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CLOSURE PLAN

TA-40 SCRAP DETONATION SITE

Facility ID No:	NM0890010515
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Originally issued: September 1985

Amended: December 1985

Amended:

FEBRUARY 1991

2453

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ACRONYMS

LANL	Los Alamos National Laboratory
RCRA	Resource Conservation and Recovery Act
DOE	U.S. Department of Energy
TCLP	toxic characteristic leaching procedure
EP	extraction procedure
PETN	pentaerythritol tetranitrate
HMX	cyclotetramethylenetetramine
RDX	cyclonite
TNT	2,4,6-trinitrotoluene
TATB	triaminotrinitrobenzene
NMEID	New Mexico Environmental Improvement Division
EPA	U.S. Environmental Protection Agency
TAL	Target Analyte List

1. INTRODUCTION

This Closure Plan identifies the steps necessary to achieve clean closure of the Los Alamos National Laboratory (LANL) Scrap Detonation Site at Technical Area 40 (TA-40-SDS) (see Figure 1.1). TA-40-SDS was a hazardous waste thermal treatment unit operated for open burning and detonation of explosive scrap under a Resource Conservation and Recovery Act (RCRA) Interim Status Part A Permit. Operation of TA-40-SDS as a thermal treatment unit ceased on April 12, 1985, and a RCRA Part B Permit was not sought for this facility.

This closure plan is a modification of a previously submitted plan, dated September 1985, and amended December 1985 (DOE 1985). Since December 1985, new regulations have been promulgated and additional data have become available, leading to the need for this modification. Closure will be achieved in accordance with the interim status requirements of the New Mexico Hazardous Waste Management Regulations HWMR-5, as amended July 9, 1989, Part VI (40 CFR Sections 265.110 through 265.120, and 265.381).

The hazardous wastes treated at TA-40-SDS were subject to regulation due to the characteristics of reactivity (D003) or ignitability (D001). The thermal treatment eliminated those characteristics. However, some of the wastes that were treated contained barium or lead compounds, and the soil could, potentially, exhibit the characteristic of toxic characteristic leaching procedure (TCLP) toxicity for those metals. Preliminary soil sampling and analysis results for TA-40-SDS identified no metals above levels formerly considered toxic using the Extraction Procedure (EP) test. These data have been provided in subsection 2.4.

This plan identifies additional site investigations and analysis needed for determining the extent of any required closure activities. In addition, the plan provides plans for the removal, treatment, and disposal of hazardous wastes, or contaminated equipment, should any be identified. Finally, the plan addresses requirements for documenting that clean closure has been achieved.

2. TA-40-SDS DESCRIPTION

2.1. SITE DESCRIPTION

TA-40-SDS includes a burn area, a detonation area, and the surrounding area. It is located on a south-facing mesa-rim shelf (New Mexico State Plane coordinates E481,920; N1,767,000) (Figure 2.1). The shelf has cliffs both to the north below the mesa top, and to the south overlooking Pajarito Canyon. The mesa-top elevation is 7,340 ft; the shelf elevation is 7,290 ft; and the canyon floor is at an elevation of 7,100 ft. The shelf is approximately 200 ft wide from north to south and slopes gently to the canyon rim. Surface water drainage is from north to south across the shelf through several shallow drainage channels.

2.1.1. Detonation Area

The detonation area is roughly circular, approximately 60 ft in diameter. Scrap detonation operations at this site probably commenced in the early 1960s (Spaulding 1959). Repeated detonations have formed a south-facing amphitheater in the northern cliff, below the mesa top. The back (north) of the amphitheater is a cliff rising 30 ft from its floor. The east and west rims of the amphitheater drop to the south, framing its opening on the mesa shelf.

The last scrap detonation operations were conducted the week ending April 12, 1985. In 1987, LANL personnel inspecting the site noted that it was no longer in use, but that some debris was present (DOE 1987). In 1990, LANL personnel inspecting the site found that it had been used for the dumping of construction rubble and debris (Anderson 1990).

Some confusion has existed regarding the potential for explosion-scattered debris to have been produced at the detonation area. Debris has been reported to have been explosion-scattered to distances of 300 ft or more (DOE 1987; Spaulding 1959). Interviews with LANL employees who remember the operations indicate that scattering of unexploded detonator debris did not occur at this site (Smith 1990a, Smith 1990b). Review of Spaulding's memo makes it clear that the TA-40-SDS, about 1300 ft east of TA-40-15, did not exist in 1959. The detonator scattering incidents occurred at sites used prior to opening TA-40-SDS. Specifically, those incidents were reported to have occurred at a former TA-40 detonation area located 450 ft east of TA-40-15 (Figure 1.1). This RCRA Closure Plan does not address the former detonation area where operations ceased in approximately 1960.

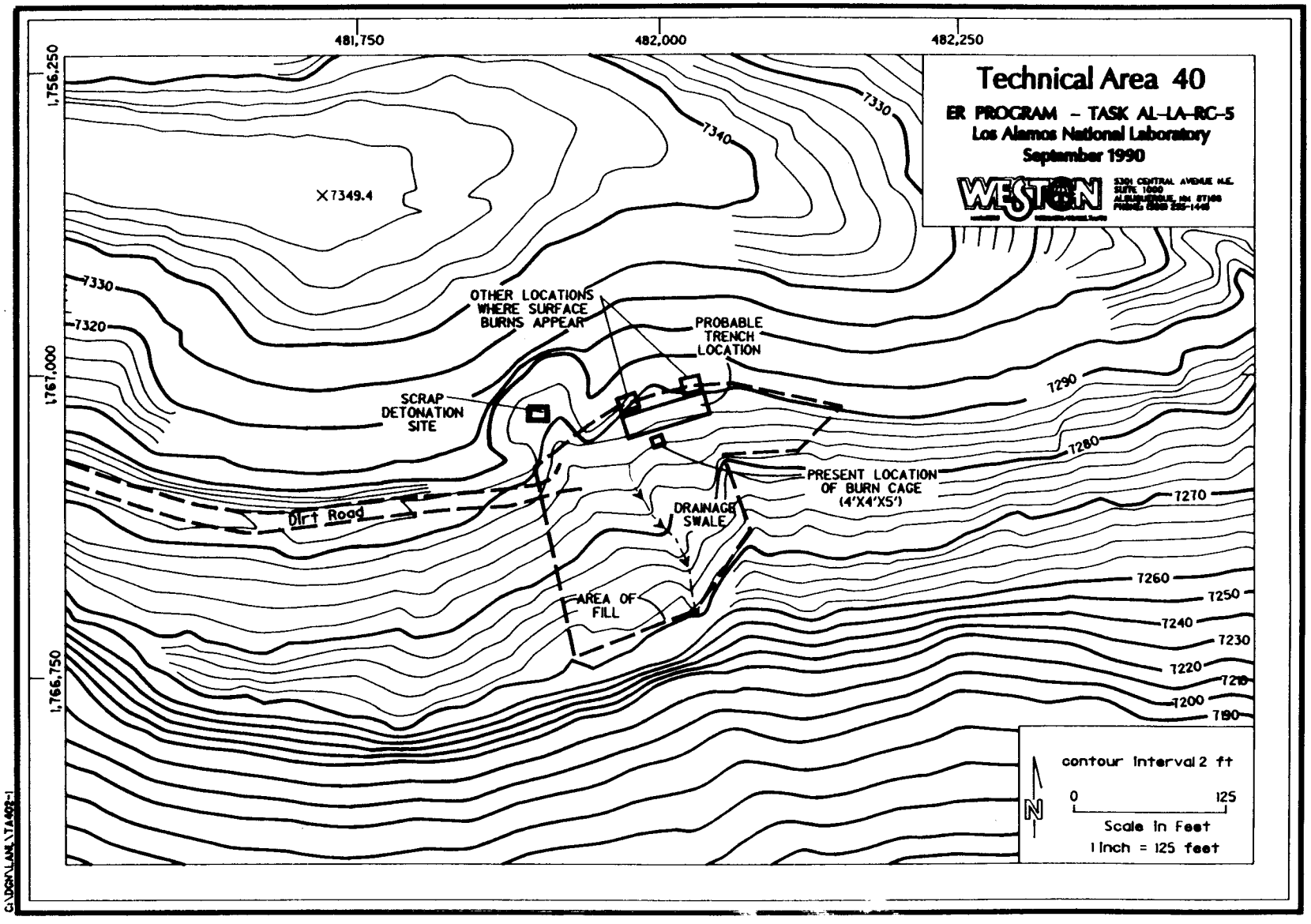


Figure 2.1. Detail of TA-40 Scrap Detonation Site.

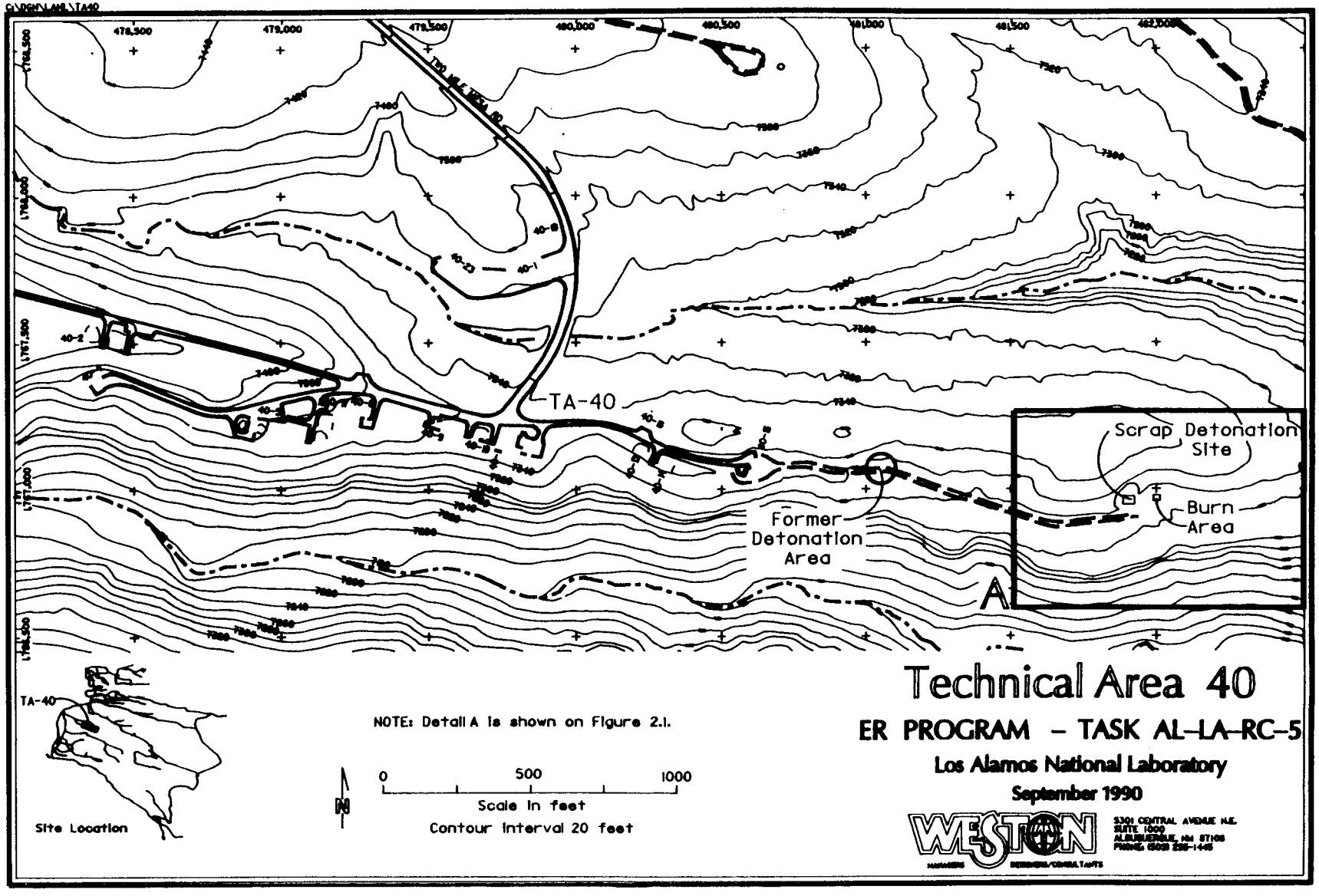


Figure 1.1. TA-40 Scrap Detonation Site.

