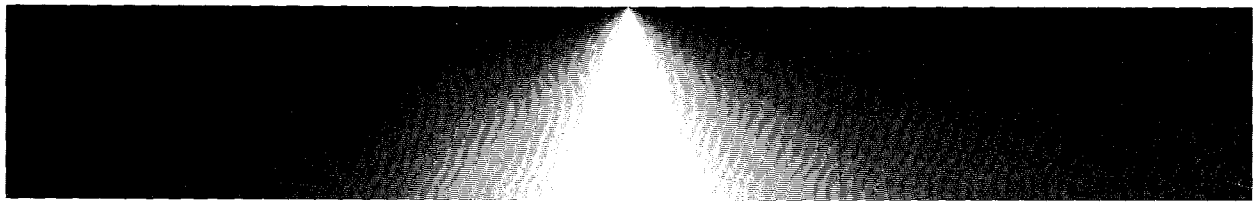
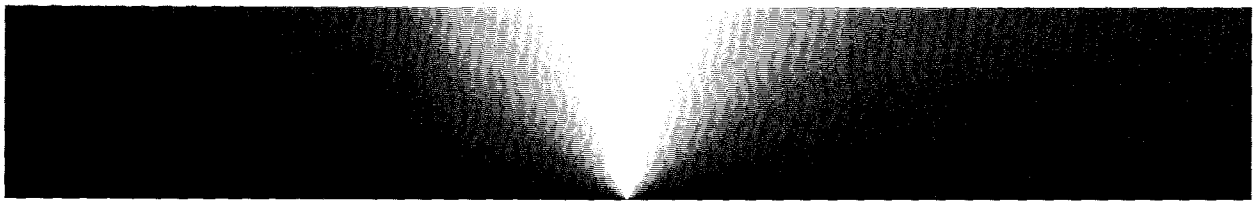
Rocky Flats Environmental Technology Site



Integrated Monitoring Plan FY98/FY99



A Working Group consisting of:

City of Broomfield
City of Arvada
City of Westminster
City of Northglenn
City of Thornton
Colorado Department of Public Health and Environment
Department of Energy, Rocky Flats Field Office
U.S. Environmental Protection Agency, Region VIII
The Kaiser-Hill Team

October 1998

Y41

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

INTEGRATED MONITORING PLAN

August 1998

Responsible Organization: Environmental Management & Compliance

Effective Date:
May 1998

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Classification/UCNI:

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Date 08/03/98 UNL

2

CONTENTS

3

4

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

AoI	Analyte of Interest
ALF	Action Levels and Standards Framework
AQM	Air Quality Management
BMP	Best Management Practice
CAA	Clean Air Act
CDPHE	Colorado Department of Public Health and Environment
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract Laboratory Program
ComRad	Community Radiation Program
COCs	Contaminants of Concern
Cr	Creek
CWA	Clean Water Act
D&D	Decontamination and Decommissioning
DMR	Discharge Monitoring Report
DOE	Department of Energy
DOE, RFFO	Department of Energy, Rocky Flats Field Office
DQO	Data Quality Objective
EcMPD	Ecological Monitoring Program Database
EPA	U.S. Environmental Protection Agency
ER	Environmental Restoration
FERC	Federal Energy Regulatory Commission
FY	Fiscal Year
GIS	Geographic Information System
IDLH	Imminent Danger to Life and Health
IMP	*Integrated Monitoring Plan*
Kaiser-Hill	Kaiser-Hill Company, L.L.C.
L	Liter
LEL	Lower Explosive Limit
m	Meter
NPDES	National Pollutant Discharge Elimination System
OP	Operating Procedure
OU2	Operable Unit 2
PA	Protected Area
PCB	Polychlorinated Biphenyl
POC	Point of Compliance
POps	*Pond Operations Plan*
QA/QC	Quality Assurance/Quality Control
RAAMP	Radioactive Ambient Air Monitoring Program
Rad NESHAP	National Emission Standards for Hazardous Air Pollutants—Radionuclides

6

RCRA	Resource Conservation and Recovery Act (Colorado Hazardous Waste Act)
RFCA	*Rocky Flats Cleanup Agreement*
RFEDS	Rocky Flats Environmental Data Base System
RFETS	Rocky Flats Environmental Technology Site
SED	Sitewide Ecological Database
Site	Rocky Flats Environmental Technology Site
SSC	Species of Special Concern
SWD	Site Soil and Water Database (formerly RFEDS)
T&E	Threatened and Endangered (species)
TAL	Target Analyte List
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
VOC	Volatile Organic Compound
WARP	Well Abandonment and Replacement Program
WWTP	Wastewater Treatment Plant
yr	Year

1.0 INTRODUCTION

Environmental monitoring programs at the Rocky Flats Environmental Technology Site (RFETS or the Site) continue to evolve in response to new regulatory drivers and accelerated Site closure. Various monitoring programs have amassed data on soils, surface water, groundwater, air, and different ecological systems. The *Rocky Flats Cleanup Agreement* (RFCA)(DOE et al., 1996) requires U.S. Department of Energy (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 itself, laws and regulations, and effective management of RFETS's resources. The *Integrated Monitoring Plan* (IMP) [Kaiser-Hill Company, L.L.C. (Kaiser-Hill), 1997a] identifies the routine monitoring programs for surface water, groundwater, air, and ecology designed to minimize duplication of efforts among DOE, CDPHE, the cities of Broomfield and Westminster, and associated data management systems. Specific Site activities involve soil monitoring, but Site-wide soil monitoring was discontinued in 1994, after many years of characterizing transuranic-contaminant distributions across the Site.

The IMP captures the Site monitoring performed for a variety of legal, contractual, and operational purposes and restates the agreed-upon types of monitoring, monitoring locations, sampling frequencies, and purposes of the monitoring to meet the RFCA goal. In some instances, the IMP captures monitoring that is already legally required outside of RFCA. 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, the Site's 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. The *IMP Background Document* (Kaiser-Hill, 1998) is not subject to enforcement under RFCA.

In developing the Integrated Monitoring Program, Site 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 (the data quality objectives, or DQOs, described below). The program is designed to provide data that meet the DQOs by supporting operational and regulatory decisions, and address the following primary regulatory drivers:

8

- The Resource Conservation and Recovery Act (RCRA);
- The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA);
- The Clean Air Act (CAA);
- The Clean Water Act (CWA);
- Standards promulgated by the Colorado Water Quality Control Commission;
- The body of regulations governing natural resource (ecological) management;
- Site-specific monitoring and cleanup agreements; and
- DOE Orders and technical guidance.

