PU&D Yard Plume Enhanced Natural Attenuation Treatability Study Work Plan

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1/17

TABLE OF CONTENTS

TABLES

FIGURES

ACRONYM LIST

ALARA	As Low as Reasonably Achievable
ASD	Analytical Services Division
CDPHE	Colorado Department of Public Health and the Environment
cm/sec	centimeters per second
DOE	Department of Energy
EDD	Electronic Disc Deliverable
EPA	Environmental Protection Agency
FIDLER	Field Instrument for the Detection of Low Energy Radiation
GOPM	Groundwater operations project manager
GPS	Global Positioning System
HRC™	Hydrogen Release Compound

2

HSS	Health and Safety Specialist
IMP	Integrated Monitoring Plan
PM	project manager
PU&D Yard	Property Utilization and Disposal Yard
PVC	polyvinyl chloride
QA/QC	Quality Assurance/Quality Control
RCT	Radiological Control Technician
RIN	report identification number
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RMRS	Rocky Mountain Remediation Services
RPD	relative percent difference
RWP	Radiological Work Permit
SAP	Sampling and Analysis Plan
SWD	Soil and Water Database
SCFA	DOE Subsurface Contaminant Focus Area
ug/kg	micrograms per kilogram
ug/l	micrograms per liter
UHSU	Upper Hydrostratigraphic Unit
VOCs	Volatile Organic Compounds

LIST OF APPLICABLE STANDARD OPERATING PROCEDURES (SOPs)

Identification Number	Procedure Title
2-S47-ER-ADM-05 14	*Use of Field Logbooks and Forms*
4-S01-ENV-OPS-FO 03	*Field Decontamination Procedures*
5-21000-OPS-FO 16	*Field Radiological Measurements*
ASD-003	*Identification System for Reports and Samples*
RF/RMRS-98-200	*Evaluation of Data for Usability in Final Reports*
RMRS/OPS-PRO 069	*Containing, Preserving, Handling and Shipping of Soil and Water Samples*
RMRS/OPS-PRO 070	*Decontamination of Equipment at Decontamination Facilities*
RMRS/OPS-PRO 072	*Field Data Management*
RMRS/OPS-PRO 102	*Borehole Clearing*
RMRS/OPS-PRO 105	*Water Level Measurements in Wells and Piezometers*
RMRS/OPS-PRO 106	*Well Development*
RMRS/OPS-PRO 108	*Measurement of Groundwater Field Parameters*
RMRS/OPS-PRO 112	*Handling of Decontamination Water and Wash Water*
RMRS/OPS-PRO 113	*Groundwater Sampling*
RMRS/OPS-PRO 114	*Drilling and Sampling Using Hollow-Stem Auger and Rotary Drilling and Rock Coring Techniques*
RMRS/OPS-PRO 117	*Plugging and Abandonment of Boreholes*
RMRS/OPS-PRO 118	*Monitoring Wells and Piezometer Installation*
RMRS/OPS-PRO 123	*Land Surveying*
RMRS/OPS-PRO 124	*Push Subsurface Soil Sampling*
RMRS/OPS-PRO 128	*Handling of Purge and Development Water*

3

1.0 INTRODUCTION

A plume of volatile organic compound (VOC) contaminated groundwater is derived from a contaminant source in the Property Utilization and Disposal (PU&D) Yard at the Rocky Flats Environmental Technology Site (RFETS) This treatability study will evaluate the effectiveness of Hydrogen Release Compound (HRC™) for enhancing natural attenuation of the VOCs in the groundwater and soil at the PU&D Yard Plume HRC™ is a proprietary, environmentally safe, food quality, polylactate ester formulated for slow release of lactic acid upon hydration The product has been used at other sites to stimulate rapid degradation of chlorinated VOC contaminants in groundwater and soil This study will evaluate the effectiveness of HRC™ in the low flow groundwater regimes common at RFETS

The study area is limited to the highest contaminant concentration portion of the PU&D Yard Plume immediately adjacent to the source area The study will include installation of several borings to place the material within the contaminated groundwater plume, installation of one monitoring well, and monitoring for one year to determine the impact on the plume Longer-term impacts will be determined by the continued monitoring of wells already specified in the Integrated Monitoring Plan (IMP), specifically wells 30900 and 01497

This project is a cooperative effort between RFETS and the Department of Energy Subsurface Contaminant Focus Area (SCFA) The funding for this project is provided by DOE SCFA

2.0 PU&D YARD PLUME SUMMARY

The PU&D Yard plume hydrogeologic setting and contaminants of concern are described in Technical Memorandum, Monitored Natural Attenuation of the PU&D Yard VOC Plume (RMRS 1999), Sampling and Analysis Plan for Groundwater Monitoring at the Property Utilization and Disposal (PU&D) Yard (PU&D Yard SAP) (RMRS 2000) and the Data Summary Report for IHSSs 170, 174A, and 174B, Property Utilization and Storage Yard (RMRS 1997) The information presented in these reports is summarized in the following sections

