DRAFT FINAL

FIELD TREATABILITY STUDY

SAMPLING AND ANALYSIS PLAN
PHASE I

SOUTH WALNUT CREEK BASIN
SURFACE WATER INTERIM MEASURES/
INTERIM REMEDIAL ACTION

OPERABLE UNIT NO. 2

U.S. DEPARTMENT OF ENERGY

Rocky Flats Plant
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM

28 June 1991

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GLOSSARY OF ACRONYMS

AS	Analytical Sample
ARAR	Applicable or Relevant and Appropriate Requirement
BNA	Base Neutral Acid
CDH	Colorado Department of Health
CLP	Contract Laboratory Program
CMP	Corrugated Metal Pipe
CS	Collection System (Surface Water)
DOE	Department of Energy
EMAD	Environmental Monitoring and Assessment Division
EPA	Environmental Protection Agency
FI	Flow Indicator
FTU	Field Treatability Unit
FQI	Flow Totalizing Indicator
FS	Feasibility Study
GAC	Granular Activated Carbon
GC/MS	Gas Chromatography/Mass Spectroscopy
GPM	Gallons Per Minute
GRRASP	General Radiochemistry and Routine Analytical Services Protocol
HP	Horsepower
IM/IRAP	Interim Measures/Interim Remedial Action Plan
MDA	Minimum Detectible Activity
OU 2	Operable Unit No. 2
PA	Protected Area
PCB	Polychlorinated Biphenyl
pCi/g	Picocuries per gram
pCi/ℓ	Picocuries per liter
ppm	Parts per million
PQL	Practical Quantitation Limit
PVC	Polyvinyl Chloride
QAA	Quality Assurance Addendum
QAPjP	EG&G Rocky Flats Sitewide Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RFP	Rocky Flats Plant
RI	Remedial Investigation
RQL	Required Quantitation Limit
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedures
SOPA	Standard Operating Procedures Addendum
SW	Surface Water
TAL	Target Analyte List
TBC	To Be Considered
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure
VOC	Volatile Organic Compound

SECTION 1

INTRODUCTION

This Sampling and Analysis Plan (SAP) presents detailed guidance for evaluation of the performance of a field treatability unit (FTU) in treating contaminated South Walnut Creek Basin surface water. This SAP has been prepared as part of the Field Treatability Study Workplan (EG&G, 1991a) for the South Walnut Creek Basin Surface Water Interim Measures/Interim Remedial Action (IM/IRA) at Operable Unit No. 2 (OU 2).

The field treatability study at South Walnut Creek Basin is part of a comprehensive remedial investigation (RI), feasibility study (FS), and remedial action (RA) program at the Rocky Flats Plant (RFP). RIs at OU 2 have identified the presence of volatile organic compound (VOC), radionuclide, and metals contamination in South Walnut Creek Basin surface waters. EG&G - Rocky Flats, Inc. (EG&G) and the U.S. Department of Energy (DOE) have conducted a detailed analysis of remedial alternatives for collection and treatment of contaminated South Walnut Creek Basin surface water (EG&G, 1991b). This analysis resulted in the following preferred IM/IRA alternative:

- Collect contaminated surface water by diversion at three surface water monitoring stations (SWs) located within the South Walnut Creek Basin: SW-59, SW-61, and SW-132 (see Figure 1-1).
- Remove suspended solids, radionuclides, and metals from the collected surface water by chemical treatment (i.e., coagulation and flocculation) and cross-flow membrane filtration.
- Remove VOCs from the surface water by granular activated carbon (GAC) treatment.

The preferred IM/IRA treatment process is illustrated in Figure 1-2. Initial operation of the IM/IRA treatment system is considered a field treatability study to confirm the selection of the preferred treatment system or to provide the basis for selection of an alternative system should the preferred IM/IRA process be judged to not perform adequately. The treatability study is being executed in two phases. Phase I involves installation of all three surface water collection systems and the VOC removal unit (i.e., GAC units). The Phase I system was operational on 13 May 1991 with the exception of the diversion and collection system at

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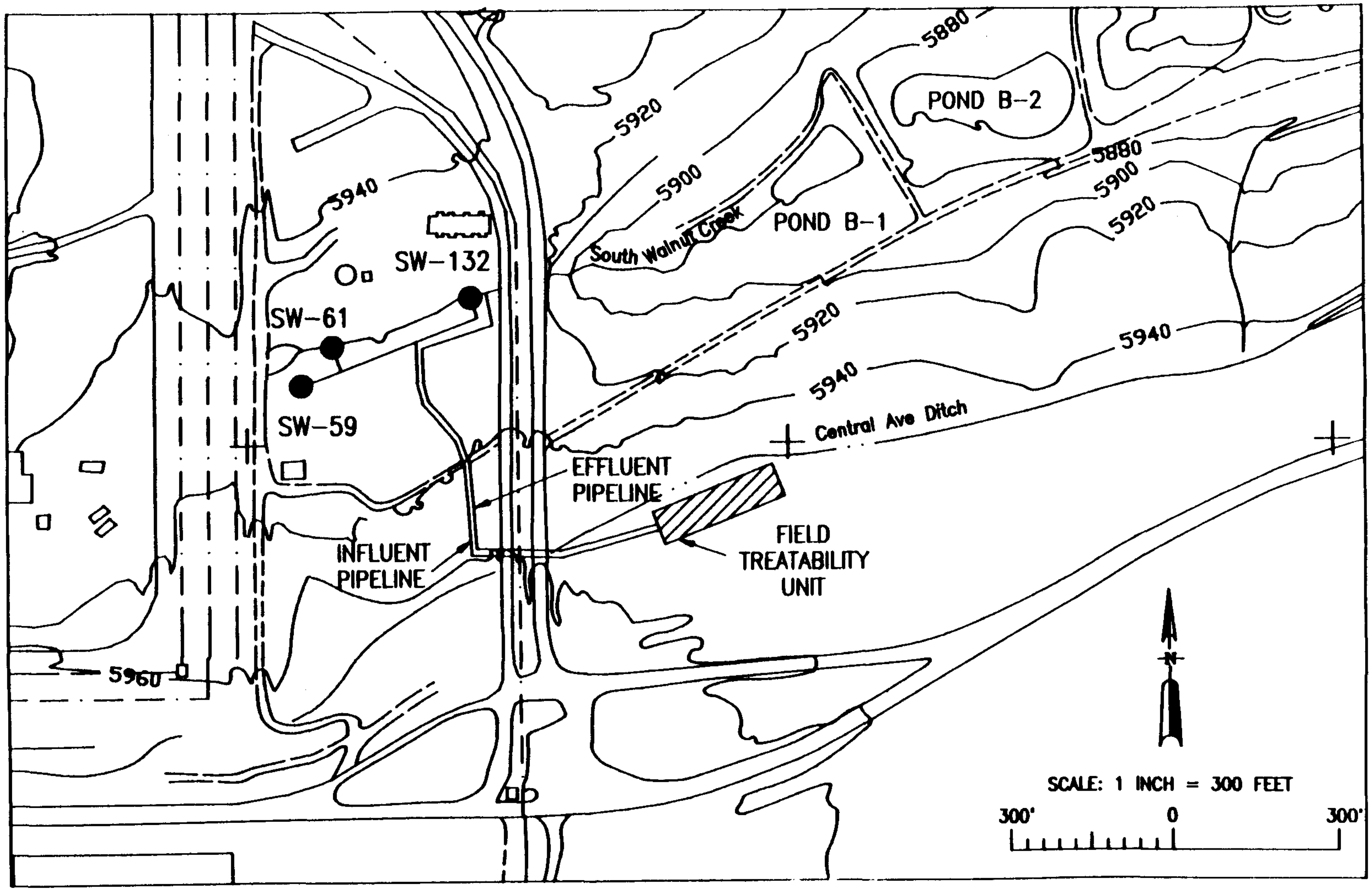


