Rocky Flats Environmental Technology Site

Integrated Monitoring Plan
Background Document

Surface Water Monitoring

October 1998

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2.0 SURFACE WATER

2.1 Introduction

This chapter of the *Integrated Monitoring Plan* (IMP) *Background Document* is written so that it can be used in two different documents, as needed. The Site-wide plan may be in draft or under negotiation at times when Rocky Mountain Remediation Services, L.L.C. (RMRS) must demonstrate and document management control of their work. Thus, two separate documents are occasionally required, but the two documents must have the identical negotiated text. This plan has been written to accommodate this need.

2.1.1 Summary of Monitoring Objectives

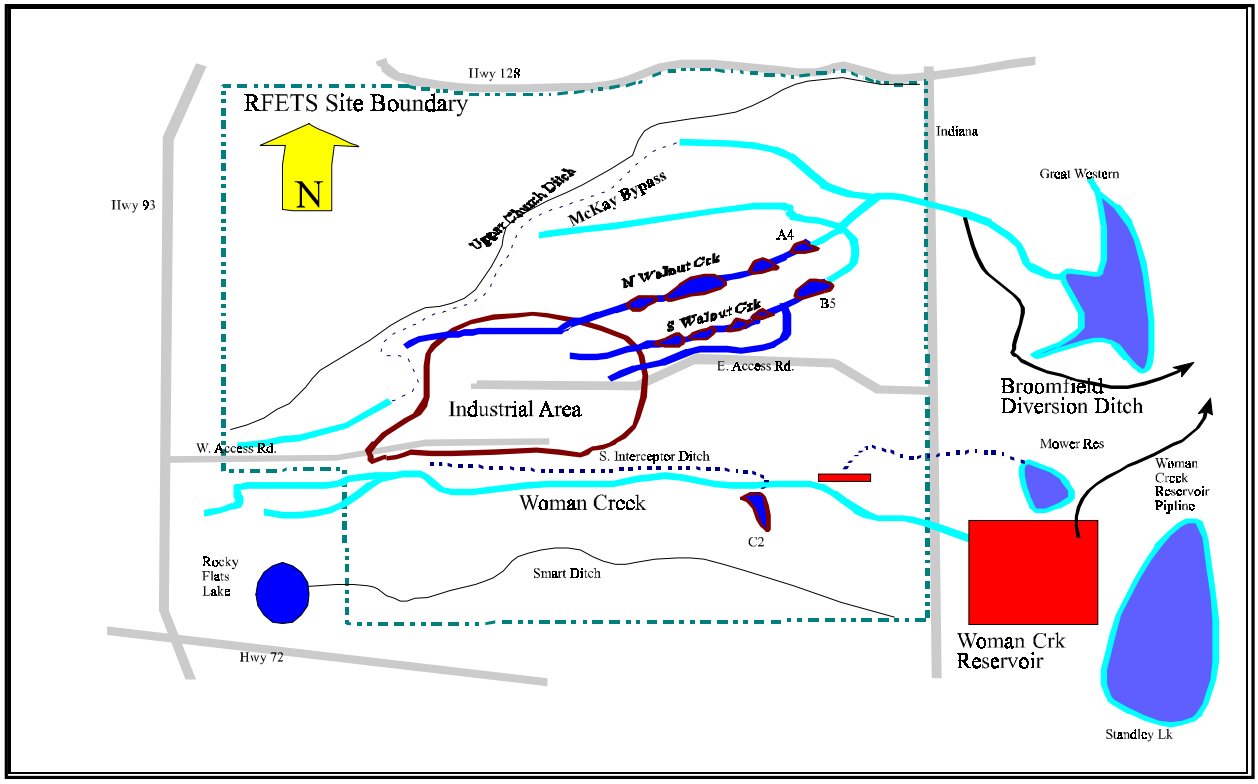
This document describes surface water monitoring objectives to be implemented for fiscal years 1998 and 1999 (FY98/FY99). The monitoring described herein integrates all surface water monitoring across the Rocky Flats Environmental Technology Site (RFETS or the Site) (see Figure 2-1), including much of the Site monitoring performed by the cities and the state.

The data quality objective (DQO) process was used to determine necessary and sufficient monitoring requirements. The process yielded over 20 data-driven decisions. Some decisions need a higher priority than others, and some need greater confidence than others. The DQO process has produced descriptions that expose the strengths and weaknesses of each data-driven decision, and the value of the data (resources required) in making each decision. Management decisions often must be made on the basis of incomplete information. The individual DQO sections of this document help management to establish funding priorities for surface water monitoring objectives.

Surface water monitoring objectives (a.k.a. decision rules under the DQO process) have been organized in a roughly upstream-to-downstream direction, beginning with process discharges within the Industrial Area and ending at the drinking water reservoirs downstream, as depicted in Figure 2-2. These monitoring objectives are summarized in the following paragraphs and are discussed in detail in the remainder of this section.

Monitoring objectives that do not fit into the upstream-to-downstream sequence are discussed in Section 2.2, Site-Wide Monitoring Objectives. For example, safe operation of the dams is dependent on some monitoring to avoid breaching a dam. This monitoring objective is placed first (Section 2.2.1), in recognition of its unique importance in avoiding imminent danger to life and health (IDLH) situations. Another monitoring objective is Source Location Monitoring, which is covered in Section 2.2.2, to locate a source of contamination detected by other monitoring objectives.

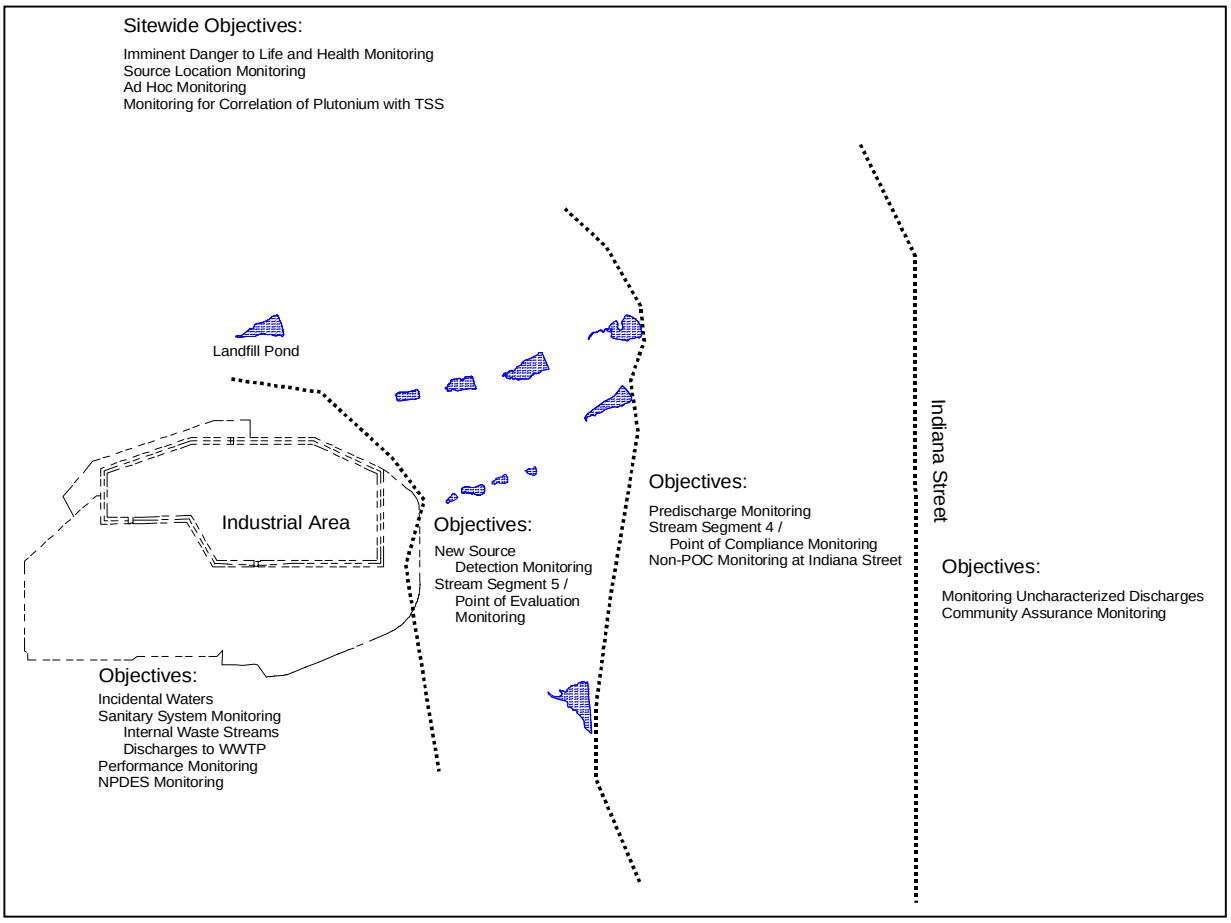
Figure 2-1. Conceptual Sketch of Major Site Surface Water Features



Location of a contaminant source could take place anywhere in the area shown in Figure 2-2; therefore, it does not fall into the upstream-to-downstream order. In addition, some monitoring needs simply cannot be known in advance and are discussed as *ad hoc* monitoring in Section 2.2.3. Furthermore, some monitoring may be performed at various locations to evaluate alternatives for surface water management, such as controlled detention[1] pond management, discharge of the Interceptor Trench System (ITS[2]) effluent into Walnut Creek, or re-routing of wastewater treatment plant (WWTP) effluent.

[1] Controlled detention is a strategy for Site pond operations that would allow continuous discharge of water from the terminal ponds under carefully controlled conditions.
[2] System designed to capture a contaminated subsurface plume on the north slope of the Solar Pond Area of the Industrial Area.

Figure 2-2. Conceptual Model of Site Monitoring Objectives



In the first of the upstream-to-downstream monitoring objectives, the *Rocky Flats Cleanup Agreement* (RFCA) (DOE et al., 1996) and the Industrial Area Interim Measures/Interim Remedial Action (IM/IRA) Decision Document (DOE, 1994) require the Site to characterize significant surface-water releases within the Industrial Area. Immediately outside the buildings of the Industrial Area, the Site must often decide whether incidental waters (see Section 2.3.1) that accumulate in berms, utility pits, etc., can be discharged directly to the environment, or whether they must be treated. Discharges to the sanitary system are monitored as discussed in Section 2.3.2. Internal waste streams are discussed in Section 2.3.2.1. To maintain current information in the National Pollutant Discharge Elimination System (NPDES) permit application, the Site must characterize all internal waste streams to establish what might reasonably occur in discharges from these processes. Additionally, the Site routinely determines whether nonroutine internal waste streams (Section 2.3.2.2) may be discharged from the Industrial Area to the WWTP. In addition, NPDES monitoring must be performed on the WWTP discharge to the ponds.

Still within the Industrial Area [usually], individual projects will sometimes warrant performance monitoring (Section 2.3.3) to detect a spill or release of contaminants specifically from that project. The Site must also monitor specific point-source discharges as specified by the NPDES permit (Section 2.3.4).

In the next section of the upstream-to-downstream monitoring objectives, the RFCA and the IM/IRA Decision Document require the Site to identify and correct significant accidental or undetected releases of contaminants from the Industrial Area to the Site Detention Ponds [surface water leaving the Industrial Area and entering Stream Segment (Segment) 5]. Section 2.4 deals with discharges from the Industrial Area to the ponds. In order to decide whether a significant release has occurred, the Site must perform new source detection (NSD) monitoring of Industrial Area runoff for significant increases in contaminants (see Section 2.4.1).

Additionally, the RFCA specifies monitoring for the upstream reaches of Site drainages (above the ponds) and specifies action levels for contaminants (Action Levels and Standards Framework [ALF]). This Stream Segment 5/point of evaluation (POE) monitoring is addressed in Section 2.4.2.

Terminal detention pond discharges and surface water leaving the Site must also be monitored. Predischarge monitoring of terminal ponds occurs prior to controlled discharges (Section 2.5.1). The Site must also monitor at points of compliance (POCs) below the terminal ponds to protect state stream standards in Segment 4 (Section 2.5.2), as specified in the RFCA. In addition, there are RFCA POCs that are monitored at the Site boundary at Indiana Street (Section 2.5.2).

The State of Colorado and downstream communities are concerned that the water quality in downstream waters might be degraded by Site discharges. Section 2.6 addresses off-Site monitoring needs. These data are used to make decisions regarding use of the water for drinking and irrigation and for compensatory actions such as providing alternate water sources and reservoirs.

Section 7.0 of this *IMP Background Document* addresses the interfaces between surface water and other media: soil, groundwater, air, and ecology. For example, groundwater and soil could conceivably contaminate surface water, and surface water could contaminate habitats of endangered species. Monitoring requirements to evaluate the interactions between media are specified in the Groundwater Monitoring Section 3.0.

2.1.2 Geologic and Hydrologic Setting

This section is included only as an introduction to the Site for the lay public not already familiar with the Site. This section contains no monitoring requirements or other commitments or agreements between the parties. This section contains no material that affects the interpretation of the rest of the document.

Geographically, the Site surface waters are bounded:

- Upstream by the West Interceptor Ditch (McKay Bypass);
- On the south by the South Interceptor Ditch (SID) or by Woman Creek, subject to discussion and context;
- On the north by the landfill drainage; and
- On the downstream end by Great Western Reservoir and Standley Lake or by Stream Segment (Segment) 1 of Big Dry Creek, subject to discussion and context.

These features are shown in Figure 2-1 and Figure 2-3. A detailed discussion of Site geology and hydrology is presented in Appendix C to Section 3.0 of this IMP.

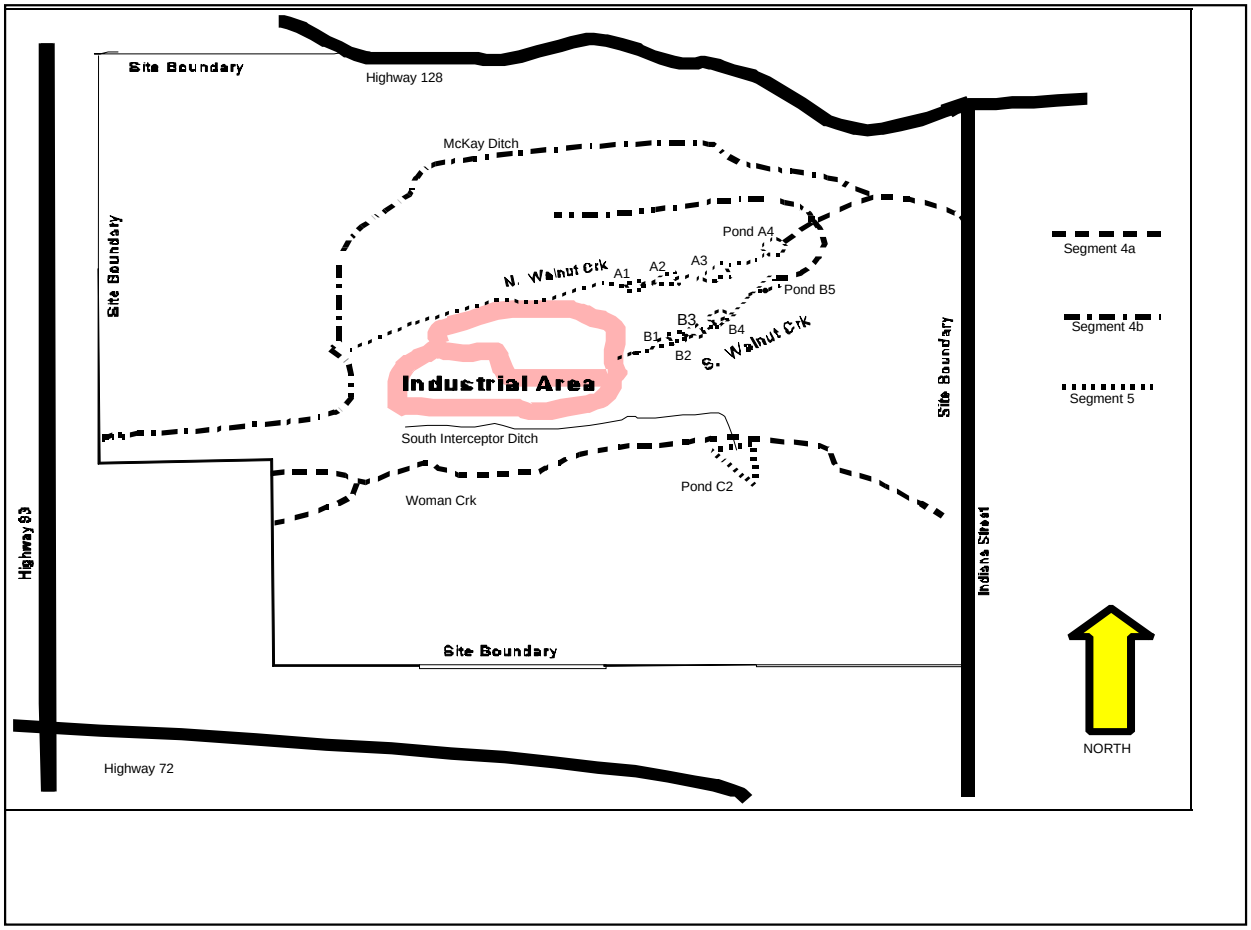
The stream drainages leading off Site are Walnut Creek, Woman Creek, and Rock Creek. The figures illustrate the first two drainages and their tributaries. North Walnut Creek and South Walnut Creek flow through the A and B series ponds, respectively. The Colorado Water Quality Control Commission (CWQCC) has designated the portion of these drainages from Ponds A4 and B5 to Indiana Street as Stream Segment (Segment) 4b. Tributaries to the A and B terminal ponds, and Pond C2 itself, are designated as Stream Segment 5. The South Interceptor Ditch and Ponds A1, A2, B1, and B2 have not been designated as waters of the State. These stream segment designations are best illustrated in Figure 2-3.

2.1.3 Assumptions

The Surface Water IMP Team had to make some assumptions in order to limit the monitoring program to address reasonable concerns. The alternative was to monitor for all possible Site conditions, contaminants, and practices, which would have been an inefficient use of tax dollars. The Team's planning assumptions are presented below. These assumptions may not continue to be true in the future in all cases, and this document does not constitute agreement between the parties that these assumptions will be maintained. However, if an assumption becomes invalid during the effective period of this plan, then some of the monitoring that was excluded on the basis of that assumption should be reconsidered and possibly implemented in future years.

- Deviation from these assumptions requires prior approval of the U.S. Environmental Protection Agency (EPA), Colorado Department of Public Health and Environment (CDPHE), and the Department of Energy (DOE), as required in RFCA Part 23, paragraph 267.

Figure 2-3. Sketch of Stream Segments 4a, 4b, and 5



- This plan is to be fully implemented during FY98.
- Monitoring objectives specified herein will be implemented by the parties, subject to funding constraints and priorities, as specified in RFCA Part 11, Subpart A.
- The ITS will not be discharged into the Walnut Creek drainage without prior treatment unless a change is agreed to by RFCA parties. Direct discharge of ITS effluents would require modification and re-approval of this plan.
- This plan incorporates all surface water monitoring of Site discharges to surface water and contaminant impacts down to and including Broomfield and Westminster water supplies. Monitoring and decisions by the Site, the State of Colorado, and the cities are included.

