

RF/RMRS-99-356

**Sampling and Analysis Plan
for the Installation of Three Geoprobe Boreholes
at Building 984 in the Protected Area**

**May 1999
Revision 0**

REVIEWED FOR CLASSIFICATION/UCN
By UC J. N. CONYERS J/NU
Date 5/24/99

ADMIN RECCRD 1/22

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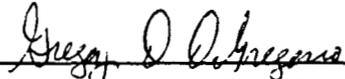
May, 1999

This Sampling and Analysis Plan has been reviewed and approved by:



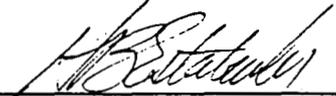
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ACRONYMS

Am	Americium
ASD	Analytical Services Division
CDPHE	Colorado Department of Public Health and the Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
DOE	U. S. Department of Energy
DOT	Department of Transportation
DQO	Data Quality Objective
EDD	Electronic Disc Deliverable
EPA	U. S. Environmental Protection Agency
ER	Environmental Restoration
FID	Flame Ionization Detector
FIDLER	Field Instrument for the Detection of Low Energy Radiation
HNO ₃	Nitric Acid
HSS	Health and Safety Specialist
IHSS	Individual Hazardous Substance Site
IMP	Integrated Monitoring Plan
K-H	Kaiser-Hill
PA	Protected Area
PAC	Potential Area of Contamination
PARCC	Precision, Accuracy, Representativeness, Completeness, and Comparability
PCE	Tetrachloroethene
PID	Photoionization Detector
PM	Project Manager
PPE	Personal Protective Equipment
Pu	Plutonium
QA/QC	Quality Assurance/Quality Control
QAPD	Quality Assurance Program Description
RCRA	Resource Conservation and Recovery Act
RCT	Radiological Control Technician
RFCA	Rocky Flats Cleanup Agreement
RFETS	Rocky Flats Environmental Technology Site
RIN	Report Identification Number
RMRS	Rocky Mountain Remediation Services, L.L.C.
RPD	Relative Percent Difference
RWP	Radiological Work Permit
SAP	Sampling and Analysis Plan
SOPs	Standard Operating Procedures
SOW	Statement of Work
SWD	Soil and Water Database
TCA	Trichloroethane
TAL	Target Analyte List
TCL	Target Compound List
U	Uranium
VOC	Volatile Organic Compound

LIST OF APPLICABLE STANDARD OPERATING PROCEDURES (SOPs)

<u>Identification Number</u>	<u>Procedure Title</u>
RF/RMRS-98-200	<i>Evaluation of Data for Usability in Final Reports</i>
2-S47-ER-ADM-05.15	<i>Use of Field Logbooks and Forms</i>
RMRS/OPS-PRO.127	<i>Field Decontamination Operations,</i>
RMRS/OPS-PRO.070	<i>Decontamination of Heavy Equipment at Decontamination Facilities</i>
RMRS/OPS-PRO.128	<i>Handling of Purge and Development Water</i>
5-21000-OPS-FO.06	<i>Handling of Personal Protective Equipment</i>
RMRS/OPS-PRO.112	<i>Handling of Field Decontamination Water and Field Wash Water</i>
RMRS/OPS-PRO.115	<i>Monitoring and Containerizing Drilling Fluids and Cuttings</i>
4-K55-ENV-OPS-FO.10	<i>Receiving, Marking, and Labeling Environmental Materials Containers</i>
RMRS/OPS-PRO.069	<i>Containing, Preserving, Handling and Shipping of Soil and Water Samples</i>
5-21000-OPS-FO.15	<i>Photoionization Detectors and Flame Ionization Detectors</i>
5-21000-OPS-FO.16	<i>Field Radiological Measurements</i>
RMRS/OPS-PRO.101	<i>Logging Alluvial and Bedrock Material</i>
RMRS/OPS-PRO.117	<i>Plugging and Abandonment of Boreholes</i>
RMRS/OPS-PRO.102	<i>Borehole Clearing</i>
RMRS/OPS-PRO.123	<i>Land Surveying</i>
RMRS/OPS-PRO.124	<i>Push Subsurface Soil Sampling</i>
RMRS/OPS-PRO.108	<i>Measurement of Groundwater Field Parameters</i>
RMRS/OPS-PRO.113	<i>Groundwater Sampling</i>
RMRS/OPS-PRO.072	<i>Field Data Management</i>
3-PRO-140RSP-09.03	<i>Radiological Characterization of Bulk or Volume Solid Materials</i>

SAMPLING AND ANALYSIS PLAN FOR THE INSTALLATION OF THREE GEOPROBE BOREHOLES AT BUILDING 984 IN THE PROTECTED AREA

1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) has been prepared by Rocky Mountain Remediation Services, L.L.C. (RMRS) for the Department of Energy (DOE) at the Rocky Flats Environmental Technology Site (RFETS). Activities performed in this investigation will be conducted in accordance with the RFETS Integrated Monitoring Plan (IMP) and the Rocky Flats Cleanup Agreement (RFCA).

