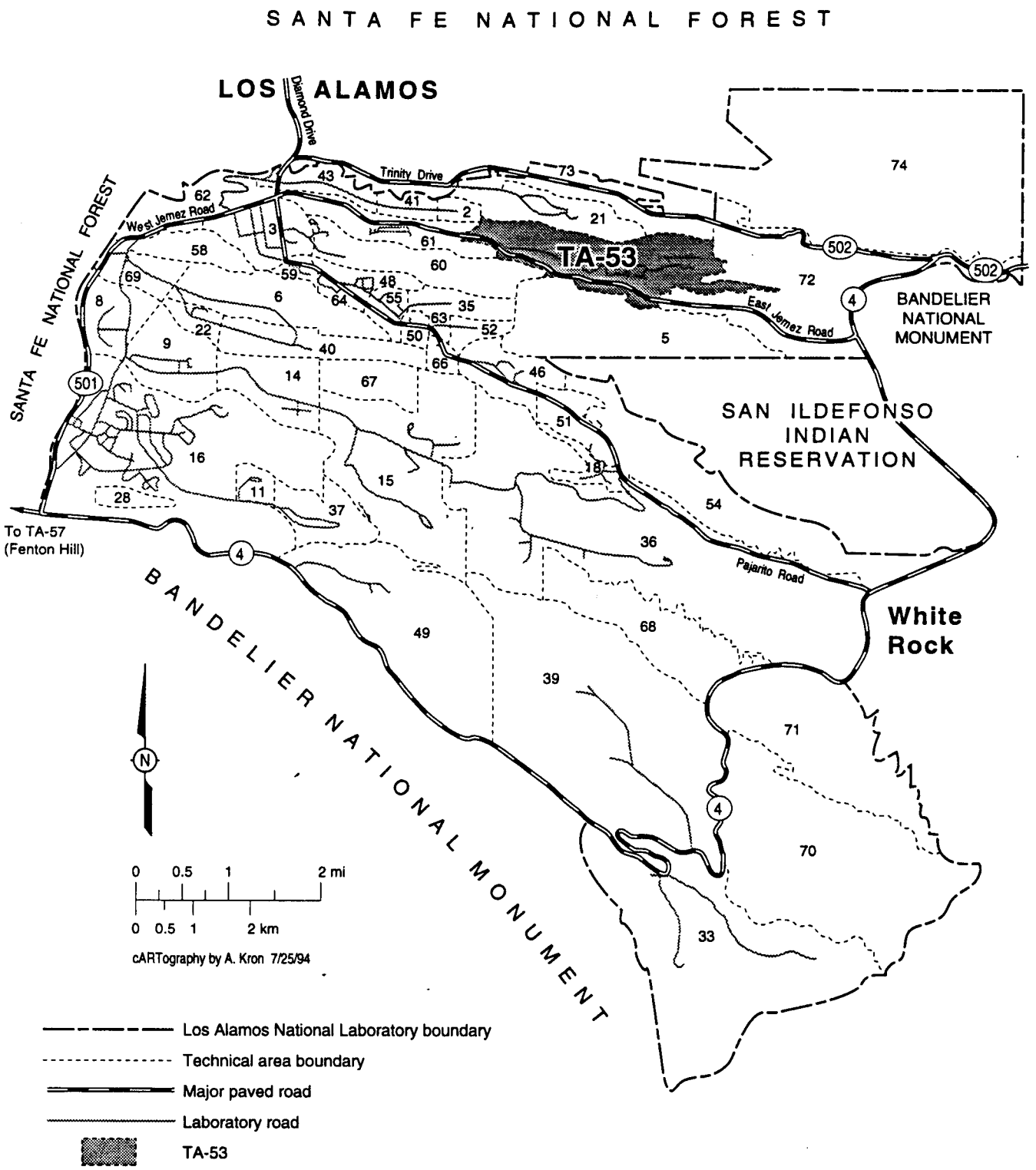


Figure 2-2. Los Alamos National Laboratory Technical Areas

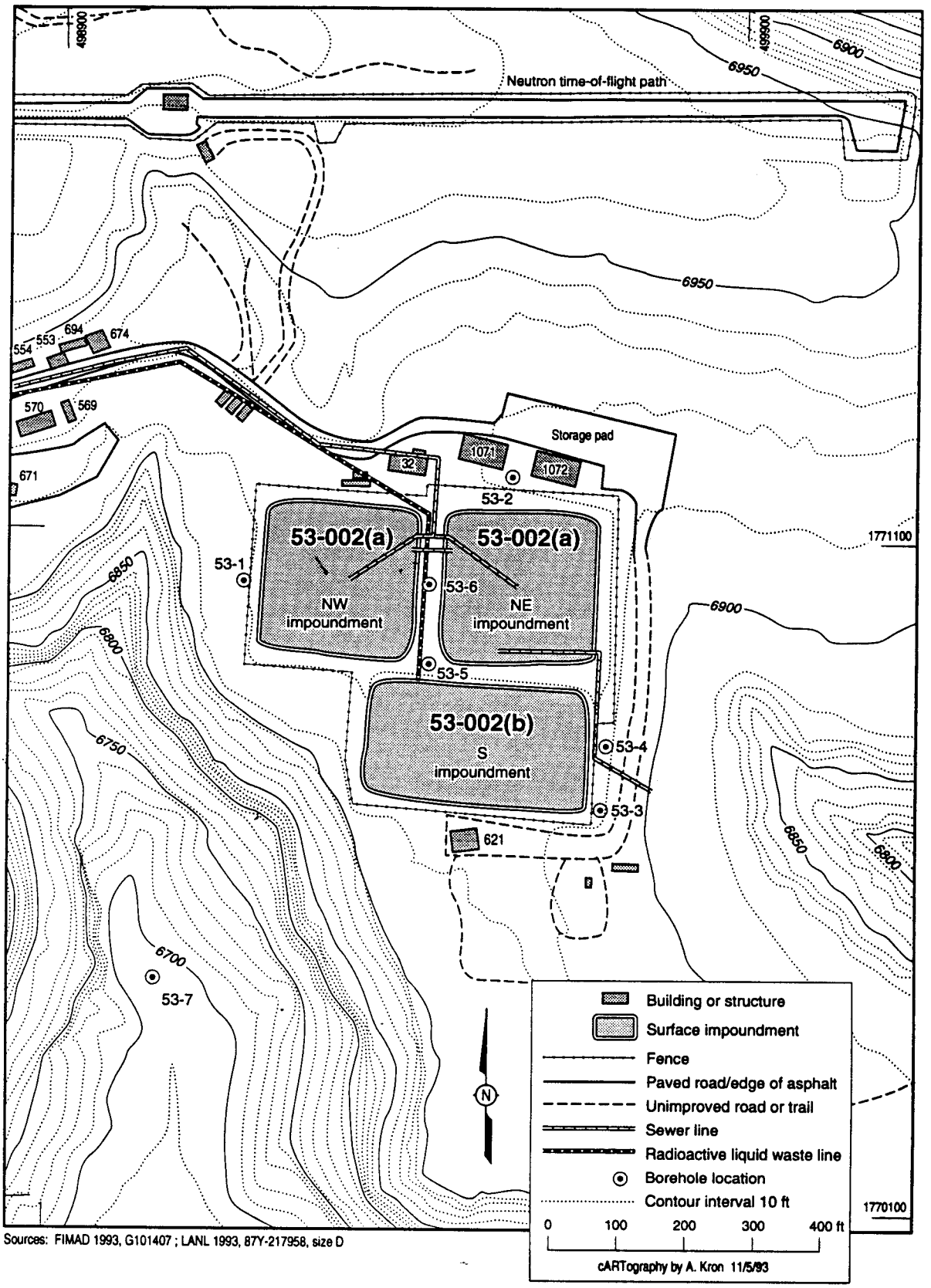
2.1.1.1 Design and Construction

The two surface impoundments addressed in this closure plan are collectively identified with Laboratory Structure No. TA-53-166; in this document, the two impoundments will be distinguished as TA-53-166 northeast (NE) and TA-53-166 northwest (NW). The two surface impoundments, constructed in 1969, are 210 ft long by 210 ft wide, and are 6 ft deep. The impoundments have liquid storage capacities of 1,600,000 gal. each. In 1985, an additional surface impoundment was constructed adjacent to and on the south side of the two surface impoundments (LANL, 1992a). Appendix A contains "as-built" drawings for these two impoundments.

The surface impoundment dikes were constructed of materials obtained on site by excavating and pulverizing the welded volcanic tuff bedrock (Bandelier Tuff). The Bandelier Tuff in this area is an ashfall and ashflow tuff that was welded to varying degrees. The pulverized tuff is essentially a cohesionless soil (Boyd, 1966) that was placed in layers and compacted to 90% of the maximum density as defined by the Modified Proctor (ASTM D1557) (LANL, 1992a).

The impoundments were built with side slopes of 2:1 (horizontal:vertical). The base elevation of both impoundments is 6,916 ft above sea level (ASL), with maximum water elevations of 6,920 ft ASL. The elevation at the top of the berms ranges from a minimum of 6,922 ft ASL on the south, east, and west sides, to 6,927 ft ASL on the north side. There is a 32-ft-wide berm separating the two impoundments (LANL, 1992a). Figure 2-3 depicts the elevations of the berms and adjacent area.

The liners in the two impoundments consist of a 4-in. layer of bentonite clay on the base of the impoundment and a gunite liner on the sidewalls. The clay liners were compacted to 95% of the maximum density as defined by the Modified Proctor (ASTM D1557). Typically, bentonite clay liners compacted to 95% of the Modified Proctor should yield a permeability of less than the standard 1×10^{-7} cm/sec. The 4-in.-thick bentonite clay liners in the impoundments are expected to have a saturated hydraulic conductivity of approximately 10^{-10} cm/sec (Fernandez et al., 1987). The gunite liners consist of approximately 4 to 6 in. of cement slurry without aggregate (shotcrete) that was sprayed onto the sides of the impoundments (LANL, 1992a). The Part B application for the impoundments (LANL, 1992a)



Sources: FIMAD 1993, G101407 ; LANL 1993, 87Y-217958, size D

Figure 2-3. Current Configurations of the TA-53 Surface Impoundments

proposed stability analysis of the dikes, including geotechnical testing of the soils, foundation materials, and fill materials used to construct the impoundment dikes and bentonite clay liners, in order to meet RCRA permitting requirements. Because the Laboratory decided to close rather than permit the impoundments, these tests were not performed.

2.1.1.2 Operation and Maintenance

The NE and NW impoundments were originally designed as total retention, evaporation ponds. The impoundments received sanitary as well as radioactive and industrial wastewaters (LANL 1992a). The initial design included an emergency overflow system that discharged to the south of the NE and NW impoundments. This system consisted of an overflow pipe connecting the two impoundments and a discharge pipe that ran southward through the impoundment berm and terminated immediately after it emerged from the berm. An outfall structure, with a blank weir plate, was located at the junction of these pipes. This design prevented any discharges. When the impoundments became operational in the early 1970s, it became clear that discharges would need to be made. Approximately one year after becoming operational, the blank weir plate was replaced with a notched weir plate to allow discharge and flow measurement. An automatic flow measuring device was added that kept continuous record of all discharges. The effluent from the discharge pipe flowed into an east-west trending ditch that drained eastward into a small tributary of Los Alamos Canyon. Studies of the impoundment discharges conducted from 1979 through 1985 showed that the effluent infiltrated quickly into the surface, usually within 400 to 800 meters of the outfall. The effluent stream did not reach the bottom of Los Alamos Canyon (LANL 1980, LANL 1981, LANL 1982, LANL 1983, LANL 1984, LANL 1985, LANL 1986). Laboratory staff familiar with the past operation of the impoundments reported that discharges to the south into Sandia Canyon were not made, nor were the impoundment berms ever overtopped.

The two-impoundment system is rated at 120,000 gal. per day on a flow-through treatment basis. Although the piping is arranged to operate the impoundments in any configuration, normal operation is for flow to proceed through the system from the NW impoundment to the NE impoundment.

In October 1978, the Laboratory received a National Pollutant Discharge Elimination System (NPDES) permit for an outfall located near the southeast corner of the NE impoundment. The effluent drained into a small tributary canyon of Los Alamos Canyon (the same canyon that had previously received discharges from the impoundments). When the decision was made to discharge to the outfall, effluent was sampled according to the NPDES permit requirements. Parameters included biological oxygen demand, chemical oxygen demand, total organic carbon, and total suspended solids, as well as pollutants specified in the NPDES permit. Chlorine was sometimes added to the impoundments to reduce the total suspended solids and biological oxygen demand below the NPDES limits before discharge (LANL, 1992a).

In 1985, a third impoundment was constructed south of the two existing impoundments to accommodate increased wastewater flows and allow the system to operate in a retention and evaporation mode. In 1989, this south impoundment, TA-53-166, was diverted into service as a total retention radioactive liquid waste storage/evaporation impoundment (LANL 1992a). The NE and NW impoundments then received only nonradioactive sanitary wastewater.

Discharges of sanitary wastewater to the NE and NW impoundments continued until February 2, 1993, when the TA-53 sanitary wastewater system was connected to the TA-46 Sanitary Wastewater System Consolidation (SWSC) Plant. Since that time, sanitary wastewater has occasionally been added to the NE and NW impoundments, as needed, to keep the sediments from drying out. However, there have been no discharges of wastewater from the impoundments since January 31, 1993. Figure 2-3 depicts the current configuration of the three impoundments including the piping and outfall.

Before the south impoundment was constructed in 1985, it is believed that discharges through the NPDES outfall occurred on a continuous basis. After the south impoundment was constructed, the discharges occurred less frequently. Typically, several months would elapse between discharges. Beginning in January 1992, the impoundments were operated on a continuous discharge basis. Discharge continued until February 1, 1993. Average monthly discharge rates for the period October 1978 through January 1993 are presented in Table 2-1. Records of discharges prior to October 1978 do not exist.

Table 2-1. Average Monthly Discharge Rate (Millions of Gallons per Day) From TA-53 Sanitary Impoundments

Year	Month											
	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
1978	NI	NI	NI	NI	NI	NI	NI	NI	NI	0.009	0.03	0.02
1979	0.016	0.02	0.018	0.01	0.0144	0.013	0.0068	0.0121	0.0033	0.006	0.014	0.0192
1980	0.0187	0.02	0.013	0.013	0.0095	0.00049	0.0035	0.0114	0.0164	0.0185	0.0212	0.0269
1981	0.0206	0.0216	0.0195	0.0149	0.0086	0.0032	0.0142	0.0196	0.0222	0.0187	0.0214	0.0259
1982	0.0241	0.0264	0.0169	0.0162	0.0186	0.0159	0.0125	0.0211	0.0179	0.0152	0.0207	0.0298
1983	0.0258	0.0224	0.0167	0.0083	0.0013	0.0075	0.0046	0.0134	0.0071	0.0168	0.0132	0.0159
1984	0.0193	0.0154	0.0165	0.0078	0.0075	0.0007	0.0058	0.0159	0.0116	0.0232	0.0130	0.0162
1985	0.0153	0.0153	0.0154	0.0133	0.0083	0.0072	0.0049	0.0104	0.0000	0.0000	0.0000	0.0000
1986	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0124	0.0000	0.0000	0.0000	0.0066	0.0045
1987	0.0075	0.0090	0.0207	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1988	0.0000	0.0000	0.0129	0.0009	0.0095	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0106
1989	0.0106	0.0442	0.0535	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
1990	0.0310	0.0573	0.0512	0.0544	0.0058	0.0326	0.0000	0.0000	0.0000	0.0000	0.0429	0.0000
1991	0.0142	0.0912	0.0284	0.0000	0.0000	0.0000	0.0390	0.0199	0.0009	0.0000	0.0000	0.0000
1992	0.0073	0.0184	0.0068	0.0065	0.0065	0.0080	0.0028	0.0062	0.0057	0.0029	0.0063	0.0081
1993	0.0102	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

Table 2-1. Average Monthly Discharge Rate (Million of Gallons per Day) From TA-53 Sanitary Impoundments (continued)

NOTES:

NI - No information available for discharges prior to October 1978.
ND - No discharge; discharge from the impoundments was stopped on February 1, 1993.

The NE and NW impoundments are each equipped with two Aqua Aerobics surface turbine aerators for aeration and enhanced evaporation to minimize the volume of water discharged to the outfall. In winter, ice forms on these impoundments, and the aerators are turned off. The aerators have also been turned off during a discharge to the outfall to prevent unnecessary disturbance of sludge and other bottom sediments (LANL, 1992a).

On occasion, water from the NE and NW impoundments was diverted to the adjacent south impoundment to maintain appropriate liquid levels and keep the liner weighted down. Later, these diversions were stopped and clean water was added to the south impoundment.

Before 1989, liquid radioactive wastewater was discharged to the two north impoundments. Special provisions have, therefore, been adopted for working in the area of the impoundments. These include treating all equipment associated with the impoundments as radioactive, and working in close coordination with the Health Physics Operations Group, EHS-1, when disposing of this equipment or working in the area of the impoundments (LANL, 1992a).

2.1.1.3 Overtopping Controls

The maximum water level in the impoundments was set to allow for at least 2 ft of freeboard. The 100-year, 24-hour storm event for the region is approximately 3 in. Therefore, in the event of a 100-year, 24-hour storm, multiplied by 1.3 to account for run-off from the dikes, the freeboard would be at 20.1 in., or 1.675 ft. The freeboard is visually inspected daily (LANL, 1992a).

A pipe in the NE impoundment would allow discharge out the NPDES-permitted outfall in the event the impoundment reached high levels; however, it is still necessary to perform inspections for freeboard since there is a potential for overtopping if influent or precipitation exceeds the flow capacity of the NPDES discharge (LANL, 1992a).

The impoundment berms serve as manmade barriers for flood control and drainage, as shown in Appendix A. In addition, natural drainage around the surface impoundments transports surface run-off away from the impoundments (LANL 1992a).

2.1.1.4 Erosion Controls

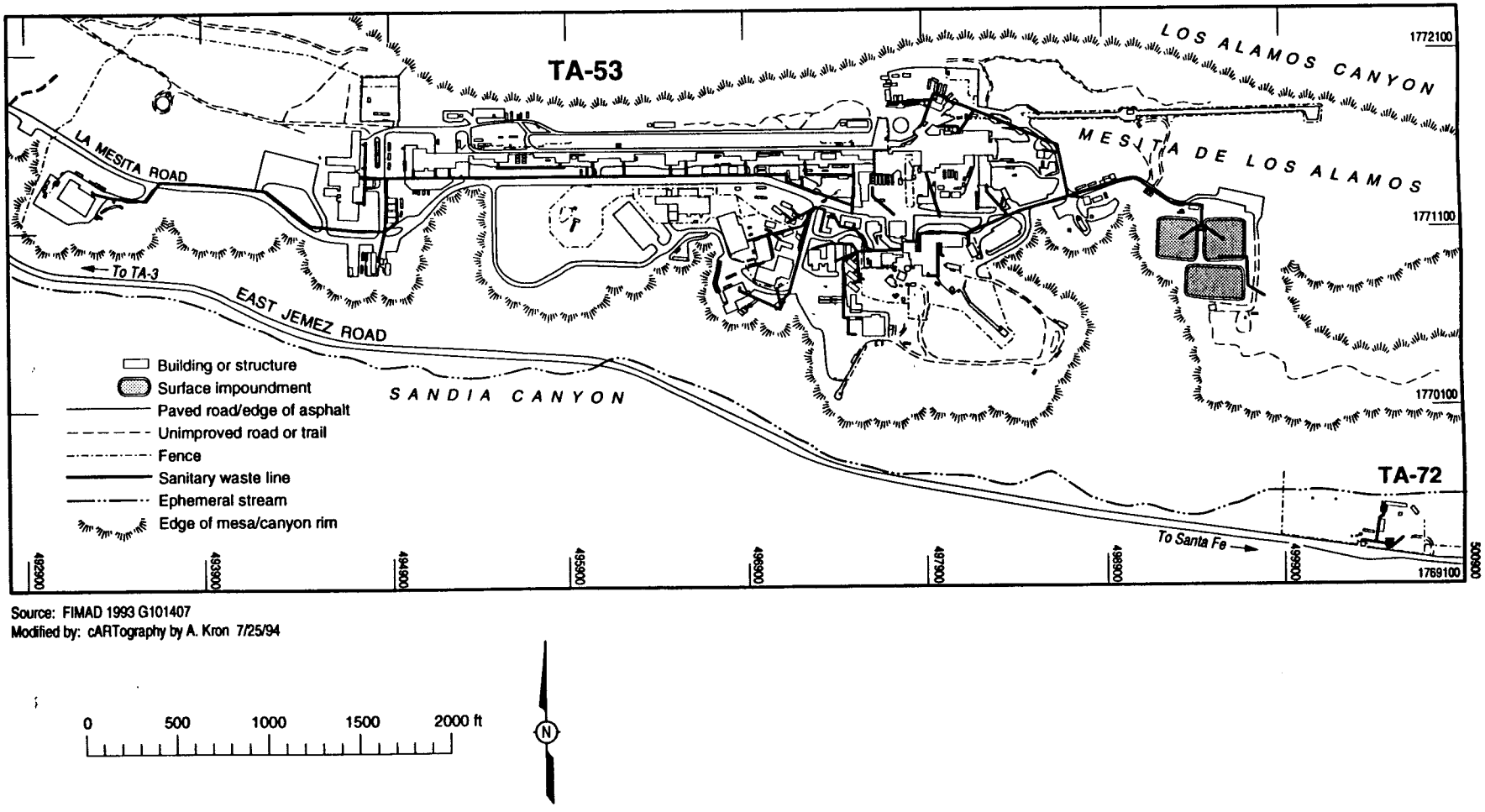
The mechanism for causing erosion of the dike slope is direct rainfall on the dikes. The site is in a semiarid region. The average annual rainfall is less than 18 in., most of which comes during the months of April through October. The slopes were seeded to encourage vegetation growth; therefore, erosion of the dike material is not expected to be significant (LANL, 1992a).

2.1.1.5 Sources and Types of Waste

The wastes in the impoundments at the time they were removed from service were wastewaters and the sludge contained in the bottom of the impoundments. The TA-53-166 NE and NW impoundments received sanitary waste and small amounts of industrial wastes since their construction in 1969; they also received radioactive waste until 1989. As a result of past disposal practices, mixed waste may have been introduced into the impoundments. Chapter 3.0 presents the results of past sampling and analysis of water and sludge. Several hazardous constituents have been detected. Administrative controls have been implemented at TA-53 to prevent mixed waste from entering the influent to the impoundments. LANL Administrative Requirement 10-3, which prohibits disposal of chemicals to sanitary sewers, has been in effect since June 1990, prior to RCRA regulation of the impoundments. LANL Environmental Protection Group (ESH-8) staff recall that posting of signs prohibiting chemical disposal to sanitary sewers was begun as early as 1986.

The TA-53 surface impoundments received all sanitary wastewaters and most radioactive wastewaters generated at TA-53. Liquid waste generated on site was transferred to the impoundments via sanitary waste sewer lines, shown in Figure 2-4. Sanitary wastes from one holding tank (TA-53-1016) were trucked to the impoundments. Janitor sinks in the main buildings and some chemical sinks drained into the surface impoundments (DOE, 1987). Sources of waste discharges within TA-53 impoundments are identified in Appendix B.

Historically, sanitary sewage waste from septic tanks and sewage pumped from manholes and lift stations were trucked from other TAs to the TA-53 NE and NW impoundments. This practice may have started in the 1970s. These wastes probably came from all the TAs having



Source: FIMAD 1993 G101407
Modified by: cARTography by A. Kron 7/25/94

Figure 2-4. Locations of Sanitary Sewer Lines in TA-53

septic tanks except TA-21 and perhaps TAs-2, 41, 43, and 73. All sanitary sewage waste originating at TA-21 was probably disposed of at the TA-21 treatment plant. All sanitary sewage waste originating from TAs-2 and 41 was probably disposed of at TA-3 because these TAs have lift stations that are connected to TA-3. All sanitary sewage waste originating at TA-43 was probably disposed of at the treatment plant in TA-3 because it was closer than TA-53. TA-73 was connected to the county sewer system and all the sanitary sewage waste from this area was probably disposed of in the county system. Beginning in 1989 or 1990, for a period of about two years, it became a standard practice to truck septic tank wastes to TA-53 rather than to the wastewater treatment plants in order to reduce the biochemical oxygen demand load on the treatment plants. All of the following TAs probably contributed sanitary sewage waste to the TA-53 impoundments during this period: TAs-3, 6, 9, 11, 15, 16, 18, 33, 36, 37, 39, 40, 46, 49, 52, 53, 54, 66, 69, and 72. This practice was discontinued in early July 1991 (LANL, 1992a). Currently, records exist that document the pumping and disposal of the septic tank waste since September 1991. The records prior to September 1991 were inadvertently thrown away by the disposal contractor and no longer exist. Information on septic tanks that may be sources of waste discharged to the surface impoundments is summarized in Appendix B.

The sludge has never been removed from the surface impoundments. Based on previous sampling efforts, the thickness of the sludge ranges from 3 to 18 in. (DOE, 1989).

It is unknown whether mixed wastes were disposed of in the surface impoundments. If they were, it is unknown what types of mixed wastes were disposed. Past sampling efforts indicate the presence of very low levels of some hazardous constituents (See Section 3.1). Based on chemical analysis, it is impossible to determine whether these hazardous constituents were derived from listed wastes, characteristic wastes, or non-RCRA wastes. Listed wastes can only be determined by knowing how the wastes were generated and knowing detailed information regarding the chemical composition of the material before it became a waste. Available information on sources on sources of waste is summarized in Appendix B.

2.1.2 Topographic Maps

A topographic map of the area near TA-53 surface impoundments is shown in Figure 2-5. Contour lines on this figure are at intervals of ten feet. This is sufficient to detail natural drainage in the vicinity of the surface impoundments.

2.1.3 Wells

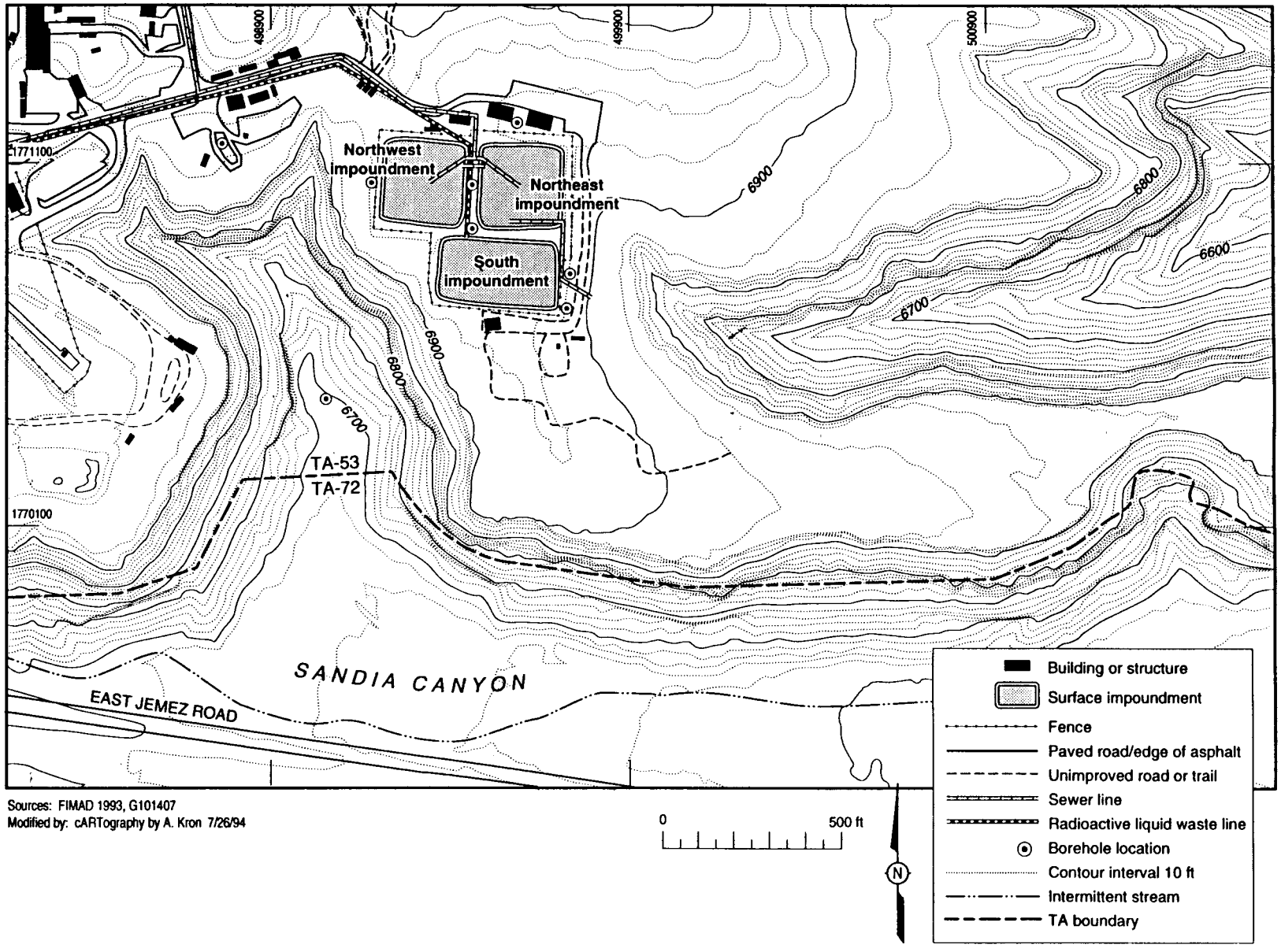
The municipal and industrial water supply for the Laboratory and the surrounding community is from fifteen deep wells in three well fields and one gallery (industrial use). These water-supply wells are described in Section 2.1.3 of the Part B permit application for the impoundments (LANL, 1992a). The nearest water supply wells to the TA-53 impoundments are Otowi-4, located in Los Alamos Canyon 2800 feet northwest of the impoundments, and PM-3, located in Sandia Canyon 3100 feet southeast of the impoundments. A test well, TW-3, is located near Otowi-4. Table 2-2 includes a summary of the location, depth to top of main aquifer, and Laboratory environmental surveillance organic data from these wells.

2.1.4 Wind Rose

Surface winds are light at Los Alamos, averaging 7 mph. Wind speeds are strongest from March through May, and weakest in December and January. The strongest winds are generally southwesterly to northwesterly and occur in the afternoon or evening. Annual wind roses for four areas at the Laboratory are presented in Section 2.1.4 of the Part B permit application for the impoundments (LANL, 1992a).

2.1.5 Land Use

The communities closest to the Laboratory are Los Alamos, just north of the Laboratory; and White Rock, east-southeast of the Laboratory (Figure 2-1). The total population of Los Alamos County is approximately 19,000. Most of Los Alamos County, and adjoining portions of neighboring Sandoval, Rio Arriba, and Santa Fe Counties, is undeveloped. The only significant developments in Los Alamos county are the Laboratory facilities and the associated residential communities. Land use for the area surrounding TA-53 and the



Sources: FIMAD 1993, G101407
Modified by: cARTography by A. Kron 7/26/94

Figure 2-5. Topographic Map of Area Around TA-53 Surface Impoundments

Table 2-2. Summary of Groundwater Data and Environmental Surveillance Organic Analyses From Wells Near TA-53 Surface Impoundments

	Otowi-4	**PM-3**	**TW-3**
Location	Midreach of Los Alamos Canyon about 2800 ft. northwest and upgradient of surface impoundments	Midreach of Sandia Canyon about 3100 ft. west-southwest and downgradient of surface impoundments	Midreach of Los Alamos Canyon just upstream of the DP Canyon confluence, about 400 feet east of Otowi-4
Depth to Top of Main Aquifer	780 feet in 1990 (Stoker et al, 1992)	765 feet in 1989 (Stoker et al, 1992)	790 feet in 1990 (LANL 1992b, p. XI-22)
Organic Analyses 1990	**Analyzed**: volatiles, semi-volatiles, pesticides, herbicides, PCBs **Detected above LOQ**: bis-2-ethyl hexyl phthalate at 32 μg/L (LANL 1992b, p. VI-19, 20, and p. G-42) (LOQs in Appendix C).	Not sampled for environmental surveillance program organics (LANL 1992b, p. VI-19, 20, and p. G-42)	**Analyzed**: volatiles, semi-volatiles, pesticides, herbicides, PCBs **Detected above LOQ**: none (LANL 1992b, p. VI-19, 20, and p. G-42) (LOQs in Appendix C).
Organic Analyses 1991	Not sampled for environmental surveillance program organics (LANL 1993a, p. VII-19)	**Analyzed**: volatiles, semi-volatiles, PCBs **Detected above LOQ**: none (LANL 1993a, p. VII-19) (LOQs in Table D-21)	Not sampled for environmental surveillance program organics (LANL 1993a, p. VII-19)
Organic Analyses 1992	Not sampled for environmental surveillance program organics (Alan Stoker, personal communication, 1-5-94)	Not sampled for environmental surveillance program organics (Alan Stoker, personal communication, 1-5-94)	Not sampled for environmental surveillance program organics (Alan Stoker, personal communication, 1-5-94)
Organic Analyses 1993	**Analyzed**: volatiles, semi-volatiles, pesticides, herbicides, PCBs **Detected above LOQ**: none (Alan Stoker, personal communication, 1-5-94).	Not sampled for environmental surveillance program organics (Alan Stoker, personal communication, 1-5-94)	Not sampled for environmental surveillance program organics (Alan Stoker, personal communication, 1-5-94)

LOQ - limits of quantification

Laboratory is described in Section 2.1.5 of the Part B permit application for the impoundments (LANL, 1992a).

2.2 Location Information

A detailed description of information related to the location of the surface impoundments is provided in Section 2.2 of the Part B permit application for the impoundments (LANL, 1992a). This information includes descriptions of:

- The impoundment location with respect to floodplains (Section 2.2.2 of the Part B application);
- The soils present at TA-53 and the Laboratory (Section 2.2.3 of the Part B application);
- The regional geology of the Laboratory and the site-specific geology of TA-53 (Section 2.2.4 of the Part B application); and
- Groundwater conditions for the Laboratory and TA-53 (Section 2.2.5 of the Part B application).

This information is summarized in the following paragraphs; more detailed descriptions are available in the above-referenced sections of the Part B permit application (LANL, 1992a). Groundwater information is also provided in Chapter 4.0 of this closure plan.

The TA-53 surface impoundments are not within the 100-year floodplain boundary (LANL, 1992a). These impoundments are at the top of an east-west-trending mesa bounded on the north and south by deep east-west-trending canyons. The base elevation of the impoundments is 6,916 ft ASL. The bottom elevation of the canyon south of the impoundments is 6,680 ft ASL.

The soils in TA-53 are classified as mesic rock outcrop. This land type is found on moderately sloping to steep mesa tops and edges and consists of about 65% tuff rock

outcrop; 5% very shallow, undeveloped soils on tuff bedrock; 5% Hackroy soils; and 25% narrow escarpments. The Hackroy soils range from a sandy loam in the top 8 cm of depth, to a clay loam in depths of from 8 to 30 cm. Permeability rates range from 5 to 15 cm per hour in the top layers, to 0.5 to 0.15 cm per hour or less in the lower layers. The shrink-swell potential is low. The available water-holding capacity is 0.11 to 0.21 cm per cm, and the soil pH varies from 6.6 to 7.8 (LANL, 1992a).

The Laboratory is on the east-central edge of the Jemez Mountains. The Jemez Mountains are formed by a complex pile of volcanic rocks along the northwest margin of the Rio Grande rift in north-central New Mexico. The immense volume of Pliocene and Quaternary extrusive rocks that represents the Jemez volcanic field covers an area of over 30 mi east-to-west and 50 mi north-to-south, and is over 4,000 ft in thickness near the center (LANL, 1992a).

TA-53 is on the western part of the Pajarito Plateau, which forms an apron of volcanic and sedimentary rocks around the eastern flanks of the Jemez Mountains. The plateau is aligned approximately north-south and is about 20-25 mi in length and 5 to 10 mi wide. It is bounded on the east by White Rock Canyon (which contains the Rio Grande), on the north and northeast by the Puye escarpment, and on the west by Sierra de los Valles. The Pajarito Plateau slopes gently eastward from an elevation of about 7,500 ft near the mountains towards the Rio Grande, where it terminates at an elevation of about 5,400 feet in steep slopes and cliffs formed by down cutting of the river. The plateau has been dissected into a number of narrow mesas by southeastward-trending intermittent streams.

The oldest unit exposed around the margins of the Pajarito Plateau and penetrated by drill holes on the plateau is the Miocene Santa Fe Group. The Santa Fe in this area consists of friable to moderately well-cemented siltstone and sandstones. Overlying the Santa Fe Group are the volcanic rocks of the Tschicoma Formation which consist of latite, quartz-latite flows, and pyroclastic rocks. Interfingering with the Tschicoma and overlying the Santa Fe Group are the conglomerate and fanglomerate rocks of the Puye Formation. Overlying and interfingering with the conglomerate of the Puye Formation are the basaltic rocks of Chino Mesa. The Pajarito Plateau is capped for the most part by the Bandelier Tuff, which ranges in thickness from about 1,050 ft along the western edge of the plateau to about 260 ft just west of White Rock.

The only aquifer of the Pajarito Plateau capable of providing municipal and industrial water supply is in rocks of the Santa Fe Group and Puye Formation. The Tschicoma Formation and the Bandelier Tuff, west of the Pajarito Plateau on the flank of the mountains, contain small, localized bodies of perched water. The Bandelier Tuff contains no perched water beneath the Pajarito Plateau.

3.0 WASTE CHARACTERIZATION

This chapter presents existing information concerning the chemical characteristics of the wastes in the Technical Area (TA)-53 surface impoundments and describes waste characterization activities planned as part of closure. Section 3.1 presents the results of previous sampling and analysis activities. Sections 3.2 through 3.6 describe waste sampling and analysis activities that will be performed during closure.

3.1 Results of Previous Analyses

The sludge and water in the two TA-53 surface impoundments have been characterized during several sampling efforts. The 1988 and 1991 sampling efforts were based on a limited number of samples. The 1988 and 1991 results are presented to summarize all existing waste characterization data; presentation of these results does not imply that the number and location of samples were sufficient for characterization. The 1992 sampling was more comprehensive and was performed using a sampling and analysis plan approved by NMED.

The DOE Headquarters Environmental Survey sampled sludge from the two impoundments during 1988 (DOE, 1989). This sampling was performed to determine if the sludge had been contaminated from possible placement of Resource Conservation and Recovery Act (RCRA) wastes in the impoundments. Three composite samples were collected from each impoundment. Each composite was formed from subsamples collected at three locations. Therefore, the samples represent material collected from a total of nine locations. The subsamples consisted of grab samples collected using a pole-mounted beaker. Volatiles analysis was performed on one of the three subsamples rather than on the composite, so that volatiles would not be lost during compositing. Each sample was analyzed for volatile and semivolatile organics, metals, and gamma-emitting radionuclides. The results of analysis for volatiles, semivolatiles, and metals above detection limits are presented in Tables 3-1 through 3-3, respectively.

These samples were analyzed for volatile and semivolatile organic compounds using the Environmental Protection Agency (EPA) 1987 Contract Laboratory Program (CLP) Statement of Work (SOW) for Organic Analysis. These methods consisted of purge and trap gas

Table 3-1. Volatile Organic Compounds Detected in Sludge Samples

Sample Location [a]	Acetone, mg/kg	2-Butanone, mg/kg	Carbon Disulfide, mg/kg	Chloroform, mg/kg	4-Isopropyl-toluene, mg/kg	Toluene, mg/kg	1,2,4-Trimethyl-benzene, mg/kg
Subpart S Action Level	8000	4000	8000	100		20000	
1993 Soil SAL	8000	4000	7.4	0.21		890	
TCLP		4000		120			
1988 Samples							
NW LAGOON - 01	0.66 B					3.6 J	
NW LAGOON - 02						0.2	
NW LAGOON - 03	0.97 B					0.87	
NE LAGOON - 04	4.9						
NE LAGOON - 05	0.25						
NE LAGOON - 06	9.0 B						
July 1991 Samples							
AB-53-NW-1S						0.068	
AB-53-NW-2S						0.042	
AB-53-NW-4SQ						0.025	
April 1992 Samples							
53-NW-A-S					0.025		
53-NW-B-S	0.03						
53-NW-E-S	0.087						

Table 3-1. Volatile Organic Compounds Detected in Sludge Samples (Continued)

Sample Location [a]	Acetone, mg/kg	2-Butanone, mg/kg	Carbon Disulfide, mg/kg	Chloroform, mg/kg	4-Isopropyl-toluene, mg/kg	Toluene, mg/kg	1,2,4-Trimethyl-benzene, mg/kg
53-NW-G-S						0.1	
53-NW-H-S						0.0066	
53-NW-I-S	0.14		0.011				0.019
53-NW-L-S						0.092	
53-NW-N-S			0.021				
53-NW-M-S	0.23	0.034	0.006			0.035	
53-NW-N-S-QA	0.11		0.014				
53-NW-O-S						0.061	
53-NW-O-S-QA			0.5			0.2	
53-NE-B1-S	0.031						
53-NE-C1-S	0.16		0.0094				
53-NE-D1-S	0.025						
53-NE-S-S	0.12						
53-NE-T-S				0.011			
53-NE-W-S				0.0054			
53-NE-X-S	0.066						
53-NE-Y-S				0.0069			
53-NE-Z-S	0.17			0.0086			

Table 3-1. Volatile Organic Compounds Detected in Sludge Samples (Continued)

Notes:

[(a)] NW indicates northwest impoundment, NE indicates northeast impoundment, A through D1 indicate sample block locations shown in Figures 3-1 and 3-2, S indicates sludge sample, Q and QA indicate duplicate samples.

Data Flags:

B - Analyte was detected in analytical method blank.

J - Analyte was positively identified, but numerical value may not be representative of amount actually present.

Table 3-2. Semivolatile Organic Compounds Detected in Sludge Samples

Sample Location [a]	Benzidine, mg/kg	Benzoic Acid, mg/kg	Benzyl Alcohol, mg/kg	Bis-2-ethylhexyl-phthalate, mg/kg	Di-n-butyl-phthalate, mg/kg	Fluoranthene, mg/kg	2-Methyl phenol, mg/kg	4-Methyl phenol, mg/kg	Pyrene, mg/kg
Subpart S Action Level	0.003			50	8000		4000	4000	
1993 Soil SAL				50	8000	3200	4000	4000	2400
TCLP									
1988 Samples									
NW LAGOON - 01									0.05 JB
NW LAGOON - 02			0.057 J				0.03 J	1.1	
NW LAGOON - 03						0.088 J			0.12 JB
NE LAGOON - 04		0.11 JB							
NE LAGOON - 05									
NE LAGOON - 06									
July 1991 Samples									
AB-53-NW-1S	3.9[b]			1.2	1.4				
AB-53-NW-2S	1.9			1.1					
AB-53-NW-3S					1.4				
April 1992 Samples									
53-NW-A-S		4.4		6.3					
53-NW-B-S		4.2		4.3					
53-NW-C-S				1.8	1.3				
53-NW-D-S		5.2		2.7					

Table 3-2. Semivolatile Organic Compounds Detected in Sludge Samples (Continued)

Sample Location [a]	Benzidine, mg/kg	Benzoic Acid, mg/kg	Benzyl Alcohol, mg/kg	Bis-2-ethylhexyl-phthalate, mg/kg	Di-n-butyl-phthalate, mg/kg	Fluoranthene, mg/kg	2-Methyl phenol, mg/kg	4-Methyl phenol, mg/kg	Pyrene, mg/kg
53-NW-E-S		4.6		5.5					
53-NW-F-S				2.1					
53-NW-H-S				2.1					
53-NW-I-S		3.8		22.7					
53-NW-J-S				13.3					
53-NW-K-S				2.9					
53-NW-N-S		3.9		5.3					
53-NW-M-S				8.8					
53-NW-N-S-QA		2.7		6.6					
53-NW-O-S				1.3					
53-NW-O-S-QA				0.99					
53-NE-A1-S				1.1					
53-NE-B1-S				1.3	3.8				
53-NE-C1-S				2.6					
53-NE-D1-S					1.1				
53-NE-Q-S					4				
53-NE-Q-S-QA					1.5				
53-NE-R-S					0.98				
53-NE-S-S				2	1.9				

Table 3-2. Semivolatile Organic Compounds Detected in Sludge Samples (Continued)

Sample Location [a]	Benzidine, mg/kg	Benzoic Acid, mg/kg	Benzyl Alcohol, mg/kg	Bis-2-ethylhexyl-phthalate, mg/kg	Di-n-butyl-phthalate, mg/kg	Fluoranthene, mg/kg	2-Methyl phenol, mg/kg	4-Methyl phenol, mg/kg	Pyrene, mg/kg
53-NE-T-S		2.5		3.4					
53-NE-U-S				2	5.3				
53-NE-V-S					2.6				

Notes:
[a] NW indicates northwest impoundment, NE indicates northeast impoundment, A through D1 indicate sample block locations shown in Figures 3-1 and 3-2, S indicates sludge sample, Q and QA indicate duplicate samples.
[b] Shaded values are above proposed RCRA Subpart S action levels.

Data Flags:
B - Analyte was detected in analytical method blank.
J - Analyte was positively identified, but numerical value may not be representative of amount actually present.

Table 3-3. Metals Detected in Sludge Samples

Sample Location [a]	Ag, mg/kg	As, mg/kg	Ba, mg/kg	Be, mg/kg	Cd, mg/kg	Cr, mg/kg	Cu, mg/kg	Hg, mg/kg	Pb, mg/kg	Se, mg/kg	Zn, mg/kg
Subpart S Action Level	200	80	4000	0.2	40	400[b]		20			
1993 SAL	400	0.4	5600	0.16	80	400[b]	3000	24	500	400	24000
TCLP	100	100	2000		20	100		4	100	20	
1988 Samples											
NW LAGOON - 01			112 B				303	1.1			578
NW LAGOON - 02	4.9 B			0.59 B[c]		12.8	119	0.5			166
NW LAGOON - 03	7.1 B			0.67 B		17.7	241	0.49			385
NE LAGOON - 04			41.2 B				78.2				118
NE LAGOON - 05			85 B	0.9 B		14	97.6				178
NE LAGOON - 06			102 B	0.9 B			122				244
July 1991 Samples (results reported in mg/L)											
53-NW-1S	0.018	0.02	0.5								
53-NW-2S		0.03	0.57								
53-NW-3S		0.03	0.56			0.01					
53-NW-4SQ		0.03	0.63							0.03	
53-NE-1S											
53-NE-2S	0.015										
53-NE-3S	0.011										
April 1992 Samples											
53-NW-A-S	2.3	2.3	26.6			6.3		0.229	9.5		

Table 3-3. Metals Detected in Sludge Samples (Continued)

Sample Location [a]	Ag, mg/kg	As, mg/kg	Ba, mg/kg	Be, mg/kg	Cd, mg/kg	Cr, mg/kg	Cu, mg/kg	Hg, mg/kg	Pb, mg/kg	Se, mg/kg	Zn, mg/kg
53-NW-B-S	2.1	2.8	44.8			11.1		0.252	17.9		
53-NW-C-S		2.7	43.8			7.7		0.165	13.5		
53-NW-D-S		2	48.5			5.9		0.081	21.7		
53-NW-E-S	2.3	2.4	50.2			7.1		0.269	16.5		
53-NW-F-S		2.7	31.4			6.4		0.302	12.6		
53-NW-G-S		2.9	46.1			14.8		0.08	11.4		
53-NW-H-S		2.2	45.3			9.8		0.178	11.5		
53-NW-I-S	3.2	3.6	28.2		1.9	8.4		0.388	26.8		
53-NW-J-S	3.8	2.8	29.4		3.1	16.4		0.407	44.8		
53-NW-K-S		2.7	36		2.8	11.3		0.48	27.3	2.1	
53-NW-L-S		2.3	43.3			8.7		0.096	20.2	2	
53-NW-N-S	2	2.6	26			7.3		0.24	14.1		
53-NW-M-S	5.1	2.5	33.5			7.4		0.34	14.4		
53-NW-N-S-QA	1.5	3	33.2			7.6		0.159	13.3		
53-NW-O-S		2.3	28.5			6.9		0.108	13.5		
53-NW-O-S-QA		2.3	44.2			6.5		0.098	15.2	5.9	
53-NE-A1-S		2.2	28.9			7		0.057	6.1		
53-NE-B1-S		2.8	38.9			6		0.039	6.2	5.8	
53-NE-C1-S	2.5	2.4	15.3			3.6		0.101	5.3	2.6	
53-NE-D1-S		3	41.4			6.1		0.043	6.9	3.6	

Table 3-3. Metals Detected in Sludge Samples (Continued)

Sample Location [a]	Ag, mg/kg	As, mg/kg	Ba, mg/kg	Be, mg/kg	Cd, mg/kg	Cr, mg/kg	Cu, mg/kg	Hg, mg/kg	Pb, mg/kg	Se, mg/kg	Zn, mg/kg
53-NE-E1-S		2.8	34.9			5.6		0.046	5.1	4.5	
53-NE-Q-S		1.8	21.7			3.5		0.035	3.7	3.2	
53-NE-Q-S-QA		2.1	22.7			5.3		0.042	4.1	1.6	
53-NE-R-S		3.3	38.3			7.9		0.034	5.6	2.5	
53-NE-S-S		4.3	52.4			9.4		0.036	10.3	2.6	
53-NE-T-S	2.8	2.8	9.3			3		0.089	4.4	6.8	
53-NE-U-S		2.5	24.4			6.1		0.043	6.2	5.3	
53-NE-V-S		3.6	39.6			8.3		0.029	5.7		
53-NE-W-S		3.4	35.1			7.7		0.03	4.9		
53-NE-W-S-QA		4.8	33.8			11.3		0.05	6.8		
53-NE-X-S		3.9	36			7.7		0.019	5.4		
53-NE-Y-S		2.8	13.2			5.4		0.114	4.4		
53-NE-Z-S	2.6	2.5	22.6			6.4		0.429	4.4		

Notes:

[a] NW indicates northwest impoundment, NE indicates northeast impoundment, A through D1 indicate sample block locations shown in Figures 3-1 and 3-2, S indicates sludge sample, Q and QA indicate duplicate samples.

[b] Action level and SAL are for hexavalent chromium.

[c] Shaded values are above proposed RCRA Subpart S action levels and/or SALs.

Data Flags:

B - Analyte was present above the instrument detection limit but below the contract-required detection limit.

chromatography/mass spectrometry (GC/MS) for volatiles and GC/MS for semivolatiles. The samples were analyzed for total metals using methods based on the EPA 1987 CLP SOW for Inorganic Analysis. Most of the metals were analyzed using inductively coupled plasma atomic emission spectroscopy (ICP-AES); however, mercury analysis was performed by cold vapor atomic absorption spectroscopy (AAS) and lead analysis was performed by graphite furnace AAS. The Toxicity Characteristic Leaching Procedure (TCLP) was requested for metals and semivolatiles when concentrations exceeded certain calculated threshold limits. The threshold limits in mg/kg were numerically equal to 20 times the TCLP regulatory limit in mg/L. None of the results exceeded the TCLP threshold limits and TCLP analyses were not performed.

The results indicate that two volatiles and six semivolatiles were detected, although most of these results are suspected of being false positives (DOE 1989). For comparison with potential levels of concern, Tables 3-1 and 3-2 also include the proposed RCRA Subpart S action levels, 1993 Laboratory Installation Work Plan for Environmental Restoration (IWP) screening action levels (SALs) for soil (LANL 1993b), and TCLP screening levels[1]. All organic results were below all screening levels. Several metals were also detected. With the exception of beryllium, all results were below proposed RCRA Subpart S action levels for soil, 1993 IWP SALs for soil, and TCLP screening levels. Four of the six beryllium results were above the proposed RCRA Subpart S action level for soil and the 1993 SAL for soil.

The proposed RCRA Subpart S action levels and IWP SALs for soil are very conservative indicators of levels of contamination that could pose a health risk through ingestion. Under both the proposed RCRA Subpart S corrective action regulations and the Laboratory Environmental Restoration (ER) Project, constituents at concentrations below action levels do not present a human health risk. Constituents at concentrations above action levels do not necessarily pose a risk, but may require a more thorough evaluation to characterize risks.

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[1] The TCLP screening level is the minimum possible total concentration that could cause a solid waste to fail the TCLP and be designated as a hazardous waste. If a constituent is present below this level, the waste could not fail the TCLP even if all of the constituent was extracted. The screening level (mg/kg) is numerically equal to 20 times the TCLP regulatory limit (mg/L).

The sludge and water in the impoundments were sampled by the Laboratory's Environmental Protection Group (ESH-8) in July 1991. Samples of sludge and water were collected from three locations at each impoundment. Water samples consisted of grab samples collected at the mid-depth of the water column. Sludge samples were grab samples collected using a pole-mounted stainless steel beaker. The samples for volatile and semivolatile organic compounds were analyzed using methods comparable to EPA SW-846 methods. The samples for volatile organic analysis were analyzed using SW-846 Method 8260 (purge and trap GC/MS). The semivolatile organic compounds were analyzed with GC/MS using methods comparable to EPA Method SW-846 8270. The metals on the TCLP list were analyzed using the following methods: flame AAS for silver, cold vapor AAS for mercury, and ICP-AES for arsenic, barium, cadmium, chromium, lead, and selenium. All water samples were also analyzed for gross alpha and beta radioactivity. In addition, one water sample from each impoundment was analyzed for tritium and gamma-emitting radionuclides, and one sludge sample from each impoundment was analyzed for gamma-emitting radionuclides. Results for volatiles, semivolatiles, and metals above detection limits in sludge samples are presented in Tables 3-1 through 3-3, respectively. Detection limits for volatiles, semivolatiles, and metals below detection are presented in Appendices C, D, and E, respectively. The detection limits are presented to allow comparison with action levels to determine if nondetected constituents are below (or potentially below) action levels.

The volatiles analysis of sludge samples showed only toluene to be present above detection limits. Three semivolatile compounds, benzidine, di-n-butylphthalate, and bis-2-ethylhexylphthalate, were detected in sludge samples. With the exception of benzidine, organics were all well below proposed RCRA Subpart S action levels and 1993 IWP SALs. Both detected values of benzidine were above the proposed RCRA Subpart S action level. Metal results were not directly comparable to action levels because results were reported in mg/L rather than mg/kg.

No volatile organics were detected in any of the water samples. The only semivolatile organic detected was benzoic acid, which was detected in one sample at 15 μg/L. Detection limits for volatile and semivolatile organics below detection are presented in Appendices C and D, respectively. Results of analysis of water samples for metals are presented in Table 3-4.

Table 3-4. Metals Detected in Water Samples

Sample Location [a]	Ag, µg/L	As, µg/L	Ba, µg/L	Cd, µg/L	Cr, µg/L	Hg, µg/L	Pb, µg/L	Se, µg/L
Subpart S Action Level [b]	50	50	1000	10	50[c]	2	50	10
1993 Water SAL	170	50	2000	5	50	2	50	50
TCLP Regulatory Level	5000	5000	100000	1000	5000	200	5000	1000
MCL	50	50	2000	5	100	2	50	50
NM Standard	50	100	1000	10	50	2	50	50
July 1991 Samples								
AB-53-NW-1W	23		60					
AB-53-NW-2W			70					
AB-53-NW-3W			70					
AB-53-NE-1W			80					
AB-53-NE-2W			80					
AB-53-NE-3W			80					
April 1992 Samples								
53-NW-O-W		6.8	27.9	4.5	5.8		2.4	4.5
53-NW-O-W-QA		6.3	33.4	4.4	5.7		3.1	3.4
53-NE-Y-W		4.6	28.3	2.8	2.9			1.3
53-NE-Y-W-QA		4.8	28.5	2.5	2.4			

Table 3-4. Metals Detected in Sludge Samples (Continued)

Notes:

[a] NW indicates northwest impoundment, NE indicates northeast impoundment, O and Y indicate sample block locations shown in Figures 3-1 and 3-2, W indicates water sample, Q and QA indicate duplicate samples.

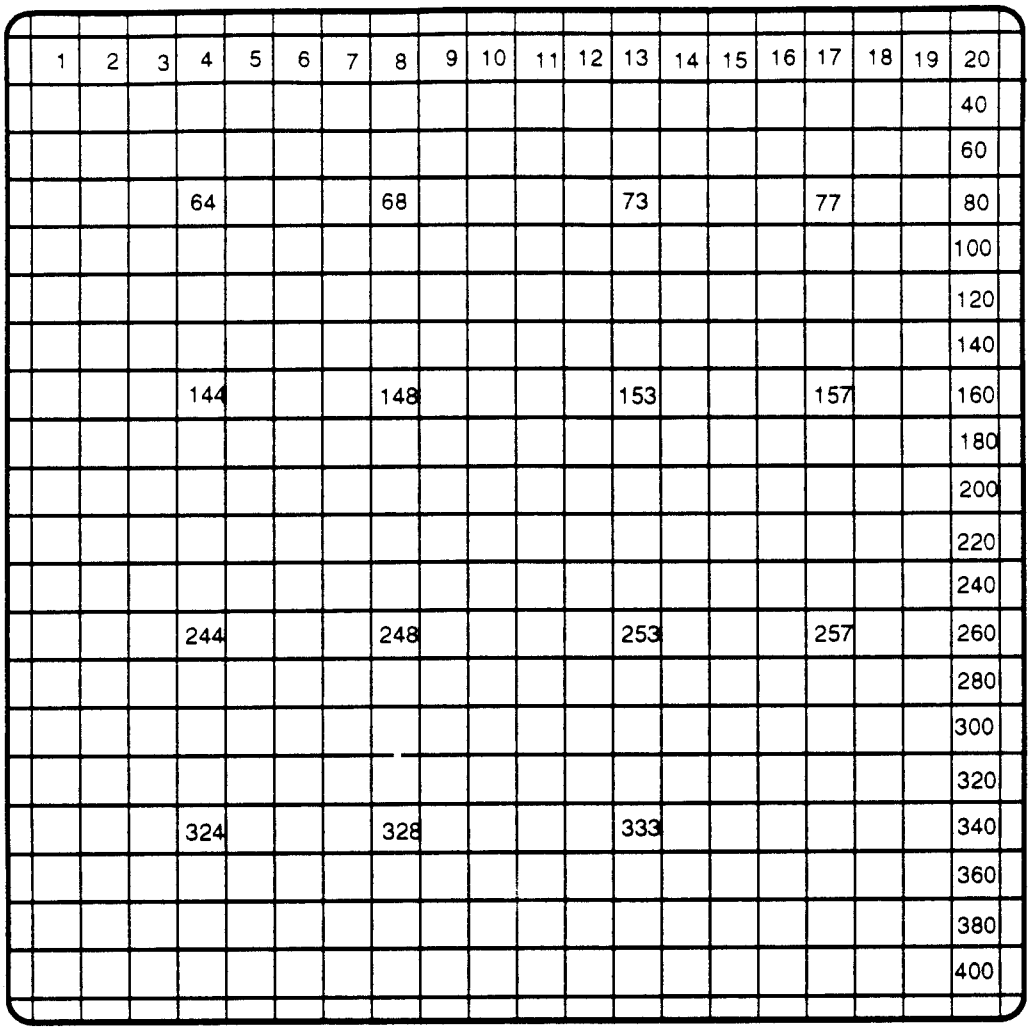
[b] Proposed Subpart S action levels are the MCLs that were in effect when the Subpart S regulations were proposed in July 1990.

[c] Action level is for hexavalent chromium.

Detection limits for metals in water are presented in Appendix E. All metals results were below proposed RCRA Subpart S action levels, 1993 IWP SALs, TCLP regulatory levels, Safe Drinking Water Act maximum contaminant levels (MCLs), and New Mexico water quality standards.

A third and more comprehensive round of sampling was performed by ESH-8 in April 1992 according to a sampling and analysis plan approved by NMED. Sludge samples were collected from 15 locations in each impoundment. Sample locations were defined using a uniform grid, as shown in Figures 3-1 and 3-2, for the northwest (NW) and northeast (NE) impoundments, respectively. Grab samples of sludge were collected using a pole-mounted stainless steel beaker. All sludge samples were analyzed for volatile organics, semivolatile organics, TCLP metals, and polychlorinated biphenyls (PCBs). Volatile organics were analyzed using SW-846 Method 8260. Semivolatile organics were analyzed using capillary column GC/MS methods consistent with SW-846 Method 8270. Metal analysis consisted of SW-846 Method 6020 (inductively coupled plasma-mass spectrometry [ICP-MS]) for arsenic, barium, cadmium, chromium, lead, silver, and selenium and cold vapor AAS Method 245.2 for mercury. PCB analysis was performed using gas chromatography electron capture (GCEC) methods consistent with SW-846 Method 8080. A sludge sample from each impoundment was also analyzed for organochlorine pesticides (SW-846 Method 8080), chlorinated herbicides (SW-846 Method 8150), pH, flashpoint, sulfide, and cyanide.

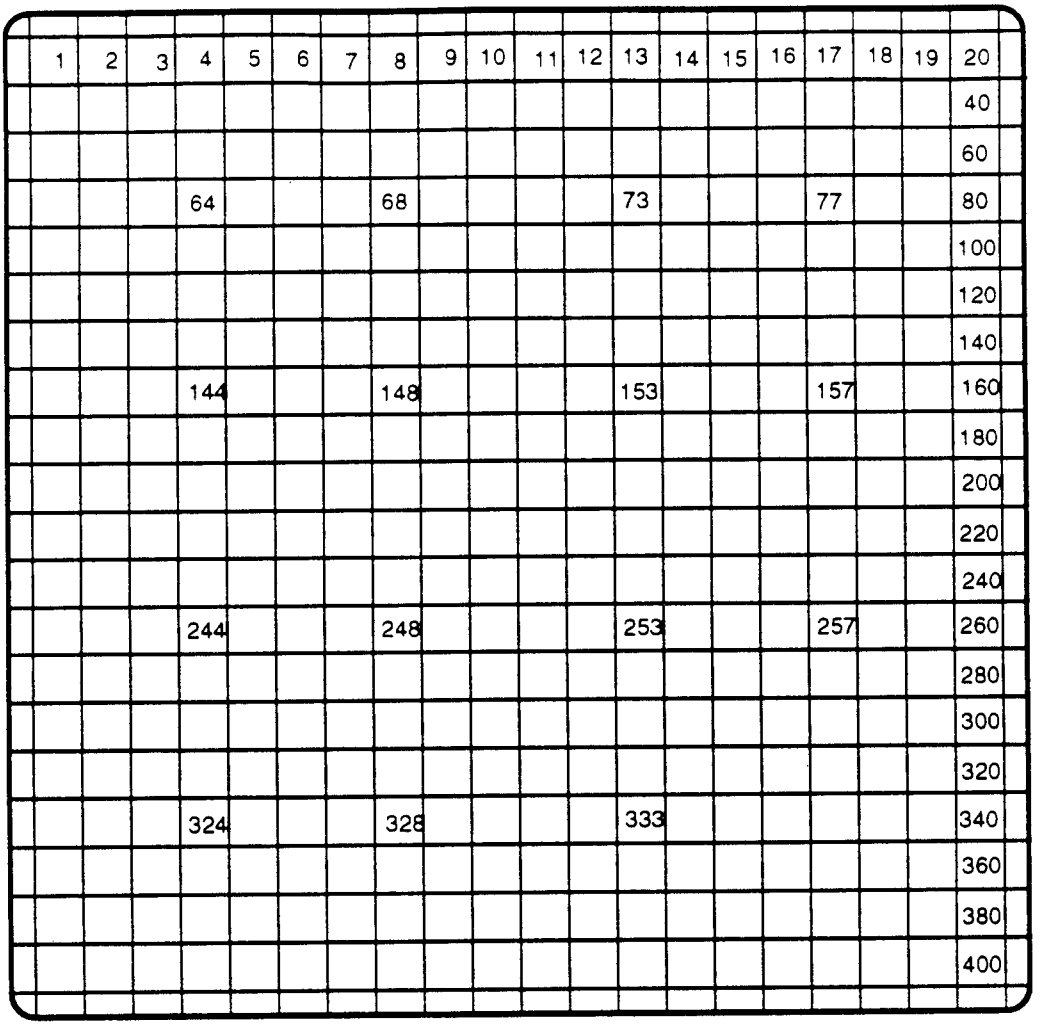
Results for volatiles, semivolatiles, metals, and PCB's above detection limits in sludge samples are presented in Tables 3-1 through 3-3, and Table 3-5 respectively. Detection limits for volatiles, semivolatiles, and metals below detection are presented in Appendices F, G, and H, respectively. Volatile and semivolatile organic results were similar to those from the July 1991 sampling, although more compounds were detected. The volatiles analysis showed acetone to be present above detection limits in eleven samples, 2-butanone in one sample, carbon disulfide in six samples, chloroform in four samples, 4-isopropyl toluene in one sample, toluene in six samples, and 1,2,4-trimethylbenzene in one sample. Semivolatiles analysis showed benzoic acid to be present above detection limits in eight samples, bis-2-ethylhexylphthalate in twenty-one samples, and di-n-butylphthalate in nine samples.



BLOCK	SAMPLE
64	A
68	B
73	C
77	D
144	E
148	F
153	G
157	H
244	I
248	J
253	K
257	L
324	M
328	N
333	O

N

Figure 3-1. Locations of Sludge Samples in Northwest Impoundment, April 1992



BLOCK	SAMPLE
64	Q
68	R
73	S
77	T
144	U
148	V
153	W
157	X
244	Y
248	Z
253	A1
257	B1
324	C1
328	D1
333	E1

N

Figure 3-2. Locations of Sludge Samples in Northeast Impoundment, April 1992

Table 3-5. PCBS Detected in Sludge Samples

Sample Location [a]	Mixed Aroclor, mg/kg	Aroclor 1242, mg/kg	Aroclor 1254, mg/kg
Subpart S Action Level	0.09		
1993 SAL	0.09		
40 CFR 761	10		
April 1992 Samples			
53-NE-C1-S	0.57	0.31	0.26
53-NE-Y-S	0.33	0.17	0.16
53-NE-Z-S	0.27	0.14	0.13

Notes:
[a] NE indicates northeast impoundment, C, Y, and Z indicate sample block locations shown in Figure 3-2, S indicates sludge sample.
[b] Shaded values are above proposed RCRA Subpart S action levels and 1993 SALs.

Detection level < 0.06 mg/kg

These organics were all well below proposed RCRA Subpart S action levels for soil, 1993 IWP SALs for soil, and TCLP screening levels. All metals above detection were below proposed RCRA Subpart S action levels for soils and TCLP screening levels. Arsenic was present above 1993 SALs in all samples. PCBs were detected in three sludge samples. The detection limit for PCB in sludge was 0.06 mg/kg. The total levels of PCB were above the proposed RCRA Subpart S action level and 1993 SAL for soil, but were below the EPA soil cleanup level of 10 mg/kg for unrestricted access areas [40 CFR 761.125(c)(4)(v)]. Several pesticides were present above detection limits. These results are presented in Table 3-6. No herbicides were present above detection limits. All pesticides that were above detection limits were present at levels below the proposed RCRA Subpart S action levels, 1993 SALs, and TCLP screening levels. For all but two of the remaining pesticides (i.e., those present below detection limits), the detection limits are below action levels and it is concluded that these constituents are below action levels. For the remaining two pesticides, heptachlor epoxide and toxaphene, detection limits are above action levels so it is not possible to determine whether these constituents are below action levels.

Water samples were also collected from one location in each impoundment. Samples were collected from the mid-depth of the water column using a discrete interval sampler. Water samples were analyzed for volatile and semivolatile organics, TCLP metals, and pesticides using the same methods as used for sludge samples. In addition, the samples were analyzed for gross alpha, beta, and gamma radioactivity, and tritium.

Metal results above detection limits for water samples are presented in Table 3-4. Detection limits for water samples are presented in Appendix H. All results are below proposed RCRA Subpart S action levels, 1993 IWP SALs, TCLP regulatory levels, MCLs, and New Mexico water quality standards. The only volatile organic detected was acetone, which was detected at 48 μg/L in the sample from the NE impoundment. Acetone was not detected in a duplicate sample from this location. This concentration is below the proposed RCRA Subpart S action level (4000 μg/L) and the 1993 IWP SAL (3500 μg/L). No semivolatile organics or PCBs were detected in water samples. Detection limits for volatile and semivolatile organics are presented in Appendices F and G, respectively.

Table 3-6. Results of Pesticide and Herbicide Analysis of Sludge Samples

Chemical	Subpart S Action Level	1993 Soil SAL, µg/kg	TCLP, µg/kg	Sample PF-NE-IT-1S, µg/kg	Sample PF-NW-IT-1S, µg/kg
April 1992 Samples					
Aldrin	40			< 2.3	< 12
alpha-BHC				< 1.7	< 9.4
beta-BHC				< 3.4	< 19
delta-BHC				< 5.1	< 28
Chlordane	500	540	600	< 8.0	< 44
p-p'-DDD	3,000	2,900		11	< 34
p-p'-DDE	2,000	2,100		57	17
p-p'-DDT	2,000			16	< 37
Dieldrin	40			9.7	< 6.2
Endosulfan I	4,000	4,000		< 8.0	< 44
Endosulfan II	4,000	4,000		154	53
Endosulfan sulfate				< 38	< 200
Endrin	20,000		400	< 3.4	< 19
Endrin aldehyde				< 13	< 72
Heptachlor	200		160	6.6	< 9.4
Heptachlor epoxide	80		160	< 47	< 260
Lindane	500		8,000	< 2.3	< 12
Methoxychlor			200,000	< 100	< 550
Toxaphene	600		10,000	< 140	< 750
2,4-D	800,000		200,000	< 41	< 45
2,4,5-T	800,000			< 6.9	< 7.5
2,4,5-TP			20,000	< 5.9	< 6.4

3.2 Sampling and Analysis Strategy

This section describes the strategy for the sampling and analysis activities to be implemented before and during closure. These activities will include sampling the water and sludge in the impoundments, the bentonite liner material, the soil/tuff beneath impoundment liners and beneath the impoundments, and any wastes generated as part of closure. As described in Sections 5.3.1 and 5.3.3, if the soil beneath the impoundment liners is contaminated and must be removed, the gunite liners must also be removed. In this case, the gunite liners will be sampled to determine the method of disposal.

Sampling and analysis are designed to support implementation of the closure strategy described in Chapter 5.0. Based on the results of previous sampling of water and sludge, it is expected that the requirements for clean closure under RCRA can be met without the need to remove sludge from the impoundments. Sampling will be performed to confirm the results of previous sampling, to assure that contamination levels have not increased since the last sampling, and to determine whether concentrations are below risk-based levels.

The results of the chemical characterization of the sludge will be used to determine whether the closure performance standard specified in Section 5.1.1 will be met. The results of radiological characterization of the sludge will be used to identify health and safety requirements for subsequent sampling, to determine whether EPA approval under National Emissions Standards for Hazardous Air Pollutants (NESHAP) is needed for closure activities, and to support decisions under the Environmental Restoration Project for final disposition of the impoundments after RCRA closure is complete.

Soil sampling will be performed to determine whether there have been any releases from the impoundments that have resulted in contamination with hazardous constituents above health-based cleanup levels. Soil samples will be collected in and below the impoundment liners to determine if releases have occurred by infiltration through or around the liners. The vadose zone under the liners will be sampled to assess potential for groundwater contamination associated with the impoundments.

Waste sampling and analysis will be performed to determine the regulatory status of wastes and to identify appropriate methods of disposal.

Sludge and water samples for radiological characterization will be collected after the closure plan has been submitted and sufficient water has evaporated from the impoundments to facilitate sampling. These samples will be taken to collect data to support health and safety planning and will not be used for RCRA closure decisions. For this reason, these samples can be taken before the closure plan is approved by NMED. Based on existing data, it is expected that the sludge can be allowed to dry for subsequent sampling. The water will be allowed to evaporate from the impoundments before sludge samples are collected for chemical characterization.

Radiological characterization of the sludge will be performed as early in the closure process as possible so that data will be available to guide subsequent decisions concerning management of the sludge and impoundments. For example, radiological characterization data are needed to confirm that the sludge can be allowed to dry prior to completing sampling. These characterization data are needed early in the closure process so that the closure plan can be amended if the data indicate that an alternate sampling approach is necessary.

Sludge samples within the impoundments will be collected using the same grid system as the April 1992 sampling. This grid system was recommended by the NMED in its response to the proposed sampling plan. Each surface impoundment will be subdivided into a grid of (approximately) 10-ft by 10-ft blocks, totalling 400 blocks. The blocks in each surface impoundment will be uniquely numbered and 16 blocks will be selected, each one equidistant from impoundment walls and from each other. An additional sample location will be established within 3 ft of the impoundment influent. Figure 3-3 shows sample locations.