1.1 Integrated Monitoring Plan

The Fiscal Year (FY) FY98/FY99 IMP is a revision of the FY97 IMP and the FY97 *IMP Background Document* (Kaiser-Hill, 1998) which describe the activities being conducted at the Site under the Integrated Monitoring Program to satisfy RFCA and other regulatory requirements and interests. The FY98/FY99 *IMP Background Document*, also developed during this review period, provides detailed discussions of the decision-making process that has resulted in this level of monitoring at the Site. This IMP lists the monitoring programs to which DOE and the other regulatory agencies are committed. The *IMP Background Document* provides additional information on the DQO decision process and the regulatory framework that drives many of the monitoring decisions at the Site.

Both the IMP and the *IMP Background Document* will continue to change with time. Revisions in FY98 have captured both minor and relatively major changes in several of the programs that have either been implemented in FY98 or are planned for FY99 implementation. An example of a relatively major change, implemented during FY98, is the use of project-specific air monitoring guidelines to provide monitoring around environmental restoration (ER) and decontamination and decommissioning (D&D) projects. Such monitoring, while not specifically driven by regulatory requirements, responds to stakeholder concerns about project emission potentials and effectiveness of project controls. Similar guidelines were also developed for project-specific groundwater monitoring. Still pending are guidelines for data presentation to the public, an effort that will rely heavily on public involvement during their development.

This IMP lists the ongoing environmental monitoring activities that DOE, CDPHE, EPA, and other stakeholders have supported during the numerous working group meetings used

9

to formulate the monitoring-based decisions represented here. The document provides an overview of the requirements for these activities and the intended uses of the data that result. The monitoring is performed in four primary areas—surface water, groundwater, air, and ecological systems. Interactions among these media have been recognized and discussed in some detail. The data that are being 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. In addition, a fifth medium, soil, and its related monitoring is discussed. These soil data relate to all of the other media in some way and continue to be important to the other programs, to future projects and project planning, and ultimately to Site closure. A discussion of soil monitoring at the Site is included in Section 6 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 agencies together developed a set of DQOs to ensure that environmental monitoring data would satisfy the requirements of the regulatory framework described above and would prevent unacceptable risks to public health and the environment. The data will be used to model contaminant movement and identify contaminant concentrations that exceed pre-established limits; support planning, implementation, and assessment of Site remedial and D&D activities; address regulatory reporting requirements and commitments; and monitor various ecological systems at the Site. Therefore, the data need to meet or exceed quality requirements to be useful in modeling, risk assessment, performance assessment, and compliance. The data must be of sufficient quality to withstand scientific and legal scrutiny, and they must be gathered using procedures that are appropriate for their intended use in making decisions for Site activities. Each environmental monitoring program includes a set of data usability requirements and procedures to ensure that high-quality data are produced.

All sampling procedures and analyses of surface water and groundwater adhere to general groundwater DQO guidance, and many also are subject to project-specific quality assurance/quality control (QA/QC) criteria. 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. A standardized set of operating procedures (OPs) ensures consistency in sampling and field measurement techniques, and all field sampling crews are trained in those techniques. Refer to the *IMP Background Document* for specific OPs and additional literature concerning QA/QC requirements.

10

2.0 SURFACE WATER

2.1 Introduction

The surface water monitoring program at the Site 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:

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

The Site maintains surface water data in the Rocky Flats Soils and Water Database (SWD) (formerly the Rocky Flats Environmental Database System, or RFEDS), and the data can be retrieved for specific purposes. Many of the data generated are not specifically reported in Site documentation, but rather are provided to requestors or decision makers as needed. However, regular reporting requirements are as follows:

- National Pollutant Discharge Elimination System (NPDES) permit compliance reporting requires monthly and annual preparation and delivery of the Discharge Monitoring Report (DMR) to EPA Region VIII.
- Pre-discharge and community assurance monitoring results gathered by the State are reported routinely to the Site and nearby cities.
- Exceedances of RFCA standards and action levels are 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.

Table 1
Surface Water Monitoring Matrix

Type of Monitoring	Locations	Sampling Frequency	Sampling Performed By	Purpose
Site-Wide				
Dam Operations (IDLH)	All detention ponds	Various regular intervals	Site personnel	Assess need for discharges from ponds to ensure dam integrity
Streamflow	7 stream locations	Continuous when flowing	Site personnel	Determine streamflow upgradient of Ponds A3, A4, B5, and C2. Determine outflow from Ponds A4, B5, and C2
Pond Elevations	4 pond locations	Daily (hourly if needed)	Site personnel	Monitor amount of water detained in Ponds A3, A4, B5, and C2
Piezometers	Dams at Ponds A3, A4, B1, B3, B4, B5, and C2	Continuous	Site personnel	Monitor level of saturated zone in detention structures
Dam Integrity Inspections	12 dams	Various	Site personnel, FERC, and DOE	Assess physical integrity of earthen dams
Ad Hoc	Varies	As needed[1]	Site personnel	Address need for special monitoring
New Contaminant Sources	Varies	As needed[1]	Site personnel	Identify source(s) of any new contamination detected by the surface water monitoring program
Plutonium Correlation	POCs, plus 5 additional locations	As needed[1]	Site personnel	Correlate plutonium concentrations to levels of more easily measurable parameters
Industrial Area				
New Source Detection	5	As needed[1]	Site personnel	Detect changes in AoI concentrations or water quality parameters that might indicate new contamination
Incidental Waters	Varies	As needed[1] (100–200 events/yr on average)	Site personnel	Determine acceptable disposal method
Performance Monitoring (Source Location)	Varies	As needed[1], generally from 18 months before project start-up to 3 months after completion	Site personnel	Establish baseline conditions and monitor effects of Site activities on water quality
Industrial Area Discharges to Ponds				
Stream Segment 5	3 Action Levels and Standards Framework (ALF) locations	Varies[1] (total approx. 85 samples)	Site personnel	Monitor compliance with RFCA action levels

Table 1
(Continued)