2 1 Hydrogeologic Setting

The PU&D Yard is located on an east-sloping pediment comprised of 30 to 40 feet of Rocky Flats Alluvium that unconformably overlies weathered claystone bedrock of the Laramie Formation (RMRS 1997) The Rocky Flats Alluvium is comprised chiefly of poorly sorted, clayey gravels and sands with abundant cobble and boulder-sized material and discontinuous lenses of clay, silt, and sand (RMRS 2000)

The PU&D Yard VOC plume is confined to the RFETS's Upper Hydrostratigraphic Unit (UHSU) In the study area, the UHSU is comprised primarily of the Rocky Flats Alluvium and the underlying weathered bedrock The main sources of UHSU groundwater recharge in this area are infiltration of incident precipitation and leakage from diversion ditches located immediately to the north Maximum recharge occurs during the spring months when precipitation is common and the ditches are flowing Depth to groundwater is approximately 5 to 20 feet with a hydraulic gradient of approximately 0 02 ft/ft towards the east (RMRS 1999) No hydraulic conductivity measurements are available from the study area However, the geometric mean for hydraulic conductivity of the Rocky Flats Alluvium is 2 1 x 10^{-4} cm/sec This results in an estimated flow rate of around 100 feet per year (EG&G 1995)

Groundwater flow is to the east along the ridge top Outside of the study area, the flow direction diverges to the northeast towards No Name Gulch and to the southeast towards North Walnut Creek Groundwater discharges at isolated small seeps, into the valley fill alluvium associated with North Walnut Creek and No Name Gulch and into the groundwater intercept system at the landfill perimeter Groundwater also discharges as surface water into No Name Gulch (RMRS 2000) Some discharge is also expected from evaporation due to the shallow water level and the high evapotranspiration rate at the RFETS

2.2 Contaminant Summary

The PU&D Yard was used to store empty drums, dumpsters, cargo boxes and excess materials from 1974 until 1997 Extensive investigation found VOC contamination in the soil only in the IHSS 174a area in the northeast corner of the PU&D Yard (Figure 1) The contamination is derived from storage of drums that contained residual VOCs The following information is summarized from the Data Summary Report for IHSSs 170, 174A, and 174B, Property Utilization and Storage Yard (RMRS 1997)

2 2 1 Subsurface Contamination Summary

Investigation results indicate that subsurface VOC contamination is present in only a few locations As shown in Table 1, the primary contaminant found was tetrachloroethene in borehole 17497 at the northern edge of IHSS 174a Trichloroethene was detected in borehole 18997 immediately east of 17497, but at an estimated concentration well below the detection limit of 630 ug/kg (RMRS 1997) No soil concentrations exceed the original Rocky Flats Cleanup Agreement (RFCA) Tier I subsurface soil action levels (DOE 1996) However, one sample collected from borehole 17497 showed a tetrachloroethene concentration above the revised RFCA Tier I Subsurface Soil Action Level provided in the Modifications to RFCA Attachment 5 Tables from July 19, 1996 to December 1998 (DOE 1999)

Table 1 Summary of VOC Concentrations in Subsurface Soils

Borehole	Sample Depth (in feet below ground)	Tetrachloroethene (ug/kg)	Trichloroethene (ug/kg)
17497	4 3-4 9	750	ND
	8 5-9 0	830	ND
	11 0-11 5	5,700	ND
18997	5 0-5 5	ND	360J
	9 5-10 0	ND	ND
RFCA Tier I Subsurface Soil Action Levels		3,150	3,280

J estimated concentration of analyte detected below detection limit
ND analyte not detected

Naphthalene was detected in one sample at a concentration below the detection limit and well below the Tier I subsurface soil action level Methylene chloride was detected in almost all samples, generally qualified as also detected in the laboratory blank sample When detected, methylene chloride concentrations ranged from 330 ug/kg to 3,000 ug/kg The current Tier I subsurface soil action level for methylene chloride is 578 ug/kg (DOE 1999), a factor of 10 lower than the 5,770 ug/kg Tier I action level in effect during the original investigation (RMRS 1997)

5

2 2 2 Groundwater Contamination Summary

Groundwater sampling for VOCs was conducted at the PU&D Yard and surrounding area during August and September 1997 In addition, groundwater samples were collected from boreholes during the 1997 source investigation Results from the study area are summarized in Table 2

The highest VOC concentration was found in a groundwater sample collected during drilling borehole 17497 This borehole also contained the highest concentrations of VOCs in soil in this area, and is likely the source area for the PU&D Plume

For groundwater monitoring wells 01097 through 01597, VOC compounds were detected in all wells Tier II groundwater action levels were exceeded for trichloroethene in well 01497, tetrachloroethene in wells 01297 and 01397 and 1,1-dichloroethene in well 01497 Carbon tetrachloride, chloroform, naphthalene, 1,2-dichloroethene, toluene, and 1,2,4-trimethylbenzene occasionally were reported below detection levels and below Tier II action levels Toluene results are qualified to reflect that the contaminant is also reported in the laboratory blank and that laboratory contamination is the probable cause for the positive detections Methylene chloride was detected, but results are qualified to indicate that laboratory contamination is the cause of the positive detections (RMRS 1997, 2000) Because methylene chloride in the groundwater is most likely a result of laboratory contamination, it is likely that the soil concentrations are also a result of laboratory contamination

