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LOS ALAMOS NATIONAL LABORATORY
Voluntary Corrective Action Plans for Potential Release Sites, Group 1

Sites under Field Unit 1 at Bandelier National Monument:
C-00-036(a), Borrow Pit #1
C-00-036(b), Borrow Pit #2
C-00-036(c), Borrow Pit #3
C-00-036(d), Borrow Pit #4

Sites under Field Unit 5 at TA-9, Explosives Technology Group:
09-010(a), Waste Container Storage Area
09-010(b), Waste Container Storage Area

ICF Kaiser Engineers, Inc.
Morrison Knudsen Corporation
Job #93069-043-00
June 9, 1995

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09-010(b), Waste Container Storage Area

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Voluntary Corrective Action Plans for Potential Release Sites, Group 1

1.0 INTRODUCTION

The potential release sites (PRSs) at Los Alamos National Laboratory (the Laboratory/LANL) addressed in this voluntary corrective action (VCA) plan have been delegated to Group 1 on the basis of their similarity and ease of implementation. Group 1 PRSs fall within the area of two technical areas (TA), each within one of the five field units (FU): Field Unit 1 (FU1) containing the TA-0 sites (sites outside of the Laboratory proper) under the responsibility of Field Unit Project Leader, Garry Allen, and Field Unit 5 (FU5) containing the TA-9 sites under the responsibility of Field Unit Project Leader, Cheryl Rofer. The tasks for Group 1 PRSs are basically housekeeping tasks, involving the removal and disposal of construction debris. No hazardous nor radioactive wastes are expected at any of the PRSs in Group 1.

1.1 FU1, PRSs C-00-036(a-d)

The TA-0 PRSs are located within Bandelier National Monument (BNM) and were originally excavated as borrow areas for the improvement of State Route 4 in the 1950s. Much of the waste identified appears to be construction debris from grade and drainage improvement and from road resurfacing. Each site is directly accessible from State Route 4, and is on BNM land. Clean-up activities may require the cutting of a BNM boundary fence (three strand barbed wire) for access, and may require the presence of a BNM Ranger.

1.2 FU5, PRSs 09-010(a,b)

The TA-9 PRSs are within a secured, active area of the Laboratory. The area is occupied by the Explosives Technology Group (DX-11) where the synthesis and machining of explosives occurs. Radionuclides are also handled at this facility. While access via Station 502 to each of the TA-9 PRSs is on paved and well-maintained roads, the proper escorts, credentials, and permissions will be required.

2.0 SITE TYPE AND DESCRIPTION

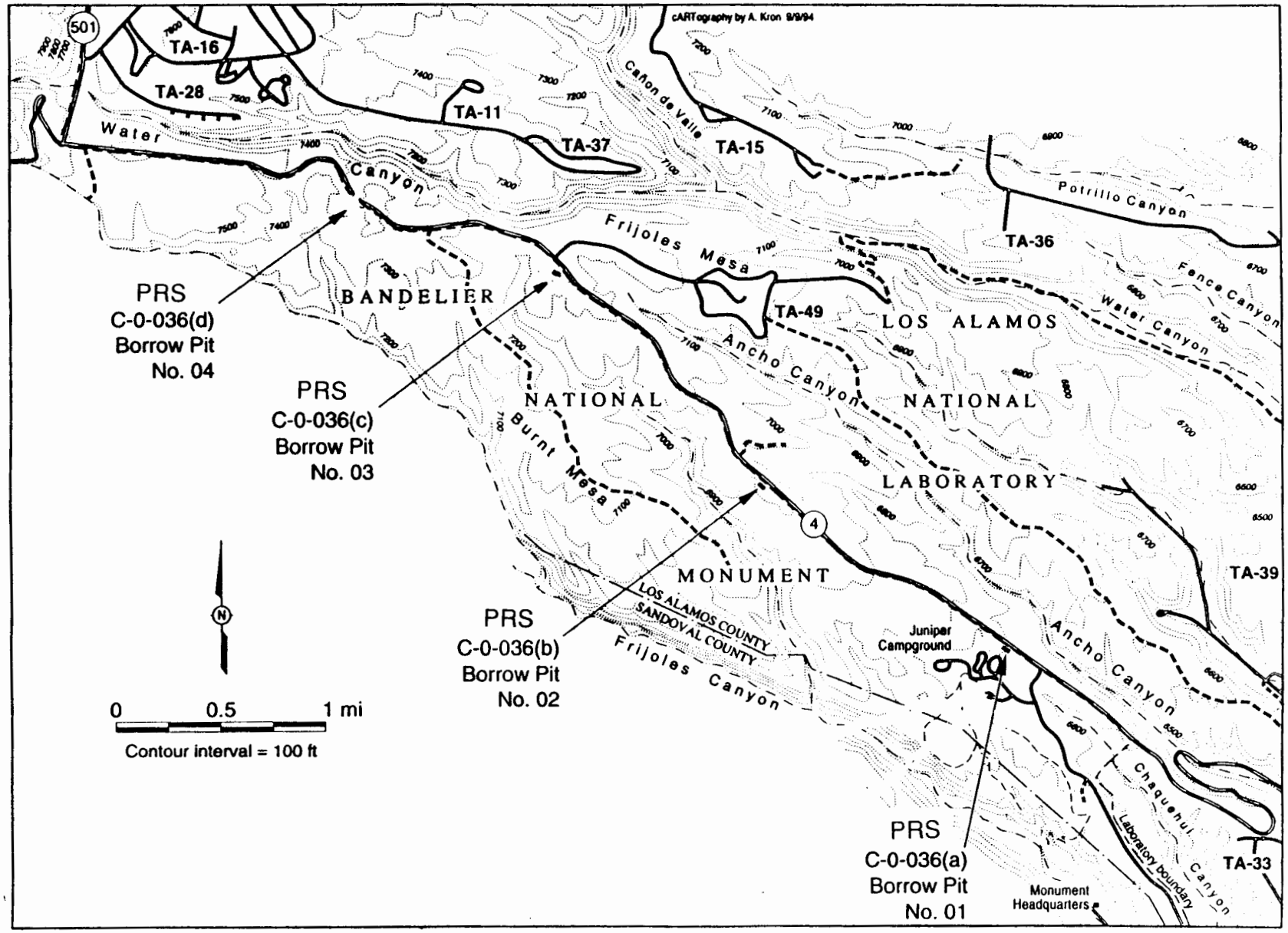
Table 2-1 identifies each PRS included in Group 1, its location, its type and description, and the type and description of the waste to be cleaned up.

Table 2-1, Site Type and Description

No.	Field Unit	OU No.	PRS No.	PRS Location	PRS Type/Description	Waste Type/Description
1	1	1071	C-00-036(a)	0.2 mile NW of BNM Entrance on SW side of State Route 4	Borrow Pit #1	Debris, CMPs, Asphalt, Concrete
2	1	1071	C-00-036(b)	2.5 miles NW of BNM Entrance on SW side of State Route 4	Borrow Pit #2	Debris, Wire Rope, Metal Bars, Asphalt, Concrete
3	1	1071	C-00-036(c)	3.9 miles NW of BNM Entrance on SW side of State Route 4	Borrow Pit #3	Debris, Wire Rope, Metal Rail, CMPs, Concrete
4	1	1071	C-00-036(d)	5.0 miles NW of BNM Entrance on SW side of State Route 4	Borrow Pit #4	Debris, CMPs
5	5	1157	09-010(a)	54 feet N of NW corner of TA-9-48	Waste Container Storage Area	Metal Storage Structure
6	5	1157	09-010(b)	45 feet S of SW corner of TA-9-45	Waste Container Storage Area	Metal Storage Structure

Figure 2-1 is a location map for all PRSs at TA-0. Figure 2-2 is a location map for the PRSs at TA-9.

Figure 2-1, PRSs at BNM Location Map



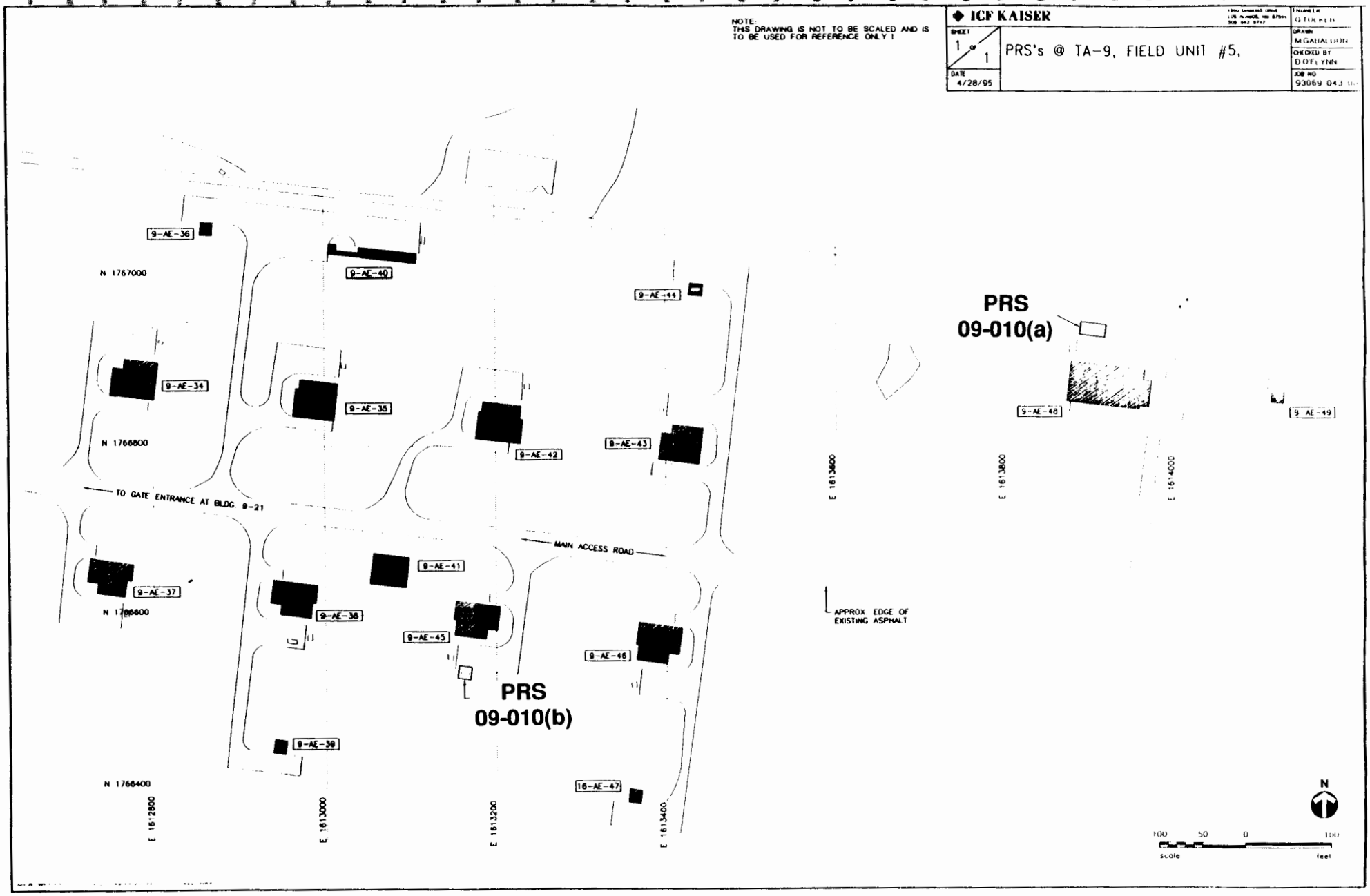


Figure 2-2, PRSs at TA-9 Location Map

3.0 PROPOSED REMEDY

Before the start of clean-up operations, a site reconnaissance will be conducted to delineate areas of potential contamination and to locate and identify the known wastes to be removed. The areas and materials will be clearly identified in the field and all remediation personnel will be familiarized with each specific site.