FIGURE 1-1

FIELD TREATABILITY UNIT PLOT PLAN
SOUTH WALNUT CREEK BASIN IM/IRA

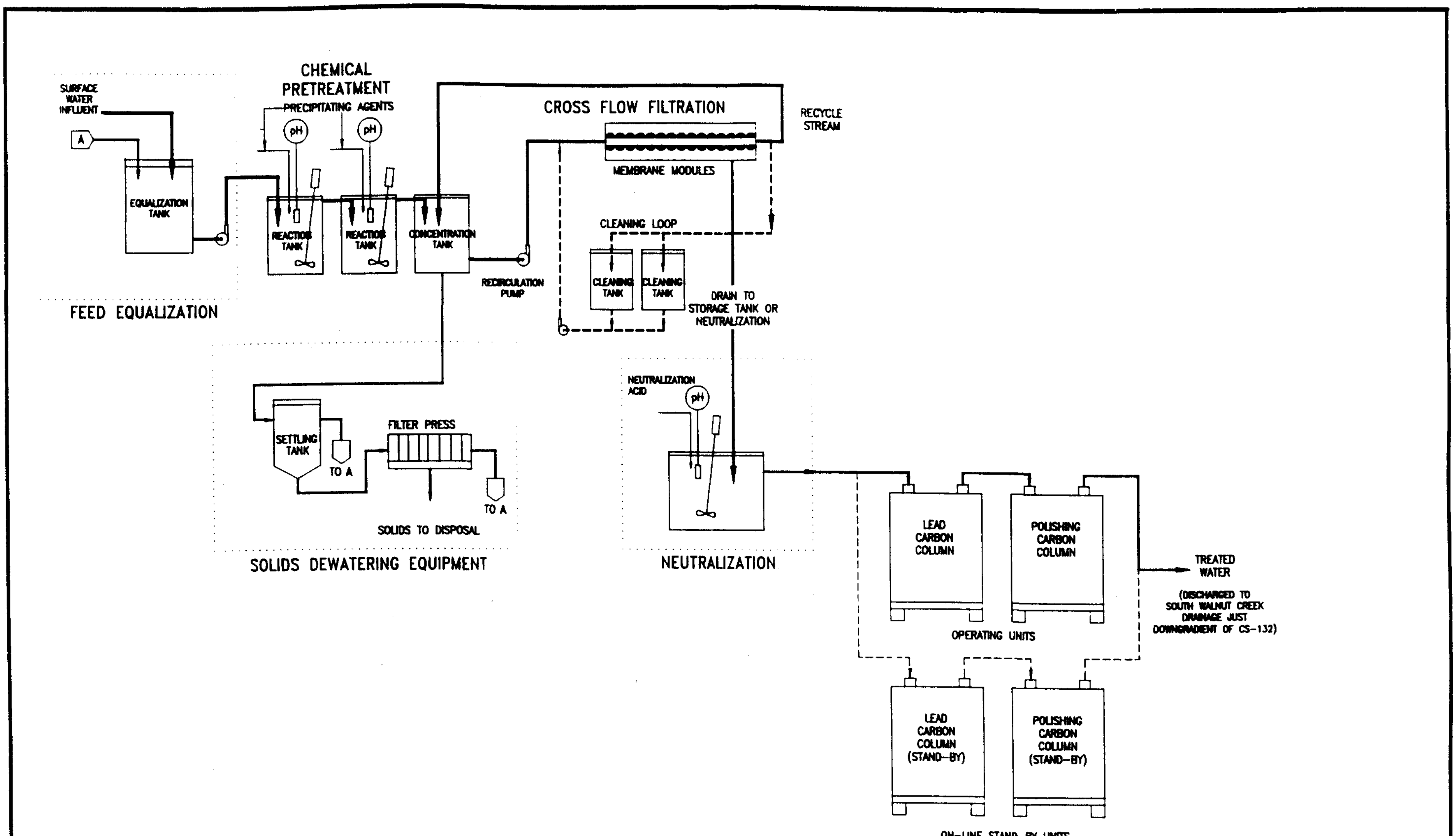


FIGURE 1-2

SOUTH WALNUT CREEK BASIN
IM/IRA TREATMENT SYSTEM
PROCESS FLOW DIAGRAM

SW-132 which is expected to be installed in September 1991. Phase II involves the addition of the suspended solids and inorganics removal unit to the Phase I system as illustrated in Figure 1-2. Completion of FTU installation (i.e., Phases I and II) is currently scheduled for 30 October 1991.

1.1 BACKGROUND

The RFP began operations in 1951. Past hazardous waste management practices at the RFP have resulted in environmental contamination at several plant site areas. One such area, designated as OU2, includes the 903 Pad, Mound, and East Trenches Areas. A portion of OU2 lies within the South Walnut Creek drainage basin. Past waste management practices at OU2 include solid and liquid waste disposal, reactive metals destruction, and waste burning.

A Phase I RI for OU 2 began in March 1987. The investigation process includes soil, ground-water and surface water sampling, various types of subsurface soil surveys, and map preparation. The RI has identified the presence of VOC, radionuclide, and metals contamination in OU 2 soils, ground water, and surface water. As investigations to fully characterize OU 2 contamination continue and a final remedy is determined, the DOE is pursuing OU 2 surface water cleanup under an IM/IRA.