1.1 Purpose

This SAP describes the soil sampling and analysis of three Geoprobe boreholes to be drilled adjacent to Building 984 in support of modifications to the building. Building 984 is located just southeast of Building 991 (Figure 1-1) in the southeast corner of the Protected Area (PA). The modifications to Building 984 consist of construction of a 24 foot by 30 foot addition along the northeast corner (including a 6-inch water line) and the installation of a utility pole adjacent to the northwest corner of the building. The estimated excavation depth for these modifications is approximately 6-8 feet below ground surface (bgs). The activities described in this SAP are designed to characterize the excavated soil associated with each modification at Building 984. This project is being performed to ensure construction worker safety and to determine the proper disposition of the soil excavated at each location. This project will be performed in accordance with applicable Federal, State, and local regulations and agreements, as well as DOE Orders, RFETS policies and procedures, and Environmental Restoration (ER) Operating Procedures.

Field activities planned under this SAP are limited to advancing three Geoprobe boreholes at the locations specified in Figure 1-1, soil sampling, and potentially groundwater sampling activities. The purpose of this SAP is to define specific data needs, sampling and analysis requirements, data handling procedures, and associated Quality Assurance/Quality Control (QA/QC) requirements for this project. All work will be performed in accordance with the RMRS Quality Assurance Program Description (QAPD) (RMRS, 1998a, Rev. 2).

1.2 Background

Building 984 is located approximately 50 feet southeast of Building 991, and is part of the Building 991 complex. Attached to Building 991 are a series of tunnels which lead to four underground vaults that are used for storage. All of the tunnels and vaults are located either north or northwest of Building 991. Building 991 was the original final assembly building where plutonium (Pu), enriched and depleted uranium (U), and other materials were assembled into final products. Uranium and plutonium pits were assembled in Building 991. Plutonium and enriched and depleted uranium are the major constituents that were used in the building. In addition, solvents were used and possibly stored at this location. There is no documentation as to the specific solvents used at Building 991. A beryllium coating operation took place in Building 991 for twelve years. The Building 991 area includes Individual Hazardous Substance Sites (IHSSs) 173 and 184. No documentation was found regarding historical soil and groundwater chemical data in the vicinity of Buildings 991 and 984.

It is possible that groundwater will be encountered during drilling of the Geoprobe boreholes at this site. This SAP provides for the possibility of encountering groundwater.

1.2.1 Potential Areas of Contamination (PACs)

The PACs were established at RFETs as a result of documented spill incidents.