Type of Monitoring	Locations	Sampling Frequency	Sampling Performed By	Purpose
Internal Waste Streams	Discharges from buildings, 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[1]	Site personnel	Consider for discharge to WWTP
WWTP Collection System	2 locations in collection system	Regular intervals specified in Site procedures	WWTP (Site) personnel	Check for signs of corrosivity and monitor LEL
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
NPDES-Permitted Discharges	WWTP outfall and terminal pond discharges	Specified in NPDES permit	Site personnel	Demonstrate permit compliance and provide data for permit updates
Water Leaving the Site				
Predischarge	Ponds A4, B5, and C2	Approximately 8–10 events/yr (1 per yr at C2)	Site personnel (CDPHE analyzes samples)	Determine quality of water to be discharged from terminal ponds
Terminal Ponds	3 terminal ponds	Frequency specified in NPDES permit or RFCA/POps Plan	Site personnel	Verify that industrial discharges do not endanger waters of the U.S.
Segment 4	5 locations	Approximately 3 samples for each of 8–10 discharge events, plus 1–3 samples per month between discharges[1]	Site personnel	RFCA point of compliance (POC) monitoring
Non-POC at Indiana St.	Walnut Cr. & Woman Cr. Drainages	Total of 21 samples annually	CDPHE	Assess effects of flow changes on nutrient loads in water leaving the site

Table 1
(Continued)

Type of Monitoring	Locations	Sampling Frequency	Sampling Performed By	Purpose
Off Site				
Uncharacterized Discharges	5 primary locations, but could vary with circumstances of discharge	As needed[1]	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

[1] Sampling frequency is determined based on project plans. (Refer to *IMP Background Document* for more information.)

Notes:

ALF	=	Action Levels and Standards Framework
AoI	=	Analyte of Interest
CDPHE	=	Colorado Department of Public Health and Environment
Cr	=	Creek
DOE	=	Department of Energy
EPA	=	U.S. Environmental Protection Agency
FERC	=	Federal Energy Regulatory Commission
IDLH	=	Imminent Danger to Life and Health
IMP	=	*Integrated Monitoring Plan*
LEL	=	Lower Explosive Limit
NPDES	=	National Pollutant Discharge Elimination System
POC	=	Point of Compliance
POps	=	*Pond Operations Plan*
RFCA	=	*Rocky Flats Cleanup Agreement*
WWTP	=	Wastewater Treatment Plant

2.2 Site-Wide Water Quality

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

- Monitoring the dams that form the Site detention ponds (dams lie within a defined area, but monitoring is performed to ensure their effectiveness);
- Locating the source of any contamination detected by the monitoring objectives described in subsequent sections of the IMP;
- 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 Site detention ponds (Figure 1) are formed by earthen dams, which are designed for stormwater detention. Water is routinely discharged from the ponds as levels rise, once water quality is determined to meet downstream standards. Although water rarely rises to the elevation of emergency spillways, if that were to happen, there is a risk that the dams could fail or sustain damage.

The Site 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 released from the ponds. The Site performs the following monitoring activities:

- Measure streamflow upgradient of Ponds A3, A4, B5, and C2; measure outflow from Ponds A4, B5, and C2;
- Monitor pond elevations continuously in terminal Ponds A3, A4, B5, and C2 [daily monitoring is adequate for normal operations;

15

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 in the earthen detention structures;

- Evaluate dam integrity through visual inspections at appropriate frequencies as determined by procedure;

- Perform routine integrity inspections on dams on all 12 ponds at appropriate frequencies as determined by *Pond Operations Plan* (POps Plan) (Kaiser-Hill et al., 1996), and perform a detailed internal inspection biannually. [Federal Energy Regulatory Commission (FERC) and DOE inspect dams externally on an annual basis];

- Monitor spatial position of the crest monument to detect movement, if any as required by the Colorado State Engineer's dam safety regulations;

- Monitor the inclinometers and evaluate dam crest movements quarterly to identify any movement of dam structure; and

- Exercise the valves in the outlet works of the terminal dams to ensure operability, as directed by the Office of the State Engineer.

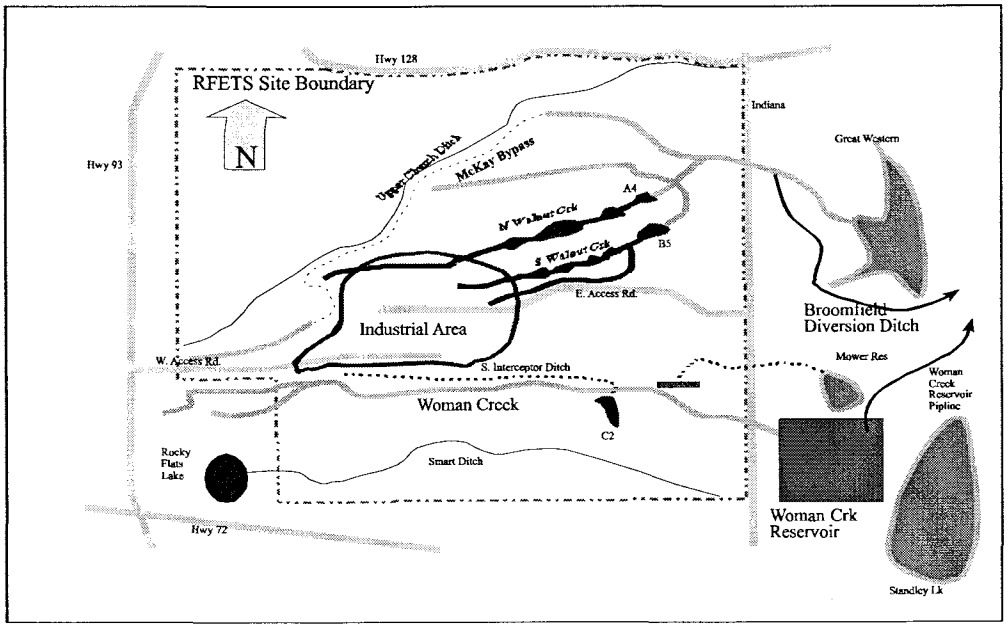

Figure 1. Schematic Surface Water Map

16

Data are entered into a spreadsheet model to assess the need for discharge, based on the *Pond Operations Plan*. 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, the Site may use portable sampling equipment to help determine its 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 (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 order requirements 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 Monitoring for Correlation of Plutonium with Indicator Parameters

The Site continues to study whether a correlation can be established between plutonium concentrations and levels of indicator parameters that can be measured frequently, or even continuously, at much less expense than radiochemically analyzing samples for plutonium. For instance, total suspended solid (TSS) concentrations may provide an indication of plutonium concentrations, because plutonium and other radionuclides tend to adsorb to particulate matter in surface water. Although measuring TSS requires a laboratory analysis, the lag time between sample collection and data delivery is considerably shorter than for a radiochemical analysis. Turbidity, which can be measured continuously, may also correlate with plutonium concentrations. If so, continuous turbidity measurements would provide an early indication of potential rising plutonium concentrations, improving the protection of public health and the environment. The technical hurdle in this effort remains the issue of sensitivity: identifying correlations at very low concentrations challenges the available analytical methods.

