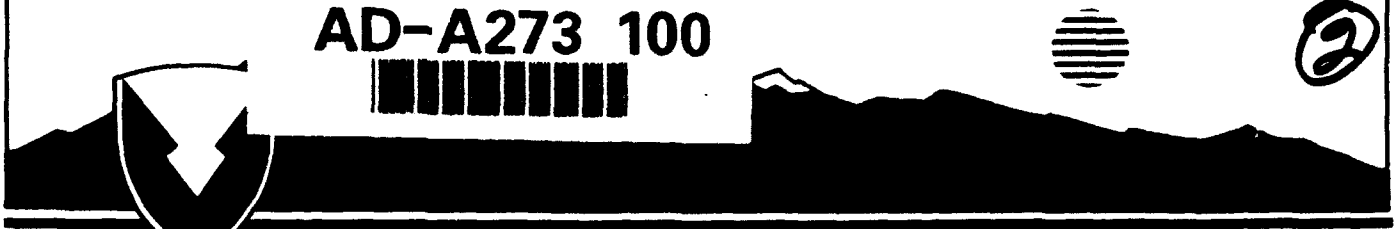

Rocky Mountain Arsenal

Final
Technical Program Plan
FY88-FY92

(Remedial Investigation/Feasibility Study/Interim Response Actions)

March 1988

PREPARED BY:

Program Manager's Office For
Rocky Mountain Arsenal
Contamination Cleanup

REQUESTS FOR COPIES OF THIS DOCUMENT SHOULD BE REFERRED TO PROGRAM MANAGER FOR ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP, AMXRM, ABERDEEN PROVING GROUND, MARYLAND 21010

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ROCKY MOUNTAIN ARSENAL CONTAMINATION CLEANUP

FINAL TECHNICAL PROGRAM PLAN
FY88 - FY92
(Remedial Investigation/Feasibility Study/ Interim Response Actions)

March 25, 1988

PREPARED BY

PROGRAM MANAGER'S OFFICE FOR
ROCKY MOUNTAIN ARSENAL
CONTAMINATION CLEANUP

TABLE OF CONTENTS
(Page 1 of 3)

Section		Page
1.0	DEVELOPMENT, FINDINGS, AND BASES OF TECHNICAL PROGRAM PLAN	1-1
	1.1 INTRODUCTION	1-1
	1.1.1 Background	1-1
	1.1.2 Relevant Legal Determinations	1-2
	1.1.3 Components of the Technical Program Plan	1-2
	1.1.4 References to and Understanding of Related Technical and Legal Material	1-3
	1.2 PROCESS FOR DEVELOPMENT AND ADOPTION OF THE TECHNICAL PROGRAM PLAN	1-3
	1.3 FINDINGS OF THE TECHNICAL PROGRAM PLAN	1-5
	1.3.1 Required Content of the Technical Program Plan	1-5
	1.3.2 Goals for Issuance of Preferred Remedial Action	1-6
	1.3.3 Identification of Status of Products and Subproducts	1-6
	1.3.4 New Products or Subproducts	1-8
	1.3.5 New ARAR Determinations	1-8
	1.3.6 Other Deliverables	1-8
	1.3.7 IRA Deadlines	1-9
	1.3.8 RI/FS Deadlines	1-10
	1.3.9 Schedule	1-11
	1.3.10 Resolution of General RI/FS	1-11
	1.4 BASES FOR TECHNICAL PROGRAM PLAN	1-12
	1.4.1 Assumptions	1-12
	1.4.2 RI/FS Process	1-13
	1.4.3 Records of Decision	1-22
2.0	RI/EA/FS PROCESS	2-1
	2.1 OVERVIEW	2-1
	2.2 REMEDIAL INVESTIGATION	2-8
	2.2.1 Data Collection/Assessment	2-8
	2.2.2 Data Interpretation	2-16
	2.3 ENDANGERMENT ASSESSMENT	2-19
	2.4 FEASIBILITY STUDY	2-28
	2.4.1 Overview of Process	2-28
	2.4.2 Approach	2-30
	2.4.3 Technology Inventory and Screening	2-31