Visual inspections and field screening will be conducted to indicate if any contamination resulting from radioactive materials is present. Potential contamination of any materials to be removed or excavated will be determined by the use of field screening with hand-held instruments. Swipes will be taken of obvious man-made objects when field screening indicates levels of radioactive contaminants above background. Contamination will be confirmed using a mobile radiological van from the Laboratory (if available) or from a contractor. This will provide real-time analyses of potential radioactive contaminants prior to or during the actual excavation and/or removal.

Additional field screening will be conducted to indicate if any contamination resulting from hazardous materials is present. Potential contamination of any materials to be removed or excavated will be determined by the use of field screening with field test kits and hand-held instruments. Contamination will be confirmed using a mobile chemistry van from the Laboratory (if available) or from a contractor. This will provide real-time analyses of potential hazardous contaminants prior to or during the actual excavation and/or removal. A field screening plan is described in Appendix A.

In lieu of a detailed Waste Management Plan (WMP), each PRS in this VCA plan has been detailed on a Characterization Strategy Form (CSF) included in Appendix B. The CSFs include a site description, an investigation or remediation waste description and volume estimate, a characterization strategy, a preliminary RCRA determination, and a listing of analyte suites to be characterized. At the point in time when the clean-up waste is ready for transfer to TA-54, Waste Disposal, and waste characterization analyses have been received, Waste Profile Forms (WPFs) and Chemical Waste Disposal Requests (CWDRs) will be prepared.

All waste removed from the PRSs will be segregated, sampled, analyzed, containerized, labeled, stored, handled, prepared for transportation and disposal, and managed in compliance with the suspected waste type presented in the CSF. Upon waste type confirmation by waste characterization analyses, the waste will be dealt with commensurate with the CSF. Waste materials confirmed to be not contaminated with hazardous or radioactive materials, nor governed by the Toxic Substances Control Act (TSCA), will be disposed of in the proper manner at an industrial waste landfill.

Excavation, material removal, and recontouring are expected to be performed using a backhoe/loader and hand-held tools. The depth at which excavation will terminate will be determined by field screening and/or use of a mobile chemistry van and/or a mobile radiological van for the potential contaminants of concern (PCOCs) under with the guidelines established by the document "...Reconsidering or Stopping Work on...Voluntary Corrective Actions" by Brad Martin, dated June 2, 1995, a copy of which has been included in Appendix C. Confirmatory (verification) sampling will be performed as required to insure that the contaminants of concern (COCs) are at or below the established clean-up level.

Disturbance of the existing vegetation will be minimized. Excavated soil materials found to be uncontaminated may be used for backfill and recontouring. Clean soil materials (with contaminants equal to or below adjacent background levels) may be brought "on-site" to complete the task of backfilling. All disturbed areas at each site will be regraded to match adjacent contours and reseeded.

Currently, no analyses are available for the PRSs at TA-0, the BNM Borrow Pits. Analyses have been made available for the PRSs at TA-9, and are included in Appendix D. If analytical data becomes available for the BNM PRSs, it will be appended to Appendix D.

3.1 FU1, PRSs at Bandelier National Monument

Several soil and debris piles are located at the PRSs at BNM. The piles which do not appear to contain debris nor exhibit evidence of surface contamination will be excavated to allow field screening of the subsurface material in order to eliminate the potential of buried waste. Piles determined not to be contaminated will be blended into the adjacent contours and revegetated. Piles determined to be contaminated or to contain buried waste materials will be excavated and disposed of as appropriate.

3.1.1 C-00-036(a), Borrow Pit #1

The proposed remedy for this site is to excavate and remove two separate piles of asphalt and concrete as well as widely scattered pieces of metal, cans, and corrugated metal pipe (CMP). The site is approximately 420 feet long by 130 feet wide, and covers approximately about 1.25 acres. The floor of the pit slopes gently and is sparsely vegetated with pine trees and shrubs. Site access is blocked by several large boulders. No radiological activity above background levels was observed during a site reconnaissance visit in 1993 and no materials specifically associated with Laboratory operations have been identified.

3.1.2 C-00-036(b), Borrow Pit #2

The proposed remedy for this site is to excavate and remove several scattered piles of asphalt, concrete, and debris including steel cables. The site is approximately 300 feet long by 100 feet wide and covers an area of about 0.7 acres. The floor of the pit slopes gently and is sparsely vegetated with pine trees that have maximum heights of about 25 feet. No radiological activity above background levels (with the exception noted below) was observed during a site reconnaissance visit in 1993 and no materials specifically associated with Laboratory operations have been identified.

3.1.3 C-00-036(c), Borrow Pit #3

The proposed remedy for this site is to excavate and remove several piles of debris containing steel cables, crushed pieces of corrugated metal pipe (CMP), and a section of small gauge rail. The rail may have come from a Laboratory sled apparatus set up at TA-49. The site is approximately 380 feet long by 130 feet wide, and covers approximately about 1.13 acres. The floor of the borrow pit is generally flat with the western one-third separated from the eastern two-thirds by a low transverse ridge that may have been an access ramp into the pit. The floor is sparsely vegetated with pine trees and shrubs. No radiological activity above background levels was observed during a site reconnaissance visit in 1993 and no other materials specifically associated with Laboratory operations have been identified.

3.1.4 C-00-036(d), Borrow Pit #4

The proposed remedy for this site is to excavate and remove several crushed pieces of corrugated metal pipe (CMP). Several cubic yards of concrete that was deposited as a slurry and formed into an innocuous, sinuous ribbon down a steeply inclined drainage channel also exists in this area. It is proposed to leave this concrete in place, since excavation and efforts to restabilize the drainage channel would cause more damage than benefit. The site is approximately 175 feet long by 15 to 20 feet wide, and covers approximately 0.1 acres. The floor of the borrow pit is nearly flat and sparsely vegetated with pine trees and shrubs. No radiological activity above background levels was observed

during a site reconnaissance visit in 1993 and no other materials specifically associated with Laboratory operations have been identified.

3.2 PRSs at FU5, TA-9, Explosives Technology Group

Sampling activities at the TA-9 PRSs revealed that the potential contaminants of concern (PCOCs) which were identified earlier do not exist (see memo from Danny Martinez in Appendix D). The remedial activities at two of the original four PRSs include the removal and disposal of two out-of-date and inadequate waste container storage shelters. Since one is still active, it will be replaced with a new, adequate unit.

3.2.1 09-010(a), Waste Container Storage Area

The proposed remedy for this site calls for the removal and disposal of a three-sided waste container storage structure built in 1961 (identified as structure number 9-276), located approximately 54 feet north of the northwest corner of TA-9-48. The structure is 11.5 feet wide by 2.5 feet deep by 6.5 feet tall. It is constructed of four steel pipe posts, anchored in concrete, with a steel-grid floor suspended (welded) on the posts approximately 1 foot above the ground. The structure is sheathed in corrugated metal, with four doors opening to the front (south), and is open to the back (north). Currently, nothing is stored within the structure, and no secondary containment pan exists below the floor. The ground surface immediately behind the structure drops approximately 12 feet at a slope of approximately 2H:1V.

Remediation of the site will include the dismantling, the removal, and the disposal of the structure as industrial waste. Since the site is within a high explosive (HE) manufacturing, machining, and handling area of the Laboratory, no cutting torches or spark generating equipment will be allowed. Dismantling will be done on site with hydraulic activated shears, or the entire structure may be removed and dismantled elsewhere.

3.2.2 09-010(b), Waste Container Storage Area

The proposed remedy for this site calls for the removal and disposal of a three-side waste container storage structure (identified as structure number 9-277), located approximately 45 feet south of the southwest corner of TA-9-45. The structure is approximately 11.5 feet wide by 2.5 feet deep by 6.5 feet tall. It is constructed of four steel pipe posts, anchored in concrete, with a steel grid floor suspended (welded) on the posts approximately 1 foot above the ground. The structure is sheathed on three sides in corrugated metal and is open to the front (north). The structure includes a secondary containment pan below the floor.

Since this is an active waste container storage area, the existing, inadequate structure will be replaced with a new unit. Remediation of this site includes: 1) the purchase, installation, and grounding of an appropriate new waste container storage structure south of TA-9-45, 2) the transfer, placement, and grounding of the existing waste containers from the existing structure to the new structure, and 3) the dismantling and disposal of the old structure as industrial waste. Currently, four 55-gallon drums, three 5-gallon drums, and two 5-gallon safety cans containing chemicals and solvents are stored within the structure. After transferring these materials to the new structure, the old structure will be dismantled, removed, and disposed of as industrial waste. Since the site is within a high explosive (HE) manufacturing, machining, and handling area of the Laboratory, no cutting torches or spark generating equipment will be allowed. Dismantling will be done on site with hydraulic activated shears, or the entire structure may be removed and dismantled elsewhere.

4.0 JUSTIFICATION/RATIONALE

4.1 FU1, PRSs C-00-036(a-d)

The disposal of construction debris and other wastes at the borrow pits located within the boundaries of BNM present a degradation of the environment (PRS C-00-036(a), is immediately adjacent to a camping area). While the debris are assumed to be non-hazardous and non-radiological, their proximity to the Laboratory proper lends themselves to suspicion. The clean-up alternatives are obvious and straightforward to implement. Physical site access is not a major problem, however, actual clean-up will need to be coordinated with BNM Rangers.

4.2 FU5, PRSs 09-010(a,b)

The waste container storage areas pose a potential health hazard to those who work near these sites. While the waste materials associated with these sites are of low volume and restricted to well-defined areas, contamination could be spread by foot traffic and by rainfall runoff. The clean-up alternatives are obvious and straightforward to implement. Physical site access is not a problem, however, timing will need to be coordinated with the day-to-day operations of the DX-11 Group.

5.0 ESTIMATED WASTE VOLUMES BY TYPE

Table 5-1 describes each PRS, the waste types, the waste description, an estimated bulk volume, proposed disposal containers, and the anticipated disposal destination.

Table 5-1, Estimated Waste Volumes by Type

PRS Number	Waste Type	Waste Description	Estimated Bulk Volume	Disposal Container Type/Description	Anticipated Disposal
C-00-036(a)	Industrial	Debris, CMPs, Asphalt, Concrete	22 yd^3	2 - 10 yd^3 Roll-off Containers	Industrial Landfill
C-00-036(b)	Industrial	Debris, Wire Rope, Metal Bars, Asphalt, Concrete	45 yd^3	5 - 10 yd^3 Roll-off Containers	Industrial Landfill
C-00-036(c)	Industrial	Debris, Wire Rope, Metal Rail, CMPs, Concrete	40 yd^3	4 - 10 yd^3 Roll-off Containers	Industrial Landfill
C-00-036(d)	Industrial	Debris, CMPs	40 yd^3	1 - 40 yd^3 Roll-off Containers	Industrial Landfill
09-010(a)	Industrial	Metal Storage Structure	3 yd^3	1 - 5 yd^3 Roll-off Containers	Industrial Landfill
09-010(b)	Industrial	Metal Storage Structure	3 yd^3	1 - 5 yd^3 Roll-off Containers	Industrial Landfill

6.0 CLEAN-UP LEVELS

Proposed site-specific clean-up levels to be used for the PRSs C-00-036(a-d), the Bandelier National Monument Borrow Pits #1-#4 are presented in table 6-1. Since the only activity for the PRSs at TA-9, 09-010(a,b), waste container storage areas consist of the removal of two metal container storage sheds, no site-specific clean-up levels area required, as no hazardous material is being cleaned up.