Table 2 Summary of VOC Concentrations in Groundwater (ug/L)

Location	Sample Date	Trichloroethene	Tetrachloroethene	Carbon Tetrachloride	1,1 Dichloroethene	1,1,1 Trichloroethane
17497*	8/20/97	ND	1,700	ND	ND	ND
18197*	8/25/97	ND	15	ND	ND	6 3
01097	9/25/97	ND	2	ND	ND	ND
01197	9/29/97	ND	ND	ND	ND	ND
01297	9/25/97	ND	7	ND	ND	ND
01397	9/30/97	0 2 J	5	0 2 J	1	5
01497	9/25/97	30	4 J	5 J	80	170
01597	9/26/97	ND	2	ND	ND	ND
Groundwater Tier II Action Levels		500	500	500	700	20,000
Groundwater Tier II Action Levels		5	5	5	7	200

* One time groundwater samples collected from boreholes
J estimated concentration of analyte detected below detection limit
ND analyte not detected

Additional wells were recently installed in the PU&D Yard as described in the Sampling and Analysis Plan (RMRS 2000) This included a new monitoring well 30900, installed immediately downgradient of borehole 17497 that is intended to monitor groundwater quality in the source area for the PU&D Yard Plume While the well has been sampled, no analytical data are available at this time

3.0 TREATABILITY STUDY

This treatability study will determine if the appropriate subsurface conditions and microbes are present at RFETS for application of HRC™ to be a successful remediation technique for VOC contaminated soil and/or groundwater

The PU&D Yard Plume area was chosen as the site for this treatability study based on information in the Data Summary Report for IHSSs 170, 174A, and 174B, Property Utilization and Storage Yard (RMRS 1997), summarized above The highest concentrations in the groundwater plume appear to occur in a limited area immediately surrounding borehole 17497 (Figure 1) This borehole is located within an area of surficial soil staining that is also a previously identified soil gas survey anomaly The source area is believed to be small because only one of the five boreholes within a 25-foot radius of 17497 showed detectable concentrations of tetrachloroethene or trichloroethene Trichloroethene was detected at a concentration of 360 ug/kg, approximately one-half of the detection limit for the analysis, at borehole 18997 located 15 feet southwest of 17497 This concentration is well below the RFCA Action Level

Based on the recommendations from Regenesis, the manufacturer of HRC™, approximately 800 pounds of HRC™ will be placed into the subsurface in the area immediately surrounding borehole 17497, the expected PU&D Yard source Nine material insertion points (geoprobe boreholes) will be installed on a grid with five feet between points on a north-south line, and three feet between points on the east-west line (Figure 1) The geoprobe boreholes used as material insertion points will be drilled as described in Section 4 2 As possible, groundwater samples will be collected for VOC analysis from the northwest and southwest material insertion points on the grid prior to insertion of the HRC™ material (Figure 1) to further refine the area of groundwater contamination

After drilling, the HRC™ will be pumped into the uncased boreholes from the bottom up, filling the saturated area The number of material insertion points required to place 800 pounds of HRC™ will depend on subsurface conditions, but is estimated to be around nine points However, up to 13 material insertion points may be required If filling the nine initial material insertion points does not use all the material, additional geoprobe holes will be drilled and used as material insertion points These additional material insertion points will be located within the area immediately surrounding borehole 17497 and located at one-half the grid spacing of the initial grid All 800 pounds of HRC™ will be placed into the subsurface surrounding borehole 17497

The HRC™ is expected to stimulate rapid degradation of chlorinated VOCs found in groundwater and soil at this location The HRC™ is expected to be a one-time application According to Regenesis, the material is expected to last approximately one year in the environment to stimulate contaminant degradation

According to the company-supplied information, HRC™ operates in a complex series of chemical and biologically mediated reactions In the presence of groundwater, HRC slowly releases lactic acid If the appropriate anaerobic microbes (such as acetogens) are present, these will metabolize the lactic acid producing consistent low concentrations of dissolved hydrogen The resulting hydrogen is then used by other subsurface microbes (reductive dehalogenators) to strip the solvent molecules of their chlorine atoms and allow for further biological degradation

An additional monitoring well will be installed 10 feet away from the existing monitoring well 30900 to monitor the effect of HRC™ on the groundwater plume Well 30900 will be sampled prior to installation of the HRC™ and will remain in place to monitor any impacts within the source area Initial groundwater samples will be collected when the monitoring well is installed to develop a baseline Based on the recommendation from Regenesis, both well 30900 and the new well will be sampled two months after HRC™ is inserted These wells will be sampled monthly for the remainder of fiscal year 2001 Groundwater monitoring details are provided in Section 5 0 of this document

8

4.0 BOREHOLE AND WELL INSTALLATION

As stated above, the HRC™ will be installed by placing the material in geoprobe boreholes drilled within the highest concentration area of the plume Monitoring will be accomplished using monitoring wells installed downgradient of the material placement boreholes Boreholes and wells will be drilled and installed in the same manner as described in the recent PU&D Yard SAP (RMRS 2000) Much of the following information was taken directly from that document

