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# WORK PLAN

**WELL ABANDONMENT AND REPLACEMENT PROGRAM** Work Plan No RF/RMRS-97-003
Revision 0
Date effective 06/25/97


APPROVED John E Law 6/24/97
John E Law, Manager, Water Management and Treatment Date

## 1 0 PURPOSE

The United States Department of Energy (DOE) Rocky Flats Environmental Technology Site (RFETS) has initiated a Well Abandonment and Replacement Program (WARP) under the direction of the Environmental Restoration Division (ER) of Rocky Mountain Remediation Services, L L C (Contractor) WARP is a well maintenance and support program that services the Groundwater Monitoring Program (GMP) and other ER programs at RFETS In past years, WARP has abandoned and installed numerous GMP wells, and supported various ER projects, including the Industrial Area (IA) IM/IRA, the waste management facility geotechnical investigation, Trench T-3/T-4 source area removals, and other projects This Work Plan and attached Addendum outline the general objectives, scope, project staffing and responsibilities, work location, site conditions, and technical procedures associated with WARP, and provide for the implementation of WARP field activities, which are normally performed on an annual basis

WARP achieves the general objective of ensuring that RFETS maintains an exemplary groundwater monitoring program through periodic assessments of well viability and monitoring network design combined with a field program of targeted infrastructure maintenance and improvements To this end, the primary program objectives are

- Protection of groundwater by prevention of intermingling of soils and surface water with groundwater through existing well casings and annular seals (i e closure of nonviable wells),
- Management of well network size in support of RFETS closure initiatives and remediation activities,
- Support of GMP projects involving drilling and Geoprobe services,
- Preservation of the hydrologic integrity of hydrostratigraphic units, and
- Minimization of physical hazards created by obsolete well structures

These objectives are based on a combination of regulatory compliance and best management practice that has been developed to protect groundwater quality and ensure the reliability of wells for groundwater monitoring purposes Indirectly, WARP also supports the achievement of ER performance measure by providing well abandonment, installation, and drilling services for remedial actions

## 2 0 SCOPE

The main body of this work plan relies on an annual work plan addendum to describe activities planned for individual fiscal year (FY) WARP projects This approach accommodates both the long-term and repetitive nature of most WARP activities and procedures, which are addressed in the main work plan, and task-specific work activities that are required by WARP but vary in scope from year to year, which are addressed in the annual Addendum Routine WARP activities, such as standard well abandonments and well installations, are incorporated into the work plan by submitting basic information in the current FY Addendum on well locations, rationale, approach, and well construction specifications Non-routine WARP activities are also incorporated

into the work plan using the current FY Addendum, however, additional detail will generally be required to adequately describe data quality objectives, special sampling and analytical requirements, methods, and other parameters that relate to performance of the work In either case, the modular work plan approach is designed to better support the GMP by eliminating the need for annually renewable WARP work plans or extensive work plan revisions, and by providing a more responsive and complete subsurface investigation service

The WARP scope of work is composed of five main tasks

- Identification of nonviable wells and piezometers that are unable to yield representative samples of groundwater and other groundwater parameters,
- Abandonment of nonviable wells, as identified above, and other wells that are classified as obsolete, redundant or obstructions,
- Pre-installation evaluation and optimization of proposed well locations using geologic and groundwater data acquired from Geoprobe push-type soil sampling surveys,
- Installation of new wells for compliance and performance monitoring, and replacement wells for abandoned well locations where groundwater compliance or performance data is required, and
- Acquisition of subsurface soil samples and groundwater data in support of ER and other site closure projects

The specific scope of current FY WARP activities is contained within the appropriate addendum, which is incorporated into the Work Plan with management approval and document control For the purpose of this Work Plan, "current FY WARP activities" refers to all WARP activities contained within a revised work plan addendum that are performed in the year of approval, the October 1st to September 30th fiscal year Work Plan activities and procedures are outlined generally in Section 4 0, and specific details are provided in the current FY WARP Addendum

The schedule for implementation of Work Plan activities is provided in the individual addenda for current FY WARP tasks The schedule addresses the time requirements for implementation of the Work Plan and deliverables from the contract award date The Contractor will determine the actual sequence and timing for the well abandonment and well installation drilling tasks, and the Contractor may alter the number of wells or boreholes to be abandoned, installed, or drilled in any current FY WARP program However, these changes in the program are anticipated to be minor and will include only abandonments and installations that cannot be delayed because of potential harm to groundwater

All WARP activities will comply with existing standard operating procedures (SOPs) in the Geotechnical (GT), Groundwater (GW), and Field Operations (FO) areas, and the Quality Assurance Program Description (QAPD) (RMRS, 1996) In addition, WARP will be implemented under a WARP project-specific Health and Safety Plan (HASP) prepared by the Contractor

## 3 0 PROJECT STAFF

Implementation of WARP will be carried out by Contractor employees and Contractor drilling and groundwater monitoring subcontractors The Contractor organization chart for WARP project activities is illustrated in the current FY Addendum Key project positions and responsibilities for WARP referenced in the current FY addenda are explained in the following sections

3 1 Project Positions

3 1 1 Contractor Project Manager

The Contractor project manager is the primary interface between Contractor management and the Contractor site geologist The Contractor project manager communicates with the site geologist as required and provides overall project direction from the Contractor The Contractor project manager or designee is responsible for coordinating project activities and providing managerial and technical support to help ensure that schedules are met and necessary resources are available to conduct the project The Contractor project manager or designee is the main point of contact for matters of project scope, technical direction, peer review of field forms, schedule, and budget

3 1 2 Contractor Quality Assurance (QA) Officer

The Contractor QA officer evaluates the task for quality requirements in compliance with the QAPD (RMRS, 1996) and standards of professional practice The Contractor QA officer approves all documents addressing quality parameters, conducts orientations, and performs reviews and audits of field activities, project records, and other functions that potentially affect project quality

3 1 3 Contractor Health and Safety Supervisor (HS Supervisor)

The Contractor HS supervisor provides oversight and direction and performs audits to help ensure adherence to the health and safety requirements of the WARP HASP and professional standards of practice

3 1 4 Contractor Health and Safety Specialist (HSS)

The Contractor HSS provides monitoring services for hazardous, chemical, and radiological contaminants in the work area Certain minimum qualifications and training requirements must be met before a HSS shall be authorized to perform monitoring services HSSs must be certified by Radiological Engineering and Industrial Hygiene in accordance with relative and appropriate standards A subcontractor HSS, to be determined, may be substituted on the basis of Contractor HSS availability

3 1 5 Contractor Site Geologist

A Contractor site geologist will supervise subcontractor drilling crews and conduct project field operations on a day-to-day basis The Contractor site geologist will be responsible for compliance with the requirements of this work plan and other applicable project documents, including completion and authentication of all field forms The Contractor site geologist will conduct a variety of support tasks that help ensure that facilities, equipment, supplies, vehicles, and records are of high quality for job performance