Site-specific clean-up levels for non-radionuclide constituents (with the exception of lead) were obtained using the equations presented in Appendix E. The toxicity values used in these equations were obtained from the Integrated Risk Information System (IRIS) and the Health Effects Assessment Summary Table (HEAST), both updated through March 1995. The equations were used to calculate the site-specific clean-up levels for carcinogenic and noncarcinogenic contaminants using recreational soil exposures. The methodologies are consistent with U.S. EPA Risk Assessment Guidance for Superfund, Part B, using LANL-specific exposure scenario parameters. The methodology is used to backcalculate a soil concentration for carcinogens from a target cancer risk value of 10^{-6} and for noncarcinogens from a target hazard quotient of 1. The equations for soil combine across exposure pathways to include ingestion, dermal, and inhalation exposures where toxicity values are available.

Lead soil clean-up levels were calculated not to exceed a target blood level of 10 µg/dl for a recreational exposure scenario (EPA 1994). Sources of lead exposure for the recreational scenario include drinking water, grocery store food products, incidental soil ingestion, and air. Dermal contact is not included in the calculation since the Integrated Exposure Uptake Biokinetic (IEUBK) model does not incorporate this source.

The Approach to Using Site-Specific Chemical Preliminary Remedial Goals (PRGs) is presented in Appendix F.

Table 6-1, Clean-Up Levels at TA-0

OU Number	PRS Number	Analytical Suite	Chemicals of Concern	PRG (mg/kg)
1071	C-00-036(a)	Polycyclic Aromatic Hydrocarbons	Benzo(a)pyrene	2.2
1071	C-00-036(b)	Polycyclic Aromatic Hydrocarbons	Benzo(a)pyrene	2.2
1071	C-00-036(c)	Polycyclic Aromatic Hydrocarbons	Benzo(a)pyrene	2.2
"	"	Metals	Lead	1600
1071	C-00-036(d)	Polycyclic Aromatic Hydrocarbons	Benzo(a)pyrene	2.2
"	"	Metals	Lead	1600

7.0 DESCRIPTION OF CONFIRMATORY SAMPLING

Table 7-1 describes each PRS and the proposed confirmatory sampling. Confirmatory analyses will be done either in the field, using the mobile chemistry van, or by a fixed laboratory depending upon the analysis to be preformed and the capabilities of the mobile lab. Both contaminated and uncontaminated materials will be handled and prepared for disposal, storage, or shipment as provided on the characterization strategy forms in Appendix B.

In addition to confirmatory sampling, waste characterization sampling will be performed as detailed in the characterization strategy forms.

Table 7-1, Description of Confirmatory Sampling

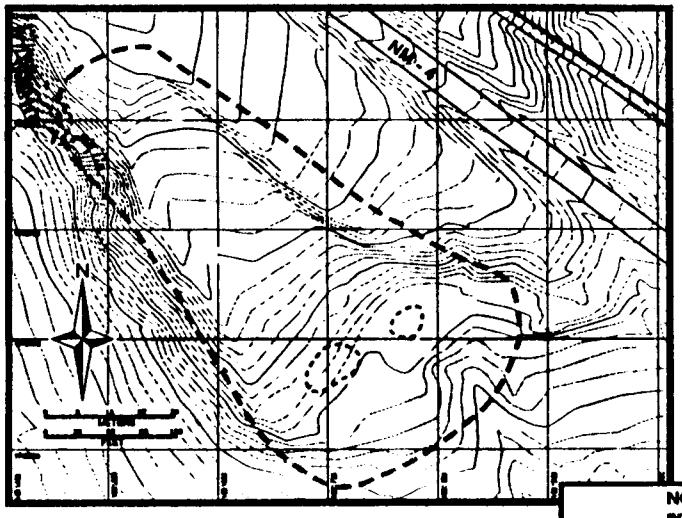
PRS Number	No. of Samples	Sampling Location Description	Drawing Reference	Analysis (Method)
C-00-036(a)	2	Under Soil Piles	Figure 7-1	Gross Alpha, Gross Beta, Gross Gamma, Gamma Spectrometry, PCBs (SW8080), TCLP Metals (6010)
C-00-036(b)	2	Under Soil Piles	Figure 7-1	Gross Alpha, Gross Beta, Gross Gamma, Gamma Spectrometry, PCBs (SW8080), TCLP Metals (6010)
C-00-036(d)	1	Under Soil Piles	Figure 7-1	Gross Alpha, Gross Beta, Gross Gamma, Gamma Spectrometry, PCBs (SW8080), TCLP Metals (6010)
C-00-036(d)	1	Under Soil Piles	Figure 7-1	Gross Alpha, Gross Beta, Gross Gamma, Gamma Spectrometry, PCBs (SW8080), TCLP Metals (6010)
09-010(a)	0	-	Figure 7-2	None
09-010(b)	0	-	Figure 7-2	None

No confirmatory sampling will be conducted for PRSs C-00-036(a-d) if field screening indicates that no hazardous or radioactive PCOCs are present or are above SAL. No confirmatory sampling is planned for the PRSs C-00-036(d) or 09-010(a,b) since no COCs have been identified.

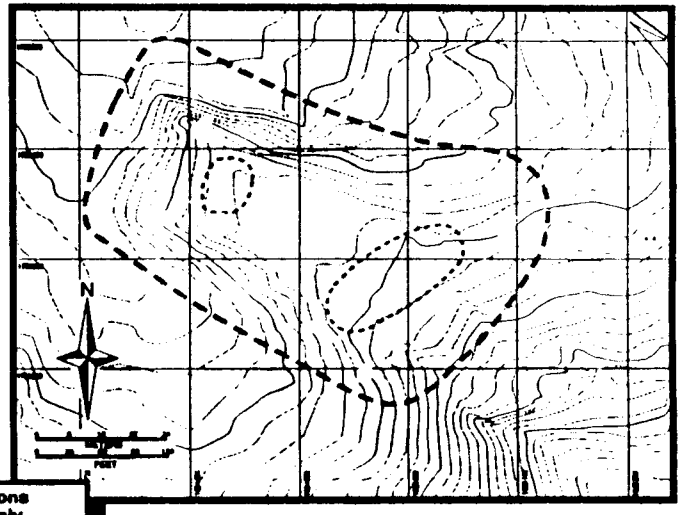
The following two figures detail the locations of each of the PRSs in Group 1.

Figure 7-1, PRSs C-00-036(a-d) Location Details

Four Borrow Pits, J. Novak 12/7/94



Borrow Pit No. 1, PRS C-0-036 (a)

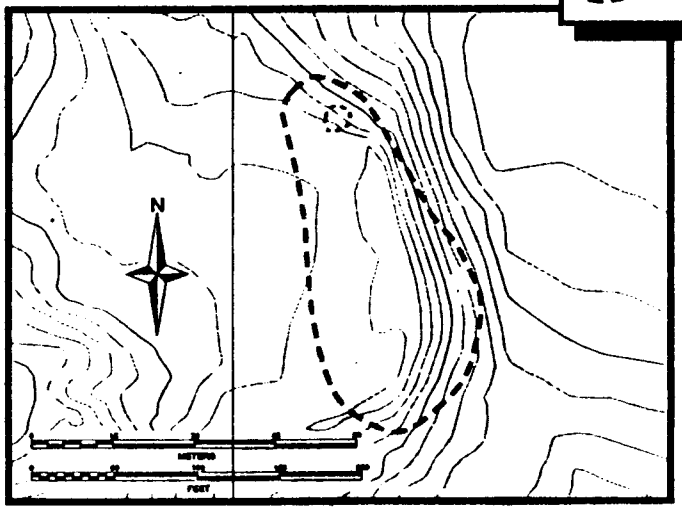


Borrow Pit No. 2, PRS C-0-036 (b)

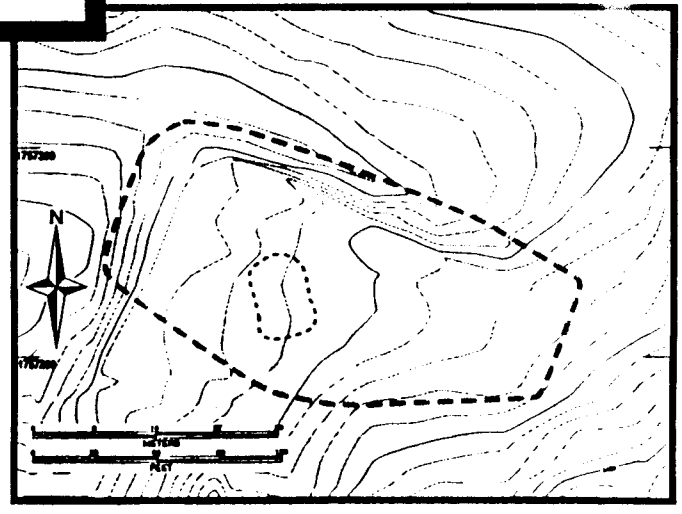
NOTE: All locations are schematic only.

location of visible debris

SWMU domain

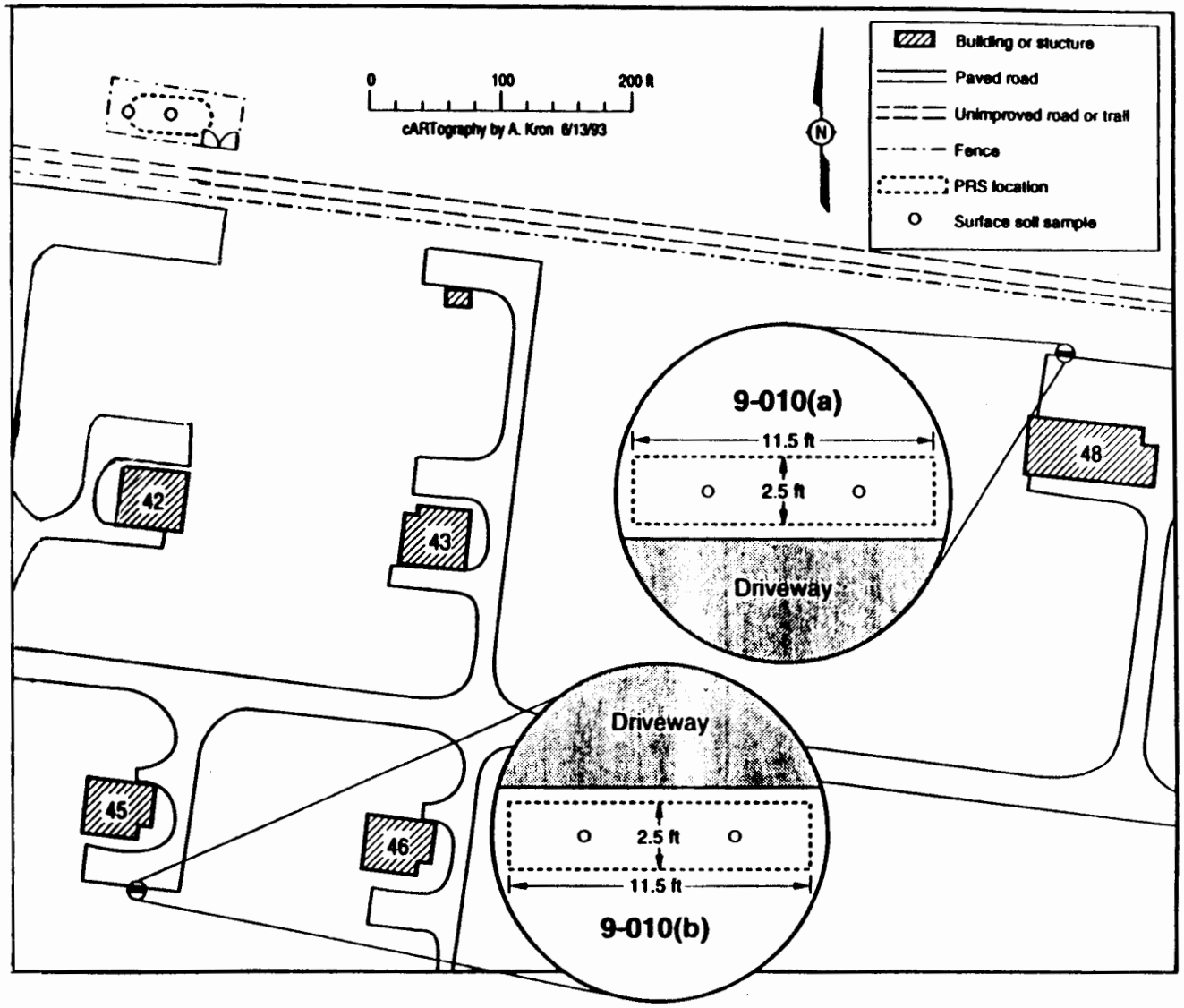


Borrow Pit No. 3, PRS C-0-036 (c)



Borrow Pit No. 4, PRS C-0-036 (d)

Figure 7-2. PRSs 09-010(a,b) Location Details



8.0 ESTIMATED SCHEDULE AND COST TO COMPLETE EACH VCA

Table 8-1 describes each PRS, and details estimated scheduling and costs to be incurred in the implementation of each PRS in Group 1. Cost estimates include the cost of characterization and confirmatory sampling and analysis. Remediation of the PRSs within Group 1 will be conducted by one field team. Cost estimate summaries by PRS have been included in Appendix G.

