Los Alamos National Laboratory
Environmental Restoration Project

EXPEDITED CLEANUP PLAN

for

SOLID WASTE MANAGEMENT UNITS 48-002(a) and 48-002(b)

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Revision 1

Environmental
Restoration

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Approvals and Reviews

This document is based on the most current information available at the time of preparation. In the event changes or modifications are required from those proposed, modifications will be made to incorporate any and all revisions. Subsequent reviews and approvals, consistent with those provided for this revision, will be required. This document has been reviewed for content and approved as reflected by the signatures below:

Document Approved By:

Allyn Pratt, Field Project Leader

24 April 95
Date

ACRONYMS

AR	administrative requirement
CEARP	Comprehensive Environmental Assessment and Response Program
CFR	Code of Federal Regulations
Chem van	mobile chemical analytical laboratory
COC	contaminant of concern
CST	Chemical Science and Technology (Division)
EC	expedited cleanup
EPA	US Environmental Protection Agency
ER	Environmental Restoration
ES&H	environment, safety, and health
HASP	health and safety plan
H&S	health and safety
Laboratory	Los Alamos National Laboratory
ORNL	Oak Ridge National Laboratory
PPE	Personal Protective Equipment
Rad van	mobile radiological analytical laboratory
RCRA	Resource Conservation and Recovery Act
RFI	Resource Conservation and Recovery Act facility investigation
SAL	screening action level
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
USGS	United States Geological Survey
VOC	volatile organic compound
UTL	upper tolerance limit
XRF	x-ray fluorescence

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1.0 INTRODUCTION

This Expedited Cleanup (EC) Plan addresses Solid Waste Management Units (SWMUs) 48-002 (a) and 48-002(b), located in the northwest portion of Los Alamos National Laboratory (the Laboratory), in Los Alamos, New Mexico (Figure 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 Operable Unit (OU) 1129 RFI Work Plan (LANL 1992, 7666).

SWMUs 48-002(a) and 48-002(b) are included in Table A of the Hazardous and Solid Waste Amendments (HSWA) permit.

SWMUs 48-002(a) and 48-002(b) are former container storage areas located at Technical Area (TA) - 48. Preliminary results from the Phase I RFI sampling efforts indicate that soils within the SWMU boundaries contain elevated levels of metallic mercury and semivolatile organic compounds (SVOCs). These data indicate that this contamination may pose an immediate threat to the environment and possibly to worker safety and may be classified as RCRA hazardous waste.

Activities comprising this EC include the removal of mercury-contaminated soil at the SWMUs. The level of effort required from initial transmittal of the plan to EPA for review, through implementation, to the completion of the final project report is identified in this EC Plan. In the development of this EC Plan, the following assumptions were made:

- The levels of contaminants of concern (COCs) and volumes anticipated are consistent with preliminary data.
- Future land use at the location of these SWMUs 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 result from the acquisition and scheduling of heavy equipment and from accepting waste at permitted disposal facilities cannot be anticipated and therefore are not considered within this plan.
- A Site-Specific Health and Safety Plan (SSHASP) and Waste Management Plan will be developed specifically to address COCs identified in this EC Plan. Deviations from the anticipated concentrations and locations of contaminants of concern may necessitate adjustments to both plans.
- Any comments generated by agencies for public review may necessitate adjustments to the scope of this EC Plan. Activities will be performed on a continuous basis during regular business hours, weather permitting, until verification samples indicate that all cleanup levels were met.
- Cost estimates are based on completing the proposed cleanup by removing contaminated soil to a depth of one foot.

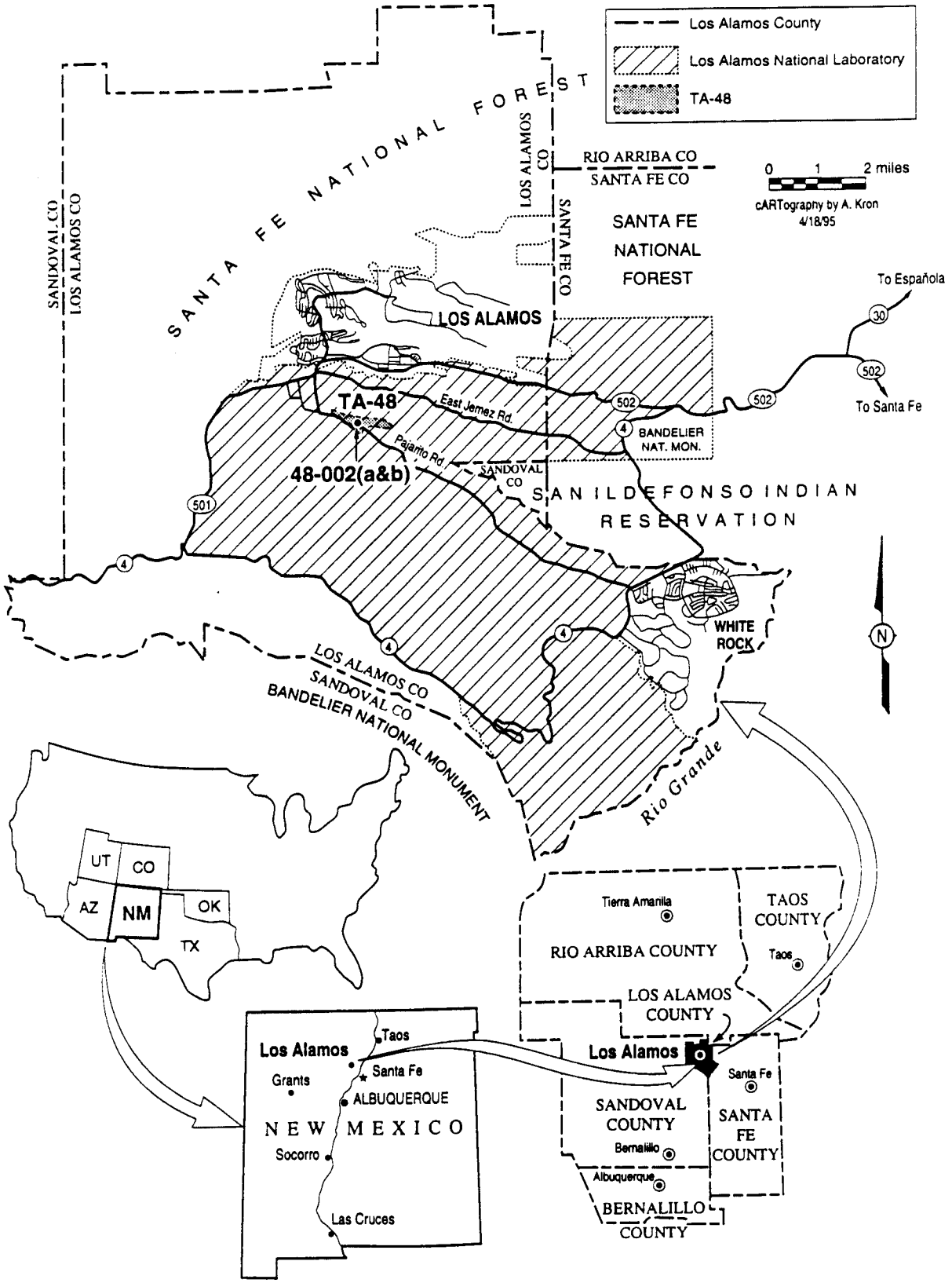


Figure 1-1. Regional location map.

2.0 SITE BACKGROUND AND ENVIRONMENTAL SETTING

2.1 Detailed Description of SWMUs 48-002(a) and 48-002(b)

SWMUs 48-002(a) and 48-002(b) are former container storage areas located adjacent to the south side of the Radiochemistry Laboratory, building TA-48-1 (Figure 2-1). The SWMUs have been addressed together during Phase I characterization due to their physical proximity and because preliminary site characterization data indicate the presence of the same suite of COCs. This EC plan continues to address the SWMUs together for these reasons.

Beginning as early as 1976, approximately 200 2-qt. metal flasks, each containing 76 lb. of triple-distilled high-purity mercury, were stored among other "junk" at SWMU 48-002(a) (Garvey 1986, 827; LANL 1990, 7511). The flasks were removed from this location in 1989 (LANL 1990, 7511). Records do not reflect any known releases of hazardous materials, but the flasks were described as "rusting" and sitting in decayed and broken wooden-framed holders (Garvey 1986, 827). No records were found indicating that the site was managed as an active storage area.

SWMU 48-002(b) consisted of an unpaved storage area located at the south end of TA-48-1 where labeled and unlabeled drums were periodically stored (LANL 1990, 7511; DOE 1987, 8663). No records have been located indicating that the area was managed as a formal container storage area. In 1986, a field observation report noted signs of spills at this SWMU, which the observer postulated were due to leaky drums (Perkins 1986, 808; DOE 1987, 8663). In 1989, an internal Laboratory environmental audit report noted only the presence of a long, unlabeled cylinder but omitted any discussion of drums or contamination (LANL 1990, 7511). In 1991, a field activity data log noted that the drums and cylinders previously observed had been removed (Roberson 1991, 884).

The boundaries of SWMUs 48-002(a) and 48-002(b) are generally defined by the physical barriers surrounding the proposed cleanup area. This area is bounded on the north by the wall of building TA-48-1, the east by the concrete retaining wall surrounding the exhaust stack FES-45, and the south by an asphalt road. The western extent of the proposed site, determined from Phase I RFI characterization, is approximately 20 ft. west of the concrete retaining wall. The site measures approximately 220 square ft. and is illustrated in Figure 2-2. The south end of building TA-48-1, where SWMUs 48-002(a) and 48-002(b) are located, is reported to have a basement and perhaps a sub-basement. This feature may be important with regard to potential pathways for contaminant migration (see Section 2.4.1).

2.1.1 Operational History

TA-48 was established in 1957 and is the site of former and current operational structures built to house research work for radiochemistry and nuclear medicine (LANL 1992, 7666). Building TA-48-1 was initially completed in 1957, and in 1963 the alpha wing was added. The alpha wing, located in the northwest end of the building, is used to process high-level alpha and/or beta-gamma emitters. The hot cell facility, which formerly handled irradiated fuel elements from the Rover Program (a nuclear rocket reactor program), is currently used for radiochemical analysis on spallation products from the Clinton P. Anderson Meson Physics Facility. The Nevada Operations Facility is also located within building TA-48-1. Personnel at this facility dissolve samples retrieved from underground shot cavities at the Nevada Test Site and perform radiochemical studies on them.

It is likely that SWMUs 48-002(a) and 48-002(b) were used informally as container storage areas throughout the operational history of the TA-48 facility. No Laboratory records were located to document the intended use of the mercury or the potential source of the SVOCs. Anecdotal information from a former employee indicates that surplus liquid mercury was shipped from Oak Ridge National Laboratory (ORNL) for possible use as shielding for gamma-ray detectors. However, most of the mercury was never used (Balagna, 1995).

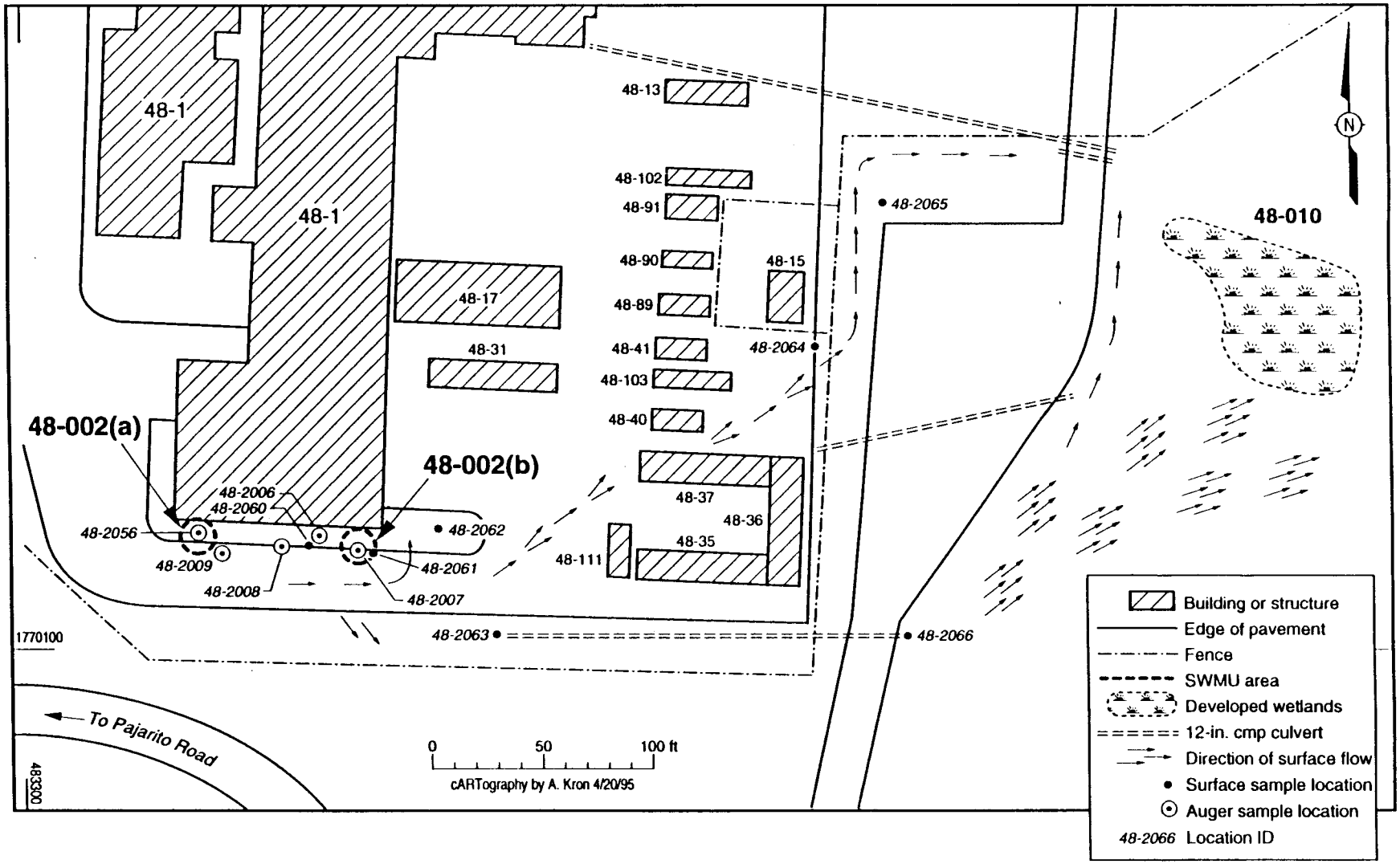


Figure 2-1. Location map for SWMUs 48-002(a) and 48-002(b).