2.1.2. Burning Area

The so-called "burn pit" is approximately 100 ft east of the detonation site and at the same elevation. Its present configuration is a wire cage approximately 4 ft by 4 ft square, and 5 ft high, with a steel plate floor. The burn cage was used to prevent wastes from being windblown before and during burning. During a site visit in September 1990 (Smith 1990c), two additional locations were identified where the burn cage may previously have been used. These areas exhibited scorched soil and rock, charred ash, and other debris. The areas were small, on the order of 6 ft by 6 ft, and the quantity of debris was small. All three surface burn areas are indicated in Figure 2.1.

Previously, there was also an open trench, probably the width of a bulldozer blade, approximately 10 ft deep and 20 ft long (Smith 1990b). This trench likely accounts for the term "burn pit." LANL engineering drawing ENG-R5121 (LANL 1983) shows the pit as approximately 60 ft long and 8 to 10 ft wide. Van Vessem (1961) proposed to dig a burn pit having dimensions of approximately 12 ft deep, 12 ft wide, and 50 ft long. It was to be located approximately 50 ft east and slightly south of the location of the burn cage at that time. Based on information gained during a September 1990 site visit (Smith 1990c), it is believed that the burn cage was located in the northwestern one of the three surface burn areas shown in Figure 2.1.

There is a reference to the disposal of the combustible portions of the magazine TA-6-4 in the pit (Courtright 1971). There may have been a sizeable volume of that material. The quantity and nature of materials in the trench are not known, although it is thought that it was not cleaned out and was eventually filled with crushed tuff created by shots at the detonation area. The pit boundaries are not presently known.

The burn pit may have been placed in operation in 1961 (Van Vessem 1961), but the year when it was backfilled is not known. In 1987, LANL personnel inspecting the site observed the wire cage and concluded that the pit was no longer in use, but that debris was present (DOE 1987). Because the last date of operation is unclear, this unit will be taken to closure with the Scrap Detonation Site.

2.2. PROCESS DESCRIPTION

The scrap detonation site was not continually manned. Personnel were at the site only for the time needed to set up a detonation or burn. Detonations were remotely controlled from the firing point TA-40-15, located on the mesa shelf 1300 ft west. Waste explosives and other explosives-contaminated wastes were delivered from other facilities just before detonation or burning. The maximum quantity of explosives treated at any one time was 100 pounds. No materials were stored at TA-40-SDS.

2.2.1. Detonation Area

One method was used to detonate explosive waste throughout operation of TA-40-SDS. Sensitive explosives were placed in a metal (early operations) or plastic trash can at the detonation area. If less sensitive explosives were to be detonated, they were placed with sensitive explosives to ensure detonation. The explosives were wrapped in a plastic bag to keep them dry when immersed in the liquid nitromethane.

A plastic pail, filled with nitromethane (a flammable liquid capable of being detonated), was mounted above the trash can with a plastic drain tube running from the pail to the trash can. After the drain valve in the tube was opened, the site was evacuated. When the nitromethane had drained into the trash can, the explosives were detonated from a remote location. The nitromethane ensured complete detonation of the waste explosives.

Following each detonation, any scattered debris was picked up and transported to a chemical waste disposal site. Rock rubble, or crushed tuff, which sloughed from the amphitheater wall, was pushed out of the amphitheater to the south, forming an area of fill extending nearly to the rim of Pajarito Canyon. In 1983, a review of practices at TA-40-SDS resulted in the approval of the procedure allowing the rubble from the amphitheater to be used as groundcover onsite (Balo 1983). Any charred debris was still to be disposed of as chemical waste.

2.2.2. Burning Area

Trash suspected of explosives contamination and other combustible wastes were stacked and burned in the pit or in the wire cage. Kerosene was poured over the waste to ensure complete burning. Burning was initiated using explosive detonators set off remotely from TA-40-15. It is not believed that burned trash was removed.

2.3. WASTE DESCRIPTION

2.3.1. Detonation Area

Detonated materials included scrap explosives pieces, chips and powder, and waste detonators. Explosives handled at TA-40, and potentially treated at TA-40-SDS, included:

Sensitive compounds used in detonators:

pentaerythritol tetranitrate (PETN)

tetryl

lead azide

thallium azide (use unlikely)

Less sensitive explosives:

baratol

cyclotetramethylenetetramine (HMX)

cyclonite (RDX)

2,4,6-trinitrotoluene (TNT)

Insensitive explosives:

triaminotrinitrobenzene (TATB)

nitroquanidine

Other nonexplosive compounds used in preparation of explosives or for other purposes:

nitromethane

nitrocellulose

ammonium nitrate

barium nitrate

Soils remaining after detonation are nonreactive and nonignitable. The soils may contain low concentrations of lead or barium, leading to the potential for the soils to be TCLP toxic hazardous wastes. Additionally, the organic nitrogen compounds comprising many of the explosives may leave organic, nitrate, or cyanide compounds following detonation. Some of those, if present, could potentially be considered hazardous constituents.

2.3.2. Burning Area

The burn pit and burn cage were used for burning explosives-contaminated combustibles. Typical wastes included rags, paper, tape, cotton swabs, wood, glassware, and other trash items that had contacted explosives and were suspected of being explosives-contaminated. The contaminated glassware included test tubes, Buchner funnels, fritted glass, and the like. Combustible portions of the magazine building TA-6-4 (probably wood) were reported to have been deposited in the pit (Courtright 1971). Warren (1983) reported "Combustible oils and solvents, paper, and wood contaminated with high explosives are collected and burned in an incinerator at S Site or in a burn pit at TA-40."

The explosive compounds that were contaminants on the wastes to be burned are the same as those listed above in the description of the detonation area wastes. Depending on the completeness of the combustion of the wastes, the potential may exist for the same residuals to be present in the soil of the

burn pit as were described for the detonation area. In addition, non-consumed solvents, oils, and the kerosene used to initiate combustion may exist at trace levels in the soil.

2.4. EXISTING SITUATION

2.4.1. Sampling Results

Samples were collected at 9 locations around the detonation and burn areas on October 28, 1985. Two samples were taken at each of 4 different locations, at depths of both 4 inches (samples 1, 2, 3, and 4), and 1.5 inches (samples 1A, 2A, 3A, and 4A) (Anon. 1985). These 4 locations were approximately 75 ft from the detonation area, as shown in Figure 2.2. Another sampling location was on the detonation area, where cores were taken to a depth of 5.4 ft. Sample 5 was 0.6 ft long; samples 5A through 5L were each 0.4 ft long; and sample 5M was 0.2 ft long. Sample 7 was taken adjacent to the burn cage at a depth of 4 inches. Two sampling locations were in drainage channels downgradient of the detonation area (sample 8) and the burn cage (sample 6). Both locations were sampled to a depth of 4 inches. The final sample (sample 9) was taken in the soil fill at the canyon rim, south of the detonation area. This single sample was taken to 1.5 ft deep.

The samples were analyzed for EP toxicity for arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver; along with total nickel, beryllium, cyanide, sulfate, nitrate, and pH. No indication of contamination was identified in any of the samples (Tables 2.1. and 2.2.). Based on these preliminary results, it is expected that minimal contamination exists at and around TA-40-SDS, and that closure activities will not be extensive.

2.4.2. Debris

During a May 1990 site visit, construction debris from remodeling of building TA-40-9 was found to have been improperly dumped in the detonation area amphitheater (Anderson 1990). The debris consists of trees and shrubs, concrete curbs, asphalt pavement, soil and roadbeds, and concrete sections cut from the building wall and footing. None of these materials originated from an area of hazardous materials use or hazardous waste generation. Knowledge of the origin of the material confirms that it is a nonhazardous solid waste that should have been disposed of at the county landfill. The debris is believed to have been dumped in the winter of 1989-1990.

No mixing of the debris with any material at the detonation site has occurred. However, the presence of the material will hinder further investigations within the detonation area amphitheater. As described in

