LIBRARY COPY

LOS ALAMOS NATIONAL LABORATORY
Voluntary Corrective Action Plans for Potential Release Sites, Group 2

Sites under Field Unit 1 at TA-21, DP Area:
21-002(b), Container Storage Area
21-013(c), Surface Disposal Area
21-013(e), Surface Disposal Area

Sites under Field Unit 1 at TA-31, East Receiving Yard:
31-001, Septic System Outfall

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

ICF KAISER

10196

T2

LOS ALAMOS NATIONAL LABORATORY
Voluntary Corrective Action Plans for Potential Release Sites, Group 2

Sites under Field Unit 1 at TA-21, DP Area:
21-002(b), Container Storage Area
21-013(c), Surface Disposal Area
21-013(e), Surface Disposal Area

Sites under Field Unit 1 at TA-31, East Receiving Yard:
31-001, Septic System Outfall

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

Table of Contents

		Page
1.0	INTRODUCTION	1
	1.1 PRS 21-002(b)	1
	1.2 PRSs 21-013(c) and 21-013(e)	1
	1.3 PRS 31-001	1
2.0	SITE TYPE AND DESCRIPTION	2
3.0	PROPOSED REMEDY	5
	3.1 PRSs at TA-21, DP Area	6
	3.1.1 21-002(b), Container Storage Area	6
	3.1.2 21-013(c), Surface Disposal Area	6
	3.1.3 21-013(e), Surface Disposal Area	6
	3.2 PRS at TA-31, East Receiving Yard	6
	3.2.1 31-001, Septic System Outfall	6
4.0	JUSTIFICATION/RATIONALE	8
	4.1 PRS 21-002(b)	8
	4.2 PRSs 21-013(c) and 21-013(e)	8
	4.3 PRS 31-001	8
5.0	ESTIMATED WASTE VOLUMES BY TYPE	9
6.0	CLEAN-UP LEVELS	10
7.0	DESCRIPTION OF CONFIRMATORY SAMPLING	12
8.0	ESTIMATED SCHEDULE AND COST TO COMPLETE EACH VCA	17
9.0	REFERENCES	18
	TABLES	
2-1	Site Type and Description	2
5-1	Estimated Waste Volumes by Type	9
6-1	Clean-up Levels at TA-21	11
6-2	Clean-up Levels at TA-31	11
7-1	Description of Confirmatory Sampling	12
8-1	Estimated Schedule and Cost to Complete	17
	FIGURES	
2-1	PRSs at TA-21 Location Map	3
2-2	PRS at TA-31 Location Map	4
7-1	PRS 21-002(b) Location Detail	13
7-2	PRS 21-013(c) Location Detail	14
7-3	PRS 21-013(e) Location Detail	15
7-4	PRS 31-001 Location Detail	16
	APPENDICES	
A	Field Screening Plan	A-1
B	Characterization Strategy Forms	B-1
C	Reconsidering or Stopping Work on VCAS	C-1
D	Sampling Information	D-1
E	Methodologies for Developing Site-Specific PRGS	E-1
F	Approach to Using Site-Specific Chemical PRGS	F-1
G	Cost Estimate Detailed Summary	G-1

Voluntary Corrective Action Plans for Potential Release Sites, Group 2

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 2 on the basis of their similarity, locale, and ease of implementation. All Group 2 sites fall under the responsibility of Field Unit 1 Project Leader, Garry Allen. The VCA tasks for sites 21-013(c) and 21-013(e) are basically of a housekeeping nature, consisting of the removal and disposal of non-hazardous and non-radioactive construction debris, and/or radioactively contaminated materials. Soil piles located at the sites will be either recontoured and restored or removed. Soils removed from these areas have the potential to be classified as Low-Level Radioactive Waste (LLW). The tasks for sites 21-002(b) and 31-001 are also of a housekeeping nature, but consist of the removal and disposal of potential hazardous wastes, mixed wastes, and/or radioactively contaminated soils.

1.1 PRS 21-002(b)

This PRS is located within an unsecured, fenced area of TA-21, also known as DP (D Prime) Site, located on DP Mesa. This site was used for chemical research and the production of plutonium metal from 1945 until 1978. The area is accessible from DP Road off State Highway 502. PRS 21-002(b) is an inactive container storage area and any materials to be removed from this area are assumed to be LLW pending confirmation.

1.2 PRSs 21-013(c) and 21-013(e)

These PRSs are within TA-21 but are not within secured areas of the Laboratory. The sites are accessible from DP road off State Highway 502. PR 21-013(c) is accessible from an unpaved road. These VCA sites are currently inactive surface disposal areas and appear to have been used for surface disposal of construction debris. "Radiological contamination is a general characteristic of TA-21...." (LANL 1991, 0689); any materials to be removed from these areas are assumed to be LLW pending confirmation.

1.3 PRS 31-001

This PRS is located at the former Technical Area 31, also known as the East Receiving Yard. The site is accessible from Nambe Place off State Route 502. While no constructed roadway directly accesses the site, access is over smooth, gently sloping grassy terrain. PRS 31-001 is the outfall from a former septic tank and any material removed from this area could be classified as hazardous waste.

2.0 SITE TYPE AND DESCRIPTION

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

Table 2-1, Site Type and Description

No.	Field Unit	OU No.	PRS Number	PRS Location	PRS Type/Description	Waste Type/Description
1	1	1106	21-002(b)	SE of TA-21-31	Container Storage Area	Mixed Waste/ Pb, LLW, Soil
2	1	1106	21-013(c)	NE of TA-21-209	Surface Disposal Area	Construction Debris/ (Hg possible)
3	1	1106	21-013(e)	NW of TA-21-20	Surface Disposal Area	Construction Debris
4	1	1079	31-001	W of LANL Airport	Septic System Outfall	Hazardous or TSCA/ PCBs, As, Soil

The following figures are general location maps for the PRSs in Group 2. Figure 2-1 is a location map for all PRSs in Group 2 at TA-21. Figure 2-2 is a location map for the single PRS in Group 2 at TA-31.