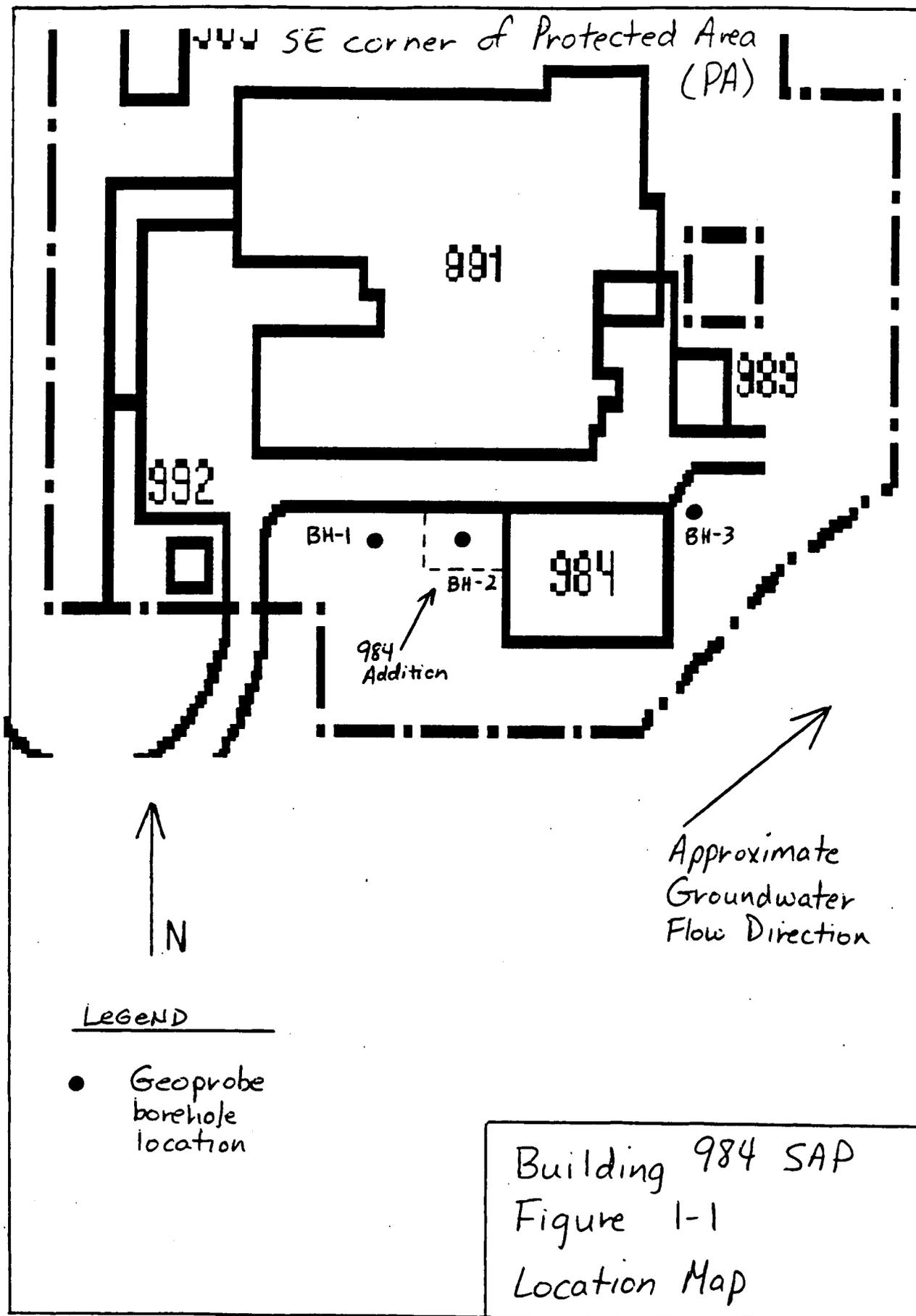
1.2.1.1 Pertinent Building 984 PACs

900-173, South Dock Building 991

Incidents involving small quantities of plutonium, uranium, and beryllium have been noted in Building 991. The south dock of Building 991 is located on the west side of the building and is a loading facility for the tunnels. Spills have occurred in the area. Small parts and equipment were washed in the dock area. Acetone, tetrachloroethene (PCE), and trichloroethane (TCA) were the solvents used.

There is no documentation available which details the constituents that may be present in the dock area. No documentation was found which details the fate of constituents released to the environment from the dock area.

Figure 1-1 Site Location, Proposed Geoprobe Locations



900-1301, Building 991 Enclosed Area

An enclosed area approximately 50 feet wide, located south of and adjacent to Building 991, was used for drum storage of various radioactively contaminated waste materials. There is no documentation available which detailed a release to the environment from these drums. Other potentially contaminated materials were stored in the same general area. The drums were contaminated with enriched and depleted uranium. No information was available which detailed the fate of the constituents to the environment. This PAC is located just to the northwest of Building 984.

1.3 Hydrogeologic Setting

The RFETS is situated on a gently eastward sloping topographic and bedrock pediment surface mantled by, depending on location, unconsolidated Rocky Flats Alluvium and/or colluvium, and underlain mainly by claystones and siltstones of the Cretaceous Laramie Formation (EG&G, 1995a).

The thickness of alluvium at Building 984 was estimated from monitoring wells 2187 and 21895, located approximately 190 feet east and approximately 75 feet north/northwest of Building 991, respectively. The thickness of alluvium at well 2187 is about 8 feet and the alluvium is about 20 feet thick at well 21895. The depth to groundwater ranged from 1.8 feet at well 2187 (2nd quarter 1997 data) to dry at well 21895 (historical data April/May 1995). Monitoring well 3386, located approximately 150 feet east of Building 991, was dry during 1997. Groundwater may be encountered during construction at depths shallower than ten feet in the Building 984 area.

Building 984 is effectively located within the original channel of South Walnut Creek. The existing channel, an engineered reroute of the original channel, flows around the south and east sides of Building 984 and then back into its natural drainage. The artificial channel is approximately 75 feet from Building 984 on the south side and approximately 200 feet from Building 984 on the east side. Groundwater in the immediate vicinity of Building 984 is expected to flow in an east/northeast direction.