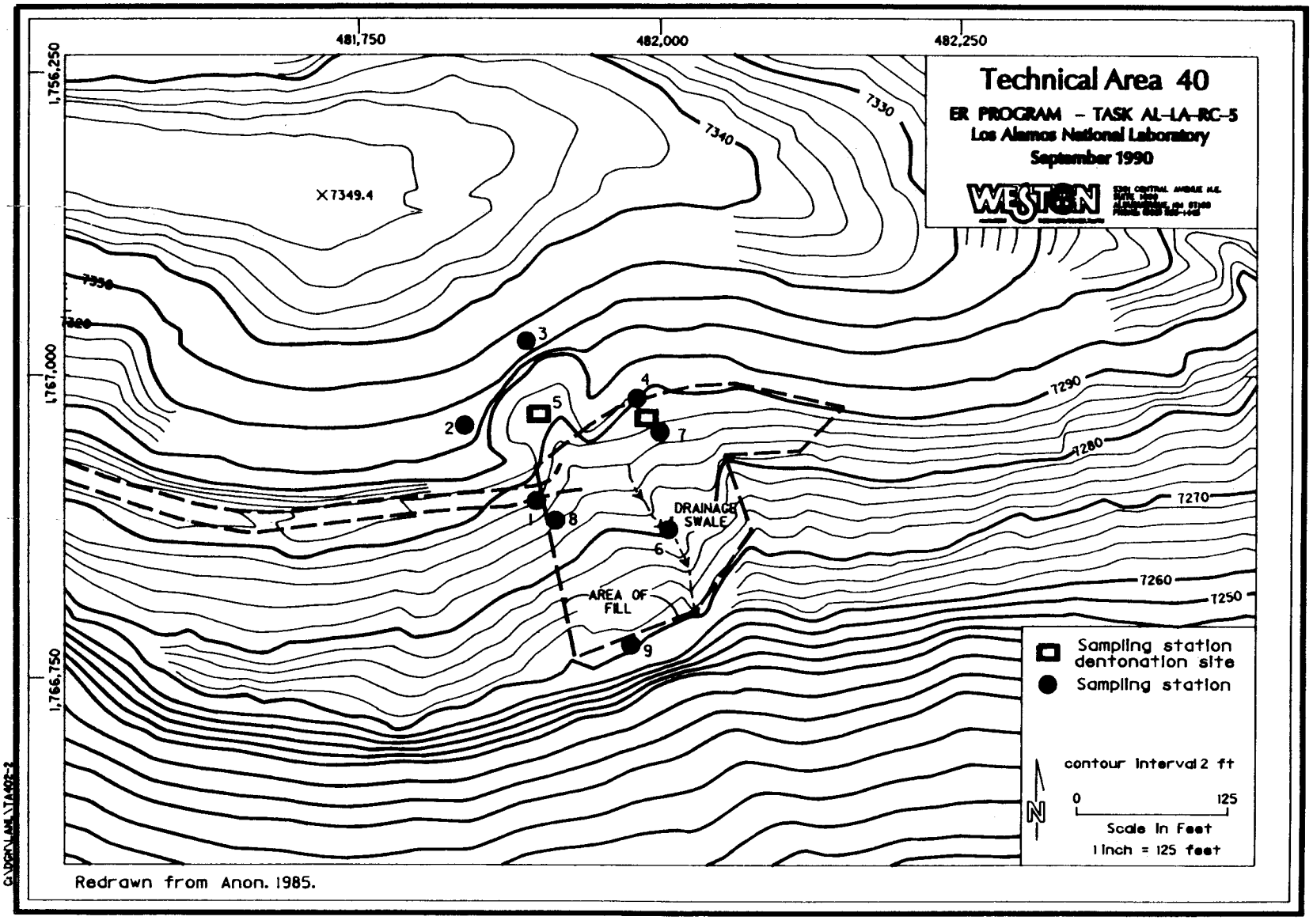


Figure 2.2. Previous sampling locations at TA-40 Scrap Detonation Site.

Table 2.1. Miscellaneous Analytical Results for TA-40 Soil Samples (Concentrations in mg/L)

Parameter	Sampling Locations														
	1	1A	2	2A	3	3A	4	4A	5	5G	5M	6	7	8	9
Nickel	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Beryllium	1.5	1.6	2.0	1.8	1.8	1.9	1.8	1.9	2.5	1.7	1.9	1.9	2.1	2.4	2.5
Cyanide	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sulfate	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	0.4	0.6	0.2	<0.2	<0.2	<0.2	1.0
pH	6.6	6.4	6.3	6.6	6.6	6.6	6.8	6.7	8.4	8.8	6.5	5.9	7.5	6.7	7.4
Nitrate	<0.9	<0.9	<0.9	1.3	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	<0.9	1.3	<0.9	<0.9	<0.9

Source: Anonymous 1985

Table 2.2. EP Toxicity Analytical Results for TA-40 Soil Samples

Parameter	EP Toxic Regulated Concentration [a] (mg/L)	Detection Limit (mg/L)	Sampling Locations														
			1	1A	2	2A	3	3A	4	4A	5	5G	5M	6	7	8	9
Arsenic	5.0	0.05 + 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	100.0	1.0 + 1.0	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	1.0	0.1 + 0.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chromium	0.5	0.5 + 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Lead	5.0	0.5 + 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mercury	0.2	0.001 + 0.001	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Selenium	1.0	0.05 + 0.025	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	5.0	0.5 + 0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[a] Hazardous Waste Management Regulations (HWMR) 201.B.5.
ND = Not Detected.

Source: Anonymous 1985

subsection 4.1.1, the construction debris will be removed prior to investigation of the detonation amphitheater. The debris will be properly disposed of at the county landfill.

3. CLOSURE AND POST-CLOSURE REQUIREMENTS

3.1. CLOSURE STANDARDS

Closure will be achieved in accordance with the interim status requirements of the New Mexico HWMR-5, as amended July 9, 1989, Part VI (40 CFR Sections 265.110 through 265.120, and 265.381).

This Closure Plan is the plan required by HWMR-5, Part VI (40 CFR 265.112). It is designed to meet the following general closure performance standards applicable to all hazardous waste management units, HWMR-5, Part VI (40 CFR 265.111 and .114):

- Minimize need for further maintenance.
- Protect human health and the environment.
- Prevent the escape of hazardous waste, hazardous constituents, leachate, contaminated run-off, or hazardous waste decomposition products to the ground or surface waters or to the atmosphere.
- Properly manage, as required for a hazardous waste generator, any removed materials that are themselves hazardous wastes.

This plan is also designed to comply with the following specific closure standards applicable to thermal treatment units, HWMR-5, Part VI (40 CFR 265.381):

- Remove all hazardous waste.

Any crushed rock fill, waste residues, or soil in or around the TA-40-SDS site that exhibit TCLP toxicity will be managed as hazardous waste. Any crushed rock fill, waste residues, or soil in or around the TA-40-SDS site that contain HWMR-5, Part V (40 CFR 264 Appendix IX) constituents will be considered contaminated and potentially subject to remedial action, as determined by the assessment described in subsection 4.6.

3.2. CLOSURE ACTIVITIES

TA-40-SDS will be clean-closed. All hazardous wastes, and all materials contaminated by hazardous constituents above contaminant-specific removal criteria, will be removed and properly disposed of, as discussed in subsequent sections of this plan. The following is the sequence of activities to be completed in the course of implementing the TA-40-SDS Closure Plan:

A. Investigate site (see Section 4, Site Investigation Plan). Assess the presence of hazardous wastes and hazardous constituents in waste residues, soils, and crushed rock fill.

1. Phase I. Sampling and analysis to investigate the fill area south of the detonation amphitheater. An assessment of Phase I analysis results will be made to determine equipment decontamination required during removal of construction debris from the detonation amphitheater.

2. Phase II. Sampling and analysis to investigate surface burn areas and burn pit.

3. Phase III. Sampling and analysis to investigate surface drainages, onsite structures, and scattered debris.

4. Phase IV. Sampling and analysis to investigate the detonation amphitheater.

5. Phase V. Assessment of results of Phase I through IV analyses to identify the presence of hazardous wastes or hazardous constituents and to determine if sampling of vicinity surface soils is needed. Sample surface soils in the vicinity of TA-40-SDS, if needed.

B. Determine extent of removal (see Section 4, Site Investigation Plan).

1. Identify hazardous wastes to be removed.

2. Determine removal criteria for any identified hazardous constituents.

3. Define areas, depths, and volumes of materials to be removed. Conduct supplementary sampling to better define excavation limits, if needed.

4. Specify waste treatment and disposal requirements for removed materials.

C. Conduct removal, treatment, and disposal activities (see Section 5, Site Decontamination).

D. Verify closure activities (see Section 5, Site Decontamination).

3.3. QUALITY ASSURANCE/QUALITY CONTROL

LANL will designate a qualified individual or individuals to independently oversee closure activities and to report directly to senior management regarding the quality of the performance of this closure. This individual will personally observe a portion of the key activities, assure that sample blanks are used and analyzed, and review the analytical reports for accuracy and adequacy. The designated individual will prepare a written statement for the final report, commenting on the adequacy of the analyses showing decontamination.

3.4. DATA QUALITY OBJECTIVES

The data acquired from this site investigation will be used to assess the presence of hazardous waste, determine the presence of hazardous constituents, and determine appropriate decontamination levels if

hazardous waste or constituents are identified (see Subsection 6.1, Decontamination Criteria). For these purposes, Levels III, IV, or V data quality (EPA 1987) are appropriate.

3.5. CLOSURE CERTIFICATION

In accordance with HWMR-5, Part VI (40 CFR 265.115), an independent registered professional engineer and the owner/operator of the facility will witness closure and ensure that closure follows this plan. Upon completion of closure, the engineer, LANL, and the U.S. Department of Energy (DOE) will prepare a letter certifying that the area has been closed in accordance with this plan. The letter will be dated and signed by each party and stamped by the registered professional engineer; and the original will be submitted to the Director of the New Mexico Environmental Improvement Division (NMEID); and one copy each will be maintained at the DOE offices and by LANL's HSE-8 Regulatory Compliance Section.

3.6. POST-CLOSURE PLAN

A post-closure plan is not required for thermal treatment units following clean closure since no waste-containing units remain for which care or monitoring is necessary. Certification of closure will serve as certification of completion of post-closure care pursuant to HWMR-5, Part VI (40 CFR 265.120).

3.7. FINAL CLOSURE REPORT

Upon completion of the closure activities, LANL will submit a Final Closure Report to the Director, NMEID. The report will document the final closure and contain, at a minimum, the following:

1. The certification described in subsection 3.4.
2. A tabular summary of all sampling results showing:
   a. the datum reported,
   b. the detection limit for each datum,
   c. a measure of analytical precision (e.g. uncertainty, range, variance),
   d. identification of analytical procedure, and
   e. identification of analytical laboratory.
3. A quality assurance/quality control statement on the adequacy of the analyses and the decontamination effort.
4. The location of the file of supporting documentation:
   a. field logbooks,

b. laboratory sample analysis reports,

c. the quality assurance/quality control documentation, and

d. chain-of-custody records.

5. Disposal location of all regulated and nonregulated materials.

6. A certification of the accuracy of the report.

7. A description of any variances from the approved closure plan.

4. SITE INVESTIGATION PLAN

4.1. INVESTIGATION PLAN AND RATIONALE

Site investigation activities for the TA-40-SDS Closure Plan will be conducted in several phases. Phase I activities will involve sampling the fill area south of the detonation amphitheater to determine if special controls, onsite access, or special requirements for decontamination of heavy equipment used for removal of debris from the detonation amphitheater will be needed. Debris removal will be conducted following an assessment of Phase I data. The intent of this phase of work is to reduce the burden of equipment decontamination, if possible, during the removal of nonhazardous debris. If the results of Phase I sample analyses indicate no hazardous wastes or hazardous constituents are present in the fill, then the fill area may be used and traversed during the debris-removal process without concern for site access or equipment decontamination.

Phase II activities will focus on sampling the surface burn areas and the burn pit. To the extent these activities are not affected by the removal of debris from the amphitheater, Phase II may proceed in parallel with Phase I.

Phase III activities will cover the shallow drainages leading from the area, the few structures present onsite, and the scattered debris that is present in the area. Again, to the extent these activities are not affected by Phase I activities, Phase III may be conducted in parallel with Phases I and II.

Phase IV will be an investigation of the detonation amphitheater following removal of the debris.

Phase V will be an investigation of surface soils in the general vicinity of TA-40-SDS. Prior to sampling the surface soils, an assessment will be made of the results of Phase I through IV investigations. If no hazardous wastes or hazardous constituents requiring removal are identified, then the Phase V investigations will not be conducted. The rationale for this approach is that the absence of hazardous wastes or hazardous constituents in the primary thermal treatment areas will be sufficient evidence that such contaminants are not present at the site and were not available to be dispersed and deposited on soils in the vicinity.