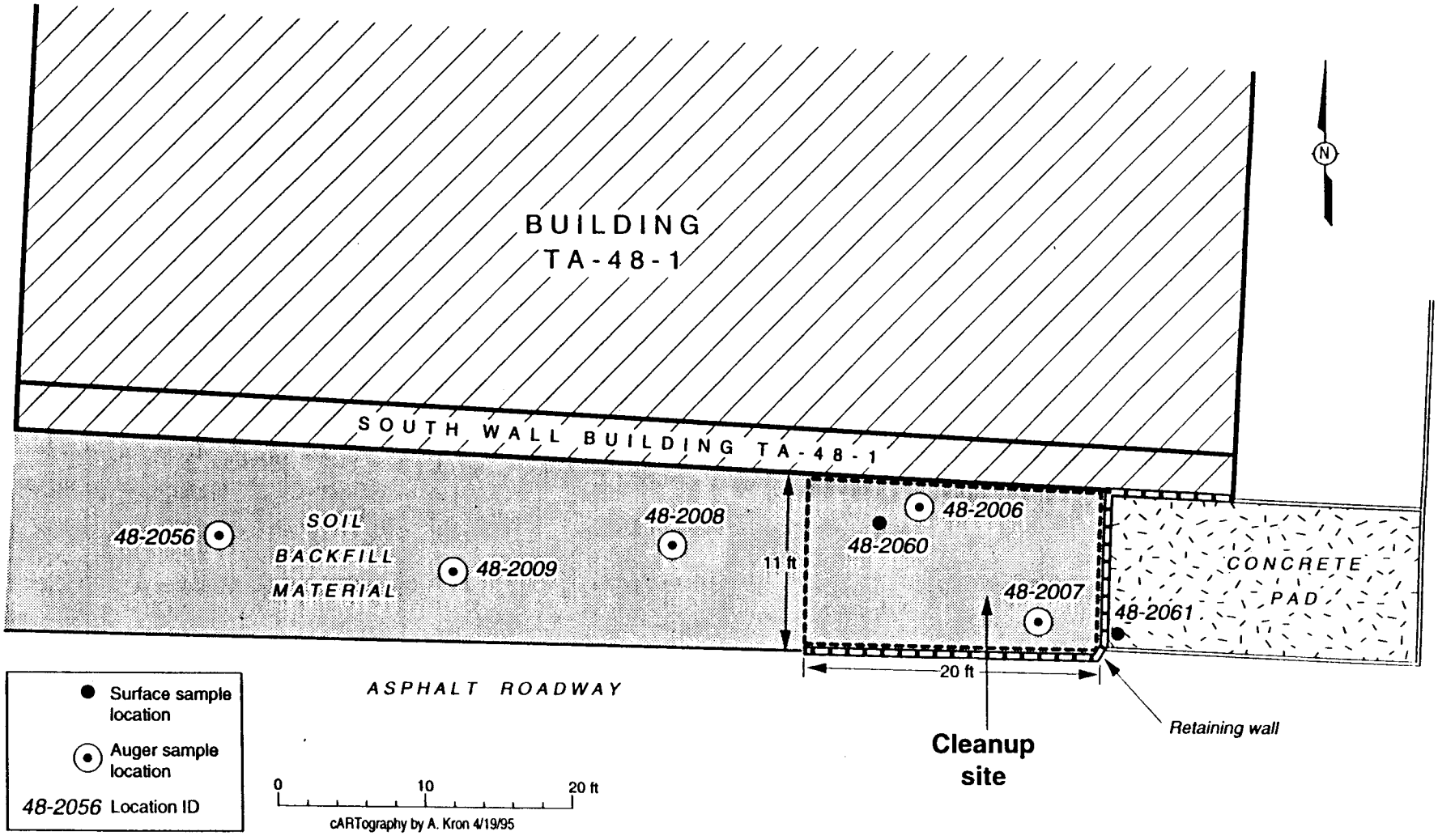


Figure 2-2. Site sketch for SWMUs 48-002(a) and 48-002(b).

2.1.2 Physical Setting

TA-48 lies within the boundaries of the Laboratory (LANL 1992, 7666) and is located north of Pajarito Road at an approximate longitude and latitude of 35:52:00 N and 106:18:20 W (USGS 1984, 21588) (LANL 1992, 7666). It is situated on Mesita del Buey between Mortandad Canyon to the north and Two Mile Canyon to the south (LANL 1992, 7666). Mesita del Buey is underlain by the Bandelier Tuff, composed of ash fall, ash-fall pumice, and rhyolitic tuff. The depth to the soil/tuff interface ranges from approximately 8 to 10 ft. near the building to approximately 3 ft. near the asphalt road. The depth to the main aquifer is approximately 1,000 ft. from the mesa top.

No archeological sites or endangered species exist within the boundary of TA-48 that could be affected during these EC activities (LANL 1992, 7666). A wetland-type area is known to exist approximately 500 ft east of the TA-48 perimeter fence. This area is identified as SWMU 48-010, surface impoundment (LANL 1990, 7511). It consists of an unlined pond that was excavated into the tuff in 1978 to catch noncontact and treated cooling water from TA-48. The perimeter of this pond has developed into a wetland area. The pond discharges to the east into a side canyon of Mortandad Canyon. EC activities at SWMUs 48-002(a) and 48-002(b) are not expected to impact the wetland-type area. SWMU 48-010 has undergone Phase I characterization in accordance the RFI Work Plan for OU 1129, and the results will be reported in a future RFI Report.

2.2 Summary of Investigations

Previous investigations at SWMUs 48-002(a) and 48-002(b) include a site evaluation under Phase I of the Comprehensive Environmental Assessment and Response Program (CEARP) and a Phase I Resource Conservation and Recovery Act (RCRA) facility investigation (RFI) under the ER Project.

2.2.1 Investigations Prior to the RFI

Prior to designation as SWMUs, the container storage areas were evaluated under Phase I of the CEARP (DOE 1987, 8663). The Phase I CEARP findings were based on a records search, an open literature survey, interviews with current and former Laboratory employees, preliminary assessments, and site inspections. SWMU 48-002(a) was identified as "TA 48-4-CA-A-HW (mercury storage)" in the Phase I draft report. SWMU 48-002(b) was identified as "TA 48-5-CA-A/I-HW/RW/PP (drum storage)."

Under the CEARP the two SWMUs were visited and field observation reports (site inspections) were filed. One report noted the corroding mercury storage flasks, but no further action was recommended at that time. The CEARP Phase I report recommended future action for the drum storage area: "During supplemental Phase I, the extent of residual environmental contamination associated with past drum storage will be determined." However, no further action was taken at either location because the program changed from the DOE CEARP to the Laboratory ER Program.

2.2.2 RCRA Field Investigations (RFI)

RCRA facility investigations conducted at the site consisted of two characterization sampling events. Surface and subsurface sampling was conducted at the site in July 1993 and surface soil sampling was conducted downgradient of the site in October 1993.

In July 1993, five boreholes were hand augered at locations 48-2006, -2007, -2008, -2009, and 2056, as shown in Figure 2-1. Borehole 48-2006 was advanced to a depth of 8 ft., boreholes 48-008 and 48-009 were advanced to a depth of 3 ft., borehole 48-2056 was advanced to a depth of 2 ft., and borehole 48-2007 was advanced to a depth of 1 foot. Soil samples from the five boreholes were collected at 1-ft intervals. In addition, one surface soil sample was collected at location 48-2060. During the collection of the surface sample, the soil was noted to be stained, and "beads" of elemental mercury were readily observed in the soil (Stellavato 1993, 45355).

All of the samples were submitted for analysis of volatile organic compounds (VOCs), SVOCs, metals, and radionuclides; additional samples were collected and field-analyzed for metals using an x-ray fluorescence (XRF) analyzer. A Jerome (Model 431-X) mercury vapor analyzer ("sniffer") was used to monitor the breathing zone and the sampling locations before and during sampling. Readings ranged from barely detectable in the breathing zone to near the Laboratory-imposed H&S action limit at the soil surface at sample location 48-2060.

In October 1993, six additional surface soil samples were collected to evaluate possible mercury migration from the SWMUs. One sample (48-2061) consisted of sediment that had accumulated from wind and/or runoff on a concrete pad associated with TA-48-1. The other five samples (48-2062 through 48-2066) were collected in areas downgradient of the site. All of these soil samples were submitted for mercury analysis.

2.2.3 Summary and Evaluation of Results

Annex 6.9 presents a summary of the RFI analytical sampling results reported above detection limits for all RFI samples collected at the site. The detected concentrations, screening action levels (SALs), and upper tolerance limits (UTLs) for background concentrations in soil are also presented for comparison. Based on preliminary review of the monitoring and sampling data, the results are summarized as follows:

- The highest concentration of mercury (62 ppm) in soil was observed near the east end of the south wall of TA-48-1 at a depth of 0.5 ft. (sample number 48-2006). Mercury was detected near the Laboratory SAL (24 ppm) in one sample collected from windblown and/or runoff sediments accumulated on a concrete pad. No mercury was detected in surface soil samples collected from areas downgradient of the SWMUs.

- SVOC concentrations were detected above Laboratory SALs with maximum values provided for benzo{a}anthrac-ene (23.2 ppm); benzo{a}pyrene (22.6 ppm); benzo{b} fluoanth-ene (25.8 ppm); benzo{k}fluoranth-ene (10.7 ppm); dibenzo{a,h}anthrac-ene (2.7 ppm); and ideno{1,2,3-(d)} pyrene (13.7 ppm).

- Thorium-228 was detected at levels slightly above the Laboratory SAL (1.5 pCi/g). The highest values for Thorium-228 (2.27 pCi/g and 2.03 pCi/g) were detected near the east end of the south wall of TA-48-1 at depths of 1 ft to 1.5 ft. Thorium concentrations are within Bandelier Tuff background range of 1.7 pCi/g to 4.0 pCi/g (Crowe, et al., 1978). The values obtained from other locations near the building are relatively consistent throughout the soils. Thorium-228 levels detected during Phase I characterization are well below the levels established to trigger remedial action under 40 CFR 192 (EPA 1994), and well below applicable values for unrestricted release found in DOE Order 5400.5, Radiation Protection of the Public and the Environment.

No identifiable compounds were detected in the VOC analysis. Based on these results, the following assumptions have been made:

- The mercury and SVOC contamination is likely limited to a rectangular area that extends from the east corner of building TA-48-1 for approximately 20 ft along the south wall of the building, and from the wall to approximately 11 ft out toward the asphalt, (Figure 2-2).

- Mercury and SVOC contamination in the soil was generally limited to a depth of approximately 1 foot. Some elemental mercury may have migrated downward between the soil/building interface.

- The reported thorium activity, while slightly above the SAL, is within the range of Laboratory background activity and will not require remediation.

2.3 Types and Volumes of Wastes Present

The nature of the wastes expected to be generated by the proposed cleanup is presented in Table 2-1.

The surface and subsurface soil samples revealed elevated levels of elemental mercury and SVOCs and may be considered RCRA hazardous waste. As described in Section 3.3, contaminated soils within 1 foot of the surface will be excavated and placed directly into drums or bulk storage containers on site prior to transport and disposal by an approved waste facility. Treatment or stabilization of the soils by the waste facility may be necessary before its disposal. The specific nature of this stabilization will be determined by the disposal facility.

Verification sampling will be performed as described in Section 3.5. A small volume of solid and liquid wastes will be generated by this activity. Waste associated with this effort may include disposable sampling equipment, personal protective equipment, and decontamination water. These materials will be handled in accordance with the site-specific Waste Management Plan and treated as potentially hazardous waste pending characterization.

TABLE 2-1
ANTICIPATED WASTE VOLUMES

Item	Type	Anticipated Volume
Sampling waste/PPE	solid - potential hazardous	1 cu. ft.
Contaminated soils	solid- potential hazardous	200 - 330 cu.ft.
Decontamination waste	liquid - potential hazardous	150 gal.

2.4 Potential Impacts on Public Health and the Environment

Receptors of possible contaminants include animals and humans. Potential exposure routes of receptors include the following:

- Inhalation (especially if the SWMUs are disturbed);
- Ingestion; and
- Skin contact with contaminated soils.

2.4.1 Potential Pathways

2.4.1.1 SWMUs in Place

If the contaminated soil is left in place, several mechanisms are available to transport contaminants from their current location. These mechanisms include:

- gravity flow of liquid metallic mercury into, through, or over the soil surface;
- volatilization and transport of vapor phase mercury through air or geologic materials;
- physical agitation of contaminated soil;
- water transport of sorbed mercury on sediment particles or colloids; and
- air or wind transport of mercury attached to airborne particulates.

The following potential pathways are thought to be the most likely to exist for the migration of contaminants from SWMUs 48-002(a) and 48-002(b):

- The field observations from July 1993 (Stellavato 1993, 45355) show that elemental mercury "beads" still exist in the shallow soil. With physical agitation these "beads" may move either downward or laterally from wind, water, or human interaction. Of particular concern is the

likelihood that mercury has migrated down the interface between the soil and the wall of building TA-48-1. This is inferred from the mercury vapor screening results which showed elevated concentrations of mercury at the soil immediately adjacent to the wall and on the wall.