Table 8-1 VCA Plan - Estimated Schedule and Cost to Complete

No.	Field Unit	PRS Number	Date to Start Construction	Date to Complete Construction	Estimated Cost
1	1	C-00-036(a)	July 5, 1995	July 10, 1995	$ 25,500.00
2	1	C-03-036(b)	July 10, 1995	July 14, 1995	$ 37,700.00
3	1	C-03-036(c)	July 14, 1995	July 20, 1995	$ 36,700.00
4	1	C-03-036(d)	July 20, 1995	July 26, 1995	$ 33,600.00
5	5	09-010(a)	July 26, 1995	July 28, 1995	$ 16,200.00
6	5	09-010(b)	July 28, 1995	August 1, 1995	$ 23,000.00
				TOTAL	$172,700.00

9.0 REFERENCES

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APPENDIX A

Field Screening Plan

Field Screening Plan

This plan outlines the steps to be taken during VCAs at the Laboratory for field screening of soil and debris. Field screening will determine the extent of contamination, and as a result, the extent of excavation or material removal. Details not explicitly stated will be developed in the field and will be implemented as appropriate. All screening will be done by field personnel assigned to the VCA task. Field testing for polychlorinated biphenyls (PCBs), benzene/toluene/ethyl benzene/xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), and high explosives (HE) will use off-the-shelf test kits. Portable hand-held field equipment will be used for radiation, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and heavy metal screening. Soil or debris may be collected in sample containers and brought out of the exclusion zone for screening or may be screened within the zone as is appropriate.

Field screening of soils and debris will be used to detect alpha, beta, and gamma radiation; VOCs with ionization potentials less than 11.7 eV; BTEX; PAHs; PCBs; HE, specifically TNT and RDX; and heavy metals using an X-Ray Fluorescence (XRF) device.

In the field screening process, the following steps will be followed, in order, where the PCOC is suspected:

1. Visual Survey
2. Radiation Screening
3. VOC/SVOC Screening
4. PCB Field Test
5. BTEX Field Test (if petroleum products or solvents are suspected)
6. PAH Field Test (if petroleum products or solvents are suspected)
7. HE Field Test
8. Heavy Metals Screen

The visual survey of each PRS involves a walkaround of the site before and during debris and soil removal. The purpose of visually surveying the site before the start of work activities is to identify the work area perimeter and the specific material(s) to be removed. Personnel performing this visual survey will be looking for surface debris, stained soil, evidence of mounds or piles, flags or stakes from previous surveys or investigations, and any other evidence delineating the site. Conditions that may hamper this activity include rain; regrading, recontouring, or revegetation of the site; discovery of archaeological artifacts; active Laboratory work; vegetation covering the site; and anything else that may inhibit the visual survey.

In addition to the visual survey, radiation screening will be done before the start of work activities. This will be done at each site, regardless of whether radioactive materials are suspected to be present. Screening equipment to be used will be approved by the Laboratory Health Physics Measurements Group (ESH-4) prior to their utilization. Each site will be surveyed using a sodium iodide (NaI) detector for gross radiation screening. Other screening equipment may be used to detect alpha, beta, and gamma radiation. The frequency of debris or soil screening will be done at the discretion of the on-site health protection technician (HPT). Personnel will be screened only if radiation is found above background.

For sites where radioactive contamination is identified as being above background, additional radiation screening will ensure that preliminary information is sufficient and that the waste is consistent with anticipated radiation levels. Soil or debris samples will be collected to determine specific radioisotopes present in the waste. Swipes may also be used to determine radioactive contamination if the HPT determines this to be an appropriate means of field screening. Personnel will be screened when leaving the regulated area.

In areas where VOCs are identified as COCs, soil or debris will be collected, placed in jars, and allowed to volatilize in a warm area for approximately 5 minutes. A photo ionization detector (PID) will then be used to check the headspace for VOCs. The only compounds that would be detected, if present, are those that have an ionization potential (IP) of less than 11.7 eV. The most probable instrument to be used for this is an HNu PI-101. The data collected will help determine the extent of contamination, whether any VOCs are present that the instrument can detect, and if any of these contaminants may become airborne and affect the health and safety of site workers. The screening frequency will be determined in the field based on whether any VOCs are identified as contaminants and if any detections are registered during excavation and removal activities. Confirmatory samples will be sent to an off-site laboratory.

In those areas where PCBs are identified as COCs, a field test kit (e.g., DTECH) will be used to determine the extent of PCB clean-up. The test kit will be used to mark the boundaries of the work area prior to waste excavation and removal. After the excavation and removal are believed to be complete, the test kit will be used to ensure that the PCB contamination has been removed. Confirmatory samples will be sent for laboratory analysis.

Where petroleum products or solvents have been identified as COCs, a field test kit (e.g., DTECH) for BTEX and a field test kit for PAH will be used. The field tests will be performed prior to the start of work activities to delineate the work area and at the end of excavation and removal to ensure that the contamination has been removed. Confirmatory samples will be sent to an off-site laboratory.

In areas where HE is identified as a COC, a field test (e.g., DTECH) will be performed to quantitatively identify HE at the site. The field test will be performed at the start of work activities and when the removal is believed to be finished. The field test will evaluate the presence or absence of HE at the site. Confirmatory samples will be sent to an off-site laboratory.

X-ray fluorescence will be used to screen in the field where heavy metals are PCOCs. The field test will be performed at the beginning of work activities and at the end of the removal. Confirmatory samples will be sent to an off-site laboratory, as applicable.

As field work progresses, decisions may be made by the Field Team Leader in conjunction with the Field Team Manager to reduce or increase the frequency of field screening. Field testing is for internal purposes only, and therefore, will not be validated. The field screening identified herein is expected to provide adequate information regarding the extent of clean-up and whether the clean-up goals were achieved. Other screening measures may be implemented if additional information is obtained concerning previously unidentified contaminants, or if more appropriate field screening measures are identified.

Samples will be collected for waste characterization by an on-site mobile radiation screening laboratory and mobile chemical screening laboratory. These characterization analyses will provide data for waste management and transportation. Because the mobile labs will have limited capabilities, the samples may be shipped off-site for further analysis.

APPENDIX B

Characterization Strategy Forms

. CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1071/FU1	C-00-036(a-d)	Bandelier NM Borrow Pits

Name: Randy Johnson	**Date:** 5-23-95
FPL: Garry Allen	**WMC:**
Type of Activity: Voluntary Corrective Action (VCA)	

Site Description:

Sites are located southeast of Highway 4 on Bandelier National Monument land. Each of the PRSs is a borrow pit resulting from the improvement and widening of Highway 4. The pits contain construction debris consisting of piles of asphalt, concrete, wire rope, corregated metal pipe (CMP), and other miscellaneous debris such as cans and metal bars. The sites range in size from about 0.1 acre to about 1.3 acre, with each being sparsely vegetated with pine and native grasses.

Investigation or Remediation Waste Description and Volume Estimate:

Construction Debris (pit #1) = 22 yds^3 of industrial waste
Construction Debris (pit #2) = 45 yds^3 of industrial waste
Construction Debris (pit #3) = 40 yds^3 of industrial waste
Construction Debris (pit #4) = 40 yds^3 of industrial waste

If required:
Decontamination water = 200 gallons potentially hazardous waste (4 sites x 50 gallons/site)
PPE = 4 - 55 gallon drum potentially hazardous waste (4 sites x 1 -55 gallon drum/site)

Waste Types: Debris, CMPs, Asphalt, Concrete, Wire Rope, Metal Bars, Metal Rail, Decontamination liquids, PPE
Waste Packaging: Tarped roll-off containers, drums for liquids and PPE (if required)

Characterization Strategy:

Soils will be field screened for radioactivity. Soils will be analyzed for: gross alpha/beta/gamma radioactivity, gamma spectrometry, PCBs, and TCLP metals. PPE and decontamination water (if required) will be characterized based on soil analyses. If required, specific analysis of decontamination water (if used) will be performed.

CHARACTERIZATION STRATEGY FORM (Continued)

OU Number/FU	PRS/SWMU Number	Title
1071/FU1	C-00-036(a-d)	Bandelier NM Borrow Pits

Preliminary RCRA Determination:

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

Soil and debris will be stored in tarped roll-off containers. Decontamination liquids and PPE (if used) will be stored in drums within segregated secondary containment. Waste will be periodically inspected for integrity.

_ 90-Day Storage Requirement (RCRA)
Waste will be stored/handled in accordance with 20 NMAC Section 262.11

Analyte Suite:

Analyte	Acceptable Knowledge		
	Direct Sampling	Present	Absent
Volatile Compounds	_	_	_
Semi-Volatile Compounds	_	_	_
Organochlorine Pesticides and PCBs	X	_	_
Inorganic Compounds	_	_	_
High Explosive Compounds	_	_	_
Gross Alpha	X	_	_
Gross Beta	X	_	_
Gross Gamma	X	_	_
Tritium	_	_	_
Asbestos	_	_	_
TCLP			
Metals	X	_	_
Organics	_	_	_
Pesticides,herbicides, fungicides	_	_	_

Signatures:

ER Waste Management

CST-17

ESH-19 Representative

CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1157/FU5	09-010(a,b)	Waste Container Storage Area

Name: Randy Johnson	**Date:** 5-25-95
FPL: Cheryl Rofer	**WMC:**
Type of Activity: Voluntary Corrective Action (VCA)	

Site Description:

PRS 09-010(a) is three-sided waste container storage structure built in 1961 (structure 9-276), located approximately 54 feet north of the northwest corner of TA-9-48. The structure is 11.5 feet wide by 2.5 feet deep by 6.5 feet tall. It is constructed of four steel pipe posts, anchored in concrete, with a steel-grid floor suspended (welded) on the posts approximately 1 foot above the ground. The structure is sheathed in corregated metal, with four doors opening to the front (south), and is open to the back (north). No secondary containment pan exists below the floor. While the site is on generally level ground, the ground surface immediately behind the structure drops approximately 12 feet at a slope of approximately 2H:1V.

PRS 09-010(b) is a three-side waste container storage structure (structure 9-277), located approximately 45 feet south of the southwest corner of TA-9-45. The structure is approximately 11.5 feet wide by 2.5 feet deep by 6.5 feet tall. It is constructed of four steel pipe posts, anchored in concrete, with a steel grid floor suspended (welded) on the posts approximately 1 foot above the ground. The structure is sheathed on three sides in corregated metal and is open to the front (north). The structure includes a secondary containment pan below the floor. The site is on generally level ground.