Details of the site investigation activities are given in the sections that follow. Table 4.1 summarizes the sampling effort.

Table 4.1. Sampling Effort

	Surface Samples	Boreholes	Borehole Samples	Wash Samples
Phase I				
Fill area		9	18	
Phase II				
Surface burn areas	3	3	6	
Burn pit		6	8	
Phase III				
Drainage swales	3			
Equipment washes				4
Debris wash				1
Phase IV				
Amphitheater	4	2	4	
Phase V				
Surface soils	16			
Totals	26	20	36	5

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

MAR 20 1991

MAR 1991
RECEIVED
HAZARDOUS WASTE
PROGRAM

Dr. Elizabeth Gordon
New Mexico Environmental Improvement Division
Harold Runnels Building
St. Francis Drive
Santa Fe, New Mexico 87503

Dear Dr. Gordon:

This forwards a copy of the Los Alamos National Laboratory (LANL) Closure Plan for Technical Area (TA)-40 Detonation Site as amended in February 1991. This office has been advised that a copy of the plan was delivered to you in person by a LANL representative on February 8, 1991, during your visit to LANL. That delivery was intended to fulfill an oral commitment for delivery of this plan by February 11, 1991.

The LANL has advised my office that further action on this Closure Plan will be held in abeyance until the New Mexico Environmental Improvement Division reviews and approves or otherwise comments on the plan. A proposed schedule for plan implementation, including your review and response, is presented in Section 6 of the enclosure. If you have any questions, please contact Steve Fong of this office at 665-5534.

Sincerely,

ORIGINAL SIGNED BY
JERRY L. BELLOWS

Jerry L. Bellows
Area Manager

Enclosure

cc w/enclosure:
R. Mayer, EPA Region 6, Dallas, TX

bcc w/o enclosure:
P. B. Schumann, LAAO
S. Fong, LAAO
J. Puckett, LANL, MS K491
R. Vocke, LANL, MS K491

LESH-031

4.1.1. Phase I. Fill Area Sampling

Investigation of the fill area extending south from the amphitheater nearly to the rim of Pajarito Canyon will be carried out using shallow borehole sampling. The origin of the fill material is sloughage from the rock walls of the amphitheater. It was pushed out, over time, in a random pattern to form a shallow fill estimated to range from 2 to 3 ft deep. In several locations within the area of fill, native tuff bedrock is exposed, indicating that the thickness of fill is variable. Three transects will be established, radiating outward from the center of the amphitheater. The angle at which each transect is extended from the amphitheater center will be chosen at random, with the constraint that one transect will fall within each of the central, eastern, and western thirds of the filled area. On each transect, three borehole locations will be randomly selected, with the constraint that one borehole will occur within each third of the length of the transect from the opening of the amphitheater to the far edge of the fill along that transect (Figure 4.1). This sampling design will provide for random selection of sampling locations within the fill area, while ensuring relatively uniform coverage of the fill. If a selected borehole location falls on exposed tuff bedrock, it will be randomly re-selected on the same transect and within the same length interval.

Each borehole will be core sampled to a nominal depth of 4 ft, and the core will be divided into two 2-ft samples. The fill material is expected to be well homogenized by the sloughage, pushing, and random placement that has occurred; thus, no biasing of the sampling to any portion of the vertical profile is necessary. If the fill in any borehole location is deeper than 4 ft, the borehole will be extended and sampled in 2-ft intervals until native tuff bedrock is encountered. If the fill depth at any location is less than 4 ft, the upper sample will retain its full 2-ft thickness, and the deeper sample will be comprised of the fill material below that depth. Native tuff should not be taken as part of the sample of fill. If the depth of the fill is less than 2 ft, one sample will be taken, comprised of the fill lying above the native tuff.

This sampling rationale is based on the need to assess the presence of contaminants in a randomly placed, homogeneous area of fill. It assumes that the likelihood of finding evidence of contamination is the same at all locations and in all depth intervals of the fill. This plan will result in a maximum of 18 samples to be analyzed.

Construction debris in the detonation amphitheater will be removed piece-by-piece for the larger items, and for the soil-like material, by front-end loader to a level 6 inches above the original surface. The debris will be properly disposed of at the county landfill. Sampling activities within the amphitheater will be conducted after manually removing the remaining 6 inches of debris at each sampling location to expose the original amphitheater surface. If it is determined that hazardous wastes or hazardous constituents are

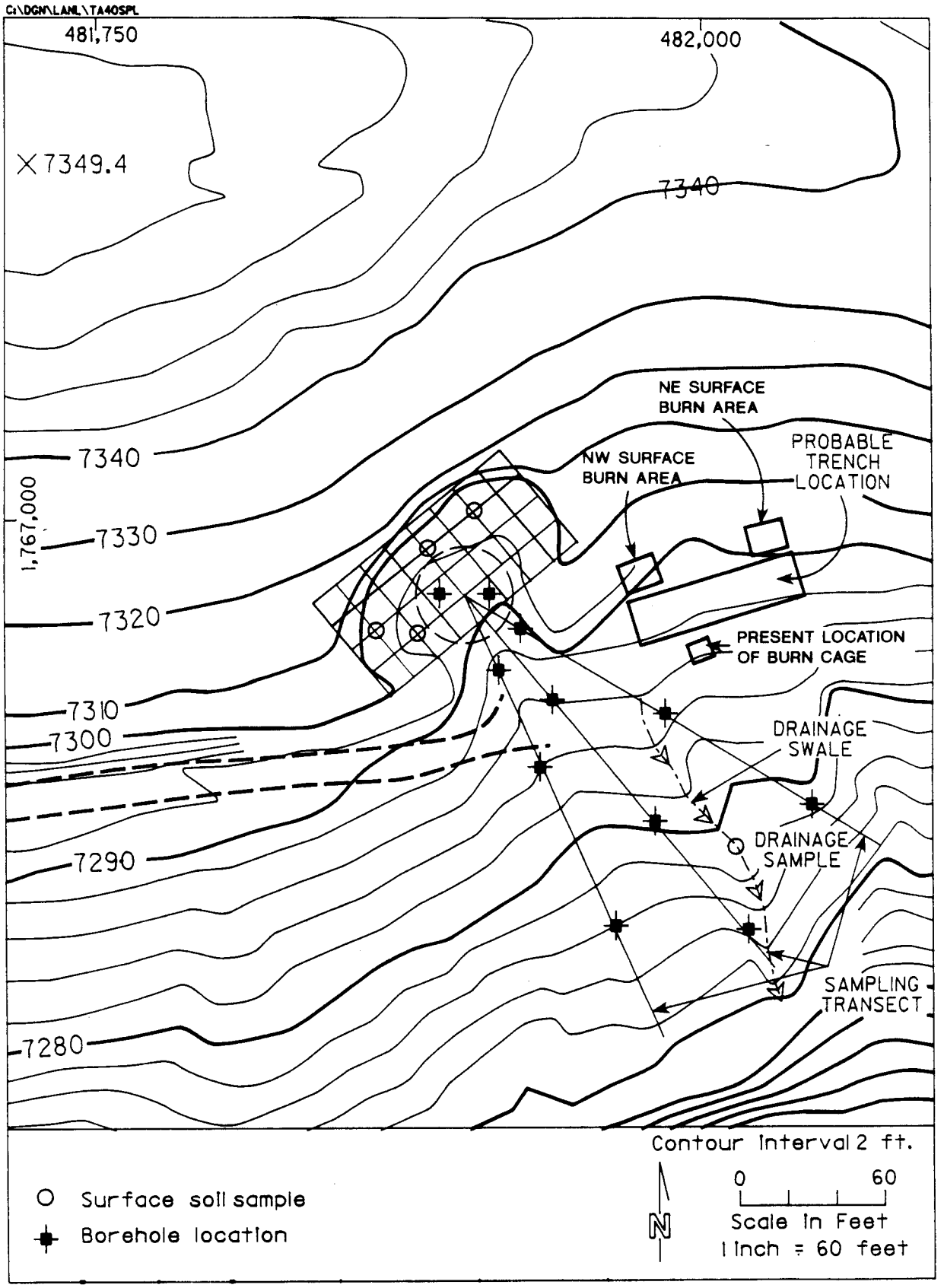


Figure 4.1. Scrap Detonation Site investigation soil sampling for amphitheater and fill.

present in the soil beneath the debris, the remaining debris will be excavated, handled, treated, and disposed of in the same fashion as the hazardous soil. This is required because of the inability to conclusively separate the remaining debris from the soil.

4.1.2. Phase II. Burn Area

Investigation of the burn area encompasses the present location of the burn cage, two other areas where evidence of surface burning is visible, and the burn pit.

4.1.2.1. Burn Cage

Investigation of the burn cage will consist of taking one surface sample and placing one borehole within the area of charred debris adjacent to the cage (Figure 4.2). The surface sample will be comprised of the charred debris in a 6-inch radius, to the depth of the soil surface. The borehole will be core sampled to a depth of 4 ft. The first core sample will be comprised of the charred debris found at the surface in the core to a minimum depth of 6 inches, but will include the full extent of any stained interval if deeper than 6 inches. The 1-ft internal immediately below the first core sample will be skipped. The second core sample will be comprised of the next deeper 1-ft interval.

The rationale for this investigation is based on the assumption that the burn cage overlies shallow native soil and is not located on an area of fill or the site of the former burn pit. If the soil depth beneath the burn cage is greater than 4 ft, the borehole will be extended until native tuff bedrock is encountered. If the borehole core indicates that the burn cage overlies the former burn pit, the burn cage borehole will be counted among those planned for during investigation of the burn pit and will be sampled as described for the burn pit investigation.

Each of the two additional areas of surface burning (to the northeast and the northwest) will be investigated in an identical fashion to that described for the present location of the burn cage.

These investigations will result in a maximum of three samples per burn area, for a total of nine samples to be analyzed.

4.1.2.2. Burn Pit

The exact location of the former burn pit is not known, although the general area in which it will be found has been identified from historical aerial photographs of TA-40. The investigation of the burn pit will take place in two stages: 1) identification of location, and 2) sampling.