4 1 Pre-Drilling Activities

Before advancing boreholes, all locations will be cleared in accordance with RMRS/OPS-PRO 102, *Borehole Clearing*, and marked in accordance with RMRS/OPS-PRO 124, *Push Subsurface Soil Sampling* A radiological survey will be conducted before site work begins in accordance with 5-21000-OPS-FO 16, *Field Radiological Measurements* All Health and Safety protocols will be followed in accordance with the *PU&D Yard Plume Health and Safety Plan* addendum that was developed for implementation of the PU&D Yard SAP

4 2 Borehole Drilling and Logging

Boreholes will be drilled at proposed material insertion sites using push-type techniques (Geoprobe®) or hollow stem auger rigs Detailed geoprobe drilling and sampling procedures are provided in OPS-PRO 124 If probe refusal is encountered before reaching bedrock, the borehole will be abandoned using procedure OPS-PRO 117, *Plugging and Abandonment of Boreholes*, and an offset boring will be attempted within 1 foot of the original boring If required, a conventional truck-mounted drill rig utilizing hollow-stem augers will be procured to allow for the desired well completion(s) All hollow-stem auger drilling activities will comply with procedure OPS-PRO 114, *Drilling and Sampling Using Hollow-Stem Auger and Rotary Drilling and Rock Coring Techniques*

4.3 Well Design

An additional Geoprobe® monitoring well will be used to monitor effects of HRC™ on the PU&D Yard VOC plume Construction of this well will be suitable for short-term monitoring of shallow water-bearing zones This well will be designed with a screened interval that fully penetrates saturated alluvium, to detect changes in contaminants in the UHSU The screened interval will be selected to account for seasonal fluctuations in water table depth Final depth determinations will be made in the field based on drilling conditions and initial depth to water

At the proposed location of the new PU&D Yard VOC plume monitoring well, the thickness of alluvial and/or colluvial deposits is between 30 and 40 feet The water level data from newly installed well 30900 will be used to calculate the screened interval, however, a length of approximately 20 feet is expected

The well will be installed using construction methods described in RMRS/OPS-PRO 118, *Monitoring Well and Piezometer Installation* Radiological soil contamination is not anticipated at any of the drilling locations associated with this SAP Typical well construction materials will consist of ¾ to 1-inch ID, schedule 40 or 80 polyvinyl chloride (PVC) riser and factory cut (0 010-inch slot width) well screen Silica sand (16-40), granular bentonite or bentonite pellets and bentonite grout are used to complete the well If a truck mounted drill rig is required, the

9

well will be constructed of 2-inch ID PVC riser and factory cut (0 010-inch slot width) screen Protective casing consisting of 6-inch ID or larger steel riser with locking cap and lock will be set in sackrete to a depth of approximately 2 to 3 feet

4 3 1 Well Installation and Development
The groundwater monitoring well will be installed in accordance with RMRS/OPS-PRO 118, *Monitoring Wells and Piezometer Installation* The monitoring well will be land surveyed in accordance with OPS-PRO 123, *Land Surveying,* or current RFETS global positioning system manuals

The monitoring well will be developed prior to sampling using the procedures specified in OPS-PRO 106, *Well Development*, with the exception that repeated vigorous surging utilizing a bailer may be employed to expedite formation damage restoration and maximize well yields for groundwater sampling This approach has the best chance for success in wells containing a sufficient water column for surging and a thin annular sand pack, such as Geoprobe® wells Under these conditions, the removal of fines associated with formation damage can be more effectively accomplished because a greater amount of surge energy is transmitted through the sand pack to dislodge materials at the borehole wall interface compared to wells completed with thick annular sand packs All water produced during well development will be handled as uncharacterized development water in accordance with RMRS/OPS-PRO 128, *Handling of Purge and Development Water*

5.0 GROUNDWATER SAMPLE COLLECTION

The site standard sample numbering system will be implemented in this project Location codes will be assigned to the new monitoring well shown in Figure 1 using the Analytical Services Division (ASD) procedure ASD-003, *Identification System for Reports and Samples* For each groundwater sample or surface water sample, dual sample numbers will be assigned 1) a standard report identification number (RIN) (i e , 00AXXXX 00X 00X) will be assigned to the project by the ASD, and 2) a Site sample number (i e , GW0XXXXRG) for internal sample tracking The block of sample numbers will be of sufficient size to include the entire number of possible samples (including QA samples) and location codes For the final report, the ASD and Site sample numbers will be cross-referenced with location codes

5.1 Groundwater Samples

Samples will be collected as described in the recent PU&D Yard SAP (RMRS 2000) to maximize integration of these two projects and to maximize use of the information Much of the following information was taken directly from that document

Groundwater samples will be collected using the methods specified in OPS-PRO 108, *Measurement of Groundwater Field Parameters*, and OPS-PRO 113, *Groundwater Sampling* After an initial sampling round is completed for all new wells, sampling of wells will be conducted weekly for the first month, then monthly to the end of the fiscal year (September 2001) Prior to sample collection, the water level will be measured according to OPS-PRO 105, *Water Level Measurements in Wells and Piezometers*, to determine purge water requirements