3 1 6 Contractor Technician and Data Manager

A Contractor data manager will be responsible for entering data acquired in the field into the Rocky Flats Environmental Database System (RFEDS) or successor database in accordance with applicable SOPs The Contractor field technician will assist the Contractor site geologist, as needed, in compliance with the requirements of this work plan and other applicable project documents, including completion of all field forms The Contractor field technician will also help with soil sampling and sample management The Contractor field technician will assist with a variety of support tasks that help ensure that facilities, equipment, supplies, vehicles, and records are of high quality for job performance A subcontractor technician or data manager may be substituted on the basis of availability

3 1 7 Drilling Subcontractor Representative

The drilling subcontractor's representative is the principal individual authorized to discuss work schedules and related matters with Contractor personnel The subcontractor's representative will submit a daily drilling summary report of work and materials referred to by bid item, which the subcontractor's representative and Contractor site geologist will co-sign at the completion of each work day

3 2 Work Location and Site Description

Site operations have generated nonhazardous, hazardous, radioactive, and mixed radioactive waste and these types of wastes may be encountered in the subsurface All WARP activities are located within the perimeter of the site, which contains approximately 6,550 acres The Site is divided into three security zones (See Figure 3-1) The major RFETS structures, including all former production buildings, are located within a 400-acre controlled area (CA) Within the CA is the Protected Area (PA), which surrounds the most secure former production areas of the Site The controlled area is surrounded by a 6,150 acre Buffer Zone (BZ) WARP work locations will vary from year to year, but are expected to occur in all three security zones Specific work locations are identified in the current FY WARP Addendum

The Site is situated on an eastward-sloping pediment capped by alluvial deposits The pediment surface is dissected by a series of east-northeast trending stream-cut valleys These valleys lie 50 to 200 feet below the level of the pediment surface Most bedrock is concealed beneath colluvial material accumulated along the gentle valley slopes The geology and hydrogeology of RFETS have been described in the Geologic and Hydrogeologic Characterization Reports (EG&G, 1995a and 1995b) These reports provide detailed descriptions of the geologic and hydrogeologic conditions found in the subsurface at RFETS Boring logs exist for all wells installed after 1986 and will be used by the Contractor Site Geologist for estimation of subsurface lithologies at the proposed new well sites Well completion and subsurface data for the wells and piezometers to be abandoned are available and are utilized to estimate the drilling and grouting requirements for current FY WARP projects

## 4 0 INSTRUCTIONS

The following sections address well abandonment, well installation, and Geoprobe boring and sampling procedures, wellbore inspection, RFETS access, reporting and documentation, permitting requirements, and field communications as they pertain to WARP All WARP activities will be conducted in accordance with EMD geotechnical, groundwater, and field operations SOPs, which are incorporated by reference into the Work Plan

4 1 Well Abandonment

This section describes the general methods and procedures that will be used for abandoning wells at RFETS Specific instructions for well abandonment activities are described in more detail in GT 11, Plugging and Abandonment of Wells, and the WARP Addendum prepared for current FY activities The following sections address key elements of GT 11 and other relevant SOPs as they apply to WARP Decontamination and environmental material handling procedures pertaining to well abandonment activities are addressed in Sections 4 5 and 4 6 Well abandonments that require special methods or procedures not identified in this section or GT 11 are described, where necessary, in the attached Addendum for the current FY WARP project

4 1 1 Pre-Abandonment Activities

Pre-abandonment activities, including radiation screening and work site preparation, will be conducted at each abandonment site in accordance with the WARP task-specific HASP, and FO 16, Field Radiological Measurements In addition, the following pre-abandonment activities will be necessary

- Measure and record groundwater level and total depth of the well,
- Calculate the volume of water contained within the well to ensure the construction of a sufficient waste liquid containment structure as described in GT 11, and
- Break up and remove the concrete well pad as specified in GT 11 Remove the protective casing as specified in GT 11

Downhole video wellbore inspections will be undertaken in selected wells at the direction of the Contractor project manager These inspections are further described in Section 4 4 of this work plan

4 1 2 Abandonment Methods

Under WARP, monitoring wells can be abandoned using a variety of techniques that depend primarily on abandonment purpose and well construction factors, such as depth, casing type and annular grout seal conditions The abandonment in-place method is preferred for most wells because abandonment costs and the volume of investigation-derived materials are minimized If this method proves to be inappropriate, the wells will be abandoned by one of the other four methods listed below as determined by the site geologist The proposed abandonment method for each well is identified in a well abandonment summary table provided in each FY WARP Addendum prepared for this Work Plan

Wells shall be abandoned by one of five methods in accordance with GT 11

- Abandonment in place (i e , without pulling the casing)
- Casing Pulling and Reaming
- Casing Destruction (drilling it out)
- Overdrilling
- Overcoring

Some wells scheduled for abandonment may have been drilled much deeper than the present total depth, then plugged back and completed in a shallower zone If grout is encountered immediately beneath the casing, drilling or reaming activities will be terminated If sand pack or backfill is present below the current total depth, it will be removed by reaming or drilling to the original total depth or until grout is encountered The grouted interval is considered to be previously abandoned, therefore, reaming or drilling through the grout is not necessary

4 1 2 1 *Abandonment in Place*

Wells that do not penetrate a confined hydrostratigraphic unit may be grouted as described in GT 11 Wells penetrating more than one aquifer or contaminant zone may also be abandoned with the casing left in place providing that construction documentation indicates that the casing opposite each confining layer or between two contaminant zones has been properly grouted If the well is known to be nonviable due to absent or inadequate grouting, the casing in such intervals must be perforated or ripped Abandonment in place shall consist of filling the casing interval with bentonite grout from well casing total depth to within 1 to 2 feet below ground surface The well casing will be cut off just above the pad or ground surface and a locking "J" cap or equivalent will be placed on the casing

4 1 2 2 *Pulling the Casing*

Wells with steel, stainless steel, or cast iron casings shallower than a total depth of 30 feet can potentially be abandoned by casing pulling It is possible that casings in some of these wells will exceed the available lifting capabilities of the drilling rigs, making it necessary to resort to overdrilling and overcoring or casing destruction Procedures for pulling casing and casing destruction are provided in GT 11 The appropriate method for accomplishing this will be determined by field personnel on the basis of existing conditions at the particular well The site geologist will determine through cuttings examination when all annular materials have been reamed from the borehole

4 1 2 3 *Destroying the Casing*

Casing destruction can be used only on wells with polyvinyl chloride (PVC) well casing This method involves drilling out the well casing and annular completion materials with a rotary drill bit or auger Procedures for drilling out casing are provided in GT 11 The site geologist will determine through cuttings examination when all annular materials have been reamed from the borehole