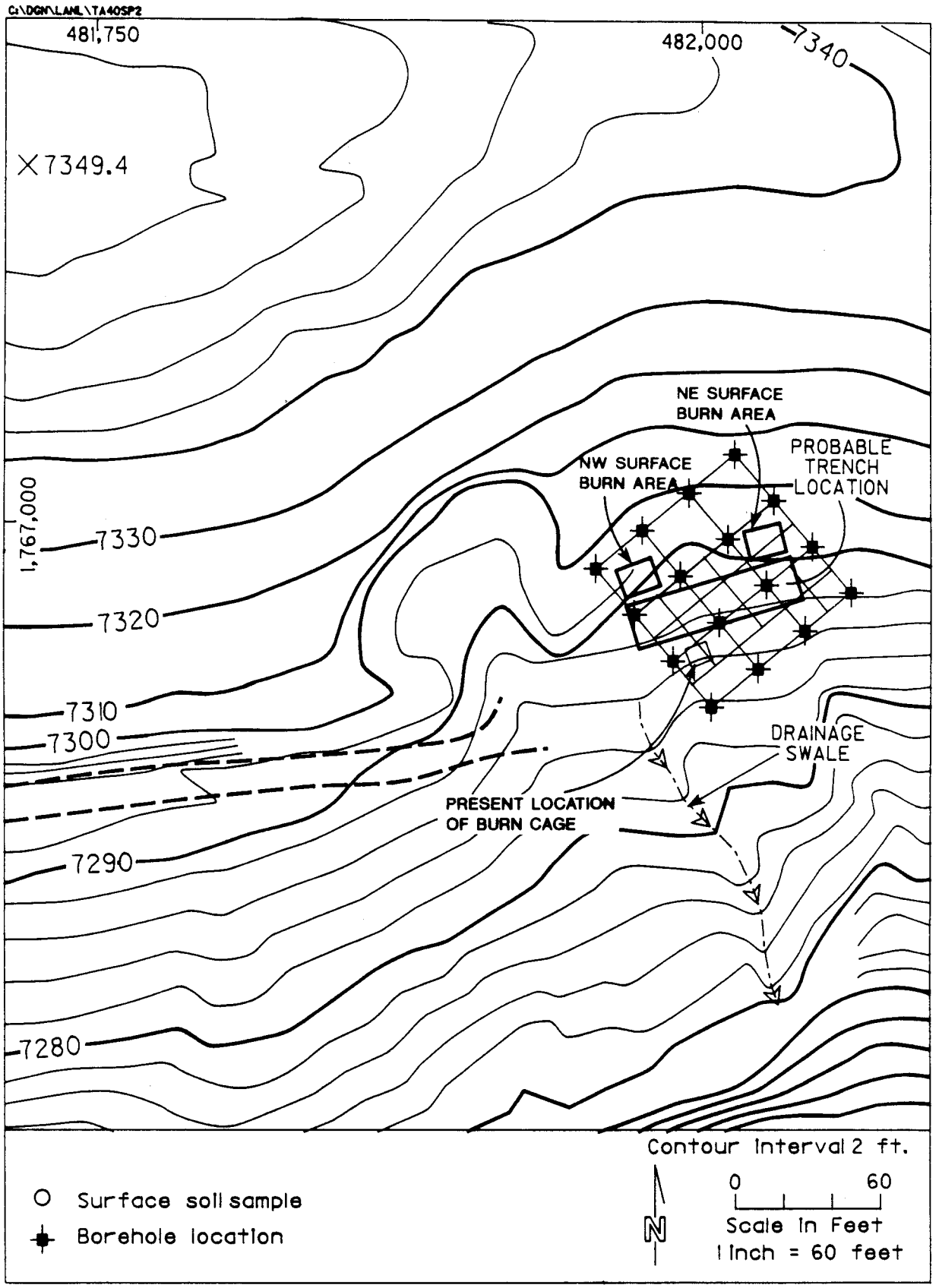


Figure 4.2. Scrap Detonation Site investigation soil sampling for burn cage and burn pit.

Identifying the location of the pit will first include a study of the historical aerial photographs of TA-40. Boreholes will then be placed on a grid in the most likely area. The boreholes will have a nominal depth of 15 ft, since one source of information indicated that the pit was to be constructed to a 12-ft depth (Van Vessem 1961). However, each borehole will be drilled until native tuff is encountered. The grid spacing will be on 16-ft centers to keep the chance reasonably small that the pit will fall between holes and be missed (Figure 4.2). It is expected that the pit is between 8 and 12 ft wide; thus, it is conceivable that the pit might fall between rows of boreholes. However, the pit is also expected to be between 20 and 60 ft long, and since it is unlikely that the pit and the borehole grid will be aligned by coincidence, there is a good probability that it will be penetrated by a borehole (Figure 4.2).

Presence of the pit will be inferred from identification of waste materials within a soil core, from identification of an area of fill if it can be differentiated from native soil, or from observation of a pattern for the depth to bedrock that is consistent with a bulldozed trench.

When one or more boreholes have indicated the location of the pit, the borehole grid will be adjusted to more clearly define the pit. Planned boreholes outside of the immediate area of interest will be dropped from the plan, and more closely spaced holes will be added within the area. One objective is to identify the orientation of the long axis of the pit. It is expected that halving the grid spacing, to 8-ft centers, will be appropriate. An example of such a grid is indicated in Figure 4.2.

If no conclusive evidence of the burn pit is found, a random sampling of soil and fill from the cores of the boreholes drilled on the grid will be submitted for analysis. This will entail collection and holding of those samples as a contingency as the drilling program progresses, until the presence of the pit is confirmed. Two samples will be submitted for analysis under this contingency.

When boreholes penetrating the burn pit have been identified, sampling will be limited to those holes. It is planned that a total of three boreholes penetrating the burn pit will be sampled. The core interval exhibiting charred debris or other evidence of the burn pit will be sampled in each of the holes. A 1-ft interval beneath the charred debris will be skipped, and the next deeper 1-ft interval will be sampled in each of the holes. In two of the holes, a sample will be taken of the fill overlying the charred debris. The interval sampled will be at least 1-ft above the interval exhibiting the debris.

This plan will result in eight samples for analysis if the pit is located; four if it is not.

4.1.3. Phase III. Other Investigations

4.1.3.1. Surface Drainages

Three shallow drainages lead south to Pajarito Canyon from TA-40-SDS. Surface erosion can potentially concentrate contaminants in sediments of the drainages, and surface sampling of those sediments is appropriate. In each drainage, one location will be selected where the potential for deposition of sediments is most likely (inside bends, ponding areas, etc.), and a surface sample will be obtained from each. These locations are biased rather than random.

4.1.3.2. Equipment and Structures

Equipment and structures will be sampled by taking rinsate wash samples. The only equipment and structures present at TA-40-SDS are the wire burn cage, several plate steel wiring boxes, and a plate steel personnel shelter located about 100 ft south of the detonation area. One rinsate wash of each of these structures will be obtained for analysis. The purpose of this sampling is to determine if any contaminants are present on the structures that may require the decontamination of the structures prior to disposal.

4.1.3.3. Scattered Debris

Scattered debris from the site, collected within a 200-ft radius of the detonation area, will be sampled by taking a rinsate wash. One rinsate wash from a collection of debris will be placed in a one-gallon bucket for analysis. The purpose of this sampling is to determine if any contaminants remain on the scattered debris that would necessitate collection and disposal of the debris.

4.1.4. Phase IV. Amphitheater Sampling

Following debris removal, surface soil samples will be taken to a depth of 6 inches at four randomly selected locations within the amphitheater (Figure 4.1). In addition, two boreholes will be cored to a depth of 4 ft. Each borehole core will be divided into two 2-ft samples. Core sampling locations will be randomly selected within a 20-ft radius of the center of the amphitheater. This investigation plan is based on the rationale that any residual contamination from the thermal treatment process will be identified in the surface soils of the amphitheater and that the nature of the detonation process is such that all locations within the amphitheater are equally likely to exhibit such contamination. Thus, random sampling of surface soils is appropriate. Borehole sampling is also appropriate to address the potential for explosive forces to drive contamination into the soil profile. Random selection of borehole locations close to the center of the amphitheater is specified since downward explosive forces will be greatest close to the detonation.

4.1.5. Phase V. Surface Soil Sampling

Prior to initiating surface soil sampling, an assessment of the Phase I through IV analyses results will be conducted to determine if there is a need for further sampling. The data assessment will be the first stage of the process described in Subsection 4.6, Decontamination Criteria. If no need for further sampling is identified, the investigation described in subsection 4.6 will not be conducted.

Thermal treatment processes at both the detonation area and the burn area created releases of airborne products. There is a potential for the deposition and accumulation of those products on surface soils immediately around the site. To address this, a wide area around the TA-40-SDS will be subjected to random surface soil sampling. A two-tiered grid system will be employed. A grid on 100-ft centers will be established around TA-40-SDS, on areas not included in the investigations described above (Figure 4.3). Grid nodes within 200 ft of the site will be included in the first tier. The grid will extend outward 800 ft, and all grid nodes beyond 200 ft will be a part of the second tier. The ten first-tier locations will be sampled and are identified in Figure 4.3. Samples will be collected at six randomly selected grid nodes from the second tier.

If a sample cannot be obtained at the exact location of the grid node, the closest suitable location will be used. This plan will result in the collection of sixteen samples for analysis.

4.2. ANALYTICAL PROGRAM

All samples taken during the site investigation will be subjected to the same suite of analyses. Solid samples will include waste residues, crushed tuff fill, soil, and sediment. Liquid samples will include equipment washes, decontamination rinsates, and certain quality assurance/quality control samples. The specific analyses to be performed, and the rationale for selecting them, are described below.

All samples will be analyzed for metals, organics, cyanide and nitrates as defined in subsections 4.2.1 through 4.2.3. Barium and lead are known to be present in some explosive compounds used at TA-40. The other metals are included to confirm they have not been used at the Scrap Detonation Site. Analyses for volatile and semivolatile organic compounds are conducted to confirm that solvents used in explosives preparation, as well as other regulated organic hazardous constituents, are not present. Both cyanide and nitrates are included in the analytical suite as they could be products of the detonation of organic nitrogen explosive compounds. Sulfides are not included in the analytical suite because sulfur compounds were not components of explosives treated at TA-40-SDS.