- Some of the inorganic elemental mercury may attach itself to silt- or clay-sized particles, which can then be mobilized by precipitation and/or wind. While the downward pathway is likely to be very small because of capillary action and soil drying during dry periods, one surface sample (48-2061) indicates that lateral movement via water and/or wind is possible.

2.4.1.2 SWMU Remediation

Potential pathways for contaminant migration during excavation of the soils are generally the same as those described above in Section 2.4.1.1. Some potential exists for sideward migration and airborne transport because of physical agitation of the soils during remediation. Appropriate dust suppression techniques will be followed to minimized this pathway. Little or no potential exists for aqueous transport during remediation because the excavated soils will be placed in 55-gallon drums and covered to prohibit contact with water. Further, the excavated area will be covered with plastic sheeting to prohibit water from entering the excavation.

2.4.2 Future Land Use

SWMUs 48-002(a) and 48-002(b) lie entirely on US Department of Energy (DOE)-owned land on Mesita del Buey. In the foreseeable future, the land is anticipated to be used exclusively for Laboratory (industrial) operations.

2.4.3 Cleanup Levels

Results from the previous investigations indicate mercury and carcinogenic PAH are contaminants of concern for this EC, and therefore, cleanup levels have been calculated for these compounds. For mercury, the soil cleanup level was set at a concentration that would result in an estimated noncarcinogenic hazard index of one or less for the occupational exposure scenario. The cleanup level for mercury has been calculated at 280 mg/kg (ppm). For carcinogenic PAH, the cleanup level has been calculated for an excess cancer risk due to occupational exposure of 1E-04 (one excess case of cancer in 10,000). This cleanup level is calculated at 80 mg/kg, based on the carcinogenic slope factor for benzo[a]pyrene (BaP). The equation and assumptions used for the calculation of cleanup levels is provided in Annex 6.10. In this case, LANL will adopt a conservative approach of summing all the carcinogenic PAH detected during verification sampling to compare to this level. It should be noted that typically, LANL will start with a cleanup level based on an excess cancer risk of 1E-06. However, this approach was not practical because the calculated cleanup level for BaP (0.75 mg/kg) is well below background at this level of risk (background UTL approximately 12 mg/kg, LANL 1995). However, the cleanup level presented is still within the EPA acceptable risk range of 1E-04 to 1E-06, and remains conservative given that exposure is highly unlikely due to the restricted access of this area. In addition, the maximum observed concentration of PAH (approximately 20 mg/kg) was observed in the first foot of soil, and it is anticipated that PAH contamination will be removed with the mercury-contaminated soil.

Attainment of these cleanup levels will be considered achieved when the upper 95% confidence level of the mean concentration of the constituent remaining in the excavated area, as demonstrated by verification sampling, is equal to or less than the established cleanup levels.

3.0 EXPEDITED CLEANUP

3.1 Overview and Rationale

Phase I RFI sampling results indicate that mercury and SVOCs exceeding cleanup levels exist in the backfill material on the south side of building TA-48-1, and the soils may be classified as RCRA hazardous waste. Excavation of mercury- and SVOC-contaminated soils at the site will be conducted to prevent the contaminants from spreading beyond the current area. This action will minimize the potential risk to human health and the environment. Verification samples will be collected to confirm that the mercury and SVOCs have been removed in accordance with this plan.

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 Laboratory Environmental Restoration (ER) Administrative Procedure (AP) LANL-ER-AP-05.1, Rev. 0, Readiness Review for Environmental Restoration Program Field Activities. Key documents to be prepared include a Site-Specific Health and Safety Plan (SSHASP) and a site-specific Waste Management Plan. 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 DOE Approval

Implementation of this EC will proceed only after DOE approval is documented through receipt of the signed Field Work Approval Form (Annex 6.7).

3.2.2 Regulatory Notification/Permit Modifications

SWMUs 48-002(a) and 48-002(b) are included in Table A of the Hazardous and Solid Waste Amendments (HSWA) permit. Implementation of this EC will require a Class III modification to the Laboratory's RCRA Permit. EPA and the New Mexico Environment Department will be notified of this project, and a request for a permit modification will be submitted.

3.2.3 DOE Approval

The DOE Los Alamos Area Office (DOE/LAAO) will follow normal protocol to evaluate cost, schedule, and technical merit for each EC plan submitted. Implementation of this EC will proceed only after DOE approval is documented through receipt of the signed Field Work Approval Form (Annex 6.7).

3.3 Cleanup Activities

The remediation of mercury- and SVOC-contaminated soils at the site will be accomplished using standard industry techniques, and in compliance with standard ER Project standard operating procedures (SOPs).

Prior to excavation, a Health and Safety/field screening walkover will be performed in the proposed cleanup area using a Jerome Mercury Vapor Analyzer to determined areas of high mercury contamination. Any identified "hotspots" and visible contamination within the area to be excavated will be vacuumed using a specially equipped high-powered vacuum fitted with appropriate filtration. The vacuum filtration will include baffles to intercept large material including gravel, a paper pre-filter,

a HEPA filter, and activated charcoal filter. Waste from the vacuum process will be placed in a 55-gallon drum, located adjacent to the cleanup site.

An initial 1-foot lift of soil will be removed in the proposed cleanup area using either shovels or a backhoe, as required by site conditions. After this lift of soil is removed, the excavated area will inspected for any visible surface contamination that will be removed by vacuum, as outlined above. Confirmatory cleanup samples will be collected on the nodes of a 3 ft. by 3 ft. grid within the excavated area; these samples will be submitted for on-site field laboratory analysis. A mobile Chem van using XRF and gas chromatography will analyze for mercury and SVOC analysis, respectively. The area for subsequent excavation will be determined based on the comparison of the results of the verification sampling to the cleanup criteria.

If necessary, additional excavation in areas that do not meet the cleanup criteria will be performed in 1-foot lifts until field laboratory analytical results indicate that mercury and SVOC concentrations in the soil at the site are below cleanup levels. Excavation equipment will be decontaminated between lifts. This phased cleanup process will continue until the entire site meets the cleanup criteria.

All vacuumed and excavated materials will be managed in 55-gallon drums. Material collected using the vacuum will be segregated from the excavated soil. The soil will be placed in 55-gallon drums to be located at the western boundary of the remediation site. Waste materials will be analyzed for mercury and SVOCs for waste characterization to verify the waste acceptance criteria (WAC) as required by the disposal facility, in accordance with appropriate waste handling and QA/QC procedures.

3.4 Waste Management Issues

The laboratory results from Phase I RFI sampling indicate that the contaminated soils may be classified as RCRA hazardous waste. Based on the projected extent of contamination, the maximum total volume of soil to be excavated and removed is estimated to be between 200 and 300 cu. ft.

Other wastes will include personal protective equipment (PPE), sampling wastes, and waste water from equipment decontamination. The volume of PPE is expected to be about one 55-gallon drum. Sampling wastes are expected to be no more than 2 cu. ft., and the decontamination water is expected to have a volume of about 150 gal. These volume estimates are based on past experience with Phase I RFI investigations.

3.4.1 Characterization of Materials for Disposal

Field laboratory analytical results from the confirmatory cleanup samples collected after each lift will be used to determine the gross contamination in the waste soils. After cleanup activities are completed, samples from a representative percentage of the waste containers will be collected and sent to a laboratory and analyzed in accordance with the disposer's WAC and 40 CFR 261 requirements. Waste water generated during equipment decontamination will be sampled and analyzed for mercury and SVOCs.

3.4.2 Treatment, Storage, and Disposal Plans for Waste

The majority of the waste materials generated in this EC will be in the form of mercury and/or SVOC-contaminated soils. These soils, sampling wastes, and PPE wastes will be transported to a permitted treatment, storage, and disposal (TSD) facility for final disposal. Several TSD facilities have Laboratory contracts to treat mercury-contaminated wastes. Laboratory disposal facilities that might be used during this EC include TA-54, Area L for the disposal of nonhazardous and hazardous wastes. Depending on the concentrations of COCs found in the decontamination water, the liquid waste may be sent to the TA-50, Liquid Waste Treatment Plant or to a permitted TSD facility for

disposal. The waste packaging, labeling, and documentation will comply with the appropriate Administrative Procedure and applicable SOPs.

3.5 Verification Plan

Verification samples will be taken to verify that contamination has been removed to the levels specified in Section 2.4.3 A combination of field laboratory analytical techniques and off-site, fixed laboratory analysis will be used to verify results.

The number of samples collected to determine whether a verification unit (in this case the 20 ft. by 11 ft. area of contamination) has achieved the cleanup standard due to excavation is dictated by the sampling frequency needed to achieve statistically defensible data. *Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Solid Media (EPA 1988)* provides the formulae for calculating the number of random samples needed to determine if the mean concentration remaining in the area after excavation is less than the cleanup goal at a specified level of confidence. The required number of samples is computed using the equation provided in Annex 6.11.

Application of this approach with assumptions as outlined in Annex 6.11 results in a verification sample size of 2 soil samples for laboratory analysis (Table 3-1). The verification sampling approach will include the evaluation of screening data after each cleanup excavation lift is accomplished. If screening data indicate that contaminant concentrations are 50% or less of the cleanup standard with a standard deviation of 25% of the C_s, then 2 verification laboratory samples will be obtained. Given the small size of this SWMU, if screening data do not achieve these results, additional soil will be removed until the screening requirements are met. An approach for larger remediated sites would consider the benefit from additional sampling to verify cleanup (i.e., the larger number of samples, the closer the UCL is to the mean) versus the cost of removing additional soil (i.e., reduce the average contaminant concentration).

Results from the laboratory verification samples will be used to calculate the 95% UCL to compare to the cleanup level established for each contaminant. The site cleanup objectives will be obtained when the calculated UCL is less than the established cleanup levels. (USEPA, 1989)

3.6 Site Restoration Plan

When sample results confirm that the site has been remediated in accordance with this plan, the excavated area will be returned to the original grade and revegetated if necessary. Backfill material will consist of uncontaminated soil excavated from the site and clean backfill obtained from the Laboratory maintenance contractor.

3.7 Acceptance Inspection

The Laboratory proposed an Acceptance Inspection as the mechanism for DOE and EPA to assess the implementation and effectiveness of the EC. A minimum of 14 days' notification will be provided to the agencies before the start of field activities. At this time, a tentative date for the inspection will be agreed upon.

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 the timing of the inspection will be developed by the Laboratory and agreed to by the other agencies. This inspection checklist will contain specific items, criteria, and requirements to be inspected that will constitute acceptance of remediation activities.

Table 3-1
SUMMARY OF VERIFICATION SAMPLES AND ANALYSES FOR SWMUs 48-002(a) and 48-002(b)

Description	Samples						Field Screening				Laboratory Analyses					
	Structure		Surface		Subsurface											
	Primary	duplicate	primary	duplicate	primary	duplicate	Beta-gamma	Alpha	Organic Vapor	Radiological Smear and Swipe Techniques	Total Uranium	Isotopic plutonium	Metals (SW 6010/7000)*	Mercury	VOCs (SW 8260)*	SVOCs (SW8270)*
Soil Samples			2	1			x	x	x					x		x
Equipment Rinsate	1						x	x	x					x		x

x: All samples
Note: Additional samples may be taken based on field surveys and observations.
*: Applicable EPA SW 846 methods.

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 will be identified for any outstanding items, and documented on the inspection checklist. The Laboratory Field Project Leader (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 VI, 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

After field activities are completed and all analytical results from the verification samples obtained a final report on the EC will be prepared. This report will outline the EC process and the "as-left" conditions of the site. 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 Allyn Pratt, the Field Project Leader (FPL). Leslie Sontag will serve as Field Team Leader (FTL) for the EC activities.

4.1 Staff and Resource Requirements

Total anticipated costs for the EC is $76,700 as detailed below.

Pre-Field Activities	
Preparation of Waste Management Plan	$1,000
Preparation of Site Health and Safety Plan	2,500
Field Work Preparation	2,500
Subtotal	$6,000
Field Activities	
Geodetic/"mark out" surveys	$3,500
Mercury vacuum/Jerome meter	2,000
Subcontractor (excavation)	2,500
Subcontractor (transportation and disposal of waste)	14,400
Site restoration	600
Subtotal	$23,000
Personnel Costs	
Field Team (FTL, SSO, 2 technicians) : $6,600/week x 2	$13,200
Backhoe Operator : $30/hr x 10 days	2,500
Subtotal	$15,700
Analytical Costs	
Rad van (assume shared cost): $1,000/day x 10 days	$10,000
Chem van (assume shared cost): $1,000/day x 10 days	10,000
Verification sampling: 4 samples x $750	3,000
Waste disposal characterization: 3 samples x $1,000	3,000
Subtotal	$26,000
Post-Field Activities	
Acceptance Inspection (including preparation of checklist)	$4,000
Final report	2,000
Subtotal	$6,000
TOTAL ESTIMATED COST	**$76,700**

4.2 Schedule

The proposed EC schedule is shown in Table 4-1. The submittal of this EC Plan to EPA in April 1995 will initiate the 60-day public review/comment period. No sooner than 15 days after the start of this period, a public meeting will be held. Preparation for field work will be conducted concurrent to the public review period. Field work will be initiated within 10 days of agency and public approval or receipt of EPA temporary authorization to proceed. The final report will be submitted to EPA within 14 days of receipt of verification sample results.