During the radiological characterization sampling, a water sample and duplicate will be collected at the first block sampled in each impoundment. Grab samples of water will be collected instead of discrete interval samples because of the shallow depth of water. The water will be allowed to evaporate to a depth of approximately 1 ft before sampling. The water samples will be analyzed for gross alpha and beta radioactivity, gamma-emitting

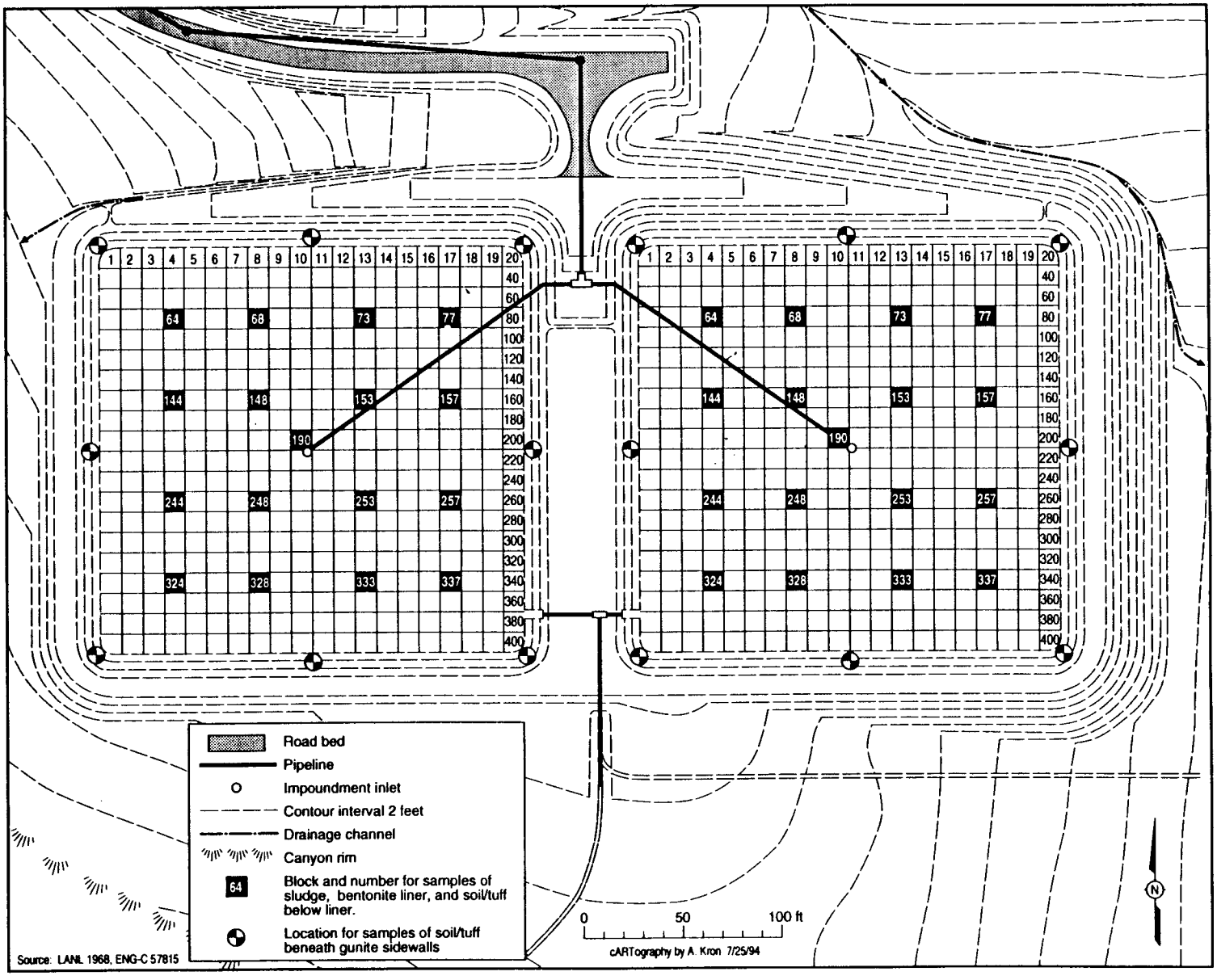


Figure 3-3. Locations of Sludge, Liner, and Soil/Tuff Samples Inside North Impoundments

radionuclides, uranium and plutonium isotopes, strontium-90, and tritium. Analytical methods are described in Section 3.4.

During the radiological characterization, sludge samples will be collected within each of the selected blocks, as near to the center of the block as can be achieved. The approximate depth of the sludge will be recorded at each sampling location. If the amount of sludge at a selected block is insufficient for the collection of an adequate sample volume, the absence of sufficient volume will be recorded in the field log book, and an immediately adjacent block will be sampled. The alternate sample location will be noted in the field log book. If a sample cannot be obtained from one of the eight adjacent blocks, then the sample will not be collected and the justification for omitting the sample recorded in the field log book. Sludge samples will be analyzed for gross alpha and beta radioactivity, gamma-emitting radionuclides, uranium and plutonium isotopes, strontium-90, and tritium. Analytical methods are described in section 3.4. Sludge samples will consist of grab samples collected at the top of the sludge profile. The top of the sludge profile represents sludge that would be exposed by drying. Sampling of the entire sludge column would be very difficult given the physical properties of the sludge. Previous sampling efforts have shown that the grab sampling method described is the only method capable of collecting sufficient amounts of sample. This sampling approach is appropriate for the initial radiological data evaluation to determine health and safety and regulatory compliance requirements.

Sludge samples for chemical characterization to determine closure requirements will be collected after the water has evaporated from the impoundments and the sludge has dried. Sludge samples will be collected at the same locations used for the radiological characterization. At each location, the sample will be collected from the entire sludge profile. Collecting samples in this manner will yield data that are most representative of the sludge remaining in the impoundment at the time of closure. Sludge samples will be analyzed for metals, volatile and semivolatile organics, PCBs and organochlorine pesticides, chlorinated herbicides, and reactive cyanide and sulfide. Analytical methods are described in Section 3.4.

The bentonite impoundment liners and the soil or tuff beneath the liners will be collected at the same location as the sludge samples. Samples will be collected from the bentonite liner material and from the depth interval 18 to 24 in. below the liner. These samples will be

collected at the same time as the sludge samples for chemical characterization. These samples must be collected after all water has evaporated in order to prevent migration of contaminants through the liner. A collar may be placed around the sampling site if necessary to prevent sludge from flowing onto the sampling surface. These samples will be collected to determine whether constituents have migrated from the impoundments into the vadose zone. All bentonite liner, soil, and tuff samples will undergo the same chemical analyses as sludge samples, except for reactive cyanide and sulfide. Only sludge is expected to have high concentrations of sulfide because of anaerobic biological activity. Bentonite liner, soil, and tuff samples will also undergo radiological analysis. The specific analyses to perform will be determined based on the results of the radiological characterization data for sludge and water.

Soil samples will also be collected beneath the gunite liners. These samples will also be collected after all water has evaporated in order to prevent possible migration of contaminants through the gunite. A collar may be placed around the sampling site, if necessary, to prevent sludge from flowing onto the sampling site. Eight samples will be collected from beneath the sidewall liner in each impoundment at the four corners and the middle of the sidewalls. The corners will be sampled because they are expected to be the most likely locations for cracking and leakage. The midpoints will be sampled because they are equidistant from the corners. These samples will be collected as close to the bentonite/gunite interface as possible in order to detect leakage under the gunite. In addition, samples will also be collected where there is evidence of leakage (i.e. cracks), up to a maximum of eight locations per impoundment. The depth interval 18 to 24 in. below the gunite liners will be sampled. This interval is of interest in determining whether constituents have migrated from the impoundments into the vadose zone. These samples will undergo the same analyses as the other soil samples.

The analyses to be performed on sludge, bentonite, and soil/tuff samples will provide the data that will be used to determine whether it is necessary to remove any sludge, bentonite, or soil/tuff to meet closure requirements. Total analyses of the waste will be run instead of the TCLP as allowed by paragraph 1.2 of the TCLP Method (40 CFR 261, Appendix II), which states, "If a total analysis of the waste demonstrates that individual analytes are not present in the waste, or that they are present but at such low concentrations that the appropriate

regulatory levels could not possibly be exceeded, the TCLP need not be run." This paragraph provides the basis for comparison of the results of total analyses with TCLP regulatory levels listed in HWMR-7, Part 261. The analytical results of the solid samples will be compared to the TCLP screening levels to determine whether TCLP regulatory levels could be exceeded. The TCLP screening levels (mg/kg) are numerically equal to 20 times the TCLP regulatory limit (mg/L). The factor of 20 accounts for the fact that the amount of extract produced by the TCLP method is equal to 20 times the weight of the solid phase of the waste. The comparison of the total analyses to the TCLP screening levels is valid only for solid samples. If the sludge samples contain both a liquid and a solid phase, the solids will be separated from the liquids (except for samples for volatile organics analysis) to allow comparison of the solid phase with the TCLP screening level. This approach is consistent with the draft guidance in a November 13, 1991 NMED memorandum which allows the comparison of total analyses of nonliquid solid wastes with 20 times the TCLP regulatory levels. The total analyses of the liquid portion of the sludge will be compared directly to the TCLP regulatory levels instead of the TCLP screening levels. If it is determined that removal of sludge, liners, or soil is necessary and that the analytical results for samples of these materials equal or exceed the TCLP screening levels (or TCLP regulatory levels for the liquid portion of the sludge), samples of the materials to be removed will be collected and analyzed using the TCLP procedure to determine if they are characteristic wastes.

Field quality assurance samples will be prepared as discussed in Section 3.5.1

3.3 Sampling Procedures

This section describes the procedures to be used for collection of water, sludge, soil and waste samples.

3.3.1 Field Logistics

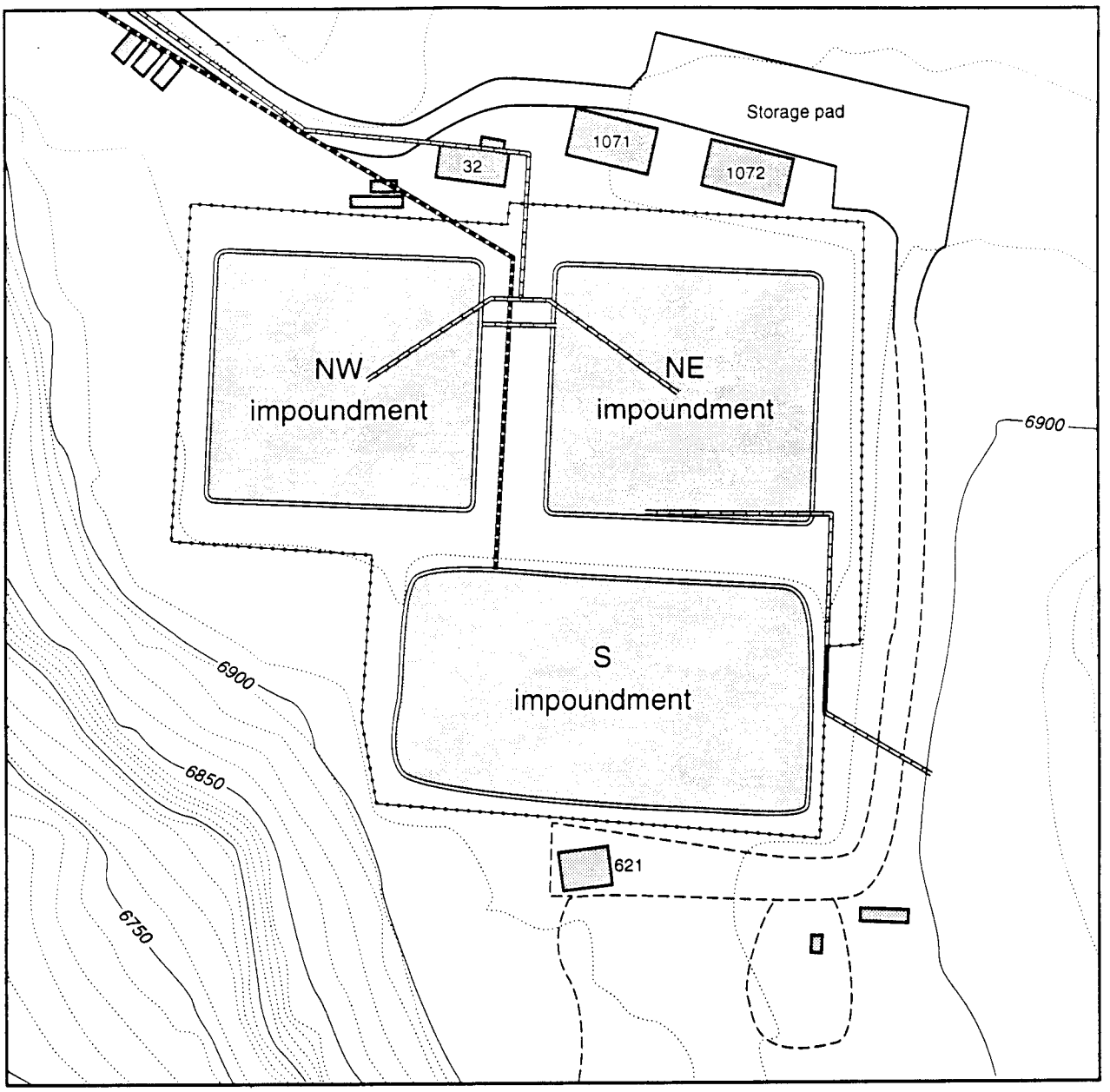
The sampling sites will be examined before the start of field sampling to ensure that all required items are available. Coordination with the responsible group personnel at TA-53 is required for the use of storage and staging areas. Access to the surface impoundment site requires keys to the security fence gates and assistance from the Health Physics Operations

Group (ESH-1). Access to TA-53 may be restricted at any time during Meson Physics Facility operations. All personnel entering TA-53 must sign for a radiation-monitoring film badge to be worn while within TA-53. Site workers must also have received all required radiation worker protection training and appropriate Occupational Safety and Health Administration and RCRA training.

Exact locations for electrical power, clean zones, and drinking water must be identified before sampling. The waters of the surface impoundments are within the exclusion zones, and protective clothing must be worn if contact with surface impoundment waters or sludges is possible. Protective clothing requirements will be determined by the health and safety officer assigned to the project and will be described in a Health and Safety Plan (HSP) to be prepared before sampling. Exclusion zones and access, staging, and decontamination areas will be designated near each surface impoundment. The areas will be selected for ease of ingress and egress to watercraft used for sampling, monitoring, water sample collection, and for initial sample processing. As depicted in Figure 3-4, the fences around the surface impoundments define the exclusion zone.

A decontamination area will be designated for tools, equipment, and personnel. (Decontamination procedures are discussed in detail in Section 3.3.10 of this plan.) All decontamination materials must be stored in containers with proper labels and identifying information. Efforts will be made to keep the volume of decontamination materials at a minimum. Persons involved in doing the actual decontamination will generally be dressed in protective clothing one level below that which the exclusion zone workers are required to wear. All personnel and equipment will be monitored for radioactive contamination before leaving an exclusion zone, the central decontamination area, and the surface impoundment field site.

Field measurements for radioactivity and organic vapors shall be made and documented before, during, and after sampling activities at each surface impoundment each day that sampling is in progress. Measurements will be made using the instruments specified in the HSP. Instruments will be calibrated at the frequency specified in the HSP. Qualified radiation protection and health and safety personnel are responsible for this monitoring. Results of monitoring will be used to evaluate possible hazards at the site, evaluate current conditions,



Sources: FIMAD 1993, G101407
LANL 1993, 87Y-217958, size D
LANL 1968, ENG-C 57815

0 100 200 ft

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N

Building or structure
Surface impoundment
Fence
Paved road/edge of asphalt
Unimproved road or trail
Sewer line
Radioactive liquid waste line
Contour interval 10 ft

Figure 3-4. Location of Fence Defining Exclusion Zone

and specify personal protective equipment. All personnel will visually monitor for extreme weather conditions, lightning, or other physical or environmental hazards that may develop. Personnel will notify the Operable Unit Project Leader (OUPL) when unanticipated physical or environmental hazards develop.

3.3.2 Surface Impoundment Ingress/Egress

Ingress and egress to watercraft and the surface impoundments shall occur in exclusion zones established for that and supporting purposes. Ingress and egress via the slope of the surface impoundment dike will be aided by installing a rope or chain and lumber-rung ladder constructed for that purpose. This ladder will be firmly anchored to the top of the dike surface by driving 18-in. steel stakes into the dike, one per ladder support. An equivalent device may be used for ingress and egress if it provides adequate footing and protection for personnel. Anchors and rigging shall be inspected before each descent or ascent of the ladder. Sampling personnel shall load equipment and supplies sufficient to collect samples from one or more designated locations into the watercraft using the ladder within the exclusion zone.

3.3.3 Sampling Point Location

Water, sludge, and soil samples will be collected at the locations described in Section 3.2. Water and sludge samples for radiological characterization will be collected by a sampling crew in a boat. A crew on the impoundment dikes will assist in directing the boat to the sample locations. The tops of the dikes will be marked with flags to indicate the north-south and east-west coordinate locations of the sample points. One person will stand on one of the north-south aligned dikes with a rope attached to the front of the sampling boat. Another person will stand across the impoundment on the other north-south aligned dike with a rope attached to the rear of the boat. The personnel on the dikes will maneuver the boat into position with the ropes using direction signals from the staff in the boat. The personnel in the boat will use the flags to determine when the boat is correctly positioned at the sampling location.

Sludge samples for chemical characterization and liner and soil/tuff samples will be collected after the water has been removed from the impoundments. Samples inside the impoundments will be located in a similar manner as that described above for water and sludge samples. That is, the sample crew will use the flags on the dikes to align themselves at the sample locations. A stake will be driven into the bottom of the impoundment to identify the sample location.

3.3.4 Water Sampling Procedures

Grab water samples will be collected using a stainless steel beaker or disposable polyethylene beaker. Samples will be collected using the following procedure:

1) Check the beaker to assure that it has been decontaminated and is clean.

2) Obtain a grab sample by slowly immersing the beaker and raising it out of the water. Take care not to disturb the sludge layer. Carefully pour the water from the beaker into the sample containers.

3) Assure that all sample containers are tightly capped. Rinse and dry the sample containers, attach labels and seals, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record.

4) Repeat Steps 2 and 3 until all sample containers for this sample location have been filled.

5) Decontaminate the used sampler before sampling at the next location. Store rags and any other waste in plastic bags for subsequent disposal.

3.3.5 Sludge Sampling Procedures

Sludge sampling will be conducted in two phases. During the first phase, samples will be collected for radiological characterization. These samples will be collected when water is in the impoundment. The second phase samples will be collected for chemical characterization.

These samples will be collected after the water has evaporated from the impoundments. Because of the difference in water content of the sludge, different sampling techniques will be used for the two phases.

3.3.5.1 Phase I Sludge Sampling

Phase I samples will be collected while water is present in the impoundments. Based on the results of previous sampling, the consistency of the sludge is too liquid to allow adequate recovery with a core sampler. Samples will be collected using a pole-mounted stainless steel or polyethylene beaker. This procedure was approved by the NMED for use during the April 1992 sampling. Grab samples will be collected from the top of the sludge profile. The sampling procedure is described below:

1) Check the sample beaker to assure that it has been decontaminated and is clean.

2) Collect a grab sample of sludge from the bottom of the sludge profile using the pole-mounted beaker. Transfer sludge from the beaker to a decontaminated stainless steel bucket. Collect additional beakers of sludge and transfer to the bucket until enough sludge has been obtained to fill all sample containers.

3) Homogenize the sludge in the bucket using a stainless steel spoon. Transfer the homogenized sludge to appropriate sample containers.

4) Assure that all sample containers are tightly capped. Rinse and dry the sample containers, attach labels and seals, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record.

5) Decontaminate the sampler, spoon, and pan before sampling at the next location. Store used rags, gloves, and other wastes in plastic bags for subsequent disposal.

3.3.5.2 Phase II Sludge Sampling

Samples of the dried sludge will be collected with a 24-in. split-spoon sampler using the following procedure:

1) Assemble the decontaminated split-spoon sampler.

2) Advance the sampler through the sludge to a depth of 24-in. or until the impoundment liner is contacted.

3) Withdraw the sampler from the sludge and transfer the sampler to the sample preparation area outside the impoundments but within the exclusion zone. Disassemble the sampler. Split the core lengthwise using a clean stainless steel knife or other appropriate sampling tool.

4) Immediately collect samples for volatile analysis from the entire vertical length of the core by either slicing vertical segments from the core using a clean stainless steel knife (or other appropriate sampling tool) or by scooping material from the length of the core using a clean stainless steel spoon.

5) Transfer the samples for volatile analysis to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool. Tightly pack or fill sample containers completely as possible to eliminate airspace.

6) Record a description of the sludge in the field log book, including the exact location of the sample, depth interval, percent recovery.

7) Collect the remaining samples by obtaining sample material from the entire vertical length of the core using a stainless steel spoon or other appropriate sampling tool. If this sample collection technique is not practical, obtain the remaining samples by transferring the sample material to a decontaminated stainless steel bucket or other appropriate container and mixing until the sample is homogenized. Transfer the

samples to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool.

8) If additional material is needed to fill sample containers, repeat steps 1 through 7 at an immediately adjacent location.

9) Assure that all sample containers are tightly capped. Decontaminate the outside of the containers, attach labels and seals, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record. Place sample containers in plastic bags and place in coolers.

10) Return excess sample residue to the site of origination.

11) Decontaminate the sampler, spoons, knives, pan, and other sampling tools before collecting the next samples. Store contaminated rags, gloves, and other waste in double plastic bags or appropriate containers for subsequent disposal.

3.3.6 Soil/Tuff Sampling Procedures

3.3.6.1 Procedure for Collection of Bentonite Liner Samples

These samples will be collected after the Phase II sludge samples. Liner samples will be collected at the same locations as the sludge samples. Samples of the bentonite liner will be collected using a 8-in. split-spoon sampler. Samples will be collected using the following procedure:

1) Remove sludge from the sampling site until the bentonite liner is exposed.

2) Place collar around the sampling site if necessary to maintain a sludge-free sampling surface.

3) Assemble the decontaminated split-spoon sampler.

4) Advance the sampler through the bentonite liner to a depth of 8-in. or until refusal.

5) Withdraw the sampler from the soil and transfer the sampler to the sample preparation area outside the impoundments but within the exclusion zone.

6) Disassemble the sampler and record a description of the liner and underlying material in the field log book including the exact location of the hole, depth interval, percent recovery, as appropriate.

7) Split the liner core lengthwise using a clean stainless steel knife or other appropriate sampling tool. Separate the impoundment liner material from the underlying soil and return the soil to the site of origination. Immediately collect samples for volatile analysis by slicing vertical segments from the liner core using a clean stainless steel knife or other appropriate sampling tool. Transfer the samples to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool. Tightly pack sample containers leaving no airspace.

8) Collect the remaining samples of the liner material by obtaining vertical slices of the liner using a stainless steel spoon or other appropriate sampling tool. Transfer samples to appropriate sample containers.

9) If additional liner material is needed to fill sample containers, repeat steps 1 through 8 at an immediately adjacent location.

10) Assure that all sample containers are tightly capped. Decontaminate the outside of the containers, attach labels and seals, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record. Place sample containers in plastic bags and place in coolers.

11) Return excess sample residue to the site of origination.

12) Decontaminate the sampler, spoons, knives, pan, and other sampling tools before sampling at the next location. Store contaminated rags, gloves, and other waste in double plastic bags or appropriate containers for subsequent disposal.

3.3.6.2 Procedure for Collection of Soil or Pulverized Tuff Samples from Beneath Bentonite Liner

After the liner sample has been collected, samples of the soil or tuff will be collected from 18 to 24 in. beneath the bentonite liner at the same location.

If the bentonite liner material is underlain by soil or pulverized tuff, samples of the underlying material will be collected with a 24-in. split-spoon sampler using the following procedure:

1) Remove sludge and bentonite liner material from the sampling site until the top of the soil or pulverized tuff is exposed.

2) Place collar around the sampling site if necessary to maintain a sludge-free sampling surface.

3) Assemble the decontaminated split-spoon sampler.

4) Advance the sampler through the underlying soil or tuff to a depth of 24-in. or until refusal.

5) Withdraw the sampler from the soil and transfer the sampler to the sample preparation area outside the impoundments but within the exclusion zone. Disassemble the sampler. Split the core lengthwise using a clean stainless steel knife or other appropriate sampling tool.

6) Immediately collect samples for volatile analysis from the bottom 6-in. interval of the core either by slicing vertical segments from the core using a clean stainless steel knife (or other appropriate sampling tool) or by scooping material from the core using a clean stainless steel spoon.

7) Transfer the samples for volatile analysis to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool. Tightly pack or fill sample containers completely as possible to eliminate airspace.

8) Record a description of the underlying soil or tuff in the field log book including the exact location of the hole, depth interval, percent recovery.

9) Collect the remaining samples by obtaining sample material from the bottom 6-in. interval of the core using a stainless steel spoon or other appropriate sampling tool. If this sample collection technique is not practical, obtain the remaining samples by transferring the bottom 6-in. interval of the core to a decontaminated stainless steel bucket or other appropriate container and mixing until the sample is homogenized. Transfer the samples to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool.

10) If additional material is needed to fill sample containers, repeat steps 1 through 9 at an immediately adjacent location.

11) Assure that all sample containers are tightly capped. Decontaminate the outside of the containers, attach labels and seals, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record. Place sample containers in plastic bags and place in coolers.

12) Return excess sample residue to the site of origination.

13) Decontaminate the sampler, spoons, knives, pan, and other sampling tools before sampling at the next location. Store contaminated rags, gloves, and other waste in double plastic bags or appropriate containers for subsequent disposal.

14) Seal the sample hole using bentonite pellets or cement-bentonite grout.

3.3.6.3 Procedure for Collection of Solid Tuff Samples from Beneath Bentonite Liner

If the bentonite liner is underlain by solid tuff, samples of the tuff will be collected using either a 24-in. split-spoon sampler or a hand-operated electric auger.

Sampling with a split-spoon sampler will be attempted first. If the sampler cannot penetrate the tuff, the samples will be collected with a hand-operated electric auger.

Sample Collection Using Split-Spoon Sampler

The following procedure will be used for collecting solid tuff samples with a split-spoon sampler:

1) Remove sludge, bentonite liner material, and soil from the sampling site until the top of the tuff is exposed.

2) Place collar around the sampling site if necessary to maintain a sludge-free sampling surface.

3) Assemble the decontaminated split-spoon sampler.

4) Advance the sampler through the underlying soil or tuff to a depth of 24-in. or until refusal.

5) Withdraw the sampler from the soil and transfer the sampler to the sample preparation area outside the impoundments but within the exclusion zone. Disassemble the sampler. Split the core lengthwise using a clean stainless steel knife or other appropriate sampling tool. If necessary, use a chisel or similar tool to remove the tuff from the sampler.

6) Immediately collect samples for volatile analysis from the bottom 6-in. interval of the core by either slicing vertical segments from the core using a clean stainless steel knife (or other appropriate sampling tool) or by scooping material from the core

using a clean stainless steel spoon. If fractures are present, the sample material will be selected from the fractured area. If the fractures are filled with soil or clay, samples will be collected of the soil or clay.

7) Transfer the samples for volatile analysis to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool. Tightly pack or fill sample containers completely as possible to eliminate airspace.

8) Record a description of the underlying soil or tuff in the field log book including the exact location of the hole, depth interval, percent recovery.

9) Collect the remaining samples by obtaining sample material from the bottom 6-in. interval of the core using a stainless steel spoon or other appropriate sampling tool. If this sample collection technique is not practical, obtain the remaining samples by transferring the bottom 6-in. interval of the core to a decontaminated stainless steel bucket or other appropriate container and mixing until the sample is homogenized. Transfer the samples to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool.

10) If additional material is needed to fill sample containers, repeat steps 1 through 9 at an immediately adjacent location.

11) Assure that all sample containers are tightly capped. Decontaminate the outside of the containers, attach labels and seals, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record. Place sample containers in plastic bags and place in coolers.

12) Return excess sample residue to the site of origination.

13) Decontaminate the sampler, spoons, knives, pan, and other sampling tools before sampling at the next location. Store contaminated rags, gloves, and other waste in double plastic bags or appropriate containers for subsequent disposal.

14) Seal the sample hole using bentonite pellets or cement-bentonite grout.

Sample Collection Using Hand-Operated Electric Auger

The following procedure will be used for collecting solid tuff samples with a hand-operated electric auger:

1) Remove sludge, bentonite liner material, and soil from the sampling site until the top of the tuff is exposed.

2) Place collar around the sampling site, if necessary, to maintain a sludge-free sampling surface.

3) Remove the decontaminated auger from its protective packaging and attach the drive head.

4) Place a clean sheet of plastic over the tuff and cut a hole for the auger using a clean knife.

5) Drill into the tuff 18 in. at 6-in. intervals using the auger. Allow the cuttings to collect on the plastic sheet. Record descriptions of the cuttings from each interval in the field log book including the location of the hole and the depth interval.

6) Discard cuttings and plastic sheet. Place a clean sheet of plastic over the hole as described in step 4.

7) Drill into the tuff from 18 to 24 in. using the auger. Allow the cuttings to collect on the plastic sheet.

8) Immediately collect samples for volatile analysis by transferring cuttings from the plastic sheet to appropriate sample containers using a clean stainless steel spoon or other appropriate sample tool. Tightly pack or fill sample containers as completely as possible to eliminate airspace.

9) Record a description of the cuttings in the field log book including the exact location of the hole and depth interval.

10) Collect the remaining samples by transferring the sample material to a decontaminated stainless steel bucket or other appropriate container and mixing until the sample is homogenized. Transfer the samples to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool.

11) If additional material is needed to fill sample containers, repeat steps 1 through 10 at an immediately adjacent location.

12) Assure that all sample containers are tightly capped. Decontaminate the outside of the containers, attach labels and seals, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record. Place sample containers in plastic bags and place in coolers.

13) Return excess sample residue to the site of origination.

14) Decontaminate the auger, spoons, knives, pan, and other sampling tools before sampling at the next location. Store contaminated rags, gloves, and other waste in double plastic bags or appropriate containers for subsequent disposal.

15) Seal the sample hole using bentonite pellets or cement-bentonite grout.

3.3.6.4 Procedure for Collection of Soil Beneath Gunite Liner

Samples of the soil beneath the gunite liner will be collected after all sludge samples have been collected and all water has evaporated. The soil samples will be collected with a 24-in. split-spoon sampler using the following procedure:

1) Remove sludge material from the sampling site until the top of the gunite liner is exposed.

2) Place collar around the sampling site if necessary to maintain a sludge-free sampling surface.

3) Remove the gunite liner material from the sample location using a jack hammer or sledge hammer. Remove any gunite fragments from the location before sampling.

4) Assemble the decontaminated split-spoon sampler.

5) Advance the sampler through the underlying soil to a depth of 24-in. or until refusal.

6) Withdraw the sampler from the soil and transfer the sampler to the sample preparation area outside the impoundments but within the exclusion zone. Disassemble the sampler. Split the core lengthwise using a clean stainless steel knife or other appropriate sampling tool.

7) Immediately collect samples for volatile analysis from the bottom 6-in. interval of the core either by slicing vertical segments from the core using a clean stainless steel knife (or other appropriate sampling tool) or by scooping material from the core using a clean stainless steel spoon.

8) Transfer the samples for volatile analysis to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool. Tightly pack or fill sample containers completely as possible to eliminate airspace.

9) Record a description of the underlying soil or tuff in the field log book including the exact location of the hole, depth interval, percent recovery.

10) Collect the remaining samples by obtaining sample material from the bottom 6-in. interval of the core using a stainless steel spoon or other appropriate sampling tool. If this sample collection technique is not practical, obtain the remaining samples by transferring the bottom 6-in. interval of the core to a decontaminated stainless steel bucket or other appropriate container and mixing until the sample is homogenized.

Transfer the samples to appropriate sample containers using a clean stainless steel spoon or other appropriate sampling tool.

11) If additional material is needed to fill sample containers, repeat steps 1 through 10 at an immediately adjacent location.

12) Assure that all sample containers are tightly capped. Decontaminate the outside of the containers, attach labels and seals, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record. Place sample containers in plastic bags and place in coolers.

13) Return excess gunite material and sample residue to the site of origination.

14) Decontaminate the sampler, spoons, knives, pan, and other sampling tools before sampling at the next location. Store contaminated rags, gloves, and other waste in double plastic bags or appropriate containers for subsequent disposal.

15) Seal the sample hole using bentonite pellets or cement-bentonite grout.

3.3.7 Waste Sampling Procedures

Wastes generated during field activities may include disposable equipment and supplies, decontamination solutions, and residuals from decontamination. Disposable equipment and supplies will not be sampled, but will be designated for management based on knowledge of the source of contamination including, in some cases, the analytical results of the site characterization samples. Decontamination wastes will not be sampled unless knowledge-of-process is not adequate to characterize these wastes for disposal. If it is necessary to sample decontamination wastes, sampling methods will result in representative samples as described in HWMR-7, Section 261.20(c).

If it is necessary to sample the decontamination liquids, these wastes will be sampled using disposable composite liquid waste samplers (Coliwasa) or similar equipment. Liquid samples will be collected using the following procedure:

1) Remove the decontaminated sampler from its protective packaging.

2) Open the sampler by pushing the interior rod down to unseat the bottom stopper.

3) Slowly lower the sampler into the liquid at a rate that permits the level of the liquid inside and outside the sampler tube to be about the same. If the level of the liquid in the sampler tube is lower than that outside the sampler, the sampling rate is too fast and will result in a nonrepresentative sample.

4) When the sampler stopper hits the bottom of the liquid container, raise the interior rod to seat the bottom stopper and close the sampler.

5) Slowly withdraw the sampler from the container with one hand and wipe the sampler tube with a disposable cloth with the other hand.

6) Carefully discharge the sample into the appropriate containers by slowly unseating the bottom stopper. Collect the samples for volatile organic analysis first by slowly discharging into the sample vials. Fill the VOA sample vials to prevent volatilization and avoid any agitation that could also cause volatilization. Completely fill the vial to eliminate any headspace. This may be achieved by gently pouring the last few drops into the vial so that surface tension holds the water in a "convex meniscus." When the cap is applied some of the overflow may be lost, but the air space in the bottle should be eliminated. After capping, turn the bottle over and tap it to check for bubbles. If any bubbles are present, repeat the same procedure. If a second try is required, use a new sample container.

7) Repeat steps 2 through 6 until all sample containers have been filled.

8) Assure that all sample containers are tightly capped. Rinse and dry the sample containers, attach labels and seals to them, record the sample information in the field log book, and complete the sample analysis request and chain-of-custody record.

9) Decontaminate the used sampler before collecting the next sample. Store rags and any other waste in plastic bags for subsequent disposal.

If it is necessary to sample solid and semisolid decontamination wastes (e.g., sludges from decontamination areas), these wastes will be sampled using a thief sampler, sampling trier, or scoop, depending on the consistency and quantity of the waste. Samples will be collected using the following procedure:

1) Remove the decontaminated sampler from its protective packaging.

2) Push the sampler downward through the waste until the sampler hits the bottom of the container. If a thief sampler is being used, rotate the inner tube to close the sampler. If a trier is being used, rotate the sampler to free it from the waste.

3) Slowly withdraw the sampler from the container with one hand and wipe the outside of the sampler tube with a disposable cloth using the other hand.

4) Open the sampler and immediately collect a sample for volatiles analysis. Collect a composite sample for volatiles analysis by removing waste from the entire sample profile using a clean stainless steel spoon. After the volatiles sample has been collected, transfer the remainder of the sample to a clean stainless steel pan and homogenize it using a stainless steel spoon. Transfer the homogenized sample to appropriate sample containers.

5) Repeat steps 2 through 4 until all sample containers have been filled.

6) Tightly cap the sample containers. Rinse and dry the sample containers, attach labels and seals to them, record sampling information in the field log book, and complete the sample analysis request sheet and chain-of-custody record.

7) Decontaminate the sampler, spoon, and pan before collecting the next sample. Store rags, gloves, and any other waste in plastic bags for subsequent disposal.

3.3.8 Sample Preservation and Handling

The samples will require cooling with ice or other chemical preservation at the time of collection or during laboratory preparation before analysis. All samples require field preservation as soon after collection as is practical. Sample containers that are prepared with the appropriate preservative at the analytical laboratory may be used to simplify field preservation. Sample preservation for chemical analysis will conform to the requirements of EPA SW-846, Volume II, Part III (EPA, 1986a). Sample containers will be precleaned (typically by the original supplier) using EPA quality assurance protocols appropriate for the intended use of the sample container. Sample container requirements, preservation, and holding times are listed in Table 3-7.

Following sample collection, sample container lids shall be fixed tightly to the containers, and the outside of the container shall be carefully rinsed with deionized water and dried. The purpose of the rinse is to minimize the spread of radioactive materials on sample container surfaces. After rinsing and drying, labels will be attached to the containers and the containers sealed with a custody seal. The custody seal will be initialed and dated by a member of the field team. The sample containers will then be placed in polyethylene Ziploc® bags as secondary confinement in the event of leakage or breakage. The outside surfaces of the secondary sample containers will be monitored for radioactivity prior to packaging for transportation to the analytical laboratory.

Samples will be packaged in shipping coolers, cooled to approximately 4° C, with adequate cushioning and absorbent materials to reduce the likelihood of breakage and to contain fluids should breakage occur. Sample custody, analytical request documentation, and any additional laboratory-required documentation will be placed in Ziploc® bags and taped inside the cooler lid. All samples will be screened at an on-site mobile laboratory for gross alpha, beta, and gamma radioactivity before packaging and shipment. Any sample with suspect hazardous constituents or with radioactive contamination greater than or equal to 2 nCi per gram must be accompanied by a completed Hazardous Materials Transfer Form.

Table 3-7. Sample Containers, Preservation, and Holding Times

	Water and Aqueous Wastes			Sludge, Soil, and Nonaqueous Wastes		
Analysis	Container	Preservative	Holding Time	Container	Preservative	Holding Time
Metals	500-mL polyethylene (poly) or nalgene (nalg)	HNO_3 to pH < 2	180 days	125-mL wide mouth poly or nalg	Cool to 4°C	6 months
Mercury	250-mL poly or nalg	reagent grade HNO_3 to pH <2	28 days	125-mL poly or nalg	Cool to 4°C	28 days
Volatile Organics	2 x 40-mL amber glass vial with teflon-lined septum cap	4 drops conc. HCl, cool to 4°C	14 days	2 x 40-mL amber glass vial with Teflon-lined septum cap or 125 mL wide mouth glass	Cool to 4°C	14 days
Semivolatile Organics, PCBs/ Organochlorine Pesticides, Chlorinated Herbicides	Amber glass with Teflon-lined cap: 1-L for semivol., 1-L for PCBs/ pest., 1-L for herb.	Cool to 4°C	Extract in 7 days, analyze within 40 days	250-mL wide mouth glass with Teflon-lined cap	Cool to 4°C	14 days
Reactive Cyanide and Sulfide	N.A.	N.A.	N.A.	4-oz amber glass	Cool to 4°C	As quickly as possible

Table 3-7. Sample Containers, Preservation, and Holding Times (Continued)

	Water and Aqueous Wastes			Sludge, Soil, and Nonaqueous Wastes		
Analysis	Container	Preservative	Holding Time	Container	Preservative	Holding Time
Gross Alpha, Beta Radioactivity, Gamma Spectroscopy, tritium, uranium and plutonium isotopes, and strontium-90	1-gal. poly or nalg	HNO_3 to pH <2 Does not need to be kept cool	6 months	16 oz. wide mouth poly or nalg	None Does not need to be kept cool	6 months

If the sample is to be shipped off site for analysis, placards bearing the word RADIOACTIVE shall be placed inside the cooler, on top of the packing materials, so as to be obvious to anyone when opening the cooler. All coolers not shipped off site will have such placards on the outside. Sample coolers will be sealed with packing tape, and radioactivity measurements will be taken at the cooler. Results of this radiation screening will be clearly indicated on the outside of the cooler. The field team manager is responsible for packaging and placarding in accordance with Department of Transportation regulations (when samples travel via ground transportation) or with International Air Transport Association regulations (when they are transported by commercial cargo aircraft). Appropriate waybills will be affixed to the shipping coolers for off-site shipment, and the samples will be transported to the analytical laboratory as quickly as is practical.

Samples will be analyzed by the Laboratory Environmental Chemistry Group (CST-9) or by an off-site analytical laboratory.

3.3.9 Field Sample Documentation

Field sampling activities will be documented through the use of a closure sampling field log book, sample labels, a chain-of-custody record, and a request for analysis form. These documents and their uses are described below. All field records generated during sampling activities will be transmitted to the Environmental Restoration Records-Processing Facility (RPF).

3.3.9.1 Field Log Book

A closure sampling field log book will be kept and will contain all information pertinent to field sampling. The log book will have bound and consecutively numbered pages. The information entered into the log book should be sufficient to reconstruct the sampling situation without relying on the sample collector's memory. Minimum entries include:

1) purpose of sample;

2) location of sample;

3) name, organization, and business address of persons collecting samples and making log entries;

4) number and volume of sample and preservatives used (if any);

5) description of each sampling location, the sampling methodology, the equipment used, etc;

6) date and time of sample collection;

7) sample destination and transporter's name;

8) sketch of the sampling site;

9) log of photographs taken, if any;

10) field observations (ambient temperature, sky conditions, recent precipitation, etc.);

11) field measurements, if any (pH, flammability, conductivity, explosivity, etc.);

12) collector's sample identification number(s); and

13) signature of person responsible for the log entry.

3.3.9.2 Sample Label

Sample labels will be affixed to each sample container. Each label must be either preprinted or completed in the field using waterproof, indelible ink (except for volatile organic analysis samples, which will be labeled using ballpoint or other non-solvent-containing ink). Labels will be of a waterproof material or covered with waterproof transparent tape. The label must include the following information:

- OU 1100, TA-53;

- unique sample identification number;
- date and time of sample collection;
- sample location (e.g., TA-53-166-NE or TA-53-166-NW, sample location grid number;
- location ID obtained from the Laboratory Facility for Information Management and Display (FIMAD);
- type of analysis requested;
- preservative (if any); and
- printed name and initials of collector.

The unique sample identification number will be determined prior to the start of field work. A unique number will be used for each sample even if the sample consists of more than one sample container. The unique sample identification numbers will consist of either preprinted sample bar code stickers obtained from the ER Program Sample Coordination Facility or hand-written numbers consisting of unique identifiers such as sample location, date, and time. The Sample Coordination Facility provides bar code stickers on sheets containing four sets of 20 unique sample bar code stickers. Each set consists of one unique number. Each sticker displays a unique seven-character alphanumeric identifier in both human-readable and bar code format. If the bar code stickers are used, they will be attached to the sample label, chain of custody/request for analysis form, and the field logbook. An example sample label is shown in Figure 3-5.

3.3.9.3 Chain of Custody/Request for Analysis Form

The chain of custody/request for analysis form (Figure 3-6) documents a sample's history from collection through analysis and disposal. Upon collection in the field, every sample shall be recorded on the chain of custody/request for analysis form using the unique sample identification number. The person(s) collecting the sample must be identified on the form. A

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

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Figure 3-5. Example Sample Label

Date: _____ COC _____

Technical Area _____ Send Lab Report to: _____ MS_____

Operable Unit _____

OU Contact _____ Date Lab Report Required _____

Contact Phone No. _____

Field Unique Sample #/ID **(Write in Sample ID Number in space below.)**	Date & Time Collected	GRAB	COMP	Sample Container Volume/Mat'l	Matrix (Liquid, Soil, Core, Sludge, Etc.)	Preservative	ANALYSIS REQUESTED TEST	METHOD	REMARKS (Condition of receipt, etc.)

Relinquished by: *(Signature)*: Affiliation:	Date:	Relinquished by: *(Signature)*: Affiliation:	Date:	Relinquished by: *(Signature)*: Affiliation:	Date:
Received by: *(Signature)*: Affiliation:	Time:	Received by: *(Signature)*: Affiliation:	Time:	Received by: *(Signature)*: Affiliation:	Time:

POSSIBLE HAZARD IDENTIFICATION:
(Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances)

Radiological____ Highly Toxic_____ Flammable _____ Skin Irritant_____ Non-hazard_____ Other____

SAMPLE DISPOSAL:

Return to client_____ disposal by Lab. __ Archive____ (indicate number of month(s): _

COMMENTS: _____

Original - SCF YELLOW - RPF PINK - FTL Copy LANL-ER SOP 01.04 R2

Figure 3-6. Example Chain of Custody/Request for Analysis Form

sample is considered to be in a person's custody when it is in his or her physical possession, in view after being in his or her physical possession, or the sample is in a secure area and maintained in a manner that any tampering would be evident. When custody of the sample(s) is passed from the sample collector to other personnel, the persons relinquishing and receiving custody must record their signature, the date on time on this form so that the custody record remains unbroken. When samples are consigned to a commercial shipper, the person having custody at that time signs as relinquisher; the shipper's waybill then becomes part of the custody record, and the receiving laboratory signs for receipt upon opening the sample cooler. Chain-of-custody records must remain part of the permanent documentation for field sampling activities.

The chain of custody/request for analysis form also provides information for the analytical laboratory on sample size, type, volume, and preservative; project identification and contact information; analytical tests to perform; project-specific quality control required; possible sample hazards, if known; and the requested disposition of the sample following analysis.

3.3.10 Decontamination

Sampling equipment will be cleaned with Alconox™ or a similar laboratory detergent before each sample is collected and at the end of sampling. All decontamination procedures shall take place within an exclusion zone or centralized decontamination area designated for that purpose. Methanol, acetone, or dilute acid rinses may be used if necessary to achieve effective decontamination. Following the detergent wash, sampling equipment will be rinsed three times with deionized water. Samples of the final deionized water rinse will be collected as rinsate blank samples. Following decontamination, sampling equipment will be monitored for radioactivity. Additional decontamination procedures to prevent the spread of radioactive contamination may be mandated by the field team manager.

3.3.11 Waste Disposal

Waste generated during field sampling activities is expected to consist of used personal protective equipment (gloves, booties, clothing, etc.), paper and packaging-type waste, excess sample fluids and materials, and decontamination liquids and sludges. Excess

sample fluids and materials may be returned to the surface impoundments from which they were collected. Decontamination liquids and sludges may also be discharged to the impoundments. If methanol, acetone, or dilute acids were used for decontamination, knowledge of process will be used to demonstrate that decontamination wastes do not exhibit the characteristics of ignitability or corrosivity before discharging these wastes to the impoundments. Other waste must be bagged in polyethylene-lined drums and contained on site. All waste generated within an exclusion zone or designated decontamination area must remain segregated from other wastes and the contents must be marked on the outside of the container. All waste will be screened for radioactivity prior to leaving the sampling site for storage or disposal.

3.4 Analytical Requirements

The requirements for clean closure will be met by demonstrating the absence of HWMR-7, Part 261, Appendix VIII constituents above health-risk-based levels. Analytical methods were selected that are capable of detecting Appendix VIII constituents reasonably expected to have been potentially present in wastes discharged to the impoundments. Evaluation of Appendix VIII constituents and identification of analytical methods, analytes, and estimated quantitation limits (EQLs) are described in Appendix I. It should be noted that the proposed analytes include non-hazardous constituents that are not on the Appendix VIII hazardous constituent list. The closure performance standard will not be applied to these non-hazardous constituents.

Certain Appendix VIII constituents are not proposed for closure analyses. Appendix I presents the rationale for not selecting these constituents for closure analyses. Most of the Appendix VIII constituents not selected fall into the following categories:

- Inorganic and organic compounds for which there are no analytical methods in SW-846 or standards:

- General classes of compounds identified as not-otherwise-specified (N.O.S.); and

- Chemicals whose common usage is inconsistent with operations at TA-53 and other TAs sending waste to the impoundments (e.g., pharmaceuticals, manufacture of organic chemicals).

Test methods for chemical analysis will be performed according to procedures documented in EPA SW-846 (EPA, 1986b; EPA, 1986c; and EPA, 1986d) or in the proposed update to EPA SW-846 (EPA, 1991).

Minimum calibration, operation, and quality control requirements (bias, precision, blank, and matrix effects) for laboratory analyses shall be performed as listed in the individual analytical methods of EPA SW-846 (EPA, 1986b; EPA, 1986c; EPA, 1986d; and EPA 1991).

Analytical methods, EQLs, proposed RCRA Subpart S action levels, and 1993 IWP SALs for analytes are presented in Appendix I. This information is presented in Tables I-2 through I-6 for volatile organics, semivolatile organics, organochlorine pesticides and PCBs, chlorinated herbicides, and metals, respectively. The EQLs may not be the detection limits actually achieved; actual detection limits are laboratory-determined based on instrumentation and sample matrix.

3.4.1 Analytical Methods

Sludge, bentonite liner, soil, and tuff samples will be analyzed for total metals, volatile organics, semivolatile organics, organochlorine pesticides and PCBs, chlorinated herbicides, and radionuclides. Sludge samples will also be analyzed for reactive cyanide and sulfide. Water samples will be analyzed for radionuclides only. Waste samples will be analyzed for TCLP and radiological constituents, as necessary for disposal. Analytical methods to be used are identified and described in the following paragraphs. Analyses to be performed are summarized in Table 3-8.

Total metals analysis may be performed using a combination of ICP and AAS methods. Prior to analysis, samples will be prepared by acid digestion. If sludge samples contain two phases, the liquids will be separated from the solids with a 0.6 to 0.8 μm glass fiber filter and the liquid and solid portions will be analyzed separately. EPA Method 3005 will be used for

Table 3-8. Summary of Analyses by Matrix

Analysis	Media			
	Water	Sludge	Soil/Tuff	Wastes
Metals		X	X	
Volatile Organics		X	X	
Semivolatile Organics		X	X	
Organochlorine Pesticides and PCBs		X	X	
Chlorinated Herbicides		X	X	
Reactive Cyanide and Sulfide		X		
TCLP				X
Gross Alpha Radioactivity [(a)]	X	X	X	X
Gross Beta Radioactivity [(a)]	X	X	X	X
Gamma Spectroscopy [(a)]	X	X	X	X
Isotopic Uranium [(a)]	X	X	[(b)]	
Isotopic Plutonium [(a)]	X	X	[(b)]	
Strontium-90 [(a)]	X	X	[(b)]	
Tritium [(a)]	X	X	[(b)]	X

Note:
[(a)] Radiological analyses are not being performed to support demonstration that the HWMR closure performance standard has been met. These data are being collected for health and safety planning and to support decisions regarding radiological contamination at this site that will be made as part of Environmental Restoration Project activities.
[(b)] Radiological analyses in addition to gross analyses will be identified based on the results of the radiological characterization of the sludge and water.

digestion of water samples, and Method 3050 for digestion of sludge and soil samples. The analytical methods to be used will be determined by the laboratory based on instrument availability and required detection limits. It is currently expected that ICP-MS (EPA Method 6020) will be used for analysis of most metals. This method was approved by the NMED for analysis of metals in the samples collected from the surface impoundments in April 1992. It is expected that a furnace AAS method will be used for analysis of selenium (EPA Method 7740) and cold vapor AAS (EPA Methods 7470 and 7471) will be used for mercury analysis. Alternately, ICP-AES (EPA Method 6010) and other furnace AAS methods (EPA 7000 series) may be used as long as the EQLs are at or below all action levels except the proposed RCRA Subpart S action level for beryllium in water. This action level is below the EQLs of current analytical methods.

Analysis of volatile organic compounds will be performed using purge and trap-gas GC/MS. Sample analysis by GC/MS will be performed using EPA Method 8260. Mass spectra library searches for Tentatively Identified Compounds (TICs) will be performed.

Analysis of semivolatile organic compounds will be performed using GC/MS. Water samples will be prepared for analysis using continuous liquid-liquid extraction (EPA Method 3520). Sludge and soil samples will be prepared for analysis using soxhlet extraction (EPA Method 3540) or sonication (EPA Method 3550). Sample extracts will then be analyzed for semivolatile organics by GC/MS using EPA Method 8270. Mass spectra library searches for TICs will be performed.

Analysis of organochlorine pesticides and PCBs will be performed using GC. Water samples will be prepared for analysis using separatory funnel liquid-liquid extraction (EPA Method 3510). Sludge and soil samples will be prepared for analysis using sonication in hexane. Sample extracts will then be analyzed for organochlorine pesticides and PCBs by GC using EPA Method 8080.

Analysis of chlorinated herbicides will be performed by GC using EPA Method 8150.

Sludge samples will be analyzed for total releasable cyanide and sulfide using the test methods presented in Sections 7.3.3.2 and 7.3.4.2 of EPA SW-846 (EPA, 1986d), respectively.

The sludge samples will be acidified to pH 2.0, and any gas that is generated will be trapped in an alkaline scrubber. The scrubber solution will then be analyzed for cyanide and sulfide using EPA Methods 9010 and 9030, respectively. The test procedures will have required detection limits of 50 mg cyanide and 100 mg sulfide per kg waste. The current EPA action levels for cyanide and sulfide for reactive wastes are 250 mg/kg and 500 mg/kg, respectively (EPA, 1986d).

As necessary for disposal characterization, waste samples will be analyzed using the TCLP, as described in HWMR-7, Part 268, Appendix I.

Radiological analysis will be performed using Laboratory procedures. Analysis for gross alpha and gross beta radioactivity will be performed using gas flow proportional counting. Approximate detection limits for gross alpha are 5 pCi/L for water and 10 pCi/g for soil and sludge. Approximate detection limits for gross beta are 6 pCi/L for water and 12 pCi/g for soil and sludge. Gamma-emitting radionuclides will be analyzed for using gamma spectroscopy. Detection limits vary with radionuclides and range from 15 to 300 pCi/L for water and 0.1 to 2.0 pCi/g for soil and sludge. Isotopic uranium and plutonium will be analyzed using alpha spectroscopy. Typical detection limits vary from 0.1 to 0.2 pCi/L for water and 0.01 to 0.05 pCi/g for soil and sludge. Strontium-90 will be analyzed using proportional counting. Typical detection limits are 3 pCi/L for water and 2 pCi/g for soil and sludge. Tritium will be analyzed for by distillation and liquid scintillation. The approximate detection limit is 400 pCi/L.

3.4.2 Laboratory Documentation

Documentation of sample acceptance at the analytical laboratory must be provided to the OUPL following sample screening and log-in. This documentation may consist of signed copies of the chain-of-custody record or a letter detailing the field sample numbers accepted. Corresponding laboratory sample identification numbers should be provided to the OUPL. The laboratory is required to have procedures for minimizing cross contamination of samples and securing sample custody within the laboratory.

All laboratory analyst notebooks, log sheets, instrument printouts, charts, calculations, etc., relevant to analyses of these samples shall be identified and remain retrievable in the RPF.

This information may be requested by the OUPL or quality assurance (QA) officer for independent review and validation.

The analytical laboratory shall be required to submit summary reports of analytical results to the OUPL. At a minimum, the data reports shall contain the information shown in the Data Format Checklist presented in Figure 3-7. Copies of the data reports will be appended to the Final Closure Report.

3.5 Quality Assurance/Quality Control

The Quality Assurance Project Plan (QAPP) for closure is contained in Appendix J. The OUPL is responsible for implementation of QA policies and quality control (QC) procedures. A QA officer, independent of this sampling and analysis task, will assume a QA function and report to the OUPL. The independent QA officer is responsible for conducting QA reviews to include second-level approvals of nonconformances and variances, primary approval of corrective actions, and audits of field and laboratory activities and documentation. Results of all QA reviews will be reported to the OUPL. QA review may be requested by the OUPL or higher-level management, or be initiated by the individual responsible for the QA function.

3.5.1 Field QC

Field QC activities will include collection of QC samples in addition to the field documentation requirements discussed in Section 3.3.9. QC samples to be collected include duplicate samples, equipment rinsate blanks, and matrix spike samples. Table 3-9 summarizes field QC samples discussed in this closure plan.

Duplicate samples of water, sludge, and soil will be collected at a frequency of one duplicate sample per twenty environmental samples for each sample matrix. The field duplicate samples will be collected at the same locations as the corresponding environmental samples and will undergo the same analyses. The results of analysis of duplicate samples will be used to indicate the variability of the sampled matrix. Results will be used to calculate relative percent difference (RPD) using the following formula:

INCLUDE ON LAB DATA SHEETS:

Location of Sample:

Type of Sample (Matrix):

Laboratory Sample Identification Number:

Client Sample Identification Number:

Date Sample Collected:

Date Sample Received by Laboratory:

Date Sample Extracted (if appropriate):

Date Sample Analyzed:

Name and Telephone Number of Analyst:

Name, Signature, and Telephone Number of Laboratory Manager:

Weight and Volume of Sample Received:

Analyte and Analytical Result With Units:

Method of Analysis

Detection Limit:

List of Tentatively Identified Compounds at or Above Method Detection Limit (if appropriate):

QA/QC That Pertains to Sample:

INCLUDE IN A NARRATIVE SUMMARY:

QA/QC Summary Listing All Technical Problems Encountered and Listing All Samples Affected:

Summary of Results by Sample for all Parameters Identified in the Closure Plan:

Report Presence of Tentatively Identified Compounds:

Figure 3-7. Data Format Checklist

Table 3-9. Summary of Field Quality Control Samples

QC Sample Type	Sample Matrix	Applicable Analysis	Frequency	Purpose	Acceptance Criteria	Corrective Action
Matrix Spike	Water, Soil, Bentonite, Tuff, Sludge	Volatile Organics, Semivolatile Organics, Pesticides/PCBs, Herbicides, Metals	One per sample delivery group	Laboratory QC, determine matrix effects	See note (b)	See note (b)
Field Duplicate	Water, Soil, Bentonite, Tuff, Sludge, Waste	Volatile Organics, Semivolatile Organics, Pesticides/PCBs, Herbicides, Metals, Reactive Cyanide and Sulfide, Radionuclides	One per 20 soil/tuff, sludge, waste samples; one per 10 water samples. At least one per impoundment	Monitor sample variability	See note (c)	Advisory -- no action required
Equipment Rinsate Blank	Water, Soil, Bentonite, Tuff, Sludge, Waste	Volatile Organics, Semivolatile Organics, Pesticides/PCBs, Herbicides, Metals, Radionuclides	One per 20 soil/tuff, sludge, waste samples; one per 10 water samples.	Monitor decontamination effectiveness and sample cross contamination	See notes (a) and (d)	Advisory -- no action required

Notes:

(a) For volatiles and semivolatiles analysis, if blank shows detectable levels of any common laboratory contaminant, sample must exhibit that contaminant at a level equal to or greater than 10 times the quantitation limit to be considered detectable. For all other contaminants, sample must exhibit that contaminant at a level equal to or greater than 5 times the quantitation limit to be considered detectable.
(b) Acceptance criteria and corrective actions for matrix spike recovery will be specified in analytical laboratory QA plan.
(c) For water samples, the goal for relative percent difference is 25%. For sludge and soil samples, the goal for relative percent difference is 50%. These goals are based on the expected variability of the matrices to be sampled. Failure to meet these goals will not require corrective action, but may require evaluation of the cause of variability.
(d) For pesticides and herbicides, if blank shows detectable level of any contaminant, sample must exhibit that contaminant at a level equal to or greater than 5 times the quantitation limit to be considered detectable.

$$RPD = 100 \times (C_1 - C_2) / C_{ave}$$

where, C_1 is the concentration in the environmental sample, C_2 is the concentration in the duplicate sample, and C_{ave} is the mean of the concentrations in the environmental and duplicate samples. The RPD will be used as an indication of variability and will not be used to indicate the need for corrective actions.

Equipment rinsate blanks are used to assess sample contamination from improperly cleaned sample equipment. Rinsate blanks will be collected during decontamination of sampling equipment. The rinsate blank sample will be collected from the final deionized water rinse. If disposable sampling equipment is used, rinsate blanks will be collected by rinsing an unused sampler with deionized water. Equipment rinsate blank samples will be collected at a frequency of one per every twenty soil, bentonite, tuff, and sludge samples, and one per every ten water samples. Rinsate blanks will be assigned a unique sample identification number for tracking purposes, but will not be identified as blanks to the analytical laboratory. Equipment blanks will undergo the same analyses as the environmental samples.

Matrix spike samples will consist of samples having double the volume of normal samples. The extra sample volume will be used by the analytical laboratory to make matrix spike and matrix spike duplicate samples. The results of the matrix spike samples are used to evaluate the effects of the sample matrix on analytical method performance. Matrix spike samples will be submitted at a frequency of one per sample delivery group for chemical analysis. The maximum number of samples per delivery group is 20.

Instrument calibration and maintenance are field activities subject to QC procedures. Field equipment requiring calibration will be limited to radioactivity-detection devices and organic vapor monitoring and other monitoring equipment specified in the HSP. This equipment will be calibrated and maintained using the manufacturer's instructions and appropriate Standard Operating Procedures.

Field personnel will monitor for organic vapors in the surface impoundment area and may prescribe additional personal protective devices based on these measurements. Monitoring shall be conducted for nonspecific organic vapors using either a photoionization detector or a

flame ionization detector. Prior to field activities, the organic vapor analyzer will be calibrated by a trained technician using a calibration gas to check instrument response and ensure proper operation. Each day before monitoring at the site, the organic vapor analyzer shall be zeroed, set in an area free from organic vapors, response-checked using a commercially available calibration gas, and then taken to the surface impoundment site for monitoring.

Field documentation is an integral part of QA/QC. Field documentation requirements and procedures are discussed in detail in Section 3.3.9 of this sample plan.

3.5.2 Laboratory QC

The analytical laboratory(ies) will operate under a QA program plan that meets the requirements given in the QAPP (Appendix J) and the NMED Components of an Adequate Laboratory Quality Assurance/Quality Control Plan. The Laboratory Quality Assurance Project Plan will specify the laboratory procedures to be used for establishing the quality of all analytical data.

3.6 Variances, Nonconformances, and Corrective Actions

Variances are deviations from approved work plans or procedures. Variance requests for field sampling and analysis procedures will be submitted to the OUPL and approved before being implemented. Telephoned or verbal approval from the OUPL is sufficient to proceed with the variance. All variances from field sampling and analysis procedures will be documented in the field log book. Variances from analytical laboratory procedures will be requested, approved, and documented as described in the Laboratory Quality Assurance Project Plan.

Nonconformances are uncontrolled deviations from approved procedures of project requirements. Nonconformances may be detected and identified by project personnel or QA personnel. Every nonconformance for field procedures that affects quality will be documented and reported to the OUPL and QA coordinator. Documentation will include identification of the person detecting the nonconformance, a description of the nonconformance, methods for correcting the nonconformance or a description of the variance

granted, and a schedule for completing corrective action, if any. Nonconformances for analytical laboratory procedures will be documented and reported as described in the Laboratory Quality Assurance Project Plan.

Corrective actions for field procedures will be implemented as described on the nonconformance report. Documentation of corrective action implementation will be submitted to the OUPL and QA coordinator. All corrective actions must be approved by the project manager and QA coordinator. Corrective actions for analytical laboratory procedures will be reported and approved as described in the Laboratory Quality Assurance Project Plan.

3.7 Sampling and Analysis Summary

A summary of the numbers and types of samples to be collected for each type of analysis is presented in Table 3-10.

Table 3-10. Sumary of Samples and Analyses

Sample	Type	Metals	Volatile Organics	Semivolatile Organics	Organochlorine Pesticides/PCBs	Chlorinated Herbicides	Reactive Cyanide/Sulfide	Gross Alpha	Gross Beta	Gamma Spectroscopy	Isotopic Uranium	Isotopic Plutonium	Strontium-90	Tritium
Phase I														
Sludge Samples, NE Impoundment	Grab, 0-6 in.							17	17	17	17	17	17	17
Duplicate Sludge, NE Impoundment	Grab, 0-6 in.							1	1	1	1	1	1	1
Sludge Samples, NW Impoundment	Grab, 0-6 in.							17	17	17	17	17	17	17
Duplicate Sludge, NW Impoundment	Grab, 0-6 in.							1	1	1	1	1	1	1
Total Sludge Samples								36	36	36	36	36	36	36
Water Samples, NE Impoundment	Grab							1	1	1	1	1	1	1
Duplicate Water, NE Impoundment	Grab							1	1	1	1	1	1	1
Water Samples, NW Impoundment	Grab							1	1	1	1	1	1	1
Duplicate Water, NW Impoundment	Grab							1	1	1	1	1	1	1
Rinsate Blank, NE Sludge Sampler								1	1	1	1	1	1	1
Rinsate Blank, NW Sludge Sampler								1	1	1	1	1	1	1

Table 3-10. Summary of Samples and Analyses (Continued)

Sample	Type	Metals	Volatile Organics	Semivolatile Organics	Organochlorine Pesticides/PCBs	Chlorinated Herbicides	Reactive Cyanide/Sulfide	Gross Alpha	Gross Beta	Gamma Spectroscopy	Isotopic Uranium	Isotopic Plutonium	Strontium-90	Tritium
Rinsate Blank, NW Water Sampler								1	1	1	1	1	1	1
Total Water Samples								7	7	7	7	7	7	7
Phase II														
Sludge Samples, NE Impoundment	Vertical Composite	17	17	17	17	17	17							
Duplicate Sludge, NE Impoundment	Vertical Composite	1	1	1	1	1	1							
Matrix Spike Sludge, NE Impoundment	Vertical Composite	1	1	1	1	1	1							
Sludge Samples, NW Impoundment	Vertical Composite	17	17	17	17	17	17							
Duplicate Sludge, NW Impoundment	Vertical Composite	1	1	1	1	1	1							
Matrix Spike Sludge, NW Impoundment	Vertical Composite	1	1	1	1	1	1							
Liner Samples, NE Impoundment	Vertical Composite	17	17	17	17	17		17	17	17	17	17	17	17
Duplicate Liner, NE Impoundment	Vertical Composite	1	1	1	1	1		1	1	1	1	1	1	1
Matrix Spike Liner, NE Impoundment	Vertical Composite	1	1	1	1	1								
Liner Samples, NW Impoundment	Vertical Composite	17	17	17	17	17		17	17	17	17	17	17	17

Table 3-10. Summary of Samples and Analyses (Continued)

Sample	Type	Metals	Volatile Organics	Semivolatile Organics	Organochlorine Pesticides/PCBs	Chlorinated Herbicides	Reactive Cyanide/Sulfide	Gross Alpha	Gross Beta	Gamma Spectroscopy	Isotopic Uranium	Isotopic Plutonium	Strontium-90	Tritium
Duplicate Liner, NW Impoundment	Vertical Composite	1	1	1	1	1		1	1	1	1	1	1	1
Matrix Spike Liner, NW Impoundment	Vertical Composite	1	1	1	1	1								
Sub-Liner Samples, NE Impoundment	Grab, 18-24 in.	33	33	33	33	33		33	33	33	33	33	33	33
Duplicate Liner, NE Impoundment	Grab, 18-24 in.	2	2	2	2	2		2	2	2	2	2	2	2
Matrix Spike Liner, NE Impoundment	Grab, 18-24 in.	2	2	2	2	2								
Sub-Liner Samples, NW Impoundment	Grab, 18-24 in.	33	33	33	33	33		33	33	33	33	33	33	33
Duplicate Liner, NW Impoundment	Grab, 18-24 in.	2	2	2	2	2		2	2	2	2	2	2	2
Matrix Spike Liner, NW Impoundment	Grab, 18-24 in.	2	2	2	2	2								
Total Sludge/Soil Samples		150	150	150	150	150	38	106	106	106	106	106	106	106
Rinsate Blank, NE Sludge Sampler		1	1	1	1	1								
Rinsate Blank, NW Sludge Sampler		1	1	1	1	1								
Rinsate Blank, NE Liner Sampler		1	1	1	1	1		1	1	1	1	1	1	1

Table 3-10. Summary of Samples and Analyses (Continued)

Sample	Type	Metals	Volatile Organics	Semivolatile Organics	Organochlorine Pesticides/PCBs	Chlorinated Herbicides	Reactive Cyanide/Sulfide	Gross Alpha	Gross Beta	Gamma Spectroscopy	Isotopic Uranium	Isotopic Plutonium	Strontium-90	Tritium
Rinsate Blank, NW Liner Sampler		1	1	1	1	1		1	1	1	1	1	1	1
Rinsate Blank, NE Sub-Liner Sampler		2	2	2	2	2		2	2	2	2	2	2	2
Rinsate Blank, NW Sub-Liner Sampler		2	2	2	2	2		2	2	2	2	2	2	2
Total Water Samples		8	8	8	8	8		6	6	6	6	6	6	6

4.0 GROUNDWATER AND VADOSE ZONE MONITORING PROGRAM

This chapter describes groundwater monitoring activities implemented at the Technical Area (TA)-53 surface impoundments. Groundwater monitoring activities include those needed to satisfy the requirements of the New Mexico Hazardous Waste Regulations-7 (HWMR-7), Part 265, Subpart F, as well as other characterization activities.

4.1 Ground-Water Monitoring Waiver

Los Alamos National Laboratory (Laboratory) has determined that the groundwater monitoring requirements under HWMR-7, Part 265, Subpart F are waived for this site, as allowed under HWMR-7, Section 265.90(c). The Laboratory implemented a program to demonstrate that there is a low potential for migration of mixed wastes or hazardous constituents from the impoundments. This program was designed to meet the requirements for a waiver under HWMR-7, Section 265.90(c).

According to Section 270.1(c), groundwater monitoring requirements under 40 CFR 264, Subpart F, are not applicable unless a post-closure permit is required. The Laboratory intends to petition NMED for a determination that a post-closure permit is not required because the closure meets the standards for closure by removal or decontamination in Section 264.228 in accordance with Section 270.1(c)(5)(ii). If the requirements for closure by removal ("clean closure") cannot be met, the Laboratory will apply for a post-closure permit and satisfy groundwater monitoring requirements under 40 CFR 264, Subpart F.

The Laboratory understands that a demonstration that groundwater contamination has not occurred is a requisite for clean closure under interim status (see preamble to interim status closure regulations, 52 FR 8705 [EPA, 1987]). As described by EPA in OSWER Policy Directive No. 9476.00-14 (Lowrance, 1988), interim status units undergoing clean closure may demonstrate that groundwater is uncontaminated without having a groundwater monitoring system in place. In order to clean close without groundwater monitoring, the owner or operator must meet the decontamination standard contained in Section 270.1(c)(5) and (6) and must make a demonstration in accordance with the policy directive. This policy directive will be used as guidance in demonstrating that groundwater contamination has not occurred.

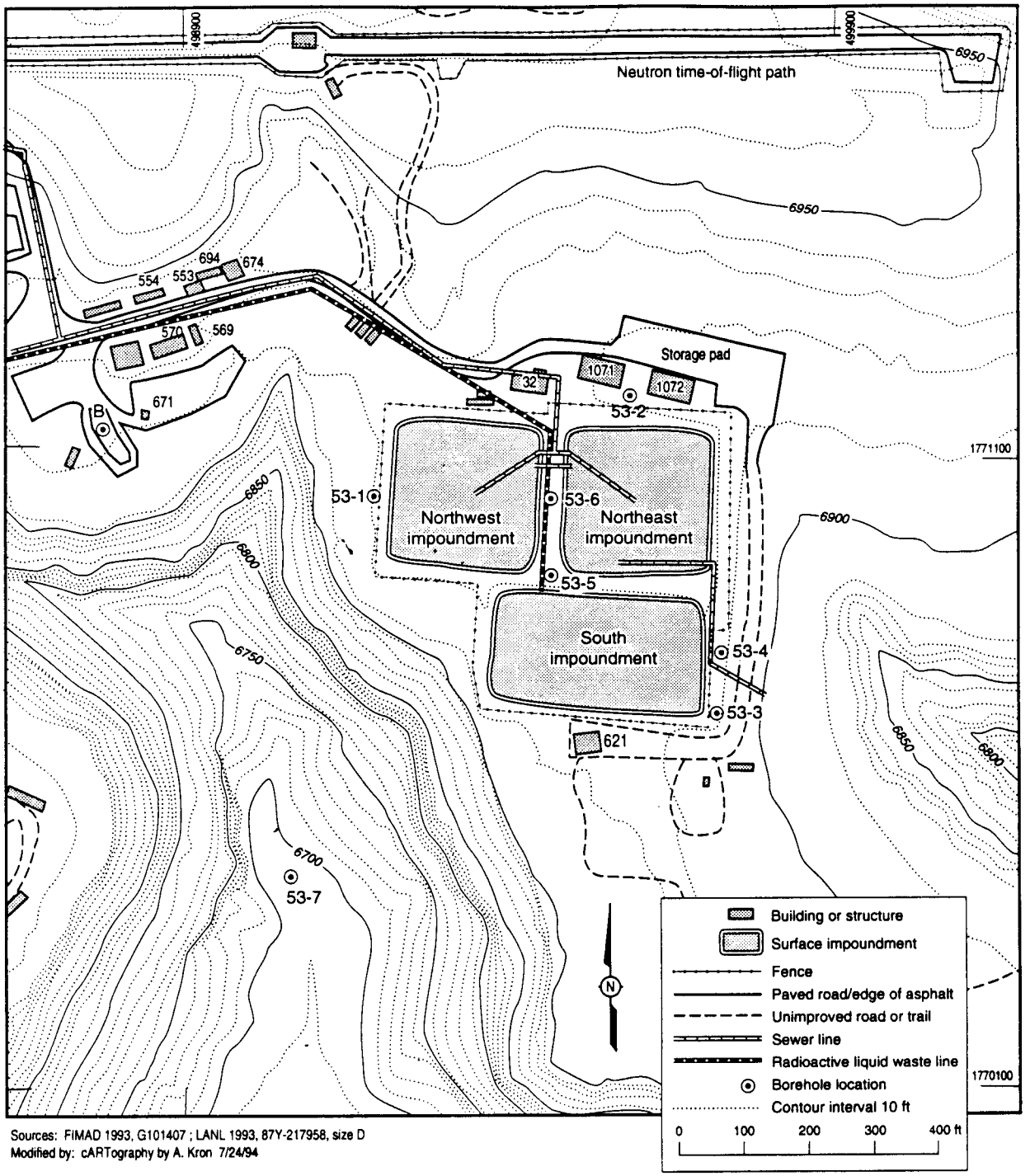
The Laboratory intends to use the results of vadose zone sampling in lieu of groundwater monitoring to demonstrate that RCRA-regulated constituents have not migrated to groundwater and to meet applicable demonstration requirements. Previous vadose zone sampling is described in Section 4.2 and in the Exposure Assessment Information Report submitted to NMED in June 1992 (LANL, 1992c). Additional vadose zone sampling to be performed beneath the impoundment liners as part of closure is described in Sections 3.2 and 3.3. Data from this sampling will be used to evaluate whether hazardous constituents have migrated through the liners. These data will also be used to characterize the source of constituents in the vadose zone (if any) for the purpose of evaluating the potential for migration to groundwater. The demonstration that groundwater is uncontaminated and that policy guidance requirements have been addressed will be included in the Final Closure Report.

4.2 Vadose Zone Monitoring Program

Based on the absence of groundwater in quantities sufficient to sample in groundwater monitoring wells, the Laboratory has implemented a vadose zone monitoring program at the TA-53 surface impoundments. Vadose zone monitoring has been performed to better characterize the unsaturated zone hydrology at the site. The vadose zone monitoring program consists of an initial characterization program and ongoing monitoring. The following sections describe the monitoring program and summarize the results. The results of the monitoring program indicate that there have been no releases of RCRA-regulated hazardous constituents from the impoundments to the vadose zone.

