Phase I Work Plan

South Walnut Creek Basin

Manual No. 21100-WP

OU 02.3

EG&G ROCKY FLATS

FINAL

PHASE I WORK PLAN

FIELD TREATABILITY STUDY
GRANULAR ACTIVATED CARBON TREATMENT SYSTEM

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

OPERABLE UNIT NO 2

U S DEPARTMENT OF ENERGY

Rocky Flats Plant
Golden Colorado

ENVIRONMENTAL RESTORATION PROGRAM

23 August 1991

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U S Department of Energy
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Golden Colorado

23 August 1991

FINAL

Prepared By

EG&G Inc
Rocky Flats Plant
Golden Colorado 80401

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GLOSSARY OF ACRONYMS

AS	Analytical Sample
ARAR	Applicable or Relevant and Appropriate Requirement
CDH	Colorado Department of Health
CS	Collection System (Surface Water)
DOE	Department of Energy
DQO	Data Quality Objective
EG&G	EG&G Rocky Flats Inc
EPA	Environmental Protection Agency
FI	Flow Indicator
FSP	Field Sampling Plan
FTU	Field Treatability Unit
FQI	Flow Totalizing Indicator
FS	Feasibility Study
GAC	Granular Activated Carbon
GPM	Gallons Per Minute
HP	Horsepower
IM/IRAP	Interim Measures/Interim Remedial Action Plan
O&M	Operations and Maintenance Manual
OU 2	Operable Unit No 2
PA	Protected Area
pCi/g	Picocuries per gram
pCi/ℓ	Picocuries per liter
ppm	Parts per million
PVC	Polyvinyl Chloride
QAA	Quality Assurance Addendum
QAPjP	EG&G Rocky Flats Sitewide Quality Assurance Project Plan
RA	Remedial Action
RFEDS	Rocky Flats Environmental Database
RFP	Rocky Flats Plant
RI	Remedial Investigation
SOP	Standard Operating Procedures
SW	Surface Water
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

This Work Plan details the field treatability study to be conducted in the South Walnut Creek drainage basin to remove volatile organic contaminants (VOCs) in the surface water seeps by granular activated carbon (GAC) At a later time this treatment process will be preceded by chemical precipitation and cross flow filtration to remove metals and suspended solids that may contain radionuclides

This project is an Interim Measure/Interim Remedial Action (IM/IRA) conducted under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) in accordance with the Interagency Agreement (IAG) between the U S Department of Energy (DOE) the Environmental Protection Agency (EPA) and the Colorado Department of Health (CDH) Successful demonstration of this treatability study will enable the transition to routine operation pending completion of the Record of Decision (ROD)

Testing of the treatment technology is to be conducted with field scale equipment to conserve time and resources Bench scale testing will be avoided because 1) available quantities of surface water were lacking during the scheduled testing duration and 2) contamination levels are currently below target treatment levels Further the treatment process capability has been overdesigned to which increased levels of contamination can be adequately treated

The treatment system will be deployed in two phases starting with operation of the GAC system in May 1991 The effectiveness of the chosen carbon in removing VOCs will be the initial goal Operational effectiveness will be advanced through studies of backwashing requirements and biofouling tendencies if experienced Operation of the entire treatability system is scheduled to start in October 1991

TITLE Introduction

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EG&G Rocky Flats serves as the primary contractor to manage and operate the Rocky Flats Plant (RFP) owned by the U S Department of Energy (DOE) The RFP began operations in 1951 and continues to this day to be a significant part of the DOE s nationwide nuclear weapons research development and production complex The Environmental Restoration Program at the RFP is directed to identify characterize and remediate contaminated areas within the plant boundaries and report all progress to the DOE Environmental Protection Agency (EPA) and the Colorado Department of Health (CDH)

This Work Plan (WP) presents guidance for performance of the field treatability testing program to cleanup contaminated South Walnut Creek Basin surface water during the Interim Measures/Interim Remedial Action (IM/IRA) at Operable Unit No 2 (OU 2) Two phases of action are planned The Phase I action addressed in this work plan provides for use of granular activated carbon (GAC) to remove of volatile organic compounds (VOCs) Phase II will be addressed in a later work plan and will provide for treatment of metals and radionuclides from these surface waters Both WPs will be consistent with the applicable Project Management Plan Quality Assurance Addendum (QAA) Field Sampling Plan (FSP) and the Operation and Maintenance (O&M) Manual

