NOTICE!

ALL DRAWINGS
ARE LOCATED
AT THE END OF
THE DOCUMENT

2C100

000062306

RMRS Rocky Mountain Remediation Services, L L C
protecting the environment

Rocky Flats Environmental Technology Site
P O Box 464
Golden Colorado 80402-0464
Phone (303) 966-2677
Fax (303) 966-8244

June 11, 1996

96-RF-03562

Ann Sieben
Kaiser-Hill Company
Rocky Flats Environmental Technology Site
P O Box 464 (T130F)
Golden, Colorado 80402

TRANSMITTAL OF DRAFT SAMPLING AND ANALYSIS PLAN - JEL-0103-96

Dr 6/13/96

The draft Sampling and Analysis Plan, Preremediation Investigation of the Mound, 903 Pad and Trench T-1 is attached This document will be issued as a controlled document in the correct format However, due to a backlog in technical editing, I am requesting that you provide comments on the rough draft, not on the formatted controlled document

Please provide comments to me no later than COB June 17, 1996 If you have comments or concerns, please call Robin Volk at extension 7700 Thank you

A L Primmer for John E. Law

John E Law, P E
Remediation Manager
Sitewide Actions Group

ALP cb

Attachment
As Stated

JUN 1996
RECEIVED
RECORDS CENTER

ADMIN RECORD

BZ-A-000484

1/48

DRAFT
SAMPLING AND ANALYSIS PLAN

PRE-REMEDIATION INVESTIGATION OF THE MOUND, 903 PAD AND TRENCH T-1 REV. 0

10 MAY, 1996

2

TABLE OF CONTENTS

3

LIST OF TABLES & FIGURES

4

LIST OF ACRONYMS

BSL	Background screening level
BGS	Below Ground Surface
CDPHE	Colorado Department of Public Health and Environment
CLP	Contract Laboratory Program
COC	Chemical-of-Concern
DCE	Dichloroethene
DOE	Department of Energy
DMP	Data Management Plan
DQO	Data Quality Objective
EPA	Environmental Protection Agency
EQS	Environmental Quality Support
ER	Environmental Restoration a k a ERM, Environmental Restoration Management
FID	Flame-ionization Detector
GC	Gas Chromatograph
GRRASP	General Radiochemistry and Routine Analytical Service Protocol
IHSS	Individual Hazardous Substance Site
OU	Operable Unit
OVA	Organic Vapor Analyzer
PAM	Proposed Action Memorandum
PCE	Tetrachloroethylene
PID	Photoionization Detector
PPRG	Programmatic Preliminary Risk -Based Remediation Goal
QAA	Quality Assurance Addendum
QAPjP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RFETS	Rocky Flats Environmental Technology Site
RFEDS	Rocky Flats Environmental Database System
SAP	Sampling and Analysis Plan
SQL	Sample quantitation limit
SVOCs	Semi-volatile organic compounds
TCE	Trichloroethylene
TCL-VOA	Target Compound List-Volatile Organic Analysis
USEPA	United States Environmental Protection Agency
VOCs	Volatile organic compounds
1,1-DCA	1,1-Dichloroethane
1,1-DCE	1,1-Dichloroethene
1,2-DCE	1,2-Dichloroethene
1,1,1-TCA	1,1,1-Trichloroethane

5

DRAFT
SAMPLING AND ANALYSIS PLAN
PRE-REMEDIATION INVESTIGATION OF
THE MOUND, 903 PAD AND TRENCH T-1

1. INTRODUCTION

This Sampling and Analysis Plan (SAP) describes the steps necessary to collect data to characterize Trench T-1 (IHSS 108), and define the areal extent of the volatile organic compound (VOC) contamination at the Mound Site (IHSS 113), and the 903 Pad (IHSS 112) in support of early removal actions The objective of the SAP is to describe the specific data needs, sampling and analysis requirements, data handling procedures, and associated Quality Assurance/ Quality Control (QA/QC) requirements for the completion of soil gas and subsurface soil sampling The data gathered from these activities will be used to estimate volumes of soil requiring removal for treatment or disposal

1.1 Background

Trench T-1 (IHSS 108), is located southeast of the Protected Area fence and north of Central Avenue as shown by Figure 1-1 The trench is roughly 150 feet long by 20 feet wide by 10 feet deep Approximately 125 drums containing depleted uranium chips, hydraulic oil, carbon tetrachloride (CCl_4), metal turnings, distillation bottoms, copper alloy, and cemented cyanide waste are believed to have been disposed in this trench from 1954 to 1962 (RF/ER-95-0010, DOE 1995a) Previous investigations included soil gas and geoprobe sampling of the area near the trench margins, ground penetrating radar (GPR), and electromagnetic surveys (EM-31 and EM-61) over the trench The electromagnetic survey results indicate metallic objects are buried within the trench Figure 1-2 illustrates a typical resistivity response within the trench

Due to concern about the suspected presence of pyrophoric uranium in some of the drums disposed of in Trench T-1, no intrusive activities have occurred within the trench boundaries Downgradient wells from the trench are subject to influence from other IHSSs and do not provide sufficient information to determine if Trench T-1 is a source of the groundwater contamination found in these wells Soil gas, soil core and/or non-aqueous phase liquid (NAPL) samples from within the trench are required to determine the nature of contaminants in the trench and whether these are a potential source of contamination to surface water through a groundwater pathway

The Mound Site is located north of Trench T-1, east of the Protected Area fence, and west of the former east inner gate (Figure 1-1) Between 1954 and 1958,

drums containing hydraulic oil and carbon tetrachloride (CCl_4) contaminated with depleted uranium and beryllium were buried at this site Additionally, historical records show some of the buried drums contained tetrachloroethene (PCE), enriched uranium, and plutonium (DOE 1991, *Final Phase II RFI/RI Work Plan TM 1, RFP 903 Pad, Mound and East Trenches Areas,* DOE 1992, *Final Historical Release Report for the Rocky Flats Plant*)

In 1970, after it was discovered the integrity of the drums was failing and leakage was detected, all the drums and the associated soils were removed from the site Later investigations have found levels of volatile organic compounds (VOCs) in groundwater samples downgradient from the site which exceed the Action Levels and Standards Framework for Subsurface Soils as established in Attachment 5 of the Rocky Flats Cleanup Agreement (March 14, 1996) Initial characterization results indicate increasing concentrations of PCE and TCE to a depth of 20 feet and decreasing concentrations below that depth A more detailed account of contamination at this site is available in the *Phase II RFI/RI Report for Operable Unit No 2 903 Pad, Mound, and East Trenches Area* Additional sampling is required to identify the amount of material which will require removal and or treatment

The 903 Pad (IHSS 112) is located west of the former east inner gate and south of Central Avenue at the western edge of the eastern buffer zone (Figure 1-1) The site was previously used for storage of drums containing cutting fluids contaminated with plutonium Leakage from the drums contaminated the area, most of which is presently sealed under an asphalt cap Previous investigations which included soil gas surveys, soil sampling, and groundwater monitoring have shown VOC constituents present within the IHSS include trichloroethene (TCE), PCE, and CCl_4 Additional sampling beneath the asphalt cap and the area surrounding the cap is necessary to adequately identify the area of VOC contamination exceeding the RFETS Action Levels for subsurface soils Other investigations are anticipated to determine the extent of radiological contamination

1.2 Data Summary

Previous investigations within OU 2 have included soil gas sampling, surface and subsurface soil sampling, as well as groundwater monitoring Tables 1 2-1 through 1 2-3 show the maximum concentrations detected for the Chemicals of Concern within and near the Mound Site, Trench T-1, and the 903 Pad The Chemicals of Concern for OU 2 were approved by the Department of Energy (DOE), the Environmental Protection Agency (EPA), and the Colorado Department of Public Health and Environment (CDPHE) in the Technical Memorandum No 9 Chemicals of Concern, Human Health Risk Assessment 903 Pad, Mound, and East Trenches Areas Operable Unit No 2, August 1994

FIGURE 1-1
MAP OF OPERABLE UNIT 2 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