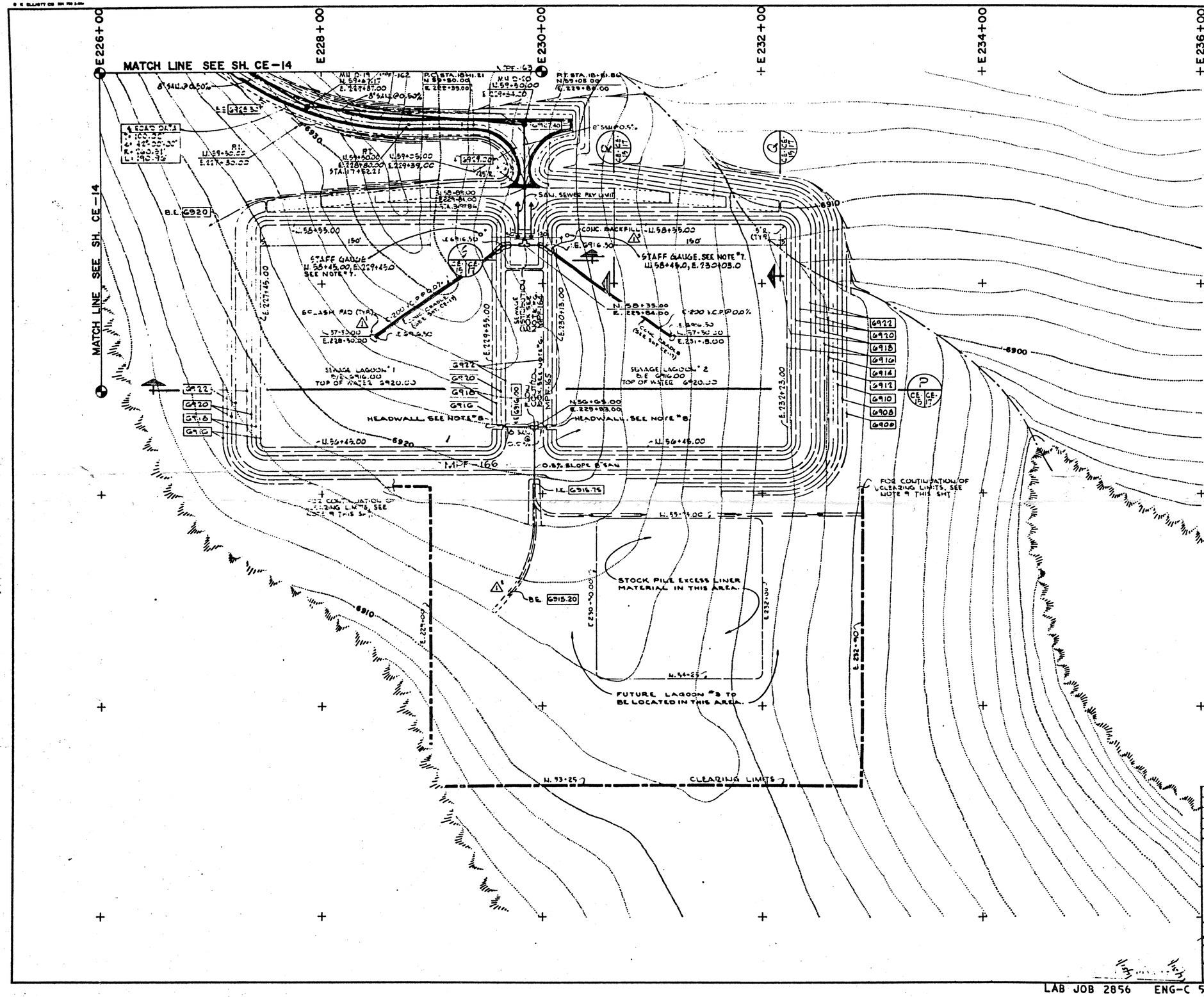
4.2.1 Initial Vadose Zone Characterization

Four 50-ft boreholes were drilled adjacent to the impoundments to determine if a saturated zone is present and to determine if contamination has resulted from placement of liquid in the impoundments. The locations of these boreholes are identified as Boreholes 1 through 4 on Figure 4-1. An additional 50-ft borehole, identified as Borehole B on Figure 4-1, was drilled 450 ft west of the impoundments to confirm expected background moisture and tritium levels. Grab samples of cuttings were collected every 5 ft in all five 50-ft boreholes, analyzed for tritium and gravimetric moisture, and scanned for gamma radiation. No saturated zone was



Sources: FIMAD 1993, G101407 ; LANL 1993, 87Y-217958, size D
Modified by: cARTography by A. Kron 7/24/94

Figure 4-1. Borehole Locations Near TA-53 Surface Impoundments



1. FOR GENERAL & GENERAL NOTES SEE DWG. CE-
2. FOR SEWER PROFILE SEE DRAWING CE-
3. FOR MANHOLE DETAIL SEE DWG CE-8
4. FOR SEWER TRENCH SECTION SEE DRAWING CE-8
5. FOR ROAD PROFILE SEE DRAWING CE-18
6. FOR DISTRIBUTION & CONTROL BOX SEE DRAWING CE-17
7. FOR STAFF GAUGE DETAIL SEE DWG CE-17.
8. FOR HEADWALL DETAIL SEE DWG CE-17.
9. CLEARING AND GRUBBING SHALL BE CONFINED TO 10'-0" BEYOND ALL CUT AND FILL AREAS, EXCEPT AS NOTED ON DWGS.

J. S. Parsons
Unclassified DATE 11/1/70

AS CONSTRUCTED DRAWING
CONSTRUCTION CONTRACT NO AT (29-2)-2586
SUBMITTED
RECOMMENDED
APPROVED

NO.	DATE	REVISIONS	BY	CHK.	PROJ. ENGR.	A.E. APP.
1	11-71	REVISED TO AS-BUILT STATUS 7-27-78	HEW			
2	8-8-69	AS CONSTRUCTED	J.P.	R.H.	R.M.	

U.S. ATOMIC ENERGY COMMISSION
ALBUQUERQUE OPERATIONS OFFICE
ALBUQUERQUE, NEW MEXICO

FIGURE 4-1
LOS ALAMOS NATIONAL LABORATORY
TA-53 SURFACE IMPOUNDMENTS
GRADING AND UTILITIES PLAN
FOR NORTHERN IMPOUNDMENTS

CONTRACT NO. AT(29-2)-2023
DRAWN P. BERNARDO
CHECKED J. McFALL
A.E. APPROVED
DESIGNED J. McFALL
PROJ. ENGR. E. McCARRAGHER
PROJ. MGR. R.A. LITTMANN
SCALE AS SHOWN
DATE 4-5-68

SUBMITTED ARCHITECT-ENGINEER
RECOMMENDED
APPROVED DRAWING OK

GIFFELS & ROSSETTI, INC.
ARCHITECTS-ENGINEERS DETROIT, MICHIGAN

JOB NO. 66-17 | SHEET NO. CE-15 | DRAWING NO. LAM-D-CE-15 | SHEET 15 OF 29

LAB JOB 2856 ENG-C 57815 [redacted]

4299

[redacted]

encountered. The boreholes were completed as neutron-moisture access wells (LANL, 1992a).

A 100-ft borehole, identified as Borehole 5 on Figure 4-1, was drilled between the three impoundments to better identify the likelihood of a release. Grab samples of cuttings were collected every 5 ft for the first 50 ft, and every 10 ft thereafter. These samples were analyzed for tritium and gravimetric moisture, and were scanned for gamma radiation. This borehole was completed as a pore-gas monitoring system (LANL, 1992a).

Two additional boreholes were drilled to collect subsurface core samples. Borehole 6 was placed between the northwest (NW) and northeast (NE) impoundments to evaluate the potential impact of these impoundments beyond the influence of a historic outfall near Borehole 5. Samples were collected at 5 ft intervals for the first 30 ft, and at 10 ft intervals thereafter, to a depth of 150 ft. These cores were analyzed for tritium and gravimetric moisture at each sampling depth; volatile organics at 5 ft through 30 ft, 50 ft, 80 ft, 100 ft, 110 ft, 140 ft, and 150 ft; semivolatile organics at 5 ft through 30 ft, 50 ft, 80 ft, 100 ft, and 150 ft; and total metals at 20 ft and 100 ft. Samples were also collected at depths of 40, 60, 100, 110, and 150 ft for hydraulic properties testing. Tests performed were initial moisture content, dry bulk density, porosity, saturated and unsaturated hydraulic conductivity, and moisture-retention characteristics (LANL, 1992a).

Borehole 7 was drilled near the head of a small canyon directly adjacent to and southwest of the impoundments (see Figure 4-1) to identify impact from the impoundments at depths beyond Boreholes 1 through 6 and B. Samples were collected at 5 ft intervals for the first 35 ft, and at 10-ft intervals thereafter, to a depth of 80 ft. These samples were analyzed for tritium and gravimetric moisture. Three samples, collected at depths of 5 ft, 20 ft, and 80 ft, were analyzed for volatile and semivolatile organics. Samples were collected at depths of 70 and 80 ft for hydraulic properties testing. This borehole was completed as a neutron-moisture access well with a cup lysimeter (LANL, 1992a).

Results of analysis of soil samples collected from the boreholes were previously submitted to the New Mexico Environment Department with the Part B permit application for the impoundments (LANL, 1992a). These results showed no detectable organics and no metals

above expected background. Results of gravimetric moisture and tritium analyses indicated that some migration of tritium into the subsurface has apparently occurred. The source of this tritium is not known. Possible sources include discharges to the unlined ditch south of the NE and NW impoundments that occurred before construction of the south impoundment, evaporation from the impoundments, air/stack emissions, and/or infiltration from the impoundments (LANL, 1992b). These results, however, do not indicate release of RCRA-regulated hazardous constituents. Samples that contained elevated levels of tritium showed no detectable organic hazardous constituents and no levels of metals above expected background (LANL, 1992a).

4.2.2 Vadose Zone Monitoring

The vadose zone monitoring system consists of one borehole with five pore-gas sample ports and five boreholes completed as neutron-moisture access wells, one of which also has a cup lysimeter. The following paragraphs present a brief description of the monitoring program and summarize relevant results. More detailed descriptions are presented in the Part B permit application for the impoundments (LANL, 1992a) and the Exposure Assessment Information Report (LANL, 1992c).

The pore-gas monitoring system was installed in Borehole 5. Pore-gas sample ports were installed at depths of 20, 40, 60, 80, and 93.5 ft. The pore-gas monitoring program is described in the Part B permit application for the impoundments. The program calls for pore gas to be sampled quarterly for one year and, if no organic hazardous constituents are detected, semiannually thereafter until closure. If organic constituents were detected before closure, quarterly sampling would resume until no significant increase was detected. Semiannual sampling would resume at that time (LANL, 1992a).

Pore-gas monitoring has been performed as described above since August 1991. Pore-gas samples have been analyzed for volatile organic compounds. No volatile organics have been detected in any of the samples at or above the detection limit of 8 μg per sample tube. These results do not indicate release of any RCRA-regulated volatile hazardous constituents from the impoundments. It is noted that low boiling point compounds that chromatographically elute before or coelute with the carbon disulfide used to extract the

sample tubes (e.g., vinyl chloride or chloromethane) would not be observed by the analytical procedure. Pore gas monitoring has not been performed using SW-846 methods because SW-846 does not include methods for pore gas sample collection and extraction of pore gas sample tubes.

Borings 1, 2, 3, 4, 7, and B were completed as neutron-moisture access wells. The moisture content monitoring program is described in the Part B permit application for the impoundments. The program calls for neutron-moisture access wells to be monitored quarterly until two consecutive years have passed with no indication of significant increase in moisture; then monitoring would occur semiannually until closure. If moisture levels increase prior to closure, quarterly sampling would resume until no significant increase was detected. Semiannual sampling would resume at that time (LANL, 1992a).

Neutron moisture monitoring has been performed as described above since August 1991. The results from the neutron moisture monitoring have not shown any significant changes in moisture content.

5.0 CLOSURE AND POSTCLOSURE REQUIREMENTS

This chapter describes how the requirements of the New Mexico Hazardous Waste Management Regulations-7 (HWMR-7) for closure of the TA-53-166 northeast (NE) and northwest (NW) impoundments will be met. Specifically, this closure plan describes how the requirements for closure by removal or decontamination ("clean closure") will be met. Clean closure requirements will be met by removing or decontaminating wastes, liners, and/or soils that are contaminated with HWMR-7 Part 261 Appendix VIII hazardous constituents above risk-based levels or that exhibit the characteristics of hazardous waste contained in HWMR-7 Part 261, Subpart C. Section 5.1 describes general closure requirements, including the process for developing cleanup levels. Section 5.2 describes specific requirements applicable to closure of surface impoundments. Decontamination procedures are presented in Section 5.3, and Section 5.4 discusses postclosure requirements.

5.1 General Closure Requirements

This section describes how general closure requirements applicable to interim status facilities will be met. As required HWMR-7 Part 270.1(c)(5), interim status surface impoundments undergoing clean closure must meet the removal and decontamination standards for permitted impoundments contained in HWMR-7, Part 264.228(a)(1).

5.1.1 Partial and/or Final Closure Activities [HWMR-7, Sections 265.111, 265.112, 264.228(a)(1) and 270.1(c)(5)]

This plan presents the activities required for final closure of the TA-53-166 NE and NW surface impoundments. The Laboratory intends to close the TA-53 surface impoundments in accordance with the clean closure requirements of HWMR-7, Sections 265.111 and 264.228(a)(1). To meet these requirements, all mixed wastes exhibiting the characteristics in HWMR-7 Part 261, Subpart C will be removed. All waste residues, containment system components, subsoils, and structures and equipment contaminated above risk-based levels will either be removed or decontaminated. Waste residues, containment system components, subsoils, and structures and equipment having hazardous constituents below risk-based levels may be left in place or removed.

5.1.1.1 Closure Performance Standard (HWMR-7, Section 265.111)

The surface impoundments will be closed in a manner that:

- minimizes the need for further maintenance, and
- controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, postclosure escape of mixed waste, hazardous constituents, leachate, contaminated run-off, or mixed waste decomposition products to ground or surface waters or to the atmosphere.

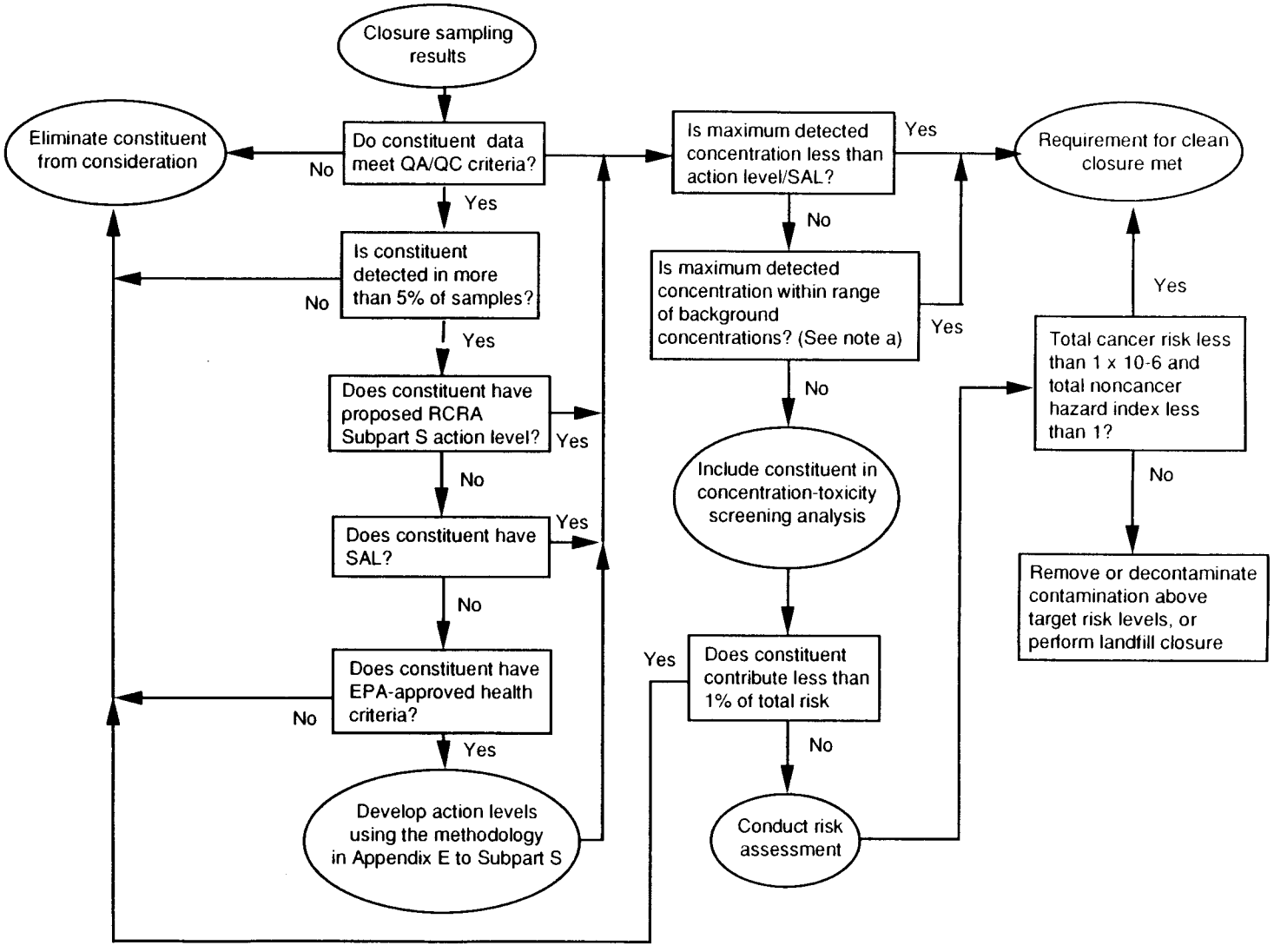
This standard will be met by the removal of all mixed wastes exhibiting the characteristics in HWMR-7 Part 261, Subpart C, from the surface impoundments. In addition, all sludge, liners, soil, equipment, and structures contaminated with HWMR-7, Part 261 Appendix VIII constituents above risk-based cleanup levels will be removed or decontaminated.

All equipment will be decontaminated, using the procedures described in Section 5.3.1, or removed for final disposition. All residuals resulting from decontamination will be removed for final disposition as described in Section 5.3.2.

The closure performance standard does not address radioactive contaminants that may be present in the impoundments. Any actions necessary to protect human health and the environment from exposure to radionuclides at this site will not be addressed as part of this closure plan, but will be addressed through the Laboratory Environmental Restoration Project. Radioactive contamination at this site will be evaluated during the Resource Conservation and Recovery Act (RCRA) Facility Investigation for TA-53 (Operable Unit 1100).

5.1.1.2 Removal/Decontamination Standard [HWMR-7, Sections 264.228(a)(1) and 270.1(c)(5)]

The approach for determining whether the closure performance standard has been met is illustrated in Figure 5-1 and is described in detail in Appendix K. This approach is based on



Notes: a - Comparison with background applies to soil and tuff samples only. Sludge constituents within background range will be inluded in risk analysis.

Figure 5-1. Process for Determining if Closure Performance Standard is Met

EPA's human-health-risk-assessment methodology and involves comparison of measured concentrations of HWMR-7 Part 261 Appendix VIII hazardous constituents in sludge, soil, bentonite, and tuff to risk-based levels. As shown in Figure 5-1, the decision whether clean closure standards have been met can be made at several stages. The process is designed so that decisions can be made as early as possible using comparisons to screening levels, thereby minimizing the number of constituents requiring a detailed risk assessment. The major steps in this process are described briefly below.

The first step in the process is to review data to determine whether they meet QA/QC criteria. Only those data meeting QA/QC criteria can be used for decision making. The next step is to eliminate constituents having a low frequency of detection. Maximum constituent concentrations will then be compared with risk-based or regulatory levels. The levels to be considered are, in order of precedence:

- Proposed RCRA Subpart S action levels or clean up levels required by other appropriate regulations, such as TSCA clean up levels for PCBs (10 mg/kg);
- Laboratory ER Project screening action levels (SALs); and
- Action levels developed using the methodology presented in Appendix E to proposed Subpart S.

If the maximum concentration is less than the action level, the clean closure performance standard will be met for that constituent.

As indicated above, if the constituent does not have an action level or SAL, an action level will be developed. Action levels will be developed using reference doses (RfDs) and/or cancer potency factors (CPFs) using the methodology presented in Appendix E of proposed Subpart S (EPA 1990). RfDs and CPFs will be obtained from EPA's Health Effects Assessment Summary Tables (HEAST) and Integrated Risk Information System (IRIS). If an RfD or CPF is not available from either HEAST or IRIS, one will be requested from EPA's Environmental Criteria and Assessments Office (ECAO). If there are no EPA-approved RfDs or CPFs, the constituent will be eliminated from consideration.

Constituents that are present above action levels will next be compared to background. Constituents in soil, subsoil, and tuff that are within the range of background concentrations for the Laboratory will be eliminated from consideration. Constituents in sludge that are present within the Laboratory background range for soils and tuff will be included in a comparison risk analysis.

All constituents passing the above screening steps will then be included in a concentration-toxicity screening analysis. The purpose of this screening is to identify each constituent's relative contribution to total risk. Those constituents contributing less than 1% of the total risk will be eliminated from consideration. The remaining constituents will be used to perform a risk assessment. If the risk assessment shows that the total cancer risk is less than 1×10^{-6} and the total noncancer hazard index is less than 1, the clean closure performance standard will be met. If not, a plan will be prepared for removal or decontamination that will reduce the risk to these target levels. Alternately, the impoundments may be closed as landfills. If it is necessary to close the impoundments as landfills, the requirements of HWMR-7, Section 265.228(a)(2) will be met. Before implementing landfill closure, an amended closure/post-closure plan will be prepared and submitted to NMED.

Application of the above process to demonstrate clean closure will be documented in a series of reports to be submitted to NMED, as described in Section 5.2.2.

5.1.1.3 Contents of Plan [HWMR-7, Section 265.112(b)]

This Plan identifies the steps necessary to perform final closure of the surface impoundments.

- Section 5.2.1 describes how the impoundments will be closed in accordance with the closure performance standard in Section 5.1.1.1 [HWMR-7, Section 265.112(b)(1)].

- Section 5.2.2 provides a general description of how final closure will be conducted [HWMR-7, Section 265.112(b)(2)].

- Section 5.2.3 identifies the maximum extent of operation that was unclosed during the active life of the impoundments [HWMR-7, Section 265.112(b)(2)].

- Section 5.2.4 estimates the maximum inventory of mixed waste in the impoundments during the active life of the impoundments [HWMR-7, Section 265.112(b)(3)].

- Section 5.2.5 provides a detailed description of the methods that will be used to characterize, remove, transport, treat, store, and dispose all mixed wastes. In addition, it identifies the off-site mixed waste management unit(s) to be used, if applicable, and the type(s) of unit(s) to be used. This section also references specific sampling and analysis procedures that will be used [HWMR-7, Section 265.112(b)(3)].

- Section 5.2.6 provides a detailed description of the steps needed to characterize, remove, or decontaminate all materials and equipment contaminated with hazardous constituents above the health-based cleanup levels. This section references methods for sampling and analysis, and criteria for determining the extent of decontamination necessary to satisfy the closure performance standard [HWMR-7, Section 265.112(b)(4)].

- Section 5.2.7 provides a detailed description of other activities necessary to ensure that the closure performance standard is met [HWMR-7, Section 265.112(b)(5)].

- Section 5.2.8 provides a schedule for final closure of each impoundment. This schedule includes the total time required to close each impoundment, and the time required to perform all of the activities described in Section 5.2 [HWMR-7, Section 265.112(b)(6)].

5.1.1.4 Amendment of Closure Plan [HWMR-7, Section 265.112(c)]

No changes in unit operating plans or unit design are expected that would require amendment to the closure plan.

The closure plan will be amended and submitted to the NMED whenever:

- there is a change in the expected year of closure, or

- an unexpected event is encountered during final closure activities that requires amendment to the closure plan. An unexpected event would include the discovery of mixed waste residuals that cannot be removed or decontaminated to meet the closure performance standard.

The closure plan must be amended and submitted to the NMED within 60 days after an unexpected event has occurred that affects the closure plan. If the unexpected event occurs during the final closure period, the closure plan must be amended and submitted within 30 days after the unexpected event. In addition, if an approved plan is being amended, a written request to authorize a change to the approved plan must accompany the amended plan.

The Laboratory Environmental Restoration Project will be responsible for maintaining and amending the closure plan.

5.1.1.5 Notification of Closure [HWMR-7, Section 265.112(d)]

Submission of the closure plan constitutes notification of the Laboratory's intent to close these impoundments. Submission of Revision 0.0 of this plan was made within 30 days of the last receipt of wastes at the impoundments, which was February 2, 1993. The date of the last receipt of mixed waste at the impoundments is not known as it is uncertain whether mixed wastes were ever discharged to the impoundments.

5.1.1.6 Closure Activities Performed Prior to Notification of Closure [HWMR-7, Section 265.112(e)]

The Laboratory did not begin removal of mixed wastes and decontamination or dismantling of equipment prior to notification of final closure.

5.1.2 Time Allowed for Closure [HWMR-7, Section 265.113]

5.1.2.1 Extension of Closure Timeframe [HWMR-7, Sections 265.113(a),(b)]

The closure regulations require the Laboratory to remove all mixed wastes within 90 days of closure plan approval and to complete final closure activities within 180 days after approval of the closure plan, unless a longer period has been approved.

An extension of these closure timeframes may be necessary. Sections 5.2.5 and 5.2.6 demonstrate that the waste removal may, of necessity, take longer than 90 days after approval of the closure plan, and final closure activities may, of necessity, take longer than 180 days after approval of the closure plan.

As described in Sections 5.2.5 and 5.2.6, removal of wastes and completion of closure activities will depend on removal of the water from the impoundments by evaporation. The time required for evaporation of water from the impoundments will depend on weather conditions and cannot be accurately predicted. Depending on the extent of evaporation that has occurred at the time the closure plan is approved, the Laboratory may request an extension of the closure timeframe.

5.1.2.2 Timeframe for Demonstrations for Extensions [HWMR-7, Section 265.113(c)]

Section 5.1.2.1 indicates that an extension of the timeframe for removal of wastes and completion of closure activities may be necessary.

If completion of final closure activities will take longer than the timeframe provided in the approved closure plan, the Laboratory will submit a demonstration referred to in HWMR-7, Section 265.113(b)(1) within at least 30 days before the expiration of the timeframe for completion of closure activities specified in the approved closure plan.

5.1.3 Disposal or Decontamination of Equipment, Structures, and Soils [HWMR-7, Section 265.114]

During the final closure period, all equipment, structures, and soil contaminated above risk-based levels must be properly disposed of or decontaminated.

Contaminated equipment will be decontaminated in accordance with the procedures described in Section 5.3.1.

Contaminated structures and soils will be identified, decontaminated, removed, and disposed of in accordance with the procedures described in Section 5.3.1.

All materials contaminated with hazardous constituents above risk-based cleanup levels will be decontaminated or removed. Section 5.3.2 describes how wastes generated during closure will be managed.

Section 5.3.3 describes the criteria used to determine when decontamination and removal activities have met the closure performance standard.

Section 5.3.4 describes the specific sampling and analysis procedures to be used to verify that all materials remaining on site after closure meet the closure performance standard.

5.1.4 Certification of Closure [HWMR-7, Section 265.115]

Within 60 days of completion of the final closure activities described in this plan, a certification of closure will be submitted to the NMED. This certification will indicate that the TA-53-166 NE and NW surface impoundments have been closed in accordance with the specifications in the approved closure plan. The closure certification will be submitted by registered mail and will be signed by the DOE Los Alamos Area Office Manager and the Laboratory Environment, Safety, and Health Division Director, or their authorized representatives, and by an independent, registered professional engineer. Exhibits 5-1 and 5-2 are examples of the closure certificates that will be submitted in the Final Closure Report described in Chapter 6.0. In addition, documentation supporting the independent registered professional engineer's

certification will be furnished to the NMED at this time. This documentation will consist of the Final Closure Report described in Chapter 6.0.

5.1.5 Survey Plat [HWMR-7, Section 265.116]

This closure plan does not include closure of the surface impoundments as landfills. Thus, submission of a survey plat indicating the location of landfill units is not required. If, during closure, it is determined that it is necessary to close any areas as disposal units, the closure plan will be amended. The amended plan will include the survey plat requirements of HWMR-7, Section 265.116.

5.1.6 Closure Cost Estimate (HWMR-7, Section 265.142)

A closure cost estimate is not required because federal facilities are exempt from this requirement per HWMR-7, Section 265.140(c).

5.1.7 Financial Assurance for Closure (HWMR-7, Section 265.143)

Financial assurance mechanisms are not required because federal facilities are exempt from this requirement per HWMR-7, Section 265.140(c).

5.1.8 Liability Requirements (HWMR-7, Section 265.147)

Liability coverage is not required because federal facilities are exempt from this requirement per HWMR-7, Section 265.140(c).

5.2 Specific Closure Requirements for Surface Impoundments

5.2.1 Description of How Each Unit Will be Closed [HWMR-7, Section 265.112(b)(1)]

The water in the impoundments will be sampled and removed as described in Sections 3.3.4 and Section 5.2.5, respectively. The sludge and waste residues (i.e., bentonite liner, soils, and tuff) may be removed from the impoundments if sample analysis reveals that

Exhibit 5-1. Example Owner or Operator Closure Certification

The undersigned, the United States Department of Energy, Los Alamos Area Office, and the University of California, which formerly owned or operated the Technical Area (TA)-53-166 Northwest and TA-53-166 Northeast surface impoundments (hereinafter "Facility) located at Los Alamos National Laboratory, in Los Alamos County, New Mexico, permanently ceased the active operation of the facility and have fully implemented all measures relating to the closure of the facility as set forth in the closure plan approved by the New Mexico Environment Department for said facility.

NOW, THEREFORE, we, the United States Department of Energy, Los Alamos Area Office, and the University of California, hereby swear and affirm that the above-named facility has been closed in accordance with the facility's closure plan approved in writing by the Secretary, New Mexico Environment Department, on _____, 19_, that all measures relating to the closure of the facility required by the closure plan and the New Mexico Hazardous Waste Regulations have been fully implemented, and that to the best of our knowledge, no violations exist that may have arisen prior to closure.

For the United States Department of Energy, Los Alamos Area Office (Owner/Operator):	For the University of California (Operator):
_____	_____
(Signature)	(Signature)
_____	_____
(Name)	(Name)
_____	_____
(Title)	(Title)

Taken, sworn and subscribed before me, this
_____ day of _____ A.D. 19_

_____

_____
(Notary)

Exhibit 5-2. Example Independent Registered Professional Engineer Closure Certification

I, _____(Name)_____, a Professional Engineer registered pursuant to the Professional Engineers registration laws of the State of New Mexico, hereby certify that I have reviewed the closure plan for the Technical Area (TA)-53-166 Northwest and TA-53-166 Northeast surface impoundments ("facility") at Los Alamos National Laboratory, that I am familiar with the New Mexico Hazardous Waste Regulations applied to closure of such facility, and that I personally have made visual inspection(s) of the aforementioned facility, and that the closure of the aforementioned facility has been performed in full and complete accordance with the facility's closure plan approved in writing by the Secretary, New Mexico Environment Department, on _____, 19_, and the New Mexico Hazardous Waste Regulations.

_____ _____

(Signature) (Date)

_____

(Professional Engineering License Number)

(Seal)

_____

(Business Address)

_____

(Telephone Number)

concentrations of HWMR-7, Part 261 Appendix VIII hazardous constituents are above the cleanup levels discussed in Section 5.1.1.2 or that the sludge or residues are characteristic mixed wastes. If removal is necessary, confirmatory sampling will be performed as described in Section 5.3.4, to demonstrate that all contaminated materials above the cleanup levels and/or mixed-waste characteristic levels have been removed. Sludge and waste residues will remain in the impoundment if analysis reveals that the closure performance standard has been met (Section 5.1.1.2) and the residues do not exhibit the characteristics in HWMR-7 Part 261, Subpart C. All contaminated materials removed from the impoundments will be packaged, labeled, and transported in accordance with Laboratory waste management requirements. Wastes that are determined through sampling and analysis to be nonhazardous, low-level radioactive wastes will be taken to TA-54 Area G for disposal. Wastes that are determined to be mixed wastes will be taken to a storage facility at TA-54 or to a permitted off-site disposal facility.

5.2.2 Description of how Final Closure will be Conducted [HWMR-7, Section 265.112(b)(2)]

Clean closure of the impoundments will be performed through several activities. These activities include: 1) sampling of the water and sludge in the impoundments; 2) removal of the water from the impoundments by evaporation; 3) sampling of the sludge, bentonite liner, and soils/tuff; 4) removal and disposal of contaminated materials, if necessary based on the results of sampling and analysis; 5) sampling and analysis to confirm removal or decontamination; and 6) stabilization of the site. The initial or confirmatory sampling activities are discussed in detail in Sections 3.3, and 5.3.4, respectively. Removal activities are discussed in Sections 5.2.5 and 5.2.7. Stabilization is discussed in Section 5.2.7.

The specific activities needed to demonstrate that clean closure requirements have been met will depend on the extent of contamination, as determined through sampling and analysis. The possible activities that be may required are outlined below:

- Conduct sampling and analysis described in Section 3.0.

- Evaluate results based on methodology described in Appendix K to determine approach for demonstrating clean closure. Prepare summary report containing results of sampling and analysis and proposed approach. Submit report to NMED.

- NMED review and approve proposed approach.

- If results indicate that clean closure can be demonstrated based on comparison to action levels without the need for risk assessment, prepare and submit Final Closure Report.

- If results indicate that risk assessment is needed, conduct risk assessment as described in Appendix K. Prepare risk assessment report presenting results of risk assessment and identifying actions needed to meet clean closure requirements (i.e., no action or removal). Submit risk assessment report to NMED.

- NMED review and approve risk assessment report.

- If risk assessment report specifies no further action, prepare and submit Final Closure Report.

- If risk assessment specifies removal:

  - perform preremoval characterization sampling, if necessary, and submit results to NMED;

  - perform removal and confirmatory sampling and analysis;

  - prepare summary report documenting removal actions and confirmatory sample results;

  - submit report to NMED;

  - NMED review and approve report; and

- prepare and submit Final Closure Report.

If it is determined that removal of all contaminated materials is not feasible due to the nature and extent of contamination, the impoundments will be closed as landfills as required by HWMR-7, Section 265.228(a)(2) and an amended closure/postclosure plan will be prepared and submitted to the NMED.

5.2.3 Identification of Maximum Extent of Operation [HWMR-7, Section 265.112(b)(2)]

The TA-53-166 NE and NW impoundments were in operation at the same time. The maximum extent of operation, therefore, includes storage of wastes in both impoundments, discharge of wastes from the impoundments, and any release of wastes beyond the impoundments by leakage. The extent of contamination, if any, resulting from discharges by leakage through the liners will be assessed through soil sampling, as described in Section 3.2.

5.2.4 Estimate of the Maximum Inventory of Hazardous Waste [HWMR-7, Section 265.112(b)(3)]

Because of incomplete knowledge concerning past disposal of mixed wastes to the impoundments, it is not possible to determine the maximum, if any, historical inventory of mixed wastes. The maximum inventory of water and sludge in the impoundments will be used as a conservative estimate of the maximum inventory of mixed wastes that may ever have been in the impoundments. A conservative estimate of the maximum inventory of water is the volume of water present when the impoundments were full (i.e., water was discharging). The maximum inventory of sludge is the inventory on February 2, 1993, when inflow to the impoundments was stopped. This inventory is the maximum sludge inventory because no sludge has ever been removed from the impoundments. These inventories are estimated below.

The maximum depth of water in the impoundments is 4 ft, which is the difference between the maximum water elevation and the elevation of the bottom of the impoundments. The design capacity of each impoundment, based on this maximum water elevation, is 1,629,144 gal. This volume represents the maximum inventory of water in each impoundment.

The sludge in the north impoundments has never been removed. Based on previous sampling activities, the sludge is estimated to be 3- to 18-in. thick (DOE, 1989). For a sludge thickness of 3 in., each impoundment will contain approximately 8,700 ft^2 (0.20 acre-ft) of sludge. For a sludge thickness of 18 in., each impoundment will contain approximately 54,000 ft^2 (1.23 acre-ft) of sludge. Therefore, it is estimated that each impoundment contains approximately 8,700 to 54,000 ft^2 of sludge, taking into account the 2:1 slope of the impoundment walls.

5.2.5 Detailed Description of Removal of Waste Inventory [HWMR-7, Sections 265.112(b)(3) and (4)]

Most of the water remaining in the impoundments after discharges were stopped on February 2, 1993, was lost to evaporation during the summer and fall of 1993. Sufficient water is being kept in the impoundments to prevent the sludge from drying and to allow sampling. After the sludge has been sampled for radiological characterization, the remaining water will be allowed to evaporate so that sludge sampling can be completed and the liners and soil beneath the sludge can be sampled. Based on past evaporation rates, several months should be needed to evaporate the remaining water so that sampling can be completed.

The results from analysis of sludge will be used to determine whether the closure performance standard has been met, as described in Section 5.1.1.2. If results indicate that the standard has not been met, it may be necessary to remove sludge from the impoundments. The specific methods and procedures to be used for removal will depend on the extent of contamination. Any expected removal can be performed with wheel- or track-mounted excavation equipment. All equipment used to remove waste inventory will be decontaminated as described in Section 5.1.3. All sludge removed from the impoundments will be packaged, labeled, and transported in accordance with approved Laboratory waste management procedures. Wastes that are determined through sampling and analysis to be nonhazardous, low-level radioactive wastes will be taken to TA-54 Area G for disposal. Soils, tuff, and liner material that are determined to be mixed wastes may be transported to an offsite mixed waste facility for treatment, if necessary, and disposal. Sites that may be used include the Envirocare of Utah, Inc., facility near Clive, Utah; the DOE Hanford Site near Richland, Washington; and the DOE Nevada Test Site near Mercury, Nevada. Selection of a

disposal site will consider waste characteristics, waste acceptance criteria, and disposal costs. If none of the off-site facilities can accept the wastes, the wastes will be taken to an interim status storage facility at TA-54, Area L and stored until a suitable treatment/disposal facility is available.

Wastes determined to be mixed wastes would be packaged in containers meeting the requirements contained in HWMR-7, Part 262, Subpart C. Radioactive and mixed wastes would be packaged in plastic-lined 55-gallon drums or in plastic-lined steel boxes. Alternately, unpackaged ("bulk") wastes may be transported in plastic-lined covered dump trucks. All packaging and transportation will meet the requirements of the waste acceptance criteria of the facility receiving the waste.

All containers will be placed on plastic sheeting while being filled in order to prevent the spread of contamination. After containers are filled and sealed, they will be given a radiological survey to determine whether they meet applicable limits for removable surface contamination. If these limits are exceeded, the containers will be decontaminated as described in Section 5.3.1. All containers must meet the surface contamination limits given in 49 CFR 173.443 in order to be transported offsite from the Laboratory.

5.2.6 Detailed Description of Removal of Waste Residues [HWMR-7, Sections 265.112(b)(4) and 265.114]

The bentonite impoundment liners, and the soil and tuff beneath the bentonite and gunite impoundment liners will be sampled as described in Section 3.3.6. The results of soil and tuff sample analysis will be used to determine whether the closure performance standard has been met, as described in Section 5.1.1.2. If results indicate that the standard has not been met, it may be necessary to remove contaminated soil and/or tuff. The specific methods and procedures to be used for removal will depend on the extent of contamination. Any expected removal can be performed with wheel- or track-mounted excavation equipment. All equipment used to remove waste residues will be decontaminated as described in Section 5.3.1. If it is necessary to remove soil from the berms, the gunite liner will also be removed and sampled to determine how it can be disposed of. All contaminated soil, tuff, and liner material will be packaged, labeled, and transported in accordance with approved Laboratory

waste management procedures. Soils, tuff, and liner material that are determined through sampling and analysis to be nonhazardous, low-level radioactive wastes will be taken to TA-54 Area G for disposal. Soils, tuff, and liner material that are determined to be mixed wastes may be transported to an offsite mixed waste facility for treatment, if necessary, and disposal. Sites that may be used include the Envirocare of Utah, Inc., facility near Clive, Utah; the DOE Hanford Site near Richland, Washington; and the DOE Nevada Test Site near Mercury, Nevada. Selection of a disposal site will consider waste characteristics, waste acceptance criteria, and disposal costs. If none of the off-site facilities can accept the wastes, the wastes will be taken to an interim status storage facility at TA-54, Area L and stored until a suitable treatment/disposal facility is available.

5.2.7 Detailed Description of other Necessary Activities [HWMR-7, Section 265.112(b)(5)]

Following completion of sampling activities, the site will be stabilized until clean closure has been certified. The site will be stabilized by covering the impoundments with a geotextile filter fabric. This cover will extend over the tops of the impoundment dikes. This cover will be installed to:

- prevent airborne release of radioactive contaminants in the sludge;
- allow consolidation and dewatering of the sludge; and
- prevent contact with the sludge by humans and animals.

If the results of the sludge, soil, bentonite, and tuff sampling indicate that materials must be removed from the impoundments to meet the closure performance standard, the cover can be temporarily removed to allow removal.

Following completion and certification of clean closure under HWMR-7, the requirements for final stabilization of the impoundments will be determined through the Laboratory Environmental Restoration Project as part of the RFI for OU 1100. If the site will be stabilized with radioactive wastes left in place, the site will be stabilized to meet the low-level waste disposal requirements of DOE Order 5820.2A (DOE, 1988).

The weekly inspections required by HWMR-7, Section 265.226(a)(2) will be continued until closure is complete. Daily inspections for freeboard will not be performed because wastewaters are no longer being added to the impoundments and the existing freeboard is adequate to contain precipitation.

The specific activities identified in HWMR-7, Section 265.112(b)(5) (i.e., groundwater monitoring, leachate collection, and run-on and run-off control) are not necessary to complete closure. Groundwater monitoring is not required, as discussed in Chapter 4.0. No leachate will be generated during closure. Run-on and run-off will be controlled by the existing surface impoundment dikes.

5.2.8 Schedule for Closure of Each Unit [HWMR-7, Section 265.112(b)(6)]

The two impoundments will be closed simultaneously. The estimated schedule for closure activities is presented in Figure 5-2.

Sampling will be performed in two phases. The first phase of sampling and analysis will involve radiological characterization of the water and sludge. Phase I data will be used to determine health and safety requirements for subsequent sampling and to evaluate whether National Emissions Standards for Hazardous Air Pollutants (NESHAP) approval is necessary. The second phase of sampling will involve chemical characterization of the sludge, liners, and soil/tuff beneath the liners. Phase II data will be used for the purpose of demonstrating compliance with RCRA closure requirements. Based on existing radiological data, it is assumed that Phase II sampling can be performed after the water has been evaporated from the impoundments. Phase I radiological data will be used to confirm this assumption. If alternate Phase II sampling procedures are required, the closure plan may have to be amended.

Radiological characterization will be performed after this closure plan has been submitted to the NMED and sufficient water has evaporated to facilitate sampling. Sampling will not be performed until the water has evaporated to a depth of approximately 1 ft above the maximum thickness of sludge. Allowing the water to evaporate to this depth will make it easier to perform the sludge sampling procedure described in Section 3.3.5.1. The water will

Activity	Months																	
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Submit Closure Plan	X																	
Phase I Water and Sludge Sampling		XXX																
Phase I Sample Analysis		X	XXX	XXX	XX													
Closure Plan Approved			X															
Evaporation of Water [a]	XXX	XXX	XXX	XXX	XX													
Evaluate Phase I Results					X	XX												
Phase II Sludge, Liner, and Soil Sampling						X	XX											
Phase II Sample Analysis							XXX	XXX	XXX									
Evaluate Phase II Results									XX	XXX	XXX	X						
Install Impoundment Covers							X	XXX	XXX	XX								
Prepare Summary Report With Recommended Action [b]											XX	XXX	XXX	X				
Submit Summary Report														X				
Summary Report Approved																X		
Preparation of Final Closure Report																X	XXX	XX

Notes:
[a] Three months assumed for evaporation of water following water and sludge sampling.
[b] Schedule assumes that clean closure requirements can be demonstrated without detailed risk assessment.

Figure 5-2. Estimated Closure Schedule

not be allowed to evaporate below this depth to avoid having the sludge layer be disturbed by the boat used for sampling.

Phase II sampling will be performed after this closure plan has been approved by the NMED and the water has evaporated from the impoundments.

As described in Section 5.2.2, the results of the sampling will be evaluated to determine the activities needed to demonstrate clean closure. It may be possible to compare results directly to action levels to demonstrate that closure standards have been met. Alternately, it may be necessary to perform a risk assessment. The risk assessment may indicate that existing levels of constituents are acceptable or may indicate that removal is necessary. If removal is performed, confirmatory sampling and analysis will be needed to demonstrate that closure standards have been met.

The results of the radiological analysis of the sludge samples will be used to determine whether subsequent closure activities would result in a release of radionuclides subject NESHAP regulations. If so, an application for existing source modification will be submitted to EPA. The results of the radiological and chemical analysis of sludge samples will also be used to determine site-specific health and safety requirements for subsequent closure activities. Preventing atmospheric release of RCRA constituents, as needed to meet the closure performance standard under 40 CFR 265.111, will be addressed in development of risk-based cleanup levels. The need for removal and confirmatory sampling will be evaluated after receipt and review of analytical data and development of risk-based cleanup levels, if necessary. Following completion of soil/tuff sampling, the impoundments will be temporarily stabilized by installation of a geotextile cover.

The total estimated cumulative time to complete closure is estimated to be 18 months. This schedule assumes that clean closure can be demonstrated without the need for a detailed risk assessment or waste removal. If removal and confirmatory sampling are necessary, an additional six months is expected to be needed.

5.3 Decontamination Procedures [HWMR-7, Section 265.112(b)(4)]

Decontamination efforts during closure of the TA-53 surface impoundments will involve decontamination of sampling equipment; any equipment operated within the impoundments to remove sludge, soil, bentonite or tuff; waste containers; and the gunite impoundment liners. Removal of contaminated sludge, soil, bentonite, and tuff was previously described in Sections 5.2.5 and 5.2.6, respectively.

5.3.1 Procedures for Cleaning Equipment and Removing Contaminated Soils [HWMR-7, Section 265.112(b)(4)]

Sampling equipment, and any other small equipment that comes into contact with water, sludge, or other residuals will be decontaminated after use. Decontamination will take place at the area specifically established for that purpose. Decontamination of small equipment will be performed as follows:

1) Equipment will be thoroughly scrubbed using a solution of Alconox® or other laboratory detergent. Detergent strength will be per the manufacturer's recommendations. All visible signs of contamination will be removed.

2) Equipment will be thoroughly rinsed with clean tap water so that no detergent is left on the equipment.

3) If necessary, the equipment will be rinsed with organic solvents or dilute acid. In general, the use of solvents or acids will be avoided; these will only be used if the detergent is ineffective in removing all contamination.

4) Equipment will be triple rinsed with deionized water.

5) If the equipment is not to be used immediately, it will be allowed to air dry and will be wrapped with clean polyethylene or aluminum foil, with the dull side of the foil toward the equipment.

6) All equipment will be radiologically surveyed to confirm radiological decontamination.

Decontamination wastes (i.e., liquids and sludges) will be collected in open tubs or buckets and disposed of to the impoundments at the end of each day. If the decontamination liquids and sludges must be sampled before disposal, these wastes will be stored in polyethylene-lined drums. Polyethylene is compatible with the dilute detergent and any contaminants expected to be present in the decontamination wastes.

Large equipment operated within the impoundments will be decontaminated within a bermed, lined decontamination area established for this purpose. Before beginning decontamination, the condition of the liner will be evaluated to determine if it is in suitable condition. The decontamination area liner will be inspected for tears, holes, and integrity of seams, if any. If the liner is judged to be in unsatisfactory condition, a new liner will be installed.

Large equipment will be decontaminated by steam cleaning using a nonphosphate detergent solution. This equipment will be steam cleaned until all visible contamination is removed, and then rinsed with clean tap water. A sample of the final water rinse will be collected to verify decontamination. Decontamination liquids and sludges will be collected within the bermed area and disposed of to the impoundments. If the decontamination liquids and sludges must be sampled before disposal, these wastes will be stored in polyethylene-lined drums.

After all equipment decontamination is complete, and the decontamination liquids and sludges have been disposed of, the liner will be decontaminated by steam cleaning followed by rinsing with clean water. The wash and rinse water will be disposed of to the impoundments. The liner will be field screened for radioactivity. If the liner is radioactive, it will be cut into strips approximately 30-in. wide. Each strip will be rolled to fit into an open-top 55-gal. polyethylene-lined drum. Each drum will be filled with liner material, sealed, labeled, and transported to TA-54 for disposal. If the liner is nonradioactive, it will be disposed of as nonradioactive solid waste.

After waste containers are sealed, all visible contamination (e.g., soil) will be removed from the surface by wiping with detergent-soaked rags. The surface of the waste containers will

then be radiologically surveyed to determine if total and removable contamination meets allowable limits. If not, additional decontamination will be performed.

The gunite impoundment liners will be decontaminated, if necessary, by steam cleaning followed by water rinsing. The gunite liner will not be decontaminated unless it is determined that the sludge must be removed from the impoundments. The rationale for not decontaminating the liner if the sludge will not be removed is that the liner is expected to be less contaminated than the sludge. Gunite liner decontamination wastes will not be collected, but will be allowed to drain into the impoundment. Gunite liner decontamination will be performed before soil samples are collected from beneath the liner. If soil sampling shows that it is necessary to remove the soil from the berms, any decontaminated gunite liner removed in order to excavate soil will be sampled to determine how it can be disposed of.

5.3.2 Management of Generated Wastes [HWMR-7, Section 265.114]

Wastes that may be generated during closure of the TA-53 surface impoundments include personnel protective clothing, disposable sampling equipment, liquids and sludges from decontamination, the liner from the equipment decontamination area, and sludge, soil, tuff, and bentonite and gunite liner material contaminated above cleanup levels that is removed from the impoundments. Wastes will be sampled as described in Section 3.3.7.

In addition to determining wastes that exceed risk-based levels, the results of chemical analysis of samples of sludge, soil/tuff, liner material, and wastes will be used to determine whether TCLP regulatory levels for toxic mixed wastes under HWMR-7, Section 261.24 could be exceeded. Any materials that must be disposed of, and that could exceed TCLP regulatory levels, will be resampled and analyzed using the TCLP procedure. Additionally, results of reactive cyanide and sulfide analysis of sludge samples will be used to determine whether the sludge is a reactive mixed waste under HWMR-7, Section 261.23. Based on existing waste characterization data (see Section 3.1), these wastes are expected to be designated as nonhazardous, low-level radioactive wastes. Liquid wastes and sludges that sampling shows to be below cleanup levels will be returned to the impoundments. All other wastes that cannot be shown to be below radiological release limits will be packaged, labeled, and transported to TA-54 for storage or disposal. Wastes containing free liquids will

be solidified to eliminate free liquids before disposal. These activities will be performed in accordance with approved Laboratory procedures for waste management.

If sampling and analysis indicate that wastes exhibit the toxicity characteristic under HWMR-7, Section 261.24 or the reactivity characteristic under HWMR-7, Section 261.23, they will be managed as mixed wastes. Mixed wastes will be drummed, labeled, manifested, and transported in accordance with Laboratory procedures. These procedures comply with the applicable requirements of HWMR-7, Parts 261 and 262. These wastes may be stored at TA-54 or transported off-site for disposal at a RCRA-permitted facility. Off-site facilities that may be used include the Envirocare of Utah, Inc., facility near Clive, Utah; the DOE Hanford Site near Richland, Washington; and the DOE Nevada Test Site near Mercury, Nevada. If a change under interim status for TA-54 is required in order to store these wastes, a revised Part A permit application will be submitted to the NMED with a request for approval, if necessary. If any of the mixed wastes to be stored exceed land disposal restriction treatment standards, storage will be addressed in the Federal Facility Compliance Agreement for the Laboratory.

5.3.3 Criteria for Determining the Extent of Decontamination Necessary [HWMR-7, Section 265.112(b)(4)]

Criteria for decontamination will depend on the type of material being decontaminated. Criteria for equipment decontamination are qualitative criteria based on how and where the equipment is used. All nondisposable sampling equipment will be decontaminated following use, primarily to avoid cross-contamination of samples. All other equipment that comes into contact with the water or sludge in the impoundments, the impoundment liners, or soils/tuff beneath the liners will be decontaminated. Any other equipment used within the contamination control area established per the health and safety plan will also be decontaminated. All equipment will be decontaminated to remove contaminants known or suspected to be present. Based on existing data (see Section 3.1), the primary contamination of concern will be radioactive contamination associated with sludge. The equipment decontamination procedures described in Section 5.3.1 are designed to remove this contamination. The qualitative equipment decontamination criteria will also be applied to the gunite liners, if necessary. As with equipment, contamination of the gunite liner is

expected to be limited to surface contamination that can be removed using the decontamination procedure.

All sludge, soil, bentonite, and tuff contaminated above the risk-based levels described in Section 5.1.1.2 will either be removed from the surface impoundments or left in place rather than decontaminated. These levels include proposed RCRA Subpart S action levels, SALs, and risk-based levels developed from a site-specific risk assessment (see Appendix K). These levels are quantitative criteria that indicate allowable levels of contamination.

5.3.4 Methods for Sampling and Testing to Demonstrate Success of Decontamination [HWMR-7, Section 265.112(b)(4)]

Decontaminated equipment will not be sampled to determine the effectiveness of chemical decontamination. Rather, effectiveness will be based on knowledge of the contaminants present, known effectiveness of the decontamination agents used, removal of all visual evidence of contamination, and collection of rinsate blank samples, as described in Section 3.5.1.

Effectiveness of radiological decontamination of equipment will also be based on knowledge of the contaminants present, known effectiveness of the decontamination agents used, removal of all visual evidence of contamination, and collection of rinsate blank samples. In addition, equipment and waste containers will be radiologically surveyed following decontamination to verify that all radioactivity is below Laboratory radiological release limits.

If sludge, liners, or soil/tuff are contaminated above the health-based cleanup levels, removal may be undertaken to meet the closure performance standard. If these materials are removed, confirmatory sampling will be necessary to confirm that remaining constituent concentrations meet cleanup levels.

As described in Appendix K, the risk assessment will include evaluation of exposure conditions and calculation of appropriate statistically-based exposure concentrations. These components of the risk assessment, including statistical tests, will determine the amount of removal required and the appropriate strategy for confirmatory sampling (e.g., numbers,

types, and locations of samples). A site-specific plan for removal and confirmatory sampling will be prepared and submitted to NMED for approval before cleanup begins.

5.4 General Postclosure Care Requirements [HWMR-7, Sections 264.228(b), 265.117 - 265.120, 265.144, and 265.145]

As currently described in this closure plan, the TA-53 surface impoundments will not be closed as mixed-waste landfills. As a result, postclosure care requirements are not applicable per HWMR-7, Section 265.110(b). If, during closure, it is determined that all mixed-waste residues cannot practicably be removed, the closure plan will be amended and additional procedures developed for meeting the closure performance standard given in Section 5.1.1.1. These additional procedures may require postclosure care. If so, a postclosure plan will be prepared that addresses the applicable requirements of HWMR-7, Sections 265.117 through 265.120. The postclosure plan will be prepared and submitted to the NMED within 90 days of determination of the need for such a plan.

It is noted that if a postclosure plan is necessary, a postclosure cost estimate (HWMR-7, Section 265.144) and a financial assurance mechanism for postclosure care (HWMR-7, Section 265.145) will not be required because federal facilities are exempt from those requirements per HWMR-7, Section 265.140(c).

6.0 CLOSURE REPORTS

Several reports may be prepared and submitted to NMED during implementation of closure. These reports are a Summary Sampling and Analysis Report, Risk Assessment Report, Preremoval Characterization Sampling and Analysis Report, Removal Report, and Final Closure Report. These reports are described briefly below.

6.1 Summary Sampling and Analysis Report

A Summary Sampling and Analysis Report will be prepared after Phase II sampling and analysis has been completed. This report will include an evaluation of the analytical data and, based on this evaluation, will recommend the approach for completing closure. The recommended approach could consist of certifying clean closure based on comparison with action levels and SALs, performing a baseline risk assessment, or amending the closure plan for landfill closure. This report will contain:

1) a tabular summary of analytical results;

2) an evaluation of the analytical data with respect to the data screening criteria described in Section 5.1.1.2, including:

    a. comparison with QA/QC criteria,

    b. evaluation of frequency of detection,

    c. comparison with action levels and SALs, and

    d. comparison with background; and

3) a description of the proposed approach for completing closure.

6.2 Risk Assessment Report

If it is necessary to conduct a risk assessment, the approach to and results of the risk assessment will be documented in a Risk Assessment Report. This report will contain:

1) a tabular summary of analytical results;

2) health criteria (RfDs and CPFs) and references for these criteria;

3) a concentration-toxicity screening analysis;

4) an exposure assessment;

5) a toxicity assessment;

6) a risk characterization evaluating total cancer risk and noncancer health hazard; and

7) an uncertainty analysis.

If the total cancer risk and/or noncancer hazard index are above levels for clean closure, the risk assessment report will also contain target cleanup levels for clean closure.

NMED approval.

6.3 Preremoval Characterization Sampling and Analysis Report

If the risk assessment indicates that removal or decontamination is needed to meet clean closure requirements, additional characterization sampling and analysis may be performed before removal/decontamination. This characterization would be performed to better define the areas requiring removal/decontamination. The results of the sampling and analysis would be presented in a Preremoval Characterization Sampling and Analysis Report. This report would contain:

1) a description of sampling activities and sample locations;

2) a tabular summary of analytical results; and

3) figures delineating the areas requiring removal or decontamination.

6.4 Final Closure Report

Upon completion of closure activities, a Final Closure Report will be sent to the Secretary, New Mexico Environment Department. Copies of all analytical data reports will be appended to the Final Closure Report. This report will document the final closure and contain, at a minimum, the following:

1) the certifications described in Section 5.1.4;

2) any variance from the activities described in the approved closure plan and the reason for the variance, any nonconformance reports for field and/or laboratory procedures that affect data quality, and documentation of corrective action implementation for nonconformance of field and laboratory procedures;

3) a tabular summary of all sampling results, showing:

   a. sample identification,

   b. sampling location,

   c. the datum reported,

   d. detection limit for each datum,

   e. a measure of analytical precision,

   f. identification of analytical procedure, and

   g. identification of analytical laboratory;

4) laboratory data analysis sheets;

5) a QA/QC statement on the adequacy of the analyses and the decontamination demonstration;

6) the location of supporting documentation, including:

   a. field log books,

   b. QA/QC documentation, and

   c. chain-of-custody records;

7) disposition and disposal location of all regulated and nonregulated residuals;

8) a certification of the accuracy of the report;

9) a demonstration of equivalency with closure requirements under HWMR-7, Part 264.228 in accordance with HWMR-7, Part 270.1(c)(5)(ii); and

10) a demonstration that groundwater is uncontaminated and that EPA policy guidance requirements have been met as described in Section 4.1.

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APPENDIX A

AS-BUILT DRAWINGS OF NORTHEAST AND NORTHWEST IMPOUNDMENTS

APPENDIX B

EVALUATION OF SOURCES OF WASTE FOR TA-53 SURFACE IMPOUNDMENTS

APPENDIX B

EVALUATION OF SOURCES OF WASTE FOR TA-53 SURFACE IMPOUNDMENTS

Two general sources of waste exist for the TA-53 surface impoundments. The first source is discharges from the sanitary sewer and radioactive liquid waste lines. The second source is discharges of septic tank sludges. Available information was reviewed to characterize the specific types of waste associated with these sources. Information was available on sources of the waste, but not on waste composition or amounts of constituents.

Sources of sanitary and radioactive liquid wastes were identified from the series of wastewater stream characterization reports prepared for the Environmental Protection Group (ESH-8). Twelve reports were prepared for TA-53 (Sante Fe Engineering, 1993a; Sante Fe Engineering, 1993b; Sante Fe Engineering, 1993c; Sante Fe Engineering, 1993d; Sante Fe Engineering, 1993e; Sante Fe Engineering, 1993f; Sante Fe Engineering, 1993g; Sante Fe Engineering, 1993h; Sante Fe Engineering, 1993i; Sante Fe Engineering, 1993j; Sante Fe Engineering, 1993k; Sante Fe Engineering, 1993l). These reports evaluated discharges from 420 structures at TA-53. The reports identified every wastewater discharge from each of these facilities, identified sources contributing to each discharge, and identified where each discharge goes. Sixty facilities were identified which discharge to the sanitary sewer; a total of 70 separate discharges were identified for these facilities. Eight facilities were identified which discharge to the radioactive liquid waste system; a total of 11 separate discharges were identified for these facilities. These discharges and their associated sources are identified in Table B-1. The wastewater stream characterization reports did not identify any discharges of hazardous wastes to the sanitary sewer or radioactive liquid waste system.

The information presented in Table B-1 shows that most of the outfalls should not have received discharges containing hazardous chemicals or radionuclides. Many of the outfalls receive only sanitary waste discharges (e.g., lavatories, water fountains) and should not have received hazardous constituents. Some of the outfalls were identified as receiving drainage from a variety of equipment including chillers, water heaters, pressure relief valves, air conditioners, boilers, compressors, and vacuum pumps. This drainage is not expected to contain hazardous chemicals.

A possible source of hazardous constituents appears to be improper disposal of chemicals to floor drains and sink drains. No records exist concerning disposal of chemicals to floor drains or sink drains. A review of the hazardous waste tracking system maintained by ESH-8 showed that 25 of the facilities listed in Table B-1 have hazardous waste accumulation areas (i.e., satellite areas). These facilities generate hazardous wastes and, presumably, could be sources of chemical discharge to the impoundments.

Historical information concerning septic sludge discharged to the TA-53 impoundments is very limited. Staff at the Waste Management Group (CST-7), ESH-8, and Johnson Controls (JCI) were interviewed to obtain information about these discharges. Information obtained from these interviews indicates that septic sludge from many of the technical areas at the Laboratory was taken to TA-53 for disposal. This practice may have started during the 1970s. During the period of approximately 1989 to 1991, the TA-53 impoundments apparently received all septic sludge at the Laboratory. Discharges of septic sludge to the sewage treatment plants was stopped during this period to prevent overloads. Records of pumping and disposal of septic tank waste prior to 1991 no longer exist.

Septic tanks whose contents may have been discharged to the TA-53 impoundments were identified from a list of septic tanks contained in the 1987 Comprehensive Environmental Assessment and Response Program (CEARP) Report (DOE, 1987), the 1990 Solid Waste Management Units (SWMU) Report (LANL, 1990), and the septic tank inventory maintained by ESH-8. These sources were reviewed to identify those tanks that were active and those that were taken out of service after 1970. These tanks, and comments concerning possible hazardous and radioactive contents, are presented in Table B-2.

The information in Table B-2 shows that some of the septic tanks may have contained chemical or radioactive contamination. The sludge from these tanks, therefore, could be a source of hazardous constituents in the impoundments. Septic sludge was not characterized before disposal so no information exists concerning constituents that may actually have been disposed of to the impoundments.

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Table B-1. Summary of Wastewater Sources at TA-53

Building No.	Sanitary Outfall No.	Radioactive Waste Outfall No.	Wastewater Sources	Satellite Area Present
1	53-1-OPN-1A		Ice machine, kitchen equipment, hand wash, general cleaning, toilet, urinal, water fountain, bar sink, coffee bar.	Yes
	53-1-OPN-1B		Floor wash, hand wash, clean up, non-emergency shower, toilet, urinal, water fountain, storm water, water heater drains, pressure relief valves, boiler blowdown, air conditioner condensate, air conditioner compressor discharge, air washer blowdown, clean room, humidifier drain.	
	53-1-OPN-1C		Hand wash, clean up, toilet, urinal, water fountain, storm water, floor drainage, chiller drain, backflow preventer, water heater pressure relief valve, boiler drains.	
	53-1-OPN-1D		Clean up, hand wash, non-emergency shower, toilet, urinal, water fountain, floor wash, steam condensate sump drain, steam pressure relief valve, boiler drain, deionized water tank drain, acid waste bypass overflow, potable water bypass overflow, vacuum pump cooling water, vacuum tank drain, vent lines, fire test, fire drain, water heater pressure relief valve, water heater drain lines, floor drainage.	
2	53-2-OPN-2		Equipment rinse, hand wash.	Yes
	53-2-OPN-3		Floor washings, hand wash, parts rinse, lavatory, hood drain, equipment rinse, backflow preventer drain, shower drain, toilet, urinal, water fountain.	

Table B-1. Summary of Wastewater Sources at TA-53 (Continued)

Building No.	Sanitary Outfall No.	Radioactive Waste Outfall No.	Wastewater Sources	Satellite Area Present
3	53-3-OPN-1		Backflow preventer, heating/air conditioning drain, potable water, floor wash, pump leak, oil catch pan, boiler relief, hot water expansion tank, boiler drain, compressed air tank, leaks in area, pressure relief valve drain, fire water drain, deionized water leaks, water heater relief, storm water, boiler pump drain, chemical feed drain, strainer/cooling water, water heater relief, hand wash, mop water, general washings, shower water, sanitary wastes, potable water, deionized water drain, hot water relief valve, heat exchanger leak, compressed air dyer, vacuum relief, chiller drain, heating and air conditioning drain, chiller pump drain, boiler discharge pipe, strainer/boiler system, strainer/tower system, chiller expansion tank, chiller discharge pipe.	Yes
		53-3-OPN-2	Deionized water system, oil catch pan, cooling tower water, sump pump.	
4	53-4-OPN-1		Emergency shower, floor wash, lavatory, service sink, hand wash, toilet, urinal, drinking water, fire line drains, condensed water drain, backflow preventer drain, pressure relief drain, rinse water, diluted utensil rinse water.	Yes
6	53-6-OPN-1		Backflow preventer, pressure release drain, floor wash, air compressor drain, water fountain, lavatory, countertop sink, service sink, toilet, urinal.	No
	53-6-OPN-2		Backflow preventer, boiler pressure relief valve, lavatory, countertop sink, service sink, toilet, urinal, water fountain.	
7	53-7-OPN-2		Backflow preventer, hot water supply/return drains, air conditioning/heating condensate drains, hand wash.	Yes
	53-7-OPN-3		Cooling tower drains, air conditioning/heating condensate drains, handwash, general cleaning, toilet, urinal.	
		53-7-OPN-1	Deionized water system.	
		53-7-OPN-5	Deionized water system drain.	

Table B-1. Summary of Wastewater Sources at TA-53 (Continued)

Building No.	Sanitary Outfall No.	Radioactive Waste Outfall No.	Wastewater Sources	Satellite Area Present
7		53-7-OPN-6	Deionized water system drain, target moderator chiller drain, backflow preventer, sampling drains.	Yes
		53-7-OPN-7	Target tunnel drain, discharge from 53-368-OPN-1.	
8		53-8-OPN-1	Deionized water system.	Yes
10	53-10-OPN-1		Permanently plugged.	Yes
14	53-14-OPN-1		Backflow preventer drain, floor wash, deionized water drain, lavatory, service sink, hand wash, shower, toilet, drinking water, treated cooling water.	Yes
15	53-15-OPN-1		Potable water faucet, once through non-contact cooling, emergency eye wash/shower, water heater pressure relief valve and drain, handwash, countertop water filters, clean-up, general cleaning, toilet, urinal.	Yes
16	53-16-OPN-1		Not used.	Yes
17	53-17-OPN-1		Domestic water pressure relief valve drain, water pressure relief valve drain, floor wash, lavatory, hand wash, service sink, hand wash, toilet, urinal, drinking fountain, fire line drain, water heater relief valve, fire line drain.	Yes
18	53-18-OPN-1		Equipment condensate drain, floor wash, sink drain (removed), condensed water drain, water heater relief valve, expansion tank, equipment drain, electric humidifier drain, hand wash	Yes
	53-18-OPN-2		Floor wash, backflow preventers, lavatory, service sink, hand wash, shower drain, equipment drain, toilet, urinal, water fountain.	
19	53-19-OPN-1		Air compressor drain, floor wash, water heater relief valve, lavatory, hand wash, shower, toilet, urinal, drinking fountain.	Yes
20	53-20-OPN-1		General cleaning.	No

Table B-1. Summary of Wastewater Sources at TA-53 (Continued)

Building No.	Sanitary Outfall No.	Radioactive Waste Outfall No.	Wastewater Sources	Satellite Area Present
21	53-21-OPN-1		Hand wash, toilet, urinal, water fountain.	No
22	53-22-OPN-1		Hand washing, drinking water	Yes
24	53-24-OPN-8		Floor drain, backflow preventer, mop bucket, hand wash, shower, toilet, urinal, water fountain, kitchen sink.	Yes
	53-24-OPN-13		Chiller drain, hand wash, toilet, urinal, water fountain.	
25	53-25-OPN-1		Hand/general washings, storm water, helium leak test drain.	Yes
26	53-26-OPN-1		Hand wash, fire water, roof drain.	Yes
27	53-27-OPN-1		Lavatory, service sink, toilet, urinal, drinking water.	No
28	53-28-OPN-1		Electronics cabinet condensate, backflow preventer, water fountain drain, deionized water system drain, water heater drain and pressure relief valve, cooling tower water drain, air conditioning/heating condensate drain, air compressor tank drain, general cleaning.	Yes
		53-28-OPN-2	Radioactive deionized water system.	
30	53-30-OPN-1		Compressed air tank drain, discharge from 53-622-OPN-9, compressed air filter drain, boiler drains and pressure relief valves, hot water supply system drains, backflow preventer.	Yes
		53-30-OPN-2	Clean up, no other direct sources.	
31	53-31-OPN-1		Steam blowoff/pressure relief valve, backflow preventer, floor wash, lavatory, countertop sink, service sink, kitchenette sink, shower drain, toilet, water fountain, heating/cooling unit overflow.	No
36		53-36-OPN-1	Deionized water drain/cooling tower drain.	No

Table B-1. Summary of Wastewater Sources at TA-53 (Continued)

Building No.	Sanitary Outfall No.	Radioactive Waste Outfall No.	Wastewater Sources	Satellite Area Present
37	53-37-OPN-1		Hand wash, toilet.	No
39	53-39-OPN-1		Rinse water, emergency eye wash, hand wash, backflow preventer, sink drain, sanitary wastewater, toilet, water fountain.	No
40	53-40-OPN-1		Hand wash, clean-up, toilet.	No
43	53-43-OPN-1		Lavatory, toilet, urinal, water fountain.	No
44	53-44-OPN-1		Drinking fountain.	No
46	53-46-OPN-1		Handwash, janitorial sink, water heater pressure relief valve, toilet, urinal.	No
47	53-47-OPN-1		Drinking fountain.	No
315	53-315-OPN-1		Water heater, humidifier, sanitary rinse.	No
364	53-364-OPN-1		Hand washing.	Yes
365	53-365-OPN-1		Air conditioning coil condensate, ground water seepage into tunnel, humidifier condensate, deionized water system drain, backflow preventer drain, flows to oil interceptor, treated cooling water drain, hand wash, light cleaning, general cleaning, tunnel floor drains, toilet, drinking fountain, non-emergency shower, urinal, air conditioning/heating condensate and system drains, cooling water system drain, make up water system drain, fire system test drain.	Yes
	53-365-OPN-2		Compressed air storage tank drain, boiler system drains, air compressor drains, boiler pressure relief valves, boiler drains, make-up water, water heater pressure relief valve, water heater drain, cooling water system drain, metered cooling tower blowdown, backflow preventer drain, air conditioner/heater condensate drain, make up water system drain, chilled water system drain.	

Table B-1. Summary of Wastewater Sources at TA-53 (Continued)

Building No.	Sanitary Outfall No.	Radioactive Waste Outfall No.	Wastewater Sources	Satellite Area Present
368		53-368-OPN-1	Deionized water system drain.	No
395	53-395-OPN-1		Non treated evaporator drain, hand wash, toilet, water fountain.	No
397	53-397-OPN-1		Hand wash, clean up, general cleaning, non-emergency shower, toilet.	No
398	53-398-OPN-1		Clean up, water fountain.	No
400	53-400-OPN-1		Lavatory, toilet, urinal.	No
401	53-401-OPN-1		Lavatory, toilet, urinal, water fountain.	No
402	53-402-OPN-1		Lavatory, toilet, water fountain.	No
403	53-403-OPN-1		Lavatory, toilet, urinal.	No
404	53-404-OPN-1		Lavatory, toilet, urinal.	Yes
405	53-405-OPN-1		Lavatory, toilet, urinal, water fountain.	No
406	53-406-OPN-1		Handwash, toilet, urinal	No
407	53-407-OPN-1		Handwash, toilet, urinal.	No
408	53-408-OPN-1		Lavatory, countertop sink, service sink, shower, toilet, water fountain.	No
409	53-409-OPN-1		Lavatory, service sink, countertop sink, toilet, water fountain.	No
410	53-410-OPN-1		Lavatory.	Yes
502		53-502-OPN-1	Clothes washing machine, hand wash, shower.	No
523	53-523-OPN-1		Lavatory, toilet.	No

Table B-1. Summary of Wastewater Sources at TA-53 (Continued)

Building No.	Sanitary Outfall No.	Radioactive Waste Outfall No.	Wastewater Sources	Satellite Area Present
526	53-526-OPN-1		Hand wash, clean-up, non-emergency shower, toilet.	No
527	53-527-OPN-1		Kitchen sink.	No
544	53-544-OPN-1		Lavatory, toilet, drinking water.	No
570	53-570-OPN-1		Lavatory, toilet, urinal, drinking water.	No
577	53-577-OPN-1		Lavatory, shower drain, toilet, water fountain.	No
622	53-622-OPN-1		General cleaning, hand wash, non-emergency shower, toilet, urinal, water fountain.	Yes
	53-622-OPN-9		Air conditioning/heating drains.	
675	53-675-OPN-1		Lavatory, toilet, drinking water.	No
694	53-694-OPN-1		Shower.	No
882	53-882-OPN-1		Hand wash, clean up, water heater pressure relief valve, general cleaning, non emergency shower, toilet.	No
888	53-888-OPN-1		Lavatory, toilet.	No
889	53-889-OPN-1		Lavatory, toilet, shower, urinal	No
898	53-898-OPN-1		Sanitary rinse, sanitary wastewater.	Yes

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-0	TA-0-14	Active as of 1987 (1987 CEARP)	Could find no additional information.
The 1990 SWMU report lists 13 septic systems in TA-0 for which the periods of use are not provided. Some of these septic systems listed in the SWMU report may be the same ones listed in the CEARP, but the corresponding structure numbers were not provided for correlation with the CEARP information. The SWMU report states that these septic systems presumably handled sanitary waste, although other potentially hazardous materials may also have been discharged to these systems. Nine out of 13 systems appear to be associated with residential areas and were apparently abandoned before the 1970s. Four systems served various Zia Company facilities (Fuel dispatch office, warehouses, materials testing laboratory).			
TA-2	TA-2-43	Became inactive in the mid-1970s and removed in 1985 (1990 SWMU); decommissioned in 1986 (1987 CEARP)	May have received industrial liquids in the past in addition to sanitary wastes. In 1967, the sludge was reported to contain strontium-90, cesium-137, and uranium.
TA-3	TA-3-79	Active as of 1990 (The 1987 CEARP identifies TA-3-79 as being abandoned; however, an E.R. Program site reconnaissance survey in 1989 found the tank was active.)	Chemical contamination unknown.
	TA-3-272	Active as of 1990 (The 1987 CEARP identifies TA-3-272 as being abandoned; however, an E.R. Program site reconnaissance survey in 1989 found the tank was active.)	Chemical contamination unknown.
	TA-3-668	Status unknown as of 1990	Grease trap. Waste is probably grease from cafeteria drains. Chemical contamination unknown.