On 8 May 1991, the DOE released an IM/IRA Plan (EG&G, 1990b) to collect and treat contaminated surface water in a portion of the South Walnut Creek drainage at OU 2. Although no immediate threat to public health or the environment is posed by this surface water contamination, there is a potential threat. Implementation of this IM/IRA will enhance DOE's efforts toward containing and managing contaminated OU 2 surface water and will mitigate downgradient contaminant migration. The South Walnut Creek Basin Surface Water IM/IRA Plan dated 8 May 1991 was approved for implementation by the Environmental Protection Agency (EPA) and the Colorado Department of Health (CDH) in May 1991.

1.2 SITE DESCRIPTION

The IM/IRA addresses surface water collection from the portion of the South Walnut Creek Basin located between the east perimeter of the Protected Area (PA) and the RFP security fence as shown in Figure 1-1. Surface water will be collected at three locations within the drainage: SW-59, SW-61, and SW-132. SW-59 represents a surface water seep flow on the south bank of the South Walnut Creek drainage. SW-61 is located within the drainage and represents the combined flows of SW-59, surface water runoff south of the PA (discharge from a corrugated metal culvert), and surface water runoff from within the PA (discharge from a concrete culvert). SW-132 represents the discharge from a second corrugated metal culvert approximately 225 feet downstream of SW-61. The discharge at SW-132 is the flow from the upper reach of South Walnut Creek. During construction of the RFP, the headwater area of South Walnut Creek had been filled, and as a result, flow originates from a buried culvert located west of Building 991. This flow is directed to the south of Building 991 and under the PA by a buried corrugated metal culvert and discharged at SW-132.

As presented in the South Walnut Creek Basin Surface Water IM/IRA Plan (EG&G, 1991b), design flows will be collected from each of the monitoring stations. The design flows, listed in Table 1-1, were developed to ensure collection of above-average precipitation wet season flows at the monitoring stations not corresponding to major storm events. The total design flow of 60 gallons per minute (gpm) is the IM/IRA treatment system capacity.

1.2.1 Contaminants of Concern

As discussed earlier, the Phase I RI at OU 2 indicated the presence of VOC, radionuclide, and metals contamination in South Walnut Creek Basin surface waters. Analysis of the data with regard to the IM/IRA surface water collection locations (i.e., SW-59, SW-61, and SW-132) identified the potential for many of the contaminants to be present above regulatory concentration limits (EG&G, 1991b). These contaminants of

TABLE 1-1

DESIGN FLOWS FOR IM/IRA SURFACE WATER DIVERSION AND COLLECTION SYSTEM

Station	Design Flow (gpm)
SW-59	4.5
SW-61	37.5
SW-132	18.0
Total Design Flow Rate	60.0 gpm

Source: "Surface Water Interim Measure/Interim Remedial Action Plan/Environmental Assessment and Decision Document, South Walnut Creek Basin, Operable Unit No. 2," EG&G-Rocky Flats, Inc., 8 March 1991.

TABLE 1-2

BASIS FOR DESIGN OF SURFACE WATER IM/IRA TREATMENT SYSTEM

	Units	Influent Concentration[a]	Effluent Requirements[b]
Organics			
1,1-Dichloroethene	μg/ℓ[1]	142	7
1,1-Dichloroethane	μg/ℓ	6	1U*
1,2-Dichloroethene (total)	μg/ℓ	10	1U*
Chloroform	μg/ℓ	82	1U
Carbon Tetrachloride	μg/ℓ	219	5U
Trichloroethene	μg/ℓ	153	5U*
Tetrachloroethene	μg/ℓ	279	1U
Dissolved Metals			
Beryllium	mg/ℓ[2]	0.0053	0.1
Manganese	mg/ℓ	0.5790	0.050
Strontium	mg/ℓ	0.8396	0.396**
Tin	mg/ℓ	0.9036	0.100
Total Metals			
Aluminum (Al)	mg/ℓ	25.12	0.2U
Antimony (Sb)	mg/ℓ	0.0655	0.060
Barium (Ba)	mg/ℓ	1.853	1.000
Beryllium (Be)	mg/ℓ	0.0519	0.1
Cadmium (Cd)	mg/ℓ	0.0132	0.01
Chromium (Cr)	mg/ℓ	0.1918	0.05
Cobalt (Co)	mg/ℓ	0.1232	0.050
Copper (Cu)	mg/ℓ	0.2664	0.2
Iron (Fe)	mg/ℓ	184.0	1.000
Lead (Pb)	mg/ℓ	0.1954	0.05
Lithium (Li)	mg/ℓ	0.4100	2.500
Manganese (Mn)	mg/ℓ	3.307	1.000
Mercury (Hg)	mg/ℓ	0.0022	0.002
Molybdenum (Mo)	mg/ℓ	0.1574	0.100
Nickel (Ni)	mg/ℓ	0.2239	0.2
Selenium (Se)	mg/ℓ	0.0070	0.01
Strontium (Sr)	mg/ℓ	0.8600	0.382**
Vanadium (V)	mg/ℓ	0.5019	0.1
Zinc (Zn)	mg/ℓ	1.348	2.0

TABLE 1-2 (Continued)

BASIN FOR DESIGN OF SURFACE WATER IM/IRA TREATMENT SYSTEM

	Units	Influent Concentration[a]	Effluent Requirements[b]
Dissolved Radionuclides			
Gross Alpha	pCi/ℓ[3]	20.11	11
Gross Beta	pCi/ℓ	39.90	19
Total Uranium	pCi/ℓ	9.96	10
Total Radionuclides			
Gross Alpha	pCi/ℓ	730	11
Gross Beta	pCi/ℓ	545	19
Plutonium 239,240	pCi/ℓ	3.28	0.05
Americium 241	pCi/ℓ	0.53	0.05
Total Uranium	pCi/ℓ	11.69	10

---

1 Micrograms per liter.

2 Milligrams per liter.

3 Picocuries per liter.

a The influent concentrations are based on flow-weighted maximum concentrations of station SW-59 and the following group of stations: SW-56, SW-60, SW-61, and SW-101. The maximum observed concentrations for each station or group of stations is multiplied by the corresponding collection station design flow. The multiplication products for each collection station are summed and divided by the sum of the CS-59 and CS-61 design flows (42 gpm). Concentration data used in the flow-weighted maximum concentration computation is obtained from the 1987, 1988, 1989, and 1990 field investigations.

b Based on Applicable or Relevant and Appropriate Requirements (ARARs). The "U" designation following many of the effluent concentrations indicates that the concentration is the detection limit for that constituent.

