

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

INTEGRATED MONITORING PLAN FY2004

SUMMARY DOCUMENT

Responsible Organization: Environmental Systems & Stewardship

Effective Date:
November 2003

Periodic Review Frequency: 1 year from the effective date

**Exempt from classification
per CEX-105-01**

TABLE OF CONTENTS

PAGE

ACRONYMS AND ABBREVIATIONS	iv
1 INTRODUCTION	1
1.1 Integrated Monitoring Plan.....	2
1.2 Data Quality Objectives.....	2
1.3 Quality Assurance	3
2 SURFACE WATER	4
2.1 Introduction	4
2.2 Site-Wide Water Quality	4
2.2.1 Monitoring Dam Operations	8
2.2.2 Locating New Contaminant Sources.....	9
2.2.3 Ad Hoc Monitoring	9
2.2.4 Indicator Parameter Monitoring for Analytical Water quality Assessment.....	10
2.3 Water Quality Within the Industrial Area	10
2.3.1 Incidental Water	11
2.3.2 Sanitary System Monitoring.....	11
2.3.2.1 Characterization of Internal Wastewater Streams to Meet Permit Requirements.	11
2.3.2.2 Monitoring Discharges to the WWTP.....	12
2.3.2.3 Monitoring the WWTP Collection System	12
2.3.2.4 WWTP Collection System Flow Monitoring.....	12
2.3.2.5 WWTP Radiological and Metals Monitoring	13
2.3.3 Performance Monitoring in surface water.....	13
2.3.4 Monitoring NPDES Discharges to Ponds	13
2.4 Industrial Area Discharges To Ponds.....	13
2.4.1 New Source Detection.....	14
2.4.2 Stream Segment 5.....	14
2.5 Water Leaving the Site	14
2.5.1 Predischarge Monitoring	15
2.5.2 Segment 4 Compliance Monitoring	15
2.5.3 CDPHE Monitoring at Indiana Street	15
2.6 Off-Site Monitoring to Support Community Water Supply Management.....	15
2.6.1 Monitoring Uncharacterized Discharges.....	16
2.6.2 Community Assurance Monitoring.....	16
2.7 Watershed Integration.....	16
2.8 Project-Specific Monitoring	17

3	GROUNDWATER	19
3.1	Groundwater Monitoring Focus.....	19
3.2	Groundwater Monitoring Program.....	19
3.2.1	Well Locations	20
3.2.2	Groundwater Sampling and Analysis.....	21
3.3	Groundwater Data Disposition	21
3.3.1	Databases.....	21
3.3.2	Reporting.....	21
3.4	Groundwater Evaluations	22
3.5	Well Abandonment and Replacement Program	22
3.6	Project-Specific Monitoring	22
4	AIR QUALITY	24
4.1	Purpose and Programs.....	24
4.1.1	Ambient Air Monitoring	24
4.1.2	Effluent Air Monitoring	24
4.1.3	Meteorological Monitoring	24
4.1.4	Project Monitoring	26
4.2	Site Air Monitoring Scope	26
4.2.1	Ambient Air.....	27
4.2.2	Effluent Air	27
4.2.3	Meteorological Conditions.....	27
4.3	Project Monitoring—Air	27
5	ECOLOGY	29
5.1	Monitoring Objectives	29
5.2	Scope of Monitoring.....	29
5.2.1	Wetlands.....	30
5.2.2	Project-Specific Monitoring.....	31
5.3	Outside Factors Affecting RFETS Ecology	32
5.4	Data Management	33
5.5	Reporting.....	33
6	REFERENCES	34

LIST OF TABLES

PAGE

Table 1. Surface-Water Monitoring Matrix	5
Table 2. Groundwater Monitoring Matrix.....	20
Table 3. Air Monitoring Matrix	25
Table 4. Ecological Monitoring Matrix.....	30
Table 5. Potential 2004 Projects at RFETS with Potential to Impact Wetlands or Preble’s Mouse Habitat.	31
Table 6. Industrial Area Revegetation Projects at RFETS.....	32

LIST OF FIGURES

PAGE

Figure 1. Schematic Surface Water Map	8
---	---

ACRONYMS AND ABBREVIATIONS

ALARA	As low as reasonably achievable
ALF	Action Levels and Standards Framework
AoI	Analyte of interest
AQM	Air Quality Management
BDCWA	Big Dry Creek Watershed Association
BMP	Best management practice
CAA	Clean Air Act
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
ComRad	Community Radiation
CWA	Clean Water Act
D&D	Decontamination and decommissioning
DOE	Department of Energy
DRCOG	Denver Regional Council of Governments
DQO	Data quality objective
EDE	Effective dose equivalent
EPA	U.S. Environmental Protection Agency
ER	Environmental restoration
ESS	Environmental Systems and Stewardship
FY	Fiscal year

GIS	Geographic information system
IMP	<i>Integrated Monitoring Plan</i>
L	Liter
mrem	millirem
NESHAP	National Emission Standards for Hazardous Air Pollutants
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
PA	Protected Area
POC	Point of Compliance
POE	Point of Evaluation
QA/QC	Quality assurance/quality control
RAAMP	Radioactive Ambient Air Monitoring Program
RCRA	Resource Conservation and Recovery Act
RFCA	<i>Rocky Flats Cleanup Agreement</i>
RFETS	Rocky Flats Environmental Technology Site
RFFO	Rocky Flats Field Office
SSC	Species of special concern
Site	Rocky Flats Environmental Technology Site
SWD	Soil and Water Database
T&E	Threatened and Endangered (Species)
TSS	Total suspended solids
WARP	Well Abandonment and Replacement Program
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

Environmental monitoring programs at the Rocky Flats Environmental Technology Site (RFETS or Site) continue to evolve in response to new regulatory requirements and accelerated Site closure activities. Various monitoring programs have amassed data on soils, surface water, groundwater, air, and different ecological systems. The *Rocky Flats Cleanup Agreement* (RFCA) (U.S. Department of Energy [DOE], 1996) requires DOE, in consultation with the Colorado Department of Public Health and Environment (CDPHE), and the U.S. Environmental Protection Agency (EPA), to establish an integrated monitoring program that effectively collects and reports the data required to ensure the protection of human health and the environment. The program is consistent with the RFCA Preamble, and complies with RFCA, laws and regulations, and effective management of RFETS resources.

This fiscal year 2004 (FY04) *Integrated Monitoring Plan* (IMP) identifies the routine monitoring programs for surface water, groundwater, air, and ecology, designed to minimize the duplication of efforts among DOE, CDPHE, the cities of Broomfield and Westminster, and associated data management systems.

The IMP details RFETS monitoring activities performed for legal, contractual, and operational purposes. It restates the agreed-upon types of monitoring, monitoring locations, sampling frequencies, and purposes of the monitoring. Much of the monitoring discussed in this document is performed to satisfy specific regulatory requirements that are not due to the RFCA agreement. Where this is the case, such monitoring requirements are not subject to enforcement pursuant to RFCA, but may be subject to enforcement in accordance with the initiating legal requirements. In addition, RFETS monitoring programs encompass best management practices (BMPs) that are not required by RFCA or other federal and state laws and regulations. The BMPs are incorporated into the IMP, but may be dependent on the availability of federal funding in accordance with RFCA, Paragraph 249.

In developing the IMP, RFETS personnel met with a working group of representatives from EPA, the State of Colorado, and the cities of Westminster, Northglenn, Thornton, Arvada, and Broomfield to develop consensus on the types of data to be gathered and their eventual uses as portrayed in the data quality objectives (DQOs) described in this IMP. The program is designed to provide data that meet the DQOs needed to support operational and regulatory decision making, and to address the requirements of the following statutes, regulations, permits and agreements:

- Resource Conservation and Recovery Act (RCRA);
- Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA);
- Clean Air Act (CAA);
- Clean Water Act (CWA);
- National Pollutant Discharge Elimination Systems (NPDES) permit and amendments;
- Colorado Hazardous Waste Acts;
- Standards promulgated by the Colorado Water Quality Control Commission;

- RFCA;
- Regulations governing natural resource (ecological) management;
- RFETS-specific monitoring and cleanup agreements; and
- DOE Orders and technical guidance.

1.1 INTEGRATED MONITORING PLAN

This document, the FY04 IMP, is a revision of the FY03 IMP (Kaiser-Hill Company, LLC [Kaiser-Hill], 2003a) and the FY03 *IMP Background Document* (Kaiser-Hill, 2003b), which describe the activities being conducted at RFETS under the IMP to satisfy RFCA and other regulatory requirements and interests. The FY04 *IMP Background Document* provides detailed discussions of the decision-making process that has resulted in numerous monitoring efforts at RFETS. This FY04 IMP lists the monitoring programs to which DOE and the other regulatory agencies are committed. The FY04 *IMP Background Document* provides additional information about the DQO decision process and the regulatory framework that drives many of the monitoring decisions at RFETS. The FY04 *IMP Background Document* is not subject to enforcement under RFCA.

This FY04 IMP lists the ongoing environmental monitoring activities that DOE, CDPHE, EPA, and other stakeholders have supported during the numerous working group meetings used to formulate monitoring-based decisions. It provides an overview of the requirements for these activities and the intended uses of the data that result. Monitoring is performed in four primary areas—surface water, groundwater, air, and ecological systems. Specific RFETS activities may involve soil monitoring, although RFETS-wide soil monitoring was discontinued in 1994 after many years of characterizing transuranic-contaminant distributions across RFETS. Currently, soil monitoring is performed on a project-specific basis. Interactions among these media have been recognized and discussed in some detail. The data collected can be used to support investigations into these interactions to the extent that the interactive effects are themselves measurable.