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 RFP Previous RIs at OU 2 have identified the presence of VOC radionuclide and metals contamination in South Walnut Creek Basin surface waters EG&G Rocky Flats Inc (EG&G) and the DOE have conducted an analysis of remedial alternatives for collection and treatment of contaminated South Walnut

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Date 9/19/91

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

- 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 GAC treatment

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 performance of the preferred IM/IRA process prove to be inadequate The Phase I Field Treatability Unit (FTU) was operational on 13 May 1991 with the exception of the diversion and collection system at SW 132 which is expected to be installed in October 1991 Upon addition of the Phase II suspended solids and inorganics removal unit to the Phase I system operation is scheduled to begin 30 October 1991

TITLE
Background

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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 OU 2 includes the 903 Pad Mound and East Trenches Areas A portion of OU 2 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 groundwater and surface water sampling various subsurface soil surveys and map preparation The RI has identified the presence of VOC radionuclide and metals contamination in OU 2 soils

groundwater 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 March 1991 the DOE released an IM/IRA Plan (EG&G 1991b) 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 March 1991 was approved for implementation by the EPA and the CDH in May 1991

2 1 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 2 1 Surface water will be collected from three surface water monitoring stations (SWs) 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

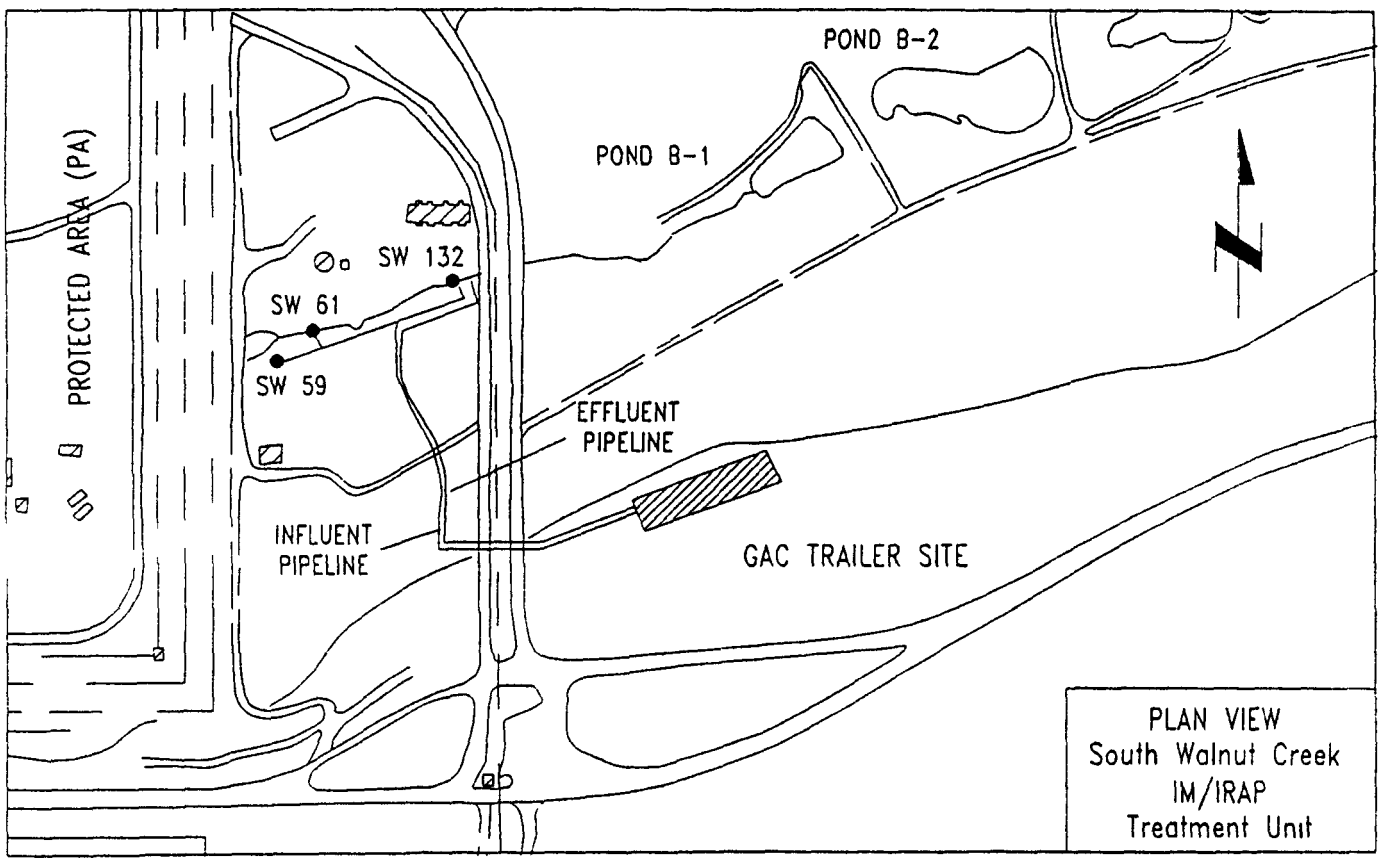

Figure 2 1 Field Treatability Unit

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TABLE 2 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