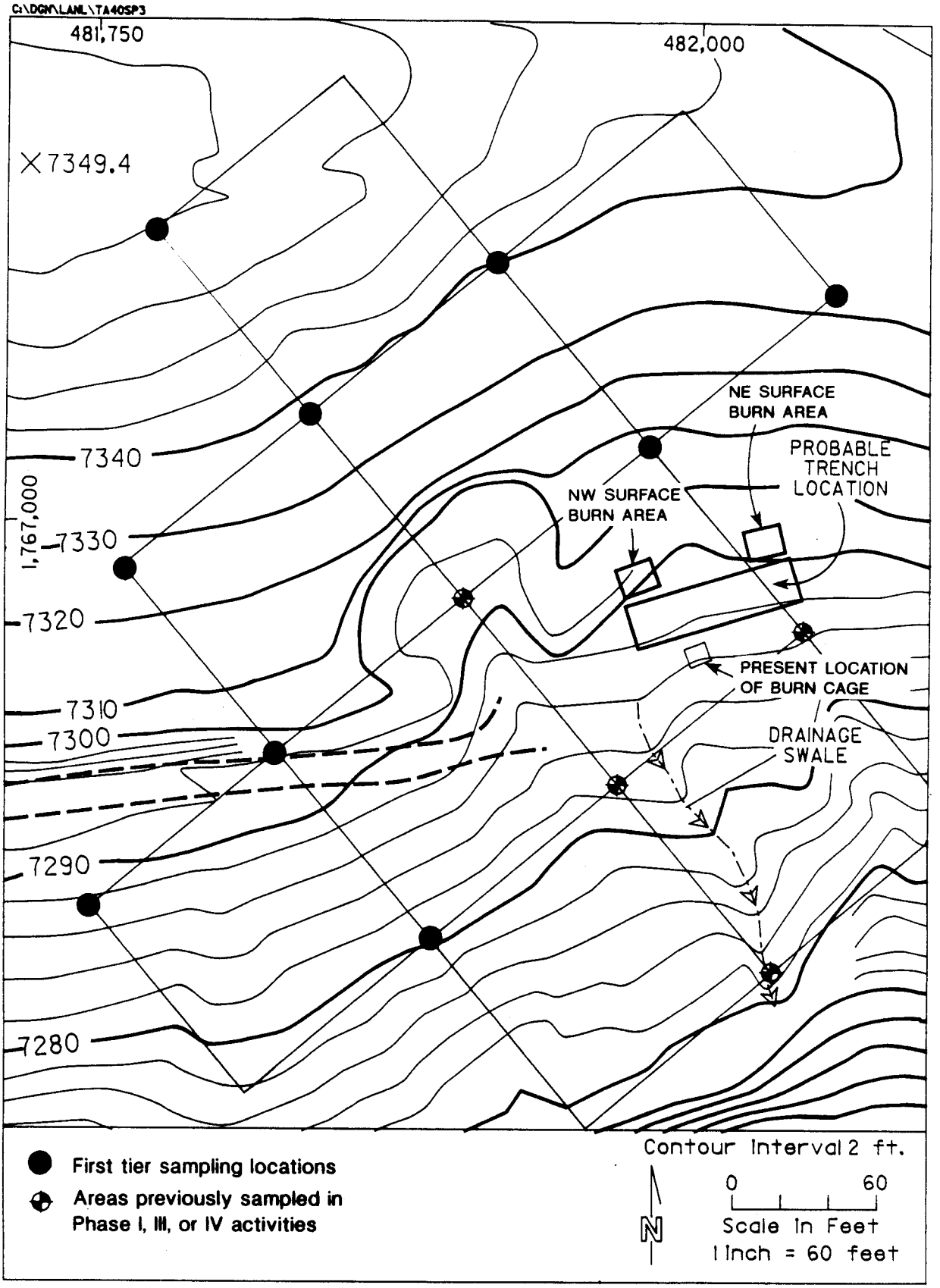


Figure 4.3. Scrap Detonation Site investigation general area surface soil sampling.

4.2.1. Metals and Cyanide

The primary concern at TA-40-SDS is the possible presence of TCLP toxic waste, due to the use of lead and barium compounds in the formulation of some explosives. Such materials may constitute a hazardous waste requiring appropriate management. Previous testing using EP toxicity did not identify any samples that would qualify as hazardous wastes. To further address this issue, all soil from the site investigation will be analyzed by the TCLP for the eight RCRA metals: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

Another concern is the possible presence in the soils of other metals that might be considered hazardous constituents. Although such a situation is considered unlikely, all samples will be analyzed for the U.S. Environmental Protection Agency (EPA) Target Analyte List (TAL) metals, as a general screening for metals (Table 4.2). Two metals suspected of having been used at TA-40 (but not known to have been present in wastes treated at TA-40-SDS), beryllium and thallium, are included on the TAL. The TAL inorganic analysis commonly includes cyanide, and this compound will be assessed as well.

4.2.2. Organic Chemicals

Examples of such possible compounds include polynuclear aromatic hydrocarbons that are commonly associated with combustion, particularly combustion of wood and paper products, and volatile organic compounds such as the volatile components of kerosene and laboratory solvents that may remain as trace contaminants in the soil of the burn pit or cage.

The EPA Target Compound Lists (TCLs) for volatile organic compounds and for base-neutral/acid (BNA) extractable organic compounds (semivolatiles) have been selected to provide a broad screening for organics (Tables 4.3 and 4.4).

4.2.3. Nitrates

All soil samples will be analyzed for nitrates. EPA Method 300.0 will be used for all nitrate analyses.

4.2.4. Comparison of Analytical Suite to 40 CFR 264, Appendix IX

With the exception of barium nitrate, none of the major explosive constituents are among the hazardous constituents listed in HWMR-5, Part V (40 CFR 264, Appendix IX). The organic scans will analyze for the presence of 199 of the 227 listed hazardous organic constituents for which there are analytical methods in SW 846 (EPA 1989). Of the remaining 28 listed organic constituents, 8 are included in the metals and

Table 4.2. Target Analyte List Inorganics and Contract-Laboratory Program Contract-Required Detection Limits for Water and Soil/Sediment[a]

Analyte	Water (µg/L)	Contract-Required Detection Limit[b,c] Soil/Sediment (mg/kg)	Analytical Instrument
Aluminum	200	40	ICP[d]
Antimony	60	12	ICP[d]
Arsenic	10	2	GFAA[e]
Barium	200	40	ICP[d]
Beryllium	5	1	ICP[d]
Cadmium	5	1	ICP[d]
Calcium	5000	1000	ICP[d]
Chromium	10	2	ICP[d]
Cobalt	50	10	ICP[d]
Copper	25	5	ICP[d]
Iron	100	20	ICP[d]
Lead	5	1	GFAA[e]
Magnesium	5000	1000	ICP[d]
Manganese	15	3	ICP[d]
Mercury	0.2	0.1	CVAA[f]
Nickel	40	8	ICP[d]
Potassium	5000	1000	ICP[d]
Selenium	5	1	GFAA[e]
Silver	10	2	ICP[d]
Sodium	5000	1000	ICP[d]
Thallium	10	2	GFAA[e]
Vanadium	50	10	ICP[d]
Zinc	20	4	ICP[d]
Cyanide	10	2	Auto Analyzer

[a]EPA. 1987a.

[b]Contract-required detection limits are subject to the restrictions specified in the first page of Part G, Section IV of Exhibit D (Alternate Methods - Catastrophic Failure). Any analytical methods specified in the EPA Statement of Work Exhibit D may be used as long as the documented instrument or method detection limits meet the contract-required detection limits. Higher detection limits may only be used in the following circumstance (EPA 1987a):

If the sample concentration exceeds five times the detection limit of the instrument or method in use, the value may be reported even though the instrument or method detection limit may not equal the contract-required detection limit. This is illustrated in the example below (EPA 1987a):

For lead:
Method in use - ICP
Instrument Detection Limit = 40
Sample Concentration = 220
Contract-Required Detection Limit = 5

Table 4.2. (continued)

The value of 220 may be reported even though instrument detection limit is greater than the contract-required detection limit. The instrument or method detection limit must be documented as described in Exhibit E (EPA 1987a).

[c]The contract-required detection limits are the instrument detection limits obtained in pure water that must be met using the procedure in Exhibit E of the EPA Statement of Work. The detection limits for samples may be considerably higher, depending on the sample matrix (EPA 1987a).

[d]ICP - Inductively coupled plasma - atomic emission spectrometer.

[e]GFAA - Graphite furnace atomic absorption spectrophotometer.

[f]CVAA - Cold vapor atomic absorption spectrophotometer.

Table 4.3. Target Compound List Volatiles and Contract Laboratory Program Contract-Required Quantitation Limits for Water[a,b]

Volatiles	CAS Number[c]	Quantitation Limits for Water (μg/L)[d]
1. Chloromethane	74-87-3	10
2. Bromomethane	74-83-9	10
3. Vinyl chloride	75-01-4	10
4. Chloroethane	75-00-3	10
5. Methylene chloride	75-09-2	5
6. Acetone	67-64-1	10
7. Carbon disulfide	75-15-0	5
8. 1,1-dichloroethene	75-35-4	5
9. 1,1-dichloroethane	75-34-3	5
10. 1,2-dichloroethene (total)	540-59-0	5
11. Chloroform	67-66-3	5
12. 1,2-dichloroethane	107-06-2	5
13. 2-butanone	78-93-3	10
14. 1,1,1-trichloroethane	71-55-6	5
15. Carbon tetrachloride	56-23-5	5
16. Vinyl acetate	108-05-4	10
17. Bromodichloromethane	75-27-4	5
18. 1,2-dichloropropane	78-87-5	5
19. 1,3-*cis*-dichloropropene	10061-01-5	5
20. Trichloroethene	79-01-6	5
21. Dibromochloromethane	124-48-1	5
22. 1,1,2-trichloroethane	79-00-5	5
23. Benzene	71-43-2	5
24. 1,3-*trans*-dichloropropene	10061-02-6	5
25. Tribromomethane	75-25-2	5
26. 4-methyl-2-pentanone	108-10-1	10
27. 2-hexanone	591-78-6	10
28. Tetrachloroethene	127-18-4	5
29. Toluene	108-88-3	5
30. 1,1,2,2-tetrachloroethane	79-34-5	5
31. Chlorobenzene	108-90-7	5
32. Ethylbenzene	100-41-4	5
33. Styrene	100-42-5	5
34. Xylenes (total)	1330-20-7	5

[a]EPA. 1987b.

Table 4.3. (continued)

[b]These are the EPA quantitation limits under the Contract Laboratory Program. Specific quantitation limits are highly matrix-dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable (EPA 1987b).

[c]CAS Number - Chemical Abstract Service Number.

[d]Quantitation limits achieved by gas chromatograph/mass spectrophotometer.

Table 4.4. Target Compound List Semivolatiles and Contract Laboratory Program Contract-Required Quantitation Limits for Water and Soil/Sediment[a,b]

Semivolatiles	CAS Number[c]	Quantitation Limits[d,e] Water µg/L	Quantitation Limits[d,e] Low Soil/Sediment[f] µg/kg
1. Phenol	108-95-2	10	330
2. bis(2-chloroethyl) ether	111-44-4	10	330
3. 2-chlorophenol	95-57-8	10	330
4. 1,3-dichlorobenzene	541-73-1	10	330
5. 1,4-dichlorobenzene	106-46-7	10	330
6. Benzyl alcohol	100-51-6	10	330
7. 1,2-dichlorobenzene	95-50-1	10	330
8. 2-methylphenol	95-48-7	10	330
9. bis(2-chloroisopropyl) ether	108-60-1	10	330
10. 4-methylphenol	106-44-5	10	330
11. N-nitroso-di-n-dipropylamine	621-64-7	10	330
12. Hexachloroethane	67-72-1	10	330
13. Nitrobenzene	98-95-3	10	330
14. Isophorone	78-59-1	10	330
15. 2-nitrophenol	88-75-5	10	330
16. 2,4-dimethylphenol	105-67-9	10	330
17. Benzoic acid	65-85-0	50	1600
18. bis(2-chloroethoxy) methane	111-91-1	10	330
19. 2,4-dichlorophenol	120-83-2	10	330
20. 1,2,4-trichlorobenzene	120-82-1	10	330
21. Naphthalene	91-20-3	10	330
22. 4-chloroaniline	106-47-8	10	330
23. Hexachlorobutadiene	87-68-3	10	330
24. 4-chloro-3-methylphenol (para-chloro-meta-cresol)	59-50-7	10	330
25. 2-methylnaphthalene	91-57-6	10	330
26. Hexachlorocyclopentadiene	77-47-4	10	330
27. 2,4,6-trichlorophenol	88-06-2	10	330
28. 2,4,5-trichlorophenol	95-95-4	50	1600
29. 2-chloronaphthalene	91-58-7	10	330
30. 2-nitroaniline	88-74-4	50	1600
31. Dimethylphthalate	131-11-3	10	330
32. Acenaphthylene	208-96-8	10	330
33. 2,6-dinitrotoluene	606-20-2	10	330
34. 3-nitroaniline	99-09-2	50	1600
35. Acenaphthene	83-32-9	10	330

