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Expedited Cleanup Plan for

Solid Waste Management Unit 16-020 Photoprocessing Facility Outfall

DRAFT

Field Unit 3

Environmental Restoration Project

February 1996

A Department of Energy
Environmental Cleanup Program

Los Alamos
NATIONAL LABORATORY

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ACRONYMS

COC	Contaminant of concern
COPC	Chemical(s) of potential concern
CSF	Waste management characterization strategy form
DOE	U.S. Department of Energy
EC	Expedited cleanup
EU	Exposure unit
EPA	U.S. Environmental Protection Agency
ER	Environmental restoration
FIMAD	Facility for Information Management and Display
FPL	Field project leader
FTL	Field team leader
HE	High explosive
HSWA	Hazardous and Solid Waste Amendments
LANL	Los Alamos National Laboratory
MDA	Material Disposal Area
NMED	New Mexico Environment Department
NPDES	National Pollutant Discharge Elimination System
OU	Operable unit
PAH	Polycyclic aromatic hydrocarbons
PPE	Personal protective equipment

QA	Quality Assurance
RCRA	Resource Conservation and Recovery Act
RFI	RCRA facility investigation
SAL	Screening action level
SMO	Sample management organization
SOP	Standard operating procedure
SSHASP	Site-specific health and safety plan
SVOC	Semivolatile organic compound
SWMU	Solid waste management unit
TA	Technical area
TCLP	Toxicity characteristic leaching procedure
TSD	Treatment, storage, and disposal
UCL	Upper confidence level
UTL	Upper tolerance limit
VOC	Volatile organic compound

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1.0 INTRODUCTION

This expedited cleanup (EC) plan addresses Solid Waste Management Unit (SWMU) 16-020. This SWMU is an outfall associated with TA-16-222, an x-ray film-processing laboratory. The site is located at Technical Area (TA)-16 in the southwestern section of the Los Alamos National Laboratory (LANL), Los Alamos, New Mexico (Fig. 1-1). This EC Plan is being proposed as part of the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) process described in the RFI Work Plan for Operable Unit (OU) 1082 (LANL 1993 1094).

SWMU 16-020 is included in Tables A and B of the Hazardous and Solid Waste Amendments (HSWA) permit.

SWMU 16-020 is an operational release area where photographic chemicals have been released to soils and stream sediments. For more than 20 years, SWMU 16-020 received significant quantities of untreated, spent x-ray fixing solutions. In 1979, the facility began to recover the silver before discharging the waste. The outfall is permitted under National Pollutant Discharge Elimination System (NPDES) Permit EPA 06A073 to release 0.5 mg/L silver daily. The facility became inactive in 1995. A site transport study published in 1985 examined the distribution of silver in soils, sediments, and plants (Kasunic et al. 1985, 0134). Details of this study are in Section 2.2.1. RFI sampling results indicate chromium contamination, from photochemical solutions, is significant particularly in the first 75 ft of the drainage channel. Polycyclic aromatic hydrocarbons (PAHs) were also found during RFI sampling. The source of this release of PAHs is not well understood. Sampling results can be found in Annex 6.9.

Activities comprising the EC include removing soil at the outfall and in the drainage, guided by field screening, until concentrations of contaminants of concern (COCs) reach proposed cleanup levels in the remaining soil. Verification sampling results will be evaluated to determine if the cleanup levels have been achieved. Any contaminated soil generated during the EC will be transported to a landfill for disposal after the waste has been characterized.

This EC Plan identifies the level of effort required from initial transmittal of the plan to the New Mexico Environment Department (NMED) and the U.S. Environmental Protection Agency (EPA) for review, through implementation, to the completion of the final report as identified in the schedule. This plan may need to be modified after results from field screening and verification sampling have been evaluated.

1.1 ASSUMPTIONS

In the development of this EC plan, the following assumptions were made:

- The levels of COCs are consistent with preliminary data (see Annex 6.9).
- The volume of anticipated waste and the estimated costs use the most conservative assessment of actual waste volumes.
- Based on current Laboratory land-use planning, future land use at the location of this SWMU will continue to be for industrial purposes.
- Minimal delays in EC operations will be experienced as a result of inclement weather and site access problems. Delays that may result from the acquisition and scheduling of heavy equipment and from acceptance of waste at permitted disposal facilities cannot be anticipated and, therefore, are not considered in this plan.
- A site-specific health and safety plan (SSHASP) and waste management characterization strategy form (CSF) will be developed specifically to address COCs identified in this EC Plan. Deviations from the anticipated concentrations, locations, or quantities of COCs may necessitate adjustments to both plans, and.
- Any comments generated by regulatory agencies or during public review may necessitate adjustments to the scope of this EC plan.

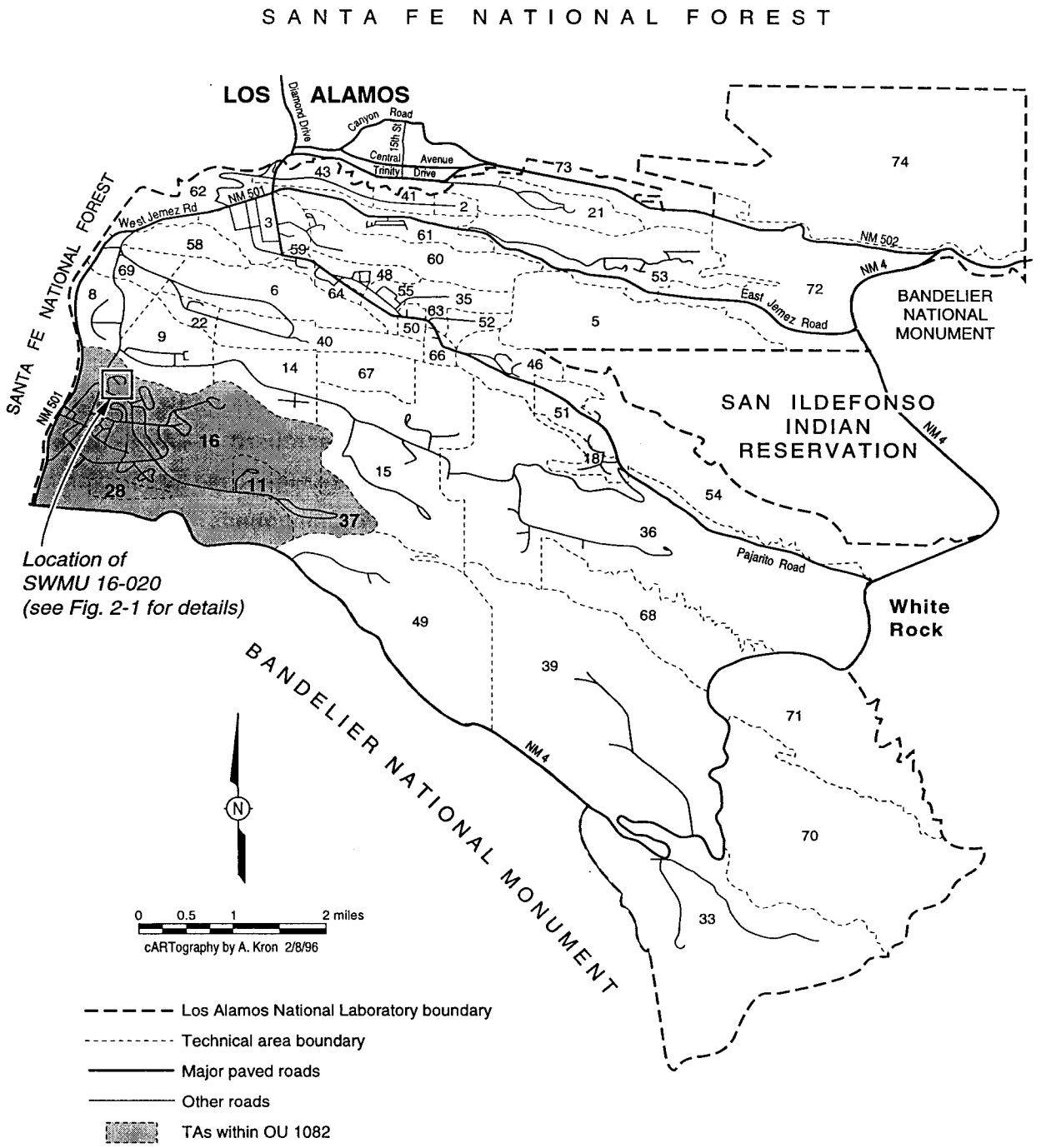

Fig. 1-1. Regional location map.

2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING

2.1 Detailed Description of SWMU 16-020

SWMU 16-020 is an inactive outfall from a photoprocessing facility located in the northern section of TA-16, also known as S-Site, within a secured area (Fig. 2-1). The outfall discharge point is located on the south side of TA-16-222, approximately 10 ft below building grade. The outfall drains into a channel that slopes gently south and east for approximately 295 ft to a confluence with the main channel of Cañon de Valle. A roof drain from TA-16-222 is located next to the outfall pipe and drains into the same channel.

For more than 20 years, SWMU 16-020 received solutions containing silver thiosulfate complexes in concentrations greater than 12 g/L as well as other compounds, including sodium thiosulfate or "hypo," boric acid, and cyanide, from untreated, spent x-ray fixing solutions released from TA-16-222. Other chemicals that may have been used at TA-16-222 include sulfuric acid and organic reducing agents such as phenols and amines used by commercial film developers (Kingslake 1955, 15-16-0579). Chromium compounds are also used in photoprocessing (Budavari et al. 1989, 15-16-454).

2.1.1 Operational History

TA-16-222 was built in 1952. In 1979, the facility began to recover the silver before discharging the waste. In 1995, the building became inactive and all photoprocessing equipment was moved to TA-16-260. The outfall will remain permitted until the operating group requests removal of the permit.

2.1.2 Physical Setting

SWMU 16-020 is located at the western edge of the Pajarito Plateau in Los Alamos County in a semiarid, temperate mountain climate at an elevation of approximately 7 520 ft above mean sea level. Rainfall at the site averages about 22 in. per year. High extremes include 2.51 in. per day of precipitation and 153 in. per year of snowfall. Average snowfall is about 55 in. per year.

SWMU 16-020 lies on a mesa between Cañon de Valle on the north and Water Canyon on the south and is located entirely on U.S. Department of Energy (DOE)-owned land. The outfall drains into a channel which runs south into Cañon de Valle. The canyon drains east-southeast to the Rio Grande approximately 10 miles east of the site. On the mesa top, the outfall channel runs through ponderosa pine forest that is dominated by bluegrass, mountain muhly, and blue grama grass in the understory. Mixed ponderosa forest is the dominant vegetation after the channel reaches the confluence with Cañon de Valle 295 ft downgradient.