TABLE OF CONTENTS
(Continued, Page 2 of 3)

Section			Page
		2.4.3.1 Technology Inventory	2-31
		2.4.3.2 Technology Screening	2-31
		2.4.3.3 Level of Detail	2-33
		2.4.3.4 Data Needs	2-33
	2.4.4	Alternative Development and Screening	2-33
		2.4.4.1 Alternative Development	2-33
		2.4.4.2 Alternative Screening	2-34
		2.4.4.3 Level of Detail	2-35
		2.4.4.4 Data Needs	2-36
	2.4.5	Detailed Analysis of Alternatives	2-36
		2.4.5.1 Level of Detail	2-38
		2.4.5.2 Data Needs	2-39
3.0	INTERIM RESPONSE ACTIONS		3-1
	3.1	OVERVIEW	3-1
	3.2	INTERFACE WITH RI/EA/FS	3-5
	3.3	IRA DESCRIPTIONS	3-5
		3.3.1 Ground Water	3-5
		3.3.1.1 Ground Water Intercept System North of RMA	3-5
		3.3.1.2 Boundary System Evaluations and Improvements	3-6
		3.3.1.3 Ground Water Intercept and Treatment System North of Basin F	3-6
		3.3.1.4 Closure of Abandoned Wells on RMA	3-7
		3.3.1.5 Basin A-Neck Ground Water Intercept and Treatment System	3-7
		3.3.2 Soils and Other Contamination Sources	3-8
		3.3.2.1 Basin F Liquids, Sludges, and Soils Removal and Basin F Liquids Treatment	3-8
		3.3.2.2 Building 1727 Sump Liquid	3-9
		3.3.2.3 Hydrazine Blending and Storage Facility (HBSF) Remediation	3-9
		3.3.2.4 Fugitive Dust Control	3-10
		3.3.2.5 Sanitary Sewer Remediation	3-10
		3.3.2.6 Asbestos Removal	3-11
		3.3.2.7 Remediation of Other Contamination Sources	3-11
		3.3.2.8 Pretreatment of CERCLA Liquid Wastes	3-11

TABLE OF CONTENTS
(Continued, Page 3 of 3)

Section		Page
4.0	IMPLEMENTATION	4-1
	4.1 INTRODUCTION	4-1
	4.2 PMO CONTRACTS	4-1
	4.3 SHELL OIL COMPANY	4-2
	4.4 U.S. ARMY CORPS OF ENGINEERS	4-3
	4.5 U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY	4-3
	4.6 SUMMARY	4-4
5.0	SCHEDULES	5-1
	5.1 SCHEDULE STRUCTURE AND ASSUMPTIONS	5-3
	5.1.1 Technical Plans	5-3
	5.1.2 Products	5-5
	5.1.3 Subproducts and Other Deliverables	5-6
	5.1.4 Dispute Resolution	5-7
	5.1.5 RI/FS/ROD Process	5-7
	5.2 ONPOST REMEDIAL INVESTIGATION SCHEDULE	5-8
	5.2.1 Onpost Remedial Investigation	5-8
	5.2.2 Onpost Remedial Investigation Deadlines	5-8
	5.3 ONPOST ENDANGERMENT ASSESSMENT SCHEDULE	5-10
	5.3.1 Onpost Endangerment Assessment	5-10
	5.3.2 Onpost Endangerment Assessment Deadlines	5-10
	5.4 FEASIBILITY STUDY SCHEDULE	5-12
	5.4.1 Onpost Feasibility Study	5-12
	5.4.2 Onpost Feasibility Study Deadlines	5-12
	5.4.3 Onpost RI/FS Report Deadline	5-12
	5.5 OFFPOST RI/FS DEADLINES AND SCHEDULE	5-12
	5.5.1 Offpost RI/FS	5-12
	5.5.2 Offpost RI/FS Deadlines	5-14
	5.5.3 Offpost RI/FS Report	5-14
	5.6 INTERIM RESPONSE ACTION DEADLINES AND SCHEDULE	5-14
	5.6.1 Interim Response Actions	5-14
	5.6.2 Interim Response Action Deadlines	5-16