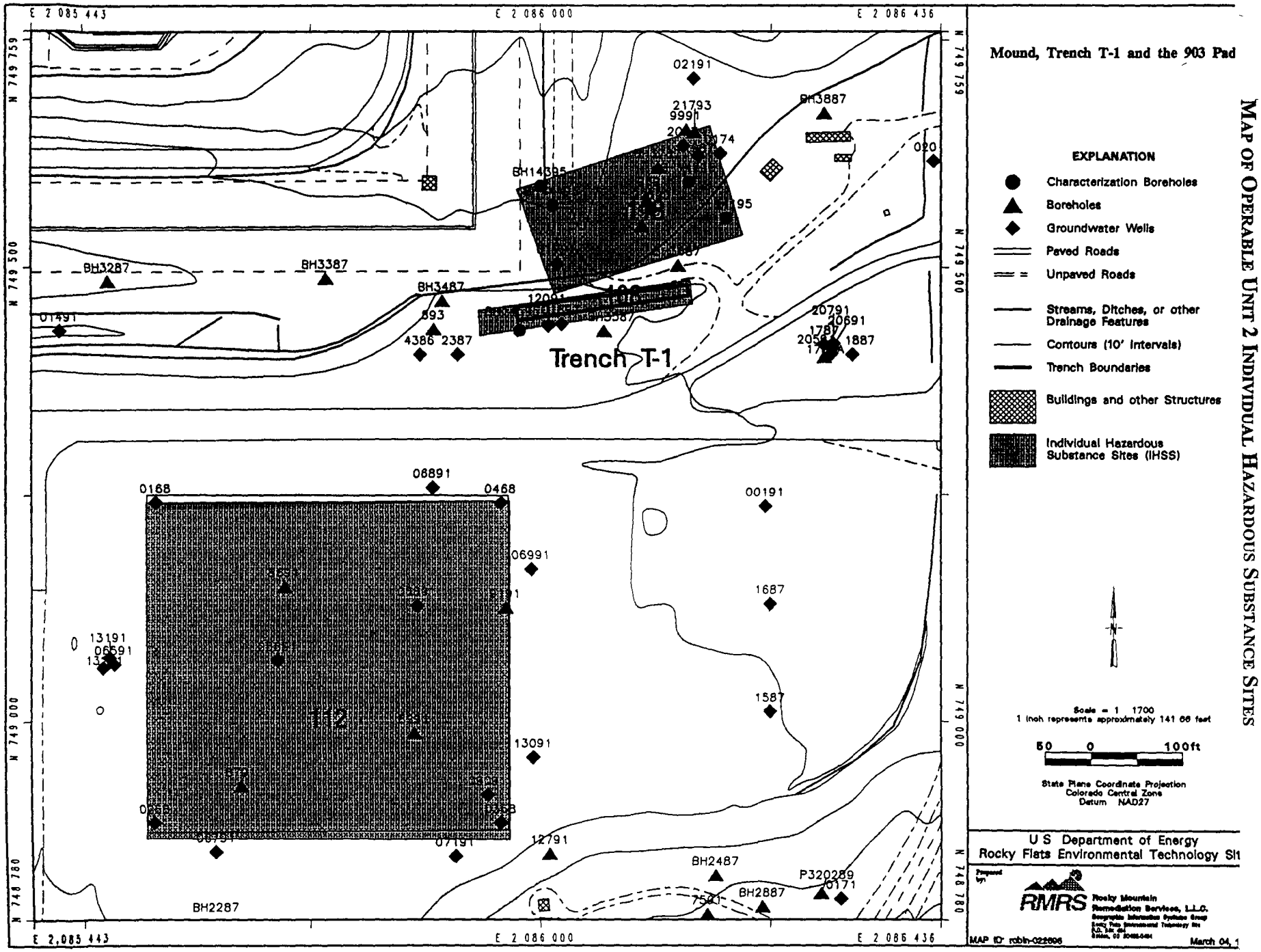


FIGURE 1-1
MAP OF OPERABLE UNIT 2 INDIVIDUAL HAZARDOUS SUBSTANCE SITES

TABLE 1.2-1
MAXIMUM CONCENTRATIONS OF CHEMICALS OF CONCERN DETECTS FOR GROUNDWATER AND SUBSURFACE SOILS NEAR IHSS 113

IHSS 113 (Mound Site)							
LOCATION CODE	SAMPLE NUMBER	SAMPLE TYPE	DEPTH	ANALYTE	RESULT	*LAB QUAL	SAMPLE DATE
174	1-74-07-23-87	GW		1,1-Dichloroethene	90 µg/l		23-Jul-87
14495	BH20855WC	BH	12 5 - 15 0 ft	Carbon Tetrachloride	5 µg/kg	J	19-May-95
21593	BH20197WC	BH	24 ft	Chloroform	66 µg/kg		10-May-93
174	1-74-05-22-87	GW		Chloroform	38 µg/l		22-May-87
14295	BH20840WC	BH	5 - 8 ft	Methylene chloride	44,000 µg/kg	B	18-May-95
174	GW00639IT	GW		Methylene chloride	4,100 µg/l	B	15-Nov-90
14295	BH20840WC	BH	5 - 8 ft	Tetrachloroethene	800,000 µg/kg		18-May-95
174	1-74-05-22-87	GW		Tetrachloroethene	500,000 µg/l		22-May-87
174	1-74-05-22-87	GW		Trichloroethene	18,000 µg/l		22-May-87
14295	BH20857WC	BH	15 7 - 16 ft	Trichloroethene	8,600 µg/kg	DJ	18-May-95
3787	BH378700005	BH	0 0 - 5 0 ft	Arsenic	20 mg/kg		16-Jul-87
22393	GW02095GA	GW		Arsenic	8 3 µG/L	B	13-Feb-95
1791	GW02598IT	GW		Cadmium	4 8 µg/l	B	17-Mar-92
3787	BH378725BR	BH	25 0 - 26 2 ft	Cadmium	3 3 mg/kg		17-Jul-87
1791	GW02173IT	GW		Mercury	0 27 g/l		19-Dec-91
21793	BH20321WC	BH	31 9 - 37 4 ft	Mercury	0 15 mg/kg		3-Jun-93
22393	GW02407GA	GW		Nitrate	2,920 µg/l		16-May-95
3787	BH37870005	BH	0 0 - 5 0 ft	Americium-241	0 48 pCi/g		16-Jul-87
174	1-74-07-23-87	GW		Americium-241	0 16 pCi/l		23-Jul-87
14295	BH20837WC	BH	0 0 - 3 5 ft	Plutonium-239/240	0 0316 pCi/g		18-May-95
174	GW00639IT	GW		Plutonium-239/240	0 0027pCi/l		15-Nov-90
14295	BH20837WC	BH	0 0 - 3 5 ft	Uranium-233/234	19 28 pCi/g		15-May-95
22393	GW02407GA	GW		Uranium-233/234	8 8591 pCi/l		16-May-95
14295	BH20837WC	BH	0 0 - 3 5 ft	Uranium-235	1 535 pCi/g		15-May-95
1791	GW01753GA	GW		Uranium-235	0 8015 pCi/l		17-Nov-94
14295	BH20837WC	BH	0 0 - 3 5 ft	Uranium-238	101 1 pCi/g		15-May-95
1791	GW0287IT	GW		Uranium-238	4 087 pCi/l		14-May-92

B - Detected concentration was less than CRDL and above IDL, or activity exceeded minimal detectable activity
D - Organics analysis performed at a dilution
E - Exceeds calibration range of instrument, or value is estimated due to interference
J - Positively identified below SQL - result is estimated

10

TABLE 1.2-2
MAXIMUM CONCENTRATIONS OF CHEMICALS OF CONCERN DETECTS FOR GROUNDWATER AND SUBSURFACE SOILS NEAR IHSS 108

IHSS 108 (Trench T-1)							
LOCATION CODE	SAMPLE NUMBER	SAMPLE TYPE	DEPTH	ANALYTE	RESULT	*LAB QUAL	SAMPLE DATE
4386	43-86-03-11-87	GW		Carbon Tetrachloride	6 µg/l		11-Mar-87
2387	23-87-02-07-89	GW		Chloroform	2 µg/l	J	7-Feb-89
1891	BH00126WCU2	BH	13 2 - 13 4 ft	Methylene chloride	30 µg/kg	B	13-Nov-91
12091	GW02876IT	GW		Methylene chloride	16 Mg/l	B	13-May-92
2387	23-87-05-03-89	GW		Tetrachloroethene	74 µg/l		3-May-89
4386	43-86-03-11-87	GW		Trichloroethene	8 µg/l		11-Mar-87
3587	BH358718BR	BH	18 4 - 19 5 ft	Arsenic	14 mg/kg		28-Jul-87
12091	GW02876IT	GW		Arsenic	2 1 µg/l	BN	13-May-92
3587	BH358718BR	BH	18 4 - 19 5 ft	Cadmium	3 3 mg/kg		28-Jul-87
2387	GW02032IT	GW		Cadmium	2 6 µg/l		23-Nov-91
2387	GW03256IT	GW		Mercury	0 33 µg/l		30-Jul-92
12091	GW02638GA	GW		Nitrate	5,190 µg/l		31-May-95
12091	GW02514IT	GW		Americium-241	1 09 pCi/l		27-Feb-92
3587	BH35870012	BH	0 0 - 12 3 ft	Americium-241	0 4 pCi/g		27-Jul-87
12091	GW02116IT	GW		Plutonium-239/240	0 012 pCi/l		19-Dec-91
4386	GW01670IT	GW		Uranium-233/234	9 858 pCi/l		20-Aug-91
3587	BH358718BR	BH	18 4 - 19 5 ft	Uranium-233/234	0 97 pCi/g		28-Jul-87
1891	GW01281GA	GW		Uranium-235	0 579 pCi/l		25-Aug-94
4386	GW01670IT	GW		Uranium-238	7 629 pCi/l		20-Aug-91
3587	BH358718BR	BH	18 4 - 19 5 ft	Uranium-238	0 91 pCi/g		28-Jul-87

•

B - Detected concentration was less than CRDL and above IDL, or activity exceeded minimal detectable activity
E - Exceeds calibration range of instrument, or value is estimated due to interference
J - Positively identified below SQL - result is estimated
N - Metals spike recoveries in the matrix spike sample did not meet advisory limits

TABLE 1.2-3
MAXIMUM CONCENTRATIONS OF CHEMICALS OF CONCERN DETECTS FOR GROUNDWATER AND SUBSURFACE SOILS NEAR IHSS 112

IHSS 112 (903 Pad)							
LOCATION CODE	SAMPLE NUMBER	SAMPLE TYPE	DEPTH	ANALYTE	RESULT	*LAB QUAL	SAMPLE DATE
6691	GW03428IT	GW		1,1-Dichloroethene	150 µg/l	E	28-Aug-92
6591	BH01256WCU2	BH	21 1 - 21 3 ft	1,1-Dichloroethene	3 µg/kg	J	3-Mar-92
6691	GW00384WC	GW		Carbon Tetrachloride	58,000 µg/l	E	19-Mar-93
6591	BH01256WCU2	BH	21 1 - 21 3 ft	Carbon Tetrachloride	330 µg/kg	E	3-Mar-92
6691	GW00384WC	GW		Chloroform	64,000 µg/l	E	19-Mar-93
6591	BH01256WCU2	BH	21 1 - 21 3 ft	Chloroform	240 µg/kg	E	3-Mar-92
6691	GW03848IT	GW		Methylene chloride	25,000 µg/l	E	17-Nov-92
6591	BH01264WCU2	BH	43 5 - 43 7 ft	Methylene chloride	66 µg/kg	B	3-Mar-92
8891	GW01764GA	GW		Tetrachloroethene	20,000 µg/l		28-Nov-94
8891	BH00954WCU2	BH	22 4 - 22 6 ft	Tetrachloroethene	110 µg/kg		3-Mar-92
8891	GW00385WC	GW		Trichloroethene	4,600 µg/l	E	12-Mar-93
8891	BH00954WCU2	BH	22 4 - 22 6 ft	Trichloroethene	27 µg/kg		3-Mar-92
6691	GW03428IT	GW		Vinyl chloride	40 g/l	E	28-Aug-92
8991	BH00752WCU2	BH	28 0 - 32 0 ft	Arsenic	9 8 mg/kg	B	11-Mar-92
8891	GW03065IT	GW		Cadmium	21 7 µg/l		23-Jun-92
9091	GW02903IT	GW		Mercury	0 95 µg/l		20-May-92
8891	GW02647GA	GW		Nitrate	32,200 µg/l		19-Jun-95
9091	GW03432IT	GW		Americium-241	30 03 pCi/l		31-Aug-92
6691	BH00518WCU2	BH	2 0 - 8 0 ft	Americium-241	7 2 pCi/g		25-Feb-92
9091	GW00388WC	GW		Plutonium-239/240	218 4 pCi/l		19-Mar-93
6691	BH00518WCU2	BH	2 0 - 8 0 ft	Plutonium-239/240	68 0 pCi/g		25-Feb-92
8891	GW01247WC	GW		Uranium-233/234	18 7 pCi/l		10-Sep-93
6591	BH01268WCU2	BH	44 0 - 50 0 ft	Uranium-233/234	1 4 pCi/g		4-Mar-92
8891	GW03849IT	GW		Uranium-235	1 pCi/l		17-Nov-92
6991	BH00706WCU2	BH	14 0 - 20 0 ft	Uranium-235	0 118 pCi/g		26-Feb-92
8891	GW01247WC	GW		Uranium-238	38 6 pCi/l		10-Sep-93
8891	BH00550WCU2	BH	2 0 - 8 0 ft	Uranium-238	2 1 pCi/g	B	3-Mar-92

B - Detected concentration was less than CRDL and above IDL, or activity exceeded minimal detectable activity
E - Exceeds calibration range of instrument, or value is estimated due to interference
J - Positively identified below SQL - result is estimated

12

Table 1 2-4 lists the established RFETS Action Levels for the VOC Chemicals of Concern within OU 2 These Action Levels will provide a basis for accelerated source removal actions within the Mound Site, Trench T-1, and the 903 Pad

TABLE 1.2-4
RFETS ACTION LEVELS [1]