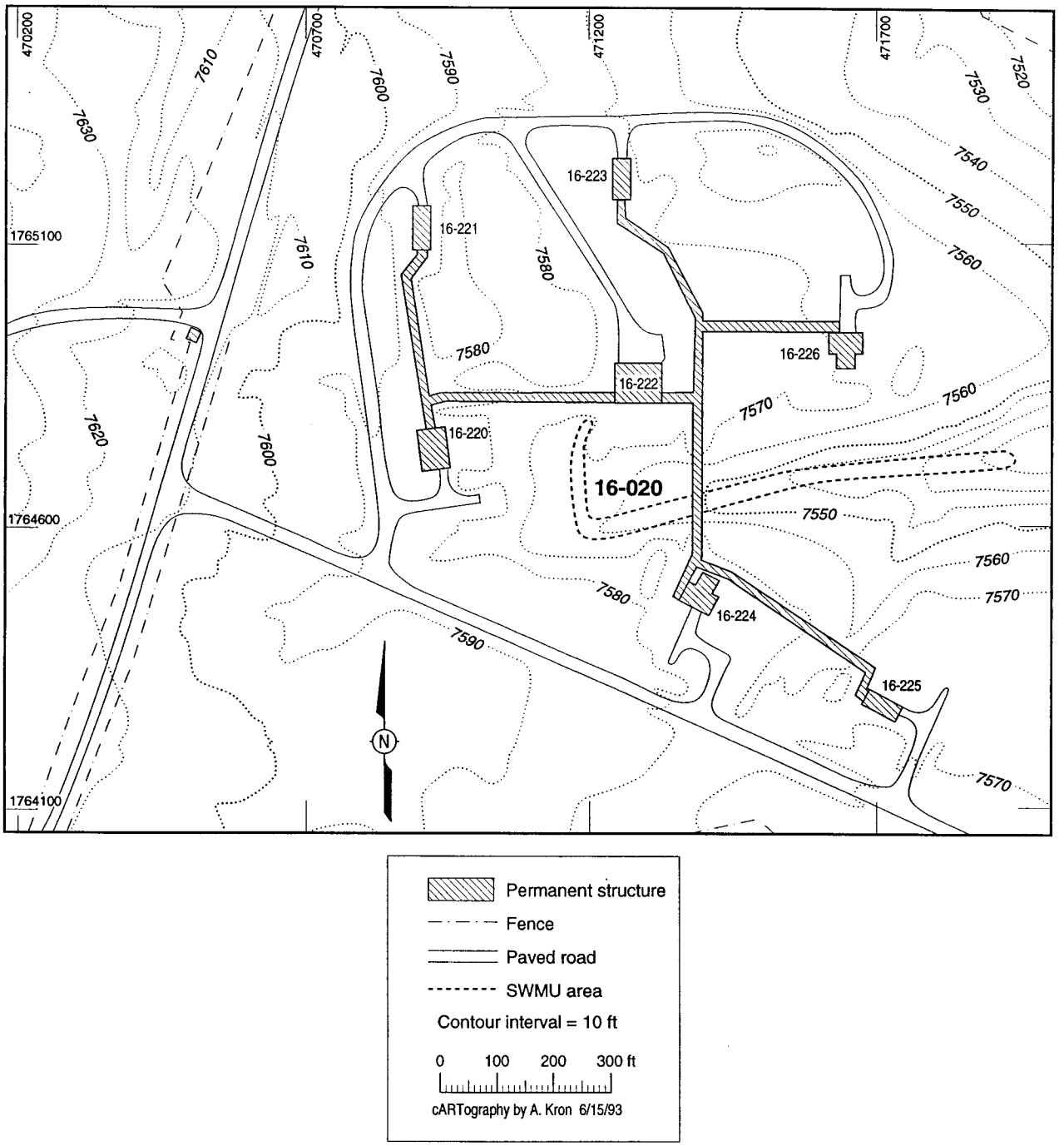

Fig. 2-1. Location map for SWMU 16-020.

The mesa top of this area overlies up to 1 100 ft of unsaturated volcanic tuff and sediments of the Bandelier and Puye Formations. However, no wells to the main aquifer have been completed at TA-16. This thick, unsaturated zone is considered to inhibit groundwater recharge by surface water infiltration. The regional aquifer, which lies beneath the Laboratory and serves as the municipal water supply for the Los Alamos area, is located in the lower Puye Formation and Santa Fe Group sediments. The depth to the regional aquifer is between 800 and 1 100 ft at the site.

Perched water exists at TA-16. Seismic hazards drill hole SHB-3, which extended to a depth of 860 ft and is located approximately 4 000 ft southwest of SWMU 16-020, contained perched water derived from a depth greater than 365 ft but less than 750 ft (Gardner et al. 1993, 15-16-423). In addition, at least five seeps and/or springs are located in and around TA-16.

A soil map presented in the RFI Work Plan for OU 1082 (LANL 1993 1094) defines the soil types present within the SWMU site. These comprise the Typic Eutroboralfs and Tocal very fine sandy loam soils as described by Nyhan et al. (Nyhan 1978, 0161).

Access to SWMU 16-020 is via State Road 501 to the entrance of S-Site. Access is restricted by two security fences with entry limited to personnel with a security clearance and escorted, uncleared personnel. The second security fence isolates the exclusion area where high explosives (HE) are stored or actively used from the area where no HE is used. SWMU 16-020 is located within the exclusion area even though no HE is stored or used in TA-16-222.

2.2 Summary of Investigations

2.2.1 Investigations Prior to RFI

A site transport study, published in 1985, examined the distribution of silver in sediments, soils, and plants. Analysis of sediments and soils defined the vertical and horizontal extent of silver in the stream channel. The silver content of the sediments and the soils decreased with increasing distance from the mouth of the outfall. Silver concentrations in sediment ranged from 14 500 ppm at the outfall to 4 ppm at 1 378 ft downgradient from the outfall, constantly decreasing. The silver screening action level (SAL) in soil is 383 ppm. Sharp decreases in the silver concentration occurred at 295 ft downgradient, where the outfall converges with Cañon de Valle, and at 984 ft downgradient, where a side canyon converges with Cañon de Valle. Silver concentration in the soils followed a much more erratic pattern, but silver concentration was typically lower in the soil than in the associated sediment. Subsurface soil analyses at 33 ft and 66 ft downgradient from the outfall indicated that subsurface concentrations

decreased with increasing distance from the outfall and with increasing depth from the surface. At 33 ft downgradient, silver concentrations ranged from 1 400 ppm at the surface to 182 ppm at the 3-ft depth (Kasunic et al. 1985, 0134).

The outfall water from TA-16-222 was analyzed several times during the late 1970s as part of the NPDES application process. Silver ranged from 2.16 to 7.30 mg/L and cyanide ranged from <0.004 to 2.080 mg/L (Keenan 1977, 15-16-441). The silver SAL in water is 0.05 mg/L and the cyanide SAL in water is 0.2 mg/L. In general, the volume of waste discharged during a single operation is insufficient to maintain surface flow more than 230 to 262 ft downstream before infiltrating into the sediments and underlying alluvium (Kasunic et al. 1985, 0134). Rainfall during a release could cause discharged waste to travel further downstream.

Sediments in Cañon de Valle were collected in April 1994 and analyzed to detect the presence of contamination. Cañon de Valle flows along the northern edge of TA-16 and the outfall from TA-16-222 drains directly into Cañon de Valle. The sediment samples were collected between 4 000 ft and 5 000 ft downgradient from the TA-16-222 outfall. This area is also downgradient from a large HE machining facility (TA-16-260) and Material Disposal Area (MDA) R, both of which may have contributed contamination to the canyon. The sediment data indicate that there is no silver above detection limits and that chromium is present in levels below the upper tolerance limit (UTL). No volatile organic compounds (VOCs) or semivolatile organic compounds (SVOCs) were present at levels above detection limits. Unfiltered water samples were also collected at the same location as the sediment samples. The results of the water analysis showed no silver, chromium, VOCs, or SVOCs at levels above detection limits. These results indicate that silver, chromium, and PAHs are not being transported to Cañon de Valle in amounts large enough to detect.

2.2.2 RCRA Facility Investigation

SWMU 16-020 was sampled as described in the RFI Work Plan for OU 1082 (LANL 1993 1094). In addition to the RFI sampling, a sample was collected 1 000 ft downgradient from the outfall in August, 1995 to confirm the extent of contamination. Eight hand-augered sample holes were bored at biased points within the center of the stream channel, which is the location where the highest concentrations of silver have been observed. The eight points were the outfall and at 25, 50, 75, 100, 492, 738, and 1 000 ft downstream from the outfall (Fig. 2-2). The holes were bored to the depth of 5 ft.

For the core samples at 0, 25, 50, 75, and 100 ft downgradient from the outfall, 6-in. laboratory samples were collected at depths of 0 to 6 in., 3 ft, and 5 ft. For the core samples at 492, 738, and 1 000 ft, analytical samples were to be collected from the surface, from 0.5 ft immediately above the clay-rich layer, and from the 0.5 ft immediately above the soil-tuff interface. No clay-rich layer was found while sampling, so the intermediate depth samples were collected at approximately half the depth to the tuff interface. For the surface samples taken at the outfall, at 492, at 738, and at 1 000 ftdowngradient of the outfall, one surface soil sample was collected at the high-water line upslope from the center of the stream bed and one was collected at the high-water line downslope of the center of the stream bed to determine lateral extent of contamination. A total of sixteen surface (0 to 6 in. depth) soil samples were collected.

All samples were analyzed for metals, cyanide, and SVOCs. Subsurface samples were also analyzed for VOCs. The moisture content of the core samples was measured. Geomorphic mapping of the core samples was used to determine the interface between the gravelly clay and the clay horizons, and establish whether subsurface transport is occurring. All samples were field screened for HE and radiation before removal from the site. Neither was detected. See Annex 6.9 for RFI analytical data.

2.2.3 Summary and Evaluation of RFI Analytical Results

Annex 6.9 presents a summary of the RFI analytical sampling results reported above LANL UTLs, where available, or detection limits for all RFI samples collected at the site. The detected concentrations, SALs, and UTLs for background concentrations in soil and sediment are also presented for comparison. The soil UTL was obtained from all soil horizons at LANL (Longmire et al. 1995, 1266).

Based on a preliminary review of the sampling data, results indicate that metals and SVOCs are the most significant components of the contamination present at this site. Cyanide was not detected in any samples. Metals present in levels above SALs are limited to silver and chromium. Other metals detected at levels above UTLs include copper, lead, mercury, nickel, vanadium, and zinc. Mercury values above UTLs and detection limits were only tentatively identified due to spiked sample control problems. SVOC contamination is largely due to PAHs. Bis (2-ethylhexyl) phthalate, di-n-butylphthalate, diethyl phthalate, di-n-octyl phthlate, 4-methylphenol, 2,4-dimethylphenol, dibenzofuran, and benzoic acid are non-PAH SVOCs that are present at levels less than 3% of SAL. The only VOCs present in subsurface samples are acetone and trichlorofluoromethane. These VOCs are present at levels less than 2% of the SAL and are located throughout the subsurface of the SWMU.