The presence of subsurface barriers or artificial sinks, such as building basements, foundation drains, deep storm drains, excavations, and buried utility corridors can locally alter groundwater flow directions and lead to containment or spreading of contaminant plumes. The effect of these manmade features on the water table is expected to be greatest during spring when water levels reach seasonal highs and interact

more extensively with the subsurface drainage structures.

Building 991 and the associated tunnels and vaults were constructed with a foundation drain system. The foundation drain system for Building 991 is fairly extensive with an east/west length of almost 1100 feet. To the northwest of Building 991, along the hillside above well 3386, the long east/west portion of the foundation drain has a pronounced effect on the water table, creating a steep hydraulic gradient towards the drain in this area. The foundation drain in this area may be responsible for well 3386 being dry during 1997.

2.0 SAMPLING RATIONALE

Historical information detailed in Section 1.2 provides general indications of the types of compounds anticipated in soils at the Building 984 construction areas, and was used to develop a systematic sampling strategy for this investigation. The sampling rationale also accounts for the presumed direction of groundwater flow evaluated for the construction areas in Section 1.3. Geoprobe boring locations have been selected based on the location of the proposed construction modifications at Building 984. Groundwater samples will only be collected if groundwater is encountered within ten feet of the ground surface at Building 984. The following conditions were considered in the development of the sampling strategy:

- The operating history of Building 991 (and associated Building 984) indicates that volatile organic compounds, uranium isotopes, plutonium and americium, and beryllium may have been released to the environment from surface sources;
- The physical and chemical properties of these contaminants suggest a chronic presence if released into the environment; and
- Subsurface Industrial Area structures and operations may cause local effects on groundwater flow direction and discharge that affect the sampling strategy.

The conceptual model of contaminant migration to groundwater involves percolation of liquids and leaching of contaminants from surface soils and foundations and drains downward through the unsaturated zone to the water table, and leaching of contaminants from subsurface waste lines during high water table periods. After contaminants encounter the saturated zone, contaminant migration will proceed laterally and follow the principal direction of groundwater flow. Contaminant movement in the unsaturated and saturated zones may be retarded to various degrees by sorption, volatilization, or biodegradation, depending on the

chemical behavior of the contaminant. Contaminant concentrations may also be reduced by dispersion during migration.

3.0 DATA QUALITY OBJECTIVES

The data quality objective (DQO) process consists of seven steps and is designed to be iterative; the outputs of one step may influence prior steps and cause them to be refined. Each of the seven steps is described below for the investigative area presented in Figure 1-1. Data requirements to support these investigations were developed and are implemented in the project using criteria established in *Guidance for the Data Quality Objective Process*, QA/G-4 (EPA 1994).

3.1 State the Problem

To summarize the problem, modifications need to be made at Building 984 that will require construction. Previous investigations near the construction sites have identified various types of contamination that have either been released to soils or leaked from various subsurface lines and/or sumps. This contamination potentially consists of VOCs, uranium isotopes, plutonium, americium, and beryllium. The purpose of this investigation is to establish soil geochemical conditions at the construction site prior to construction activities, and to determine the presence or absence of potential hazardous and/or radioactive contamination located in soil (and potentially groundwater) at the construction sites in order to determine the final disposition of the excavated material.

3.2 Identify the Decision

This step identifies what questions the study will attempt to resolve, and what actions may result. Characterization data collected for this study will be used to make the following decisions. The following are questions that may be answered by this study:

- Do contaminants of concern from the soil excavated from activities associated with the modifications at Building 984 have the potential to impact worker safety?
- Will concentrations of potential contaminants in soil result in cost prohibitive waste generation?

3.3 Identify Inputs to the Decision

Inputs to the decision include radiochemical and chemical results from soil and groundwater (if groundwater is encountered) samples collected from the Geoprobe boreholes. The parameters of interest include the analyses outlined in Table 4-1, *Soil and Groundwater Sampling and Analysis Program*.

3.4 Define the Boundaries

The investigative boundary is shown on Figure 1-1.

3.5 Decision Rule

If the radiochemical activities or chemical concentrations in the soil exceed established RFCA guidelines, as described in the IMP, an evaluation of potential impacts is required.

3.6 Limits on Decision Errors

Tolerable limits on decision errors will be discussed in the Project Health and Safety Plan since the project objective is to ensure worker safety during modification to Building 984.

3.7 Optimize the Design

Additional characterization, if required, will be based upon an evaluation of data collected under this SAP. If further characterization is required, based on laboratory analytical results, then the results of this investigation will be used to design additional characterization field activities associated with implementation of the modifications at Building 984.

4.0 SAMPLING ACTIVITIES AND METHODOLOGY

4.1 Geoprobe Boring Locations

The three Geoprobe borings associated with the Building 984 modifications will be located so that they are within the limits of the construction areas located primarily on the northwest and northeast sides of Building 984 (Figure 1-1).