17

Plutonium concentrations are already being monitored at the terminal pond outfalls and at the Indiana Street RFCA points of compliance (POCs). The Site also monitors TSS concentrations when possible at these five stations. In addition, the Site monitors, when possible, TSS and turbidity at stations SW022, GS10, SW093, SW091, and SW027, which are located sufficiently upstream in Segment 5 that they would provide at least 2 hours warning before exceedances could occur in Segment 4. The Site also monitors precipitation at several locations.

The Site will evaluate the data from this monitoring objective to study the correlation between plutonium concentrations and levels of indicator parameters. Based on this analysis, this monitoring objective may be modified in the future to further define any correlations observed.

2.3 Water Quality Within the Industrial Area

The Site monitors waters 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 monitor 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/or remediation. The Site conducts the following activities under this portion of the surface water monitoring program:

- Project-specific performance monitoring;
- Management of incidental waters;
- Sanitary system monitoring including:
  - Characterize internal wastewater streams for NPDES permit compliance,
  - Monitoring discharges to the Wastewater Treatment Plant (WWTP), and
  - Monitor total flow, potentially dangerous or damaging waste streams, and radiological activity of influent to the WWTP;

- WWTP influent monitoring;
- WWTP collection system monitoring.

2.3.1 Incidental Waters

Approximately 100–200 occurrences of incidental water at the Site require monitoring each year. Waters that accumulate in utility pits, berms, footing drains, sumps, and excavation sites, or that are released within buildings or onto the ground, are evaluated using field screening observations and measurements, coupled with the process knowledge of Site personnel. Additional analysis is required if the circumstances or field observations provide cause to suspect the presence of oil or hazardous/radioactive constituents.

The program for monitoring incidental waters provides for routine, data-driven decision making on whether to allow discharge of these waters into the environment without treatment. In 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 waters. Waters 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 the Site D&D project managers and WWTP operators information about collection system condition within the Industrial Area as specific areas contributing to the WWTP flow. Current and prospective monitoring systems provide 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
- Monitor explosive levels at the headworks for worker safety
- Monitor for corrosive substances that may impact the treatment units
- Determine if influent concentrations and loads are trending up or down

- Monitor within the collection system to establish pollutant loads attributable to specific industrial internal waste streams (such as the laundry water at the Site)

Five distinct monitoring objectives have been identified for sanitary system monitoring. Separate decision rules have been developed for each of these objectives.

2.3.2.1 Characterization of Internal Wastewater Streams

The first monitoring objective is to characterize routine internal waste streams to meet NPDES permit requirements (see *IMP Background Document* Section 2.3.2.1 - Internal Waste Stream Characterization to Meet Permit Requirements). Data on internal wastewater streams are used to make decisions regarding the disposition of contaminated waste water produced on the Site. Monitoring is needed because some wastewater requires treatment and some can be discharged 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 Site's NPDES permit.

The existing NPDES permit also covers all discharges to surface water (including the WWTP outflow). Site personnel use monitoring data to maintain the permit and to renew the permit every five years. Both permit maintenance and renewal may require modifying specific conditions, particularly as Site closure activities accelerate. (Note: A new NPDES permit for the Site is anticipated to be effective January 1, 1999.) The NPDES permit specifies all managed and incidental discharges to be monitored, including all sanitary discharges and process wastewater streams from Site buildings, along with discharges from Building 374, the WWTP, and the terminal ponds. Any new wastewater streams must be characterized and monitored as well. In addition, the cooling towers are being monitored pending a decision on whether their discharge should be included in the permit. Site personnel must fully disclose all wastewater streams to EPA Region VIII, which conducts annual NPDES permit inspections of the Site to enforce this disclosure requirement.

2.3.2.2 Monitoring Discharges to the WWTP

This monitoring objective is distinct from the nonroutine objective, for which a distinct decision rule has been developed (see *IMP Background Document* Section 2.3.2.2 - Monitoring Discharges to the WWTP). Any new wastewater streams generated on the Site must be evaluated to determine how best to dispose of them. Most can be discharged to the WWTP under the terms of the NPDES permit but some cannot. The latter must be disposed of in accordance with applicable requirements. Site personnel screen all 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

Finally, 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 at two locations for pH, conductivity, and lower explosive limit (LEL). They also take manual pH readings at the headworks. Conductivity and pH are indicators of corrosivity, which could damage the treatment equipment, and LEL readings are taken to ensure worker safety. Additional monitoring activities added for FY99 include collection system flow monitoring and influent radiological activity. This monitoring is added to ensure that the plant effectively processes wastewaters that change as Site 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 - WWTP Radiological Monitoring, respectively.

2.3.2.4 WWTP Collection System Flow Monitoring

Flow information for the Site's sanitary collection system is currently limited to influent records for the WWTP. The initial scope of collection system monitoring is intended to provide Site collection system flow information by installing continuous recording flow monitoring equipment at B990 on the two main collection system lines. The flow record will be used to establish annual baseline conditions for the flows from the Protected Area (PA) and non-PA areas. 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 D&D.

2.3.2.5 WWTP Radiological Monitoring

This section also includes the monitoring of radiological parameters at the influent to the WWTP for the purpose of tracking pollutant loads coming through the WWTP collection system. The assumption is that these radiologic loads to the WWTP should be decreasing, since the Site has systematically tried to eliminate any possible connections between waste streams containing radionuclides and the collection system.

2.3.3 Performance Monitoring

Performance monitoring may be specified for individual projects (e.g., D&D, specific remedial activities, transition actions, or BMPs for transport and fate of plutonium in surface water runoff) within the Industrial Area.[1] In general, such project-specific

[1] Although performance monitoring may be conducted at any location on the Site, the majority occurs within the Industrial Area.