- Decisions regarding IDLH are deserving of special attention and will be segregated from decisions regarding likely low-risk health concerns to ensure that no confusion will arise regarding the priority of IDLH decisions over water quality decisions.

- The parties agree that continuous water-quality monitoring probes will be used as indicators that may suggest a need for additional monitoring, mitigating action, or management decision. The parties agree that compliance and enforcement issues will be resolved on the basis of standard analytical procedures specified by the applicable regulation or agreement, e.g., NPDES, RFCA, or Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The parties agree that continuous monitoring field probes should NOT be used to determine compliance or serve as a basis for enforcement action, unless the applicable regulation specifies such a probe as the enforceable analytical method for a particular measurement.

- For purposes of computation in regulatory reporting, the sample date for a multi-day composite sample will be the date that the sample was started. Although this will give the impression that multi-week samples are being reported months late, this convention is consistent with all other Site data.

- Termination for Cause: Completion of a flow-paced composite sample is determined by several factors that are evaluated by the sampling team. These include, but are not limited to, the required sample volume for analysis [normally ≥ 4 liters (L)], weather conditions, work schedules, sample preservation, potential loss of data, regulatory reporting schedules, and other concerns.

- Non-Sufficient Quantity (NSQ): If sample accumulation is terminated for cause, and sample volume is inadequate for routine lab analyses, then no analyses are required, and the sample will not be used in the computation of a 30-day moving average. For example, routine lab analysis for plutonium (Pu), americium (Am), and tritium requires 4.5L. Therefore, samples of less than 4.5L may be discarded and not used in the computation and evaluation of compliance parameters, but must be reported. This requirement may be referred to as the NSQ requirement regarding insufficient quantity of sample.

- The 30-day moving averages will be computed twice each month within 5 working days of the 15th day and the last day of the month for sample results received between the reporting dates and reported per the RFCA ALF.

- Where there is no significant flow, there may be no samples completed within a 30-day period. However, flow-paced sampling will continue during dry periods,

even though flows may be so low that it may take longer than 30 days to fill the sample carboy.

- If no samples are taken during a 30-day interval, then no sample result will be available for use in the computation of a 30-day moving average, and no such average will be reported for that period.

- All samples taken for RFCA monitoring under this plan must be reported, even if they are not analyzed, and the reason for not analyzing (e.g., NSQ) must be reported.

- All monitoring data acquired under the same procedural controls as used for RFCA monitoring are actionable[3] under RFCA and applicable regulations, even though it may not have been specifically identified as an analyte of interest (AoI) in Tables A-26 and A-27 in Appendix A to this section.

- Many areas of the Site are linked by the flow of water within and above the ground surface in an upstream-to-downstream direction. Contaminants monitored in one area may have originated in an upstream area.

- These monitoring objectives are driven by both federal and state regulations which include Site-specific CWA requirements and underlying CWQCC standards and the Colorado Water Quality Control Act.

- Each monitoring objective that requires comparison to baseline assumes that establishment of baseline will be performed before decisions are made on the basis of the data. Each monitoring objective that specifies decisions based on statistical tests assumes that variability of data will be established before decisions are made on the basis of the data.

2.1.4 Outstanding Issues

- As of this revision, the NPDES permit has not been re-issued. When the new permit is approved, the IMP Surface Water Working Group (SWWG) will review permit requirements for impacts on monitoring.

- The Site operators request to change pond operations protocol from batch discharge to controlled detention for off-Site release of surface waters and related impacts on monitoring are also unresolved.

[3] The term “enforceable” has been reserved for Segment 4 standards, as opposed to Segment 5 action levels. The term “actionable” is intended here to include enforcement actions, actions taken in response to action level exceedances, and any other action required under RFCA in response to monitoring data.

- Terminal ponds will continue to be operated in a batch mode throughout FY98 until agreed on by all parties.

- A detailed summary of ongoing Industrial Area decontamination and decommissioning (D&D) monitoring is not part of the IMP or the *IMP Background Document*. This information should be reported in an annual summary to accompany the IMP and the IMP Background Document. This summary should include a review of performance monitoring and any monitoring of routine sanitary waste streams.

2.1.5 Quality Assurance

Sampling and analysis of Site surface water is controlled by Standard Operating Procedures, the RMRS *Quality Assurance Program Plan*, the *Site Quality Assurance Manual*, and Analytical Services' *Statement of Work for Analytical Measurements, General Laboratory Requirements.* The *Statement of Work for Analytical Measurements, General Laboratory Requirements* presents the approved analytical methods, hold times, detection limits and laboratory data reporting protocol. Sample sizes (number of independent samples analyzed) for FY98 were determined by the NPDES permit in some cases and by desired confidence intervals, subject to funding limitations, in other cases. For additional details, such as requirements for blanks and duplicate samples, refer to the following plans and procedures.

- *Statement of Work for Analytical Measurements, General Laboratory Requirements, Module GR01-A*. Kaiser-Hill Company, L.L.C., Golden, Colorado, December 10, 1996.

- *Site Quality Assurance Manual, Rocky Flats Plant.* Rocky Flats Environmental Technology Site, Golden, Colorado, 1996.

- *Quality Assurance Program Plan. Manual No. 95-QAPP-001, Rev. 0, 10/4/95*. Rocky Mountain Remediation Services, L.L.C., Golden, Colorado, 1995.

- *EMD Operating Procedures Volume I, Field Operations, Manual No. 5-21000-OPS-FO*. EG&G Rocky Flats, Inc., Rocky Flats Plant, Golden, Colorado, 1992.

- *EMD Operating Procedures Volume IV, Surface Water, Manual No. 5-21000-OPS-SW*. EG&G Rocky Flats, Inc., Rocky Flats Plant, Golden, Colorado, 1992.

2.1.6 Reporting

Data specified in the surface water monitoring objectives are used in decision making. Many of the data are not routinely reported other than to the decision-maker(s) for a particular decision.

Such data remain available in the Site Soil and Water Database (SWD) for subsequent queries. (Secondary data usage is quite common.) Some typical examples of data usage are described below. (This is not a complete list.)

- IDLH data are used to determine when valves and flood gates should be opened and closed. Some of these data may be reported verbally to the DOE, Rocky Flats Field Office (RFFO) and regulators during the decision-making process, but no formal report of pond levels, valve positions, and piezometer readings is produced as a regulatory report.

- If data helped to locate a new contaminant source, then the source and data would be reported for appropriate management action.

- *Ad hoc* monitoring requested by on-Site parties is reported to the requestor.

- The results of monitoring for correlation of Pu with particulates could be published in a letter report, at the discretion of the Site.

- The NSD monitoring would be reported internally to initiate action if a new contaminant source were detected, but no public or regulatory report would be routinely produced.

- The disposition of internal waste streams and incidental waters is based on data-driven decisions. The data are recorded and reported to the decision maker, with an annual summary of routine internal waste streams provided to the EPA.

There are a few routine reports prepared for surface water data. Current reports are:

- NPDES monitoring data are reported in a Discharge Monitoring Report (DMR) each month to EPA;

- CDPHE routinely reports predischarge and community-assurance monitoring results to the Site and cities;

- Exceedance of RFCA standards and action levels must be reported to both EPA and CDPHE; and

- Many of the surface water data are summarized and reported at the Quarterly Information Exchange Meetings.

2.2 Site-Wide Monitoring Objectives

The monitoring objectives in this IMP are generally presented in an upstream-to-downstream order. This section deals with monitoring objectives that cannot be ordered in that way. This section also deals with cross-cutting monitoring objectives such as: safe operation of the dams (Section 2.2.1), location of contaminant sources wherever they may occur (Section 2.2.2), special request (*ad hoc*) monitoring (Section 2.2.3), and the use of operational indicators for Pu to describe actinide transport and to design and implement pond operations (Section 2.2.4). None of this monitoring is confined to a single geographical area of the Site. Figure 2-4 shows the locations of specific monitoring locations referenced under each objective. In the interest of fiscal and operational efficiency, many of these locations collect data to support multiple monitoring objectives. The location code shown is the code used in the Site Soil and Water Database (SWD).

2.2.1 IDLH Decision Monitoring

This IDLH section uses the term "action level" in reference to dam operations. This is an entirely different usage unrelated to the RFCA Action Levels and Standards Framework (ALF) discussed elsewhere in this document.

The Site has a network of detention ponds with earthen dams (Figure 2-4). Failure of an earthen dam would present an IDLH. Safety and health professionals often refer to such conditions as IDLH conditions. The Site has several ponds formed by dams that can hold a limited amount of water safely. Water may be discharged from these ponds through the outlet works or by pumping. Water does not normally overtop the dams, which are all of earthen construction and would be damaged and could fail under those conditions. Heavy rain or snow melt can challenge the capacity of the ponds faster than the ponds can be predischarge monitored and subsequently batch discharged.

Problem Statement:

If water levels rise above safety limits that preserve dam integrity, then ponds must be discharged to prevent overflow or breaching.[4] The risk to the public and environment is far greater from a dam breach than from the normally low levels of contaminants that might be found in pond waters.

Problem Scope:

The actual decision process for managing pond operations and conducting pond and dam monitoring activities is too complex to be treated in this document. Detailed information

[4] Maximum discharge rate for earthen dams is one foot per day to achieve drawdown without inducing sloughing of the saturated sides of the dam.

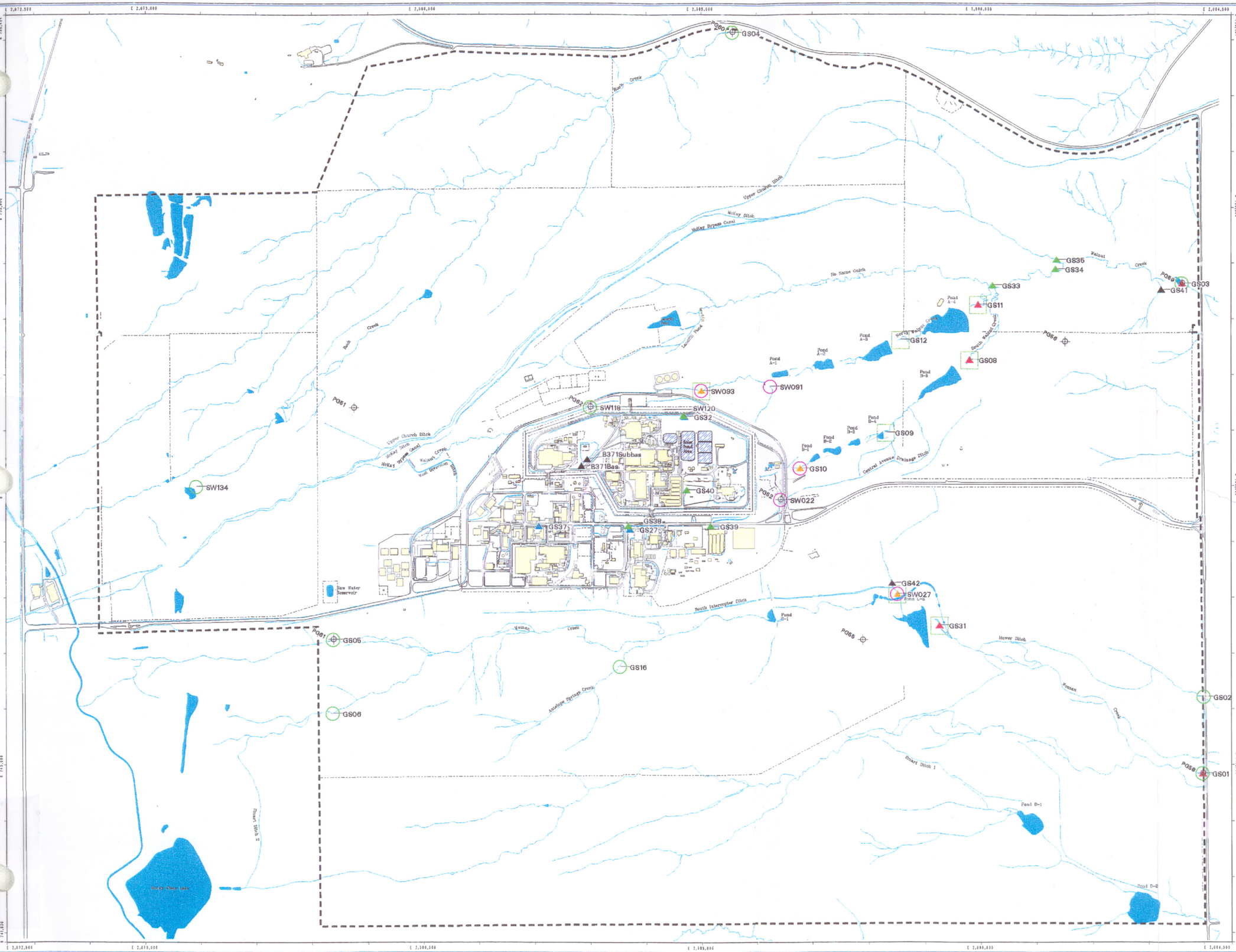


Figure 2-4

RFETS Intergrated Monitoring Plan

Surface Water Features with Sample and Monitoring Locations

EXPLANATION

- Precipitation Gage

Monitoring Location Objective*

- Buffer Zone Hydrologic
- New Source Detection
- Point of Compliance
- Point of Evaluation
- Performance
- Source Location
- Ad Hoc
- IDLH**

Standard Map Features

- Buildings and other structures
- Solar evaporation ponds
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences and other barriers
- Rocky Flats boundary
- Paved roads

DATA SOURCE:
Buildings, fences, hydrography, roads and other structures from 1994 aerial fly-over data captured by EG&G RSL, Las Vegas. Digitized from the orthophotographs. 1/95

NOTE:
* The monitoring objective(s) performed at each location are detailed in the Surface Water Section of the Site Integrated Monitoring Plan.

** IDLH (Immediate Danger to Life & Health) refers to the monitoring objective for safe operation of the Site detention ponds.

Scale = 1 : 20140
1 inch represents approximately 1678 feet

500 0 1000 2000ft

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

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

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MAP ID: 98-0240

August 13, 1998

/gis2/projects/fy98/98-0240/fig2-4.aml

can be found in the *Pond Operations Plan* (POps)(Kaiser-Hill et al., 1996), and the *Action Level Response Plan for Dams A-4, B-5, or C-2* (EG&G, 1995). The following *generalized decisions* must be made on a continuous basis for Pond A4. Similar decisions are made for Ponds A3, B5, and C2. A series of simultaneous equations are solved via an expert system framework to consider actions associated with modeled action levels.

Information Types and Frequency:

The decision factors include safe pond capacity, actual pond elevation, current and projected flow rates into and out of the ponds, and several indicators of dam integrity, such as piezometer readings, inclinometer readings, and cracks or sloughs of embankment material. The information needs are as follows:

- Pond inflow rates into Ponds A3, A4, B5, and C2 (must be continuously monitored for daily to hourly averages with instantaneous measurement capability)[5]
- Pond elevation for Ponds A3, A4, B5, and C2 (must be continuously monitored for daily to hourly averages with instantaneous measurement capability)
- Measurements from piezometers in dams (indication of water pore pressure in dam structures)
- Daily to hourly visual inspections of dam integrity
- Results from the expert system that rates the above inputs to determine whether to release water from a dam despite water quality [Note: *Pond Operations Plan* (Kaiser-Hill et al., 1996) details decision tree that describes this logic]
- Pond discharge rates (pumped or through outlets; daily to hourly averages with instantaneous measurement capability)
- Weather prediction (affects the weighting factors in the expert system)
- Biannual dam inspections
- Annual Federal Energy Regulatory Commission (FERC) inspection

[5] Critical measurements, such as pond inflow rates and elevations, require hourly monitoring capability, even though daily monitoring may be adequate for a portion of the year. For example, during FY 1996 (FY96), hourly monitoring was actually used for 85 days during the year.

- Crest monument movement monitoring [required by *Code of Colorado Regulations* (CCR) for dams]

- Inclinometer monitoring (required by CCR for dams)

Boundaries:

Spatial: Flow in streams upgradient to Ponds A3, A4, B5, and C2 is used in decision making. Each individual dam and the water volumes in each pond is included in decision making. The only dams that are normally operated to contain or release water off Site are A4, B5, and C2 in the North Walnut Creek, South Walnut Creek, and Woman Creek drainages, respectively. (Woman Creek normally flows around Pond C2, through an artificial diversion. However, Pond C2 is directly in the natural drainage of Woman Creek and may receive overflow from Woman Creek during extreme flood conditions.) Pond A3 may also be included in this list as a terminal pond under some conditions, such as during construction activities in Pond A4.

Temporal: Information is collected at varying intervals based on the pond conditions and rate of change of the specific parameter. Daily or more frequent dam piezometer data, hourly in-flow data, and hourly to daily pond level data are all transmitted by telemetry. Most decisions are made Monday through Friday on a daily basis; however, during a crisis situation, hourly decisions may be made seven days a week. The Site also maintains instantaneous measurement capability for all telemetry data.

Decision Statements:

IF Water quality analytical results meet all applicable standards to protect downstream water users, and dam is at pond operations Action Level 3 or less [determined by piezometer readings (water level in dam structure), dam inspections, pool level, and inflow data]—

THEN The Site will discharge water from the pond.

IF A pond reaches Action Level 4 (i.e., exceeds its safe capacity based on data including piezometer readings, dam inspections, pool level, and inflow data)—

THEN The Site will release water (without waiting for analytical results) from the pond at a drawdown rate of one foot per day and notify the Colorado State Engineer and other specified agencies.

IF A pond reaches Action Level 5 [spillway overflow occurring or overtopping expected and/or breaching possible based on data including piezometer and inclinometer (measures the change in a slope, providing early warning of a potential dam failure) readings, dam inspections, pool level, inflow data]—

THEN The Site will release water (without waiting for analytical results) from the pond at a drawdown rate of 2 feet per day. Notifications to Colorado State Engineer and other agencies are required.

IF Routine or emergency dam inspections, inclinometer readings, piezometer readings, and/or other monitoring activities reveal changed conditions affecting the structural integrity of a dam—

THEN The Site will notify the Colorado State Engineer and other agencies, as required by the CCR (2 CCR 402-1, Rules 14 and 15) and *Colorado Revised Statutes* (CRS) (CRS 37-87-102 through 115), and develop alternatives, as necessary and appropriate, to correct the identified problem.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — The Surface Water IMP Team determines the frequency and type of monitoring specified as appropriate to identify any structural problems in a timely manner consistent with standard industry practices and applicable regulations.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — Does not apply.

Monitoring Requirements:

Monitoring requirements determined to safely operate the dams are presented in Table 2-1.