APPENDIX A--TASK SUMMARIES
APPENDIX B--RMA RI/FS SCHEDULE, GLOSSARY AND GANTT CHARTS
APPENDIX C--COMMENTS AND RESPONSES TO
THE DRAFT FINAL TECHNICAL PROGRAM PLAN,
DECEMBER 1987

LIST OF TABLES

Table		Page
2-1	Site Summary	2-4

LIST OF FIGURES

Figure		Page
1-1	RI/FS New Technical Plans	1-15
1-2	RI/FS Products	1-17
1-3	RI/FS Product/Task Matrix	1-20
1-4	RI/FS Report(s) Process	1-21
1-5	ROD Process	1-23
1-6	Level of Detail in Alternatives Analysis	1-26
2-1	RMA RI/FS Process Flow Diagram	2-2
2-2	Operable Units and Study Areas	2-3
2-3	Endangerment Assessment Flow Diagram	2-21
2-4	Pathway Models	2-22
2-5	Surface Use/Exposure Pathway Matrix	2-24
2-6	Exposure Matrix	2-25
2-7	EA Interactive Flow Scheme	2-27
2-8	FS Process Flow Diagram	2-29
3-1	Interim Response Action Process	3-3
5-1	Plan Products and Time Sequence	5-2
5-2	Offpost ROD Flow Diagram	5-4
5-3	Remedial Investigation Flow Diagram	5-9
5-4	Endangerment Assessment Flow Diagram	5-11
5-5	Feasibility Study Flow Diagram	5-13
5-6	Interim Response Action Flow Diagram	5-15

1.0 DEVELOPMENT, FINDINGS, AND BASES OF TECHNICAL PROGRAM PLAN

1.1 INTRODUCTION

1.1.1 Background

In October 1984, the Department of the Army (Army) commenced its Remedial Investigation/Feasibility Study (RI/FS) with respect to onpost and offpost contamination associated with the Rocky Mountain Arsenal (RMA).

From that date until mid-1987, this activity took the form of the Army conducting various RI/FS tasks in substantive compliance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and the National Contingency Plan (NCP), and then preparing various draft reports that were forwarded to the U.S. Environmental Protection Agency (EPA), the Shell Oil Company (Shell), and the State of Colorado (State) for review and comment (with a meeting frequently being held in conjunction with the review period). Thereafter, the Army would respond in writing to all comments and make appropriate modifications of the draft task plan or task results. Although this process resulted in a substantial exchange of pertinent information and much real progress in the RI/FS, these cooperative efforts were always impacted and sometimes constrained by the simultaneous need to act in accordance with the adversarial relationships existing between the United States and Shell, Colorado and the United States, and Colorado and Shell in connection with the related cases of United States v. Shell Oil Co., Colorado v. United States, and Colorado v. U.S. Dept. of the Army. Nevertheless, by early summer of 1987, the Army had completed most of the initial phases of its investigations of potential onpost and offpost RMA-related contamination.

At that time, serious settlement negotiations were initiated between the United States, Shell, and the State that offered the prospect of resolving all outstanding litigation. In this connection, it was agreed that it would be beneficial to all concerned for technical representatives of the Army, EPA, Shell, and the State to meet and take stock of what had been accomplished to date in the RI/FS, to endeavor to reach a consensus on the outstanding issues and remaining milestones and on the most appropriate manner for achieving the earliest possible commencement of comprehensive

remediation at the RMA CERCLA Site that would be consistent with protection of the public health and environment. Accordingly, technical representatives of these entities met for extended periods of time throughout the summer and early fall of 1987 for purposes of thoroughly and freely discussing all significant aspects of the RI/FS.

Although the State ultimately withdrew in 1987 from settlement negotiations, it remained an active participant throughout the Technical Review Process.

This Technical Program Plan (TPP) is derived in large part from the candid discussions and deliberations that resulted from the Technical Review.

1.1.2 Relevant Legal Determinations

The TPP is also the product of legal determinations made in the context of the proposed Consent Decree, and in the RI/FS Process Document that became effective and binding on the Army, EPA, and Shell on January 29, 1988. The TPP also is prepared to be not inconsistent with CERCLA and the NCP, and pertinent EPA guidance that is not inconsistent with CERCLA and the NCP.

