FINAL

PHASE I RFI/RI WORK PLAN

ROCKY FLATS PLANT
100 AREA
(OPERABLE UNIT NO. 13)

U.S. DEPARTMENT OF ENERGY
Rocky Flats Plant
Golden, Colorado

ENVIRONMENTAL RESTORATION PROGRAM

OCTOBER, 1992
(Revised March 10, 1993)

Volume I of III
Text

U NI

REVIEWED FOR CLASSIFICATION/UCNI
BY G T Ostdiek
DATE 3-31-93

ADMIN RECORD

TABLE OF CONTENTS

Section		Page
1.0	INTRODUCTION	1-1
1 1	ENVIRONMENTAL RESTORATION PROGRAM	1-1
1 2	WORK PLAN SCOPE	1-2
1 3	REGIONAL AND PLANT-SITE BACKGROUND INFORMATION	1-4
1 3 1	Facility Background	1-4
1 3 2	Plant Operations	1-5
1 3 3	Previous Investigations	1-5
1.3 4	Physical Setting	1-7
1.3 4.1	Location	1-7
1 3 4.2	Topography	1-9
1.3 4 3	Meteorology and Climate	1-11
1.3 4.4	Surface Water Hydrology	1-15
1.3 4.5	Precipitation	1-19
1.3 4 6	Ecology	1-19
1 3 4 7	Surrounding Land Use and Population Density	1-21
1.3 4 8	Future Population and Land Use Projections	1-23
1.3 4 9	Regional Geology and Hydrogeology	1-26
2.0	SITE CHARACTERIZATION	2-1
2 1	BACKGROUND AND PHYSICAL SETTING OF OU13	2-1
2 1 1	Locations and Operational Histories of IHSSs	2-2
2 1 1 1	North Chemical Storage Site (IHSS 117 1)	2-2
2 1 1.2	Middle Chemical Storage Site (IHSS 117 2)	2-7
2.1.1.3	South Chemical Storage Site (IHSS 117.3)	2-9
2.1 1 4	Oil Burn Pit No. 1 Waste Leak (IHSS 128)	2-12
2 1 1 5	Lithium Metal Destruction Site (IHSS 134)	2-12
2 1.1 6	Waste Spills (IHSS 148)	2-17
2 1 1 7	Fuel Oil Tank (IHSS 152)	2-20
2 1 1 8	North Area Radioactive Site (IHSS 157.1)	2-21
2 1 1 9	Building 551 Radioactive Site (IHSS 158)	2-24
2 1.1.10	Waste Peroxide Drum Burial (IHSS 169)	2-26
2 1.1.11	Solvent Burning Ground (IHSS 171)	2-27
2 1.1 12	Valve Vault (IHSS 186)	2-29
2 1.1.13	Caustic Leak (IHSS 190)	2-33
2.1 1 14	Hydrogen Peroxide Spill (IHSS 191)	2-36
2 1 2	Topography	2-38
2 1.3	Geology	2-38
2.1.3.1	Rocky Flats Alluvium	2-38
2.1.3 2	Colluvium	2-38
2 1.3 3	Soils	2-41
2 1 3 4	Artificial Fill	2-41
2 1 3.5	Buried Bedrock Surface	2-42
2 1 4	Hydrogeology	2-58
2.1.4.1	Recharge and Discharge	2-58
2 1 4 2	Piezometers and Monitoring Wells	2-60
2.1 4.3	Hydrostratigraphic Units	2-60
2 1 4 4	Water Level Map	2-66