Table 2-1
Monitoring Requirements (Number of Samples/Analyses) for Safe Operation of Dams

Data Types Monitored	Pond											
	A1	A2	A3	A4	B1	B2	B3	B4	B5	C1	C2	Landfill
Inflow rate (telemetry measurement)	—	—	9/day [SW093]	9/day [GS12]	—	—	—	—	9/day [GS09]	—	9/day [SW027]	—
Inflow rate (field measurement)	1/week	1/week	1/day	1/day	1/week	1/week	—	—	1/day	—	1/day	—
Discharge rate (telemetry measurement)	—	—	9/day [GS12]	9/day [GS11]	—	—	—	—	9/day [GS08]	—	9/day [GS31]	—
Discharge rate (field measurement during discharge)	4/day	4/day	4/day	4/day	4/day	4/day	—	—	4/day	—	4/day	4/day
Pond elevation (telemetry measurement)	—	—	9/day	9/day	—	—	—	—	9/day	—	9/day	—
Pond elevation (field measurement)	1/week	1/week	3/week	3/week	1/week	1/week	—	—	3/week	—	3/week	1/week
Piezometers (telemetry measurement)	—	—	3/day	3/day	—	—	—	—	3/day	—	3/day	—
Piezometers (field measurement)	—	—	1/week	1/week	1/week	—	1/week	—	1/week	—	1/week	1/week
Routine dam inspection	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week	1/week
Biannual detailed dam inspection	2/year	2/year	2/year	2/year	2/year	2/year	2/year	2/year	2/year	2/year	2/year	2/year
Annual FERC and DOE dam inspection	1/year	1/year	1/year	1/year	1/year	1/year	1/year	1/year	1/year	1/year	1/year	1/year
Inclinometer (field measurement)	—	—	—	4/year	—	—	—	—	4/year	—	4/year	—
Crest monument movement (field measurement)	—	—	—	4/year	—	—	—	—	4/year	—	4/year	—
Use of computer expert system to predict pond filling and/or discharge events (using data from telemetry and field measurement)	1/week	1/week	1/week	1/ week	1/week	1/week	—	—	1/ week	—	1/ week	1/week

Notes:

Where nine measurements per day are indicated, this is the estimated average of critical measurements that are actually targeted. This varies from daily to hourly, and the hourly capability is required for 50-100 days per year. Instantaneous measurement capability is also desired for telemetry data.

— = Not applicable
DOE = Department of Energy
FERC = Federal Energy Regulatory Commission
Specific automated gauging station locations shown as: [GS12] for example

2.2.2 Source Location Monitoring

As used in this section a "source" is a contaminant source. The term "new source" as used in this section means any source that has not yet been located, halted, mitigated, quantified, or corrected. The parties intend that this decision rule will initiate appropriate action, even though a source may exist prior to the implementation of this IMP.[6]

Problem Statement:

When new contaminant sources are detected by surface water monitoring within the Industrial Area, at NSD locations, at POEs, at POCs, or in the downstream reservoirs, additional monitoring may be required to identify[7] the source and evaluate for mitigating action pursuant to the RFCA ALF. The Source Location Monitoring objective is used to locate the source of contamination when a new source of contamination is detected.[8]

Information Types and Frequency:

Analyte suites under this decision rule are determined based on the contaminant of current concern that has caused the exceedance, or related indicators. The information types are entirely dependent on the results of other monitoring objectives under which the source was detected. The analyte suites are limited to parameters which will aid in the identification and evaluation of a contaminant source.

Boundaries:

Spatial: Source location monitoring may be implemented anywhere within the Site surface water drainage area (especially within the Industrial Area) where a new contaminant source or exceedance is detected. The distribution of monitoring points is determined by the details of the specific source evaluation to determine source location and to efficiently utilize resources. For example, if monitoring (just outside the Industrial Area) for NSD suggests a new source within the Industrial Area, then portable sampling equipment may be installed within the Industrial Area to locate the source. And, if monitoring for compliance in Segment 4 suggests a new source, then monitoring to identify the source may begin in Segment 5.

Temporal: Source location monitoring should begin as soon as practical after source detection and continue until the source is identified and evaluated or is no

[6] A decision rule under the DQO process links Site environmental data with operational and regulatory decisions.

[7] Note that the term "identify" is used here to mean "locate." Characterization is also implied.

[8] The various monitoring objectives might "detect" a new source through an increase in baseline or exceedance of an action level, standard, permit limitation, etc., depending on the monitoring objective under which the potential new source was detected.

longer detected. The number of samples will be based on the status of the source evaluation, taking into account, but not limited to, weather conditions, water availability, and process knowledge.

Decision Statement:

IF A new contaminant source is identified by any monitoring objective—

THEN The Site will take appropriate and immediate action to halt or mitigate, locate and quantify the source, and implement mitigating action pursuant to the RFCA ALF.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — This decision rule is only invoked when new sources are detected under other monitoring objectives. Comprehensive monitoring for *detection* of new sources is an issue for other monitoring objectives. Comprehensiveness and representativeness may be developed for specific instances of source location actions.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — A generally applicable statistical sampling design has not been used.

Monitoring Requirements:

The need for source location monitoring stations is dependent on the results of monitoring under other objectives. Therefore, it is impossible to estimate the exact monitoring targets under the Source Location Monitoring objective for each year. In FY97, Pu water-quality exceedances were detected at GS03, GS10, and SW093. As part of the source evaluation, eight source location monitoring stations may be operated in FY98. For planning purposes, Table 2-2 contains estimated analyses supporting the FY98 source evaluations, that would be performed at multiple source location stations, to locate and characterize the sources contributing to any of the exceedances.

2.2.3 *Ad Hoc* Monitoring

The Site often monitors surface waters on an *ad hoc* basis for a variety of reasons. This monitoring may or may not be used in decision-making processes, but it has been frequently requested by DOE, RFFO, cities, agencies, building managers, and the WWTP in the past. The Surface Water IMP Team anticipates that the DOE, RFFO will continue to request such *ad hoc*

Table 2-2
Estimated FY98 Number of Samples and Parameter Collection Frequency for Source Location Monitoring

Gauging Station : Location Description	Pu, Am	TSS	Total Samples/Year
GS33: No Name Gulch at confluence with Walnut Creek	12	12	12
GS34: Walnut Creek above confluence with McKay Ditch	12	12	12
GS35: McKay Ditch at confluence with Walnut Creek	12	12	12
GS38: Central Ave. Ditch NW of Building 889	12	12	12
GS39: Ditch N of 904 Pad	12	12	12
GS40: Drainage Outfall E of Tenth St. S of Building 997	12	12	12
SW120: To be installed Drainage Ditch N of Solar Ponds inside PA along perimeter road	12	12	12
SW118: N. Walnut Creek W of Portal 3	12	12	12

monitoring in the future, regardless of whether funding is allocated for that purpose. This monitoring will not always require sample analyses. In some cases only flow alarms will be needed. Some examples that may warrant *ad hoc* monitoring include:

- Major precipitation events that disrupt routine pond predischarge monitoring and discharge schedules;
- Community assurance monitoring at the request of downstream cities and the DOE, RFFO;
- Unanticipated changes in regulatory permits, agreements, or funding;
- Anticipated but unfunded changes in permits or agreements;
- Construction projects;
- Spill events; or
- Operational monitoring (i.e. footing drains, septic lift stations).

The monitoring estimates in Table 2-3 are based on fiscal years 1995-1996 (FY95/FY96) actual monitoring, with spring 1995 sampling taken at 70% of actual to correct for the unusually high

monitoring requirements during April, May, and June of 1995. Analytes listed are typical of current and past monitoring, but actual monitoring for future periods will certainly differ from this estimate.

Table 2-3
Example of Estimated Annual *Ad Hoc* Monitoring Requirements
(Number of Samples/Analyses)

Analyses	995 Sand Filter Effluent	995 Influent	Pond					Walnut Creek at Indiana	Woman Creek at Indiana	Total
			A3	A4	B5	C1	C2			
Acute toxicity	—	—	2	—	—	—	—	—	—	2
Am-241	—	—	—	8	8	52	5	16	5	94
CBOD5	—	104	—	—	—	—	—	—	—	104
Fecal coliform	10	—	—	—	—	—	—	—	—	10
Gross alpha/beta	—	—	—	60	56	52	35	80	35	318
HSL metals	—	—	—	4	4	—	2	4	2	16
AA-Ag, As, Cd, Hg, Pb	—	—	—	4	4	—	2	4	2	16
NVSS	—	—	—	2	—	—	—	—	—	2
Pu-238	—	—	—	—	—	52	—	8	—	60
Pu-239/240	—	—	—	8	8	52	5	16	5	94
Tritium (H-3)	—	—	—	56	56	52	35	56	35	290
TSS	—	108	—	56	56	—	35	56	35	346
U-isotopic	—	—	—	8	8	52	5	16	5	94
Total samples for FY97	10	212	2	206	200	312	124	256	124	1446

Notes:
AA = Atomic absorption
Ag = Silver
Am = Americium
As = Arsenic
CBOD5 = 5-day carbonaceous biological oxygen demand
Cd = Cadmium
FY = Fiscal year
Hg = Mercury
HSL = Hazardous Substances List
NVSS = Nonvolatile suspended solids
Pb = Lead
Pu = Plutonium
TSS = Total suspended solids
U = Uranium

2.2.4 Monitoring for Correlation of Plutonium with TSS[9]

The Site intends to move toward controlled detention operation of the ponds in FY98. The controlled detention design basis indicator for Pu will be at first total suspended solids (TSS), which historical stormwater data have shown to be correlated with Pu activity (Gilbert, 1987) at several locations. This correlation was a primary assumption in the design basis for the controlled detention *Pond Operations Plan*[10] (Kaiser-Hill et al., 1996). To test these hypotheses, it is desired that samples be analyzed for Pu and TSS at selected monitoring locations to be used operationally for controlled detention discharge of the ponds in the future. This analysis may quantify the correlation between Pu and TSS.

Problem Statement:

> This monitoring objective is intended to establish the relationship of Pu concentrations with several indicator parameters, such as TSS, turbidity, or flow rate. The determination of relationships between Pu and indicator parameters will support future pond operations, investigations into actinide transport, and management decision making.
>
> The design basis for controlled detention is that Pu can be estimated as a function of TSS. Under controlled detention, the operational indicator might be turbidity, flow, or other indicators that can be monitored in real time. This section also addresses the correlation of Pu with other parameters that can be monitored in real time for operational decision making. TSS requires time for a laboratory analysis, so although it may provide a satisfactory design basis, it cannot be used as an operational indicator.
>
> This section specifies data needed to develop deterministic regression models for estimating Pu concentrations in Segment 4 (below the terminal ponds) on the basis of TSS or turbidity data from Segment 5 (above the terminal ponds) and from within the Industrial Area. This section will also provide data for models that could estimate the magnitude of Pu contaminant sources within the Industrial Area on the basis of data from Segments 4 and 5. With respect to surface water, research indicates a relationship may exist between the amount of Pu activity and the amount of TSS in the water. Radionuclides, including Pu, tend to associate with particulate materials. When particles are carried in surface water runoff, radionuclides attached to the particles are transported as well. Therefore, measuring the amount of TSS in runoff from a specific drainage area

[9] Note: This section on the relationship of Pu with suspended particulates is *not complete*. The material in this section has been retained for future use, but several fundamental issues must be resolved, and a major rewrite will almost certainly be required before indicator monitoring should begin. Consensus on this section may be difficult to achieve due to the concerns surrounding controlled detention operation of Site ponds. However, all members of the Surface Water IMP Team have agreed that decisions regarding controlled detention should be well-informed decisions based on monitoring data such as is identified in this section.

[10] Pu is transported primarily on particulates in stormwater.

can provide a characteristic ratio of Pu to TSS for that basin and insight into the amount of Pu activity being transported in the water.

If an initial correlation between Pu activity and TSS is determined for a drainage basin, it would prove useful for monitoring future cleanup and containment of Pu within that area. For example, removing a source of Pu-contaminated sediments from a watershed would result in less transport of Pu from the basin, and, barring the creation of new sources of contaminated suspended sediments, the Pu activity associated with a given TSS concentration would also have been lowered. Therefore, a decrease in the ratio of Pu activity to TSS would be indicative of the effectiveness of the source removal. In contrast, an increased ratio might indicate a new source of Pu.

Data from this monitoring would also support evaluations of the impact of D&D and watershed improvement activities.

Information Types and Frequency:

To evaluate the correlation between TSS, turbidity, and flow with Pu, monitoring at any three stations would suffice, but six stations should be monitored in case some do not correlate well. Since Pu is already monitored at terminal pond outfalls (POCs) and at the Industrial Area boundary (POE and NSD locations), flow, TSS, and turbidity (turbidity monitored real time) will also be monitored at these eight stations.

To evaluate the predictive capability of the real-time flow and turbidity parameters, the Site must monitor these parameters at locations most likely to be predictive and far enough upstream to provide at least 2 hours of warning before an exceedance could occur in Segment 4 (at a POC). These stations include POEs GS10, SW093, and SW027 and NSDs SW022 and SW091. Each of these stations will be equipped with real-time, water-quality probes to continuously monitor turbidity.

Ideally, TSS would be analyzed for all samples collected at the above locations. However, sampling protocols for these stations (detailed in Sections 2.4.1, 2.4.2, and 2.5.2) often result in composite samples that are collected over periods exceeding the 7-day hold time for TSS analyses. Therefore, TSS cannot be analyzed for all composite samples but will be analyzed when possible. For reference, NSD locations collect composite samples during singular runoff events, while POCs and POEs collect composite samples continuously during all flows.

Boundaries:

Spatial: Data may be acquired as far upstream as Segment 5 or even within the Industrial Area to predict Pu as far downstream as the reservoirs.

Temporal: No known constraints.

Decision Statement:

IF The correlation between total Pu activity and TSS exceeds 0.80 at three or more monitoring location pairs[11] for a period of six months or more, including peak spring runoff events and base flow, (Gilbert, 1987) (see reference)—

THEN Knowledge of this correlation is shared with the Actinide Migration Studies Team for further investigation. The Actinide Migration Studies Team will work with the RFCA monitoring team to determine whether the relationship between Pu and TSS is significant enough to be used as a design basis for operation of the ponds, and the Site may then attempt to establish the specific numerical values needed to design protective pond operations and structures. Results of these studies will be presented to stakeholders for consideration as a basis for operations.

An identical decision may be made for a relationship between Pu activity and turbidity, or a combination of TSS and turbidity, or other indicators. Note that use of the relationship between Pu and suspended particulates as a design basis for pond operations would not necessarily preclude real-time monitoring, short-term storage and screening, alternative routing of pond water, or other protective engineering features.

IF The Site can demonstrate mathematically that a regression model of discharged Pu as a function of turbidity and/or flow and/or another real-time parameter[12] would provide at least 4 hours of warning before discharged Pu would exceed the applicable RFCA standard so that outlet works could be closed or so that the effluent could be redirected,

AND IF A controlled detention terminal pond can be isolated from the WWTP and ITS—

THEN The parties to this document will actively support a full one-year trial of controlled detention for that terminal pond, subject to approval of the operational plan.

[11] Monitoring location pairs: Theoretically, monitoring for TSS at GS10 (east edge of Industrial Area) may predict Pu activity monitored at GS08 (below Pond B5). In this case, GS10 and GS08 would be a monitoring location pair.
[12] Precipitation and snow melting conditions may also provide an acceptable model.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — In order to provide a representative estimate of variability during FY98/FY99, it will be sufficient to monitor approximately one event per month at event monitoring stations (NSDs) and monitor a target of 20 samples taken over the full range of flow conditions, for each of the flow-paced stations (POEs and POCs). Monitoring at the POE and the NSD stations would represent the main drainage basins for which correlations are needed.

  — Each of the stations must continuously monitor for turbidity due to the method (continuous probe). Monitoring for Pu and TSS at each of the event monitoring stations (SW022 and SW091) during every sampled event would provide adequate confidence that significant events are sampled and representative at those locations. Monitoring for TSS at the flow-paced stations (GS10, SW093, SW027) should be performed only when Pu monitoring is performed and should provide at least 20 data pairs for FY98/FY99. The data set should include samples taken over the full range of flow conditions.

- *Acceptable Decision Error Rates for Statistical Sampling Design:*

  — Design of a sampling plan would require some knowledge of the variability, which is not yet available. Samples taken during FY98/FY99 will provide this variability information so that a statistical sampling design may be implemented when possible.

  — Acceptable decision error rate for the decision to accept the correlation between TSS and Pu as a design basis: $r^2 \geq 0.8$ for three or more locations.

Monitoring Requirements:

The requirements shown in Table 2-4 are partially redundant with other decision rule monitoring requirements, but are specified here to retain the independence and separability of the monitoring requirements for each decision rule.

Precipitation is currently measured in 5- and 15- minute intervals at nine locations around the Site. The effective precipitation for any monitoring location drainage basin can be calculated from these data.

Table 2-4
Annual Monitoring Targets (Number of Samples/Analyses) to Evaluate the Relationship of Plutonium with Indicator Parameters

Monitoring Location	Pu Analyses	TSS Analyses	Turbidity Measurement Frequency	Flow Measurement Frequency
Into the Ponds - Monitoring Indicators in Segment 5 for Pu in Segment 4				
SW093	10	10	15 min	15 min
SW027	10	10	15 min	15 min
GS10	10	10	15 min	15 min
SW022	12	12	15 min	15 min
SW091	12	12	15 min	15 min
Leaving the Ponds - Monitoring Pu in Segment 4, and correlation with indicators				
GS11	10	10	15 min	15 min
GS08	10	10	15 min	15 min
GS31	3	3	15 min	15 min

Notes:

—	=	Not applicable
hr	=	Hour
min	=	Minute
Pu	=	Plutonium
TSS	=	Total suspended solids

2.3 Industrial Area Monitoring Objectives

This section includes the monitoring objectives for decisions regarding the Industrial Area.[13] Some of the monitoring performed to make these decisions is actually performed outside the Industrial Area. For example, to detect a new source of contamination within the Industrial Area, the Site actually monitors surface water just after it flows out of the Industrial Area.

This Industrial Area Monitoring section also addresses monitoring of incidental waters, the sanitary system, and performance monitoring. Immediately outside the buildings of the Industrial Area, the Site must often decide whether incidental waters (see Section 2.3.1) that accumulate in berms, utility pits, etc, can be discharged directly to the environment, or whether they must be treated. Discharges to the sanitary system are monitored as discussed in Section 2.3.2. Internal waste streams are discussed in Section 2.3.2.1. To maintain current information in the NPDES permit application, the Site must characterize all routine internal waste streams to establish what might reasonably occur in discharges from these processes. Additionally, the Site routinely determines whether nonroutine internal waste streams (Section 2.3.2.2) may be discharged from the Industrial Area to the WWTP. In addition, NPDES monitoring must be performed on the WWTP discharge to the ponds.

2.3.1 Incidental Waters Monitoring

[13] In the surface water monitoring objectives, the term "Industrial Area" is intended to include the 903 Pad. Runoff from the 903 Pad flows through monitoring stations SW022 and SW027.

Problem Statement:

Incidental water is precipitation, surface water, groundwater, utility water, process water, or wastewater collecting in one or more of the following areas:

- Excavation sites, pits, or trenches;
- Secondary containments or berms;
- Valve vaults;
- Electrical vaults;
- Steam pits and other utility pits;
- Utility manholes;
- Other natural or manmade depressions that must be dewatered; or
- Discharges from a fire suppression system that has been breached within a radiological buffer area or a contamination area.