* No ARAR standard exists for this constituent; effluent requirement is To be Considered (TBC) concentration, considered as an IM/IRA treatment goal.

** No ARAR or TBC standard exists for this constituent; effluent requirement is background concentration, considered as an IM/IRA treatment goal.

Source: "Surface Water Interim Measures/Interim Remedial Action Plan/Environmental Assessment and Decision Document, South Walnut Creek Basin, Operable Unit No. 2," EG&G - Rocky Flats, Inc., 8 March 1991.

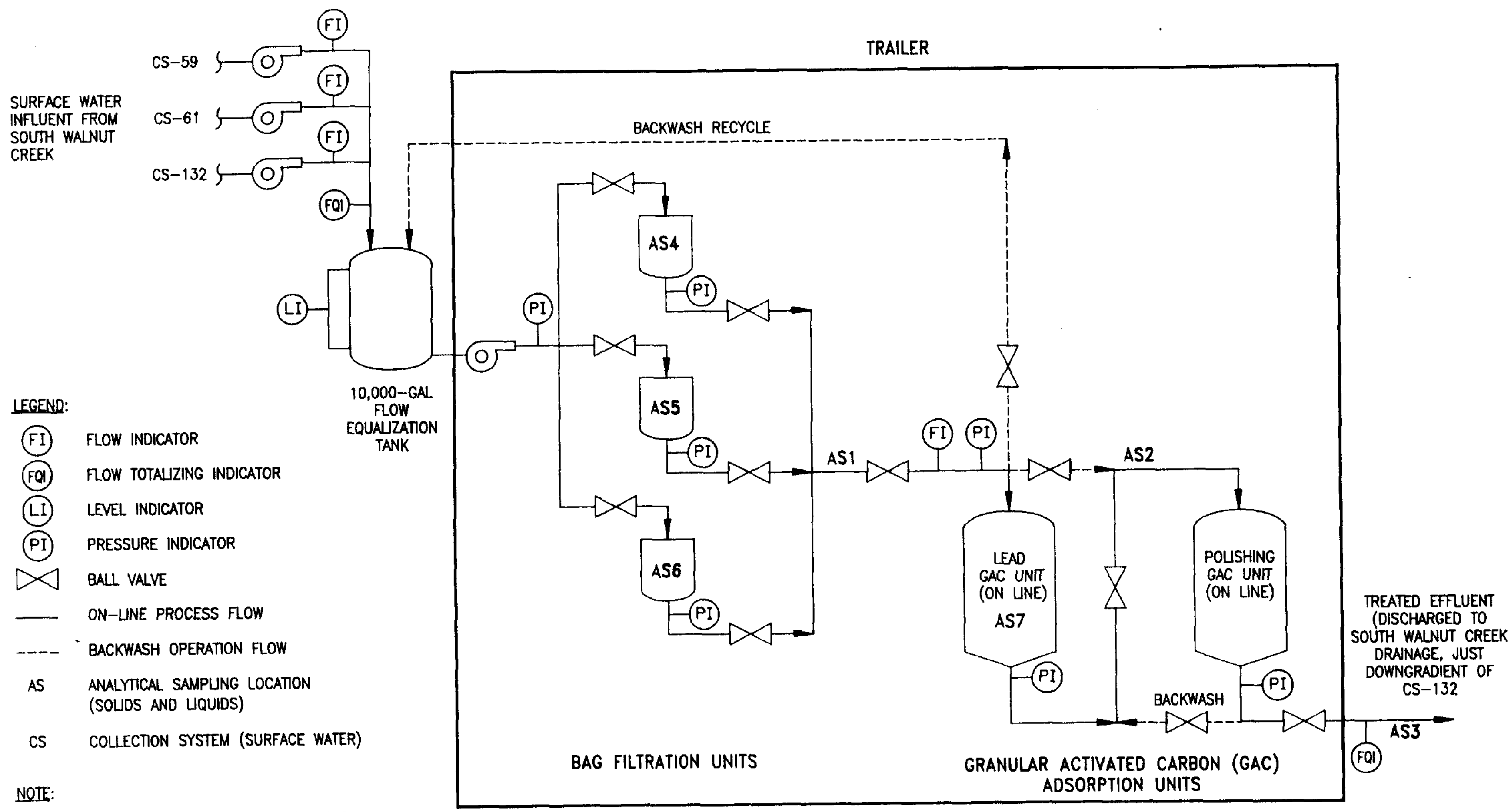
concern, along with their expected maximum concentrations in the influent to the IM/IRA treatment system, are listed in Table 1-2. The maximum expected contaminant influent concentrations listed in Table 1-2 are based on the flow-weighted maximum concentrations of station SW-59 and the following group of stations: SW-56, SW-60, SW-61, and SW-101 (EG&G, 1991b). The effluent requirements listed in Table 1-2 are based on an analysis of all applicable or relevant and appropriate requirements (ARARs). Expected flow and influent concentration together with the effluent requirements provide the basis of design for the IM/IRA treatment system.

1.3 FIELD TREATABILITY UNIT DESCRIPTION (PHASE I)

As mentioned earlier, Phase I of the FTU became operational on 13 May 1991. Figure 1-3 illustrates that the Phase I FTU consists of three surface water collection systems (CSs), a flow equalization tank, bag filtration units, and GAC units. CS-59, CS-61, and CS-132 (to be installed in July 1991) serve to divert and transfer design flows from SW-59, SW-61 and SW-132, respectively. A surface water flow at SW-59, SW-61, or SW-132 in excess of the corresponding CS design flow may be permitted to overflow the CS and continue downstream along its pre-IM/IRA flow path.

Each CS includes a precast reinforced concrete catch basin with a stainless steel submersible pump. The pump is placed inside each catch basin and its operation is controlled by a float switch. The raw water is pumped from the catch basins to a flow equalization tank through double-walled polyethylene piping. The piping is wrapped with heat tape and insulation to protect against freezing during the winter months.

The equalization tank has a capacity of 10,000 gallons and is fabricated of cross-linked polyethylene. Surface water influent levels in the tank are continuously monitored and displayed. Level indication includes low, high, and overflow visual and audible alarms at 5, 90, and 95 percent of tank capacity, respectively.