1.1.3 Components of the Technical Program Plan

The TPP consists of this document, including its appendices and Schedules.

The TPP contains the following components in order to fulfill the functions assigned by the RI/FS Process Document:

(a) Section 1.0 provides a short background of the TPP, summarizes the principal findings of the TPP, and identifies the factual and legal bases, factual assumptions, and many of the pertinent aspects of the RI/FS Process Document upon which the TPP findings and the Schedules are predicated;

(b) Section 2.0 summarizes the basic elements of the RI/FS process that relate to the TPP findings and the Schedules;

(c) Section 3.0 summarizes the basic components of the Interim Response Action (IRA) process that relate to the TPP findings and the Schedules;

(d) Section 4.0 summarizes the process for implementation of the RI/FS and IRAs that is relevant to the TPP findings and Schedules;

(e) Section 5.0 describes the process for development of the Schedules, the assumptions underlying the Schedules, and identifies the Deadlines that result from the critical dates on the Schedules;

(f) Appendix A summarizes the nature and status of the tasks in connection with the TPP findings and Schedules;

(g) Appendix B provides a glossary for use in connection with the Schedules and the Gantt Charts;

(h) Appendix C sets forth verbatim the comments of EPA, Shell, and the State and provides the Army's responses;

(i) Gantt charts providing hard copies of the Schedules are enclosed in the pocket to the TPP (each Organization and the State is also provided a floppy disk containing the Schedules).

1.1.4 References to and Understanding of Related Technical and Legal Material

The TPP frequently references in a summary fashion aspects of CERCLA, the NCP, pertinent EPA guidance, the proposed Consent Decree, the RI/FS Process Document, and the RI/FS and IRA tasks that are relevant in this context. These brief summaries are provided in this context only for the convenience of the reader and are not intended to supplant the actual text of these provisions or the descriptions and data available in the relevant task documents. For the specifics, reference should be made to the full text of these provisions or task documents.

In order that the TPP may be kept to a length reasonable for planning purposes, it has been written at a level that presumes that the reader has considerable familiarity with or has access to persons with sufficient familarity with the RMA Cleanup.

1.2 PROCESS FOR DEVELOPMENT AND ADOPTION OF THE TECHNICAL PROGRAM PLAN

Part XII of the RI/FS Process Document governs the development and adoption of the TPP.

Consistent with Paragraphs 12.4 and 12.5 of the RI/FS Process Document, the Army prepared the initial draft of the TPP following repeated meetings with

EPA, Shell, and the State and by consensus to the maximum extent practicable. In accordance with Paragraph 12.6, the Army transmitted the draft TPP to the Organizations and the State prior to December 4, 1987 for 50 days of review and comment. Following thorough review of all comments, the Army is transmitting on this date to the Steering and Policy Committee (SAPC) and the other Organizations and the State:

(a) The draft final TPP;

(b) Copies of the written comments of the other Organizations and the State;

(c) The Army's response to timely written comments received from the other Organizations and the State; and

(d) By separate cover, the Army's response to Shell's proposals to be Lead Party.

Within approximately 15 days of receipt of the draft final TPP and the comments and responses, SAPC will meet to decide the unresolved issues, to reconcile any inconsistencies, and to direct the finalization of the TPP in accordance with its decisions. During the week prior to the SAPC meeting, the Organizations shall meet to reconcile as many differences as possible concerning the TPP. All unresolved issues shall be placed on the agenda for the SAPC meeting.

If an Organization does not object to the draft final TPP during the course of the SAPC review, it shall be deemed to have approved the TPP.

Any of the Organizations may elevate an issue to the Final Review Committee (FRC) if the SAPC cannot decide a dispute concerning the TPP within 20 days of SAPC's initial meeting. An issue may be elevated by notifying the other Organizations in writing of such intent within 5 days of the close of the SAPC's review period.

The decision of the FRC with respect to any dispute shall be reflected in the Final TPP. Fifteen days after SAPC or FRC direct a revision of the draft final TPP, the TPP shall be revised accordingly by the Army. After revising the TPP, the Army shall transmit a copy to SAPC which shall approve

the TPP if it finds it to be consistent with each revision directed by the SAPC or FRC.