Investigation or Remediation Waste Description and Volume Estimate:

Dismantled Storage Structure = 6 yd^3 industrial waste (2 sites x 3 yd^3 each)

Waste Types: Metal structures
Waste Packaging: Tarped roll-off containers

Characterization Strategy:

Structures will be field screened for radioactivity, HE, VOCs, and SVOCs (no contaminants are expected).

CHARACTERIZATION STRATEGY FORM (Continued)

OU Number/FU	PRS/SWMU Number	Title
1157/FU5	09-010(a,b)	Waste Container Storage Area

Preliminary RCRA Determination:

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

The dismantled structures will be placed in tarped roll-off containers.

_ 90-Day Storage Requirement (RCRA)
Waste will be stored/handled in accordance with 20 NMAC Section 262.11

Analyte Suite:

Analyte	Acceptable Knowledge		
	Direct Sampling	Present	Absent
Volatile Compounds	_	_	_
Semi-Volatile Compounds	_	_	_
Organochlorine Pesticides and PCBs	_	_	_
Inorganic Compounds	_	_	_
High Explosive Compounds	_	_	_
Gross Alpha	_	_	_
Gross Beta	_	_	_
Gross Gamma	_	_	_
Tritium	_	_	_
Asbestos	_	_	_
TCLP			
Metals	_	_	_
Organics	_	_	_
Pesticides,herbicides, fungicides	_	_	_

Signatures:

ER Waste Management

CST-17

ESH-19 Representative

APPENDIX C

Framework for Reconsidering or Stopping Work on Expedited Clean-ups and Voluntary Corrective Actions

FRAMEWORK FOR RECONSIDERING OR STOPPING WORK ON EXPEDITED CLEANUPS AND VOLUNTARY CORRECTIVE ACTIONS

During the conduct of expedited cleanups (ECs) or voluntary corrective actions (VCAs), it is important to **preplan** a framework for understanding when the potential release site (PRS) conceptual model is flawed to the extent that continuing an EC or VCA should be **reconsidered**. This determination may not be straight forward and may be complicated by factors that are not readily apparent. While pursuing the EC or VCA is important to the ER project success, we must be careful to ensure that the pursuit of a "bean" does not tempt us to ignore emerging problems during the field work. The Field Project Leader (FPL) should reconsider any time information becomes available that indicates the site conceptual model may be off target. Furthermore, if the additional information warrants, **work should be stopped**.

Several past examples demonstrate the need for reconsideration and stopping criteria:

- Waste type was thought to be solely hazardous, but was in reality "mixed waste".
- Volume of waste was thought to be small , but was, in fact, much larger.
- Spatial boundaries of the site were thought to be defined, but subsequently were found to be much larger.
- Waste was thought to be uncontaminated debris, but upon disposal was determined to be contaminated with radionuclides.

Have we just been unlucky? Probably not. These are classic examples of the old maxim that if something can go wrong, it will. We must, therefore, maximize the opportunity to reconsider or stop work before it becomes a safety hazard, a professional embarrassment, or a bottomless pit for scarce resources, such as budget dollars or site disposal capacity.

If one or more factors change the prevailing site conceptual model, then **reconsider** the consequences of the change(s) and **stop work** if the change warrants it. Consider the following as a framework, **not** as a prescriptive solution to this difficult problem. The examples provided below are **not** intended to be an exhaustive listing of all possible changes, only an indication of changes frequently encountered.

When stopping work is determined to be the appropriate action, it is crucial to have a plan that describes "safe" shutdown for the site EC or VCA operation. "Safe" in this context should consider such things as worker and trespasser safety, safe storage of wastes generated to date, and a shutdown configuration that ensures conditions at the site do not further mobilize contaminants or provide enhanced pathways for off site migration.

POSSIBLE CRITERIA FOR RECONSIDERING AND/OR STOPPING WORK ON ECs/VCAs

1) WASTE - Changes in type, volume, disposal capacity, disposal location, etc.

- If the composition of waste changes and there is limited capacity for the site waste, such as mixed wastes,

- If the volume of waste begins to grow by more than 50%[1] of the initial estimate, or

- If the disposal or treatment capacity for the site waste is not immediately available and would require waste storage for more than 90 days.

Reconsider the consequences of the change(s) and **Stop**, if the change warrants it.

2) COST - Changes in available budget, total cost of project, etc.

- If the budget for site EC or VCA grows by more than 50%[1] of the initial estimate,

- If sites are prioritization similarly, those with increasing costs may go down in project priority due to added costs, as the project would accomplish fewer EC/VCAs, or

- If continuation will affect the program's ability to take action at sites of equal or greater urgency.

Reconsider the consequences of the change(s) and **Stop**, if the change warrants it.

3) LEVEL OF PROBLEM UNDERSTANDING - Changes in contamination type or level, job difficulty, etc.

- If the waste constituents change and impact the selected treatment/disposal alternatives,

- If the extent of contaminant movement or the contaminant transport mechanism affects the overall job difficulty, or

---

[1] Initial estimates of engineering costs are typically only good within a range of + or - 50%. The relationship of waste management volume to waste management cost is usually linear, so that if volume increases 50% then so do costs.

- If the impact of continuing the action creates a greater problem (e.g., regulatory, public relations, ecological, etc.) than stopping work.

Reconsider the consequences of the change(s) and **Stop**, if the change warrants it.

4) RESOURCES - Changes in knowledge, expertise, equipment, services, etc.

- If new or additional site data causes the site problem to change from understood/ documented historical site data,

- If the remediation equipment needed for the changed site problem is unavailable,

- If the expertise of available staff does not match the changed site problem, or

- If the sensitivity or analytical detection limits of available analytical methods for the changed site problem does not meet the revised site cleanup requirements.

Reconsider the consequences of the change(s) and **Stop**, if the change warrants it.

5) SAFETY - Changes in engineering plan or risk to remedial site worker, LANL worker, or off-site citizen, etc.

- If additional site findings suggest a new or greatly increased risk of an acute or chronic nature to remedial site worker, LANL worker, or off-site citizen,

- If a change to the remedial engineering plan, such as the depth of excavation, differs from the site safety plan, or

- If getting a "bean" by end of the fiscal year appears to compromise safety.

Reconsider the consequences of the continued action(s) and **Stop**, if the finding warrants it.

6) "LAUGH" TEST - Question the appropriateness of what is being done.

- If you doubt that your actions are consistent with common sense, or

- If you think you are being asked to do something stupid, but in a smarter way.

Reconsider the consequences of the continued action(s) and **Stop**, if the finding warrants it.

APPENDIX D

Sampling Information

Los Alamos
NATIONAL LABORATORY

memorandum

Engineering Sciences and Applications Division
ESA-EPE Energy & Process Engineering

To/MS: Gary Tucker, I.C.F. Kaiser
From/MS: Danny A. Martinez, ESA-EPE, MS G736
Phone/FAX: 7-4060/FAX 7-0600
Symbol: ESA-EPE:95
Date: May 5, 1995

SUBJECT: VCA Sample Results

A summary of the data for VCA's 09-010(a), 09-010(b), and 09-011(c) has been generated. Please note that there were no detects above SAL's.

Site 09-011(b) had only HE data. It showed no detects.

cy: ESA-EPE File

09-010(a) Soil Detects

Location ID	Depth of Sample	Sample ID	Analyte	Results	Units	SAL
09-4020	0.5 - 1.0 ft.	AAB0828	Trichloro-1,2,2-trifluoroethane [1,1,2-]	0.011 (J)	MG/KG	n/a
			Trichloroethene	0.006	MG/KG	3.2
09-4021	0.5 - 1.0 ft	AAB0830	Trichloro-1,2,2-trifluoroethane [1,1,2-]	0.011 (J)	MG/KG	n/a
n/a Not available.						

09-010(b) Soil Detects

Location ID	Depth of Sample	Sample ID	Analyte	Results	Units	SAL
09-4030	0.5 - 1.0 ft.	AAB0832	Trichloro-1,2,2-trifluoroethane [1,1,2-]	.025 (J)	MG/KG	n/a
09-4031	0.5 - 1.0 ft.	AAB0834	Methylene chloride	0.027	MG/KG	5.6
09-4032	0.5 - 1.0 ft.	AAB0836	Methylene chloride	0.021	MG/KG	5.6
		AAB0836	Trichloro-1,2,2-trifluoroethane [1,1,2-]	0.018 (J)	MG/KG	n/a
09-4033	0.5 - 1.0 ft.	AAB0838	Trichloro-1,2,2-trifluoroethane [1,1,2-]	0.028 (J)	MG/KG	n/a
09-4034	0.5 - 1.0 ft.	AAB0840	Trichloro-1,2,2-trifluoroethane [1,1,2-]	0.035 (J)	MG/KG	n/a
09-4035	0.5 - 1.0 ft.	AAB0842	Methylene chloride	0.006	MG/KG	5.6
		AAB0842	Trichloro-1,2,2-trifluoroethane [1,1,2-]	0.051	MG/KG	n/a
09-4036	0.5 - 1.0 ft.	AAB0844	Trichloro-1,2,2-trifluoroethane [1,1,2-]	0.087	MG/KG	n/a
		AAB0844	Trichloroethane [1,1,1-]	0.059	MG/KG	1000
		AAB0844	Trichloroethene	0.12	MG/KG	3.2
09-4037	0.0 - 0.5 ft.	AAB0845	Bis(2-ethylhexyl)phthalate	2.7	MG/KG	50
09-4037	0.5 - 1.0 ft.	AAB0846	Trichloro-1,2,2-trifluoroethane [1,1,2-]	0.026 (J)	MG/KG	n/a
n/a Not available.						

APPENDIX E

Methodologies for Developing Site-Specific Preliminary Remedial Goals to Demonstrate Clean Closure

Methodologies for Developing Site-Specific Preliminary Remedial Goals to Demonstrate Clean Closure

1.0 APPROACH

Site-specific risk-based clean-up levels were calculated for PRSs at Bandelier National Monument (BNM). There are no analytical data for the PRSs at these sites with which to identify specific COCs. Thus, suspected COCs are based on existing information on site activities. The PRSs at BNM were originally excavated as borrow areas for the improvement of State Route 4 in the 1950's. Much of the waste identified appears to be construction debris and modern cultural materials (i.e. cans, bottles, etc.) While it is likely that nothing will be identified as a concern at these sites, risk-based clean-up levels for PCOCs are provided as guidance. The most health conservative chemical for each analytical suite was selected as an indicator for developing the site-specific preliminary clean-up levels. Indicator chemicals for BNM PRSs are presented in Table E-1.

Table E-1, Indicator Chemicals for Bandelier National Monument

Analytical Suite	Indicator Chemicals
Polycyclic Aromatic Hydrocarbons	Benzo(a)pyrene
Metals	Lead

2.0 Preliminary Remedial Goals

2.1 Chemicals other than Lead

Site-specific clean-up levels were calculated using modified EPA equations and site-specific input parameters. The clean-up levels for PRSs at BNM will be based on a reasonable maximum exposed individual (an adult for carcinogens and a child for noncarcinogens) under a recreational land use scenario.

For the EPA recreational land use scenario, risk due to exposure to chemicals in soil is assumed to be the result of direct ingestion, inhalation of particulates from the soil, and dermal exposure. For carcinogens, it is assumed that exposure occurs over a lifetime (70 years) and affects a 70 kg adult, while noncarcinogens are assumed to exert a greater effect on a 15 kg child. The exposure parameters are adjusted accordingly to calculate soil clean-up levels based on carcinogenic risk or noncarcinogenic health hazard. In the cases where carcinogenic and noncarcinogenic effects are both likely for a particular chemical, the most conservative calculated clean-up goal will be used.

Calculations of PRGs are consistent with Risk Assessment Guidance for Superfund (RAGS), Part B (EPA 1991), but also consider updates to the RAGS, Part B, equations (EPA 1994). The PRGs were developed using the most current sources of EPA-approved toxicity criteria, such as the Integrated Risk Information System (IRIS), the Health Effects Assessment Summary Table (HEAST), and the Environmental Criteria and Assessment Office (ECAO). When toxicity criteria were available for only one route of exposure (i.e., either inhalation or oral) for a particular

chemical, this value was used as the surrogate toxicity criteria for the missing route-specific toxicity criteria.