Each of the four major monitoring programs is discussed below. Soils are also considered. Soils and soil monitoring, as well as a discussion of the interactions between the media, are discussed below. Soil data relate to other media in various ways and continue to be important to the other programs, to future projects and project planning, and ultimately to Site closure. A discussion of RFETS soil monitoring is included in Section 6.0, and interactions between media are included in Section 7.0 of the *IMP Background Document*.

1.2 DATA QUALITY OBJECTIVES

Representatives of DOE, Rocky Flats Field Office (RFFO), Kaiser-Hill, and the various federal, State of Colorado, and local stakeholder groups together developed a set of DQOs to ensure that environmental monitoring data would satisfy the requirements of the regulations listed above and would aid in detection of conditions that could lead to unacceptable risks to public health and the environment. The data will be used to: 1) model contaminant movement and identify contaminant concentrations that exceed pre-established limits; 2) support planning, implementation, and assessment of remedial, and decontamination and decommissioning,

activities; 3) address regulatory reporting requirements and commitments; and 4) monitor various ecological systems at RFETS.

Therefore, the data need to meet or exceed quality requirements to ensure accuracy in modeling, risk assessment, performance assessment, and compliance. The data must be of sufficient quality to withstand scientific and legal scrutiny, and must be gathered using appropriate procedures for their intended use in making decisions for RFETS activities. Each environmental monitoring program includes a set of data usability requirements and procedures to ensure that high-quality data are produced.

1.3 QUALITY ASSURANCE

The quality of the RFETS environmental monitoring data is ensured through careful planning and design of monitoring programs and implementation of work control procedures that address sampling, analysis, and data management activities. Presented in this document are statements of the major decisions that need to be made based on monitoring data, how the data will be applied in decision making, and the approaches used to obtain the data. Procedures cover monitoring activities, including sampling, analysis, and data management, and consist of approved, controlled documentation. Monitoring procedures are referenced in the various environmental program plans, which are contained in the RFETS *Environmental Management Program Manual* (MAN-080-EMPM).

RFETS environmental program and analytical services managers have a significant role in controlling the quality of environmental monitoring data. They are responsible for designing adequate environmental monitoring programs, collecting environmental samples and field data of high quality, properly submitting samples, ensuring data are managed per procedures, and interpreting and reporting monitoring results.

Minimum requirements for laboratory quality assurance/quality control (QA/QC) programs have been promulgated. These requirements ensure that each laboratory generating data has procedures for assuring that the precision, accuracy, completeness, and representativeness of data generated are known and documented.

Additionally, analytical data are subject to data assessment (quality assurance evaluation of analytical chemistry data). Assessments cover monitoring activities, including sampling and analysis. Subcontracted laboratories are routinely audited and participate in inter-laboratory cross-check programs. Assessments are conducted pursuant to the RFETS *Site Integrated Oversight Manual* (1-MAN-013-SIOM), in compliance with DOE Order 414.1 and the Kaiser-Hill Team Quality Assurance program. Assessment findings are tracked and corrected pursuant to the *Site Corrective Action Requirements Manual* (1-MAN-012-SCARM) and the Kaiser-Hill Corrective Action Process (3-X31-CAP-001). The *IMP Background Document* details the overall QA/QC requirements, including field duplicate and blank samples, analytical detection limits, and standards for accuracy and completeness.

2 SURFACE WATER

2.1 INTRODUCTION

The surface-water monitoring program at RFETS addresses the requirements of statutes, regulations, orders, and agreements, and supports many decision-making processes. Surface-water monitoring (summarized in Table 1) encompasses five areas:

- RFETS-wide water quality;
- Quality of waters within the Industrial Area;
- Quality of discharges from the Industrial Area;
- Quality of water leaving RFETS; and
- Off-Site water quality.

Protocols for sampling and analysis of surface water, as well as QA/QC requirements, are defined in several documents. Refer to Section 2.1.5 of the *IMP Background Document* for details.

RFETS maintains surface-water data in the Rocky Flats Soil and Water Database (formerly the Rocky Flats Environmental Database System). The data can be retrieved and reported in many formats for specific purposes. Many of the data generated are not specifically reported in RFETS documentation, but are provided to requestors or decision makers as needed. However, regularly generated reports include:

- NPDES permit compliance reports including monthly and annual preparation and delivery of the Discharge Monitoring Report to EPA Region VIII.
- Pre-discharge and community assurance monitoring results gathered by the State, and reported routinely to RFETS and nearby cities.
- Reportable RFCA monitoring results (those above of RFCA standards and action levels) reported to EPA and CDPHE.
- The bulk of the surface-water data collected are summarized and reported at Quarterly Information Exchange Meetings, which have been held since 1972.
- An *Annual Automated Surface Water Monitoring Report* including all required data summaries and evaluations.

2.2 SITE-WIDE WATER QUALITY

This section deals with surface-water monitoring objectives that are not confined to a particular part of RFETS. Site-wide monitoring includes:

- Monitoring the dams that form the RFETS detention ponds (dams lie within a defined area, but monitoring is performed to ensure their integrity and safety);

Table 1. Surface-Water Monitoring Matrix

Type of Monitoring	Locations	Sampling Frequency	Sampling Performed By	Purpose
SITE-WIDE				
Dam Operations—Imminent Danger to Life and Health	Detention ponds	Various regular intervals	Site personnel	Assess need for discharges from ponds to ensure dam integrity
Streamflow	8 stream locations	Continuous when flowing	Site personnel	Determine streamflow upgradient of Ponds A-3, A-4, B-5, and C-2. Determine outflow from Ponds A-3, A-4, B-5, and C-2
Pond Elevations	5 pond locations	Daily (hourly if needed)	Site personnel	Monitor amount of water detained in Ponds A-3, A-4, B-5, and C-2
Piezometers	Dams at Ponds A-3, A-4, B-1, B-3, B-4, B-5, and C-2, and Landfill	Continuous	Site personnel	Monitor level of saturated zone in detention structures
Dam Integrity Inspections	12 dams	Various	Site, DOE, and Federal Energy Regulatory Commission personnel	Assess physical integrity of earthen dams
<i>Ad Hoc</i>	Varies	As needed ^a	Site personnel	Address need for special monitoring
Source-Location	Varies	As needed ^a	Site personnel	Identify sources of new contamination detected by the surface water monitoring program
Indicator Parameter	Varies	As needed ^a	Site personnel	Evaluation of analytical results using field measured indicator parameters
INDUSTRIAL AREA				
New Source Detection	5 locations	As needed ^a	Site personnel	Detect changes in analyte of interest concentrations or water-quality parameters that might indicate new contamination

Table 1. Continued

Type of Monitoring	Locations	Sampling Frequency	Sampling Performed By	Purpose
Incidental Waters and Contaminated Non-Stormwaters	Varies	As needed ^a (approximately 100 events per year on average)	Site personnel	Determine acceptable disposal method per NPDES permit
Performance Monitoring	Varies	As needed ^a , generally from 18 months before project start-up to 3 months after completion	Site personnel	Establish baseline conditions and monitor effects of RFETS activities on water quality
INDUSTRIAL AREA DISCHARGES TO PONDS				
Stream Segment 5	4 Action Levels and Standards Framework locations	Varies ^a (total approximately 99 samples)	Site personnel	Monitor compliance with RFCA action levels
Internal Wastestreams	Discharges from buildings, Wastewater Treatment Plant (WWTP), terminal ponds, and cooling towers, plus any new discharges	Various intervals, depending on location	Site personnel (EPA Region VIII conducts annual NPDES permit inspections)	Confirm NPDES permit compliance
Discharges to WWTP	New waste streams	As needed ^a	Site personnel	Consider for discharge to WWTP
WWTP Collection System	2 locations in collection system	Regular intervals specified in <i>IMP Background Document</i>	Site WWTP personnel	Check for signs of corrosivity and monitor lower explosive limits
WWTP Radiological Monitoring	WWTP influent collection lines and effluent	Influent monthly, effluent monthly	Site personnel	Monitor impact of cleanup activities on WWTP and determine removal efficiency

Table 1. Continued

Type of Monitoring	Locations	Sampling Frequency	Sampling Performed By	Purpose
--------------------	-----------	--------------------	-----------------------	---------

NPDES-Permitted Discharges	WWTP outfall	Specified in NPDES permit	Site personnel	Demonstrate permit compliance and provide data for permit updates
WATER LEAVING THE SITE				
Predischarge	Ponds A-4, B-5, and C-2	About 8-10 events per year (1 event per year at C-2)	Site personnel (CDPHE analyzes samples)	Determine quality of water and safety of discharges from terminal ponds
Terminal Ponds	3 terminal ponds	Frequency specified in <i>IMP Background Document</i>	Site personnel	Verify that pond discharges do not adversely affect downstream water quality
Segment 4	5 locations	About 3 samples for each of 8-10 discharge events, plus 1-3 samples per month between discharges ^a	Site personnel	Point of compliance (POC) monitoring
Non-POC at Indiana Street	Walnut Creek & Woman Creek Drainages	Total of 21 samples annually	CDPHE	Assess effects of flow changes on nutrient loads in water leaving RFETS
OFF SITE				
Uncharacterized Discharges	5 primary locations, but could vary with circumstances of discharge	As needed ^a	Site personnel	Assess impact of uncharacterized discharges on community water supply facilities
Community Assurance	4 points in Westminster and Broomfield water treatment process streams	Weekly, with samples composited semiannually or annually	Westminster and Broomfield municipal employees	Notify municipalities in the event of water-quality exceedances; provide data for dose reconstruction studies
^a Sampling frequency is determined based on project plans. (Refer to <i>IMP Background Document</i> for more information.)				