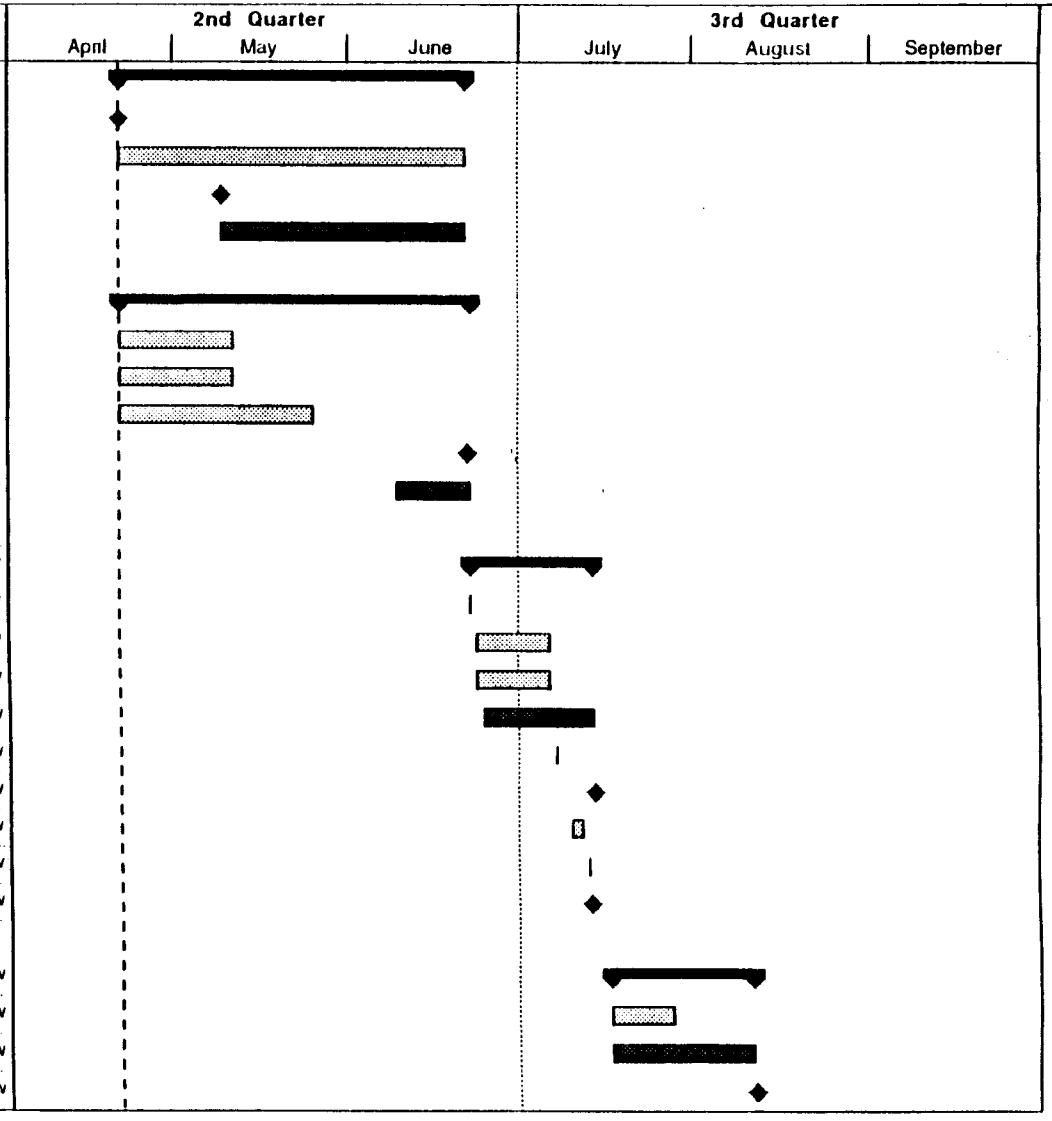
4.3 Stakeholder Notifications

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

The submission to EPA of this EC plan will trigger publication of a public notice starting a 60-day public comment period.

TABLE 4-1 PROPOSED SCHEDULE - SWMUs 48-002(a and b)

ID	Name	Duration
1	1.0 PUBLIC ACCEPTANCE	8.77ew
2	1.1 SUBMIT EC PLAN TO EPA	0w
3	1.2 PUBLIC COMMENTS	44d
4	1.3 PUBLIC MEETING	0ew
5	1.4 RESPOND TO PUBLIC COMMENT	6.4w
6		
7	2.0 PLANNING	8.91ew
8	2.1 PREPARE/REVISE HEALTH AND SAFETY PLAN	3w
9	2.2 PREPARE/REVISE WASTE MANAGEMENT PLAN	3w
10	2.3 FIELD WORK PLANNING	5w
11	2.4 FIELD WORK APPROVAL FORM SIGNED	0w
12	2.5 14-DAY NOTIFICATION OF FIELD WORK	2w
13		
14	3.0 IMPLEMENT EXPEDITED CLEANUP	3.2ew
15	3.1 MOBILIZATION	0.2w
16	3.2 PERFORM CLEANUP	2w
17	3.3 VERIFICATION SAMPLING	2w
18	3.4 VERFICATION ANALYSIS	3w
19	3.5 ACCEPTANCE INSPECTION	0.2w
20	3.6 ANALYSIS COMPLETE	0w
21	3.7 SITE RESTORATION	0.6w
22	3.8 DEMOBILIZATION	0.2w
23	3.9 COMPLETE EC	0w
24		
25	4.0 REPORT PREPARATION	3.63ew
26	4.1 VALIDATE SAMPLE DATA	2w
27	4.2 PREPARE FINAL REPORT	4w
28	4.3 SUBMIT REPORT	0w



Project: EXPEDITED CLEANUP
Date: 4/21/95

Critical — Noncritical — Progress — Milestone — Summary

Los Alamos National Laboratory

5.0 REFERENCES

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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 1995 revision, Los Alamos National Laboratory, Los Alamos, New Mexico.

6.3 Site-Specific Health and Safety Plan

See Los Alamos National Laboratory (LANL) ER 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 IV, Records Management Program Plan.

6.5 Public Involvement Plan

See Installation Work Plan for Environmental Restoration, Revision 4, Chapter V, Public Involvement Program Plan.

6.6 Waste Management Plan

6.7 Field Work Approval Form

6.8 Proposed Outline for Expedited Cleanup Final Report

6.9 RFI Analytical Results

6.10 Risk-Based Cleanup Level Calculations

6.11 Verification Plan Calculations

ANNEX 6.7

FIELD WORK APPROVAL FORM

ATTACHMENT 3
FIELD WORK APPROVAL FORM

This form must be completed prior to starting remediation field work in accordance with Voluntary Corrective Action Plans.

I, _____, DOE-LAAO, **Approve** the field work as proposed in the accompanying Voluntary Corrective Action Plan for Potential Release Site _____, TA-___.

I, _____, DOE-LAAO, DO NOT APPROVE the field work as proposed in the accompanying voluntary correction plan for Potential Release Site _____, TA-___.

The following reasons reflect the decision for disapproval:

Signed:_____ Date:_____

ANNEX 6.8

PROPOSED OUTLINE FOR EXPEDITED CLEANUP 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 WASTES GENERATED

5.0 OUTSTANDING ITEMS FROM THE ACCEPTANCE INSPECTION

6.0 PROBLEMS ENCOUNTERED AND LESSONS LEARNED

APPENDICES

A ANALYTICAL DATA
B ACCEPTANCE INSPECTION CHECKLIST
C WASTE STREAM INVENTORY
D PHOTOGRAPHS
E CERTIFICATION OF COMPLETION

ANNEX 6.9

RFI ANALYTICAL RESULTS

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
48-2006	0.0 - 0.5 ft	AAA3753	Aluminium	12000	MG/KG	n/a	123000
			Arsenic	2.5	MG/KG	n/a	11.6
			Barium	120	MG/KG	5600	1143
			Beryllium	0.81	MG/KG	n/a	3.31
			Calcium	2000	MG/KG	n/a	54362
			Chromium	8	MG/KG	n/a	34.2
			Cobalt	4	MG/KG	n/a	51.1
			Copper	4.2	MG/KG	3000	15.7
			Iron	11000	MG/KG	n/a	35586
			Lead	10	MG/KG	400	39
			Lithium	14	MG/KG	n/a	n/a
			Magnesium	1900	MG/KG	n/a	16147
			Manganese	330	MG/KG	11000	1030
			Mercury	25	MG/KG	24	0.1
			Mercury	28.8	MG/KG	24	0.1
			Mercury	36	MG/KG	24	0.1
			Mercury	40	MG/KG	24	0.1
			Mercury	41	MG/KG	24	0.1
			Nickel	7	MG/KG	1600	26.7
			Potassium	1400	MG/KG	n/a	6179
			Sodium	110	MG/KG	n/a	1884
			Strontium	20	MG/KG	48000	n/a
			Vanadium	16	MG/KG	560	66
			Zinc	58	MG/KG	24000	101
48-2006	0.0 - 0.5 ft	AAA4494	Acenaphthene	1.1	MG/KG	4800	3.4
			Aluminium	11000	MG/KG	n/a	123000
			Anthracene	2.3	MG/KG	24000	4.29 *
			Arsenic	2.6	MG/KG	n/a	11.6
			Barium	100	MG/KG	5600	1143
			Benzo[a]anthracene	12.5	MG/KG	1	12.4 *
			Benzo[a]pyrene	12	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	13.8	MG/KG	1	12.2 *
			Benzo[g,h,i]perylene	4.2	MG/KG	n/a	5.9 *
			Benzo[k]fluoranthene	3.2	MG/KG	1	19.4 *
			Beryllium	0.72	MG/KG	n/a	3.31
			Calcium	1800	MG/KG	n/a	54362
			Chromium	7	MG/KG	n/a	34.2
			Chrysene	13.6	MG/KG	96	19.5
			Cobalt	3.4	MG/KG	n/a	51.1
			Copper	3.5	MG/KG	3000	15.7
			Dibenzo[a,h]anthracene	1.6	MG/KG	0.1	2.9 *
			Fluoranthene	20.5	MG/KG	3200	32.5 *
			Fluorene	0.72	MG/KG	3200	3.3 *
			Indeno[1,2,3-cd]pyrene	5.5	MG/KG	1	6 *
			Iron	11000	MG/KG	n/a	35586
			Lead	9	MG/KG	400	39
			Lithium	13	MG/KG	n/a	n/a
			Magnesium	1700	MG/KG	n/a	16147
			Manganese	270	MG/KG	11000	1030
			Mercury	35	MG/KG	24	0.1
			Mercury	38.1	MG/KG	24	0.1
			Mercury	47	MG/KG	24	0.1

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Mercury	62	MG/KG	24	0.1
			Nickel	7	MG/KG	1600	26.7
			Phenanthrene	13.2	MG/KG	n/a	24.2 *
			Plutonium-238	0.0399	PCI/G	20	0.014
			Plutonium-239	0.0308	PCI/G	18	0.052
			Potassium	1300	MG/KG	n/a	6179
			Pyrene	22.6	MG/KG	2400	12.8 *
			Radvan Americium-241	0.23	PCI/G	17	n/a
			Radvan Cesium-137	3.63	PCI/G	4	1.4
			Radvan Cobalt-60	0.11	PCI/G	0.9	n/a
			Radvan Ruthenium-106	0.77	PCI/G	14	n/a
			Sodium	87	MG/KG	n/a	1884
			Strontium	17	MG/KG	48000	n/a
			Thorium-228	1.19	PCI/G	1.5	n/a
			Thorium-230	3.88	PCI/G	5	n/a
			Thorium-232	0.97	PCI/G	5	2.68
			Uranium-234	1.13	PCI/G	86	2.03
			Uranium-235	0.329	PCI/G	18	0.088
			Uranium-238	0.776	PCI/G	59	1.9
			Vanadium	15	MG/KG	560	66
			Zinc	50	MG/KG	24000	101
48-2006	0.5 - 1.5 ft	AAA4493	Benzo[a]anthracene	0.65	MG/KG	1	12.4 *
			Benzo[a]pyrene	0.77	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	0.99	MG/KG	1	12.2 *
			Carbon disulfide	0.006	MG/KG	7.4	n/a
			Chrysene	0.81	MG/KG	96	19.5 *
			Fluoranthene	1.3	MG/KG	3200	32.5 *
			Phenanthrene	0.82	MG/KG	n/a	24.2 *
			Pyrene	1.5	MG/KG	2400	12.8 *
			Radvan Americium-241	0.06	PCI/G	17	n/a
			Radvan Ruthenium-106	0.48	PCI/G	14	n/a
			Thorium-228	2.27	PCI/G	1.5	n/a
			Thorium-230	1.04	PCI/G	5	n/a
			Thorium-232	1.02	PCI/G	5	2.68
			Uranium-234	0.552	PCI/G	86	2.03
			Uranium-235	0.0029	PCI/G	18	0.088
			Uranium-238	0.701	PCI/G	59	1.9
48-2006	1.5 - 3.0 ft	AAA4495	Acenaphthene	0.63	MG/KG	4800	3.4 *
			Anthracene	1.1	MG/KG	24000	4.29 *
			Benzo[a]anthracene	5.6	MG/KG	1	12.4 *
			Benzo[a]pyrene	6.2	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	6.6	MG/KG	1	12.2 *
			Benzo[g,h,i]perylene	2.2	MG/KG	5.9 *	5.9 *
			Benzo[k]fluoranthene	2.9	MG/KG	1	19.4 *
			Chrysene	6	MG/KG	96	19.5 *
			Dibenzo[a,h]anthracene	0.72	MG/KG	0.1	2.9 *
			Fluoranthene	11.4	MG/KG	3200	32.5 *
			Fluorene	0.41	MG/KG	3200	3.3 *
			Indeno[1,2,3-cd]pyrene	2.9	MG/KG	1	6 *
			Phenanthrene	8	MG/KG	n/a	24.2 *
			Plutonium-238	0.0095	PCI/G	20	0.014
			Plutonium-239	0.0247	PCI/G	18	0.052