Chemical of Concern	Action Levels (mg/kg)
TCE	9 27
PCE	11 5
Carbon Tetrachloride	11 0
TPH, fuel constituents (benzene)	8 08

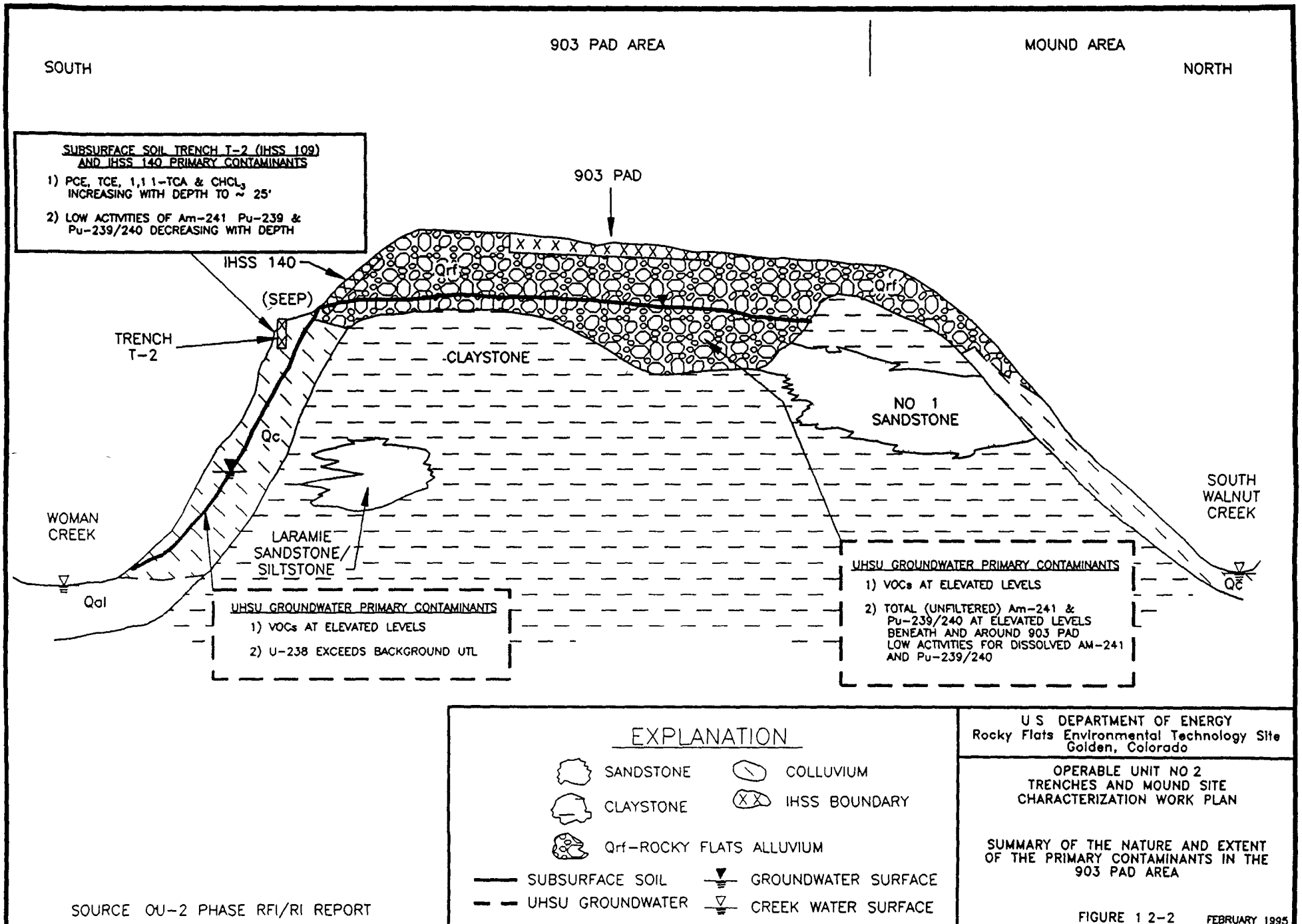
[1] Action Levels and Standards Framework for Subsurface Soils as established in Attachment 5 of the Rocky Flats Cleanup Agreement (March 14, 1996)

1.3 Conceptual Site Model

The surficial geology in this area consists of Quaternary alluvium and colluvium, along with artificial fill, soil and debris deposits, and disturbed soil The surficial deposits overlie bedrock consisting of weathered claystone and minor bedrock sandstones of Cretaceous Arapahoe and Laramie Formations Surficial deposits consist of sandy clay and clayey gravel

The primary contaminant sources are located at the 903 Pad, Mound and East Trenches areas Potential release mechanisms from contaminated soil to the environment include storm water runoff, volatilization, wind suspension, infiltration and percolation to groundwater, direct contact, root uptake, and radioactive decay Transport media include groundwater, surface water, soil gas, and air These release and transport mechanisms and affected media are illustrated in the Conceptual Site Model (CSM) presented in Appendix B, Figure 10 1 Conceptual Site Model for Human Exposure Pathways Primary subsurface soil contaminants and UHSU groundwater contaminants for each IHSS are shown on Figures 1 3-1 and 1 3-2

13

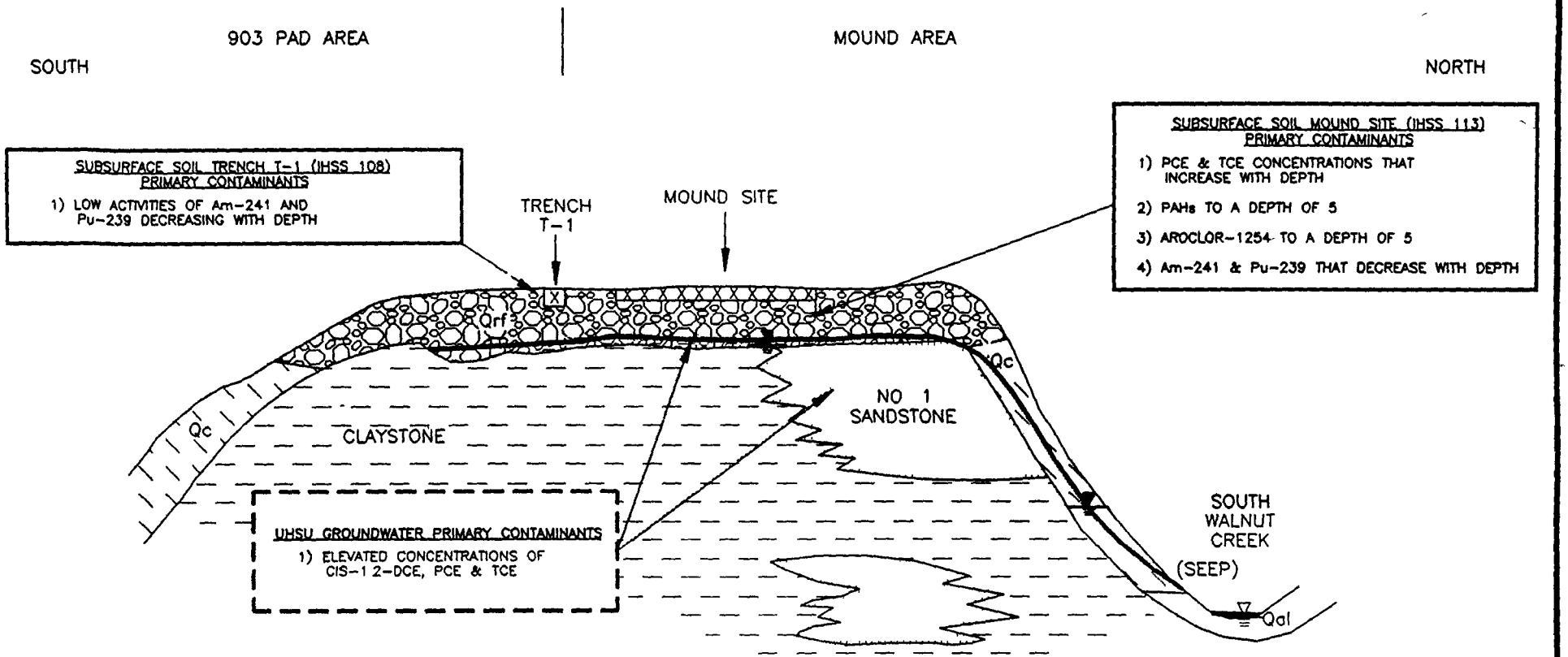

SOUTH
903 PAD AREA
MOUND AREA
NORTH
SUBSURFACE SOIL TRENCH T-2 (IHSS 109) AND IHSS 140 PRIMARY CONTAMINANTS
1) PCE, TCE, 1,1,1-TCA & CHCL3 INCREASING WITH DEPTH TO ~ 25'
2) LOW ACTIVITIES OF Am-241 Pu-239 & Pu-239/240 DECREASING WITH DEPTH
903 PAD
IHSS 140
(SEEP)
TRENCH T-2
Qrf
CLAYSTONE
NO 1 SANDSTONE
Qc
WOMAN CREEK
LARAMIE SANDSTONE/ SILTSTONE
SOUTH WALNUT CREEK
Qal
UHSU GROUNDWATER PRIMARY CONTAMINANTS
1) VOCs AT ELEVATED LEVELS
2) U-238 EXCEEDS BACKGROUND UTL
UHSU GROUNDWATER PRIMARY CONTAMINANTS
1) VOCs AT ELEVATED LEVELS
2) TOTAL (UNFILTERED) Am-241 & Pu-239/240 AT ELEVATED LEVELS BENEATH AND AROUND 903 PAD
LOW ACTIVITIES FOR DISSOLVED AM-241 AND Pu-239/240
EXPLANATION
SANDSTONE
COLLUVIUM
CLAYSTONE
IHSS BOUNDARY
Qrf-ROCKY FLATS ALLUVIUM
SUBSURFACE SOIL
GROUNDWATER SURFACE
UHSU GROUNDWATER
CREEK WATER SURFACE
SOURCE OU-2 PHASE RFI/RI REPORT
U S DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden, Colorado
OPERABLE UNIT NO 2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN
SUMMARY OF THE NATURE AND EXTENT OF THE PRIMARY CONTAMINANTS IN THE 903 PAD AREA
FIGURE 1 2-2
FEBRUARY 1995
0U2R8826 1=1

14

FIGURE 1.3-1
SUMMARY OF THE NATURE AND EXTENT OF THE PRIMARY CONTAMINANTS IN THE 903 PAD AREA

15

FIGURE 1.3-2
Summary of the Nature and Extent of the Primary contaminants in the Mound Area



EXPLANATION

- SANDSTONE
- COLLUVIUM
- CLAYSTONE
- IHSS BOUNDARY
- Qrf-ROCKY FLATS ALLUVIUM
- SUBSURFACE SOIL
- GROUNDWATER SURFACE
- UHSU GROUNDWATER
- CREEK WATER SURFACE