10

5 1 2 Sample Handling and Analysis
Samples will be handled according to RMRS/OPS-PRO 069, *Containing, Preserving, Handling, and Shipping of Soil and Water Samples* If necessary, a Health and Safety Specialist (HSS) or Radiological Control Technician (RCT) will scan each sample with a Field Instrument for the Detection of Low Energy Radiation (FIDLER) Equipment will also be monitored for radiological contamination during and after sampling activities, if required

Table 3 indicates the analytical requirements for groundwater samples for the initial round of sampling Table 4 indicates the requirements for natural attenuation monitoring samples Samples will be submitted to an offsite, Environmental Protection Agency (EPA) approved laboratory for analysis with a 30-day result turnaround time

Table 3 Analytical Requirements for Initial Groundwater Samples

Analysis	No of Samples[a]	No of Events	EPA Method	Container	Preservation	Holding Time
Target Compound List (TCL) Volatiles	5[a]	1	EPA 524 2	3 (three) 40 ml amber glass vials with teflon-lids	Unfiltered, cool, 4° C	14 days
Rad Screen	3[b]	1	N/A[b]	1 (one) 125 ml poly bottle	Unfiltered	180 days

[a] Includes one duplicate and one rinsate QC sample, excludes rad screens
[b] Initial characterization sampling only

Table 4 Analytical Requirements for Enhanced Natural Attenuation Monitoring Parameters

Analytes	Analytical Method	Media Type	Container	Preservative	Comments/Holding Time
Volatile Organic Compounds	EPA Method 524 2	Water	2 x 40 ml VOA vials - Teflon lined septa lids	Cool, 4° C HCl	Zero head space 14 day hold time
Dissolved Methane	8015 Modified	Water	2 x 40 ml VOA vials – Teflon lined septa lids	Cool, 4° C, (optional HCl)	7 day hold time, 14 day hold time-HCl
Sulfates	EPA 375 1	Water	1 liter plastic bottle	Cool, 4° C	Sulfates, Sulfides and Alkalinity come from same bottle, 28 day hold time
Sulfides	EPA 376 1	Water	1 liter plastic bottle	Cool, 4° C	Sulfates, Sulfides and Alkalinity come from same bottle, 7 day hold time
Alkalinity	SW-846 310 1 320 2	Water	1 liter plastic bottle	Cool, 4° C	Sulfates, Sulfides and Alkalinity come from same bottle, 14 day hold time
Nitrates	NO_3 EPA 300 0, NO_3 +NO_2 EPA 353 2	Water	250 ml plastic bottle	Cool, 4° C	48 day hold time
Total Organic Carbon	EPA 415 1	Water	1 liter plastic bottle	Cool, 4° C pH<2 w/HCl	28 day hold time
Chloride	EPA 300 0	Water	100 ml Plastic bottle	None	28 day hold time
Dissolved Iron and Manganese	CLP SOW dissolved	Water	1 liter plastic bottle	Cool, 4° C, HNO_3, pH <2	Field filtering required 28 day hold time
Total Iron and Manganese	CLP SOW total	Water	1 liter plastic bottle	Cool, 4° C, HNO_3, pH <2	28 day hold time
Ferrous Iron	Field Parameter	Water	—	—	—
pH	Field Parameter	Water	—	—	—
Dissolved Oxygen	Field Parameter	Water	—	—	—
Oxidation-Reduction Potential	Field Parameter	Water	—	—	—
Temperature	Field Parameter	Water	—	—	—
Conductivity	Field Parameter	Water	—	—	—

11

5.2 Equipment Decontamination and Waste Handling

Reusable drilling and sampling equipment will be decontaminated with Liquinox solution, and rinsed with deionized or distilled water, in accordance with procedure 4-S01-ENV-OPS-FO 03, *Field Decontamination Procedures* Decontamination waters generated during the project will be managed according to procedure OPS-PRO 112, *Handling of Decontamination Water and Wash Water* Geoprobe® and drilling equipment will be decontaminated following project completion using procedure OPS-PRO 070, *Decontamination of Equipment at Decontamination Facilities* No soil or investigative derived material waste is expected to be generated

6.0 DATA MANAGEMENT

As was specified for the PU&D Yard SAP (RMRS 2000), a project field logbook will be created and maintained by the project manager or designee (Field Geologist) in accordance with Site Procedure 2-S47-ER-ADM-05 14, *Use of Field Logbooks and Forms* The logbook will include time and date of all field activities, sketch maps of sample locations, and any additional relevant information not specifically required by this document The originator will legibly sign and date each logbook page Appropriate field data forms will also be utilized when required by the operating procedures that govern the field activity A peer reviewer will examine each completed original hard copy of data Any modifications will be indicated in ink, and initialed and dated by the reviewer Borehole geologic logs (if generated) will be entered into the Equis Geo database for electronic storage and future applications