4 1 2 4 *Overdrilling and Overcoring*

Overdrilling and overcoring employ a hollow-stem auger (for overdrilling) or air-rotary coring bit (for overcoring) to remove annular materials from around the casing, isolating and freeing it for removal The only difference between the two methods is the drilling technique used Overdrilling, which is typically less time-consuming than overcoring, can be used only on relatively shallow wells where the casing is embedded in soft or unconsolidated materials Overcoring is used as necessary on deeper wells or where the casing is embedded in consolidated rock Which method to use will be decided in the field by drilling crews In most situations, overdrilling may be used to a certain depth, at which point the drilling subcontractor will switch to overcoring

4 1 3 Wellbore Grouting

After the casing has been removed, abandoned wellbores will be grouted in accordance with the detailed procedures in GT 05, Plugging and Abandonment of Boreholes and modified, as necessary, in the FY WARP Addendum due to special soil remediation and excavation activity requirements

4 1 4 Surface Protection

Surface protection features for abandoned wells are addressed in GT 11 Features include the construction of a small concrete pad at the surface of each abandoned well site This pad will require preparation of a form with a diameter approximately equal to the diameter of the wellbore A permanent stainless steel marker will be affixed to each concrete pad

4 2 Well Installations

This section describes the general methods and procedures used for installing new monitoring and replacement monitoring wells at RFETS Instructions for well installation activities are described in more detail in GT 06, Monitoring Well and Piezometer Installation, and the Addendum prepared specifically for current FY WARP activities The following sections address key elements of GT 06 and other relevant SOPs as they apply to WARP Well installations that require special methods or procedures not identified in this section or GT 06 are described, where necessary, in the attached addenda for individual fiscal year WARP projects

All WARP well borings will be drilled in accordance with GT 01, Logging Alluvial and Bedrock Material, GT 02, Drilling and Sampling Using Hollow-Stem Auger Techniques, and GT 04, Rotary Drilling and Rock Coring Decontamination and waste handling procedures pertaining to well installation are addressed in Sections 4 5 and 4 6

4 2 1 Pre-Drilling Activities

The Office of the State Engineer, Colorado Division of Water Resources, must be informed of all wells planned for installation at the site The Well Installation Notification form is provided in GT 06

Before wells are drilled, well locations will be cleared in accordance with GT 10, Borehole Clearing, and marked in accordance with GT 02 A pre-work radiological survey will be conducted in accordance with FO 16, Field Radiological Measurements A Geoprobe boring program will be conducted in advance of well drilling to assist in well placement, if recommended by the Contractor site geologist Required permits will be obtained as described in Section 4 8 All necessary H&S protocols will be followed in accordance with the WARP task-specific HASP

4 2 2 Borehole Drilling

Well boreholes will be drilled using hollow-stem auger techniques, unless otherwise specified in the current FY Addendum Detailed hollow-stem auger drilling and sampling procedures are provided in GT 02 Borehole samples collected during implementation of the Field Sampling Plan as described in Section 4 7 and modified, as necessary, in the current FY Addendum, will be handled in accordance with FO 13, Containerization, Preserving, Handling and Shipping of Soil and Water Samples, and logged per GT 01 Detailed sample logging will be performed by the site geologist

4 2 3 Well Installation

Groundwater monitoring wells will be installed in accordance with GT 06, Monitoring Wells and Piezometer Installation, and constructed with 2-inch diameter PVC casing and screen, unless otherwise specified in the current FY year Addendum Monitoring wells completed in the Upper Hydrostratigraphic Unit (UHSU) will utilize single casing well construction designs, except in areas where special well installation objectives, high soil contaminant levels, or weathered bedrock UHSU completions necessitate the use of a multiple-casing well construction approach If applicable, these exceptions are to be specified in the current FY Addendum The base of well screens installed in surficial deposits will be completed as near to the base of the alluvium as possible Penetration into bedrock of several feet by drilling and sampling the underlying consolidated materials will be used to confirm the top of bedrock To the extent possible, the top of well screens and annular sand pack materials of UHSU wells completed in weathered bedrock will be set at least 1 foot below the bedrock contact in order to provide a sufficient annular grout seal thickness for preserving the hydrologic integrity of the two geologic units Deeper wells will be completed using multiple casings to ensure hole stability and minimize contact and potential cross contamination with shallower materials New monitoring wells will be land surveyed in accordance with GT 17, Land Surveying, or RFETS global positioning system manuals (Ashtech, 1993)

4 3 Geoprobe Boring and Sampling

This section describes the general methods and procedures used for Geoprobe push-type borings and sampling at RFETS Instructions for Geoprobe soil sampling are described in more detail in GT 39, Push Subsurface Soil Sample, and, as appropriate, in the Addendum prepared specifically for current FY WARP activities The following sections address key elements of GT 39 and other relevant SOPs as they apply to WARP Geoprobe

borings that involve special sampling requirements or procedures not identified in this section or GT 39 are described, where necessary, in the attached addenda for current FY WARP projects

Geoprobe borings drilled and sampled under this work plan will primarily be used for two purposes

- To position new monitoring wells in areas known to have shallow water table depths (less than 20 feet) and laterally discontinuous patterns of saturation These areas include the eastern margin of the Rocky Flats Alluvium, hillslope colluvial deposits, and valley-fill alluvium
- To collect hydrogeologic data and subsurface soil samples in support of GMP project characterization, design, and monitoring

The procedures for routine Geoprobe exploration of new well sites are contained within the Work Plan, as described below Customized Geoprobe investigations, such as those required for special GMP projects, are described separately in the current FY WARP Addendum

All WARP Geoprobe borings will be drilled, completed and abandoned in accordance with GT 39, Push Subsurface Soil Sample, and the current FY WARP Addendum Decontamination and waste handling procedures pertaining to well installation are addressed in Sections 4 5 and 4 6

4 3 1 Pre-Drilling Activities

Before advancing boreholes, all locations will be cleared in accordance with GT 10 and marked in accordance with GT 02 A prework radiological survey will be conducted in accordance with FO 16 Required permits will be obtained as described in Section 4 8 All necessary Health and Safety protocols will be followed in accordance with the WARP task-specific HASP

4 3 2 Borehole Drilling

Boreholes will be drilled using push-type techniques at proposed well locations specified in the current FY WARP Addendum Detailed drilling and sampling procedures using this methodology are provided in GT 39

The number of Geoprobe borings required to site a monitoring well is estimated to range from 3 to 10, depending on the size of the target area, complexity of the hydrogeologic setting, and success at finding groundwater Generally, borings will be located along a line oriented normal to the expected groundwater flow path at spacings ranging from 10 to 50 feet, as determined by the Contractor site geologist All Geoprobe borings will be advanced to a sufficient depth to confirm the presence and depth of weathered bedrock, unless prevented by probe refusal or depth exceeding 30 feet In the event that refusal occurs prior to reaching bedrock, up to two offsets will be attempted to achieve greater penetration, if the reason for refusal is related to a downhole obstruction At the discretion of the Contractor site geologist, temporary small diameter (1/2 to 3/4 inch) PVC well screen and casing will be installed in the borings to determine the static water level and saturated thickness, and allow for groundwater sampling These temporary piezometers will be installed in accordance with GT 06, Monitoring Wells and Piezometer Installation