Equations 1 and 2 were used to calculate PRGs for carcinogenic and noncarcinogenic chemicals, respectively, under the recreational exposure scenario. The methodology is used to backcalculate a soil concentration for carcinogens from a target cancer risk value of 10^{-6} (i.e., 1 in 1,000,000) for recreational exposures. Clean-up levels for noncarcinogen chemicals are backcalculated for a reasonably exposed child from a target hazard quotient of 1. The equations for soil combine across pathways for direct exposure (i.e., ingestion, skin contact, and inhalation).

The cancer slope factor and reference dose (RfD) for dermal exposure are calculated in Equations 3 and 4, respectively. Table E-2, Spreadsheet for Calculating PRGs for Recreational Soil Exposures, provides chemical-specific input parameters and calculated site-specific PRGs for the COCs.

Equation 1: Direct Exposures to Carcinogenic Constituents in Recreational Camper Soil

$$C(mg/kg) = \frac{TR \times BW_a \times AT_c \times 365 d/y}{EF_o \times ED_o \left[\frac{IRS_o \times CSF_o}{10^6\ mg/kg} + \frac{SA_a \times CSF_d \times AF \times ABS}{10^6\ mg/kg} + IRA_a \times CSF_i \times \left(\frac{1}{VF_s} + \frac{1}{PEF} \right) \right]}$$

Where:

C(mg/kg) = Preliminary remedial goal for soil based on exposure to carcinogenic constituents (mg/kg)

TR = Target cancer risk (unitless)
Considered to be 1×10^{-6}

BW_a = Body Weight, adult (kg)
Considered to be 70 kg (EPA 1991a)

AT_c = Averaging Time - cancer (years)
Considered to be 70 years (EPA 1991a)

EF_o = Exposure Frequency - recreational camper (d/y)
Considered to be 28 d/y (LANL 1993)

ED_o = Exposure Duration - recreational camper (years)
Considered to be 20 years (LANL 1993)

IRS_o = Soil Ingestion - occupational (mg/day)
Considered to be 100 mg/day (LANL 1993)

CSF_o = Cancer slope factor-oral $(mg/kg\text{-}d)^{-1}$ (IRIS, HEAST, or ECAO)

SA_a = Surface area, adult (cm^2)
Considered to be 5000 cm^2 (EPA 1992)

CSF_d = Cancer slope factor-dermal $(mg/kg\text{-}d)^{-1}$
(See Equation 3)

AF = Adherence factor (mg/cm^2)
Considered to be 0.2 mg/cm^2 (EPA 1992)

ABS = Skin absorption
Considered to be 0.1 for organics (EPA 1994)
Considered to be 0.01 for inorganics (EPA 1994)

IRA_a = Inhalation rate - adult (m^3/day)
Considered to be 20 m^3/day (EPA 1991a)

CSF_i = Cancer slope factor-inhalation $(mg/kg\text{-}d)^{-1}$ (IRIS, HEAST, or ECAO)

VF_s = Volatilization factor for soil (m^3/kg)
(See Equation 5)

PEF = Particulate emission factor (m^3/kg)
Considered to be $1.32 \times 10^{+9}$ (m^3/kg) (EPA 1994)

Equation 2: Direct Exposures to Noncarcinogenic Constituents in Recreational Camper Soil

$$C(mg/kg) = \frac{THQ \times BW_a \times ED_o \times 365\ d/y}{EF_o \times ED_o \cdot [\frac{1}{RfD_o} \times \frac{IRS_o}{10^6 mg/kg} + \frac{1}{RfD_d} \times \frac{SA_a \times AF \times ABS}{10^6 mg/kg} + \frac{1}{RfD_i} \times (\frac{IRA_a}{VF_s} + \frac{IRA_a}{PEF})]}$$

Where:

C(mg/kg) = Preliminary remedial goal for soil based on exposure to noncarcinogenic constituents (mg/kg)

THQ = Target hazard quotient (unitless)
Considered to be 1

BW_a = Body weight, child (kg)
Considered to be 15 kg (EPA 1991a)

ED_o = Exposure duration - recreational camper (years)
Considered to be 6 years (EPA 1991a)

EF_o = Exposure Frequency - recreational camper (d/y)
Considered to be 28 d/y (LANL 1993)

RfD_o = Reference dose-oral (mg/kg-d) (IRIS, HEAST, or ECAO)

IRS_o = Soil ingestion - occupational (mg/day)
Considered to be 200 mg/day (EPA 1991a)

RfD_d = Reference dose-dermal (mg/kg-d) (IRIS, HEAST, or ECAO)
(See Equation 4)

SA_a = Surface area, child (cm^2)
Considered to be 2000 cm^2 (EPA 1992)

AF = Adherence factor (mg/cm^2)
Considered to be 0.2 mg/cm^2 (EPA 1992)

ABS = Skin absorption
Considered to be 0.1 for organics (EPA 1994)
Considered to be 0.01 for inorganics (EPA 1994)

RfD_i = Reference dose inhalation (mg/kg-d) (IRIS, HEAST, or ECAO)

IRA_a = Inhalation rate - child (m^3/day)
Considered to be 10 m^3/day (EPA 1991a)

VF_s = Volatilization factor for soil (m^3/kg)
(See Equation 5)

PEF = Particulate emission factor (m^3/kg)
Considered to be 1.32 x 10^{+9} (m^3/kg) (EPA 1994)

Equation 3: Dermal Cancer-Slope Factor (CSFd) Based Upon Absorbed Dose

Cancer slope factors based upon administered doses will be adjusted for absorption to obtain estimates of potential dermal cancer-slope factors (1992). Where absorption factors and oral cancer slope factors are available, dermal cancer-slope factors will be calculated using the following equation:

$$CSF_{absorbed} = \frac{CSF_{administered}}{A_{bs}}$$

Where:

$CSF_{absorbed}$	=	cancer-slope factor based on absorbed dose
$CSF_{administered}$	=	oral cancer-slope factor
A_{bs}	=	oral absorption factor

Equation 4: Dermal Reference Dose (RfDd) Based Upon Absorbed Dose

Reference doses based upon administered doses will be adjusted for absorption to obtain estimates of potential dermal reference doses (1992). Where absorption factors and oral reference doses are available, dermal reference doses will be calculated using the following equation:

$$RfD_{absorbed} = RfD_{administered} \times A_{bs}$$

Where:

$RfD_{absorbed}$	=	reference dose based on absorbed dose
$RfD_{administered}$	=	oral reference dose
A_{bs}	=	oral absorption factor

Table E-5, Spreadsheet for Calculating PRGs for Recreational Soil Exposure

Chemical	Reference Dose (RfD) (mg/kg/day)	Oral Absorption Factor	Dermal RfD (mg/kg/day)	Oral Slope Factor $(mg/kg/day)^{-1}$	Dermal Slope Factor $(mg/kg/day)^{-1}$	Inhalation RfD (mg/kg/day)	Inhalation Slope Factor $(mg/kg/day)^{-1}$	Recreational Soil Scenario (mg/kg)		
								Noncancer PRG	Cancer PRG	PRG (Lower of two)
Benzo(a)pyrene	-	1	-	7.3E+00	7.3E+00	-	7.3E+00	-	2.2E+00	2.2E+00
Lead	See Section 2.2, Appendix E							1.6E+03	-	1.6E+03

2.2 Lead

2.2.1 Exposure

EPA has not derived CSFs or RfDs for evaluating the toxicity of lead or lead compounds. Previously, EPA had considered the concentration range of 500 to 1,000 mg/kg lead in soil to be acceptable as an interim clean-up level for residential sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, EPA 1992). This interim clean-up level was proposed in a Center of Disease Control document (CDC 1985) on lead poisoning in children, as children and fetuses are considered the most sensitive receptors for lead's toxic endpoints. More current EPA (1994) guidance has suggested a lead concentration in soil of 400 mg/kg as the threshold screening level. However, EPA has recommended replacing the 500 to 1000 mg/kg clean-up range, and the 400 mg/kg threshold level for residential sites with levels derived by its Integrated Exposure Uptake Biokinetic (IEUBK) Model (Version 09.99d).

2.2.2 Recreational Scenario Clean-up Level

Since the land use scenario for sites at BNM is recreational, EPA's IEUBK Model was used to estimate a lead soil clean-up level. The IEUBK Model estimates lead uptake and resultant blood lead concentrations in children which are the most sensitive receptors for this land use. The output from the IEUBK Model is presented on the next four pages.

A blood lead concentration of 10 µg/dl is the target blood lead level for exposure to lead in the environment, regardless of the source. Sources include drinking water, grocery store food products, incidental soil ingestion, and the air. Therefore, the calculation of a soil lead clean-up level for a recreational exposure scenario includes the contribution to blood lead levels from non-site sources.

A conservative soil lead clean-up level of 1600 ppm was calculated. The soil lead clean-up level includes the contribution to blood lead levels from non-site sources as well as on-site soil contact, soil ingestion and was calculated not to exceed the target level of 10 µg/dl. The model default values for air concentration (0.1 $\mu g/m^3$) and for drinking water (4 µg/dl) were used. Soil and dust exposures were calculated based on a background upper threshold level (UTL) of 37 µg/g lead in Los Alamos. Recreational intake of lead at the Bandelier sites was estimated using default intake parameters (e.g., hours exposure, amount of soil ingested, etc.) presented in Appendix K of the Installation Work Plan (IWP). The following equation was used to calculate recreational intake of lead by incidental soil ingestion:

$$\text{Intake } (\mu g/day) = \frac{CS \times IR \times ED \times EF \times 10^{-6}\ kg/mg \times 1000\ \mu g/mg}{24\ hr/d \times 365\ d/yr}$$

Where:

CS = lead concentration in soil
IR = ingestion rate (200 mg/day)
ED = exposure duration (2 hr/day)
ER = exposure frequency (170 days/yr)

Lead intake from engaging in on-site recreational activities, calculated to be 12.4 µg/day, was added to lead intake from non-site sources to estimate a total lead intake. The model determined a mean blood lead level of 3.8 µg/day from non-site sources with only a 1.99% probability that the total blood lead level would exceed the target level of 10 µg/day. This is well below the recommended 5% probability.

LEAD MODEL Version 0.99d

AIR CONCENTRATION: 0.100 ug Pb/m3 DEFAULT
Indoor AIR Pb Conc: 30.0 percent of outdoor.
Other AIR Parameters:

Age	Time Outdoors (hr)	Vent. Rate (m3/day)	Lung Abs. (%)
0-1	1.0	2.0	32.0
1-2	2.0	3.0	32.0
2-3	3.0	5.0	32.0
3-4	4.0	5.0	32.0
4-5	4.0	5.0	32.0
5-6	4.0	7.0	32.0
6-7	4.0	7.0	32.0

DIET: DEFAULT

DRINKING WATER Conc: 4.00 ug Pb/L DEFAULT
WATER Consumption: DEFAULT

SOIL & DUST:
Soil: constant conc.
Dust: constant conc.