Figure 2-1, PRS at TA-21 Location Map

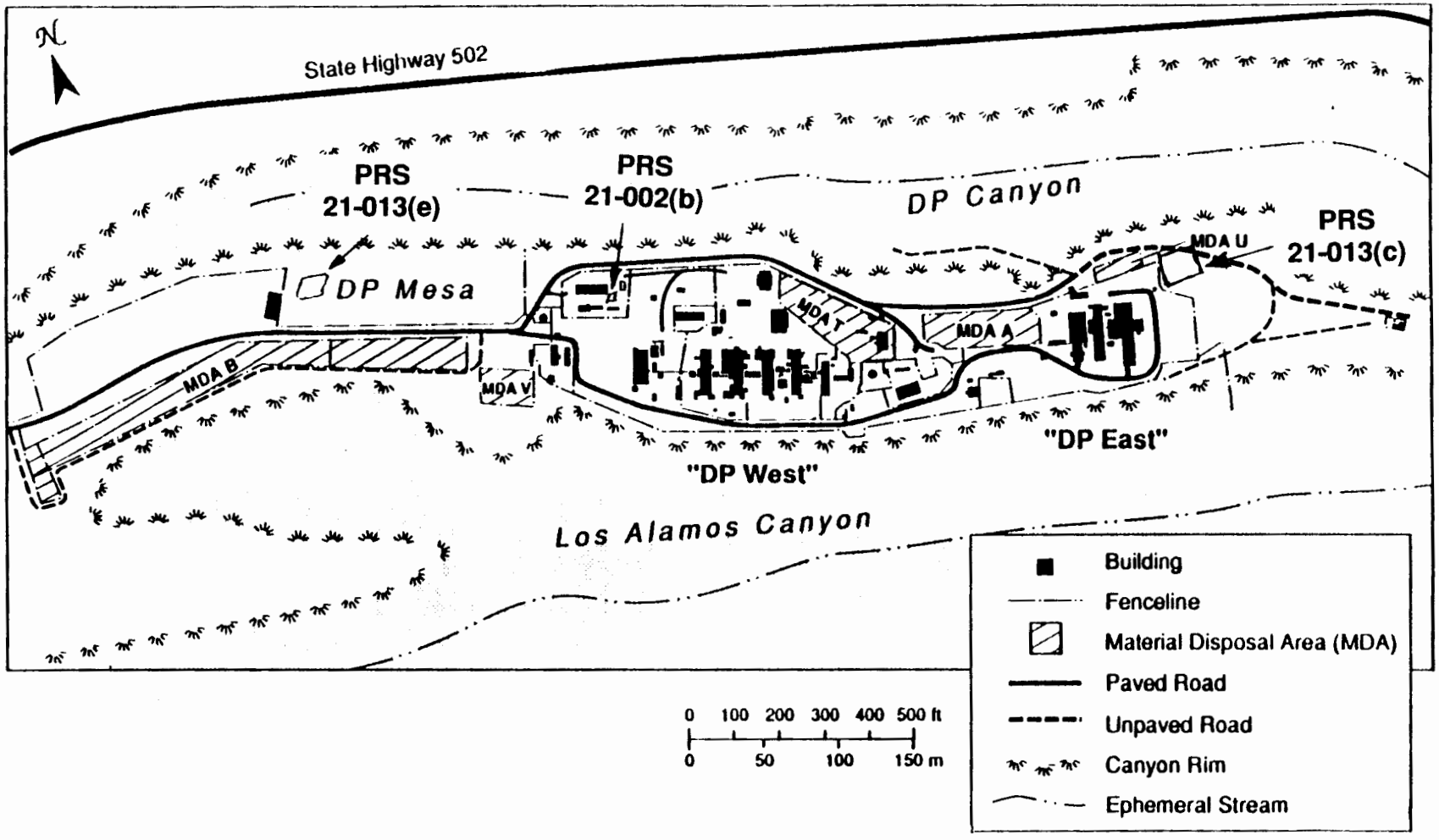
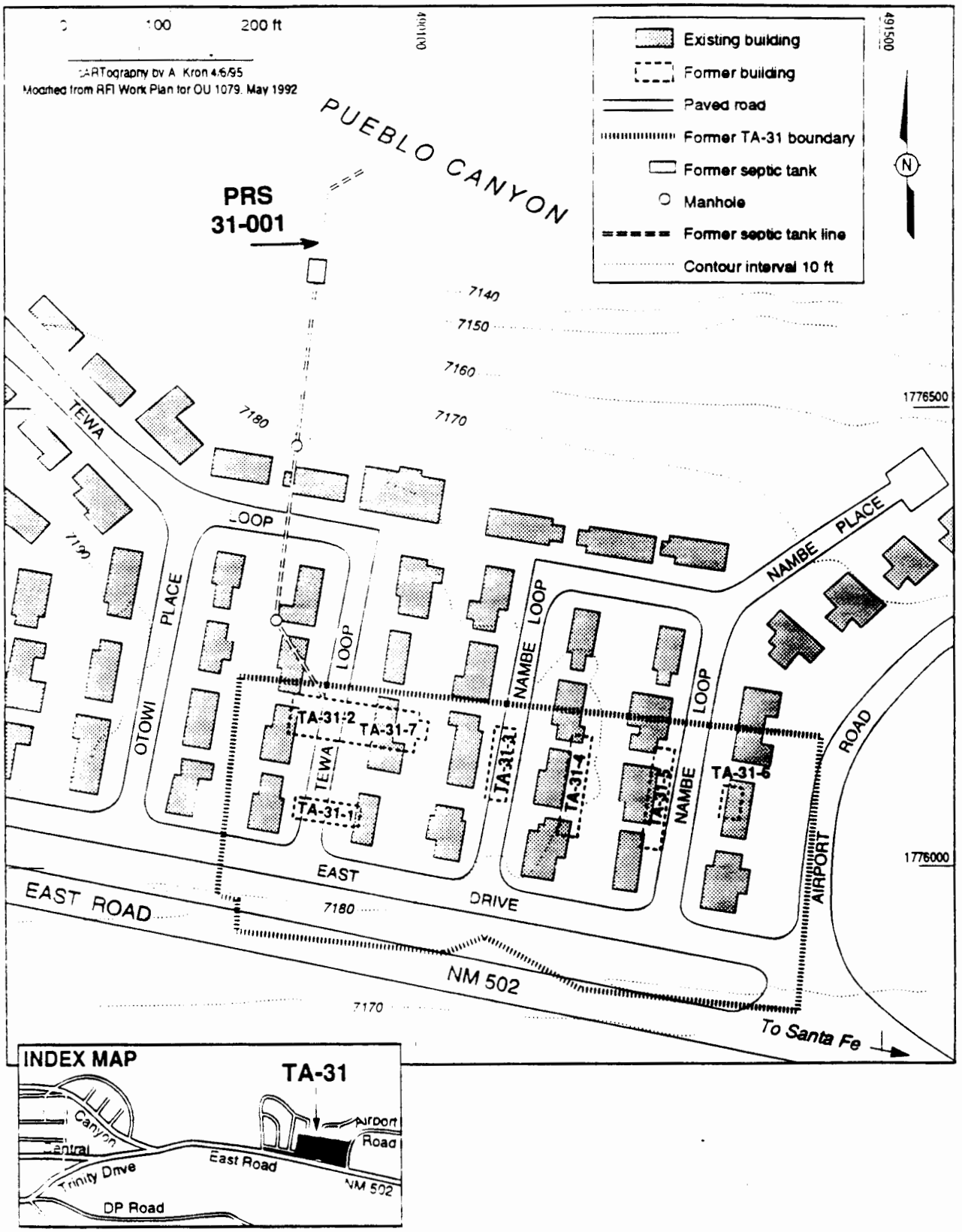


Figure 2-2, PRS at TA-31 Location Map



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 in Group 2. Analytical data will be placed into Appendix D when it becomes available.

3.1 PRSs at TA-21, DP Area

Several piles of what appear to be soil are located at these PRSs. Soil piles, which do not appear to contain debris or exhibit evidence of surface contamination above background and/or clean-up goals, will be excavated to allow field screening of the subsurface material to determine the potential for buried waste. Piles determined not to be contaminated (above background) and/or clean-up goals 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. Since radiological contamination is a general characteristic of TA-21, all materials to be removed will be considered as LLW pending analysis.

3.1.1 21-002(b), Container Storage Area

This site is located southeast of Building TA-21-31; Figure 3-3 should be referenced for its location. This site includes a former drum storage structure, TA-21-38, decommissioned in 1966. No contaminated soil was removed nor was any clean soil brought into the area of the former building following decommissioning. The contents of the drums formerly stored in this area are unknown. Preliminary, unvalidated data indicate radioactive contamination and/or lead (Pb) contamination. The proposed remedy for this site entails the excavation/removal and disposal of the soils contained within the area of concern. Wastes excavated will be sampled and analyzed (characterized) but will be handled as potential mixed wastes pending analytical results.

3.1.2 21-013(c), Surface Disposal Area

This site is located northeast of TA-21-209 and is a surface disposal area. This site is depicted on Figure 3-1. The area was disturbed and appears to only contain construction debris and several small soil piles. Drilling activities have recently been conducted in this area. Drums of waste generated from these drilling activities currently stored on PRS 21-013(c) are not included in this VCA. There is a potential for encountering mercury (Hg) contamination at this site; this could result in the generation of a mixed waste. The proposed remedy for this site is to excavate/remove the construction debris and to remove and/or recontour the soil piles.

3.1.3 21-013(e), Surface Disposal Area

This site is located northwest of the "cold dump," approximately 308 feet east of the fence adjacent to the Lobo Lift building and approximately 175 feet north of the fence along DP Road. The location of this site is depicted on Figure 3-2. PRS 21-013(e) has been used to dispose of construction debris. There are soil piles and assorted other debris on the site. The proposed remedy for this site is to excavate/remove the construction (and other) debris, and to remove and/or recontour the soil piles.

3.2 PRS at TA-31, East Receiving Yard

3.2.1 31-001, Septic System Outfall

This site is located on East Mesa in the area north of East Road and west of the Los Alamos Airport. This site is located in former TA-31, the East Receiving Yard. This site contains the outfall from the sanitary septic system for the former supply warehouse. This VCA site is shown on Figure 3-4. A RCRA Facility Investigation (RFI) has been completed for this area. The results of this RFI indicate that the only area with analyte concentrations at levels requiring a VCA involving soil removal and confirmation sampling is the area directly below the septic tank outfall pipe. The polychlorinated biphenyl (PCB) Aroclor

1254_{tm} was detected at levels above the screening action level (SAL) and arsenic (As) was found at levels above the background upper tolerance limit (UTL).

The proposed remedy for this site is to excavate the soil below the outfall pipe to the underlying tuff interface, estimated to be at a depth of approximately one foot. Waste material will be containerized and assumed to be potentially hazardous waste. If PCBs are present in the waste, but no hazardous constituents are present, the waste will be considered a TSCA waste and will be managed as such. Confirmatory sampling and analyses will be performed immediately beneath the soil removal location. After analytical data have been received and the area is confirmed to meet clean-up criteria, the excavation area will be backfilled, recontoured, and reseeded by hand broadcasting.

4.0 JUSTIFICATION/RATIONALE

4.2 PRS 21-002(b)

PRS 21-002(b) poses a potential health hazard to those who work near this site. While the waste materials associated with this site is of low volume and low contamination levels, contamination could be spread by foot traffic, rainfall runoff, and wind. Remediation of this site will eliminate any human health or ecological risk, and is straightforward and easily implemented. Physical site access is not a problem, however, work at 21-002(b) could interfere with vehicle traffic.

4.2 PRSs 21-013(c) and 21-013(e)

The disposal of construction debris and other wastes at these sites presents a degradation of the environment. While the debris is assumed to be non-hazardous and non-radiological, soils removed in the remediation of these sites may be radioactively contaminated. If these soils are radioactively contaminated they could pose a potential health hazard to those who work near these sites. Contamination could be spread by wind, rainfall runoff, or foot traffic. The remediation of these sites is straightforward and easily implemented. Physical site access is not a major problem, nor is security access.

4.3 PRS 31-001

PRS 31-001 poses a potential health hazard to those who live near this site, as it is readily accessible to the general public. The canyon habitat below the outfall is not highly disturbed and contains sensitive habitats. While the waste materials associated with this site is of low volume and low contamination levels, contamination could be spread by foot traffic, rainfall runoff, and wind. Remediation of this site will eliminate any human health or ecological risk, and is straightforward and easily implemented. Physical site access is not a problem.

5.0 ESTIMATED WASTE VOLUMES BY TYPE

Table 5-1 displays 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
21-002(b)	Mixed	Pb, LLW, Soil	50 yd^3	5 - 10 yd^3 Roll-off Containers	On-Site LLW Disposal (possible mixed)
21-013(c)	Industrial	Construction Debris (Hg possible)	65 yd^3	7 - 10 yd^3 Roll-off Containers	On-Site LLW Disposal/ Industrial Landfill (possible mixed)
21-013(e)	Industrial	Construction Debris	80 yd^3	8 - 10 yd^3 Roll-off Containers	On-Site LLW Disposal/ Industrial Landfill
31-001	Haz(c) or TSCA	PCBs, As, Soil	20 yd^3	6 - 3.3 yd^3 B-25 Boxes	Off-Site Hazardous Disposal or TSCA Waste Facility

NOTES:
* Waste Type: Haz(a) = VOCs or SVOCs, Haz(b) = RCRA Metals, Haz(c) = Haz(a) or Haz(b) plus PCBs

6.0 CLEAN-UP LEVELS

Proposed site-specific clean-up levels to be used for PRSs 21-002(b), container storage area, 21-013(c) and 21-013(e), surface disposal areas, are presented in Table 6-1, below. Clean-up levels to be used for PRS 31-001, septic system outfall, is presented in Table 6-2 below.