Following SAPC or FRC approval of the TPP, copies of the final TPP shall be issued by the Army to the other Organizations and the State. The RI/FS Deadlines and the IRA Deadlines established by the TPP shall be appended to the RI/FS Process Document. Thereafter, the Deadlines shall apply and be enforceable except to the extent that additional time is granted pursuant to the terms of the RI/FS Process Document or the proposed Consent Decree.

1.3 FINDINGS OF THE TECHNICAL PROGRAM PLAN

1.3.1 Required Content of the Technical Program Plan

Paragraphs 12.2 and 12.3 of the RI/FS Process Document provide that the TPP shall:

(a) Have goals for the issuance of the Army's preferred remedial action for the Offpost Operable Unit and Onpost Operable Unit;

(b) Identify the Products or Subproducts that shall proceed without substantial modification, those that are sufficiently completed as of this date, and those that will require such substantial modification as to be designated New Products or Subproducts;

(c) Identify any New Products or Subproducts which shall be added to the RI/FS for the Onpost and Offpost Operable Units;

(d) Identify any new Products or Subproducts that require Applicable or Relevant and Appropriate Requirement (ARAR) determinations;

(e) Identify Other Deliverables to the extent known:

(f) Establish Deadlines for the completion of IRA Decision Documents;

(g) Identify RI/FS Deadlines;

(h) Identify Schedules; and

(i) Identify and resolve any previously identified or new issues which solely relate to the general conduct of the RI/FS.

The TPP is not to address specific issues that can be better resolved in the context of the specific Technical Plans, Products, Subproducts, Other Deliverables, RI/FS Reports, and Records of Decisions (RODs).

The pertinent findings with respect to each of these requirements for the TPP are set forth in Sections 1.3.2 through 1.3.10 below.

1.3.2 Goals for Issuance of Preferred Remedial Action

Paragraph 12.2(a) of the RI/FS Process Document provides that the TPP shall "[h]ave goals for the issuance of the Army's preferred remedial action for the Off-post Operable Unit and for the On-post Operable Unit...."

Based on the Army's own analysis and after full consideration of all of the written comments received, the Army's goal for issuance of the RI/FS Report with preferred remedial action for the Offpost Operable Unit is August 23, 1989.

Following similar review, the Army's goal for issuance of the RI/FS Report with preferred remedial action for the On-post Operable Unit is June 27, 1992.

The bases for these goals are described succinctly in Section 5.0 (Schedules).

1.3.3 Identification of Status of Products and Subproducts

Paragraph 12.2(b) of the RI/FS Process Document provides that the TPP shall "[i]dentify, without specifics the Products and Subproducts listed in paragraphs 16.48, 16.50, and 16.52 which (1) shall proceed without substantial modification, (2) are sufficiently completed as of the date of the Technical Program Plan, or (3) require such substantial modification as to be designated New Products or Subproducts in accordance with paragraphs 16.25-16.26...."

Based on the Army's own analysis and after its full consideration of all of the written comments received, the Army makes the following findings with respect to each of the designated Products or Subproducts:

(1) Onpost Air RI Product--Proceed without substantial modification;

(2) Onpost Buildings RI Product--Proceed without substantial modification;

(3) Onpost Biota RI Product--Proceed without substantial modification;

(4) Onpost Water RI Product--Proceed without substantial modification;

(5) Onpost Study Area Reports (SARs)--Proceed without substantial modification;

(6) Onpost RI Report Product--Proceed without substantial modification;

(7) Onpost Endangerment Assessment (EA) Contaminant Identification Product--Proceed without substantial modification;

(8) Onpost EA Exposure and Toxicity Assessment Product--Proceed without substantial modification;

(9) Onpost EA Report Product--Proceed without substantial modification;

(10) Onpost FS Development and Screening of Alternatives Product--Proceed without substantial modification;

(11) Onpost FS Evaluation of Alternatives--Proceed without substantial modification;

(12) Onpost FS Report Product--Proceed without substantial modification;