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 2 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

2 2 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 concern along with their expected maximum concentrations in the influent to the IM/IRA treatment system are listed in Table 2 2 The maximum expected contaminant influent concentrations listed in Table 2 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 2 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

2 3 Collection and Equalization

Phase I of the FTU became operational on 13 May 1991 Figure 2 2 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 Fall 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

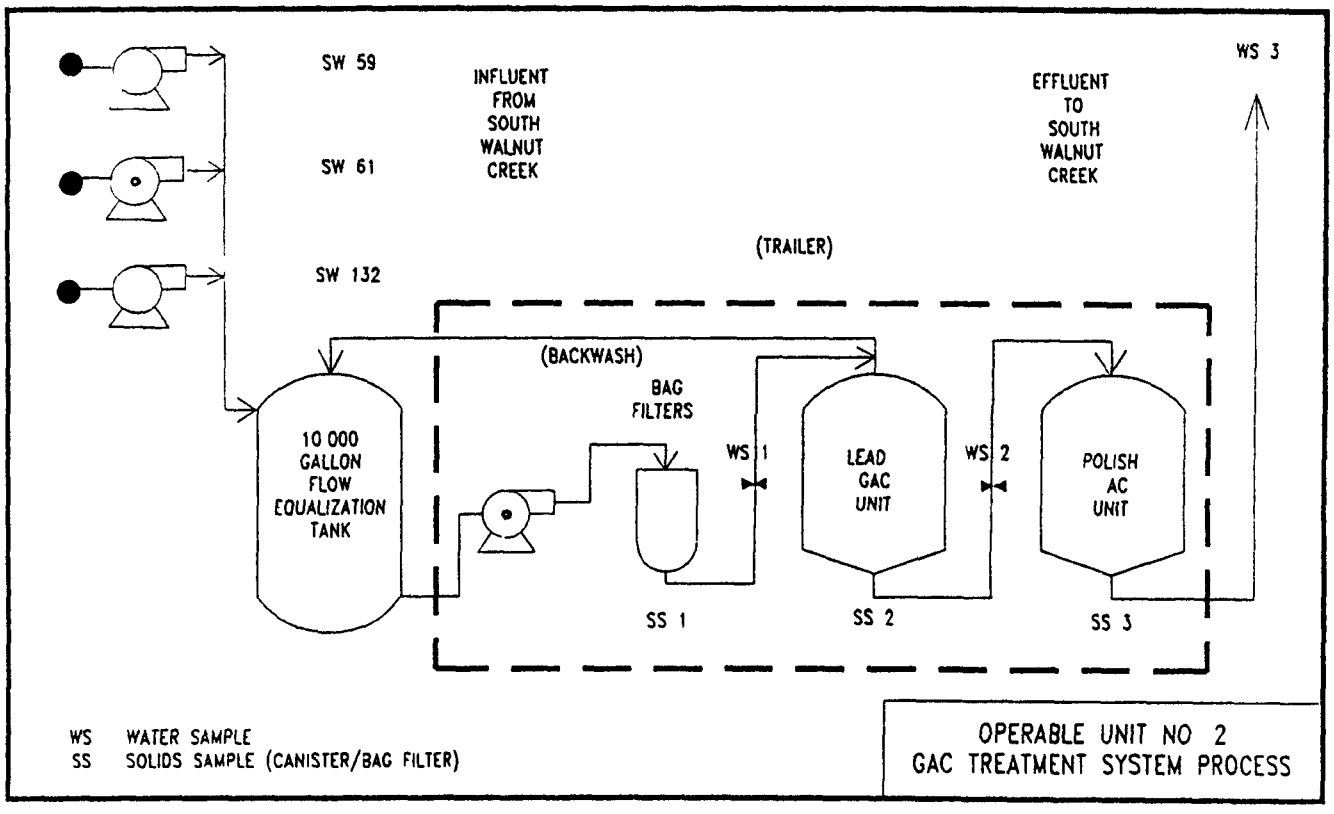

Figure 2 2 South Walnut Creek Basin IM/IRA GAC Treatment System Process Flow Diagram