TABLE OF CONTENTS - Continued

Section		Page
	2 1 4.5 Hydraulic Conductivities	2-68
	2 1 5 Surface Water Hydrology	2-68
	2 1.5.1 North Walnut Creek	2-72
	2 1.5 2 South Walnut Creek	2-74
	2.1 6 Air	2-77
2 2	NATURE AND EXTENT OF CONTAMINATION	2-78
	2.2 1 North Chemical Storage Site (IHSS 117 1)	2-84
	2 2 2 Middle Chemical Storage Site (IHSS 117 2)	2-89
	2.2.3 South Chemical Storage Site (IHSS 117.3)	2-95
	2.2 4 Oil Burn Pit No 1 (IHSS 128)	2-103
	2 2.5 Lithium Metal Destruction Site (IHSS 134)	2-107
	2.2 6 Waste Spills (IHSS 148)	2-110
	2 2 7 Fuel Oil Tank (IHSS 152)	2-112
	2.2.8 North Area Radioactive Site (IHSS 157 1)	2-113
	2 2 9 Building 551 Radioactive Site (IHSS 158)	2-118
	2.2 10 Waste Peroxide Drum Burial (IHSS 169)	2-121
	2 2.11 Solvent Burning Ground (IHSS 171)	2-121
	2 2 12 Valve Vault (IHSS 186)	2-123
	2 2 13 Caustic Leak (IHSS 190)	2-126
	2.2.14 Hydrogen Peroxide Spill (IHSS 191)	2-128
	2.2 15 Summary of Surficial Material, Bedrock, and Groundwater Contamination and Additional Data Requirements	2-128'
	2 2 16 Summary of Surface-Water and Sediment Contamination and Additional Data Requirements	2-129
	2 2.16 1 Introduction	2-129
	2 2.16.2 Approaches	2-129
	2 2.16.3 Results	2-139
	2 2.16 4 Conclusions	2-148
	2 2 17 Summary of Air Impacts and Data Requirements	2-149
	2 2.17 1 Air Quality Data Analysis	2-151
	2 2 17.2 Use of Existing Data	2-154
	2 2 17 3 Description of Additional Data Required	2-156
	2.2.18 Previous Investigations in the OU13 Area	2-158
2 3	SUMMARY OF IHSS CONCEPTUAL MODELS	2-159
	2 3.1 OU13 GENERALIZED CONCEPTUAL MODEL	2-162
	2 3 1.1 Contaminant Sources	2-162
	2 3 1 2 Potential Transport Mechanisms and Receptors	2-165
	2.3.2 GROUP-SPECIFIC CONCEPTUAL MODELS	2-169
	2.3 2 1 Group I: Releases Originating Above Ground and Affecting Surficial Materials	2-169
	2 3 2 2 Group II Releases Originating and Affecting Transport Media Below Ground Surface	2-179
3.0	ROCKY FLATS PLANT CHEMICAL SPECIFIC BENCHMARKS	3-1
4.0	RCRA FACILITY INVESTIGATION/REMEDIAL INVESTIGATION TASKS	4-1

TABLE OF CONTENTS - Continued

Section		Page
4 1	PROJECT PLANNING	4-1
4 2	COMMUNITY RELATIONS	4-2
4 3	FIELD INVESTIGATION	4-3
4 4	SAMPLE ANALYSIS AND DATA VALIDATION	4-4
4 5	DATA EVALUATION	4-4
	4 5.1 Site Characterization	4-4
	4.5.2 Source Characterization	4-5
	4 5.3 Nature and Extent of Contamination	4-6
4 6	PHASE I BASELINE RISK ASSESSMENT.	4-6
4 7	PRELIMINARY REMEDIAL ACTION ALTERNATIVES	4-7
	4 7 1 Surficial Materials, Bedrock, Surface Water and Sediments, and Groundwater	4-7
	4 7 1.1 Development and Screening of Remedial Alternatives	4-7
	4 7.2 Air	4-15
4 8	TREATABILITY STUDIES	4-15
4 9	REMEDIAL INVESTIGATION REPORT	4-21
5.0	**DATA QUALITY OBJECTIVES AND DATA NEEDS**	5-1
5 1	DATA QUALITY OBJECTIVES	5-1
	5 1 1 Stage 1 Identification of Decision Types	5-2
	5 1 1.1 Identification of Data Users	5-3
	5 1.1 2 Evaluation of Available Data	5-3
	5 1 1 3 Site Conceptual Model	5-6
	5 1.1.4 Data Objectives and Decisions	5-7
	5 1 2 Stage 2 - Identify Data Uses and Needs	5-7
	5 1 2.1 Identify Data Uses	5-7
	5 1 2.2 Identify Data Types	5-8
	5.1 2.3 Identify Data Quality Needs	5-8
	5.1.2 4 Identify Data Quantity Needs	5-16
	5 1.2 5 Evaluate Sampling/Analysis Options	5-24
	5 1 2 6 Review of PARCC Parameter Information	5-31
	5 1.3 Stage 3 - Design Data Collection Program	5-33
6.0	**FIELD SAMPLING AND ANALYSIS PLAN**	6-1
6 1	OU13 RFI/RI OBJECTIVES	6-1
6 2	BACKGROUND AND SAMPLING RATIONALE	6-2
	6 2.1 Background	6-2
	6.2 2 Sampling Rationale	6-2
	6.2.3 Analytical Rationale	6-29
	6.2.4 Relevant Studies of Other OUs	6-29
6 3	SAMPLING	6-32
	6 3.1 Stage 1 Investigation	6-32
	6 3 1 1 North Chemical Storage Site (IHSS 117.1)	6-39
	6 3 1 2 Middle Chemical Storage Site (IHSS 117 2)	6-40
	6 3 1.3 South Chemical Storage Site (IHSS 117.3)	6-44
	6 3 1.4 Oil Burn Pit No. 1 (IHSS 128)	6-45
	6.3.1.5 Lithium Metal Destruction Site (IHSS 134)	6-47