For example, many precipitation events leave rainwater in some utility pits and secondary containments. Disposition of such waters depends on the contaminants present, if any, that may have been picked up from the surroundings or contaminant materials. Waters containing oil, radioactive constituents, and hazardous substances may require management (e.g., treatment, storage, or disposal) under appropriate regulations, rather than by direct discharge. This Incidental Waters Monitoring objective provides for the routine data-driven decisions on whether to allow discharge of these incidental waters into the environment. The Site must determine how to manage incidental waters (i.e., whether or not to discharge to the environment[14]).

This decision includes only incidental (not routine) accumulations of water (not waste). Discharges of water containing oil, radioactive constituents, and hazardous substances above the established control limits are prohibited. This monitoring objective does not include decisions regarding appropriate treatment of contaminated waters for which authorization to discharge to the environment is denied. This monitoring objective does not require laboratory analyses of snow melt, rain water, groundwater, or potable water, unless there is reasonable cause to suspect contamination.

[14] The environment, in these cases, includes storm drainages, surface waters, and the surface of the ground.

This program manages incidental water discharges of greater than 50 gallons. Waters that are denied discharge authorization under this decision rule may be considered for discharge to the WWTP under the internal waste stream decision rule elsewhere in this plan, or they may be managed using other treatment, storage, or disposal options.

Data Types and Frequency:

The Site incidental waters program uses field screening observations and measurements, and chemical analyses for known or suspected constituents in order to determine the appropriateness of discharge to the environment. The field screening initial assessment is made on the basis of the screening criteria in Table 2-5.

Table 2-5
Incidental Waters Screening Criteria

Observation Parameter	Criterion
An estimate of volume	50 gallons
Process knowledge of the immediate vicinity	Professional judgement
Field pH using pH paper or similar indicator	pH 6 to 9
Appearance	Visible sheen or color
Field nitrate using probe, colorimetry, or similar indicator	10 mg/L
Field conductivity probe	700 µmho/cm^2

Notes:

µmho	=	Micromhos	L	=	Liter
cm^2	=	Square centimeter	mg	=	Milligram

Additional testing is performed when known or suspected contaminants exist, including tests for gross alpha/beta, volatile organic compounds, and metals.

Boundaries:

Spatial: This decision is restricted to accumulations of water within the Industrial Area and within the Site Buffer Zone, where such waters may accumulate in containment structures and be contaminated to levels unacceptable for discharge.

Temporal: Incidental waters are more common in rainy seasons, but may occur during any part of the year. Although the frequency of occurrence varies seasonally, there are no formal monitoring frequencies for the decision.

Decision Statement:

IF Incidental waters appear to be potable water or rain water accumulations that are collected in areas that have no potential for contamination (i.e., individual hazardous substance sites, material storage or handling areas, and high traffic areas) and initial screening tests or chemical analyses are negative—

THEN Incidental waters may be discharged to the environment at the discretion of the Surface Water Program manager. [15]

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — The Incidental Waters Program is well established, and there is low probability that accumulations of incidental waters would go unreported and unevaluated before being pumped and discharged to the environment.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — Recall that these accumulations of water in berms and utility pits are nearly always from rain, snow melt, groundwater, or potable water. If process knowledge, screening, and chemical analyses fail to indicate the presence of oil, or hazardous or radioactive substances, then the discharge is authorized. A single measurement or observation will be adequate, if performed at all. Therefore, a statistical sampling design is not applicable to this decision rule.

Monitoring Requirements:

Monitoring of incidental waters will require field observation and screening, and additional chemical analyses of an estimated 15 incidental water accumulations per month during FY98/FY99. For each instance, screening is required, with additional chemical analyses necessary when known or suspected contaminants exist. For planning

[15] Incidental waters may also be discharged to the WWTP, with approval of the WWTP manager. However, the decision logic for these DQOs is that incidental waters become internal waste streams if they fail to qualify for discharge to the environment. Logically, there are three possible outcomes for the incidental water: the water may be discharged to the environment, subjected to the internal waste stream decision, or the responsible organization may elect to employ other treatment, storage, or disposal options. Therefore, the formal decision for incidental waters addresses only the discharge to the environment. The decision to discharge to the WWTP is handled as the internal waste stream decision elsewhere in this document; and the decision to manage under other regulations is out of scope for this document.

purposes, estimated monitoring targets for this monitoring objective are presented in Table 2-6.

Table 2-6
Estimated Field Test Monitoring Targets (Number of Samples/Analyses) for Incidental Waters

Parameter	Justification	Measurements per Year FY98/FY99
PH	NPDES permit and stream standards restrict pH of plant discharges. Lab analysis of pH performed only if pH paper field test is inconclusive.	120
Nitrate as N	NPDES permit and stream standards have restrictive nitrate limitations.	120
Conductivity	Indicator parameter for metals. NPDES permit and stream standards restrict metals.	120
Gross alpha/beta	BMP to restrict radionuclides in SW discharges.	90
VOCs	NPDES permit and stream standards restrict VOCs in SW discharges.	30
Inorganic metals	NPDES permit and stream standards restrict metals in SW discharges.	10

Notes:

AoI	=	Analyte of interest
BMP	=	Best Management Practice
FY98/FY99	=	Fiscal years 1998 and 1999
N	=	Nitrogen
NPDES	=	National Pollutant Discharge Elimination System
VOCs	=	Volatile organic compounds
SW	=	Surface water

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; and
- Monitor within the collection system to establish pollutant loads attributable to specific industrial internal waste streams (e.g., laundry water at the Site).

Five distinct monitoring requirements have been identified for sanitary system monitoring. Separate decision rules have been developed for each of these requirements. The first monitoring requirement is to characterize routine internal waste streams to meet NPDES permit requirements. This requirement is distinct from the nonroutine, for which separate requirements and decision rules have been developed. Finally, three requirements were identified for monitoring of the WWTP influent flows. These include collection system flow monitoring, WWTP protective monitoring, and WWTP radiological influent monitoring. The requirements and unique decision rules are described in the following subsections.

2.3.2.1 Internal Waste Stream Characterization to Meet Permit Requirements

Both of the next two sections deal with internal waste streams (IWS) but have very different decision rules and monitoring requirements. These IWS Monitoring objectives address two of the most conceptually complex surface water decisions to be made. These are decisions regarding disposition of contaminated waste streams produced on Site. Some can be discharged to the sanitary system, some must be treated under the Resource Conservation and Recovery Act (RCRA), some require treatment for radionuclides under DOE Orders, and some require management by still other regulations. These related issues, neither of which is monitoring required by the RFCA, are introduced below:

- The first main NPDES issue is that the Site must maintain strict compliance with NPDES permit conditions. This compliance requirement drives two distinct monitoring activities:
  - The Site must monitor permitted discharges as specified in the permit and report as specified in the permit. This issue of NPDES compliance monitoring is covered below.
  - The Site must manage discharges to the WWTP for two reasons that are combined operationally under the “authorization to discharge” process:
    1. The Site must ensure that the operational capabilities of the WWTP are not exceeded, resulting in a permit violation for the WWTP effluent. This activity is covered in Section 2.3.2.2.

2. The Site must ensure that waste streams discharged to the WWTP are compliant with the NPDES permit, DOE Orders, and other regulations. This activity is also covered in Section 2.3.2.2.

- The second main NPDES issue is that of working with regulators toward well-informed decisions regarding permit conditions for the next NPDES permit or permit modification. (This is an ongoing process, so there is always a "next" permit or permit modification.) The Site provides input to the decision process through preparation and maintenance of the NPDES permit application. This second monitoring issue is covered in this section.

The quantity and complexity of this activity will increase during D&D and implementation of the 10-Year Plan. As the Site population decreases, the quantity of aqueous waste streams may decrease. But as the mission changes, process streams will undergo significant changes that must be reflected in the permit application. New challenging waste streams will arise more frequently as buildings are deactivated and drained of their fluid contents and as other facilities modify their operations accordingly.

Problem Statement:

Determining appropriate permit conditions is, in part, a data-driven process. The Site provides the data, and the regulators make the decisions. Data for these decisions are provided in the NPDES permit application. Data used in the permit application include detailed information about process streams emanating from buildings in the Industrial Area and discharged to the collection system. The nature of all Site processes and a detailed characterization of certain[16] discharges must be included in the permit application. These characterizations must include flow rates, constituents, and concentrations. Routine discharges are most likely to be monitored and may be incorporated in the NPDES permit.

Problem Scope:

The permit application has been supplemented with information about most internal waste streams and incidental waters that discharge to surface water. Sanitary discharges and process waste streams from all Site buildings, and discharges from Building 374, the WWTP, and the terminal ponds are potential monitoring targets included within the scope of this section.

The main objective covered in this section is that the Site must keep the permit application current. This will require that the Site characterize new waste streams for

[16] The Clean Water Act (CWA) regulations require specific information about waste streams that arise from categorical processes identified in 40 CFR 400-500.

disclosure in the permit application. The following are excluded from the scope of this section:

- Process or sanitary discharges of any quantity (internal waste streams) are subject to evaluation under Section 2.3.2.2.

- Incidental waters (which do not contain oil, or hazardous or radioactive substances) are covered in Section 2.3.1 of this document. Stormwater runoff monitoring is excluded from this section.

Data Types and Frequency:

- The following items are included in the permit application, as needed:

  — Complete NPDES application,

  — Update notifications that have been presented to the permitting agency,

  — Current drawings for each facility,

  — Descriptions of discharges from the facility to waters of the United States, and

  — Current available characterization for each discharge.

Boundaries:

Spatial: The data collected for this monitoring objective is limited to the Industrial Area. All facilities and all storm water drainages from the Industrial Area are included.

Temporal: This section has no temporal boundaries; it deals only with present and future discharges. The permit application requires resubmission every five years.

The actual data-driven decision is made by the regulator. That is the decision whether to establish a permit condition, limitation, or requirement in response to a specific contaminant concentration in a specific discharge stream described in the permit application.

Decision Statement:

IF Any facility on Site discharges wastes to surface water directly or indirectly through a treatment facility—

THEN The discharge must be characterized and must be reflected in the permit application.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — Site processes for review, notification, and approval of facility modifications are not fully implemented in some cases. Often, facility inspections are needed to provide complete identification and full disclosure of discharges. A planned approach to thoroughly inspect facilities and processes should be used to provide completeness for the permit application.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — Regulatory emphasis is on full disclosure rather than on accuracy. A rigorous statistical treatment is inappropriate for this decision because typically only one analysis will be performed. Therefore, sampling variability will not be evaluated and will not drive additional sampling to achieve some desired confidence level. Analytical results are required to be representative of typical conditions in discharged waste streams, but failure to report a discharge carries a greater risk than flawed characterization. Therefore, completeness is more important than the rigor of a statistically designed sampling protocol, except in those cases where the Site elects to negotiate a specific issue and requires project-specific monitoring data to negotiate that issue. Such monitoring is not addressed in this plan.

Monitoring Requirements:

For planning purposes, it is estimated that three new waste streams will require characterization each year during FY98/FY99 in order to maintain the NPDES permit application.

2.3.2.2 Monitoring Discharges to the WWTP

This section addresses the monitoring for granting authorization to discharge a waste stream to the WWTP. The Site must make frequent decisions regarding disposition of waste streams. Nonroutine incidental process discharges must be evaluated prior to discharge into the WWTP. NPDES, RCRA, and other regulations prohibit discharge of some hazardous, toxic, radioactive, and otherwise regulated materials to the WWTP.

This section covers nonroutine process or sanitary discharges. Incidental waters (which do not contain oil, or hazardous or radioactive substances) are covered in Section 2.3.1 of this document. Stormwater runoff monitoring is excluded from this section.

If waste streams may not be discharged to the WWTP, then they may need to be evaluated for treatment, storage, or disposal under appropriate regulations such as RCRA, CERCLA, or DOE Orders prior to discharge. However, monitoring for treatment decisions is outside the scope of this environmental monitoring plan.

There are five sets of criteria against which monitoring may be required to verify compliance, depending on process knowledge.

- NPDES regulations prohibit certain hazardous substances from being discharged to surface water. Table A-24 (see Appendix A to this section) shows a list of NPDES hazardous substances that must be considered (but not necessarily analyzed) during the characterization of each internal waste stream. Sampling required to characterize each discharge is subject to process knowledge available and is limited to those analytes reasonably expected to be present.

- WWTP operational capabilities limit the loading of many substances and the values of some physical parameters, such as pH, in the WWTP influent stream. Table A-25 (see Appendix A to this section) specifies these limitations.

- RCRA hazardous wastes are also prohibited from being discharged to surface waters, and discharge to the WWTP is regulated. RCRA regulations for listed, characteristic, and derived hazardous wastes are included in this document by reference only.

- Oil in WWTP influent streams is limited to 100 milligrams (mg)/L unless a greater loading is specifically authorized by the WWTP manager.

- Radionuclides discharged to the WWTP are limited to loadings that will not result in exceedance of Segment 4 stream standards under RFCA. As low as reasonably achievable (ALARA) also applies to discharges of radionuclides.

Data Types and Frequency:

Process knowledge is the most valuable indicator. Process knowledge might include the source of the waste stream, current location, and historic precedent. Screening inputs are shown in Table 2-7. Additional chemical analyses are performed when process knowledge and screening results are insufficient to adequately characterize a waste stream.

Table 2-7
Internal Waste Stream Screening Tests

- Process Knowledge
  - Location
  - Source
  - History
- Visible Sheen
- Color
- Clarity
- Volume
- Field Conductivity
- pH (paper)

Table 2-8
Requests (Number of Samples/Analyses)
for Authorization to Discharge

Requests	Total	Approved	Denied
Number of Requests for FY97	52	48	4
Number of Requests for FY98 (through May)	34	32	2

Notes:
FY = Fiscal year
Numbers shown are examples for planning purposes in future years

All facilities within the Industrial Area are included under this monitoring objective. This monitoring objective has no temporal boundaries, except that it deals only with present and future discharges. All liquids for which a facility requests authorization to discharge to the WWTP are included under this objective. Examples include chemical solutions, condensate, foundation drainage, some incidental waters that are not acceptable for discharge to the environment, and new process discharges.

Decision Statement:

The ideal decision rule is stated below.

IF A waste stream for which a facility has requested authorization to discharge to the WWTP fails to qualify under any applicable regulatory criterion—

THEN Do not authorize discharge to the WWTP.

This ideal rule requires the decision maker to be virtually omniscient. Some finite, practical, and protective monitoring must be implemented to approach the ideal. The practical decision rules used to implement this monitoring objective are presented below.

IF Process knowledge and the standard screening protocol shown in Table 2-7 offer no reasonable cause to suspect prohibited contaminants in a waste stream for which authorization to discharge has been requested—

THEN The Site will grant authorization to discharge to the WWTP, subject to approval of the WWTP manager.

IF Screening results[17] or process knowledge indicate that contaminants would prohibit the discharge under any applicable regulation—

THEN The Site will either:

- Deny the request to discharge; or
- Perform more specific analyses and evaluate the estimated contaminant load to the WWTP and estimated contaminant concentrations discharged to the main stream channels of waters of the state after passing through the WWTP or ponds.

IF More specific or more sensitive analyses indicate that the waste stream would not cause a violation of applicable regulations—

THEN The Site will authorize discharge to the WWTP with the approval of the WWTP manager.

[17] Screening results may be single values or averaged values at the discretion of the surface water manager or WWTP manager.

The responsible organization may elect to perform additional analyses at their expense to resolve concerns raised by process knowledge or screening tests.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative and Acceptable Decision Error Rates for Statistical Sampling Design:

  — A single sample will typically be appropriate, and a statistical sampling design will not be needed.

Monitoring Requirements:

The Surface Water IMP Team estimates that there will be approximately 40 requests each year for authorization to discharge during FY98/FY99. Each will be screened as specified in Table 2-7. This is due to grouping several similar waste streams (e.g., barrels) into single requests for administrative efficiency.

2.3.2.3 WWTP Collection System Protective Monitoring

At this time, collection system protective monitoring is minimal and consists of real-time monitoring for pH, conductivity, and Lower Explosive Limit (LEL) at two locations, in the equalization basins and at the headworks to the plant. Some manual pH readings are also taken by plant personnel at the headworks. As D&D proceeds and buildings with drains to the WWTP are impacted, the need to expand the collection system monitoring will be evaluated.

The pH and conductivity monitoring are indicators for corrosivity and spills. LEL readings are for protecting worker safety and have a separate decision rule.

Data Types and Frequencies:

The following indicators should be considered: pH, conductivity, LEL, and monitoring for radionuclides.

Boundaries:

Spatial: All collection system lines influent to the WWTP up to but not including lines inside the buildings inside the Industrial Area.

Temporal: This is real-time operational monitoring.

Decision Statement:

Proposed decision rules to be developed for FY98 are presented below.

IF pH or conductivity monitoring shows uncharacteristic changes over past results—

THEN The chief operator will be notified and will determine whether the influent should be rerouted to the flow equalization basin not currently in use while the problem is investigated.

IF The LEL is exceeded (see Table A-25)—

THEN Emergency procedures will be activated.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — To be determined.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — To be determined.

Monitoring Requirements:

To be determined.

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 (Building 990) 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.

Problem Statement:

The sanitary collection system consists of two components, one serving the Protected Area and one serving all areas outside of the Protected Area (PA and non-PA, respectively). Flows from the two areas remain segregated until they enter the equalization basins located at B990. Influent to the WWTP (B995) is monitored for pH, conductivity, and LEL on a continuous basis. These parameters are also monitored at B990 on both the PA and non-PA systems. None of these locations has a continuously recording flow monitoring device.

Data Types and Frequencies:

Installation of the described equipment will facilitate the collection of flow rates on the PA and non-PA collection systems. These inputs can be combined with currently recorded pH, conductivity, LEL levels, and precipitation and other existing continuous monitoring programs.

Boundaries:

Spatial: The areas described in the problem statement and scope are all areas at RFETS served by the existing sanitary collection system.

Decision Statement:

IF A baseline for flow does not exist—

THEN Develop a baseline and correlate its relationship with ground water levels and precipitation.

After developing a collection system flow baseline:

IF Flow in the PA or non-PA collection lines deviate from the baseline influent flows—

THEN Identify the source of abnormal flows and evaluate the impact on the sanitary collection system.

Monitoring Requirements:

Continuous flow monitoring of the sanitary collection system in the main transmission lines from the PA and non-PA areas into B990.

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 wastestreams containing radionuclides and the collection system.

Problem Statement:

With the onset of D&D activities and remedial actions, the possibility of introducing contamination into the WWTP exists. Monitoring is one way to track whether there is an impact by an unknown source to the WWTP as a result of clean up activities.

Data Types and Frequencies:

Influent WWTP monitoring will include the suite of radiological parameters: isotopic Pu, Am, uranium (U), tritium, plus alpha and beta activity. Influent flow is also a required input in order to determine the loading into the treatment plant. Effluent WWTP monitoring includes the suite of radiological parameters: isotopic Pu, Am, U, tritium, plus alpha and beta activity.

Boundaries:

Spatial: All collection system lines influent to the WWTP and WWTP effluent.