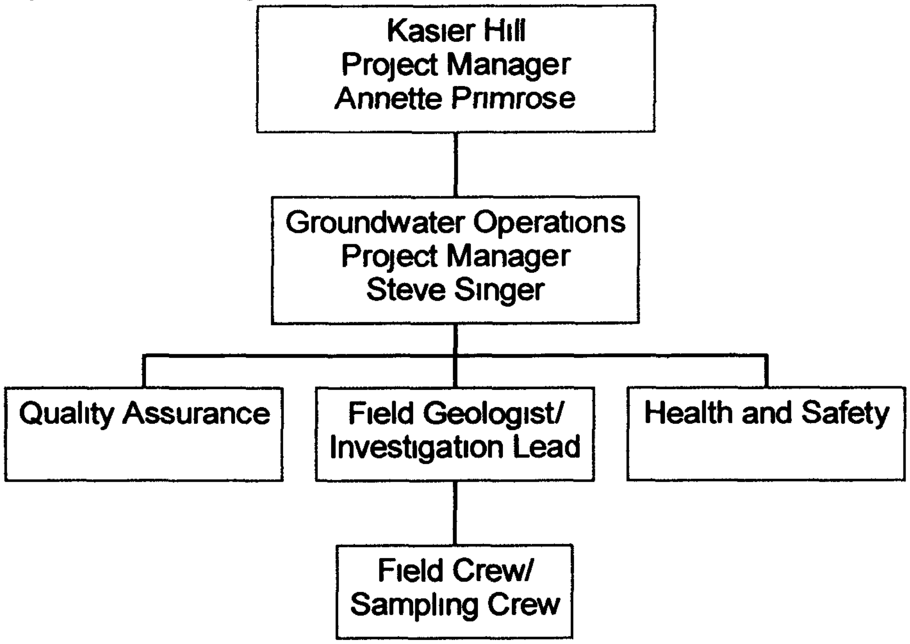
Analytical data record storage for this project will be performed by KH-ASD Sample analytical results will be delivered directly from the laboratory to KH-ASD in an Electronic Disc Deliverable (EDD) format and archived in the Soil and Water Database (SWD) as per RMRS/OPS-PRO 072, *Field Data Management* Hard copy records of laboratory results will be obtained from KH-ASD in the event that the analytical data are unavailable in EDD or SWD at the time of report preparation Project results will be compiled into a treatability study report

7.0 PROJECT ORGANIZATION

Figure 2 illustrates the project organization structure The Kaiser-Hill Project Manager (PM) will be responsible for project direction The RMRS Groundwater Operations Project Manager (GOPM) will be responsible for maintaining data collection and management methods that are consistent with Site operations The PM is the individual responsible for overall project execution from pre-conceptual scoping through project implementation and closeout Other individuals assisting with the implementation of this project are the project Health and Safety Supervisor who is responsible for overall compliance with and implementation of the Project Health and Safety Plan The project Quality Assurance (QA) engineer will provide the first level of oversight and support implementation of quality controls within all quality-affecting activities of the project The project Radiological Engineer is responsible for overseeing the development and implementation of and ensuring compliance with the radiological aspects of the Project Health and Safety Plan, ALARA Job Review (if needed), and approval of applicable Radiological Work Permits (RWPs)

12

Figure 2 Project Organization Chart



The Field Geologist/Investigation Lead is responsible for field data collection, documentation, directing drilling, and well installation and oversight of the sampling personnel The Health and Safety Specialist is responsible for onsite compliance with and implementation of the Project Specific Health and Safety Plan The Field Crew/Sampling Crew are responsible for field data collection, sample collection, and transfer of samples for analysis Field data collection will include sampling and obtaining screening results Documentation will require field logs and completing appropriate forms for data management and chain-of-custody shipment The sampling crew will coordinate sample shipment for on-site and off-site analyses through the ASD personnel The sampling personnel are responsible for verifying that chain-of-custody forms are complete and accurate before the samples are shipped to the analytical laboratories

8.0 QUALITY ASSURANCE

All components and processes within this project will comply with the Kaiser-Hill Team Quality Assurance Plan (KH, 1999) The QA Program is consistent with quality requirements and guidelines mandated by the EPA, Colorado Department of Public Health and Environment (CDPHE), and DOE In general, the applicable categories of quality control are as follows

- Quality Program,
- Training,
- Quality Improvement,
- Documents/Records,
- Work Processes,
- Design,
- Procurement,
- Inspection/Acceptance Testing,
- Management Assessments, and
- Independent Assessments

13

The project manager will be in direct contact with QA to identify and address issues with the potential to affect project quality Field sampling quality control will be conducted to ensure that data generated from all samples collected in the field for laboratory analysis represents the actual conditions in the field The confidence levels of the data will be maintained by the collection of quality control (QC) samples, including duplicate samples and equipment rinsate samples

Duplicate samples will be collected on a frequency of one duplicate sample for every twenty real samples Rinsate samples will be generated at a frequency of one rinsate sample for every 20 real samples collected Data validation will be performed on 25% of the laboratory data according to the Rocky Flats ASD, Performance Assurance Group procedures Samples will be randomly selected from adequate subsurface water sample sets by ASD personnel to fulfill data validation of 25% of the total number of VOC analyses