- Locating the source of contamination detected by the monitoring objectives described in subsequent sections of the IMP;
- Monitoring at stormwater outfalls to evaluate a) the effectiveness of the RFETS Stormwater Pollution Prevention Program, and b) whether stormwater discharges are adversely affecting Segment 5 water quality;
- Specific monitoring activities in response to requests (i.e., *ad hoc* monitoring);
- Monitoring to establish a correlation between plutonium concentrations and levels of indicator parameters; and
- Monitoring performed for operational reasons and BMPs, but not enforceable under RFCA or other federal and state laws and regulations.

The Site-wide monitoring is described below.

2.2.1 MONITORING DAM OPERATIONS

The RFETS detention ponds (Figure 1) are formed by earthen dams, which are designed for stormwater detention. Once water quality is determined to meet downstream standards, water is routinely discharged in a controlled manner from the final or terminal ponds to maintain safe pool levels. Although water rarely rises to the elevation of emergency spillways, there is a risk that the dams could fail or sustain damage under extreme conditions.

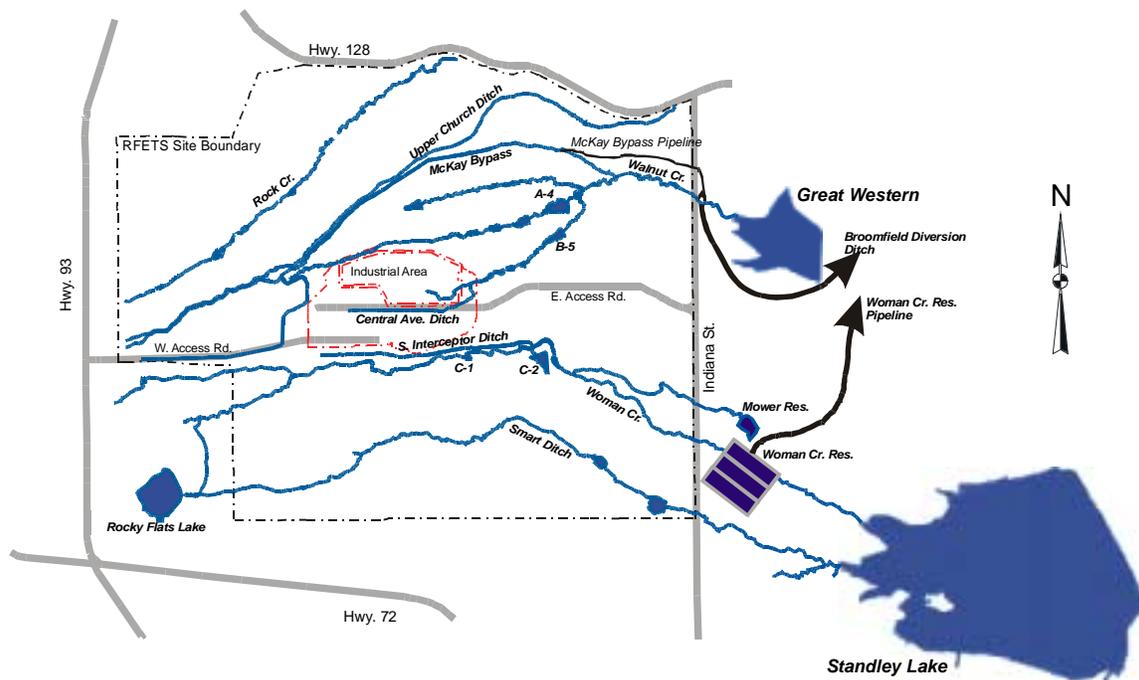


Figure 1. Schematic Surface Water Map

RFETS uses data from the monitoring activities listed below, along with water-quality data from the ponds, within a specific decision-making process (see *IMP Background Document*,

Section 2.2.1, and ancillary documents cited therein) to determine if, and when, water should be discharged from the ponds. RFETS performs the following monitoring activities:

- Measure streamflow upgradient of Ponds A-3, A-4, B-5, and C-2.
- Measure outflow from Ponds A-3, A-4, B-5, and C-2.
- Monitor pond water elevations at regular intervals in Pond A-3, Landfill Pond, and terminal ponds A-4, B-5, and C-2. Weekly to monthly monitoring is adequate for normal operations; daily or even hourly monitoring is invoked as established by procedure (e.g., in response to storms) to ensure dam safety.
- Monitor piezometers installed in the dams to track the level of the saturated zone within the earthen detention structures.
- Evaluate dam integrity through visual inspections at appropriate frequencies as determined by best engineering judgement or procedure.
- Perform routine integrity inspections on dams on the 12 ponds at appropriate frequencies, as determined by best engineering judgement, and perform a detailed internal inspection annually. Federal Energy Regulatory Commission and DOE personnel conduct an annual external inspection of the dams.
- Monitor the inclinometers and dam crest movement monuments twice a year to identify any movement of dam structure.
- Annually exercise the valves in the outlet works of the terminal dams to ensure operability, as directed by the Colorado State Engineer.

Data are entered into a spreadsheet model to assess the need for discharge, based on the *Pond Operations Plan* (Kaiser-Hill, 1996) and applicable procedures. Meteorological data are also used in the model, along with inflow and discharge rates as applicable.

2.2.2 LOCATING NEW CONTAMINANT SOURCES

If new contamination is indicated by surface-water monitoring, New Source Detection stations, Point of Evaluation (POE) stations, or Point of Compliance (POC) stations, RFETS may use portable sampling equipment to help further isolate the source. This monitoring may cross the boundaries of other surface-water monitoring objectives. For instance, if contaminants are detected outside the Industrial Area, portable sampling equipment may be deployed inside the Industrial Area to locate the source of the contaminants (see *IMP Background Document*, Section 2.2.2).

2.2.3 AD HOC MONITORING

Ad hoc monitoring is designed to address specific identified data needs. The data needs arise in response to circumstances that are not addressed by the routine monitoring program. *Ad hoc* monitoring falls into one of two categories:

- Required—Statutory, regulatory, permit, or other requirements mandate that monitoring must be done to obtain analytical data; and

- Discretionary—Where analytical data could help with further decision making, or a need for additional data is otherwise strongly indicated.

Ad hoc monitoring may be conducted in response to events such as unusual precipitation volumes, community concerns, changes in permit or regulatory requirements, construction projects, operations, or spills.

2.2.4 INDICATOR PARAMETER MONITORING FOR ANALYTICAL WATER QUALITY ASSESSMENT

RFETS continues to study whether a correlation can establish relationships between analytical measurements of constituents, such as actinides or metals and selected indicator parameters (i.e., total suspended solids [TSS], turbidity, precipitation, and flow rate).

Plutonium concentrations are already being monitored at the terminal pond outfalls and at the Indiana Street RFCA POCs. RFETS also monitors TSS concentrations when possible for samples collected at the locations covered by the other decision rules in this section. To evaluate the relationship between turbidity and analytical constituents, turbidity is monitored at the locations where required by the other applicable decision rules. To evaluate the relationship between precipitation and analytical constituents, precipitation is currently monitored at 10 locations across RFETS.

RFETS is continuing to evaluate the data to study the correlation between actinide and metals concentrations, and levels of selected indicator parameters. Based on this analysis, this monitoring objective may be modified in the future to further define observed correlations. Although correlation can be demonstrated under some conditions, the results have not shown a reliable quantitative correlation across the Site sufficient to allow indicator parameters to be substituted for the primary measurements. The indicator parameters prove useful as an investigative tool to assist in understanding source-related environmental conditions.

2.3 WATER QUALITY WITHIN THE INDUSTRIAL AREA

RFETS monitors water within the Industrial Area to detect new sources of contamination, assess the performance of facilities or project elements (e.g., during closure of a facility) in preventing releases of specific constituents, and assess the quality of incidental rainwater or snowmelt that may accumulate in utility pits and bermed areas. Indications of a contaminant release would trigger reporting and decision making for response and remediation. RFETS conducts the following activities under this portion of the surface water monitoring program:

- Project-specific performance monitoring;
- Managing incidental waters;
- Monitoring the sanitary system including:
 - Characterizing internal wastewater streams for NPDES permit compliance,
 - Monitoring discharges to the WWTP, and
 - Monitoring total flow, potentially dangerous or damaging waste streams, and radiological activity of influent to the WWTP;
- WWTP influent monitoring; and

- WWTP collection system monitoring.

2.3.1 INCIDENTAL WATER

At RFETS, about 85 occurrences of incidental water per year require monitoring. Water that accumulates in utility pits, berms, footing drains, sumps, and excavation sites, or that is discharged within buildings or onto the ground, is evaluated using field screening observations and measurements, coupled with the process knowledge of RFETS personnel and/or specific analytical tests. Additional analysis is required if the circumstances or field observations provide cause to suspect the presence of oil, or hazardous or radioactive constituents.