NOTE:

IN ADDITION TO THE *LEAD* AND *POLISHING* GAC UNITS SHOWN, THE TRAILER CONTAINS TWO ON-LINE, STANDBY, GAC UNITS (NOT SHOWN FOR CLARITY). THE PROCESS PIPING HAS BEEN DESIGNED SO THAT ANY ONE OF THE FOUR GAC UNITS MAY BE PLACED IN THE ON-LINE LEAD OR POLISHING POSITION WITHOUT PHYSICAL RELOCATION.

FIGURE 1-3

FIELD TREATABILITY UNIT (PHASE I) PROCESS FLOW DIAGRAM

A 7.5-horsepower (hp) stainless steel centrifugal pump is used to transfer influent surface water from the equalization tank through the treatment unit and to the point of discharge just downstream of CS-132 within the South Walnut Creek drainage. The water is first filtered by one of three stainless-steel bag filtration units operated in parallel. The parallel filtration configuration facilitates filter media changes without a significant standby mode. When the lead unit GAC becomes spent, it is taken out of service. The GAC unit in the polishing position becomes the new lead unit and one of the on-line, standby units is placed in the polishing position. "Rotation" of the GAC units into the lead, polishing, and standby positions is accomplished by changing the open/closed configuration of the process valves. Physical movement of unspent GAC units is not necessary. The spent GAC unit is replaced with a new unit containing virgin GAC. The newly installed unit is immediately placed in the on-line, standby mode. Each of the four vessels contains 2,000 pounds of GAC. Based on the influent VOC concentrations presented in Table 1-2, it is estimated that the GAC usage rate will be 0.6 pounds per 1,000 gallons of surface water treated (EG&G, 1991b). Assuming a flow rate of 60 gpm, the service life of a GAC unit in the lead position is predicted to be approximately 6 weeks. This is a conservative estimate of GAC unit service life since the assumed influent VOC concentrations represent a worst case scenario. As FTU influent concentration and process performance data become available, improved service life predictions can be made.

The GAC units are skid mounted and are connected to the process piping via stainless steel, quick connect couplings. The GAC vessels are fabricated of stainless steel and all process piping, fittings, and valving are manufactured from schedule 80 polyvinyl chloride (PVC). The process pump, bag filter units and GAC units are housed in a 48 ft. x 8-1/2 ft. trailer. The trailer is provided with lighting, heating, ventilation, and air conditioning.

Locally-mounted, stainless-steel pressure gauges on the inlets and outlets of the bag filter units and the GAC units will indicate plugging of the filter media (i.e., pressure drop increase) due to particulate loading and/or biofouling. In this case, bag filter media are replaced and the GAC is backwashed (i.e., usually the GAC unit in the "lead" position). As indicated in Figure 1-3, treated water is used to backwash GAC. Backwashing is conducted in an upflow mode and the spent backwash is recycled to the flow equalization tank. The FTU will be operated for a brief period following backwashing with bag filter media possessing a nominal pore size smaller than what is typically used during normal operation. This procedure will result in more effective removal of particulate matter introduced into the system by the influent surface water than would be possible with the larger pore size filter media employed during normal treatment operation. The exact filter media that will be selected for use during FTU treatment and post-backwash modes will be determined in the early part of the treatability study based on process performance information.

1.4 SAMPLING AND ANALYSIS PLAN ORGANIZATION

Section 2 through 5 of this SAP have been prepared to specifically address Phase I of the field treatability study. This Plan will be revised in the future to reflect the final treatability study plan for evaluation of the complete FTU.

Section 2 of this SAP discusses the objectives of the field treatability study. Section 3 presents the sampling and analysis test program necessary to fulfill the desired objectives, specifically addressing the locations, frequencies, and analyses of the treatability test samples along with rationale for their inclusion in the test program. Sections 4 and 5 present sample equipment decontamination and quality assurance/quality control (QA/QC) guidance, respectively. Section 6 lists literature sources referenced in this SAP.

SECTION 2

FIELD TREATABILITY STUDY OBJECTIVES

Two primary objectives exist for Phase I of the field treatability study. These include evaluation of the performance of the Phase I FTU with regard to:

- Collection of the required South Walnut Creek Basin flows (i.e., CS design flows).
- Removal of VOCs from the collected surface water.

The first objective will be satisfied by daily monitoring of the flow rates of surface water pumped from each CS (i.e., CS-59, CS-61, and CS-132) along with an estimation of the rate of overflow at each CS. The rates of flow transferred by the CSs are obtained from flow indicators (FIs) mounted on the CS pipelines (see Figure 1-3). CS overflow rates, if any, will be estimated with the bucket and stopwatch technique, a flume, and V-notch overflow weir for CS-59, CS-61, and CS-132, respectively. CS-59 overflow will be collected in the bucket immediately upon exit from the catch basin. CS-61 overflow will be estimated with a new flume installed immediately downstream of CS-61 within the South Walnut Creek drainage. The CS-132 overflow will be estimated with the calibrated V-notch overflow weir that is currently installed within the drainage immediately downstream of CS-132.

The second primary objective of the field treatability study will be satisfied by sampling GAC unit influent and effluent process streams and analyzing the samples for VOCs. The details of the FTU sampling and analysis program are presented in Section 3.

In addition to the primary test objectives, several secondary objectives exist for Phase I of the field treatability study. These include chemical characterization of FTU influent, assessment of the Phase I FTU in removing radionuclide and metals contaminants, and characterization of Phase I FTU waste streams. Characterization of FTU influent is important not only in establishing a baseline from which the VOC removal efficiency can be determined, but also in gaining further understanding on the nature of surface water contamination to be addressed in the IM/IRA. With regard to VOCs, it is imperative to verify the expected absence of acetone, methylene chloride, and vinyl chloride as indicated by the Phase I RI data (EG&G, 1991b) since these constituents are not effectively removed by GAC. It is also important to verify the expected concentrations of VOCs, radionuclides, and metals in the influent surface water, and thus, the basis of the IM/IRA treatment system design.

Although GAC treatment technology is not intended for removal of radionuclides and metals, some removal of the constituents existing in a particulate state may occur through filtering by the GAC as well as by the bag filter media. Sampling and analysis procedures to assess this removal are also presented in Section 3.

The final secondary objective for Phase I of the field treatability study is to characterize secondary waste streams. Spent bag filter media will be analyzed to assess disposal options. Spent GAC will require either regeneration or disposal. If, during the course of surface water treatment, GAC is contaminated with radionuclides, it may not be suitable for regeneration and may require disposal as a hazardous, mixed waste. Sampling and analysis procedures to characterize spent bag filter media and GAC are also presented in Section 3.