Temporal: Present and future influent and effluent to the WWTP.

Decision Statement:

IF A baseline for influent radiological levels does not exist—

THEN Establish a baseline with initial loading data for WWTP radiological influent monitoring.

After developing a influent radiological baseline:

IF Influent loading for any radiological constituents show a significant increase over the established baseline—

THEN An evaluation will be conducted to determine potential cause.

The WWTP radiological effluent monitoring data will be compared with influent data to evaluate WWTP removal efficiency.

Monitoring Requirements:

For the 1998 IMP, the Site will collect a 24-hour composite sample at the headworks to the WWTP, at a time representative of full operation of the complex (not on weekends). The volume of flow associated with the 24-hour composite needs to be provided by the Site and made available to CDPHE. CDPHE will pick up the composite sample from the Site and will perform the analyses and calculate the loadings. For 1998, the sampling frequency will be once per month.

The Site collects an 8-hour composite sample of WWTP effluent once a month. The sample is analyzed for isotopic Pu, Am, U, and tritium. Alpha and beta screens are performed twice monthly.

Sampling protocol and data quality objectives for WWTP monitoring are specified in the related sampling and analysis plan.

2.3.3 Performance Monitoring

Problem Statement:

This section addresses monitoring the performance of specific actions[18] on Site for the release of contaminants to the environment. Project-specific performance monitoring may 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 for the specific action being monitored. For example, performance monitoring for specific analytes may be needed for:

- D&D Actions: The review and approval process for a D&D action may identify the need for performance monitoring specific to that action.

- Remedial Actions: There are monitoring requirements associated with specific Operable Unit (OU) activities. For example, the existing consolidated treatment plant for OU1 and OU2 has a surface water discharge. Performance monitoring specific to this discharge is specified in the work plans.

[18] This is project specific versus the global monitoring (NSD and POE) of the Industrial Area discussed in Sections 2.4.1 and 2.4.2.

- Transition Actions: For example, DOE, RFFO has proposed changes in the operation of the ITS. Specific performance monitoring may be needed in light of this change if other monitoring in this IMP fails to provide adequate assurance of protecting the environment and public health.

- Best Management Practices (BMPs) for the Control of Plutonium Transport in Surface Water Runoff: For example, when a BMP (barrier, trap, filter, or other watershed improvement) is installed to control a potential source of Pu-contaminated runoff, the Site would like to determine the effectiveness of the BMP so that resources may be allocated where they are most effective.

Monitoring of activities within the Industrial Area is achieved, in general, through the NSD and POE monitoring (see Sections 2.4.1 and 2.4.2 for details).

Project-specific performance monitoring stations must be portable to monitor specific high-risk Site activities, such as D&D activities for a particular building. These mobile, temporary stations will be placed upstream from the routine monitoring stations, closer to specific Site activities to monitor a sub-basin for releases of contaminants specific to the activity in the sub-basin.

Boundaries:

Spatial: Performance monitoring can occur anywhere within the Site surface water drainage areas (especially within the Industrial Area), downstream from a BMP, remediation, or high-risk activity.

Temporal: Generally, monitoring is initiated with enough time prior to project activities such that 10 - 15 samples over varying flow rates can be collected (preferably 18 months prior to project initiation[19]). Results from these samples are used to establish a baseline for the sub-basin. Monitoring continues during the activity attempting to collect one sample per month. After project completion, monitoring continues long enough to determine any beneficial impacts to surface-water quality.

Data Types and Frequency:

The types of data to be collected must be specified in the project plan. Analyte suites are generally determined by the constituents of concern associated with a specific activity or location. Generally, automated samples are flow-paced composites of 15 grabs taken on

[19] Due to the dynamic nature of Site Cleanup, initiation of performance monitoring 18 months prior to an activity is rarely achieved. However, additional samples are often collected at an increased rate to establish baseline prior to initiation of project activities.

the rising limb of a runoff event. However, protocols may be modified depending on the specific conditions for a monitoring location or drainage basin. For example, a location with substantial groundwater seepage or a periodic footing drain discharge may warrant monitoring of those flows. Regardless, the sampling protocols are designed to accurately characterize existing flows and confidently monitor for changes during the project activities.

With the administrative transfer of OU2 monitoring (see Table 2-9) to the IMP to facilitate closeout of OU2 IM/IRA activities, quarterly grab samples are collected and analyzed as specified in the OU2 closure document. Reporting for these locations will be included in the quarterly report and no longer be reported in the Consolidated Water Treatment Facility report.

Decision Statement:

Decision rules must be specified for individual projects. A project-specific indicator might be a single monitoring result, a 30-day average for a specific analyte, or an indicator for the analyte of concern. Example decision rules are shown below.

IF	The project-specific indicator is greater than the 95% upper tolerance level (UTL) of baseline—
THEN	The Site will evaluate the specific activity to improve performance.
IF	The project-specific indicator is less than the 95% lower tolerance level (LTL)—
THEN	The Site will conclude that the project has reduced environmental releases of the specific contaminant.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:
  - — The specific project plan must specify an adequate monitoring method.
- Acceptable Decision Error Rates for Statistical Sampling Design:
  - — The specific project plan must specify the decision criteria. Examples are shown in the decision rule section, above.

Monitoring Requirements:

Monitoring details will be specific to the project. The projected performance monitoring to take place in FY98 is given in Table 2-9. Analyte suites and sample collection protocols are project-specific and are contained in the individual project plans for automated locations. This same information can be found in the Surface Water (SW) Monitoring Technical Design Document (RMRS, 1996) which can be obtained from RMRS Water Management and Treatment (WM&T) personnel. The performance monitoring for FY99 will depend on Site closure activities and schedules.

Table 2-9
Projected FY98 Performance Monitoring Locations

Location Code	Location Description	Project	Supporting Documentation
GS27	Small ditch NW of B884	D&D of B889; Watershed Improvements evaluation	SW Monitoring Technical Design Document
GS32	Corrugated metal pipe (1.5 ft) north of Solar Ponds in PA draining B779 area	D&D of B779	SW Monitoring Technical Design Document
GS37	Central Ave. Ditch north of B443	D&D of B123	SW Monitoring Technical Design Document
GS39	Corrugated metal pipe (1.0 ft) north of 904 Pad draining 903/904 Pads and Contractor Yard areas	ER projects for 903 Pad; also serves as Source Location monitoring station for GS10 Source Evaluation	SW Monitoring Technical Design Document
SW061[20]	S. Walnut Creek upstream of B995	OU2 Closure	Final Surface Water Interim Measures/Interim Remedial Action Plan/ Environmental Assessment and Decision Document, S. Walnut Creek Basin
SW132	S. Walnut Creek, outfall of culvert draining 700 and 900 Areas, south of B995	OU2 Closure	Final Surface Water Interim Measures/Interim Remedial Action Plan/ Environmental Assessment and Decision Document, S. Walnut Creek Basin

[20] The inclusion of SW061 and SW132 monitoring in the IMP completes the OU2 IM/IRA administrative transfer of former OU2 monitoring.

2.3.4 National Pollutant Discharge Elimination System Permit Monitoring

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. The Site's first NPDES permit was issued by EPA in 1974. The current permit was reissued by EPA in 1984, expired in 1989, and has been administratively extended to date. A draft permit has completed the public comment process and is awaiting issuance by EPA. All monitoring for NPDES compliance is prescriptively required by EPA and is not covered by the IMP process or detailed in this document. Please refer to the current permit for specific monitoring requirements.

Current Permit:

> The current permit for the Site identifies six monitoring points 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.

Draft Permit:

> The draft permit for the Site is expected to address only two permitted discharge points, the WWTP effluent and Building 374 product water effluent. The other previously permitted discharge locations will be regulated under CERCLA via the RFCA. Additional expanded scope includes plans and procedures for operations of influent/effluent storage tanks, influent monitoring at WWTP, internal wastestream monitoring, stormwater monitoring, stormwater pollution prevention plan, and WWTP influent real-time radiological monitoring feasibility study.

2.4 <u>Monitoring Objectives for Industrial Area Discharges To Ponds</u>

This section addresses monitoring of surface water before it arrives in the terminal ponds (i.e., surface waters running off of the Industrial Area to Segment 5 waters upstream of the terminal ponds). These discharges are the major transport pathways available for contaminants leaving the Industrial Area. Ongoing activities and remediation tasks at the Site could create new contaminant source areas within and around the Industrial Area and could thus degrade downstream surface-water quality. For example, a D&D or remediation project could result in the release of contaminants to soils near the facility, which could be transported via runoff into Site drainages, and possibly off Site.

The Site must monitor runoff to detect significant spills or leaks from ongoing activities such as remediation, D&D, construction, and continuing operations. Merely monitoring the terminal

pond discharges is not adequate to protect water quality above the terminal ponds (in compliance with RFCA requirements), or to detect acute contaminant runoff from significant new sources within the Industrial Area.

2.4.1 New Source Detection Monitoring

The NSD Monitoring objective provides comprehensive coverage of the entire Industrial Area but is not specifically focused on individual actions within the Industrial Area. Performance monitoring of specific activities within the Industrial Area (or elsewhere) may be carried out under the Performance Monitoring objective. This NSD objective monitors the performance of all remedial activities within the Industrial Area with respect to their impact on surface waters. However, it does not necessarily identify and locate a specific source within the Industrial Area.[21] This monitoring objective provides for monitoring of all main drainages from the Industrial Area into the three main channels of Stream Segment 5.[22]

This NSD monitoring is one of many possible spill response actions, but spill response is not the primary focus of the NSD Monitoring objective. Sampling and analysis of spills is addressed in other Site planning documents, such as the *Spill Prevention, Control, and Countermeasures/Best Management Practice Plan* (SPCC/BMP) (EG&G, 1992a).

Data Types and Frequency:

This decision requires contaminant concentration data from surface water samples taken at permanent monitoring locations located on the five main surface water pathways to the Site detention ponds. Analyses are performed for each of the contaminants and parameters listed below in order to establish a baseline. After a baseline has been established, evaluations will be performed as required by the decision rules. The basis for selecting these contaminants of concern and indicator parameters is described below.

- Isotopic Pu, U, and Am are primary contaminants of concern.
- Turbidity, pH, nitrate (NO_3), and conductivity are measurements performed continuously because they are inexpensive per measurement and can be used as real-time indicators to provide or negate reasonable cause to analyze for other specific contaminants.
- Turbidity may indicate increased contaminant loads in general and increased Pu specifically. (Pu in surface water is generally bound to particulates.)

[21] Location of a specific source would be performed under the Source Location Monitoring objective in Section 2.2.2.

[22] The Site also desires early detection of smaller releases within the Industrial Area, by monitoring closer to the anticipated sources during D&D activities. This will be achieved through the Performance Monitoring objective (see Section 2.3.3).

- pH can be used to detect an acid or caustic spill.
- Nitrate may be useful in detection of chemical spills that include plutonium nitrate.
- Conductivity can be used to corroborate a pH reading and to detect salt solution spills or metal spills such as chromium (Cr), beryllium (Be), silver (Ag), or cadmium (Cd).
- Precipitation can be used to determine whether a flow event is rain/snow runoff or a spill. Precipitation data is collected at nine locations across the Site. Effective precipitation for a given monitoring location drainage can be calculated.
- Water flow rate is needed to identify an event, trigger an automatic sampler, control the flow-paced sampling, and evaluate the magnitude of the spill or contaminant source (mass loading).
- Small changes to base flow not attributable to rain or snowmelt or an unusual runoff hydrograph shape may indicate a spill.

This monitoring objective is limited to information collected at the Industrial Area boundary, as represented by surface-water monitoring stations SW022, SW091, SW093, SW027, and GS10[23] (see Figure 2-4). This monitoring focuses on runoff into the three main drainage areas leaving the Industrial Area: North Walnut Creek, South Walnut Creek, and the South Interceptor Ditch/Pond C2 drainage (see Figure 2-3 and Figure 2-4). Normally, SW022 waters are subsequently monitored at GS10, so there is some redundancy in this set of monitoring stations. SW022 has been included at the request of the EPA to provide increased sensitivity for its drainage area. SW022 would also be used to determine the location of any new source detected at GS10.

For SW022 and SW091, sampling is event-specific, focused on the time period during which the first flush conditions prevail; specifically, the time period during the rising limb of a direct runoff hydrograph after any storm event. Automatic samplers are triggered when direct runoff is detected at the location [for example, >0.1 cubic feet per second (cfs); location specific].[24] The sample is analyzed when the runoff volume [for

[23] Subdrainage monitoring stations within the Industrial Area are used for performance monitoring and source location but are excluded from the planned monitoring for this NSD decision rule.

[24] Note that specific boundary conditions are not procedural, legal, quality assurance (QA), or policy requirements. They serve only to clarify the objective so that a decision rule can be articulated. The flow rate and volume given in the text are only examples and may never actually be used in the field. These parameters vary greatly, depending on the season and the character of runoff events common during that season (e.g., snow melt or thunder shower). The parameters are selected such that representative samples can be collected on the rising limb for varying flow rates, runoff conditions, and seasons.

example, >25,000 gallons (gal)] is sufficient such that a flow-paced composite sample (in a 15-L carboy) can be collected that represents the first flush (presumed water-quality worst case). Seasonal adjustments are applied to define the conditions that represent first flush and direct runoff. Professional judgement will be used to select the most representative sample for each month from each station for analysis, when a sample is available for that month at that station. Samples are selected to provide analytical results for rising limbs with varying flow rates and runoff characteristics. This monitoring pushes the limits of the sampling equipment, and collection of one representative sample a month is an appropriate goal.

For SW093, GS10, and SW027, the information used in the NSD objective will be the same data as collected from the continuous flow-paced sampling used for monitoring Segment 5 action levels (see Section 2.4.2). These POE stations have base flow, whereas the other two stations do not.

Only surface-water runoff from the Industrial Area is included, (i.e., base flow, stormwater runoff flow, and spills to surface water). Spills are only included in this NSD monitoring as a secondary monitoring objective if an increase in flow rate is detected and cannot be attributed to precipitation, snow melt, or other previously monitored discharge. However, other management controls (e.g., SPCC/BMP) address monitoring of spills as a primary objective. These locations also provide confirmation that containment measures for spills or accidental discharges have been effective through monitoring of the real-time indicator parameters and subsequent analyses of collected samples.

Indicator monitoring will be performed for the parameters specified at the top of each column of Table 2-10. The first three columns are AoIs monitored directly through sample analytical measurements. Although these three columns and rows have a different relationship than the others, they have been included so that all monitored parameters are shown on the same table. The remaining columns are indicator parameters that are monitored with inexpensive real-time probes in lieu of analyzing for the AoIs identified at the left of each row. If a significant increase is detected in any one of these indicator parameters, then there is reasonable cause to suspect the presence of the AoI identified at the left end of the row in which an "X" appears. For example, if the nitrate probe detects a high nitrate concentration, then the Site would have reasonable cause to suspect the presence of plutonium nitrate, extreme pH, cadmium nitrate, and, of course, high nitrate, all of which are AoIs for Segment 5. If there were reasonable cause to suspect the presence of these AoIs, then the Site could perform additional analytical procedures specific for the AoI.

Decision Statement:

Screening for reasonable cause to suspect a new source:

IF The mean concentration of any of the screening indicator variables in Table 2-10 exceeds the 95% UTL of baseline for that variable—

THEN The Site will evaluate the need for further action under RFCA ALF, such as source evaluation and control. Evaluations will address persistence, trends, and risk of action level exceedances at POEs.

Table 2-10
Screening for New Source Detection AoIs vs. Indicator Parameters

	Routinely Monitored Parameters							
	Monitored AoIs			**Indicator Parameters for AoIs**				
AoIs	**Pu**	**U**	**Am**	**Turbidity**	**pH**	**Conductivity**	**NO_3**	**Flow Rate and Precipitation**
Plutonium	X			X			X	X
Uranium		X						X
Americium			X	X				X
Turbidity				X				X
pH					X		X	X
Conductivity						X		X
Nitrate						X	X	X
Chromium					X	X	X	X
Beryllium						X		X
Silver						X		X
Cadmium						X	X	X

Notes:

Am = Americium
AoIs = Analytes of interest
NO_3 = Nitrate
Pu = Plutonium
U = Uranium

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — The Site desires detection through sampling of runoff events within a month of a significant new contaminant release.[25] This is achieved through sampling all major drainages from the Industrial Area during high flow and analyzing approximately one sample per station per month. The Site must monitor runoff events at four locations (SW093, SW091, GS10, and SW027) to provide an acceptable level of confidence that significant events will be observed. Monitoring at SW022 is not required for the desired confidence.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — Baseline is defined by an average value for the parameter of interest over all monitored precipitation events for a single baseline year, at the discretion of the DOE, RFFO. A single measured value is accepted as representing a contaminant of interest. If a single measured value exceeds the 95% UTL of baseline, that will provide adequate confidence of new source detection and invoke the action(s) specified by the decision rule.

Monitoring Requirements:

Table 2-11 presents detailed monitoring requirements for this decision rule. Analytical and real-time, water-quality probe indicator monitored parameters are in Table 2-10.

[25] Runoff events may be more than a month apart. The intent here is to detect a release to the environment from within the Industrial Area that is being flushed out of the Industrial Area by a runoff event within a few weeks.

Table 2-11
Monitoring Requirements (Number of Samples) for New Source Detection

Monitoring Station	SW093	SW091	GS10	SW027	SW022
Sample Analyses					
Total Pu-239/240	12/year[a]	12/year	12/year[a]	12/year[a]	12/year
Total Am-241	12/year[a]	12/year	12/year[a]	12/year[a]	12/year
Total U Isotopes	12/year[a]	12/year	12/year[a]	12/year[a]	12/year
Real-Time, Water-Quality Probe Indicator Parameters					
pH	15-min	15-min	15-min	15-min	15-min
Specific Conductivity	15-min	15-min	15-min	15-min	15-min
Turbidity	15-min	15-min	15-min	15-min	15-min
Nitrate	15-min	15-min	15-min	15-min	15-min
Flow	15-min	15-min	15-min	15-min	15-min
Precipitation	Site-wide locations				

Notes:
[a] Only SW091 and SW022 will be monitored for the rising limb of the hydrograph, as originally specified for this decision rule. Stations SW093, SW027, and GS10 are the Segment 5 action level (POE) monitoring stations. At these Segment 5 stations, NSD will be performed by statistically testing the flow-paced sample results. The same test criterion will be used, except that flow-paced samples will be tested against flow-paced variability. These locations will collect more than the target 12 samples for the NSD objective. All results collected at these locations under the POE objective will be used in the NSD objective.

Am	=	Americium	Pu	=	Plutonium
U	=	Uranium	min	=	minute

2.4.2 Stream Segment 5/Point of Evaluation Monitoring

This monitoring objective deals with POE monitoring of Segment 5 for adherence with RFCA action levels. RFCA provides specific criteria for virtually every possible contaminant for the main stream channels of Segment 5. In Table A-26 (presented at the end of this section in Appendix A), the DQO team identified a subset of those contaminants that are of sufficient interest to warrant monitoring. Figure 2-3 illustrates the stream segments, and Figure 2-4 shows the monitoring points used for various decisions.