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-3	TA-3-689	Abandoned prior to 1987, date not provided (1987 CEARP)	Chemical contamination unknown. Was discovered in 1989 during trenching activities. Probably served Bldg. 23 (formerly TA-3-282). No further information available (1990 SWMU).
	TA-3-1484	Active as of 1991	Possible chemical contamination from research and development (R&D) activities.
	TA-3-2035**	Active as of 1991	Holding tank and grease trap. Waste is probably grease from cafeteria drains. Chemical contamination unknown. Installation date unknown. Active until at least 1991 (1990 SWMU, 1991 list).
TA-6	TA-6-40**	Active as of 1991	Holding tank. Possible chemical contamination from laboratory operations at TA-6, including HE, solvents and other chemicals. Served Bldg. 1 (carpenter's shop) and Bldg. 3 (silkscreen facility). Operated 1946 to at least 1991(1987 CEARP, 1990 SWMU, 1991 list).
	TA-6-43**	Active as of 1991	Holding tank. Possible chemical contamination from laboratory operations at TA-6, including HE, solvents and other chemicals. Served Bldg. 6 (office, laboratory, and shop) from 1946 to at least 1991(CEARP 1987, 1990 SWMU, 1991 list).
TA-9	TA-9-48	Uncertain status as of 1987 (1987 CEARP)	Could find no additional information.
	TA-9-81	Abandoned 1970	Potential spent photo solutions and small quantities of industrial waste contamination. Tank may have received strontium-90 from TA-8. In operation from 1950 to 1970 (1987 CEARP, 1990 SWMU).
	TA-9-105	Active as of 1990	Potential spent photo solutions and small quantities of industrial waste contamination. In operation 1952 to at least 1990 (1987 CEARP, 1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-9	TA-9-106	Active as of 1987; inactive as of 1990	Potential spent photo solutions and small quantities of industrial waste contamination. In operation from 1952 to sometime between 1987 and 1990 (1987 CEARP, 1990 SWMU).
	TA-9-107**	Active as of 1991	Holding tank. May be contaminated with toxic chemicals. Potential spent photo solutions and small quantities of industrial waste contamination. In operation from 1952 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-9-108	Active as of 1991	May contain chemicals and other materials from R&D activities. Potential spent photo solutions and small quantities of industrial waste contamination. In operation from 1952 to at least 1991(1987 CEARP, 1990 SWMU, 1991 list).
	TA-9-109	Active as of 1991	Potential spent photo solutions and small quantities of industrial waste contamination. In operation from 1952 to at least 1991(1987 CEARP, 1990 SWMU, 1991 list).
	TA-9-110**	Active as of 1991	Holding tank. Potential spent photo solutions and small quantities of industrial waste contamination. In operation from 1952 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-9-211	Abandoned 1986 (CEARP 1987)	Potential spent photo solutions and small quantities of industrial waste contamination. In operation from 1961(estimated) to 1986 (1990 SWMU).
TA-10	TA-10-39	Status Uncertain	This tank was listed in the CEARP as a septic tank, however, it was not listed in the 1990 SWMU report. It may have been confused with the liquid disposal tank, SWMU 10-003(i), that served TA-10-39.

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-11	TA-11-20**	Active as of 1991	Holding tank. Potentially contaminated with HE; however nature of chemical contamination is unknown. Possibly received photographic chemical wastes. Tank was most likely connected only to sinks and sanitary facilities. In service from 1944 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-11-43	Active as of 1991	Potentially contaminated with HE; however, nature of chemical contamination is unknown. Tank was most likely connected only to sinks and sanitary facilities. In operation from 1963 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
TA-14	TA-14-19	Active as of 1991	Potentially contaminated with chemicals. Served Bldg. 6 (shop and a darkroom). In operation from 1955 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
TA-15	TA-15-00	Active as of 1991	Chemical contamination unknown. Served Hydrotest site. Date of installation unknown; active until at least 1991 (1990 SWMU, 1991 list)
	TA-15-00	Active as of 1991	Chemical contamination unknown. Served radiographic lab. Date of installation unknown; active until at least 1991 (1990 SWMU, 1991 list).
	TA-15-51	Active as of 1991	Potentially contaminated with chemicals. This tank was sampled for HE in 1981 and none was detected; no analyses were performed for other chemicals. Served Bldg. 20 (assembly shop). In operation from 1949 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-15-61	Active as of 1991	Primarily received sanitary waste; hazardous constituent contamination unknown. Served Bldg. 45. In operation from 1951 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-15	TA-15-62**	Active as of 1991	Holding tank. Possible chemical contamination. Primarily received sanitary waste; hazardous constituent contamination unknown. As of 1990, the tank had been sampled and no volatiles were detected. Served Bldg. 44. In operation from 1951 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-15-63	Active as of 1991	May have received photo processing waste. Served Bldg. 40 (office). In operation from 1951 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-15-72	Inactive as of 1987; semi-active as of 1990	Primarily received sanitary waste; hazardous constituent contamination unknown. Served Bldg. 27. In operation from 1947 to at least 1990 (1987 CEARP, 1990 SWMU).
	TA-15-80	Abandoned 1980 (1987 CEARP)	Could find no additional information.
	TA-15-195**	Active as of 1991	Chemical contamination from laboratory likely. In the past, the tank had required pumping due to scum development which might have indicated the presence of chemicals. As of 1990, the tank had been sampled and no volatiles were detected. Served Bldg. 183 (laboratory and office). In operation from 1961 to 1976 (old tank) and from 1976 to at least 1991 (new tank) (1987 CEARP, 1990 SWMU, 1991 list).
	TA-15-205	Active as of 1991	Potential chemical and solvent contamination from R&D activities. Could possibly have received mixed waste; however, LANL staff consider this unlikely. Serves Bldgs. 185 and 186 (PHERMEX facility). In operation from 1961 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list)
	TA-15-282	Active as of 1991	Primarily received sanitary waste; hazardous constituent contamination unknown. Serves Bldg. 280 (ECTOR facility). In operation from late 1970s to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-15	TA-15-284	Active as of 1991	Possible solvent contamination such as kerosene and acetone. Serves Bldg. 233 (Betatron building); however tank was installed after the Betatron equipment had been removed. In operation from 1979 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-15-286	Active as of 1991	Possible solvent contamination from shop building. Serves Bldg. 285 (confinement and test facility). In operation from 1981 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
TA-16	TA-16-00	Active as of 1991	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. Served Bldg. 370 (1991 list). Date of installed unknown; active until at least 1991 (1990 SWMU, 1991 list).
	TA-16-161	Decommissioned, date not provided (1990 SWMU)	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. Served Bldgs. 42, 43, 44, and 45. Active from 1945 until unknown date prior to 1990 (1990 SWMU)
	TA-16-173	Abandoned 1971 (1987 CEARP); decommissioned and removed 1971 (1990 SWMU)	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. Active from 1949 to 1971 (1990 SWMU).
	TA-16-174	Decommissioned, date not provided (1987 CEARP). 1990 SWMU report indicates that this tank may not have been removed	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. Active from 1945 until unknown date prior to 1990 (1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-16	TA-16-175	Active as of 1991	Potential chemical contamination from R&D activities. Tank was sampled in November 1988. Volatiles were present and EP Toxic metals were below detection limits. Served Bldg. 54. Active from 1946 to 1988 (old tank) and 1988 to at least 1991 (new tank) (1987 CEARP, 1990 SWMU, 1991 list).
	TA-16-176	Decommissioned, date not provided (1990 SWMU); removed, date not provided (1987 CEARP)	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. In operation from 1945 until unknown date prior to 1987 (1990 SWMU).
	TA-16-178	Active as of 1991	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. Serves Bldg. 210. In operation from 1952 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-16-179	Decommissioned, date not provided (1987 CEARP and 1990 SWMU)	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. Serves Bldg. 37. In operation from 1948 until unknown date prior to 1987 (1987 CEARP and 1990 SWMU).
	TA-16-272	Decommissioned, date not provided (1990 SWMU)	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. Possibly received TNT, HMX, RDX, boron, and barium. Served Bldg. 260. In operation from 1951 until unknown date prior to 1990 (1990 SWMU).
	TA-16-371**	Active as of 1991	Holding tank. Potential chemical contamination from R&D activities. Served Bldg. 370. In operation from 1951 or 1953 to at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-16-381	Active as of 1991	Potential chemical contamination from R&D activities. Served Bldg. 380. In operation from 1952 or 1954 to at least 1991 (1987 CEARP, 1990 SWMU and 1991 list).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-16	TA-16-385**	Active as of 1991	Holding tank. Tank was sampled in November 1988. Volatiles were present and EP Toxic metals were below detection limits. Served Bldg. 389. In operation from 1963 to at least 1991 (1987 CEARP, 1990 SWMU and 1991 list).
	TA-16-504	1987 CEARP states tank was removed in 1960. 1990 SWMU states that tank was reportedly removed in 1963, but may not have been removed after all.	Received solvents and possibly received photographic solutions. In operation from 1948 to 1960, 1963, or unknown date (1987 CEARP and 1990 SWMU).
	TA-16-526	As of 1990, it was unknown whether tank was active or inactive (1990 SWMU)	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. In operation from 1945 until unknown date, status unknown (1990 SWMU).
	TA-16-527 (V-12, 1987 CEARP)	Became inactive prior to 1987 (CEARP)	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. May have handled liquids containing HE residues. In operation from 1944 until unknown date prior to 1987 (1990 SWMU).
	TA-16-1137	Decommissioned, date not provided (1990 SWMU)	Grease trap. Decommissioned prior to 1990, Could find no additional information (1990 SWMU).
	TA-16-1153	Active as of 1990	Some of the TA-16 tanks possibly received industrial waste. Volatile organic contamination has been detected in other TA-16 tanks. In operation from 1987 to at least 1990 (1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-18	TA-18-39	Active as of 1991	Potential radiological contamination. Received wash water from Kiva 1 drains. Waste contains uranium, plutonium, and perhaps hazardous materials. In operation from 1947 or 1950 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-18-40	Decommissioned prior to 1987 (1987 CEARP); reportedly removed before March 1980 (1990 SWMU)	Primarily received sanitary waste. Possibly received small quantities of solvents and other chemicals. May also have received beryllium, uranium-235, photo processing chemicals and hazardous chemicals. In operation from 1952 until sometime before March 1980 (1990 SWMU).
	TA-18-41	Decommissioned prior to 1987 (1987 CEARP); reportedly removed before March 1980 (1990 SWMU)	Primarily received sanitary waste. Possibly received small quantities of solvents and other chemicals. May also have received beryllium, uranium-235, photo processing chemicals and hazardous chemicals. In operation from 1952 until sometime before March 1980 (1990 SWMU).
	TA-18-42	Active as of 1991	Received wash water from Kiva 2 drains. Waste contains uranium, plutonium, and perhaps hazardous materials. In operation from 1950 or 1952 until at least 1991 (1987 CEARP, 1990 SWMU).
	TA-18-43	Removed prior to 1987 (1987 CEARP); reportedly removed before March 1980. (1990 SWMU)	Primarily received sanitary waste. Possibly received small quantities of solvents and other chemicals. May also have received beryllium, uranium-235, photo processing chemicals and hazardous chemicals. Served Bldgs. 1 and 47. In operation from 1944 until sometime before March 1980 (1990 SWMU).
	TA-18-105	Active as of 1990	Received wash water from Kiva 1 drains. Waste contains uranium, plutonium, and perhaps hazardous materials. Served Bldg. 23. In operation from 1946 until at least 1990 (1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-18	TA-18-120	Active as of 1991	Potential contamination with radionuclides and oil. Received wash water from Kiva 3 drains. Waste contains uranium, plutonium, and perhaps hazardous materials. High oil content also reported. Served Bldg. 116. In operation from 1959 or 1960 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-18-152	Abandoned prior to 1987 (1987 CEARP); may have been removed, date unknown (1990 SWMU)	Primarily received sanitary waste. Possibly received small quantities of solvents and other chemicals. May also have received uranium-235 and beryllium. Served Bldg. 28. Date of installed unknown. Date abandoned or removed unknown, but prior to 1987 (1987 CEARP, 1990 SWMU).
TA-20	TA-20-49 (TA-0-276, 1987 CEARP)	Replaced in 1989	Received sanitary waste and may have received chemicals and solvents in the past. Date installed unknown; active until 1989 when it was replaced by septic system TA-72-18 (1987 CEARP, 1990 SWMU).
TA-22	TA-22-50	Active as of 1991	Potential contamination with HE waste (such as PETN, RDX, tetryl, and PBX). Serves Bldg. 34. In operation from 1952 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-22-51	Active as of 1991	Potential contamination with HE waste (such as PETN, RDX, tetryl, and PBX). Serves Bldgs. 1, 4, 5, 32, 52, 90, 91, and 93. In operation from 1952 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
TA-33	TA-33-23**	Active as of 1990	Holding tank. May have previously received HE waste. Serves Bldg. 181 (residential trailer)In operation from 1987 until at least 1990 (1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-33	TA-33-31	Active as of 1991	Several tanks in TA-33 are possibly contaminated with beryllium, mercury, lead, various organic constituents, and radioactive liquid waste (tritium and depleted uranium), especially TA-33-31. A radiation survey for tritium at tank 31 was negative. Served several laboratory buildings and machine shop. Possible chemical contamination. Active from before 1951 until at least 1991 (1987 CEARP, 1990 SWMU).
	TA-33-32	Decommissioned 1975 (1987 CEARP)	Could find no additional information.
	TA-33-33**	Active as of 1991	Holding tank. Several tanks in TA-33 are possibly contaminated with beryllium, mercury, lead, various organic constituents, and radioactive liquid waste (tritium and depleted uranium). Contamination information specific to this tank is not known. Serves Bldg. 24 (control building). Active from 1950 until at least 1991 (1987 CEARP, 1990 SWMU).
	TA-33-93	Active as of 1991	Potential radionuclide contamination in tank. This tank is not listed in the 1990 SWMU report, but according to the SWMU report, several tanks in TA-33 are possibly contaminated with beryllium, mercury, lead, various organic constituents, and radioactive liquid waste (tritium and depleted uranium). Serves Bldg. 86. Active from 1955 until at least 1991 (1987 CEARP, 1991 list).
	TA-33-96	Active as of 1991	Possible chemical contamination from a laboratory. Several tanks in TA-33 are possibly contaminated with beryllium, mercury, lead, various organic constituents, and radioactive liquid waste (tritium and depleted uranium). Serves Bldg. 87 (firing site control building). Active from 1955 until at least 1991 (1987 CEARP, 1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-33	TA-33-121	Active as of 1991	This tank may have received photo processing waste (including silver and other metals) and volatile organic compounds from the 1940s to the 1960s. Several tanks in TA-33 are possibly contaminated with beryllium, mercury, lead, various organic constituents, and radioactive liquid waste (tritium and depleted uranium). Serves Bldg. 1 (portable laboratory). (It is not clear whether the laboratory is still active; the 1990 SWMU report states it is inactive, and the 1991 list indicates that it is active). Active from 1957 until at least 1991 (1987 CEARP, 1990 SWMU & 1991 list).
	TA-33-161	Active as of 1987 (1987 CEARP); inactive as of 1990 (1990 SWMU)	Several tanks in TA-33 are possibly contaminated with beryllium, mercury, lead, various organic constituents, and radioactive liquid waste (tritium and depleted uranium). Contamination information specific to this tank is not known. Served Bldg. 169 (portable office building, now removed). Date installed is unknown; became inactive between 1987 and 1990 (1987 CEARP, 1990 SWMU).
	TA-33-179	Active as of 1991	Contamination information specific to this tank was not known. (Tank was not listed in the 1990 SWMU Report or 1987 CEARP). Active from 1987 until at least 1991 (1991 list).
	TA-33-206** (TA-33-HP23, 1991 list)	Active as of 1991	Holding tank. Contamination information specific to this tank is not known. (Tank was not listed in the 1990 SWMU Report or 1987 CEARP). Active from 1987 until at least 1991 (1991 list).
TA-35	TA-35-14	Abandoned 1975 (1987 CEARP and 1990 SWMU)	Potential oil contamination. Possible industrial waste contamination. Active from 1951 to 1975 (1987 CEARP, 1990 SWMU).
	TA-35-44**	Active as of 1990 (1990 SWMU)	Possible industrial waste contamination. Active from 1961 until at least 1990. As of 1990, tank was being pumped weekly (1987 CEARP, 1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-35	TA-35-65**	Active as of 1990 (1990 SWMU)	Potential chemical contamination from laboratory building. Possible industrial waste contamination. Active from 1966 until at least 1990. As of 1990, tank was routinely being pumped (1987 CEARP, 1990 SWMU).
	TA-35-76	Abandoned 1975, but outfall may still be active	Possible industrial waste contamination. Active from 1966 to 1975 (1987 CEARP, 1990 SWMU).
TA-36	TA-36-17	Active as of 1991	Potential chemical contamination from laboratory building. Laboratory waste may have included depleted uranium, solvents, and spent photo liquids. Serves Bldgs. 1 and 22. Active from 1950 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-36-61** (TA-15-67, 1991 list)	Active as of 1991	Holding Tank. According to 1987 CEARP, tank potentially received radionuclide and HE contamination. According to the 1990 SWMU report, this tank most likely received only sanitary waste. Served Bldg. 55 (formerly TA-15-31). Active from 1949 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-36-70	Active as of 1991	This tank most likely received only sanitary waste from guard station. Active from 1985 until at least 1991 (1990 SWMU, 1991 list).
	TA-36-100 (TA-36-00, 1991 list)	Active as of 1991	This tank most likely received only sanitary waste from Bldg. 1 (Bldg. M-8). Active from 1988 until at least 1991 (1990 SWMU, 1991 list).
TA-37	TA-37-28	Active as of 1991	This tank most likely received only sanitary waste from Bldg. 1. Date installed not provided. Active until at least 1991 (1987 CEARP, 1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-39	TA-39-104 (TA-39-12, 1987 CEARP and 1991 list)	Active as of 1991 (new tank, installed with same structure number)	Documentation shows that the old tank received photo processing solutions in quantities that interfered with the sewage digestion processes. New tank receives about 1 gal/month of tray and sink photo waste. Until recently, may have received small quantities of solvents and other chemicals from labs. Active from 1952 to 1986 (old tank) and 1986 until at least 1991 (new tank) (1987 CEARP, 1990 SWMU, 1991 list).
	TA-39-132 (TA-39-00, 1991 list)	Active as of 1991	Tank receives only sanitary waste from Pulsed Power building. Active from 1985 or 1989 until at least 1991 (1990 SWMU, 1991 list).
TA-40	TA-40-24	Active as of 1991	Solvents and chemicals from previous years are suspected. Tank received sanitary and other liquid waste from Bldgs. 1, 19, and 23. Active from 1949 or 1950 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-40-25**	Active as of 1991	Potential solvent and chemical contamination from previous years are suspected from R&D lab activities. Tank received sanitary and other liquid waste from Bldg. 11. Active from 1949 until at least 1991. As of 1990, tank was pumped when full (about every 3 months) (1987 CEARP, 1990 SWMU, 1991 list).
TA-42	TA-42-4**	Abandoned in 1952, decommissioned and removed in 1978	Documented radiological contamination. Because a decontamination operation took place at TA-42, solvents and perhaps acids may also be present. Samples of liquid collected in 1973 contained plutonium-239, uranium-235, tritium, and fission products. During decommissioning in 1978, the liquid waste contained Pu-239, U-235, tritium and fission products; and the sludge contained 350 nCi/g of plutonium-239. Active from 1951 until 1952, removed in 1978. Periodically, the tank liquids were removed and either placed in Pit 4, Area G in TA-54, or treated at TA-50 (1987 CEARP, 1990 SWMU).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-46	TA-46-8	Abandoned 1973	Potential radiological, acid, organic, inorganic, and beryllium contamination. Active from 1954 to 1973 (1987 CEARP, 1990 SWMU).
	TA-46-22	Abandoned 1973	Potential radiological, acid, organic, inorganic, and beryllium contamination. Active from 1956 to 1973 (1987 CEARP, 1990 SWMU).
	TA-46-49	Abandoned 1973	Potential radiological, acid, organic, inorganic, and beryllium contamination. Active from 1956 to 1973 (1987 CEARP, 1990 SWMU).
	TA-46-53	Abandoned 1973	Potential radiological, acid, organic, inorganic, and beryllium contamination. Plutonium was found in sludge from tank TA-46-53 when the tank was pumped. Active from 1956 to 1973 (1987 CEARP, 1990 SWMU).
	TA-46-66	Abandoned 1973	Potential radiological, acid, organic, inorganic, and beryllium contamination. Active from 1960 to 1973 (1987 CEARP, 1990 SWMU).
	TA-46-94	Abandoned 1972 (1987 CEARP); abandoned and backfilled 1974 (1990 SWMU)	Possible radiological, acid, organic, inorganic, and beryllium contamination. Active from 1960 to 1972 or 1974 (1987 CEARP, 1990 SWMU).
	TA-46-230**	Active as of 1991	Believed to receive only sanitary waste, but suspect for other wastes. Date installed was not provided. Active in 1987 and at least until 1991. As of 1990 the tank was pumped frequently (1990 SWMU, 1991 list).
TA-48	TA-48-5	Abandoned and removed in 1986	Possible contamination with chemical waste, photo processing solutions, and radionuclides. Served Bldg. 1. Active from 1957 to 1986 (1987 CEARP, 1990 SWMU).
	TA-48-29 (1987 CEARP)	Status uncertain	This tank is listed in the 1987 CEARP but not in the 1990 SWMU report. It may be confused with tank TA-48-32, which serves Bldg. TA-48-29.

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-48	TA-48-32**	Active as of 1991	It is believed that the tank only managed sanitary waste because it only served office buildings. Active from 1983 until at least 1991. Prior to 1986, tank was pumped frequently (1990 SWMU, 1991 list).
TA-49	TA-49-118**	Active as of 1991	Tank receives only sanitary waste from office building. Active from 1985 until at least 1991. As of 1990, tank was pumped periodically (1990 SWMU and 1991 list).
	TA-49-119**	Active as of 1991	Tank receives only sanitary waste. Active from 1985 until at least 1991. As of 1990, tank was pumped periodically (1990 SWMU and 1991 list).
TA-50	TA-50-10	Decommissioned and removed in 1983	The tank received only sanitary waste. Active from 1963 to 1983 (1987 CEARP, 1990 SWMU).
TA-51	TA-51-4 (TA-54-4, 1990 SWMU)	Active as of 1991	This tank has received animal waste and sanitary waste and may contain hazardous and radioactive constituents. Active from 1962 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-51-9 (TA-54-9, 1990 SWMU)	Active as of 1991	This tank has received animal waste and sanitary waste and may contain hazardous and radioactive constituents. Active from 1960 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list).
	TA-51-30	Active as of 1991	Tank generally handles sanitary waste. Chemical contamination is unknown. Serves Bldgs. 11 and 12. Active from 1983 until at least 1991 (1987 CEARP, 1990 SWMU).
TA-52	TA-52-2	Status uncertain	This tank is listed in the 1987 CEARP but not in the 1990 SWMU report. It may refer to one of two underground storage tanks located in the basement of Bldg. TA-52-2.
	TA-52-3**	Active as of 1991	Potentially contaminated with chemicals and solvents from UHTREX facility. Active from 1963 or 1968 until at least 1991. As of 1990, tank was routinely pumped (1987 CEARP, 1990 SWMU, 1991 list).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-52	TA-52-4	Status uncertain	This tank is listed in the 1987 CEARP but not in the 1990 SWMU report. It may refer to the distribution box (TA-52-4) which is connected to TA-52-3.
	TA-52-34a**	Active as of 1991	Chemical contamination unknown. Serves Bldg. 44. Active from 1983 until at least 1991. As of 1990, tank was routinely pumped (1987 CEARP, 1990 SWMU, 1991 list).
	TA-52-34b**	Active as of 1991	Chemical contamination unknown. Serves Bldg. 45. Active from 1983 until at least 1991. As of 1990, tank was routinely pumped (1987 CEARP, 1990 SWMU, 1991 list).
	TA-52-46	Active as of 1990	Chemical contamination unknown. Serves TA-52 transportable buildings. Active from 1984 until at least 1990 (1990 SWMU).
	TA-52-47	Active as of 1990	Chemical contamination unknown. Serves TA-52 transportable buildings. Active from 1984 until at least 1990 (1990 SWMU).
	TA-52-49	Active as of 1990	Potentially contaminated with chemicals and solvents from UHTREX building and maintenance shop. Active from 1984 (estimated) until at least 1990 (1990 SWMU).
	TA-52-95**	Active as of 1991	Holding tank. Chemical contamination unknown. Serves trailers. Date installed not provided; active until at least 1990 (1990 SWMU, 1991 list).
	TA-52-97**	Active as of 1991	Chemical contamination unknown. This tank is believed to discharge into the TA-52-34 tanks. Serves Bldgs. 41 and 42 (and possible 45). Active from 1983 until at least 1991. As of 1990, tank was occasionally pumped (1990 SWMU, 1991 list).
	TA-52-98**	Active as of 1991	Chemical contamination unknown. This tank is believed to discharge into the TA-52-34 tanks. Serves Bldg. 33 (and possibly 44). Active from 1983 until at least 1991. As of 1990, tank was occasionally pumped (1990 SWMU, 1991 list).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-52	TA-52-99 (TA-52-00, 1991 list)	Active as of 1991	Chemical contamination unknown. Serves Bldgs. 35 and 36. Active from 1983 until at least 1991 (1990 SWMU, 1991 list).
TA-53	TA-53-1016** (TA-0-190, 1987 CEARP) (TA-53-00, 1991 list)	Active as of 1991	Holding tank. Tank handles sanitary waste from office trailer. Active from 1967 until at least 1991 (1990 SWMU, 1991 list).
TA-54	TA-54-16	Active as of 1991	This tank may contain hazardous and radioactive constituents because it is located in waste handling area. Serves Bldg. 2 (compactor building) and Bldg. 11 (waste management control facility). Active from 1977 until at least 1991 (1987 CEARP, 1990 SWMU and 1991 list).
	TA-54-28	Active as of 1991	This tank may contain hazardous and radioactive constituents because it is located in waste handling area. Serves Bldg. 22 (office building). Active from 1983 until at least 1991 (1990 SWMU and 1991 list).
	TA-54-43**	Active as of 1991	Holding tank. Because of tank's location, hazardous or radioactive contamination may be possible. Serves trailer and the PCB Waste Storage Facility (TA-54-39). Active from 1988 until at least 1991 (1990 SWMU and 1991 list).
	TA-54-80**	Active as of 1991	Holding tank. Chemical contamination unknown. (Tank was not listed in the 1987 CEARP or 1990 SWMU report). Active from 1989 until at least 1991 (1991 list).
	TA-54-89	Active as of 1991	Chemical contamination unknown. (Was not listed in the 1987 CEARP or 1990 SWMU report). Active from 1988 until at least 1991 (1991 list).
	TA-54-150**	Active as of 1991	Holding tank. Chemical contamination unknown. (Was not listed in the 1987 CEARP or 1990 SWMU report). Active from 1990 until at least 1991 (1991 list).

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-54	TA-54-West	Active as of 1990	This tank may contain hazardous and radioactive constituents because it is located in waste handling area. Serves Bldg. 34 (office building) and Bldg. 38 (TRU drum assay building). Date installed was not provided, but it was new system as of 1990 (1990 SWMU).
TA-58	TA-58-00**	Active as of 1991	Holding tank. Chemical contamination unknown. (Was not listed in the 1990 SWMU Report or 1987 CEARP). Active from 1989 until at least 1991 (1991 list).
TA-59	TA-59-4	Decommissioned and removed in 1979	Potentially contaminated with photographic chemical wastes. Also could have received other industrial waste. Served Bldg. 1. Active from 1966 to 1979 (1987 CEARP, 1990 SWMU).
TA-60	SWMU No. 60-006(b)	Inactive sometime after 1979, exact date unknown	Chemical contamination unknown. Served trailers that were located on Sigma Mesa during the drilling of the geothermal well. Active from 1979 until unknown date prior to 1990 (1990 SWMU).
	TA-60-00	Active as of 1989 (1990 SWMU)	Chemical contamination unknown. Date of installation is unknown. Active as of 1989, according to the Active Septic Tank Systems List dated December 1989 (1990 SWMU)
	TA-60-1885 (TA-3-1885)	Active as of 1990	Paints, solvents, or oils may have entered the drains to the tank from operations in the paint booth in Bldg. 17. Active from 1979 until at least 1990 (1990 SWMU).
TA-63	TA-63-12 (TA-52-12, 1991 list)	Active as of 1991	Chemical contamination unknown. Serves Bldg. 48. Date of installation unknown. Active until at least 1991 (1990 SWMU and 1991 list).
	TA-63-14 (TA-52-154, 1991 list) (TA-0-154, 1987 CEARP, 1991 list)	Active as of 1991	Possible solvent and chemical contamination from previous maintenance shop activities. Serves office building previously used as maintenance shop. Active from 1965 until at least 1991 (1987 CEARP, 1990 SWMU, 1991 list)

Table B-2. Septic Tanks Whose Contents May Have Been Disposed of to TA-53 Surface Impoundments (Continued)

Technical Area	Structure No.	Tank Status as of the Date Specified	Comments
TA-66	TA-66-03 (TA-66-00, 1991 list)	Active as of 1991	Chemical contamination unknown. (Was not listed in the 1990 SWMU Report or 1987 CEARP). Serves ATAC Bldg. Active from 1988 until at least 1991 (1991 list).
TA-69	TA-69-09** (TA-0-69, 1987 CEARP)	Active as of 1991	Holding tank. Tank is believed to handle only sanitary waste from Bldg. 1 (guard station). Active from 1953 or 1954 until at least 1991 (1990 SWMU and 1991 list).
	TA-69-10 (TA-6-00, 1991 list) (TA-6, 1987 CEARP)	Active as of 1991	Tank is believed to handle only sanitary waste from Bldg. 2 (trailer). Active from 1986 until at least 1991 (1990 SWMU and 1991 list).
TA-72	TA-72-18	Active as of 1991	Tank is believed to handle only sanitary waste from small arms firing range. Active from 1989 until at least 1991 (replaced septic tank TA-0-276 in 1989).(1990 SWMU and 1991 list).
TA-73	SWMU Nos. 73-004 (b), (c), & (d) (1990 SWMU)	Inactive, date not provided	The periods of activity for the three inactive septic systems are unknown. Thus, they may have contributed waste to the TA-53 impoundments. SWMU No. 73-004(c) and (d) are associated with the control tower and landfill office and are believed to have handled sanitary waste only. SWMU No. 73-004(b) is associated with the garbage truck cleaning plant and is believed to have received wash water as well as sanitary waste (1990 SWMU).

Notes:

* Structure No. - The current number is listed and old numbers are in parentheses

** Tank was routinely, periodically, or occasionally pumped.

Some of the septic systems listed in this table may not have been active when the TA-53 impoundments received waste from other TAs (from early 1970s to Sept. 1991). The three sources used had some data gaps, such as unknown dates of decommissioning, removal, or abandonment for septic systems.

APPENDIX C

DETECTION LIMITS FOR VOLATILE ORGANICS FOR JULY 1991 SAMPLING

APPENDIX C

DETECTION LIMITS FOR VOLATILE ORGANICS FOR JULY 1991 SAMPLING

Table C-1 presents the detection limits for volatile organic analyses performed on samples collected during July 1991. Minimum and maximum detection limits are reported because detection limits can vary from sample to sample. Minimum and maximum detection limits are presented for both sludge samples and water samples. The minimum and maximum detection limits are the lowest and highest detection limits, respectively, reported for each analyte for all of the sludge and water samples for this period.

Table C-1. Detection Limits for Volatile Organics, July 1991

Compound	July 1991 Sludge Samples		July 1991 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Acetone	0.02	0.02	20	20
Acrolein	0.1	0.1	100	100
Acrylonitrile	0.1	0.1	100	100
Benzene	0.005	0.005	5	5
Bromobenzene	0.005	0.005	5	5
Bromochloromethane	0.005	0.005	5	5
Bromodichloromethane	0.005	0.005	5	5
Bromoform	0.005	0.005	5	5
Bromomethane	0.01	0.01	10	10
2-Butanone	0.02	0.02	20	20
n-Butylbenzene	0.005	0.005	5	5
sec-Butylbenzene	0.005	0.005	5	5
tert-Butylbenzene	0.005	0.005	5	5
Carbon disulfide	0.005	0.005	5	5
Carbon tetrachloride	0.005	0.005	5	5
Chlorobenzene	0.005	0.005	5	5
Chlorodibromomethane	0.005	0.005	5	5
Chloroethane	0.01	0.01	10	10
2-Chloroethylvinyl ether	0.05	0.05	50	50
Chloroform	0.005	0.005	5	5
Chloromethane	0.01	0.01	10	10
o-Chlorotoluene	0.005	0.005	5	5
p-Chlorotoluene	0.005	0.005	5	5
1,2-Dibromo-3-chloropropane	0.01	0.01	10	10

Table C-1. Detection Limits for Volatile Organics, July 1991 (Continued)

Compound	July 1991 Sludge Samples		July 1991 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
1,2-Dibromoethane	0.005	0.005	5	5
Dibromomethane	0.005	0.005	5	5
o-Dichlorobenzene	0.005	0.005	5	5
m-Dichlorobenzene	0.005	0.005	5	5
p-Dichlorobenzene	0.005	0.005	5	5
Dichlorodifluoromethane	0.01	0.01	10	10
1,1-Dichloroethane	0.005	0.005	5	5
1,2-Dichloroethane	0.005	0.005	5	5
1,1-Dichloroethene	0.005	0.005	5	5
trans-1,2-Dichloroethylene	0.005	0.005	5	5
cis-1,2-Dichloroethylene	0.005	0.005	5	5
1,2-Dichloropropane	0.005	0.005	5	5
1,3-Dichloropropane	0.005	0.005	5	5
2,2-Dichloropropane	0.005	0.005	5	5
1,1-Dichloropropane	0.005	0.005	5	5
cis-1,3-Dichloropropene	0.005	0.005	5	5
trans-1,3-Dichloropropene	0.005	0.005	5	5
Ethylbenzene	0.005	0.005	5	5
Ethylene dibromide	0.005	0.005	5	5
2-Hexanone	0.02	0.02	20	20
Isopropylbenzene	0.005	0.005	5	5
4-Isopropyltoluene	0.005	0.005	5	5
Methyl iodide	0.005	0.005	5	5
4-Methyl-2-pentanone	0.02	0.02	20	20
Methylene chloride	0.005	0.005	5	5

Table C-1. Detection Limits for Volatile Organics, July 1991 (Continued)

Compound	July 1991 Sludge Samples		July 1991 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Propylbenzene	0.005	0.005	5	5
Styrene	0.005	0.005	5	5
1,1,1,2-Tetrachloroethane	0.005	0.005	5	5
1,1,2,2-Tetrachloroethane	0.005	0.005	5	5
Tetrachloroethylene	0.005	0.005	5	5
Toluene	0.005	0.005	5	5
1,1,2-Trichloro-1,2,2-trifluoroethane	0.005	0.005	5	5
1,1,1-Trichloroethane	0.005	0.005	5	5
1,1,2-Trichloroethane	0.005	0.005	5	5
Trichloroethene	0.005	0.005	5	5
Trichlorofluoromethane	0.005	0.005	5	5
1,2,3-Trichloropropane	0.005	0.005	5	5
1,2,4-Trimethylbenzene	0.005	0.005	5	5
1,3,5-Trimethylbenzene	0.005	0.005	5	5
Vinyl acetate	0.01	0.01	10	10
Vinyl chloride	0.01	0.01	10	10
Xylenes	0.005	0.005	5	5

APPENDIX D

DETECTION LIMITS FOR SEMIVOLATILE ORGANICS FOR JULY 1991 SAMPLING

APPENDIX D

DETECTION LIMITS FOR SEMIVOLATILE ORGANICS FOR JULY 1991 SAMPLING

Table D-1 presents the detection limits for semivolatile organic analyses performed on samples collected during July 1991. Minimum and maximum detection limits are reported because detection limits can vary from sample to sample. Minimum and maximum detection limits are presented for both sludge samples and water samples. The minimum and maximum detection limits are the lowest and highest detection limits, respectively, reported for each analyte for all of the sludge and water samples for this period.

Table D-1. Detection Limits for Semivolatile Organics, July 1991

Compound	July 1991 Sludge Samples		July 1991 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Acenaphthene	0.48	0.65	10	24
Acenaphthylene	0.48	0.65	10	24
Aniline	0.48	0.65	10	24
Anthracene	0.48	0.65	10	24
Azobenzene	0.48	0.65	10	24
m-Benzidene	0.48	0.65	10	24
Benzo(a)anthracene	0.48	0.65	10	24
Benzo(a)pyrene	0.48	0.65	10	24
Benzo(b)fluoranthene	0.48	0.65	10	24
Benzo(g,h,i)perylene	0.48	0.65	10	24
Benzo(k)fluoranthene	0.48	0.65	10	24
Benzoic acid	0.48	0.65	10	24
Benzyl alcohol	0.48	0.65	10	24
bis(2-Chloroethoxy) methane	0.48	0.65	10	24
bis(2-Chloroethyl ether)	0.48	0.65	10	24
bis(2-Chloroisopropyl) ether	0.48	0.65	10	24
bis(2-Ethylhexyl) phthalate	0.48	0.65	10	24
4-Bromophenyl-phenylether	0.48	0.65	10	24
Butylbenzylphthalate	0.48	0.65	10	24
4-Chloro-3-methylphenol	0.48	0.65	10	24
4-Chloroaniline	0.48	0.65	10	24
2-Chloronaphthalene	0.48	0.65	10	24
o-Chlorophenol	0.48	0.65	10	24

Table D-1. Detection Limits for Semivolatile Organics, July 1991 (Continued)

Compound	July 1991 Sludge Samples		July 1991 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, µg/L	Maximum Detection Limit, µg/L
4-Chlorophenyl-phenylether	0.48	0.65	10	24
Chrysene	0.48	0.65	10	24
Di-n-butylphthalate	0.48	0.65	10	24
Di-n-octylphthalate	0.48	0.65	10	24
Dibenz(a,h)anthracene	0.48	0.65	10	24
Dibenzofuran	0.48	0.65	10	24
1,2-Dichlorobenzene	0.48	0.65	10	24
1,3-Dichlorobenzene	0.48	0.65	10	24
1,4-Dichlorobenzene	0.48	0.65	10	24
3,3'-Dichlorobenzidine	0.48	0.65	10	24
2,4-Dichlorophenol	0.48	0.65	10	24
Diethylphthalate	0.48	0.65	10	24
Dimethylphthalate	0.48	0.65	10	24
2,4-Dimethylphenol	0.48	0.65	10	24
2,4-Dinitrophenol	0.48	0.65	10	24
2,4-Dinitrotoluene	0.48	0.65	10	24
2,6-Dinitrotoluene	0.48	0.65	10	24
Fluoranthene	0.48	0.65	10	24
Fluorene	0.48	0.65	10	24
Hexachlorobenzene	0.48	0.65	10	24
Hexachlorobutadiene	0.48	0.65	10	24
Hexachlorocyclopentadiene	0.48	0.65	10	24
Hexachloroethane	0.48	0.65	10	24
Indeno(1,2,3-cd)pyrene	0.48	0.65	10	24

Table D-1. Detection Limits for Semivolatile Organics, July 1991 (Continued)

Compound	July 1991 Sludge Samples		July 1991 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Isophorone	0.48	0.65	10	24
4,6-Dinitro-2-methylphenol	0.48	0.65	10	24
2-Methylnaphthalene	0.48	0.65	10	24
2-Methylphenol	0.48	0.65	10	24
4-Methylphenol	0.48	0.65	10	24
Naphthalene	0.48	0.65	10	24
2-Nitroaniline	0.48	0.65	10	24
3-Nitroaniline	0.48	0.65	10	24
4-Nitroaniline	0.48	0.65	10	24
Nitrobenzene	0.48	0.65	10	24
2-Nitrophenol	0.48	0.65	10	24
4-Nitrophenol	0.48	0.65	10	24
N-Nitroso-di-N-propylamine	0.48	0.65	10	24
N-Nitrosodimethylamine	0.48	0.65	10	24
N-Nitrosodiphenylamine	0.48	0.65	10	24
Pentachlorophenol	0.48	0.65	10	24
Phenanthrene	0.48	0.65	10	24
Phenol	0.48	0.65	10	24
Pyrene	0.48	0.65	10	24
1,2,4-Trichlorobenzene	0.48	0.65	10	24
2,4,5-Trichlorophenol	0.48	0.65	10	24
2,4,6-Trichlorophenol	0.48	0.65	10	24

APPENDIX E

DETECTION LIMITS FOR METALS FOR JULY 1991 SAMPLING

APPENDIX E

DETECTION LIMITS FOR METALS FOR JULY 1991 SAMPLING

Table E-1 presents the detection limits for metals analyses performed on samples collected during July 1991. Minimum and maximum detection limits are reported because detection limits can vary from sample to sample. Minimum and maximum detection limits are presented for both sludge samples and water samples. The minimum and maximum detection limits are the lowest and highest detection limits, respectively, reported for each analyte for all of the sludge and water samples for this period.

Table E-1. Detection Limits for Metals, July 1991

Element	July 1991 Sludge Samples		July 1991 Water Samples	
	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Arsenic	20	20	20	20
Cadmium	10	10	10	10
Chromium	10	10	10	10
Mercury	0.2	0.2	0.2	0.2
Lead	50	50	50	50
Selenium	20	20	20	20
Silver	10	10	10	10

APPENDIX F

DETECTION LIMITS FOR VOLATILE ORGANICS FOR APRIL 1992 SAMPLING

APPENDIX F

DETECTION LIMITS FOR VOLATILE ORGANICS FOR APRIL 1992 SAMPLING

Table F-1 presents the detection limits for volatile organic analyses performed on samples collected during April 1992. Minimum and maximum detection limits are reported because detection limits can vary from sample to sample. Minimum and maximum detection limits are presented for both sludge samples and water samples. The minimum and maximum detection limits are the lowest and highest detection limits, respectively, reported for each analyte for all of the sludge and water samples for this period.

Table F-1. Detection Limits for Volatile Organics, April 1992

Compound	April 1992 Sludge Samples		April 1992 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Acetone	0.02	0.092	20	20
Benzene	0.005	0.023	5	5
Bromobenzene	0.005	0.023	5	5
Bromochloromethane	0.005	0.023	5	5
Bromodichloromethane	0.005	0.023	5	5
Bromoform	0.005	0.023	5	5
Bromomethane	0.01	0.046	10	10
2-Butanone	0.02	0.092	20	20
n-Butylbenzene	0.005	0.023	5	5
sec-Butylbenzene	0.005	0.023	5	5
tert-Butylbenzene	0.005	0.023	5	5
Carbon disulfide	0.005	0.023	5	5
Carbon tetrachloride	0.005	0.023	5	5
Chlorobenzene	0.005	0.023	5	5
Chlorodibromomethane	0.005	0.023	5	5
Chloroethane	0.01	0.046	10	10
Chloroform	0.005	0.023	5	5
Chloromethane	0.01	0.046	10	10
o-Chlorotoluene	0.005	0.023	5	5
p-Chlorotoluene	0.005	0.023	5	5
1,2-Dibromo-3-chloropropane	0.01	0.046	10	10
1,2-Dibromoethane	0.005	0.023	5	5
Dibromomethane	0.005	0.023	5	5
o-Dichlorobenzene	0.005	0.023	5	5

Table F-1. Detection Limits for Volatile Organics, April 1992 (Continued)

Compound	April 1992 Sludge Samples		April 1992 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, µg/L	Maximum Detection Limit, µg/L
m-Dichlorobenzene	0.005	0.023	5	5
p-Dichlorobenzene	0.005	0.023	5	5
Dichlorodifluoromethane	0.01	0.046	10	10
1,1-Dichloroethane	0.005	0.023	5	5
1,2-Dichloroethane	0.005	0.023	5	5
1,1-Dichloroethene	0.005	0.023	5	5
trans-1,2-Dichloroethylene	0.005	0.023	5	5
cis-1,2-Dichloroethylene	0.005	0.023	5	5
1,2-Dichloropropane	0.005	0.023	5	5
1,3-Dichloropropane	0.005	0.023	5	5
2,2-Dichloropropane	0.005	0.023	5	5
1,1-Dichloropropane	0.005	0.023	5	5
cis-1,3-Dichloropropene	0.005	0.023	5	5
trans-1,3-Dichloropropene	0.005	0.023	5	5
Ethylbenzene	0.005	0.023	5	5
Ethylene dibromide	0.005	0.023	5	5
2-Hexanone	0.02	0.092	20	20
Isopropylbenzene	0.005	0.023	5	5
4-Isopropyltoluene	0.005	0.005	5	5
Methyl iodide	0.005	0.023	5	5
4-Methyl-2-pentanone	0.02	0.092	20	20
Methylene chloride	0.005	0.023	5	5
Propylbenzene	0.005	0.023	5	5
Styrene	0.005	0.023	5	5

Table F-1. Detection Limits for Volatile Organics, April 1992 (Continued)

Compound	April 1992 Sludge Samples		April 1992 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
1,1,1,2-Tetrachloroethane	0.005	0.023	5	5
1,1,2,2-Tetrachloroethane	0.005	0.023	5	5
Tetrachloroethylene	0.005	0.023	5	5
Toluene	0.005	0.023	5	5
1,1,2-Trichloro-1,2,2-trifluoroethane	0.005	0.023	5	5
1,1,1-Trichloroethane	0.005	0.023	5	5
1,1,2-Trichloroethane	0.005	0.023	5	5
Trichloroethene	0.005	0.023	5	5
Trichlorofluoromethane	0.005	0.023	5	5
1,2,3-Trichloropropane	0.005	0.023	5	5
1,2,4-Trimethylbenzene	0.005	0.023	5	5
1,3,5-Trimethylbenzene	0.005	0.023	5	5
Vinyl acetate	0.01	0.046	10	10
Vinyl chloride	0.01	0.046	10	10
Xylenes	0.005	0.023	5	5

APPENDIX G

DETECTION LIMITS FOR SEMIVOLATILE ORGANICS FOR APRIL 1992 SAMPLING

APPENDIX G

DETECTION LIMITS FOR SEMIVOLATILE ORGANICS FOR APRIL 1992 SAMPLING

Table G-1 presents the detection limits for semivolatile organic analyses performed on samples collected during April 1992. Minimum and maximum detection limits are reported because detection limits can vary from sample to sample. Minimum and maximum detection limits are presented for both sludge samples and water samples. The minimum and maximum detection limits are the lowest and highest detection limits, respectively, reported for each analyte for all of the sludge and water samples for this period.

Table G-1. Detection Limits for Semivolatile Organics, April 1992

Compound	April 1992 Sludge Samples		April 1992 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Acenaphthene	0.93	2.00	11	11
Acenaphthylene	0.93	2.00	11	11
Aniline	0.93	2.00	11	11
Anthracene	0.93	2.00	11	11
Azobenzene	0.93	2.00	11	11
m-Benzidene	0.93	2.00	11	11
Benzo(a)anthracene	0.93	2.00	11	11
Benzo(a)pyrene	0.93	2.00	11	11
Benzo(b)fluoranthene	0.93	2.00	11	11
Benzo(g,h,i)perylene	0.93	2.00	11	11
Benzo(k)fluoranthene	0.93	2.00	11	11
Benzoic acid	0.93	2.00	11	11
Benzyl alcohol	0.93	2.00	11	11
bis(2-Chloroethoxy) methane	0.93	2.00	11	11
bis(2-Chloroethyl ether)	0.93	2.00	11	11
bis(2-Chloroisopropyl) ether	0.93	2.00	11	11
bis(2-Ethylhexyl)phthalate	1.90	1.90	11	11
4-Bromophenyl-phenylether	0.93	2.00	11	11
Butylbenzylphthalate	0.93	2.00	11	11
4-Chloro-3-methylphenol	0.93	2.00	11	11
4-Chloroaniline	0.93	2.00	11	11
2-Chloronaphthalene	0.93	2.00	11	11
o-Chlorophenol	0.93	2.00	11	11

Table G-1. Detection Limits for Semivolatile Organics, April 1992 (Continued)

Compound	April 1992 Sludge Samples		April 1992 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
4-Chlorophenyl-phenylether	0.93	2.00	11	11
Chrysene	0.93	2.00	11	11
Di-n-butylphthalate	1.90	2.00	11	11
Di-n-octylphthalate	0.93	2.00	11	11
Dibenz(a,h)anthracene	0.93	2.00	11	11
Dibenzofuran	0.93	2.00	11	11
1,2-Dichlorobenzene	0.93	2.00	11	11
1,3-Dichlorobenzene	0.93	2.00	11	11
1,4-Dichlorobenzene	0.93	2.00	11	11
3,3'-Dichlorobenzidine	0.93	2.00	11	11
2,4-Dichlorophenol	0.93	2.00	11	11
Diethylphthalate	0.93	2.00	11	11
Dimethylphthalate	0.93	2.00	11	11
2,4-Dimethylphenol	0.93	2.00	11	11
2,4-Dinitrophenol	0.93	2.00	11	11
2,4-Dinitrotoluene	0.93	2.00	11	11
2,6-Dinitrotoluene	0.93	2.00	11	11
Fluoranthene	0.93	2.00	11	11
Fluorene	0.93	2.00	11	11
Hexachlorobenzene	0.93	2.00	11	11
Hexachlorobutadiene	0.93	2.00	11	11
Hexachlorocyclo-pentadiene	0.93	2.00	11	11
Hexachloroethane	0.93	2.00	11	11
Indeno(1,2,3-cd)pyrene	0.93	2.00	11	11

Table G-1. Detection Limits for Semivolatile Organics, April 1992 (Continued)

Compound	April 1992 Sludge Samples		April 1992 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Isophorone	0.93	2.00	11	11
4,6-Dinitro-2-methylphenol	0.93	2.00	11	11
2-Methylnaphthalene	0.93	2.00	11	11
2-Methylphenol	0.93	2.00	11	11
4-Methylphenol	0.93	2.00	11	11
Naphthalene	0.93	2.00	11	11
2-Nitroaniline	0.93	2.00	11	11
3-Nitroaniline	0.93	2.00	11	11
4-Nitroaniline	0.93	2.00	11	11
Nitrobenzene	0.93	2.00	11	11
2-Nitrophenol	0.93	2.00	11	11
4-Nitrophenol	0.93	2.00	11	11
N-Nitroso-di-N-propylamine	0.93	2.00	11	11
N-Nitrosodimethylamine	0.93	2.00	11	11
N-Nitrosodiphenylamine	0.93	2.00	11	11
Pentachlorophenol	0.93	2.00	11	11
Phenanthrene	0.93	2.00	11	11
Phenol	0.93	2.00	11	11
Pyrene	0.93	2.00	11	11
1,2,4-Trichlorobenzene	0.93	2.00	11	11
2,4,5-Trichlorophenol	0.93	2.00	11	11
2,4,6-Trichlorophenol	0.93	2.00	11	11

APPENDIX H

DETECTION LIMITS FOR METALS FOR APRIL 1992 SAMPLING

APPENDIX H

DETECTION LIMITS FOR METALS FOR APRIL 1992 SAMPLING

Table H-1 presents the detection limits for metals analyses performed on samples collected during April 1992. Minimum and maximum detection limits are reported because detection limits can vary from sample to sample. Minimum and maximum detection limits are presented for both sludge samples and water samples. The minimum and maximum detection limits are the lowest and highest detection limits, respectively, reported for each analyte for all of the sludge and water samples for this period.

Table H-1. Detection Limits for Metals, April 1992

Element	April 1992 Sludge Samples		April 1992 Water Samples	
	Minimum Detection Limit, mg/kg	Maximum Detection Limit, mg/kg	Minimum Detection Limit, μg/L	Maximum Detection Limit, μg/L
Cadmium	0.92	2.1		
Mercury			0.1	0.1
Lead			1	1
Selenium	1.2	1.9	1	1
Silver	0.92	2.1	1	1

APPENDIX I

EVALUATION OF APPENDIX VIII CONSTITUENTS FOR SELECTION OF ANALYTICAL METHODS

APPENDIX I

EVALUATION OF APPENDIX VIII CONSTITUENTS FOR SELECTION OF ANALYTICAL METHODS

An evaluation of the sources of waste discharged to the impoundments indicated that information on waste constituents was extremely limited. For this reason, all HWMR-7 Part 261 Appendix VIII constituents were considered in selecting analytical methods for closure sampling.

Analytical methods were initially identified based on the results of previous sampling and requirements for waste characterization. Previous sampling detected volatile and semivolatile organics, organochlorine pesticides and PCBs, and metals. Waste characterization requirements include analysis for Toxicity Characteristic Leaching Procedure (TCLP) constituents and reactive cyanide and sulfide. TCLP constituents consist of volatile and semivolatile organics, organochlorine pesticides, chlorinated herbicides, and metals. Based on these considerations, the following SW-846 methods were initially selected for analysis:

- Volatiles organics (Method 8260);
- Semivolatile organics (Method 8270);
- Organochlorine pesticides and PCBs (Method 8080);
- Chlorinated herbicides (Method 8150);
- Metals (Methods 6020, 7470, 7471, and 7740);
- Reactive cyanide (Methods 7.3.3.2 and 9010); and
- Reactive sulfide (Methods 7.3.4.2 and 9030).

The lists of analytes associated with these methods were then compared with the list constituents in Appendix VIII. Table I-1 identifies the Appendix VIII constituents that are not included in the proposed analyses. These constituents were evaluated to determine if additional analyses were required. This evaluation considered the likelihood that the constituents would be present in wastes and the availability of SW-846 methods for these constituents.

The likelihood that the constituents would be present in wastes was based on consideration of:

- Common usage of the constituent, as reported in the Merck Index;
- The general nature of activities conducted in the areas identified as sources of wastes (see Appendix B);
- Lists of chemical products currently used at TA-53; and
- The identification of sources of wastes based on information provided by Laboratory and Johnson Controls employees and wastewater stream characterization reports prepared for TA-53 (see Appendix B).

Usage of these constituents is identified in Table I-1. Many of the identified uses fell into one or more of the following categories:

- Synthesis and manufacture of organic chemicals;
- Insecticides, fungicides, rodenticides, acaricides, herbicides, and nematocides; and
- Drugs and pharmaceuticals

These uses, as wells as other uses identified in Table I-1 are not consistent with activities conducted at TA-53.

The availability of SW-846 analytical methods was also considered. Most of the constituents identified in Table I-1 are not analytes of SW-846 methods. Some of the organic constituents included in Table I-1 are included in the list of analytes for the SW-846 methods, but are not specifically identified as analytes of the proposed methods because of uncertainty in the effectiveness of the extraction methods. Depending on the performance of the methods with the samples taken during closure, these analytes may be reported. As noted in the comments in Table I-1, individual components of some of the Appendix VIII constituents are analytes. For example, arsenic pentoxide is not an analyte, but arsenic is.

Based on this evaluation, it was concluded that the proposed analyses include the Appendix VIII constituents expected to be present and that no additional analyses are necessary. The proposed methods, analytes, estimated quantitation limits (EQL), proposed Resource Conservation and Recovery Act (RCRA) Subpart S action levels, and 1993 Laboratory Environmental Restoration Project Screening Action Levels (SALs) for volatile organics, semivolatile organics, pesticides and PCBs, chlorinated herbicides, and metals are summarized in Tables I-2 through I-6, respectively.

Table I-1. Appendix VIII Constituents Not Included in Analysis

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Acetophenone	98-86-2	U004		Method 8270, performance with extraction method not determined.
2-Acetylaminefluorene	53-96-3	U005		Method 8270, performance with extraction method not determined.
Acetyl chloride	75-36-5	U006	Acetylating agent.	No SW-846 method.
1-Acetyl-2-thiourea	591-08-2	P002		Method 8270, performance with extraction method not determined.
Acrylamide	79-06-1	U007		Methods 8015, 8032, and 8316.
Aflatoxins	1402-68-2	---	No use; naturally occurring toxin.	No SW-846 method.
Aldicarb	116-06-3	P070		Method 8318.
Aluminum phosphide	20859-73-8	P006	Source of phospine; semiconductor research.	Constituent (Al) to be analyzed for.
4-Aminobiphenyl	92-67-1	---		Method 8270, performance with extraction method not determined.
5-(Aminomethyl)-3-isoxazolol	2763-96-4	P007	Molecular probe.	No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
4-Aminopyridine	504-24-5	P008	Manufacture of drugs and dyes.	No SW-846 method.
Amitrole	61-82-5	U011	Herbicide.	No SW-846 method.
Ammonium vanadate	7803-55-6	P119	Dye, photgraphic developer.	Constituent (V) to be analyzed for.
Aniline	62-53-3	U012		Method 8270, performance with extraction method not determined.
Antimony compounds, N.O.S.	---	---		Constituent (Sb) to be analyzed for.
Aramite	140-57-8	---		Method 8270, performance with extraction method not determined.
Arsenic compounds, N.O.S.	---	---		Constituent (As) to be analyzed for.
Arsenic acid	7778-39-4	P010	Manufacture of arsenates.	Constituent (As) to be analyzed for.
Arsenic pentoxide	1303-28-2	P011	Weed control, fugicide.	Constituent (As) to be analyzed for.
Arsenic trioxide	1327-53-3	P012	Manufacture of arsenicals.	Constituent (As) to be analyzed for.
Auramine	492-80-8	U014		No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Azaserine	115-02-6	U015	Antibiotic.	No SW-846 method.
Barium compounds, N.O.S.	---	---		Constituent (Ba) to be analyzed for.
Barium cyanide	542-62-1	P013	Electroplating, metallurgy.	Constituent (Ba) to be analyzed for.
Benz[c]acridine	225-51-4	U016		No SW-846 method.
Benzal chloride	98-87-3	U017		Method 8121.
Benzenearsonic acid	98-05-5	---	Reagent for tin.	Constituent (As) to be analyzed for.
Benzidine	92-87-5	U021		Method 8270, nonreproducible chromatographic performance.
Benzo[j]fluoranthene	205-82-3	---		No SW-846 method.
p-Benzoquinone	106-51-4	U197		Method 8270, performance with extraction method not determined.
Benzotrichloride	98-07-7	U023		Method 8121.
Beryllium compounds, N.O.S.	---	---		Constituent (Be) to be analyzed for.
Brucine	357-57-3	P018		No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Cacodylic acid	75-60-5	U136	Herbicide.	Constituent (As) to be analyzed for.
Cadmium compounds, N.O.S.	---	---		Constituent (Cd) to be analyzed for.
Calcium chromate	13765-19-0	U032	Pigment, corrosion inhibitor.	Constituents (Ca, Cr) to be analyzed for.
Calcium cyanide	592-01-8	P021	Pesticide.	Constituents (Ca, CN) to be analyzed for.
Carbon oxyfluoride	353-50-4	U033		No SW-846 method.
Chloral	75-87-6	U034	Manufacture of chloral hydrate, DDT.	No SW-846 method.
Chlorambucil	305-03-3	U035	Drug.	No SW-846 method.
Chlordane (alpha and gamma isomers)	---	U036	Insecticide.	Method 8181.
Chlorinated benzenes, N.O.S.	---	---		Specific chlorinated benzenes to be analyzed for.
Chlorinated ethane, N.O.S.	---	---		Specific chlorinated ethanes to be analyzed for.
Chlorinated fluorocarbons, N.O.S.	---	---		Specific chlorinated fluorocarbons to be analyzed for.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Chlorinated naphthalene, N.O.S.	---	---		Specific chlorinated naphthalenes to be analyzed for.
Chlorinated phenol, N.O.S.	---	---		Specific chlorinated phenols to be analyzed for.
Chlornaphazin	494-03-1	U026	Drug.	No SW-846 method.
Chloroacetaldehyde	107-20-0	P023		Method 8010.
Chloroalkyl ethers, N.O.S.	---	---		Specific chloro alkyl ethers to be analyzed for.
p-Chloroaniline	106-47-8	P024		Method 8270, performance with extraction method not determined.
Chlorobenzilate	510-15-6	U038		Method 8270, performance with extraction method not determined.
Chloromethyl methyl ether	107-30-2	U046		Method 8010, poor performance.
1-(o-Chlorophenyl)thiourea	5344-82-1	P026		No SW-846 method.
3-Chloropropionitrile	542-76-7	P027	Pharmaceutical and polymer synthesis.	Purge and trap (Method 8260) inappropriate for this analyte.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Chromium compounds, N.O.S.	---	---		Constituent (Cr) to be analyzed for.
Citrus red No. 2	6358-53-8	---	Food dye.	No SW-846 method.
Coal tar creosote	8007-45-2	---	Wood preservative, insecticide.	No SW-846 method.
Copper cyanide	544-92-3	P029		Constituents (Cu, CN) to be analyzed for.
Creosote	---	U051		Method 8100.
Cresol (Cresylic acid)	1319-77-3	U052		Method 8270 for individual isomers, performance with extraction method not determined.
Crotonaldehyde	4170-30-3	U053	Manufacture of butyl alcohol, butyraldehyde, quinaldine.	Method 8260.
Cyanogen	460-19-5	P031		No SW-846 method.
Cyanogen bromide	506-68-3	U246		No SW-846 method.
Cyanogen chloride	506-77-4	P033	Chemical synthesis, military poison gas.	No SW-846 method.
Cycasin	14901-08-7	---		No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
2-Cyclohexyl-4,6-dinitrophenol	131-89-5	P034		Method 8270, performance with extraction method not determined.
Cyclophosphamide	50-18-0	U058	Defleecing agent for sheep.	No SW-846 method.
2,4-D, salts, esters	---	U240		Constituent (2,4-D) to be analyzed for.
Daunomycin	20830-81-3	U059	Antibiotic.	No SW-846 method.
Diallate	2303-16-4	U062		Method 8270, performance with extraction method not determined.
Dibenz[a,h]acridine	226-36-8	---		No SW-846 method.
Dibenz[a,j]acridine	224-42-0	---		Method 8270, performance with extraction method not determined.
7H-Dibenzo[c,g]carbazole	194-59-2	---		No SW-846 method.
Dibenzo[a,e]pyrene	192-65-4	---		Method 8270, performance with extraction method not determined.
Dibenzo[a,h]pyrene	189-64-0	---		No SW-846 method.
Dibenzo[a,i]pyrene	189-55-9	U064		No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
1,2-Dibromo-3-chloropropane	96-12-8	U066		Method 8260, poor purging efficiency. Method 8270, performance with extraction method not determined.
Dichlorobenzene, N.O.S.	25321-22-6	---		Specific dichlorobenzenes to be analyzed for.
Dichloroethylene, N.O.S.	25323-30-2	---		Specific dichloroethylenes to be analyzed for.
Dichloromethyl ether	542-88-1	P016		No SW-846 method.
Dichlorophenylarsine	696-28-6	P036		Constituent (As) to be analyzed for.
Dichloropropane, N.O.S.	26638-19-7	---		Specific dichloropropanes to be analyzed for.
Dichloropropanol, N.O.S.	26545-73-3	---		No SW-846 method.
Dichloropropene, N.O.S.	26952-23-8	---		Specific dichloropropenes to be analyzed for.
Diethylarsine	692-42-2	P038		Constituent (As) to be analyzed for.
N,N'-Diethylhydrazine	1615-80-1	U086		No SW-846 method.
O,O-Diethyl S-methyl dithiophosphate	3288-58-2	U087		No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Diethyl-p-nitrophenyl phosphate	311-45-5	P041	Insecticide.	No SW-846 method.
O,O-Diethyl O-pyrazinyl phosphorothioate	297-97-2	P040		Method 8270, performance with extraction method not determined.
Diethylstilbesterol	56-53-1	U089		Method 8270, performance with extraction method not determined.
Dihydrosafrole	94-58-6	U090		No SW-846 method.
Diisopropylfluorophosphate (DFP)	55-91-4	P043	Veterenary miotic.	No SW-846 method.
Dimethoate	60-51-5	P044		Method 8270, performance with extraction method not determined.
3,3'-Dimethoxybenzidine	119-90-4	U091		Method 8270, performance with extraction method not determined.
p-Dimethylaminoazobenzene	60-11-7	U093		Method 8270, performance with extraction method not determined.
7,12-Dimethylbenz[a]anthracene	57-97-6	U094		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
3,3'-Dimethylbenzidine	119-93-7	U095		Method 8270, performance with extraction method not determined.
Dimethylcarbamoyl chloride	79-44-7	U097		No SW-846 method.
1,1-Dimethylhydrazine	57-14-7	U098	Rocket fuel formulations.	No SW-846 method.
1,2-Dimethylhydrazine	540-73-8	U099		No SW-846 method.
alpha,alpha-Dimethylphenethylamine	122-09-8	P046		No SW-846 method.
Dimethyl sulfate	77-78-1	U103	Methylating agent in organic chemical manufacturing.	No SW-846 method.
Dinitrobenzene, N.O.S.	25154-54-5	---		Method 8270 for individual isomers, performance with extraction method not determined.
4,6-Dinitro-o-cresol salts	---	P047		Constituent (4,6-Dinitro-o-cresol) to be analyzed for.
Disulfoton	298-04-4	P039		Method 8270, performance with extraction method not determined.
Dithiobiuret	541-53-7	P049	Plasticizer, intermediate in chemical manufacture.	No SW-846 method.
Endothall	145-73-3	P088	Herbicide, defoliant.	No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Endrin metabolites	---	P051		No SW-846 method.
Epichlorohydrin	106-89-8	U041	Solvent for natural and synthetic resins, gums, cellulose esters.	Purge and trap (Method 8260) inappropriate for this analyte.
Epinephrine	51-43-4	P042	Drug.	No SW-846 method.
Ethyl carbamate (urethane)	51-79-6	U238		Method 8270, performance with extraction method not determined.
Ethylenebisdithiocarbamic acid	111-54-6	U114		No SW-846 method.
Ethylenebisdithiocarbamic acid, salts and esters	---	U114		No SW-846 method.
Ethylene glycol monoethyl ether	110-80-5	U359	Solvent for nitrocellulose, laquers, and dopes.	No SW-846 method.
Ethyleneimine	151-56-4	P054	Manufacture of triethylenemelamine.	No SW-846 method.
Ethylenethiourea	96-45-7	U116		Method 8330.
Ethyl methanesulfonate	62-50-0	U119		Method 8270, performance with extraction method not determined.
Famphur	52-85-7	P097		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Fluorine	7782-41-4	P056		No SW-846 method.
Fluoroacetamide	640-19-7	P057	Rodenticide, insecticide.	No SW-846 method.
Fluoroacetic acid, sodium salt	62-74-8	P058		No SW-846 method.
Formaldehyde	50-00-0	U122		Method 8315.
Formic acid	64-18-6	U123	Decalcifier, reducer in dyeing wool fast colors.	No SW-846 method.
Glycidylaldehyde	765-34-4	U126		No SW-846 method.
Halomethanes, N.O.S.	---	---		Specific halomethanes to be analyzed for.
Heptachlor epoxide (alpha, beta, and gamma isomers)	---	---		Heptachlor epoxide to be analyzed for.
Heptachlorodibenzofurans	---	---		Method 8290.
Heptachlorodibenzo-p-dioxins	---	---		Method 8290.
Hexachlorodibenzo-p-dioxins	---	---		Method 8290.
Hexachlorodibenzofurans	---	---		Method 8290.
Hexachlorophene	70-30-4	U132		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Hexachloropropene	1888-71-7	U243		Method 8270, performance with extraction method not determined.
Hexaethyl tetraphosphate	757-58-4	P062		No SW-846 method.
Hydrazine	302-01-2	U133	Reducing agent; organic hydrazine derivatives; rocket fuel.	No SW-846 method.
Hydrogen cyanide	74-90-8	P063	Rodenticide, insecticide.	Constituent (CN) to be analyzed for.
Hydrogen fluoride	7664-39-3	U134	Catalyst, fluorinating agent.	No SW-846 method.
Hydrogen sulfide	7783-06-4	U135	Manufacture of chemicals, metallurgy, analytical reagent.	Constituent (sulfide) to be analyzed for.
Isodrin	465-73-6	P060		Method 8270, performance with extraction method not determined.
Isosafrole	120-58-1	U141		Method 8270, performance with extraction method not determined.
Kepone	143-50-0	U142		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Lasiocarpine	303-34-1	U143		No SW-846 method.
Lead compounds, N.O.S.	---	---		Constituent (Pb) to be analyzed for.
Lead acetate	301-04-2	U144		Constituent (Pb) to be analyzed for.
Lead phosphate	7446-27-7	U145		Constituent (Pb) to be analyzed for.
Lead subacetate	1335-32-6	U146		Constituent (Pb) to be analyzed for.
Maleic anhydride	108-31-6	U147		Method 8270, performance with extraction method not determined.
Maleic hydrazide	123-33-1	U148	Experimentally in horticulture and agriculture.	No SW-846 method.
Melphalan	148-82-3	U150	Drug.	No SW-846 method.
Mercury compounds, N.O.S.	---	---		Constituent (Hg) to be analyzed for.
Mercury fulminate	628-86-4	P065		Constituent (Hg) to be analyzed for.
Methapyrilene	91-80-5	U155		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Methomyl	16752-77-5	P066		Method 8318.
Methyl chlorocarbonate	79-22-1	U156		No SW-846 method.
3-Methylcholanthrene	56-49-5	U157		Method 8270, performance with extraction method not determined.
4,4-Methylenebis(2-chloroaniline)	101-14-4	U158	Curing agent for polyurethane and epoxy resins.	Method 8270, performance with extraction method not determined.
Methyl ethyl ketone peroxide	1338-23-4	U160		No SW-846 method.
Methyl hydrazine	60-34-4	P068	Rocket fuel, intermediate in chemical synthesis.	No SW-846 method.
Methyl isocyanate	624-83-9	P064	Organic synthesis, manufacture of carbamate pesticides.	No SW-846 method.
2-Methyllactonitrile	75-86-5	P069	Organic synthesis.	No SW-846 method.
Methyl methanesulfonate	66-27-3	---		Method 8270, performance with extraction method not determined.
Methyl parathion	298-00-0	P071	Insecticide.	Method 8270, performance with extraction method not determined.
Methylthiouracil	56-04-2	U164	Thyroid inhibitor.	No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Mitomycin C	50-07-7	U010		No SW-846 method.
MNNG	70-25-7	U163		No SW-846 method.
1,4-Naphthoquinone	130-15-4	U166		Method 8270, performance with extraction method not determined.
alpha-Naphthylamine	134-32-7	U167		Method 8270, performance with extraction method not determined.
beta-Naphthylamine	91-59-8	U168		Method 8270, performance with extraction method not determined.
alpha-Naphthylthiourea	86-88-4	P072		No SW-846 method.
Nickel compounds, N.O.S.	---	---		Constituent (Ni) to be analyzed for.
Nickel carbonyl	13463-39-3	P073	Organic synthesis.	Constituent (Ni) to be analyzed for.
Nickel cyanide	557-19-7	P074	Nickel plating.	Constituents (Ni, CN) to be analyzed for.
Nicotine	54-11-5	P075		Method 8270, performance with extraction method not determined.
Nicotine salts	---	P075		No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Nitric oxide	10102-43-9	P076	Manufacture of nitric acid.	No SW-846 method.
Nitrogen dioxide	10102-44-0	P078	Intermediate in nitric and sulfuric acid production; nitration of organics.	No SW-846 method.
Nitrogen mustard	51-75-2	---	Base as gas warfare agent.	No SW-846 method.
Nitrogen mustard, hydrochloride salt	---	---		No SW-846 method.
Nitrogen mustard N-oxide	126-85-2	---		No SW-846 method.
Nitrogen mustard, N-oxide, hydro-chloride salt	---	---		No SW-846 method.
Nitroglycerin	55-63-0	P081	Manufacture of dynamite.	No SW-846 method.
Nitrosamines, N.O.S.	35576-91-1	---		Specific nitrosamines to be analyzed for.
N-Nitrosodi-n-butylamine	924-16-3	U172		Method 8270, performance with extraction method not determined.
N-Nitrosodiethanolamine	1116-54-7	U173	Gasoline and lubricant additive; antioxidant; stabilizer.	No SW-846 method.
N-Nitrosodiethylamine	55-18-5	U174		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
N-Nitroso-N-ethylurea	759-73-9	U176	Experimental mutagen; ethylating agent.	No SW-846 method.
N-Nitrosomethylethylamine	10595-95-6	---		Method 8270, performance with extraction method not determined.
N-Nitroso-N-methylurea	684-93-5	U177		No SW-846 method.
N-Nitroso-N-methylurethane	615-53-2	U178		No SW-846 method.
N-Nitrosomethylvinylamine	4549-40-0	P084		No SW-846 method.
N-Nitrosomorpholine	59-89-2	---		Method 8270, performance with extraction method not determined.
N-Nitrosonornicotine	16543-55-8	---		No SW-846 method.
N-Nitrosopiperidine	100-75-4	U179		Method 8270, performance with extraction method not determined.
N-Nitrosopyrrolidine	930-55-2	U180		Method 8270, performance with extraction method not determined.
N-Nitrososarcosine	13256-22-9	---		No SW-846 method.
5-Nitro-o-toluidine	99-55-8	U181		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Octamethylpyrophosphoramide	152-16-9	P085		Method 8270, performance with extraction method not determined.
Osmium tetroxide	20816-12-0	P087	Oxidizing agent for converting olefins to glycols.	No SW-846 method.
Paraldehyde	123-63-7	U182		Method 8015
Parathion	56-38-2	P089		Method 8270, performance with extraction method not determined.
Pentachlorobenzene	608-93-5	U183		Method 8270, performance with extraction method not determined.
Pentachlorodibenzo-p-dioxins	---	---		Method 8290.
Pentachlorodibenzofurans	---	---		Method 8290.
Pentachloroethane	76-01-7	U184		Purge and trap (Method 8260) inappropriate for this analyte.
Pentachloronitrobenzene (PCNB)	82-68-8	U185		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Phenacetin	62-44-2	U187		Method 8270, performance with extraction method not determined.
Phenylenediamine	25265-76-3	---		No SW-846 method.
Phenylmercury acetate	62-38-4	P092	Herbicide, fugacide.	Constituent (Hg) to be analyzed for.
Phenylthiourea	103-85-5	P093	Medical genetics.	No SW-846 method.
Phosgene	75-44-5	P095	Organic synthesis; warfare gas.	No SW-846 method.
Phosphine	7803-51-2	P096		No SW-846 method.
Phorate	298-02-2	P094		Method 8270, performance with extraction method not determined.
Phthalic acid esters, N.O.S.	---	---		Methods 8060 and 8061 for specific compounds.
Phthalic anhydride	85-44-9	U190		Method 8270, performance with extraction method not determined.
Potassium cyanide	151-50-8	P098	Extracting gold and silver from ore; electroplating; fumigant.	Constituent (CN) to be analyzed for.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Potassium silver cyanide	506-61-6	P099	Silver plating; bactericide.	Constituents (Ag, CN) to be analyzed for.
Pronamide	23950-58-5	U192		Method 8270, performance with extraction method not determined.
1,3-Propane sultone	1120-71-4	U193		No SW-846 method.
1,2-Propylenimine	75-55-8	P067		No SW-846 method.
Propylthiouracil	51-52-5	---		Method 8270, performance with extraction method not determined.
Pyridine	110-86-1	U196	Solvent for anhydrous mineral salts; synthetic intermediate.	Purge and trap (Method 8260) inappropriate for this analyte. Method 8270, performance with extraction method not determined.
Reserpine	50-55-5	U200	Drug.	No SW-846 method.
Resorcinol	108-46-3	U201		Method 8270, performance with extraction method not determined.
Saccharin	81-07-2	U202	Artificial sweetener.	No SW-846 method.
Saccharin salts	---	U202		No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Safrole	94-59-7	U203		Method 8270, performance with extraction method not determined.
Selenium compounds, N.O.S.	---	---		Constituent (Se) to be analyzed for.
Selenium dioxide	7783-00-8	U204	Reagent for alkaloids; oxidizing agent.	Constituent (Se) to be analyzed for.
Selenium sulfide	7488-56-4	U205		Constituent (Se) to be analyzed for.
Selenourea	630-10-4	P103		Constituent (Se) to be analyzed for.
Silver compounds, N.O.S.	---	---		Constituent (Ag) to be analyzed for.
Silver cyanide	506-64-9	P104	Silver plating.	Constituents (Ag, CN) to be analyzed for.
Sodium cyanide	143-33-9	P106	Extracting gold and silver from ore; electroplating; fumigant.	Constituent (CN) to be analyzed for.
Streptozotocin	18883-66-4	U206	Production of experimental diabetes in laboratory animals.	No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Strychnine	57-24-9	P108	Poison baits for rodents.	Method 8270, performance with extraction method not determined.
Strychnine salts	---	P108		No SW-846 method.
TCDD	1746-01-6	---		Method 8290.
1,2,4,5-Tetrachlorobenzene	95-94-3	U207		Method 8270, performance with extraction method not determined.
Tetrachlorodibenzo-p-dioxins	---	---		Method 8290.
Tetrachlorodibenzofurans	---	---		Method 8290.
Tetrachloroethane, N.O.S.	25322-20-7	---		Specific tetrachloroethanes to be analyzed for.
2,3,4,6-Tetrachlorophenol	58-90-2	See F027		Method 8270, performance with extraction method not determined.
Tetraethyldithiopyrophosphate	3689-24-5	P109		Method 8270, performance with extraction method not determined.
Tetraethyl lead	78-00-2	P110	Gasoline additive.	Constituent (Pb) to be analyzed for.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Tetraethyl pyrophosphate	107-49-3	P111		Method 8270, performance with extraction method not determined.
Tetranitromethane	509-14-8	P112	Oxidizer in rocket propellants; Diesel fuel additive.	No SW-846 method.
Thallium compounds, N.O.S.	---	---		Constituent (Tl) to be analyzed for.
Thallic oxide	1314-32-5	P113		Constituent (Tl) to be analyzed for.
Thallium(I) acetate	563-68-8	U214		Constituent (Tl) to be analyzed for.
Thallium(I) carbonate	6533-73-9	U215	Manufacture of imitation diamonds.	Constituent (Tl) to be analyzed for.
Thallium(I) chloride	7791-12-0	U216	Catalyst in chlorinations.	Constituent (Tl) to be analyzed for.
Thallium(I) nitrate	10102-45-1	U217	Reagent in analytical chemistry.	Constituent (Tl) to be analyzed for.
Thallium selenite	12039-52-0	P114		Constituents (Se, Tl) to be analyzed for.
Thallium(I) sulfate	7446-18-6	P115	Rat poison, ant bait; reagent in analytical chemistry.	Constituent (Tl) to be analyzed for.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Thioacetamide	62-55-5	U218	Laboratory substitute for hydrogen sulfide.	No SW-846 method.
Thiofanox	39196-18-4	P045		Method 8321.
Thiomethanol	74-93-1	U153	Intermediate in manufacture of jet fuels, pesticides, fungicides, plastics.	No SW-846 method.
Thiophenol	108-98-5	P014		Method 8270, performance with extraction method not determined.
Thiosemicarbazide	79-19-6	P116	Reagent for detection of metals.	No SW-846 method.
Thiourea	62-56-6	U219	Photographic fixing agent.	No SW-846 method.
Thiram	137-26-8	U244	Rubber accelerator; vulcanizer; seed disinfectant; fungicide.	No SW-846 method.
Toluenediamine	25376-45-8	U221		No SW-846 method.
Toluene-2,4-diamine	95-80-7	---		Method 8270, performance with extraction method not determined.
Toluene-2,6-diamine	823-40-5	---		No SW-846 method.
Toluene-3,4-diamine	496-72-0	---		No SW-846 method.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Toluene diisocyanate	26471-62-5	U223		Method 8270, performance with extraction method not determined.
o-Toluidine	95-53-4	U328		Method 8270, performance with extraction method not determined.
o-Toluidine hydrochloride	636-21-5	U222		No SW-846 method.
p-Toluidine	106-49-0	U353	Manufacture of dyes and other organic chemicals.	No SW-846 method.
Trichloromethanethiol	75-70-7	P118		No SW-846 method.
Trichloropropane, N.O.S.	25735-29-9	---		Specific trichloropropanes to be analyzed for.
O,O,O-Triethyl phosphorothioate	126-68-1	---		Method 8270, performance with extraction method not determined.
1,3,5-Trinitrobenzene	99-35-4	U234		Method 8270, performance with extraction method not determined.
Tris(1-aziridinyl)phosphine sulfide	52-24-4	---	Insect sterilant.	No SW-846 method.
Tris(2,3-dibromopropyl) phosphate	126-72-7	U235		Method 8270, performance with extraction method not determined.