TABLE 2 2

BASIS FOR DESIGN OF SURFACE WATER IM/IRA TREATMENT SYSTEM

	Units	Influent Concentration	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

TABLE 2 2 (Continued)

BASIN FOR DESIGN OF SURFACE WATER IM/IRA TREATMENT SYSTEM

	Units	Influent Concentration	Effluent Requirements[b]
Strontium (Sr)	mg/ℓ	0 8600	0 382**
Vanadium (V)	mg/ℓ	0 5019	0 1
Zinc (Zn)	mg/ℓ	1 348	2 0
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

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

TABLE 2 2 (Continued)

BASIN FOR DESIGN OF SURFACE WATER IM/IRA TREATMENT SYSTEM

[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

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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

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

2 4 Granular Activated Carbon Treatment System Description

A 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 particle filtration units operated in parallel The parallel configuration facilitates bag filter 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 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 2 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 2 2 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

2 5 Management of Residuals

The generation of residuals is an expected occurrence in that design and operation of the treatment system provides for their accumulation and removal The extent to which even minor quantities of residuals may be encountered is presently unknown specifically accumulation of solids requiring disposal may occur as follows

- Sediments retained by the filter socks
- Solids which pass through the filters and are retained on the GAC then backwashed into the flow equalization tank

- Possible radionuclide accumulation on the GAC which complicates its ultimate disposal as a mixed waste

- Possible biological floc accumulation on the GAC

Generation of liquids which require disposal is limited to purge water at sample taps during sampling This water can be returned to the flow equalization tank as is the backwash water The contribution of personal protective equipment (PPE) will be minimal since use of Level C protective clothing during sampling is planned Minimal trash broken materials or expendable sampling items are anticipated Standard Operating Procedures (SOPs) have been prepared for the collection storage and disposal of PPE and miscellaneous sampling materials Current SOPs governing the management of the precess residuals are general in nature and may be revised upon full characterization of the process wastes

TITLE
Field Treatability Study Objectives

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Manager Remediation Programs — Date 9/16/91

The primary objective of the Phase I IRA is to determine the effectiveness of the GAC treatment system in reducing levels of volatile organics in the upper reaches of surface water flow to South Walnut Creek There are several secondary objectives including

- Improved characterization of the flows influent to the FTU
- Determination if sediment accumulation if any occurs in the GAC units and prefilters
- Determination of requirements if any for backwashing the GAC units to free accumulated sediment
- Determination if biofouling the GAC units occurs
- Determination of volatiles associated with solid residues

Technical objectives and associated data quality objectives (DQOs) for this IRA are as specified in the QAA 2 3 and the Phase I Field Sampling Plan (FSP) These will be met by sampling and analysis of water and solids (sediments filters and used GAC material) at several points within the FTU as developed and presented in the FSP In addition pressure drop measurements will be utilized to evaluate the effectiveness of particulate filters requirements for GAC backwashing and to identify possible bio fouling problems

Process data will be submitted to the Rocky Flats Environmental Database (RFEDS) system Data validation is not necessary for this IM/IRA treatability study

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Date 9/20/91

EG&G ROCKY FLATS PLANT	Manual	21100 WP OU02 3
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Test Equipment ~~Lead~~ ROCKY FLATS ENVIRONMENTAL MANAGEMENT
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Manager Remediation Programs — Date 9/16/91

Field test equipment includes the flow equalization tank particle filter vessels GAC units and all associated gages and flow measurement devices described in Subsections 2 3 and 2 4 of Section 2 0 No additional test equipment is necessary provided the carbon selected for this treatability study proves effective in removing volatile organic compounds If improved carbons are sought then a small water side stream may be diverted to evaluate other GAC columns

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Date 9 Oct 91

EG&G ROCKY FLATS PLANT	Manual	21100 WP OU02 3
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TITLE
Test Procedure

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9/16/91
Date

The O&M Manual for the OU 2 GAC Treatment System presents detailed operation and test procedures as well as trouble shooting guides Quality affecting operations are governed by particular SOPs identified in the QAA 2 3 and the FSP (Section 6 0)

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Date 9/20/91

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TITLE EG&G — ROCKY FLATS PLANT DOCUMENT MANAGEMENT
Field Sampling Plan