SOURCE OU-2 PHASE RFI/RI REPORT

U S DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden, Colorado

OPERABLE UNIT NO 2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

SUMMARY OF THE NATURE AND EXTENT OF PRIMARY CONTAMINANTS IN THE MOUND AREA

FIGURE 1 2-3 FEBRUARY 1995

OU2R827 1=1

2 SAMPLING AND DATA QUALITY OBJECTIVES

The primary objective of this SAP is to support the selection of remediation alternatives and accelerated source removal activities currently being planned for the Mound Site, Trench T-1, and the 903 Pad The data collected under this SAP will characterize contaminants contained within Trench T-1 as well as identify and delineate contaminated soil within the Mound Site, Trench T-1 and the 903 Pad Identifying and delineating the areal extent of the contamination will allow for a determination of the excavation areas and the volume of contaminated media to be treated, mitigating the impact to the environment and costs associated with the selected remediation alternatives

2.1 Data Quality Objectives

Data quality objectives (DQO) are set forth to optimize sample collection with respect to accomplishing the ultimate remediation objectives The DQO methodology will ensure collection of as few samples as possible (to minimize cost), while collecting enough samples to determine with a stated level of scientific confidence whether the project objectives have been accomplished The method is consistent with the latest EPA guidance (EPA), 1994, "EOA QA/G-4") For this project, the DQO is to acquire adequate data to characterize the contaminants within Trench T-1 and approximately define the three-dimensional extent of VOC contaminated soils within the Mound and the 903 Pad, for the ultimate purpose of excavation and treatment

DQO	How Achieved
Acquire adequate analytical data to characterize the contaminants within Trench T-1	Collect subsurface soil samples from eight borehole locations within Trench T-1 Continually monitor and examine core for high VOCs, Rads, NAPL, and visible staining Collect samples at five and ten foot depths and if NAPL or visible staining is found Analyze for VOCs, SVOCs, Radionuclides, Metals, and TPH using Level III analytical methods
Define the areal extent of contaminated soils at the Mound Site to sufficiently support planning of remedial activities	Perform Soil Gas Surveys within and surrounding the Mound Site Continually monitor and examine core for high VOCs, Rads, NAPL, and visible staining Collect soil gas samples at five foot intervals Monitor soil gas for Total VOCs using an OVA Collect 10 % of samples within high areas of VOCs or if NAPL or visible staining is found for laboratory analysis to confirm field instrumentation
Define the areal extent of contaminated soils at the 903 Pad to sufficiently support planning of remedial activities	Perform Soil Gas Surveys within and surrounding the 903 Pad Continually monitor and examine core for high VOCs, Rads, NAPL, and visible staining Collect soil gas samples at five foot intervals Monitor soil gas for Total VOCs using an OVA Collect 10 % of samples within high areas of VOCs or if NAPL or visible staining is found for laboratory analysis to confirm field instrumentation

2.2 Data Adequacy

Subsurface soil samples and soil gas samples have been collected at the Mound Site during earlier investigations The existing data confirms the presence of high VOC and radionuclide concentrations within the IHSS However, available data is not adequate for determining the lateral or vertical extent of contamination Additional data is necessary to identify the areal extent of the contaminant plume and the volume of contaminated material to be excavated and treated

19

Previous investigations in Trench T-1 avoided the interior of the trench Therefore the available data is not suitable for characterizing suspected VOC and radiological contaminants Analytical data is necessary to confirm the suspected presence of radiological contaminants and VOCs as well as positively identify contaminants and estimate the volume of contaminated material within the trench This information is crucial in determining the final disposition of the trench and selecting a remediation method

The nature of residual VOC and the volume of contaminated material contained beneath the 903 Pad is presently unknown General knowledge of the releases and contaminants is available, but specific data which is necessary to determine the extent of residual VOC contamination beneath the asphalt cap and soil is not available Existing patterns of groundwater contamination suggest the 903 Pad area contributes to a generally eastward moving plume in alluvial groundwater Previous investigations were broad in scope and were not focused on locating subsurface source areas, or provide sufficient information to develop an accurate volume estimate of contaminated soil

2.3 Data Analytical Levels

The level of analytical data appropriate for this investigation is as follows

- Laboratory analysis of VOCs, SVOCs, and metals in subsurface samples from VOC high concentration areas will be performed in accordance with Level III analytical procedures and reporting requirements
- Laboratory analysis of NAPLs, if performed, will be in accordance with Level III analytical procedures and reporting requirements
- Laboratory analysis of soil gas confirmation samples will be conducted using gas chromatography (GC) methods in accordance with Level II analytical requirements
- Initial screening of subsurface material samples using a FID or PID and field radiological detector including field analysis of soil gas samples using a organic vapor analyzer (OVA) will be performed in accordance with Level I analytical requirements
- Analytical results will be compared with field screening results as a check for field instrument accuracy

3. SAMPLE COLLECTION AND ANALYSES

In order to ensure adequate data is collected to characterize Trench T-1 and derive the necessary volume estimates of contaminated soil at the Mound Site, Trench T-1 and the 903 Pad a combination of soil gas and subsurface soil samples will be collected

20

3 1 Sampling and Analyses

All boreholes will be drilled with a hydraulic push drill rig one to two feet into bedrock or to a sufficient depth to confirm weathered bedrock Depths are estimated to be between fifteen and twenty feet below ground surface The exception to this will be boreholes located within Trench T-1 Boreholes within the trench will extend only to the trench bottom which is estimated to be between nine and ten feet below ground surface This will mitigate the possibility of creating new or additional pathways for contaminant migration from the trench to groundwater

Core samples will be collected continuously in five foot intervals from the surface to approximately two feet into bedrock or the bottom of the trench Five foot long core runs will be pushed using a hydraulic sampling tool (Geoprobe) Sampling intervals are detailed in sections 3 2 1, 3 2 2 and 3 2 3 Core samples will first be subjected to radiological field screening, then inspected visually under natural light for signs of NAPLs or staining, visually logged by the field geologist, and finally screened for VOCs as detailed below

After samples are screened for radiological contamination, they will be placed in sealed transparent containers The soil samples inside the sealed containers will be warmed to approximately 20 degrees centigrade to allow any VOCs present in the soil sample to volatilize in the sealed container's head space A head space sample in the sealed container will then be evaluated with an organic vapor analyzer (OVA) Samples with an OVA reading of 10 or greater parts per million will be considered to require remedial action The samples will then be placed in plastic bags and core boxes for storage Soil Gas Sampling and Field Analyses (5-21000-ER-OP-GT 09) procedures will be utilized during soil gas sampling

Subsurface soil samples will be collected for laboratory analysis to characterize contaminants within Trench T-1 and to verify field instrumentation results of soil gas analyses Soil samples will be handled in accordance with Rocky Flats SOP FO 10, Receiving, Labeling, and Handling Environmental Material Containers, and Rocky Flats SOP FO 13, Containerization, Preserving, handling, and Shipping of Soil and Water Samples Depths of sampling may be altered if the field screening or visual inspection indicates the presence of contamination at depths other than those specified in sections 3 2 1, 3 2 2 and 3 2 3

Field conditions expected during the investigation

- Background levels of radionuclides are expected to be encountered, during most operations but soil cores will be field screened upon retrieval At the 903 Pad higher levels are expected and no activities will be prior to a full radiological screening of the soil gas monitoring locations Continuous radiological monitoring will occur during intrusive activities

21

- Field work will be performed primarily in modified-Level D Personal Protective Equipment (PPE), except where otherwise indicated by the HASP
- Soil core sampling may be performed in Level B PPE if high VOC readings occur during monitoring

3.2 Soil Boring Locations

3.2.1 Trench T-1

Eight geoprobe soil borings will be located within Trench T-1 near areas believed to contain buried drums located during electromagnetic surveys These areas were identified during the 1995 Trenches Area and Mound Site Characterization activities by electromagnetic surveys Boreholes will be located close to the areas believed to contain drums, but far enough away to avoid inadvertently puncturing any drums Prior to intrusive, the proposed areas will be cleared using magnetometer surveys Figure 3 2 1-1 shows the location of Trench T-1 and the proposed borehole locations based upon the results of the electromagnetic survey These locations may be modified pending the results of magnetometer surveys prior to drilling Depth of borings will not exceed 10 feet in Trench T-1 to avoid penetrating the bottom of the trench and creating a potential pathway for contaminant migration Soil samples will be collected at depths of five and ten feet BGS unless examination of the core indicates staining or the presence of NAPL is detected In these instances, samples will be collected from the appropriate segments of the core sample

3.2.2 Mound Site

Geoprobe borings for soil gas and subsurface soils at the Mound will be located in the area of previously detected high soil gas readings, per the diagram in Figure 3 2 2-1 These locations are based upon previous sampling activities and will concentrate around the area of borehole 14295 which exhibited the highest levels of VOCs found at the Mound Site Soil gas sample locations will be spotted twenty feet to the north, south, east and west of location BH 14295 Samples will be collected at five feet intervals below ground surface (BGS) to a depth of one or two feet below bedrock If total VOCs are detected above ten ppm, then the sampling grid will be extended an additional twenty feet to the north, south, east, and west of that location and additional samples will be taken

If NAPL is encountered, the step out will be reduced to 10 feet This process will continue until the area contaminants are above 10 PPM is defined Soil samples (approximately 10%) will be collected from the areas of the highest Total VOC concentrations as confirmation samples Geoprobe locations will be

22

modified in the field on the basis of the field results as obtained (i e if areas of high VOC contamination are found, additional locations for soil gas sampling may be required to further delineate the extent of contamination)

3.2.3 903 Pad

Geoprobe soil gas and subsurface soil sampling at the 903 Pad will be implemented near wells 08891, 06691, and 09091 using the same sampling grid as the Mound Site Geoprobe holes will be located 20 feet apart per Figure 3 2 3-1 Soil gas sample locations will be spotted twenty feet to the north, south, east and west of locations 08891, 06691, and 09091 Samples will be collected at five feet intervals below ground surface (BGS) to a depth of one or two feet below bedrock If total VOCs are detected above ten ppm, then the sampling grid will be extended an additional twenty feet to the north, south, east, and west of that location and additional samples will be taken

If NAPL is encountered, the step out will be reduced to 10 feet This process will continue until the area contaminants are above 10 PPM is defined Soil samples (approximately 10%) will be collected from the areas of the highest Total VOC concentrations as confirmation samples Geoprobe locations will be modified in the field on the basis of the field results as obtained (i e if areas of high VOC contamination are found, additional locations for soil gas sampling may be required to further delineate the extent of contamination)

Table 3 2-1 presents a summary of the investigative methods to be used at each site

TABLE 3.2-1
INVESTIGATIVE METHODOLOGY BY LOCATION

Location	Method
Trench T-1 IHSS 108	Geoprobe soil core sampling (8 subsurface soil sampling locations with samples collected at 5 and ten foot intervals BGS), geophysical (magnetometer) survey to clear the area prior to any intrusive activities to ensure buried drums will not be punctured during soil sampling activities
Mound Site IHSS 113	Geoprobe soil core sampling (2 locations with samples collected at five foot intervals BGS based upon field observations and detected areas of high Total VOC concentrations) and soil gas sampling (approximately 15 sampling locations with samples collected at five foot intervals BGS to bedrock) along a twenty foot sampling grid based around location BH14295