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Pyrene	11.7	MG/KG	2400	12.8 *
			Radvan Ruthenium-106	0.14	PCI/G	14	n/a
			Thorium-228	1.28	PCI/G	1.5	n/a
			Thorium-230	4.19	PCI/G	5	n/a
			Thorium-232	1.38	PCI/G	5	2.68
			Uranium-234	1.1	PCI/G	86	2.03
			Uranium-238	0.892	PCI/G	59	1.9
48-2006	3.0 - 4.0 ft	AAA3769	Fluoranthene	0.44	MG/KG	3200	32.5 *
			Plutonium-238	0.115	PCI/G	20	0.014
			Plutonium-239	0.0775	PCI/G	18	0.052
			Pyrene	0.39	MG/KG	2400	12.8 *
			Radvan Americium-241	0.28	PCI/G	17	n/a
			Radvan Ruthenium-106	4.83	PCI/G	14	n/a
			Thorium-228	1.45	PCI/G	1.5	n/a
			Thorium-230	1.05	PCI/G	5	n/a
			Thorium-232	0.487	PCI/G	5	2.68
			Uranium-234	0.73	PCI/G	86	2.03
			Uranium-235	0.181	PCI/G	18	0.088
			Uranium-238	0.807	PCI/G	59	1.9
48-2006	4.0 - 5.0 ft	AAA3770	Benzo[a]anthracene	0.49	MG/KG	1	12.4 *
			Benzo[a]pyrene	0.51	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	0.54	MG/KG	1	12.2 *
			Chrysene	0.5	MG/KG	96	19.5 *
			Fluoranthene	1.2	MG/KG	3200	32.5 *
			Phenanthrene	1.1	MG/KG	n/a	24.2 *
			Plutonium-239	0.121	PCI/G	18	0.052
			Pyrene	1.1	MG/KG	2400	12.8 *
			Radvan Americium-241	0.6	PCI/G	17	n/a
			Radvan Ruthenium-106	1.35	PCI/G	14	n/a
			Thorium-228	1.12	PCI/G	1.5	n/a
			Thorium-230	3.89	PCI/G	5	n/a
			Thorium-232	1.1	PCI/G	5	2.68
			Uranium-234	0.453	PCI/G	86	2.03
			Uranium-238	0.829	PCI/G	59	1.9
48-2006	5.0 - 6.0 ft	AAA3771	Benzo[a]anthracene	0.47	MG/KG	1	12.4 *
			Benzo[a]pyrene	0.6	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	0.68	MG/KG	1	12.2 *
			Chrysene	0.51	MG/KG	96	19.5 *
			Fluoranthene	1.5	MG/KG	3200	32.5 *
			Phenanthrene	1.3	MG/KG	n/a	24.2 *
			Plutonium-238	0.0009	PCI/G	20	0.014
			Pyrene	1.3	MG/KG	2400	12.8 *
			Radvan Americium-241	0.25	PCI/G	17	n/a
			Thorium-228	0.911	PCI/G	1.5	n/a
			Thorium-228	1.44	PCI/G	1.5	n/a
			Thorium-230	1.49	PCI/G	5	n/a
			Thorium-230	2.64	PCI/G	5	n/a
			Thorium-232	0.629	PCI/G	5	2.68
			Thorium-232	0.896	PCI/G	5	2.68
			Uranium-234	0.837	PCI/G	86	2.03
			Uranium-234	1.14	PCI/G	86	2.03
			Uranium-235	0.184	PCI/G	18	0.088

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Uranium-235	0.189	PCI/G	18	0.088
			Uranium-238	0.792	PCI/G	59	1.9
			Uranium-238	1.01	PCI/G	59	1.9
48-2006	6.0 - 7.0 ft	AAA3772	Fluoranthene	0.81	MG/KG	3200	32.5 *
			Phenanthrene	0.65	MG/KG	n/a	24.2 *
			Plutonium-238	0.0727	PCI/G	20	0.014
			Pyrene	0.65	MG/KG	2400	12.8 *
			Radvan Americium-241	0.45	PCI/G	17	n/a
			Radvan Cesium-137	3.64	PCI/G	4	n/a
			Radvan Ruthenium-106	0.43	PCI/G	14	n/a
			Thorium-228	1.35	PCI/G	1.5	n/a
			Thorium-230	2.12	PCI/G	5	n/a
			Thorium-232	1.19	PCI/G	5	2.68
			Uranium-234	0.645	PCI/G	86	2.03
			Uranium-238	0.595	PCI/G	59	1.9
48-2006	7.0 - 8.0 ft	AAA3773	Aluminium	3200	MG/KG	n/a	123000
			Arsenic	1.8	MG/KG	n/a	11.6
			Barium	34	MG/KG	5600	1143
			Beryllium	0.46	MG/KG	n/a	3.31
			Calcium	1100	MG/KG	n/a	54362
			Chromium	3.8	MG/KG	n/a	34.2
			Cobalt	1.4	MG/KG	n/a	51.1
			Copper	0.82	MG/KG	3000	15.7
			Fluoranthene	0.78	MG/KG	3200	32.5 *
			Iron	7400	MG/KG	n/a	35586
			Lead	4.6	MG/KG	400	39
			Lithium	5.7	MG/KG	n/a	n/a
			Magnesium	740	MG/KG	n/a	16147
			Manganese	240	MG/KG	11000	1030
			Mercury	1.2	MG/KG	24	0.1
			Mercury	2	MG/KG	24	0.1
			Mercury	2.7	MG/KG	24	0.1
			Phenanthrene	0.7	MG/KG	n/a	24.2 *
			Potassium	440	MG/KG	n/a	6179
			Pyrene	0.72	MG/KG	2400	12.8 *
			Radvan Cobalt-60	0.12	PCI/G	0.9	n/a
			Radvan Ruthenium-106	1.21	PCI/G	14	n/a
			Sodium	73	MG/KG	n/a	1884
			Strontium	7.8	MG/KG	48000	n/a
			Thorium-228	1.47	PCI/G	1.5	n/a
			Thorium-230	1.22	PCI/G	5	n/a
			Thorium-232	0.455	PCI/G	5	2.68
			Uranium-234	1.02	PCI/G	86	2.03
			Uranium-235	0.0196	PCI/G	18	0.088
			Uranium-238	0.811	PCI/G	59	1.9
			Vanadium	7	MG/KG	560	66
			Zinc	33	MG/KG	24000	101
48-2007	0.0 - 0.5 ft	AAA3755	Radvan Americium-241	0.16	PCI/G	17	n/a
			Radvan Ruthenium-106	0.24	PCI/G	14	n/a
48-2007	0.0 - 0.5 ft	AAA4496	Acenaphthene	2.6	MG/KG	4800	3.4 *
			Aluminium	6400	MG/KG	n/a	123000
			Americium-241	0.035	PCI/G	17	n/a

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Anthracene	5.1	MG/KG	24000	4.29 *
			Arsenic	2.2	MG/KG	n/a	11.6
			Barium	76	MG/KG	5600	1143
			Benzo[a]anthracene	23.3	MG/KG	1	12.4 *
			Benzo[a]pyrene	22.6	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	25.8	MG/KG	1	12.2 *
			Benzo[g,h,i]perylene	13.3	MG/KG	n/a	5.9 *
			Benzo[k]fluoranthene	10.7	MG/KG	1	19.4 *
			Beryllium	0.66	MG/KG	n/a	3.31
			Calcium	1700	MG/KG	n/a	54362
			Carbon disulfide	0.0058	MG/KG	7.4	n/a
			Chromium	13	MG/KG	n/a	34.2
			Chrysene	26	MG/KG	96	19.5 *
			Cobalt	3	MG/KG	n/a	51.1
			Copper	4.1	MG/KG	3000	15.7
			Dibenzofuran	0.94	MG/KG	n/a	n/a
			Dibenzo[a,h]anthracene	2.7	MG/KG	0.1	2.9 *
			Fluoranthene	0.36	MG/KG	3200	32.5 *
			Fluorene	2.1	MG/KG	3200	3.3 *
			Indeno[1,2,3-cd]pyrene	13.7	MG/KG	1	6 *
			Iron	8000	MG/KG	n/a	35586
			Lead	25	MG/KG	400	39
			Lithium	7.1	MG/KG	n/a	n/a
			Magnesium	1300	MG/KG	n/a	16147
			Manganese	250	MG/KG	11000	1030
			Naphthalene	0.61	MG/KG	3200	0.66 *
			Nickel	10	MG/KG	1600	26.7
			Phenanthrene	26.2	MG/KG	n/a	24.2 *
			Plutonium-238	0.051	PCI/G	20	0.014
			Plutonium-239	0.718	PCI/G	18	0.052
			Potassium	860	MG/KG	n/a	6179
			Pyrene	44.4	MG/KG	2400	12.8 *
			Radvan Americium-241	0.16	PCI/G	17	n/a
			Radvan Ruthenium-106	0.24	PCI/G	14	n/a
			Sodium	64	MG/KG	n/a	1884
			Strontium	15	MG/KG	48000	n/a
			Thorium-228	1.718	PCI/G	1.5	n/a
			Thorium-230	1.477	PCI/G	5	n/a
			Thorium-232	2.082	PCI/G	5	2.68
			Uranium-234	0.801	PCI/G	86	2.03
			Uranium-235	0.024	PCI/G	18	0.088
			Uranium-238	0.823	PCI/G	59	1.9
			Vanadium	11	MG/KG	560	66
			Zinc	40	MG/KG	24000	101
48-2007	0.5 - 1.0 ft	AAA4497	Americium-241	0	PCI/G	17	n/a
			Benzo[a]anthracene	12.3	MG/KG	1	12.4 *
			Benzo[a]pyrene	12.9	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	15.9	MG/KG	1	12.2 *
			Benzo[g,h,i]perylene	5.2	MG/KG	n/a	5.9 *
			Benzo[k]fluoranthene	4.3	MG/KG	1	19.4 *
			Cerium-144	0.514	PCI/G	64	n/a
			Cesium-137	0.06	PCI/G	4	1.4

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Chrysene	15.6	MG/KG	96	19.5 *
			Cobalt-60	0.003	PCI/G	0.9	n/a
			Fluoranthene	22.1	MG/KG	3200	32.5 *
			Indeno[1,2,3-cd]pyrene	6	MG/KG	1	6 *
			Phenanthrene	12.4	MG/KG	n/a	24.2 *
			Plutonium-238	0.006	PCI/G	20	0.014
			Plutonium-239	0.043	PCI/G	18	0.052
			Pyrene	23.4	MG/KG	2400	12.8 *
			Radvan Americium-241	0.31	PCI/G	17	n/a
			Radvan Cobalt-60	0.77	PCI/G	0.9	n/a
			Radvan Ruthenium-106	1.88	PCI/G	14	n/a
			Thorium-228	2.027	PCI/G	1.5	n/a
			Thorium-230	1.744	PCI/G	5	n/a
			Thorium-232	2.526	PCI/G	5	2.68
			Uranium-234	1.049	PCI/G	86	2.03
			Uranium-235	0.032	PCI/G	18	0.088
			Uranium-238	0.946	PCI/G	59	1.9
48-2008	0.0 - 0.5 ft	AAA4499	Acenaphthene	0.41	MG/KG	4800	3.4 *
			Americium-241	0.124	PCI/G	17	n/a
			Anthracene	0.84	MG/KG	24000	4.29 *
			Benzo[a]anthracene	4.3	MG/KG	1	12.4 *
			Benzo[a]pyrene	5.1	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	5.4	MG/KG	1	12.2 *
			Benzo[g,h,i]perylene	2.1	MG/KG	n/a	5.9 *
			Benzo[k]fluoranthene	2	MG/KG	1	19.4 *
			Cerium-144	0.346	PCI/G	64	n/a
			Cesium-137	0.151	PCI/G	4	1.4
			Chrysene	4.6	MG/KG	96	19.5 *
			Dibenzo[a,h]anthracene	0.63	MG/KG	0.1	2.9 *
			Fluoranthene	7.4	MG/KG	3200	32.5 *
			Indeno[1,2,3-cd]pyrene	2.4	MG/KG	1	6 *
			Phenanthrene	4.2	MG/KG	n/a	24.2 *
			Plutonium-238	0.009	PCI/G	20	0.014
			Plutonium-239	0.231	PCI/G	18	0.052
			Pyrene	7.1	MG/KG	2400	12.8 *
			Radvan Cesium-137	0.72	PCI/G	4	n/a
			Radvan Cobalt-60	0.12	PCI/G	0.9	n/a
			Radvan Ruthenium-106	2.27	PCI/G	14	n/a
			Thorium-228	1.54	PCI/G	1.5	n/a
			Thorium-230	1.214	PCI/G	5	n/a
			Thorium-232	1.796	PCI/G	5	2.68
			Uranium-234	0.729	PCI/G	86	2.03
			Uranium-235	0.037	PCI/G	18	0.088
			Uranium-238	0.726	PCI/G	59	1.9
48-2008	0.5 - 1.5 ft	AAA4500	Americium-241	0.105	PCI/G	17	n/a
			Anthracene	0.39	MG/KG	24000	4.29 *
			Benzo[a]anthracene	1.3	MG/KG	1	12.4 *
			Benzo[a]pyrene	1.5	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	1.6	MG/KG	1	12.2 *
			Benzo[g,h,i]perylene	0.82	MG/KG	n/a	5.9 *
			Benzo[k]fluoranthene	0.8	MG/KG	1	19.4 *
			Chrysene	1.6	MG/KG	96	19.5