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This section presents the sampling and analysis program necessary to satisfy the process performance and chemical characterization objectives of the Granular Activated Carbon (GAC) Phase I field treatability study Specifically the objectives addressed by this program include

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Performance evaluation of the Field Treatability Unit (FTU) in removing volatile organic compounds (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

6 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 Analytical Sample 1 (AS1) AS2 and AS3 respectively (Figure 6 1) 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 VOCs radionuclides and metals analysis as described below

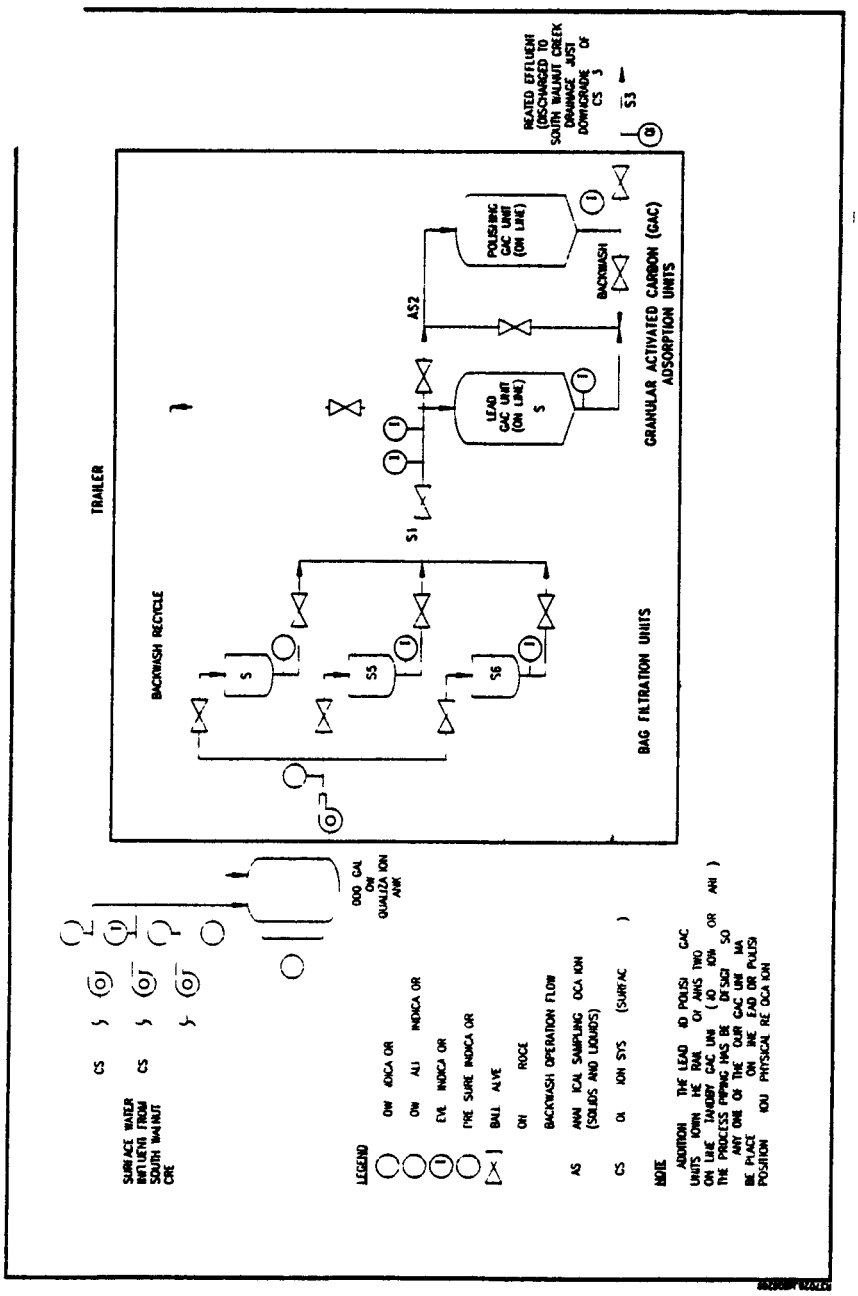

Figure 6 1

Field Treatability Unit (Phase I)
Process Flow Diagram

6 1 1 Volatile Organic Compounds

FTU process samples will be collected for VOC analysis at locations AS1 AS2 and AS3 These samples will be collected twice per week for the first 6 months of Phase I of the field treatability study The samples will be analyzed for the full suite of EPA Target Compound List (TCL) VOCs (Table 6 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 6 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 6 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 6 1