(13) Onpost RI Phase I Contamination Assessment Report (CAR) Subproducts--Proceed without substantial modification;

(14) Onpost EA Risk Characterization Subproduct--Proceed without substantial modification;

(15) Onpost FS Technology Inventories Subproduct--Proceed without substantial modification;

(16) Onpost FS Treatment/Incineration Study Subproduct--Proceed without substantial modification;

(17) Onpost FS Disposal Facility Study Subproduct--Proceed without substantial modification;

(18) Onpost FS Advanced Technologies and Pilot Treatment Studies Subproduct--Proceed without substantial modification;

(19) Offpost Proposed RI and EA-related ARAR Determination Product--Proceed without substantial modification; and

(20) Offpost Proposed EA and FS (with proposed FS-related ARAR Determination) Product--Proceed without substantial modification.

1.3.4 New Products or Subproducts

Paragraph 12.2(c) of the RI/FS Process Document provides that the TPP shall "[i]dentify any New Products or Subproducts not identified in paragraph 16.48, 16.50, and 16.52 which shall be added to the RI/FS for the On-Post and Off-Post Operable Units...."

Based on the Army's own analysis and after its full consideration of all of the written comments received, the Army finds it to be unnecessary at this time to add any further New Products or Subproducts to the RI/FS for the Onpost and Offpost Operable Units.

1.3.5 New ARAR Determinations

Paragraph 12.2(d) of the RI/FS Process Document provides that the TPP shall "[i]dentify any New Products or Subproducts that require ARAR determinations."

Based on the Army's own analysis and after its full consideration of all the written comments received, the Army finds at this time that no New Products or Subproducts require ARAR determinations in addition to those already designated in the RI/FS Process Document.

1.3.6 Other Deliverables

Paragraph 12.2(e) of the RI/FS Process Document provides that the TPP shall "[i]dentify Other Deliverables, to the extent they are known...."

Based on currently available knowledge, the Army designates the following as Other Deliverables to be treated in accordance with Paragraphs 16.77-16.79 of the RI/FS Process Document:

(1) Army RI Phase II CAR Data Addenda;

(2) Army FS Ground Water Modeling;

(3) Shell FS Air Modeling;

(4) Shell RI Biota Investigation(s);

(5) Army FS Pilot Treatability Test(s);

(6) Shell FS Pilot Treatability Test(s);

(7) Shell RI Sewer Investigation(s);

(8) Army RI Bald Eagle Studies;

(9) Army RI Composite Well Program;

(10) Shell RI Hydrological Investigation;

(11) Shell RI Geological Investigation;

(12) Army RI Soil Gas Study;

(13) Army Partition Coefficient Study; and

(14) Shell Re-mapping of the Arsenal Soils Study.

1.3.7 IRA Deadlines

Paragraph 12.2(f) of the RI/FS Process Document provides that the TPP shall "[e]stablish Deadlines for the Completion of IRA Decision Documents...."

Based on the Army's own analysis and its consideration of the written comments received, the Army designates the following IRA Deadlines that will be enforceable and subject to the stipulated civil penalties provided by paragraphs 19.2-19.10 of the proposed Consent Decree:

Draft IRA Decision Document	Issuance Date
Basin F IRA--Liquids, Sludges, and Soils Removal (IR-07-07)	4 Dec 87
Fugitive Dust IRA	N/A
Asbestos Removal	N/A
Well Closure IRA (IR-05-19)	28 Mar 88
North Boundary System IRA--Trench (IR-03-12)	15 Apr 88
Hydrazine Facility IRA (IR-09-26)	28 July 88
Building 1727 Sump IRA (IR-08-26)	28 Aug 88
Basin F Ground Water IRA (IR-04-26)	28 Aug 88
Ground Water System North of RMA IRA (IR-02-22)	29 Aug 88
Basin A Neck Ground Water IRA (IR-06-26)	25 Sept 88
North Boundary System IRA--System Improvements (IR-03-42)	7 Dec 88
Sanitary Sewer Removal IRA (IR-11-26)	27 Jan 89
CERCLA Liquid Wastes (IR-14-26)	25 Sept 89
Hot Spot Removal IRA (Each discrete "hot spot" removal action will be subject to a separate IRA Decision Document after it is determined whether removal is	

warranted for that contamination source. While the Army hopes to issue at least one such Decision Document between November 1988 through March 1989, this will depend on the progress of the assessment process, the Army's contractual process and the assistance available from Shell) (IR-13-26)