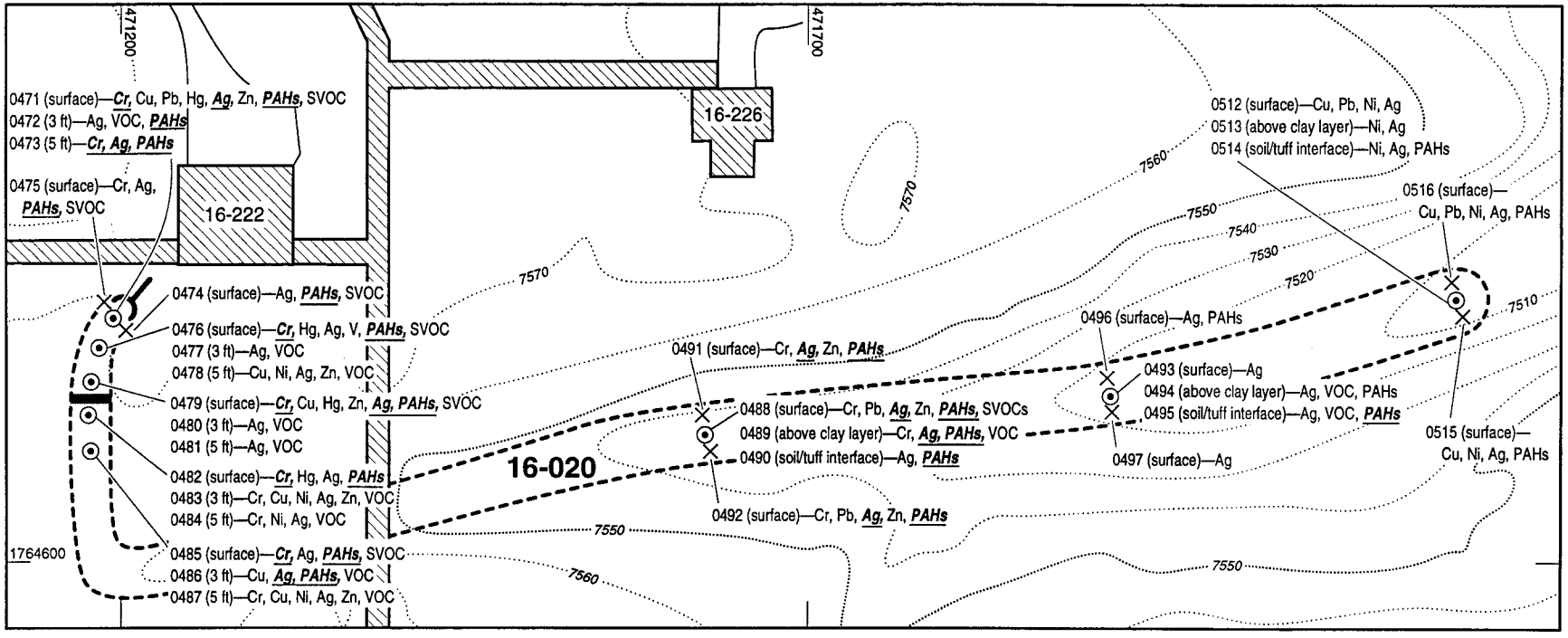

Fig. 2-2 RFI sampling map for SWMU 16-020

The maximum levels of metal contamination in surface soils were 1 190 ppm for chromium and 465 ppm for silver. Surface chromium contamination at levels above SAL extended 100 ft downgradient from the outfall but peaked at 75 ft. Chromium contamination above SAL is limited to the surface and the center of the drainage at points beyond the outfall. The chromium contamination is believed to be Cr(III) because photo developing compounds, such as chromic potassium sulfate, are in that oxidation state. Cr(III) is also more likely to be found in soils, given the naturally occurring reducing agents available in the environment (Lindsay 1979, 15-16-625; Brookins 1988 15-16-624).

Surface silver contamination at levels above SAL extended 492 ft downgradient from the outfall. Silver contamination at levels above SAL was detected on the surface at the high-water line 492 ft downgradient from the outfall. Subsurface silver contamination reached 672 ppm 492 ft downgradient from the outfall at a depth of 1.5 ft in the center of the channel.

Contamination from PAHs and SVOCs is concentrated at the surface but RFI sampling results found contamination at 5 ft depth at the outfall itself. Very high levels of PAH contamination, between 100 ppm and 1 000 ppm, are present in surface soil at the outfall. The level of PAH contamination drops significantly beyond the outfall until it reaches levels below SALs at 738 ft downgradient. As seen with the silver contamination, PAH levels at the high-water lines were similar in magnitude to those found in the center of the outfall. The high level of PAH contamination at the outfall is characteristic of a single release as opposed to repeated releases.

At the surface, lower levels of silver contamination were found during RFI sampling than the silver levels that Kasunic measured in her study of this outfall (see Subsection 2.2.1). In the subsurface, silver concentrations were somewhat higher than Kasunic measured. The silver has been dispersed and diluted by environmental processes. Kasunic did not study chromium compounds in the soil, but chromium-containing compounds, such as chromic potassium sulfate, are used for photoprocessing (Budavari et al. 1989, 15-16-454).

The presence of silver and PAH contamination at levels above SAL at the high-water lines 492 ft downgradient from the outfall indicates contamination dispersal by sediment transport and/or aqueous transport over time. PAH contamination is very significant at the outfall but decreases to levels of 10 to 30 ppm within 75 ft of the outfall and then decreases to levels of 1 to 5 ppm between 100 and 492 ft from the outfall. PAH contamination is concentrated at the surface, probably due to its absorption onto organic materials, but has been found at depth.

Surface soil moisture ranged between 5% and 51%. Subsurface soil moisture ranged between 3% and 25%. These results indicate that surface soils are generally partially saturated by standing water in the stream channel. This leads to the sediment and aqueous transport described in the paragraph above. The results also show that the subsurface is not saturated. There is no evidence for a perched alluvial aquifer within the sampling region of this site.

2.3 Types and Volumes of Waste Present

The nature of the wastes expected to be generated by the proposed cleanup is presented in Table 2-1. All personal protective equipment (PPE) and equipment will be decontaminated and reused.

TABLE 2-1

ANTICIPATED WASTE VOLUMES

ITEM	TYPE	ANTICIPATED VOLUME
Sampling waste/PPE[a]	Solid - potentially hazardous	0 yds^3
Decontamination waste	Liquid - potentially hazardous	500 gal.
Bulk soil	Solid - RCRA organic (F003)	15 yds^3
Bulk soil	Solid - potentially hazardous	100 yds^3

[a] PPE = personal protective equipment

2.4 Potential Impacts on Public Health and the Environment

2.4.1 Potential Pathways

2.4.1.1 SWMU - In Place

Exposure pathways are the mechanisms through which an individual may come into contact with a chemical in the environment. Exposure pathways are influenced by environmental conditions, by the potential for the chemical to move from one medium (i.e., soil, water, or air) to another, and by the general lifestyles and/or work activities of the potentially exposed population (i.e., construction work or residential activity). Although many potential pathways are possible, only a few may be complete and pose a potential risk to exposed populations. For a pathway to be complete, each of the following elements must exist:

- a source and mechanism for chemical release into the environment;
- a point of potential contact with the environment; and
- an exposure route at the contact point (i.e., inhalation, ingestion, and dermal contact).

Sampling results at this SWMU indicate that contamination is largely limited to the surface soils associated with the outfall and some contamination occurs at depth at the outfall itself. If the contaminated soils remain in place, several mechanisms are available to transport contaminants from their current locations including sediment transport from surface water runoff, erosion of soil, and wind dispersion. A conceptual model for sites with surface soil contamination was presented in the RFI Work Plan for OU 1082 (LANL 1993 1094). The following potential human exposure pathways to surface soils were identified in the conceptual exposure model:

- incidental soil ingestion
- dermal contact with soil
- inhalation of particulates

These three exposure pathways are considered potentially complete, and will be considered in the derivation of cleanup levels for this SWMU.

2.4.1.2 SWMU - Remediation

Potential exposure pathways for workers involved with remediation activities at this SWMU are the same as those identified in the conceptual model and described above. Excavation activities may increase the potential for worker exposure and contaminant transport. Therefore, precautions will be taken to minimize exposure during remediation or excavation activities. Appropriate dust suppression techniques will be used to prevent contaminants from becoming airborne. Covered storage containers for excavated materials and plastic sheeting covering the excavated area will prohibit rainwater and/or runoff from contacting potentially contaminated material.

2.4.2 Future Land Use

SWMU 16-020 lies entirely on DOE-owned land and the area is removed from public access roads. Entrance to TA-16 is limited by security fences. Access to the area is limited to Q-cleared and escorted personnel who have been allowed into the high explosives exclusion area. In the foreseeable future, the land will be used exclusively for LANL (industrial) operations, as stated in the Site Development Plan Annual Update 1994 (LANL 1994, 1171).

Exposure scenarios describe the circumstances by which an individual may come into contact with chemicals in the environment through the identified exposure pathways. Because this site will remain dedicated to continued Laboratory operations into the future, only the continued laboratory operations exposure scenario (long-term worker) will be evaluated to derive cleanup levels.

2.4.3 Cleanup Levels

Chemicals of potential concern (COPCs) considered for this EC were identified based on simple comparisons of RFI analytical results for this SWMU to background and SAL concentrations. Analytical results from the Phase I RFI sampling (Annex 6.9) indicate that chromium, silver, and PAHs are the COPCs in the soil contamination.

Table 2-2 presents the preliminary continued laboratory operations soil cleanup levels for the COPCs identified for this EC. Typically, the Laboratory derives cleanup levels for accelerated action with a point of departure of 1E-06 risk for carcinogens, and a hazard index of 0.1 for noncarcinogens as an acceptable level of risk. This conservative approach is adopted to account for the presence of multiple constituents. With this approach, the residual risk remaining at the site following remediation will fall within the EPA acceptable risk range of 1E-04 to 1E-06 for carcinogens, and less than a hazard index of 1 for noncarcinogens. The equations and assumptions used to calculate the cleanup levels in this plan are provided in Annex 6.10.

TABLE 2-2

PRELIMINARY SOIL CLEANUP LEVELS FOR A CONTINUED LABORATORY OPERATIONS SCENARIO

CHEMICAL	CARCINOGENIC RANGE			NONCARCINOGENIC[a]	
	10^{-4} RISK	10^{-5} RISK	10^{-6} RISK	HI = 1	HI = 0.1
	CLEANUP LEVEL (mg/kg)				
Chromium, total	45 000	4 500	450		
PAH					
Anthracene				19	1.9
Benzo[a]pyrene	26	2.6	0.26		
Benzo[b]fluoranthene	260	26	2.6		
Benzo[k]fluoranthene	2 600	260	26		
Benz[a]anthracene	260	26	2.6		
Chrysene	2 400	240	24		
Dibenzo[a,h]anthracene	26	2.6	0.26		
Indeno[1,2,3-cd]pyrene	260	26	2.6		
Silver				8 500	850

[a] HI = hazard index

Several factors must be considered when establishing the cleanup levels for this site:

1. This outfall occurs in a remote area that has highly controlled personnel access. Therefore, the standard default exposure parameters for the long-term worker are highly conservative and represent an extreme upper bound estimate of potential risk.

2. A roof drain, draining a large asphaltic roof of Building 222 discharges to this outfall. The presence of this drain is suspected of contributing a continuous source of PAHs to the drainage. It could represent a low level contribution to the PAHs found on site. Because of this continuous source, it is recommended that a target risk value of 10^{-5} be selected for carcinogenic PAHs, and a hazard index of 1 be selected for noncarcinogenic PAHs to calculate cleanup levels.

3. The concentrated contaminants at the outfall will be removed during this remediation. Field screening techniques will be applied to monitor the excavation and removal efforts to assure that cleanup criteria will be met. A performance standard of one-half the cleanup level will be used to determine the extent of excavation. Verification sampling following remediation is designed to demonstrate that residual risk remaining in the environment will meet EPA's target risk range of 10^{-4} to 10^{-6} for carcinogens and a hazard index of less than 1.

The Laboratory, therefore, recommends the soil cleanup levels presented in Table 2-3.