Site-specific clean-up levels for non-radionuclide constituents (with the exception of lead and PCBs) 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), updated through March 1995. The equations calculated the site-specific clean-up levels for carcinogenic and noncarcinogenic chemicals using intrusive and nonintrusive industrial soil exposures for the PRSs at TA-21. Site-specific clean-up levels for carcinogenic and noncarcinogenic chemicals were also calculated for recreational soil exposure for PRS 31-001. The methodologies are consistent with U.S. EPA Risk Assessment Guidance for Superfund, Part B, using LANL-specific exposure scenario parameters. The methodology backcalculates a soil concentration for carcinogens from a target cancer risk value of 10^{-4} for industrial exposure (TA-21) and from a target cancer risk value of 10^{-6} for recreational exposure (TA-31). Soil concentrations for noncarcinogens are backcalculated from a target hazard quotient of 1 for both the industrial exposure scenarios (TA-21) and recreational exposure scenarios (TA-31). The equations for soil combine across exposure pathways to include ingestion, dermal, and inhalation exposures.

A site-specific clean-up level of 1 mg/kg PCBs is recommended when other chemicals of concern are present at sites where the public may have unrestricted access (recreational exposure scenario at TA-31) (ER Assessment Council 1995). Lead soil clean-up levels were calculated not to exceed a target blood level of 10 µg/dl for both the industrial exposure scenario (TA-21) and the recreational exposure scenario (TA-31) (EPA 1994). Sources of lead exposure include drinking water, grocery store food products, soil (incidental soil ingestion and dermal contact), and air for the industrial exposure scenario. Sources of lead exposure for the recreational exposure scenario are similar except that dermal contact is not included in the Integrated Exposure Uptake Bio-Kinetic (IEUBK) model.

Preliminary remedial goals (PRGs) for cesium-137 were calculated using RESRAD version 5.191. RESRAD is a microcomputer program developed by the Argonne National Laboratory for DOE for use at LANL. Standard site-specific parameters and default settings representing mesa tops were used (Stout and LaFrate preliminary clean-up guidelines, March 1995) and the initial clean-up levels were calculated based on a 30 mrem/yr exposure scenario in compliance with proposed 10 Code of Federal Regulations (CFR) 834 rulemaking for industrial exposure. All model pathway were analyzed, with the exception of the food and drinking water pathway. An "as low as reasonably achievable" (ALARA) evaluation was conducted to assess the feasibility and cost effectiveness of possible additional remediation in accordance with proposed 10 CFR 834. The ALARA evaluation was based on sites within TA-21 where more specific analytical information was available, but could also apply to other PRSs within TA-21. Based on the ALARA evaluation, a clean-up level based on 15 mrem/yr (half the guidelines for the 30 mrem/yr) was calculated (Stout and LaFrate preliminary clean-up guidelines, March 1995).

The approach to using site-specific chemical PRGs is presented in Appendix F.

Table 6-1
Clean-Up Levels at TA-21

OU Number	PRS Number	Analytical Suite	Chemicals of Concern	PRG Intrusive (mg/kg)	PRG Non-Intrusive (mg/kg)
1106	21-002(b)	Metals	Lead	3000	3000
1106	21-002(b)	Radionuclides	Cesium-137	30*	30*
1106	21-013(c)	Metals	Mercury	160	250
1106	21-013(c)	Radionuclides	Cesium-137	30*	30*
1106	21-013(e)	Radionuclides	Cesium-137	30*	30*

NOTES:
* Cesium-137 preliminary clean-up levels are in pCi/g.

Table 6-2
Clean-Up Levels at TA-31

OU Number	PRS Number	Analytical Suite	Chemicals of Concern*	PRG (mg/kg)
1079	31-001	Polychlorinated Biphenyls	PCBs	1
1079	31-001	Metals	Lead	1600
1079	31-001	Metals	Arsenic	17
1079	31-001	Metals	Mercury	240

NOTES:
* Chemicals of concern were identified in the RFI report for this PRS (May 5, 1995).

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 performed 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.

Table 7-1, Description of Confirmatory Sampling

PRS Number	No. of Samples	Sampling Location Description	Drawing Reference	Analysis (Method)
21-002(b)	2	Center Line of Excavated Area	Figure 7-1	Gross Alpha, Gross Beta, Gross Gamma, Tritium, Isotopic Uranium, Isotopic Plutonium, Americium-241, Strontium-90, VOCs (SW8240), SVOCs (SW8270), PCBs (SW8080), TCLP Metals (6010)
21-013(c)	2	Center Line of Excavated Area	Figure 7-2	Gross Alpha, Gross Beta, Gross Gamma, Tritium, Isotopic Uranium, Isotopic Plutonium, Americium-241, Strontium-90, VOCs (SW8240), SVOCs (SW8270), PCBs (SW8080), TCLP Metals (6010)
21-013(e)	2	Center Line of Excavated Area	Figure 7-3	Gross Alpha, Gross Beta, Gross Gamma, Tritium, Isotopic Uranium, Isotopic Plutonium, Americium-241, Strontium-90, VOCs (SW8240), SVOCs (SW8270), PCBs (SW8080), TCLP Metals (6010)
31-001	2	Center Line of Excavated Area	Figure 7-4	Gross Alpha, Gross Beta, Gross Gamma, PCBs (SW8080), TCLP Metals (6010)

The following four figures detail the locations of each of the PRSs in Group 2.