Analysis of Phase I Remedial Investigation (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

TABLE 6 1

TARGET COMPOUND LIST VOLATILE ORGANIC COMPOUNDS AND AQUEOUS PHASE QUANTITATION LIMITS

	Analyte	CAS Number	Aqueous Phase RQL (ug/l)[1]*	Aqueous Phase PQL (ug/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	

Micrograms per liter
EPA Contract Laboratory Program (CLP) Requ red Quantitation Lim t (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

TABLE 6 2

BASIS FOR DESIGN OF SURFACE WATER IM/IRA TREATMENT SYSTEM

	Units	Influent Concentration	Effluent Requirements[b]
Organics			
1 1 Dichloroethene	µg/ℓ[1]	142	7
1 1 Dichloroethane	µg/ℓ	6	1 U
1 2 Dichloroethene (total)	µg/ℓ	10	1 U*
Chloroform	µg/ℓ	82	1 U
Carbon Tetrachloride	µg/ℓ	219	5 U
Trichloroethene	µg/ℓ	153	5 U*
Tetrachloroethene	µg/ℓ	279	1 U
Dissolved Metals			
Beryllium	mg/ℓ[2]	0 0053	0 100
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 1200	0 2U
Antimony (Sb)	mg/ℓ	0 0655	0 060
Barium (Ba)	mg/ℓ	1 8530	1 000
Beryllium (Be)	mg/ℓ	0 0519	0 100
Cadmium (Cd)	mg/ℓ	0 0132	0 010
Chromium (Cr)	mg/ℓ	0 1918	0 050
Cobalt (Co)	mg/ℓ	0 1232	0 050
Copper (Cu)	mg/ℓ	0 2664	0 200
Iron (Fe)	mg/ℓ	184 0000	1 000
Lead (Pb)	mg/ℓ	0 1954	0 050
Lithium (Li)	mg/ℓ	0 4100	2 500
Manganese (Mn)	mg/ℓ	3 3070	1 000
Mercury (Hg)	mg/ℓ	0 0022	0 002
Molybdenum (Mo)	mg/ℓ	0 1574	0 100
Nickel (Ni)	mg/ℓ	0 2239	0 200
Selenium (Se)	mg/ℓ	0 0070	0 010
Strontium (Sr)	mg/ℓ	0 8600	0 382**
Vanadium (V)	mg/ℓ	0 5019	0 100
Zinc (Zn)	mg/ℓ	1 3480	2 000

TABLE 6 2 (Continued)

BASIN FOR DESIGN OF SURFACE WATER IM/IRA TREATMENT SYSTEM

	Units	Influent Concentration	Effluent Requirements[b]
Dissolved Radionuclides			
Gross Alpha	pCi/ℓ[3]	20 11	11 00
Gross Beta	pCi/ℓ	39 90	19 00
Total Uranium	pCi/ℓ	9 96	10 00
Total Radionuclides			
Gross Alpha	pCi/ℓ	730 00	11 00
Gross Beta	pCi/ℓ	545 00	19 00
Plutonium 239 240	pCi/ℓ	3 28	0 05
Americium 241	pCi/ℓ	0 53	0 05
Total Uranium	pCi/ℓ	11 69	10 00

Micrograms per liter

[2] Milligrams per liter

Picocuries per liter

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

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

current Interim Measures/Interim Remedial Action (IM/IRA) treatment system design basis Sampling of surface water at SW 132 is currently being conducted under the RFP environmental monitoring program

Characterization of the 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

6 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 month for the first 6 months of Phase I of the field treatability study This program will result in a sufficient number of data points (i e 6) to adequately assess the degree of radionuclide and metal 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 6 3 and the radionuclides listed in Table 6 4 The metals listed in Table 6 3 include the full suite of

TABLE 6 3

METAL ANALYTES AND AQUEOUS PHASE DETECTION LIMITS

Analyte	Aqueous Phase Detection Limit (ug/l)
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

Micrograms per liter

Source General Radiochemistry and Routine Analytical Services Protocol (GRRASP) Revision 1 1 EG&G Rocky Flats Inc September 1990

TABLE 6-4

RADIONUCLIDES AND MINIMUM DETECTABLE ACTIVITIES

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

[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

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 the minimum detectable activities (MDAs) for radionuclides are presented in Tables 6 3 and 6 4 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