TABLE 2-3

RECOMMENDED SOIL CLEANUP LEVELS FOR A CONTINUED LABORATORY OPERATIONS SCENARIO

CHEMICAL	CLEANUP LEVEL (mg/kg)	RATIONALE
Chromium, total	450	Carcinogenic endpoint for total chromium [1/6 ratio Cr(VI)/Cr(III)]. Based on a target risk level of 10^{-6}.
PAH		
Anthracene	19	Noncarcinogenic. Based on a hazard index of 1.
Benzo[a]pyrene	3	Carcinogenic. Based on a target risk level of 10^{-5}.
Benzo[b]fluoranthene	26	Carcinogenic. Based on a target risk level of 10^{-5}.
Benzo[k]fluoranthene	260	Carcinogenic. Based on a target risk level of 10^{-5}.
Benz[a]anthracene	26	Carcinogenic. Based on a target risk level of 10^{-5}.
Chrysene	240	Carcinogenic. Based on a target risk level of 10^{-5}.
Dibenzo[a,h]anthracene	3	Carcinogenic. Based on a target risk level of 10^{-5}.
Indeno[1,2,3-cd]pyrene	26	Carcinogenic. Based on a target risk level of 10^{-5}.
Silver	850	Noncarcinogenic. Based on a hazard index of 0.1.

3.0 EXPEDITED CLEANUP

3.1 Overview and Rationale

Phase I RFI sampling results indicate that chromium and PAHs are present above SALs in surface and subsurface soils at the site. Silver was found slightly above its SAL of 383 ppm. The Phase I results alsoindicate that the levels of these contaminants pose a threat to human health and the environment. Phase I results sufficiently bound the extent of contamination to permit cleanup of this site. Expedited cleanup of the site will ensure that migration of these contaminants will not occur.

3.2 Permitting, Approval, and Notification Requirements

An excavation permit will be prepared and submitted for approval before execution of this plan. Documentation will be prepared in accordance with the latest revision of LANL Environmental Restoration (ER) Administrative Procedure LANL-ER-AP-05.1, Readiness Review for Environmental Restoration Program Field Activities. Key documents to be prepared include a

SSHASP and CSF. Personnel training requirements will be specified and will require completion prior to implementation of this EC plan. Site workers must have received all training for this project as specified in the SSHASP.

3.2.1 Regulatory Notification/Permit Modifications

SWMU 16-020 is included in Tables A and B of the HSWA module. Implementation of this EC will require a Class III modification to the HSWA module. EPA and NMED have been notified of this project, and a request for a permit modification will be submitted. Implementation of this EC will proceed upon receipt of EPA approval except as provided in Subsection 3.2.2.

3.2.2 DOE Approval

If the Laboratory intends to implement this EC prior to receiving EPA approval, DOE approval will be documented through receipt of the signed fieldwork approval form (Annex 6.7).

3.3 Cleanup Activities

In February 1996, two soil samples were collected directly south and downgradient from the outfall. The two locations were guided by field screening and visual inspection for sediment traps. These sample results are still pending and will detect contamination from large volumes of liquid in the outfall that could have flowed down this slope. The samples are being analyzed for metals, VOCs, and SVOCs and will indicate if contamination is present well outside the drainage channel.

Before cleanup activities begin, an unfiltered water sample will be collected from both the roof drain and the permitted building drain and analyzed for SVOCs, VOCs, and metals. Results will determine whether the drains represent a continuing source of contamination. If contamination is found in the water samples, the activities in this EC plan may be reevaluated. Before excavation occurs, the drains will be rerouted around the excavation to avoid dispersing exposed contaminated soil.

Cleanup activities will entail soil removal in three areas of this outfall. Soil will be removed at the outfall and in the outfall channel in the first 75 ft to possibly as far as 100 ft downgradient of the outfall where contamination is known to exist above cleanup levels. Contingent on field screening results, soil may be removed in the area between 60 ft and 70 ft downgradient from the outfall where soil was disturbed by industrial activity. In this second area, soil may be removed from a width up to 13 ft from the center of the drainage channel. Contingent on field screening and laboratory analytical results, soil may be removed from 100 ft to as far as 738 ft downgradient from the outfall. Cleanup activities for these three areas are described below.

Any field screening that takes place will use EPA approved EnSys or DTECH PAH field screening kits. These kits have detection limits of less than 1 ppm PAH and measure the total PAH concentration. These kits should be effective at this site because the distribution of different PAH compounds is highly correlated. For example, on the average, benzo(a)pyrene constitutes approximately 8% of the total PAH content in a sample from this site with greater than 1 ppm total PAH concentration. Although the test kit may differ in its sensitivity to a specific PAH, the correlation among PAH components makes it possible to establish a total PAH cleanup level. This total PAH cleanup level is based on the individual PAH cleanup levels shown in Table 2-3 and the specific PAH sensitivities of each kit. Soil which screens at a value of 50% of the calculated total PAH cleanup level will be removed. This conservative choice allows for variability in the ratio of benzo(a)pyrene to total PAH, as well as variability in the field screening kit results.

Soil at the outfall itself is highly contaminated and will be removed. Phase I RFI sampling results indicate contamination present at levels above SAL at a depth of 5.5 ft. Therefore, soil at the outfall will be removed to 5.5 ft, after which point field screening for PAHs will guide further soil removal. Contamination extending 3 ft into tuff may require reevaluating the activities in this EC plan. The width of the excavation will be dictated by the size of backhoe bucket used to remove soil. It is estimated that a backhoe will make a hole five feet in diameter at the outfall.

Soil removal to a depth of 1 ft will extend from the outfall to a distance of 75 ft downgradient from the outfall. Phase I RFI sample results indicate that the channel is contaminated above cleanup levels to 75 ft downgradient of the outfall but that levels of PAHs in the soil decrease between 75 ft and 100 ft from the outfall. The area to be excavated is shown in Fig. 3-1. Excavation beyond a depth of 1 ft and excavation between 75 ft and 100 ft will be guided by field screening results from Ensys or DTECH PAH field screening kits. Soil that screens at a value of 50% of the cleanup level will be excavated.

Chromium contamination above cleanup levels is limited to the first 75 ft of the drainage channel, based on Phase I RFI sampling results. Silver contamination is not present at levels above the cleanup level and therefore is not directly impacting the cleanup activities. Because the first 75 ft of the drainage channel will be excavated, there is no need for field screen for metal contamination during the cleanup activities. Verification samples will be analyzed for metal contamination after excavation is complete.

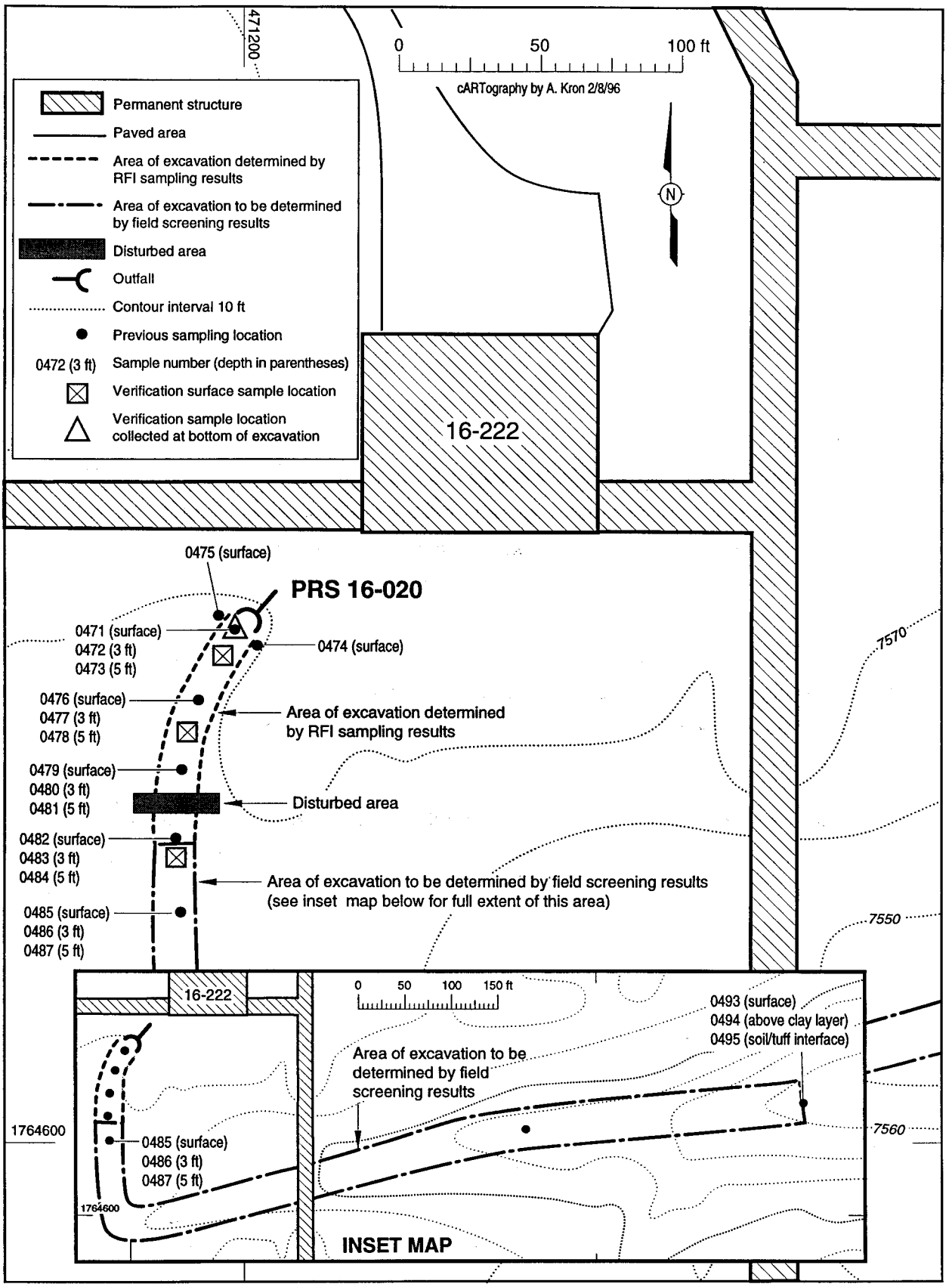

Fig. 3-1 Verification sample locations for SWMU 16-020

The width of the surface removal possibly as far as 100 ft downgradient will be determined in the field from evidence of the historical high water lines. If historical high water lines cannot be visibly determined, the width of surface removal will be 5 ft, the width of the high-water lines 492 ft downgradient. Soil will be removed up to and including the high water lines for up to 100 ft along the drainage, depending on the distance of surface soil removal described in the paragraph above. Excavation of contaminated soil beyond the high water lines will be guided by field screening with Ensys or DTECH PAH field screening kits to 50% of the cleanup level. Soil will be excavated to a depth of 1 ft, unless field screening indicates that PAH contamination extends further. Depth screening for excavating contaminated soil will be at 50% of the cleanup level. Soil that screens at less than 50% of the cleanup level will not be excavated.

In December 1995, during the construction of a new steam system at S-Site, the area of the outfall 60 ft to 70 ft downgradient was disturbed by trucks driving across the drainage (Fig. 3-1). Because this area of the drainage is known to be contaminated with metals and PAHs, some of these contaminants were probably spread from the drainage by truck tires. Because of this disturbance, PAH field screening kits will be used to screen for contamination in the area disturbed by the trucks. The area to be screened will be approximately 7 ft across and will extend up to 10 ft from the high water lines on each side of the outfall drainage. A minimum of four screening points at 2 ft intervals from the high water line will be selected on each side. If field screening indicates that contamination has been spread by the trucks, soil from the disturbed area where contamination was detected will be removed based on field screening results.