Figure 7-1, PRS 21-002(b) Location Detail

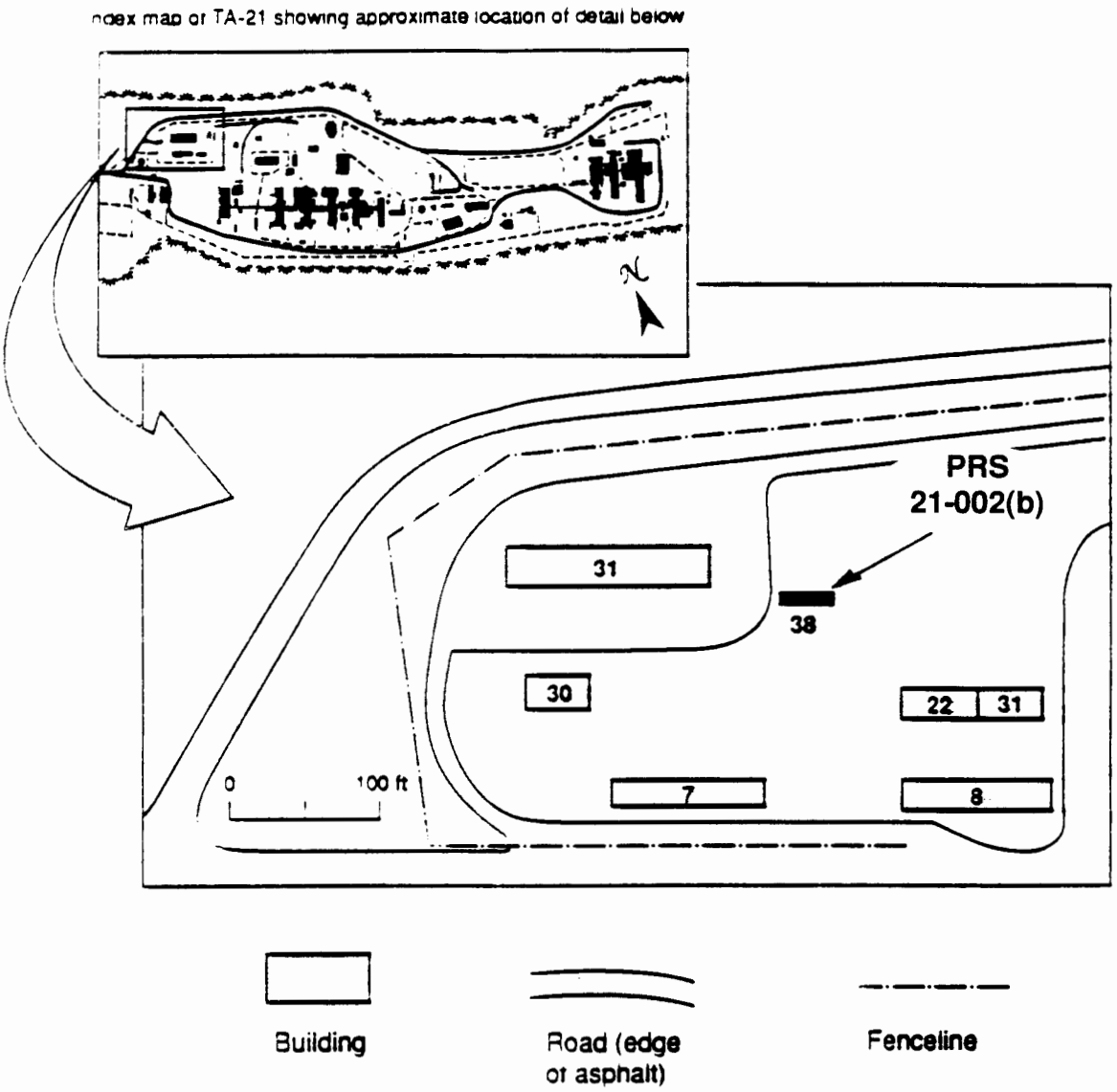


Figure 7-2, PRS 21-013(c) Location Detail

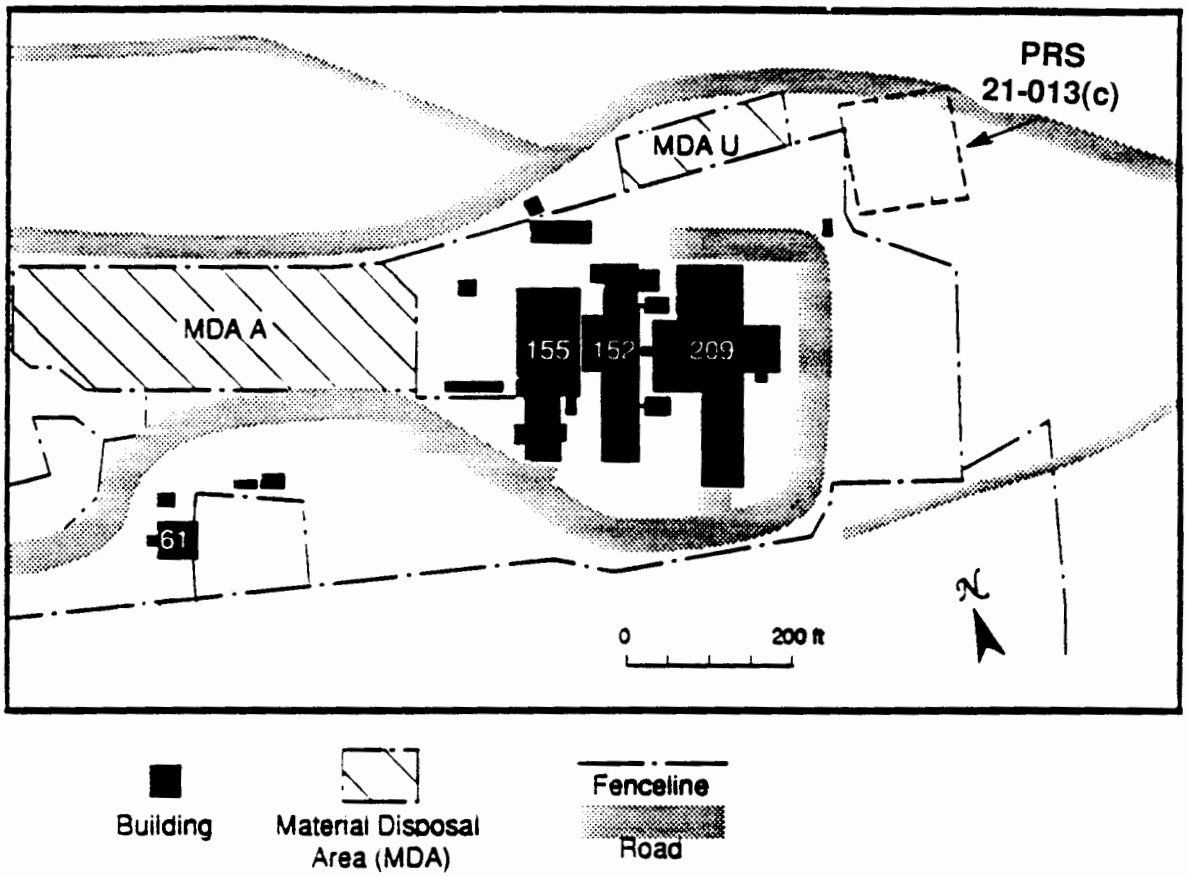


Figure 7-3, PRS 21-013(e) Location Detail

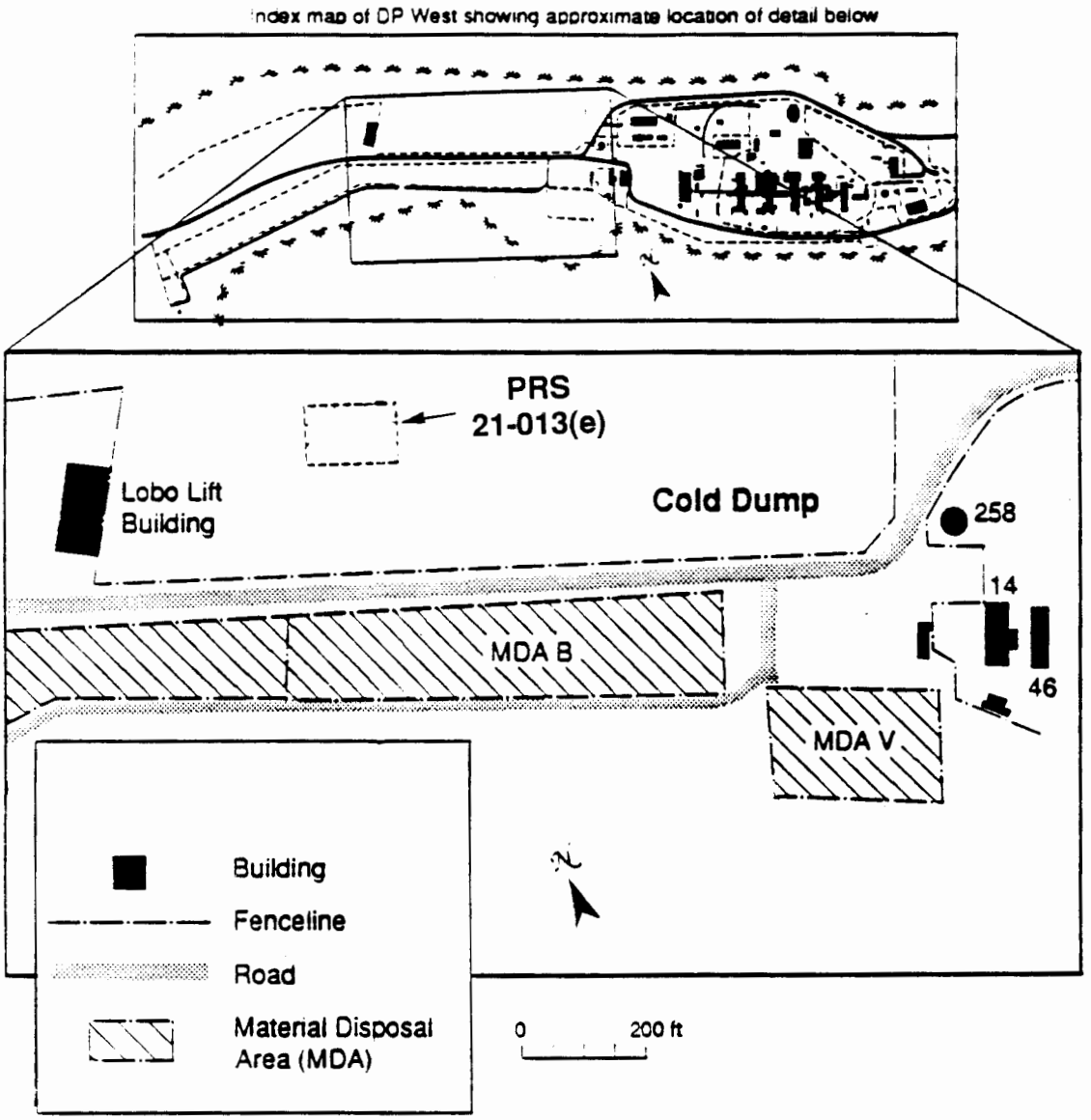
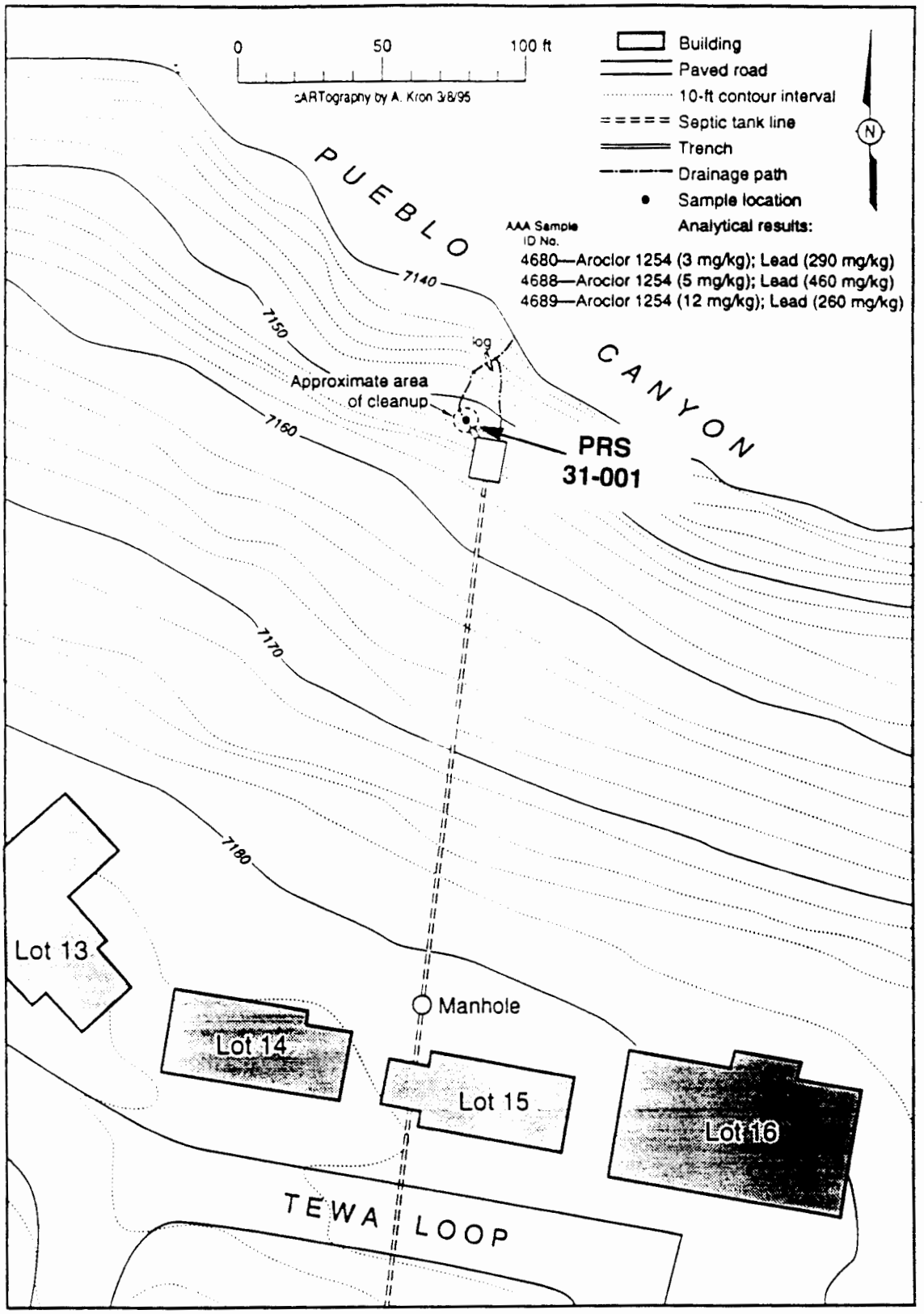