23

903 Pad IHSS 112	Soil gas (approximately 30 sampling locations with samples collected at five foot intervals BGS to bedrock) along a twenty foot sampling grid based around locations 08891, 06691 and 09091 and soil core [1] sampling (four minimum locations with samples collected at five foot intervals BGS based upon field observations and detected areas of high Total VOC concentrations)

[1]Approximately three samples per borehole, dependent on soil gas results with a minimum of four locations at the discretion of the field geologist

This SAP will be conducted under the Environmental Restoration (ER) Sitewide Quality Assurance Project Plan (QAPjP) Table 3 2-2 summarizes the analytical protocols for subsurface soils and soil gas analyses Table 3 2-3 summarizes the analytical protocols to be used for liquids

TABLE 3.2-2
ANALYTICAL PROTOCOLS FOR SOILS AND SOIL GAS

Soils Analysis				
Analysis Method	**No. of Samples**	**QC Samples**	**Total Samples**	**Container/ Preservatives/ Holding Time**
*Volatile Organics/TCL-VOA Method 8240, 8270, 8015	60	1 duplicate per 20	63	500 ml glass jars /4°C/ 7 days
		1 field blank	1	4 oz glass w/ Teflon liner/4°C/ 7 days
*Radionuclides/ Am241, Pu239/240, U, Alpha Spec	64	1 duplicate per 20	67	1 L glass jars/NA/61 days
		1 field blank	1	500 ml glass jars/NA/61 days
Soil gas Analysis				
*OVA measurement/GT 09	90	9 duplicates	99	500 ml glass jars /NA/NA

* The number of samples collected will be determined by field observations made by the geologist and by results from field instrumentation

24

TABLE 3.2-3
ANALYTICAL PROTOCOLS FOR LIQUIDS

Analyte Method	Samples	QC Samples	Total Samples	Containers/ Preservative/ Holding Time
Groundwater	if present			
*Volatile Organics/TCL-VOA Method 8240, 8270, 8015	3	1 duplicate	4	2, 1 L amber glass /4°C/7 days
		1 rinsate	1	250 ml glass jars/NA/61 days
*Pu239/240 Am241 U Alpha Spec	3	1 duplicate	4	1 L Poly jars/NA/61 days
NAPL	if present			
*Volatile Organics/TCL-VOA Method 8240, 8270, 8015	3	1 duplicate	4	2, 1 L amber glass /4°C/7 days
		1 rinsate		4 oz glass w/ Teflon liner/4°C/7 days
*Pu239/240 Am241 U Alpha Spec	3	1 duplicate	4	1 L Poly jars/NA/61 days

* The number of samples collected will be determined by field observations made by the geologist and by results from field instrumentation

FIGURE 3.2.1-1
PROPOSED SAMPLING LOCATIONS WITHIN TRENCH T-1

FIGURE 3.2.2-1
PROPOSED SAMPLING LOCATIONS WITHIN THE MOUND SITE

FIGURE 3.2.3-1
PROPOSED SAMPLING LOCATIONS WITHIN THE 903 PAD AREA

3.3 Soil Boring Surveying and Abandonment

The borings will be marked with unique numbered flags immediately after completion The numbering on the flags will be correlated with the sample analyses Boring locations will be surveyed using the Global Positioning System (GPS) which provides digital information that will be placed into the Rocky Flats Environmental Database System (RFEDS) The digital information will be used to produce computer generated maps of the soil boring locations The GPS survey will be conducted in accordance with the manuals provided by the manufacturer of the surveying equipment, Ashtech, Inc

The borings will be abandoned in accordance with procedure Plugging and Abandonment of Boreholes (5-21000-ER-OPS-GT 05) and modified as follows The borehole will be backfilled with powdered or granular bentonite from ground surface

4. SAMPLE DESIGNATION

The location and depth interval of all subsurface materials, either solid or liquid recovered from the Mound Site, Trench T-1, or the 903 Pad during the course of this investigation will be recorded in the field log book RFEDS location codes will be cross indexed to appropriate sample grid location designations in the field log book Soil core and other material that is subject to only field screening will be identified by the sample location code and grid coordinates and depth interval where the sample is obtained Samples undergoing VOC or radioisotope analysis will have RFEDS sample numbers applied to the container labels in the field The numbers will be applied sequentially as the samples are collected and the COC form is prepared A block of sample numbers for soil gas samples and borehole samples as well as a block of location codes will be obtained from the RFEDS A block of location codes and sample numbers will be of sufficient size to include the entire number of possible locations and samples scheduled for analysis and an additional twenty percent for potential additional locations and samples

Soil gas sample numbers will be assigned the prefix "SG" followed by a four digit number and a contractor indicator Borehole samples will be assigned the prefix "BH" followed by a four digit number and a contractor indicator All samples numbers will be assigned sequentially

5. SAMPLING EQUIPMENT AND PROCEDURES

Sampling will be conducted through the use of the Geoprobe, equipped for core recovery and liquid sampling The core recovery equipment will be operated in accordance with procedures presented in GT 02, subsection 5 3 5 and as modified by GT 39, Push Subsurface Soil Sample If free product is

32

encountered in any of the boreholes, an attempt will be made to collect a liquid sample and submit it for analysis

Tables 5-1 and 5-2 list the applicable procedures for this SAP

TABLE 5-1
FIELD AND ADMINISTRATIVE STANDARD OPERATING PROCEDURES

IDENTIFICATION NUMBER:	PROCEDURE TITLE
5-21000-OPS-FO 3	General Equipment Decontamination
5-21000-OPS-FO 6	Handling of Personal Protective Equipment
5-21000-OPS-FO 7	Handling of Decontaminated Water and Waste Water
5-21000-OPS-FO 10	Receiving, Labeling, and Handling Environmental Materials Containers
5-21000-OPS-FO 11	Field Communications
5-21000-OPS-FO 12	Decontamination Facility Operations
5-21000-OPS-FO 13	Containerization Preserving, Handling, and Shipping of Soil and Water Samples
5-21000-OPS-FO 14	Field Data Management
5-21000-OPS-FO 15	Photoionization Detectors and Flame Ionization Detectors
5-21000-OPS-FO 16	Field Radiological Measurements
5-21000-OPS-FO 18	Environmental Sample Radioactivity Content Screening
4-B11-ER-OPS-FO 25	Shipping Limited Quantities of Radioactive Materials in Samples
5-21000-ER-OPS-GT 01	Logging Alluvial and Bedrock Material
5-21000-ER-OPS-GT 02	Drilling and Sampling Using Hollow Stem Auger Techniques
5-21000-ER-OPS-GT 05	Plugging and Abandonment Boreholes
5-21000-ER-OPS-GT 09	Soil Gas Sampling and Field Analysis
4-S64-ER-OPS-GT 39	Push Subsurface Soil Sample
5-21000-ER-OPS-GW 06	Groundwater Sampling
1-50000-ADM-12 01	Control of Measuring and Test Equipment

TABLE 5-2
LABORATORY STANDARD OPERATING PROCEDURES

ANALYTICAL SUITE:	CONTROLLING DOCUMENTS·
VOCs	Title 40 of the Codes of Federal Regulation Part 264 Appendix IX Methods 8240 and others applicable to TCL-VOA in soils All laboratory analyses will also adhere to protocols specified in Parts A and B of the RFETS General Radiochemistry and Routine Analytical Services Protocol (GRRASP)
Radionuclides	Part B of the GRRASP

5.1 Sample Handling and Analysis

Core samples will be visually inspected for free liquids or staining using natural and light, and by OVA instruments operated in accordance with procedures GT 09, Soil Gas Sampling and Filed Analysis, subsections 5 1 and 5 2, and FO 15 Photoionization Detectors and Flame Ionization Detectors However, calibration verification will only be performed daily, not after every 20 samples Headspace analysis will be performed utilizing sealed containers

Sample labeling, handling, and shipping shall be performed in accordance with FO 13, "Containerization, Preserving, Handling and Shipping of Soil and Water Samples "

All laboratory work will be done according to the US Environmental Protection Agency's (USEPA's) Contract Lab Program (CLP) standards The CLP-type analysis is outlined in the document entitled "EG&G Rocky Flats, General Radiochemistry and Routine Analytical Service Protocol (GRRASP) version 3 0, 1994 "

5.2 Documentation

A field notebook will be created and maintained for the project by the Project Manager or their designee This will be used in conjunction with the appropriate field data forms required by the operating procedures (Table 5-1) governing the field activities occurring during this project It is not necessary to duplicate items recorded on field data forms in the field notebook, but if additional clarification of entries on the forms is required, they should be recorded in the field notebook The field notebook should include time and date information concerning the field activities and a sketch map of actual sample locations with a cross index of sample location IDs, RFEDS and other sample numbers, and COC numbers Information not specifically required by the field