PAH contamination at levels above SALs extends downgradient further than 100 ft from the outfall. The Phase I RFI sampling results indicate that surface and subsurface samples 100 ft downgradient are not contaminated above the cleanup level but that the surface samples 492 ft downgradient are. PAHs were found at levels slightly above SALs 738 ft downgradient from the outfall. This indicates that PAH contamination above cleanup levels may be present between 100 and 738 ft from the outfall. In determining the area to excavate, consideration must be given to the impact of the excavation on the local ecology. Removing contaminated soil for hundreds of feet from the outfall would cause significant disruption to the ecosystem that extends into Cañon de Valle.

In order to minimize ecological impact at this site, field screening with PAH test kits will be used extensively to determine contaminated zones between 100 and 738 ft downgradient from the outfall. This region will be divided into two exposure units (EUs). Each EU will be approximately 17 ft wide and 320 ft long. Field screening with the PAH test kits will take place every 33 ft in

the center of the channel . If the field screening results are above cleanup levels, the high water line samples from each side of the channel will also be field screened. If field screening results at either of the two high water lines are above cleanup levels, a sample beyond the contaminated point(s) will be field screened. The three samples with the highest field screening results in each EU will be sent for laboratory analysis, for a total of six laboratory samples. The samples will be analyzed for metals, VOCs, and SVOCs. These laboratory results, combined with the Phase I RFI results, will be used to calculate the 95% upper confidence level (UCL) for the mean of each PAH in each EU for comparison with the established cleanup level. If this value exceeds cleanup levels, soil in the EU will be excavated and removed based on the field screening results collected every 33 ft. Field screening locations with levels of contamination at least 50% of the cleanup level will be excavated. If the calculated UCL for an EU is less than the established cleanup level, no soil will be removed in the EU.

Surface soil will be removed with earthmoving equipment or with earth-suctioning equipment. Use of either type of equipment will be determined by the field team leader based on field conditions. The soil in the region of this outfall consists of fill material at the outfall itself and large cobbles mixed with soil in the area downgradient from the outfall. In the first 100 to 200 ft downgradient of the outfall, the tuff interface is approximately 4 ft deep with areas of exposed tuff present further down the drainage channel. Any large cobbles removed during excavation will be decontaminated by pressure washing and returned to the site. This will significantly reduce the volume of waste generated because the soil, and not the cobbles, are contaminated.

These activities may not occur in this order and may occur simultaneously to expedite the cleanup process. Verification samples will be collected after excavation is complete to determine if cleanup goals were met (see Section 3.5).

If the data received during EC activities differ from the data contained in Annex 6.9, the remediation plans may be reevaluated. Other issues that could cause reevaluation of remediation activities include significant changes in the volume and type of waste, significant changes in costs or resources, safety factors, and changes in the general level of understanding of the project.

3.4 Waste Management Issues

As indicated in Section 2.3, wastes expected to be generated during this EC include silver, chromium, and PAH-contaminated soils and decontamination waste. All waste will be disposed of in accordance with the CSF.

3.4.1 Characterization of Materials for Disposal

Before the waste is disposed off-site, waste samples will be collected and analyzed for VOCs and toxicity characteristic leaching procedure (TCLP) metals. TCLP results are currently pending for two samples taken from the soil *in-situ* at the highest chromium concentration and at one of the highest silver concentrations. These results may indicate that metal leaching will not be significant. The TCLP results from the container sampling will determine whether the excavated soil constitutes hazardous waste. The VOC results from this sampling will determine whether the soil is considered to be a RCRA-regulated waste due to the presence of trichlorofluoromethane, an F002 waste compound. Blank samples will be sent with the waste samples to insure that any low levels of VOCs found during analysis actually originated in the waste.

3.4.2 Treatment, Storage, and Disposal Plans for Waste

The waste generated from this EC will consist of soil contaminated with metals, such as silver and chromium, and with SVOCs, such as PAHS. Very low levels (parts per billion) of VOCs may be present in the contaminated soil.

Excavated soil will be placed in roll-off containers or 55-gal. drums. If low levels of VOCs do not cause the waste to be classified as RCRA organic waste, the excavated soil will be disposed of in an industrial landfill as special waste, unless TCLP data from the waste storage containers indicate that the metals in the waste are leachable. If the excavated soil fails the TCLP analysis or the soil is contaminated with VOCs, it is considered a hazardous waste and will be transported to a permitted treatment, storage, and disposal (TSD) facility for final disposal. All waste streams will be segregated and disposed of in accordance with the CSF found in Section 6.6

3.5 Verification Plan

3.5.1 Problem Definition

Verification sampling will be performed to determine whether the cleanup levels for SWMU 16-020 have been attained. If the cleanup objectives have been met, the expedited cleanup at this site will be complete for this SWMU.

3.5.2 Design

Two different verification plans will be used because of the two different sampling and cleanup plans that will take place up to 100 ft downgradient and beyond 100 ft. Verification samples will be collected from soil remaining after excavation is complete and should be representative of the remaining soil. Soil samples should be collected at the lowest point of the excavation unless representative soil is not found there. If the bottom of the excavation is located in the tuff layer, soil samples will be collected from the side of the excavation where soil is present. All verification samples will be collected from 0-6 in. depth from the surface of the excavation. Table 3-1 contains a summary of verification samples and analyses.

A total of four verification samples will be collected from the exacavation between the outfall and 100 ft downgradient from the outfall (Fig. 3-1 and Table 3-1). All samples will be taken along the center line of the remediated drainage. One sample will be collected at the bottom of the excavation within two feet of the outfall pipe, at the same location as sample 0316-95-471. One sample will be collected at a randomly selected point between 5 ft and 15 ft downgradient from the outfall. One sample will be collected at a randomly selected point between 20 ft and 50 ft downgradient from the outfall. The remaining sample will be collected at the end of the excavation. All samples will be 0-6 in. depth samples. Standard field quality assurance (QA) will suffice to ensure data quality. The field crew will survey, describe, and report actual sample locations, which may deviate slightly from those proposed depending on conditions after remediation is completed. These four verification samples will address the cleanup of the first 100 ft of the outfall drainage.

If the drainage is not excavated further than 100 ft, more verification samples will not be collected. If the drainage is excavated further than the first 100 ft, verification samples will be needed to determine if the remediation activity successfully accomplished the cleanup goal. The number of verification samples needed will be determined by the area of unremediated soil remaining within the EU. Unremediated areas may contain analytical sample locations with laboratory results relevant for use during verification. The laboratory data can be from either the Phase I RFI results or from the six laboratory results obtained prior to remediation. These existing laboratory data will be supplemented by at least one verification sample and not more than three verification samples, so that the total number of locations with laboratory data for the EU is at least three. The first two verification samples will be collected at random within remediated stretches of the channel. If a third verification sample is needed, it will be selected from an unremediated stretch (unless the entire 320 ft of channel within the EU have been excavated). All samples will be from the 0-6 in. depth. All laboratory data from the EU, except data from samples representing soil that has been removed, will be used to recompute the 95% UCL for the mean in that EU.

Samples will be analyzed for metals and SVOCs. One verification samples from within the first 75 ft of the channel will be analyzed for Cr(III)/Cr(VI) ratio. Standard good laboratory practices, documented by the standard data deliverable, will suffice to ensure data quality. An accelerated turnaround time for the samples will be requested to ensure that the cleanup will be completed in a timely manner. Results from the laboratory verification samples will be used to calculate the 95% UCL to compare with the established cleanup level. The 95% UCLs for the means of the constituents for which cleanup levels have been calculated (chromium, silver, and the PAHs), will be compared with those levels. The site cleanup objectives will be obtained when the calculated UCL is less than the established cleanup levels (EPA 1989, 0305).

To evaluate the success of the cleanup in terms of aqueous contaminant transport, two water samples will be collected from the site within six months after site restoration has occurred. The unfiltered water samples will be collected from the first 75 ft of the channel. If water maximum contaminant levels (MCLs) are exceeded in the waste samples, the site may have to be revisited.

TABLE 3-1

SUMMARY OF VERIFICATION SAMPLES AND ANALYSES FOR SWMU 16-020

AREA OF EXCAVATION	NUMBER OF VERIFICATION SAMPLES	ANALYSES
0 ft to 100 ft downgradient of outfall	4	Metals (SW-846 8010), SVOCs (SW-846 8270)
100 ft to 420 ft downgradient of outfall (first EU)	1-3	Metals (SW-846 8010), SVOCs (SW-846 8270)
420 ft to 738 ft downgradient of outfall (second EU)	1-3	Metals (SW-846 8010), SVOCs (SW-846 8270)
Post-remediation water samples	2	Metals (SW-846 8010), SVOCs (SW-846 8270)

3.5.3 Implementation

All samples collected during the verification stage will be soil samples from the 0-6 in. layer of exposed soil in the excavation. If the soil remaining in the excavation is not representative of the soil remaining at the site (e.g., tuff), a soil sample may be collected from representative soil at depth in the side of the excavation. All samples will be collected in accordance with LANL-ER-SOP-06.09, R0, ICN2, Spade and Scoop Method for Collection of Soil Samples. In addition, a duplicate confirmatory sample will be collected in conformance with LANL-ER-SOP-1.05, R0, Field Quality Control Samples.

Field activities for this EC will be documented according to LANL ER standard operating procedures (SOPs). All samples will be handled and controlled in accordance with LANL-ER-SOP-1.01, R0, ICN, General Instructions for Field Investigations, and LANL-ER-SOP-1.04, R2, ICN, Sample Control and Field Documentation. In addition, the verification samples will be handled in accordance with LANL-ER-SOP-1.02, R0, Sample Container and Preservation, and LANL-ER-SOP-1.03, R1, Handling, Packaging, and Shipping of Samples. Laboratory samples will be submitted to the analytical laboratory through LANL's Sample Management Office (SMO).

All verification samples will be analyzed for metals following method SW-846 6010, for SVOCs following method SW-846 8270, and for VOCs following method SW-846 8260. Field data and electronic form production will be managed using the ER Project 4D database system.

3.5.4 Data Assessment

Data packages will be checked for completeness and reported deficiencies by routine data verification and validation procedures. Focused validation will be performed only if these checks indicate possible problems with the analytes for which cleanup levels have been calculated.

3.5.5 Administration

Training requirements for the field team will be determined by the field project leader (FPL) in coordination with the field team leader (FTL). All personnel will meet the specified training requirements. Upon completion of the field activities, the field report and field data (location coordinates, descriptions, etc.) will be provided to Facility for Information Management and Display (FIMAD) by field team. Laboratory analytical results will be electronically uploaded into FIMAD upon their receipt. Complete hard copy data packages will be stored at the SMO along with hard copies of validation reports.

3.6 Site Restoration Plan

Any soil excavation that was necessary during cleanup will be backfilled with clean fill. Bedrock tuff will be left exposed where streambed sediments have been removed. The site will then be graded and compacted to prevent any undue or unnatural erosion and contoured to harmonize with the surroundings. Erosion protection such as flow diversions, berms, and revegetation with native species will be used to minimize erosion from the roof drain which will continue to discharge to this drainage. The area will be seeded with native grasses, such as buffalo grass and blue grama.

3.7 Acceptance Inspection

The Laboratory proposes an acceptance inspection as the mechanism for DOE, EPA , and NMED to assess the implementation and effectiveness of the EC. A minimum of 10 days notice will be provided to DOE, EPA, and NMED before the start of field activities. Tentative inspection dates will be agreed upon once activities are approved.

An inspection checklist will be used to document the scope of the inspection and will become part of the EC final report. The checklist and timing of the inspection will be developed by the Laboratory and agreed to by DOE, EPA, and NMED. The inspection checklist will contain specific items, criteria, and requirements to be inspected that will constitute acceptance of remediation activities.