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Fluoranthene	2.7	MG/KG	3200	32.5 *
			Indeno[1,2,3-cd]pyrene	0.88	MG/KG	1	6 *
			Phenanthrene	1.7	MG/KG	n/a	24.2 *
			Plutonium-238	0.055	PCI/G	20	0.014
			Plutonium-239	0.826	PCI/G	18	0.052
			Pyrene	2.7	MG/KG	2400	12.8 *
			Radvan Cobalt-60	0.07	PCI/G	0.9	n/a
			Radvan Ruthenium-106	0.87	PCI/G	14	n/a
			Thorium-228	1.754	PCI/G	1.5	n/a
			Thorium-230	1.29	PCI/G	5	n/a
			Thorium-232	2.064	PCI/G	5	2.68
			Uranium-234	0.627	PCI/G	86	2.03
			Uranium-235	0.024	PCI/G	18	0.088
			Uranium-238	0.638	PCI/G	59	1.9
48-2008	1.5 - 3.0 ft	AAA3749	Americium-241	0.099	PCI/G	17	n/a
			Benzo[a]anthracene	0.45	MG/KG	1	12.4 *
			Benzo[a]pyrene	0.47	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	0.58	MG/KG	1	12.2 *
			Chrysene	0.55	MG/KG	96	19.5
			Fluoranthene	0.86	MG/KG	3200	32.5 *
			Phenanthrene	0.53	MG/KG	n/a	24.2 *
			Plutonium-238	0.053	PCI/G	20	0.014
			Plutonium-239	0.436	PCI/G	18	0.052
			Pyrene	0.89	MG/KG	2400	12.8 *
			Radvan Americium-241	0.04	PCI/G	17	n/a
			Radvan Cobalt-60	0.19	PCI/G	0.9	n/a
			Radvan Ruthenium-106	1.4	PCI/G	14	n/a
			Thorium-228	1.622	PCI/G	1.5	n/a
			Thorium-230	1.159	PCI/G	5	n/a
			Thorium-232	1.902	PCI/G	5	2.68
			Uranium-234	0.599	PCI/G	86	2.03
			Uranium-235	0.017	PCI/G	18	0.088
			Uranium-238	0.625	PCI/G	59	1.9
48-2009	0.0 - 0.5 ft	AAA3750	Aluminium	11000	MG/KG	n/a	123000
			Americium-241	0.003	PCI/G	17	n/a
			Arsenic	2.6	MG/KG	n/a	11.6
			Barium	100	MG/KG	5600	1143
			Benzo[b]fluoranthene	0.4	MG/KG	1	12.2 *
			Beryllium	0.77	MG/KG	n/a	3.31
			Bis(2-ethylhexyl)phthalate	0.7	MG/KG	50	n/a
			Calcium	2200	MG/KG	n/a	54362
			Chromium	7.3	MG/KG	n/a	34.2
			Cobalt	4.6	MG/KG	n/a	51.1
			Copper	3.1	MG/KG	3000	15.7
			Fluoranthene	0.56	MG/KG	3200	32.5 *
			Iron	11000	MG/KG	n/a	35586
			Lead	12	MG/KG	400	39
			Lithium	12	MG/KG	n/a	n/a
			Magnesium	1800	MG/KG	n/a	16147
			Manganese	310	MG/KG	11000	1030
			Nickel	8	MG/KG	1600	26.7
			Plutonium-238	0.005	PCI/G	20	0.014

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Plutonium-239	0.34	PCI/G	18	0.052
			Potassium	1100	MG/KG	n/a	6179
			Pyrene	0.58	MG/KG	2400	12.8 *
			Radvan Ruthenium-106	2.08	PCI/G	14	n/a
			Sodium	120	MG/KG	n/a	1884
			Strontium	20	MG/KG	48000	n/a
			Thorium-228	1.661	PCI/G	1.5	n/a
			Thorium-230	1.37	PCI/G	5	n/a
			Thorium-232	1.962	PCI/G	5	2.68
			Uranium-234	0.643	PCI/G	86	2.03
			Uranium-235	0.027	PCI/G	18	0.088
			Uranium-238	0.61	PCI/G	59	1.9
			Vanadium	15	MG/KG	560	66
			Zinc	36	MG/KG	24000	101
48-2009	0.0 - 0.5 ft	AAA3757	Radvan Cesium-137	0.12	PCI/G	4	n/a
			Radvan Cobalt-60	0.3	PCI/G	0.9	n/a
			Radvan Ruthenium-106	3.57	PCI/G	14	n/a
48-2009	0.0 - 0.5 ft	AAA3758	Benzo[a]pyrene	0.37	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	0.44	MG/KG	1	12.2 *
			Bis(2-ethylhexyl)phthalate	3.8	MG/KG	50	n/a
			Chrysene	0.36	MG/KG	96	19.5
			Fluoranthene	0.62	MG/KG	3200	32.5 *
			Phenanthrene	0.35	MG/KG	n/a	24.2 *
			Pyrene	0.74	MG/KG	2400	12.8 *
			Radvan Ruthenium-106	2.08	PCI/G	14	n/a
48-2009	0.5 - 1.5 ft	AAA3751	Americium-241	0.011	PCI/G	17	n/a
			Benzo[a]anthracene	0.43	MG/KG	1	12.4 *
			Benzo[a]pyrene	0.43	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	0.5	MG/KG	1	12.2 *
			Chrysene	0.4	MG/KG	96	19.5
			Fluoranthene	1.1	MG/KG	3200	32.5 *
			Phenanthrene	1.1	MG/KG	n/a	24.2 *
			Plutonium-239	0.011	PCI/G	18	0.052
			Pyrene	0.99	MG/KG	2400	12.8 *
			Radvan Cesium-137	0.32	PCI/G	4	n/a
			Radvan Cobalt-60	0.07	PCI/G	0.9	n/a
			Radvan Ruthenium-106	0.87	PCI/G	14	n/a
			Thorium-228	1.656	PCI/G	1.5	n/a
			Thorium-230	1.247	PCI/G	5	n/a
			Thorium-232	1.869	PCI/G	5	2.68
			Uranium-234	0.543	PCI/G	86	2.03
			Uranium-235	0.02	PCI/G	18	0.088
			Uranium-238	0.596	PCI/G	59	1.9
48-2009	1.5 - 3.0 ft	AAA3752	Americium-241	0.003	PCI/G	17	n/a
			Fluoranthene	0.39	MG/KG	3200	32.5 *
			Phenanthrene	0.33	MG/KG	n/a	24.2 *
			Plutonium-238	0.002	PCI/G	20	0.014
			Plutonium-239	0.388	PCI/G	18	0.052
			Pyrene	0.38	MG/KG	2400	12.8 *
			Radvan Ruthenium-106	1.3	PCI/G	14	n/a
			Thorium-228	1.619	PCI/G	1.5	n/a
			Thorium-230	1.174	PCI/G	5	n/a

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Thorium-232	1.675	PCI/G	5	2.68
			Uranium-234	0.461	PCI/G	86	2.03
			Uranium-235	0.016	PCI/G	18	0.088
			Uranium-238	0.473	PCI/G	59	1.9
48-2056	0.0 - 0.5 ft	AAA3765	Aluminium	6000	MG/KG	n/a	123000
			Americium-241	0.003	PCI/G	17	n/a
			Arsenic	1.7	MG/KG	n/a	11.6
			Barium	62	MG/KG	5600	1143
			Benzo[a]anthracene	0.41	MG/KG	1	12.4 *
			Benzo[a]pyrene	0.45	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	0.52	MG/KG	1	12.2 *
			Beryllium	0.62	MG/KG	n/a	3.31
			Bis(2-ethylhexyl)phthalate	0.37	MG/KG	50	n/a
			Calcium	1300	MG/KG	n/a	54362
			Cerium-144	0.238	PCI/G	64	n/a
			Cesium-137	0.0645	PCI/G	4	1.4
			Chromium	5.1	MG/KG	n/a	34.2
			Chrysene	0.44	MG/KG	96	19.5
			Cobalt	2.4	MG/KG	n/a	51.1
			Cobalt-60	0.0454	PCI/G	0.9	n/a
			Copper	1.1	MG/KG	3000	15.7
			Fluoranthene	1.2	MG/KG	3200	32.5 *
			Iron	8000	MG/KG	n/a	35586
			Lead	6.1	MG/KG	400	39
			Lithium	10	MG/KG	n/a	n/a
			Magnesium	1200	MG/KG	n/a	16147
			Manganese	270	MG/KG	11000	1030
			Nickel	5.4	MG/KG	1600	26.7
			Phenanthrene	1.1	MG/KG	n/a	24.2 *
			Plutonium-238	0.005	PCI/G	20	0.014
			Plutonium-239	0.014	PCI/G	18	0.052
			Potassium	760	MG/KG	n/a	6179
			Pyrene	1.1	MG/KG	2400	12.8 *
			Radvan Cobalt-60	0.88	PCI/G	0.9	n/a
			Radvan Ruthenium-106	1.11	PCI/G	14	n/a
			Sodium	79	MG/KG	n/a	1884
			Strontium	11	MG/KG	48000	n/a
			Thorium-228	1.579	PCI/G	1.5	n/a
			Thorium-230	1.163	PCI/G	5	n/a
			Thorium-232	1.86	PCI/G	5	2.68
			Uranium-234	0.66	PCI/G	86	2.03
			Uranium-235	0.027	PCI/G	18	0.088
			Uranium-238	0.671	PCI/G	59	1.9
			Vanadium	9.6	MG/KG	560	66
			Zinc	34	MG/KG	24000	101
48-2056	0.5 - 1.5 ft	AAA3766	Americium-241	0.008	PCI/G	17	n/a
			Benzo[a]anthracene	0.39	MG/KG	1	12.4 *
			Benzo[a]pyrene	0.49	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	0.57	MG/KG	1	12.2 *
			Cerium-144	0.114	PCI/G	64	n/a
			Cesium-137	0.0788	PCI/G	4	1.4
			Chrysene	0.5	MG/KG	96	19.5

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Cobalt-60	0.0027	PCI/G	0.9	n/a
			Fluoranthene	0.81	MG/KG	3200	32.5 *
			Phenanthrene	0.5	MG/KG	n/a	24.2 *
			Plutonium-238	0.016	PCI/G	20	0.014
			Plutonium-239	0.032	PCI/G	18	0.052
			Pyrene	0.83	MG/KG	2400	12.8 *
			Radvan Americium-241	0.24	PCI/G	17	n/a
			Radvan Ruthenium-106	0.82	PCI/G	14	n/a
			Thorium-228	1.836	PCI/G	1.5	n/a
			Thorium-230	1.155	PCI/G	5	n/a
			Thorium-232	1.973	PCI/G	5	2.68
			Uranium-234	0.672	PCI/G	86	2.03
			Uranium-235	0.021	PCI/G	18	0.088
			Uranium-238	0.772	PCI/G	59	1.9
48-2056	1.5 - 2.0 ft	AAA3767	Americium-241	0.009	PCI/G	17	n/a
			Cerium-144	0.246	PCI/G	64	n/a
			Cesium-137	0.0924	PCI/G	4	1.4
			Cobalt-60	0.0404	PCI/G	0.9	n/a
			Fluoranthene	0.6	MG/KG	3200	32.5 *
			Phenanthrene	0.57	MG/KG	n/a	24.2 *
			Plutonium-238	0.078	PCI/G	20	0.014
			Plutonium-239	0.084	PCI/G	18	0.052
			Pyrene	0.56	MG/KG	2400	12.8 *
			Radvan Americium-241	0.3	PCI/G	17	n/a
			Radvan Cobalt-60	0.23	PCI/G	0.9	n/a
			Ruthenium-106	0.0506	PCI/G	14	n/a
			Thorium-228	1.414	PCI/G	1.5	n/a
			Thorium-230	1.046	PCI/G	5	n/a
			Thorium-232	1.732	PCI/G	5	2.68
			Uranium-234	0.618	PCI/G	86	2.03
			Uranium-235	0.024	PCI/G	18	0.088
			Uranium-238	0.628	PCI/G	59	1.9
48-2060	0.0 - 0.5 ft	AAA3775	Americium-241	0.009	PCI/G	17	n/a
			Benzo[a]anthracene	14.2	MG/KG	1	12.4 *
			Benzo[a]pyrene	14.5	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	18.5	MG/KG	1	12.2 *
			Benzo[g,h,i]perylene	5.2	MG/KG	n/a	5.9 *
			Benzo[k]fluoranthene	5	MG/KG	1	19.4 *
			Chrysene	17.1	MG/KG	96	19.5
			Fluoranthene	27.2	MG/KG	3200	32.5 *
			Indeno[1,2,3-cd]pyrene	5.7	MG/KG	1	6 *
			Phenanthrene	18.2	MG/KG	n/a	24.2 *
			Plutonium-238	0.002	PCI/G	20	0.014
			Plutonium-239	0.045	PCI/G	18	0.052
			Pyrene	29.4	MG/KG	2400	12.8 *
			Radvan Americium-241	0.17	PCI/G	17	n/a
			Radvan Ruthenium-106	1.01	PCI/G	14	n/a
			Thorium-228	1.617	PCI/G	1.5	n/a
			Thorium-230	1.3	PCI/G	5	n/a
			Thorium-232	1.759	PCI/G	5	2.68
			Uranium-234	0.547	PCI/G	86	2.03
			Uranium-235	0.017	PCI/G	18	0.088