Responses to exceedances at POEs are different than the responses associated with contaminated runoff before it reaches Segment 5 or after it enters Segment 4. Industrial Area monitoring upgradient of Segment 5 is designed to detect new contaminant sources within the Industrial Area. Downstream, Segment 4 is monitored at POCs to determine compliance with RFCA standards. This subsection of the document deals with POE monitoring of Segment 5 for compliance with RFCA action levels.

Historical data indicate that several regulated contaminants may exceed their RFCA action level criteria at the designated POEs. Such exceedances will require source evaluation and the development of a mitigation plan. The initial response to these exceedances might be to invoke the source location decision rule, perform special monitoring tailored to the specific source evaluation, and take action upstream of Segment 5 to protect Segment 5 from contaminant sources that caused such exceedances.

Data Types and Frequency:

The necessary decision inputs are those analytes specified as the Segment 5 AoIs per Table A-26 (see Appendix A to this section), as sampled at the POEs for Stream Segment 5. Segment 5 includes the terminal ponds (A4 and B5), and the main stream channels of North and South Walnut Creek, Pond C2, and the SID. Monitoring will be performed for Stream Segment 5 only as represented by POEs SW093, GS10 and SW027 (see Figure 2-4).

Sampling for AoIs at POEs is performed by collecting continuous flow-paced composite samples. Indicator parameters are measured using real-time, water-quality probes. These AoIs and indicator parameters are evaluated using 30-day or 1-day moving averages, as specified in RFCA[26] and implemented by the ALF or DQO working groups involving consensus of all parties to RFCA. Pu, Am, U, Be, Cr, dissolved Ag, and dissolved Cd are evaluated using volume-weighted 30-day moving averages at these POEs.[27] Indicator parameters pH and nitrate are evaluated as one-day arithmetic averages (averaging of pH takes into consideration the logarithmic characteristics of pH measurement).

Moving averages are to be calculated for the preceding period, verified by additional analyses at the discretion of the monitoring organization, and formally reported to the DOE, RFFO within 30 days of gaining knowledge that an exceedance may have occurred (i.e., within 30 days of receiving a high analytical result). This 30-day period allows time for verification analyses after the monitoring organization gains knowledge that an exceedance may have occurred before formal notification to DOE, RFFO of an actual exceedance is required. RFCA requires that DOE, RFFO inform regulators within 15 days of DOE, RFFO gaining knowledge (not just a suspicion) that an exceedance

[26] Moving averages are to be calculated on whatever data are available, which may range from N=0 to more nearly ideal sample sizes computed on the basis of variability and confidence levels, unaffected by budgetary constraints. Where N=0, the average is not available. Where N=1, the average is the value for that single sample.

[27] The 30-day average for a particular day is calculated as a volume-weighted average of a "window" of time containing the previous 30-days which had flow. Each day has its own discharge volume (measured at the location with a flow meter) and activity (from the sample carboy in place at the end of that day). Therefore, there are 365 (366 in a leap year) 30-day moving averages for a location which flows all year. At locations that monitor pond discharges or have intermittent flows, 30-day averages are reported as averages of the previous 30 days of greater than zero flow. For days where no activity is available, either due to failed laboratory analysis or NSQ for analysis, no 30-day average is reported.

(verified) has (actually) occurred. During this 45-day period between first suspicion and formal notification to regulators, the DOE, RFFO may initiate discretionary mitigating action. The delay interval will prevent undue public alarm when the initial high result is not confirmed by subsequent monitoring. Informal communications between the parties are intended during the delay interval.

Decision Statement:

IF The appropriate summary statistic[28] for any AoI[29] in the main stream channels of Stream Segment 5, as monitored at the designated POEs,[30] exceeds the appropriate RFCA action level—

THEN The Site must notify EPA and CDPHE, evaluate for source location, and implement mitigating action[31] if appropriate.[32]

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — The flow-paced monitoring method ensures that significant events will be sampled. This method involves taking a fixed volume [e.g., 200 milliliters (ml) or 1 L] into the composite sample carboy (e.g., 15 - 22 L) as each Nth volume of flow [e.g., 500 L or 73,000 cubic feet(ft^3)] passes the monitoring point. Approximately 75 to 110 grab samples can be composited in the sample carboy with sufficient grab sample volume repeatability.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — Variability is not known for flow-paced monitoring. Therefore, decision error rates cannot be estimated. Sampling design was based, instead, on flow and professional judgement.

The decision error types and consequences for Segment 5 are presented in Table 2-12.

[28] Appropriate action levels and standards for volume-weighted, 30-day moving averages or 1 calendar-day arithmetic averages, are specified for individual contaminants in RFCA.
[29] AoIs are specified in Table A-26 in Appendix A to this section.
[30] POE monitoring stations for Segment 5 are designated in Figure 2-4.
[31] Mitigating action may include, but not be limited to, the following examples: 1) immediate action to halt a discharge or contain a spill; or 2) use of the source location decision rule to seek out and mitigate upstream contaminant sources.
[32] RFCA may actually specify consequences for an exceedance of any action level (not just those for AoIs) at any location within the segment (not just at the consensus monitoring points). This decision rule presents the consensus decision rule that drives our monitoring activities. It is an implementation, rather than a reiteration, of RFCA.

Statisticians from the Pacific Northwest National Laboratory (PNNL) evaluated sampling protocol designs based on the decision error limitations shown in Table 2-12, but historical data were inadequate to determine the number of samples needed to meet these decision error limitations.[33] Therefore, the statistical design team recommended a pilot study or alternatively that the initial design be based on flow. This design should be reevaluated (vs. Table 2-12) after flow-paced data become available.

Table 2-12
Decision Error Types and Consequences in Segment 5

Error Type	Consequences
Failure to determine that an exceedance has occurred.	If the true average concentrations of AOIs are above RFCA action levels but data fail to detect this, the Site may not be compliant with RFCA.
Incorrect determination that an exceedance has occurred.	The Site would be required to provide notification, planning, a schedule, and response action that consumes limited resources when no exceedance had actually occurred, and the response would not be justifiable.

The decision error limitations shown in Table 2-13 were not used to design and specify the FY98/FY99 monitoring targets. They are retained here, however, for use in future sampling designs when variability becomes known for the flow-paced sampling method. Note that the decision error limitations shown in Table 2-13 are based on the assumption that failure to detect an exceedance is more important than falsely reporting an exceedance when no exceedance has occurred. The DQO team discussed this issue, but consensus was not achieved. When flow-paced data become available and the sampling design is reevaluated, this issue will be resolved.

[33] Actually, the statisticians were able to provide sample sizes based on historical data variability, but these sample sizes were impractically large due to the high variability in historical sampling methods (storm flow samples taken from the rising limb of the hydrograph). Because the FY98/FY99 monitoring at POEs will use, in part, the flow-paced method (with much lower variability expected) sample sizes based on historical variability would be inappropriate.

Table 2-13
Proposed Decision Error Limit Design Constraints for Segment 5 Monitoring

"Assumed-True" Parameter Value	Correct Decision	Acceptable Probability of Making an Incorrect Decision
0.1 x action level	Does not exceed action level	0.05
0.5 x action level	Does not exceed action level	0.10
0.5 to 1 x action level	Does not exceed action level	Gray region: No probability specified
2 x action level	Exceeds action level	0.05
4 x action level	Exceeds action level	0.01

Note:

This table is retained for future use, but was not used for FY98/FY99 decision rules.

Monitoring Targets:

The recommended monitoring design for the Site is to take samples for FY98/FY99, as specified in Table 2-14, and analyze each sample for the Segment 5 AoIs specified in Table A-27, attempting to take no less than one sample per quarter and no more than four sequential carboy samples per month from each of the three monitoring points for each month. The ideal sampling rate is one 15-L sample carboy for each 500,000 gallons of stream flow, and each 15-L sample carboy should comprise approximately 50 flow-paced grab samples.

Table 2-14 presents the number of samples per month recommended by statisticians at PNNL. There are both practical and statistical advantages to this sample allocation design. Averaging a larger number of samples is more expensive, but it protects the Site from regulatory action in response to a spurious nonrepresentative monitoring result.

There are secondary advantages to this monitoring plan. A larger number of samples allows for estimates of variability that can be used to refine the monitoring plan over time. The monitoring program specified here is a technically defensible approach that represents a compromise between a statistical design, a design based on professional judgement, and a design based on budgetary constraints. This design will generate data that are representative of actual contaminant levels and loads.

This design is consistent with the intent of the 30-day moving average specified in RFCA but allows some flexibility. Where there is no significant flow, there may be no samples completed within a 30-day period, and where the flows, loads, and variability are expected to be higher, sample numbers are also higher. Note that flow-paced monitoring will continue during dry periods, even though flows may be so low that it takes more than 30 days to fill the composite sample carboy.

Table 2-14
Monitoring Targets (Annual Number of Composite Samples) for Segment 5 POEs

	SW093	GS10	SW027
Month	**Number of Samples**		
October	3	3	0
November	4	3	0
December	2	1	1
January	2	1	0
February	2	2	0
March	4	4	1
April	4	4	4
May	4	4	4
June	4	4	4
July	2	3	0
August	2	2	0
September	3	3	1
Annual Total	36	34	15

Note: Total samples for all 3 stations = 85

Alternative Minimum Required Monitoring:

Although one sample per month would be adequate to demonstrate the Site's compliance status to EPA or CDPHE, there is a significant chance of declaring a false exceedance associated with smaller sample sizes. However, if budgets and priorities make the possibility of regulatory action preferable to the expense of the recommended sample sizes, then the Site may elect to gather samples as specified in Table 2-14 but analyze only one composite of those independent and sequential samples per month per station, and then perform additional analyses only if an exceedance is suggested in the composite and the historical mean for that AoI is below the action level at that monitoring station.

Several planning assumptions were adopted to estimate the minimum monitoring requirements for this high risk approach:

- Only one exceedance will be established for a single AoI at all three POEs in Segment 5, and the mitigation plan in response to that exceedance will establish increased work scope but no additional monitoring.

- Based on statistical evaluation, only Pu will exceed its action level. Thus, in the first month, Pu would incur one analysis from each station. No verification analyses would be performed because the historical average is greater than the

action level. Therefore, the exceedance does not cause a change in the number of analyses during the first month.

- After the initial exceedance, only one sample per station per month would be taken.

- This one sample would be a composite that does not exceed a new criterion established by the mitigation plan.

The resulting projection of absolute minimum analytical requirements for Segment 5 is detailed in Table 2-15.[34]

Table 2-15
Estimated Minimum Segment 5 Action Level Monitoring Requirements

Analyses	Sampling Protocol
Plutonium	3(1+11) = 36
Uranium	3 x 12 = 36
Americium	3 x 12 = 36
Beryllium	3 x 12 = 36
Chromium	3 x 12 = 36
Silver	3 x 12 = 36
Cadmium	3 x 12 = 36
Hardness	3 x 12 = 36
pH	Continuous
Conductivity	Continuous
Turbidity	Continuous
Nitrate	Continuous
Flow	Continuous

[34] Note that this approach is contrary to the approach negotiated by the DOE, RFFO and approved during development of the IMP. This approach would incur significant risk of exceedances and regulatory response actions. Although Segment 5 may not be subject to penalties for exceedances, there would be increased risk of failure to notify, plan, schedule, and implement mitigating actions due to the much larger number of exceedances resulting from natural variability of single sample preparations and analytical results (rather than averages), combined with reduced resources and a smaller work force.

2.5 Monitoring Objectives for Terminal Detention Pond Discharges and Water Leaving the Site

This section covers all surface water monitoring in streams leaving the eastern Site boundary (Indiana Street). This water is designated as Stream Segment 4a and/or 4b. This water is first monitored prior to discharge from the terminal ponds. Monitoring for RFCA compliance in Stream Segment 4 takes place at the terminal pond outfalls, and in both Woman and Walnut Creeks, near Indiana Street (RFCA POCs). Additional non-POC monitoring at Indiana Street has been identified by the working group and is described at the end of this section.

2.5.1 Predischarge Monitoring

As the Site moves into its accelerated cleanup, there is a possibility that new or increased levels of pollutants will be introduced into the pond systems from activities in the Industrial Area. The other monitoring objectives in this IMP are focused on specific analytes and indicators of greatest concern. Flow-paced monitoring of those parameters for pond inflows is comprehensive. However, some unusual contaminant could be overlooked by the other monitoring objectives. It is important, therefore, to include a comprehensive analysis at some point, even when the historical data show no previous exceedances. The single sample predischarge monitoring is the least expensive method for including a comprehensive analytical suite in this IMP.

Under normal batch pond operations, nearly all water produced at the Site (including surface water runoff, treated effluents, and various approved process waste streams) is detained in one of three terminal ponds. The terminal ponds serve as the last control[35] point for the water before it leaves the Site.

For these reasons, predischarge monitoring is needed for a full range of constituents, including radionuclides, inorganics, and organics. Samples should represent the water to be discharged (i.e., grab samples should be depth integrated where applicable, and addition of water to the discharge should be minimized after the grab sample is taken). If the State of Colorado believes that the first sample is not representative of the discharge, the State may request, and the Site will provide, one additional predischarge sample if the discharge has not yet begun, or a during-discharge sample if the discharge is not yet complete. However, because of dam safety, the Site has sole discretion to determine the schedule for discharges, independent of any action the State may take with regard to predischarge monitoring. If the predischarge monitoring suggests an exceedance of a contaminant that is also monitored by flow-paced methods, the parties recognize that the flow-paced methods would be more representative of the discharge compliance status.

[35] The Site's control over impounded water is quite limited. There are no treatment options readily available, and the detention time is limited by the capacity of the pond and the rate of influx from precipitation and other sources.

It is the intention of the parties that for predischarge monitoring the Site will perform the sample collection and that CDPHE will perform the laboratory analysis and reporting functions of the completed analytical data to the Site.

Data Types and Frequency:

It is estimated that a total of 8-10 predischarge samples will be taken annually from the ponds in the Walnut Creek drainage and one sample per year is expected to be taken from Pond C2 in the Woman Creek drainage. CDPHE will analyze the samples for an extensive list of constituents, including inorganics, metals, volatile organics, semivolatile organics, radiologic parameters, herbicides, and pesticides. The final list will be detailed in CDPHE's annual monitoring plan.

This predischarge monitoring is limited to Ponds A4, B5, and C2, or any other pond functioning as a terminal pond (e.g., Pond A3 during construction in Pond A4). Samples are intended to be taken far enough in advance of the discharge so that isolation, containment, flow-paced compliance monitoring (at the terminal pond outfall POCs), or other actions can be taken to mitigate an exceedance, but near enough to the time of discharge that the sample is representative of the discharge. It is the intent of all parties that sampling will be performed so that results are known prior to discharge.

Decision Statement:

IF Predischarge monitoring results suggest apparent exceedances of the applicable stream standards—

THEN CDPHE may notify the Site of additional AoIs for that discharge.

- The Site would then perform flow-paced POC monitoring for the additional AoI(s) during the discharge, as part of the Segment 4 compliance monitoring (see Section 2.5.2); and

- The Site may evaluate other water management options, including but not limited to treatment, storage, or disposal, rather than immediate discharge.

It should be noted that the results of predischarge monitoring can only indicate an *apparent* exceedance because:

- The water sampled is impounded and not discharged at the time of sampling (the predischarge sampling protocol applies to water to be discharged); and

- The single grab predischarge sample does not necessarily reflect the quality associated with a 30-day moving average, against which nearly all standards are measured.

If an apparent exceedance is reported, DOE, RFFO has the responsibility to decide management alternatives. It is the intent of the parties that predischarge monitoring is not enforceable under RFCA, but it will be performed as a prudent management practice that all parties endorse.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — Predischarge monitoring is a routine practice. It is unlikely that a discharge would occur without predischarge monitoring.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — The parties intend that only one sample will be taken. No statistical sampling design is needed.

Monitoring Targets:

Monitoring analyses to be performed by CDPHE are shown in Table 2-16.

Table 2-16
Predischarge Monitoring Targets (Number of Samples/Analyses)

Analytical Parameter	Average Analyses per Month
Volatile organic analyses (502.2)	0.8
Chlorinated herbicide analyses (515.1)	0.8
Semivolatiles (525.2)	0.8
Selected Hazardous Substance List metals (total/total recoverable)	0.8
Selected Hazardous Substance List metals (dissolved)	0.8
Total dissolved solids	0.8
Total suspended solids	0.8
Nitrate/Nitrite as N	0.8
Nitrite an N	0.8

Table 2-16
(continued)

Analytical Parameter	Average Analyses per Month
Total phosphate	0.8
Orthophosphate	0.8
Ammonia	0.8
Sulfide	0.8
Gross alpha	0.8
Gross beta	0.8
Plutonium/uranium/americium	0.8
Tritium	0.8
pH	0.8
Dissolved oxygen	0.8
Conductivity	0.8
Totals	16.8

Note: Numbers of analyses are based on historical pond discharge operations.

2.5.2 Stream Segment 4/Point of Compliance Monitoring

RFCA provides specific standards for Walnut and Woman Creeks below the terminal ponds (Segment 4). These criteria and the responses to them are different than the criteria and actions associated with Segment 5. This section deals only with monitoring discharges from the terminal ponds into Segment 4 and the additional points of compliance for Segment 4 at Indiana Street. Terminal pond discharges will be monitored by POCs GS11, GS08, and GS31. Walnut Creek will be monitored at Indiana Street by POC GS03. Woman Creek will be monitored at Indiana Street by POC GS01. These locations are shown on Figure 2-4.

With the completion of the Woman Creek Reservoir, located just east of Indiana Street and operated by the city of Westminster, all Woman Creek flows will be detained in cells of the new reservoir until the water quality has been assured by monitoring of Site discharges via Woman Creek at Indiana Street (at GS01). Reservoir water will then be pumped from Woman Creek Reservoir into the Walnut Creek drainage below Great Western Reservoir.

In the past, the majority of natural flow in Woman Creek was diverted to Mower Reservoir and did not exit the Site via Woman Creek. This is no longer the case; the Mower Ditch headgates have been upgraded, and all flows in Woman Creek will leave the Site via Woman Creek (at GS01) and enter the Woman Creek Reservoir. In the past, Pond C2 (located off channel in the Woman Creek drainage) was predischarge sampled and subsequently pumped from Woman

Creek into the Walnut Creek drainage on Site. Currently, the Site pump discharges Pond C2 directly into Woman Creek (at GS31), which then flows to the Woman Creek Reservoir.

There is concern that meeting standards for radiologic parameters in Pond C2 discharge does not adequately demonstrate that all water leaving the Site via Woman Creek and entering the Woman Creek Reservoir is meeting the radiologic standards. Other Woman Creek water (combined with Pond C2 or flowing in the absence of any Pond C2 water) will enter the Woman Creek Reservoir. This is the basis for setting an additional RFCA POC for Woman Creek at Indiana Street (GS01) for those radiologic contaminants that could be directly attributable to the Site (i.e., not naturally occurring).