After data validation and verification (for ASD), the analytical data are electronically transmitted to SWD for data user access Analytical data collected in support of the groundwater program are evaluated using the guidance established in the procedure RF/RMRS-98-200, *Evaluation of Data for Usability in Final Reports* This procedure establishes the guidelines for evaluating the analytical data with respect to the PARCC parameters The data are evaluated for the PARCC parameters as discussed below The Data Quality Assessment will be included in the technical report for this project

PARCC parameters are indicators of data quality Analytical data that are collected in support of this SAP will be evaluated using the guidance developed in procedure RF/RMRS-98-200, *Evaluation of Data for Usability in Final Reports* This procedure establishes the guidelines for evaluating analytical data with respect to the PARCC parameters The following paragraphs define these PARCC parameters in conjunction with this project

Precision The precision of a measurement is an expression of mutual agreement among duplicate measurements of the same property taken under prescribed similar conditions Precision is a measure of the reproducibility of results and is evaluated by comparing results from field duplicate samples with results from associated real samples Precision is evaluated quantitatively by calculating the relative percent difference (RPD) using the following equation

$$RPD = \frac{|C_1 - C_2|}{(C_1 + C_2)/2} * 100$$

C_1 = first sample result (in terms of concentration)
C_2 = duplicate sample result (in terms of concentration)

The purpose of the field duplicate samples is to evaluate the precision of the field sampling process The acceptable RPD limits for non-radiological field duplicate measurements are ≤ 30% for water At least 85% of all quality control samples are required to comply with the established precision, or RPD goals Duplicate samples exceeding the RPD criteria require an explanation of the deficiencies

14

Accuracy Accuracy is the degree of agreement of a measurement with an accepted reference or true value and is a measure of the bias in a system The closer the measurement to the true value, the more accurate the measurement All analytical data are compared with the required analytical method, and detection limit with the actual method used, and its detection limit for each medium and analyte to assess the data quality objective compliance for accuracy

Representativeness Representativeness is a measure of the degree to which data accurately and precisely represent a characteristic of a population parameter at a sampling point Representativeness is a qualitative term that should be evaluated to determine whether samples are collected in such a manner that the resulting data appropriately reflect the contamination present Typically the discussion of representativeness is limited to an evaluation of whether analytical results for field samples are truly representative of environmental concentration, or whether they may have been influenced by the introduction of contamination during collection and handling This is assessed by evaluating the results of various blanks, specifically equipment rinsates Representativeness is also accomplished by obtaining an adequate number of samples from appropriate spatial locations within the medium of interest The actual sample types and quantities will be compared with those stated in this SAP and organized by analytical suite Deviation from the required and actual parameters will be justified in the Data Quality Assessment

Completeness Completeness is a measure of the amount of valid usable data obtained from a measurement system compared to the amount that was expected to be obtained under correct normal conditions Usability is determined by evaluation of the PARCC parameters excluding completeness Those data that are validated and need no qualification, or are qualified as estimated or undetected, are considered usable Rejected data are not considered usable Completeness is calculated following data evaluation A completeness goal of 90% has been established for this project If this goal is not met, additional sampling may be necessary to adequately achieve project objectives Completeness is calculated using the following equation

$$Completeness = DP_u = \left[\frac{DP_t - DP_n}{DP_t}\right]100$$

Where	DP_u	=	Percentage of usable data points
	DP_n	=	Non usable data points
	DP_t	=	Total number of data points

Comparability Comparability is a qualitative parameter Consistency in the acquisition, handling, and analysis of samples is necessary for comparing results Data developed under this investigation are collected and analyzed using standard EPA or nationally recognized analytical methods, and QC procedures to ensure comparability of results with other analyses performed in a similar manner Data resulting from this sampling effort may be compared to other data sets Quantitative values for the PARCC parameters are provided in Table 5

15

Table 5 PARCC Parameter Summary

PARCC	Radionuclides	Non-Radionuclides
Precision	N/A	RPD ≤ 30% for VOCs
Accuracy	N/A	Comparison of Laboratory Control Sample Results with Real Sample Results
Representativeness	N/A	Based on SOPs and SAP
Comparability	N/A	Based on SOPs and SAP
Completeness	N/A	90% Useable

Laboratory validation shall be performed on 25% of data collected for the Site Laboratory verification shall be performed on the remaining 75% of the data Data usability shall be performed on laboratory validated data according to procedure RF/RMRS-98-200, *Evaluation of Data for Usability in Final Reports*

Data validation will be performed according to KH-ASD procedures, but will be done after the data is used for its intended purpose Analytical laboratories supporting this task have all passed regular laboratory audits by KH-ASD

9.0 SCHEDULE

Well installation activities are scheduled to be completed during calendar year 2000 Well development, groundwater sampling, and surface water sampling will commence within one week of well completions Land surveying or global positioning system (GPS) location of well and material insertion point locations and elevations will be performed following the completion of all intrusive activities Results of the treatability study will be reported in a technical report within 90 days of the receipt of laboratory analytical data