Table I-1. Appendix VIII Constituents Not Included in Analysis (Continued)

Common Name	Chemical Abstracts No.	Hazardous Waste No.	Usage (Merck)	Comments
Trypan blue	72-57-1	U236	Biological stain.	No SW-846 method.
Uracil mustard	66-75-1	U237	Drug.	No SW-846 method.
Vanadium pentoxide	1314-62-1	P120	Oxidation catalyst; manufacture of yellow glass; depolarizer.	Constituent (V) to be analyzed for.
Warfarin	81-81-2	U248	Rodenticide.	No SW-846 method.
Warfarin	81-81-2	U248	Rodenticide.	No SW-846 method.
Warfarin salts, when present at concentrations less than 0.3%	---	U248	Rodenticide.	No SW-846 method.
Warfarin salts, when present at concentrations greater than 0.3%	---	U248	Rodenticide.	No SW-846 method.
Zinc cyanide	557-21-1	P121	Electroplating; removal of ammonia from producer gas.	Constituents (CN, Zn) to be analyzed for.
Zinc phosphide, when present at concentrations greater than 10%	1314-84-7	P122	Rat and mice poison preparations.	Constituent (Zn) to be analyzed for.
Zinc phosphide, when present at concentrations less than 10%	1314-84-7	U249	Rat and mice poison preparations.	Constituent (Zn) to be analyzed for.

Table I-2. Analytes for Volatiles Analysis (Method 8260)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
Acetone	67-64-1	ND[c]	8,000,000	8,000,000	ND	4,000	3,500	No
Acetonitrile	75-05-8	5	500,000		5	200		Yes
Acrolein	107-02-8	5			5			Yes
Acrylonitrile	107-13-1	5	1,000		5	0.06		Yes
Allyl alcohol	107-18-6	5	400,000		5	200		Yes
Allyl chloride	107-05-1	5			5			Yes
Benzene	71-43-2	5		670	5		5	Yes
Benzyl chloride	100-44-7	5			5			Yes
Bromoacetone	598-31-2	ND			ND			Yes
Bromodichloromethane	75-27-4	5	500	11,000	5	0.03	0.56	No
Bromoform	75-25-2	5	2,000,000	89,000	5	700	4.40	Yes
Bromomethane	74-83-9	5	100,000	430	5	50	49	Yes
n-Butanol	71-36-3	5			5			Yes
2-Butanone (MEK)	78-93-3	ND	4,000,000	4,000,000	ND	2,000	1,700	Yes
Carbon disulfide	75-15-0	ND	8,000,000	7,400	ND	4,000	3,500	Yes
Carbon tetrachloride	56-23-5	5	5,000	210	5	0.30	5	Yes
Chloral hydrate	302-17-0	ND			ND			No

Table I-2. Analytes for Volatiles Analysis (Method 8260) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
Chlorobenzene	108-90-7	5	2,000,000	67,000	5	700	100	Yes
2-Chloro-1,3-butadiene	126-99-8	5			5			Yes
Chlorodibromomethane	124-48-1	5		83,000	5		4.20	No
Chloroethane	75-00-3	5		3,300,000	5			No
2-Chloroethanol	107-03-3	ND			ND			No
bis-(2-Chloroethyl) sulfide	505-60-2	ND			ND			Yes
2-Chloroethyl vinyl ether	110-75-8	5			5			Yes
Chloroform	67-66-3	5	100,000	210	5	6	100	Yes
Chloromethane	74-87-3	5		6,400	5		27	Yes
Chloroprene	126-99-8	5			5			Yes
3-Chloropropene	107-05-1	5			5			Yes
1,2-Dibromo-3-chloropropane	96-12-8	ND			ND			Yes
1,2-Dibromoethane	106-93-4	5	8		5	0.0004		Yes
Dibromomethane	74-95-3	5			5			Yes
1,2-Dichlorobenzene	95-50-1	5		1,600,000	5		600	Yes
1,3-Dichlorobenzene	541-73-1	5		7,200,000	5		600	No

Table I-2. Analytes for Volatiles Analysis (Method 8260) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
1,4-Dichlorobenzene	106-46-7	5		290,000	5		75	Yes
cis-1,4-Dichloro-2-butene	1476-11-5	5			5			Yes
trans-1,4-Dichloro-2-butene	110-57-6	ND			ND			Yes
Dichlorodifluoromethane	75-71-8	5	20,000,000		5	7,000		Yes
1,1-Dichloroethane	75-34-3	5		410,000	5		3,500	Yes
1,2-Dichloroethane	107-06-2	5	8,000	200	5	5	5	Yes
1,1-Dichloroethene	75-35-4	5	10,000	590	5	7	7	Yes
trans-1,2-Dichloroethene	156-60-5	5		1,600,000	5		100	Yes
1,2-Dichloropropane	78-87-5	5		6,500	5		5	Yes
1,3-Dichloro-2-propanol	96-23-1	ND			ND			No
cis-1,3-Dichloropropene	10061-01-5	5	20,000	170	5	10	0.19	Yes
trans-1,3-Dichloropropene	10061-02-6	5	20,000	170	5	10	0.19	Yes
1,2:3,4-Diepoxybutane	1464-53-5	5			5			Yes
Diethyl ether	60-29-7	5			5			No
1,4-Dioxane	123-91-1	ND			ND			Yes

Table I-2. Analytes for Volatiles Analysis (Method 8260) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
Ethyl benzene	100-41-4	5	8,000,000	3,100,000	5	4,000	700	No
Ethylene oxide	75-21-8	ND			ND			Yes
Ethyl methacrylate	97-63-2	5			5			Yes
Hexachlorobutadiene	87-68-3	5	90,000	90,000	5	4	4.50	Yes
2-Hexanone	591-78-6	ND			ND			No
Iodomethane	74-88-4	5			5			Yes
Isobutyl alcohol	78-83-1	ND	20,000,000		ND	10,000		Yes
Isopropyl benzene	98-82-8	5			5			No
Malononitrile	109-77-3	ND			ND			Yes
Methacrylonitrile	126-98-7	ND	8,000		ND	4		Yes
Methylene chloride	75-09-2	5	90,000	5,600	5	5	5	Yes
Methyl iodide	74-88-4	5			5			Yes
Methyl methacrylate	80-62-6	5			5			Yes
4-Methyl-2-pentanone (MIBK)	108-10-1	ND	4,000,000	510,000	ND	2,000	1,700	No
Naphthalene	91-20-3	5			5			Yes
Nitrobenzene	98-95-3	5	40,000	5,300	5	20	18	Yes
2-Nitropropane	79-46-9	5			5			Yes

Table I-2. Analytes for Volatiles Analysis (Method 8260) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
2-Picoline	109-06-8	ND			ND			Yes
Propargyl alcohol	107-19-7	ND			ND			Yes
beta-Proiolactone	57-57-8	ND			ND			No
Propionitrile (ethyl cyanide)	107-12-0	5			5			Yes
n-Propylamine	107-10-8	5			5			Yes
Styrene	100-42-5	5	20,000,000	16,000,000	5	7,000	100	No
1,1,1,2-Tetrachloro-ethane	630-20-6	5	300,000		5	10		Yes
1,1,2,2-Tetrachloro-ethane	79-34-5	5	40,000	3,900	5	2	1.80	Yes
Tetrachloroethene	127-18-4	5	10,000	5,900	5	0.70	5	Yes
Toluene	108-88-3	5	20,000,000	890,000	5	10,000	1,000	Yes
1,2,4-Trichlorobenzene	120-82-1	5	2,000,000	160,000	5	700	70	Yes
1,1,1-Trichloroethane	71-55-6	5	7,000,000	1,000,000	5	3,000	200	Yes
1,1,2-Trichloroethane	79-00-5	5	100,000	6,300	5	6	5	Yes
Trichloroethene	79-01-6	5	60,000	3,200	5	5	5	Yes
Trichloromonofluoro-methane	75-69-4	5	20,000,000		5	10,000		Yes

Table I-2. Analytes for Volatiles Analysis (Method 8260) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
1,2,3-Trichloropropane	96-18-4	5			5			Yes
Vinyl acetate	108-05-4	5			5			No
Vinyl chloride	75-01-4	5		13	5		2	Yes
o-Xylene[d]	95-47-6	5	200,000,000	160,000,000	5	70,000	10,000	No
m-Xylene[d]	108-38-3	5	200,000,000	160,000,000	5	70,000	10,000	No
p-Xylene[d]	106-42-3	5	200,000,000	160,000,000	5	70,000	10,000	No

Notes:
[a] EQL is for wet weight.
[b] Action level is proposed RCRA Subpart S Action Level.
[c] ND - Estimated quantitation limit has not been determined due to possible poor performance with purge and trap for this analyte.
[d] Action levels and SALs are for total xylene.

Table I-3. Analytes for Semivolatiles Analysis (Method 8270)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
Acenaphthene	83-32-9	660		4,800,000	10		2,100	No
Acenaphthylene	208-96-8	660			10			No
Acetophenone	98-86-2	ND[c]	8,000,000		10	4,000		Yes
Aniline	62-53-3	ND	100,000		10	6		Yes
Anthracene	120-12-7	660		24,000,000	10		10,000	No
2-Acetylamino-fluorene	53-96-3	ND			20			Yes
4-Aminobiphenyl	92-67-1	ND			20			Yes
Benzoic Acid	65-85-0	3300		320,000,000	50		140,000	No
Benzo[a]-anthracene	56-55-3	660		640	10		0.10	Yes
Benzo[b]-fluoranthene	205-99-2	660		700	10		0.20	Yes
Benzo(k)-fluoranthene	207-08-9	660		1,500	10		0.20	Yes
Benzo(g,h,i) perylene	191-24-2	660		44,000	10			No
Benzo[a]pyrene	50-32-8	660		100	10		0.20	Yes
Benzyl alcohol	100-51-6	1300			20			No

Table I-3. Analytes for Semivolatiles Analysis (Method 8270) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
Bis(2-chloro-ethoxy) methane	111-91-1	660			10			Yes
Bis(2-chloro-ethyl) ether	111-44-4	660	600	130	10	0.03	0.032	Yes
Bis(2-chloro-isopropyl) ether	108-60-1	660			10			Yes
Bis(2-ethylhexyl) phthalate	117-81-7	660	50,000	50,000	10	3	4	Yes
4-Bromophenyl phenyl ether	101-55-3	660			10			Yes
Butyl benzyl phthalate	85-68-7	660	20,000,000	16,000,000	10	7,000	100	Yes
4-Chloroaniline	106-47-8	ND		320,000	20		140	Yes
Chlorobenzilate	510-15-6	ND			10			Yes
4-Chloro-3-methylphenol	59-50-7	1300		16,000,000	20		7,000	Yes
2-Chloro-naphthalene	91-58-7	660		6,400,000	10		2,800	Yes
2-Chlorophenol	95-57-8	660	400,000	400,000	10	200	170	Yes
4-Chlorophenyl phenyl ether	7005-72-3	660			10			No
Chrysene	218-01-9	660		22,000	10		0.20	Yes

Table I-3. Analytes for Semivolatiles Analysis (Method 8270) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
2-Cyclohexyl-4,6-dinitr ophenol	131-89-5	ND			100			Yes
Diallate	2303-16-4	ND			10			Yes
Dibenz(a,j) acridine	224-42-0	ND			10			Yes
Dibenz[a,h] anthracene	53-70-3	660		86	10		0.30	Yes
Dibenzofuran	132-64-9	ND			10			No
Di-n-butyl phthalate	84-74-2	ND	8,000,000	8,000,000	10	4,000	3,500	Yes
1,2--Dichloro-benzene	95-50-1	660		1,600,000	10		600	Yes
1,3-Dichloro-benzene	541-73-1	660		7,200,000	10		600	Yes
1,4-Dichloro-benzene	106-46-7	660		290,000	10		75	Yes
3,3'-Dichloro-benzidine	91-94-1	1300	2,000	1,600	20	0.05	0.078	Yes
2,4-Dichloro-phenol	120-83-2	660	200,000	240,000	10	100	100	Yes
2,6-Dichloro-phenol	87-65-0	ND			10			Yes
Diethyl phthalate	84-66-2	660	60,000,000	64,000,000	10	30,000	5,000	Yes

Table I-3. Analytes for Semivolatiles Analysis (Method 8270) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
3,3'-Dimethoxy-benzidine	119-90-4	ND			100			Yes
Dimethyamino-azobenzene	60-11-7	ND			10			Yes
3,3'-Dimethyl-benzidine	119-93-7	ND			10			Yes
2,4-Dimethyl-phenol	105-67-9	660		1,600,000	10		700	Yes
Dimethyl phthalate	131-11-3	660		80,000,000	10		35,000	Yes
4,6-Dinitro-2-methylphenol	534-52-1	3300			50			Yes
2,4-Dinitrophenol	51-28-5	3300	200,000	160,000	50	70	70	Yes
2,4-Dinitrotoluene	121-14-2	660		1,000	10		0.05	Yes
2,6-Dinitrotoluene	606-20-2	660		1,000	10		0.05	Yes
Diphenylamine	122-39-4	ND	2,000,000	2,000,000	ND	900	880	Yes
1,2-Diphenyl-hydrazine	122-66-7	ND	900		ND	0.04		Yes
Di-n-octylphthalate	117-84-0	660		1,600,000	10		700	Yes
Disulfoton	298-04-4	ND	3,000		10	1		Yes
Ethyl methanesulfonate	62-50-0	ND			20			Yes

Table I-3. Analytes for Semivolatiles Analysis (Method 8270) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
Famphur	52-85-7	ND			20			Yes
Fluoranthene	206-44-0	660		3,200,000	10		1,400	Yes
Fluorene	86-73-7	660		3,200,000	10		1,400	No
Hexachlorobenzene	118-74-1	660		440	10		1	Yes
Hexachlorobutadiene	87-68-3	660	90,000	90,000	10	4	4.50	Yes
Hexachlorocyclo-pentadiene	77-47-4	660	600,000	560,000	10	200	50	Yes
Hexachloroethane	67-72-1	660	80,000	80,000	10	30	25	Yes
Hexachloropropene	1888-71-7	ND			10			Yes
Indeno[1,2,3-cd] pyrene	193-39-5	660		410	10		0.40	Yes
Isodrin	465-73-6	ND			20			Yes
Isophrone	78-59-1	660	2,000,000	7,400,000	10	90	370	No
Kepone	143-50-0	ND			20			Yes
Methapyrilene	91-80-5	ND			100			Yes
2-Methynaphthalene	91-57-6	660			10			No
3-Methylcholanthrene	56-49-5	ND			10			Yes
Methy methanesulfonate	66-27-3	ND			10			Yes

Table I-3. Analytes for Semivolatiles Analysis (Method 8270) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
2-Methyl-5-nitroaniline	99-55-8	ND			ND			Yes
Methyl parathion	298-00-0	ND			10			Yes
2-Methylpyridine	109-06-8	ND			ND			Yes
Naphthalene	91-20-3	660		3,200,000	10		1,400	Yes
1,4-Naphthoquinone	130-15-4	ND			10			Yes
2-Naphthylamine	91-59-8	ND			10			Yes
2-Nitroaniline	88-74-4	3300		4,800	50		2.10	No
3-Nitroaniline	99-09-2	3300			50			No
4-Nitroaniline	100-01-6	ND			20			No
Nitrobenzene	98-95-3	660		5,300	10		18	Yes
2-Nitrophenol	88-75-5	660			10			No
4-Nitrophenol	100-02-7	3300			50			Yes
N-Nitrosodibutylamine	924-16-3	ND	100		10	0.006		Yes
N-Nitrosodiethylamine	55-18-5	ND			20			Yes
N-Nitrosodimethyl-amine	62-75-9	ND			ND			Yes
N-Nitrosomethyl-ethylamine	10595-95-6	ND	30		ND	0.002		Yes

Table I-3. Analytes for Semivolatiles Analysis (Method 8270) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
N-Nitrosodiphenyl-amine	86-30-6	660	100,000	140,000	10	7	7.10	No
N-Nitrosodi-n-propyl-amine	621-64-7	ND	100	100	10	0.005	0.005	Yes
N-Nitrosopiperidine	100-75-4	ND			20			Yes
N-Nitrosopyrrolidine	930-55-2	ND	300		40	0.02		Yes
Parathion	56-38-2	ND	20,000		10	9		Yes
Pentachlorobenzene	608-93-5	ND	60,000		10	30		Yes
Pentachloronitro-benzene	82-68-8	ND	200,000		20	100		Yes
Pentachlorophenol	87-86-5	3300	2,000,000	5,800	50	1,000	1	Yes
Phenacetin	62-44-2	ND			20			Yes
Phenanthrene	85-01-8	660			10			No
Phenol	108-95-2	660	50,000,000	48,000,000	10	20,000	21,000	Yes
Phorate	298-02-2	ND			10			Yes
Pronamide	23950-58-5	ND			10			Yes
Pyrene	129-00-0	660		2,400,000	10		1,000	No
Safrole	94-59-7	ND			10			Yes
1,2,4,5-Tetrachloro-benzene	95-94-3	ND	20,000		10	10		Yes

Table I-3. Analytes for Semivolatiles Analysis (Method 8270) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
2,3,4,6-Tetrachloro-phenol	58-90-2	ND	2,000,000		10	1,000		Yes
Tetraethyl dithiopyrophosphate	3689-24-5	ND	40,000		ND	20		Yes
Tetraethyl pyrophosphate	107-49-3	ND			40			Yes
Thionazine	297-97-2	ND			20			Yes
Thiophenol	108-98-5	ND			20			Yes
o-Toluidine	95-53-4	ND			10			Yes
1,2,4-Trichloro-benzene	120-82-1	660	2,000,000	160,000	10	700	70	Yes
2,4,5-Trichlorophenol	95-95-4	660	8,000,000	8,000,000	10	4,000	3,500	Yes
2,4,6-Trichlorophenol	88-06-2	660	40,000	64,000	10	2	3.20	Yes
1,3,5-Trinitrobenzene	99-35-4	ND		4,000	10		1.80	Yes
Tris(2,3-dibromo-propyl) phosphate	126-72-7	ND			200			Yes
O,O,O-Triethyl phosphorothioate	126-68-1	ND			ND			Yes

Notes:
[a] EQL is for wet weight.
[b] Action level is proposed RCRA Subpart S Action Level.
[c] ND - Estimated quantitation limit has not been determined due to unknown performance with extraction procedure for this analyte.

Table I-4. Analytes for Pesticides and PCBs Analysis (Method 8080)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
Aldrin	309-00-2	2.7	40		0.04	0.002		Yes
alpha-BHC	319-84-6	2	100	100	0.03	0.006	0.0056	No
beta-BHC	319-85-7	4	4,000	4,000	0.06	0.2	0.19	No
delta-BHC	319-86-8	6			0.09			No
gamma-BHC (Lindane)	58-89-9	2.7	500		0.04	4		Yes
Chlordane	57-74-9	9.4	500	540	0.14	0.03	0.2	Yes
DDD	72-54-8	7.4	3,000	2,900	0.11	0.1	0.15	Yes
DDE	72-55-9	2.7	2,000		0.04	0.1		Yes
DDT	50-29-3	8	2,000	2,100	0.12	0.1	0.1	Yes
Dieldrin	60-57-1	1.3	40		0.02	0.002		Yes
Endosulfan I	959-98-8	9.4	4,000	4,000	0.14	2	1.8	No
Endosulfan II	33213-65-9	2.7	4,000	4,000	0.04	2	1.8	No
Endosulfan sulfate	1031-07-8	44			0.66			No
Endrin	72-20-8	4	20,000		0.06	0.2		Yes
Endrin aldehyde	7421-93-4	15			0.23			No
Heptachlor	76-44-8	2	200		0.03	0.008		Yes
Heptachlor epoxide	1024-57-3	56	80		0.83	0.004		No

Table I-4. Analytes for Pesticides and PCBs Analysis (Method 8080) (Continued)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
4,4'-Methoxychlor	72-43-5	120			1.76			Yes
Toxaphene	8001-35-2	160	600		2.4	5		Yes
Aroclor-1016	12674-11-2	ND[c]	90	90	ND	0.005	0.5	Yes
Aroclor-1221	11104-28-2	ND	90	90	ND	0.005	0.5	Yes
Aroclor-1232	11141-16-5	ND	90	90	ND	0.005	0.5	Yes
Aroclor-1242	53469-21-9	44	90	90	0.65	0.005	0.5	Yes
Aroclor-1248	12672-29-6	ND	90	90	ND	0.005	0.5	Yes
Aroclor-1254	11097-69-1	ND	90	90	ND	0.005	0.5	Yes
Aroclor-1260	11096-82-5	ND	90	90	ND	0.005	0.5	Yes

Notes:
[a] EQL is for wet weight.
[b] Action level is proposed RCRA Subpart S Action Level.
[c] ND - Estimated quantitatio limit has not been determined for this analyte.

Table I-5. Analytes for Chlorinated Herbicides Analysis (Method 8250)

Analyte	CAS No.	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
2,4-D	94-75-7	240	80,000		12	400		Yes
2,4-DB	94-82--6	180			9.1			No
2,4,5-TP (Silvex)	93-72-1	40			2	10		Yes
2,4,5-T	93-76-5	34	80,000		1.7			Yes
Dalapon	75-99-0	1200			58			No
Dicamba	1918-00-9	54			2.7			No
Dichlorprop	120-36-5	130			6.5			No
Dinoseb	88-85-7	14			0.7			Yes
MCPA	94-74-6	49800			2490			No
MCPP	93-65-2	38400			1920			No

Notes:
[a] EQL is for wet weight.
[b] Action level is proposed RCRA Subpart S Action Level.

Table I-6. Analytes and Methods for Metals Analysis

Element	CAS No.	SW-846 Method	EQL, µg/kg W[a]	Action Level, µg/kg[b]	1993 SAL, µg/kg	EQL, µg/L	Action Level, µg/L[b]	1993 SAL, µg/L	Appendix VIII?
Aluminum	7429-90-5	6020	10			0.1			No
Antimony	7440-36-0	6020	2	30,000	32,000	0.02	10	6	Yes
Arsenic	7440-38-2	6020	40	80,000	400	0.4	50	50	Yes
Barium	7440-39-3	6020	2	4,000,000	5,600,000	0.02	1,000	2,000	Yes
Beryllium	7440-41-7	6020	10	200	160	0.1	0.008	4	Yes
Cadmium	7440-43-9	6020	7	40,000	80,000	0.07	10	5	Yes
Chromium	7440-47-3	6020	2	400,000	400,000	0.02	50	50	Yes
Cobalt	7440-48-4	6020	1			0.01			No
Copper	7440-50-8	6020	3		3,000,000	0.03		1,300	No
Lead	7439-92-1	6020	2		500,000	0.02	50	50	Yes
Manganese	7439-96-5	6020	4		8,000,000	0.04		3,500	No
Mercury	7439-97-6	7471 (solid) 7470 (water)	10	20,000	24,000	0.2	2	2	Yes
Nickel	7440-02-0	6020	3	2,000,000	1,600,000	0.03	700	100	Yes
Selenium	7782-49-2	7740	200		400,000	2		50	Yes
Silver	7440-22-4	6020	4	200,000	400,000	0.04	50	50	Yes
Thallium	7440-28-0	6020	5		6,400	0.05		2	Yes
Zinc	7440-66-6	6020	8		24,000,000	0.08		10,000	No

Table I-6. Analytes and Methods for Metals Analysis (Continued)

Notes:

[a] EQL is for wet weight.
[b] Action level is proposed RCRA Subpart S Action Level.

APPENDIX J

QUALITY ASSURANCE PROJECT PLAN

SIGNATURE PAGE

Approval for Implementation

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   TITLE: Quality Program Project Leader, ER Project, Los Alamos National Laboratory

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   SIGNATURE: _____ DATE: _____

5. NAME:
   TITLE: New Mexico Environment Department

   SIGNATURE: _____ DATE: _____

6. NAME: T. E. Gene Gould
   TITLE: Operable Unit Project Leader, Technical Engineering Support Group (ESA-4), Los Alamos National Laboratory

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APPENDIX J

QUALITY ASSURANCE PROJECT PLAN

Closure of the TA-53-166 Northeast (NE) and Northwest (NW) Surface Impoundments is being performed under the Los Alamos National Laboratory Environmental Restoration (ER) Project and will follow applicable ER Project quality assurance (QA) requirements. This Quality Assurance Project Plan (QAPP) for the TA-53-166 NE and NW Surface Impoundments Closure Plan (closure plan) was written as a matrix report (Table J-1) based on the Environmental Restoration (ER) Project's generic QAPP (Attachment J-1).

The generic QAPP describes the format for each ER Project's QAPPs. In the generic QAPP, Section 1 is the Signature Page, which is included in the front of this QAPP. Section 2 is a Table of Contents, which was omitted from this QAPP because it is presented as a matrix. Section 3 is the Project Description and Subsection 3.1 is the Introduction. This introduction will serve as the equivalent of Subsection 3.1 and the matrix (Table J-1) will begin with Subsection 3.2, Facility Description.

The closure plan QAPP matrix (Table J-1) appears as a table in which the generic QAPP criteria are listed in the first column; these criteria correspond to the sections of the generic QAPP. The second column lists the specific requirements of the generic QAPP that the closure plan QAPP must meet; the subsection titles and numbers in the second column correspond directly with those contained in the generic QAPP. Sections of the generic QAPP that do not contain specific requirements are not included in the matrix, e.g., Subsection 3.4. The third column lists the location of information in the Installation Work Plan for Environmental Restoration (IWP) and/or the closure plan that fulfills the requirements in the generic QAPP. If the closure plan will be following the requirements in the generic QAPP, and no further information is necessary, the column will contain the phrase "generic QAPP accepted." In some cases, a standard operating procedure (SOP) and/or a clarification note are included. Specific SOPs are attached to this QAPP. Closure activities are being conducted in conjunction with the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) for Operable Unit (OU) 1100 at Los Alamos National Laboratory. As appropriate, reference is also made to the RFI Work Plan for OU 1100.

Table J-1. TA-53-166 NE and NW Surface Impoundment Closure Plan QAPP Matrix

Generic QAPP Criteria	Generic QAPP Requirements by Subsection	Closure Plan Incorporation of Generic QAPP Requirements
Project Description	3.2 Facility Description	IWP, Chapter 2 and closure plan, Chapter 2
	3.3 ER Project	IWP, Chapter 3.
	3.4.1 Project Objectives	Closure plan Sections 3.2 and 5.1.
	3.4.2 Project schedule	Closure plan Section 5.2.8.
	3.4.3 Project Scope	Closure plan Section 5.2.
	3.4.4 Background Information	Closure plan Chapter 2.
	3.4.5 Data Management	IWP, Annex IV (Attachment J-2).
Project Organization	4.1 Line Authority	OU 1100 RFI Work Plan, Annex I (Attachment J-3).
	4.2 Personnel Qualifications, Training, Resumes	ER Project Files.
	4.3 Organizational Structure	LANL-ER-QPP, Section 2, and OU 1100 RFI Work Plan, Annex 1. See **Note 1.**
Quality Assurance Objectives for Measurement Data in Terms of Precision, Accuracy, Representativeness, Completeness, and Comparability	5.0 Quality Assurance Objectives	Generic QAPP accepted.
	5.1 Level of Quality Control	Generic QAPP accepted. See **Notes 2 and 3.**
	5.2 Precision, Accuracy, and Sensitivity of Analyses	Generic QAPP accepted. See **Note 4.**
	5.3 QA Objectives for Precision	Generic QAPP accepted. See **Note 5.**
	5.4 QA Objectives for Accuracy	Generic QAPP accepted. See **Note 6.**
	5.5 Representativeness, Completeness, and Comparability	Generic QAPP accepted.
	5.6 Field Measurements	Generic QAPP accepted.
	5.7 Data Quality Objectives	Closure plan Chapters 3 and 5.

Table J-1. TA-53-166 NE and NW Surface Impoundment Closure Plan QAPP Matrix (Continued)

Generic QAPP Criteria	Generic QAPP Requirements by Subsection	Closure Plan Incorporation of Generic QAPP Requirements
Sampling Procedures	6.0 Sampling Procedures	Closure plan Section 3.3.
	6.1 Quality Control Samples	Closure plan Section 3.5.1.
	6.2 Sample Preservation During Shipment	Closure plan Section 3.3.8.
	6.3 Equipment Decontamination	Closure plan Sections 3.3.10 and 5.3.
	6.4 Sample Designation	Generic QAPP accepted, including ER SOP-01.04 (Attachment J-4).
Sample Custody	7.1 Overview	Generic QAPP accepted, including ER SOP-01.04.
	7.2 Field Documentation	Generic QAPP accepted, including ER SOP-01.04. Closure plan Section 3.3.9. See **Note 7.**
	7.3 Sample Management Facility	Generic QAPP accepted. See **Note 8.**
	7.4 Laboratory Documentation	Generic QAPP accepted.
	7.5 Sample Handling, Packaging, and Shipping	Generic QAPP accepted, including ER SOP-01.03 (Attachment J-5).
	7.6 Final Evidence File Documentation	Generic QAPP accepted.
Calibrations Procedures and Frequency	8.1 Overview	Generic QAPP accepted.
	8.2 Field Equipment	Generic QAPP accepted.
	8.3 Laboratory Equipment	Generic QAPP accepted.
Analytical Procedures	9.1 Overview	Generic QAPP accepted.
	9.2 Field Testing and Screening	Generic QAPP accepted.
	9.3 Laboratory Methods	Closure plan Section 3.4.
Data Reduction, Validation, and Reporting	10.0 Data Reduction, Validation, and Reporting	Generic QAPP accepted.
	10.1 Data Reduction	Generic QAPP accepted.

Table J-1. TA-53-166 NE and NW Surface Impoundment Closure Plan QAPP Matrix (Continued)

Generic QAPP Criteria	Generic QAPP Requirements by Subsection	Closure Plan Incorporation of Generic QAPP Requirements
	10.2 Data Validation	Generic QAPP accepted. See **Notes 2 and 9.**
	10.3 Data Reporting	Generic QAPP accepted.
Internal Quality Control Checks	11.0 Internal Quality Control Checks	Generic QAPP accepted.
	11.1 Field Sampling Quality Control Checks	Generic QAPP accepted.
	11.2 Laboratory Analytical Activities	Generic QAPP accepted. Closure plan Section 3.4.
Performance and System Audits	12.0 Performance and System Audits	Generic QAPP accepted.
Preventative Maintenance	13.0 Preventative Maintenance	Generic QAPP accepted.
	13.1 Field Equipment	Generic QAPP accepted.
	13.2 Laboratory Equipment	Generic QAPP accepted.
Specific Routine Procedures Used to Assess Data Precision, Accuracy, Representativeness, and Completeness	14.0 Specific Routine Procedures	Generic QAPP accepted.
	14.1 Precision	Generic QAPP accepted.
	14.2 Accuracy	Generic QAPP accepted.
	14.3 Sample Representativeness	Generic QAPP accepted. **See Note 10.**
	14.4 Completeness	Generic QAPP accepted.
Corrective Action	15.0 Corrective Action	Generic QAPP accepted.
	15.1 Overview	Generic QAPP accepted, including LANL-ER-QP-01.3Q (Attachment J-6). See **Note 11.**
	15.2 Field Corrective Action	Generic QAPP accepted.
	15.3 Laboratory Corrective Action	Generic QAPP accepted.
Quality Assurance Reports to Management	16.1 Field Quality Assurance Reports to Management	Generic QAPP accepted. See **Note 12.**

Table J-1. TA-53-166 NE and NW Surface Impoundment Closure Plan QAPP Matrix (Continued)

Generic QAPP Criteria	Generic QAPP Requirements by Subsection	Closure Plan Incorporation of Generic QAPP Requirements
	16.2 Laboratory Quality Assurance Reports to Management	Generic QAPP accepted.
	16.3 Internal Management Quality Reports	Generic QAPP accepted.

Note 1: Subsection 4 - Project Organization and Responsibility

The organizational structure of the ER Project is presented in Chapter 2 of the LANL ER Quality Program Plan (QPP) to the Programmatic Project Leader (PPL) level, including quality assurance functions. Annex I of the OU 1100 RFI work plan(Attachment J-3) describes the organizational structure from the PPL-level down, and presents an organizational chart to demonstrate line authority.

Note 2: Subsection 5.1 - Level of Quality Control
Subsection 10.2 - Data Validation

For radiological samples, the acceptance criteria for field duplicates as presented in Table X.1 is replaced with the following:

> "RPD less than or equal to 50% for sample values greater than 10 times the Minimum Detectable Activity (MDA). Failure to achieve the RCD values will trigger corrective action, which will involve an evaluation in order to determine the probable source and the impact on sampling results. This failure will not, by itself, invalidate the results."

Note 3: Subsection 5.1.1 - Field Sampling

The types of frequency of field QC samples will be as specified in Table 3-9 of the closure plan.

Note 4: Subsection 5.2 - Precision, Accuracy, and Sensitivity of Analysis

The PQLs and MDLs for specific test methods may be greater or less than the SALs for constituents for each sample. Where the PQLs and/or MDLs are higher than the SALs, non-detect results will then be interpreted on a case-by-case basis to determine if additional action is needed (see Appendix K).

Note 5: Subsection 5.3 - QA Objectives for Precision

Failure to achieve RCD values will trigger corrective action, which will involve an evaluation in order to determine the probable source and the impact on sampling results. This failure will not, by itself, invalidate the results.

Note 6: Subsection 5.4 - QA Objectives for Accuracy

Failure to achieve recovery values will trigger corrective action, which will involve an evaluation in order to determine the probable source and the impact on sampling results. This failure will not, by itself, invalidate the results.

Note 7: Subsection 7.2 - Field Documentation

In addition to field notebooks and LANL ER Program forms, field data may also be collected in notebook type portable computers. Any data collected on portable computers will use appropriate hardware, software and data management procedures to ensure that all required data are entered and that the resulting electronic files are protected from subsequent undocumented changes.

Note 8: Subsection 7.3 - Sample Management Facility

Alternately, samples may be shipped by the field team directly to an offsite analytical laboratory.

Note 9: Section 10.2.1 - Field Technical Data Validation

Validation of objective field and technical data will be performed by the OUPL or his designee.

Note 10: Subsection 14.3 - Sample Representativeness

The sampling plan presented in Chapter 3 of the closure plan was developed to meet the sample representativeness criteria described in Subsection 14.3 of the Generic QAPP.

Note 11: Subsection 15.1 - Overview

Corrective action may also include an evaluation to determine the probable source of the deficiency and the impact on sampling results.

Note 12: Subsection 16.1 - Field Quality Assurance Reports to Management

The OU 1100 QA Officer, or designee, will provide a monthly field progress report to the ER Program Manager and the ER Quality Program Project Leader. This report will consist of the information identified in Subsection 16.1 of the Generic QAPP.

ATTACHMENT J-1

GENERIC QUALITY ASSURANCE PROJECT PLAN FOR RCRA FACILITY INVESTIGATIONS FOR THE LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

Los Alamos National Laboratory

Environmental Restoration

A Department of Energy environmental clean-up program

GENERIC QUALITY ASSURANCE PROJECT PLAN FOR RCRA FACILITY INVESTIGATIONS

FOR THE

LOS ALAMOS NATIONAL LABORATORY ENVIRONMENTAL RESTORATION PROGRAM

May 1991

GENERIC QUALITY ASSURANCE PROJECT PLAN FOR RCRA FACILITY INVESTIGATIONS

for the

LOS ALAMOS NATIONAL LABORATORY
ENVIRONMENTAL RESTORATION PROGRAM

APPROVAL FOR IMPLEMENTATION

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   TITLE: ER Program Manager, Los Alamos National Laboratory

   SIGNATURE: Robert W Vocke DATE: 5-23-91

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   TITLE: Quality Program Project Leader, ER Program, Los Alamos National Laboratory

   SIGNATURE: Larry Maassen DATE: 5-22-91

3. NAME: Craig Leasure
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   SIGNATURE: C. D. L DATE: 5/28/91

4. NAME: Margaret Gautier
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   SIGNATURE: Margaret A. Gautier DATE: 5-27-91

5. NAME: Rich Mayer
   TITLE: Environmental Engineer, Region VI, Environmental Protection Agency

   SIGNATURE: Rich Mayer DATE: 7-1-91

6. NAME: Alva L. Smith
   TITLE: Chief of Office of Quality Assurance, Region VI Environmental Protection Agency

   SIGNATURE: Alva L. Smith DATE: 7/12/91

This additional approval will be required for each operable unit Quality Assurance Project Plan.

7. NAME: TO BE DETERMINED
   TITLE: Project Leader, Los Alamos National Laboratory

   SIGNATURE: _____ DATE: _____

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LIST OF ACRONYMS

AA	-	Atomic Absorption
AA/ICP	-	Atomic Absorption/Inductively Coupled Plasma
AP	-	Administrative Procedure
ASA	-	American Society of Agronomy, Inc.
ASTM	-	American Society for Testing and Materials
BNA	-	Base/neutral/acid
C	-	Centigrade
CAS	-	Chemical Abstract Service number
CLP	-	Contract Laboratory Program, U.S. Environmental Protection Agency
COE	-	U.S. Army Corp of Engineers
1,3-DNB	-	1,3-Dinitrobenzene
2,4-DNT	-	2,4-Dinitrotoluene
2,6-DNT	-	2,6-Dinitrotoluene
DOE	-	Department of Energy
DOT	-	U.S. Department of Transportation
DQO	-	Data Quality Objective
EPA	-	U.S. Environmental Protection Agency
ER	-	Environmental Restoration
GC	-	Gas Chromatograph
GC/MS	-	Gas Chromatograph/Mass Spectrometer
HPLC	-	High Pressure Liquid Chromatograph
HMX	-	Octahydro-1,3,4,7-tetranitro-1,3,5,7-tetrazocine
HSE	-	Health, Safety and Environment Division
HSWA	-	Hazardous and Solid Waste Amendments
IATA	-	International Air Transportation Association
ICP	-	Inductively Coupled Plasma
LANL	-	Los Alamos National Laboratory
MDL	-	Method Detection Limit
MS	-	Mass Spectrometer
NB	-	Nitrobenzene
NIST	-	National Institute of Standards and Technology
PCB	-	Polychlorinated biphenyl
PEST	-	Pesticide
PID	-	Photoionization Detector
PQL	-	Practical Quantitation Limit
QA	-	Quality Assurance
QAP	-	Quality Assurance Plan
QAPjP	-	Quality Assurance Project Plan
QA/QC	-	Quality Assurance/Quality Control
QC	-	Quality Control
QP	-	Quality Procedure
QPP	-	Quality Program Plan
QPPL	-	Quality Program Project Leader
RCRA	-	Resource Conservation and Recovery Act

LIST OF ACRONYMS (con't)

RDX	-	Hexahydro-1,3,5-trinitro-s-triazine
RMP	-	Records Management Plan
RPD	-	Relative Percent Difference
SMF	-	Sample Management Facility
SOP	-	Standard Operating Procedure
SOW	-	Statement of Work
SSSA	-	Soil Science Society of America, Inc.
SW	-	Solid Waste
TETRYL	-	2,4,6-Trinitrophenylmethylnitramine
1,3,5-TNB	-	1,3,5-trinitrobenzene
2,4,6-TNT	-	2,4,6-Trinitrotoluene
USATHAMA	-	U.S. Army Toxic and Hazardous Materials Agency
VOA	-	Volatile Organic Analysis

3.0. PROJECT DESCRIPTION

3.1. INTRODUCTION

This Quality Assurance Project Plan (QAPjP) is a generic plan that has been prepared to provide instruction to Los Alamos National Laboratory (LANL) and its contractors so that the work performed during the Environmental Restoration (ER) Program will be of the quality desired to satisfy the project objectives and will be responsive to the requirements of the U.S. Environmental Protection Agency (EPA), Region VI. LANL and its contractors are responsible for effecting minimal procedures to ensure that all data are of known quality, well-documented and meet the criteria of precision, accuracy, completeness, representativeness, and comparability as established by each operable unit (OU) QAPjP.

LANL will prepare an OU QAPjP for each task conducted under the ER Program in which data are generated. Data Quality Objectives (DQOs) will be identified for each task to ensure that the OU QAPjP addresses the appropriate data requirements. The intent of the OU QAPjP is to have a document that defines, describes, delineates, and implements the procedures necessary to effectively accomplish the project objectives by assuring that usable, high quality data are produced.

This Generic QAPjP addresses, at a minimum, the 16 essential elements detailed in the EPA document "Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans" (QAMS-005/80) (EPA 1980). This project plan is tiered to the LANL Quality Program Plan (QPP) for Environmental Restoration Activities (Annex II of the Laboratory's ER Program Installation Work Plan (IWP) (LANL 1990). The QPP meets the requirements of the consensus standard "Quality Assurance Program Requirements for Nuclear facilities" (ANSI/ASME NQA-1) plus the EPA's "Interim Guidelines and Specifications for Preparing Quality Assurance Program Plans" (QAMS-004/80).

During the course of the ER Program, there is the possibility that some of the methods, procedures, detection limits, etc., may change. These modifications will be reviewed and incorporated, and implemented as appropriate using LANL ER Administrative Procedures (APs), "Review and Approval of Environmental Restoration Program Plans and Reports" and " Preparation, Review, and Approval of Standard Operating Procedures".

This Generic QAPjP has been designed to serve as a framework for preparing OU-specific QAPjPs. Thus, only changes to a limited number of the sections plus the addition of necessary Standard Operating Procedures (SOPs) will be required. The boxes that appear in sections of this QAPjP provide guidance and technical information necessary for preparing the OU QAPjP. When a section of this QAPjP is adopted as written in OU QAPjP, no text is required in that section of the OU QAPjP. When information required for an OU QAPjP can be found in the OU RFI work plan, a reference to the section of the work plan is sufficient to include the information in the OU QAPjP. OU QAPjPs are an appendix to the OU RFI work plans.

3.2. FACILITY DESCRIPTION

A facility description of Los Alamos National Laboratory and descriptions of individual areas are presented in Section 2.0 of the LANL ER Program Installation Work Plan (IWP).

3.3. ENVIRONMENTAL RESTORATION PROGRAM

A description of the ER Program is presented in Section 3.0 of the IWP.

3.4. PROJECT DESCRIPTION

This section may be written in the OU QAPjP to define changes or OU-specific information not referenced elsewhere, and is to include the following, as applicable:

1. Comprehensive statement of objectives (purpose).
2. Dates for start and completion of project and sampling activities.
3. Overview of project's scope (activities).
4. Background information.
5. Brief statement of intended data usage(s).

4.0. PROJECT ORGANIZATION AND RESPONSIBILITY

The overall organizational structure of the ER Program is presented in Section 2.0 of the LANL ER Quality Program Plan (QPP). Organizational structures specific to OU work activities will be found in the OU RFI Work Plan. The Sample Management Facility (SMF) is the designated sample custodian.

Key organizations/people should be identified in this section of the OU QAPjP or by reference. Complete information includes the following:

1. Line authority explained or demonstrated by including an organizational chart.
2. Personnel qualifications including training, experience, and resumes.
3. An organizational structure appropriate to accomplish the Quality Assurance (QA) objectives of the project.

5.0. QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA IN TERMS OF PRECISION, ACCURACY, REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

The precision, accuracy and completeness objectives for LANL ER Program projects are based upon historical precision and accuracy data where available, and upon the completeness needed to accomplish project goals. Where historical information is not available, the published precision and accuracy for the method are the basis for the stated objectives.

The analytical methods that will be used for analysis at Los Alamos are detailed in the LANL documents LA-10300-M, Volumes 1 and 2, Health and Environmental Chemistry: Analytical Techniques, Data Management, and Quality Assurance. These methods are based on EPA methods when available, or generally recognized and accepted institutions such as the American Public Health Association or American Society for Testing and Materials.

The overall quality assurance objective is to develop and implement procedures that will ensure quality in field sampling, field testing, chain-of-custody, laboratory analysis, and data reporting. Specific procedures for sampling, chain-of-custody, audits, preventive maintenance, and corrective actions are described in other sections of this QAPjP. This section defines the goals for accuracy, precision, completeness, representativeness, and comparability. Quality assurance goals for field measurements are also discussed.

SUMMARY OF PRECISION, ACCURACY AND COMPLETENESS

When changes or additions are made to objectives presented in this Generic QAPjP, the following information is to be included in the operable unit-specific QAPjP in tabular form:

- Measurement parameter
- Method
- Matrix (experimental conditions)
- Precision (as a standard deviation)
- Accuracy
- Completeness if other than 90%

5.1. LEVEL OF QUALITY CONTROL

5.1.1. Field Sampling

Field blanks, reagent blanks, field replicate samples, equipment (rinsate) blanks, and trip blanks will be submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the field sampling program. Blank samples will be analyzed to check for procedural contamination and ambient conditions at the site that may have caused sample contamination. Replicate samples will be analyzed to check for sampling and analytical reproducibility.

A recommended level of quality control for non-radiological samples is summarized in Table V.1. Additional information is presented in Section 11.1.1 for soil sampling and Section 11.1.2 for water sampling. Two types of field quality control samples will be collected and analyzed for radiological constituents. These are: field duplicates and rinsate blanks. Table X.1 in Section 10.2.2 describes these samples and the acceptance criteria that will be used to evaluate the radiological data obtained from the analysis of these samples. The frequency of field duplicates for soil and water radiological samples will be 1 per 20 samples (5 percent). Rinsate (equipment) blanks for radiological samples will be collected at a frequency of 1 per 20 samples (5 percent) for soil samples and 1 per 10 samples (10 percent) for water samples.

5.1.2. Field Measurements

The quality control level of effort for the field measurement of pH consists of a pre-measurement calibration and a post-measurement verification using two standard reference solutions each time. This procedure will be performed for each water sample tested. Quality control effort for field conductivity measurements will include a daily calibration of the instrument using standard solutions of known conductivity. LANL ER Program SOP, Field Analytical Measurements of Groundwater describes field measurements on ground water samples, including quality control efforts.

5.1.3. Analytical Laboratory

Matrix samples provide information about the effect of the sample matrix on the analytical methodology. All matrix spikes are performed in duplicate. The matrix spike/matrix spike duplicates are not counted in the total number of samples because they are laboratory quality control samples.

A matrix spiked sample will be analyzed with every analytical batch or every 20 investigative samples per sample matrix (soil, surface water, sediment, and groundwater), whichever is more frequent.

The level of laboratory quality control effort for analyses performed by EPA SW (Solid Waste)-846 protocol is specified in the methods for organic and inorganic analyses (EPA 1987). Table V.2 presents a summary of the level of laboratory quality control effort.

5.2. PRECISION, ACCURACY, AND SENSITIVITY OF ANALYSES

The precision, accuracy, and sensitivity of laboratory analytical data must satisfy the quality control acceptance criteria of the analytical protocols. Table V.3 presents the U.S. EPA SW-846 practical quantitation limits (PQLs) for the analysis of volatile organic chemicals in groundwater and low soil/sediment by gas chromatography/mass spectrometry (GC/MS) Method 8240 (EPA 1987). Table V.4 presents the U.S. EPA SW-846 PQLs for the analysis of semivolatile organic chemicals in groundwater and low soil/sediment by GC/MS capillary column technique Method 8270 (EPA 1987). Table V.5 presents the method detection limits (MDLs) for the analysis of organochlorine pesticides and PCBs (polychlorinated biphenyls) by gas chromatography (GC) Method 8080 (EPA 1986a). Table V.6 presents the PQLs for the analysis of organochlorine pesticides and PCBs in groundwater and low level soil by gas chromatography (GC) Method 8080 (EPA 1986a). Table V.7 presents the estimated instrumental detection limits for the analysis of inorganics by inductively coupled plasma-atomic emission spectroscopy Method 6010 (EPA 1987). Table V.8 presents the radionuclide MDLs for water and soil/sediment samples (DOE 1983). Table V.9 presents the MDLs for miscellaneous analytes in water and soil/sediment samples by ion chromatography (EPA 1990). Table V.10 presents the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) high explosive list and MDLs for water and soil samples (USATHAMA n.d.).

5.3. QUALITY ASSURANCE OBJECTIVES FOR PRECISION

Analytical precision is calculated by expressing, as a percentage, the difference between the results of analysis of duplicate samples relative to the average of those results for a given analyte. Precision is expressed as the relative percent difference (RPD). The quality assurance objectives for metals analysis are different from those of organic analysis. The U.S. EPA SW-846 precision

objectives for metals are discussed in Section 5.3.1. Section 5.3.2 discusses the U.S. EPA SW-846 precision objectives for organic analysis.

5.3.1. Metals Analysis (Inorganics)

The quality assurance objective for precision for metals analysis is + or - 20% RPD for sample values greater than 10 times the instrument detection limit. This RPD is for replicate analyses, as specified by Method 6010, Inductively Coupled Plasma-Atomic Emission Spectroscopy in U.S. EPA SW-846 (EPA 1987).

5.3.2. Organic Analysis

Analytical precision for organic analysis (GC/MS) under the criteria of U.S. EPA SW-846 (EPA 1986a; EPA 1987) is measured by comparing the recovery of surrogate compounds in the standard matrix (e.g., blank/blank spike) or by comparing the recovery of a select number of target analytes in duplicate samples or blanks (e.g., matrix spike/matrix spike duplicate). The quality assurance objectives for precision of organic analysis (expressed by the RPD for analysis of matrix spike and matrix spike duplicate samples) are presented in Table V.~~11~~12. Failure to achieve the RPD values will trigger corrective action as defined in the U.S. EPA SW-846 criteria (EPA 1986a; EPA 1987).

5.4. QUALITY ASSURANCE OBJECTIVE FOR ACCURACY

Analytical accuracy is calculated by expressing, as a percent, the recovery of a standard reference material or an analyte that has been added to the sample (or standard matrix) at a known concentration before analysis. The spiked (fortified) concentration used will be specified by laboratory quality control requirements as detailed in the applicable U.S. EPA SW-846 method (EPA 1986a; EPA 1987).

The quality assurance objectives for accuracy according to U.S. EPA SW-846 criteria are different for organic and inorganic analyses. The accuracy objectives specific to inorganic analyses are presented below in Section 5.4.1. Section 5.4.2 presents the accuracy objectives for organic analysis.

5.4.1. Inorganic Analysis

Analytical accuracy for metals is measured from analysis of a spiked replicate sample and a sample spiked with the analyte of interest (analyte spike). The quality assurance objectives for accuracy in metals analysis, for these quality control samples, are taken from the U.S. EPA SW-846 Method 6010 (EPA 1987) and are summarized below.

Sample	Recovery %
Spiked replicate	80 - 120
Analyte spike	75 - 125

Recovery values outside the quality control limits for spiked replicate samples will trigger corrective action. Recovery values for matrix analyte spike samples that are outside the quality control limits may indicate a matrix effect. If spectral overlap is suspected, use of computerized compensation, an alternate wavelength, or comparison with an alternate method is recommended (EPA 1987). For other inorganic parameters, laboratory control charts and method-specific quality control criteria will be used to define the quality assurance objectives.

5.4.2. Organic Analysis

For organic analysis (gas chromatography (GC) and GC/Mass Spectrometry (MS)), analytical accuracy is obtained from the surrogate recovery measured in each sample and blank or from the analysis of samples or blanks spiked with a select number of target analytes.

The U.S. EPA SW-846 quality assurance objectives for accuracy for organic surrogate spike recovery are summarized in Table V.12 (EPA 1986a; EPA 1987). The U.S. EPA SW-846 quality assurance objectives for precision and accuracy of matrix spike analyses are given in Table V.11. Failure to achieve the recoveries summarized in Tables V.11 and V.12 will trigger corrective action as specified under criteria established in the U.S. EPA SW-846 methods.

5.5. REPRESENTATIVENESS, COMPLETENESS, AND COMPARABILITY

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition. Data representativeness will be attained through the proper design of the sampling program, including background and/or upgradient samples, which will make certain that sample locations and the number of samples chosen will sufficiently describe the site. The sampling program design will be developed using applicable statistical methods to ensure that an appropriate number of samples are collected and where applicable, will use LANL ER Program SOPs.

Completeness is a measure of the relative number of analytical data points that meet all the acceptance criteria for accuracy, precision, and any other criterion required by the specific analytical methods used. The quality assurance objective for analytical data completeness for the LANL ER Program is 90%. Data completeness is affected by laboratory accidents, insufficient sample volume, or sample breakage during shipment, etc. Additionally, the ability to meet or exceed this objective depends on the nature of the samples submitted for analysis. For example, the application of routine organic analysis methods to non-routine matrices, such as drum samples, wipes, and air samples, may result in poor method performance and, therefore, adversely impact the data completeness goal.

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be achieved through the use of standard sampling and analytical techniques. Data results will be reported in appropriate units consistent with existing site data and applicable regulatory levels.

5.6. FIELD MEASUREMENTS

Most data derived from ER Program environmental investigations at LANL will be developed in the on-site and off-site analytical laboratories from the samples collected in the field. However, some measurements may be performed in the field at the time of sample collection. Examples of field measurement data include surface water and groundwater sample measurements such as specific conductance, temperature, pH, and alkalinity. If surface water and/or groundwater samples are collected, required measurements will be performed and recorded in the field. The primary quality assurance objectives for all field activities where measurements will be taken are to verify that quality control checks are performed, verify that measurements were obtained to the degree of accuracy

consistent with their intended use, and provide documentation of adherence to the measurement procedures. LANL ER Program SOPs describe in detail the procedures for obtaining accurate and precise measurements in the field. Standard formats for documenting data collection are included in the SOPs. Adherence to the procedures described in the LANL ER Program SOPs will ensure the accuracy, precision, and completeness of the field measurement data.

All surface and subsurface locations sampled during ER Program environmental investigations at LANL will be surveyed. Surveying and preparation of site maps will be conducted to provide a common frame of reference for data reporting and interpretation.

5.7. DATA QUALITY OBJECTIVES

Precision, accuracy, representativeness, completeness, and comparability of data are the terms used to define DQOs.

DQOs are qualitative and quantitative statements that specify the quality of the data required to support specific project decisions. DQOs also specify the level of uncertainty that a decision maker is willing to accept in results derived from environmental data, when the results are used in a regulatory or programmatic decision, such as establishing analytical method requirements, establishing sampling protocols, and revision or development of industry standards.

The development of DQOs shall be the first step in initiating any environmental monitoring data collection activity and shall consist of a three-stage process: the decision shall be defined; the information that is required for the decision shall be identified; and the data collection program shall be designed. A DQO example scenario is presented in Appendix A.

Table V.1. Field Sampling Recommended Level of Quality Control Summary for Non-radiological Samples

Sample Type	Applicable Matrix	Sample Frequency
Field Blank	Soil and Water	1 per 20 samples
Reagent Blank	Soil and Water	1 per 20 samples
Field replicate	Soil Water	1 per 20 samples 1 per 10 samples
Rinsate Blank	Soil Water	1 per 20 samples 1 per 10 samples
Trip Blank	Water	1 per shipping container for VOA analyses only

Table V.2. Laboratory Level of Quality Control Summary for U.S. Environmental Protection Agency Solid Waste (SW) 846 Analyses[a]

Sample Type	Sample Frequency
Matrix Spiked Sample	1 per analytical batch or every 20 samples, whichever is more frequent.
Reagent Blank	1 per analytical batch.
Surrogate Compounds	Every blank, standard, and environmental sample (including duplicates, quality control reference samples, and check standards) will be spiked with surrogate compounds prior to purging or extraction.
Quality Control Reference Sample	1 per analytical batch or every 20 samples, whichever is greater.
Spiked Replicate Sample	At a frequency of 20% for metals analysis.

[a] EPA. 1987.

Table V.3. U.S. Environmental Protection Agency Solid Waste (SW) 846 Volatiles Practical Quantitation Limits for Water and Low Soil/Sediment by Method 8240 Gas Chromatography/Mass Spectrometry[a,b]

		Practical Quantitation Limits[c]	
		Water	Low Level Soil
Volatiles[d]	CAS Number[e]	ug/L	ug/kg
Acetone	67-64-1	100	100
Acetonitrile	75-05-8	100	100
Allyl chloride	107-05-1	5	5
Benzene	71-43-2	5	5
Benzyl chloride	100-44-7	100	100
Bromodichloromethane	75-27-4	5	5
Bromoform	75-25-2	5	5
Bromomethane	74-83-9	10	10
2-butanone	78-93-3	100	100
Carbon disulfide	75-15-0	100	100
Carbon tetrachloride	56-23-5	5	5
Chlorobenzene	108-90-7	5	5
Chlorodibromomethane	124-48-1	5	5
Chloroethane	75-00-3	10	10
2-chloroethyl vinyl ether	110-75-8	10	10
Chloroform	67-66-3	5	5
Chloromethane	74-87-3	10	10
Chloroprene	126-99-8	5	5
1,2-dibromo-3-chloropropane	96-12-8	100	100
1,2-dibromoethane	106-93-4	5	5
Dibromomethane	74-95-3	5	5
1,4-dichloro-2-butene	764-41-0	100	100
Dichlorodifluoromethane	75-71-8	5	5
1,1-dichloroethane	75-34-3	5	5
1,2-dichloroethane	107-06-2	5	5
1,1-dichloroethene	75-35-4	5	5
1,2-trans-dichloroethene	156-60-5	5	5
1,2-dichloropropane	78-87-5	5	5
1,3-cis-dichloropropene	10061-01-5	5	5
1,3-trans-dichloropropene	10061-02-6	5	5
Ethylbenzene	100-41-4	5	5
Ethyl methacrylate	97-63-2	5	5
2-hexanone	591-78-6	50	50
Isobutyl alcohol	78-83-1	100	100
Methacrylonitrile	126-98-7	100	100
Methylene chloride	75-09-2	5	5
Methyl iodide	74-88-4	5	5

Table V.3. Continued

Volatiles[d]	CAS Number[e]	Practical Quantitation Limits[c] Water ug/L	Low Level Soil ug/kg
Methyl methacrylate	80-62-6	5	50
4-methyl-2-pentanone	108-10-1	50	50
Pentachloroethane	76-01-7	10	10
Propionitrile	107-12-0	100	100
Styrene	100-42-5	5	5
1,1,1,2-tetrachloroethane	630-20-6	5	5
1,1,2,2-tetrachloroethane	79-34-5	5	5
Tetrachloroethene	127-18-4	5	5
Toluene	108-88-3	5	5
1,1,1-trichloroethane	71-55-6	5	5
1,1,2-trichloroethane	79-00-5	5	5
Trichloroethene	79-01-6	5	5
1,2,3-trichloropropane	96-18-4	5	5
Vinyl acetate	108-05-4	50	50
Vinyl chloride	75-01-4	10	10
Xylene (total)	1330-20-7	5	5

[a] EPA. 1987.

[b] Sample practical quantitation limits (PQLs) are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable. See the following information for further guidance on matrix-dependent PQLs (EPA 1987).

[c] PQLs listed for soil/sediment are based on wet weight. Normally data is reported on a dry weight basis; therefore, PQLs will be higher, based on the percent moisture in each sample (EPA 1987).

[d] Compounds listed are from EPA SW-846 Method 8240 (EPA 1987).

[e] CAS Number - Chemical Abstract Service Number.

Table V.4. U.S. Environmental Protection Agency Solid Waste (SW) 846 Semivolatiles Practical Quantitation Limits for Water and Low Soil/Sediment by Method 8270 Gas Chromatography/Mass Spectrometry Capillary Column Technique[a,b]

		Practical Quantitation Limits[c]	
		Water	Low Level Soil
Semivolatiles[d]	CAS Number[e]	ug/L	ug/kg
Acenaphthene	83-32-9	10	660
Acenaphthylene	208-96-8	10	660
Acetophenone	98-86-2	10	ND
2-acetylaminofluorene	53-96-3	20	ND
1-acetyl-2-thiourea	591-08-2	1000	ND
2-aminoanthraquinone	117-79-3	20	ND
Aminoazobenzene	60-09-3	10	ND
4-aminobiphenyl	92-67-1	20	ND
Anilazine	101-05-3	100	ND
o-anisidine	90-04-0	10	ND
Anthracene	120-12-7	10	660
Aramite	140-57-8	20	ND
Azinphos-methyl	86-50-0	100	ND
Barban	101-27-9	200	ND
Benzoic acid	65-85-0	50	3300
Benz(a)anthracene	56-55-3	10	660
Benzo(b)fluoranthene	205-99-2	10	660
Benzo(k)fluoranthene	207-08-9	10	660
Benzo(g,h,i)perylene	191-24-2	10	660
Benzo(a)pyrene	50-32-8	10	660
p-benzoquinone	106-51-4	10	ND
Benzyl alcohol	100-51-6	20	1300
bis(2-chloroethoxy)methane	111-91-1	10	660
bis(2-chloroethyl)ether	111-44-4	10	660
bis(2-chloroisopropyl)ether	39638-32-9	10	660
bis(2-ethylhexyl)phthalate	117-81-7	10	660
4-bromophenyl phenyl ether	101-55-3	10	660
Bromoxynil	1689-84-5	10	ND
Butyl benzyl phthalate	85-68-7	10	660
Captafol	2425-06-1	20	ND
Captan	133-06-2	50	ND
Carbaryl	63-25-2	10	ND
Carbofuran	1563-66-2	10	ND
Carbophenothion	786-19-6	10	ND
Chlorfenvinphos	470-90-6	20	ND
4-chloroaniline	106-47-8	20	1300
Chlorobenzilate	510-15-6	10	ND

Table V.4. Continued

Semivolatiles[d]	CAS Number[e]	Practical Quantitation Limits[c] Water ug/L	Practical Quantitation Limits[c] Low Level Soil ug/kg
5-chloro-2-methylaniline	95-79-4	10	ND
4-chloro-3-methylphenol	59-50-7	20	1300
3-(chloromethyl)pyridine hydrochloride	6959-48-4	100	ND
2-chloronaphthalene	91-58-7	10	660
2-chlorophenol	95-57-8	10	660
4-chlorophenyl phenyl ether	7005-72-3	10	660
Chrysene	218-01-9	10	660
Coumaphos	56-72-4	40	ND
p-cresidine	120-71-8	10	ND
Crotoxyphos	7700-17-6	20	ND
2-Cyclohexyl-4,6-dinitro-phenol	131-89-5	100	ND
Demeton-o	298-03-3	10	ND
Demeton-s	126-75-0	10	ND
Diallate (cis or trans)	2303-16-4	10	ND
Diallate (trans or cis)	2303-16-4	10	ND
2,4-diaminotoluene	95-80-7	20	ND
Dibenz(a,j)acridine	224-42-0	10	ND
Dibenz(a,h)anthracene	53-70-3	10	660
Dibenzofuran	132-64-9	10	660
Dibenzo(a,e)pyrene	192-65-4	10	ND
Di-n-butylphthalate	84-74-2	10	ND
Dichlone	117-80-6	NA	ND
1,2-dichlorobenzene	95-50-1	10	660
1,3-dichlorobenzene	541-73-1	10	660
1,4-dichlorobenzene	106-46-7	10	660
3,3'-dichlorobenzidine	91-94-1	20	1300
2,4-dichlorophenol	120-83-2	10	660
2,6-dichlorophenol	87-65-0	10	ND
Dichlorovos	62-73-7	10	ND
Dicrotophos	141-66-2	10	ND
Diethyl phthalate	84-66-2	10	660
Diethyl stilbesterol	56-53-1	20	ND
Diethyl sulfate	64-67-5	100	ND
Dimethoate	60-51-5	20	ND
3,3'-dimethoxybenzidine	119-90-4	100	ND
Dimethylaminoazobenzene	60-11-7	10	ND
7,12-dimethylbenz(a)-anthracene	57-97-6	10	ND

Table V.4. Continued

Semivolatiles[d]	CAS Number[e]	Practical Quantitation Limits[c] Water ug/L	Practical Quantitation Limits[c] Low Level Soil ug/kg
3,3'-dimethylbenzidine	119-93-7	10	ND
a,a-dimethylphenethylamine	122-09-8	ND	ND
2,4-dimethylphenol	105-67-9	10	660
Dimethyl phthalate	131-11-3	10	660
1,2-dinitrobenzene	99-65-0	40	ND
1,3-dinitrobenzene	528-29-0	20	ND
1,4-dinitrobenzene	100-25-4	40	ND
4,6-dinitro-2-methylphenol	534-52-1	50	3300
2,4-dinitrophenol	51-28-5	50	3300
2,4-dinitrotoluene	121-14-2	10	660
2,6-dinitrotoluene	606-20-2	10	660
Dinocap	39300-45-3	100	ND
Dinoseb	88-85-7	20	ND
5,5-diphenylhydantoin	57-41-0	20	ND
Di-n-octylphthalate	117-84-0	10	660
Disulfoton	298-04-4	10	ND
EPN	2104-64-5	10	ND
Ethion	563-12-2	10	ND
Ethyl carbamate	51-79-6	50	ND
Ethyl methanesulfonate	62-50-0	20	ND
Famphur	52-85-7	20	ND
Fensulfothion	115-90-2	40	ND
Fenthion	55-38-9	10	ND
Fluchloralin	33245-39-5	20	ND
Fluoranthene	206-44-0	10	660
Fluorene	86-73-7	10	660
Hexachlorobenzene	118-74-1	10	660
Hexachlorobutadiene	87-68-3	10	660
Hexachlorocyclopentadiene	77-47-4	10	660
Hexachloroethane	67-72-1	10	660
Hexachlorophene	70-30-4	50	ND
Hexachloropropene	1888-71-7	10	ND
Hexamethyl phosphoramide	680-31-9	20	ND
Hydroquinone	123-31-9	ND	ND
Indeno(1,2,3-cd)pyrene	193-39-5	10	660
Isodrin	465-73-6	20	ND
Isophorone	78-59-1	10	660
Isosafrole	120-58-1	10	ND
Kepone	143-50-0	20	ND
Leptophos	21609-90-5	10	ND

Table V.4. Continued

Semivolatiles[d]	CAS Number[e]	Practical Quantitation Limits[c] Water ug/L	Practical Quantitation Limits[c] Low Level Soil ug/kg
Malathion	121-75-5	50	ND
Maleic anhydride	108-31-6	NA	ND
Mestranol	72-33-3	20	ND
Methapyrilene	91-80-5	100	ND
Methoxychlor	72-43-5	10	ND
3-methylcholanthrene	56-49-5	10	ND
4,4'-methylenebis(2-chloraniline)	101-14-4	NA	ND
Methylmethanesulfonate	66-27-3	10	ND
2-methylnaphthalene	91-57-6	10	660
Methyl parathion	298-00-0	10	ND
2-methylphenol	95-48-7	10	660
3-methylphenol	108-39-4	10	ND
4-methylphenol	106-44-5	10	660
Mevinphos	7786-34-7	10	ND
Mexacarbate	315-18-4	20	ND
Mirex	2385-85-5	10	ND
Monocrotophos	6923-22-4	40	ND
Naled	300-76-5	20	ND
Naphthalene	91-20-3	10	660
1,4-naphthoquinone	130-15-4	10	ND
1-naphthylamine	134-32-7	10	ND
2-naphthylamine	91-59-8	10	ND
Nicotine	54-11-5	20	ND
5-nitroacenaphthene	602-87-9	10	ND
2-nitroaniline	88-74-4	50	3300
3-nitroaniline	99-09-2	50	3300
4-nitroaniline	100-01-6	20	ND
5-nitro-o-anisidine	99-59-2	10	ND
Nitrobenzene	98-95-3	10	660
4-nitrobiphenyl	92-93-3	10	ND
Nitrofen	1836-75-5	20	ND
2-nitrophenol	88-75-5	10	660
4-nitrophenol	100-02-7	50	3300
5-nitro-o-toluidine	99-55-8	10	ND
4-nitroquinoline-1-oxide	56-57-5	40	ND
N-nitrosodibutylamine	924-16-3	10	ND
N-nitrosodiethylamine	55-18-5	20	ND
N-nitrosodiphenylamine	86-30-6	10	660
N-nitroso-di-n-propylamine	621-64-7	10	660

Table V.4. Continued

Semivolatiles[d]	CAS Number[e]	Practical Quantitation Limits[c] Water ug/L	Low Level Soil ug/kg
N-nitrosopiperidine	100-75-4	20	ND
N-nitrosopyrrolidine	930-55-2	40	ND
Octamethyl pyrophosphoramide	152-16-9	200	ND
4,4'-oxydianiline	101-80-4	20	ND
Parathion	56-38-2	10	ND
Pentachlorobenzene	608-93-5	10	ND
Pentachloronitrobenzene	82-68-8	20	ND
Pentachlorophenol	87-86-5	50	3300
Phenacetin	62-44-2	20	ND
Phenanthrene	85-01-8	10	660
Phenobarbital	50-06-6	10	ND
Phenol	108-95-2	10	660
1,4-phenylenediamine	106-50-3	10	ND
Phorate	298-02-2	10	ND
Phosalone	2310-17-0	100	ND
Phosmet	732-11-6	40	ND
Phosphamidon	13171-21-6	100	ND
Phthalic anhydride	85-44-9	100	ND
2-picoline	109-06-8	ND	ND
Piperonyl sulfoxide	120-62-7	100	ND
Pronamide	23950-58-5	10	ND
Propylthiouracil	51-52-5	100	ND
Pyrene	129-00-0	10	660
Pyridine	110-86-1	ND	ND
Resorcinol	108-46-3	100	ND
Safrole	94-59-7	10	ND
Strychnine	57-24-9	40	ND
Sulfallate	95-06-7	10	ND
Terbufos	13071-79-9	20	ND
1,2,4,5-tetrachlorobenzene	95-94-3	10	ND
2,3,4,6-tetrachlorophenol	58-90-2	10	ND
Tetrachlorvinphos	961-11-5	20	ND
Tetraethyl pyrophosphate	107-49-3	40	ND
Thionazine	297-97-2	20	ND
Thiophenol (benzenethiol)	108-98-5	20	ND
Toluene diisocyanate	584-84-9	100	ND
o-toluidine	95-53-4	10	ND
1,2,4-trichlorobenzene	120-82-1	10	660
2,4,5-trichlorophenol	95-95-4	10	660

Table V.4. Continued

Semivolatiles[d]	CAS Number[e]	Practical Quantitation Limits[c] Water ug/L	Low Level Soil ug/kg
2,4,6-trichlorophenol	88-06-2	10	660
Trifluralin	1582-09-8	10	ND
2,4,5-trimethylaniline	137-17-7	10	ND
Trimethyl phosphate	512-56-1	10	ND
1,3,5-trinitrobenzene	99-35-4	10	ND
Tris-(2,3-dibromopropyl) phosphate	126-72-7	200	ND
Tri-p-tolyl phosphate	78-32-0	10	ND
0,0,0-triethyl phosphorothioate	126-68-1	NT	ND

[a] EPA. 1987.