4 3 3 Geoprobe Borehole Monitoring and Sampling

Core samples will be collected continuously in 2- to 5-foot increments from the surface to approximately 2 feet into bedrock Core samples collected during implementation of the Field Sampling Plan as described in Section 4 7 and, if applicable, in the current FY WARP Addendum, will be handled in accordance with FO 13, and visually logged per GT 01 Detailed sample logging will be performed by the Contractor site geologist

The water level in each Geoprobe piezometer will be checked daily for the first week after completion until a static water level condition is established, or until the piezometer is proven to be dry If necessary, monitoring will continue on a weekly basis until terminated by the Contractor site geologist Piezometers with a sufficient amount of water will be sampled for chemical analysis, as directed by the Contractor project manager, to assist with final well placement Groundwater samples will be collected using the methods specified in the Field Sampling Plan and GW 06, Groundwater Sampling The recommended location for well placement will be determined by the Contractor site geologist based on consideration of the geologic, hydrologic and chemical data collected from the Geoprobe survey at each proposed well site

At the completion of the well placement survey, all Geoprobe borings and piezometers will be abandoned in accordance with GT 05 and GT 11, respectively

4 4 Wellbore Inspection

Wellbore inspection using a borehole camera, tripod, and winch system will be performed at the discretion of the Contractor site geologist for purposes of pre-abandonment planning and documentation These inspections will be conducted to determine well casing and screen integrity, and to confirm well construction details, including top and bottom of screen depths and sump length A video cassette recorder (VCR), video monitor, and video cassettes will be used with the approval of site security Video cassettes will be labeled with well location code, date, and "Property of U S DOE/RFFO "

4 5 Equipment Decontamination

Equipment used for WARP field operations will be decontaminated in accordance with FO 03, General Equipment Decontamination, and FO 04, Heavy Equipment Decontamination Decontamination activities requiring the use of the RFETS Main Decontamination Facility (MDF) will be performed per the requirements of FO 12, Decontamination Facility Operations Other SOPs cross-referenced in FO 03, FO 04, and FO 12 contain additional applicable equipment-specific decontamination guidance

Decontamination procedures will be implemented to minimize the following potential cross-contamination

- Offsite contaminant migration
- Personnel exposure from improperly decontaminated equipment

The Contractor site geologist will be responsible for ensuring that all decontamination protocols specified in the SOPs are followed

4 6 Environmental Material Handling, Labeling, and Disposal

WARP field operations will generate liquid and solid environmental investigation-derived materials (IDM) Liquid materials include drilling fluids, decontamination and wash water, and residual groundwater Solid materials include drill cuttings, removed casing, surface soils, disposable personal protective equipment (PPE), and plastic Handling and disposal of these materials will be conducted in accordance with the following SOPs

- FO 06, Handling of Personal Protective Equipment — Applicable to personal protective equipment and plastic ground sheet used at work sites
- FO 07, Handling of Decontamination Water and Wash Water — Applicable to decontamination and wash water
- FO 08, Handling of Drilling Fluids and Cuttings — Applicable to drill cuttings, drilling fluids, surface soil, and residual groundwater displaced during well abandonment

- FO 10, Receiving, Labeling, and Handling Environmental Material Containers — Provides guidance for the procurement, labeling, and use of environmental material containers (i e , drums)
- FO 23, Management of Soil and Sediment Investigative Derived Materials (IDM) — Provides guidance for handling soil and sediment from the point of generation through the characterization process and includes the handling of drums in which these materials are contained
- GT 02, Drilling and Sampling Using Hollow-Stem Auger Techniques — Provides guidance for obtaining geochemical data to characterize environmental materials placed into drums
- GT 11, Plugging and Abandonment of Wells — Provides information on handling and disposal of removed casing and additional information on handling and disposal of displaced residual groundwater

The Contractor site geologist will be responsible for proper handling of environmental materials at the work sites, proper labeling of environmental material containers, and completion of required forms and documentation The Contractor site geologist will be responsible for coordinating the removal and transfer of all environmental materials from the project work areas to the designated transfer area The data manager will be responsible for entering appropriate location code numbers and sample numbers into a database compatible with the Rocky Flats Environmental Database System (RFEDS) in accordance with FO 14 and Administrative Procedure 17 01, Records Capture and Transmittal for all Records

FO 23, Management of Soil and Sediment Investigation Derived Materials (IDM), describes the conditions under which drill cuttings and annular materials will be contained in drums If the monitoring well to be installed or abandoned is located in an area of concern such as a radiologically controlled area (RCA), IHSS, a Potential Area of Concern (PAC), an Additional Area of Concern (AAC), or if field screening indicates that constituent concentrations are above the ambient levels as measured by field instruments, then all material brought to the surface will be drummed and composite sampled for waste determination

If well abandonments are located in any of the above referenced areas of concern, analytical data generated during previous soil and water sampling (GT 02) and the results of field screening (SOPs FO 15, FO 16, and FO 23) will be used to determine the proper disposition of drummed materials At soil remediation sites, drill cuttings and well construction materials generated during abandonment may be stored and treated as part of soil remediation operations

The Contractor site geologist will ensure that subcontractor personnel do the following

- Arrange for the appropriate drums to be collected from the wellsite and transferred to the appropriate storage area
- Ensure that waste materials are not commingled and are properly segregated (i e , PPE with other solid wastes)
- Ensure that drums are properly filled, labeled, and positioned in the field
- Ensure that all documentation is completed properly and a tracking system is implemented that shall account for each drum
- Assist with periodic inspections of drums issued for WARP
- Arrange for drum transfer

## 4 7 Field Sampling Plan

Sampling and analysis activities performed under WARP are controlled by the general guidance provided in this section and specific information contained within the current FY WARP Addendum This section outlines the general RFETS sampling and analytical requirements for characterization of investigation-derived waste

materials and subsurface contaminant extent associated with WARP drilling operations The current FY WARP Addendum references this information and provides further detail on sample locations, collection and analysis, where appropriate In this regard, the current FY WARP Addendum fulfills the function of a sampling and analysis plan and will be utilized as the main work controlling document for specific activities conducted in the field

Applicable SOPs are GT 02, GT 04, and FO 13 All chemical laboratory work will be done according to the U S Environmental Protection Agency's (EPA's) Contract Lab Program (CLP) standards The CLP-type analysis is outlined in the Analytical Services Division Statement of Work for Analytical Measurements (ASDSWAM) (Kaiser-Hill, 1997)