Table 4.4. (continued)

Semivolatiles	CAS Number[c]	Quantitation Limits[d,e] Water µg/L	Low Soil/Sediment[f] µg/kg
36. 2,4-dinitrophenol	51-28-5	50	1600
37. 4-nitrophenol	100-02-7	50	1600
38. Dibenzofuran	132-64-9	10	330
39. 2,4-dinitrotoluene	121-14-2	10	330
40. Diethylphthalate	84-66-2	10	330
41. 4-chlorophenyl-phenyl ether	7005-72-3	10	330
42. Fluorene	86-73-7	10	330
43. 4-nitroaniline	100-01-6	50	1600
44. 4,6-dinitro-2-methylphenol	534-52-1	50	1600
45. N-nitrosodiphenylamine	86-30-6	10	330
46. 4-bromophenyl-phenylether	101-55-3	10	330
47. Hexachlorobenzene	118-74-1	10	330
48. Pentachlorophenol	87-86-5	50	1600
49. Phenanthrene	85-01-8	10	330
50. Anthracene	120-12-7	10	330
51. Di-n-butylphthalate	84-74-2	10	330
52. Fluoranthene	206-44-0	10	330
53. Pyrene	129-00-0	10	330
54. Butylbenzylphthalate	85-68-7	10	330
55. 3,3'-dichlorobenzidine	91-94-1	20	660
56. Benzo(a)anthracene	56-55-3	10	330
57. Chrysene	218-01-9	10	330
58. bis(2-ethylhexyl)phthalate	117-81-7	10	330
59. Di-n-octylphthalate	117-84-0	10	330
60. Benzo(b)fluoranthene	205-99-2	10	330
61. Benzo(k)fluoranthene	207-08-9	10	330
62. Benzo(a)pyrene	50-32-8	10	330
63. Indeno(1,2,3-cd)pyrene	193-39-5	10	330
64. Dibenz(a,h)anthracene	53-70-3	10	330
65. Benzo(g,h,i)perylene	191-24-2	10	330

[a]EPA. 1987b.

Table 4.4. (continued)

[b]These are the EPA quantitation limits under the Contract Laboratory Program. Specific quantitation limits are highly matrix-dependent. The quantitation limits listed herein are provided for guidance and may not be achievable (EPA 1987b).

[c]CAS Number - Chemical Abstract Service Number.

[d]Quantitation limits achieved by gas chromatograph/mass spectrophotometer.

[e]Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required by the contract, will be higher.

[f]Medium soil/sediment Contract Laboratory Program contract-required quantitation limits for semivolatile TCL compounds are 60 times the individual low soil/sediment contract-required quantitation limits.

cyanide analyses. None of the remaining 20 listed organic constituents are used in explosives manufacture.

4.2.5. Sample Volume Requirements

Sampling must provide sufficient volume within each sampling interval to satisfy the sample volume needs of all analyses, including periodic duplication of samples for quality assurance/quality control purposes. At least 500 grams of each sample need to be collected.

4.3. SAMPLING METHODS

Sampling by the methods described below is consistent with guidance given in Samplers and Sampling Procedures for Hazardous Waste Streams (EPA 1983) and Test Methods for Evaluating Hazardous Solid Wastes "SW-846" (EPA 1989).

4.3.1. Surface Soil

Surface soil samples will be taken to a depth of 6 inches, using a trowel or a scoop.

4.3.2. Soil Coring

Collection of soil cores will be done using a Central Mining Equipment Model 85 (CME-85) drilling rig equipped with a hollow-stem auger with 3-inch-diameter coring capabilities. This equipment is capable of coring to greater than 150 ft in bedrock tuff. Coring with the hollow-stem auger produces borehole cuttings that will be left onsite.

4.3.3. Equipment Washes

Liquid wash samples from the burn cage, personnel shelter, wiring boxes, and collected debris will be obtained by rinsing the surface of those items with a slow stream of distilled water (as from a laboratory wash bottle, for example). The water will be collected in a sample container as it drains off the structure. Preliminary cleaning of the structure is not expected, as the purpose of the wash water collection is to determine the need for decontamination of the structure.

4.3.4. Quality Assurance/Quality Control Samples

All sampling will be subjected to quality assurance and quality control according to the new revised toxicity characteristics final rule (EPA 1990a). For example, at least 1 blank will analyzed for every 20 extractions. Blanks will include field blanks and trip blanks. At least 1 matrix spike will be performed for each set of samples submitted to the laboratory. In addition, 1 field duplicate will be collected for every 20 samples.

4.3.5. Sampling Equipment Decontamination

All sampling tools will be decontaminated between samples by washing with a Liquinox or Alconox solution, rinsing with tap water, rinsing with distilled water, draining of excess water, and air-drying or wiping dry with a clean paper towel. Water from decontamination of sampling tools will be drained in a single location onsite.

4.4. SAMPLE HANDLING AND DOCUMENTATION

Sample labels, as shown in Figure 4.4, will be affixed to the sample container at the time of sampling. Site, location, sample, and sampler identifications will be made on each sample label. Sample containers will be sealed with a gummed paper seal (Figure 4.5) attached to the container in such as way that the seal must be broken in order to open the container. Sample descriptions will be identified on the Hazardous Material Sample Analysis Request (Figure 4.6), which will be used to document field information pertinent to the sample collection, such as soil texture and surface appearance, ambient temperature and cloud cover, and precipitation conditions within the past 24 hours.

Multipart chain-of-custody forms, as shown in Figure 4.7, will be used to track and document sample possession from the time of collection. The original must accompany the sample, and a copy is retained by LANL when custody of the sample is relinquished to another organization.

Each person responsible for field activities will maintain a separate field log book for recording information pertinent to field surveys and sampling. The book is to have bound and consecutively numbered pages in an 8-1/2- by 11-inch format. Minimum entries include:

a. Purpose of sample (routine sampling, special sampling).

b. Location of sampling (coordinates of sampling point, grid location, etc.).

c. Identification of person making log entry.

d. Type of process producing waste.

OFFICIAL SAMPLE LABEL

Collector_____ Collector's Sample No._____

Place of Collection_____

_____

Date Sampled_____ Time Sampled_____

Field Information_____

_____

_____

ALTERNATE SAMPLE LABEL

DATE TIME SAMPLE NO. ORIGIN

LOCATION SAMPLED

_____

DESCRIPTION

_____

REMARKS

_____

REQUESTED ANALYSIS

_____

SAMPLED BY: (PRINT AND SIGN) LOG REFERENCE

TAG NO.____OF____

_____

Figure 4.4. Examples of sample labels.

OFFICIAL SAMPLE SEAL

Collected by_____ Collector's Sample No._____
(Signature)

Date Collected_____ Time Collected_____

Place Collected_____

_____

_____

Figure 4.5. Example of sample seal.

PART I: FIELD SECTION

Collector_____ Date Sampled_____ Time_____hours

Location of Sampling_____
name of company, disposal site, etc.

Address_____
number street city state zip

Telephone (___)_____ Company Contact_____

HML NO. (Lab only)	COLLECTOR'S SAMPLE NO.	TYPE OF SAMPLE*	FIELD INFORMATION

Analysis Requested_____

_____

_____

Special Handling and/or Storage_____

_____

PART II: LABORATORY SECTION

Received by_____Title_____Date_____

Sample Allocation: __HML __LBL __LABL __SRL Date_____

Analysis Required_____

_____

_____

*Indicate whether sample is sludge, soil, etc.; **Use back of page for additional information.

Figure 4.6. Hazardous materials sample analysis request.

Hazardous Materials
Collectors Sample No.____

Location of Sampling: __Producer __Hauler __Disposal Site

__Other:_____

Company's Name_____Telephone (___)_____

Address_____
number street city state zip

Collector's Name_____Telephone (___)_____
signature

Date Sampled_____ Time Sampled_____hours

Type of Process Producing Waste_____

Waste Type Code_____ Other_____

Field Information_____

_____

_____

Sample Allocation:

1. _____
name of organization

2. _____
name of organization

3. _____
name of organization

Chain of Possession

1. _____ _____ _____ _____
signature title inclusive dates

2. _____ _____ _____ _____
signature title inclusive dates

3. _____ _____ _____ _____
signature title inclusive dates

Figure 4.7. Chain of custody record.

e. Number and volume of samples taken.

f. Description of sampling location, sampling methodology, equipment used.

g. Date and time of sample collection

h. Sample destination and transporter's name (name of laboratory, UPS, etc.).

i. Map or photograph of sampling site, if any.

j. Field observations (ambient temperature, sky conditions, past 24-hour precipitation, etc.).

k. Field measurements, if any.

l. Sample identification number.

m. Analytical parameters requested for sample analysis.

n. Signature of person responsible for the log entry.

Sample shipments and chain-of-custody records must be accompanied by the sample analysis request, as shown in Figure 4.6. The request sheet has two parts: field and laboratory. The field portion of this form must be completed by the person collecting the sample and may include pertinent information from the log book. The laboratory portion is intended to be completed by analytical laboratory personnel when the sample is received.

4.5. PERSONNEL PROTECTION

Personnel involved in sampling and equipment decontamination will wear rubber gloves, rubber boots, safety glasses, and coveralls. Personnel involved in dust generating activities, such as sampling, coring, and drumming of sampling wastes, will wear respiratory protection to prevent inhalation of contaminated dust, unless sufficient dust-suppression measures are imposed to curtail the generation of dust. The LANL Industrial Hygiene Group, HSE-5, will determine the required level of dust suppression or respiratory protection based on a review of this plan.

4.6. SITE DECONTAMINATION CRITERIA

EPA action levels set in draft 40 CFR 264, Subpart S (ref), will be compared to the concentration of each hazardous constituent found in the samples, and will be used as site decontamination criteria for those constituents found. If an identified hazardous constituent is not represented by an action level in Subpart S, the methodology of Subpart S will be used to create action levels for those constituents. As an alternative, LANL may choose to prepare a risk assessment for any constituent to determine the threshold

concentration for each constituent that represents a significant risk to human health and the environment. Soils will be considered "contaminated" that contain regulated constituent levels above the Subpart S action level or, alternatively, above the threshold concentration, and these will be removed for appropriate management and disposal.

A copy of the comparisons to EPA action levels in draft Subpart S, comparisons to newly created action levels, or a completed risk assessment along with pertinent backup data, will be provided to NMEID for review and approval. Should NMEID find the Subpart S action levels or the risk assessment to be inadequate, LANL will negotiate decontamination criteria agreeable to both parties. Closure will not start until the decontamination criteria have been approved by NMEID.