4.1.1 Pre-Drilling Activities

Before drilling activities begin, 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 necessary health and safety protocols will be followed in accordance with the Project Health and Safety Plan.

4.1.2 Borehole Drilling and Logging

Borings will be drilled using push-type techniques (Geoprobe) at all proposed locations. Detailed drilling and sampling procedures using this methodology are provided in OPS-PRO.124. If probe refusal is encountered before reaching the target borehole depth of ten feet bgs, the boring will be abandoned using procedure OPS-PRO.117, *Plugging and Abandonment of Boreholes*, and an offset boring will be attempted within 3 feet of the original boring. If probe refusal occurs on the third attempt, the total depth will be recorded from the deepest Geoprobe boring at that location..

Soil cores will be recovered continuously in at least two-foot increments using a 2-inch diameter (or 2.125-inch diameter for the dual-wall system) by 24- to 48-inch long stainless steel- or lexon-lined core barrel. Two samples will be collected from each borehole for submittal to the analytical laboratory. One sample will be collected just below grade and the other will be a composite of the remainder of the borehole or to just above the water table if groundwater is encountered. Cores will be monitored following recovery, for health and safety purposes, with a Flame Ionization Detector (FID) or a Photoionization Detector (PID), as appropriate, in accordance with Site Procedure 5-21000-OPS-FO.15, *Photoionization Detectors and Flame Ionization Detectors*. The core samples will then be boxed and logged in accordance with OPS-PRO.101, *Logging Alluvial and Bedrock Material*, except that logging will be conducted more qualitatively than specified in OPS-PRO.101 (i.e., sieving, examination with a microscope, and plasticity testing will not be conducted). All core boxes will be labeled and transferred to an ER core storage conex for archiving following project completion. Land surveying of Geoprobe locations (± 1.0 foot) and elevations (± 0.01 foot) will be conducted as per RMRS/OPS-PRO.123, *Land Surveying*, to provide horizontal and vertical control for borehole location.

4.2 Sample Designation

The site standard sample numbering system will be implemented in this project, 1) a standard Report Identification Number (RIN) sample number will be assigned to the project by the Analytical Services Division (ASD), and 2) an RMRS sample number will be assigned 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 reporting purposes, the ASD and RMRS sample numbers will be cross-referenced with location codes.

4.3 Sample Collection and Analysis

All sampling equipment will be decontaminated with a Liquinox solution, and rinsed with deionized or distilled water, in accordance with OPS-PRO.127, *Field Decontamination Operations*. Field forms will include standard items such as chain of custody seals and forms, drilling logs, field calibration logs, and investigation derived material forms. Samples will be submitted to an offsite EPA-approved laboratory for analysis under a 30-day turnaround time.

Health and safety requirements will be specified in the Project Health and Safety Plan. Personal protective equipment (PPE), air monitoring requirements, and hazard assessments will be addressed in the Project Health and Safety Plan.

4.3.1 Soil Sampling

Subsurface soil samples will be collected in approximately two-foot increments from the three Geoprobe boreholes drilled at the proposed construction areas at Building 984 (Figure 1-1). Soil samples will be collected using the methods specified in OPS-PRO.124, *Push Subsurface Soil Sampling*. The purpose of collecting subsurface soil samples is to characterize the soil that will be excavated during the modifications to Building 984. Two soil samples from each borehole will be sent to the analytical laboratory. One sample will be collected just below grade, and the other will be a composite of the remainder of the borehole that is above the water table. Table 4-1 summarizes the analytical requirements for soil samples.

Table 4-1 Soil and Groundwater Sampling and Analysis Program

Analysis	Matrix	EPA Method	Container	Preservation	Holding Time
Target Analyte List (TAL) Metals	Soil	EPA CLP SOW for Inorganics	4-oz. Plastic	None	Hg, 28 days; others, 6 months
Target Analyte List (TAL) Metals	Water	EPA CLP plus beryllium	1 (one) 1-liter poly bottle	Field filtered (0.45 μ m membrane), Cool to 4° C, HNO ₃ to pH < 2	180 Days
Target Compound List (TCL) Volatiles	Soil	EPA CLP SOW	4-oz. Glass	Cool to 4° C	10 days
Target Compound List (TCL) Volatiles	Water	EPA 524.2	3 (three) 40 ml amber glass vials with teflon-lids	Unfiltered, Cool to 4° C	14 days
Uranium Isotopes (U233/244, U235, and U-238)	Soil	Alpha Spectrometry; N/A	125 ml glass or poly	None	Not specified
Uranium Isotopes (U233/244, U235, and U-238)	Water	N/A ^a	1 (one) 1-liter poly bottle	Field filtered (0.45 μ m membrane), HNO ₃ to pH < 2	180 days
Am-241, Pu-239/240	Soil	Alpha Spectrometry, N/A	125 ml glass or poly	None	Not specified
Am-241, Pu-239/240	Water	N/A ^a	1 (one) 1-gallon poly bottle	Unfiltered, HNO ₃ to pH < 2	180 days
Rad Screen	Soil	Gas Flow Proportional Counting, N/A ^a	60 or 125 ml glass or poly	None	6 months
Rad Screen	Water	N/A ^a	1 (one) 125 ml poly bottle	Unfiltered	180 days