4 7 1 Well Abandonments

Composite samples of drummed drill cuttings and well construction materials generated during well abandonment will be collected at well locations where previous soil or groundwater analyses are unavailable or are inadequate for waste characterization purposes It is expected that no more than one suite of waste characterization samples will be required for each separate well location These waste characterization soil samples will be analyzed for volatile organic analytes (VOAs) by EPA-CLP SOW (ASDSWAM, Kaiser-Hill, 1997), selected radionuclides, and target analyte list (TAL) metals by EPA-CLP SOW (ASDSWAM, Kaiser-Hill, 1997) Specific analytes of radionuclide analysis will include a radiation screen, gross alpha, gross beta, uranium 233/234, 235, and 238, plutonium 239/240, and americium 241 These waste characterization soil samples will be labeled with the prefix "BP "

4 7 2 Well Installations

Composite samples of borehole core or drummed soils will be collected for waste characterization purposes for new well installations located in an RCA, IHSS, PAC, or AAC It is expected that no more than one suite of waste characterization samples will be required for each separate well location These waste characterization soil samples will be analyzed for VOA by EPA-CLP SOW (ASDSWAM, Kaiser-Hill, 1997), selected radionuclides, and target analyte list (TAL) metals by EPA-CLP SOW (ASDSWAM, Kaiser-Hill, 1997) Radiological analyses will include a radiation screen, gross alpha, gross beta, uranium 233/234, 235, and 238, plutonium 239/240, and americium 241 Analysis for radioactive isotopes will only be conducted if field readings are greater than twice background which indicate the potential for radioactive contamination These waste characterization soil samples will be labeled with the prefix "BH "

As stated in Section 4 2 3, surface soil samples at the drilling location and subsurface soil samples from the bottom of the surface casing may be collected from multiple-casing well installations where documentation is required to demonstrate that potential contamination from overlying soils and groundwater has been effectively isolated from deeper completion zones These soil samples may be analyzed for VOA by EPA-CLP SOW (ASDSWAM, Kaiser-Hill, 1997), selected radionuclides, and target analyte list (TAL) metals by EPA-CLP SOW (ASDSWAM, Kaiser-Hill, 1997), depending on the contaminants of concern, as specified in the current FY WARP Addendum For locations with potentially elevated levels of radionuclides, specific analytes will include radiation screen, gross alpha, gross beta, uranium 233/234, 235, and 238, plutonium 239/240, and americium 241 These samples may be stored onsite to be analyzed at a later date for radionuclides if groundwater analyses are considered anomalous The surface soil samples and soil from the bottom of the surface casing will be labeled with the prefix "SS "

Well development and groundwater sampling are not planned as part of the well installation activities These activities will be performed as part of routine groundwater monitoring operations under the proposed Integrated Monitoring Program (IMP)

4 7 3 Geoprobe Boreholes and Piezometers

Soil and groundwater samples from Geoprobe borings and piezometers will be collected, as specified in the current FY WARP Addendum, to assist with new well placement and further delineate the extent of subsurface soil and groundwater contamination for future well placement These samples will be analyzed for VOA by EPA-CLP SOW (ASDSWAM, Kaiser-Hill, 1997), selected radionuclides, and target analyte list (TAL) metals by EPA-CLP SOW (ASDSWAM, Kaiser-Hill, 1997) Samples collected from Geoprobe borings and piezometers will be labeled with prefix "BH" for soils and "GW" for groundwater A more detailed description of Geoprobe sample planning and activity, if applicable, is contained within the current FY WARP Addendum

4 8 Permits

Permits and procedures for authorizing intrusive work at RFETS are discussed in GT 10 Drilling activities will require obtaining soil disturbance approval as provided in Level 1 Procedure 1-F20-ER-EMR-EM 001, Environmental Approval Process for Construction Activities on or Near Individual Hazardous Substance Sites (IHSSs) Access permits are also required for work in some restricted areas The WARP HASP will outline access permits required due to Health and Safety concerns A project-specific land use permit will also be required

Actions relating to the wells located in the floodplains that are proposed for installation shall be reviewed to maintain compliance with the National Environmental Policy Act (NEPA) and the requirements of 10 CFR 1021 and 10 CFR 1022

4 9 Field Communications

RFETS field communications will follow protocols described in FO 11, Field Communications A short training session on the use of site telephones and radios will be conducted by RFETS personnel Communication protocols and emergency signals will be included in the training In the event of an emergency, procedures outlined in the WARP HASP shall be followed

A WARP project office will be served by telephone Field teams will use two-way radios for communication with the field office and other field teams All field activities will be conducted in pairs or groups of personnel

**5 0 RECORDS**

Daily WARP field activity documentation will entail completion by the site geologists of field forms provided in the SOPs Field data will be managed in accordance with FO 02 and FO 14 In addition, field activity daily logs shall be maintained by the geologists These logs will contain a chronological account of the day's activities and shall include interpretations of the final subsurface conditions Particular attention shall be given to documenting the quantity of grout used in each borehole or well casing and the total drilling depth The groundwater level before abandonment shall be recorded, and any unusual conditions shall be documented At the end of each day, a signed copy of the daily logs shall be presented to the field supervisor for review and filing and a weekly transmittal will be sent to the project manager

A sample tracking spreadsheet will be maintained by RFETS personnel for use in tracking sample collection and shipment

Project reporting for WARP will consist of the following

- Daily Contact — The field supervisor shall apprise the WARP project manager or designee of project progress on a daily basis
- Weekly Reports — During the course of field activities, weekly memos will be prepared by the WARP project manager for the Contractor project manager summarizing the progress of the project as it relates to their specific task and any problems encountered
- Data Reports — Field data will be input to RFEDS using a remote data entry module Data will be entered on a 3 5-inch computer diskette and will be delivered on a timely basis Procedures for data quality control, verification, entry into RFEDS, archiving, and security will follow FO 14
- WARP Report — A report will be prepared following completion of current FY WARP field activities which will detail the performance and results of the project
- Notification Letters — Copies of well abandonment logs and forms and well installation logs and forms for each well, along with a summary letter explaining the activities, will be delivered to Kaiser-Hill for submittal to DOE-RFFO
- State Well Abandonment Forms — Copies of the State of Colorado Well Abandonment Forms for each abandoned well shall be filled out and submitted to Kaiser-Hill for submittal to DOE-RFFO upon completion of current FY WARP field activities
- State Well Permit Application Forms — A Notice of Intent to Construct a Well for each new well shall be filled as specified in GT 06 Copies of the State of Colorado Well Permit Application Forms will be submitted to Kaiser-Hill for submittal to DOE-RFFO upon completion of current FY WARP field activities

## 6 0 HEALTH AND SAFETY

Health and safety requirements for WARP field operations are provided in the project-specific Health and Safety Plan (HASP) prepared by the implementing Contractor The HASP is a project-specific document developed to address site task-specific issues such as the following