21

monitoring targets 18 months of data prior to project startup to establish baseline conditions, and continues for 3 months after project completion. The Site recently conducted performance monitoring at Buildings 886, 779, and 123.

2.3.4 Monitoring NPDES Discharges to Ponds

The NPDES permit program controls the release of pollutants into the waters of the United States and requires routine monitoring of point source discharges and reporting of results. In the current Site permit, six monitoring points are specified for control of discharges. These locations include the effluent of the WWTP, two interior ponds, and three terminal ponds capable of discharging water off site. The NPDES permit terms were modified by the Federal Facility Compliance Agreement (FFCA) signed on March 25, 1991 (DOE, 1991). Modifications included the elimination of inactive discharge points and inclusion of new monitoring parameters at other discharge locations.

Permit negotiations are currently underway to revise the Site permit. The revised draft permit for the Site is expected to address only two permitted discharge points, the WWTP effluent and Building 374 product water effluent. The revised permit specifies WWTP effluent to be discharged directly downstream of the terminal ponds, in effect bypassing the stormwater detention pond system. The other previously permitted discharge locations will be regulated under CERCLA via the RFCA.

2.4 Industrial Area Discharges To Ponds

Industrial Area discharges to the ponds include surface water runoff, discharges from the wastewater treatment plant (WWTP), and waters in Segment 5 (including the stream channels and interior ponds). Under this portion of the surface water monitoring program, the Site monitors:

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

2.4.1 New Source Detection

The Site 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 the specific contaminants. For

22

example, plutonium and americium concentrations are generally 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.

2.4.2 Stream Segment 5

The Site monitors Segment 5 water quality (as represented by stations SW093, SW027, and GS10) for compliance with RFCA action levels. Exceedances require development of a response action plan.

The RFCA Action Levels and Standards Framework (ALF) provides criteria for identified contaminants. A subset of these contaminants are monitored under this portion of the program (see Table A-26 in the *IMP Background Document*). The Site collects samples (one to four per month depending on flows) from each station for an estimated total of 85 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, collecting approximately 10 liters (L) of water for each 500,000 gallons of stream flow to a maximum of four per month, and targeting each 15-L sample composite to contain approximately 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, and the Site performs four monitoring objectives to assess its quality:

- Predischarge monitoring;
- NPDES monitoring of terminal ponds as required by the current Site permit;
- RFCA POC monitoring of Segment 4; and
- Additional, non-point of compliance (non-POC) monitoring.

23

2.5.1 Predischarge Monitoring

Before water is discharged from the Terminal Ponds, it must be evaluated for a range of constituents to ensure that unexpected contaminants have not been introduced. Therefore, the Site collects predischarge samples 8 to 10 times per year from the Walnut Creek Drainage at Ponds A4 (North Walnut Creek) and B5 (South Walnut Creek), once per year from the Woman Creek Drainage at Pond C2, and as needed from any other ponds temporarily functioning as a terminal pond. CDPHE analyzes the samples for an extensive list of constituents, including inorganic compounds, metals, volatile and semivolatile organic compounds, radiologic parameters, herbicides, and pesticides (see Table 2-16 in the *IMP Background Document* for analyte list and sampling targets). The 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

The Site performs RFCA POC monitoring at five stations in Segment 4 (GS11, GS08, GS31, GS03, and GS01). POC monitoring is concerned primarily with concentrations of plutonium, americium, and tritium, although additional analytes are monitored in a subset of samples. Approximately three samples are collected during each pond discharge event (approximately 8 to 10 discharge events per year, see Table 2-19 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 Non-POC 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 the Site. CDPHE collects samples periodically from Walnut Creek to assess the composition of the water when it consists of:

- 100% Site effluent (five samples);
- Mixed effluent and natural stream flow (five samples); and
- 100% natural stream flow (five samples).

In addition to these 15 samples, CDPHE collect 5 samples from Woman Creek during times when Pond C2 is not discharging and 1 sample during Pond C2 discharge. All 21 samples are analyzed for total ammonia, nitrite, nitrate, phosphate, orthophosphate, uranium isotopes, beryllium, cadmium, silver, and chromium. (In the future, the latter four metals may be deleted from the analyte suite, depending on initial water quality results.)

24

2.6 Off-site Monitoring to Support Community Water Supply Management

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

2.6.1 Monitoring Uncharacterized Discharges

This monitoring 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 and POE monitoring at Indiana Street, or if flow leaving the Site exceeds the capacity of the downstream ditch or reservoirs.

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

- Unmonitored storm flow exceeds the capacity of Broomfield's diversion ditch and enters Great Western Reservoir; and
- Water quality in downstream waters that may have been impacted by unmonitored effluent from the Site.

2.6.2 Community Assurance Monitoring

Several factors have made it necessary for the communities to reassure residents that their environment is safe, including RFETS' 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 the Site to the neighboring municipalities. Adequate and timely information regarding the impact of the Site is necessary. The level of concern fluctuates with activities at the Site but may be expected to continue as long as environmental contamination and special nuclear materials are present at the Site.

Since the completion of the Standley Lake Protection Project and the Great Western Reservoir Replacement Project, which were designed to protect the 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, and the fact that the reservoir is considered to be unsuitable for potable use raises questions on the part of irrigation customers. Therefore, during FY98/FY99, community assurance monitoring continues at Great Western Reservoir as specified in Section 2.6.2 of the *IMP Background Document*.

3.0 GROUNDWATER

3.1 Purpose

Most of the groundwater at the Site is hydraulically connected to surface water. The groundwater monitoring program (Table 2) is designed to accomplish the following:

- Detect and identify contaminants in groundwater and monitor their concentrations;
- Identify contaminant sources and monitor remediation efforts;
- Delineate contaminant pathways;
- Assess the effects of Site remediation and closure activities;
- Protect groundwater from new sources of contamination; and
- Evaluate any effects of contaminated groundwater on surface water.

3.2 Monitoring Focus

Several contaminant plumes have been identified in Site groundwater (see Appendix D and Plate 3 in the *IMP Background Document*). The main contaminants of concern (COCs) are volatile organic compounds (VOCs), which originated from the Site's historical chemical use and storage during its years of producing nuclear weapons components. Possible sources of contaminants that could affect groundwater include storage tanks, the process wastewater system, drains, sumps, historical.storage areas, and spills. The monitoring scope is designed to be conducted before, during, and after Site operations that may affect groundwater quality.