^a No EPA-approved method is currently in place for isotopics analysis. However, the laboratories perform isotopic analysis according to the ASD Statement of Work for Analytical Measurements, Module RC01B.

4.3.2 Groundwater Sampling

In the event that groundwater is encountered during drilling, one groundwater sample will be collected from each of the Geoprobe boreholes. Groundwater samples will be collected using the methods specified in OPS-PRO.108, *Measurement of Groundwater Field Parameters*, and OPS-PRO.113, *Groundwater Sampling*. The samples will be collected by inserting teflon tubing through the Geoprobe drill rods and retrieving the sample with a peristaltic pump. Table 4-1 summarizes the analytical requirements for groundwater samples.

4.3.3 Radiological Screening

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. Samples sent offsite for analysis will require evaluation under 49 CFR 173, the U.S. Department of Transportation's (DOT) radioactive materials criteria of 2,000 pCi/g total radioactivity. Table 4-1 includes the requirements for collecting radiological screening samples.

4.4 Sample Handling

Samples will be handled according to RMRS/OPS-PRO.069, *Containing, Preserving, Handling, and Shipping of Soil and Water Samples*, and 4-K55-ENV-OPS-FO.10, *Receiving, Marking, and Labeling Environmental Materials Containers*.

4.5 Equipment Decontamination and Waste Handling

Reusable sampling equipment will be decontaminated in accordance with procedure OPS-PRO.127, *Field Decontamination Operations*. Decontamination waters generated during the project will be managed according to procedure OPS-PRO.112, *Handling of Field Decontamination Water and Field Wash Water*. Geoprobe equipment will be decontaminated following project completion using procedure OPS-PRO.070, *Decontamination of Heavy Equipment at Decontamination Facilities*. Personal protective equipment will be disposed of according to 5-21000-OPS-FO.06, *Handling of Personal Protective Equipment*. If groundwater is encountered, purge and development water will be handled according to RMRS/OPS-PRO.128, *Handling of Purge and Development Water*. Any wastes that are generated during drilling will be handled according to RMRS/OPS-PRO.115, *Monitoring and Containerizing Drilling Fluids and Cuttings*.

5.0 DOCUMENTATION AND DATA MANAGEMENT

A project field logbook will be created and maintained by the project manager or his/her designee in accordance with Site Procedure 2-S47-ER-ADM-05.15, *Use of Field Logbooks and Forms*. The logbook will include the time and date of all field activities, sketch maps of sample locations, and any additional pertinent information not specifically required by the SAP. The originator will legibly sign and date each completed original hard copy of data. 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. Logbooks will be controlled through RMRS Document Control.

Analytical data record storage for this project will be performed by Kaiser-Hill (K-H) ASD. Sample analytical results will be delivered directly from the laboratory to K-H 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 K-H ASD in the event that the analytical data is unavailable in EDD or SWD at the time of report preparation. Soil, and potentially groundwater, analytical results will be compiled into a sampling and analysis report.