The program for monitoring incidental water and non-stormwaters is governed by the RFETS NPDES permit and provides for routine, data-driven decision making on whether to allow discharge of these waters into the environment without treatment. When evaluating incidental water, field personnel estimate the volume of water present, note its appearance (especially its color or presence of a visible sheen), and field test its pH, nitrate level, and conductivity. In conjunction with knowledge of the processes occurring in the immediate vicinity, these data guide the process of deciding how to dispose of the incidental water. Water that cannot be discharged to the environment may be considered for discharge to the WWTP (under internal wastewater stream rules) or may be managed under other applicable regulations.

2.3.2 SANITARY SYSTEM MONITORING

Sanitary collection system monitoring may provide decommissioning project managers and WWTP operators information about collection system conditions within the Industrial Area contributing to the WWTP flow. Current and prospective monitoring systems provide quantitative information about the relative contribution of the two main branches of the sanitary collection system, and qualitative information about the content of flows through the headworks of the WWTP. Sanitary system monitoring is conducted to:

- Determine percent removals across the treatment plant and, therefore, be able to predict compliance or noncompliance with NPDES permit effluent limitations;
- Assess explosive levels at the headworks for worker safety;
- Identify corrosive substances that may impact the treatment units;
- Determine if trends in influent concentrations and loads are fluctuating up or down;
- Establish pollutant loads attributable to specific internal wastestreams; and
- Establish baseline conditions for the flows from the former Protected Area (PA) and non-PA areas.

Five distinct monitoring objectives have been identified for sanitary system monitoring. Separate decision rules have been developed for each of these objectives and are detailed in the *IMP Background Document*. Each of the five objectives are discussed in the following sections.

2.3.2.1 Characterization of Internal Wastewater Streams to Meet Permit Requirements

The first monitoring objective is to characterize routine internal wastestreams to meet NPDES permit requirements (see *IMP Background Document*, Section 2.3.2.1 Internal Wastestream

Characterization to Meet Permit Requirements). Data on internal wastestreams are used to make decisions regarding the disposition of contaminated wastewater produced on RFETS. Monitoring is needed to determine when wastewater requires pretreatment versus when it can be discharged directly to the WWTP. The data are used to determine whether discharges to the WWTP are compatible with the activated sludge, exceed the facility's ability to handle it, and comply with the NPDES permit.

The NPDES permit also covers discharges to surface water (including the WWTP outflow). RFETS personnel use monitoring data to maintain the permit and to negotiate periodic permit renewals. Both permit maintenance and renewal may require modifying specific conditions, particularly as closure activities accelerate. The permit specifies that the managed and incidental discharges be monitored, including sanitary discharges and non-sanitary wastewater streams from buildings and discharges from the WWTP. New non-sanitary wastewater streams must be characterized and, potentially, monitored as well. A list of non-sanitary wastewater streams must be reported annually to EPA Region VIII, which conducts regular NPDES compliance inspections.

2.3.2.2 Monitoring Discharges to the WWTP

This monitoring objective is separate from the non-routine objective, for which a distinct decision rule has been developed (see *IMP Background Document*, Section 2.3.2.2 Monitoring Discharges to the WWTP). New wastewater streams generated at RFETS must be evaluated to determine how best to dispose of them. Most, but not all, wastewater can be discharged to the WWTP under the terms of the NPDES permit. Wastewater that is not sent to the WWTP must be disposed of according to applicable requirements. RFETS personnel screen wastewater streams for visible sheen, color, clarity, volume, field conductivity, and pH. However, the most important factor in determining the means of disposal is knowledge of the specific process that produces the wastewater. This information is considered in making decisions regarding disposal of wastewater streams.

2.3.2.3 Monitoring the WWTP Collection System

Monitoring of the WWTP influent flows include collection system flow monitoring, protective monitoring, and radiological influent monitoring. WWTP personnel regularly check the WWTP collection system for pH, conductivity, and lower explosive limits at three locations, using real-time, online monitoring. This monitoring ensures that the WWTP effectively processes wastewaters that change as closure activity increases. The WWTP monitoring objectives and decision rules are described in the *IMP Background Document*, Section 2.3.2.3 WWTP Collection System Protective Monitoring, Section 2.3.2.4 WWTP Collection System Flow Monitoring, and Section 2.3.2.5 CDPHE WWTP Influent Radiological and Metals Monitoring.

2.3.2.4 WWTP Collection System Flow Monitoring

Flow information for the sanitary collection system consists of influent records for the WWTP. The flow record will be used to establish annual baseline conditions and assist in further data assessment needs for flows from the PA and non-PA areas, as currently modified. Changes from the established baseline flow may be attributable to normal collection system conditions, such as infiltration and inflow, or abnormal conditions, such as increased flows from areas undergoing decommissioning. A preliminary sanitary collection system flow baseline was initiated during

FY01, and flow data are reported on a calendar year basis to EPA and CDPHE in an annual report required by the NPDES permit.

2.3.2.5 WWTP Radiological and Metals Monitoring

This objective includes the monitoring of radiological and selected metals parameters at the influent to the WWTP, for the purpose of tracking pollutant loads entering the WWTP collection system. Radiological and metal loads at the WWTP should be decreasing, since RFETS has systematically tried to eliminate possible connections between wastestreams containing radionuclides and the collection system. During FY02, radiological and metals influent monitoring was conducted monthly, using 24-hour composite samples that were analyzed by the CDPHE.

2.3.3 PERFORMANCE MONITORING IN SURFACE WATER

Performance monitoring may be specific to individual projects (e.g., decommissioning, remedial activities, transition actions, or BMPs for transport and fate of plutonium in surface water runoff) within the Industrial Area. While performance monitoring may be conducted at any location on RFETS, most monitoring occurs within the Industrial Area. In general, project-specific monitoring targets 18 months of data prior to project startup to establish baseline conditions, and continues for three months after project completion.

2.3.4 MONITORING NPDES DISCHARGES TO PONDS

The NPDES permit program controls the discharge of pollutants into the waters of the United States, and requires routine monitoring of point source discharges and reporting of results. The first RFETS NPDES permit was issued by EPA in 1974. The current permit was renewed in 2000. Monitoring for NPDES compliance is prescriptively required by EPA, and is not covered by the IMP process or detailed in this document. The RFETS NPDES permit prescribes that stormwater discharges will be monitored in accordance with the stormwater provisions of this IMP.

The renewed RFETS permit identifies one monitoring point for control of discharges, the WWTP (Building 995) effluent. The NPDES/Federal Facility Compliance Agreement was terminated by the renewal of the permit. Modifications included the elimination of discharge points except for the WWTP discharge point. The other previously permitted discharge locations are now regulated under CERCLA via the RFCA. Additional expanded scope includes requirements for plans and procedures for operations of influent/effluent storage tanks, influent monitoring at WWTP, internal wastestream reporting, stormwater monitoring, stormwater pollution prevention plan and associated annual comprehensive Site compliance evaluations, and WWTP influent real-time radiological monitoring feasibility study. New stormwater monitoring provisions result from new regulations promulgated since the 1984 permit renewal. Refer to the permit for specific monitoring requirements.

2.4 INDUSTRIAL AREA DISCHARGES TO PONDS

Industrial Area discharges to the ponds include surface water runoff, discharges from the WWTP, and waters in Segment 5 that include the stream channels and interior ponds. Under this portion of the surface water monitoring program, RFETS monitors:

- Segment 5 water quality; and
- NPDES-regulated discharges to the ponds.

2.4.1 NEW SOURCE DETECTION

RFETS collects surface-water samples at stations SW022, SW091, SW093, SW027, and GS10, which are located in the upper reaches of the three main drainages through which runoff leaves the Industrial Area. Analytes of interest (AoIs) include plutonium, uranium, and americium isotopes; water-quality parameters, including turbidity, pH, nitrate, and conductivity (measured every 15 minutes); and precipitation data (measured continuously at SW022) and flow rate (measured continuously). Additional AoIs also may be identified.

The “indicator parameters,” those that can be and are monitored continuously, provide a qualitative early warning of potential contaminant releases without the long turnaround time or cost of more frequent sample analyses for specific contaminants. For example, plutonium and americium concentrations may be correlated with TSS (which correlates with turbidity), and plutonium may be correlated with nitrate concentrations. Additionally, levels of chromium, beryllium, silver, and cadmium may correlate with conductivity readings. If a continuously monitored parameter provides cause for concern about a particular contaminant, samples may be collected and analyzed for that contaminant. It should be noted that none of the monitoring to date clearly demonstrates the correlations suggested here.

2.4.2 STREAM SEGMENT 5

RFETS monitors Segment 5 water quality at four RFCA POE monitoring locations (as represented by stations SW093, SW027, GS10, and 995POE) for compliance with RFCA action levels. Reportable values require development of a source evaluation plan and source evaluation.

The RFCA Action Levels and Standards Framework (ALF) provides criteria for identified contaminants. A subset of these contaminants is monitored under this portion of the program (see Table F-5 in Appendix F to the *IMP Background Document*). RFETS collects samples (one to four per month depending on flows) from each station for an estimated total of 99 samples during the year (see Table 2-14 in the *IMP Background Document*). The number of samples collected from each station is determined using historical flow data. Approximately 15 liters (L) of water are collected for each 500,000 gallons of stream flow to a maximum of four per month, and each 15-L sample composite is designed to contain about 50 flow-paced grab samples.

Collecting only one sample per month and analyzing only for the AoIs listed above would be sufficient to comply with RFCA requirements. However, the higher number of samples reduces the chance of recording a false exceedance or of missing a short-duration contaminant surge. Sampling frequency may be adjusted to accommodate changing data needs.