Site personnel determine the concentrations of groundwater AoIs and compare them to established background levels, as well as to Site action levels or standards. They evaluate exceedances of these criteria to determine whether the data demonstrate an ongoing trend, and they factor the presence or absence of discernible trends into the Site decision-making process (see Section 3.4.2 of the *IMP Background Document*) to assess the need for new 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 program for measuring water levels and the sampling and analysis program provide temporally related data for use in direct comparisons from year to year.

Table 2
Groundwater Monitoring Matrix

Type of Monitoring	Locations	Sampling Frequency	Purpose
Sample for determination of analyte concentrations	86 wells	Semi-annual	Monitor analyte concentrations in groundwater
Sample for determination of analyte concentrations	12 wells	Quarterly	Monitor analyte concentrations in groundwater
Water-level measurement	72 wells	Monthly	Characterize groundwater flow regime
Water-level measurement	68 wells	Quarterly	Characterize groundwater flow regime
Water-level measurement	100 wells	Semi-annual	Characterize groundwater flow regime
Water-level measurement	25 wells	Real-time	Characterize groundwater flow regime

3.3 Monitoring Program

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

- Semi-annual sampling in a network of 86 wells;
- Quarterly sampling of 12 wells and seeps;
- Monthly measurement of water-table elevations in 72 wells;
- Quarterly measurement of water-table elevations in 68 wells;
- Real-time measurement of water-table elevations in 25 wells;
- Semi-annual water level measurement in 100 wells;
- Data interpretation and reporting;

27

- Database management; and
- Well abandonment and replacement program (WARP).

3.3.1 Well Locations

Wells have been installed along known or suspected pathways between contaminated areas and outlets to surface water. The majority of the wells are located around the perimeter of the Industrial Area, the former Operable Unit 2 (OU2) and the existing landfill. Additional wells are located within the Site drainages, because stream flow is ephemeral. Boundary wells are maintained at the downgradient (eastern) Site boundary to confirm that contaminants are not migrating off Site. On-Site wells fall into eight categories:

- Plume definition;
- Boundary;
- Plume extent;
- Performance;
- Drainage;
- Closure activities;
- RCRA (covers monitoring of permitted wastewater storage units); and
- Plume degradation.

3.3.2 Groundwater Sampling and Analysis

Field crews measure groundwater temperature, pH, specific conductance, turbidity, and alkalinity, and submit a sample to a laboratory for measurement of total dissolved solids (TDS). They collect filtered samples for determination of metals concentrations and uranium isotopes. They also collect unfiltered samples for organic compound analyses, water quality determination, and measurement of all other radionuclides. Analytes of concern vary among wells, depending on the particular constituents in the plume being monitored. The scopes of work for the analytical laboratories contain complete target analyte lists (TALs).

The groundwater flow regime at the Site is such that sample volumes from some wells may be limited. If an available sample volume precludes determination of the entire analyte suite for a particular well, the analyses are performed in the following order of priority:

- VOCs [Contract Laboratory Program (CLP) Method 524.2];
- Semivolatile organic compounds;
- Pesticides and polychlorinated biphenyls (PCBs);
- Nitrate/nitrite, as nitrogen;
- Screening analysis for radionuclides;
- Metals (TAL, plus cesium, lithium, strontium, tin, molybdenum, and silica);
- Any specific metals for a particular well (see TALs);
- Uranium-233/234, -235, -238;
- Strontium-89/90;
- Plutonium-239/240 and americium-241;
- Major anions (chloride, fluoride, sulfate, carbonate/bicarbonate); and
- Tritium.

3.4 Data Disposition

3.4.1 Databases

Site personnel enter all field data and analytical data into the SWD. They maintain data integrity through the use of standard data entry OPs and by running error-checking routines when loading data.

Data can be extracted for various uses, including using the geographic information system (GIS) to map constituent distribution, and using various analytical models to assess groundwater movement and constituent migration.

3.4.2 Reporting

Groundwater monitoring activities are reported through the following vehicles:

- RFCA Annual Groundwater Report: Quarterly reporting at the Quarterly Information Exchange Meeting presents data gathered during the reporting period, provides notification of any exceedances of RFCA groundwater

24

action levels, and lists required actions for exceedances. The Annual Groundwater Report replaced various previously required reports and serves as the primary compliance report.

- RFCA Quarterly Reporting: These data replace all previous quarterly reporting, integrating the elements of each regulatory driver into a single reporting vehicle. Quarterly reporting at the Quarterly Information Exchange Meeting summarizes data gathered during the reporting period and also provides notification of any exceedances of RFCA groundwater quality standards.

- IMP: The IMP is the vehicle for changing required groundwater monitoring program elements. It is reviewed and updated annually.

3.5 Well Abandonment and Replacement Program (WARP)

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

Wells are considered for abandonment if they are damaged or poorly constructed (or construction details are unknown), present a potential for cross contamination of other wells or the aquifer, or no longer needed. Activities conducted under the WARP are reported in the RFCA Annual Report.

4.0 AIR QUALITY

4.1 Purpose and Programs

The air monitoring activities on the Site (Table 3) assist in protecting the public and the environment by detecting and tracking the impacts of Site operations on air quality at and near the Site, characterizing any airborne materials that may be introduced, and monitoring the meteorological conditions that influence the transport and dispersion of airborne materials. Data are used to plan, implement, and assess the effects of on-Site activities, including operations, construction, and closure activities; maintain emergency preparedness; and demonstrate compliance with relevant regulations.

The Air Quality Management (AQM) group within Kaiser-Hill's Environmental Compliance and Operations organization develops the scope for Site air monitoring and reporting activities required to maintain compliance with applicable air quality regulations and DOE Orders. In addition, CDPHE conducts oversight monitoring.

4.1.1 Ambient Air Monitoring

Ambient monitoring of radionuclides on the Site and at the perimeter is performed by AQM and by CDPHE, which also monitors nonradioactive pollutants on and around the Site. Ambient monitoring in the communities immediately adjacent to the Site is coordinated by DOE. The purpose of these monitoring stations is to characterize any Site-related airborne emissions. The community stations, which monitor airborne plutonium concentrations, are operated independently by members of the communities of Arvada, Westminster, Broomfield, and Northglenn (the Community Radiation Program, or ComRad).