TABLE OF CONTENTS - Continued

Section			Page
		6 3 1 6 Waste Spills (IHSS 148)	6-51
		6 3 1.7 Fuel Oil Tank (IHSS 152)	6-53
		6 3 1.8 North Area Radioactive Site (IHSS 157.1)	6-54
		6 3 1 9 Building 551 Radioactive Site (IHSS 158)	6-57
		6 3 1.10 Waste Drum Peroxide Burial (IHSS 169)	6-58
		6 3 1.11 Solvent Burning Ground (IHSS 171)	6-59
		6 3 1 12 Valve Vault (IHSS 186)	6-60
		6 3 1.13 Caustic Leak (IHSS 190)	6-63
		6 3 1.14 Hydrogren Peroxide Spill	6-63
		6 3 1.15 HRR PACs and PICs	6-63
	6 3 2	Stage 2 Investigation	6-66
	6.3.3	Stage 3 Investigation	6-70
6 4	SAMPLING EQUIPMENT AND PROCEDURES		6-72
	6 4 1	Radiological Survey Procedure	6-72
	6 4 2	Soil Gas Survey	6-74
	6 4 3	Surficial Soil Sampling Procedure	6-74
		6 3 4.1 Surficial Soils Sampling—Vertical Profiles	6-74
	6 4 4	Borehole Drilling and Soil Sampling Procedures	6-75
	6 4 5	Asphalt/Concrete Sampling Procedure	6-77
	6 4 6	Installing and Sampling of Ground Water Monitoring Wells	6-77
	6 4 7	Sump Sampling Procedure	6-79
	6 4 8	Surveying of Sample Locations	6-79
6 5	SAMPLE ANALYSIS		6-79
	6 5 1	Soil Gas Analysis	6-79
	6 5 2	Borehole Samples	6-80
		6 5.2.1 Chemical Analysis	6-80
		6 5.2.2 Physical Analysis	6-80
	6.5.3	Groundwater Samples	6-80
	6 5 4	Sample Containers and Preservation	6-81
	6.5.5	Sample Handling and Documentation	6-81
	6.5.6	Sample Designation	6-83
6 6	FIELD QC PROCEDURES		6-83
7.0	**TASKS AND SCHEDULING**		7-1
8.0	**HUMAN HEALTH RISK ASSESSMENT PLAN**		8-1
8 1	OVERVIEW		8-1
	8.1.1	Regulatory Basis	8-1
	8.1.2	Background of Site Contamination	8-4
8 2	CONTAMINANTS OF CONCERN		8-6
	8.2 1	Data Collection	8-6
	8 2 2	Data Evaluation	8-7
	8 2 3	Hazard Identification	8-8
	8.2 4	Selection of Contaminants of Concern	8-9
8 3	EXPOSURE ASSESSMENT		8-9
	8 3 1	Conceptual Site Model.	8-10