2.5 WATER LEAVING THE SITE

Water leaves the Site in Stream Segment 4 at Indiana Street. Three monitoring objectives have been established to assess Segment 4 water quality:

- Predischarge monitoring;

- RFCA POC monitoring of Segment 4; and
- Additional, non-point of compliance (non-POC) monitoring.

2.5.1 PREDISCHARGE MONITORING

Before water is discharged from the terminal ponds, it must be evaluated for a range of constituents to ensure its safety and that unexpected contaminants have not been introduced. Therefore, RFETS collects predischARGE samples 8 to 10 times per year from the Walnut Creek Drainage at Ponds A-4 (North Walnut Creek) and B-5 (South Walnut Creek), once per year from the Woman Creek Drainage at Pond C-2, and as needed from any other pond temporarily functioning as a terminal pond. RFETS and CDPHE analyze the samples for an extensive list of constituents, including inorganic compounds, metals, and radiologic parameters (see Tables 2-17 and 2-18 in the *IMP Background Document* for analyte list and sampling targets). Sampling and analyses are conducted far enough in advance of a planned discharge to allow action to be taken if exceedances are noted, but near enough to the time of discharge to be representative of the discharge composition.

2.5.2 SEGMENT 4 COMPLIANCE MONITORING

RFETS performs monitoring at five RFCA POC stations in Segment 4 (GS11, GS08, GS31, GS03, and GS01). POC monitoring is concerned primarily with concentrations of plutonium, americium, and total uranium, although additional analytes are monitored in a subset of samples. About three samples are collected during each pond discharge event (about 8 to 10 discharge events per year; see Table 2-21 in the *IMP Background Document* for POC monitoring targets), and flow-proportional sampling is conducted between discharges when flow rates are sufficient to obtain required water sample volumes.

2.5.3 CDPHE MONITORING AT INDIANA STREET

Various off-Site reservoir construction and water diversion projects will cause changes in the surface-water flow regime. The CDPHE conducts additional monitoring to assess the effects of these flow changes on nutrient loads in water leaving RFETS. CDPHE collects samples quarterly from Walnut Creek to assess the composition of the water when it consists of either:

- 100% RFETS effluent;
- Mixed effluent and natural stream flow; or
- 100% natural stream flow.

In addition to these samples, CDPHE collects an annual sample from Woman Creek during a Pond C-2 discharge. Samples are analyzed for a variety of parameters, including water quality and selected metals.

2.6 OFF-SITE MONITORING TO SUPPORT COMMUNITY WATER SUPPLY MANAGEMENT

RFETS and CDPHE personnel provide monitoring data to nearby communities for their use. Procedures are in place to monitor uncharacterized discharges from RFETS and to provide data that address public concerns regarding water quality.

2.6.1 MONITORING UNCHARACTERIZED DISCHARGES

Monitoring of uncharacterized discharges would normally be required only if monitoring, specified under the previous decision rules, is not performed in accordance with the sampling and analysis protocols (e.g., POC monitoring at Indiana Street) or if flow leaving RFETS exceeds the capacity of the downstream ditch or reservoirs.

If surface water of unknown quality (unmonitored) leaves RFETS, it is necessary to demonstrate that the water quality is acceptable to downstream users. Examples include:

- Unmonitored storm flow exceeding the capacity of Broomfield's diversion ditch that enters Great Western Reservoir; and
- Downstream water that may have been impacted by unmonitored effluent from RFETS.

2.6.2 COMMUNITY ASSURANCE MONITORING

Several factors have made it necessary for the communities to reassure residents that their environment is safe. These factors include the Site's past mission as a nuclear weapons production facility, the nature of the contaminants, the history of releases and accidents, and the geographic and hydrologic relationship of RFETS to the neighboring municipalities. Adequate and timely information regarding the impact of RFETS is necessary. The level of concern fluctuates with activities at RFETS, but may be expected to continue as long as environmental contamination or special nuclear materials are present at RFETS.

Since the completion of the Standley Lake Protection Project and the Great Western Reservoir Replacement Project, which were designed to protect potable water supplies, routine monitoring of the municipal treatment and distribution systems is no longer warranted. However, Great Western Reservoir is still used as an irrigation supply. Therefore, during FY04, community assurance monitoring continues at Great Western Reservoir as specified in Section 2.6.2 of the *IMP Background Document*.

2.7 WATERSHED INTEGRATION

Geographically, RFETS lies at the head of the Big Dry Creek Basin; functionally, every effort has been made to isolate RFETS from the rest of the watershed. Historical strategies on the part of RFETS and the downstream communities have focused on limiting, to the maximum extent possible, the natural flow of surface water from RFETS. Examples include past spray irrigation practices, the "Zero Discharge" goal, and the continuing detention of treated sanitary effluent and stormwater pending demonstration of acceptable water quality. Although these water management practices have been necessary to protect and reassure the downstream communities, they negatively impact the ecology of the basin and are inconsistent with the ultimate vision for the Site, as outlined in RFCA. As RFETS moves toward closure, the focus must evolve toward integrating the headwaters of Big Dry Creek with the rest of the watershed.

To accomplish this objective, RFETS must extend its water management strategy beyond Indiana Street, and participate with other stakeholders in identifying and implementing appropriate water-quality and use goals for the basin. During 1996, DOE and its contractors progressed toward this goal by actively participating in a consensus group with the objective of achieving agreement on as many issues as possible prior to a standard-setting hearing before the

Colorado Water Quality Control Commission. The group included representatives from RFETS, regulatory agencies and surrounding communities, but the focus was limited to water-quality issues impacting wastewater dischargers.

More recently, RFETS personnel helped to establish the Big Dry Creek Watershed Association (BDCWA). The BDCWA began as an extension of the original consensus group, but has evolved to include any entities or individuals interested in water-related issues within the basin. In addition to the original four dischargers (i.e., RFETS, Broomfield, Westminster, and Northglenn), participants include representatives of agriculture, parks, recreation, open space, and a variety of government agencies. The BDCWA has been recognized by Denver Region Council of Governments (DRCOG) as a district watershed in the Regional Clean Water Plan. The goals of the BDCWA include public education, monitoring activities, and protection of water quality, aquatic life, and habitat.

The DOE has recognized the effectiveness of this approach by becoming a party to a formal agreement to participate, with the cities, in supporting monitoring activities within the basin. The agreement states that such support may consist of monetary contributions or in-kind services, but shall be equitably distributed among the parties. Monitoring decisions are made jointly by the group, with input from regulators and planning agencies including EPA, the Water Quality Control Division, and DRCOG. The immediate use of the data is to characterize the watershed, and to identify and quantify sources of impairment. Ultimately, water quality and biological data will be used to support water-quality standards, native species protection, and basin-wide planning activities. A coordinated effort to obtain accurate information about existing conditions and relative impacts is beneficial and cost-effective for stakeholders.

2.8 PROJECT-SPECIFIC MONITORING

Project-specific performance monitoring must be detailed in a project plan through the review and approval process when the project poses a concern for a specific contaminant release, especially for a contaminant that may not be adequately monitored by other monitoring objectives downstream. Each performance monitoring location will target the contaminants of greatest concern, as identified by the implementing organization, for the specific action. Performance monitoring for specific analytes as specified in Section 2.3.3 of the *IMP Background Document* may be needed for decommissioning actions, remedial actions, transition actions, and BMPs for the control of plutonium transport in surface water runoff.

Project-specific performance monitoring stations must be sited to monitor specific high-risk Site activities, such as decommissioning activities. These project-specific stations will be placed upstream from the routine monitoring stations (assuming more than one source area could be contributing to the routine location), to ensure the monitor will be quantitative for releases of AoI. Data types must be specified in the project plan, and analyte suites and sample collection protocols are project specific. The schedule for performance monitoring will vary with individual projects. However, the initiation will begin far enough in advance of project initiation that a statistically defensible baseline can be established. Monitoring will continue during the project activities at a rate that allows the project managers and monitoring staff to make timely changes in activities that may be impacting the water channel. The frequency will be specified in the project's Sampling and Analysis Plan. After project completion, monitoring will continue

long enough to identify residual impacts to surface-water quality that may be attributable to the project activities.

3 GROUNDWATER

Most of the groundwater at RFETS is hydraulically connected to surface water. The groundwater monitoring program is designed to accomplish the following:

- Monitor groundwater contaminant concentrations;
- Delineate contaminant pathways;
- Investigate newly identified groundwater contaminant sources;
- Assess the effectiveness of RFETS remediation and closure activities as specified in decision documents; and
- Evaluate the potential impact of contaminated groundwater on surface water.

3.1 GROUNDWATER MONITORING FOCUS

Several contaminant plumes have been identified in RFETS groundwater (see Plate 3 in the FY03 *IMP Background Document*). The main AoI are volatile organic compounds, nitrate, and uranium. Possible sources of contaminants that could affect groundwater include storage tanks, the process waste system, drains, sumps, historical storage areas, and spills. The monitoring scope is designed to monitor known groundwater contaminant plumes that may impact surface-water quality.

The RFETS groundwater monitoring program determines the concentration of groundwater AoIs. These constituent concentrations are compared to RFCA groundwater action levels and background concentrations. Action level exceedances are evaluated to determine whether the data demonstrate a statistically discernable trend. The presence or absence of statistically discernible trends is factored into the decision-making process (see Section 3.4.2 of the *IMP Background Document*) to assess the potential need for previously unidentified remediation efforts or changes in ongoing activities.