4.1.2 Effluent Monitoring

Air emissions (effluent) from Site facilities that contain significant quantities of radioactive materials are monitored continuously in accordance with state and federal regulatory requirements and are used to verify the effectiveness of radiation control mechanisms. Facilities with lesser potential to emit radionuclides are monitored periodically to verify low emissions. Emissions data are also 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 the Site to generate data for use in air dispersion models that predict the transport of airborne emissions. Site

Table 3
Air Monitoring Matrix

Type of Monitoring	Locations	Sampling Performed By	Sampling Frequency	Purpose
Ambient air	35 samplers	Site personnel (AQM)	Continuous	Detect and characterize Site-related airborne emissions
	Additional samplers on Site and at perimeter	CDPHE	Continuous	Detect and characterize Site-related airborne emissions
Effluent from Industrial Area facilities	52 exhaust outlets	Site personnel (AQM)	Monthly from significant sources; annually from insignificant sources (filters collected monthly and composited)	Comply with state and federal regulatory requirements for monitoring and verify effectiveness of radiation control mechanisms
Meteorology	1 tower with instruments at ground level and at 10, 25, and 60 m; 1 backup tower with instruments at 10 m	Site personnel (AQM)	Continuous	Monitor meteorological conditions for use in air quality modeling
	5 towers at Site perimeter	CDPHE	Continuous	Provide data as needed for emergency response modeling
Project specific	Selected subset of existing ambient air monitoring locations	Site personnel (AQM)	Continuous; filters exchanged weekly	Assess impacts of remediation or D&D projects; provide data to better characterize airborne emissions

Notes:
m = Meter
AQM = Air Quality Management

32

personnel use model predictions to evaluate Site operations and closure projects, and for emergency preparedness.

4.2 Site Air Monitoring Scope

Ambient air monitoring and effluent monitoring are performed at the Site to satisfy 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 (DOE) Facilities" (Rad NESHAP) and DOE Orders. CDPHE and the ComRad program perform 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 35 samplers. Twelve of these existing samplers have been included in a proposal to satisfy regulatory compliance demonstration requirements under the CAA using environmental measurements; the others are used for backup should there be accidental releases from the Site or for determining local impacts from remediation projects. The samplers run continuously, collecting airborne particulates on pairs of filters that represent different size fractions. Personnel collect the filters regularly, submitting them 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 on Site and at the perimeter. The two monitoring networks serve as independent measures of public exposure to radioactive releases, and they also monitor additional analytes, including beryllium, nitrogen dioxide, and non-radiologic pollutants regulated under the National Ambient Air Quality Standards.

4.2.2 Effluent

Exhaust air emissions from all Site facilities that contain radioactive materials (52 locations in the Industrial Area) are monitored by analyzing filters taken from continuous effluent sampling systems. Filters are analyzed monthly from sources considered to be "significant" (i.e., having the potential to contribute more than 0.1 millirem per year effective dose equivalent, uncontrolled, to any member of the public). Filters are collected monthly from "insignificant" sources, and these filters are composited and analyzed annually. In addition to analyzing filters for plutonium, uranium, and americium isotopes, samples are collected three times weekly at five locations for tritium analysis.

4.2.3 Meteorological Conditions

A 61-meter (m) tower is located in the northwest part of the Buffer Zone, with monitoring instruments at ground level and at 10, 25, and 60 m above the ground. A separate 10-m tower nearby provides backup data. Instruments measure wind speed and direction, temperature, and relative humidity (dew point), solar radiation, precipitation, and information used to calculate atmospheric stability class. CDPHE operates five meteorological towers located about the Buffer Zone perimeter, and they provide data from these towers as needed to support Site emergency response modeling.

4.3 Project-Specific Monitoring

Whenever a D&D or environmental restoration project is planned that has a significant potential to release radionuclides, the existing on-Site and off-Site ambient sampler network will be employed to provide project-specific monitoring. Samplers in the immediate vicinity of the project will have filters exchanged weekly instead of monthly. Filters from these "project-specific" monitors will be screened for radioactive contamination and the results compared to predefined notification levels specific to each project and each sampler. 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 dose standards.

5.0 ECOLOGY

The Buffer Zone around the Industrial Area at the Site 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 the Site:

- Xeric tallgrass prairie;
- Tall upland shrubland;
- Great Plains riparian woodland complex;
- High-quality wetlands; and
- Mesic mixed grassland.

In addition to the terrestrial vegetation communities, the aquatic communities of the riparian channels and ponds at the Site are monitored for ecological health.

Ecological monitoring is designed to protect wildlife in the Buffer Zone, including any special-concern species (i.e., threatened, endangered, candidate, proposed, state-listed, or other sensitive species). The Preble's meadow jumping 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 Site cleanup activities that will occur over the next decade. Data also demonstrate compliance with applicable natural resource protective regulations.

Site 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 from year to year enable ecologists to detect changes, identify potential causes, and plan corrective actions for changes that result from Site activities, rather than from natural fluctuations.

Table 4
Ecological Monitoring Matrix

Basis for Monitoring	Number of Locations	Sampling Frequency	Purpose of Monitoring
Manage and conserve migratory bird species numbers and richness; comply with Migratory Bird Treaty Act.	20 Transects	15 times per year	Track changes in numbers and richness of migratory birds at the Site
Manage and conserve significant wildlife species and bird species numbers and richness; comply with Endangered Species Act, other federal acts, and Colorado wildlife protection statutes.	16 Transects	12 times per year	Track changes in numbers, richness, and habitat dependence of significant wildlife species (including birds) at the Site
Manage and conserve significant species numbers and richness; comply with Endangered Species Act, other federal acts, and Colorado wildlife protection statutes.	1 Sitewide Survey (Follows all passable Buffer Zone roads.)	12 times per year	Track changes in numbers, richness, and area use of significant wildlife species at the Site
Monitor and conserve viable Preble's mouse populations in appropriate habitat, and monitor and conserve current coverage of characteristic Preble's mouse habitat. Comply with Endangered Species Act and Colorado wildlife protection statutes.	Approximately 4 locations per year based on previous year's results	2 times per year (800 trap-nights per location per year)	Monitor presence, relative populations, and habitat dependence of Preble's mouse at the Site
Monitor and conserve unique and rare vegetation communities and develop management strategies for their protection and enhancement.	44 Management Units	2 times per year	Track changes in numbers and richness of plant species, health of plant communities, and changes in areal extent of high-value vegetation communities
Monitor the noxious weeds at the Site; comply with weed control regulations.	Variable by year	2 times per year	Evaluate effectiveness of, and aid in outyear planning for, weed control actions at the Site
Monitor the effectiveness of controlled burning as a management tool for conservation and enhancement of high-value vegetation communities.	Variable by year	2 times per year	Evaluate effectiveness of, and aid in outyear planning for, controlled burning actions at the Site
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