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Uranium-238	0.608	PCI/G	59	1.9
48-2061		AAA3787	Mercury	23	MG/KG	24	0.1
			Mercury	24	MG/KG	24	0.1
			Mercury	27	MG/KG	24	0.1
XRF Results							
48-2006	0.0 - 0.5 ft	AAA4494	Barium	514	PPM	5600	1143
			Calcium	0.59	%	n/a	54362
			Chromium	15	PPM	n/a	34.2
			Copper	12	PPM	3000	15.7
			Iron	1.8	%	n/a	35586
			Lead	25	PPM	400	39
			Manganese	440	PPM	11000	1030
			Mercury	32	PPM	24	0.1
			Potassium	2.67	%	n/a	6179
			Thorium	20	PPM	n/a	n/a
			Titanium	2239	PPM	n/a	n/a
			Zinc	53	PPM	24000	101
48-2006	0.5 - 1.5 ft	AAA4493	Barium	393	PPM	5600	1143
			Barium	445	PPM	5600	1143
			Calcium	0.58	%	n/a	54362
			Calcium	0.58	%	n/a	54362
			Chromium	11	PPM	n/a	34.2
			Chromium	12	PPM	n/a	34.2
			Copper	12	PPM	3000	15.7
			Iron	1.81	%	n/a	35586
			Iron	1.87	%	n/a	35586
			Lead	22	PPM	400	39
			Lead	29	PPM	400	39
			Manganese	401	PPM	11000	1030
			Manganese	424	PPM	11000	1030
			Mercury	10	PPM	24	0.1
			Nickel	16	PPM	1600	26.7
			Potassium	2.83	%	n/a	6179
			Potassium	2.87	%	n/a	6179
			Thorium	15	PPM	n/a	n/a
			Thorium	17	PPM	n/a	n/a
			Titanium	2211	PPM	n/a	n/a
			Titanium	2212	PPM	n/a	n/a
			Zinc	44	PPM	24000	101
			Zinc	46	PPM	24000	101
48-2006	1.5 - 3.0 ft	AAA4495	Barium	331	PPM	5600	1143
			Calcium	0.48	%	n/a	54362
			Chromium	12	PPM	n/a	34.2
			Iron	1.57	%	n/a	35586
			Lead	28	PPM	400	39
			Manganese	362	PPM	11000	1030
			Mercury	190	PPM	24	0.1
			Potassium	3.13	%	n/a	6179
			Thorium	20	PPM	n/a	n/a

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Titanium	1575	PPM	n/a	n/a
			Zinc	44	PPM	24000	101
48-2006	3.0 - 4.0 ft	AAA3769	Barium	417	PPM	5600	1143
			Calcium	0.52	%	n/a	54362
			Iron	1.59	%	n/a	35586
			Lead	26	PPM	400	39
			Manganese	318	PPM	11000	1030
			Potassium	3.05	%	n/a	6179
			Thorium	16	PPM	n/a	n/a
			Titanium	1610	PPM	n/a	n/a
			Zinc	44	PPM	24000	101
48-2006	4.0 - 5.0 ft	AAA3770	Barium	345	PPM	5600	1143
			Calcium	0.51	%	n/a	54362
			Iron	1.52	%	n/a	35586
			Lead	26	PPM	400	39
			Manganese	304	PPM	11000	1030
			Potassium	3.11	%	n/a	6179
			Thorium	17	PPM	n/a	n/a
			Titanium	1475	PPM	n/a	n/a
			Zinc	38	PPM	24000	101
48-2006	5.0 - 6.0 ft	AAA3771	Barium	363	PPM	5600	1143
			Calcium	0.49	%	n/a	54362
			Chromium	11	PPM	n/a	34.2
			Copper	12	PPM	3000	15.7
			Iron	1.56	%	n/a	35586
			Lead	27	PPM	400	39
			Manganese	323	PPM	11000	1030
			Potassium	3.08	%	n/a	6179
			Thorium	16	PPM	n/a	n/a
			Titanium	1504	PPM	n/a	n/a
			Zinc	45	PPM	24000	101
48-2006	6.0 - 7.0 ft	AAA3772	Barium	298	PPM	5600	1143
			Calcium	0.46	%	n/a	54362
			Iron	1.49	%	n/a	35586
			Lead	20	PPM	400	39
			Manganese	292	PPM	11000	1030
			Potassium	3.07	%	n/a	6179
			Thorium	11	PPM	n/a	n/a
			Titanium	1307	PPM	n/a	n/a
			Zinc	41	PPM	24000	101
48-2006	7.0 - 8.0 ft	AAA3773	Barium	243	PPM	5600	1143
			Calcium	0.35	%	n/a	54362
			Iron	1.38	%	n/a	35586
			Lead	23	PPM	400	39
			Manganese	314	PPM	11000	1030
			Nickel	17	PPM	1600	26.7
			Potassium	3.19	%	n/a	6179
			Thorium	23	PPM	n/a	n/a
			Titanium	1016	PPM	n/a	n/a
			Zinc	42	PPM	24000	101
48-2007	0.0 - 0.5 ft	AAA4496	Barium	460	PPM	5600	1143
			Calcium	0.61	%	n/a	54362

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Chromium	14	PPM	n/a	34.2
			Copper	18	PPM	3000	15.7
			Iron	1.83	%	n/a	35586
			Lead	40	PPM	400	39
			Manganese	533	PPM	11000	1030
			Potassium	2.97	%	n/a	6179
			Thorium	15	PPM	n/a	n/a
			Titanium	2134	PPM	n/a	n/a
			Zinc	59	PPM	24000	101
48-2007	0.5 - 1.0 ft	AAA4497	Barium	409	PPM	5600	1143
			Calcium	0.53	%	n/a	54362
			Iron	1.62	%	n/a	35586
			Lead	30	PPM	400	39
			Manganese	429	PPM	11000	1030
			Potassium	2.88	%	n/a	6179
			Thorium	16	PPM	n/a	n/a
			Titanium	1662	PPM	n/a	n/a
			Zinc	45	PPM	24000	101
48-2008	0.0 - 0.5 ft	AAA4499	Barium	417	PPM	5600	1143
			Barium	421	PPM	5600	1143
			Calcium	0.59	%	n/a	54362
			Calcium	0.59	%	n/a	54362
			Copper	10	PPM	3000	15.7
			Iron	1.66	%	n/a	35586
			Iron	1.67	%	n/a	35586
			Lead	29	PPM	400	39
			Lead	33	PPM	400	39
			Manganese	354	PPM	11000	1030
			Manganese	372	PPM	11000	1030
			Potassium	2.92	%	n/a	6179
			Potassium	2.97	%	n/a	6179
			Thorium	12	PPM	n/a	n/a
			Thorium	12	PPM	n/a	n/a
			Titanium	1856	PPM	n/a	n/a
			Titanium	1859	PPM	n/a	n/a
			Zinc	41	PPM	24000	101
			Zinc	43	PPM	24000	101
48-2008	0.5 - 1.5 ft	AAA4500	Barium	445	PPM	5600	1143
			Calcium	0.62	%	n/a	54362
			Chromium	11	PPM	n/a	34.2
			Iron	1.81	%	n/a	35586
			Lead	27	PPM	400	39
			Manganese	385	PPM	11000	1030
			Potassium	2.86	%	n/a	6179
			Thorium	18	PPM	n/a	n/a
			Titanium	2183	PPM	n/a	n/a
			Zinc	46	PPM	24000	101
48-2008	1.5 - 3.0 ft	AAA3749	Barium	351	PPM	5600	1143
			Calcium	0.48	%	n/a	54362
			Chromium	10	PPM	n/a	34.2
			Iron	1.46	%	n/a	35586
			Lead	24	PPM	400	39

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Manganese	378	PPM	11000	1030
			Potassium	2.99	%	n/a	6179
			Thorium	14	PPM	n/a	n/a
			Titanium	1536	PPM	n/a	n/a
			Zinc	39	PPM	24000	101
48-2009	0.0 - 0.5 ft	AAA3750	Barium	461	PPM	5600	1143
			Calcium	0.54	%	n/a	54362
			Chromium	17	PPM	n/a	34.2
			Iron	1.77	%	n/a	35586
			Lead	20	PPM	400	39
			Manganese	431	PPM	11000	1030
			Mercury	31	PPM	24	0.1
			Nickel	17	PPM	1600	26.7
			Potassium	2.7	%	n/a	6179
			Titanium	2150	PPM	n/a	n/a
			Zinc	44	PPM	24000	101
48-2009	0.5 - 1.5 ft	AAA3751	Barium	379	PPM	5600	1143
			Calcium	0.49	%	n/a	54362
			Iron	1.54	%	n/a	35586
			Lead	24	PPM	400	39
			Manganese	388	PPM	11000	1030
			Potassium	2.99	%	n/a	6179
			Thorium	16	PPM	n/a	n/a
			Titanium	1639	PPM	n/a	n/a
			Zinc	42	PPM	24000	101
48-2009	0.5 - 1.5 ft	AAA3759	Barium	348	PPM	5600	1143
			Calcium	0.5	%	n/a	54362
			Iron	1.59	%	n/a	35586
			Lead	20	PPM	400	39
			Manganese	368	PPM	11000	1030
			Potassium	2.95	%	n/a	6179
			Thorium	10	PPM	n/a	n/a
			Titanium	1795	PPM	n/a	n/a
			Zinc	39	PPM	24000	101
48-2009	1.5 - 3.0 ft	AAA3752	Barium	386	PPM	5600	1143
			Calcium	0.5	%	n/a	54362
			Chromium	13	PPM	n/a	34.2
			Copper	10	PPM	3000	15.7
			Iron	1.55	%	n/a	35586
			Lead	26	PPM	400	39
			Manganese	378	PPM	11000	1030
			Potassium	2.97	%	n/a	6179
			Thorium	20	PPM	n/a	n/a
			Titanium	1669	PPM	n/a	n/a
			Zinc	38	PPM	24000	101
48-2056	0.0 - 0.5 ft	AAA3765	Barium	256	PPM	5600	1143
			Calcium	0.41	%	n/a	54362
			Iron	1.7	%	n/a	35586
			Lead	21	PPM	400	39
			Manganese	370	PPM	11000	1030
			Potassium	2.94	%	n/a	6179
			Thorium	17	PPM	n/a	n/a

48-002(a/b) Detects

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Titanium	1662	PPM	n/a	n/a
			Zinc	43	PPM	24000	101
48-2056	0.5 - 1.5 ft	AAA3766	Barium	308	PPM	5600	1143
			Calcium	0.41	%	n/a	54362
			Iron	1.4	%	n/a	35586
			Lead	19	PPM	400	39
			Manganese	344	PPM	11000	1030
			Mercury	12	PPM	24	0.1
			Potassium	3.03	%	n/a	6179
			Thorium	12	PPM	n/a	n/a
			Titanium	1361	PPM	n/a	n/a
			Zinc	40	PPM	24000	101
48-2056	1.5 - 2.0 ft	AAA3767	Barium	353	PPM	5600	1143
			Calcium	0.51	%	n/a	54362
			Chromium	12	PPM	n/a	34.2
			Copper	15	PPM	3000	15.7
			Iron	1.53	%	n/a	35586
			Lead	21	PPM	400	39
			Manganese	371	PPM	11000	1030
			Potassium	3.06	%	n/a	6179
			Thorium	14	PPM	n/a	n/a
			Titanium	1504	PPM	n/a	n/a
			Zinc	40	PPM	24000	101
48-2060	0.0 - 0.5 ft	AAA3775	Arsenic	36	PPM	n/a	11.6
			Barium	135	PPM	5600	1143
			Calcium	0.57	%	n/a	54362
			Chromium	17	PPM	n/a	34.2
			Copper	31	PPM	3000	15.7
			Iron	1.48	%	n/a	35586
			Lead	18	PPM	400	39
			Manganese	352	PPM	11000	1030
			Mercury	50110	PPM	24	0.1
			Potassium	2.48	%	n/a	6179
			Thorium	57	PPM	n/a	n/a
			Titanium	2080	PPM	n/a	n/a

* UTL value is taken from the Assessments Council position paper "Interim Guidance for Evaluating PAHs in Soil"

48-002(a/b) Detects above SAL and/or UTL

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
48-2006	0.0 - 0.5 ft	AAA3753	Mercury	25	MG/KG	24	0.1
			Mercury	28.8	MG/KG	24	0.1
			Mercury	36	MG/KG	24	0.1
			Mercury	40	MG/KG	24	0.1
			Mercury	41	MG/KG	24	0.1
48-2006	0.0 - 0.5 ft	AAA4494	Benzo[a]anthracene	12.5	MG/KG	1	12.4 *
			Benzo[a]pyrene	12	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	13.8	MG/KG	1	12.2 *
			Benzo[k]fluoranthene	3.2	MG/KG	1	19.4 *
			Radvan Cesium-137	3.63	PCI/G	4	1.4
			Dibenzo[a,h]anthracene	1.6	MG/KG	0.1	2.9 *
			Indeno[1,2,3-cd]pyrene	5.5	MG/KG	1	6 *
			Mercury	35	MG/KG	24	0.1
			Mercury	38.1	MG/KG	24	0.1
			Mercury	47	MG/KG	24	0.1
			Mercury	62	MG/KG	24	0.1
			Plutonium-238	0.0399	PCI/G	20	0.014
48-2006	0.5 - 1.5 ft	AAA4493	Uranium-235	0.329	PCI/G	18	0.088
			Benzo[a]pyrene	0.77	MG/KG	0.1	12.1 *
48-2006	1.5 - 3.0 ft	AAA4495	Thorium-228	2.27	PCI/G	1.5	n/a
			Benzo[a]anthracene	5.6	MG/KG	1	12.4 *
			Benzo[a]pyrene	6.2	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	6.6	MG/KG	1	12.2 *
			Benzo[k]fluoranthene	2.9	MG/KG	1	19.4 *
			Dibenzo[a,h]anthracene	0.72	MG/KG	0.1	2.9 *
48-2006	3.0 - 4.0 ft	AAA3769	Indeno[1,2,3-cd]pyrene	2.9	MG/KG	1	6 *
			Benzo[a]pyrene	0.51	MG/KG	0.1	12.1 *
48-2006	5.0 - 6.0 ft	AAA3771	Plutonium-239	0.121	PCI/G	18	0.052
			Benzo[a]pyrene	0.6	MG/KG	0.1	12.1 *
			Uranium-235	0.184	PCI/G	18	0.088
48-2006	6.0 - 7.0 ft	AAA3772	Uranium-235	0.189	PCI/G	18	0.088
48-2006	7.0 - 8.0 ft	AAA3773	Plutonium-238	0.0727	PCI/G	20	0.014
			Mercury	1.2	MG/KG	24	0.1
			Mercury	2	MG/KG	24	0.1
48-2007	0.0 - 0.5 ft	AAA4496	Mercury	2.7	MG/KG	24	0.1
			Benzo[a]anthracene	23.3	MG/KG	1	12.4 *
			Benzo[a]pyrene	22.6	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	25.8	MG/KG	1	12.2 *
			Benzo[k]fluoranthene	10.7	MG/KG	1	19.4 *
			Dibenzo[a,h]anthracene	2.7	MG/KG	0.1	2.9 *
			Indeno[1,2,3-cd]pyrene	13.7	MG/KG	1	6 *
			Plutonium-238	0.051	PCI/G	20	0.014
			Plutonium-239	0.718	PCI/G	18	0.052
48-2007	0.5 - 1.0 ft	AAA4497	Thorium-228	1.718	PCI/G	1.5	n/a
			Benzo[a]anthracene	12.3	MG/KG	1	12.4 *
			Benzo[a]pyrene	12.9	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	15.9	MG/KG	1	12.2 *
			Benzo[k]fluoranthene	4.3	MG/KG	1	19.4 *
			Indeno[1,2,3-cd]pyrene	6	MG/KG	1	6 *
48-2008	0.0 - 0.5 ft	AAA4499	Thorium-228	2.027	PCI/G	1.5	n/a
			Benzo[a]anthracene	4.3	MG/KG	1	12.4 *
			Benzo[a]pyrene	5.1	MG/KG	0.1	12.1 *