- Levels of personal protection
- Overall hazard estimate for the various work areas
- Site conditions and material characteristics (including a radiological assessment)
- Work area control zones
- Decontamination
- Emergency procedures
- Personnel H&S responsibilities
- Drilling safety protocols

The HASP incorporates elements of previous WARP Health and Safety Plans In addition, the HASP will comply with Occupational Safety and Health Administration (OSHA) regulations defined in 29 CFR 1910

The HSS will be responsible for ensuring that all personnel performing or supporting project field operations are cognizant of all health and safety procedures The HSS and the site geologist will be responsible for ensuring that field personnel follow these procedures Contractor personnel will provide a contaminant characterization for each work area before work begins in that area

## 7 0 QUALITY ASSURANCE ADDENDUM

This section consists of the quality assurance Addendum (QAA) for the WARP This QAA supplements the Quality Assurance Program Description (QAPD) (RMRS, 1996) This QAA identifies the site-specific quality

assurance (QA) controls applicable to the WARP activities described in Section 2 0 and the current FY WARP Addendum

As stated previously, WARP consists of an annual maintenance program for the RFETS GMP The primary objectives of WARP are to properly abandon groundwater monitoring wells and piezometers that are no longer viable or needed as part of the GMP, to install new wells to be added to the GMP, and to install replacement wells or piezometers at locations where a nonviable but useful well or piezometer (i e , one that generates groundwater monitoring data that is used in the GMP) is removed The scope of the WARP program is described generally in Section 1 0, and more specifically in the current FY WARP Addendum

## 7 1 Organization and Responsibilities

The overall organization of the Contractor and the ER Division, which is responsible for implementing the ER Program activities at RFETS, is presented in Section 1 0 of the QAPD Functional responsibilities for the ER Division are also described in Section 1 0 of the QAPD The project-specific organization for WARP is shown in each current FY WARP Addendum The project specific staffing and description of responsibilities were discussed in Section 3 0

## 7 2 QA Program

The quality controls and requirements for WARP will be followed in accordance to the RMRS Quality Assurance Program Description, 95-QAPD-001, Rev 0, October, 10, 1995

### 7 2 1 Training

Personnel H&S training requirements are identified in the WARP task-specific HASP Contractor and subcontractor staff working on the WARP shall be trained in, and familiar with, the ER SOPs listed in Table 7 1 that are applicable to their assigned tasks and this work plan Evidence of completion of training will be recorded, with verifiable documentation, and submitted to the WARP Project Manager before initiating the WARP activities described in this work plan and attached addenda Contractor and subcontractor personnel shall be qualified to perform the tasks they have been assigned

### 7 2 2 QA Reports to Management

A QA summary report will be prepared at the conclusion of each FY of WARP activities by the ER QA Program Manager This report will include a summary of any field operation and sampling oversight inspections and surveillance conducted, and a report on data verification/validation results, as appropriate

## 7 3 Design Control and Control of Scientific Investigations

### 7 3 1 Design Control

The WARP Work Plan establishes the requirements and specifications for well and piezometer abandonment and replacement, collection of subsurface soil samples from the drilling and installation of replacement wells and piezometers, and collection of subsurface soil and groundwater samples from Geoprobe borings for well placement As such, the WARP Work Plan and addenda are considered the environmental investigation control plans for the proposed WARP field activities

TABLE 7-1

APPLICABLE FIELD AND ADMINISTRATIVE OPERATING PROCEDURES

| Procedure Number | Procedure Title |
|---|---|
| 2-G01-ER-ADM-5 14 | Use of Field Logbooks and Forms |
| 2-G18-ER-ADM-17 01 | Records Capture and Retrieval |
| 5-21000-OPS-FO 03 | General Equipment Decontamination |
| 4-S02-ENV-OPS-FO 04 | Heavy Equipment Decontamination |
| 5-21000-OPS-FO 06 | Handling of Personal Protective Equipment |
| 5-21000-OPS-FO 07 | Handling of Decontamination Water and Wash Water |
| 4-K56-ENV-OPS-FO 08 | Handling of Drilling Fluids and Cuttings |
| 5-21000-OPS-FO 11 | Field Communications |
| 5-21000-OPS-FO 12 | Decontamination Facility Operations |
| 5-21000-OPS-FO 13 | Containerizing, 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 |
| 4-F99-ENV-OPS-FO 23 | Management of Soil and Sediment Investigation Derived Material |
| 5-21000-OPS-GT 01 | Logging Alluvial and Bedrock Material |
| 5-21000-OPS-GT 02 | Drilling and Sampling Using Hollow Stem-Auger Techniques |
| 5-21000-OPS-GT 04 | Rotary Drilling and Rock Coring |
| 5-21000-OPS-GT 05 | Plugging and Abandonment of Boreholes |
| 5-21000-OPS-GT 06 | Monitoring Wells and Piezometer Installation |
| 5-21000-OPS-GT 10 | Borehole Clearing |
| 5-21000-OPS-GT 11 | Plugging and Abandonment of Wells |
| 5-21000-OPS-GT 15 | Geophysical Borehole Logging |
| 5-21000-OPS-GT 17 | Land Surveying |
| 4-S64-ER-OPS-GT 39 | Push Subsurface Soil Sample |
| 5-21000-OPS-GW 01 | Water Level Measurements in Wells and Piezometers |
| 5-21000-OPS-GW 02 | Well Development |
| 5-21000-OPS-GW 05 | Field Measurement of Groundwater Field Parameters |
| 5-21000-OPS-GW 06 | Groundwater Sampling |

7 3 2 Data Quality Objectives

Data requirements to support this project were developed using criteria established in *Guidance for the Data Quality Objective Process*, EPA QA/G-4 (EPA, 1994) The data gaps, study boundaries, and decisions related to WARP are described below

Sampling and data collection efforts associated with WARP serves the following purposes

- Characterization of IDM, such as drill cuttings and soils, produced from well abandonment and installation activities for waste determinations in support of disposition actions,

- Siting of well locations used for monitoring potential groundwater contaminant interaction with surface water and,
- Generation of basic geologic and hydrologic data for use in interpreting groundwater flow and contaminant movement

The primary data users and decisions makers of WARP include Contractor and subcontractor technical staff that are responsible for implementing the WARP activities, and the Contractor, subcontractor, DOE, EPA, and CDPHE technical staff who are responsible for collecting, reviewing, and interpreting data associated with the GMP and ER remediation projects Secondary decision makers include other project managers who will use analytical data from samples collected during the drilling of new or replacement wells to help determine the presence and extent of contamination associated with their projects

Existing GMP data was reviewed and evaluated to determine which of the existing wells and piezometers needed to be abandoned and replaced on a priority basis This information is presented in the current FY Addendum Information from existing wells was also used to select the zones of completion and projected depths for new and replacement wells, as shown in the current FY WARP Addendum