Water-level measurements are incorporated into water elevation maps and hydrographs to define groundwater gradients and flow rates. Both the water-level measurements and the sampling and analysis activities provide temporally related data for use in assessing trends.

3.2 GROUNDWATER MONITORING PROGRAM

The groundwater monitoring program includes the following components (see *IMP Background Document*, Appendix E):

- Sampling of monitoring wells;
- Measurement of water-table elevations;
- Data management, interpretation, and reporting;
- Groundwater impact evaluations; and
- Well control, abandonment, and replacement.

Table 2 lists the frequency and number of wells for samples and water levels.

Table 2. Groundwater Monitoring Matrix

Type of Monitoring	Locations	Sampling Frequency	Purpose
Measure analyte concentrations	164 wells and footing drains	Semi-annually	Monitor RFCA analyte concentrations in groundwater
Measure analyte concentrations	8 wells	Quarterly	Monitor RCRA analyte concentrations in groundwater
Measure analyte concentrations	3 wells	Quarterly	Monitor Solar Ponds treatment system
Measure analyte concentrations	2 wells	Quarterly	Monitor Operable Unit 1 Corrective Action Decision/Record of Decision treatment system
Water-level measurement	18 wells	Quarterly	Characterize groundwater flow regime
Water-level measurement	196 wells	Semi-annually	Characterize groundwater flow regime
Water-level measurement	36 wells	Real-time	Characterize groundwater flow regime

3.2.1 WELL LOCATIONS

Groundwater sampling wells have been installed along known or suspected pathways between contaminated areas and outlets to surface water. The majority of the monitored wells are located around the perimeter of the Industrial Area, the former Operable Unit (OU) 2, and the Present Landfill. Additional wells are located within RFETS drainages where stream flow is ephemeral. Boundary wells are maintained at the downgradient (eastern) RFETS boundary to confirm that contaminants are not migrating off Site. On-Site monitoring wells fall into eight categories:

- Plume definition: 45 wells;
- Boundary: 6 wells;
- Plume extent: 26 wells;
- Performance: 29 wells;
- Drainage: 8 wells;
- Project-specific D&D: 72 wells;
- RCRA units: 8 wells, and
- Plume degradation: 0 wells (added to program on as needed basis).

3.2.2 GROUNDWATER SAMPLING AND ANALYSIS

Field crews measure groundwater temperature, pH, conductivity, turbidity, and alkalinity. The crews collect filtered samples for determination of metals concentrations and uranium isotopes, and also collect unfiltered samples for organic compounds and radionuclide analyses. AoIs vary among wells, depending on the constituents present in each plume. The scopes of work for the analytical laboratories contain complete target analyte lists.

The groundwater flow regime at RFETS limits sample volumes from some wells. If sample volume precludes collection and analysis of the entire analyte suite for a particular well, the analytes are prioritized based on the objectives of the well. The following list shows the usual analyte priority; however, this priority may be modified to meet the sampling objectives for a particular well:

- Volatile organic compounds;
- Semi-volatile organic compounds;
- Nitrate/nitrite, as nitrogen;
- Metals;
- Uranium-233/234, -235, -238; and
- Plutonium-239/240 and americium-241.

3.3 GROUNDWATER DATA DISPOSITION

3.3.1 DATABASES

RFETS personnel enter field data and analytical data into the Rocky Flats Soil and Water Database (SWD). Data integrity is maintained through the use of standard data entry operating procedures and by running error-checking routines when loading data.

Data are extracted for various uses, including quarterly and annual reporting and *ad hoc* queries to support other Site projects. These data are also mapped using a geographic information system (GIS) to delineate constituent distributions, and to assess groundwater movement and constituent migration.

3.3.2 REPORTING

Groundwater monitoring activities are reported through the following vehicles:

- **Annual RFCA Groundwater Monitoring Report:** The *Annual RFCA Groundwater Monitoring Report* summarizes the data for each calendar year and provides evaluations of the data gathered throughout the year. Based on these evaluations, changes or improvements to the RFCA groundwater monitoring program may be proposed. The *Annual RFCA Groundwater Monitoring Report* replaced various previously required reports and serves as the primary compliance report. The *Annual RFCA Groundwater Monitoring Report* is a calendar year report and is available in the designated RFETS reading rooms.

- **RFCA Quarterly Reporting:** Quarterly reporting presents data gathered during the reporting period, provides notification of any exceedances of RFCA groundwater action levels, and lists required actions for exceedances. These reports replace all historic quarterly reporting, integrating the elements of each regulatory driver into a single reporting vehicle. Quarterly reports are presented at the Quarterly Information Exchange Meetings, which are held off Site and are open to the public.
- **IMP:** The IMP, reviewed quarterly, as needed, but at least once annually, is the vehicle for documenting required groundwater monitoring program elements. It is updated when necessary.

3.4 GROUNDWATER EVALUATIONS

Many of the DQO decisions for groundwater monitoring require an evaluation of the potential impact of groundwater contamination on surface-water quality. If AoI concentrations at previously uncontaminated wells exceed the groundwater action levels, three subsequent monthly samples will be collected to verify the analytical results. If analyses of follow-up samples confirm the results, or if historic data indicate a potential impact to surface water that has not been evaluated, an evaluation will be performed. DQOs will be developed and presented as part of the groundwater evaluation.

3.5 WELL ABANDONMENT AND REPLACEMENT PROGRAM

Section 3.6.7 of the *IMP Background Document* describes the Well Abandonment and Replacement Program (WARP), which specifies the approval process for well installation and ensures proper recording and registration of well installation activities. RFETS personnel maintain a database of well locations, construction, permitting, and other relevant information. They also maintain a core repository for use in hydrological and geological characterization.

Well abandonment is considered if: 1) the wells are damaged or poorly constructed; 2) construction details are unknown; 3) the wells present a potential for cross-contamination with other wells or the aquifer; or 4) the wells are no longer needed. Activities conducted under the WARP are reported in the RFCA annual report.

3.6 PROJECT-SPECIFIC MONITORING

Project-specific remediation and decommissioning activities may require groundwater monitoring. This monitoring is intended to detect decommissioning project impacts on groundwater quality or to verify and evaluate the effectiveness of remedial actions in mitigating groundwater impacts to surface water. Three categories of wells have been defined to satisfy these project-specific monitoring requirements. The categories include project-specific monitoring for soil remedial actions, D&D monitoring for buildings, and plume degradation monitoring where the remedial decision may involve monitored natural attenuation. In cases where monitoring is not currently performed, or when there is a need for additional information not provided by existing monitoring near the planned activity, AoI analyte suites will be developed based on knowledge of historic operations and chemical use. Wells will be placed downgradient from potential contaminant sources. Upgradient wells may be required if existing upgradient data are not available. Sampling protocols will be established for individual projects

and sampling will begin prior to decommissioning activities to establish baselines. Four quarters of baseline monitoring data will be collected for each decommissioning project requiring monitoring. After four quarters of baseline data are collected, monitoring will be suspended until building decommissioning is complete. Monitoring will be reinitiated upon the completion of decommissioning and continue for a period after project completion to observe the results of the decommissioning effort. The frequency and duration of the D&D monitoring will be determined per the RFCA consultative process. D&D monitoring activities may involve other potential contaminant pathways such as underbuilding contamination, building footing drains, and building sumps. Disposition of potential sources is handled as part of building decommissioning, and integrated with Environmental Restoration program activities.

4 AIR QUALITY

4.1 PURPOSE AND PROGRAMS

Air monitoring activities at RFETS (listed in Table 3) assist in both protecting and informing the public, and in protecting the environment by detecting and trending the impacts of RFETS operations on air quality at and near RFETS. Monitoring characterizes airborne radionuclide materials that may be introduced and identifies the associated meteorological conditions that influence the transport and dispersion of the airborne materials. Data are used to plan, implement, and assess the effects of on-Site activities including operations, construction, and closure activities, and to maintain emergency preparedness and demonstrate compliance with relevant regulations.

The Air Quality Management (AQM) group within Kaiser-Hill's Environmental Systems and Stewardship (ESS) organization determines the scope of RFETS air monitoring and reporting activities required to maintain compliance with air quality regulations and DOE Orders. In addition, CDPHE conducts oversight monitoring through a grant from DOE.

4.1.1 AMBIENT AIR MONITORING

Ambient monitoring of radionuclides on RFETS, at the perimeter and at several locations in the community, is performed by ESS. CDPHE monitors radioactive and non-radioactive pollutants on and around RFETS. Ambient monitoring in the communities immediately adjacent to RFETS has been supported further by DOE through the Community Radiation (ComRad) program. ComRad stations, which monitor airborne plutonium concentrations, are operated independently through a DOE grant overseen by the Community Oversight Panel representing local governments.

4.1.2 EFFLUENT AIR MONITORING

Air emissions (effluent) from RFETS facilities that have the potential to contain significant quantities of radioactive materials, but that are not undergoing active decommissioning, are monitored continuously in accordance with state and federal regulatory requirements and agreements. Effluent monitoring is used to verify the effectiveness of radiation control mechanisms. These emissions data may be used as part of the evaluation process to keep radioactive emissions as low as reasonably achievable.

4.1.3 METEOROLOGICAL MONITORING

Instruments continuously monitor meteorological conditions at RFETS to generate data for use in air dispersion models that estimate the transport of airborne emissions. RFETS personnel use model predictions to evaluate operations and closure projects, and to support emergency preparedness.