48-002(a/b) Detects above SAL and/or UTL

Location ID	Depth of sample	Sample ID	Analyte	Results	Units	SAL	UTL
			Benzo[b]fluoranthene	5.4	MG/KG	1	12.2 *
			Benzo[k]fluoranthene	2	MG/KG	1	19.4 *
			Dibenzo[a,h]anthracene	0.63	MG/KG	0.1	2.9 *
			Indeno[1,2,3-cd]pyrene	2.4	MG/KG	1	6 *
			Plutonium-239	0.231	PCI/G	18	0.052
48-2008	0.5 - 1.5 ft	AAA4500	Thorium-228	1.54	PCI/G	1.5	n/a
			Benzo[a]anthracene	1.3	MG/KG	1	12.4 *
			Benzo[a]pyrene	1.5	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	1.6	MG/KG	1	12.2 *
			Plutonium-238	0.055	PCI/G	20	0.014
			Plutonium-239	0.826	PCI/G	18	0.052
48-2008	1.5 - 3.0 ft	AAA3749	Thorium-228	1.754	PCI/G	1.5	n/a
			Benzo[a]pyrene	0.47	MG/KG	0.1	12.1 *
			Plutonium-238	0.053	PCI/G	20	0.014
			Plutonium-239	0.436	PCI/G	18	0.052
48-2009	0.0 - 0.5 ft	AAA3750	Thorium-228	1.622	PCI/G	1.5	n/a
			Plutonium-239	0.34	PCI/G	18	0.052
48-2009	0.0 - 0.5 ft	AAA3758	Thorium-228	1.661	PCI/G	1.5	n/a
48-2009	0.5 - 1.5 ft	AAA3751	Benzo[a]pyrene	0.37	MG/KG	0.1	12.1 *
			Benzo[a]pyrene	0.43	MG/KG	0.1	12.1 *
48-2009	1.5 - 3.0 ft	AAA3752	Thorium-228	1.656	PCI/G	1.5	n/a
			Plutonium-239	0.388	PCI/G	18	0.052
48-2056	0.0 - 0.5 ft	AAA3765	Thorium-228	1.619	PCI/G	1.5	n/a
			Benzo[a]pyrene	0.45	MG/KG	0.1	12.1 *
48-2056	0.5 - 1.5 ft	AAA3766	Thorium-228	1.579	PCI/G	1.5	n/a
			Benzo[a]pyrene	0.49	MG/KG	0.1	12.1 *
			Plutonium-238	0.016	PCI/G	20	0.014
48-2056	1.5 - 2.0 ft	AAA3767	Thorium-228	1.836	PCI/G	1.5	n/a
			Plutonium-238	0.078	PCI/G	20	0.014
48-2060	0.0 - 0.5 ft	AAA3775	Plutonium-239	0.084	PCI/G	18	0.052
			Benzo[a]anthracene	14.2	MG/KG	1	12.4 *
			Benzo[a]pyrene	14.5	MG/KG	0.1	12.1 *
			Benzo[b]fluoranthene	18.5	MG/KG	1	12.2 *
			Benzo[k]fluoranthene	5	MG/KG	1	19.4 *
			Indeno[1,2,3-cd]pyrene	5.7	MG/KG	1	6 *
48-2061		AAA3787	Thorium-228	1.617	PCI/G	1.5	n/a
			Mercury	27	MG/KG	24	0.1
XRF Results							
48-2006	0.0 - 0.5 ft	AAA4494	Mercury	32	PPM	24	0.1
48-2006	0.5 - 1.5 ft	AAA4493	Mercury	10	PPM	24	0.1
48-2006	1.5 - 3.0 ft	AAA4495	Mercury	190	PPM	24	0.1
48-2007	0.0 - 0.5 ft	AAA4496	Copper	18	PPM	3000	15.7
			Lead	40	PPM	400	39
48-2009	0.0 - 0.5 ft	AAA3750	Mercury	31	PPM	24	0.1
48-2056	0.5 - 1.5 ft	AAA3766	Mercury	12	PPM	24	0.1
48-2060	0.0 - 0.5 ft	AAA3775	Arsenic	36	PPM	n/a	11.6
			Copper	31	PPM	3000	15.7
			Mercury	50110	PPM	24	0.1

* UTL value is taken from the Assessments Council position paper "Interim Guidance for Evaluating PAHs in Soil"

ANNEX 6.10

RISK-BASED CLEANUP LEVEL CALCULATIONS

Chemical	EPA Cancer Class	Risk Range			Cleanup Level mg/kg Occupational Scenario Carcinogenic Range			Noncarc.
Arsenic	A	1.00E-04	-	1.00E-06	250	-	2	613
Barium	D							7,530
Cadmium	B1	1.00E-04	-	1.00E-06	2,523	-	25	2,044
Chromium VI	A	1.00E-04	-	1.00E-06	378	-	4	10,220
Copper								75,628
Manganese								793
Mercury	D							279
Nickel	A							40,880
Silver	D							10,220
Thallium								164
Vanadium								14,308
Zinc	D							613,200
Benzene	A	1.00E-04	-	1.00E-06	277	-	3	
cis-1,2-Dichloroethene								20,440
Methylene Chloride	B2	1.00E-04	-	1.00E-06	2,508	-	25	11,545
Tetrachlorethene	B-C	1.00E-04	-	1.00E-06	3,088	-	31	20,440
1,1,1-Trichloroethane	D							7,259
Trichloroethene	B-C	1.00E-04	-	1.00E-06	1,347	-	13	
Benzo[a]pyrene	B2	1.00E-04	-	1.00E-06	78	-	1	
PCBs	B2	1.00E-04	-	1.00E-06	74	-	1	
2,4-DNT	B2	1.00E-04	-	1.00E-06	842	-	8	4,088
2,6-DNT	B2	1.00E-04	-	1.00E-06	842	-	8	2,044
HMX								102,200
PETN								40,880
RDX	C	1.00E-04	-	1.00E-06	5,203	-	52	6,132
TNT	C	1.00E-04	-	1.00E-06	19,077	-	191	1,022

Residential PRGs are based on the following assumptions:

Carcinogenic averaging time (years) =	70
Non carcinogenic Averaging time (years) =	30
Exposure frequency (days/year) =	350
Age adjusted soil ingestion factor (mg-yr/kg-day) =	114
Age adjusted inhalation factor (m^3-yr/kg-day) =	13

$$C = \frac{TR \times AT \times 365\ days/year}{(SF_o \times 10^{-6}\ kg/mg \times EF \times IF_{soil}) + [SF_i \times EF \times IF_{air} \times (1/Y)]}$$

$$C = \frac{THI \times AT \times 365\ days/year}{((1/RfD_o) \times 10^{-6}\ kg/mg \times EF \times IF_{soil}) + [(1/RfD_i) \times EF \times IF_{air} \times (1/Y)]}$$

Occupational PRGs are based on the following assumptions:

Adult body weight (kg) =	70
Carcinogenic averaging time (years) =	70
Non carcinogenic Averaging time (years) =	25
Exposure frequency (days/year) =	250
Exposure duration (years) =	25
Soil ingestion rate (mg/day) =	50
Workday inhalation rate (m^3/day) =	20
Particualte emission factor (m^3/kg) =	1.11E+07

$$C = \frac{TR \times BW \times AT \times 365\ days/year}{EF \times ED \times [(SF_o \times 10^{-6}\ kg/mg \times IF_{soil}) + (SF_i \times IF_{air} \times (1/Y))]}$$

$$C = \frac{THI \times BW \times AT \times 365\ days/year}{EF \times ED \times [((1/RfDo) \times 10^{-6}\ kg/mg \times IR_{soil}) + ((1/RfDi) \times IR_{air} \times (1/Y))]}$$

Recreational PRGs are based on the following assumptions:

Carcinogenic averaging time (years) =	70
Non carcinogenic Averaging time (years) =	20
Exposure frequency (days/year) =	28
Age adjusted soil ingestion factor (mg-yr/kg-day) =	93
Age adjusted inhalation factor (m^3-yr/kg-day) =	9.5

$$C = \frac{TR \times AT \times 365\ days/year}{(SF_o \times 10^{-6}\ kg/mg \times EF \times IF_{soil}) + [SF_i \times EF \times IF_{air} \times (1/Y)]}$$

$$C = \frac{THI \times AT \times 365\ days/year}{((1/RfD_o) \times 10^{-6}\ kg/mg \times EF \times IF_{soil}) + [(1/RfD_i) \times EF \times IF_{air} \times (1/Y)]}$$

Y = VF for volatiles; PEF for nonvolatiles

Chemical	EPA Cancer Class	Carcinogenic Slope Factors (kg-day/mg) Oral	Carcinogenic Slope Factors (kg-day/mg) Inhalation	Chronic RfDs (mg/kg-day) Oral	Chronic RfDs (mg/kg-day) Inhalation	VF m^3/kg
Arsenic	A	1.75	15	0.0003		
Barium	D			0.07	0.00014	
Cadmium	B1		6.3	0.001		
Chromium VI	A		42	0.005		
Copper				0.037		
Manganese				0.14	0.000014	
Mercury	D			0.0003	0.00009	
Nickel	A			0.02		
Silver	D			0.005		
Thallium				0.00008		
Vanadium				0.007		
Zinc	D			0.3		
Benzene	A	0.029	0.029			5700
cis-1,2-Dichloroethene				0.01		4600
Methylene Chloride	B2	0.0075	0.0016	0.06	0.86	2900
Tetrachlorethene	B-C	0.052	0.002	0.01		6000
1,1,1-Trichloroethane	D			0.09	0.29	5100
Trichloroethene	B-C	0.011	0.006			5800
Benzo[a]pyrene	B2	7.3				
PCBs	B2	7.7				
2,4-DNT	B2	0.68		0.002		
2,6-DNT	B2	0.68		0.001		
HMX				0.05		
PETN				0.02		
RDX	C	0.11		0.003		
TNT	C	0.03		0.0005		

ANNEX 6.11

VERIFICATION PLAN CALCULATIONS

Verification Plan

The number of samples to be taken to determine whether a confirmation unit (in this case the 20 by 11 foot area of contamination) has achieved the cleanup standard due to excavation is dictated by the sampling frequency needed to achieve statistically defensible data. *Methods for Evaluating the Attainment of Cleanup Standards, Volume 1, Solid Media (EPA 1988)* provides the formulae for calculating the number of random samples needed to determine if the mean concentration remaining in the area after excavation is less than the cleanup goal at a specified level of confidence. The required number of samples is computed using the following equation:

$$n_d = \frac{\left(z_{1-\beta} + z_{1-\alpha}\right)^2}{\tau^2} \quad where \quad \tau = \frac{(C_s - \mu_1)}{\sigma}$$

The required number of samples is computed using the following parameters and assumptions:

Parameter	Assumption	Value
α	alpha - the desired false positive rate	0.05
β	beta - the desired false negative rate	0.2
τ	tau - an expression of relative difference	calculated
C_s	cleanup standard for the sample area	for Hg = 280 mg/kg for PAH = 80 mg/kg
μ_1	the mean concentration where the site should be declared clean with a high probability	assume 50% of C_s
σ	the estimate of the standard deviation of the individual contaminant concentrations within the CU	assume a coefficient of variation of 50% which is 50% of μ_1 or 25% of C_s

Application of this approach with assumptions as outlined results in a confirmatory sample size of 2 soil samples for laboratory analysis. The confirmatory sampling approach will include the evaluation of screening data after each cleanup excavation lift is accomplished. If screening data indicate that contaminant concentrations are 50% or less of the cleanup standard with a standard deviation of 25% of the C_s, the 2 confirmatory

laboratory samples will be obtained. Given the small size of this SWMU, if screening data do not achieve these results, additional soil will be removed until the screening requirements are met. An approach for larger remediated sites would consider the benefit from additional sampling to verify cleanup (i.e., the larger number of samples, the closer the UCL is to the mean) versus the cost of removing additional soil (i.e., reduce the average contaminant concentration).

Results from the 2 laboratory confirmatory samples will be used to calculate the 95% UCL to compare to the cleanup level established for each contaminant. The site cleanup objectives will be obtained when the calculated UCL is less than the established cleanup levels.

REFERENCE

0794 EPA (US Environmental Protection Agency), February 1989. "Methods for Evaluating the Attainment of Cleanup Standards," Volume 1: Soils and Solid Media, EPA 230/02-89-042, National Technical Information Service, Springfield, Virginia. (EPA 1989, 0794) Verified