[b] Practical quantitation limits (PQLs) listed for soil/sediment are based on wet weight. Normally data is reported on a dry weight basis, therefore, PQLs will be higher, based on the percent moisture in each sample. This is based on a 30-g sample and gel permeation

chromatography cleanup (EPA 1987).

[c] Sample PQLs are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable (EPA 1987).

[d] Compounds listed are from EPA SW-846 Method 8270 (EPA 1987).

[e] CAS Number - Chemical Abstract Service Number.

ND = Not determined.

NA = Not applicable.

NT = Not tested.

Table V.5. U.S. Environmental Protection Agency Solid Waste (SW) 846 Organochlorine Pesticides and PCBs Method Detection Limits by Method 8080 Gas Chromatography[a]

Compound[b]	CAS Number[c]	Method Detection Limit (ug/L)
Aldrin	309-00-2	0.004
alpha-BHC	319-84-6	0.003
beta-BHC	319-85-7	0.006
delta-BHC	319-86-8	0.009
gamma-BHC (lindane)	58-89-9	0.004
Chlordane (technical)	57-74-	0.014
4,4'-DDD	72-54-8	0.011
4,4'-DDE	72-55-9	0.004
4,4'-DDT	50-29-3	0.012
Dieldrin	60-57-1	0.002
Endosulfan I	959-98-8	0.014
Endosulfan II	33213-65-9	0.004
Endosulfan sulfate	1031-07-8	0.066
Endrin	72-20-8	0.006
Endrin aldehyde	7421-93-4	0.023
Heptachlor	76-44-8	0.003
Heptachlor epoxide	1024-57-3	0.083
Methoxychlor	72-43-5	0.176
Toxaphene	8001-35-2	0.240
Aroclor-1016	12674-11-2	ND
Aroclor-1221	11104-28-2	ND
Aroclor-1232	11141-16-5	ND
Aroclor-1242	53469-21-9	0.065
Aroclor-1248	12672-29-6	ND
Aroclor-1254	11097-69-1	ND
Aroclor-1260	11096-82-5	ND

a EPA. 1986a.

b Compounds listed are from EPA SW-846 Method 8080 (EPA 1986a).

c CAS Number - Chemical Abstract Service Number.

ND = Not determined.

Table V.6. U.S. Environmental Protection Agency Solid Waste (SW) 846 Organochlorine Pesticides and PCBs Practical Quantitation Limits by Gas Chromatography by Method 8080 for Water and Low-Level Soil[a]

		Practical Quantitation Limits[b]	
		Water[c]	Low Level Soil[d]
Compound[e]	CAS Number[f]	ug/L	ug/kg
Aldrin	309-00-2	0.04	2.68
alpha-BHC	319-84-6	0.03	2.01
beta-BHC	319-85-7	0.06	4.02
delta-BHC	319-86-8	0.09	6.03
gamma-BHC (lindane)	58-89-9	0.04	2.68
Chlordane (technical) 57-74-9	0.14	9.38	
4,4'-DDD	72-54-8	0.11	7.37
4,4'-DDE	72-55-9	0.04	2.68
4,4'-DDT	50-29-3	0.12	8.04
Dieldrin	60-57-1	0.02	1.34
Endosulfan I	959-98-8	0.14	9.38
Endosulfan II	33213-65-9	0.04	2.68
Endosulfan sulfate	1031-07-8	0.66	44.22
Endrin	72-20-8	0.06	4.02
Endrin aldehyde	7421-93-4	0.23	15.41
Heptachlor	76-44-8	0.03	2.01
Heptachlor epoxide	1024-57-3	0.83	55.61
Methoxychlor	72-43-5	1.76	117.92
Toxaphene	8001-35-2	2.40	160.80
Aroclor-1016	12674-11-2	ND	ND
Aroclor-1221	11104-28-2	ND	ND
Aroclor-1232	11141-16-5	ND	ND
Aroclor-1242	53469-21-9	0.65	43.55
Aroclor-1248	12672-29-6	ND	ND
Aroclor-1254	11097-69-1	ND	ND
Aroclor-1260	11096-82-5	ND	ND

[a] EPA. 1986a.

[b] Sample practical quantitation limits (PQLs) are highly matrix-dependent. The PQLs listed herein are provided for guidance and may not always be achievable (EPA 1986a).

[c] The PQLs for groundwater consist of the individual compound Method Detection Limit X a factor of 10 (EPA 1986a).

[d] The PQLs for low-level soil consist of the individual compound Method Detection Limit X a factor of 670. These PQLs are for low-level soil by sonication with gel permeation chromatography (GPC) cleanup (EPA 1986a).

[e] Compounds listed are from EPA SW-846 Method 8080 (EPA 1986a).

[f] CAS Number - Chemical Abstract Service Number.

ND = Not determined.

Table V.7. U.S. Environmental Protection Agency Solid Waste (SW) 846 Estimated Instrumental Detection Limits for Inorganics by Method 6010 Inductively Coupled Plasma-Atomic Emission Spectroscopy[a]

Element	CAS Number[b]	Estimated Detection Limit[c] (ug/L)
Aluminum	7429-90-5	45.
Antimony	7440-36-0	32.
Arsenic	7440-38-2	53.
Barium	7440-39-3	2.
Beryllium	7440-41-7	0.3
Cadmium	7440-43-9	4.
Calcium	7440-70-2	10.
Chromium	7440-47-3	7.
Cobalt	7440-48-4	7.
Copper	7440-50-8	6.
Iron	7439-89-6	7.
Lead	7439-92-1	42.
Lithium	7439-93-2	5.
Magnesium	7439-95-4	30.
Manganese	7439-96-5	2.
Molybdenum	7439-98-7	8.
Nickel	7440-02-0	15.
Phosphorus	7723-14-0	51.
Potassium	7440-09-7	d
Selenium	7782-49-2	75.
Silver	7440-22-4	7.
Sodium	7440-23-5	29.
Strontium	7440-24-6	0.3
Thallium	7440-28-0	40.
Vanadium	7440-62-2	8.
Zinc	7440-66-6	2.

[a] EPA. 1987.

[b] CAS No. - Chemical Abstract Service Number.

[c] The estimated instrumental detection limits shown are given as a guide for an instrumental limit. The actual method detection limits are sample dependent and may vary as the sample matrix varies (EPA 1987).

[d] Highly dependent on operating conditions and plasma position (EPA 1987).

Table V.8. Radionuclide Method Detection Limits for Water and Soil/Sediment[a]

Radionuclide	Method Detection Limit Water	Method Detection Limit Soil/Sediment[a]
Americium-241	3.0 pCi/g	
Americium-241	0.04 pCi/L[b]	0.002 pCi/g[b]
Cesium-137	20.0 pCi/L[d]	0.1 pCi/g[d]
Gamma spectroscopy	15.0-300 pCi/L[d]	0.1-2.0 pCi/g[d]
Gross alpha	3.0-5.0 pCi/L[e]	4.0-10. pCi/g
Gross beta	3.0-6.0 pCi/L[e]	5.0-12.0 pCi/g
Isotopic plutonium (Pu-238, -239, -240)	0.04 pCi/L[b]	0.005 pCi/g[b]
Isotopic thorium (Th-228, -230, -232)	0.1 pCi/L	0.01 pCi/g
Total Uranium	2.0 ug/g[c]	0.5 ug/g[c]
Isotopic uranium		
U-234, -238	0.2 pCi/L	0.01 pCi/g
U-235	0.2 pCi/L	0.05 pCi/L
Radium-226	0.5 pCi/L	0.5 pCi/g[d]
Strontium/Yttrium-90	3.0 pCi/L	2.0 pCi/g
Tritium	400 pCi/L	400 pCi/L

[a] This footnote applies to all analytes in this table except those given footnotes b or c below. Methods are specified in Section 9. Method reference: DOE 1983. The detection limits listed are the method detection limits. Lower detection limits can be achieved with larger sample aliquots, additional chemistry, and extended counting times.

[b] Methods are specified in Section 9. Method reference: LANL methods manual LA-10300-M. The detection limits listed are the method detection limits. Lower detection limits can be achieved with larger sample aliquots, additional chemistry, and extended counting times.

[c] Methods are specified in Section 9. Method reference: LANL methods manual LA-10300-M. The detection limits listed are the method detection limits.

[d] The detection limit is dependent upon the mixture of isotopes in the sample.

[e] The detection limit listed is achievable providing the concentration of dissolved solids is equal to or less than 200 parts per million.

Table V.9. Method Detection Limits for Miscellaneous Analytes in Water and Soil/Sediments[a]

Analyte	Method Detection Limit Water	Method Detection Limit Soil/Sediment
Boron	0.1 mg/L	0.005 mg/L
Chloride	1.0 mg/L	1.0-10.0 mg/kg[b]
Fluoride	1.0 mg/L	1.0-10.0 mg/kg[b]
Nitrate	1.0 mg/L	1.0-10.0 mg/kg[b]
Nitrate & nitrite	0.04 mg/L	
Nitrite	0.02 mg/L	
Sulfate	1.0 mg/L	1.0-10.0 mg/kg[b]
Sulfide	0.1 mg/L	
Bromide	2.0 mg/L	
Carbonate	0. mg/L	
Phosphate	0.04 mg/L	
Ammonia/Nitrogen	0.01 mg/L	
Silica	5. mg/L	
Cyanide (total)	0.01 mg/L	5. mg/L
Mercury	0.02 ug/L	0.2 ug/L
Chromium (+6)	0.02 mg/L	0.5 mg/L
TOC	0.01 mg/L	
TSS	1. mg/L	

[a] EPA. 1990.

[b] The detection limit for soil/sediment samples varies depending upon the amount of sample used and the extraction procedure (EPA 1990).

Table V.10. USATHAMA Method Detection Limits for High Explosives in Water and Soil[a]

		Method Detection Limits	
		Water	Low Level Soild
Compounds[b]	CAS Number[c]	ug/L	ug/kg
HMX	2691-41-0	1.30	1.27
RDX	121-82-4	0.63	0.98
NB	98-95-3	1.13	0.42
1,3-DNB	99-65-01	0.61	0.59
1,3,5-TNB	99-35-4	0.56	2.09
2,4-DNT	121-14-2	0.60	0.42
2,6-DNT	606-20-2	0.55	0.40
2,4,6-TNT	118-96-7	0.78	1.92
TETRYL	35572-78-2	0.66	0.25

[a] U.S. Army Toxic and Hazardous Materials Agency, n.d.

[b] HMX Octahydro-1,3,4,7-tetranitro-1,3,5,7-tetrazocine
RDX Hexahydro-1,3,5-trinitro-s-triazine
NB Nitrobenzene
1,3-DNB 1,3-Dinitrobenzene
1,3,5-TNB 1,3,5-trinitrobenzene
2,4-DNT 2,4-Dinitrotoluene
2,6-DNT 2,6-Dinitrotoluene
2,4,6-TNT 2,4,6-Trinitrotoluene
TETRYL 2,4,6-Trinitrophenylmethylnitramine

[c] CAS Number - Chemical Abstract Service Number.

Table V.11. U.S. Environmental Protection Agency Solid Waste (SW) 846 Quality Assurance Objectives for Precision and Accuracy of Matrix Spike Analyses[a,b]

Matrix Spike		Percent Recovery Limit		Percent RPD Limits	
Fraction	Compound	Water	Soil/Sediment	Water	Soil/Sediment
VOA	1,1-dichloroethene	61-145	59-172	14	22
VOA	Trichloroethene	71-120	62-137	14	24
VOA	Benzene	76-127	66-142	11	21
VOA	Toluene	76-125	59-139	13	21
VOA	Chlorobenzene	75-130	60-133	13	21
BNA	Phenol	12-89	26-90	42	35
BNA	2-chlorophenol	27-123	25-102	40	50
BNA	1,4-dichlorobenzene	36-97	28-104	28	27
BNA	N-nitroso-di-n-propylamine	41-116	41-126	38	38
BNA	1,2,4-trichlorobenzene	39-98	38-107	28	23
BNA	4-chloro-3-methyl-phenol	23-97	26-103	42	33
BNA	Acenaphthene	46-118	31-137	31	19
BNA	4-nitrophenol	10-80	11-114	50	50
BNA	2,4-dinitrotoluene	24-96	28-89	38	47
BNA	Pentachlorophenol	9-103	17-109	50	47
BNA	Pyrene	26-127	35-142	31	36
Pest	Lindane	56-123	46-127	15	50
Pest	Heptachlor	40-131	35-130	20	31
Pest	Aldrin	40-120	34-132	22	43
Pest	Dieldrin	52-126	31-134	18	38
Pest	Endrin	56-121	42-139	21	45
Pest	4,4-DDT	38-127	23-134	27	50

[a] EPA. 1987

[b] EPA. 1986a

RPD - Relative Percent Difference.

VOA - Volatile organic analysis by Method 8240.

BNA - Base/neutral/acid by Method 8270.

PEST - Pesticide by Method 8080.

Table V.12. U.S. Environmental Protection Agency Solid Waste (SW) 846 Quality Assurance Objectives for Accuracy of Organic Surrogate Spike Analyses[a,b]

Fraction	Surrogate Compound	Percent Recovery Low/Medium Water	Percent Recovery Low/Medium Soil/Sediment
VOA	Toluene-d_8	88-110	81-117
VOA	4-bromofluorobenzene	86-115	74-121
VOA	1,2-dichloroethane-d_4	76-114	70-121
BNA	Nitrobenzene-d_5	35-114	23-120
BNA	2-fluorobiphenyl	43-116	30-115
BNA	p-terphenyl-d_{14}	33-141	18-137
BNA	Phenol-d_6	10-94	24-113
BNA	2-fluorophenol	21-100	25-121
BNA	2,4,6-tribromophenol	10-123	19-122
PEST	Dibutylchlorendate	24-154	24-150[c]

[a] EPA. 1987.

[b] EPA. 1986a.

[c] These percent recovery are advisory (EPA 1987).

VOA - Volatile organic analysis by Method 8240.

BNA - Base/neutral/acid by Method 8270.

PEST - Pesticide by Method 8080.

6.0. SAMPLING PROCEDURES

QAPjPs for specific operable units will contain or reference detailed and specific SOPs for the various sampling media that will be found at LANL. If an EPA-accepted SOP is used, it only needs to be referenced. If a unique procedure is needed, then a detailed step-by-step SOP must be written and referenced in the operable unit-specific QAPjP.

In most cases, procedures for collecting soil and aqueous samples will be selected, as appropriate, from already prepared LANL ER Program SOPs. Air sampling, other than that performed for health and safety monitoring, may potentially be performed. If air sampling is performed, U.S. EPA protocols such as TO-14 (EPA 1984a) will be used. The exact procedure(s) to be used for each sampling event, as are the guidelines for selection of sampling sites, are defined in the LANL operable unit field sampling plans.

All samples will be collected and containerized in properly cleaned sample containers. Sample containers will vary according to the matrix and nature of the sample to be collected. The LANL ER Program SOP, Containers, Sampling and Preservation contains information on the selection of the correct containers, container cleaning, required sample volumes, preservation criteria, and holding times. This information is for routine analytical measurements, such as physical properties, metals, organics, semivolatile organics, inorganics, PCBs, pesticides, and radiological samples. Non-routine analytical measurements, such as physicochemical tests, have specialized requirements.

These requirements, as appropriate, can be detailed in the operable unit-specific QAPjP.

6.1 Quality Control Samples

Quality control samples will be collected as part of all LANL ER Program sampling. Specific quality control samples are identified for surface water and groundwater sampling, and soil sampling activities. Table V.1 in Section 5.1.1 presents a summary of the field sampling level of quality control for non-radiological samples. Additional information for non-radiological quality control samples is presented in Section 11.1.1 for soil samples and Section 11.1.2 for water samples. The quality control level of effort for radiological samples is presented in Table X.1 in Section 10.2.2.

6.2. SAMPLE PRESERVATION DURING SHIPMENT

All samples will be labeled when collected and stored as required by the appropriate standard operating procedure. Chain-of-custody documentation for all samples will be maintained. A chain-of-custody document will accompany the samples to the analytical laboratory. In addition, chain-of-custody documents should be sealed in plastic bags to ensure protection from melt water during shipment to the analytical laboratory.

6.3. EQUIPMENT DECONTAMINATION

All LANL ER Program samples will be collected with properly decontaminated equipment. Equipment decontamination is an integral part of the data collection and quality assurance process. The implementation of proper decontamination practices and procedures will begin in the field prior to the use of sample collection equipment. Equipment decontamination procedures are described in LANL ER Program SOP, General Equipment Decontamination. The use of each type of sampling equipment is described in a LANL SOP. Each SOP used should also be reviewed for additional information regarding specific decontamination procedures. Wash water and other fluids created during decontamination should be handled in accordance with the ER Program Procedure for RFI-Generated Waste Management (SOP-01.06).

Sampling of some LANL environments, such as surface water systems, outfall pipes, waste streams, or containerized materials will be performed with the use of hand-held equipment. Due to the small number of these samples expected to be collected, and the inaccessibility of the sample locations, it is likely that expendable sampling equipment would be justified. All expendable sampling equipment will be certified clean prior to use. The use of expendable sampling equipment would provide the highest level of quality data by eliminating the possibility of cross-contamination between samples. Also, expendable sampling equipment would not require decontamination between samples which would generate solutions that may be potentially contaminated and require costly disposal.

6.4. SAMPLE DESIGNATION

Samples will be assigned a unique alphanumeric identifier to provide chain-of-custody control during the transfer of samples from the time of collection through analysis and reporting. The LANL procedure for Sample Control and Documentation describes the ER Program sample numbering system. This procedure presents details of the chain-of-custody procedures, and field documentation requirements.

7.0. SAMPLE CUSTODY

7.1. OVERVIEW

Strict chain-of-custody procedures shall be used to ensure the proper handling of samples during collection and analysis. Sample custody procedures require that the possession and handling of the sample from the moment of its collection through analysis be documented by written record. The chain-of-custody records will be initiated at the time of sample collection and remain in effect until the sample is disposed of. The chain-of-custody record lists the sample identifier, sampling date, sample matrix, number of containers, analysis requested and turn-around time required. Individuals receiving and relinquishing custody of the samples will sign and date the form using indelible blue or black ink. Record-keeping documentation for the samples includes the following:

- Field logbook or appropriate forms to document sampling activities in the field,
- Waterproof labels to identify individual samples,
- Chain-of-custody record sheets for documenting transfer and possession of samples, and
- Laboratory analysis request sheet for documenting analyses to be performed.

LANL ER Program SOP, Sample Control and Documentation, describes the chain-of-custody procedures.

7.2. FIELD DOCUMENTATION

7.2.1. Sample Identification

A numbering system has been developed to identify each boring location; monitor well; and sample collected during surface water, groundwater, sediment, waste stream, soil and air sampling programs. This numbering system provides a tracking procedure to all data retrieval. Sample identification numbers will be assigned in accordance with the LANL ER SOP-01.04, Sample Control and Documentation. Familiarity with the sample numbering system among the key LANL program staff will ensure that the numbering system is universally applied to samples collected during the project.

7.2.2. Field Logs

All data collection activities performed at a site will be documented, using indelible blue or black ink, either in a field notebook or on LANL ER Program forms. Field notebooks will be bound books and will be assigned to individual field personnel for the duration of their assignment. Entries will be as detailed and descriptive as possible so that a particular situation can be recalled without reliance on the collector's memory.

7.2.3. Data Collection Forms

As the primary means of assuring the collection of accurate field and sampling information, standardized data collection forms will be used. LANL ER Program forms have been developed and will be used to record data in a consistent format that limits individual interpretations or preferences. By explicitly outlining reporting methods, identifying appropriate units of measure, and specifying alternative test procedures, these forms provide a measure of quality control and quality assurance in the data collection process.

The standard data collection forms prepared for the LANL ER Program SOPs group data and information according to problem-solving needs. They are a means of preventing the collection of invalid or redundant data and eliminating critical data gaps. Each data collection form precisely defines what data are necessary to accurately characterize a particular property or relationship. This reduces the likelihood of initiating field sampling or laboratory analyses, only to discover that key pieces of information have not been collected and that further field sampling is required.

Each SOP for a data collection activity provides an example of all forms required for the accurate recording of the procedure. A blank form will be used for each new location or sample, as specified by the SOP. During a LANL ER Program field investigation, each form will be completed as accurately and completely as possible, as indicated by the example and instructions contained in the SOP. Before submittal to the LANL ER Records Processing Facility, all data collection forms will be reviewed by the appropriate LANL ER Program field team leader or other applicable technical reviewer. The review will ensure completeness and accuracy in both form completion, as well as data integrity. The reviewer will then sign, date and record the time on each form.

7.2.4. Corrections to Documentation

Incorrect entries will be crossed out with a single line and signed and dated by the person originating the entry, and the appropriate LANL ER Program technical field team leader. The correct information will be entered and the correction signed and dated by the person making the correction. There will be no erasures or deletions from any type of data document record.

7.3. SAMPLE MANAGEMENT FACILITY

All samples will initially be transported by the field team to the LANL ER Program Sample Management Facility (SMF). The LANL SMF will coordinate the ER Program sample collection activities and analytical chemical analysis. The SMF is staffed and operated by the Health and Environmental Chemistry Group (HSE-9) in LANL's Health, Safety and Environment (HSE) Division. The following ER Program activities are coordinated by the SMF:

- Project Sampling Plan Review,
- Delivery of Samples,
- Sample Validation,
- Sample Packaging and Shipment, to contract laboratories, and
- Disposition of Samples

Appendix O, Sample Coordination Facility, in the LANL ER Program Installation Work Plan contains the details of the above listed activities which are coordinated by the LANL SMF.

7.4. LABORATORY DOCUMENTATION

The following subsections describe laboratory custody procedures associated with sample receipt, storage, preparation, analysis and general security. The custody procedures described herein, and procedures described in the analytical laboratory quality assurance manuals of each of the participating laboratories, will be adhered to for all analyses.

7.4.1. Sample Receipt

Each laboratory participating in analysis of LANL ER Program samples will telephone LANL's SMF to acknowledge the receipt of each shipment of samples.

- The laboratory sample custodian will inspect all sample containers for integrity. The presence of leaking or broken containers will be noted on the chain-of-custody record. The sample custodian will also identify any discrepancies in the chain-of-custody documentation. The sample custodian will sign the chain-of-custody record (with date and time of receipt), thus assuming custody of the samples.

- The information of the chain-of-custody record will be compared with that on sample tags and labels to verify sample identity. The laboratory sample custodian will notify the LANL SMF Coordinator of all discrepancies in the chain-of-custody record. Any inconsistencies will be resolved with the LANL SMF Coordinator before sample analysis proceeds. If needed, LANL's SMF Coordinator will initiate and document all necessary corrective actions.

- Samples will be placed in storage prior to analysis. The storage location will be recorded on the chain of custody record.

- The sample custodian will alert the appropriate section managers and analysts of any analyses requiring immediate attention because of short holding times.

7.4.2. Sample Storage

Where appropriate, samples will be maintained in storage in one of the locked storage refrigerators prior to sample preparation and analysis. The storage refrigerators are maintained at 4 degrees + or - 2 degrees C. Analytical laboratory personnel will request samples for preparation and analysis from the sample custodian. The sample custodian and analyst will sign using indelible blue or black ink, date and record the time on the chain-of-custody record to acknowledge transfer of custody to the analyst.

7.4.3. Sample Tracking

When samples are extracted or digested for analysis, all pertinent data are recorded in a bound laboratory notebook. Extraction or digestion data are entered, when appropriate, in to the laboratory information management system by the person performing the extraction or digestion. Extracts or digestions are maintained in the appropriate storage until analyzed.

7.4.4. Record-Keeping

Data related to all sample preparation and analysis procedures and observations by laboratory analysts are recorded in bound and numbered laboratory notebooks that are issued by the laboratory quality assurance coordinator. Laboratory notebook entries are signed and dated using indelible blue or black ink. Corrections to notebook entries are made by drawing a single line through the erroneous entry and by writing the correct entry next to the one crossed out. All corrections are signed (or initialed) and dated by the analyst.

7.5. SAMPLE HANDLING, PACKAGING, AND SHIPPING

All samples shipped off-site will be shipped, by courier such as Federal Express, to the appropriate participating analytical laboratory. Only samples that contain a material listed in the Hazardous Material Table (49 CFR 172.101) should be handled, packaged, and shipped as hazardous material. The U.S. Department of Transportation (DOT) (CFR 49 1985) and the International Air Transport Association (IATA) (IATA 1988) have established specific regulations governing the packaging of hazardous samples for shipment. LANL ER Program SOP, Guide to Handling, Packaging and Shipping of Samples, and Appendix O, Sample Management Facility, in the ER Program Installation Work Plan provide information and references that must be reviewed prior to selection of appropriate packaging materials, shipping containers, and shipping labels.

7.6. FINAL EVIDENCE FILE DOCUMENTATION

All LANL ER Program RFI project participants will maintain records to document the quality assurance/quality control activities and to provide support for possible evidential proceedings. All records generated for the ER Program are the property of the LANL ER Program Office. Records which provide documentary evidence of quality shall be specified, prepared and maintained in accordance with appropriate LANL ER Program Administrative Procedures (APs).

The LANL Records Management Plan (RMP) provides requirements on the identification, classification, and management of project records. A detailed description of the LANL RMP and its coordination with other aspects of the ER Program is presented in Annex IV of the LANL Installation Work Plan (LANL 1990). Additional information is presented in Section 17 of the LANL ER Program Quality Program Plan.

8.0. CALIBRATION PROCEDURES AND FREQUENCY

8.1. OVERVIEW

Measuring and test equipment used in the field and laboratory are controlled by formal calibration programs. The programs provide equipment of the proper type, range, accuracy, and precision to provide data compatible with the specified requirements and desired results. Routine calibration services are provided by the LANL Metrology Group, MEC-9.

Devices are calibrated and adjusted at specified, predetermined intervals using equipment and material having known valid relationships to National Institute of Standards and Technology (NIST) standards, other recognized standards, or accepted values of natural physical constants. If national standards do not exist, the basis of calibration is documented. Documentation of all calibration activities are maintained and performed in accordance with written SOPs. Calibration is based on the type of equipment, inherent stability, manufacturer's recommendations, values given in national standards, intended use, and experience.

Routine calibration procedures are required to ensure proper operation of equipment and instruments. Established procedures and frequency are necessary to produce and document the quality of data required for task objectives.

8.2. FIELD EQUIPMENT

A list of analytical and health and safety screening procedures that may be used in the field during environmental investigations is presented in Appendix M of the LANL Installation Work Plan. Specific information regarding calibration procedures and frequency of calibration for field equipment is presented in the applicable LANL ER Program SOPs.

The instruments will be calibrated according to manufacturer's specifications before and after each field use, or as otherwise described in the LANL ER Program SOPs. Where necessary, instruments will be calibrated each day during field use.

Records for each field instrument used as part of environmental investigations at LANL will be maintained to assure its capability of providing accurate and precise measurements. Records will be maintained on instrument maintenance and calibration. Tracking of instrument records will be accomplished by assigning unique numbers to each instrument which will correspond to its record file.

8.3. LABORATORY EQUIPMENT

Before any instrument is used as a measuring device, the instrument response to known reference materials must be determined. The manner in which various instruments are calibrated is dependent on the particular type of instrument and its intended use. All sample measurements will be made within the calibrated range of the instrument.

Routine calibration standards will be used in the analytical laboratory to demonstrate that the performance of an instrument does not cause unnecessary error in the analysis. This calibration will indicate instrument stability and sensitivity. The methods for verification and documentation of instrument conditions prior to and during testing shall be detailed by each participating laboratory in specific laboratory procedures.

Laboratory instrument calibrations typically consist of two types, initial calibration and continuing calibration. Initial and continuing calibration criteria must meet the method acceptance criteria before sample analysis can begin. Initial calibration procedures establish the calibration range of the instrument and determine instrument response over that range. Typically, three to five analyte concentrations are used to establish instrument response over a concentration range. The instrument response over that range is expressed as a correlation coefficient (e.g., for atomic absorption, inductively coupled plasma, UV-visible/infrared spectrophotometry, ion chromatography) or by a response factor, amount/response (e.g., for gas chromatography (GC), gas chromatograph/mass spectrometer (GC/MS), high performance liquid chromatography (HPLC)).

Continuing calibration usually includes measurement of the instrument response to one or more calibration standards and requires instrument response to compare within certain limits (e.g., + or - 10 percent) of the initial measured instrument response. Continuing calibration is performed at least once per operating shift for all analyses.

Calibration criteria for each sampling event, beyond that given in the analytical methods, will be specified in operable unit sampling and analysis plans. Specific instrument calibration procedures for various analytical instruments are described in detail in the Quality Assurance Plan (QAP) of each participating laboratory or their procedure.

9.0. ANALYTICAL PROCEDURES

9.1. OVERVIEW

Analytical procedures must be established in a data measurement program. These procedures will enable participants in the sampling program to determine the data quality that is to be expected. Each measurement parameter, in the field and laboratory, will follow LANL ER Program SOPs to ensure that correct measurements are taken.

9.2. FIELD TESTING AND SCREENING

As part of the analytical protocol for all surface and groundwater samples, several parameters will be measured in the field during LANL ER Program environmental investigations. All aqueous samples will be tested for specific conductance, temperature, pH, and alkalinity. LANL ER Program SOP, Field Analytical Measurements of Groundwater will be used for field determination of these parameters.

9.3. LABORATORY METHODS

Groundwater, surface water, and soil samples collected during LANL ER Program environmental investigations will be analyzed using EPA SW-846 (EPA 1986a; EPA 1986b; EPA 1987) and other analytical methods specified in Tables IX.1 and IX.2. Radionuclides, miscellaneous analytes and high explosives in aqueous and solid matrices will be analyzed according to methods referenced in Tables IX.1 and IX.2, respectively. Physicochemical tests on soil samples will be performed according to methods referenced in Table IX.2. In addition, new methods will be used once approved for use.

Tables V.3 through V.7 contain, for specific analytical methods, a list of parameters to be determined and, as appropriate, the practical quantitation limits or method detection limits for each parameter, as currently required by the EPA SW-846 analytical protocols (EPA 1986a; EPA 1986b; EPA 1987). Radionuclide method detection limits are listed in Table V.8 (DOE 1983). Method detection limits for miscellaneous analytes (in aqueous and solid matrices) are listed in Table V.9 (EPA 1990). USATHAMA method detection limits for high explosives in water and soil samples are presented in Table V.10 (USATHAMA n.d.).

The operable unit-specific sampling plans will specify parameters and analyses for sampling activities. Where more than one method is given for a parameter or parameter group, the sampling plan will indicate the appropriate method. In general, methods that provide the most qualitative information will be used during the characterization phases of the project. For example, GC/MS methods may be used to determine the specific method parameters as well as to identify other compounds present that may be of interest. After all compounds of concern are known, other more specific methods may be used wherever available. Where EPA methods are not available, methods from generally recognized and accepted institutions such as the American Public Health Association or American Society for Testing and Materials will be employed.

For special or unusual analytical methodologies (e.g., explosives), SOPs will be developed as necessary. The methods will describe in detail the exact procedures and materials required to analyze the samples. Data will be included, if appropriate, to support the limitations and the applicability of the method.

All analytical methods are to be used as written. All changes and modifications to SOPs will be documented thoroughly in the narrative summary for the data package. All parameters specified by the analytical methods will be determined. Compounds may be added to subsequent analyses if they are identified and judged to be of concern.

All laboratory analyses will be performed by an analytical laboratory with demonstrated proficiency for each parameter.

TABLE IX.1. ANALYSIS PLAN FOR AQUEOUS SAMPLES

Analyte	Method
Volatile organics	EPA SW-846 Method 8240[a,b]
Semivolatile organics	EPA SW-846 Method 8270[a,c]
Organochlorine Pesticides and PCBs	EPA SW-846 Method 8080[def]
Inorganics (metals)	EPA SW-846 Method 6010[a,g]
<u>Radionuclides</u>	
Americium-241	Radiochemical separation and alpha spectrometer[n,o]
Cesium-137	Gamma spectrometry[h,i]
Gamma spectroscopy (all peaks reported)	Gamma spectrometry[h,i]
Gross alpha	Gas flow proportional counter[h,i]
Gross beta	Gas flow proportional counter[h,i]
Isotopic plutonium (plutonium-238, -239, -240)	Radiochemical separation and alpha spectrometer[n,o]
Isotopic thorium (thorium-228, -230, -232)	Radiochemical separation and alpha spectrometer[h,i]
Total uranium	Inductively Coupled Plasma Mass Spectroscopy (ICP MS)[n,o]
Isotopic uranium (uranium-234, -235, -238)	Radiochemical separation and alpha spectrometer[h,i]
Radium-226	Radiochemical separation and alpha scintillation counter[h,i]
Strontium/Yttrium-90	Gas flow proportional counter[h,i]
Tritium	Distillation and liquid scintillation[h,i]
<u>Miscellaneous</u>	
Boron	LANL Method WI-220, Colorimetry[n,o]
Chloride	EPA Method 300.0 by Ion Chromatography[j,k]
Fluoride	EPA Method 300.0 by Ion Chromatography[j,k]
Nitrate	EPA Method 300.0 by Ion Chromatography[j,k]
Nitrate & nitrite	LANL Method WI-280, Flow Injection Colorimetry[n,o]
Nitrite	LANL Method WI-310, Flow Injection Colorimetry[n,o]
Sulfate	EPA Method 300.0 by Ion Chromatography[j,k]
Sulfide	EPA Method 376.2, Colorimetry[p,q]
Bromide	EPA Method 320.1, Titrimetric[p,q]
Carbonate	EPA Method 310.1, Titrimetric[p,q]
Phosphate	EPA Method 365.4, Colorimetric[p,q]
Ammonia/Nitrogen	LANL Method WI-210, Automated Colorimetry[n,o]
Silica	LANL Method WI-340, Flow Injection Colorimetry[n,o]
Cyanide (total)	EPA Method 335.3, Colorimetric, Automated UV[p,q]
Mercury	EPA Method 245.1, Manual Cold Vapor Technique[p,q]
Chromium (Hexavalent)	LANL Method WI-260, Flow Injection Colorimetry[n,o]
TOC	EPA Method 415.1, Combustion or Oxidation[p,q]
TSS	EPA Method 160.2, Gravimetric, dried at 103-105 C[p,q]

TABLE IX.1. (CONTINUED) ANALYSIS PLAN FOR AQUEOUS SAMPLES

Analyte	Method
High Explosives	
HMX	USATHAMA by High Performance Liquid Chromatography[l,m]
RDX	USATHAMA by High Performance Liquid Chromatography[l,m]
NB	USATHAMA by High Performance Liquid Chromatography[l,m]
1,3-DNB	USATHAMA by High Performance Liquid Chromatography[l,m]
1,3,5-TNB	USATHAMA by High Performance Liquid Chromatography[l,m]
2,4-DNT	USATHAMA by High Performance Liquid Chromatography[l,m]
2,6-DNT	USATHAMA by High Performance Liquid Chromatography[l,m]
2,4,6-TNT	USATHAMA by High Performance Liquid Chromatography[l,m]
TETRYL	USATHAMA by High Performance Liquid Chromatography[l,m]

SW - Solid Waste

USATHAMA - U.S. Army Toxic and Hazardous Materials Agency

HMX - Octahydro-1,3,4,7-tetranitro-1,3,5,7-tetrazocine

RDX - Hexahydro-1,3,5-trinitro-s-triazine

NB - Nitrobenzene

1,3-DNB - 1,3-Dinitrobenzene

1,3,5-TNB - 1,3,5-trinitrobenzene

2,4-DNT - 2,4-Dinitrotoluene

2,6-DNT - 2,6-Dinitrotoluene

2,4,6-TNT - 2,4,6-Trinitrotoluene

TETRYL - 2,4,6-Trinitrophenylmethylnitramine

[a] EPA. 1987.

[b] See Table V.3 for EPA practical quantitation limits.

[c] See Table V.4 for EPA practical quantitation limits.

[d] EPA. 1986a.

[e] See Table V.5 for EPA method detection limits.

[f] See Table V.6 for EPA practical quantitation limits.

[g] See Table V.7 for EPA estimated instrumental detection limits.

TABLE IX.1. (CONTINUED) ANALYSIS PLAN FOR AQUEOUS SAMPLES

Analyte	Method

[h] DOE. 1983.

[i] See Table V.8 for DOE method detection limits.

[j] EPA. 1990.

[k] See Table V.9 for EPA method detection limits.

[l] U.S. Army Toxic and Hazardous Materials Agency, n.d.

[m] See Table V.10 for USATHAMA method detection limits.

[n] LANL methods manual LA-10300-M.

[o] See Table V.8 for LANL method detection limit.

[p] EPA 1983

[q] See Table V.9 for EPA method detection limits.

TABLE IX.2. ANALYSIS PLAN FOR SOIL/SEDIMENT SAMPLES

Analyte	Method
Volatile organics	EPA SW-846 Method 8240[a,b]
Semivolatile organics	EPA SW-846 Method 8270[a,c]
Organochlorine Pesticides and PCBs	EPA SW-846 Method 8080[def]
Inorganics (metals)	EPA SW-846 Method 6010[a,g]
<u>Radionuclides</u>	
Americium-241	Radiochemical separation and alpha spectrometer[n,o]
Americium-241	Gamma spectrometry[h,i]
Cesium-137	Gamma spectrometry[h,i]
Gamma spectroscopy (all peaks reported)	Gamma spectrometry[h,i]
Gross alpha	Gas flow proportional counter[h,i]
Gross beta	Gas flow proportional counter[h,i]
Isotopic plutonium (plutonium-238, -239, -240)	Radiochemicalseparation and alpha spectrometer[n,o]
Isotopic thorium (thorium-228, -230, -232)	Radiochemical separation and alpha spectrometer[n,o]
Total uranium	Inductively Coupled Plasma Mass Spectroscopy (ICPMS) or Delayed Neutron Assay[n,o]
Isotopic uranium (uranium-234, -235, -238)	Radiochemical separation and alpha spectrometer[h,i]
Radium-226	Radiochemical separation and alpha scintillation counter[h,i]
Strontium/Yttrium-90	Gas flow proportional counter[h,i]
Tritium	Distillation and liquid scintillation[h,i]
<u>Miscellaneous</u>	
Boron	LANL Method WI-220, Colrimetry[r,s]
Chloride	EPA Method 300.0 by Ion Chromatography[j,k]
Fluoride	EPA Method 300.0 by Ion Chromatography[j,k]
Nitrate	EPA Method 300.0 by Ion Chromatography[j,k]
Sulfate	EPA Method 300.0 by Ion Chromatography[j,k]
Cyanide (total)	EPA Method 9010, Colorimetry[a,k]
Mercury	EPA Method 7470, Cold Vapor[a,k]
Chromium (hexavalent)	EPA Method 7196, Colorimetry[a,k]
<u>Tests</u>	
Triaxial permeability	COE Laboratory Soil Testing EM1110-2-1906[l]
Moisture content	ASTM D2216 (1980)[m,n]
Density	ASTM D698 (1978)[m,n]
Porosity	ASTM D4645 (1987)[m,n]
Clay mineralogy	ASTM D4647 (1987)[m,n]
Percent organic	ASTM D2974 (1987)[m,n]
Capillary-moisture	ASTM D2325 (1986)[m,n]

TABLE IX.2. (CONTINUED) ANALYSIS PLAN FOR SOIL/SEDIMENT SAMPLES

Analyte	Method
Grain size	ASTM D421 (1985)[m,n], ASTM D422 (1963)[m,n, and] ASTM D1140 (1954)[m,n]
Attenberg limits	ASTM D4318 (1984)[m,n]
Air permeability	ASTM D4525 (1985)[m,n]
Total organic carbon	ASA and SSSA Method 29-2.2.5.1[o]
<u>High Explosives</u>	
HMX	USATHAMA by High Performance Liquid Chromatography[p,q]
RDX	USATHAMA by High Performance Liquid Chromatography[p,q]
NB	USATHAMA by High Performance Liquid Chromatography[p,q]
1,3-DNB	USATHAMA by High Performance Liquid Chromatography[p,q]
1,3,5-TNB	USATHAMA by High Performance Liquid Chromatography[p,q]
2,4-DNT	USATHAMA by High Performance Liquid Chromatography[p,q]
2,6-DNT	USATHAMA by High Performance Liquid Chromatography[p,q]
2,4,6-TNT	USATHAMA by High Performance Liquid Chromatographyp,q
TETRYL	USATHAMA by High Performance Liquid Chromatography[p,q]

SW - Solid Waste

COE - U.S. Army Corps of Engineers

ASTM - American Society for Testing and Materials

ASA - American Society of Agronomy, Inc.

SSSA - Soil Science Society of America, Inc.

USATHAMA - U.S. Army Toxic and Hazardous Materials Agency

HMX - Octahydro-1,3,4,7-tetranitro-1,3,5,7-tetrazocine

NB - Nitrobenzene

1,3-DNB - 1,3-Dinitrobenzene

1,3,5-TNB - 1,3,5-trinitrobenzene

2,4-DNT - 2,4-Dinitrotoluene

2,6-DNT - 2,6-Dinitrotoluene

2,4,6-TNT - 2,4,6-Trinitrotoluene

TETRYL - 2,4,6-Trinitrophenylmethylnitramine

TABLE IX.2. (CONTINUED) ANALYSIS PLAN FOR SOIL/SEDIMENT SAMPLES

[a] EPA. 1987.

[b] See Table V.3 for EPA practical quantitation limits.

[c] See Table V.4 for EPA practical quantitation limits.

[d] EPA. 1986a.

[e] See Table V.5 for EPA method detection limits.

[f] See Table V.6 for EPA practical quantitation limits.

[g] See Table V.7 for EPA estimated instrumental detection limits.

[h] DOE. 1983.

[i] See Table V.8 for DOE method detection limits.

[j] EPA. 1990.

[k] See Table V.9 for EPA method detection limits.

[l] COE. 1970.

[m] ASTM. 1988.

[n] The year the current edition of the ASTM method was approved, in parentheses.

[o] ASA and SSSA. 1982.

[p] U.S. Army Toxic and Hazardous Materials Agency, n.d.

[q] See Table V.10 for USATHAMA method detection limits.

[r] LANL methods manual LA-10300-M.

[s] See Table V.9 for LANL method detection limit.

10.0. DATA REDUCTION, VALIDATION AND REPORTING

Data generation from sampling activities is usually a four step process: data collection, data reduction, data validation, and data reporting. All these activities are governed by standard operating procedures, and routine reviews which include checking for errors in calculations, data entry, data transmission, and transcription. In addition, the field and/or laboratory analytical data have internal quality control checks such as method blanks, field blanks, spiked blanks, matrix spikes, internal standards, surrogates, and calibration standards with established method acceptance criteria.

10.1. DATA REDUCTION

Data reduction is defined as those activities involving conversion of raw data to reportable units, transfer of data between recording media, and computation of summary statistics, standard errors, confidence intervals, tests of hypotheses relative to the parameters, and model validation. Statistically-acceptable data analysis procedures will be implemented for all data reduction steps.

10.1.1. Field Technical Data Reduction

Field technical data (i.e., non-laboratory generated) collected during ER Program environmental investigations can generally be characterized as either objective or subjective data. Objective data include all direct measurements such as field screening, field analyses, and water level measurements. Subjective data include descriptions and observations. Some activities, for example, test boring and well logs, include both types of data in that the data recorded in the field are descriptive but can be reduced using the standardized lithologic coding system.

As described in Section 7.0, all field data will be recorded by field personnel on ER Program forms. For example, during drilling activities, the field team member supervising a drill rig will keep a chronological log of drilling activities, a vertical descriptive log of lithologies encountered, other pertinent drill information (e.g., staining, odors, field screening, working conditions, water levels, and geotechnical data), and a labor and materials account in the project's bound logbook. At the completion of a task, copies of all field logs, and ER Program forms will be presented to the Operable Unit Project Leader. After checking the field data and the ER Program forms, the data are

reduced to tabular form wherever possible, by entering the data into database files. Where appropriate, the database files will be set up for direct input into the project database system. Subjective data will be filed as hard copies for incorporation into technical reports as appropriate.

10.1.2. Laboratory Data Reduction

Data are initially collected, converted to standard reporting units, and recorded in standard formats by the project analysts. The project analysts will conduct preliminary data analyses using a variety of methods and procedures. Because many analytical instruments are microprocessor-controlled, some of the analyses can be performed directly in the instrument's operating or outputting mode. Those instruments interfaced to stand-alone computers or microprocessors often permit data analysis programs to be written and modified to produce data formats specially suited to end user requirements. Data requiring manual recording, integration and/or analysis must be converted to a more appropriate format prior to subsequent analyses.

The associated quality control data (e.g., blanks, blank spikes, duplicates, and continuing calibration checks) will be entered onto quality control charts and verified to be within control limits. Quality control data outside control limits will be reported with a qualifier. During all stages and aspects of data processing, the data are double-checked for translation or transcription errors and initialed by both the recorder and the checker.

The data will be entered into the laboratory computer system, and the data summaries (including raw data) will be submitted for review to the laboratory Quality Control (QC) reviewer. The laboratory data manager will be notified when the data are ready to be reported. The completed analyses will be removed from the laboratory backlog and a hardcopy report will be generated. The laboratory data manager generates a hard-copy data summary that is reviewed and is signed by the laboratory section manager, the laboratory manager, and the QA officer.

10.2. DATA VALIDATION

Data validation, an after-the-fact review of data, is the process whereby data are determined to be of acceptable or unacceptable quality based on a set of predefined criteria. These criteria depend upon the type(s) of data involved and the purpose for which data are collected.

10.2.1. Field Technical Data Validation

Validation of objective field and technical data will be performed at two different levels. On the first level, data will be validated at the time of collection by following standard procedures and quality control checks. At the second level, data will be validated by the Operable Unit Project Leader, who will review the data to ensure that the correct codes and units have been included. After data reduction into tables or arrays, the Operable Unit Project Leader will review data sets for anomalous values. Any inconsistencies or anomalies discovered by the Operable Unit Project Leader will be resolved immediately, if possible, by seeking clarification from the field personnel responsible for collecting the data.

Subjective field and technical data will be validated by the Operable Unit Project Leader, who will review field reports for reasonableness and completeness. In addition, random checks of sampling and field conditions will be made to confirm the recorded observations. Whenever possible, peer review will also be incorporated into the data validation process, particularly for subjective data, to maximize consistency among field personnel. For example, during drilling activities, the Operable Unit Project Leader will schedule periodic reviews of archived lithologic samples to ensure that the appropriate lithologic descriptions and codes are being consistently applied by all field personnel. In addition, for field analyses and tests, an independent review of the applicable items listed in Section 10.2.2, Laboratory Data Validation, will be conducted (e.g., calibration methods, control limits, instrument checks, etc.).

10.2.2. Laboratory Data Validation

Non-Radiological Analytical Data

In general, the criteria to be reviewed in the data validation process will depend on criteria unique to the analysis parameters (i.e., organic, inorganic, radiological, and physical testing), instrument limitations, and regulatory requirements. At a minimum, the following items will be reviewed during the validation process of non-radiological analytes:

- Sample holding times,
- Documentation that the analytical results are within control limits,
- Documentation that data and calculations were checked by the supervisor who was not involved in the sample analysis or data reduction,

- Documentation that a final review of the data was made by the laboratory manager for correctness and validity of the data,
- Calibration of methods and instruments,
- Routine instrument checks (noise levels, drift, linearity, etc.),
- Documentation of traceability of instrument standards, samples, and data,
- Documentation af analytical methodology and QC methodology,
- The control for interference contaminants in analytical methods (use of reference blanks and check standard for method accuracy and precision),
- Documentation of sample preservation and transport,
- Preparation and analysis of the appropriate number and type of laboratory quality control samples,
- Complete data packages, and
- For the field and laboratory quality control samples, conformance with established acceptance criteria.

Radiological Data

Data validation criteria, such as EPA Contract Laboratory Program (CLP) or other EPA analytical methodologies, generally do not apply to radiological data. Therefore, ER Program environmental investigations will use the criteria described in this section to evaluate the acceptability of radiological data. These criteria should be evaluated with the approval of the analytical laboratory selected to perform the analyses. In addition, if analyte-specific requirements are necessary, these issues should also be identified and evaluated prior to sample collection.

The evaluation of the radiological data will consist of the following components:

- Were the appropriate procedures followed during sample collection?
- Were the samples containerized and handled as described in the field sampling plan and procedures?
- Were the appropriate number and type of field quality control samples collected?
- Were the appropriate number and type of laboratory quality control samples prepared and analyzed?

- Are the data packages complete (Section 10.3.2)?
- Did the field and laboratory quality control samples meet established acceptance criteria?

The following sections describe the field and laboratory quality control samples that will be collected/prepared and analyzed in order to evaluate the acceptability of the radiological data.

Field Quality Control Samples

Two types of field quality control samples will be collected and analyzed for radiological constituents. These are: field duplicates and rinsate blanks. Table X.1 describes these samples and the acceptance criteria that will be used to evaluate the radiological data obtained from the analysis of these samples.

Laboratory Quality Control Samples

Table X.2 describes the laboratory quality control samples and their purpose and frequency. Table X.3 describes the laboratory radiological quality control acceptance criteria. If the data are acceptable against these criteria, the data are approved and a report is generated. If the data are rejected, the laboratory will notify the recipient (Operable Unit Project Leader) of the data package and/or re-analysis will be initiated, as appropriate.

10.3. DATA REPORTING

Data will be reported on magnetic media; in hard copy data reports; and by using the quality assurance verification, tabular output, and archiving capabilities of the project database.

10.3.1. Non-radiological Analytical Laboratory

The standard commercial laboratory data reports for non-radiological data will consist of a transmittal letter and the following for organic analyses:

- cover page describing data qualifiers, sample collection, sample receipt, extraction and analysis dates, and a description of any technical problems encountered with the analyses,
- copies of the chain-of-custody forms,
- copies of the analytical forms,

- spreadsheet sample analytical results and quality control summaries,
- instrument tuning results and mass spectra,
- calibration results,
- mass spectra and chromatogram for each sample,
- calculated recoveries for all quality control samples, method duplicate or duplicate spike and method blank results,
- all laboratory quality control data including method blank, method blank spike, matrix spike, laboratory duplicate or spike duplicate, and surrogate recovery data,
- method quantitation limits for all parameters and dilutions,
- calibration ranges and all raw data for all analyses, as appropriate, and
- five-peak library search report for GC/MS volatiles and semivolatiles.

Organic analytical results (volatiles, semivolatiles and pesticides/PCBs) will be reported in ug/L for aqueous samples and in ug/kg for soil/sediment samples. Inorganic (metals) analytical results will be reported in ug/L. Miscellaneous analyte parameters will be reported in mg/L for aqueous samples and in mg/kg for soil/sediment samples.

The standard commercial laboratory data reports for non-radiological data will consist of a transmittal letter and the following for inorganic analyses:

- cover page describing data qualifiers, sample collection, sample receipt, digestion and analysis dates, and a description of any technical problems encountered with the analyses,
- copies of the chain-of-custody forms,
- analytical results and quality control summaries which include laboratory blanks,
- quality control summary report on laboratory quality control samples (accuracy).

The following will be archived by HSE-9:

- instrument standardization and calibration results,
- method quantitation limits for all parameters and dilutions,
- calibration ranges and all raw data for all analyses, as appropriate,

10.3.2. Radiological Analytical Laboratory Data Reporting

Radiochemical analyses are not part of established EPA data reporting packages, such as EPA CLP. Data packages for radiochemical analyses will consist of the following elements:

- cover page describing data qualifiers, sample collection, sample receipt, preparation and analysis dates and a description of any technical problems encountered with the analyses,
- copies of the chain-of-custody forms,
- instrument calibration information (date, time, technician),
- all laboratory radiochemical quality control data (see Tables X.2 and X.3) including reagent blank, method blank, blind repeat, laboratory duplicate (replicate), spiked samples (matrix spikes), standard reference materials, and blind replicate standard,

The following will be archived by HSE-9:

- results of standards, including instrument blanks and calibration standards,
- raw data, including counting time and number of disintegrations per sample;
- calculated activity, per unit mass or liquid volume, with the following associated statistics:
    - relative counting error at the 95% confidence level,
    - lower detection limit,
    - average bias, and
    - average relative precision.

Radiochemical analytical results will be reported in pCi/L for aqueous samples and in pCi/g for soil samples.

10.3.3. Non-analytical Data Reporting

Non-analytical data will consist of results of physicochemical tests performed on soil core samples (Table IX.2). The results of these tests will be reported in the units specified in the specific American Society for Testing and Materials (ASTM) or U.S. Army Corps of Engineers (COE) method. SOPs will be written and approved as needed.

TABLE X.1. FIELD RADIOLOGICAL QUALITY CONTROL SAMPLES

Type	Purpose of Sample	Frequency	Acceptance Criteria
Field duplicate	To evaluate the reproducibility of the sampling technique	1 out of 20 samples or less	RPD less than or equal to 20% (similar to CLP inorganics)
Rinsate blank	To evaluate decontamination procedures	1 out of 20 samples or less (if a dedicated sampling tool is not used)*	If radiological constituents are detected, the data will be evaluated in order to determine probable source and impact on sampling results.

* - Rinsate blank frequency for soil samples is 5%. The frequency for water samples is 10%.

RPD - relative percent difference

CLP - Contract Laboratory Program, U.S. EPA

TABLE X.2. LABORATORY RADIOLOGICAL QUALITY CONTROL

Sample Type	Purpose of Sample	Frequency
Reagent blank	Determine the background of each reagent/solvent to be used in an analysis. Must use identical conditions to actual analysis including detection system. Background must not interfere with intended analysis.	With each new batch of reagents/ solvents.
Method blank	The analysis is performed using only the reagents and solvents used in the method. Determines cumulative interference. If cumulative interference cannot be eliminated, it must be taken into account when computations are done.	With each group of samples, 1 out of 20 samples, or daily, whichever is more frequent.
Blind repeat	An aliquot of a sample, unknown to analyst at time of sample log in, is introduced by QC Coordinator (known to QC Coordinator).	1 out of 100 or at least once a month.
Replicate	An aliquot of a sample known to analyst. Calculate relative percent difference.	1 out of 20 samples.
Spiked samples (matrix spikes)	A known concentration of a specific parameter is added to an aliquot of a sample with the matrix of interest. Percent recovery is determined and spike is compared against an unspiked aliquot.	1 out of 20 samples.

TABLE X.2. LABORATORY RADIOLOGICAL QUALITY CONTROL SAMPLES

Type	Purpose of Sample	Frequency
Standard reference materials	Standards prepared by recognized external agency (e.g., NIST) and used to determine performance of entire system instrumentation and analysis.	Scheduled periodic basis per specific lab procedure.
Blind replicate standard	A replicate standard of fixed concentration added by QC Coordinator, unknown to analyst.	Monthly.

QC - Quality Control.

NIST - National Institute of Standards and Technology.

TABLE X.3. LABORATORY RADIOLOGICAL QUALITY CONTROL ACCEPTANCE CRITERIA

Type	Accuracy and Precision Application	Introduced by	Acceptance Criteria
Reagent Blank	No	Analyst	Reagent values acceptable[a]
Method Blank	Yes	Analyst	Blank values acceptable[a]
Blind Repeat	Yes	QC Coordinator	+ or - 3 sigma of original sample (+ or - 2 sigma = warning limit).
Replicate	Yes	Analyst	+ or - 3 sigma of original sample (+ or - 2 sigma = warning limit).
Spiked samples (matrix spikes)	Accuracy only	Analyst	+ or - 3 sigma (+ or - 2 sigma = warning limit).
Standard reference materials	Accuracy only	Analyst or QC Coordinator	+ or - 3 sigma (+ or - 2 sigma = warning limit).
Blind replicate standard	Yes	QC Coordinator	+ or - 3 sigma of original sample (+ or - 2 sigma = warning limit).

QC - Quality Control.

[a] If high blank or reagent background is observed, laboratory glassware and reagents will be checked for contamination and the analysis halted until the system is brought under control. (High background is defined as contamination sufficient to result in a difference in sample value greater than or equal to the smallest significant digit known to be true.)

11.0. INTERNAL QUALITY CONTROL CHECKS

Internal quality control checks will allow evaluation the consistency and validity of generated data. Confidence in generated data in the form of internal quality control checks will allow task personnel to work efficiently.

As appropriate, internal quality control samples will be analyzed to establish and document the consistency and validity of the sample data. The quality control checks may include:

- Field duplicates,
- Laboratory duplicates,
- Spiked blank samples,
- Spiked site matrix samples,
- Field bottle or equipment blanks,
- Method blanks,
- Internal standards,
- Surrogate spikes,
- Reagent blanks,
- Calibration standards,
- Sample duplicates,
- Laboratory control samples,
- Standard reference materials, and
- Calibration check samples.

11.1. FIELD SAMPLING QUALITY CONTROL CHECKS

Quality control checks for field sampling provides a means of evaluating the integrity of a sample from the time of collection through analysis at an approved laboratory.

Specific field sampling quality control checks apply to both soil samples and water samples as described below.

11.1.1. Soil Sampling

Quality control checks for field soil sampling activities will follow guidance provided in the Soil Sampling Quality Assurance User's Guide (EPA 1984b). Table V.1 presents the recommended level of quality control for soil sampling activities.

Field replicate soil samples will be given a unique alphanumeric identifier and submitted to the laboratory blind, (i.e., without indicating the location). These samples will serve as blind field splits and will be used to evaluate laboratory reproducibility and field reproducibility. Field duplicate soil samples will be identified on the appropriate LANL ER Program forms.

Trip blanks and equipment (rinsate) blanks are not suggested Quality Assurance/Quality Control (QA/QC) procedures for soil samples according to the U.S. EPA Soil Sampling Quality Assurance User's Guide (EPA 1984b). Therefore, trip blanks will not be part of field QA/QC programs for soil sampling activities.

Equipment blanks, however, will be included as part of the field QA/QC program for soil sampling activities. Since radiological contamination may be encountered at many LANL locations, the addition of equipment blanks will serve as a check on the sampling device cleanliness.

11.1.2. Water Sampling

Quality control checks for field surface water and groundwater sampling activities will include the recommended types of samples presented in Table V.1.

Field duplicate water samples will be given a unique alphanumeric identifier and submitted to the laboratory blind, (i.e., without indicating the location). These samples will serve as blind field splits and will be used to evaluate laboratory reproducibility and field reproducibility. Field duplicate water samples will be identified on the appropriate LANL ER Program forms.

11.2. LABORATORY ANALYTICAL ACTIVITIES

A summary of laboratory-based quality control samples and frequency is presented in Table V.2. The information in Table V.2 is based on criteria in the U.S. EPA SW-846 methods. At a minimum, 1 laboratory matrix spike and replicate per 20 environmental samples or analytical batch, whichever is more frequent, will be used. Reagent blanks will be at a frequency of 1 per analytical batch. Spike replicate samples for inorganic (metals) analysis will be at a frequency of 10 percent. Specific types of laboratory quality control samples are described in the following subsections.

11.2.1. Laboratory Standards

Three types of laboratory standards will be utilized:

1) calibration standards,
2) check standards, and
3) quality control reference sample.

Calibration standards are prepared by diluting the stock analyte solution in graduated amounts which cover the expected range of the samples being analyzed. Calibration standards must be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. These criteria are applicable to organic and inorganic chemical analyses. Results obtained from analysis of standards are used to generate a standard curve which plots concentrations of known analyte standards versus the instrument response to the analyte. The standard curve is used to quantitate the compound in an environmental sample. A minimum of three calibration standards will be used to generate a standard curve for all inorganic analyses and a five-point calibration curve will be used for organic analyses.

A check standard is a material of known composition that is analyzed concurrently with test samples to evaluate a measurement process. One check standard should be analyzed with each analytical batch or every 20 samples, whichever is greater. The check standard is prepared by the analyst to monitor and verify instrument performance on a daily basis.

A quality control reference samples is prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. An independent standard is defined as a standard composed of the analyte(s) of interest from a different source that used in the preparation of standards for use in preparing the standard curve. The quality control reference sample serves as an independent check of technique, methodology, and standards. A quality control reference sample will be analyzed with every analytical batch or every 20 samples, whichever is greater. This applies to organic and inorganic analyses.

11.2.2. Laboratory Replicates

Laboratory replicate samples are two aliquots taken from the same container and analyzed independently. In the case of volatile organic samples, duplicate samples are obtained in the field for replicate analysis rather than obtaining replicates in the laboratory.

11.2.3. Laboratory Spike Samples

Two types of laboratory spikes will be used for quality control evaluation purposes:

1) Matrix spikes, and

2) Surrogate spikes.

A matrix spike analysis is performed by adding a pre-determined quantity of stock solutions of certain analytes to a sample matrix prior to sample extraction/digestion and analysis. Matrix spikes provide a measure of accuracy for the method used in a given matrix. The concentration of the spike should be at the regulatory standard level, or the practical quantitation limit for the method. Precision and accuracy criteria of matrix spike analyses (percent recovery limits and relative percent difference) are presented in Table V.11.

Surrogate spikes are organic compounds similar to analytes of interest in chemical composition, extraction, and chromatography; but which are not normally found in environmental samples. Surrogate spikes simulate the background and interferences found in actual samples. Surrogate

compounds are spiked into all blanks, calibration and check standards, samples (including duplicates and quality control reference samples) and spiked samples prior to analysis. Percent recoveries are calculated for each surrogate spike compound and are a measure of the accuracy of the total analytical method. The accuracy criteria for surrogate spike analyses, measured as percent recoveries, are presented in Table V.12.

11.2.4. Laboratory Blank Samples

Two types of laboratory blanks will be analyzed:

1) calibration blanks, and

2) reagent blanks.

Calibration blanks are usually an organic or aqueous solution that is as free of analyte as possible. Calibration blanks are prepared with the same volume of chemical reagents used in the preparation of the calibration standards and diluted to the appropriate volume with the same solvent (water or organic) used in the preparation of the calibration standard. The calibration blank is used to give the null reading (baseline) for the instrument response versus concentration calibration curve. One calibration blank will be analyzed with analytical batch or every 20 samples, whichever is greater.

Reagent blanks are usually an organic or aqueous solution that is as free of analyte as possible. The reagent blank contains all the reagents in the same volume as used in the processing of the environmental samples. The reagent blank must be carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The purpose of the reagent blank is to correct for possible contamination resulting from the preparation or processing of the environmental samples. One reagent blank will be analyzed with each analytical batch or every 20 samples, whichever is greater.

Narratives and documentation on the performance of these laboratory quality controls will be provided as part of the data package submitted by the participating laboratory. Frequency and methods used in performing these quality controls will be in accordance with LANL standards. Activities that do not meet LANL requirements will require corrective action by the laboratory. Such corrective action will also be in accordance with LANL standards.

The following should be addressed in each operable unit QAPjP or document included by reference:

1. Does the plan describe procedures for both field and laboratory?
2. Are the protocols used (spikes, surrogates, blanks, etc.) described for each parameter and matrix?
3. Are the acceptance or control limits specified for each?
4. Is the frequency of the checks described?
5. Is it clear whether the intent is to measure total error/variability or component (sampling/lab) error/variability?

12.0. PERFORMANCE AND SYSTEM AUDITS

Performance and system audits are addressed in two LANL ER Program Quality Procedures. The process for conducting performance audits is described in LANL-ER-QP-01.1Q, Audits. The term utilized for a performance audit with the ER Program is survey. The process for conducting surveys (i.e., performance audits) is described in LANL-ER-QP-01.2Q, Surveys. These procedures are derived from the requirements presented in Section 18, Audits and Surveys, of the LANL ER Quality Program Plan.

13.0. PREVENTIVE MAINTENANCE

Proper preventive maintenance of field and laboratory equipment is a necessary element for achieving equipment reliability. All field and laboratory instruments and equipment will be maintained to manufacturer's recommendations and specifications. System checks and service will be performed on a schedule specified by the manufacturer. Maintenance will be performed when the instrument will not adequately tune or calibrate. The professional judgement of the equipment operator or lead analyst will determine when maintenance is necessary.

Section 12 of the LANL ER Program Quality Program Plan provides additional discussion of control of measuring and test equipment. This section provides information on equipment identification, maintenance and calibration.

13.1. FIELD EQUIPMENT

Field equipment will be properly calibrated, charged, and in good general working condition before the beginning of each working day. LANL ER Program SOPs define the required equipment checks and calibration requirements for each type of field equipment. Field equipment which does not meet the calibration requirements will be taken out of service until acceptable performance can be verified. Non-operational field equipment will also be removed from service and returned to the supplier, and a replacement will be obtained. Maintenance records will be maintained for each field instrument according to a unique number affixed to the instrument. These records will be reviewed prior to their use in the field to assure that instrument maintenance and calibration are up to date.

All field instruments will be properly protected against inclement weather conditions during environmental investigations. At the end of each working day, all field equipment (except self-propelled equipment) will be taken out of the field and placed in appropriate storage.

All self-propelled field equipment (e.g., drill rigs, water trucks and support vehicles) will arrive at the site in proper working condition each day. All lubricating, hydraulic, and motor oils will be checked before the start of each work day to make certain all fluid reservoirs are full and there are no leaks. If a leak is detected, the equipment will be removed from service for repair or replacement.

13.2. LABORATORY EQUIPMENT

The ability to generate valid data requires that all analytical instrumentation be properly maintained. Service contracts may provide routine preventive maintenance and emergency repair service. The elements of preventive maintenance programs for each participating analytical laboratory are discussed in their respective laboratory Quality Assurance Plans.

13.2.1. Instrument Maintenance Logbooks

Requirements for instrument maintenance logbooks are described in Section 12 of the LANL ER Quality Program Plan.

13.2.2. Instrument Calibration and Maintenance

Requirements for analytical instrument calibration and maintenance are described in Section 12 of the LANL ER Quality Program Plan.

Major analytical instruments have specific preventive maintenance and calibration schedules. Preventive maintenance and calibration is generally performed by the manufacturer's service representatives on a routine basis. Each participating analytical laboratory Quality Program Plan should provide maintenance frequency information which should be reviewed for each operable unit QAP/P.

13.2.3. Spare Parts

Each participating analytical laboratory will maintain an inventory of routinely required spare parts relevant to the services provided (i.e., sources, vacuum pumps, and filaments for GC/MS; torches and burner heads for AA/ICP).

14.0. SPECIFIC ROUTINE PROCEDURES USED TO ASSESS DATA PRECISION, ACCURACY, REPRESENTATIVENESS, AND COMPLETENESS

Precision, accuracy, and completeness are means of evaluating the consistency of generated data. These procedures have been identified to inform task personnel of the standards against which data is to be evaluated. Procedures for calculating precision and accuracy must comply with the criteria contained in the most recent editions and updates of U.S. EPA SW-846 Chapter 1, when analytical activities are in support of RCRA compliance. Analytical precision and accuracy will be calculated and reported by the laboratory for every data set. The LANL personnel will calculate field duplicate sample precision during the data validation process, because these samples were submitted blind to the laboratory.

14.1. PRECISION

Analytical precision is calculated by expressing, as a percentage, the difference between the results of analysis of standard reference materials or duplicate samples relative to the average of those results for a given analyte. Precision is expressed as the Relative Percent Difference (RPD) and is calculated as follows (EPA 1987):

$$RPD = \frac{D1 - D2}{(D1 + D2)/2} \times 100,$$

where:

RPD = relative percent difference.

D1 = first sample value.

D2 = second sample value (replicate).

14.2. ACCURACY

Analytical accuracy is calculated by expressing, as a percent, the recovery of a standard reference material or an analyte that has been added to the sample (or standard matrix) at a known concentration before analysis and is expressed by the following formula (EPA 1987):

$$\% \text{ Recovery} = \frac{(SSR - SR)}{SA} \times 100,$$

where:

SSR = spiked sample result,

SR = sample result, and

SA = spike added.

The spiked (fortified) concentration used will be specified by laboratory quality control requirements as detailed in the applicable U.S. EPA SW-846 method (EPA 1986a; EPA 1987).

14.3. SAMPLE REPRESENTATIVENESS

Data obtained during environmental investigations at LANL should characterize the site conditions. Obtaining representative data requires strict adherence to the procedures for sample collection and analysis that are presented in the QAPjP. In addition, the samples will be carefully selected to ensure that they are representative of the site location that they are intended to characterize. The details on the types, locations and number of samples to be collected are listed in the individual sampling and analysis plan for each operable unit. The following points serve as guidelines for ensuring representativeness of the samples:

- Where sample composition may vary with location (e.g., in sampling from soil or from waste treatment piles), a sufficient number of samples will be collected so that the entire area can be characterized. A statistically based sampling scheme may be used to choose the sampling locations, where appropriate.

- Where sample composition may vary with time (e.g., in sampling of groundwater, surface water or process streams), samples will be collected over a sufficient period of time so that the variation with time can be described.

Composite samples may be collected to represent the average of several individual samples. Site-specific objectives will determine the choice of sample collection (i.e., individual samples or composite samples).

14.4. COMPLETENESS

Completeness is a measure of the relative number of analytical data points that meet all the acceptance criteria for accuracy, precision, and any other criterion required by the specific analytical methods used. The percent completeness for analytical data can be expressed by the following formula:

$$\% \text{ Completeness} = \frac{V}{T} \times 100,$$

where:

V = valid data, and

T = total analyses.

The initial responsibility to monitor the quality of an analytical system lies with the analyst. The analyst will verify that all quality control procedures are followed and that results of analysis of quality control samples are within acceptance criteria. If acceptance criteria limits are exceeded, this must be described in the analytical report case narrative. This requires that the analyst assess the correctness of the following items, as appropriate:

- initial calibration,
- calibration verification,
- method blank result,
- duplicate analysis,
- laboratory control standard, and
- fortified sample result.

15.0. CORRECTIVE ACTION

The ER QP, Deficiency Reporting, applies to both field and laboratory activities. Corrective action is initiated when the following situations arise:

- Specific requirements of the analysis method or SOPs are not met.
- Data quality objectives for precision, accuracy and completeness are not achieved.
- Lab or field data review indicates that data are incomplete or that improper calculation, methodology or technique was employed, or that an instrument malfunction has occurred.

15.1. OVERVIEW

The LANL ER Program process for deficiency reporting is presented in quality procedure, Deficiency Reporting. This procedure describes the methods by which deficiencies are identified and corrected.

Where deficiencies are found, the LANL ER Program QPPL and Operable Unit Project Leader will determine if the data in question are essential to the project and what corrective action will be taken. Corrective action may include one or more of the following:

- Additional information or recalculations are supplied.
- Instrument operation and calibration are checked. Calibration standards are checked and new standards obtained if necessary. Instrument malfunctions are corrected.
- Personnel repeat the task using the same procedure.
- A different individual repeats the task using the same procedure.
- Samples are re-analyzed (if holding time permits).
- Sampling and/or analytical procedures are evaluated and amended.

- Personnel repeat the task using a validated new or modified procedure.

- If practical, a new sample is collected and analyzed.

If the anomaly is not resolved after the above steps are taken, the data are reported with qualifying statements. In some cases, depending on the nature and degree of deviation, no data may be reported.

15.2. FIELD CORRECTIVE ACTION

The initial responsibility for monitoring the quality of field measurements and observations lies with the field personnel. The field Technical Team Leader is responsible for verifying that all quality control procedures are followed. This requires that the field Technical Team Leader assess the correctness of field methods and the ability to meet quality assurance objectives. If a deficiency occurs that might jeopardize the integrity of the project or cause some specific quality assurance objective not to be met, it is the responsibility of all field project staff to report it. Field project staff must report all such suspected deficiencies according to the process defined in LANL ER Program quality procedure for Deficiency Reporting.