SECTION 3

FIELD TREATABILITY UNIT SAMPLING AND ANALYSIS PROGRAM

This section presents the sampling and analysis program necessary to satisfy the process performance and chemical characterization objectives of Phase I of the field treatability study (Section 2). Specifically, the objectives addressed by this program include:

- Performance evaluation of the FTU in removing VOCs from collected South Walnut Creek Basin surface water.
- Characterization of collected surface water with respect to VOCs, radionuclides, and metals.
- Assessment of the ability of the FTU in removing radionuclides and metals from collected surface water.
- Chemical characterization of spent FTU bag filter media and GAC.

The procedures presented in this sampling and analysis program may be modified during conduct of Phase I testing based on newly acquired process operating and performance knowledge.

3.1 FTU PROCESS SAMPLING AND ANALYSIS

FTU process samples will be collected before and after the lead GAC unit and after the polishing GAC unit. These sample locations are designated as AS1, AS2, and AS3, respectively (Figure 1-3). Process samples will be collected from sample lines installed in the process piping at each sampling location. The sample lines will be purged prior to delivery of process liquid samples to appropriate sample containers. FTU process samples will be collected for VOC, radionuclide and metals analysis as described below.

3.1.1 Volatile Organic Compounds

FTU process samples will be collected for VOC analysis at locations Analytical Sample 1 (AS1), AS2, and AS3. These samples will be collected twice per week for the first three weeks of Phase I of the field treatability study and once per week thereafter. In addition, samples will be collected daily at AS2 during the week before and the week after the predicted breakthrough time for the lead GAC unit (see Section 1.3 for a discussion on breakthrough prediction). The samples will be analyzed for the full suite of EPA Target Compound List (TCL) VOCs (Table 3-1) according to EPA Contract Laboratory Program (CLP) protocol. CLP protocol specifies Method 624 Gas Chromatography/Mass Spectroscopy (GC/MS) for analysis of TCL VOCs. The CLP aqueous phase Required Quantitation Limits (RQLs) for the TCL VOCs are listed in Table 3-1. In addition to Method 624, EPA Method 502.2 will be used to analyze FTU samples for the presence of 1,1-dichloroethene; 1,2-dichloroethene (total); chloroform; and tetrachloroethene. Method 502.2 employs GC to allow lower detection limits for these constituents than is possible with Method 624. The lower detection limits afforded by Method 502.2 are necessary to determine if FTU effluent requirements (Table 1-2) are being met with respect to 1,1-dichloroethene; 1,2-dichloroethene (total); chloroform; and tetrachloroethene. Method 502.2 Practical Quantitation Limits (PQLs) for these four VOCs are listed in Table 3-1.

Analysis of Phase I RI surface water contamination data for South Walnut Creek Basin sources (EG&G, 1991b) suggests that only a subset of the TCL VOCs will be present in collected surface water. It is, however, useful to analyze FTU process samples for the entire TCL VOC suite for several reasons. First, surface water quality at SW-132 is not currently available. Estimation of contaminant concentrations in collected surface water assumed that the water quality at SW-132 was similar to the quality of surface water runoff south of the PA (SW-60). SW-132 may introduce additional VOC contaminants not included in the current IM/IRA treatment system design basis. Sampling of surface water at SW-132 is currently being conducted under the RFP environmental monitoring program. As discussed in Section 2, it is also important to analyze the influent for the presence of acetone (Analyte #6, Table 3-1), methylene chloride (Analyte #5), and vinyl chloride (Analyte #3); compounds not effectively removed by GAC treatment.

TABLE 3-1

TARGET COMPOUND LIST (TCL) VOLATILE ORGANIC COMPOUNDS AND AQUEOUS PHASE QUANTITATION LIMITS

Analyte	CAS Number	Aqueous Phase RQL (μg/ℓ)[1]*	Aqueous Phase PQL (μg/ℓ)**
1. Chloromethane	74-87-3	10	
2. Bromomethane	74-83-9	10	
3. Vinyl Chloride	75-01-4	10	
4. Chloroethane	75-00-3	10	
5. Methylene Chloride	75-09-2	5	
6. Acetone	67-64-1	10	
7. Carbon Disulfide	75-15-0	5	
8. 1,1-Dichloroethene	75-35-4	5	
9. 1,1-Dichloroethane	75-34-3	5	1
10. 1,2-Dichloroethene (total)	540-59-0	5	1
11. Chloroform	67-66-3	5	1
12. 1,2-Dichloroethane	107-06-2	5	
13. 2-Butanone	78-93-3	10	
14. 1,1,1-Trichloroethane	71-55-6	5	
15. Carbon Tetrachloride	56-23-5	5	
16. Vinyl Acetate	108-05-4	10	
17. Bromodichloromethane	75-27-4	5	
18. 1,1,2,2-Tetrachloroethane	79-34-5	5	
19. 1,2-Dichloropropane	78-87-5	5	
20. trans-1,3-Dichloropropene	10061-02-6	5	
21. Trichloroethene	79-01-6	5	
22. Dibromochloromethane	124-48-1	5	
23. 1,1,2-Trichloroethane	79-00-5	5	
24. Benzene	71-43-2	5	
25. cis-1,3-Dichloropropene	10061-01-5	5	
26. Bromoform	75-25-2	5	
27. 2-Hexanone	591-78-6	10	
28. 4-Methyl-2-pentanone	108-10-1	10	
29. Tetrachloroethene	127-18-4	5	1
30. Toluene	108-88-3	5	
31. Chlorobenzene	108-90-7	5	
32. Ethyl Benzene	100-41-4	5	
33. Styrene	100-42-5	5	
34. Total Xylenes	1330-20-7	5	

[1] Micrograms per liter.
* EPA Contract Laboratory Program (CLP) Required Quantitation Limit (RQL)
** EPA Method 502.2 Practical Quantitation Limit (PQL)

Source: General Radiochemistry and Routine Analytical Services Protocol (GRRASP), Revision 1.1, EG&G-Rocky Flats, Inc., September 1990.

3.1.2 Radionuclides and Metals

FTU process samples will be collected at locations AS1 and AS3 for total and dissolved radionuclide and metals analysis. These samples will be collected once every two weeks for a period of approximately six months. This program will result in a number of data points (i.e., 10 to 12) to adequately assess the degree of contaminant removal by the Phase I FTU. Furthermore, the additional inorganic characterization data resulting from this program may prove to be useful in the detailed specification and operation of Phase II FTU equipment (e.g., chemical addition ratios).