5.2 Scope of Monitoring

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

- 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 data, and bird and mammal baseline was established in the *1996 Annual Wildlife Survey Report* (Kaiser-Hill, 1997b).
- Identify rare or imperiled plant or animal species.
- Make annual estimates of plant, bird, and mammal species richness. (Plant data are collected in the spring and summer to ensure that spring ephemerals and late-maturing plants are recorded, and bird and mammal species richness is measured monthly.)
- Conduct weed mapping and photo surveys. (Photo surveys are conducted in both summer and winter in woody communities and annually in grasslands.)
- Make annual assessments of endpoints for the vegetation community and wildlife populations.
- Monitor the presence of noxious weeds and the effects of weed control efforts.
- Anticipate impacts from proposed Site projects, and estimate the potential area affected.

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. The aquatic monitoring component of the ecological monitoring program includes monitoring for the continued presence and health of fish populations in streams and ponds at the Site. Due to the limited aquatic habitat available, aquatic sampling is not extensive.

5.2.1 Preble's Meadow Jumping Mouse

Populations of Preble's meadow jumping mouse have been identified within areas of tall upland shrubland and Great Plains riparian woodland. Monitoring activities in these areas include:

- Annual estimates of plant species richness, density, height, and canopy cover are made.

- Characterizing Preble's mouse populations (using all monitoring through 1996 as a baseline) and monitoring the source populations over time. Monitoring concentrates on determining the presence or absence of the species; quantitative population measurements are not appropriate because of its rarity. Monitoring data provide a basis for tracking ratios of males to females and adults to juveniles, enabling population viability to be confirmed. Ecologists monitor the known population areas on a rotating basis through a 2- to 3-year period, depending on results from the previous field season. They trap during May through September because the mouse hibernates over the winter months.

5.2.2 Wetlands

In addition to the activities listed above, the U.S. Army Corps of Engineers determines the extent of wetlands at the Site every five years. They will conduct the next wetlands evaluation in the year 2000. A comprehensive plan (Kaiser-Hill, 1997c) to manage and protect Site wetlands was issued in 1997, detailing the methods and procedures that will be used to identify wetlands and minimize impacts to them from Site closure and remediation projects.

5.2.3 Project-Specific Monitoring

Proposed Site projects will be evaluated in terms of potential effects on threatened and endangered (T&E) species, species of special concern (SSC), and migratory birds and wetlands. Much of the data for such evaluations will come from the monitoring activities listed above, 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; and

- Biological characteristics of species of concern (feeding and nesting habits, home range, habitat preference), and potential effects of the proposed project.

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

5.3 Data Disposition

Ecological data have historically been stored in two databases [the Ecological Monitoring Program Database (EcMPD) and the Sitewide Ecological Database (SED)]. Because extracting data for specific purposes requires a high degree of system-specific knowledge, the two databases are being combined (Kaiser-Hill, 1997d). The new database will allow for multi-user access (with security restrictions) and ease of use with minimal training.

5.4 Reporting

A comprehensive ecological management plan (Kaiser-Hill, 1997e) is in place, setting forth the management actions that will be required to preserve the valuable ecological resources present at the Site. Site ecologists will update or modify this plan as required by variations in Site conditions, available technology, or changing regulations.

The Ecological Monitoring Program issues the following reports annually:

- Wildlife survey report (including a status report on the Preble's meadow jumping mouse); and
- Site vegetation report.

The overall Site Integrated Weed Control Strategy report (Kaiser-Hill, 1997f) and the Weed Control Strategy and Integrated Treatment Plan (Kaiser-Hill, 1997g) are issued annually to document planned weed control efforts.

Additional reports are issued as necessary to document baseline conditions of plant communities or wildlife populations.

351

6.0 INTERACTIONS AMONG MEDIA

Interactions can be identified between groundwater and surface water, between air and soils and among all of these media and ecological conditions both on-Site and potentially at off-Site locations (see Table 7-1 of the *IMP Background Document*). Also, activities upgradient from the Site (e.g., aggregate mining to the west) can influence environmental conditions on the Site and downgradient from it. The monitoring described in the previous sections provides information from which correlations among media can be identified and their effects characterized. For example, surface water quality will be influenced by groundwater perturbations, at least near their interface, and the interaction can be characterized.

Soil chemical and physical characteristics can influence the air, surface water and groundwater quality. While soils are not monitored routinely as part to the Integrated Monitoring Program, many of the interactions are relatively well understood and others are being characterized through special Actinide Migration Studies currently in progress through Site funding. In particular, this study will assist in understanding the importance of soil transport and the influence of water and air on that transport relative to the ultimate fate of radioactive contaminants known to exist in the surficial soils at the Site. This study may point to additional monitoring needs to take the Site to a safe, environmentally sound closure.

Significant habitat effects could accrue from upgradient off-Site activities, as well as on-Site projects, and variations in water supply could affect on-Site and downgradient off-Site habitats. Therefore, to gather data beyond those generated by the monitoring programs described previously, Site personnel collect watershed-level information to assess water availability in the Buffer Zone. Instruments continuously monitor flow at 15 Site locations, and personnel collect seasonal grab samples from seven of those locations for chemical analysis to assess compliance with various regulations (see Table 6-2 in the *IMP Background Document*). In FY99, aquatics sampling on the Site will be performed for the first time in a number of years. The resulting data, and other water quality data, will be analyzed in concert with data being collected off-Site by other stakeholders. These data will supplement understanding of downgradient influences due to Site and upgradient impacts on water quality.

Site-specific correlations between ecological health and water availability have not been quantified, but such interactions have been discussed in the Special Projects working group set up during the current IMP revision process. As more is known about the water balance at the Site, this issue will be revisited so that DQOs could be defined and the need for monitoring assessed.

The IMP working group will continue to meet during the year to discuss new data needs to address our understanding of the interactions among media, especially relating water quality and quantity to the ecological condition of the Site.

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41/41