Based on the existing information and the objectives of WARP, data are needed to ensure that field activities are properly documented, and physical and contamination hazards to workers and the environment are minimized Available soil analytical data are generally lacking or inadequate for waste characterization purposes at many work sites These data are required to determine whether hazardous or radiological contamination exists in IDM, and to determine the fate of IDM The types of data to be generated during implementation of WARP are described below

Monitoring wells located within and around remediation and decontamination and decommissioning (D&D) projects may no longer be functional for monitoring groundwater due to physical disturbances planned during contaminant source removals, plume containment and treatment, building demolition, or other site closure activities Generally, wells that are not located within the path of soil disturbance zones will be abandoned in place while wells located within soil disturbance zones will be completely removed Generated waste will be drummed for future disposal or will be treated with other remediation or demolition wastes generated by site removal actions Wastes generated during abandonment of these wells will be analyzed for Resource Conservation and Recovery Act (RCRA) characteristics that includes TAL metals, volatile organic compounds (VOCs), and radionuclides, where necessary

Groundwater monitoring wells will be installed to fill data gaps for defining the extent of groundwater contamination in the UHSU and to identify if additional action may warranted due to future migration of contamination If contaminant concentrations exceed the RFETS Tier II standards for groundwater, necessary action will be performed in accordance to the criteria outlined in RFCA (DOE, 1996) The current FY WARP Addendum identifies these data gaps and specifies the location of proposed well locations Sampling and analysis of groundwater samples will be performed in temporary Geoprobe piezometers for assisting with new monitoring well placement Sampling and analysis of groundwater samples will not, however, be performed in new wells but, instead, will be conducted through the GMP Specific SOPs are identified in Table 7 1 Wastes generated during drilling will be disposed of at the landfill or will be drummed for future disposal Samples of waste materials will be analyzed for Resource Conservation and Recovery Act (RCRA) characteristics that include TAL metals, volatile organic compounds (VOCs), and radionuclides, where necessary

The field data to be generated during implementation of WARP field screening techniques and analysis (or measurements) using portable instruments The quality of field data will be controlled by adhering to the ER Operating Procedures identified previously in Section 7 2 1 and summarized below, in addition to the manufacturers specifications for use and calibration

The WARP field measurement data will include wellbore depths and diameters, depths to bedrock and water level in wells and piezometers, and depth of soil samples These measurements will be made and controlled in accordance with instructions contained in GT 02, Drilling and Sampling Using Hollow Stem Auger Techniques, GT 03, Isolating Bedrock from Alluvium with Grouted Surface Casing Drill core from borings for replacement wells/piezometers will be logged according to GT 01, Logging Alluvial and Bedrock Material Where necessary, electromagnetic or ground penetrating radar (GPR) measurements will be made of all wellbore locations for new or replacement wells as part of surface geophysical surveys conducted to detect areas where subsurface metal objects or utilities might be located The use of geophysical equipment to generate electromagnetic or GPR data will be as specified in GT 10, Borehole Clearing The use of downhole geophysical logging tools will be in accordance with instructions specified in GT 15, Geophysical Borehole Logging Radiation contamination screening measurements will be made at all existing and proposed well locations in accordance with instructions specified in FO 16, Field Radiological Measurements Radiation and organic vapor screening measurements will also be made during drilling and sampling activities Organic vapor measurements will be made in accordance with instructions specified in FO 15, Photoionization Detectors (PIDs) and Flame Ionization Detectors (FIDs)

7 3 3 Sampling

The relevant operating procedures to be followed during the implementation of this plan are listed in the references presented in Table 7-1 The analytical methods will be performed in accordance with the ASDSWAM and the waste acceptance criteria for the approved disposal facility

7 3 4 Quality Control

Field sampling quality control (QC) will consist of the collection and analysis of duplicate soil and groundwater samples at the rate of 1 per 20 samples and preparation and analysis of an equipment rinsate blank for every 20 samples collected Precision and accuracy of the analyses will be in accordance with the QC programs of the selected laboratories and/or per requirements of the approved disposal facility waste acceptance criteria Analytical laboratory QC for soil and groundwater sample analyses shall be as specified in ASDSWAM (Kaiser-Hill, 1997) Duplicate samples shall be analyzed for the same analytes of interest as regular (identified as "REAL" in the RFEDS) samples Equipment blanks shall be analyzed for the same target analytes as regular samples, however, radionuclide analysis of equipment blanks shall be limited to gross alpha, gross beta, gamma, and tritium A completeness goal of 100% is proposed for the program

7 3 5 Data Reduction, Verification, and Reporting

Field data generated during implementation of the WARP field activities shall be recorded on field data forms provided in the applicable SOPs Data reduction, verification, and reporting of field data shall be accomplished according to the instructions specified in FO 14, Field Data Management Figure 7-1, Data Flow for Analytical Data, illustrates the data management process

7 4 Control of Processes

The overall processes of generating field data and collecting samples require control The processes are controlled by adhering to the WARP Work Plan and the operating and sampling procedures referenced