4.8. ADDITIONAL SAMPLING TO REFINE EXCAVATION LIMITS

At LANL's option, additional site investigations may be conducted prior to commencing site decontamination, if such investigations are deemed necessary by LANL to clearly define the limits of materials required to be removed. If additional investigations are needed, LANL will provide NMEID with notice of its intent within the review period for the decontamination criteria. The notice will identify the specific objectives of the additional investigations.

5. SITE DECONTAMINATION

5.1. SITE DECONTAMINATION METHODS

5.1.1. Material Excavation

The approach to decontamination will depend on the extent of contamination, as determined by the site investigation. If identified quantities of contaminated soils are small and confined to the surface, the contaminated material will be removed by hand shovel or backhoe, placed into drums, and transferred via truck to appropriate storage or disposal facilities.

If the volumes are large, excavation will be by backhoe or front-end loader. The material will be transported in sealed and covered dump trucks or gondola trucks. For regulated wastes, LANL will contract with a permitted disposal site contractor for the trucks, transportation, and any required treatment and disposal.

5.1.2. Personnel Protection

Personnel involved in excavation and decontamination will wear rubber gloves, rubber boots, safety glasses, and coveralls. Personnel involved in dust generating activities, such as digging and filling drums, will wear respiratory protection to prevent inhalation of contaminated dust. The LANL Industrial Hygiene Group, HSE-5, will review the sampling results from the site investigation, specify the type of respiratory protection to be used, and recommend any additional protective clothing that may be needed.

5.1.3. Equipment Decontamination

Equipment used to excavate contaminated materials may include shovels, backhoes, front-end loaders, and similar equipment. All equipment will be scraped and brushed clean, and the removed material will be contained and disposed of with the associated excavated material. Following the dry removal of material from the equipment, the potentially contaminated portions will be bagged in plastic and sealed, and transported to the TA-50 decontamination pad where the equipment will be washed and rinsed. The wash and rinse water will be contained and treated at a permitted waste water treatment facility. No testing for decontamination of excavation equipment will be conducted since the regulated substances potentially present are not acutely toxic and washing with detergent is adequate to allow the equipment to be safely handled.

Since the potential exists for materials excavated from different areas of the site to have different disposal requirements, it may be necessary to separately decontaminate equipment for each type of area

excavated. If possible, work will be scheduled such that excavation of non-hazardous materials will precede excavation of contaminated materials for which equipment decontamination is required.

5.2. WASTE SEGREGATION, STORAGE, TREATMENT, AND DISPOSAL

Materials to be excavated will be identified prior to excavation as non-hazardous, hazardous constituent-contaminated, or hazardous waste. Non-hazardous materials will be disposed of at the Los Alamos County Landfill.

5.2.1. Hazardous Constituent-Contaminated Materials

Materials categorized as hazardous constituent-contaminated will be those in which one or more hazardous constituents exceed an action level or risk-based contamination criterion (see subsection 4.6). Waste storage, treatment, and disposal options for such materials may vary depending on the particular hazardous constituent. The appropriate treatment and disposal options will be determined on the basis of the site investigation sampling results, and will be identified to NMEID prior to commencing remedial activities. Such options will be in compliance with New Mexico HWMR-5, as amended July 9, 1989, and with appropriate EPA regulations.

5.2.2. Hazardous Wastes

Hazardous wastes that may potentially be identified at TA-40-SDS are soils determined to be TCLP-toxic for lead or barium. Such materials will be subject to full regulation as hazardous waste and will be managed in compliance with New Mexico HWMR-5, amended July 9, 1989, and with appropriate EPA regulations. In particular, certain hazardous wastes may be subject to land disposal restrictions and may need to be treated by specific techniques prior to disposal at a permitted facility. The appropriate treatment and disposal options will be determined on the basis of the site investigation sampling results, and will be identified to NMEID prior to commencing remedial actions. As necessary, LANL will contract with a permitted disposal site contractor for transport, treatment, storage, and disposal of the wastes.

5.3. DECONTAMINATION VERIFICATION

Decontamination of the site will be demonstrated by additional sampling. Surface soil/tuff samples will be taken following excavation at the same locations used to define the contaminated area. The suite of analytes and the method for determining contamination will be as previously discussed; however, verification analyses will be limited to those constituents that necessitated the removal.

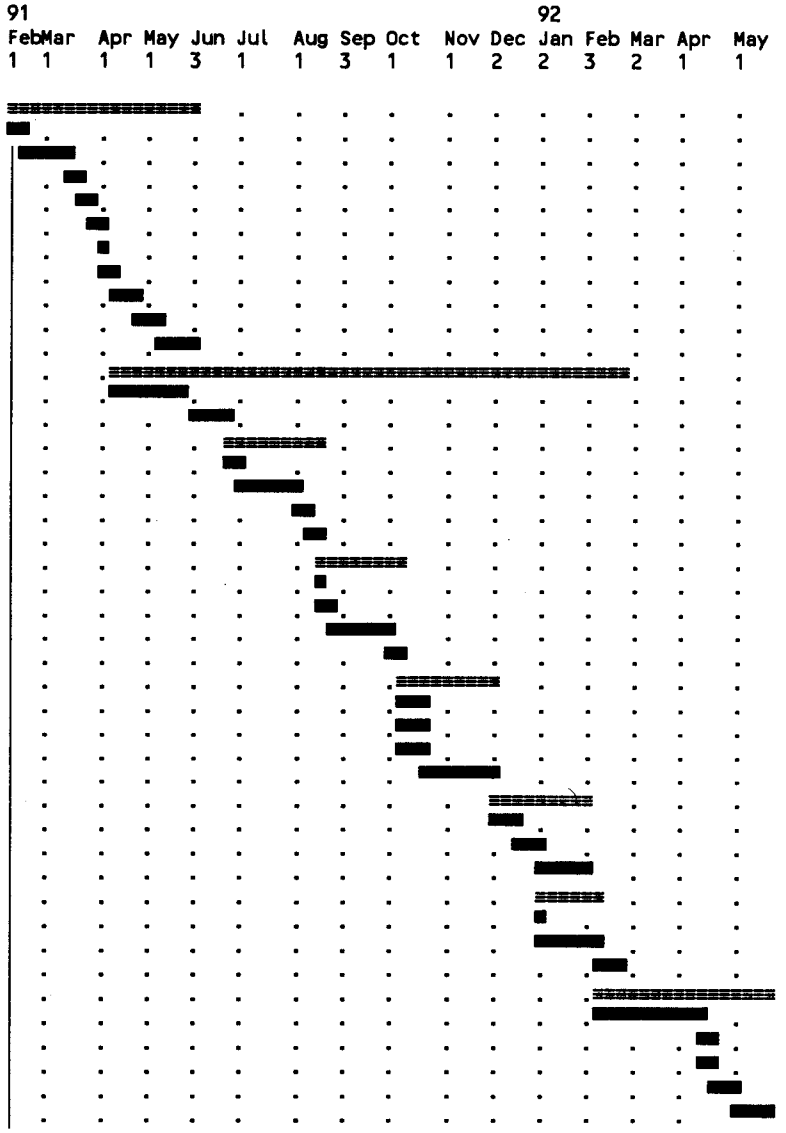
6. SCHEDULE

The year of closure will be 1992, although initiation of closure activities will occur in late 1990 or early 1991. The schedule will commence upon receipt by LANL of notice of approval of the plan by NMEID. A detailed schedule is provided in Figure 6.1 based on an assumed approval date of December 3, 1990. The TA-40-SDS is prone to snow cover in the winter. Field activities are subject to delay pending suitable weather and soil conditions. A nominal weather contingency has been explicitly identified in the schedule. The schedule includes the optional sampling identified in subsection 4.8 and all removal and waste treatment and disposal activities. Such activities are considered unlikely based on preliminary sample analysis results. However, this schedule is considered to represent the maximum likely duration for the project.

Schedule Name : TA-40 Scrap Detonation Site Closure
Responsible : John Krueger
As-of Date : 4-Feb-91 Schedule File : C:\TL3\STCLOSE2

Schedules for activities that depend on State approval are subject to change.

Task Name	Start Date	End Date	Duratn (Days)
Closure Plan Submittal	22-Jan-91	28-May-91	89
Draft Transmittal	22-Jan-91	11-Feb-91	15
State Review	12-Feb-91	14-Mar-91	22
State Comment Transmittal	15-Mar-91	21-Mar-91	5
Draft SOW Preparation	22-Mar-91	28-Mar-91	5
Draft SOW Review	29-Mar-91	1-Apr-91	2
Final SOW Submittal	2-Apr-91	3-Apr-91	2
Approval/Funding Transfer	4-Apr-91	8-Apr-91	3
Final Publication	9-Apr-91	22-Apr-91	10
Final Transmittal	23-Apr-91	6-May-91	10
State Approval	7-May-91	28-May-91	15
Closure Implementation	9-Apr-91	25-Feb-92	222
Subcontracting	9-Apr-91	20-May-91	30
Mobilization	29-May-91	18-Jun-91	15
Phase I-III Sampling	19-Jun-91	14-Aug-91	40
Sampling	19-Jun-91	25-Jun-91	5
Lab Analysis	26-Jun-91	31-Jul-91	25
Data Assessment	1-Aug-91	7-Aug-91	5
Debris Removal	8-Aug-91	14-Aug-91	5
Phase IV Sampling	15-Aug-91	3-Oct-91	35
Remobilization	15-Aug-91	19-Aug-91	3
Sampling	20-Aug-91	21-Aug-91	2
Lab Analysis	22-Aug-91	26-Sep-91	25
Data Assessment	27-Sep-91	3-Oct-91	5
Assess Need for Removal	4-Oct-91	2-Dec-91	40
Set Removal Criteria	4-Oct-91	17-Oct-91	10
Set Waste Treatment/Di	4-Oct-91	17-Oct-91	10
Set Excavation Specs	4-Oct-91	17-Oct-91	10
Subcontracting	18-Oct-91	2-Dec-91	30
Removal Action	3-Dec-91	30-Jan-92	40
Mobilization	3-Dec-91	16-Dec-91	10
Excavation	17-Dec-91	31-Dec-91	10
Disposal	2-Jan-92	30-Jan-92	20
Verification Sampling	2-Jan-92	10-Feb-92	27
Sampling	2-Jan-92	3-Jan-92	2
Lab Analysis	6-Jan-92	10-Feb-92	25
Site Restoration	11-Feb-92	25-Feb-92	10
Closure Report	11-Feb-92	26-May-92	74
Preliminary Draft	11-Feb-92	13-Apr-92	44
Closure Certification	14-Apr-92	20-Apr-92	5
P.D. Review	14-Apr-92	20-Apr-92	5
Draft Publication	21-Apr-92	4-May-92	10
Draft Transmittal	5-May-92	26-May-92	15



Detail Task — Summary Task — Milestone
(Started) — (Started) — Conflict
(Slack) — (Slack) — Resource delay

Scale: 1 week per character

TIME LINE Gantt Chart Report, Strip 1

Figure 6.1. TA-40-SDS Closure Plan Schedule

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