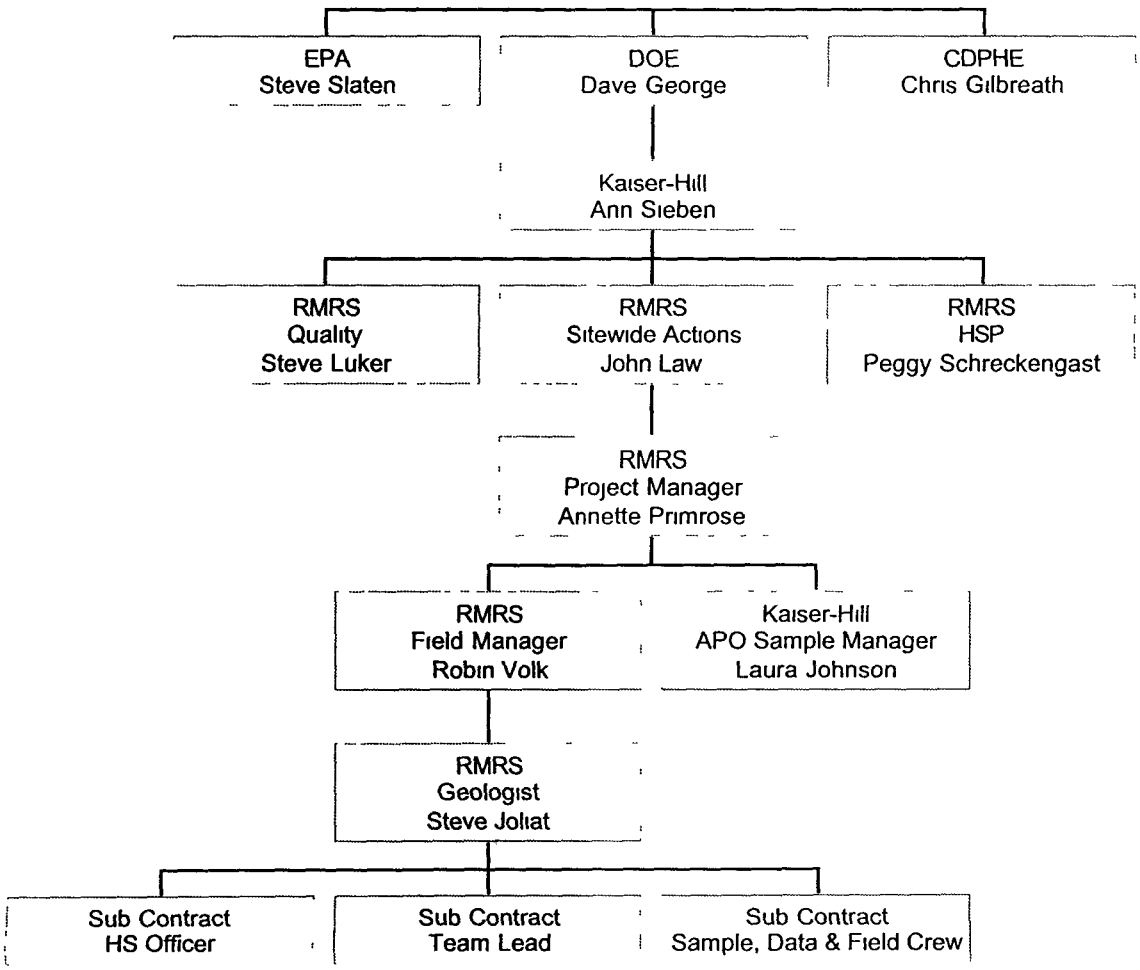
34

data forms should be recorded in the field notebook Soil cores will be logged in accordance with GT 01, "Logging Alluvial and Bedrock Material" with sufficient detail in the field that detailed logging will not be performed Soil core observations will be recorded on Form GT 1A, Rocky Flats Plant Borehole Log and not on Form GT 1B, Preliminary Well-Site Field Log Soil core will be screened for VOCs and radioactive contaminants, a portion or portions from different intervals of the same core run will be used for ambient temperature headspace (ATH) readings per GT 09, and the remaining sections of core will be placed into Ziploc bags before placement in a core box for future reference Samples for ATH will be labeled with location code and depth interval Soil samples will not have to be photographed

6. PROJECT ORGANIZATION

For the purpose of this investigation the work breakdown structure shown in Figure 1-6 shall be implemented

FIGURE 6-1
PRE-REMEDIATION INVESTIGATION OF THE MOUND, TRENCH T-1 AND THE 903 PAD ORGAN



35

7. DATA MANAGEMENT and QUALITY CONTROL

Data management and Quality Control issues are addressed in Sections 2 4 and 3 0 of the RFETS OU-2 Trenches and Mound Site Characterization Work Plan, February 1995, RF/ER-95-0010

36

8. REFERENCES

Rocky Flats Historical Release Report RF/ER-95-0010, DOE 1995a

DOE 1991, *Final Phase II RFI/RI Work Plan TM 1, RFP 903 Pad, Mound and East Trenches Areas*

DOE 1992, *Final Historical Release Report for the Rocky Flats Plant*

Technical Memorandum No 9 Chemicals of Concern, Human Health Risk Assessment 903 Pad, Mound, and East Trenches Areas Operable Unit No 2, August 1994

the *Phase II RFI/RI Report for Operable Unit No 2 903 Pad, Mound, and East Trenches Area*

EPA, 1994, "EOA QA/G-4"

37

9. APPENDIX B: APPLICABLE SECTIONS FROM THE TRENCHES AND MOUND SITE CHARACTERIZATION WORK PLAN OPERABLE UNIT NO. 2

receptors for a qualitative risk evaluation in the EE/CA The conceptual site model (Section 1 2 1 2) illustrates the release and transport mechanisms and affected media Transport of contamination to groundwater is of primary concern in the evaluation of remediation alternatives for the source areas

1.2.5 Step 5 - Develop a Decision Rule

Step 5 defines the process by which the data collected will be compared to the decision criteria The data collection program for the trenches and Mound Site will use an observational approach that will allow field results to be evaluated as each field activity is completed For this type of field program a decision rule diagram, Figure 1 2-6, has been developed to define the pathway on which the field program must proceed to collect appropriate data for future use in the EE/CA and implementation plan

Data collected during the OU-2 Trenches and Mound Site Work Plan field investigation will be compared against the decision criteria developed in the EE/CA The decision criteria will be developed using the following site specific ARARs chemical specific, such as PRGs, action specific, and location specific, and will be presented in the EE/CA

In general, all the available data (chemical and physical) will be summarized in the EE/CA Identification and an estimate of the size of source areas will be made based on field soil gas screening results, field observations, and sample analytical results A qualitative risk evaluation and comparison of analytical data to PRGs will be performed to support development of removal action/remediation alternatives Remediation alternatives will be identified and evaluated with respect to effectiveness, implementability, and cost A comparative analysis of alternatives will be performed and an alternative will be recommended A decision rule diagram, Figure 1 2 7, has been developed to identify the decision process for the EE/CA

1.2.6 Step 6 - Specify Acceptable Limits on Decision Error

During this step of the DQO process, constraints on the level of uncertainty that the decision maker is willing to accept in the determination of the outcome of the decision are identified These constraints typically include the establishment of acceptable decision error limits and consequences of false positive or negative results on the decision to be made Decision error is comprised of both sampling error and measurement error

Procedures have been incorporated in this work plan to reduce field and laboratory measurement error and uncertainty As an example, two methods of field analysis for soil gas will be performed to reduce uncertainty field instrument screening and on-site mobile laboratory analysis of soil gas Initially, soil gas samples will be screened in the field using field instruments Approximately 30 percent of the screened locations will be sampled concurrently and sent to an on-site mobile laboratory for confirmation analysis The purpose of the on-site analysis is to reduce the uncertainty inherent with a field instrument Additional soil gas samples will be collected for analyses from locations of the trench where the highest initial soil gas concentrations are found At these locations, soil samples will also be collected to provide confirmation of screening results and reduce further uncertainty If the soil sample results conflict with the soil gas screening results, additional soil samples may be collected to further reduce uncertainty

Section 3 0 of this work plan provides a discussion of the quality assurance/quality control procedures which will be implemented to minimize measurement error to the extent practical, particularly for soil and soil gas analyses performed by the laboratory Minimum measurement error will be accomplished in part by analyzing field and laboratory QA/QC samples in conjunction with analyses of field soil and soil gas samples

Additionally, this work plan provides a field sampling and analytical program rationale, including geophysical and soil gas surveys, which is intended to identify VOC high concentration areas within the trenches and Mound Site for subsequent soil sample collection and analysis Therefore, the potential for significant impacts on decision making due to sampling error have been addressed to the extent practical

- Screening level data using a photoionization detector (PID) and/or flame-ionization detector (FID) on the concentration of VOCs in soil gas samples collected from two different depths within each trench

- Screening level data (PID and/or FID) on the concentration of VOCs and the radiological activity in subsurface material samples collected from VOC high concentration areas within each trench and the Mound Site

- Chemical data (VOCs) for confirmation samples collected to verify the results of the soil gas survey

- Chemical data (VOCs, SVOCs, metals, and radionuclides) for subsurface materials collected in VOC high concentration areas

- Chemical data for NAPLs collected from the boreholes within the trenches and Mound Site, if present

1.2.7.2 Data Use

Chemical data derived from the OU-2 Trenches and Mound Site Characterization field investigation will be used for a number of purposes, including

- Screening of soil gas samples using a PID and/or FID and a field radiological detector to identify areas of VOC high concentrations, aid in selecting subsurface material samples for laboratory analysis, and health and safety monitoring

- Laboratory analysis of soil gas confirmation samples to verify the results of the soil gas screening survey Results from the laboratory are expected within 24 hours of receipt

- Laboratory analysis of subsurface material samples from VOC high concentration areas to evaluate the nature of contamination in those areas

- Laboratory analysis of geotechnical samples to evaluate the physical properties of subsurface materials in the source areas

- Laboratory analysis to characterize the nature of NAPLs present at a particular location

1.2.7.3 Data Quality

The analytical options available to support data collection activities are presented in five general levels (EPA 1993) The level of data that is obtained for each data type is dependent on the intended use of the data These levels (listed below) are distinguished by the types of technology and documentation used

- Level V - Laboratory analysis using nonstandard methods Radiological analyses and analyses that may require method modification and/or development The laboratory may or may not be a Contract Laboratory Program (CLP) laboratory This level is appropriate for use in the EE/CA

- Level IV - CLP Routine Analytical Services (RAS) This level is characterized by rigorous QA/QC protocol and documentation All analyses are performed in an off-site CLP analytical laboratory following CLP protocol This level is not necessary and/or cost effective for use in the EE/CA

- Level III - Laboratory analysis using methods other than CLP RAS This level is used primarily to support engineering studies and risk assessments using standard EPA-approved procedures Some procedures may be equivalent to CLP RAS without CLP requirements for documentation The laboratory

may or may not be a CLP laboratory This level is appropriate for use in the EE/CA

- Level II - This level is characterized by the use of portable analytical instruments which can be used on site, or in mobile laboratories stationed near a site This level is appropriate for determining the presence of contaminants, relative concentrations, and screening of samples Appropriate for real-time data (i e , turnaround time within hours of receipt) This level is appropriate for use in the EE/CA

- Level I - This level is characterized by the use of portable instruments which can provide real-time data to assist in the optimization of sampling point locations This level is appropriate for screening

The level of analytical data deemed appropriate for the OU-2 Trenches and Mound Site Characterization field investigation is as follows

- Laboratory analyses for radionuclides are considered non-standard analyses, therefore, the analytical level for these constituents in all media will be in accordance with Level V analytical requirements (EPA 1993)

- Laboratory analysis of VOCs, SVOCs, and metals in subsurface samples from VOC high concentration areas will be performed in accordance with Level III analytical procedures and reporting requirements Sufficient documentation will be obtained to allow for full data validation Laboratory analysis of TPH (Total Petroleum Hydrocarbons), will also be in accordance with Level III analytical requirements

- Laboratory analysis of NAPLs, if performed, will be in accordance with Level III analytical procedures and reporting requirements Sufficient documentation will be obtained to allow for full data validation

- Laboratory analysis of soil gas confirmation samples will be conducted using gas chromatography (GC) methods in accordance with Level II analytical requirements

- Initial screening of subsurface material samples using a PID and/or FID and field radiological detector and the analysis of soil gas samples using a PID and/or FID will be performed in accordance with Level I analytical requirements

- Analytical results will be compared with field screening results as a check for field instrument accuracy