Table 3. Air Monitoring Matrix

Type of Monitoring	Analyte	Locations	Performed By	Sampling Frequency	Purpose
Routine ambient air	Radio-particulate	34 Radioactive Ambient Air Monitoring Program (RAAMP) samplers ^a	RFETS AQM	Continuous (monthly filter exchange; monthly analyses of 14 perimeter samplers) ^a	Detect and characterize Site-related airborne radiological emissions and demonstrate compliance with state and federal regulations
CDPHE monitoring	Radio-particulate, alpha/beta activity	11 on-Site continuous samplers and 6 close-in samplers (around selected projects)	CDPHE	Continuous	Detect and characterize Site-related radiological airborne emissions
Effluent from Industrial Area facilities	Radio-particulate	6 exhaust outlets	RFETS AQM	Continuous (weekly filter changes with monthly compositing and analysis)	Verify effectiveness of radiation control mechanisms and provide secondary compliance data
Meteorology	-	1 tower with instruments at 1.5 and 10 meters	RFETS AQM	Continuous (RFETS tower will be decommissioned during calendar year 2003; substitute data will be collected from the National Renewable Energy Laboratory meteorological tower 1.2 miles north of current RFETS tower)	Monitor meteorological conditions for use in air quality modeling and for inputs to emergency response models
Meteorology	-	Five 10-meter towers at Site perimeter	CDPHE	Continuous	Provide data as needed for emergency response modeling

Table 3. Continued

Type of Monitoring	Analyte	Locations	Performed By	Sampling Frequency	Purpose
Project	Radio-particulate	Selected subsets of existing RAAMP locations	RFETS AQM	Continuous during subject demolition projects; weekly filter exchange, followed by gross alpha/beta counting and/or gamma spectroscopy; isotopic analyses as required	Assess radiological impacts of decommissioning and environmental restoration projects against environmental standards
Project	Beryllium	Six portable air samplers	RFETS AQM	During active demolition only; filter exchange and analysis determined on a project-specific basis	Assess beryllium impacts of selected decommissioning and environmental restoration projects against environmental benchmarks
<p>^a Project monitoring for radionuclides uses designated subsets of the 34 RAAMP samplers, with weekly filter exchanges.</p> <p>Notes: - = Not applicable</p>					

4.1.4 PROJECT MONITORING

Ambient monitoring for radionuclides and beryllium around selected building demolition and environmental restoration projects is performed by ESS. This monitoring effort characterizes the potential short-term impacts of emissions from such projects on ambient air quality and receptors closer to the projects than the RFETS perimeter. This scope differs from routine ambient monitoring because of shorter sampling periods, increased sampling frequency, closer proximity to potential source locations, and in one case, a different AoI (i.e., beryllium). Additionally, while no regulatory standards apply specifically to this scope, the ambient concentration limits identified in the standards are used as guidance to establish action levels (regulatory compliance for radionuclides is determined using the routine ambient samplers at the RFETS perimeter; no beryllium standards currently apply to RFETS).

4.2 SITE AIR MONITORING SCOPE

Most ambient air monitoring and effluent monitoring performed at RFETS is done to satisfy the requirements of Title 40 of the *Code of Federal Regulations*, Part 61, Subpart H, *National Emission Standards for Emissions of Radionuclides Other Than Radon from Department of Energy Facilities* (Rad-NESHAP), and DOE Orders. CDPHE and the ComRad Monitoring Program provide additional, independent air monitoring.

4.2.1 AMBIENT AIR

The Radioactive Ambient Air Monitoring Program (RAAMP) collects ambient radioparticulate air data. The RAAMP network comprises 34 size-partitioning, high-volume ambient air samplers. Fourteen of the 34 samplers are used to demonstrate compliance with Rad-NESHAP. Remaining samplers can be used for emission confirmation purposes should there be an accidental release from RFETS. Designated subsets of the RAAMP network are also used to determine localized impacts from decommissioning and environmental restoration (ER) projects, as described below.

The RAAMP samplers run continuously, collecting airborne particles on pairs of sampler substrates that segregate smaller inhalable particles from larger, more easily deposited airborne particulate matter. Filters and impactor substrates are routinely collected and submitted for analysis for specific isotopes of plutonium, uranium, and americium. The *IMP Background Document* details specific sampling intervals and analytical detection limits.

The CDPHE also operates air samplers within RFETS and at the perimeter of RFETS. The CDPHE-operated monitoring network serves to independently measure RFETS air quality conditions and public exposure to radioactive releases.

4.2.2 EFFLUENT AIR

Air emissions exhausted from buildings that could contain radioactive materials in sufficient quantity to have the potential to contribute at least 0.1 millirem (mrem) per year effective dose equivalent (EDE), uncontrolled, to any member of the public (significant sources) are monitored by continuous effluent sampling systems. This excludes those emission points undergoing active decommissioning that, as a result of decommissioning, can no longer provide representative effluent air samples. Filters from these systems are changed weekly and composited for analysis for selected plutonium, americium, and uranium isotopes. Historically, more than 50 locations within the Industrial Area were monitored; currently, 6 building release points are continuously sampled. Sources having low emission potential (insignificant sources) are not monitored unless building operational requirements dictate that continuous sampling be performed. Radioparticulate emissions from insignificant sources that are not monitored using effluent samplers will be accounted for through the ambient monitoring network. Sampling for tritium in effluent air, once conducted at one or more locations at RFETS, has been discontinued following the removal of all waste materials having substantial emissions potential for tritium.

4.2.3 METEOROLOGICAL CONDITIONS

A 61-meter tower is operated in the northwest part of the Buffer Zone by ESS, with monitoring instruments at 1.5 and 10 meters above the ground. Instruments measure horizontal and vertical wind speeds, horizontal wind direction, temperature, relative humidity (dew point), solar radiation, and precipitation. CDPHE operates five 10-meter meteorological towers, located around the RFETS perimeter, that can provide data to support Site emergency response modeling.

4.3 PROJECT MONITORING—AIR

When a decommissioning project or ER project is planned that has the estimated potential to release radionuclides in sufficient amounts to contribute a 0.1 mrem dose to the most impacted public receptor, existing on-Site ambient air samplers are used to provide project monitoring for radionuclides. Sampler substrates from selected RAAMP samplers that surround the affected project are exchanged weekly instead of monthly. Filters are screened through gross alpha/beta counting and/or gamma spectroscopy, and the results compared to predefined action levels. If necessary, results of the screening may be used by project personnel to adjust schedule or project controls to ensure Site-wide compliance with state and federal regulatory requirements and to confirm the effectiveness of as low as reasonably achievable (ALARA) principles. The filters and impactor substrates may also be analyzed for selected plutonium, americium, and uranium isotopes.

The CDPHE may conduct independent project monitoring for radionuclides during selected demolition and remediation projects. Filters will be collected and analyzed for gross alpha activity. If necessary, results of the screening may be used by project personnel to adjust schedule or project controls to ensure Site-wide compliance with state and federal regulatory requirements, and to confirm the effectiveness of ALARA principles. The filters may also be analyzed for selected plutonium, americium, and uranium isotopes. These monitoring efforts shall include, but are not limited to, the 903 Pad remediation and Building 865 demolition.

For beryllium monitoring purposes, a subject project will be ringed with six portable ambient air samplers that operate during periods of active demolition or remediation. Filters will be exchanged and shipped to off-Site laboratories for a total beryllium analysis, at a frequency set on a project-by-project basis. Results of beryllium analyses will be compared to ambient concentration benchmarks defined in the beryllium *National Emission Standards for Hazardous Air Pollutants* (NESHAP; 40 CFR 61, Subpart H). Although building demolitions are not subject sources pursuant to the beryllium NESHAP, the ambient air concentration standard listed therein was developed to be protective of human health and the environment, and therefore provides a reasonable basis for evaluating project monitoring results.

5 ECOLOGY

The Buffer Zone around the Industrial Area at RFETS is one of only a few areas along Colorado's Front Range that has remained largely undisturbed by encroaching development. The Buffer Zone contains several unique assemblages of animals and vegetation, and the ecological monitoring activities described in this section have been designed by DOE and its contractors to protect these valuable natural resources. Five major vegetation communities have been identified at RFETS:

- Xeric Tallgrass Prairie;
- Tall Upland Shrubland;
- Great Plains Riparian Woodland Complex;
- High Quality Wetlands; and
- Mesic Mixed Grassland.

Ecological monitoring is designed to protect wildlife in the Buffer Zone, including special-concern species (i.e., threatened, endangered, candidate, proposed, state-listed, or other sensitive species). The Preble's meadow jumping mouse (Preble's mouse) is of particular concern because it was listed as a threatened species on May 13, 1998.

5.1 MONITORING OBJECTIVES

The Ecological Monitoring Program (summarized in Table 4) is designed to provide data that can be used in management and conservation decision making during RFETS cleanup activities that will occur over the next several years. Data also demonstrate compliance with applicable natural resource protective regulations.

RFETS ecologists monitor key variables in the five vegetation communities and other habitats, and changes in any of these variables would trigger ecological protection and compliance decision making. Comparisons of monitoring data over time enable ecologists to detect changes, identify potential causes, and plan corrective actions for changes that result from RFETS activities, rather than from natural fluctuations.