Figure 7-4, PRS 31-001 Location Detail



8.0 ESTIMATED SCHEDULE AND COST TO COMPLETE EACH VCA

Table 8-1 describes each PRS, and details of estimated scheduling and costs to be incurred in the implementation of each PRS in Group 2. Cost estimates include the cost of characterization and confirmatory sampling and analysis. One field team is scheduled to perform the remediation for all the PRSs in Group 2. Cost estimate summaries by PRS have been included in Appendix G.

Table 8-1, Estimated Schedule and Cost to Complete

No.	Field Unit	PRS Number	Date to Start Construction	Date to Complete Construction	Estimated Cost
1	1	21-002(b)	July 12, 1995	July 18, 1995	$ 51,200.00
2	1	21-013(c)	July 19, 1995	July 25, 1995	$ 36,600.00
3	1	21-013(e)	July 26, 1995	August 3, 1995	$ 58,500.00
4	1	31-001	August 4, 1995	August 10, 1995	$ 27,700.00
				TOTAL	$174,000.00

9.0 REFERENCES

Cal/EPA (California Environmental Protection Agency, Department of Toxic Substance Control) 1993. Cal-Tox, a Multimedia Total Exposure Model for Hazardous Waste Sites. Office of Science Affairs, Department of Toxic Substances Control. June.

CDC (United States Centers for Disease Control) 1985. Preventing Lead Poisoning in Young Children. U.S. Department of Health and Human Services, Atlanta, GA.

EPA (U.S. Environmental Protection Agency) 1992. Revised Guidance on Establishing Soil Lead Clean-up Levels at CERCLA/RCRA Sites. OSWER Directive 9355, 4-0B.

EPA (U.S. Environmental Protection Agency) 1994. Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities. OSWER Directive No. 9355.4-12. July 14, 1994.

ER Assessment Council, February 6, 1995. "Guidance for Evaluation and Clean-up of PCBs in Soil for the Los Alamos National Laboratory Environmental Restoration Project," final draft, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory), May 1991. "TA-21 Operable Unit RFI Work Plan for Environmental Restoration," Volumes I-III, Los Alamos National Laboratory Report LA-UR-91-962, Los Alamos, New Mexico. (LANL 1991, 0689)

LANL (Los Alamos National Laboratory), May 1995, "RFI Report for Potential Release Site 31-001, Field Unit 1", Los Alamos National Laboratory Report LA-UR-95-XXX, Los Alamos, New Mexico. (LANL 1995, XXXX)

LANL (Los Alamos National Laboratory), October 1987, "Comprehensive Environmental Assessment and Response Program (CEARP)," Phase I Draft Report, Los Alamos, NM.

LANL (Los Alamos National Laboratory), November 1990, "Solid Waste Management Units (SWMU) Report," LA-UR-90-3400, Los Alamos, NM.

U.S. Environmental Protection Agency (EPA), 1992, "Test Methods for Evaluating Solid Waste, Physical/Chemical Methods," EPA-SW-846, Third Edition, Final Update II, Office of Solid Waste and Emergency Response, U.S. Government Printing Office, Washington, D.C.

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 potential contaminant of concern (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 contaminants of concern (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
1106/FU1	21-002(b)	Container Storage Area

Name: Randy Johnson	**Date:** 6-1-95
FPL: Garry Allen	**WMC:**
Type of Activity: Voluntary Corrective Action (VCA)	

Site Description:

Site located southeast of Building TA-21-31. Site includes a former drum storage structure, TA-21-31. Contents of drums formerly stored are unknown. Preliminary data indicates radiological contamination and/or lead contamination. No contaminated soil has been removed nor was clean soil brought in following area decommissioning. All materials removed will be considered LLW pending analysis.

Investigation or Remediation Waste Description and Volume Estimate:

Excavated soil = 50 yds^3 of mixed waste
Decontamination water = 50 gallons of mixed waste
PPE = 1 - 55 gallon drum of mixed waste

Waste Types: Soils, decontamination liquids, PPE
Waste Packaging: Tarped roll-off containers, drums for liquid and PPE

Characterization Strategy:

Soils will be field screened for radioactivity. Soils will be analyzed for: gross alpha/beta/gamma radioactivity, gamma spectrometry, isotopic analysis, TCLP (8 metals/32 organics), TOX (total organic halides), hydrogen sulfide, hydrogen cyanide, soil PH per Envirocare Inc's requirements for mixed waste. PPE and decontamination water will be characterized based on analyses performed for soil. If required, specific analysis of decontamination water will be performed.

CHARACTERIZATION STRATEGY FORM (Continued)

OU Number/FU	PRS/SWMU Number	Title
1106/FU1	21-002(b)	Container Storage Area

Preliminary RCRA Determination:

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

Soil will be stored in tarped roll-off bins. PPE and liquids will be stored within segregated secondary containment. Wastes 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: (Note: See form attachment following. Analyses to be per Envirocare Inc.'s requirements for mixed waste.)

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

Signatures:

ER Waste Management

CST-17

ESH-19 Representative

CHARACTERIZATION STRATEGY FORM (Attachment)

OU Number/FU	PRS/SWMU Number	Title
1106/FU1	21-002(b)	Container Storage Area

Analysis Suite Required by Envirocare of Utah, Inc., by a Utah Certified Lab for MIXED WASTE

Gamma spectroscopy (natural and man-made isotopes)
Isotopic analysis (if required)
TCLP (8 metals/32 organics)
TOX (total organic halides)
Hydrogen sulfide
Hydrogen cyanide
Soil pH/paint filter liquids test

CHARACTERIZATION STRATEGY FORM

OU Number/FU	PRS/SWMU Number	Title
1106/FU1	21-013(c)	Surface Disposal Area

Name: Randy Johnson	**Date:** 5-31-95
FPL: Garry Allen	**WMC:**
Type of Activity: Voluntary Corrective Action (VCA)	

Site Description:

Site is located northeast of TA-21-209. Area appears to only contain construction debris and several small soil piles. All materials removed will be considered LLW, pending analysis. There is a potential to encounter mercury contamination which might result in the generation of mixed waste.

Investigation or Remediation Waste Description and Volume Estimate:

Construction debris, soil = 65 yd^3 LLW or Industrial Waste (possible Mixed Waste)
Decontamination water = 50 gallon LLW
PPE = 1/2 - 55 gallon drum LLW

Waste Types: Construction debris, soil, decontamination liquids, PPE
Waste Packaging: Tarped roll-off containers, drums for contaminated soil, debris, liquid and PPE

Characterization Strategy:

Soils and debris will be field screened for radioactivity. Soils will be analyzed for: gross alpha/beta/gamma radioactivity, gamma spectrometry, tritium, isotopic uranium, isotropic plutonium, americium-241, strontium-90, VOCs, SVOCs, PCBs, and TCLP metals.

If metals and radioactivity are encountered, waste will be analyzed per Envirocare Inc.'s requirements for mixed waste. PPE and decontamination water will be characterized based on analyses performed on soil. If required, specific analysis of decontamination water will be performed.

CHARACTERIZATION STRATEGY FORM (Continued)

OU Number/FU	PRS/SWMU Number	Title
1106/FU1	21-013(c)	Surface Disposal Area

Preliminary RCRA Determination:

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

Contaminated wastes, soil, debris, PPE, and liquids will be stored in drums within segregated secondary containment. Wastes 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	X	_	_
Semi-Volatile Compounds	X	_	_
Organochlorine Pesticides and PCBs	X	_	_
Inorganic Compounds	_	_	_
High Explosive Compounds	_	_	_
Gross Alpha	X	_	_
Gross Beta	X	_	_
Gross Gamma	X	_	_
Tritium	X	_	_
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
1106/FU1	21-013(e)	Surface Disposal Area

Name: Randy Johnson	**Date:** 5-31-95
FPL: Garry Allen	**WMC:**
Type of Activity: Voluntary Corrective Action (VCA)	

Site Description:

Site is located northeast of "cold dump," northwest of TA-21-20, 308 feet east of fence adjacent to Lobo Lift Building, and 175 feet north of fence along DP Road. Site was used to dispose of construction debris, and contains soil piles and debris. All materials removed will be considered LLW pending analysis.