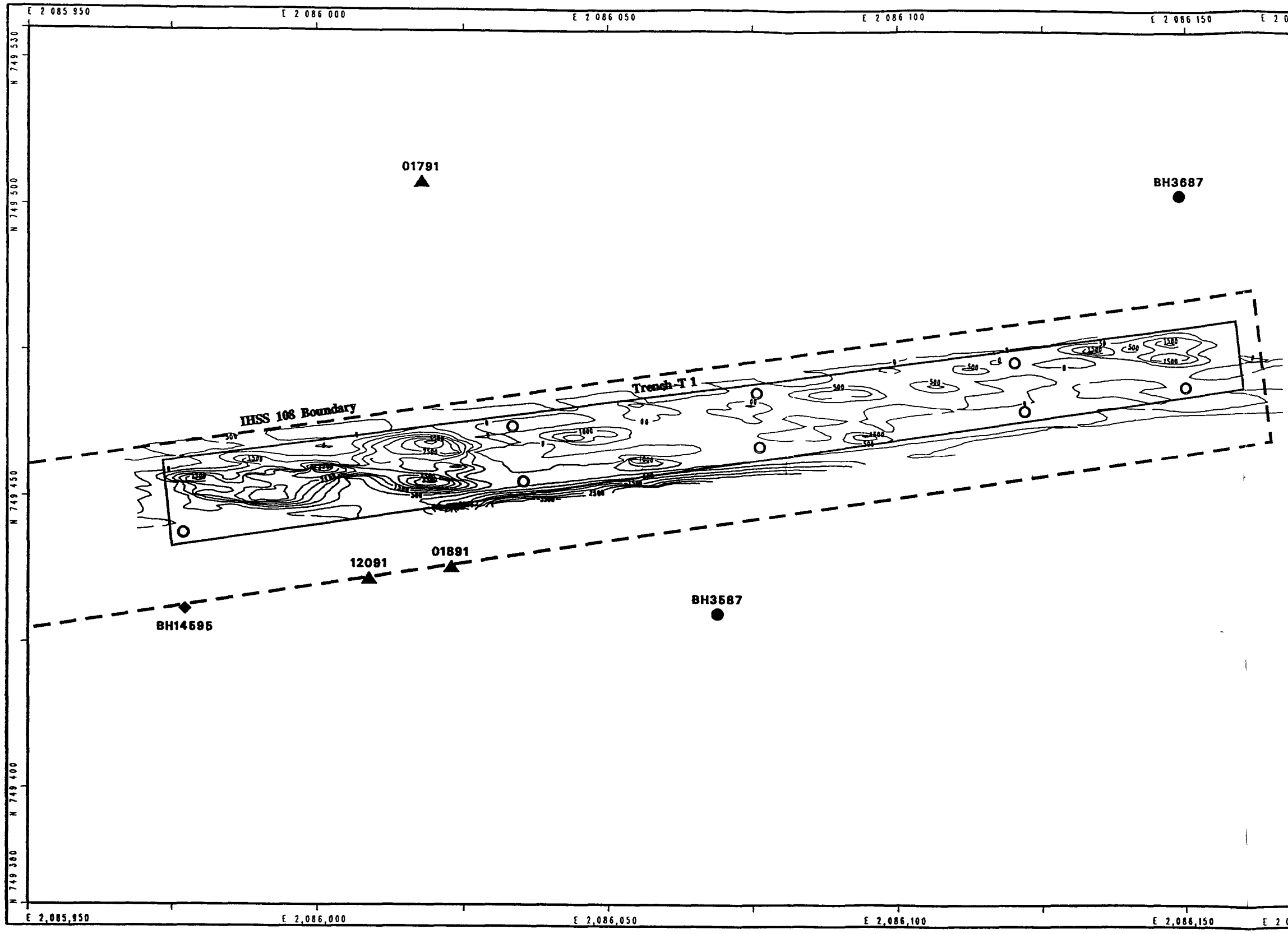
1.2.7.4 Data Quantity

Soil gas samples will be collected from two depths at approximately 20 sampling stations in each trench Additional soil gas sample locations needed to delineate VOC high concentration areas will be determined by the results of the initial screening Approximately 30 percent of the soil gas samples will be selected at random and submitted for on-site mobile laboratory analysis as confirmation of the soil gas results Approximately eight subsurface material samples will be collected in the Mound Site and submitted for laboratory analysis The number of subsurface samples collected in the trenches will be determined based on the results of the soil gas survey NAPLs will be sampled if encountered in the trenches Samples will be analyzed for TPH if staining is encountered The number and type of samples to be collected during implementation of the OU-2 Trenches and Mound Site Characterization field investigation program is further discussed in the SAP (Section 2 0)

1.2 7 5 PARCC Parameters

The PARCC parameters (i e , precision, accuracy, representativeness, completeness, and comparability) are indicators of data quality These indicators will be used to assess the overall quality of the data obtained from this sampling program Precision is a quantitative

measurement of the reproducibility of the data under a given set of conditions Accuracy is defined as the degree of agreement of a measurement to an accepted reference or true value, and may be indicative of the bias in a measuring system The degree to which a data set is representative of the study area is known as representativeness Completeness may be defined as the percentage of valid measurements obtained from a sampling program Comparability is a qualitative indicator of how well newly collected data will be comparable with previously collected data The PARCC parameters and their specific applications for the OU-2 Trenches and Mound Site Characterization Work Plan are discussed in Section 3 0



Operable Unit 2
IHSS 108 Trench T 1

Electromagnetic Contour Map
EM-61 Data
Channel 2 Response

Sampling Types

- Borehole
- Groundwater Well
- Characterization Borehole
- Proposed Sample Locations
- Channel 2 Response Isopleth Contour Interval = 500 mv
- IHSS Boundary
- Trench Boundary

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. 19
Hydrology provided by USGS (date unknown)
Electromagnetic data provided by Woodward-Clyde June, 1995.
Characterization Boreholes provided by Woodward Clyde May 1995.

Scale 220
Inch represents approximately 6.83 feet

5 0 10ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S Department of Energy
Rocky Flats Environmental Technology Sit

Prepared by:
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: new-trench

March 6, 1996

27

E 2 085 894 E 2 086 050 E 2 086 200 E 2 086 311

N 749 731 N 749 731

02191

BH38

9991 2179

0174

BH3687

BH14595

12091 01891

BH3587

178

Trench T-1

N 749 550 N 749 550

N 749 412 N 749 412

E 2,085 894 E 2 086,050 E 2,086 200 E 2,086 311

Mound Proposed Sampling Locations

EXPLANATION

- Characterization Boreholes
- Boreholes
- Groundwater Wells
- Paved Roads
- Unpaved Roads
- Streams Ditches, or other Drainage Features
- Contours (10 Intervals)
- Trench Boundaries
- Buildings and other Structures
- Individual Hazardous Substance Sites (IHSS)
- 10 Grid