10.0 REFERENCES

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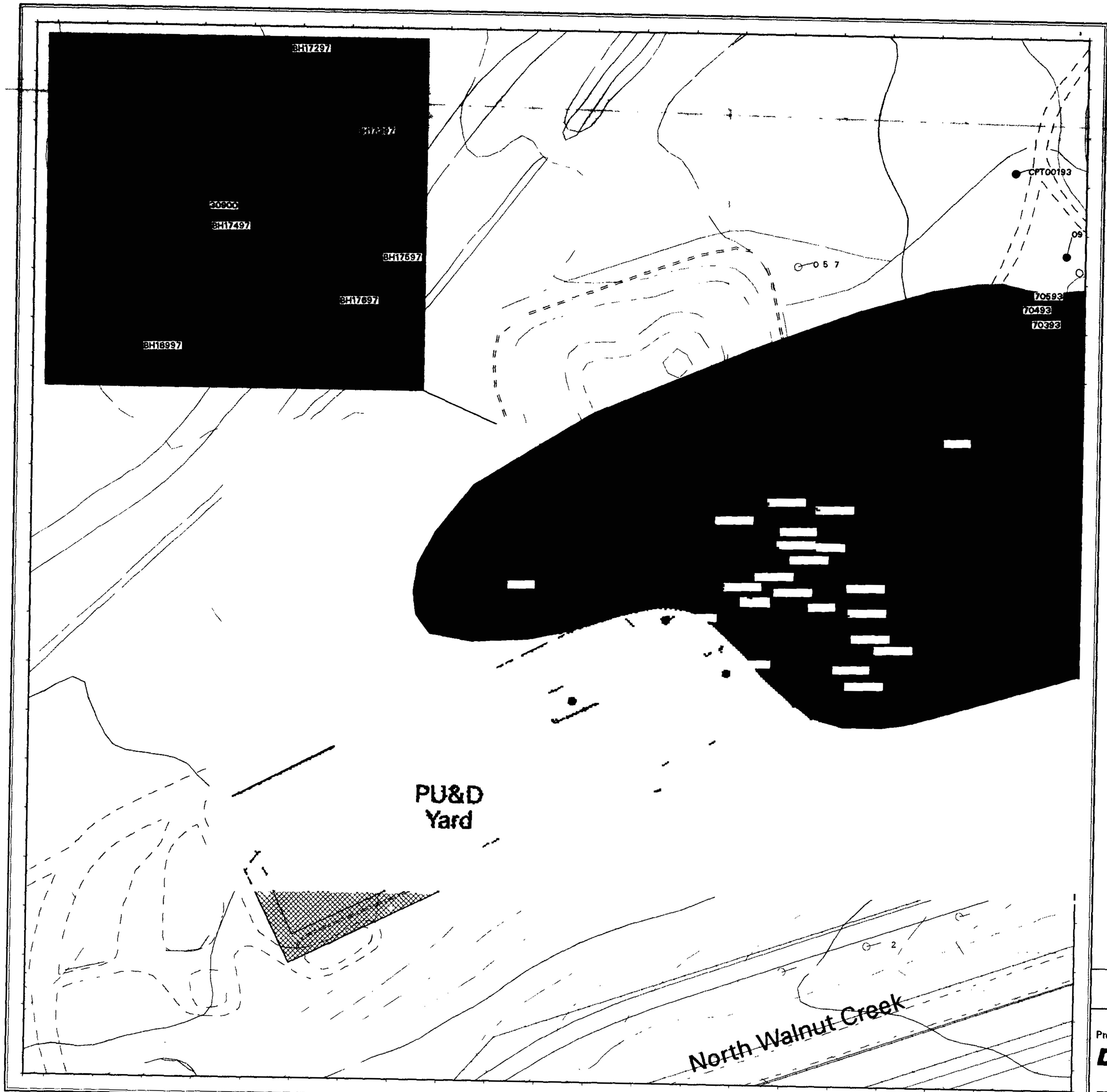
17/17

Figure 1
PU&D Yard
Groundwater VOC Plume
Project Area



EXPLANATION

- PU&D Ya d Mo it ng Well
- Gr ndw Mo ito Well UHSU Su fic al Mat al
- Gro ndwat Monit Well UHSU Bed k
- Gro dwat Mo Well LHSU Bed k
- Bo h l Lo at
- Aband d Mo Well
- Prop d Mo it g Well
- Mat ll ser io Po
- Compo t VOC Gro ndwat Pl me (o at q al t MCL)
- Compo t VOC Gro ndwat Pl me (100 X MCL)
- PU&D Y d IHSS

Standard M p F ture

- Bu ld ng and the tr ture
- Landf ll Po d
- Str am d tche or the drai ag f atu
- Fence and the barrie
- Conto (5 Fo t)
- Paved ad
- Dirt ad

N T
Sourc ls av la pon eque

Sc l 1 1890
1 nch r p t pp mat ly 158 f t

S a Pl C d Pr j tio
C l ad Ce t l Z
D t m NAD27

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Rocky Flats Environmental Technology Site

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