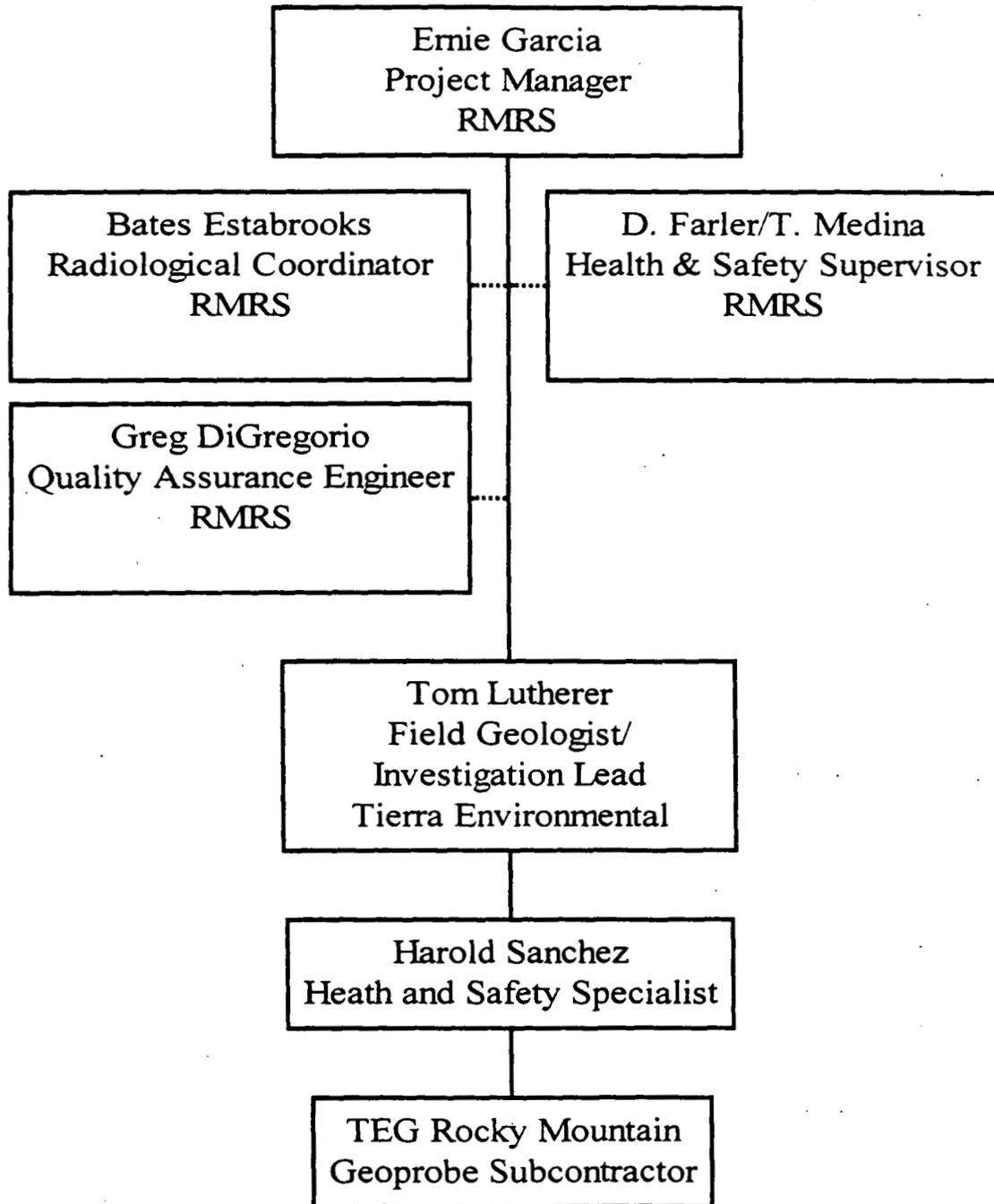
The QA Records for the project include the field forms and chain of custody records. Each QA Record is subject to the applicable QA records management procedures, RM-06.02, Records Identification, Generation and Transmittal.

6.0 PROJECT ORGANIZATION

Figure 6-1 illustrates the project organization structure. The RMRS ER Groundwater Operations Project Manager (PM) 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 RMRS Health and Safety Supervisor who is responsible for overall compliance with and implementation of the Project Health and Safety Plan. The RMRS Quality Assurance Engineer will provide the first level of oversight and support implementation of quality controls for the project. The RMRS 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, As Low As Reasonably Achievable (ALARA) Job Review, and approval of applicable Radiological Work Permits (RWPs).

Figure 6-1 Project Organization Chart



The Field Geologist/Investigation Lead will be responsible for field data collection, documentation, directing sampling and well installation. The Geologist will oversee the Health and Safety Specialist who will be responsible for onsite compliance with and implementation of the Project Specific Health and Safety Plan. In addition, the Geologist will also oversee sampling personnel responsible for field data collection, sample collection, and transfer of samples for analysis. Field data collections 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 onsite and offsite analyses through the ASD personnel. The sampling personnel are responsible for verifying that chain-of-custody documents are complete and accurate before the samples are shipped to the analytical laboratories.

7.0 QUALITY ASSURANCE

All components and processes within this project will comply with the RMRS Quality Assurance Program Description RMRS-QAPD-001, Revision 2, April 15, 1998, which is consistent with the K-H Team QA Program. The RMRS QA Program is consistent with quality requirements and guidelines mandated by the Environmental Protection Agency (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.