Scale 400
1 Inch represents approximately 33.33 feet

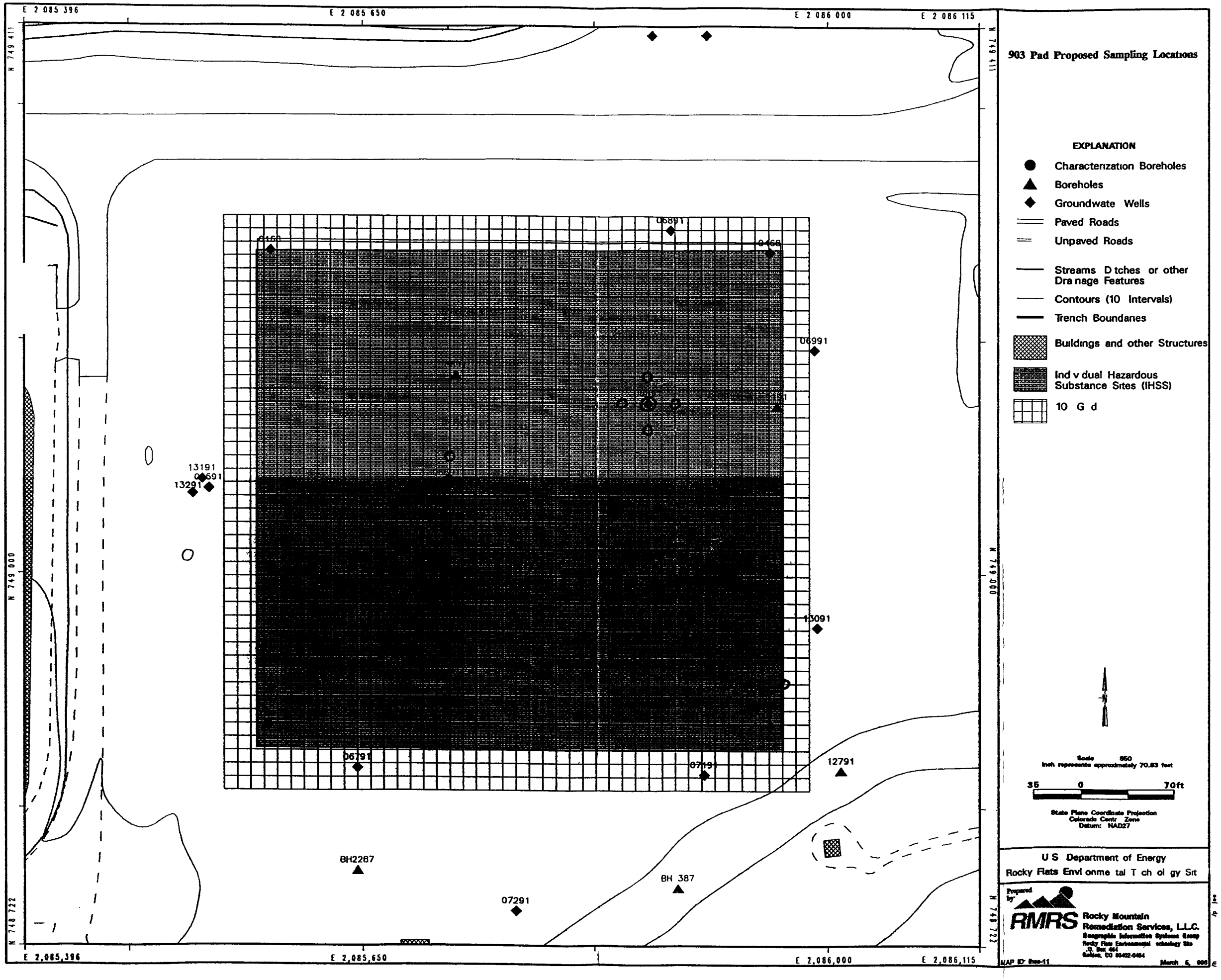
15 0 30ft

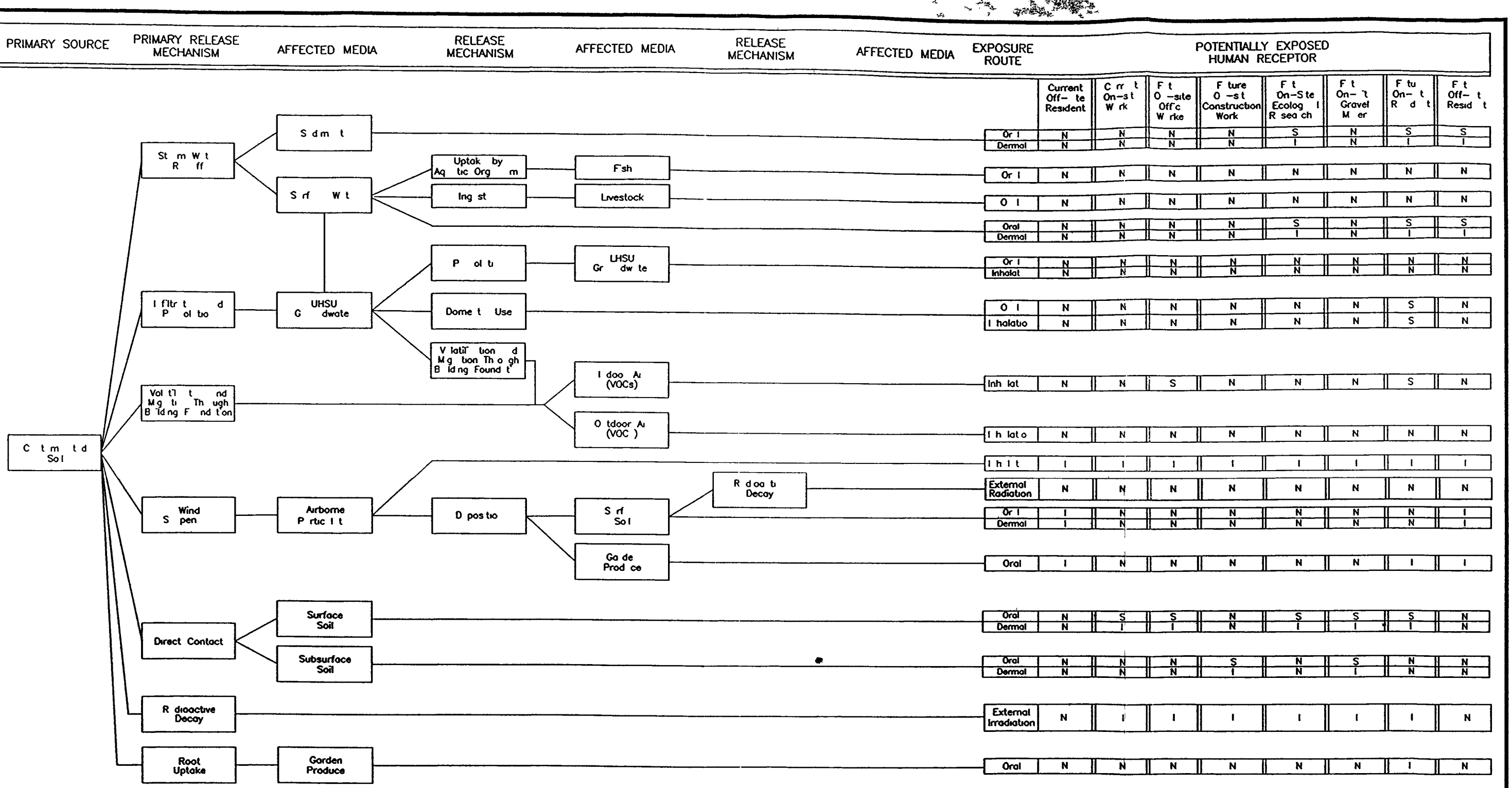
State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U S Department of Energy
Rocky Flats Environmental Technology Site

Prepared by
RMRS Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental Technology Site
P.O. Box 464
Golden, CO 80402-0464

MAP ID: Base-1 March 6, 1996


E 2 085 396
E 2 085 650
E 2 086 000
E 2 086 115
N 749 411
N 749 000
N 748 722
E 2,085,396
E 2,085,650
E 2,086,000
E 2,086,115
06891
06991
13191
13291
13091
06791
07191
12791
BH2287
07291
BH 387
903 Pad Proposed Sampling Locations
EXPLANATION
Characterization Boreholes
Boreholes
Groundwate Wells
Paved Roads
Unpaved Roads
Streams D tches or other Dra nage Features
Contours (10 Intervals)
Trench Boundaries
Buildings and other Structures
Ind v dual Hazardous Substance Sites (IHSS)
10 G d
Scale 950
Inch represents approximately 70.83 feet
35 0 70ft
State Plane Coordinate Projection
Colorado Centr Zone
Datum: NAD27
U S Department of Energy
Rocky Flats Envi onme tal T ch ol gy Sit
Prepared by
RMRS
Rocky Mountain Remediation Services, L.L.C.
Geographic Information Systems Group
Rocky Flats Environmental echnology Site
P.O. Box 464
Golden, CO 80402-0464
MAP ID: ffee-11
March 5, 996



LEGEND

- S Significant Potential Exposure Pathway
- I Insignificant Potential Exposure Pathway
- N Negligible or Incomplete Exposure Pathway
- UHSU Upper Hydrostratigraphic Unit
- LHSU Lower Hydrostratigraphic Unit

Note Significant and insignificant potential exposure pathways will be quantitatively evaluated

U S DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden Colorado

OPERABLE UNIT 2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

CONCEPTUAL SITE MODEL FOR HUMAN EXPOSURE PATHWAYS

FIGURE 12-1 FEBRUARY 1995

OU2RI825 1=1

REVIEW HISTORICAL AERIAL PHOTOGRAPHS AND INFORMATION TO IDENTIFY APPROXIMATE TRENCH LOCATIONS AND DIMENSIONS

MOBILIZE AND PERFORM EM AND GPR SURVEYS EVALUATE RESULTS

HAVE INTERPRETED EM & GPR TRENCH BOUNDARIES SURVEYED AND PLOTTED ON FIGURE

IS THERE DETECTION OF METAL IN TRENCH (PARTICULARLY TRENCH T-1)

YES

CONSULT WITH EG&G REEVALUATE/MODIFY GEOPROBE AND DRILLING LOCATIONS IF APPROPRIATE

NO

MOBILIZE AND PERFORM INITIAL SOIL GAS SURVEY ANALYZE SAMPLES USING ONSITE FID/PID APPROXIMATELY 30% OF SAMPLES WILL BE ANALYZED BY ONSITE MOBILE LABORATORY FOR CONFIRMATION ANALYSIS

EVALUATE FIELD MEASUREMENTS FROM INITIAL SOIL GAS SURVEY TO ASSESS VOC HIGH CONCENTRATION AREAS

ARE THERE ANY VOC HIGH CONCENTRATION SOIL GAS AREAS WITHIN THE TRENCH?

NO

DO ONSITE LAB ANALYSES CONFIRM FIELD MEASUREMENTS?

NO

CONSULT WITH EG&G RECOMMEND ADDITIONAL SAMPLING AND ANALYSIS IF APPROPRIATE

YES

YES

PERFORM VOC HIGH CONCENTRATION AREA SOIL GAS SURVEY TO DELINEATE HIGH CONCENTRATION AREAS ANALYZE SAMPLES USING ONSITE FID/PID APPROXIMATELY 30% OF SAMPLES WILL BE ANALYZED BY ONSITE MOBILE LABORATORY FOR CONFIRMATION ANALYSIS

PLOT INITIAL SOIL GAS AND HIGH CONCENTRATION SOIL GAS RESULTS ON TRENCH MAPS

EVALUATE AND INCORPORATE THE FOLLOWING APPLICABLE INFORMATION ON TO MAPS

1) AREAL EXTENT OF VOC HIGH CONCENTRATION SOIL GAS AREA

2) NUMBER AND LOCATION OF PREVIOUS BOREHOLES DRILLED IN THE VOC HIGH CONCENTRATION AREA

3) TYPE OF CONTAMINANT AND CONCENTRATION IN THE VOC HIGH CONCENTRATION AREA (BASED ON SOIL GAS DATA AND HISTORIC BOREHOLE DATA)

4) DEPTH TO HIGH GROUNDWATER (AS MEASURED DURING 2ND QUARTER 1992 FROM NEARBY WELLS)

5) DEPTH TO GROUNDWATER (AS MEASURED AT THE BEGINNING OF THE MOST RECENT QUARTER FROM NEARBY WELLS)

6) LOCATION OF GROUNDWATER PLUMES

7) FIELD OBSERVATIONS DURING SOIL GAS SURVEY (NAPL DRUMS VOID SPACES)

U S DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden Colorado

OPERABLE UNIT 2
TRENCHES CHARACTERIZATION

DECISION PATH DIAGRAM FOR FIELD WORK IN THE OU-2 TRENCHES
(PAGE 1 OF 2)

CONTINUED FROM PAGE 1 OF 2

MEET WITH EG&G REPRESENTATIVES TO DETERMINE SUBSURFACE SOIL SAMPLING LOCATIONS (ie BOREHOLE) FOR EACH TRENCH

WILL THE BOREHOLE BE LOCATED WITHIN THE TRENCH?

YES

PUSH OR DRILL AND COLLECT SAMPLES WITH GEOPROBE OR H S A TO THE BASE OF TRENCH (ASSUMED TO BE TO A DEPTH OF 10 WITH THE EXCEPTION OF T-2 [ASSUMED TO BE TO A DEPTH OF 5])

NO

DRILL AND COLLECT SAMPLES USING H S A TECHNIQUE TO TOP OF GROUNDWATER (MOUND BOREHOLE WILL BE DRILLED AND SAMPLES USING THIS METHODOLOGY

SUBMIT VOC SAMPLES FOR RUSH (TURNAROUND) ANALYSIS

OBTAIN AND EVALUATE VOC RESULTS

MEET WITH EG&G AND DOE REPRESENTATIVES TO DETERMINE IF DEEPER SUBSURFACE SOIL SAMPLES ARE NEEDED DECISIONS WILL BE BASED ON EVALUATION OF THE FOLLOWING DATA

1) AREAL EXTENT OF VOC HIGH CONCENTRATION AREA AS IDENTIFIED BY THE SOIL GAS SURVEY
2) LOCATION OF HISTORICAL BOREHOLES
3) VOC ANALYTICAL RESULTS OBTAINED FROM THE SHALLOW BOREHOLES WITHIN THE TRENCHES
4) DEPTH TO HIGH GROUNDWATER FROM NEARBY WELLS (AS MEASURED DURING 2ND QUARTER OF 1992)
5) DEPTH TO GROUNDWATER FROM NEARBY WELLS (AS MEASURED AT THE BEGINNING OF THE QUARTER)
6) LOCATION OF CONTAMINATED GROUNDWATER PLUMES
7) FIELD OBSERVATIONS (NAPL DRUMS VOID SPACES)

ARE DEEPER SUBSURFACE SOIL SAMPLES NEEDED BENEATH TRENCH?

NO

YES

DRILL AND COLLECT SAMPLES BENEATH TRENCH USING ANGLE DRILLING TECHNIQUE TO THE TOP OF GROUNDWATER

IS NAPL OR LIQUID PRESENT IN THE BOREHOLE?

YES

STOP DRILLING OF BOREHOLE ATTEMPT TO OBTAIN NAPL OR LIQUID SAMPLE FOR ANALYSIS IF NO SAMPLE CAN BE OBTAINED OR AFTER SAMPLE IS COLLECTED PLUG AND ABANDON BOREHOLE OFFSET ~ 5 TO DRILL NEW BOREHOLE

NO

ADVANCE BOREHOLE TO GROUNDWATER (EXCEPT FOR SATURATED BIOTREATABILITY SAMPLES)

DO OFF-SITE LAB ANALYSES CONFIRM SOIL GAS RESULTS?

NO

CONSULT WITH EG&G RECOMMEND ADDITIONAL SAMPLING AND ANALYSIS IF APPROPRIATE

YES

PREPARE AND SUBMIT SOIL GAS AND SUBSURFACE MATERIAL SAMPLE RESULTS REPORT TO EG&G

U S DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden Colorado

OPERABLE UNIT 2
TRENCHES CHARACTERIZATION

DECISION PATH DIAGRAM FOR FIELD WORK IN THE OU-2 TRENCHES (PAGE 2 OF 2)

FIGURE 1 2-6 MARCH 1995