TABLE OF CONTENTS - Continued

Section		Page
	8 3 2 Contaminant Fate and Transport	8-10
	8.3 3 Exposure Pathways	8-11
	8 3 4 Exposure Point Concentrations	8-12
	8.3 5 Contaminant Intake Estimation	8-13
	8.3.6 Uncertainty in the Exposure Assessment	8-14
8 4	TOXICITY ASSESSMENT	8-14
8 5	RISK CHARACTERIZATION	8-17
8 6	UNCERTAINTIES, LIMITATIONS, AND ASSUMPTIONS	8-19
9.0	ENVIRONMENTAL EVALUATION	9-1
9 1	INTRODUCTION	9-1
9.2	BIOLOGICAL AND HABITAT SITE CHARACTERIZATION	9-2
9 3	ECOTOXICOLOGICAL INVESTIGATIONS	9-3
10.0	QUALITY ASSURANCE ADDENDUM	10-1
10 1	ORGANIZATION AND RESPONSIBILITIES	10-1
10 2	QUALITY ASSURANCE PROGRAM	10-2
	10.2.1 Training	10-4
	10.2.2 Quality Assurance Reports to Management	10-4
10 3	DESIGN CONTROL AND CONTROL OF SCIENTIFIC INVESTIGATIONS	10-4
	10.3.1 Design Control	10-4
	10.3 2 Data Quality Objectives	10-7
	10 3 3 Sampling Locations and Sampling Procedures	10-8
	11.3.4 Analytical Procedures	10-8
	10 3.5 Equipment Decontamination	10-17
	10 3.6 Air Quality	10-17
	10.3.7 Quality Control	10-17
	10 3.7 1 Objectives for Field QC Samples	10-18
	10.3.7.2 Laboratory QC	10-18
	10 3 8 Quality Assurance Monitoring	10-20
	10 3 9 Data Reduction, Validation, and Reporting	10-20
	10.3.9 1 Analytical Reporting Turnaround Times	10-20
	10.3 9.2 Data Reduction	10-20
	10 3.9.3 Data Validation	10-21
	10 3.9.4 Data Reporting	10-21
10 4	PROCUREMENT DOCUMENT CONTROL	10-22
10.5	INSTRUCTIONS, PROCEDURES, AND DRAWINGS	10-22
10 6	DOCUMENT CONTROL	10-23
10 7	CONTROL OF PURCHASED ITEMS AND SERVICES	10-23
10 8	IDENTIFICATION AND CONTROL OF ITEMS, SAMPLES, AND DATA	10-24
	10 8 1 Sample Containers/Preservation	10-24
	10 8 2 Sample Identification	10-24
	10 8 3 Chain-of-Custody	10-24
10 9	CONTROL OF PROCESSES	10-24
10 10	INSPECTION	10-25

TABLE OF CONTENTS - Continued

Section		Page
10 11	TEST CONTROL	10-25
10 12	CONTROL OF MEASURING AND TEST EQUIPMENT (M&TE)	10-25
	10 12.1 Field Equipment	10-25

OPERABLE UNIT 13 FIGURES 6-4 THROUGH 6-10

In order to minimize multiple reiterations of expensive color copies, only black and white copies were included in this submittal. If the changed figures are acceptable to CDH and EPA, final color copies will be transmitted within seven working days.

TITLE DQOs Approved By

04/01/93 _____ / /
Effective Date Manager Date

7.0 TASKS AND SCHEDULING

The Interagency Agreement (IAG) schedule for conducting the OU 13 Phase I RFI/RI is summarized in Figure 7-1. The IAG schedule includes the established milestones and includes contingencies for regulatory review of a brief Technical Memorandum to be prepared after Stage 2 of the FSAP. The schedule does not address issues related to obtaining contractual authorization to proceed. Laboratory turnaround time for reporting analytical results is assumed to take 21 days; data validation is assumed to require an additional 30 days, and both have been factored into the schedule Approximately two years will elapse from the time the Work Plan is implemented until the final RFI/RI Phase I report is issued.

Several key elements of the Work Plan overlap chronologically. This reflects both the flexibility designed into the Work Plan and the need to implement the Work Plan on an aggressive schedule

Data validation will begin approximately one month after the site characterization task begins in anticipation that sufficient data will be generated from this stage of the RFI/RI until its completion. It will therefore be necessary to utilize a full-time data validation staff. Implementing data validation concurrent with site characterization will assist in the refinement of data collection procedures and in completing RFI/RI activities within the time frame established in the IAG.

IAG OU13 RFI/RI Schedule

ID	Name	Start	Finish
1	Submit Draft Phase I Workplan	Apr 15 '92	Apr 15 '92
2	EPA/CDH/LRA Review	Apr 15 '92	Aug 3 '92
3	Prepare Final Phase I Workplan	Jul 21 '92	Oct 12 '92
4	Submit Final Phase I Workplan	Oct 12 '92	Oct 12 '92
5	Prepare Project Mgmt. Plans	Nov 15 '92	Dec 11 '92
6	EG&G/RFP/DOE Review & Approval	Dec 14 '92	Jan 29 '93
7	Implement Community Relations Plan	Feb 1 '93	Jan 11 '95
8	Site Charracterization	Feb 1 '93	Oct 22 '93
9	Site Physical Characteristics	Feb 1 '93	Jul 30 '93
10	Data Validation	Mar 15 '93	Dec 17 '93
11	Conduct Risk Assessment	Nov 1 '93	Mar 4 '94
12	Evaluate Remedial Technologies	Jan 10 '94	May 13 '94
13	Select Remedial Technology	Feb 21 '94	Jun 10 '94
14	Prepare Draft Phase I Report	Apr 4 '94	Aug 8 '94
15	Submit Draft RFI/RIPhase I Report	Aug 8 '94	Aug 8 '94
16	EPA, CDH, LRA Review	Jul 12 '94	Nov 14 '94
17	Prepare Final RFI/RI Phase I Report	Oct 18 '94	Jan 11 '95
18	Submit Final RFI/RI Phase I Report	Jan 11 '95	Jan 11 '95