15.3. LABORATORY CORRECTIVE ACTION

The initial responsibility for monitoring the quality of an analytical system lies with the analyst. In this pursuit, the analyst will verify that all quality control procedures are followed and that the results of analysis of quality samples are within acceptance criteria. This requires that the analyst assess the correctness of all of the following items, as appropriate:

- sample preparation procedures,
- initial calibration,
- calibration verification,
- method blank result, and
- laboratory control standard.

If the assessment by the analyst reveals that any of the quality control acceptance criteria, as defined by the most recent edition and updates of the analytical method are not met, the analyst must immediately assess the analytical system to correct the deficiency. The analyst must notify the LANL laboratory analytical unit leader and the LANL laboratory quality assurance coordinator of the deficiency and, if possible, identify potential causes and corrective action.

The nature of the corrective action obviously depends on the nature of the deficiency. For example, if a continuing calibration verification is determined to be out of control, the corrective action may require re-calibration of the analytical system and re-analysis of all samples since the last acceptable continuing calibration standard.

Quality control samples (e.g., matrix spikes and matrix spike duplicates) provide an indication of matrix effects on analyses. Failure to achieve method specific performance on quality control samples will trigger corrective action or additional re-analysis as appropriate.

When the appropriate corrective action measures have been defined and the analytical system is determined to be "in control", the analyst documents the problem, the corrective action, and the data, demonstrating that the analytical system is in control. Copies of this documentation will be provided to the LANL laboratory analytical unit leader and the LANL laboratory quality assurance coordinator.

All personnel are responsible for identifying the need for corrective action. The LANL ER Program QPPL and the originator of the Deficiency Report must approve all proposed corrective actions.

16.0. QUALITY ASSURANCE REPORTS TO MANAGEMENT

16.1. FIELD QUALITY ASSURANCE REPORTS TO MANAGEMENT

The Operable Unit Project Leader will provide a monthly field progress status report to the LANL ER Program Manager. This report will include a copy of all field data sets compiled, a description of the activities performed, a description of unusual occurrences or situations encountered, a discussion of any deviations from established procedures, and documentation of any nonconformances.

16.2. LABORATORY QUALITY ASSURANCE REPORTS TO MANAGEMENT

The laboratory quality assurance coordinator will provide monthly, quarterly, and annual reports to the LANL ER Program QPPL. These reports summarize quality assurance activities for the reporting period including the following items:

- results of performance audits (external and internal),
- results of system audits (external and internal),
- summaries of corrective action to remedy nonconforming activities, and
- recommendations for revisions of laboratory procedures to improve the analytical systems.

All final reports will contain QA sections.

The laboratory quality assurance coordinator will immediately notify the LANL ER Program QPPL when laboratory quality assurance situations occur which require immediate corrective action.

16.3. INTERNAL MANAGEMENT QUALITY ASSURANCE REPORTS

Monthly QA reports will be prepared for the ER Program Manager. Each report will summarize the status with regard to overall precision, accuracy, and completeness results obtained to date. Additionally, each monthly QA report as a matter of record will discuss the following items:

- audit findings and any deficiencies noted,

- corrective actions taken and the effectiveness of the corrective action,
- any deviations from the established procedures, and
- a discussion of the methods and protocols utilized for the field and laboratory activities as set forth in this QAPjP.

If any of the above listed monthly QA report items have not occurred since the previous reporting period, this fact will be so noted in the report.

The LANL ER Program Manager will prepare a monthly project summary report for the LANL ER Program Project Director (HSE Deputy Division Leader). The purpose of the monthly project summary is to provide continued communication among the project management and technical personnel in order to ensure that problems are remedied and solutions documented in a timely manner.

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APPENDIX A - DATA QUALITY OBJECTIVE - EXAMPLE SCENARIO

This section will be rewritten to define the specific project description.

Groundwater Monitoring for Land Disposal Facilities under RCRA.

The primary goal of the sampling and analytical activities of the program is to determine if the groundwater at a facility is contaminated. The data generated will provide a "snapshot" of the condition of the groundwater at the time of sampling. Data will not be generated over an extended period of time to show variations due to seasonal or other factors. Thus, the data collected from the study will be used to support the need for additional data collection activities and/or be used in conjunction with existing monitoring data to make decisions regarding needed actions.

The goal for the reliability of Program data will be at the 95% confidence level. A goal of + or - 20% is proposed for sampling precision. Sampling precision will be evaluated using duplicate field samples. Duplicate sample results will help to establish precision among different samples collected from the same site. Splits of the same sample will provide a measure of precision within that sample (sample homogeneity). Duplicate samples will be collected for volatile organic analysis at all wells. Duplicated samples for semivolatile and inorganic analytes and indicator parameters will be collected from at least 5% of the monitoring wells or at least two duplicates per site.

The DQO for this Program will be developed in two phases. The DQO presented above defines goals for Phase I of the Program. Using data generated from Phase I, more definitive DQO will be developed for Phase II of the Program.

The following information needs to be considered in developing Quality Data Objectives, as apporpriate:

- A clear qualitative statement of the decision to be made or the problem under evaluation;
- A statement of why environmental data are needed and how the data will specifically be used;
- Schedule and budget constraints on data collection;
- A description of the data to be collected or measurements to be made;

- Specifications regarding the domain (i.e., that portion of the environmental or physical system from which samples will be collected); and
- The calculations, statistical or otherwise, that will be performed on the data to arrive at a result.

Do the Quality Assurance objectives and Data Quality Objectives address the following:

1. Is there a comprehensive statement of intended data usage?
2. Are secondary data usages discussed?
3. Do the DQOs reflect the administrative process (dialogue between technical staff and decision maker or between producers of the data and users) and tie the DQO to the decision to be made or the use of the data?
   a. Is the person(s) responsible for formatting DQOs identified?
   b. Have the following been considered in the development of the DQOs: intended use, measurement process, available resources and cost?
4. Are DQOs quantitatively stated for precision and accuracy (bias)?
   a. Have the following been defined for each matrix and parameter:
      1) Level of QA effort (frequency of QA, etc.)?
      2) Accuracy (matrix spikes, surrogate spikes, reference samples, etc.)?
      3) Precision (replicate samples)?

4) Sensitivity or Method Detection Limit?

5) Statistical reporting units?

b. Are quantitative limits established for each?

c. Are both field and lab covered?

d. Is it clear that a distinction has been defined to "total" system availability and bias vs. only looking at the laboratory?

e. Are objectives/requirements properly expressed (e.g., not confused with capabilities)?

5. If appropriate, are completeness objectives quantitatively stated?

6. Are representativeness and comparability appropriately addressed?

QUALITY ASSURANCE/QUALITY CONTROL DEFINITIONS

Accuracy - The degree of agreement of a measurement (or an average of measurements of the same thing), X, with an accepted reference or true value, T, usually expressed as the difference between the two values X-T, or the difference as a percentage of the reference or true value, 100 (X-T)/T, and sometimes expressed as a ratio, X/T. Accuracy is a measure of the bias in a system. Accuracy is assessed by means of reference samples and percent recoveries.

Analytical Batch - The basic unit for analytical quality control is the analytical batch. The analytical batch is defined as samples which are analyzed together with the same method sequence and the same lots of reagents and with the manipulations common to each sample within the same time period or in continuous sequential time periods. Samples in each batch should be of similar composition (e.g., groundwater, sludge, ash, etc.).

Audit - A systematic check to determine the quality of operation of some function or activity. Audits may be two basic types: (1) performance audits in which quantitative data are independently obtained for comparison with routinely obtained data in a measurement system, or (2) system audits of a qualitative nature that consist of an on-site review of a laboratory's quality assurance system and physical facilities for sampling, calibration, and measurement.

Bias - A systematic displacement of all the observations in a sample from the true or accepted value, or a systematic and consistent error in test results.

Blank or Sample Blank - A sample of a carrying agent (gas, liquid, or solid) normally used to selectively capture a material of interest. The blank or sample is subjected to the usual analytical or measurement process to establish a zero baseline or background value and is used to adjust or correct routine analytical results.

Calibration - Establishment of a relationship between various calibration standards and the measurements of them obtained by a measurement system or portions of the system. The levels of the calibration standards should bracket the range of levels obtained when actual measurements are to be made.

Calibration Standard - A standard used to quantitate the relationship between the output of a sensor and a property to be measured. Calibration standards should be traceable to standard reference materials, certified reference materials, or a primary standard.

Certified Reference Materials - A material produced in quantity when certain properties have been certified to the extent possible to satisfy its intended use by the National Institute of Standards and Technology or other agencies.

Chain-of-Custody - Inventory control information that, when documented, attests to the integrity of data (sample[s]) collected.

Check Standard - A material of known composition that is analyzed concurrently with test samples to evaluate a measurement process. An analytical standard that is analyzed to verify the calibration of the analytical system. One check standard should be analyzed with each analytical batch or every 20 samples, whichever is greater.

Comparability - Expresses the confidence with which one data set can be compared to another.

Completeness - A measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions.

Data Quality - The totality of features and characteristics of data that bears on its ability to satisfy a given purpose. The characteristics of major importance are: accuracy, precision, completeness, representativeness, and comparability.

Data Quality Objectives - Qualitative and quantitative statements specified to ensure that data of known and appropriate quality are obtained to support specific decisions or regulatory actions.

Data Validation - A systematic process for reviewing a body of data against a set of criteria to provide assurance that the data are adequate for their intended use. Data validation consists of data editing, screening, checking, auditing, verification, certification, and review.

Defensibility - Ability to defend, through documented objective evidence, the origin, chain-of-custody, matrix of scientifically-acceptable operations performed, reduction and transcription of data, so that limitations, representativeness, and applicability are clearly known.

Environmental Samples - An environmental sample or field sample is a representative sample of any material (aqueous, non-aqueous, or multi-media) collected from any source for which determination of composition or contamination is requested or required. For the purposes of this investigation, environmental samples shall be classified as follows:

Surface Water and Groundwater;

Drinking Water -- delivered water (treated or untreated) designated as potable water;

Water/Wastewater -- raw source waters for public drinking water supplies, ground waters, municipal influents/effluents, and industrial influents/effluents;

Sludge -- municipal sludges and industrial sludges;

Waste -- aqueous and non-aqueous liquid wastes, chemical solids, contaminated soils, and industrial liquid and solid wastes.

Environmentally Related Measurements - A term used to describe essentially all field and laboratory investigations that generate data involving (1) the measurement of chemical, physical, or biological parameters in the environment, (2) the determination of the presence or absence of criteria or priority pollutants in waste streams, (3) assessment of health and ecological effect studies, (4) conduct of clinical and epidemiological investigations, (5) performance of engineering and process evaluations, (6) study of laboratory simulation of environmental events, and (7) study or measurement on pollutant transport and fate, including diffusion models.

Equipment (Rinsate) Blank - Usually an organic or aqueous solution that is as free of analyte as possible and is transported to the site, opened in the field, and poured over or through the sample collection device, collected in a sample container, and returned to the laboratory. This serves as a check on the sampling device cleanliness. One equipment blank should be analyzed with each analytical batch or every 20 samples, whichever is greater.

Field Blank - Usually an organic or aqueous solution that is as free of analyte as possible and is transferred from one vessel to another at the sampling site and preserved with the appropriate reagents. This serves as a check on reagent and environmental contamination. One field blank should be analyzed with each analytical batch or every 20 samples, whichever is greater.

Field Duplicate Samples - Duplicate samples are two separate samples taken from the same source (i.e. in separate containers and analyzed independently). Independent samples collected in such a manner that they are co-located samples equally representative of the sample matrix at a given location and time. Field duplicates will be indistinguishable from other analytical samples so that the personnel performing the analyses are not able to determine which samples are duplicates. Field duplicates determine total random error.

Grab Sample - A discrete aliquot which is representative of a specific location at specific time.

Internal Quality Control - The routine activities and checks, such as periodic calibrations, duplicate analyses, and the use of spiked samples, that are included in normal internal procedures to control the accuracy and precision of a measurement process.

Laboratory (Reagent) Blank - A sample which is prepared and analyzed by the laboratory, prior to and during analysis of each sample batch, to demonstrate that identified compound concentrations do not reflect laboratory contamination.

Laboratory Duplicates - Two aliquots taken in the laboratory from the same sample container with one of the aliquots identified as the duplicate and the other aliquot the original sample. Each aliquot is treated identically through the laboratory analytical procedure.

Matrix Spike - A matrix spike is employed to provide a measure of accuracy for the method used in a given matrix. A matrix spike analysis is performed by adding a predetermined quantity of stock solutions of certain analytes to a sample matrix prior to sample extraction/digestion and analysis. The concentration of the spike should be at the regulatory standard level or the practical quantitation limit (PQL) for the method. When the concentration of the analyte in the sample is greater than 0.1%, no spike of the analyte is necessary.

Method Detection Limit (MDL) - The method detection limit is defined as the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte.

Minimum Detectable Level (Limit of Detection) - The limit of detection for an analytical method is the minimum concentration of the constituent or species of interest that can be observed by the instrument and distinguished from instrument noise with a specified degree of probability.

Performance Audits - (See Audit).

Practical Quantitation Limit (PQL) - The practical quantitation limit is the lowest limit that can be reliably achieved within specified limits of precision and accuracy during routine laboratory operating conditions.

Precision - A measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Precision is the agreement between a set of replicate measurements without assumption or knowledge of the true value. Precision is assessed by means of duplicate/replicate sample analysis. Precision is best expressed in terms of the standard deviation. Various measures of precision exist depending upon the "prescribed similar conditions."

Quality Assurance - The total integrated program for assuring the reliability of monitoring and measurement data. A system for integrating the quality planning, quality assessment, and quality improvement efforts to meet user requirements.

Quality Assurance Program Plan (QAPP) - An orderly assembly of management policies, objectives, principles and general procedures by which an organization outlines how it intends to produce quality data.

Quality Assurance Project Plan (QAPjP) - An orderly assembly of detailed and specific procedures by which an organization delineates how it produces quality data for a specific project or measurement method.

Quality Control - The routine application of procedures for obtaining prescribed standards of performance in the monitoring and measurement process.

Quality Control Reference Sample - A sample prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. An independent standard is defined as a standard composed of the analyte(s) of interest from a

different source than that used in the preparation of standards for use in the standard curve. A quality control reference sample is intended as an independent check of technique, methodology, and standards and should be run with every analytical batch or every 20 samples, whichever is greater. This is applicable to all organic and inorganic analyses.

Quality Control Samples - A planned check of the operation of a measurement system to obtain a measure of the quality of the data generated. Examples of Quality Control sample types are:

- Blank samples,
- Duplicate samples,
- Split (replicate) samples, and
- Matrix spike samples.

Reagent Blank - Usually an organic or aqueous solution that is as free of analyte as possible and contains all the reagents in the same volume as used in the processing of the samples. The reagent blank must be carried through the complete sample preparation procedure and contains the same reagent concentrations in the final solution as in the sample solution used for analysis. The reagent blank is used to correct for possible contamination resulting from the preparation or processing of the sample. One reagent blank should be prepared for every analytical batch or for every 20 samples, whichever is greater.

Reagent Grade - Analytical reagent (AR) grade, ACS reagent grade, and reagent grade are synonymous terms for reagents which conform to the current specifications of the Committee on Analytical Reagents of the American Chemical Society.

Replicate Analysis - Repeated, but independent, determinations of the same sample by the same analyst, at essentially the same time and under the same conditions.

Replicate Samples - Replicate samples are two aliquots taken from the same sample container and analyzed independently. In cases where aliquoting is impossible, as in the case of volatiles, duplicate samples must be taken for the replicate analysis.

Representativeness - Expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

Reproducibility - The precision, usually expressed as a standard deviation, measuring the variability among results of a measurement of the same sample at different laboratories.

Sensitivity - The degree by which an instrument (or method) can detect a particular compound.

Spiked Sample - A normal sample of material (gas, liquid, or solid) to which is added a known amount of some substance of interest. The extent of the spiking is unknown to those analyzing the sample. Spiked samples are used to check on the performance of a routine analysis or the recovery efficiency of a method.

Standard Curve - A standard curve is a curve which plots concentrations of known analyte standards versus the instrument response to the analyte. Calibration standards are prepared by diluting the stock analyte solution in graduated amounts which cover the expected range of the samples being analyzed. Standards should be prepared at the frequency specified in the appropriate method. The calibration standards must be prepared using the same type of acid or solvent and at the same concentration as will result in the samples following sample preparation. This is applicable to organic and inorganic chemical analyses.

Standard Operating Procedures (SOP) - A written document which details operation, analysis, or action whose mechanisms are thoroughly prescribed and which is commonly accepted as the method for performing certain routine or repetitive tasks.

Surrogate - Surrogates are organic compounds which are similar to analytes of interest in chemical composition, extraction, and chromatography, but which are not normally found in environmental samples. These compounds are spiked into all blanks, calibration and check standards, samples (including duplicates and quality control reference samples) and spiked samples prior to analysis. Percent recoveries are calculated for each surrogate.

Survey - (See Systems Audit).

System Audit - A review of the Quality Control system to ensure that a comprehensive set of Quality Control methods, procedures, reviews, and sign-off approvals are established or in place. Such audits may be either planned or unannounced.

Traceability - A documented chain of comparisons connecting a working standard to a national standard, such as a standard maintained by the National Institute of Standards and Technology.

Trip Blank - Usually an organic or aqueous solution that is as free of analyte as possible and is transported to the sampling site and returned to the laboratory without being opened. A trip blank consists of a sample that is prepared by the laboratory prior to the sampling event. The trip blank is contained in the actual sample containers and is kept with the investigative samples throughout the sampling event. Trip blanks are handled and packaged for shipment in the same manner as other investigative samples. This serves as a check on sample contamination originating from sample transport, shipping, and from the site conditions. One trip blank should be analyzed with each analytical batch or every 20 samples, whichever is greater. Trip blanks are generally used only in volatile organic sampling and shipping activities.

Water - Any reference to water in the EPA SW-846 Method refers to American Society for Testing and Materials (ASTM) Type II reagent water (unless otherwise specified) which is free of contaminants that may interfere with the analytical test in question.

ATTACHMENT J-2

LOS ALAMOS NATIONAL LABORATORY INSTALLATION WORK PLAN FOR ENVIRONMENTAL RESTORATION, ANNEX IV, RECORDS MANAGEMENT PROGRAM PLAN

1.0 INTRODUCTION

This document constitutes the Records Management Program Plan for the Environmental Restoration (ER) Program at Los Alamos National Laboratory (the Laboratory), which is being implemented by the Department of Energy (DOE) and the University of California (UC). At this stage of the ER Program, certain aspects of the plan are being redefined and are considered future goals. This plan is intended to establish general guidelines for records management, including technical data sets. The specific methods and details of protecting records are implemented through quality procedures (QPs), administrative procedures (APs), standard operating procedures (SOPs), and management guidance developed in cooperation with the ER Program's quality assurance staff and the Laboratory's Records Management Program requirements document (LANL 1992, 0814).

1.1 Organization of Records Management Program Plan

This program plan is organized to interface with the body of the Installation Work Plan (IWP) and is divided into seven major sections. The introduction presents the organization, regulatory mandate, purpose, objectives, and terminology of the plan. Section 2 describes a threefold approach to records management and how it will be implemented. The Records-Processing Facility (RPF) and the Facility for Information Management, Analysis, and Display (FIMAD) are described in Section 3. Sections 4 through 7 describe how the records management program will be coordinated with the quality program, the health and safety (H&S) program, management, and community relations activities.

1.2 Regulatory Mandate

The development and implementation of this plan are mandated by the Hazardous and Solid Waste Amendments (HSWA) Module of the DOE/UC's permit to operate the Laboratory under the Resource Conservation and Recovery Act (RCRA) (EPA 1990, 0306). General requirements for data management are presented in Task II, Section B (p. 7), of the HSWA Module, but many other references to technical data are made throughout the document. The manner in which records of work performed under the permit are managed is of primary importance in ensuring the integrity and intended function of the data and documentation contained in the records submitted to the Environmental Protection Agency (EPA). The ER Program's records also include the publicly accessible documentation composing the administrative record required by the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) (DOE 1991, 0560; EPA 1990, 0559).

1.3 Purpose

The purposes of this Records Management Program Plan are to

- protect and manage records relevant to work conducted under the HSWA Module,
- provide an ongoing tool to support the technical efforts of UC and its ER Program contractors, and

- function as a support system for management decisions throughout the life of the program.

The plan addresses programmatic needs for all forms of technical data, program records, technical literature, and other documentation. The records are collected, organized, indexed, stored, and protected with the goal of providing efficient use and retrievability to a diverse group of users. This goal applies to both manual and automated methods of handling records. The plan enhances interactions with the local community, adjacent communities, the State of New Mexico Environment Department, EPA Region 6, the DOE, and other parties who may have an interest in the ER Program at the Laboratory.

1.4 Objective

This program plan establishes the general guidelines for managing records, regardless of their physical form or characteristics, generated and/or used by the ER Program at the Laboratory. It is important that the plan be consistently implemented to provide an auditable and legally defensible system for records management.

Coordination with other aspects of the ER Program (such as the quality and H&S programs) is important for achieving useful programwide guidelines for managing records and obtaining technical data, which, in some cases, may not be reproducible.

1.5 Terminology

It is important to use terms consistently to ensure that information is correctly conveyed to the reader of this plan. Definitions for records, technical data, information, and other terms are varied and rigorously debated. To ensure consistent use of terms, the statutory definition for "records" (44 USC 3301) is used. "Records" are defined as "...books, papers, maps, photographs, machine-readable materials, or other documentary materials, regardless of physical form or characteristics,...appropriate for preservation...because of the informational value of the data in them." Thus, the term records includes technical data and is used in this document to reflect the broader scope of protecting all ER Program records. This usage is also consistent with the General Records Schedules for environmental records, as defined by the National Archives and Records Administration (1989, 0357).

2.0 DESCRIPTION AND IMPLEMENTATION OF THE RECORDS MANAGEMENT PROGRAM

The general challenge addressed by this plan is summarized in the following question:

> "How will the ER Program's records be handled to ensure the integrity and protection of information, efficient and cost-effective access, and legal and technical defensibility?"

2.1 Plan Description

The plan incorporates a threefold approach based on records control and total commitment to quality program guidelines. This approach includes the following precepts:

- Structured work flow for records. Records control is maintained through a structured work flow and processing procedure for records.

- Use of approved procedures. Quality program requirements are met through the documented use of approved procedures by appropriately trained employees.

- Referable information base. ER Program records are submitted to an information base accessible to ER Program participants and the public while providing records protection through a documented process of change control.

2.2 Plan Implementation

2.2.1 Structured Work Flow for Records

The RPF functions both as an interim repository for records while they are being processed and as a reference library for the ER Program.

2.2.1.1 Submittal of Records

Participants are required to review their records as they are generated to determine whether the information represents an ER record as defined in Section 3.1 of the Procedure for LANL ER Records Management (LANL-ER-AP-02.1). This determination can be made in two ways:

- ER records are those specifically identified in QPs, APs, SOPs, ER Program plans, and management guidance documents.

- ER records are those identified at the discretion of ER Program participants as essential to the program and required for the continued functioning and/or interests of the ER Program.

Submittal of records must be performed as required by LANL-ER-AP-02.1. All technical data, including raw data, must be submitted to the RPF for processing and eventual inclusion in the FIMAD.

Records from program administrators, analytical teams, technical teams, and contractors must be submitted to the RPF in hard copy (i.e., paper, logbooks, or similar media) and, whenever possible, also on machine-readable electronic media. Requirements, formats, and constraints on transferring electronic records are defined in Attachment E of LANL-ER-AP-02.1.

2.2.1.2 Records Flow

Figure IV-1 is a detailed diagram of records flow in the ER Program. The model represents a top-down analysis of the general types of records, which shows how they will proceed through processing from the time of generation to final disposition.

2.2.2 Use of Approved Procedures

Only approved procedures are used for handling records. Personnel involved in processing records are trained in the use of applicable procedures.

2.2.3 Referable Information Base

Records sent to the RPF and the FIMAD provide a base of information to which all program participants can refer. They include records that document ER Program activities at the Laboratory, as well as certain records originating outside the Laboratory ER Program that have been submitted in accordance with the records management procedure.

When the originator needs to change a record in the referable information base, he/she completes an ER Record Correction Form as directed in procedure LANL-ER-AP-02.1. This process ensures that ER Program participants have access to the latest version of the record.

2.3 Special Topics

2.3.1 Operable Unit Work Plans

This Reccrds Management Program Plan is the basis for managing records for all operable units in the ER Program at the Laboratory and meets the HSWA Module requirement for a data management plan. As such, it is cited in Annex IV of each operable unit work plan. The QPs, APs, and SOPs define records requirements for technical work and typically address such matters as how to document samples, measurements, survey locations, and activity logs. Project participants protect the resulting raw data and field records until they are submitted to the RPF in accordance with LANL-ER-AP-02.1.

2.3.2 Technical Data

2.3.2.1 Data Validation

Data validation may be needed to address replicate measurements, to identify outlying values, and to explain results determined to be below detection limits. These conditions are handled in accordance with ER Program SOPs and RCRA facility investigation guidance (EPA 1989, 0088, or later revisions), if applicable. The user may develop alternate means for handling inconsistencies in data as long as the method is documented, reproducible, and technically defensible. Any reduction of data must be documented in accordance with relevant SOPs.

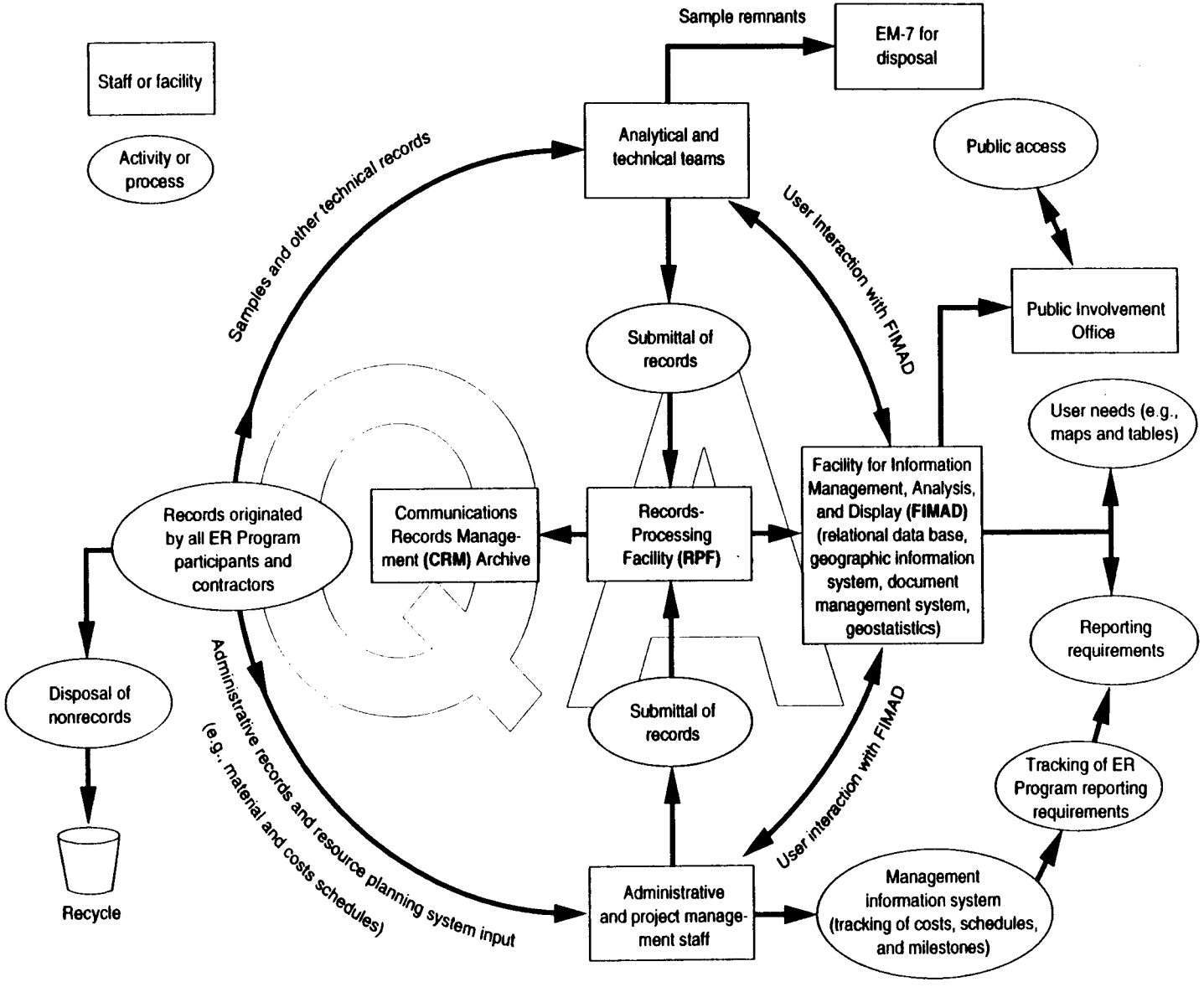

Figure IV-1. Overview of records flow in the ER Program.

2.3.2.2 Data Analysis

Once technical data have been submitted, they become part of the program's referable information base (Section 2.2.3 of this plan). The FIMAD will provide the necessary capabilities for preparing tabular and two- and three-dimensional graphical displays of data, generating maps, performing statistical analyses, sorting data according to various parameters, and meeting similar requirements as specified in ER Program SOPs and the Resource Conservation and Recovery Act (RCRA) corrective action plan (EPA 1988, 0295).

2.3.3 Records Working Group

An ad hoc team of program participants may need to meet periodically to resolve special issues related to records or specific sets of technical data. The group will comprise program participants with appropriate expertise and will be selected and activated as needed by the manager of the ER Program (or designee).

3.0 DESCRIPTION OF RECORDS MANAGEMENT PROGRAM FACILITIES

3.1 Records-Processing Facility

The RPF receives and processes ER Program records to prepare them for delivery to the FIMAD. The RPF, which is located at 2101 Trinity Drive in Los Alamos, currently houses records used in compiling site histories for potential release sites (PRSs). During processing, original records are retained at the RPF in 1-hr fire-rated equipment as defined in the Standard for the Protection of Records of the National Fire Protection Association, Inc. (1986, 0358). Either original documents or a micrographic copy, consistent with guidance obtained from the National Archives and Records Administration and the Laboratory's Records Management Program, are sent to the Laboratory's Communication and Records Management (CRM) Division or a similar long-term storage facility to ensure compliance with NQA-1 (ANSI/ASME 1989, 0018) requirements for retention and protection.

The RPF serves as a reference library that contains information that cannot or should not be entered in the FIMAD or that contains information that is accessed only occasionally (e.g., a large, multivolume, bound report from EPA). The RPF also provides the capability to retrieve records based on a variety of parameters such as keywords, technical areas, dates, PRSs, and structures.

3.2 Facility for Information Management, Analysis, and Display

The ER Program Office has established the FIMAD in Building SM 215, TA-3, which is equipped with the hardware and software necessary to facilitate capture, display, and analysis of data. This information is readily accessible to project participants through a network of work stations. The network will comprise "miniclusters" distributed throughout the Laboratory to allow users, including ER Program contractors and the public, access to the FIMAD. Each minicluster may include graphics work stations and other necessary hardware.

3.2.1 System Capabilities

The system will be capable of executing numerous tasks using X-11 windows in a UNIX operating environment. The planned capabilities are listed below:

- geographic analysis, using the ARC/INFO/ORACLE Geographic Information System (GIS) and the GEOEAS geostatistics package;
- the ORACLE relational data base management system;
- the TOPIC document management system;
- management of video images;
- two- and three-dimensional graphics support for modeling;
- storage, compression, and conversion support for certain types of data;
- integration of various types of information; and
- automated backup and copy to a disaster recovery facility.

3.2.2 System Configuration

The development of the local area network is based on the concept of "open systems," which adhere to existing standards and protocols. Commercial software is used whenever possible to address quality program concerns about code modification and to ensure the best use of limited resources. Software quality assurance guidelines are being developed. The initial system includes RISC-based UNIX work stations, which provide a good port to the ARC/INFO/ORACLE software. This software package is a critical component of the FIMAD because it is compatible with EPA's software.

3.2.3 Configuration Management

Configuration management is being implemented as a means of accounting for, controlling, and reporting the planned and actual design of components for the FIMAD. Configuration management ensures that the latest version of the whole computer system is always approved and accessible. The end product of configuration management is formal documentation of the process of systems development to permit identification of the relevant configuration at any given period in the life of the ER Program. The documentation follows accepted practices for designing and developing information systems. Configuration management during development of FIMAD will permit flexibility in selecting system components.

3.2.4 Electronic Data Acquisition and Quality Control

ER Program participants have access to FIMAD data bases for the purposes of reviewing and updating information; however, only authorized personnel (primarily members of the FIMAD staff) may modify data. The FIMAD staff are also responsible for ensuring the quality of data originating at FIMAD (e.g., orthophoto data and the major portion of the GIS data base). Program participants who provide data to the FIMAD for electronic conversion are responsible for the accuracy of the data they submit to FIMAD; the FIMAD ensures the precision of the electronic conversion only.

3.3 Integrated Capabilities of RPF and FIMAD

The ER Program uses a hybrid approach to records management that incorporates the power and functionality of imaging technology and the reliability and precedent of micrographics.

3.3.1 Optical Disk Storage

Optical storage systems, which efficiently store enormous volumes of paper records, consist of hardware and software that convert hard-copy documents to digital form. Both government agencies and private industry are considering these systems; however, the technology presents some formidable problems relative to industry standards, legal acceptance, longevity of the medium, and costs. Optical disk storage will be used at the FIMAD to efficiently store and disseminate information via the FIMAD network. Legal issues with optical disk storage will be accommodated through the use of micrographics, as described below.

3.3.2 Microfilm

Industry standards for microfilming technology are reliable and widely accepted; therefore, this technology is used for capturing most ER Program records. The ability of the human eye to read a record on microfilm compensates for the lack of hardware standards in some components of optical disk systems. Microfilm standards and legal defensibility are well established. Microfilm may also be used to transmit color graphics information.

3.3.3 File Standards and Compatibility

The ER Program uses several different operating systems, including MS-DOS, Apple, UNIX, and VMS, which are not directly compatible. The problem of file compatibility is neither unique to the ER Program nor is it simple. This plan specifies using systems that adhere to existing standards and protocols to exchange information.

3.4 Progress in Technology

The changes in hardware and software technology are frequent and substantial and demand that attention be given to industry standards. How a product fulfills regulatory requirements for records retention, data access, and legal defensibility

influences which products are selected. Personnel assigned to operate and maintain the RPF and FIMAD keep abreast of industry trends and recommend conversions and/or modifications to the system, as necessary, to keep it a viable component of the ER Program.

Retention requirements for many records extend well beyond the typical life of systems currently used. Retention requirements are met by converting records, where practicable, to archive quality micrographic media, subject to regulatory guidelines and approval.

4.0 COORDINATION WITH THE QUALITY PROGRAM

LANL-ER-AP-02.1, which is approved by the quality project leader, is used for managing program records. The procedures and any revisions are written in accordance with LANL-ER-AP-01.1, Preparation, Review, and Approval of Administrative Procedures. The procedure is applied uniformly throughout the ER Program to achieve the objectives of this plan and to fulfill the obligations defined in the HSWA Module.

4.1 Records Protection Before Submittal

Program participants should carefully manage records, documentation, and technical data resulting from ER Program activities. The originator should protect the records in a manner commensurate with the value of the information they contain until they are submitted to the RPF in accordance with LANL-ER-AP-02.1.

4.2 Records Protection During Submittal

Records submitted to the RPF are processed in accordance with LANL-ER-AP-02.1 and other relevant procedures specific to the RPF. The processing steps are summarized below.

- The originating organization sends records to the RPF.
- While the records are being processed, a copy of an indexing form and the original record are retained at the RPF in 1-hr fire-rated equipment as defined in the Standard for the Protection of Records of the National Fire Protection Association, Inc. (National Fire Protection Association, Inc., 1986, 0358).
- When the FIMAD is fully operational, a copy of the record will be forwarded to the FIMAD.

4.3 Records Protection after Submittal

After the records are received at the RPF, the following steps are taken:

- A detailed index form is completed for each record received.
- The records processor makes a microfilm copy of both the record and the index form.

- The information from the index form is entered in the ER record data base.

- A quarterly report of records received at the RPF is sent to the originator. The original record (or a microfilm copy), which has been temporarily stored at the RPF, is forwarded to CRM Division for long-term storage. Working copies of the records are made available at the RPF and will eventually be made available through the FIMAD.

5.0 COORDINATION WITH THE HEALTH AND SAFETY PROGRAM

Certain health and safety records that result from ER Program activities are to be included in the referable information base. This information pertains to safety training and medical surveillance of each person working at a PRS. Because of the confidential nature of certain types of medical information, many records are appropriately maintained in the Occupational Medicine Group's (HS-2's) data base or by participating contractors. For convenience, training records are maintained by the appropriate Laboratory organization or by the contractors, and the ER records contain only information about the completion of training, the dates of required refresher training, and the location of the training records. The information fields to be included are

- a unique identifier for each worker,
- employer,
- dates of work at each hazardous waste site,
- dates required training was completed,
- dates of medical examinations,
- locations of training and medical examination records, and
- dates of required refresher training.

6.0 COORDINATION WITH THE ER MANAGEMENT INFORMATION SYSTEM

The ER Program's management information system monitors costs, schedules, and deliverables. The software has the capability of monitoring the reporting documents required by the ER Program, all of which are integrated in the system (as milestones or deliverables) and are disseminated to ER Program staff at regular intervals. Specific regulatory requirements for reporting, including data types and report frequency, are incorporated in the systems information. Any special reporting requirements and applicable restrictions on data type and format (e.g., cost and schedule control systems criteria or major systems acquisition) are also included.

Work breakdown structure (WBS) and activity data sheet identifiers are being integrated in the indexing plan for records as an option for querying records. Concerns about changes in the WBS and similar identifiers are legitimate and justify the decision not to use these numbers as primary indices for records.

7.0 COORDINATION WITH THE COMMUNITY RELATIONS PROGRAM

RCRA and CERCLA require that records be made available to the public. Two complementary approaches that give the public access are under way; however, because protection of the data is imperative, system security is weighted heavily in determining the optimal solution. The RPF houses the administrative record required by CERCLA. Electronic copies will be accessible through FIMAD.

7.1 Hard Copy

Hard-copy files will supplement electronic records and will be retained in a reading room accessible to the public.

7.2 Electronic Access

The best approach to providing public access to data in a manner that protects the data base has not yet been finalized; however, a computer work station or optical reading device will be used.

References for Annex IV

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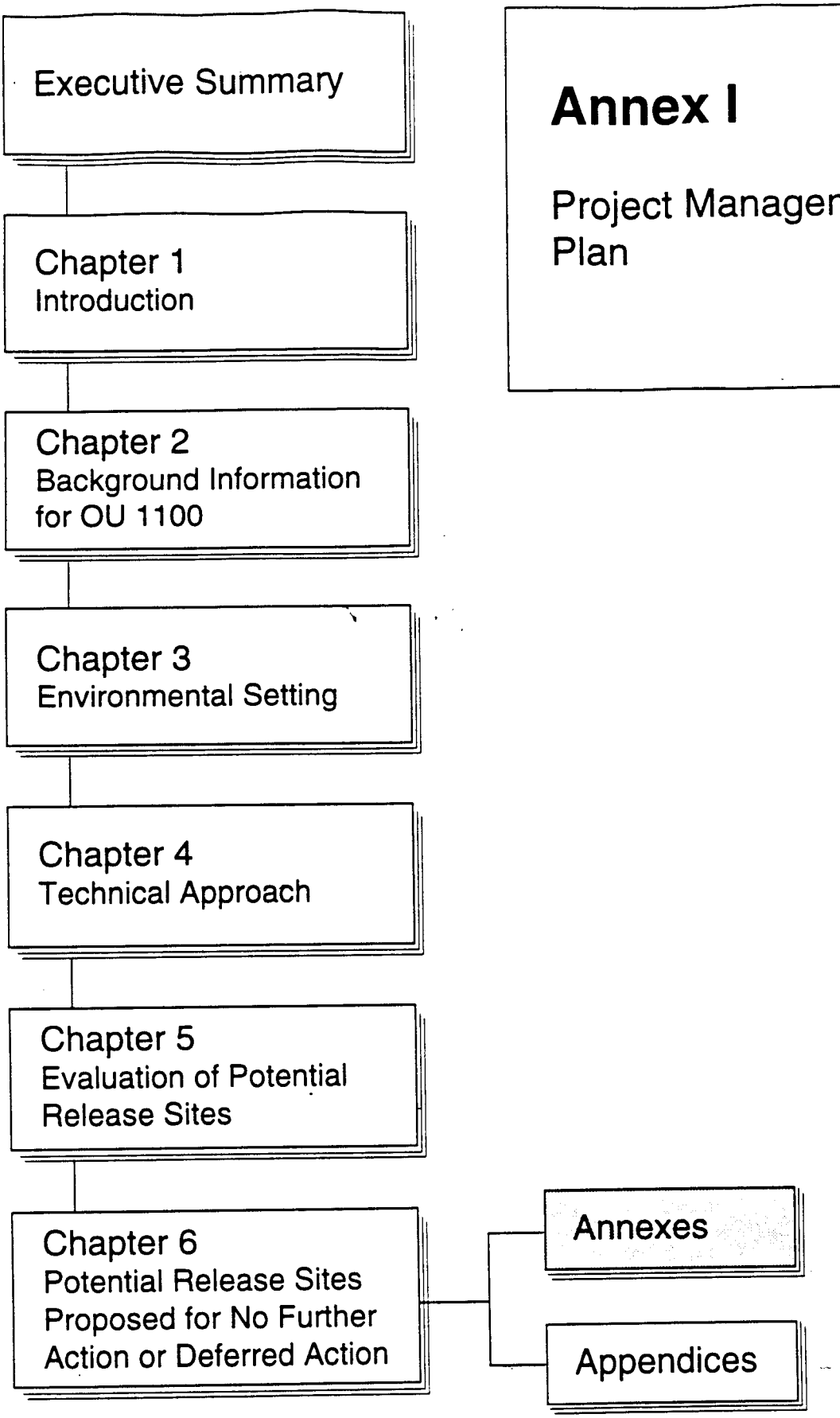
National Fire Protection Association, Inc., 1986. "Standard for the Protection of Records," NFPA 232, Batterymarch Park, Quincy, Massachusetts. (National Fire Protection Association, Inc., 1986, 0358)

ATTACHMENT J-3

RFI WORK PLAN FOR OU 1100, ANNEX I, PROJECT MANAGEMENT PLAN

Annex I

Project Management Plan



1.0 PROJECT MANAGEMENT PLAN

This annex provides the technical approach, schedule, reporting requirements, budget, organization and responsibilities for the implementation of the (RCRA) facilities investigation (RFI) for OU 1100. This project management plan (PMP) is an extension of ER Program's Management Plan described in Annex I of the IWP (LANL 1993, 1017) and follows the DOE's basic management philosophy outlined in DOE Order 4700.1, Project Management System (DOE 1987, 0069). This annex discusses the requirements for PMPs set forth in the HSWA Module (Task II, E, p. 39) of the Laboratory's permit to operate under RCRA (EPA 1990, 0306) as they pertain to OU 1100. Qualifications of key personnel, including contractors, are also provided.

1.1 Technical Approach

The technical approach to the RFI for OU 1100 is described in Chapter 4 of this work plan. This approach is based on the ER Program's overall approach to the RFI/corrective measures study (CMS) process as described in Chapter 4 of the IWP. The following key features characterize the ER Program's approach:

- use of preselected "screening action levels" as criteria to trigger voluntary corrective action (VCA) or Phase II investigations;
- site characterization based on a "sample and analysis" approach;
- use of decision analysis and cost-effectiveness studies in selecting remedial corrective measures and their remedial alternatives; and
- the application of an "observational," or "streamlined," approach to the RFI/CMS process.

The general philosophy of the RFI/CMS process is to develop and iteratively refine the OU 1100 conceptual exposure model through carefully planned stages of investigation and data interpretation. This will be followed by a study that investigates and proposes various methods for addressing potential release sites (PRSs) that are determined to need remediation. Another objective is to use the minimum data necessary to support either interim corrective measures or a CMS.

1.2 Technical Objectives

The technical objectives of this work plan, and the subsequent RFI, are to

- locate, or confirm the location of, each PRS within OU 1100;
- through Phase I investigations, identify contaminants present at each PRS and the concentrations within structures and environmental media;

- conduct VCAs and propose no further action (NFA) or Phase II investigations as appropriate;
- determine the vertical and horizontal extent of the contamination at each PRS during Phase II investigations, as may be required;
- identify contaminant migration pathways during Phase II investigations;
- acquire sufficient information to allow quantitative assessment of migration pathways and the associated risk for all PRSs carried forward to Phase II investigations; and
- determine if a CMS is required.

2.0 SCHEDULE

The plan and schedule for the RFI/CMS process were developed as a joint effort between the operable unit project leader (OUPL) and the management information system staff of the ER Program Office. The initial step was to develop and agree on an ER Program-wide work breakdown structure at the upper levels (i.e., Level 1 down through Level 6, which included all the operable units). Level 6 was expanded for OU 1100 and all the necessary activities were graphically laid out on a detailed logic diagram. All of the activities were related to each other by sequence (i.e., before, after, or in parallel with). Duration (in working days) and cost estimates (in dollars) were made for each of the activities. The schedule and cost estimate were calculated as a function of time and were calculated first as a financially unconstrained case and were then replanned to account for constrained funding, which was already allocated for fiscal year (FY) 93. Key milestones for the RFI are presented in Table I-1. A CMS is not anticipated for OU 1100, but will be scheduled if Phase II investigations indicate a need.

Implementation of RFI activities is contingent on regulatory review and approval of this work plan and on available funding. The assumptions used to generate this schedule include the following:

- Review and approval of the work plan and supporting project plans by regulatory agencies are scheduled to be completed by September 1, 1994.
- Certain tasks may be initiated before the regulatory agencies grant final approval of the work plan.
- PRSs expected to require subsequent investigations have been scheduled earlier in the RFI to allow time for data assessment and subsequent investigations.

TABLE I-1

SCHEDULE FOR OU 1100 RCRA FACILITY INVESTIGATION AND CORRECTIVE MEASURES STUDY

Milestone	Date
Start RFI Work Plan	10/01/92
DOE Draft RFI Work Plan Completed	01/03/94
EPA/New Mexico Environment Department (NMED) RFI Work Plan Submitted	05/23/94
EPA/NMED Draft of Phase I Report Completed	06/07/96
EPA/NMED Draft of RFI Report Completed	11/04/98

- The schedule assumes that an adequate number of support personnel (e.g., health and safety technicians, trained drilling contractors) will be available for conducting necessary tasks.
- EPA review and comments on phase reports/work plan modifications are assumed to take two months. Another month is allowed for Laboratory revision and EPA final approval.
- Adequate funding is available to accomplish the work shown in the plan and schedule.

3.0 REPORTING

Results of the RFI field work will be presented in four principal documents:

- ER quarterly technical reports.
- Phase reports/work plan modifications.
- RFI report.
- CMS report (as required).

These reports are summarized in the following sections. A schedule for submission of draft and final reports is presented in Table I-2.

TABLE I-2

REPORTS PLANNED FOR THE OU 1100 RFI

Type of Report and Subject	Draft Date	Final Date
ER Quarterly Technical Reports • Summary of Technical Activities and Data		03/31 (yearly) 06/30 (yearly) 09/30 (yearly) 12/31 (yearly)
Phase Reports/Work Plan Modifications • Phase I Report • Phase II Report	06/07/96	
RFI Report • Final RFI Report	11/04/98	

3.1 ER Quarterly Technical Reports

As the OU 1100 RFI is implemented, technical progress will be summarized in quarterly technical progress reports submitted by the ER Program, as required by the HSWA Module of the Laboratory's RCRA Part B operating permit (Task V, C, p. 46). Detailed technical assessments will be provided in phase reports/work plan modifications.

3.2 Phase Reports/Work Plan Modifications

Phase reports/work plan modifications will be submitted at the end of each phase for work conducted on PRSs in this operable unit. The first report will summarize Phase I results on initial site characterization and describe the proposed follow-on activities of Phase II, including any modifications to field sampling plans suggested by the Phase I results. This report will also identify any PRSs proposed for NFA. A Phase II report (as distinct from a final RFI report) will be prepared only if Phase II investigations are proposed. The standard outline for a phase report/work plan modification is presented in Section 3.5.1.2 of the IWP (LANL 1993, 1017) and may be modified as needed.

3.3 RFI Report

The RFI report will summarize all field work conducted during the duration of the RFI. The RFI report will describe the procedures, methods, and results of field investigations and will include information on the types and extent of contamination, sources and migration pathways, and actual and potential receptors. The report will also contain adequate information to support the delisting of NFA sites and corrective action decisions.

3.4 CMS Report

A CMS is not currently anticipated for OU 1100. However, if needed, the CMS report will propose methods of remediation for selected PRSs listed in the RFI

report. Not all PRSs will need remediation because some will have been delisted based on recommendations made in the RFI report. The CMS report will describe the proposed remediation methods, procedures, and expected results, along with a plan, schedule, and cost estimate.

4.0 BUDGET

It is impractical (almost impossible) to separate schedule and cost because changing one affects the other. For example, the start and end dates for OU 1100 were fixed by a combination of regulations and the requirements of the ER Program Office. These schedule decisions affect the cost as a function of time.

The detailed planning, scheduling, and cost estimating were done in late FY 91 and have recently been revised as part of a baseline change proposal submitted to DOE in FY 94. As stated previously, the schedule and cost estimate were calculated first as a financially unconstrained case and were then replanned to account for constrained funding that was allocated for FY 93. DOE funding decisions are set two years in advance (in this case, for FYs 93 and 94). Therefore, the first year that OU 1100 RFI is not constrained by past budget decisions could be FY 95.

Table I-3 presents project costs for completion of the RFI for OU 1100. Each activity on the logic network was assigned one or more resources (i.e., people, materials, or equipment). Through a rate table, the resources were converted to dollars. The estimated costs are escalated for all years beyond FY 93 and do not contain contingency.

The plan, schedule, and budget (allocation) for FY 93 are now baselined by the DOE's Albuquerque Operations Office. The outyears, FY 94 through 98, are not baselined.

TABLE I-3

ESTIMATED COSTS OF COMPLETING RFI OU 1100

Estimate to Complete	$2,428,000
Escalation	$ 466,000
Prior Years	$ 727,.000
Total at Completion	$3,621,000

5.0 OU 1100 ORGANIZATION AND RESPONSIBILITIES

The organizational structure for the ER Program is presented in Chapter 3 of the IWP (LANL 1993, 1017). ER Program personnel are identified to the technical team leader (TTL) and OUPL level in Figure 3-2 of the IWP, which has been updated and is presented here as Figure I-1. Section 3.3 of the IWP identifies line authority and personnel responsibilities for each position identified in the figure. Records of qualifications and training of all personnel working on the OU 1100 RFI field work will be maintained as ER records. Summaries of their qualifications are presented in Section 6 of this annex.

The management organization for field investigations is shown in Figure I-2. The names of individuals assigned to the positions indicated in the figure have not been determined at this time. The following sections define the responsibilities of the positions identified in Figure I-2.

5.1 Operable Unit Project Leader

The responsibilities of the OUPL are to

- oversee day-to-day operations, including planning, scheduling, and reporting of technical and administrative activities;
- ensure preparation of scientific investigation planning documents and procedures;
- prepare monthly and quarterly reports for the ER Program Manager;
- coordinate with TTLs;
- oversee RFI field work and manage the field teams manager;
- oversee subcontractors, as appropriate;
- conduct technical reviews and direct preparation of final reports;
- comply with the Laboratory's technical requirements for the ER Program;
- interface with the ER quality program project leader (QPPL) to resolve quality concerns and participate with the quality assurance (QA) staff on audits; and
- comply with the ER Program requirements for health and safety, records management, and community relations.

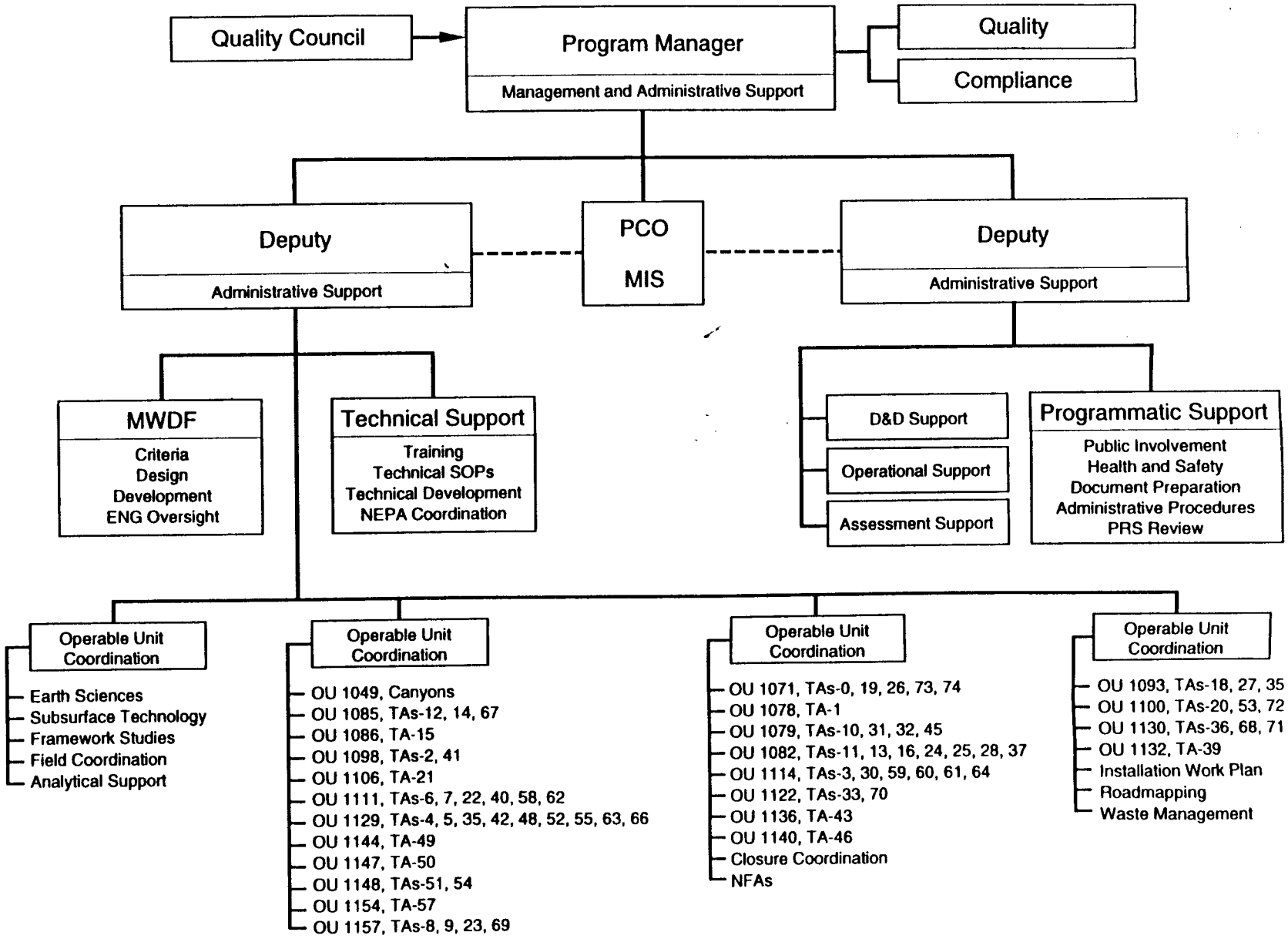


Figure I-1. Environmental Restoration Program organizational structure.

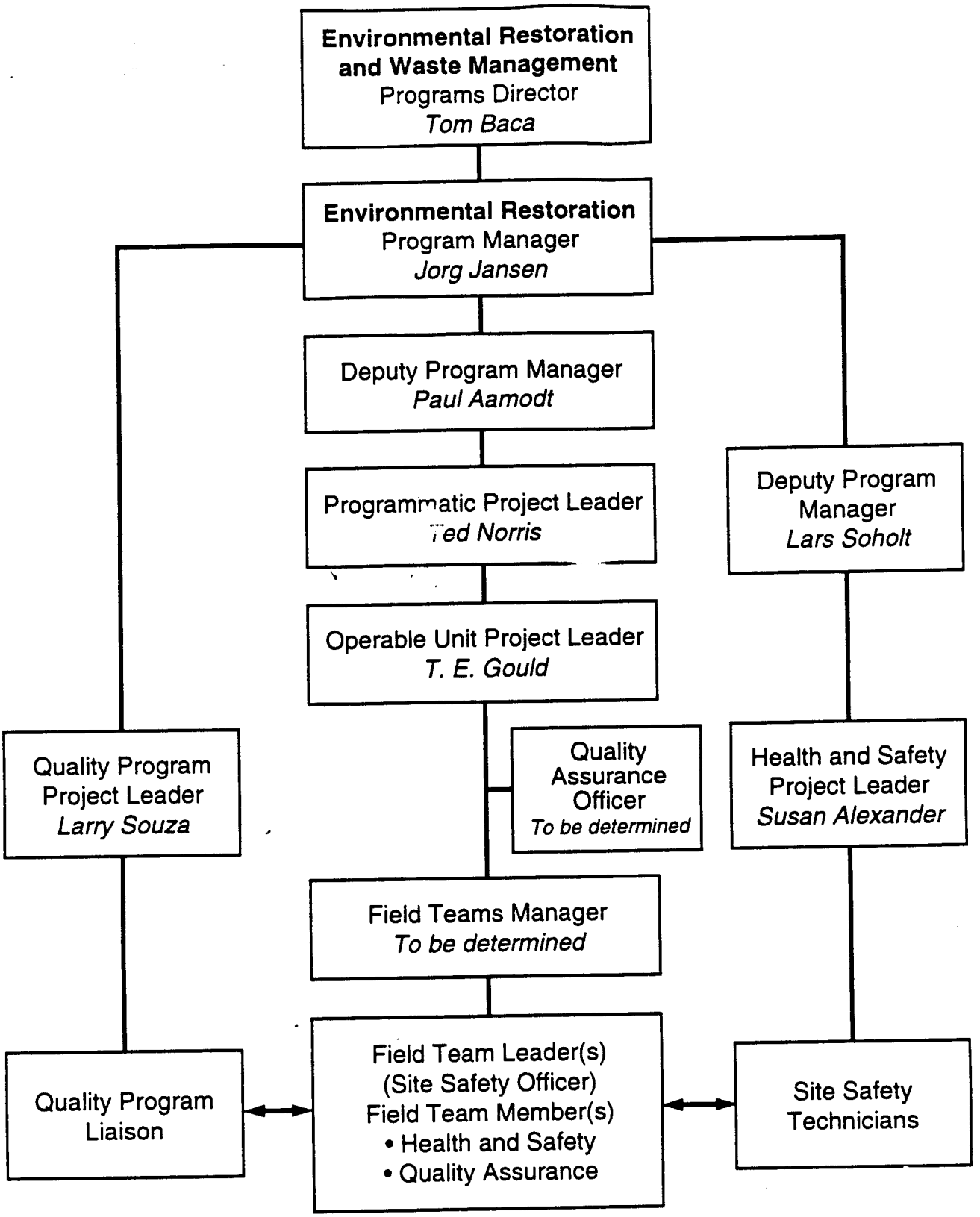


Figure I-2. OU 1100 field organization chart.

5.2 Health and Safety Project Leader

The health and safety project leader sets policies and standards of health and safety for the OU 1100 RFI and supervises the site safety officers.

5.3 Quality Assurance Officer

The quality assurance program that governs the design and implementation of the RFI for OU 1100 is described in Annex II, Quality Assurance Project Plan. The QA officer is responsible for ensuring that these plans are properly incorporated into the implementation of the field investigation, including the selection and location of sampling points, sample collection and processing, data handling, and reporting of results. As shown in the project organization chart, the QA officer reports directly to the OUPL, ensuring the independence of the QA officer from field activities. Although the field team leader has the responsibility of ensuring that all necessary procedures are followed, this independent oversight by the QA officer will provide an extra measure of assurance that the QA program is properly implemented at all stages of the investigation.

5.4 Field Teams Manager

The field teams manager directs day-to-day field operations and conducts planning and scheduling for the implementation of the RFI field activities detailed in Chapter 5.

5.5 Technical Team Leader(s)

TTLs are responsible for providing support in their discipline throughout the RFI/CMS process. During the OU 1100 RFI, the TTLs will participate in the development of the work plan; development of the individual field sampling plans; and performance of the field work, data analysis, report preparation, work plan modifications, and planning of subsequent investigations, as necessary.

The OU 1100 technical team requires these primary disciplines: hydrogeology, statistics, geophysics, geochemistry, and health physics. The composition of the technical team may change with time as the technical expertise needed to implement the OU 1100 RFI changes.

5.6 Field Team Leader(s)

The field team leaders will implement work assignments in the field from the field teams manager. Each field team leader will direct the execution of field sampling activities, using crews of field team members as appropriate. Field team leaders may be contractor personnel.

5.7 Site Safety Officer(s)

The site safety officers observe, advise, and document the execution of the health and safety aspects of the OU 1100 work. They report any procedural violations to the health and safety project leader. The site safety officers may be contractor personnel.

5.8 Field Team Member(s)

Field team members may include sampling personnel, geologists, geophysicists, hydrologists, health physicists, and other required disciplines.

All field team members require access to a site safety officer and a qualified field sampler. They are responsible for conducting the work detailed in field sampling plans, under the direction of the field team leaders. Field team members may be contractor personnel.

6.0 PERSONNEL QUALIFICATIONS

The following personnel hold key positions in the development and implementation of the RFI work plan for OU 1100. Complete resumes for these individuals are available in the ER Program files. Other project staff are identified in Appendix A.

T. E. (Gene) Gould - Operable Unit Project Leader

Mr. Gould holds a BA in history from New Mexico Institute of Mining and Technology (1972) and has earned graduate credits in accounting and business law from the College of Santa Fe. He has received additional training in program management planning and control, management skills development, and indirect cost accounting.

He has been employed at the Laboratory since May 1974, where he has held positions as assistant group leader for M-3 (Denotation Physics), assistant division leader for M-Division (Dynamic Testing), and technical coordinator for the Los Alamos ICF Program. He was appointed OUPL for OU 1100 in July 1992.

C. Joseph English - Work Plan Development Leader for OU 1100

Mr, English received a BS in Civil Engineering (1977) and an MS in Civil Engineering (1979) from Oregon State University. He has taken additional course work in hydrology and organic chemistry and has training in hazardous waste operations and emergency response.

Mr. English has been employed by ICF Kaiser Engineers since 1985 working on projects involving management of hazardous, radioactive, and mixed wastes. He has been providing support to the Laboratory ER Program since 1992. Prior to 1992, he managed Remedial Investigation/ Feasibility Study (RI/FS) projects for EPA Region 10 under the Superfund Program and managed RI/FS tasks for the US Air Force. Mr. English managed and worked on numerous radioactive and mixed waste projects at the DOE Hanford Site, including preparation of RI Work Plans, historical data reviews for inactive waste sites, RCRA Part B permit applications, RCRA closure plans, and environmental compliance assessments. From 1979 to 1985 Mr. English was employed by Battelle Pacific Northwest Laboratories and Battelle Project Management Division. Mr. English participated in waste management projects for the DOE, EPA, and US Army. He managed and worked on RIs at six Army installations, managed the FS for a Superfund site, helped initiate the CERCLA compliance program at Hanford, and managed

preparation of RCRA Part B permit applications and closure plans for the Y-12 Plant.

Patrick M. Griffin - Assistant Work Plan Development Leader for OU 1100

Dr. Griffin received his BS (1971), MS (1972), and PhD (1980) from the University of California at Berkeley in Geotechnical Engineering. He has received additional training in hydrogeology, geophysical methods, waste management, and environmental regulations.

Dr. Griffin has been employed at Morrison Knudsen Corporation since 1980. During his more than 20 years of professional experience, he has participated in numerous projects related primarily to civil and geotechnical engineering, environmental restoration, and waste management. Dr. Griffin has been providing support to the Laboratory ER Program since early in 1992. Prior to that, he provided remedial design support to the DOE ER project at Weldon Spring and to the DOE Uranium Mill Tailings Remedial Action Project. He also has extensive experience with field investigation and sampling methods, and design and construction of corrective measures for contaminated mining and industrial facilities.

Julie L. Wanslow - Geologist

Ms. Wanslow received a BS in Geology (1981) and a MS in Geology (1985) from the University of Arkansas. She has received additional training in hazardous waste regulations, hazardous material sampling, and groundwater investigations.

Ms. Wanslow was employed by the Environmental Protection Agency in Dallas, Texas, from April 1985 to November 1986, where she evaluated RCRA groundwater monitoring systems/programs for regulatory compliance and technical adequacy, and conducted groundwater inspections at hazardous waste sites. From December 1986 to January 1991, she worked for the Hazardous Waste Section at the New Mexico Environment Department, where she continued to evaluate groundwater monitoring systems/programs and conduct groundwater inspections. This work included analyzing geologic and hydrogeologic data, monitoring system design, sampling programs, groundwater and soil geochemical data for evidence of contamination, and groundwater portions of RCRA permits. From February 1991 to June 1992, she worked for Advanced Sciences, Inc., at the Waste Isolation Project Plant (WIPP) in Carlsbad, New Mexico, and for the WIPP Project Office in Albuquerque, New Mexico, evaluating environmental documents for compliance with certain DOE orders and RCRA regulations. She has been employed by ICF Kaiser Engineers since June 1992, and has provided support to the Laboratory ER Program since December 1992.

Claudine A. Kasunic - Risk Assessor

Ms. Kasunic received a BS degree in Biology from New Mexico State University (1972) and an MS degree in Toxicology from the University of Arizona (1982). She has received additional training in human health and ecological risk assessment.

Ms. Kasunic is a Principal Scientist with ICF Kaiser Engineers and has been providing support to the Laboratory ER Program since 1992. She has provided input to and reviewed RFI Work Plans; developed a technical document addressing the source, environmental fate, and toxicity of PCOCs; and developed general Work Plan input on explosives. Ms. Kasunic has worked in research, industry, and consulting and for the past 8 years has prepared, critiques, and managed human health risk assessments and ecological risk evaluations. She has provided technical information related to sampling, data quality, chemical toxicity, fate and transport, exposure, and risk for the development of work plans and risk assessments.

Wilette M. Wehner - Technical Editor

Ms. Wehner received a BA from Michigan State University in journalism (1972). She was employed by Los Alamos Technical Associates, Inc. from 1974 to 1981, where she provided technical editing on such projects as an Environmental Monitoring Plan for Argonne National Laboratory-East, Proceedings of a Workshop on Atmospheric Research Needs, report of the Lunar Base Working Group, and an environmental impact statement for Idaho National Engineering Laboratory. She has been employed by ICF Kaiser Engineers, in Los Alamos, since 1991. She edited and organized an Occurrence Reporting Handbook addressing compliance with DOE orders and is currently the technical editor for RFI work plans for OUs 1093 and 1100.

Charles Randall Mynard - Designer

Mr. Mynard received a BA from University of Texas at Austin in 1968 majoring in zoology with minors in chemistry and ma[illegible]. He has been employed by the Laboratory since January 1977, beginning with the Illustrations Group, ISD-3, where he provided technical illustrations for nuclear reactor designs, solar, and super-conducting power systems He was hired by Weapons Planning and Coordination Group (WPC-1) in December 1978 to do illustrations for nuclear weapon design proposals. He joined V[illegible]4, now Technical Engineering Support (MEE-4), in June 1980 to do complex e[illegible]neering drawings, computer graphics, 35 mm photography, videotaping, and p[illegible]ide safety support services. As safety representative for MEE-4 since 198[illegible] he plans, schedules, conducts, and documents the group's environmental, safety, and health (ES&H) program, which includes hazard assessment, safety inspections, audits, chemical inventory, chemical waste storage and disposal, hazard communication, ES&H training, and emergency planning. He is presently providing archival research, field surveys, photography, and graphics support services to the ER Program, working on OU 1100.

REFERENCES FOR ANNEX I

DOE (US Department of Energy), March 6, 1987. "Project Management System," DOE Order 4700.1, Washington, DC. (DOE 1987, 0069)

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ATTACHMENT J-4

ER-SOP-01.04

Los Alamos National Laboratory **Environmental Restoration Program** Standard Operating Procedure	No: LANL-ER-SOP-01.04 Rev: 2

SAMPLE CONTROL AND FIELD DOCUMENTATION

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SAMPLE CONTROL AND FIELD DOCUMENTATION

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SAMPLE CONTROL AND FIELD DOCUMENTATION

1.0 PURPOSE

This procedure describes the steps necessary to document the traceability of samples collected for the Environmental Restoration (ER) Program.

2.0 SCOPE

2.1 Applicability

This procedure is applicable to all ER Program activities involving samples collected for regulatory analysis.

2.2 Training

The Operable Unit Project Leader (OUPL), Field Team Leader (FTL), Sample Coordination Facility (SCF) staff, and site workers responsible for collecting samples and preparing documentation should be familiar with the objectives of sample control and documentation. They must document that they have read and understood this procedure.

3.0 DEFINITIONS

Chain-of-Custody: The procedural steps to assure traceability of a sample from initial collection to final disposition.

A sample is in one's custody when one or more of the criteria listed below have been satisfied:

- the sample is in one or more of the field team members physical possession, or
- the sample is in one's view after being in one's physical possession, or
- the sample is in a secure area (accessible only to personnel within the sample chain) and maintained in a manner that any tampering would be evident.

Documentation of the above action provides the evidence that the chain-of custody has been maintained. Chain-of-custody (COC) establishes the traceability of the data derived from the sample to the location from which it was collected.

Field Team: Those authorized individuals present at a sampling site during sample collection. Their presence at the site must be documented. This can be done through Daily Activity Logs, Field Notebooks, or Tailgate Safety Meeting Forms.

4.0 BACKGROUND AND CAUTIONS

All work performed for the ER Program must be documented. Sample control and documentation is necessary to ensure traceability and defensibility of data and to document the work performed in the field. Data collection must be thoroughly and accurately documented. Failure to have complete documentation may result in loss of the validity of field work and may have serious legal ramifications.

5.0 EQUIPMENT

N/A

6.0 PROCEDURES

A. Obtain preprinted forms and supplies associated with this standard operating procedure (SOP) from the Controlled Documents Coordinator at the Records Processing Facility (RPF), or utilize computer-generated forms.

B. Obtain the ER location identification (ID) for the area where sample collection is planned. The location ID is a unique number corresponding to the geographic coordinates that designate an ER Program location. It is obtained from the Facility for Information Management, Analysis, and Display (FIMAD).

C. Make form entries with dark-colored indelible ink; computer or typewritten entries a also acceptable.

D. Separate forms or instructions for media-specific sample collection have been developed for recording explicit data. These forms or instructions will be included in the individual SOPs and will be completed when applicable.

E. Documents shall not be destroyed or discarded even if they are illegible or contain inaccuracies that require replacement documents. Any inaccuracies shall be resolved upon discovery by crossing through the error with a single line, correcting it on the original document, and initialing and dating the correction. If the correction is not self-explanatory, the individual shall assign a number to the correction and attach to the original a sheet that fully describes the correction that has been performed.

6.1 Sample Identification

Preprinted forms and labels have been prepared so that identification and chain-of-custody records can be maintained and sample disposition can be controlled. These items, with the exception of the unique sample number bar code stickers, are obtained from the Controlled Document Coordinator. The unique sample bar code stickers are obtained from the SCF. The labels and forms associated with this procedure are listed below. Examples are provided as Attachments A through G and are listed below.

- unique sample number bar code stickers - SCF
- sample labels - RPF
- sample collection logs - RPF
- master collection log - RPF
- chain-of-custody/request for analysis - RPF
- custody seals - RPF

Computer-generated versions of these forms are acceptable, provided they are functional equivalents. Slight variations in the placement of information is acceptable on computer-generated forms. However, all computer-generated forms must contain the same information identified in this SOP. All sample numbers must be assigned by the SCF.

6.1.1 Unique Sample Bar Code Stickers

1. The ER Program has established a sample identification system that uses preprinted self-adhesive stickers (Attachment A). The FTL will obtain a sufficient supply of bar code stickers from the SCF to accommodate the total samples required by the operable unit (OU) -specific Sampling and Analysis Plan. Each sheet contains four sets of 20 unique sample bar code stickers. Each set consists of one unique number. Each sticker displays a unique seven-character alphanumeric identifier in both human-readable and bar code form.

2. A unique alphanumeric bar code is used per sample even if the sample has more than one sample container. Apply the same sample number to each container of the same sample.

3. One sticker is affixed to each of the following:

   - sample container lid (except 40 mL vials with Teflon™ septa)
   - sample label (containers may be labeled before going to the field)
   - sample collection log
   - master collection log, if used

4. Discard any remaining stickers.

6.1.2 Sample Labels

1. Sample labels (Attachment B) provide information regarding the samples. Preprinted sample labels will be provided by the Controlled Document Coordinator. Alternatively, any label displaying the complete information as listed below is acceptable.

2. Each label should be completed with the following information:

   - Operable Unit
   - Technical Area

- unique sample bar code or bar code sticker
- date and time of collection
- sample location
- location ID obtained from FIMAD
- type of analysis requested
- preservative (if any)
- printed name and initials of collector

3. Ensure that completed sample labels are affixed to the sample containers immediately following the sampling activity if not done previously.

6.1.3 Sample Collection Logs

1. The FTL is responsible for the completion of the Sample Collection Log (Attachment C) and will record all information pertinent to the collection of sample media on this log. A computer-generated, functionally equivalent form is acceptable.

2. A sample collection log will be completed for each sample collected.

3. Information will be supplied for all spaces provided on the Sample Collection Log. If the space is not applicable to a specific project, write not applicable. Record additional information in the comments section. The comment section may be customized to the OU's data needs.

4. Daily entries on these logs will include the following:

   - Date and Time: The date and time when the sample was collected.

   - Technical Area: One or two-digit number indicating the technical area in which the sampling activities are being executed.