The Acceptance inspection will be conducted by an independent professional skilled in the appropriate technical discipline. During the acceptance inspection, written resolution and an anticipated schedule for completion of any outstanding items will be identified, and documented on the inspection checklist. The Laboratory FPL, or designee, will be responsible for completing outstanding inspection items and documenting their resolution in the EC final report.

Upon completion of remediation activities, the Laboratory will submit a written certification to EPA Region 6, stating that the remedy has been completed in accordance with the EC plan and acceptance inspection checklist. The certification will be signed by the permitee and by the independent professional conducting the inspection. The certification will accompany the EC final report.

3.8 Final Report

Following the return of analytical data from the verification sampling and completion of all field activities, a final report will be prepared. A proposed outline for this report is presented as Annex 6.8.

4.0 PROJECT MANAGEMENT

Overall implementation of this expedited cleanup will be managed by Brad Martin, the FPL. Lynn Kidman will serve as the field team manager (FTM) for EC activities.

4.1 Staff and Resource Requirements

Total anticipated costs for the EC are $260 400, as detailed below. Cost estimates are based on the worst-case reasonably expected, soil removal for a distance of 650 ft from the outfall, 5 ft wide and 1 ft deep.

Pre-Field Activities

Preparation of expedited cleanup plan	$ 22 500
Preparation of waste management plan	$ 6 000
Preparation of site-specific health and safety plan	$ 6 000
Fieldwork preparation (including subcontracting)	$ 12 000
Submit EPA draft and incorporate comments	$ 28 500
Subtotal	**$75 000**

Field Activities

Mobilization	$ 4 800
Soil excavation	$ 20 200
Site restoration	$ 16 000
Demobilization	$ 4 800
Subtotal	**$ 22 000**

Waste Disposal

RCRA waste disposal	$ 2 000
Industrial (special) waste disposal	$ 3 600
Subtotal	**$ 5 600**

Sampling/Analytical

Screening sample collection	$ 13 200
Screening sample analysis	$ 2 500
Verification sample collection (10 samples + 1 duplicate)	$ 4 800
Verification sample analysis	$ 13 800
Waste management sample collection and analysis	$ 27 500
Subtotal	**$ 61 800**

Post-Field Activities

Acceptance inspection	$ 9 000
Waste management and disposal	$ 64 800
Preparation of expedited cleanup report	$ 15 700
Review report, issue EPA draft, and incorporate comments	$ 6 500
Subtotal	**$ 96 000**
TOTAL ESTIMATED COST	**$260 400**

4.2 Schedule

The proposed EC schedule is shown in Fig. 4-1. The submittal of this plan to EPA and NMED is anticipated for February 29, 1996. Public notification will initiate the 60-day stakeholder review period. No sooner than 15 days and no later than 45 days after the start of this period, a public meeting will be held. Preparation for fieldwork will be conducted concurrent to the stakeholder review period. Fieldwork will be initiated within 10 days of agency and stakeholder approval or receipt of EPA and NMED temporary authorization to proceed. The final report will be submitted to EPA within 14 days of receipt of final verification sample results.

4.3 Stakeholder Notifications

Stakeholder notifications are an integral part of the procedure for conducting ECs. The ER Project will notify state and local governments, external and internal stakeholders, and individuals on the ER Project's mailing list of the availability of the EC plan. The EC plan will be available to the stakeholders at the LANL Community Reading Room in Los Alamos, at the document repositories in the Los Alamos, Española, and Santa Fe public libraries and at the Governor's office at San Ildefonso Pueblo.

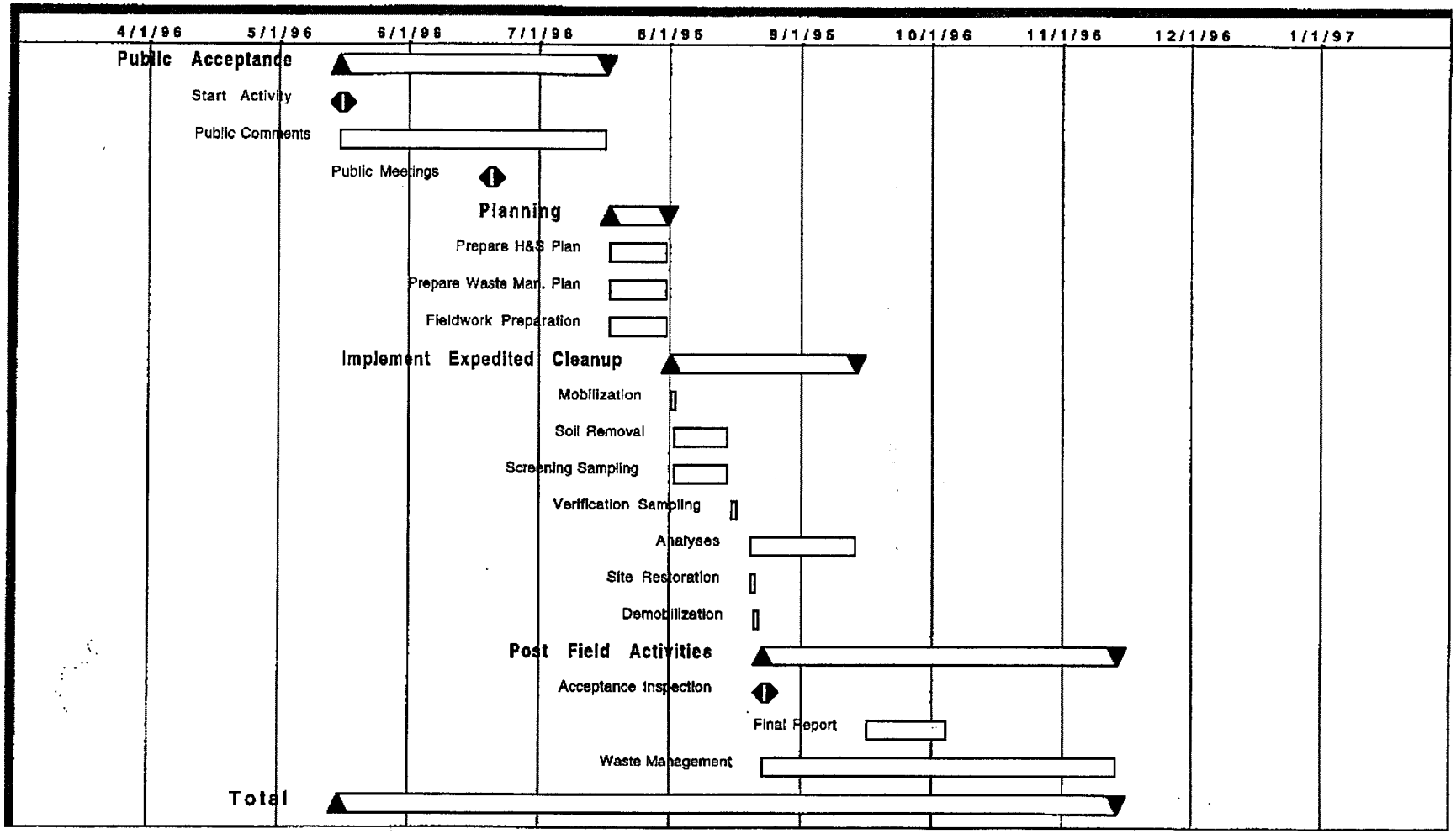

Fig. 4-1. EC schedule.

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(Longmire et al. 1995, 1266)

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6.0 ANNEXES

6.1 Implementation SOPs

See Environmental Restoration Standard Operating Procedures, Volumes I and II, November 17, 1993, Los Alamos National Laboratory.

6.2 Quality Assurance Plan

See Quality Program Plan and Quality Assurance Project Plan for Environmental restoration, February 1996 revision, Los Alamos National Laboratory.

6.3 Site-Specific Health and Safety Plan

See Los Alamos National Laboratory Environmental Restoration Project Health and Safety Plan (HASP) (LANL, February 11, 1995).

6.4 Records Management Plan

See Installation Work Plan for Environmental Restoration, Revision 4, Chapter 4, Records Management Program Plan.

6.5 Public Involvement Plan

See Installation Work Plan for Environmental restoration, Revision 4, Chapter 5, Public Involvement Program Plan.

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6.6 Characterization Strategy Form

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CHARACTERIZATION STRATEGY FORM

OU NUMBER/FU	PRS/SWMU Number	Title
1082/3	16-020	Outfall

Name: Karen Schultz Paige	**Date:** 2/13/96
FPL: Brad Martin	**WMC:**
Type of Activity: Expedited Cleanup (EC)	

Site Description

SWMU 16-020 is an inactive, NPDES permitted operational outfall where photographic chemicals have been released to the soils and stream sediments. For a period of more than 20 years, SWMU 16-020 received significant quantities of silver in untreated, spent x-ray fixing solutions. The outfall is located on the south west side of TA-16-222, a photographic lab building. The contaminants found above SAL at this site include chromium, silver, and polycyclic aromatic hydrocarbons (PAHs). No high explosives or radioactive materials have been used in this building. Screening of soil samples collected during RFI sampling confirmed that no rad or HE was present in the samples.

Investigation or Remediation Waste Description and Volume Estimate:

Excavation of contaminated surface soil is expected to yield sixteen cubic yards of waste. PPE will be laundered and reused. Decontamination water will be containerized and sampled for disposal characterization.

Waste Types: potentially RCRA hazardous soil (characteristic for metals); non-hazardous, non-radioactive soil; non-hazardous, non-radioactive decontamination liquid

Waste Packaging: One 55 gallon drum will be used for decontamination liquid. Soil removed from the site will be placed in roll-off containers.

Characterization Strategy:

Samples of soil waste will be analyzed for TCLP-metals, SVOCs and, VOCs and a sample of liquid waste will be analyzed for total metals, SVOCs, and VOCs. The number of samples needed will be determined by a statistician once waste volumes are known.

If the waste fails TCLP, the concentration of underlying hazardous constituents will be determined using existing environmental data from RFI sampling. Areas of this PRS have a large amount of existing data. Statistical analysis will indicate if more information is needed to characterize underlying hazardous constituents.

Any waste taken off site will be screened for the presence of HE, even though no HE contamination is expected.

Any waste taken off site will be screened for the presence of rad using a pancake detector and alpha scintillator. An ESH-1 representative will screen waste using a sodium iodide detector (2x2 or SPA-3) and a low energy gamma detector (LEG-1 or PG-2).

CHARACTERIZATION STRATEGY FORM (Continued)

OU Number/FU	PRS/SWMU Number	Title
1082/3	16-020	Outfall

Preliminary RCRA Determination:

No 90-Day Storage Requirement (non-RCRA)
Describe how waste will be stored and handled:

Non-RCRA contaminated soil will be stored at the site until it is removed for disposal.

90-Day Storage Requirement (RCRA)
TCLP results from sample locations with the highest silver and chromium content are pending. These results will be available before excavation begins. The se results will indicate if soil is a RCRA waste. If soils fail TCLP or results have not been received, a 90 day storage area for the waste will be established.
Waste will be stored and handled in accordance with 20 NMAC Section 262.11.