A similar point of compliance, GS03, will be established at Walnut Creek and Indiana Street. Although the Walnut Creek drainage is not undergoing operational changes like those in Woman Creek, it is possible that contaminated overland runoff or landfill drainage may enter Walnut Creek below the terminal pond monitoring points (GS11 and GS08), yet upstream of Indiana Street.

Data Types and Frequency:

- RFCA AoIs, as sampled for Stream Segment 4 terminal pond discharges (see Table A-27 in Appendix A to this section).
- Isotopic Pu, Am, and tritium at Indiana Street POCs.
- Source(s) of the water sampled. Monitoring at Indiana Street POCs GS01 and GS03 calls for samples to be segregated based on water origin (natural creek flows or terminal pond discharges commingled with natural flows).
- Samples collected will be continuous flow-paced composites.
- Flow-paced monitoring is maintained at all times for all five POCs in Segment 4, even though no samples are anticipated from terminal pond stations except during planned pond discharges.

Terminal pond discharges currently occur approximately once per year for Pond C2 and nine times per year for Ponds A4 and B5. Since the DQO process targeted 3 samples per discharge, terminal pond POCs currently target 30 composite samples to be collected annually.

During FY97, all routine North and South Walnut Creek water was discharged from Pond A4. (Pond B5 was pump transferred to Pond A4 with the exception of IDLH operations requiring

direct discharge of Pond B5, see Section 2.2.1.)[36] Therefore, sampling protocols will be modified for FY98/FY99 such that the number of continuous flow-paced composite samples to be collected annually for discharge from either Pond A4 or Pond B5 will be comparable to FY97. For fiscal years 1993 through 1997, the total combined discharge volume for Pond A4 and Pond B5 was 687 thousand gallons (Mgals) in 43 discharge batches, or 16 Mgals per discharge on average. Targeting three composite samples per discharge gives one composite sample per 5.3 Mgals of discharge volume. This modification will preserve the targeted sampling frequencies (based on discharge volume) while maintaining effective cost controls (based on total sample costs). For planning purposes, 8 samples will be collected from Pond A4, and 19 from Pond B5, resulting in the collection of the targeted 27 composite samples (see Table 2-19). However, this sample planning is dependent on the routing for the WWTP effluent. Any future changes in the management of Walnut Creek water could result is sampling protocol modifications while preserving the initial intent of the DQO process. For Pond C2 discharges, three composite samples will be collected per discharge, regardless of volume.

The Indiana Street stations would generate the same number of samples during discharges, plus additional samples from storm runoff and base flow between discharges. GS01 will collect three samples for the one expected Pond C2 discharge, and storm runoff and base flow samples based on average annual volumes. During storm runoff and base flow, the target is one sample per 500,000 gallons, with a maximum of three samples during any one month (see Table 2-19). GS03 will collect the targeted 27 samples during Pond A4 and Pond B5 discharges. (GS03 will collect the same number of composite samples as the terminal pond POCs for each discharge). During storm runoff and base flow periods between discharges, GS03 will target two samples per period. The goal is to have two analytical results for any 30-day period for averaging purposes. The Site reserves the right to combine samples of the same flow pacing to save resources, as long as two sample results are available for any 30-day period. This sample frequency increase from FY97 for GS03 is a result of sampling protocol changes due to the occurrences of NSQ samples in FY97.

POC monitoring will be confined to Stream Segment 4 only, as represented by samples taken from the terminal pond discharges at GS11, GS08, and GS31, and the Indiana Street monitoring stations (GS01 and GS03). Table 2-17 shows the associations between monitoring locations and station designators.

[36] It is expected that Pond B5 will be periodically direct discharged to Walnut Creek using the new outlet works. This discharge scenario is subject to agreement by the concerned parties.

Table 2-17
POC Monitoring Station Designators for Segment 4

Pond A4	GS11
Pond B5	GS08
Pond C2	GS31
Walnut Creek at Indiana Street	GS03
Woman Creek at Indiana Street	GS01

Decision Statement:

IF The volume-weighted 30-day moving average[37] for any AoI in Stream Segment 4, as represented by samples from the specified RFCA POCs (i.e., terminal pond discharges and Indiana Street) exceeds the appropriate RFCA standard—

THEN RFCA requires that DOE, RFFO inform regulators within 15 days of DOE, RFFO gaining knowledge (not just a suspicion) that an exceedance (verified) has (actually) occurred:

- Notify EPA, CDPHE, and either Broomfield or Westminster, whichever is affected;
- Submit a plan and schedule to evaluate for source location, and implement mitigating action if appropriate; and
- The Site may receive a notice of violation.

Note that for the Indiana Street POCs, the only compliance monitoring to be performed is for Pu, Am, and tritium activity as measured at GS01 or GS03.[38]

[37] The 30-day average for a particular day is calculated as a volume-weighted average of a "window"of time containing the previous 30-days that had flow. Each day has its own discharge volume (measured at the location with a flow meter) and activity (from the sample carboy in place at the end of that day). Therefore, there are 365 30-day moving averages for a location that flows all year. At locations that monitor pond discharges or have intermittent flows, 30-day averages are reported as averages of the previous 30 days of greater than zero flow. For days where no activity is available, either due to failed laboratory analysis or NSQ for analysis, no 30-day average is reported.

[38] GS01 and GS03 are the POC monitoring stations for Woman Creek at Indiana Street, and Walnut Creek at Indiana Street, respectively.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:

  — The Site will attempt to gather at least one sample representative of each pond discharge event, and multiple sequential samples may be taken. Flow-proportional monitoring will be maintained at all times but may not be effective during dry periods when evaporative losses would invalidate the data, or when samples are inadequate for analysis due to a variety of operational problems.

- Acceptable Decision Error Rates for Statistical Sampling Design:

  — The decision error types and consequences for Segment 4 are presented in Table 2-18.

Table 2-18
Decision Error Types and Consequences in Segment 4

Error Type	Consequences
Failure to determine that an exceedance has occurred.	Potential for downstream water quality impacts.
Incorrect determination that an exceedance has occurred.	The Site would be required to provide notification, planning, a schedule, and response action that consumes limited resources when no exceedance has actually occurred, and the response would not be technically justifiable. The Site may also be subject to inappropriate fines or penalties or other regulatory action.

CDPHE and EPA representatives on the DQO team favored a simple decision rule that would be easier to explain to a concerned public. This led to a decision rule that placed equal emphasis on false alarms and failures to detect exceedances. The statistical design team recommended that the initial design be based on flow, and that this design should be reevaluated after flow-paced data become available.

Monitoring Targets:

Table 2-19 presents monitoring targets for Segment 4 POCs. The overall strategy is to sample each discharge as stated in the *Data Types and Frequency* text above. This plan assumes 8 samples per year from Pond A4, 19 samples from Pond B5, and 3 samples from Pond C2. There is no storm or base flow immediately below the dams. At Walnut

Creek and Indiana Street (GS03), the Site assumes that 27 samples will be collected annually during discharges from Ponds A4 and B5, and two samples of storm runoff and base flow during the periods between discharges (approximately 20 samples). The Site will attempt to schedule discharges from Ponds A4 and B5 concurrently. Therefore, approximately 10 discharge cycles per year will occur in Walnut Creek. At Woman Creek and Indiana Street (GS01), the Site plans to take three samples during one Pond C2 discharge per year and volume based number of samples each month for storm runoff and base flow periods. The increase in storm runoff and base flow samples at GS01 is due to the new routing of Mower Ditch water to Woman Creek Reservoir and the corresponding increase in volume to be monitored. Note that the analyte lists for the terminal pond discharges are different than the analyte lists for the Indiana Street POCs.

Table 2-19
POC Monitoring Targets (Number of Samples/Analyses) for Segment 4 POCs

Time Period	Pond			Walnut Creek at Indiana Street	Woman Creek at Indiana Street	Total Number of Samples
	A4	B5	C2			
During Discharge	8	19	3	27	3	60
Storm and Base Flow						
January	--	--	--	1	2	3
February	--	--	--	1	2	3
March	--	--	--	2	3	5
April	--	--	--	2	3	5
May	--	--	--	2	3	5
June	--	--	--	2	3	5
July	--	--	--	2	2	4
August	--	--	--	2	2	4
September	--	--	--	2	0	2
October	--	--	--	1	1	2
November	--	--	--	2	2	4
December	--	--	--	1	2	3
FY Totals	8	19	3	47	28	105

Note:
-- = Not applicable
FY = Fiscal year

2.5.3 Non-POC Monitoring at Indiana Street

The State of Colorado has proposed to conduct this non-POC monitoring as a prudent management action, and it is the intent of the RFCA parties that no enforcement action will be taken on the basis of this monitoring. There are several reasons to monitor for certain possible contaminants and nutrients in the water leaving the Site in both drainages. The actions to be taken on the basis of this monitoring are variable and may not be known until the monitoring results are available.

The CWQCC is moving toward waste load allocations for all segments of the Big Dry Creek drainage. Nutrient loadings generated by the Site are carried off Site via Walnut Creek, which either can bypass the Great Western Reservoir or be directed into the reservoir. Water bypassing the reservoir enters Segment 1 of Big Dry Creek, which then flows into the South Platte River. The Broomfield water replacement project will result in changes to the quantity and quality of water that could enter Great Western Reservoir. For these reasons, it will be necessary to monitor nutrient loads leaving the Site under all three of these conditions:

- Water leaving the Site via Walnut Creek that is 100% Site pond discharge (either originates as surface water on Site or is used and potentially contaminated by the Site before discharge from terminal ponds);

- Water leaving the Site via Walnut Creek is 100% stream flow and does not include pond discharge; and

- Water leaving the Site via Walnut Creek that is a mixture of Site discharge and stream flows.

With the changes in flow configuration in the Woman Creek drainage, there is a need to monitor to determine new ambient levels for various analytes at monitoring station GS01. The results of these analyses will be used to determine what changes in water quality, if any, have occurred as a result of the new flow configuration.

Data Types and Frequency:

The complete list of analytes (analyzed by CDPHE) are given in Table 2-20. The real-time parameters will be collected by the Site. Note that pH and temperature are needed to calculate un-ionized ammonia, and that the parties intend to drop monitoring for Be, Cd, Ag, and Cr in the FY98 monitoring plan, unless FY97 monitoring results provide reasonable cause for concern. Nutrient analysis samples are grab samples. Un-ionized ammonia analyses are for samples from Walnut Creek at Indiana Street.

The source(s) of water at these locations during any sampling event must be identified. Sample collection frequency will be as follows:

- Walnut Creek:

  — Five per year for 100% Site effluent (pond discharges),
  — Five per year for mixed effluent and natural stream flow, and
  — Five per year for 100% natural stream flow.

- Woman Creek:

  — Five per year not during Pond C2 discharge, and
  — One per year during Pond C2 discharge.

Table 2-20
Non-POC Monitoring Requirements (Number of Samples/Analyses)
at Indiana Street

Analyte	Number of Samples
Total ammonia	21
Nitrite	21
Nitrate	21
Total phosphate as P	21
Orthophosphate	21
Be, Cd, Ag, Cr	21
Isotopic uranium	21
pH	Continuous 15 min intervals
Temperature	Continuous 15 min intervals
Conductivity	Continuous 15 min intervals
Flow	Continuous 15 min intervals

Notes:

Five samples at each of the three flow mixtures in Walnut Creek, plus one Woman Creek sample during Pond C2 discharge and five samples when Pond C2 is not discharging: (5 x 3) + 1 + 5 = 21. CDPHE will take their own grab samples independently for all nutrients, four metals, and U.

Ag = Silver
Be = Beryllium
Cd = Cadmium
CDPHE = Colorado Department of Public Health and Environment
Cr = Chromium
min = Minute
P = Phosphorous
POC = Point of compliance
U = Uranium

Non-POC monitoring is limited to Stream Segment 4, as represented by samples taken from Walnut Creek at Indiana Street and Woman Creek at Indiana Street (GS03 and GS01, respectively).

At different times, the water flowing off Site has differing composition of Site and natural stream flow. Samples will be scheduled so as to be representative of this variable composition.

Decision Statement:

IF Concentrations or loadings of specified contaminants in Woman Creek exceed their 95% UTLs—

THEN CDPHE will notify the Site and cities, and the Site may propose a change in ambient standards.

No formal action has been identified as being dependent on nutrient monitoring of Walnut Creek at Indiana Street. The data may or may not be used in determining a waste load allocation for the Site in the future.

Acceptable Decision Errors:

- Confidence that Significant Events are Physically Sampled and Representative:
  - — No special measures are needed beyond standard operating procedures.
- Acceptable Decision Error Rates for Statistical Sampling Design:
  - — To be decided after variability is determined through FY97 monitoring.

Monitoring Targets:

One objective of FY97 nutrient load monitoring was to establish the variability of the data so that FY98 monitoring can be statistically designed. Three samples would be the absolute minimum required to estimate variability. Five samples for each parameter are planned. This monitoring is presented in Table 2-20.

2.6 Off-Site Monitoring Objectives: Community Water Supply Management

Contaminants generated by operations at the Site may have migrated off Site and impacted the downstream reservoirs. In addition, D&D activities at the Site may increase the risk of environmental contaminant release. The potential for the public to be exposed to contaminants originating from the Site that can impact the community water supplies engenders public

concern. Government officials in the downstream communities must respond to this public concern with adequate and timely monitoring data.

The ultimate decision regarding the management of community water resources rests with the affected community; however, monitoring data generated by other entities, such as CDPHE and the Site, are used to assess potential impacts, demonstrate acceptable water quality, and allay consumer concerns. These data are critical inputs for operational decisions.

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 ditches 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:

- Flow that has the potential to exceed the capacity of the Walnut Creek Diversion Ditch and enter Great Western Reservoir instead of being diverted around the reservoir; and

- Water quality in downstream waters that may have been impacted by unmonitored effluent from the Site.

Data Types and Frequency:

- Flow at the following monitoring locations:

  — Pond A4: North Walnut Creek, GS11,
  — Pond C2, GS31,
  — Pond B5: South Walnut Creek, GS08,
  — Woman Creek at Indiana Street, GS01,
  — Walnut Creek at Indiana Street, GS03, and
  — McKay Ditch (currently monitored by temporary source location monitoring station GS35).

  Flow from these stations is needed to evaluate:

  — The potential for Walnut Creek to exceed the capacity of the Walnut Creek Diversion Ditch [estimated at 40 cubic feet per second (cfs)] and spill over into Great Western Reservoir, and

— The relative contribution of various sources (ponds, storm drainages) to the total flow leaving the Site.

After the release event, water quality data may be evaluated in combination with flow data to estimate the total impact. Note that the flow data will already be available from monitoring performed under other decision rules.

- Water quality as follows:

  — Analytes are shown in Table 2-21.

  — Note: Constituents appearing on the "Short List" represent a minimum analyte list for all unplanned releases or discharges. Some or all of the constituents on the "Long List" may be necessary depending on the nature of the event, the source of the release, and the receiving water. The composition of either list may change depending on activities at the Site at the time of the event. Samples should be taken, but not necessarily analyzed, for all possibilities.

Table 2-21
Off-Normal Discharge Monitoring Inputs

Constituent Group	Short List	Long List
Radionuclides	Pu, gross alpha/beta (rapid turnaround indicator)	Gross alpha/beta, Pu, Am, U (isotopic), tritium
Physical properties and general water quality measurements	pH, temperature, turbidity, TSS, conductivity or TDS	pH, temperature, turbidity, TSS, conductivity, TDS, hardness, alkalinity, fluoride, chloride, sulfate
Nutrients	Nitrate + nitrite	Nitrate, nitrite, ammonia (total and un-ionized), orthophosphate, total phosphorus
Organics	None	VOCs (EPA 524.2)
Metals	None	All metals having stream standards (As, Be, Cd, Cr, Cu, Fe, Pb, Mn, Hg, Ni, Se, Ag, Zn)

Notes:

Ag	=	Silver	Ni	=	Nickel
Am	=	Americium	Pb	=	Lead
As	=	Arsenic	Pu	=	Plutonium
Be	=	Beryllium	Se	=	Selenium
Cd	=	Cadmium	TDS	=	Total dissolved solids
Cr	=	Chromium	TSS	=	Total suspended solids
Cu	=	Copper	U	=	Uranium
Fe	=	Iron	VOC	=	Volatile Organic compound
Hg	=	Mercury	Zn	=	Zinc
Mn	=	Manganese			

- Action levels:

— Action levels would be the applicable CWQCC standard for the potentially impacted downstream segment (Segments 4a/b and 5).

- Sampling locations:

  Specific locations are event-driven, but may include:
  — Walnut Creek at Indiana Street, GS03,
  — Woman Creek at Indiana Street, GS01, or
  — Great Western Reservoir (only necessary if release of surface water enters Great Western Reservoir).

- Sampling frequency:

  — Event driven; only when uncharacterized water leaves the Site.

- Sample type:

  — Walnut and Woman Creeks at Indiana Street: If flow-paced composite sampling as specified under POC monitoring cannot be conducted, then grab samples will be collected as soon as the event is detected and every 4 hours thereafter until continuous monitoring is reestablished or the event terminates.
  — Reservoirs: Representative reservoir sampling will be conducted in accordance with the event and as agreed by the impacted parties. At a minimum, a surface composite sample, consisting of grab samples collected at various points in the reservoir, and a depth composite sample will be collected 48 hours after the event.

Geographically, this monitoring objective is bounded by the Walnut and Woman Creek basins, from the western Site boundary to the main stem of Big Dry Creek. However, the downstream communities are primarily concerned about the negative impact of contaminants leaving the Site on downstream reservoirs and water supplies; thus the monitoring locations of interest are:

- Woman Creek at Indiana Street, GS01;
- Walnut Creek at Indiana Street, GS03;
- Great Western Reservoir;
- Woman Creek Reservoir; and
- Mower Reservoir.

For this decision, monitoring would only be required when water of unknown quality leaves the Site. Under routine operations wherein surface water is under full management

control of the Site, dam safety is not threatened, and POC monitoring is conducted as specified under Section 2.5.2, this monitoring is not needed.

Decision Statement:

IF Surface water of unknown or unacceptable quality leaves the Site

THEN The affected community will take appropriate protective measures until analytical data show that water quality is acceptable for the intended use.

For example, in the event of a contaminant release to Woman Creek Reservoir, Westminster might refrain from discharging water downstream until water quality has been analyzed and determined to be acceptable.

Acceptable Decision Errors:

Because this monitoring is event-driven, decisions regarding necessary and sufficient monitoring must be based on the nature of the event. Samples may be single grab samples, location composites, or time composites. Statistically-based sample sizes will not be used for development of this FY98/FY99 monitoring plan.

Monitoring Targets:

For planning purposes, no uncharacterized discharges are projected for FY98/FY99. If such a discharge does occur and this monitoring is needed, then the number and type of samples would be determined on a case-by-case basis.

2.6.2 Community Assurance Monitoring

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 have made it necessary for the communities to reassure residents that their environment is safe. 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. Citizens' concerns are more effectively addressed by a routine monitoring program to measure the contaminants of concern at the locations of concern, than by institutional controls, modeling, and on-Site monitoring. The minimal community monitoring needed to provide this assurance is relatively inexpensive and demonstrates a community commitment on the part of DOE, RFFO. This community monitoring and Site monitoring are discussed at the Quarterly Information Exchange Meetings. The DOE, RFFO has also sponsored a dose reconstruction study for the Site.