The project manager will be in direct contact with the QA Engineer to identify and correct issues with potential quality affecting issues. 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 QC samples, consisting of 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. All rinsate samples will be prepared by pouring carbon-filtered water over decontaminated sampling equipment, between collection of regular samples. Rinsate samples are collected only when re-usable sampling equipment is being used. 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 sample sets (RINS) by ASD personnel to fulfill data validation of 25% of the total number of VOC and radioisotope analyses. Table 7-1 provides the QA/QC samples and frequency requirements of QA sample generation.

Table 7-1 QA/QC Sample Type, Frequency, and Quantity

Sample Type	Frequency	Comments	Estimated Quantity
Duplicate	One duplicate for each twenty real samples	None	1
Rinse Blank	One rinse blank for each twenty real samples	To be performed with reusable sampling equipment following decontamination procedures	1

Analytical data that is collected in support of this SAP will be evaluated using the guidance developed by the Rocky Flats Administrative 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 precision, accuracy, representativeness, completeness, and comparability (PARCC) parameters. Quantitative values for PARCC parameters for the project are provided in table 7-2.

Table 7- 2 PARCC Parameter Summary

PARCC	Radionuclides	Non-Radionuclides
Precision	Duplicate Error Ratio ≤ 1.42	RPD $\leq 30\%$ for Organics RPD $\leq 30\%$ for Non-Organics
Accuracy	Detection Limits per method and ASD Laboratory SOW	Comparison of Laboratory Control Sample Results with Real Sample Results
Representativeness	Based on SOPs ,SAP, and analytical methods	Based on SOPs, SAP, and analytical methods
Comparability	Based on SOPs and SAP	Based on SOPs and SAP
Completeness	90% Useable	90% Useable

A definition of PARCC parameters and the specific applications to the investigation are as follows:

Precision. A quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate or duplicate measurements of a parameter. The closer the numerical values of the measurements are to each other, the lower the relative percent difference (RPD) and the greater the precision. The RPD for results of duplicate and replicate samples will be tabulated according to matrix and analytical suites to compare for compliance with established precision Data Quality Objectives (DQOs). Specifications on repeatability are provided in Table 7-2. Deficiencies will be noted and qualified, if required.

Accuracy. A quantitative measure of data quality that refers to the degree of difference between measured or calculated values and the true value of a parameter. The closer the measurement to the true value, the more accurate the measurement. The actual analytical method and detection limits will be compared with the required analytical method and detection limits for VOCs and radionuclides to assess the DQO compliance for accuracy.

Representativeness. A qualitative characteristic of data quality defined by the degree to which the data absolutely and exactly represents the characteristics of a population. Representativeness is 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 the SAP or other related documents and organized by media type and analytical suite. Deviation from the required and actual parameters will be justified.

Completeness. A quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained from a measurement system. A completeness goal of 90% has been set for this SAP. Real samples and QC samples will be reviewed for the data usability and achievement of internal DQO usability goals. If sample data cannot be used, the non-compliance will be justified, as required.

Comparability. A qualitative measure defined by the confidence with which one data set can be compared to another. Comparability will be attained through consistent use of industry standards (e.g., SW-846) and standard operating procedures, both in the field and in laboratories. Statistical tests may be used for quantitative comparison between sample sets (populations). Deficiencies will be qualified, as required.

Laboratory validation shall be performed on 25% of the characterization data collected in support of this project. Laboratory verification shall be performed on the remaining 75% of the data. Data usability shall be performed on laboratory validated data according to procedure 2-G32-ER-ADM-08.02, *Evaluation of ERM Data for Usability in Final Reports*.

Data validation will be performed according to K-H 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 K-H ASD.

8.0 SCHEDULE

Drilling activities are scheduled to begin in May, 1999. A summary report will be provided within 60 days of the receipt of final laboratory analytical data or the conclusion of construction at Building 984, whichever is later.

9.0 REFERENCES

DOE 1992a, *Historical Release Report for the Rocky Flats Plant*, Rocky Flats Plant, Golden, CO.

DOE 1993, *Background Geochemical Characterization Report*, September.

EG&G, 1995a, *Geologic Characterization Report for the Rocky Flats Environmental Technology Site, Volume 1 of the Sitewide Geoscience Characterization Study*, Final Report, April.

EPA 1994, *Guidance for Data Quality Objectives Process*, EPA QA/G-4, September.

RMRS 1998a *RMRS Quality Assurance Program Description*, RMRS-QAPD-001, Rev. 2, April.

RMRS, 1998b, *1997 Annual Rocky Flats Cleanup Agreement (RFCA) Groundwater Monitoring Report for Rocky Flats Environmental Technology Site*, RF/RMRS-98-273.UN, November