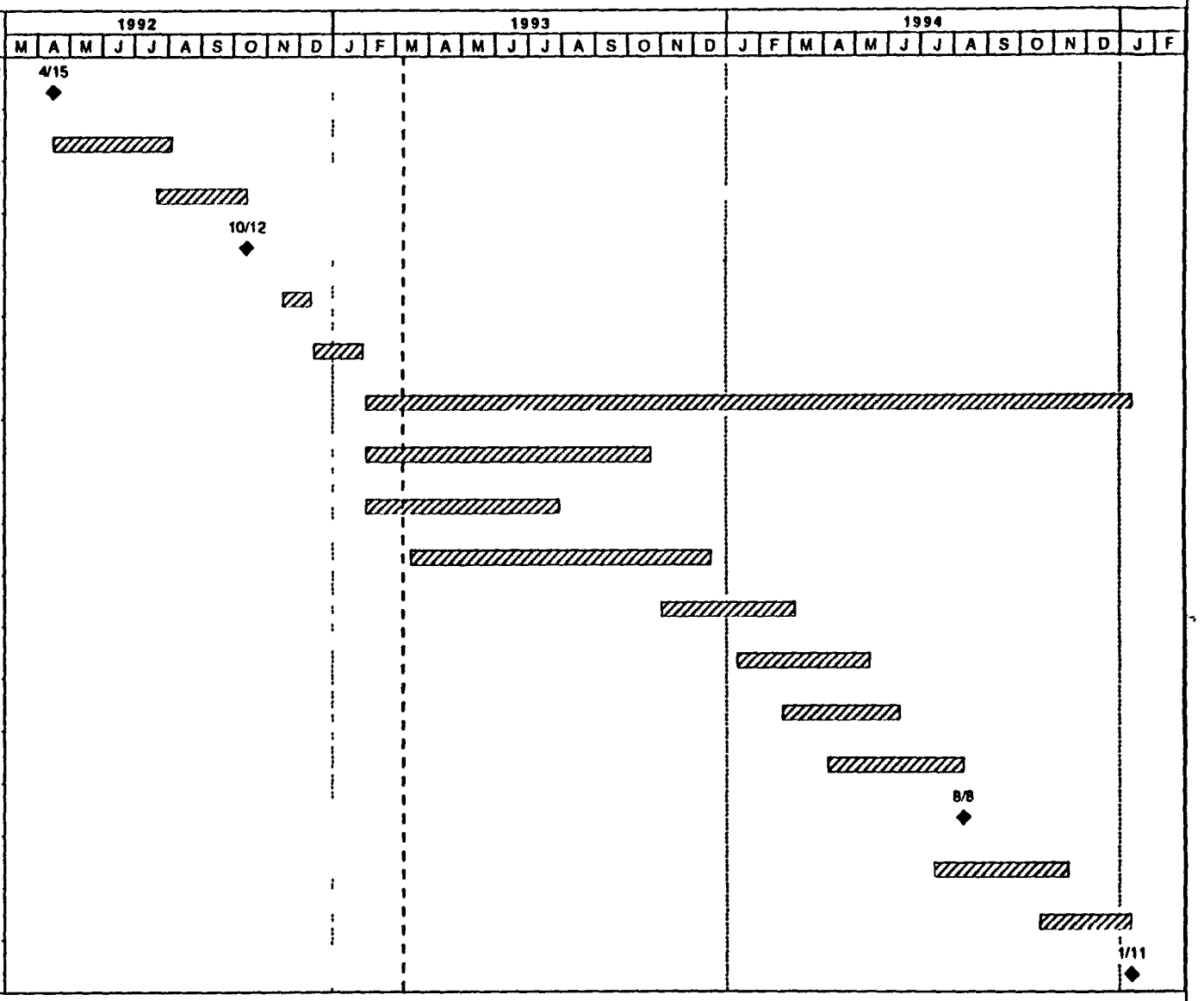

FIGURE 7-1

Critical — Noncritical — Progress — Milestone — Summary — Rolled Up

Page 1