Adequate and timely information regarding the impact of the Site on the neighboring environment is needed so that the communities can respond to citizens' concerns and the Site can

foster a credible public image. Inadequate monitoring results in poor public relations, impaired trust, increased public resistance to proposed activities at the Site, *and increased mandatory monitoring*. The necessity for repeated public meetings and clean-up delays due to negative public comment may increase costs of operating the Site.

Data Types and Frequency:

- Sampling locations:
  - 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. Ongoing assessment is needed to address these question.
  - For FY98/FY99, Great Western Reservoir is the only sampling location needed.

- Sample types:
  - Quarterly depth-integrated composite samples are adequate to characterize the contaminant concentration in Great Western Reservoir.

- Sampling methods:
  - City personnel routinely conduct sampling in Great Western Reservoir and will collect the necessary samples for this objective as part of Broomfield's sampling program.
  - A sampling protocol acceptable to all parties will be developed and documented.

- Analytical methods:
  - Analytical methodology must be adequate to provide detection limits comparable to those reported by CDPHE since 1992—approximately 0.003 picocuries (pCi)/L for treated water and 0.006 pCi/L for raw water.

- Analyte list:

  This monitoring is limited to radionuclide contamination that is potentially attributable to the Site.

  — Pu-239/240,
  — Am-241,
  — U, isotopic (at least U-233/234:U-238), and
  — Tritium.

  The total number of samples needed for this monitoring objective would be four samples per year for FY98/FY99.

  The hydrologic regime for the Great Western Reservoir will change over time as the cities' irrigation and reuse projects are implemented. Sampling locations, types, and frequencies will be reevaluated to reflect these changes.

Decision Statement:

IF The potential for public exposure to contaminants attributable to the Site causes reasonable concern in the neighboring communities—

THEN Monitoring to quantify contaminant concentrations and provide the necessary information must be performed.

The response to a significant change in contaminant levels would be a different decision. The monitoring objectives described in previous sections are designed to prevent increased concentrations in the community drinking water systems. These community assurance monitoring data are used to address routine inquiries and to respond to occasions of unusual public concern. The data have been needed in the past and should be considered in future planning.

Acceptable Decision Errors:

Sufficient sampling and analysis must be performed to provide credible assurance that community water quality is adequately monitored and understood. A high level of confidence that the monitoring meets the desired objective is necessary. Because the type of monitoring involved is inconsistent with multiple samples, the required certainty must be achieved through appropriate sampling procedures, adequate sample volumes, laboratory quality control, and good analysis validation protocols.

Monitoring Targets:

Monitoring requirements for this section are presented in Table 2-22.

Table 2-22
Monitoring Targets (Number of Samples/Analyses) for Community Assurance Monitoring

Analyte	Analyses for FY98/FY99	
	Great Western Reservoir (Analyses per year)	Total
Pu-239/240	4	8
Am-241	4	8
U, isotopic[39]	4	8
Tritium	4	8

Notes:

Am	=	Americium	Pu	=	Plutonium
FY	=	Fiscal year	U	=	Uranium

2.7 References

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[39] Total U and U-233/234:U-238 ratio, as a minimum.

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APPENDIX A

Additional Tables

APPENDIX A

Additional Tables

List of Tables

Table A-24 40 CFR 122 Appendix D Analytes for Internal Waste Stream Characterization A-3

Table A-25 Operational Limitations on Influent to WWTP A-6

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Table A-27 RFCA Analytes of Interest for Segment 4 ..... A-12

Table A-24
40 CFR 122 Appendix D Analytes for Internal Waste Stream Characterization

Table I-Conventional Pollutants

Total suspended solids (TSS)	pH
Total dissolved solids (TDS)	Total Kjeldahl nitrogen
Chemical oxygen demand (COD)	Nitrate plus nitrite
5-day biological oxygen demand (BOD5)	Dissolved phosphorus
Oil and grease	Total ammonia plus organic nitrogen
Fecal coliform	Total phosphorus
Fecal streptococcus	

Table II-Organic Toxic Pollutants in Each of Four Fractions in Analysis by Gas Chromatography/Mass Spectroscopy (GS/MS)

Volatiles

acrolein	dichlorobromomethane	1,1,2,2-tetrachloroethane
acrylonitrile	1,1-dichloroethane	tetrachloroethylene
benzene	1,2-dichloroethane	toluene
bromoform	1,1-dichloroethylene	1,2-trans-dichloroethylene
carbon tetrachloride	1,2-dichloropropane	1,1,1-trichloroethane
chlorobenzene	1,3-dichloropropylene	1,1,2-trichloroethane
chlorodibromomethane	ethylbenzene	trichloroethylene
chloroethane	methyl bromide	vinyl chloride
2-chloroethylvinyl ether	methyl chloride	
chloroform	methylene chloride	

Table III-Other Toxic Pollutants (Metals and Cyanide) and Total Phenols

Antimony, Total	Chromium, Total	Nickel, Total	Zinc, Total
Arsenic, Total	Copper, Total	Phenols, Total	Cyanide, Total
Beryllium, Total	Lead, Total	Silver, Total	Selenium, Total
Cadmium, Total	Mercury, Total	Thallium, Total	

Table IV-Conventional and Nonconventional Pollutants Required to be Tested by Existing Dischargers if Expected to be Present

Bromide	Nitrogen, Total Organic	Surfactants	Molybdenum, Total
Chlorine, Total	Oil and Grease	Aluminum, Total	Manganese, Total
Residual	Phosphorus, Total	Barium, Total	Tin, Total
Color	Radioactivity	Boron, Total	Titanium, Total
Fecal Coliform	Sulfate	Cobalt, Total	
Fluoride	Sulfide	Iron, Total	
Nitrate-Nitrite	Sulfite	Magnesium, Total	

Table V-Toxic Pollutants and Hazardous Substances Required to be Identified by Existing Dischargers if Expected to be Present

Toxic Pollutants

Asbestos

Hazardous Substances

Acetaldehyde	Disulfoton	Phosgene
Allyl alcohol	Diuron	Propargite
Allyl chloride	Epichlorohydrin	Propylene oxide
Amyl acetate	Ethion	Pyrethrins
Aniline	Ethylene diamine	Quinoline
Benzonitrile	Ethylene dibromide	Resorcinol
Benzyl chloride	Formaldehyde	Strontium
Butyl acetate	Furfural	Strychnine
Butylamine	Guthion	Styrene
Captan	Isoprene	2,4,5-T (2,4,5-Trichlorophenoxy acetic acid)
Carbaryl	Isopropanolamine	TDE (Tetrachlorodiphenylethane)
Carbofuran	Dodecylbenzenesulfonate	2,4,5-TP [2-(2,4,5-Trichlorophenoxy) propanoic acid]
Carbon disulfide	Kelthane	Trichlorofan
Chlorpyrifos	Kepone	Triethanolamine dodecylbenzenesulfonate
Coumaphos	Malathion	Triethylamine
Cresol	Mercaptodimethur	Trimethylamine
Crotonaldehyde	Methoxychlor	Uranium

Hazardous Substances (Continued)

Cyclohexane	Methyl mercaptan	Vanadium
2,4-D (2,4-Dichlorophenoxy acetic acid)	Methyl methacrylate	Vinyl acetate
Diazinon	Methyl parathion	Xylene
Dicamba	Mevinphos	Xylenol
Dichlobenil	Mexacarbate	Zirconium
Dichlone	Monoethyl amine	
2,2-Dichloropropionic acid	Monomethyl amine	
Dichlorvos	Naled	
Diethyl amine	Napthenic acid	
Dimethyl amine	Nitrotoluene	
Dintrobenzene	Parathion	
Diquat	Phenolsulfanate	

Notes:
CFR = *Code of Federal Regulations*

Table A-25
Operational Limitations on Influent to WWTP

No person shall discharge or cause to be discharged to the sanitary sewer any stormwater, surface water, groundwater, roof runoff, subsurface drainage, cooling water, air conditioning wastewater, or any other domestic, commercial or industrial wastewater not meeting the following limitations:

1 Must have an instantaneous pH value in the range of five (5.0) to ten (10.0) standard units.

2 Must not contain any solid, viscous or liquid wastes which allow or may cause obstruction to the flow in a collection line or otherwise interfere with the proper operation of the WWTP. Prohibited materials include all solid objects, material, refuse, and debris not normally contained in sewage.

3 Must not contain explosive mixtures consisting of liquids, solids, or gases which by reason of their nature or quantity are, or may be, sufficient either alone or by interaction with other substances to cause fire or explosion or be injurious in any way to the operation of the WWTP. At no time shall two (2) successive readings on an explosion hazard meter at the point of discharge into the wastewater system be more than five percent (5%), nor may any single reading be over ten percent (10%) of the lower explosive limit (LEL) of the meter. Prohibited materials include, but are not limited to: gasoline, kerosene, naphtha, benzene, toluene, xylene, ethers, alcohols, ketones, aldehydes, peroxides, chlorates, perchlorates, bromates, carbides, hydrides and sulfides.

4 Must not contain any flammable substance with a flashpoint lower than 186 degrees F.

5 Must have a temperature between 32 degrees to 150 degrees F.

6 Must not contain grease or oil or other substance that will solidify or become viscous between 32 degrees and 150 degrees F.

7 Must not contain improperly shredded garbage that has not been ground or comminuted to such a degree that all particles will be carried freely in suspension under flow conditions normally prevailing in the wastewater system to which the user is connected. At all times, no particle shall be greater than one-half inch (½) in any direction.

8 Must not contain gases or vapors either free or occluded in concentrations toxic or dangerous to humans or animals.

9 Must not contain any pollutant, including oxygen demanding pollutants (BOD5, etc.) released at a rate and/or concentration which has a reasonable potential, in the opinion of the WWTP manager, to adversely affect the WWTP (inhibition, pass-through, sludge contamination, or endangerment of the WWTP operators).

10 Must not contain any toxic or irritating substance which will create conditions hazardous to public health and safety.

11 Must not contain in excess of 100 ppm of any grease or oil or any oily substance from petroleum or mineral origin, or both, including but not limited to: a) cooling or

	quenching oils; b) lubrication oil; c) cutting oils; and d) non-saponifiable oils.
12	Must not contain toxic or poisonous solids, liquids or gases in sufficient quantity, either singly or by interaction with other wastes, to injure or interfere with any sewage treatment process, to create any hazard in the receiving waters of the WWTP or to contaminate the sludge of any wastewater treatment process.
13	Must not cause the temperature of the treatment plant to exceed 40 degrees C (104 degrees F).
14	Must not contain organic toxic pollutants, introduced by the intentional or accidental dumping of solvents, used in operations involving degreasing, surface preparation, tank washing, paint thinning, paint equipment cleaning or any other process.
15	Must not contain any hazardous waste, either listed or characteristic.
16	Numerical guidelines. See Allowable Concentrations worksheet.

Notes:

C	=	Celsius
F	=	Fahrenheit
LEL	=	Lower explosive limit
ppm	=	parts per million
WWTP	=	Wastewater treatment plant

Table A-26
RFCA Analytes of Interest for Segment 5

RFCA Attachment 5, Table 1 specifies additional limitations beyond those specified here, and all RFCA Table 1 contaminant limitations are applicable. But most of those contaminant limitations are not exceeded and pose hypothetical health risks well below a 10^{-6} criterion, and are not a threat to the environment. Those contaminants do not need to be monitored. The analytes of interest (AoIs) specified here are the analytes for which monitoring funds will actually be requested.

Assumptions:

These AoIs were developed and agreement achieved on the basis of the assumptions below. These assumptions allow all parties to agree that funding and resources should be focused on this relatively short list of contaminants for which there is reasonable cause to expect exceedances of RFCA standards and action levels.

- Discharges into Segment 4 will be from batch operations as currently conducted.
- Sampling for Segments 4 and 5 RFCA compliance will be flow-proportional.
- Predischarge sampling by CDPHE will be comprehensive.
- Cost effective analytical methods used to monitor the AoIs will also yield information about other potential, but unanticipated, contaminants.
- The Site will perform tritium monitoring in Segment 4 at the Indiana Street Point of Compliance.
- Any of the parties may, from time to time, identify additional AoIs for cause, for a specific discharge event. If the parties agree, additional contaminants may be added to the ongoing AoIs specified here.

Table A-26
(continued)

Segment 5 Analytes Of Interest The signatory parties to this plan agree that the AoIs for Segment 5 main stream channel monitoring stations are those listed below.		
Radionuclides:	Pu 239, 240	High level of public concern. Known carcinogen. Known past releases (within the past 8 years) have exceeded RFCA stream standards and action levels. This provides reasonable cause to expect future releases in excess of RFCA action levels.
	U 233, 234, 235, 238	Known renal toxicity. Present on Site. Past exceedances provide reasonable cause to expect future releases in excess of RFCA stream standards and action levels.
	Am 241	Known carcinogen. Present on Site. Known past exceedances provide reasonable cause to expect future releases in excess of RFCA stream standards and action levels.
Metals:	Be	Known to cause berylliosis in susceptible individuals when exposed by inhalation. May also cause contact dermatitis. Present on Site. Will be monitored as an indicator of releases from process and waste storage areas.
	Cr	Physiological and dermal toxicity. High level of regulatory concern due, in part to the chromic acid incident of 1989. Low levels can cause significant ecological damage.
	Ag (dissolved)	Highly toxic to fish at low levels if chronic. State of Colorado has temporarily removed its stream standard for silver, while under study. The study has been completed, and the standard will be reinstated at the next triennial review of South Platte stream standards, if not before. Used on Site only for photographic development. Routinely accepted by POTWs as municipal waste, but discharge is regulated. May be removed from this list later if data do not support concern.

Table A-26
(continued)

Metals (Continued)	Cd (dissolved)	Highly toxic to fish at low levels if chronic. Known human carcinogen (prostate cancer) and depletes physiologic calcium. Used on Site in plating processes. Monitoring data for the Interceptor Trench System (ITS) and the proposed discharge of untreated ITS waters into Walnut Creek provide reasonable cause to expect future releases in excess of RFCA action levels.
	Hardness	Required to evaluate metals analyses due to its effect on solubility of these metals.
Real Time Monitoring of Physical and Indicator Parameters: These parameters provide real-time indication for a wide variety of regulated contaminants and are also a required component of monitoring for AoIs. They require no laboratory analyses and are the Site's most cost effective defensive monitoring.	pH	Toxicity to humans and ecology. Regulatory concern due to chromic acid incident. Real-time monitoring is inexpensive and effective method of detecting acid spills such as (chromic acid or plutonium nitrate) or failure of treatment systems.
	Conductivity	Conductivity is an indicator of total dissolved solids, metals, anions, and pH. Real-time monitoring of conductivity is an inexpensive indicator of overall water quality.
	Turbidity	Turbidity is a general indicator of elevated contaminant levels and may be correlated with Pu.
	NO_3	Past releases near RFCA stream standards and action levels upstream of ponds provide reasonable cause to expect future releases in excess of RFCA stream standards and action levels. ITS discharges are often high in nitrate and may challenge RFCA action levels.
	Flow	Required to detect flow events, evaluate contaminant loads, and plan pond operations and discharges. Affects nearly every decision rule and is the most commonly discussed attribute of Site surface waters.

Notes:

VOAs, Fe, and Mn are specifically excluded from this list. The parties recognize that VOAs will not be effectively monitored at these monitoring stations, and defer to the decision rules that drive monitoring closer to the sources of VOA contamination.

AoI = Analytes of interest
Ag = Silver
Am = Americium
Be = Beryllium

Table A-26
(continued)

Cd	=	Cadmium
Cr	=	Chromium
Fe	=	Iron
ITS	=	Interceptor Trench System
Mn	=	Manganese
NO_3	=	Nitrate
POTW	=	Publically owned treatment works
Pu	=	Plutonium
RFCA	=	Rocky Flats Cleanup Agreement
U	=	Uranium
VOA	=	Volatile organic analysis

Table A-27
RFCA AoLs for Segment 4

Segment 4 Analytes Of Interest This extremely focused list of AoIs was developed and agreed upon based on the following assumptions: • The Site will perform Segment 5 monitoring for the AoIs described in Table A-26. • CDPHE will perform comprehensive monitoring, including tritium, for the predischarge samples.		
Terminal Pond Discharge Monitoring POCs		
Radionuclides:	Pu 239, 240	High level of public concern. Known carcinogen. Known past releases (within the past 8 years) have exceeded RFCA stream standards and action levels. This provides reasonable cause to expect future releases in excess of RFCA stream standards and action levels.
	U 233, 234, 235, 238	Known renal toxicity. Present on Site. Past exceedances provide reasonable cause to expect future releases in excess of RFCA stream standards and action levels.
	Am 241	Known carcinogen. Present on Site. Known past exceedances provide reasonable cause to expect future releases in excess of RFCA stream standards and action levels.
Real-Time Monitoring of Physical and Indicator Parameters: These parameters provide real-time indicators for a wide variety of regulated contaminants and are also a required component of monitoring for AoIs. They require no laboratory analyses and are the Site's most cost effective defensive monitoring.	pH	Toxicity to humans and ecology. Regulatory concern due to chromic acid incident. Real-time monitoring is inexpensive and effective method of detecting acid spills such as (chromic acid or plutonium nitrate) or failure of treatment systems.
	Conductivity	Conductivity is an indicator of total dissolved solids, metals, anions, and pH. Real-time monitoring of conductivity is an inexpensive indicator of overall water quality.
	Turbidity	Turbidity is a general indicator of elevated contaminant levels and may be correlated with Pu.
	NO_3	Past releases near RFCA stream standards and action levels upstream of ponds provide reasonable cause to expect future releases in excess of RFCA stream standards and action levels. ITS discharges are often high in nitrate and may challenge RFCA action levels.

Table A-27
(continued)

Terminal Pond Discharge Monitoring POCs		
Real-Time Monitoring of Physical and Indicator Parameters (continued)	Flow	Required to detect flow events, evaluate contaminant loads, and plan pond operations and discharges. Affects nearly every decision rule and is the most commonly discussed attribute of Site surface waters.
Indiana Street Monitoring POCs		
Radionuclides:	Pu 239, 240	High level of public concern. Known carcinogen. Known past releases (within the past 8 years) have exceeded RFCA stream standards and action levels. This provides reasonable cause to expect future releases in excess of RFCA stream standards and action levels.
	Am 241	Known carcinogen. Present on Site. Known past exceedances provide reasonable cause to expect future releases in excess of RFCA stream standards and action levels.
	Tritium	Tritium is an AoI for the cities due to the past release of tritium (1973).
Real Time Monitoring:	--	Indiana Street is not a point of compliance for the real-time monitoring parameters.

Note:

Non-POC monitoring specified in Table 2-21 is not reflected in this table, because the parties intend that Indiana Street not be a POC for the parameters.

-- = Not applicable
AoI = Analytes of interest
Am = Americium
ITS = Interceptor Trench System
NO_3 = Nitrate
POC = Point of compliance
Pu = Plutonium
RFCA = Rocky Flats Cleanup Agreement
VOA = Volatile organic analysis
U = Uranium