Final "Hot Spot" Removal Draft IRA Decision Document to be issued	27 Nov 89
Basin F IRA--Liquids Remediation (IR-07-43)	28 Jan 90

1.3.8 RI/FS Deadlines

Paragraph 12.2(g) of the RI/FS Process Document provides that the TPP shall "[i]dentify RI/FS Deadlines for the milestones listed in paragraphs 18.1 and 18.2...."

Based on the Army's own analyses and the full consideration of the written comments received, the Army designates the following RI/FS Deadlines for issuance of the designated Draft Product Reports that will be enforceable pursuant to paragraphs 19.1-19.5 of the RI/FS Process Document and subject to the civil penalty provisions in paragraphs 20.1-20.5 of the RI/FS Process Document:

1. Onpost RI

Onpost Air RI Draft Product Report	15 Mar 89
Onpost Buildings RI Draft Product Report	15 Mar 89
Onpost Water RI Draft Product Report	15 Mar 89
Onpost Biota RI Draft Product Report	15 Mar 89
Onpost Western SAR Draft Product Report	15 Mar 89
Onpost South Plants SAR Draft Product Report	15 Mar 89
Onpost Central SAR Draft Product Report	15 Mar 89
Onpost North Central SAR Draft Product Report	15 Mar 89
Onpost North Plants SAR Draft Product Report	15 Mar 89
Onpost Eastern SAR Draft Product Report	15 Mar 89
Onpost Southern SAR Draft Product Report	15 Mar 89
Onpost Final RI Draft Product Report	8 Oct 89

2. Onpost EA

Onpost Contaminant Identification/ARAR Determination Draft Product Report	6 Jun 88
Onpost Exposure Assessment Draft Product Report	15 Mar 89
Onpost Endangerment Assessment Draft Product Report	17 Jul 90

3. Onpost FS

Onpost Development/Screening of Alternatives Draft Product Report	17 Jul 90
Onpost Evaluation of Alternatives Draft Product Report	10 Apr 91
Onpost FS Report (with Preferred Alternative) Draft Product Report	1 Feb 92

4. Offpost RI/FS

RI Report with EA ARARs	30 Sept 88
FS with Preferred Alternative and EA	29 Mar 89

In addition to the above Product Deadlines, the Army will provide Publication of Availability of the Onpost RI/FS Report on or before July 7, 1992, and the Offpost RI/FS Report on or before September 2, 1989.

1.3.9 Schedule

Paragraph 12.2(h) of the RI/FS Process Document provides that the TPP shall "[i]dentify Schedules...."

Based on the Army's own analysis and after its full consideration of all of the written comments received, the Army is providing the Schedules that are enclosed in pockets at the end of this TPP.

1.3.10 Resolution of General RI/FS

Paragraph 12.3 of the RI/FS Process Document provides that the TPP "[s]hall also address and resolve previously identified and new issues which solely relate to the general conduct of the RI/FS that are clearly raised by the Organization or the State during the course of drafting or commenting on the draft Technical Program Plan."

The Army finds that no new issues that solely relate to the general conduct of the RI/FS were clearly raised during the preparation of the draft TPP.

1.4 BASES FOR TECHNICAL PROGRAM PLAN

1.4.1 Assumptions

The TPP findings with the accompanying Schedules are predicated on the following assumptions:

(a) The RI/FS Process Document will not be substantially modified;

(b) The proposed Consent Decree will be entered by the Court without any substantial modification;

(c) CERCLA will not be substantially modified;

(d) The NCP will not be substantially modified except to the extent necessary to conform to the 1986 Amendments of CERCLA;

(e) Existing EPA, Agency for Toxic Substances and Disease Registry (ATSDR), Department of Defense (DOD), and Department of Interior (DOI) regulations and guidance which pertain to the RMA RI/FS and IRA process will not be substantially modified except to the extent necessary to conform to the 1986 Amendments of CERCLA;