   - Operable Unit: Four-digit number indicating the operable unit where sampling activities are being executed.

   - Name/Signature: Printed name and written signature of preparer.

   - Sample Identification: One unique sample bar code or bar code sticker.

   - Control number: A unique number assigned by the OUPL to each COC.

- Sample Location: General description of sampling location (e.g borehole HDH-1 by TA-16-03, outfall samples in Mortandad Canyon, etc.).

- Location ID: A unique identifier associated with the geographic coordinate that designates an ER Program site. It is obtained from FIMAD.

- Sample Type: Example descriptions include soil, ground water, surface water, filter air, charcoal tubes, ambient air, personnel air, sludge, drum contents, oil, vegetation, fauna, wipe, sediment, etc.

- Containers Used: Number, volume, and type of containers used [e.g., two 1-liter glass containers, amber container for volatile organic compounds (VOCs)].

- Analysis Requested: Type of contaminant for which sample is being analyzed (e.g., metals, volatile organic analysis, gamma).

- Composite Type: If composite samples are taken, identify the type of composite sample (e.g., 24-hour composite, spatial composite).

- Depth of Sample: Description of sample intervals in inches or feet and indicate unit (e.g., depth of sample in feet, distance or transe in feet).

- Weather: Approximate temperature, sun and moisture conditions.

- Any additional field observations/comments, which may include but are not limited to the following:

  - sample preservation (e.g., ice, cooled to 4°C, HNO_3);

  - calibration procedures for field equipment; or

  - results of photoionization detection and flame ionization detection in parts per million (ppm).

- SOP Number: The unique identifier of the Los Alamos National Laboratory (the Laboratory) ER SOP utilized to collect the sample.

6.1.4 Master Collection Log

1. The Master Collection Log (Attachment D) or functional equivalent is used to track samples from the site to the mobile lab or SCF and to the final laboratory destination. Use of this form is optional. As some

sites require numerous samples, this log is a helpful organizational tool.

2. The following information is included on this log:

- Date: The date of entry.
- Sheet Number: Number all sheets that are used consecutively (e.g., 1 of 2, 2 of 2, etc.).
- Technical Area: One or two-digit number indicating the technical area in which the sampling activities are being executed.
- Operable Unit: Four-digit number indicating the operable unit where sampling activities are being executed.
- Name of Preparer: Printed name of preparer.
- Sample Identification: Place a unique sample bar code or bar code sticker in the box Affix Sample Sticker for each sample included in the Master Collection Log.
- Date and Time Collected: The date and time when the sample was collected.
- Sample Type: Example descriptions include soil, ground water, surface water, filter air, charcoal tubes, ambient air, personnel air; sludge, drum contents, oil, vegetation, fauna, wipe, sediment, etc.
- Sample Location: General description of sampling location (e.g., borehole HDH-1 by TA-16-03, outfall samples in Mortandad Canyon).
- Date Samples Delivered: Include the date the samples are delivered to either the SCF, Mobile Rad Van, or Mobile Chemical Analysis Van.
- QC Samples: Enter yes or no.
- Location ID: A unique identifier associated with the geographic coordinate that designates an ER Program location. It is obtained from FIMAD.

6.1.5 Chain-of-Custody/Request for Analysis Forms

1. COC (Attachment E) forms are used to document the integrity of all samples, maintain a record of sample collection, transfer between personnel, shipment, and receipt by the laboratory.

2. Complete a COC form for each sample. If required, more than one sample number may appear on a single COC form. Obtain preprinted three-part COC forms or use a computer-generated form. A unique chain-of-custody control number must appear on each three-part set of forms. The control number will have the structure "YYYY-XXXX," where YYYY is the OU designation, and XXXX is a unique sequential number assigned by the OUPL or his designee for each OU. These numbers may be assigned in blocks when taking large numbers of samples. Thus, a sample COC control number for OU 1100 would be "1100-0001." The OUPL has the responsibility for ensuring that unique control numbers are assigned to each three-part set of COCs. Preprinted forms assigned from the Controlled Document Coordinator will not have control numbers entered on them.

3. All copies of the COC must accompany the sample(s) to the mobile rad van (or to the SCF if the sample is delivered there directly). After an individual at the rad van or SCF has acknowledged receipt of samples by signing the COC, the FTL will keep the third, or pink copy. The original (top or white) copy will be kept with the samples and the second (yellow) copy will be sent to the RPF by the SCF.

   NOTE: COC signed off by the rad van is not a completed record. The FTL should retain the pink copy for his/her use only!

4. Information will be supplied for all blank spaces on the COC. If the space is not applicable, write N/A.

5. The COC will contain the following information:

   - Date: The date the COC is filled out.

   - Control Number: A unique number on each COC. (Note: Remember to write this number on the Sample Collection Log(s) that coincides with the sample on the COC. Control numbers are issued by the OUPL.

   - Technical Area: One or two-digit number indicating the technical area in which the sampling activities are being executed.

   - Send lab report to: The name and address of the operable unit contact to whom the contract laboratory results should be sent.

   - Operable Unit: Four-digit number indicating the operable unit where sampling activities are being executed.

   - OU Contact: OUPL or designee, as appropriate.

- Contact Phone No: Give the telephone number of the OUPL or designee indicated as the operable unit contact.

- Date Lab Report Required: Give an approximate date that the lab results are needed.

- Field Unique Sample #/ID: Sample number/identification for each sample in shipment. This number must be printed if computer-generated forms are not being used. (You are making 3 copies).

- Date and Time Collected: For each sample in shipment.

- Grab/Comp.: Indicate if it is a grab sample or composite sample.

- Sample Container Volume/Material: Type and material of sample container used and volume (e. g., 1-L glass, amber container for VOCs).

- Matrix: Sample description (e.g., liquid soil, core, sludge).

- Preservative: Type of preservative used.

- Analysis Requested, Test, Method: Analysis requested for each sample. Also note preferred analytical method, if known.

- Remarks: Any additional remarks that supply relevant information pertaining to the samples (e.g., condition on receipt, etc.).

- Relinquished by: When the possession of the samples is transferred from a field team member to the mobile lab or SCF or to any other authorized person, the individual relinquishing the samples prints and signs his/her name and affiliation and records the date and time on the COC document in the "Relinquished By" box. If computer-generated forms are used, the individuals must sign all copies unless carbons (or the equivalent thereof) are used.

- Received by: The individual receiving the samples prints who signs his/her name and affiliation and ensures that the date and time entered by the person relinquishing the samples is correct. CAUTION: If you do not sign the form in the relinquish block, custody will be broken, and you will have to resample. If computer-generated forms are used, the individuals must sign both copies unless carbons are used.

  NOTE: The individual accepting custody of a sample or set of samples must verify that all containers identified on the chain-of-custody form are contained in the packages(s) being accepted. T

signature on the COC acknowledges that the sample containers have been received.

- Possible Hazard Identification: Indicate if sample(s) is hazardous material and/or suspected to contain high levels of hazardous substances by checking the appropriate space(s): Radiological, Highly Toxic, Flammable, Skin Irritant, Non-Hazard, or Other. If "Other" is selected, indicate in writing what the other hazard is.

- Sample Disposal: Indicate what actions will be taken for final disposal of the samples. Check spaces provided for Return to Client, Disposal by SCF, and Archive. If archived, indicate the number of months. Normally all samples are returned to the SCF and eventually disposed of.

- Comments: Any additional comments are included here.

6. The FTL is responsible for ensuring delivery of the samples to the SCF, the Mobile Rad Van, or the Mobile Chem Van and for the completion of the COC form. The FTL will inspect the form for completeness and accuracy.

6.1.6 Custody Seals

1. Custody seals (Attachment F or functional equivalent) will be used to ensure samples are not tampered with during their shipment to the SCF.

2. The lid of every sample container will be sealed with custody seal. The custody tape will be in contact with the bottle and lid.

3. The custody seal for every sample will be initialed and dated by a member of the sampling team.

4. The sealed sample containers will then be delivered to the SCF, the Mobile Rad Van, or Mobile Chemical Laboratory.

6.2 Field Investigation Summaries

Field Log Books will be used for detailed summaries of information pertaining to the field investigation and for recording additional field data (e.g., unusual events such as storms, etc.) Include information for the Daily Report Form (Attachment G) in the Log Book. The Log Books can be obtained from the Controlled Documents Coordinator. Log Books will be used by field personnel to record all pertinent field information. Review LANL-ER-SOP-03.12 for guidance on use of field notebooks. These Log Books are tracked documents; unique identifying numbers will be issued by the Controlled Documents Coordinator. Log books will be bound notebooks, p paginated with consecutively numbered pages.

6.2.1 Daily Activity Entries

1. The FTL is responsible for preparing daily field reports that briefly summarize each day's progress.

2. If Daily Activity Log Forms (Attachment H) are used, paginate each sheet of the Daily Activity Log for each day (e.g., 1 of 4, 2 of 4, etc.).

3. Entries in the logs will include the following:

   - Date: Month, day, and year at the start of each day and at the top of each page.

   - Time: The time of each activity.

   - Technical Area: One or two-digit number indicating the technical area in which the sampling activities are being executed.

   - Operable Unit: Four-digit number indicating the operable unit in which sampling activities are being executed.

   - Signature: Preparer must sign the entries at the end of each day.

   - Comments: The comments section may include, but is not limited to the following:

     - a general description of daily activities

     - deviations from approved plans or procedures, including justification for deviation

     - field team members' names

     - a description of general field conditions encountered

     - special problems

     - sketches and calculations as they pertain to the job

     - performance of subcontractors, such as their equipment's suitability and adequacy

     - names and affiliations of all personnel onsite doing work for the ER Program

     - supplies and equipment used

- when photographs are taken in the field, the time, date, locatior roll identification number, picture number on the roll, general compass direction, a description of the subject matter, and the photographer's name

- decontamination practices, such as the time decontamination is performed and results of equipment inspection after decontamination

- a description of waste generated as a result of the field investigation

- any additional field observations pertinent to the investigation

6.2.2 Daily Summary

All OUPLs **performing field work** must report daily to the Environmental Restoration Program Office. This policy is to regularly apprise the Program Office of all field activities so that the Program Office can report when called to do so by the Department of Energy-Los Alamos Area Office.

Daily reports are reported on the Synchronize calendar system in the FIMAD. The reports are made in a pop-up note in the "To-Do" section of the OU's calendar in Synchronize. These reports must be made at the end of each field day and must include an overview of activities performed, unusually high screening analytical results, and any unexpected events. Synchronize will enable all interested personnel connected to have access to field information.

If you do nct have Synchronize available, contact FIMAD at 665-2451 and obtain an account to access the electronic calendar system. Until Synchronize is available, submit daily reports through electronic mail

(Eudora) to the Field Coordinator at e-mail number, royb @ er2.lanl.gov, and send a copy to your programmatic project leader.

If you do not have access to Synchronize or Eudora, fax your daily report (Attachment H) to 665-4747.

The Daily Report Form includes the following:

1. Name: Name of preparer

2. Position or Title: Position or title of preparer

3. Date: Month, day, and year

4. OU#: Operable Unit number

5. Time: Time of Daily Report Form preparation

6. PRS#: Number(s) of Potential Release Sites surveyed or sampled in the day's activities

7. Field Activities: Using the given information in the form, complete for the day's activities. Be brief but thorough.

7.0 REFERENCES

LANL-ER-SOPs in Section 1.0, General Instructions
LANL-ER-SOP-03.12, Field Notebook
LANL-ER-AP-02.1, Procedure for the Laboratory ER Records Management

8.0 RECORDS

Field Notebooks
Daily Activity Logs (if completed)
Sample Collection Log
Master Collection Log (optional)
Chain-of-Custody/Request for Analysis Form
Daily Report Form

These records shall be transferred to the ER Records Processing Facility in accordanc with the Administrative Procedure for the Laboratory ER Records Management (LANL-ER-AP-02.1).

9.0 ATTACHMENTS

Attachment A - Unique Sample Bar Code Sticker
Attachment B - Sample Labels
Attachment C - Sample Collection Log
Attachment D - Master Collection Log
Attachment E - Chain-of-Custody/Request for Analysis
Attachment F - Custody Seal
Attachment G - Daily Report Form
Attachment H - Daily Activity Log

UNIQUE SAMPLE NUMBER STICKERS

EXAMPLE ONLY

SAMPLE LABELS

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

LOS ALAMOS NATIONAL LABORATORY	
OU _____ TA _____	AFFIX BAR CODE STICKER HERE
LOCATION:	DATE:
LOCATION ID NO.:	TIME:
ANALYSIS:	PRESERVATIVE:
NAME (print): INITIALS:	

Los Alamos National Laboratory Environmental Restoration
SAMPLE COLLECTION LOG

Date: _____ Time_____

Technical Area _____ Operable Unit _____

AFFIX BAR CODE STICKER HERE

Name/Signature _____

Control No. (from Chain of Custody form)_____

Location ID No _____ Sample Type _____

Sample Location _____

Composite _____ YES _____ NO

Composite Type_____

Depth of Sample _____(in) (ft)

Weather _____

Containers Used	Analysis Requested

LANL ER SOP#_____ was used to collect this sample.

COMMENTS_____

Los Alamos National Laboratory Environmental Restoration
MASTER COLLECTION LOG

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

NAME (print) _____

AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____
AFFIX BAR CODE STICKER HERE	Date/Time Collected _____ Sample Location _____ QC Samples (YES/NO) _____ Location I.D. _____	Sample Type _____ Date Samples Delivered _____

Los Alamos National Laboratory Environmental Restoration
CHAIN OF CUSTODY/REQUEST FOR ANALYSIS

Date: _____ COC _____

Technical Area _____ Send Lab Report to: _____ MS_____

Operable Unit _____

OU Contact _____ Date Lab Report Required _____

Contact Phone No. _____

Field Unique Sample #/ID **(Write in Sample ID Number in space below.)**	Date & Time Collected	GRAB	COMP	Sample Container Volume/Mat'l	Matrix (Liquid, Soil, Core, Sludge, Etc.)	Preservative	ANALYSIS REQUESTED TEST	METHOD	REMARKS (Condition of receipt, etc.)

Relinquished by: *(Signature)*: Affiliation:	Date:	Relinquished by: *(Signature)*: Affiliation:	Date:	Relinquished by: *(Signature)*: Affiliation:	Date:
Received by: *(Signature)*: Affiliation:	Time:	Received by: *(Signature)*: Affiliation:	Time:	Received by: *(Signature)*: Affiliation:	Time:

POSSIBLE HAZARD IDENTIFICATION:
(Please indicate if sample(s) are hazardous materials and/or suspected to contain high levels of hazardous substances)

Radiological____ Highly Toxic____ . Flammable _____ Skin Irritant_____ Non-hazard_____ Other____

SAMPLE DISPOSAL:

Return to client____ disposal by Lab____ Archive____ (indicate number of month(s):__

COMMENTS: _____

Origina F YELLOW - RPF PINK - FTL Copy LANL-ER-SOP-01.04, R2

Los Alamos National Laboratory Environmental Restoration
CUSTODY SEAL

(Example Only)

Los Alamos
Los Alamos National Laboratory
Los Alamos, NM 87545

LAB SAMPLE

DO NOT TAMPER

Date _____

Initials _____

This label is red.

Los Alamos National Laboratory Environmental Restoration Program
DAILY REPORT FORM

Name _____ Date _____

Position or Title _____ OU# _____

Time _____ PRS# _____

Field Activities:

Surveys (i.e., Geodetic, Geophysical, Radiation, etc.)

_____

_____

Drilling Activities: (Number and type hole drilled, type of drilling (split spoon auger, air rotary, etc. Depth completed (daily and total))

_____

_____

Sampling: (Number of samples collected, types of sample media collected analyses requested)

_____

_____

_____

Field Monitoring Results: (Instrument reading above background, high analytical results)

_____

_____

_____

Unexpected Events:

_____

_____

_____

Los Alamos National Laboratory Environmental Restoration
DAILY ACTIVITY LOG

Date: _____ Sheet _____ of _____

Technical Area _____ Operable Unit _____

Site Work Plan _____

Signature _____

Comments:

_____ CHECK HERE IF CONTINUED ON BACK OF THIS SHEET

ATTACHMENT J-5

ER-SOP-01.03

Los Alamos National Laboratory **Environmental Restoration Program** Standard Operating Procedure	No: LANL-ER-SOP-01.03 Rev: 1

HANDLING, PACKAGING AND SHIPPING OF SAMPLES

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Handling, Packaging and Shipping of Samples

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Handling, Packaging, and Shipping of Samples

1.0 PURPOSE

This procedure describes handling, packaging, and shipping of samples collected for the Environmental Restoration (ER) Program. After preparation, the samples are transported to the radiation control (rad) van, chemical analysis (chem) van, or the Sample Coordination Facility (SCF) at TA-59 or TA-35 over public-access roads.

2.0 SCOPE

2.1 Applicability

This procedure is applicable to all ER, rad van, and chem van activities that involve the handling, packaging, or shipping of samples.

2.2 Training

Rad van and chem van personnel, the field team leader (FTL), and field team members must be familiar with the objectives of sample handling, packaging, and shipping and must document that they have read and understood this procedure as well as the other procedures in LANL-ER-SOPs, Section 1.0, General Instructions.

The packaging and transportation of Department of Transportation (DOT)-hazardous materials (including samples and supplies such as acids or gasoline) requires a field team member as well as rad van and chem van operators that are trained according to the Los Alamos National Laboratory (LANL) designation, Driver III. Contact BUS-6 for specific information on training requirements.

Packaging hazardous or radioactive samples requires more extensive training. Contact the training office of BUS-6 for further information if it is necessary.

3.0 DEFINITIONS

A. Environmental samples: Air, soil, water, or other media samples that are collected from streams, wells, and soils or other locations and are not expected to exhibit properties classified by DOT as hazardous.

B. Hazardous samples: Samples of on-site air particulates, soil, or water and materials collected at waste sites that are known or thought to meet the definition of a hazard class as defined in 49 CFR 171.8. In this SOP, "hazardous" does <u>not</u> refer to Resource Conservation Recovery Act (RCRA) hazardous wastes unless so stated.

C. ORM-D material: Other Regulated Material such as a consumer commodity, which although otherwise subject to the regulations of Subchapter C of 49 CFR 100, presents a limited hazard during transportation due to the form, quantity, and packaging. It must be a material for which exceptions are provided in the 49 CFR 172.101 Table.

D. Radioactive material: Any material having a specific activity greater than 2 nanocuries per gram (nCi/g), is the activity per unit mass of the material and in which the radionuclide is evenly distributed. (This is a DOT definition.)

4.0 BACKGROUND AND/OR CAUTIONS

In general, samples taken for the ER Program are expected to have low concentration of potential contaminants, although higher concentrations will be present in some cases. These low-concentration samples that do not satisfy the DOT hazard class definitions are classified as environmental samples and are thus not subject to DOT regulations. Historical data, knowledge-of-process, and field-screening results will assist the team members in making decisions as to whether a sample can be designated as "environmental" or need to be treated as a DOT hazardous material.

The samples are handled according to good field practice for environmental samples and according to regulations for hazardous samples. During shipment of samples, the sample integrity must be maintained. The health and safety of people and the environment must be protected from detrimental effects of hazardous materials if the samples are hazardous materials.

This SOP directs the preparation for shipping of environmental and sanitary waste samples. For DOT hazardous samples, including radioactive samples, this SOP guides the field team members to appropriate assistance.

All sample collection must be coordinated with the SCF coordinator for numbers and types of samples, analyses required, schedule for collection, numbers of containers required, and all other pertinent preparation information. The SCF staff schedules chemical analyses in cooperation with participating commercial and CST-9, Health and Protection Chemistry Group, analytical laboratories.

All samples collected for analysis are transported either to the rad van, chem van, or SCF for analytical services. A sample custodian will review each sample for proper sample size, container, preservative, and labels. The custodian documents any discrepancies in these areas and notifies the FTL of the possible consequences of these discrepancies and possible corrective actions. The custody of samples is then transferred to SCF.

A final data package is to be sent to the SCF staff for review by the participating laboratory. After the data have been validated, the report containing the chemical analyses will be released to the Operable Unit Project Leader (OUPL) and transferred to the ER Program's information management computer system.

5.0 EQUIPMENT

N/A

6.0 PROCEDURE

A. Classify samples collected at a site as either environmental (non-hazardous) or hazardous (including radioactive) samples according to the DOT requirements. Preliminary classification must be made in the field to ensure that the samples are transported on public-access roads safely and according to regulations. Use Sections 6.1 and 6.2 of this SOP as guides to determine characterization of sample types and applicable packaging requirements for the samples. See Attachment A for a flow chart.

B. Preserve and package samples being collected for the Laboratory's ER Program according to EPA requirements. Refer to LANL-ER-SOP-01.02, Sample Containers and Preservation for guidance.

C. Seal and label samples prior to packing the samples. Ensure that the sample containers and containers used for transport exhibit no external contamination. If necessary, decontaminate the containers according to equipment decontamination procedures.

D. Pack all samples so as to minimize the possibility of breakage during shipment. For all liquid samples, place sufficient absorbent material in the transport container to absorb all contained liquids in the event of a sample container breakage. Seal or lock the package so that any tampering can be readily detected.

E. For transport of hazardous samples or materials, prepare a Hazardous Materials Transfer Form, if applicable. Material must be packaged, marked and labeled in accordance with DOT regulations. The Hazardous Materials Transfer Form can be obtained from BUS-6 Customer Service or SCF. The Hazardous Materials Transfer Form must contain <u>two</u> 24-hour emergency telephone numbers, and a copy of the form must be sent to the Emergency Management Office.

F. After all samples are collected, packaged, and preserved, transport them to the rad van, chem van, or SCF under chain-of-custody. After the samples have been verified with the chain-of-custody documentation, a field team member relinquishes custody to rad van, chem van, or SCF personnel. Rad van or chem van personnel must maintain proper control of the samples in their custody and must reseal the packages containing samples before transporting the samples to the SCF.

G. Deliver samples to the rad van, chem van, or SCF during any legal workday between the hours of 8:00 a.m. and 12:00 p.m. and 1:00 p.m. and 5:00 p.m. Special arrangements can be made with the SCF coordinator for sample delivery during off hours.

H. All comments and any deviations from this procedure must be documented on the Daily Activity Log per SOP-01.04, Sample Control and Field Documentation.

6.1 Non-Hazardous or Environmental Samples

In general, samples that are collected in non-laboratory-use areas (for example, from wetlands, wells, and soils) are not expected to be contaminated with levels of hazardous or radioactive materials high enough to be considered hazardous by DOT. Most sampling is being performed to eliminate the question of contamination at waste management sites, and unless historical data, knowledge of process, or screening results suggest that samples are DOT-hazardous, samples will be transported as non-hazardous. Follow the instructions in Attachment B for packaging and handling environmental samples.

Samples taken from inactive sanitary waste lagoon or septic systems are exempt from all DOT and International Air Transport Authority (IATA) requirements if the sample collector can verify that the samples no longer contain infectious material. See Attachment C for instructions on handling sanitary waste.

6.2 Hazardous Samples

Although the sample media in the ER Program is expected to be soil, water, or sludge, the ER Program may have cause to sample pure product waste or highly concentrated hazardous material. If the amount of the hazardous material in the sample is small, it may be shipped under the DOT limited- or small-quantity exceptions. Small quantities of hazardous material are excepted from the DOT requirements for packaging, shipping papers, labels, and placards for that hazardous material and can be shipped as environmental samples. See exception for small quantities in 49 CFR 173.4. Hazardous materials may be transported under the limited quantity exception if that material has an excepted noted in column 8A of Table 49 CFR 172.101. Actual quantities are given in the reference indicated in Column 8A. The shipment of limited quantities must follow all requirements in the referenced section. Excepted radioactive samples must be accompanied by the specified information indicated in Section 6.2.2 of this document. For assistance, contact BUS-6 (667-4127).

6.2.1 Non-Radioactive Samples

Samples known or expected to be classified as DOT-hazardous materials must be transported according to DOT requirements. After determination of the hazardous characteristics, the selection of the appropriate hazard class and packaging exceptions, if any, can be determined from the list and text presented in 49 CFR 173.2. Attachment D provides a listing of the hazard classes and references for definitions and labeling.

Except for sanitary waste, if a known hazardous sample is to be shipped, BUS-6 must be contacted (667-4127) or SCF for assistance. In addition to the more stringent shipping requirements for hazardous samples, additional training requirements must be met to prepare these samples for transportation.

Samples taken from sanitary waste in active septic tanks or sewage lagoons can be classified as Diagnostic Specimens, which exempt them from special handling during ground transportation by 49 CFR 173.196 (h)(1). However, because these samples may be shipped by air for off-site analysis, the field team members must collect them in

the proper containers with all the appropriate packaging, per IATA. See Attachment D for collection and packaging requirements for sanitary waste samples.

CAUTION: nitric acid, which is used as a sample preservative, has restrictive DOT packaging and transportation requirements, with no exceptions allowed. All regulations in 49 CFR 172.101 and 173.158 must be followed when moving any amount of undiluted nitric acid. However, water samples preserved by nitric acid (or any other additive) are no longer forbidden because of the dilution of the nitric acid according to 49 CFR 172.101(d)(1) and can be packaged and shipped following standard practice for shipping environmental samples.

Shipment of samples preserved by DOT-regulated hazardous materials are also addressed by 40 CFR 136.3, Table II, Note 3.

6.2.2 Radioactive Samples

Most of the samples taken at ER sites will be of activity levels of 2 nCi/g or less. Since DOT only regulates radioactive material with a specific activity greater than 2 nCi/g, most samples taken at ER sites may be handled as an environmental samples unless other regulated hazards are identified or presumed to exist in the sample.

Because the DOT specifies curie amounts, which are not field readings, Attachment E, the summary table for DOT requirements for radioactive material, indicates some approximate disintegrations per minute (d/m). The health physics technician can convert d/m to counts per minute (c/m) for field readings. In this way, the health physics technician will be able to determine if a sample is above 2 nCi/g, approximately 4.4×10^3 d/m.

The LANL Radiation Protection Group (ESH-1) has established action levels of radioactivity in the ER Model Site-Specific Health and Safety Plan to alert the health physics technician of increased requirements for workers protection. Action Levels I and II, noted in Attachment E, are below the DOT-regulated radioactivity. Even though the LANL action levels of radioactivity are not regulated by DOT, special safety precautions must be taken if the activity at a sample location indicates one of the action levels. Be sure to follow all requirements in the Site-Specific Health and Safety Plan.

For materials exceeding the minimum 2 nCi/g activity, the following information applies. Contact BUS-6 for assistance if the health physics technician indicates readings in the following ranges:

A. For materials with activities of greater than 2 nCi/g but less than Type A quantities, DOT identifies a limited-quantity category and specifications for excepted packaging. Radioactive materials in the limited-quantity category may

be transported with minimum restrictions. See Attachment E for a summary sheet of DOT categories and levels of radioactivity in this category. Limited-quantity shipments must have the following label:

> **This package conforms to the conditions and limitations specified in 49 CFR 173.421 for radioactive material, excepted package-limited quantity of material, UN2910.**

B. Type A and B quantity samples are not expected in the ER Program. However, the summary sheet indicates the continuum of shipping requirements for all radioactive material. The summary sheet also indicates d/m for some isotopes that would cause those isotopes to be shipped as Type A material.

Also, be sure to keep the SCF coordinator informed if levels of radioactivity are in the action level or limited-quantity ranges. Refer to Attachment E for activities for these ranges. The SCF coordinator will need to make special arrangements for handling the samples to keep SCF personnel from unknowingly receiving doses of radiation and to keep SCF equipment from contamination.

If 2 nCi/g activity is exceeded, and a package for transportation must be shipped limited quantity, follow the packaging requirements listed in the summary sheet. Contact BUS-6 or SCF for assistance.

7.0 REFERENCES

The following are directly related to this procedure and should be reviewed before field operations:

LANL-ER-SOPs in Section 1.0, General Instructions.

LANL Environmental Safety and Health Administrative Requirements, AR 10-3, Hazardous and Mixed Waste.

40 CFR, 1993. Code of Federal Regulations, Title 49, U.S. Environmental Protection Agency, Parts 100 -149. July 1, 1993, U.S. Government Printing Office, Washington, D.C.

49 CFR. 1994. Code of Federal Regulations, Title 49, U.S. Department of Transportation, Parts 100-199. October 1, 1992. U.S. Government Printing Office, Washington, D.C.

Charlton, Thomas J., P.E., Chief, Standards Division, Office of Hazardous Materials Regulation, Materials Transportation Bureau, DOT, Letter to Myron D. Lair, P.E., Chief, Hazardous Waste Section, ESB, ESD, Region IV, EPA, March 22, 1985.

Dangerous Goods Regulations, International Air Transport Authority. 35th Edition, Effective January 1, 1994.

EPA Region IV, 1991. Standard Operating Procedures and Quality Assurance Manual. Environmental Services Division, Athens, GA.

Los Alamos National Laboratory, 1993. Installation Work Plan for Environmental Restoration. LA-UR-93-3987.

Weitzman, David, "Final Regulation Package for Compliance with DOT Regulations in the Shipment of Environmental Laboratory Samples," Memo from Work Group Chairman, Office of Occupational Health and Safety (PM-273), EPA, April 13, 1981.

8.0 RECORDS

A. Completed Chain-of-Custody/Request for Analysis Form

B. Completed Daily Activity Log

C. Copy of the Hazardous Material Transportation Form, if applicable

It is the responsibility of the OUPL to ensure that records are transmitted to the Records Processing Facility, MS M707.

9.0 ATTACHMENTS

A. Flow Chart for Sample Classification for Shipping

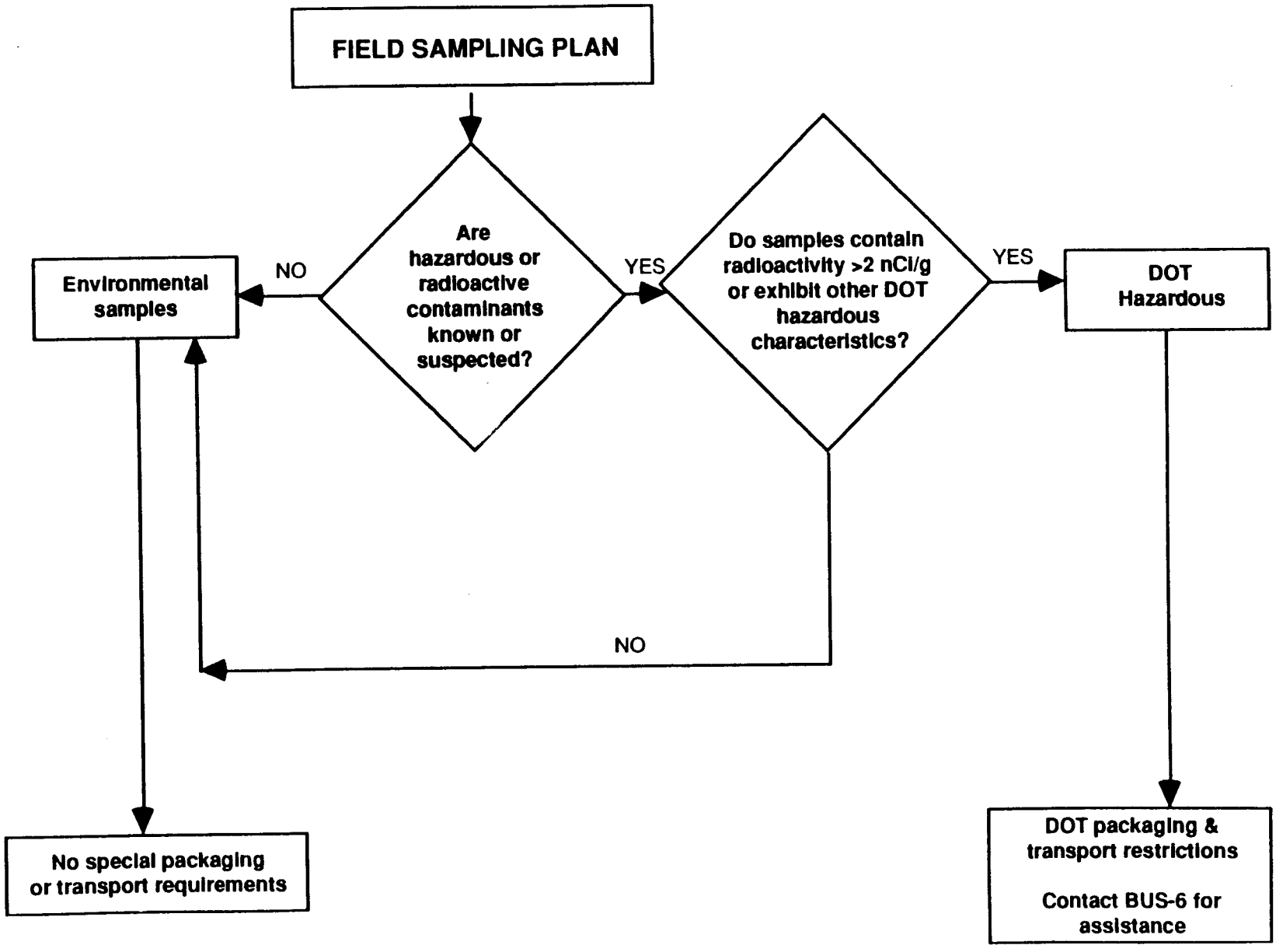
B. Preparation of Environmental Samples for shipment

C. DOT Hazardous Material Classification

D. Preparation of Sanitary Waste Samples for Shipment

E. Range of Material Radioactivities and Corresponding Transportation Requirements

FLOW CHART FOR SAMPLE CLASSIFICATION FOR SHIPPING



PREPARATION OF ENVIRONMENTAL SAMPLES FOR SHIPMENT

Environmental samples must be prepared for delivery in the following manner:

A. Packaging

1. Before any samples are placed in their delivery containers, the exterior of the sample containers should be decontaminated, if appropriate, and wiped dry.

2. For purposes of controlling leakage, sample containers should be placed, properly labeled and securely sealed, into a polyethylene sealable (e.g., Ziplock®) bag and the bag sealed.

3. If there are multiple sample containers, care should be taken to prevent breakage. Styrofoam "peanuts" or other cushioning material should be used as appropriate to prevent multiple samples from being broken during movement.

4. If the FTL deems it necessary for liquid samples, sufficient absorbent material should be placed in the cooler (or other transport container) to absorb all liquid in the event of a sample container breakage.

5. For samples requiring preservation at 4°C ± 2°C, the samples with ice or Blue Ice™ should be placed in a sturdy ice chest. The presence of ice or frozen Blue Ice™ in an amount approximately equal to the volume of samples is sufficient indication that the samples are adequately cooled.

6. When wet ice is used, it must be placed in sealed containers, such as doubled Ziplock® bags, so water does not fill the cooler as the ice melts.

HINT: If wet ice is to be used, try to purchase and use the "old" ice (bags at the bottom of the store's freezer) because newly delivered ice is not as efficient as ice that has been in the store's freezer for several days.

7. If samples are to be immediately chilled to below 4°C before delivery, they must be totally immersed in a separate cooler containing an ice slush solution that is below 4°C. To ensure this tempature before placing samples in the delivery container, a sample container of the same size filled with distilled water can be checked with a thermometer to determine when the samples have reached the desired temperature. The temperature check must be recorded.

8. Water samples must not be frozen or shipped with dry ice.

9. When using Blue Ice™, samples for volatile organic analysis (VOA) must be wrapped with bubble pads because direct contact between the samples and Blue Ice™ can freeze and burst the 40-ml VOA vial.

10. Completed original Chain-of-Custody/Request for Analysis forms (LANL-ER-SOP-01.04) must be placed in watertight containers and placed inside the shipping container lid.

11. The cooler or other transport container must be completely closed and secured with tape.

B. Marking/Labeling

DOT placards, marking, or labeling are not required for non-DOT regulated environmental samples that are taken to the rad van, chem van, or SCF*. However, per 40 CFR 261.4 (d), all samples must be accompanied by

- The sample collector's name, mailing address, telephone number
- The laboratory's name, mailing address, telephone number
- The quantity of the sample
- The date of shipment
- Description of the sample

Some of the required information is contained on the chain-of-custody form. The first two bulleted items are not on the chain-of-custody form, so a piece of paper containing that information might be preprinted to attach to the chain-of-custody form or otherwise placed with the cooler.

Transport containers (ice chests) will be marked Environmental Samples.

* For samples from septic tanks and lagoons that contain sanitary waste, see Attachment D for packaging and shipping requirements.

PREPARATION OF SANITARY WASTE SAMPLES FOR SHIPPING

These instructions are for the handling and shipping of samples from septic tanks and lagoons that contain sanitary waste.

A. Samples from Inactive Septic Systems and Lagoons

A number of septic systems at the Laboratory have been inactive and have not received sanitary waste in a number of years. If the ER Program is taking samples from these septic systems, the field team manager and the OUPL can conclude that the sample media is not infectious using the following prudent and resource-conservative philosophy:

- The types of human pathogens found in sanitary waste cannot maintain a viable state because conditions of pH, temperature, oxygen and other gases, etc., are not favorable.
- Without the addition of new waste and new pathogens, the samples are not infectious.

If the OUPL and the field team manager decide that samples from inactive sanitary waste systems are not infectious, the decision, with the supporting reasons, should be documented in the Daily Activity Log. These samples can be collected and prepared for transport as soil or water samples and designated as environmental samples.

B. Samples from Active Septic Systems and Lagoons

Samples that come from active sanitary systems and are expected to contain human wastes can be designated as diagnostic samples and are excluded from the specific packaging and shipping requirements per 49 CFR 173.196 (h)(1). However, because some ER Program samples must be shipped by air to meet EPA holding-time requirements, collection and preparation of these samples must satisfy IATA requirements.

According to IATA provisions, these shipments can be identified as Diagnostic Specimens "that have a low probability of containing infectious substances." The field team manager or OUPL may determine the following prudent and resource-conservative philosophy:

- Even though there may be infectious substances in the sample, the count would be low, and the probability of sudden illness or death occurring from contact with the infectious substance is low.
- If this determination is made, the responsible party may designate the diagnostic specimen as having a low probability of containing infectious substances.
- This designation reduces the testing requirements for the containers and increases the allowed amounts in a shipping package.

If the OUPL and the field team manager decide that samples from active sanitary waste systems are diagnostic specimens with low probability for causing illness or death, the decision with the supporting reasons should be documented in the Daily Activity Log.

For ground transportation of these samples, these samples can be packaged and transported as though they were environmental samples. The SCF will be responsible for packaging and shipping the samples, whether by ground or air, to an off-site laboratory. However, if these samples will be shipped by air, certain restrictions will apply.

1. Containers

   For material designated as diagnostic specimens, the total volume per shipping container cannot exceed 500 ml, and the maximum volume per inner container must not exceed 100 ml. Therefore, when SCF indicates that the samples will be shipped by air, they must be collected in containers that are typically smaller than those used for analyses. The sampling team must coordinate with the SCF to address this issue before taking samples because SCF is responsible for packaging the shipment per IATA 650. The SCF will provide sample containers that meet IATA 650.

2. Warning Labels

   Although DOT does not require placarding or labeling, safety of laboratory personnel requires that the samples should be identified as sanitary waste. A label will alert all personnel handling the samples as to the sample's potential hazard. A typical warning label attached to the outside of the transport container might read

   This package contains samples of sanitary waste. If leakage is noted, take all prudent precautions and notify the sampling team that collected the samples.

DOT HAZARDOUS MATERIAL CLASSIFICATION (49 CFR 173.2)

Class No.	Name of Class or Division	49 CFR Definition Reference	49 CFR Label Reference
1	Explosives	173.50	172.411
2	Gases	173.115	172.415, 416 and 417
3	Flammable and combustible liquid	173.120	172.419
4.1	Flammable solid	173.124	172.420
4.2	Spontaneously conbustible material	173.124	172.422
4.3	Dangerous when wet material	173.124	172.423
5.1	Oxidizer	173.127	172.426
5.2	Organic peroxide	173.128	172.427
6	Poisonous and infectious materials	173.132 and 134	172.430, 431 and 432
7	Radioactive Material	173.403	172.436, 438 and 440
8	Corrosives	173.136	172.442
9	Other Regulated Material	173.140	172.446

RANGE OF MATERIAL RADIOACTIVITIES AND CORRESPONDING TRANSPORTATION REQUIREMENTS

DOT Definition "Radioactive Material"

Not Regulated in Transport	Limited Quantities	Type A Quantity*	Type B Quantity*
LANL ESH-1 Action Level I** Above background but, < 500 cpm/probe α < 5000 cpm/probe β/γ	See 49 CFR 173.421 Contact BUS-6	See 49 CFR 173.431	
	Packaging: Strong, tight, leakproof External rad ≤ 0.5 mrem Outside package marked "Radioactive" If no inner packaging, otherwise inner packaging "Marked"		
LANL ESH-1 Action Level II** ≥ 500 cpm/probe α ≥ 5000 cpm/probe β/γ ≥ 5 mR/hr	Excepted from: Shipping papers & Certification Specification packaging Labeling Marking		
	2 nCi/g (0.002 μCi/g) 4.4×10^3 d/m	^{60}Co, 1×10^{10} d/m ^{226}Ra, 1×10^8 d/m ^{227}Ra, 6×10^6 d/m ^{230}Th, 4×10^8 d/m ^{235}U, 4×10^8 d/m ^{238}Pu, 6×10^6 d/m ^{239}Pu, 4×10^6 d/m ^{241}Am, 1×10^7 d/m For others, see 49 CFR 173 Subpart I		

*Not expected in the ER program

**Follow requirements cited in the Site-Specific H&S

ATTACHMENT J-6

ER-QP-01.3Q

Los Alamos National Laboratory **Environmental Restoration Program** Quality Procedure	No: LANL-ER-QP-01.3Q	Rev: 0

DEFICIENCY REPORTING

Larry Maassen
LARRY MAASSEN
Quality Program Project Leader

13 March 1991
(Date)

Robert W Vocke
ROBERT VOCKE
Program Manager

15 March 1991
(Date)

Effective Date: March 18, 1991

DEFICIENCY REPORTING

1.0 PURPOSE

This procedure describes the methods by which conditions adverse to quality, hereafter referred to as deficiencies, are identified and corrected. This procedure implements the requirements of Section 15, *Nonconformance*, and Section 16, *Corrective Action*, of the Los Alamos National Laboratory (LANL) Environmental Restoration (ER) Quality Program Plan (QPP).

2.0 SCOPE

This procedure applies to deficiencies that are identified by LANL ER Program personnel and contractor personnel working under the ER QPP.

3.0 DEFINITIONS

3.1 Condition Adverse to Quality

A condition that if not corrected could have a serious effect on safety, operation, or data defensibility.

3.2 Corrective Action

A measure taken to rectify and preclude repetition of conditions adverse to quality.

3.3 Nonconformance

A deficiency in characteristic, documentation, or procedure that renders the quality of an item unacceptable or indeterminate.

4.0 RESPONSIBILITIES

4.1 The Quality Program Project Leader

- maintains the Deficiency Report (DR) Log,
- concurs with description of deficiency,
- approves proposed disposition,
- ensures verification of completion of corrective action(s),
- compiles and distributes the completed records package.

4.2 The Originator of a DR

- initiates a DR and describes the deficiency,
- forwards the DR Form to the QPPL, and
- approves proposed disposition.

4.3 Responsible Individual

The responsible individual provides and/or implements the resolution of a deficiency.

5.0 PROCEDURE

5.1 Initiation of a Deficiency Report

Anyone working on the ER program may initiate a Deficiency Report (DR). The originator of the DR completes Part IA of the DR Form (Attachment 1). The originator forwards the DR to the Quality Program Project Leader (QPPL) for review and concurrence.

The QPPL reviews the DR to be certain the deficiency is clearly and properly stated. The QPPL signs Part IB, signifying agreement with the deficiency as stated. The QPPL obtains a DR number from the DR Log (Attachment 2) and assigns it to the DR Form. The QPPL then forwards the DR Form to management of the organization responsible for disposition of the DR.

5.2 Disposition of Deficiency

Management of the organization responsible for disposition of the DR assigns an individual to be responsible for disposition. This person should be competent in the specific area to be evaluated, understands the requirements pertinent to the disposition, and have access to applicable background information. The responsible individual proposes the disposition of the deficiency by entering the applicable information in Part II of the DR Form. Additional pages may be added as necessary. The DR Form is then forwarded to the Originator and QPPL for approval of the proposed disposition. NOTE: It is recommended that the responsible individual reach an agreement with the Originator and QPPL on the proposed disposition prior to responding formally on the DR Form.

If the deficiency concerns an item, the item may be considered nonconforming. The responsible individual ensures that work on the item is stopped and that further processing, delivery, installation, or use of the item is prohibited until resolution of the DR is complete. The item shall be identified with a completed Hold Tag, or by marking the item in a legible and easily recognizable manner with the DR number. If possible, segregate the item to prevent inadvertent use.

5.3 Approval of Proposed Disposition

The QPPL and Originator sign Part III of the DR Form when they are satisfied with the proposed disposition. The QPPL notifies the responsible party of acceptability of the proposed disposition by sending an information copy of the signed DR Form to the responsible individual. The QPPL retains the original.

5.4 Implementation and Verification of Deficiency Disposition

Upon assurance that the proposed disposition is satisfactory to the QPPL and Originator, the responsible individual implements the corrective action(s).

The responsible individual notifies the QPPL upon completion of the corrective action(s). The QPPL or designee then verifies satisfactory completion of the corrective action(s) and completes Part IV of the DR form.

5.5 Closing the DR

After verification of completion of the corrective action(s) and completion of the DR form, the DR is considered closed. The QPPL

- ensures that all tags or marks on nonconforming items have been removed,
- prepares a records package that includes the DR, its attachments, and related correspondence and forwards one copy to the originator, one copy to the responsible organization, and one copy to the ER Records Processing Facility (RPF), and
- enters the close-out date on the DR Log.

6.0 REFERENCES

LANL-ER-QPP - Quality Program Plan for Environmental Restoration Activities at Los Alamos National Laboratory.

7.0 RECORDS

Records generated as a result of this procedure are

- the DR,
- attachments to the DR as applicable,
- related correspondence, and
- the DR Log.

The first three documents are compiled into a records package as specified in Section 5.5. The Deficiency Report Log is maintained by the QPPL, who forwards a copy to the RPF during the first quarter of each calendar year.

8.0 ATTACHMENTS

Attachment 1	Deficiency Report Form (2 pages)
Attachment 2	Deficiency Report Log

LOS ALAMOS

ENVIRONMENTAL RESTORATION PROGRAM
DEFICIENCY REPORT FORM
Page 1 of 2

DR No.:_____

PART IA- INITIATION (ORIGINATOR)

REQUIREMENT:

DESCRIPTION OF DEFICIENCY:

IF DR IS A RESULT OF AN AUDIT OR SURVEY FINDING, ENTER NUMBER _____

ORGANIZATION ASSIGNED DISPOSITION _____

ORIGINATOR (PRINT)	SIGNATURE	DATE

PART IB - QPPL CONCURRENCE

QPPL (PRINT)	SIGNATURE	DATE

EXAMPLE

PART II - DISPOSITION (RESPONSIBLE INDIVIDUAL)

ROOT CAUSE OF DEFICIENCY:

CONTACT THE
ER PROGRAM OFFICE
(665-4557) TO OBTAIN
ORIGINAL FOR YOUR USE

CORRECTIVE ACTION:

CORRECTIVE ACTION TO PREVENT RECURRENCE:

DATE FOR COMPLETION OF CORRECTIVE ACTIONS:_____

RESPONSIBLE PERSON (PRINT)	SIGNATURE	DATE

LANL Environmental Restoration Program
DEFICIENCY REPORT FORM
Page 2 of 2

DR No.:_____

PART III - APPROVAL OF PROPOSED DISPOSITION (QPPL AND ORIGINATOR)

QPPL (PRINT)	SIGNATURE	DATE
ORIGINATOR (PRINT)	SIGNATURE	DATE

PART IV - VERIFICATION OF COMPLETION AND/OR CLOSE OUT (QPPL)

METHOD OF VERIFICATION, JUSTIFICATION, ETC (AUDIT, SURVEILLANCE)

VERIFIED BY (PRINT)	SIGNATURE	DATE

EXAMPLE

CONTACT THE
ER PROGRAM OFFICE
(665-4557) TO OBTAIN
ORIGINAL FOR YOUR USE

LANL Environmental Restoration Program
DEFICIENCY REPORT LOG

DR No.	Date Initiated	Responsible Individual/Group	Corrective Actions Verified (Date)

EXAMPLE

CONTACT THE
ER PROGRAM OFFICE
(665-4557) TO OBTAIN
ORIGINAL FOR YOUR USE

APPENDIX K

DATA EVALUATION AND RISK ASSESSMENT METHODOLOGIES FOR DEMONSTRATING CLEAN CLOSURE

APPENDIX K

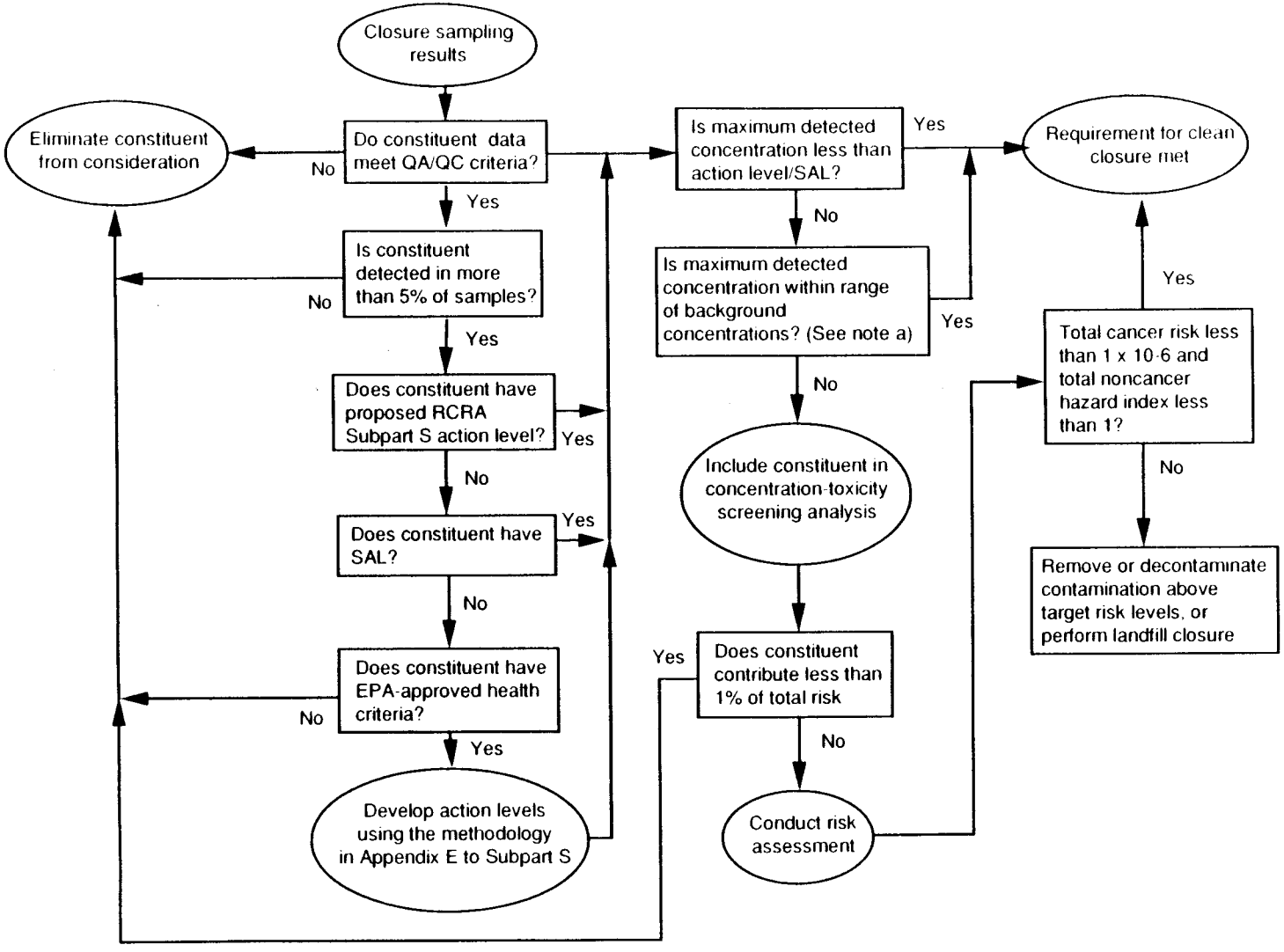
DATA EVALUATION AND RISK ASSESSMENT METHODOLOGIES FOR DEMONSTRATING CLEAN CLOSURE

K.1 DATA EVALUATION

The process for evaluating data from the proposed sampling plan is summarized in Figure K-1. All data will first be qualified per quality assurance/quality control (QA/QC) requirements. The QA/QC evaluation will be based on the Quality Assurance Project Plan (Appendix J to the Closure Plan) and Appendix K to the Installation Work Plan for Environmental Restoration (IWP) (LANL, 1994a). Data that do not meet the QA/QC criteria will be flagged and eliminated from the quantitative risk assessment. The rationale for the elimination of specific data will be provided in the Summary Sampling and Analysis Report.

Chemicals detected infrequently may be artifacts in the data due to sampling, analytical, or other problems and may not be related to site operations or disposal practices. Therefore, data that meet QA/QC requirements will be eliminated from the quantitative risk assessment if the constituent is detected infrequently within the exposure unit (i.e., in less than 5% of the samples [EPA, 1989; LANL, 1994a]). Infrequently detected constituents considered for further evaluation include those constituents detected at high concentrations (i.e., at least one detection at a concentration greater than or equal to five times the limit of detection (LOD) (LANL, 1994a; EPA, 1989) or Group A carcinogens with at least one detection, regardless of concentration (EPA, 1989).

Remaining constituents will be compared with action levels. Those detected at concentrations less than the action levels will be eliminated from the quantitative risk assessment. The initial comparison will be made with proposed Resource Conservation and Recovery Act (RCRA) Subpart S action levels (EPA, 1990). Screening action levels (SAL) developed for the Environmental Restoration Project (LANL, 1994b) will be used for constituents with no proposed Subpart S action levels. For those constituents with toxicity criteria approved by the U.S. Environmental Protection Agency (EPA) but with no proposed Subpart S action levels or SAL values, action levels will be calculated using equations in



Notes: a - Comparison with background applies to soil and tuff samples only. Sludge constituents within background range will be inluded in risk analysis.

Figure K-1. Summary of Data Evaluation Process

Appendix E to proposed Subpart S (EPA, 1990). The most current sources of EPA-approved toxicity criteria will be consulted. The Integrated Risk Information System (IRIS) is updated monthly and supersedes all other sources of appropriate toxicity criteria (EPA, 1989). Information in the Health Effects Assessment Summary Tables (HEAST) is the second most current source of toxicity information and will be consulted only for those constituents not listed in IRIS. EPA's Environmental Criteria and Assessment Office (ECAO) will be consulted for those constituents with no toxicity criteria listed in IRIS or HEAST. Constituents with no EPA-approved toxicity criteria (i.e., IRIS, HEAST, ECAO) will be eliminated from the quantitative risk assessment and addressed in a qualitative manner. The results of the action level screening will be presented in the Summary Sampling and Analysis Report.

Remaining constituents detected below background concentrations in soil, subsoil, and tuff are not considered to be related to TA-53 surface impoundment activities. Thus, constituents within these media that are within the range of Laboratory background concentrations will be eliminated from the quantitative risk assessment (LANL, 1994a; EPA, 1989). Constituents in sludge samples within the range of Laboratory soil background concentrations will be included in the risk analysis. However, a comparison risk analysis related to Laboratory background concentrations will also be developed (EPA, 1989) to help the reviewer evaluate whether allowing the sludge to remain would result in an increase in human health risk. The results of the background comparison will be presented in the Summary Sampling and Analysis Report.

Remaining constituents most likely to contribute significantly to the risk will be identified using a concentration-toxicity screen (C-T screen) (LANL, 1994a; EPA, 1989). Those constituents within each exposure unit that contribute less than 1% of the total cancer risk and overall chronic health hazard for that exposure unit will be eliminated from the quantitative risk assessment (LANL, 1994a; EPA, 1989). The maximum constituent concentration within each exposure unit, whether in soil, subsoil, liner, tuff, or sludge, will be used in the C-T screening analysis (EPA, 1989). The most conservative toxicity criteria (i.e., inhalation or oral) for each constituent will be used (EPA, 1989). Toxicity criteria used will be EPA-approved (i.e., IRIS, HEAST, ECAO).

The C-T screen will be conducted using the following equations:

Equation 1: Individual chemical score per health effect (i.e., cancer or chronic noncancer):

$$R_i = (C_i)(T_i) \quad (1)$$

where:

R_i = risk factor for chemical *i*

Taken to be:

- cancer risk factor, or
- noncancer health hazard,

C_i = concentration of chemical *i* in the medium

Taken to be the maximum concentration in soil, subsoil, liner, tuff, or sludge

T_i = toxicity value for chemical *i*

Taken to be:

- most conservative cancer potency factor for chemical *i*, or
- 1/RfD, where RfD is the most conservative reference dose for chemical *i*

Equation 2: Total chemical score per health effect (i.e., cancer or chronic noncancer):

$$R_j = R_{1j} + R_{2j} + R_{3j} + \ldots + R_{ij} \quad (2)$$

where:

R_j = total cancer risk or noncancer health-hazard factor

Taken to be :

- total cancer risk factor for all chemicals, or
- total noncancer health hazard for all chemicals

$R_{1j} + \ldots + R_{ij}$ = risk factors for chemicals *1* through *i*

Decision: If $R_i/R_j < 0.01$, chemical *i* will be eliminated from the quantitative risk assessment (LANL, 1994a)

The results of the C-T screening will be presented in the Risk Assessment Report.

K.2 EXPOSURE ASSESSMENT

The exposure assessment will be conducted based on a future residential land use. This approach will be used in order to account for the loss of RCRA regulatory control following certification of clean closure. This approach is very conservative because it does not consider the institutional site control required by the Department of Energy (DOE) due to the presence of radionuclides at the site. This exposure assessment conservatively assumes baseline conditions (i.e., no clean-up, capping of the sludge, or stabilization of the sludge with clean soil will occur prior to building).

The exposure unit will be 500 square meters (EPA, 1989; LANL, 1994a) and will be situated to cover the area of greatest concern, i.e., exposure unit(s) with the highest C-T screen for cancer and noncancer health effects. Should the C-T screen show that one exposure unit has the highest potential for cancer effects and another unit has the highest potential for noncancer effects, a quantitative risk assessment will be conducted for both exposure units. Seventeen exposure units are possible within each surface impoundment, for a total of 34. For each surface impoundment: one exposure unit would encompass 5 samples, 8 exposure units would encompass 4 samples, 4 exposure units would encompass 3 samples, and 4 exposure units would encompass only 2 samples (see Figure K-2).

For those constituents within the selected exposure unit(s), the quantitative risk assessment will evaluate the following routes of exposure: (1) inhalation of dust and/or volatile emissions, (2) incidental ingestion of soil/sludge, (3) ingestion of garden produce (inorganics and/or bioaccumulative chemicals), and (4) dermal contact with soil/sludge.

Soil/sludge concentrations used in the assessment will be the lesser of either the 95% upper confidence level (UCL) of the mean or the maximum detected concentration for each constituent within the selected exposure unit (EPA, 1989). A default value of half the detection limit will be used for all nondetects in calculating the 95% UCL of the mean for each constituent detected within the selected exposure unit (EPA, 1989).

A reasonable maximum exposure (RME) will be calculated for an adult and a child. Equations and input parameters for calculating media concentrations and dose will be based on EPA

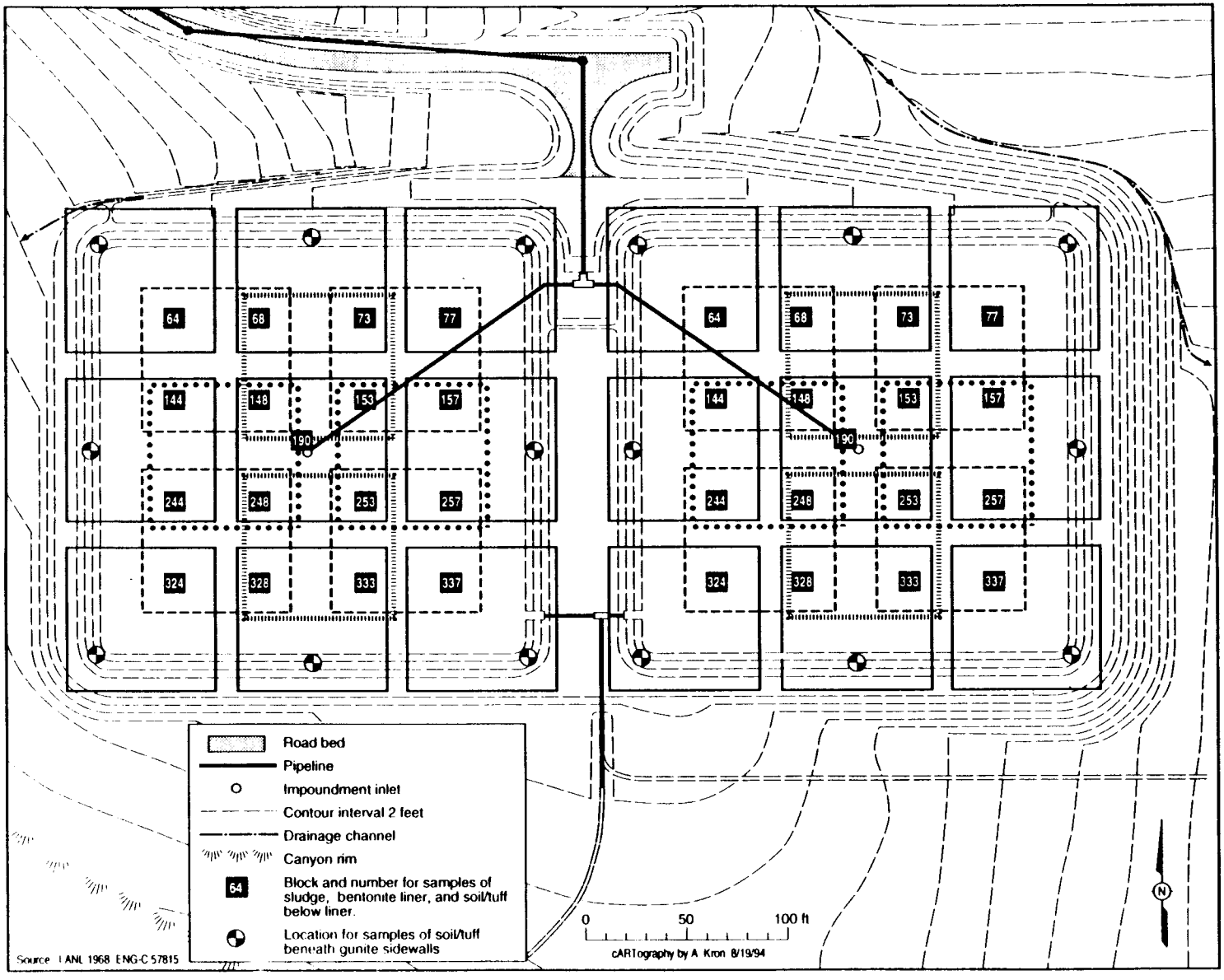


Figure K-2. Locations of Exposure Units in Surface Impoundments

default input parameters (EPA, 1991a), the IWP (LANL, 1994a); and site-specific information. These are provided in Table K-1. Chemical-specific input parameters (e.g., soil-to-plant uptake factors, etc.) will be provided to the New Mexico Environment Department (NMED) prior to any calculation of media concentrations, exposure, and toxicity criteria.

The RME will be calculated using the following equations:

Equation 3: Intakes via inhalation or ingestion

$$intake = \frac{C * IR * ET * EF * ED * CF_1 * CF_2}{BW * AT} \quad (3)$$

where:

intake	=	contaminant-specific intake
C	=	concentration of chemical in the media
IR	=	contact rate
ET	=	exposure time
EF	=	exposure frequency
ED	=	exposure duration
CF_1	=	mass/volume unit-conversion factor (as appropriate)
CF_2	=	d/24 hr
BW	=	body weight (kg)
AT	=	averaging time ([365d/yr] * yr)

Equation 4: Intakes via dermal absorption

$$intake = \frac{CS * SA * AF * ABS * EF * EF * CF}{BW * AT} \quad (4)$$

where:

intake	=	contaminant-specific intake associated with dermal contact
CS	=	concentration of chemical in soil (mg/kg)
SA	=	skin surface area available for contact (cm^2)
AF	=	soil-to-skin adherence factor (mg/cm^2/event)
ABS	=	chemical-specific absorption factor (unitless)
EF	=	event frequency (events/yr)
ED	=	exposure duration (yr)
CF	=	unit conversion factor (kg/1,000,000 mg)
BW	=	body weight (kg)
AT	=	averaging time (365d/yr * yr)

Table K-1. Default Input Parameters

Exposure Route	Inhalation (dust and/or volatile emissions)	Incidental Ingestion (soil)	Ingestion (garden produce)	Dermal Contact (skin)
C (chemical concentration)	Cai = Cs(ppm) * 60 $\mu g/m^3$ dust (NM AAQS), or Cao = Cs(μg/kg)/Volatilization Factor (kg/m^3) (EPA, 1991b) C(s) = 95% UCL of the mean or maximum soil concentration	Cs = 95% UCL of the mean or maximum soil concentration (mg/kg)	Cp = C(s) * chemical-specific soil-to-plant uptake factor C(s) = 95% UCL of the mean or maximum soil concentration (mg/kg)	C(s) = 95% UCL of the mean or maximum soil concentration (mg/kg)
IR (contact rate)	adult: 20 m^3/day child: 16 m^3/day	adult: 100 mg/day child: 200 mg/day	adult: 102 g/day child: 23 g/day (based on adult ingestion rate/body weight ratio)	NA
SA (contact area)	NA	NA	NA	adult: 5000 cm^2 child: 2200 cm^2 (based on adult surface area/body weight ratio)
ET (exposure time) (hr/d)	adult: 16 hr/day (24 hr/day - 8 hr/day at work) child: 24 hr/day	NA	NA	NA
AF (adherence factor) (mg/cm^2/event)	NA	NA	NA	1 mg/cm^2/event
ABS (absorption factor) (unitless)	NA	NA	NA	chemical-specific
EF (exposure frequency) (days or events/yr)	274 days/yr (365 - 91 days) 91 days when soil is wet or covered with snow	275 days/yr (365 - 91 days) 91 days when soil is wet or covered with snow	91 days/yr (fresh produce consumption over 3 month harvesting period)	275 events/yr (365 - 91 days) 91 days when soil is wet or covered with snow
ED (exposure duration) (yrs)	adult: 30 years child: 6 years	adult: 30 years child: 6 years	adult: 30 years child: 6 years	adult: 30 years child: 6 years
CF1 (conversion factor)	mg/1000 μg	NA	NA	kg/1,000,000 mg
CF2 (d/24 hr)	d/24hr	NA	NA	NA

Table K-1. Default Input Parameters (Continued)

Exposure Route	Inhalation (dust and/or volatile emissions)	Incidental Ingestion (soil)	Ingestion (garden produce)	Dermal Contact (skin)
BW (body weight) (kg)	adult: 70 kg child: 15 kg	adult: 70 kg child: 15 kg	adult: 70 kg child: 15 kg	adult: 70 kg child: 15 kg
AT (averaging time) ([365 d/yr] * yr)	cancer (adult): (365 d/yr) * 70 yr non-cancer (adult): (365 d/yr) * 30 yr non-cancer (child): (365d/yr) * 6 yr	cancer (adult): (365 d/yr) * 70 yr non-cancer (adult): (365 d/yr) * 30 yr non-cancer (child): (365d/yr) * 6 yr	cancer (adult): (365 d/yr) * 70 yr non-cancer (adult): (365 d/yr) * 30 yr non-cancer (child): (365d/yr) * 6 yr	cancer (adult): (365 d/yr) * 70 yr non-cancer (adult): (365 d/yr) * 30 yr non-cancer (child): (365d/yr) * 6 yr

Footnotes:

NA - Not applicable to this exposure route
All default input parameters are based on EPA's "Standard Default Exposure Factors" (EPA, 1991a) and site specific information
Cai: inorganic or non-volatile constituent concentration in air ($\mu g/m^3$)
Cao: volatile organic constituent concentration in air ($\mu g/m^3$)
Cp: constituent concentration in garden produce
Cs: constituent concentration in soil (95% UCL of the mean or maximum concentration)
NM AAQS: New Mexico Ambient Air Quality Standard (60 $\mu g/m^3$ - annual geometric mean suspended particulates)

K.3 TOXICITY ASSESSMENT

The most current sources of EPA-approved toxicity criteria (i.e., IRIS, HEAST, ECAO) will be used. Should no toxicity criteria be available from the primary source of information (i.e., IRIS) for a specific route of exposure (i.e., inhalation or oral), the other two sources (HEAST and ECAO) will be consulted. Should route-specific toxicity criteria be unavailable for a specific constituent, the route of exposure for that particular constituent will be eliminated from the quantitative risk assessment (EPA, 1989). The implications of the absence of this potential contribution to risk from this constituent through this route of exposure will be qualitatively addressed in the uncertainty section of the risk assessment (EPA, 1989).

Dermal-toxicity criteria will be derived from oral-toxicity criteria (where available). Oral-toxicity criteria (slope factors and references doses [RfDs]) that are based upon administered doses will be adjusted for absorption to obtain estimates of potential dermal cancer risk or noncancer health hazard (EPA, 1992).

Where absorption factors and oral-toxicity criteria are available, dermal-toxicity criteria will be calculated using the following equations:

Equation 5: Cancer slope factor based upon absorbed dose:

$$\frac{CSF_{administered}}{Abs} = CSF_{absorbed} \qquad (5)$$

where:

$CSF_{administered}$ = oral cancer slope factor
Abs = oral absorption factor

Equation 6: Reference dose based upon absorbed dose

$$RfD_{administered} * Abs = RfD_{absorbed} \qquad (6)$$

where:

$RfD_{administered}$ = oral reference dose
Abs = oral absorption factor

K.4 RISK CHARACTERIZATION

The potential cancer risk and chronic noncancer health hazard will be evaluated for the exposure unit(s) of concern. Cancer risk will be calculated for a reasonably maximally exposed adult. The child is the most sensitive indicator of chronic noncancer health hazard. Thus, the noncancer health hazard will be calculated for a reasonably maximally exposed child.

The potential cancer risk for the RME adult will be calculated for each carcinogen within the selected exposure unit via each pathway of exposure for which EPA-approved toxicity criteria are available.

Where EPA-approved toxicity criteria are available, potential cancer risk for the RME adult will be calculated using the following equations:

Equation 7: Cancer risk for one carcinogen through one pathway of exposure

$$\text{Risk} = (\text{Chronic Daily Intake}) * (\text{Cancer Slope Factor}) \quad (7)$$

where:

Cancer Slope Factor = Route-specific cancer slope factor

Taken to be:

- inhalation cancer slope factor,
- oral cancer slope factor, or
- dermal cancer slope factor (i.e., $CSF_{absorbed}$)

Equation 8: Cancer risk for one carcinogen through all pathways of exposure

$$\text{Risk}_i = \text{Cancer risk}_{(\text{inhalation})} + \text{Cancer risk}_{(\text{soil ingestion})} + \text{Cancer risk}_{(\text{garden produce})} + \text{Cancer risk}_{(\text{dermal})} \quad (8)$$

Equation 9: Total cancer risk

$$\text{Risk}_T = \Sigma\ \text{Risk}_i \quad (9)$$

where:

$Risk_T$ = the total cancer risk
$Risk_i$ = the risk estimate for the ith carcinogen

Decision: Total cancer risk will be compared to a default target risk value of 1-in-a-million risk (i.e., 1×10^{-6}).

The potential noncancer hazard will be calculated for the RME child for each noncarcinogen within the selected exposure unit via each pathway of exposure for which EPA-approved toxicity criteria are available.

Where EPA-approved toxicity criteria are available, potential noncancer hazard for the RME child will be calculated using the following equations:

Equation 10: Noncancer hazard for one noncarcinogen through one pathway of exposure

$$\text{Hazard Quotient} = CDI/RfD \qquad (10)$$

where:

CDI = Route-specific chronic daily intake

RfD = Route-specific EPA-approved chronic reference dose.

Taken to be:

- inhalation RfD,
- oral RfD, or
- dermal RfD (i.e., $RfD_{absorbed}$)

Equation 11: Noncancer hazard for one noncarcinogen through all pathways of exposure

$$\text{Hazard Quotient} = \text{Hazard Quotient}_{(\text{inhalation})} + \text{Hazard Quotient}_{(\text{soil ingestion})} + \text{Hazard Quotient}_{(\text{garden produce})} + \text{Hazard Quotient}_{(\text{dermal})} \qquad (11)$$

Equation 12: Total noncancer hazard

$$\text{Hazard Index}_T = \Sigma\ \text{Hazard Quotient}_i \qquad (12)$$

where:

Hazard Index_T = the total chronic hazard index for each toxic end-point (i.e., kidney effects, liver effects, etc.)

Hazard Quotient$_i$ = Total Hazard Quotient for the ith noncarcinogen

Decision: Total noncancer hazard will be compared to a default target risk value of 1.

K.5 UNCERTAINTY ANALYSIS

A qualitative discussion of uncertainty will be presented. At a minimum, the uncertainty discussion will qualitatively address the physical setting (i.e., chemicals not included, future land use, each exposure pathway selected), model uncertainty (i.e., media concentrations), parameter values, fate and transport, and toxicity criteria.

K.6 REFERENCES

EPA 1989: U.S. Environmental Protection Agency, "Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part A), Office of Emergency and Remedial Response, Interim Final Report EPA/540/1-89/002, December 1989.

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EPA 1991a: U.S. Environmental Protection Agency, "Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual, Supplemental Guidance, 'Standard Default Exposure Factors'," OSWER Directive 9285.6-03, Office of Solid Waste and Emergency Response, Washington, D.C.

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LANL 1994a: Los Alamos National Laboratory, "installation Work Plan, Revision 4, Appendix K," in draft, unpublished, 1994.

LANL 1994b: Los Alamos National Laboratory, "installation Work Plan, Revision 3, Appendix J," in draft, unpublished, 1994.