Age	Soil (ug Pb/g)	House Dust (ug Pb/g)
0-1	37.0	200.0
1-2	37.0	200.0
2-3	37.0	200.0
3-4	37.0	200.0
4-5	37.0	200.0
5-6	37.0	200.0
6-7	37.0	200.0

Additional Dust Sources: None DEFAULT

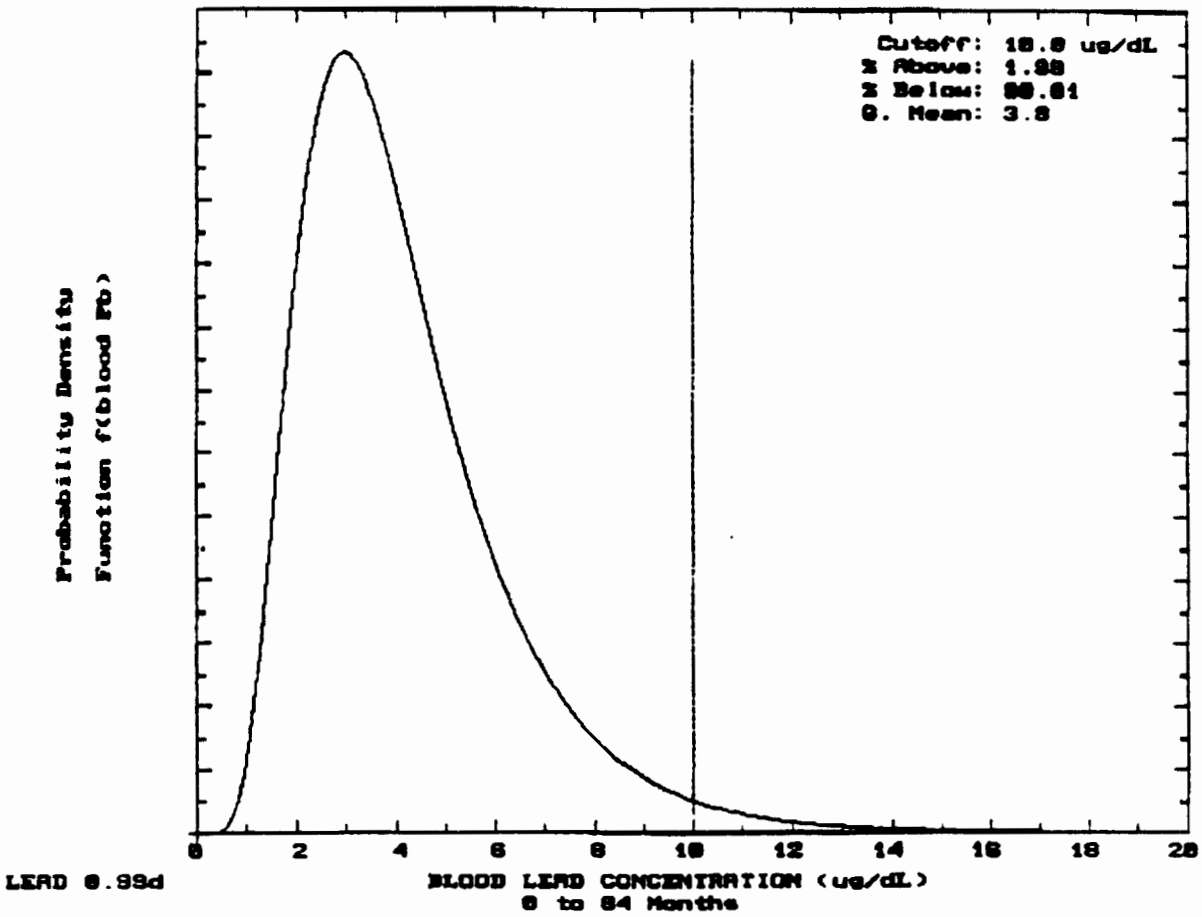
Recreational Intake: varied by year as follows:
0-1: 0.00 ug Pb/day
1-2: 12.40 ug Pb/day
2-3: 12.40 ug Pb/day
3-4: 12.40 ug Pb/day
4-5: 12.40 ug Pb/day
5-6: 12.40 ug Pb/day
6-7: 12.40 ug Pb/day

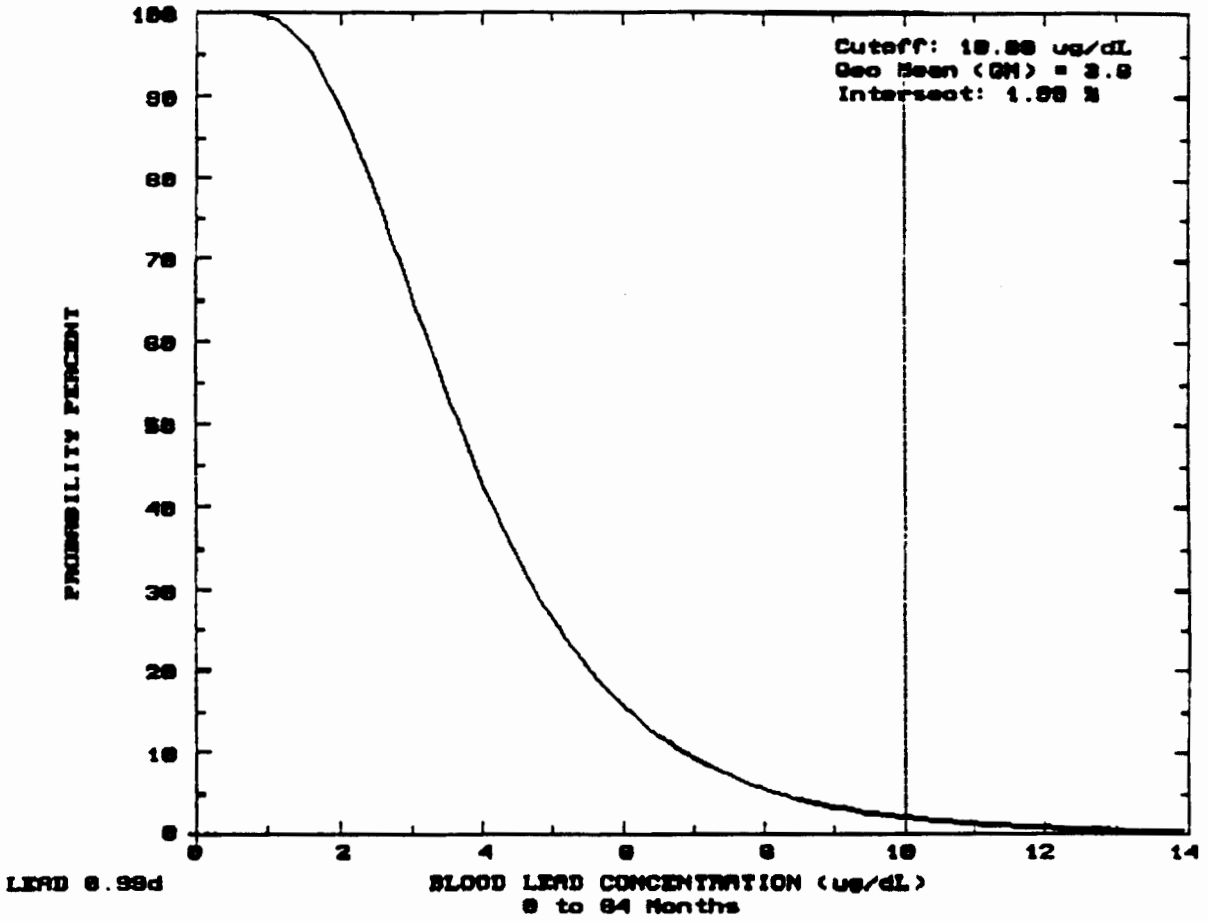
MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

CALCULATED BLOOD Pb and Pb UPTAKES:

YEAR	Blood Level (ug/dL)	Total Uptake (ug/day)	Soil+Dust Uptake (ug/day)
0.5-1:	3.3	5.99	3.02
1-2:	4.6	11.54	4.63
2-3:	4.5	12.07	4.69
3-4:	4.2	12.13	4.75
4-5:	3.8	11.01	3.58
5-6:	3.4	10.97	3.24
6-7:	3.2	11.16	3.07

YEAR	Diet Uptake (ug/day)	Water Uptake (ug/day)	Rec. Uptake (ug/day)	Air Uptake (ug/day)
0.5-1:	2.58	0.37	0.00	0.02
1-2:	2.61	0.90	3.36	0.03
2-3:	2.97	0.95	3.40	0.06
3-4:	2.89	0.98	3.44	0.07
4-5:	2.83	1.04	3.50	0.07
5-6:	3.01	1.10	3.53	0.09
6-7:	3.33	1.12	3.54	0.09


Cutoff: 10.0 ug/dL
% Above: 1.98
% Below: 98.01
G. Mean: 3.8
Probability Density
Function f(blood Pb)
0
2
4
6
8
10
12
14
16
18
20
LEAD 0.99d
BLOOD LEAD CONCENTRATION (ug/dL)
0 to 84 Months


Cutoff: 10.00 ug/dL
Geo Mean (GM) = 3.8
Intersect: 1.00 %
PROBABILITY PERCENT
100
90
80
70
60
50
40
30
20
10
0
0
2
4
6
8
10
12
14
LEAD 6.99d
BLOOD LEAD CONCENTRATION (ug/dL)
0 to 64 Months

APPENDIX F

Approach to Using Site-Specific Indicator Chemical PRGS

Approach to Using Site-Specific Indicator Chemical PRGS

1.0 MULTIPLE CHEMICAL PRG ANALYSIS

Following clean-up operations, confirmatory sampling and analysis will be conducted for specific COCs (when identified) or suspected suites of chemicals, when indicator PRGs are used. For sites where analytical data are not available, clean-up will be based on indicator PRG levels. Site-specific indicator chemical PRGs are used when analytical data are not available for a site. Existing information on site activities is used to identify suspected chemicals of concern. Indicator PRGs are the most health conservative predictor of single-contaminant risk for each suite of chemicals (e.g., inorganics, organic high explosives, polycyclic aromatic hydrocarbons, semivolatiles, and volatiles).

If confirmatory sample concentrations are below their indicator PRG levels for all chemicals within a suite, the site will be considered to meet clean-up criteria. If confirmatory sample concentrations within a suite of chemicals are above the indicator PRG level for that suite, sample concentrations will be compared to background upper tolerance levels (UTLs). If sample concentrations are below their respective background UTLs, the site will be considered to meet clean-up criteria. Should sample concentrations exceed their respective background UTLs, chemical-specific PRGs will be developed for those chemicals.

A multiple chemical PRG risk analysis will be conducted for exposure to residual radioactivity, carcinogenic risk, and noncarcinogenic health hazard when two or more confirmatory chemical concentrations are at or below their respective PRGs within one or more or the aforementioned groups. Non-radioactive chemicals with both carcinogenic and noncarcinogenic toxicity criteria will be included in both the carcinogen and noncarcinogen groups. The multiple chemical PRG risk analysis will be estimated by summing the fractional contribution (i.e., site-specific concentration/PRG) of each chemical. The site-specific concentration will be based on the maximum or 95% upper confidence level (UCL) of the arithmetic mean. For exposure to residual radioactivity, the fractional contribution of each will be summed and multiplied by the 15 mrem/yr target exposure level:

$$\textit{Multiple PRG ExposureLevel} = [(conc_x/PRG_x) + (conc_y/PRG_y) + (conc_z/PRG_z)] \times 15 \text{ mrem/yr}$$

If the multiple PRG risk is at or below the target exposure level of 15 mrem/yr, then the site will be considered to meet clean-up criteria for exposure to residual radioactivity.

For cancer risk estimates, the fractional contribution of each will be summed and multiplied by 10^{-4} target cancer risk:

$$\textit{Multiple PRG Risk} = [(conc_x/PRG_x) + (conc_y/PRG_y) + (conc_z/PRG_z)] \times 10^{-4}$$

If the multiple PRG risk is at or below the target value of 10^{-4}, then the site will be considered to meet clean-up criteria for carcinogenic risk.

For noncancer hazard estimates, the fractional contribution of each will be summed and compared with a target hazard index of 1:

$$\textit{PRG Hazard Index} = [(conc_x/PRG_x) + (conc_y/PRG_y) + (conc_z/PRG_z)]$$

If the PRG hazard index is at or below the target hazard index of 1, then the site will be considered to meet clean-up criteria for noncarcinogenic risk.