6 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 6 1

6 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 upon change out of the bag filters by cutting off the lower portion of the closed end of the spent filters (i e one sample taken 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 6-5 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 6-6 and analysis of the zero head space extract for the VOCs listed in Table 6 6 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

6 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 6 4 The MDAs listed in Table 6 4 for soil analysis apply for GAC analysis

TABLE 6 5

RADIOLOGICAL ANALYSIS REQUIREMENTS AND MDAs FOR SPENT FABRIC FILTER MEDIA

Analyte	MDA (pCi/g[1])
Gross Alpha	4 00
Gross Beta	10 00
Plutonium 239 240	0 07
Americium 241	0 07
Uranium 233 234	0 10
Uranium 235	0 05
Uranium 238	0 10

[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 6 6

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

6 2 3 Baseline Radiochemical Characterization

As with all materials virgin 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 composite samples of virgin GAC and bag filter media will be collected and analyzed for the radionuclides listed in Tables 6 4 and 6 5 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 3 randomly selected filter socks The nature of the GAC manufacturing and packaging process naturally composites the GAC Therefore the GAC contained in 2 new sidestream GAC canisters 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 6 6 A comparison of TCLP test data with baseline data is not required to assess the nature of spent media and thus disposal options

6 3 SAMPLING AND ANALYSIS SUMMARY

A sampling and analysis summary for Phase I of the field treatability study is provided in Table 6 7 Table 6 7 presents no more information than is presented in Sections 6 1 and 6 2 but provides the project engineer or FTU operator with a convenient summarized sampling and analysis reference In addition Table 6 8 is provided to summarize the sample preservatives containers and holding times necessary for VOCs radionuclides and metals analysis

TABLE 6 7

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 for the first 6 months of the Field Treatability Study
Dissolved Metals	AS1 AS3	Once every month for the first 6 months of Field Treatability Study
Total Metals	AS1 AS3	Once every month for the first 6 months of Field Treatability Study
Dissolved Radionuclides	AS1 AS3	Once every month for the first 6 months of Field Treatability Study
Total Radionuclides	AS1 AS3	Once every month for the first 6 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 three virgin filter socks
Spent Bag Filter Media	TCLP/ Radionuclides	AS4 AS5 AS6	After each bag filter replacement sequence to obtain one composite sample consisting of portions of three spent filters Each composite sample will be split for TCLP and radionuclide analysis
Virgin GAC	Radionuclides	NA	Two composite samples Each composite sample is obtained from a new sidestream GAC canister (see Section 6 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

TABLE 6 8

SAMPLE PRESERVATIVES CONTAINERS AND HOLDING TIMES FOR AQUEOUS PROCESS SAMPLES

ANALYTES	PRESERVATIVE	CONTAINER	MAXIMUM HOLDING TIME
VOCs	Acidify to pH <2 with HNO_3 [1]	2X40 ml amber vials with Teflon lined septa	7 days for extraction 14 days for analysis
Metals/Cyanides	Acidify to pH <2 with HNO_3 [1]	1 liter plastic	Mercury 28 days All other metals 180 days
Gross Alpha	Acidify to pH <2 with HNO_3 [1]	1 liter plastic	180 days
Tritium	None	Plastic 250 ml	180 days
Select Isotopes	HNO_3 to pH <2	Polyethylene 3 1 gallons bottles	180 days
Turbidity [2]	N/A	N/A	N/A

[1] After collection and preservation samples will be maintained at 4°C during shipment and for storage

[2] Field measurement

Source General Radiochemistry and Routine Analytical Services Protocol (GRRASP) Revision 1 1 EG&G Rocky Flats Inc September 1990

TITLE Quality Assurance/Quality Control

Approved by

Manager Remediation Programs

Date 9/16/91

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

Standard Operating Procedures (SOPs) presented in the QAPjP QAA 2 3 and QAA 2 3(A) will be followed in the conduct of specific FTU field operation sampling and data management activities These SOPs are presented in Table 7 1

Other SOPs addressing the quality affecting criteria in operation of the GAC system are currently in preparation and are as follows

SOP	TITLE	NATURE
TRS 01	Granular Activated Carbon Treatment Unit Replacement	Procedure for replacing spend GAC in FTU
TRS 02	Particulate Filter Vessel Replacement	Procedure for replacing used bag filters
TRS 03	Backwashing of Cargon Treatment Systems	Procedure for performing FTU backwash sequences
TRS 04	Equipment Calibration	Procedure for frequency and method of FTU equipment calibration
TRS 05	Handling and Treatment Media Generated from Large Scale Treatability Testing	Procedure for sampling GAC and bag filters
4 7	Collection of Tap Water Samples	Procedure Change Notice for FTU process stream purging and sampling