Investigation or Remediation Waste Description and Volume Estimate:

Construction debris and soil = 80 yd^3 LLW
Decontamination water = 50 gallons LLW
PPE = 1/2 - 55 gallon drum LLW

Waste Types: Construction debris, soil, decontamination liquids, and PPE
Waste Packaging: Tarped roll-off containers, drums for liquids and PPE

Characterization Strategy:

Soils and debris will be field screened for radioactivity. Soils will be analyzed for: gross alpha/beta/gamma radioactivity, gamma spectrometry, tritium, isotopic uranium, isotropic plutonium, americium-241, strontium-90, VOCs, SVOCs, PCBs, and TCLP metals.

PPE and decontamination water will be characterized based on analyses performed on soil. If required, specific analysis of decontamination water will be performed.

CHARACTERIZATION STRATEGY FORM (Continued)

OU Number/FU	PRS/SWMU Number	Title
1106/FU1	21-013(e)	Surface Disposal Area

Preliminary RCRA Determination:

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

Contaminated waste soil and debris will be stored in tarped roll-off containers. PPE and liquids will be stored in drums within segregated secondary containment. Wastes 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	Direct Sampling	Acceptable Knowledge Present	Acceptable Knowledge Absent
Volatile Compounds	X	_	_
Semi-Volatile Compounds	X	_	_
Organochlorine Pesticides and PCBs	_	_	_
Inorganic Compounds	_	_	_
High Explosive Compounds	_	_	_
Gross Alpha	X	_	_
Gross Beta	X	_	_
Gross Gamma	X	_	_
Tritium	X	_	_
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
1079/FU1	31-001	Septic System Outfall

Name: Randy Johnson	**Date:** 5-31-95
FPL: Garry Allen	**WMC:**
Type of Activity: Voluntary Corrective Action (VCA)	

Site Description:

Site is located in the former TA-31 on East Mesa, north of East Road, and west of the Los Alamos Airport. Involved is a sanitary septic system outfall for a former supply warehouse, specifically, the area directly below the outfall. PCB Aroclor 1254_{tm} was detected above SAL and arsenic was found at levels above UTL.

Investigation or Remediation Waste Description and Volume Estimate:

PCB's, arsenic, and soil = 20 yd^3 of hazardous waste or TSCA waste
Decontamination water = 25 gallons of hazardous waste
PPE = 1/2 - 55 gallon drum of hazardous waste

Waste Types: Soil, decontamination liquids, PPE
Waste Packaging: B-25 Boxes, drums for liquids and PPE

Characterization Strategy:

Soils and debris will be field screened for radioactivity. Soils will be analyzed for: PCBs and TCLP metals. PPE and decontamination water will be characterized based upon analyses performed on soil. If required, specific analysis of decontamination water will be performed.

CHARACTERIZATION STRATEGY FORM (Continued)

OU Number/FU	PRS/SWMU Number	Title
1079/FU1	31-001	Septic System Outfall

Preliminary RCRA Determination:

_ No 90-Day Storage Requirement (non-RCRA) Describe how waste will be stored/handled:
X 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	_	_	_
Gross Beta	_	_	_
Gross Gamma	_	_	_
Tritium	_	_	_
Asbestos	_	_	_
TCLP			
Metals	X	_	_
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

Sampling Information

No sampling analyses are currently available for the PRSs in Group 2. Sampling and analytical data will be placed in this appendix as it becomes 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 TA-21, DP Area, and PRS 31-001 at TA-31, East Receiving Yard. There are no analytical data for the PRSs at TA-21 with which to identify specific chemicals of concern. Thus, suspected chemicals of concern are based on existing information on site activities. At PRS 21-002(b), the container storage area, the suspected chemicals of concern include low-level radioactive waste and metals. At PRSs 21-013(c) and 21-013(e), surface disposal sites, the suspected chemicals of concern also include low-level radioactive waste and metals. 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 TA-21 are presented in Table E-1.

Table E-1, Indicator Chemicals for TA-21

Analytical Suite	Indicator Chemicals		
	PRS 21-002(b)	21-013(c)	21-013(e)
Low-Level Radioactive Waste	Cesium-137	Cesium-137	Cesium-137
Metals	Lead	Mercury	-

Sampling conducted at PRS 31-001, the septic system outfall, indicated that polychlorinated biphenyls and some metals failed the screening assessment (comparison to background concentrations and SALs) and have been identified as contaminants of concern (COCs) at PRS 31-001. The chemicals of concern at this PRS are presented in Table E-2.

Table E-2, Chemicals of Concern at PRS 31-001

Analytical Suite	Chemicals of Concern
Polychlorinated Biphenyls	Aroclor 1254
Metals	Arsenic
"	Lead
"	Mercury

2.0 PRG DEVELOPMENT

The following is the methodology used to develop site-specific preliminary remedial goals (PRGs) to demonstrate clean closure of the PRSs in Group 2.

2.1 Non-Radionuclide Constituents other than Lead or PCBs

Site-specific clean-up levels were calculated using modified EPA equations and site-specific input parameters. Due to the location of TA-21 sites, clean-up levels will be based on a reasonable aximum exposed individual (a healthy working adult) under a continued laboratory operations land use scenario. The clean-up levels for PRS 31-001 will be based on a reasonable maximum exposed individual (an adult for carcinogens and a child for noncarcinogens) under a recreational land use scenario.

Under the EPA default industrial land use scenario, risk due to exposure to chemicals in soil is assumed to be due to direct ingestion, inhalation of volatiles from the soil, inhalation of particulates from the soil, and dermal exposure. For intrusive work (e.g., soil excavation), it is also assumed that there is a greater potential for the use of heavy equipment and thus a greater potential for soils to be disturbed and produce particulate and volatile emissions than in most residential and recreational land use scenarios. EPA default parameters are based on the type of industrial exposure activities expected after clean-up, and the physical properties of the COCs. One set of circumstances includes parameters such as exposure frequency and exposure duration, which are adjusted to reflect a maintenance worker versus a construction worker (or surface versus subsurface contamination scenarios), depending on the type of continued laboratory operations activity expected (i.e., non-intrusive or intrusive, respectively). The most conservative calculated clean-up goal (i.e., intrusive or non-intrusive) for a particular chemical will be used as the target clean-up level.

For the EPA default recreational land use scenario, risk due to the exposure to chemicals in soil is also 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 a 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 preliminary remedial goals (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 under the industrial exposure scenario, respectively. For industrial exposures, the methodology backcalculates a soil concentration for carcinogens from a target cancer risk value of 10^{-4} (i.e., 1 in 10,000). Clean-up levels for non-carcinogenic chemicals are backcalculated for reasonably exposed adult from a target hazard quotient of 1. The equations for soil combine across pathways for direct exposure (i.e., ingestion, skin contact, and inhalation).

Equations 3 and 4 were used to calculate PRGs for carcinogenic and noncarcinogenic chemicals, respectively, under the recreational exposure scenario. Equations 3 and 4 are similar to Equations 1 and 2, but with different site-specific input parameters. The methodology backcalculates a soil concentration for carcinogens from a target cancer risk value of 10^{-6} (i.e., 1 in 1000000) for recreational exposures. Clean-up levels for non-carcinogenic 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 is calculated in Equations 5 and 6, respectively. Table E-3, Spreadsheet for Calculating PRGs for Commercial/Industrial and Recreational Soil Exposures, provides chemical-specific input parameters and calculated site-specific PRGs for the chemicals of concern.

Equation 1: Direct Exposures to Carcinogenic Constituents in Industrial 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 x 10^{-4}

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, occupational (d/y)
NONINTRUSIVE
Considered to be 200 d/y
Based on 250 d/y (EPA 1991a) minus 50 workdays when soil is wet or covered with snow
INTRUSIVE
Considered to be 90 d/y (LANL 1993)

ED_o = Exposure Duration, occupational (years)
NONINTRUSIVE
Considered to be 25 years (EPA 1991a)
INTRUSIVE
Considered to be 1 year (LANL 1993)

IRS_o = Soil Ingestion, occupational (mg/day)
NONINTRUSIVE
Considered to be 50 mg/day (EPA 1991a)
INTRUSIVE
Considered to be 480 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)
NONINTRUSIVE
Considered to be 5000 cm^2 (EPA 1992)
INTRUSIVE
Considered to be 3200 cm^2

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)

Equation 1 (Continued)

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)
Nonintrusive
Considered to be $1.11 \times 10^{+7}$ (m^3/kg) (LANL)
Intrusive
Considered to be $1.32 \times 10^{+9}$ (m^3/kg) (EPA 1994)

Equation 2: Direct Exposures to Noncarcinogenic Constituents in Industrial Soil

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

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, adult (kg)
Considered to be 70 kg (EPA 1991a)

ED_o = Exposure Duration, occupational (years)
NONINTRUSIVE
Considered to be 25 years (EPA 1991a)
INTRUSIVE
Considered to be 1 year (LANL 1993)

EF_o = Exposure Frequency, occupational (d/y)
NONINTRUSIVE
Considered to be 200 d/y
Based on 250 d/y (EPA 1991a) minus 50 workdays when soil is wet or covered with snow
INTRUSIVE
Considered to be 90 d/y (LANL 1993)

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

IRS_o = Soil Ingestion, occupational (mg/day)
NONINTRUSIVE
Considered to be 50 mg/day (EPA 1991a)
INTRUSIVE
Considered to be 480 mg/day (LANL 1993)

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

SA_a = Surface Area, adult (cm^2)
NONINTRUSIVE
Considered to be 5000 cm^2 (EPA 1992)
INTRUSIVE
Considered to be 3200 cm^2

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, adult (m^3/day)
Considered to be 20 m^3/day (EPA 1991a)

Equation 2 (Continued)

VF_s = Volatilization Factor, soil (m^3/kg)
(See Equation 5)