5.2 SCOPE OF MONITORING

RFETS ecologists conduct several types of monitoring in the five vegetation communities, as well as some activities specific to one or more communities. The following activities are common to the five vegetation communities:

- Define the extant area of the community.
- Provide baseline estimates of the presence of birds and mammals, and estimate the baseline species richness of plant, bird, and mammal populations (plant species richness baseline will be determined from 1993–96 or 1997 data, as applicable; the bird and mammal baseline was established in the *1996 Annual Wildlife Survey Report* (Kaiser-Hill, 1997a).

Table 4. Ecological Monitoring Matrix

Basis for Monitoring	Number of Locations	Sampling Frequency	Purpose of Monitoring
Manage and conserve significant species numbers and richness; comply with Endangered Species Act, other federal acts, and Colorado wildlife protection statutes	One Site-wide survey (follows passable Buffer Zone roads.)	12 times per year	Track changes in numbers, richness, and area use of significant wildlife species at RFETS.
Monitor noxious weeds at RFETS; comply with weed control regulations	Variable by year	In flowering season and as available for observation	Evaluate effectiveness of weed control actions, and aid in out-year planning for weed controls at RFETS.
Perform monitoring of selected revegetation areas	Variable by year	Annually	Evaluate effectiveness of revegetation efforts. Use information for management of areas.
Monitor for the presence, or potential presence, of special-concern, threatened, or endangered plant and wildlife species and wetlands; comply with federal, state, and local protection and conservation regulations	Variable by year	As required	Ensure compliance of projects with applicable ecological regulations and protect rare, threatened, and endangered species from harm.

- Identify rare or imperiled plant or animal species.
- Conduct weed mapping and photo surveys.
- Monitor the presence of noxious weeds and the effects of weed control efforts.
- Anticipate impacts from proposed RFETS projects, and estimate the potential area affected.
- Perform monitoring of selected revegetated areas after remediation activities.

Ecologists also monitor the presence of noxious weeds and changes in plant community characteristics in areas not included within the five vegetation communities defined above.

5.2.1 WETLANDS

In addition to the activities listed above, the U.S. Army Corps of Engineers and the EPA conduct periodic wetland characterizations. The EPA is the lead agency on wetlands for CERCLA project activities impacting wetlands. The U.S. Army Corps of Engineers is the lead agency on wetlands for non-CERCLA project activities. The last characterization was completed in 1994. A comprehensive plan to manage and protect RFETS wetlands was issued in 1997 (Kaiser-Hill, 1997b), detailing the methods and procedures that will be used to identify wetlands and minimize impacts from closure and remediation projects.

5.2.2 PROJECT-SPECIFIC MONITORING

Proposed RFETS projects will be evaluated in terms of potential effects on threatened and endangered (T&E) species, species of special concern (SSC), migratory birds, and wetlands. Additionally, monitoring will be conducted for the revegetation projects in accordance with the RFETS *Industrial Area Revegetation Plan*. Much of the data for such evaluations will come from the monitoring activities listed above and previously collected baseline information, but additional data needs may be identified to assess the impact of such projects in specific areas. Project-specific data needs may include:

- Seasonal presence or absence of affected species, and the seasonal timing of the proposed project;
- Presence of habitat considered suitable for T&E and SSC species;
- Biological characteristics of species of concern (e.g., feeding and nesting habits, home range, habitat preference), and potential effects of the proposed project; and
- Revegetation location monitoring data.

Proposed projects will also be evaluated in terms of their impacts to migratory birds and RFETS wetlands. Wetlands include both those areas mapped by the U.S. Army Corps of Engineers and those areas not included on the map.

Table 5 lists several potential 2004 projects that may impact wetlands or Preble's mouse habitat.

Table 5. Potential 2004 Projects at RFETS with Potential to Impact Wetlands or Preble's Mouse Habitat.

Project	Status of Project	Summary of Monitoring Requirements
Original Landfill (W,P)	Scheduled 2004	Pending
Present Landfill (W)	Scheduled 2004	Pending
East Firing Range(W,P)	Scheduled 2004	Pending
903 Pad and Lip Area (W)	Ongoing	Pending
Well Abandonment and Removal Program (W,P)	Ongoing	None
Pond Remediation Activities (W,P)	Scheduled 2004	Pending
General Industrial Area Revegetation (W,P)	Ongoing	Began in 2003
Notes: W indicates potential wetland impacts. P indicates potential Preble's impacts.		

Certain project activities may require a biological assessment or biological opinion, or a wetland mitigation plan. These plans may include monitoring activities for specified objectives over time. The DQOs for each activity will be indicated in the project-specific biological assessment or opinion, or mitigation plan. Future annual updates to this section are anticipated to include a project summary of the projects listed in Table 5, the DQOs, and the current status of projects.

Numerous locations within the Industrial Area are revegetated in accordance with the Site's *Industrial Area Revegetation Plan*. The plan specifies various elements for revegetating the Industrial Area including prescribed seed mixes, seeding time frames, monitoring requirements, and success criteria. Table 6 provides a summary of current Industrial Area revegetation monitoring for the year.

Table 6. Industrial Area Revegetation Projects at RFETS

Project	Summary of Monitoring Requirements	Status of Monitoring
Building 111	Photo/Qualitative	Began in 2003
Building 123	Photo/Qualitative	Began in 2003
Building 333	Photo/Qualitative	Began in 2003
Building 335	Photo/Qualitative	Began in 2003
Building 442	Photo/Qualitative	Began in 2003
Building 452 complex	Photo/Quantitative	Began in 2003
Building 886	Photo/Quantitative	Began in 2003
Building 889	Photo/Qualitative	Began in 2003
New Landfill	Photo/Quantitative	Began in 2003
Solar Ponds	Photo/Quantitative	Began in 2003
Tweeter Tower	Photo/Qualitative	Began in 2003
Modular Storage Tanks	Photo/Quantitative	Began in 2003
B-5 Pipeline	Photo/Qualitative	Began in 2003
Building 910	Photo/Qualitative	Began in 2003
Building 884	Photo/Qualitative	Began in 2003
Across from Building 910	Photo/Qualitative	Began in 2003
Building 993	Photo/Qualitative	Began in 2003
Air Tower	Photo/Qualitative	Began in 2003

5.3 OUTSIDE FACTORS AFFECTING RFETS ECOLOGY

The ecological resources at RFETS are influenced not only by Site activities but also by issues and activities that occur off Site. Outside factors that may affect ecological resources at RFETS include, for example, noxious weeds, chronic wasting disease, West Nile virus, plague, and other zoonoses. These and other factors often affect the surrounding region, which must be considered when evaluating the ecology of the Site.

For example, the Colorado Division of Wildlife killed and tested a portion of the existing deer population for chronic wasting disease in late FY02. If chronic wasting disease had been found, it may have been necessary to destroy the entire population.

Activities on adjacent properties may also impact Site vegetative communities and habitats. The Site borders lands used for various activities, including grazing, mining, and open space. While the Site continues to implement a comprehensive integrated ecological management program, the Site is influenced by the activities on neighboring lands that are beyond the control of Site personnel. Wind-blown materials from adjacent mining activities can readily cross property lines, as can prairie dogs and noxious weeds.

5.4 DATA MANAGEMENT

Ecological data was historically stored in two databases, the Ecological Monitoring Program Database and the Sitewide Ecological Database. Because extracting data for specific purposes requires a high degree of system-specific knowledge, the two databases were combined. The new database, the Site Ecological Database, allows for multi-user access (with security restrictions) for Site personnel.

5.5 REPORTING

An Ecological Resource Management Plan for the Rocky Flats Environmental Technology Site (Kaiser-Hill, 1997c) is in place, setting forth the management actions that will be required to preserve valuable RFETS ecological resources. RFETS ecologists will update or modify this plan as required by variations in Site conditions, available technology, or changing regulations.

The Ecological Monitoring Program issues an annual ecology report for the Site. A *Vegetation Management Plan* is issued annually to document planned weed control and other management efforts for the year.

6 REFERENCES

- DOE, 1996. U.S. Department of Energy, Colorado Department of Health and Environment, and U.S. Environmental Protection Agency, *Final Rocky Flats Cleanup Agreement*, July, 1996.
- Kaiser-Hill, 1996. Kaiser-Hill Company, L.L.C. and Rocky Mountain Remediation Services, L.L.C., *Pond Operations Plan: Revision 2*, RF/ER-96-0014.UN, PADC-96-00358, Golden, Colorado. 1996.
- Kaiser-Hill, 1997a. Kaiser-Hill Company, L.L.C., *1996 Annual Wildlife Survey Report. Natural Resource Compliance and Protection Program*, prepared by PTI Environmental Services, Boulder, Colorado, March.
- Kaiser-Hill, 1997b. Kaiser-Hill Company, L.L.C., *Site-Wide Wetland Comprehensive Plan for the Rocky Flats Environmental Technology Site*, prepared by PTI Environmental Services, Boulder, Colorado, March.
- Kaiser-Hill, 1997c. Kaiser-Hill Company, L.L.C., *Ecological Resource Management Plan for the Rocky Flats Environmental Technology Site*, prepared by PTI Environmental Services, Boulder, Colorado, March.
- Kaiser-Hill, 2003a. Kaiser-Hill Company, L.L.C., *FY2003 Integrated Monitoring Plan, Summary Document*, Golden, Colorado. April, 2002.
- Kaiser-Hill, 2003b. Kaiser-Hill Company, L.L.C., *FY2003 Integrated Monitoring Plan, Background Document*, Golden, Colorado. April, 2002.