If the multiple PRG risk analysis for radionuclides, non-radioactive carcinogens, or noncarcinogens exceeds target values, further clean-up or characterization of the site may be warranted.

1.1 Concentration Term

The maximum detected concentration will be used in the initial PRG risk analysis and multiple PRG risk analysis. Use of the maximum detected concentration provides the worst case analysis and is not considered to be representative of actual exposure concentrations. If maximum concentrations are at or below their respective PRG levels and multiple PRG risk analysis target levels are not exceeded, the site will be considered to meet clean-up criteria. If, however, use of maximum concentrations results in exceeding the target levels, a 95% UCL of the arithmetic mean will be calculated and used in the PRG analysis and multiple PRG risk analysis. The 95% UCL of the mean provides a conservative estimate of the mean concentration and accounts for uncertainties due to limited sampling. If possible, the 95% UCL of the mean will be calculated using sample concentration data gathered over the entire exposure unit for the industrial site. For exposure areas with limited data or extreme variability in the measured data, the 95% UCL of the mean may be greater than the maximum concentration. If this occurs, the maximum concentration will be used as the concentration term.

APPENDIX G

Cost Estimate Detailed Summary

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites C-00-36A: Borrow Pit No. 1									
36A101	EXCAVATION PERMITS	1 LS					500		500
36A102	HIGHWAY HAULING PERMIT	1 LS					250		250
36A103	UTILITY LOCATION/RELOCATION PERMIT	1 LS							
36A201	SECURITY ESCORT FOR SITE WORK	3 DAY					1,500		1,500
	Unit Costs:						500.000		500.000
36A202	MEDICAL EXAMINATIONS OF WORKMEN	1 LS					375		375
36A203	HAZWOPER 40 HR. TRAINING	1 LS					1,500		1,500
36A204	RAD II TRAINING FOR EACH WORKMAN	1 LS					1,500		1,500
36A301	E S H Supplies and Expenses	1 LS					1,124		1,124
36A501	Bandelier National Monument	22 CY	86	2,227	225	375	3,162		5,988
	Unit Costs:		3.916	101.223	10.227	17.024	143.723		272.198
36A502	SUBCONTRACTOR DECON OPERATION	1 LS	20	509	90	67	588		1,254
36A601	Charaterization Lab Analysis	1 LS					3,000		3,000
36A602	Confirmatory Lab Analysis	1 LS					3,000		3,000
36A603	ASBESTOS SAMPLES	1 LS							
36A604	FIELD SCREENING SAMPLES	1 LS					2,500		2,500
36A605	Decon Water Sample Analysis	1 LS					3,000		3,000
36A701	WORK REPORTS,DAILY,WEEKLY,MONTHLY	1 LS							
	Subtotal, Borrow Pit No. 1		106	2,736	315	442	21,998		25,491
	Takeoff Units:	22 CY	4.833	124.367	14.318	20.071	999.927		1,158.683
	Adjusted to Bid Quantity:	22 CY	106	2,736	315	442	21,998		25,491
	Unit Costs:		4.818	124.364	14.318	20.091	999.909		1,158.682

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites C-00-36B: Borrow Pit No. 2									
36B101	EXCAVATION PERMITS	1 LS					500		500
36B102	HIGHWAY HAULING PERMIT	1 LS					250		250
36B103	UTILITY LOCATION/RELOCATION PERMIT	1 LS							
36B201	SECURITY ESCORT FOR SITE WORK	6.500 DAY					3,250		3,250
	Unit Costs:						500.000		500.000
36B202	MEDICAL EXAMINATIONS OF WORKMEN	1 LS					375		375
36B203	HAZWOPER 40 HR. TRAINING	1 LS					1,500		1,500
36B204	RAD II TRAINING FOR EACH WORKMAN	1 LS					1,500		1,500
36B301	E S H Supplies and Expenses	1 LS					2,692		2,692
36B501	Bandelier National Monument	45 CY	234	6,037	375	1,459	7,047		14,918
	Unit Costs:		5.204	134.151	8.333	32.426	156.609		331.520
36B502	SUBCONTRACTOR DECON OPERATION	1 LS	20	509	90	67	588		1,254
36B601	Characterization Lab Analysis	1 LS					3,000		3,000
36B602	Confirmatory Lab Analysis	1 LS					3,000		3,000
36B603	ASBESTOS SAMPLES	1 LS							
36B604	FIELD SCREENING SAMPLES	1 LS					2,500		2,500
36B605	Decon Water Sample Analysis	1 LS					3,000		3,000
36B701	WORK REPORTS,DAILY,WEEKLY,MONTHLY	1 LS							
	Subtotal, Borrow Pit No. 2		254	6,546	465	1,526	29,203		37,740
	Takeoff Units:	45 CY	5.652	145.466	10.333	33.916	648.949		838.664
	Adjusted to Bid Quantity:	45 CY	254	6,546	465	1,526	29,203		37,740
	Unit Costs:		5.644	145.467	10.333	33.911	648.956		838.667

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites C-00-36C: Borrow Pit No. 3									
36C101	EXCAVATION PERMITS	1 LS					500		500
36C102	HIGHWAY HAULING PERMIT	1 LS					250		250
36C103	UTILITY LOCATION/RELOCATION PERMIT	1 LS							
36C201	SECURITY ESCORT FOR SITE WORK	6.250 DAY					3,125		3,125
	Unit Costs:						500.000		500.000
36C202	MEDICAL EXAMINATIONS OF WORKMEN	1 LS					375		375
36C203	HAZWOPER 40 HR. TRAINING	1 LS					1,500		1,500
36C204	RAD II TRAINING FOR EACH WORKMAN	1 LS					1,500		1,500
36C301	E S H Supplies and Expenses	1 LS					2,608		2,608
36C501	Bandelier National Monument	40 CY	226	5,825	375	1,352	6,578		14,130
	Unit Costs:		5.654	145.616	9.375	33.805	164.458		353.253
36C502	SUBCONTRACTOR DECON OPERATION	1 LS	20	509	90	67	588		1,254
36C601	Characterization Lab Analysis	1 LS					3,000		3,000
36C602	Confirmatory Lab Analysis	1 LS					3,000		3,000
36C603	ASBESTOS SAMPLES	1 LS							
36C604	FIELD SCREENING SAMPLES	1 LS					2,500		2,500
36C605	Decon Water Sample Analysis	1 LS					3,000		3,000
36C701	WORK REPORTS,DAILY,WEEKLY,MONTHLY	1 LS							
	Subtotal, Borrow Pit No. 3		246	6,334	465	1,419	28,524		36,742
	Takeoff Units:	40 CY	6.158	158.345	11.625	35.480	713.094		918.545
	Adjusted to Bid Quantity:	40 CY	246	6,334	465	1,419	28,524		36,742
	Unit Costs:		6.150	158.350	11.625	35.475	713.100		918.550

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites C-00-36D: Borrow Pit No. 4									
36D101	EXCAVATION PERMITS	1 LS					500		500
36D102	HIGHWAY HAULING PERMIT	1 LS					250		250
36D103	UTILITY LOCATION/RELOCATION PERMIT	1 LS							
36D201	SECURITY ESCORT FOR SITE WORK	5 DAY					2,500		2,500
	Unit Costs:						500.000		500.000
36D202	MEDICAL EXAMINATIONS OF WORKMEN	1 LS					375		375
36D203	HAZWOPER 40 HR. TRAINING	1 LS					1,500		1,500
36D204	RAD II TRAINING FOR EACH WORKMAN	1 LS					1,500		1,500
36D301	E S H Supplies and Expenses	1 LS					2,099		2,099
36D501	Bandelier National Monument	40 CY	178	4,587	225	1,087	6,195		12,094
	Unit Costs:		4.454	114.664	5.625	27.170	154.881		302.340
36D502	SUBCONTRACTOR DECON OPERATION	1 LS	20	509	90	67	588		1,254
36D601	Characterization Lab Analysis	1 LS					3,000		3,000
36D602	Confirmatory Lab Analysis	1 LS					3,000		3,000
36D603	ASBESTOS SAMPLES	1 LS							
36D604	FIELD SCREENING SAMPLES	1 LS					2,500		2,500
36D605	Decon Water Sample Analysis	1 LS					3,000		3,000
36D701	WORK REPORTS,DAILY,WEEKLY,MONTHLY	1 LS							
	Subtotal, Borrow Pit No. 4		198	5,096	315	1,154	27,007		33,571
	Takeoff Units:	10 CY	19.832	509.571	31.500	115.384	2,700.691		3,357.146
	Adjusted to Bid Quantity:	10 CY	198	5,096	315	1,154	27,007		33,572
	Unit Costs:		19.800	509.600	31.500	115.400	2,700.700		3,357.200

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites 09-010-A: Cantainer Storage									
10A201	SECURITY ESCORT AS REQUIRED	3 DAY					1,500		1,500
	Unit Costs:						500.000		500.000
10A202	MEDICAL EXAMINATIONS OF WORKMEN	1 LS					375		375
10A203	HAZWOPER 40 HR. TRAINING	1 LS					1,500		1,500
10A204	RAD II TRAINING FOR EACH WORKMAN	1 LS					1,500		1,500
10A301	E S H Supplies and Expenses	1 LS					447		447
10A401	WASTE STORAGE AND MONITORING	1 LS	45	1,054		29	102		1,186
10A501	Cantainer Storage Demolition	3 CY	42	993	955	115	352		2,414
	Unit Costs:		13.860	330.929	318.189	38.395	117.313		804.826
10A601	Charaterization Lab Analysis	1 LS					3,000		3,000
10A602	Confirmatory Lab Analysis	1 LS					3,000		3,000
10A603	ASBESTOS SAMPLES	1 LS							
10A604	FIELD SCREENING SAMPLES	1 LS					1,250		1,250
10A701	WORK REPORTS,DAILY,WEEKLY,MONTHLY	1 LS							
	Subtotal, Cantainer Storage		87	2,047	955	145	13,026		16,172
	Takeoff Units:	8 CY	10.868	255.896	119.321	18.073	1,628.265		2,021.555
	Adjusted to Bid Quantity:	8 CY	87	2,047	955	145	13,026		16,173
	Unit Costs:		10.875	255.875	119.375	18.125	1,628.250		2,021.625

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites 09-010-B: Cantainer Storage									
10B201	SECURITY ESCORT FOR SITE WORK	4 DAY					2,000		2,000
	Unit Costs:						500.000		500.000
10B202	MEDICAL EXAMINATIONS OF WORKMEN	1 LS					375		375
10B203	HAZWOPER 40 HR. TRAINING	1 LS					1,500		1,500
10B204	RAD II TRAINING FOR EACH WORKMAN	1 LS					1,500		1,500
10B301	E S H Supplies and Expenses	1 LS					703		703
10B401	WASTE STORAGE AND MONITORING	1 LS	45	1,054		29	102		1,186
10B501	Cantainer Storage Replacement	3 CY	66	1,547	6,258	211	468		8,484
	Unit Costs:		21.840	515.522	2,085.906	70.355	156.052		2,827.835
10B601	Characterization Lab Analysis	1 LS					3,000		3,000
10B602	Confirmatory Lab Analysis	1 LS					3,000		3,000
10B603	ASBESTOS SAMPLES	1 LS							
10B604	FIELD SCREENING SAMPLES	1 LS					1,250		1,250
10B701	WORK REPORTS,DAILY,WEEKLY,MONTHLY	1 LS							
	Subtotal, Cantainer Storage		111	2,601	6,258	240	13,898		22,997
	Takeoff Units:	13 CY	8.529	200.073	481.363	18.497	1,069.072		1,769.005
	Adjusted to Bid Quantity:	13 CY	111	2,601	6,258	240	13,898		22,997
	Unit Costs:		8.538	200.077	481.385	18.462	1,069.077		1,769.000