PEF = Particulate Emission Factor (m^3/kg)
Nonintrusive
Considered to be $1.11 \times 10^{+7}$ (m^3/kg) (LANL)
Intrusive
Considered to be $1.32 \times 10^{+9}$ (m^3/kg) (EPA 1994)

Equation 3: 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, 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 4: Direct Exposures to Noncarcinogenic Constituents in Recreational Camper Soil

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

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, 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 5: 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
$CSF_{administered}$	=	Cancer-Slope Factor, oral
A_{bs}	=	Absorption factor, oral

Equation 6: 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
$RfD_{administered}$	=	Reference Dose, oral
A_{bs}	=	Absorption factor, oral

Table E-3, Spreadsheet for Calculating PRGs for Commercial/Industrial and Recreational Soil Exposure

Chemical	Oral 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 $(mg/kg/day)^{-1}$
Arsenic	3E-04	0.95	2.85E-04	1.8E+00	1.84E+00	3E-04	1.51E+01
Cesium-137	See Section 2.4, Appendix E						
Lead	See Section 2.2, Appendix E						
Mercury	3E-04	0.1	3.0E-05	-	-	8.4E-05	---
PCBs	See Section 2.3, Appendix E						

Chemical	Intrusive Industrial Soil Scenario (mg/kg)			Nonintrusive Industrial Soil Scenario (mg/kg)			Recreational Soil Scenario (mg/kg)		
	Noncancer PRG	Cancer PRG	PRG (Lower of two)	Noncancer PRG	Cancer PRG	PRG (Lower of two)	Noncancer PRG	Cancer PRG	PRG (Lower of two)
Arsenic	1.75E+02	2.33E+03	1.75E+02	6.15E+02	2.7E+02	2.7E+02	2.9E+02	1.7E+01	1.7E+01
Cesium-137*	-	3.0E+01	3.0E+01	-	3.0E+01	3.0E+01	-	3.0E+01	3.0E+01
Lead	3.0E+03	-	3.0E+03	3.0E+03	-	3.0E+03	1.6E+03	-	1.6E+03
Mercury	1.6E+02	-	1.6E+02	2.5E+02	-	2.5E+02	2.4E+02	-	2.4E+02
PCBs	-	1.0E+01	1.0E+01	-	1.0E+01	1.0E+01	-	1.0E+00	1.0E+00

NOTES:
* Cesium-137 PRGs are in pCi/g.

2.2 Lead

2.2.1 Lead Exposures

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 Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) sites (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 Industrial Clean-up Levels

Since the anticipated future use of the TA-21 sites is industrial/commercial, the residential exposure scenario is not relevant for this site. Under this exposure scenario, a healthy adult worker is the reasonable maximum exposed individual. The California Environmental Protection Agency (Cal/EPA) (1993) has developed its own model to predict blood lead (PbB) levels for adults as well as children. The Cal/EPA model was employed in this assessment to evaluate potential adverse health effects to adults from lead in soil at TA-21.

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, soil (incidental soil ingestion and dermal contact), and the air. Therefore, the calculation of a soil lead clean-up level for an industrial exposure scenario includes the contribution to blood lead levels from non-site sources.

A soil lead clean-up level of 3000 ppm was calculated using a computer spreadsheet algorithm for estimating blood lead concentrations in adults based on a multi-pathway analysis developed by the California Department of Toxic Substances Control (DTSC) (Cal/EPA 1993) (see attached table). The California EPA algorithm is similar to the EPA's Integrated Exposure Uptake Biokinetic Model (IEUBK) for children. However, unlike the IEUBK model which addresses children only, the DTSC computer spreadsheet can calculate blood lead levels for an adult. 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 inhalation pathways and was calculated not to exceed the target level of 10 µg/dl at the 95th percentile concentration. The contact rate for soil ingestion was changed from 0.03 g soil/day to 0.05 g soil/day to reflect the on-site industrial exposure pathway. The lead concentrations used in the water and food ingestion pathways are default values and represent background lead levels that may be encountered in tap water and grocery store food products. All other exposure input parameters are default values based on a residential exposure scenario.

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

INPUT		OUTPUT					
MEDIUM	LEVEL		percentiles				
LEAD IN AIR (ug/m^3)	0.01		50th	90th	95th	98th	99th
LEAD IN SOIL (ug/g)	3385	BLOOD Pb, ADULT (ug/dl)	5.7	8.9	10.0	11.6	12.8
LEAD IN WATER (ug/l)	15						
PLANT UPTAKE? 1=YES 0=NO	0						
AIRBORNE DUST (ug/m^3)	50						

EQUATIONS, ADULTS

Pathway	Blood Pb ug/dl		Route-specific constant		concentration in medium	contact rate	percent of total
SOIL CONTACT:	0.66	=	1E-04 (ug/dl)/(ug/day)	*	3385 ug/g	* 1.85 g soil/day (5 g/m^2 * 0.37 m^2)	12%
SOIL INGESTION:	2.98	=	0.018 (ug/dl)/(ug/day)	*	3385 ug/g	* 0.05 g soil/day	53%
INHALATION:	0.29	=	1.64 (ug/dl)/(ug/m^3)	*	0.18 ug/m^3		5%
WATER INGESTION:	0.84	=	0.04 (ug/dl)/(ug/day)	*	15 ug/l	* 1.4 l water/day	15%
FOOD INGESTION:	0.88	=	0.04 (ug/dl)/(ug/day)	*	10.0 ug Pb/kg diet	* 2.2 kg diet/day	16%

EQUATIONS, DIETARY LEAD

TOTAL DIETARY LEAD = 0.945 * 10 + 0.055 * Pb in produce (ug/kg) = 10.0 ug/kg

LEAD IN PRODUCE = 10 ug/kg or 0.00045 * soil lead = 10.0 ug/kg

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

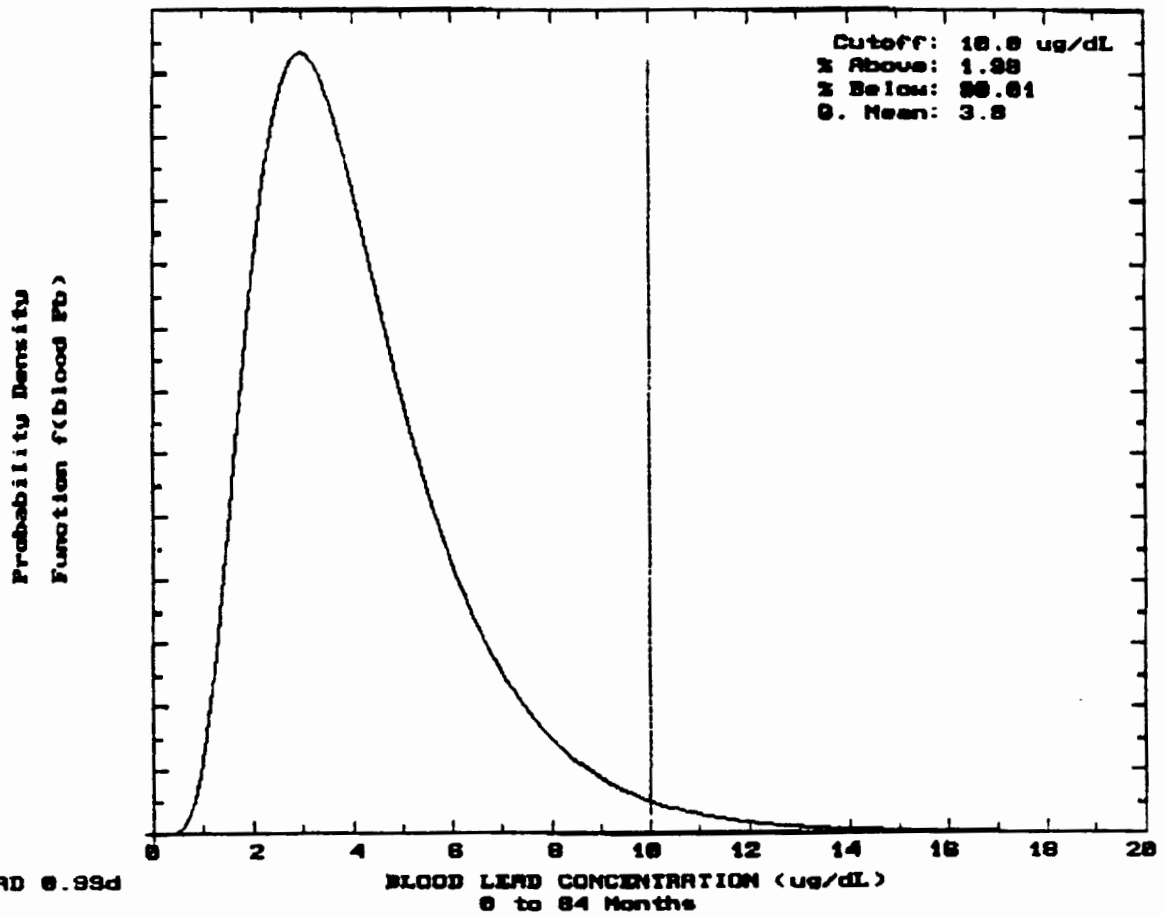
Recreational Intake: varied by year as follows:
0-1: 0.00 ug Pb/day
1-2: 12.40 ug Pb/day
2-3: 12.40 ug Pb/day
3-4: 12.40 ug Pb/day
4-5: 12.40 ug Pb/day
5-6: 12.40 ug Pb/day
6-7: 12.40 ug Pb/day