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TABLE 7 1

Standard Operating Procedures and Construction and Operating Procedures for OU 2 IM/IRA Water Treatment System and Operating and Sampling Activities for Which They are Applicable

STANDARD OPERATING PROCEDURES	GAC System Operation	System Sampling	Surface Water Characterization
1 2 Field Document Control	●	●	●
1 3 General Equipment Decontamination		●	●
1 6 Handling of Personal Protective Equipment	●	●	●
1 7 Handling of Decontamination Water & Wash Water		●	
1 9 Handling of Residual Samples		●	
1 10 Receiving Labeling and Handling Waste Containers		●	
1 11 Field Communications	●	●	
1 12 Decontamination Facility Operations		●	
1 13 Containerizing Preserving Handling, and Shipping of Soil and Water Samples		●	●
4 Data Base Management		●	●
1 15 Use of PIDs and FIDs	X		
1 16 Field Radiological Measurements	X		
4 2 Field Measurements of Surface Water Parameters		●	●
4 7 Collection of Tap Water Samples		●	●

X As required by H&S plan

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TITLE
Analysis of Results

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The effectiveness of the GAC FTU will be measured in terms of achieving design performance through VOC removal Measures of effectiveness will also be applied to the collection flow equalization and particulate filter subsystems comprising the total GAC FTU

Total System Effectiveness

System performance will be based on VOC removal and the achievement of ARARs using the average values of influent and composited effluent samples Values of VOCs are expected to be very low essentially near detection limits or minimal detectable activity Statistical comparisons of numerical means may therefore be necessary to determine treatment effectiveness These comparisons will use variance analysis and Duncan s multiple range test

Collection, Equalization and Return Flow Conveyances

Evaluation of the mechanical system performance will provide a straightforward assessment of treatment system reliability Flow averages and contaminant concentration levels in the flow equalization tank will permit better comparison of design options

Detailed Analysis of Results

With respect to the treatability testing objectives stated in Section 6 0 the following analysis of test results is planned

GAC Effectiveness

(1) Determination of the variation of organic concentrations of influent and effluent for the lead and polish GAC columns with time at specified residence times

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	(2)	Determination of breakthrough in terms of throughput volumes at specified residence times
	(3)	Change GAC if indicated and repeat (1) and (2)
	(4)	Apply statistical analysis
	(5)	Determination of reproducibility of results obtained in (1) and (2)
Sediment Accumulation	(1)	Increase in pressure drop across the units will be cause to (a) change the filter sock (b) backwash the GAC column or (c) consider different filter media
GAC Backwashing	(1)	The duration of scour will be taken as a measure of backwashing effectiveness to permit return to operation pressure drop characteristics
	(2)	Any hysteresis will be noted and (a) scouring improved or (b) inspection conducted to observe biofouling
Biofouling	(1)	If present (a) disinfection will be conducted with dilute Chlorox and (b) backwashing testing will be repeated
Radionuclide Contamination	(1)	If occurring can only be determined by radionuclide analysis
	(2)	Specific analytes will be identified

(3) Gross alpha and beta measurements will be used for sample screening prior to shipment for off site analysis

Volatiles Associated with Solids/Residues

(1) Use of an HNU sensor for headspace analysis to confirm

(2) If present effectiveness of backwashing will be evaluated

TITLE
Reports and Schedule

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In addition to the draft and final Treatability Test Reports required by the IAG monthly progress reports will be prepared These reports will detail the operations activities evaluate system effectiveness and recommend process modifications to increase efficiency

The following milestones have been established by the IAG for this IM/IRA

Start of GAC System Operation	May 13 1991
Completion of Construction	September 30 1991
Start of Entire Field Treatability Unit Operations	October 30 1991
Draft Final Treatability Test Report	April 2 1992
Final Treatability Test Report	June 2 1992

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TITLE (NTROLLED DOCU

References Cited

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SECTION 10

REFERENCES CITED

U S Department of Energy March 1991 Final Surface Water IM/IRAP and Decision Document 903 Pad Mound and East Trenches Areas (OU 2)

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 Marc h 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 Adde ndum 2 3 South Walnut Creek Surface Water Treatment Facility Operable Unit No 2 Marc h 1991

EG&G 1991e Rocky Flats Plant Site wide Quality Assurance Project Plan Quality Assurance Adde ndum 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

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