The samples collected at AS1 and AS3 will be analyzed for the metal analytes listed in Table 3-2 and the radionuclides listed in Table 3-3. The metals listed in Table 3-2 include the full suite of EPA Target Analyte List (TAL) constituents as well as five non-TAL constituents: cesium, lithium, molybdenum, strontium, and tin. The aqueous phase detection limits for the metal analytes and radionuclides are presented in Tables 3-2 and 3-3, respectively. Many of the analytes in the TAL are not considered hazardous (e.g., sodium, calcium, etc.). However, they are included in the TAL because in many cases their quantification is necessary to adequately determine the concentrations of the other TAL constituents.

3.2 FTU PROCESS WASTE SAMPLING AND ANALYSIS

Spent FTU bag filtration media and GAC will be sampled and characterized to assess disposal and regeneration (in the case of spent GAC) options. Samples from each media will be analyzed for the presence of radionuclide contamination and will also be characterized by the EPA Toxicity Characteristic Leaching Procedures (TCLP). Spent bag filter samples will be obtained from all three filtration units. For purposes of this treatability study, the three bag filter sampling locations are denoted AS4, AS5, and AS6. Spent GAC samples will be obtained from small sidestream GAC canisters plumbed alongside each GAC unit. The GAC sampling location is denoted AS7. Solids sampling locations AS4 through AS7 are noted on Figure 1-3.

TABLE 3-2

METAL ANALYTES AND AQUEOUS PHASE DETECTION LIMITS

Analyte	Aqueous Phase Detection Limit (μg/ℓ)[1]
Aluminum	200
Antimony	60
Arsenic	10
Barium	200
Beryllium	5
Cadmium	5
Calcium	5000
Celsium	1000
Chromium	10
Cobalt	50
Copper	25
Iron	100
Lead	5
Lithium	100
Magnesium	5000
Manganese	15
Mercury	0.2
Molybdenum	100
Nickel	40
Potassium	5000
Selenium	5
Silver	10
Sodium	5000
Strontium	200
Thallium	10
Tin	200
Vanadium	50
Zinc	20

[1] Micrograms per liter.

Source: *General Radiochemistry and Routine Analytical Services Protocol (GRRASP), Revision 1.1, EG&G-Rocky Flats, Inc., September 1990*

TABLE 3-3

RADIONUCLIDES AND MINIMUM DETECTABLE ACTIVITIES (MDAs)

Analyte	MDA Water (pCi/ℓ[1])	MDA Soil (pCi/g[2])
Gross Alpha	2	4
Gross Beta	4	10
Strontium 89,90	1	1
Plutonium 239,240	0.01	0.03
Americium 241	0.01	0.02
Tritium	400	400
Total Uranium 233/234, 235, 238	0.6	0.3

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[1] Picocuries per liter.

[2] Picocuries per gram.

Source: General Radiochemistry and Routine Analytical Services Protocol (GRRASP), Revision 1.1, EG&G-Rocky Flats, Inc., September 1990.

3.2.1 Bag Filter Media

One composite spent bag filter media sample will be collected from all three bag filtration units on a weekly basis. The composite sample will be obtained by cutting off the lower portion of the closed end of 21 spent filters (i.e., one random sample taken daily from each of the three bag filtration units). Each composite bag filter sample will be split to obtain both radionuclide analysis and TCLP characterization. Radiological analysis will be in accordance with guidance set forth by the EG&G Waste Compliance Division for characterization of spent fabric filter media (EG&G, 1991g). This guidance specifies the radiological parameters for which the filter media must be analyzed. The radiological parameters, along with their required minimum detectable activities (MDAs) for fabric filter media analysis, are listed in Table 3-4. The TCLP tests will involve: size reduction of the filter media; TCLP extraction; zero head space extraction; analysis of the TCLP extract for the base neutral acid (BNA) organic compounds, pesticides, herbicides, and metals listed in Table 3-5; and analysis of the zero head space extract for the VOCs listed in Table 3-5. Although it is unlikely that the TCLP extract will contain pesticides, herbicides, and many of the BNAs, the extract must be examined for these constituents to aid in an accurate assessment of proper disposal alternatives for spent bag filter media.

3.2.2 Granular Activated Carbon

Spent GAC samples are obtained from small, sidestream canisters each containing approximately 5 pounds of GAC. Two GAC canisters are supplied with each GAC unit. The canisters are plumbed in parallel with their "parent" GAC unit so that proportionally-sized process sidestreams are directed through the canisters throughout the operating life of the GAC vessel. When the GAC in a lead unit becomes spent, the two canisters are removed and forwarded to an approved laboratory for radionuclide analysis and TCLP testing. Radiological examination of the GAC will involve analysis for the radionuclide parameters listed in Table 3-3. The MDAs listed in Table 3-3 for soil analysis apply for GAC analysis.

TABLE 3-4

RADIOLOGICAL ANALYSIS REQUIREMENTS AND MDAs FOR SPENT FABRIC FILTER MEDIA

Analyte	MDA (pCi/g[1])
Gross Alpha	4
Gross Beta	10
Plutonium 239, 240	0.07
Americium 241	0.07
Uranium 233, 234	0.10
Uranium 235	0.05
Uranium 238	0.10

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1 Picocuries per gram.

Source: Memorandum from R. J. Stevens to A. A. Church entitled "Radiological Data for Filter Sock Waste Determination", EG&G, 6 March 1991.

TABLE 3-5

MAXIMUM CONCENTRATION OF CONTAMINANTS FOR TOXICITY CHARACTERISTIC (parts per million [ppm])

Arsenic	5.0
Barium	100.00
Benzene	0.5
Cadmium	1.0
Carbon tetrachloride	0.5
Chlordane	0.03
Chlorobenzene	100.0
Chloroform	6.0
Chromium	5.0
o-Cresol	200.0
m-Cresol	200.0
p-Cresol	200.0
Cresol	200.0
2,4-D	10.0
1,4-Dichlorobenzene	7.5
1,2-Dichloroethane	0.5
1,1-Dichloroethylene	0.7
2,4-Dinitrotoluene	0.13
Endrin	0.02
Heptachlor (and its epoxide)	0.008
Hexachlorobenzene	0.13
Hexachlorobutadiene	0.5
Hexachloroethane	3.0
Lead	5.0
Lindane	0.4
Mercury	0.2
Methoxychlor	10.0
Methyl ethyl ketone	200.0
Nitrobenzene	2.0
Pentachlorophenol	100.0
Pyridine	5.0
Selenium	1.0
Silver	5.0
Tetrachloroethylene	0.7
Toxaphene	0.5
Trichloroethylene	0.5
2,4,5-Trichlorophenol	400.0
2,4,6-Trichlorophenol	2.0
2,4,5-TP Silvex	1.0
Vinyl chloride	0.2

3.2.3 Baseline Radiochemical Characterization

As with all materials, virgin (i.e., unused) bag filter media and GAC may exhibit some levels of radioactivity. To accurately assess radiochemical contamination of these media resulting from their participation in FTU operation, three composite samples each of virgin GAC and bag filter media will be collected and analyzed for the radionuclides listed in Tables 3-3 and 3-4, respectively. The results of the analyses will provide a baseline for comparison of the radiochemical analysis results for spent media. Each virgin bag filter composite sample will be obtained by cutting off the lower portion of the closed end of 10 randomly selected filter socks. The nature of the GAC manufacturing and packaging process naturally composites the GAC. Therefore, the GAC contained in three new sidestream GAC cannisters will be used as the virgin composite samples.