Analyte Suite: For soil waste

Analyte Category	Analytical Method	Direct Sampling of Containerized Waste	Acceptable Knowledge		
			Existing Information		Data from Site Characterization
			Present	Absent	
Volatile Compounds	8240	X			
Semi-Volatile Compounds	8270		X		
Organochlorine Pesticides & PCBs				X	
Inorganic compounds	6010		X		
High Explosive Compounds				X	
Gross Alpha				X	
Gross Beta				X	
Gross Gamma				X	
Tritium				X	
Asbestos				X	
TCLP -				X	
Metals	6010A	X			
Organics				X	
Pesticides, herbicides, fungicides				X	

CHARACTERIZATION STRATEGY FORM (Continued)

OU Number/FU	PRS/SWMU Number	Title
1082/3	16-020	Outfall

Analyte Suite: For liquid waste

Analyte Category	Analytical Method	Direct Sampling of Containerized Waste	Acceptable Knowledge		
			Existing Information		Data from Site Characterization
			Present	Absent	
Volatile Compounds	8240	X			
Semi-Volatile Compounds	8270		X		
Organochlorine Pesticides & PCBs				X	
Inorganic compounds	6010	X			
High Explosive Compounds				X	
Gross Alpha				X	
Gross Beta				X	
Gross Gamma				X	
Tritium				X	
Asbestos				X	
TCLP -				X	
Metals	6010A		X		
Organics				X	
Pesticides, herbicides, fungicides				X	

Signatures:

Gregory Bayhurst
ER Waste Management Coordinator

Mary Jane Wind 2/20/96
Waste Management Representative

Gary Maasson
ER Project Office Representative

6.7 Field Work Approval Form

This form must be completed prior to starting remediation fieldwork for expedited cleanups that do not have an EPA-approved work plan.

I, _____, DOE-LAAO, APPROVE the fieldwork as proposed in the accompanying Expedited Cleanup Plan for SWMU 16-020, TA-16.

I, _____, DOE-LAAO, DO NOT APPROVE the fieldwork as proposed in the accompanying Expedited Cleanup Plan for SWMU 16-020, TA-16.

The following reasons reflect the decision for disapproval:

Signed: _____ Date:_____

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6.8 Proposed Outline for Expidited Cleanup Final Report

1.0 SUMMARY OF EXPEDITED CLEANUP

1.1 Overview

1.2 Expedited Cleanup

2.0 DISCUSSION OF SAMPLING AND ANALYSIS

2.1 Verification Sampling and Analysis

2.1.1 Sampling Objectives

2.1.2 QA/QC

2.1.3 Sampling Activities

2.2 Site Restoration

3.0 MODIFICATIONS TO THE EC PLAN

4.0 QUANTITIES AND TYPES OF WASTE GENERATED

5.0 OUTSTANDING PROBLEMS FROM THE ACCEPTANCE INSPECTION

6.0 PROBLEMS ENCOUNTERED AND LESSONS LEARNED

APPENDIX A ANALYTICAL DATA

APPENDIX B ACCEPTANCE INSPECTION CHECKLIST

APPENDIX C WASTE STREAM INVENTORY

APPENDIX D PHOTOGRAPHS

APPENDIX E CERTIFICATION OF COMPLETION

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6.9 RFI Analytical Results

TABLE 6.9-1

VOC DATA

SAMPLE ID	DEPTH (ft)	Acetone (mg/kg)	Trichlorofluoromethane (mg/kg)
SAL	N/A	2029	710
0316-95-0472	2.5-4.5	0.011 (J)	ND
0316-95-0478	4-5.5	0.009 (J)	ND
0316-95-0481	4-5.5	0.021 (J)	0.009
0316-95-0483	2-3.5	0.011 (J)	0.007
0316-95-0484	4-5	0.018 (J)	0.008
0316-95-0486	2-3	0.012 (J)	0.009
0316-95-0487	3-4	0.022 (J)	0.009
0316-95-0495	1.2-1.5	ND	0.0012 (J-)
0316-95-2016	2-3.5	0.008 (J)	ND

Note 1:
Bold indicates values above SAL.
** Sample 0316-95-2016 is a duplicate of 0316-95-0483.
NC - not calculated
N/A - not applicable
ND - not detected

Note 2:
Samples 0316-95-048, 0490, and 0494 were listed as containing methylene chloride qualified by J-.
Upon reanalysis of these samples, methylene chloride was no longer detected.
Initial analysis of sample 0316-95-0490 did not indicate that toluene was present above detection limits (0.005 mg/kg).
Reanalysis of this sample indicated the presence of 0.003 mg/kg toluene.
Neither toluene or methylene chloride are included in this table for the reasons listed above.
The soil SAL for toluene is 1900 ppm.
The soil SAL for methylene chloride is 11 ppm.

Qualifier codes:
(J) Analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
(J-) Numerical value likely has a low bias.
(J+) Numerical value likely has a high bias.
(B) Reported value was obtained from a reading that was less than the estimated quantitation limit bu greater than or equal to the instrument detection limit
(P) Duplicate analysis is not within control limits.
(N) Spike sample recovery was not within control limits.
(U) Analyte was analyzed for but was not detected above the reported sample quantitation limit.

TABLE 6.9-2

METAL DATA

SAMPLE ID	DEPTH (ft)	CHROMIUM (mg/kg)	COPPER (mg/kg)	LEAD (mg/kg)	MERCURY (mg/kg)	NICKEL (mg/kg)	VANADIUM (mg/kg)	ZINC (mg/kg)	SILVER (mg/kg)
LANL UTL	N/A	19.3	30.7	23.3	0.1	15.2	41.9	50.8	NC
Sediment UTL	N/A	8.77	10	13.8	NC	10	21.3	62	NC
SAL	N/A	210	2,848	400	23	1534	537	23,004	383
0316-95-0471	0-0.5	**433**	54.2	56.4	0.1 (B,N)	5.8	19.1	160	**423**
0316-95-0472	2.5-4.5	16.8	3.9	4.8	0.06 (U)	3.1 (B)	11.1	28.9	251
0316-95-0473	4.5-5.5	**277**	10.7	8	0.07 (B)	5.7	22.6	36.9	**446**
0316-95-0474	0-0.5	6.2	5.8	5.9	0.06 (N,U)	4.6	12	27.1	35
0316-95-0475	0-0.5	30.7	6.3	11.5	0.06 (N,U)	4.8	16.5	28.1	121
0316-95-0476	0-0.5	**1190**	29.4	11.7	0.19 (N)	3.4 (U)	44.4	42.9	346
0316-95-0477	2.5-3	6.1	4.3	6.9	0.06 (U)	5.5	12.8	38.4	31
0316-95-0478	4.5-5.5	8.3	186	4.1	0.05 (U)	40.8	5	139	25
0316-95-0479	0-0.5	**466**	45.2	21.4	0.26 (N)	5.2 (U)	17.8	64	**455**
0316-95-0480	1-1.5	15.5 (P)	10.2	12.2	0.06 (U)	8.6	24.1	38.4 (P,J-)	276 (P)
0316-95-0481	3.5-5	8.9	25.7	4.5	0.05 (U)	11.7	11.6	46	48
0316-95-0482	0-0.5	**673**	16.8	11.7	0.25 (N)	2.9 (U)	21.8	27	298
0316-95-0483	2-3	61.8	41.5	5.4	0.06 (U)	35	7.9	61.9	103
0316-95-0484	4-5	50.3	26.3	4.6	0.06 (U)	27.5	10.3	49.9	98
0316-95-0485	0-0.5	**225**	13.6	10.4	0.08 (N,U)	2.6 (U)	19.9	45	329
0316-95-0486	2-3	16.9	44.9	7.2	0.05 (U)	10.1	7	46.9	**397**
0316-95-0487	3-4	74.2	231	4.4	0.06 (U)	75.4	8.9	154	341
0316-95-0488	0-0.5	158	18	25.4	0.15 (N,U)	7.4 (U)	28.8	63.1	**465**
0316-95-0489	0.7-1.2	33.4 (N,J+)	6	11.3 (J+)	0.06 (U)	3.1 (B)	18.6	29.9 (N,J+)	**672**
0316-95-0490	1.2-1.4	11.4 (N,J+)	5.16	9.67 (J+)	0.06 (U)	3.99 (B)	14.7	29.6 (N, J+)	345
0316-95-0491	0-0.5	137	16.7	22.2	0.14 (N,U)	7.0 (U)	28.6	68.5	**454**
0316-95-0492	0-0.5	163	18.1	24.1	0.16 (N,U)	9	29.3	62.3	**423**
0316-95-0493	0-0.5	8.6	7.3	11.7	0.08 (N,U)	7.5	21.6	31.3	338
0316-95-0494	0.7-1.1	5.4 (N,J+)	4.67	9.8 (J+)	0.058 (U)	4.61	14.7	25.3 (N,J+)	49.5
0316-95-0495	1.2-1.5	5.1 (N,J+)	4.29	14.4 (J+)	0.058 (U)	4.33	19	25.5 (N,J+)	43.1
0316-95-0496	0-0.5	8.8	8	11.7	0.08 (N,U)	7.8	20	31.8	303
0316-95-0497	0-0.5	5.8	5.6	10.2	0.06 (N, U)	5.8	20.3	25.2 (J+)	82.5
0316-95-0512	0-0.5	8.43 (N,J+)	33.5	24.7 (J+)	0.058 (U)	123	13.1	24.2 (N,J+)	5.7
0316-95-0513	0.7-1.1	7.42 (N,J+)	22.9	11.4 (J+)	0.059 (U)	106	20.1	25.3 (N,J+)	17.6
0316-95-0514	1.2-1.4	6.83 (N,J+)	25.2	15.5 (J+)	0.061 (U)	113	18.2	25.4 (N,J+)	25.9
0316-95-0515	0-0.5	11.5 (N,J+)	51	23.2 (J+)	0.062 (U)	147	12.2	26.8 (N,J+)	7.91
0316-95-0516	0-0.5	18.3 (N,J+)	65.9	30.4 (J+)	0.08 (U)	200	16.4	32.4 (N,J+)	17.1
0316-95-2016	2-3.5	53.4	40	5.2	0.05 (U)	30.4	9.7	62.9	72.4

Note 1:
Bold indicates values above SAL.
** Sample 0316-95-2016 is a duplicate of 0316-95-0483.
NC - not calculated
N/A - not applicable
ND - not detected

Qualifier codes:
(J) Analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
(J-) Numerical value likely has a low bias.
(J+) Numerical value likely has a high bias.
(B) Reported value was obtained from a reading that was less than the estimated quantitation limit bu greater than or equal to the instrument detection limit
(P) Duplicate analysis is not within control limits.
(N) Spike sample recovery was not within control limits.
(U) Analyte was analyzed for but was not detected above the reported sample quantitation limit.