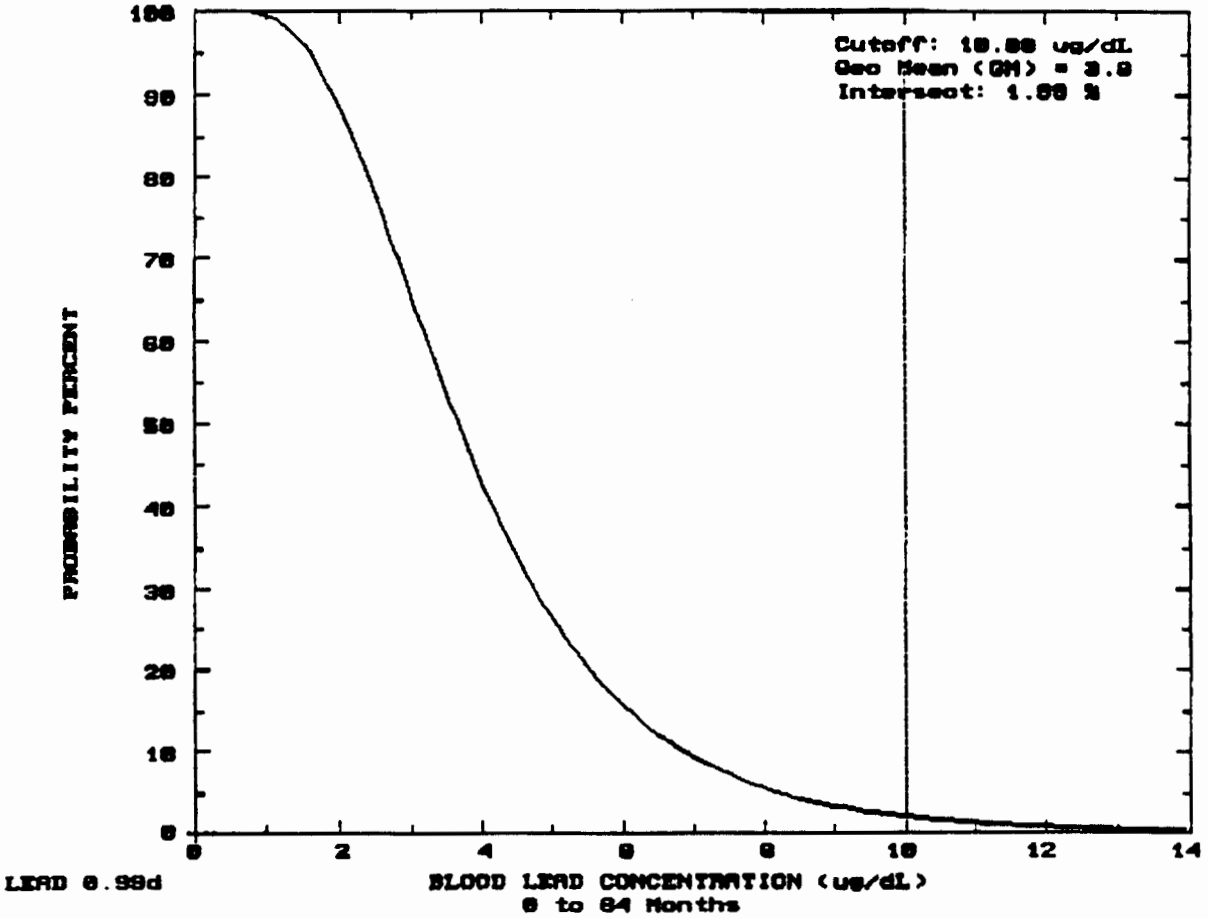
MATERNAL CONTRIBUTION: Infant Model
Maternal Blood Conc: 2.50 ug Pb/dL

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) = 3.0
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 0.99d
BLOOD LEAD CONCENTRATION (ug/dL)
0 to 84 Months

2.2.3 Recreational Clean-up Levels

Since the anticipated future land use of the TA-31 site is recreational, EPA's Integrated Exposure Uptake Biokinetic Model (IEUBK) was used to estimate a lead soil clean-up level. Under this exposure scenario, a child is the reasonable maximum exposed individual. The IEUBK model estimates lead uptake and resultant blood lead concentrations in children.

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, soil (incidental soil ingestion and dermal contact), 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 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/l) 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 TA-31 was estimated using default intake parameters (e.g., hours exposure, amount of soil ingested, etc.) presented in Appendix K of the 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)

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

2.3 PCBs

The clean-up level of PCBs in soil depends primarily on the potential human exposure estimate based on future land use, and on the presence of other environmental chemicals at the site. Another factor influencing the derivation of PCB clean-up levels in soil is the potential impact of residual concentrations of PCBs on ground- and surface water quality. A clean-up level of 1 mg/kg PCBs is recommended for sites when other chemicals of concern are present at sites where there is unrestricted access (ER Assessments Council 1995). This value falls within the protective range of 10^{-4} to 10^{-6} individual excess cancer risk and is consistent with the Toxic Substances Control Act (TSCA) which establish a clean up level of 1 mg/kg to a minimum depth of 10 inches.

2.4 Radionuclides

A PRG for cesium-137 was calculated using RESRAD version 5.191. Standard site-specific parameters and default settings representing mesa tops were used (Stout and LaFrate preliminary clean-up guidelines, March 1995) and the initial clean-up levels were calculated based on a 30 mrem/yr exposure scenario in compliance with proposed 10 Code of Federal Regulations (CFR) 834 rulemaking. All model pathway were analyzed, with the exception of the food and drinking water pathway. An "as low as reasonably achievable" (ALARA) evaluation was conducted to assess the feasibility and cost effectiveness of possible additional remediation. The ALARA evaluation was based on sites within TA-21 where more specific analytical information was available, but could also apply to other PRSs within TA-21. Based on the ALARA evaluation, a clean-up level based on 15 mrem/yr (half the guidelines for the 30 mrem/yr) was calculated (Stout and LaFrate preliminary clean-up guidelines, March 1995). Based on a 15 mrem/yr exposure, a soil clean-up level for cesium-137 was calculated at 30 pCi/g.

APPENDIX F

Approach to Using Site-Specific Chemical PRGS

Approach to Using Site-Specific 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 under the industrial exposure scenario, 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 for the industrial exposure scenario and by 10^{-6} target cancer risk for the recreational exposure scenario:

$$\textit{Multiple PRG Risk} = [(conc_x/PRG_x) + (conc_y/PRG_y) + (conc_z/PRG_z)] \times (10^{-4} \text{ or } 10^{-6})$$

If the multiple PRG risk is at or below the target value of 10^{-4} for the industrial exposure scenario or 10^{-6} for the recreational exposure scenario 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 21-002-B: Container Storage									
21-501	Subcontractor Earthwork	28 HR	265	6,757	2,362	527	41,553		51,200
	Unit Costs:		9.450	241.339	84.343	18.829	1,484.045		1,828.555
	Takeoff Units:	50 CY	5.292	135.150	47.232	10.544	831.065		1,023.991
	Adjusted to Bid Quantity:	50 CY	265	6,757	2,362	527	41,553		51,199
	Unit Costs:		5.300	135.140	47.240	10.540	831.060		1,023.980

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites 21-013-C: Surface Disposal									
21-501	Subcontractor Earthwork	20 HR	189	4,827	1,687	377	29,681		36,571
	Unit Costs:		9.450	241.339	84.343	18.829	1,484.045		1,828.555
	Takeoff Units:	15 CY	12.600	321.785	112.457	25.106	1,978.726		2,438.074
	Adjusted to Bid Quantity:	15 CY	189	4,827	1,687	377	29,681		36,572
	Unit Costs:		12.600	321.800	112.467	25.133	1,978.733		2,438.133

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites 21-013-E: Surface Disposal									
21-501	Subcontractor Earthwork	32 HR	302	7,723	2,699	603	47,489		58,514
	Unit Costs:		9.450	241.339	84.343	18.829	1,484.045		1,828.555
	Takeoff Units:	80 CY	3.780	96.536	33.737	7.532	593.618		731.422
	Adjusted to Bid Quantity:	80 CY	302	7,723	2,699	603	47,489		58,514
	Unit Costs:		3.775	96.537	33.738	7.538	593.613		731.425

Sheet No.	Description	Quantity	Manhours	Labor	Perm. Mat'ls	Equip.	Supplies	Sub-Contracts	Total Cost
Potent.Release Sites 31-001--: Septic System									
31-201	SECURITY ESCORT EACH DAY	1 DAY					500		500
31-202	MEDICAL EXAMINATIONS OF WORKMEN	1 LS					375		375
31-203	HAZWOPER 40 HR. TRAINING	1 LS					1,500		1,500
31-204	RAD II TRAINING FOR EACH WORKMAN	1 LS					1,500		1,500
31-301	E S H Supplies and Expenses	1 LS					1,470		1,470
31-501	Septic Outfall Earthwork	20 CY	118	2,990	5,886	373	1,638		10,889
	Unit Costs:		5.922	149.513	294.325	18.672	81.916		544.426
31-502	SUBCONTRACTOR DECON OPERATION	1 LS	20	509	90	67	588		1,254
31-601	Characterization Lab Analysis	1 LS					3,000		3,000
31-602	Confirmatory Lab Analysis	1 LS					3,000		3,000
31-603	ASBESTOS SAMPLES	1 LS							
31-604	FIELD SCREENING SAMPLES	1 LS					1,250		1,250
31-605	Decon Water Sample Analysis	1 LS					3,000		3,000
31-701	WORK REPORTS,DAILY,WEEKLY,MONTHLY	1 LS							
	Subtotal, Septic System		139	3,499	5,976	440	17,821		27,737
	Takeoff Units:	10 CY	13.860	349.943	597.650	44.048	1,782.089		2,773.729
	Adjusted to Bid Quantity:	10 CY	139	3,499	5,976	440	17,821		27,736
	Unit Costs:		13.900	349.900	597.600	44.000	1,782.100		2,773.600