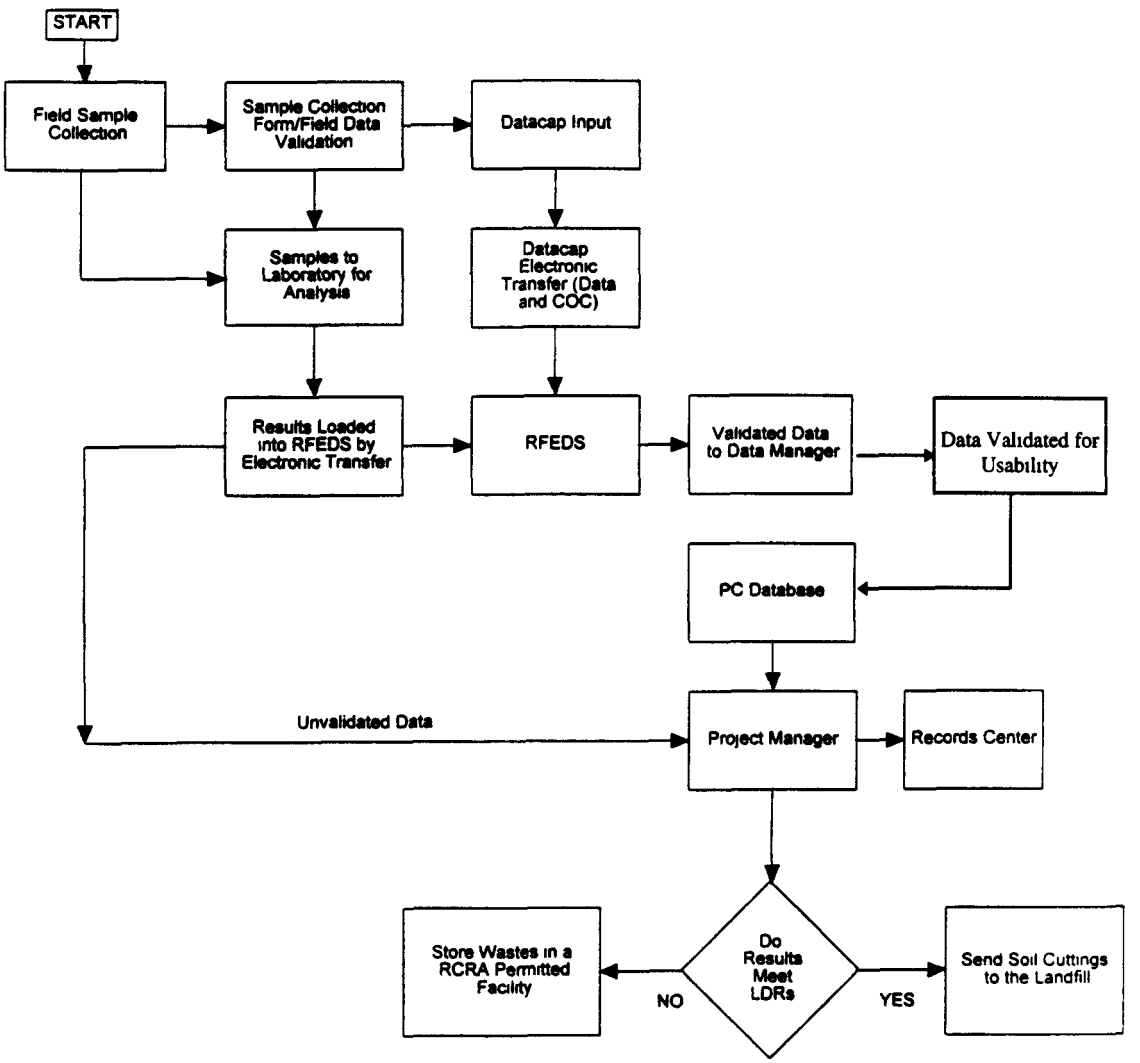
7 5 QA Records

Field QA records will be controlled in accordance with FO 14, Field Data Management, EMD Administrative Procedure 3-21000-ADM-17 01, and ADM-5 14 Field QA records include the SOPs data forms that are

completed as a result of implementing the WARP field activities and copies of field logbooks This WARP Work Plan and any subsequent changes or revisions are also considered QA records

**FIGURE 7-1**

**DATA FLOW FOR ANALYTICAL DATA**



## 8 0 REFERENCES

Ashtech, 1993, Ashtech XII GPS Receiver Operating Manual, Version 7,

EG&G, March 1995a, *Geologic Characterization Report for the Rocky Flats Environmental Technology Site* Volume I of the Sitewide Geoscience Characterization Study, EG&G Rocky Flats, Golden, Colorado

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Kaiser-Hill, 1997, *The Analytical Services Division Statement of Work for Analytical Measurements*

Rocky Mountain Remediation Services (RMRS), 1996, *Quality Assurance Program Description (QAPD)*, RMRS-QAPD-001

U S Department of Energy, March 1996, *Regulated Federal Facilities Compliance Act, Rocky Flats Environmental Technology Site, Action Levels and Standards Framework for Surface Water, Ground Water, and Soils*, U S Department of Energy, Rocky Flats Environmental Technology Site, Golden, Colorado

U S Environmental Protection Agency, 1994, *Guidance for Planning for Data Collection in Support of Environmental Decision Making Using the Data Quality Objectives Process*, EPA QA/G-4, interim final

## 9 0 ABBREVIATIONS, ACRONYMS, AND INITIALISMS

| | |
|---|---|
| AAC | Additional Area of Concern |
| ASDSWAM | Analytical Services Division Statement of Work for Analytical Measurements |
| BH | Waste characterization soil sample prefix code |
| BP | Waste characterization soil and well construction sample prefix code |
| BZ | buffer zone |
| CA | controlled area |
| CDPHE | Colorado Department of Public Health and Safety |
| CERCLA | Comprehensive Environmental Response, Compensation, and Liability Act |
| CLP | Contract Lab Program |
| D&D | Decontamination and Decommissioning |
| DOE | Department of Energy |
| EMD | Environmental Management Division |
| EPA | Environmental Protection Agency |
| ER | Environmental Restoration Division |
| FO | Field Operations |
| FY | Fiscal Year |
| GMP | Groundwater Monitoring Program |
| GPR | Ground Penetrating Radar |
| GT | Geotechnical |
| GW | Groundwater sample prefix code |
| H&S | Health and Safety |
| HASP | Health and Safety Plan |
| HSS | Health and Safety Specialist |

| | |
|---|---|
| IA | Industrial Area |
| IDM | Investigation-Derived Materials |
| IHSS | Individual Hazardous Substance Site |
| IM/IRA | Interim Measure/Interim Remedial Action |
| IMP | Integrated Monitoring Plan |
| MDF | Main Decontamination Facility |
| NEPA | National Environmental Policy Act |
| OSHA | Occupational Safety and Health Administration |
| PA | Protected Area |
| PAC | Potential Area of Concern |
| PPE | Personal Protective Equipment |
| PVC | polyvinyl chloride |
| QA | Quality Assurance |
| QC | Quality Control |
| QAA | QA Addendum |
| QAPD | Quality Assurance Program Description |
| RCA | Radiologically Controlled Area |
| RCRA | Resource Conservation and Recovery Act |
| RCA | Rocky Flats Compliance Agreement |
| RFEDS | Rocky Flats Environmental Data Base |
| RFETS | Rocky Flats Environmental Technology Site |
| RFFO | Rocky Flats Field Office |
| RMRS | Rocky Mountain Remediation Services, L L C |
| SOP | Standard Operating Procedure |
| SOW | statement of work |
| SS | soil sample prefix code |
| TAL | target analyte list |
| UHSU | Upper Hydrostratigraphic Unit |
| VOA | volatile organic analysis |
| VCR | video cassette recorder |
| VOC | volatile organic compound |
| WARP | Well Abandonment and Replacement Program |

# Site Location Base Map

## Figure 3-1

**EXPLANATION**

- Buffer Zone
- Industrial Area
- Protected Area

**Standard Map Features**

- Buildings
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Contours (20' Intervals)
- Rocky Flats boundary
- Paved roads
- Dirt roads

DATA SOURCE:
Buildings, roads, and fences provided by Facilities Dept., EG&G Rocky Flats, Inc., 1991
Hydrology provided by USGS (date unknown)

N

Scale = 1" = 2000'
1 inch represents approximately 1704 feet

500 0 1000 2000

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

Prepared by:
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MAP ID: 97-0080

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