TABLE 6.9-3

SVOC DATA

SAMPLE ID	DEPTH (ft)	Acenaphthene (mg/kg)	Acenapthylene (mg/kg)	Anthracene (mg/kg)	Benzoic acid (mg/kg)	Benzo(a)anthracene (mg/kg)	Benzo(b)fluoranthene (mg/kg)	Benzo(k)fluoranthene (mg/kg)	Benzo(a)pyrene (mg/kg)	Benzo(g,h,i)perylene (mg/kg)	Bis(2-ethylhexyl) phthalate (mg/kg)	Chrysene (mg/kg)
SAL	N/A	360	NC	19	100 000	0.61	0.61	6.09	0.06	NC	50	24
0316-95-0471	0-0.5	50	120	**120**	ND	**420**	**580**	**140**	**460**	350	ND	**610**
0316-95-0472	2.5-4.5	ND	ND	ND	ND	0.076 (J)	0.089(J)	ND	**0.07(J)**	ND	ND	0.12(J)
0316-95-0473	4.5-5.5	1.5	0.064 (J)	2.7	ND	**8.6**	**11**	3.5	**8.5**	3	ND	13
0316-95-0474	0-0.5	0.076	ND	0.13 (J)	ND	0.36	0.46	0.18 (J)	**0.37**	ND	ND	0.47
0316-95-0475	0-0.5	0.19 (J)	ND	0.35	ND	**1.1**	**1.3**	0.52	**1.1**	0.82	ND	1.3
0316-95-0476	0-0.5	1.4 (J)	ND	3.2 (J)	ND	**13**	**16**	**6.6**	**14**	12	ND	21
0316-95-0477	2.5-3	ND	ND	0.051 (J)	ND	0.15 (J)	0.18 (J)	0.077 (J)	**0.15 (J)**	0.066 (J)	ND	0.22 (J)
0316-95-0478	4-5.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0316-95-0479	0-0.5	1.2 (J)	ND	2.6 (J)	ND	**8.9**	**12**	4.8	**10**	8.6	1.8	11
0316-95-0482	0-0.5	8.8 (J)	ND	13 (J)	ND	**29**	**32**	**13**	**29**	20	ND	**45**
0316-95-0484	4-5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.059 (J)
0316-95-0485	0-0.5	0.36 (J)	ND	0.58 (J)	ND	**1.9**	**2.5**	0.9	**2**	1.6	0.28 (J)	3.3
0316-95-0486	2-3	ND	ND	ND	ND	0.058(J)	0.09(J)	ND	**0.062 (J)**	ND	ND	0.11 (J)
0316-95-0487	3-4	ND	ND	ND	ND	ND	0.079 (J)	ND	ND	ND	ND	0.097 (J)
0316-95-0488	0-0.5	0.33 (J)	ND	0.76 (J)	0.98 (J)	**3.9**	**8.2 (J)**	3.5 (J)	**4.9 (J)**	2 (J)	0.42 (J)	5.7
0316-95-0489	1.5	0.078 (J)	ND	0.16 (J)	0.2 (J)	**0.68**	**1.3 (J)**	0.49 (J)	**0.79 (J)**	0.44 (J)	ND	1.2
0316-95-0490	1.2-1.4	0.057 (J)	ND	0.12 (J)	0.17 (J)	**0.66**	**1.1**	0.46	**0.75**	0.45	ND	1.1
0316-95-0491	0-0.5	ND	ND	ND	ND	**3.4**	**5.3**	1.8	**3.7**	3.2	ND	6.4
0316-95-0492	0-0.5	ND	ND	ND	ND	**3.4**	**5.1**	ND	**4**	3.1	ND	6.3
0316-95-0494	0.7-1.1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0316-95-0495	1.2-1.5	ND	ND	ND	ND	0.13 (J)	0.16 (J)	ND	**0.12 (J)**	ND	ND	0.16 (J)
0316-95-0496	0-0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0316-95-0514	1.2-1.4	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
0316-95-0515	0-0.5	ND	ND	ND	ND	ND	0.07 (J)	ND	ND	ND	ND	0.063 (J)
0316-95-0516	0-0.5	ND	ND	ND	ND	ND	ND	0.093 (J)	ND	ND	ND	0.081 (J)

TABLE 6.9-3 (CONTINUED)

SVOC DATA

SAMPLE ID	DEPTH (ft)	Di-n-butylphthalate (mg/kg)	Dibenzo(ah)anthracene (mg/kg)	Dibenzofuran (mg/kg)	Diethylphthalate (mg/kg)	2,4-Dimethylphenol (mg/kg)	Di-n-octylphthalate (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno(1,2,3-cd)pyrene (mg/kg)	2-Methylnaphthalene (mg/kg)	4-Methylphenol (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)
SAL	N/A	6 500	0.06	260	52 000	1 300	1 300	2 607	300	0.61	NC	330	800	NC	1 955
0316-95-0471	0-0.5	ND	**68**	25	ND	ND	ND	980	40	**270**	14 (JD)	ND	35 (JD)	610	720
0316-95-0472	2.5-4.5	ND	ND	ND	ND	ND	ND	0.2 (J)	ND	ND	ND	ND	ND	0.16 (J)	0.14 (J)
0316-95-0473	4.5-5.5	ND	**0.9**	1	ND	0.054 (J)	ND	20	1.7	**3.6**	0.7	0.088 (J)	1.8	15	15
0316-95-0474	0-0.5	ND	ND	0.036 (J)	ND	ND	ND	0.88	0.07 (J)	0.27 (J)	ND	ND	0.083 (J)	0.63	0.82
0316-95-0475	0-0.5	ND	ND	0.077 (J)	ND	ND	ND	2.4	0.16 (J)	**0.78**	0.043 (J)	ND	0.14 (J)	1.6	2.1
0316-95-0476	0-0.5	ND	**3**	0.87 (J)	ND	ND	ND	36 (J)	1.6 (J)	**10**	0.35 (J)	ND	1.1	16 (J)	21
0316-95-0477	2.5-3	ND	**0.064 (J)**	ND	ND	ND	ND	0.32 (J)	ND	0.071 (J)	ND	ND	ND	0.24 (J)	0.29 (J)
0316-95-0478	4-5.5	ND	ND	ND	0.043 (J)	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.43 (J)
0316-95-0479	0-0.5	ND	**2.3**	ND	ND	ND	ND	26 (J)	ND	**8.7**	ND	ND	0.54 (J)	11 (J)	14
0316-95-0482	0-0.5	ND	**5.5**	6.9 (J)	ND	ND	ND	62	11 (J)	**18**	4.6	ND	17	61 (J)	50
0316-95-0484	4-5	ND	ND	ND	ND	ND	ND	0.078(J)	ND	ND	ND	ND	ND	ND	0.066(J)
0316-95-0485	0-0.5	ND	ND	0.26 (J)	ND	ND	ND	5.3 (J)	0.4 (J)	**1.6**	0.17 (J)	ND	0.62	3.2 (J)	2.5
0316-95-0486	2-3	ND	ND	ND	ND	ND	ND	0.15 (J)	ND	ND	ND	ND	ND	0.065 (J)	0.12 (J)
0316-95-0487	3-4	ND	ND	ND	ND	ND	ND	0.14 (J)	ND	ND	ND	ND	ND	0.065 (J)	ND
0316-95-0488	0-0.5	0.78 (J)	**1.8(J)**	ND	ND	ND	ND	8.3	0.28 (J)	**2.4 (J)**	ND	ND	ND	3.7	10
0316-95-0489	1.5	ND	**0.12 (J)**	ND	ND	ND	ND	1.5	0.074 (J)	0.46	ND	ND	ND	0.087	2
0316-95-0490	1.2-1.4	ND	**0.12 (J)**	ND	ND	ND	ND	1.4	0.05 (J)	0.47	ND	ND	ND	0.69	1.8
0316-95-0491	0-0.5	ND	ND	ND	ND	ND	ND	8.9 (J)	ND	**2.5**	ND	ND	ND	3.4 (J)	5.3
0316-95-0492	0-0.5	ND	**0.74 (J)**	ND	ND	ND	ND	9.8 (J)	ND	**2.8**	ND	ND	ND	3.2 (J)	5.4
0316-95-0494	0.7-1.1	ND	ND	ND	ND	ND	ND	0.081 (J)	ND	ND	ND	ND	ND	ND	0.092 (J)
0316-95-0495	1.2-1.5	ND	ND	ND	ND	ND	ND	0.28 (J)	ND	ND	ND	ND	ND	0.25 (J)	0.34 (J)
0316-95-0496	0-0.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.43 (J)
0316-95-0514	1.2-1.4	ND	ND	ND	ND	ND	0.063 (J)	0.068 (J)	ND	ND	ND	ND	ND	0.047 (J)	0.44 (J)
0316-95-0515	0-0.5	ND	ND	ND	ND	ND	ND	0.1 (J)	ND	ND	ND	ND	ND	0.048 (J)	0.11 (J)
0316-95-0516	0-0.5	ND	ND	ND	ND	ND	ND	0.14 (J)	ND	ND	ND	ND	ND	0.077 (J)	0.13 (J)

Note 1:
Bold indicates values above SAL.
** Sample 0316-95-2016 is a duplicate of 0316-95-0483.
NC - not calculated
N/A - not applicable
ND - not detected

Qualifier codes:
(J) Analyte was positively identified. The associated numerical value is the approximate concentration of the analyte in the sample.
(J-) Numerical value likely has a low bias.
(J+) Numerical value likely has a high bias.
(B) Reported value was obtained from a reading that was less than the estimated quantitation limit bu greater than or equal to the instrument detection limit
(P) Duplicate analysis is not within control limits.
(N) Spike sample recovery was not within control limits.
(U) Analyte was analyzed for but was not detected above the reported sample quantitation limit.

6.10 Risk-Based Cleanup Level Calculations

The equations and assumptions used to calculate industrial soil cleanup levels for carcinogenic and noncarcinogenic contaminants for this EC are presented in this annex. The equations are based on three exposure routes: ingestion, skin contact and inhalation.

Equation 1 - Combined Exposures to Carcinogenic Contaminants in Industrial Soil:

$$C\ (mg/kg) = \frac{TR \times BW_a \times AT_c}{EF_o \times ED_o \left[\left(\frac{IRS_o \times CSF_o}{10^6 mg/kg} \right) + \left(\frac{SA_a \times AF \times ABS \times CSF_o}{10^6 mg/kg} \right) + \left(\frac{IRA_a \times CSF_i}{VF_s^a} \right) \right]}$$

Equation 2 - Combined Exposures to Noncarcinogenic Contaminants in Industrial Soil:

$$C\ (mg/kg) = \frac{THQ \times BW_a \times AT_n}{EF_o \times ED_o \left[\left(\frac{1}{RfD_o} \times \frac{IRS_o}{10^6 mg/kg} \right) + \left(\frac{1}{RfD_o} \times \frac{SA_a \times AF \times ABS}{10^6 mg/kg} \right) + \left(\frac{1}{RfD_i} \times \frac{IRA_a}{VF_s^a} \right) \right]}$$

[a] Note: VF_s for volatile chemicals (defined as having a Henry's Law Constant [atm-m^3/mol] greater than 10^{-5} and a molecular weight less than 200 grams/mol), or PEF for non-volatile chemicals.

The standard default exposure factors used to calculate the industrial soil cleanup levels are as follows (factors adopted from Region IX Preliminary Remediation Goals Table, Second Half 1995):

PARAMETER	DEFINITION	UNITS	VALUE
C	cleanup level - chemical concentration in soil	mg/kg	---
TR THQ	target excess individual lifetime cancer risk target hazard quotient	unitless unitless	10^{-6} 1
BW_a	body weight - adult	kg	70
AT_c AT_n	carcinogenic averaging time noncarcinogenic averaging time	days days	25,550 ED x 365
EF_o ED_o	exposure frequency - occupational exposure duration - occupational	days/yr years	250 25
IRS_o IRA_a	soil ingestion - occupational inhalation rate - adult	mg/day m^3/day	50 20
CSF_o CSF_i RfD_o RfD_i	cancer slope factor oral cancer slope factor inhaled reference dose oral reference dose inhaled	$(mg/kg\text{-}day)^{-1}$ $(mg/kg\text{-}day)^{-1}$ mg/kg-day mg/kg-day	chemical-specific chemical-specific chemical-specific chemical-specific
SA_a AF ABS	25% surface area - adult adherence factor skin Absorption organics inorganics	cm^2/day mg/cm^2 unitless	5,000 0.2 0.1 0.01
VF_s PEF	volatilization factor for soil particulate emission factor - specific to Laboratory sites	m^3/kg m^3/kg	chemical-specific 1.11×10^7