Baseline toxicity characterization of virgin bag filter media and GAC is not necessary since regulatory concentration limits exist for extract analytes. In other words, toxicity characteristic constituents present in the test extracts are either above or below the regulatory concentration limits listed in Table 3-5. A comparison of TCLP test data with baseline data is not required to assess the nature of spent media, and thus, disposal options.

3.3 SAMPLING AND ANALYSIS SUMMARY

A sampling and analysis summary for Phase I of the field treatability study is provided in Table 3-6. Table 3-6 presents no more information than is presented in Sections 3.1 and 3.2, but provides the project engineer or FTU operator with a convenient summarized sampling and analysis reference.

TABLE 3-6

FIELD TREATABILITY STUDY (PHASE I) SAMPLING AND ANALYSIS SUMMARY

I. AQUEOUS PROCESS SAMPLES

Sample Type	Process Sample Locations*	Sampling Frequency
VOCs	AS1, AS2, AS3	Twice per week during first three weeks of Field Treatability Study; once per week thereafter.
	AS2	Once per day during the week before and the week after the predicted breakthrough time for the lead GAC unit.
Dissolved Metals	AS1, AS3	Once every two weeks for the first six months of Field Treatability Study.
Total Metals	AS1, AS3	Once every two weeks for the first six months of Field Treatability Study.
Dissolved Radionuclides	AS1, AS3	Once every two weeks for the first six months of Field Treatability Study.
Total Radionuclides	AS1, AS3	Once every two weeks for the first six months of Field Treatability Study.

II. SOLIDS SAMPLES

Sample Media	Sample Type	Process Sample Locations*	Sampling Frequency
Virgin Bag Filter Media	Radionuclides	NA	Three composite samples consisting of individual samples from ten virgin filter socks.
Spent Bag Filter Media	TCLP/ Radionuclides	AS4, AS5, AS6	Once per day to obtain a weekly composite sample containing 21 individual samples. Weekly composite samples will be split for TCLP and radionuclide analysis.
Virgin GAC	Radionuclides	NA	Three composite samples. Each composite sample is obtained from a new sidestream GAC canister (see Section 3.2.3).
Spent GAC	TCLP/ Radionuclides	AS7	Every time a lead GAC unit is determined to be spent and is taken out of service.

*Process sample locations are defined as follows:

AS1 - Influent to lead GAC unit
AS2 - Effluent from lead GAC unit
AS3 - Effluent from polishing GAC unit
AS4 - Bag filter unit No. 1
AS5 - Bag filter unit No. 2
AS6 - Bag filter unit No. 3
AS7 - Lead GAC unit
NA - Not Applicable

SECTION 4

QUALITY ASSURANCE/QUALITY CONTROL

FTU sampling and analysis activities will be conducted in accordance with QA/QC guidance presented in the RFP Site-Wide Quality Assurance Project Plan (QAPjP) (EG&G, 1991c), QAPjP Quality Assurance Addendum (QAA) 2.3 (EG&G, 1991d), and QAPjP QAA 2.3(A) (EG&G, 1991e). QAA 2.3 and QAA 2.3(A) have been prepared to specifically address QA/QC requirements for construction/installation and operation of the South Walnut Creek Basin FTU, respectively. The QA/QC guidance presented in these documents provides the framework for ensuring that the sampling and analytical data collected during conduct of the field treatability study are of acceptable quality.

In addition to QA/QC guidance presented in the QAPjP, QAA 2.3, and QAA 2.3(A), several Standard Operating Procedures (SOPs) prepared by the EG&G Environmental Monitoring and Assessment Division (EMAD) will be followed in conduct of specific FTU field operation, sampling, and data management activities. EMAD-prepared SOPs (EG&G, 1991f) relevant to the field treatability study are summarized in Table 1 of QAA 2.3(A). Two SOP Addenda (SOPA) will also be prepared to include FTU-specific sampling guidance not addressed by the current SOPs. The SOPs to be amended and the nature of the amendments are summarized below.

SOP	Title	Nature of Amendment
1.13	Containerizing, Preserving, Handling and Shipping of Soil and Water Samples	Bag Filter media composite sampling procedure.
4.7	Collection of Tap Water Samples	FTU process stream purging and sampling.

SECTION 5

REFERENCES

EG&G, 1990, General Radiochemistry and Routine Analytical Services Protocol (GRRASP), Revision 1.1, September 1990.

EG&G, 1991a, Treatability Study Workplan, Surface Water Interim Measures/Interim Remedial Action, South Walnut Creek Basin, Operable Unit No. 2, May 1991.

EG&G, 1991b, Surface Water Interim Measures/Interim Remedial Action Plan/Environmental Assessment and Decision Document, South Walnut Creek Basin, Operable Unit No. 2, 8 March 1991.

EG&G, 1991c, Rocky Flats Plant Site-wide Quality Assurance Project Plan, Draft, 13 February 1991.

EG&G, 1991d, Rocky Flats Plant Site-wide Quality Assurance Project Plan, Quality Assurance Addendum 2.3, South Walnut Creek Surface Water Treatment Facility, Operable Unit No. 2, March 1991.

EG&G, 1991e, Rocky Flats Plant Site-wide Quality Assurance Project Plan, Quality Assurance Addendum 2.3(A), South Walnut Creek Surface Water Treatment Facility, Operable Unit No. 2, May 1991.

EG&G, 1991f, Rocky Flats Plant Environmental Monitoring and Assessment Standard Operating Procedures, Volume IV -- Surface Water, February 1991.

EG&G, 1991g, Memorandum from R. J. Stevens to A. A. Church entitled "Radiological Data for Filter Sock Waste Determination", 6 March 1991.