(f) A Force Majeure event does not occur with respect to the RI/FS or IRA process;

(g) No significant data results from the RI/FS that will warrant substantial modification of the anticipated progression of Products and Subproducts;

(h) The RI/FS, IRA process, and cleanup of the entire RMA Site are to be carried out exclusively pursuant to CERCLA;

(i) There is a sufficient availability of appropriated funds for the RI/FS and IRA process;

(j) The Army will not need to devote significant resources to any litigation in connection with RMA;

(k) There will be a sufficient availability of qualified contract labor;

(l) There will be no Dispute Resolution invoked;

(m) The final CERCLA remediation of RMA will be performed through the Onpost Operable Unit and the Offpost Operable Unit;

(n) The assessment, selection, design, construction, and implementation of Response Actions for the Site, including the

identification and application of ARARs and the development and application of any other standard, requirement, criterion, or limitation for a Response Action, shall be based upon and consistent with the terms and conditions of the proposed Consent Decree, including without limitation the restrictions and requirements set forth in Paragraphs 23.2 and 23.3 of the proposed Consent Decree or developed pursuant to Paragraph 23.4 of the proposed Consent Decree.

(o) There will be no New Products or Subproducts for the Onpost Operable Unit RI;

(p) If Shell or the State is the proponent of a New Product or Subproduct that becomes part of the RI/FS, it shall prepare as the proponent the draft Technical Plan for that Product or Subproduct; if EPA is the proponent, it shall prepare the statement of work for the New Technical Plan and the Army shall prepare the Technical Plan;

(q) EPA, Shell, and the State will fully abide by the prescribed periods for comments and other activities set forth in the RI/FS Process Document;

(r) Even if the State does not execute the proposed Consent Decree or the RI/FS Process Document, it will nevertheless act in conformance with the RI/FS and IRA process set forth in the proposed Consent Decree and the RI/FS Process Document;

(s) The RI/FS and IRA process shall be carried out by the Organizations in the most cooperative manner practicable;

(t) No Federal, State, or local permit shall be required for the portion of each removal or remedial action conducted entirely on the RMA CERCLA site; and

(u) Prior Products, Subproducts, and Other Deliverables are issued on schedule.

1.4.2 RI/FS Process

The TPP findings and the accompanying Schedules are also predicated on the performance of the RI/FS in accordance with the terms and conditions of the RI/FS Process Document.

The process set forth in detail in that document may be briefly summarized as set forth below.

The Organizations will follow an extensive process for the exchange of information and documents relative to the RI/FS. These documents and all other documents that are included in the Administrative Records for the Onpost and Offpost Operable Units shall be maintained in the Joint Administrative Record and Document Facility (JARDF) which shall be located on or near RMA.

Under the RI/FS Process Document, there will be an RMA Committee which is to be responsible on a daily basis for ensuring the implementation of the RI/FS. In addition, there is to be an RMA Council which will hold regular meetings for purposes of reviewing and commenting on progress of the TPP, commenting on progress of each Technical Plan and on the status of all Technical Plans, Products, Subproducts, and Other Deliverables, and for purposes of informally resolving any differences between the Army, EPA, and Shell. There is also to be a Technical Review Committee, composed primarily of local community representatives, that will provide a meaningful opportunity for these persons to become informed and to express their opinions about important aspects of the RI/FS. Significant disputes between the Army, EPA, and Shell shall be resolved by the SAPC and FRC.

The RI/FS Process Document provides that there are to be no New Products or Subproducts for the RI for the Onpost Operable Unit. However, New Products or Subproducts may be proposed for the endangerment assessment (EA) or FS for the Onpost Operable Unit and for the RI, EA, or the FS for the Offpost Operable Unit.

New Technical Plans shall be prepared by the respective proponents (the Army or Shell) for all New Products and Subproducts, except that if the EPA is the proponent, the Army shall prepare the New Technical Plan. New Technical Plans constitute the only type of Technical Plan that is subject to Dispute Resolution (Figure 1-1).

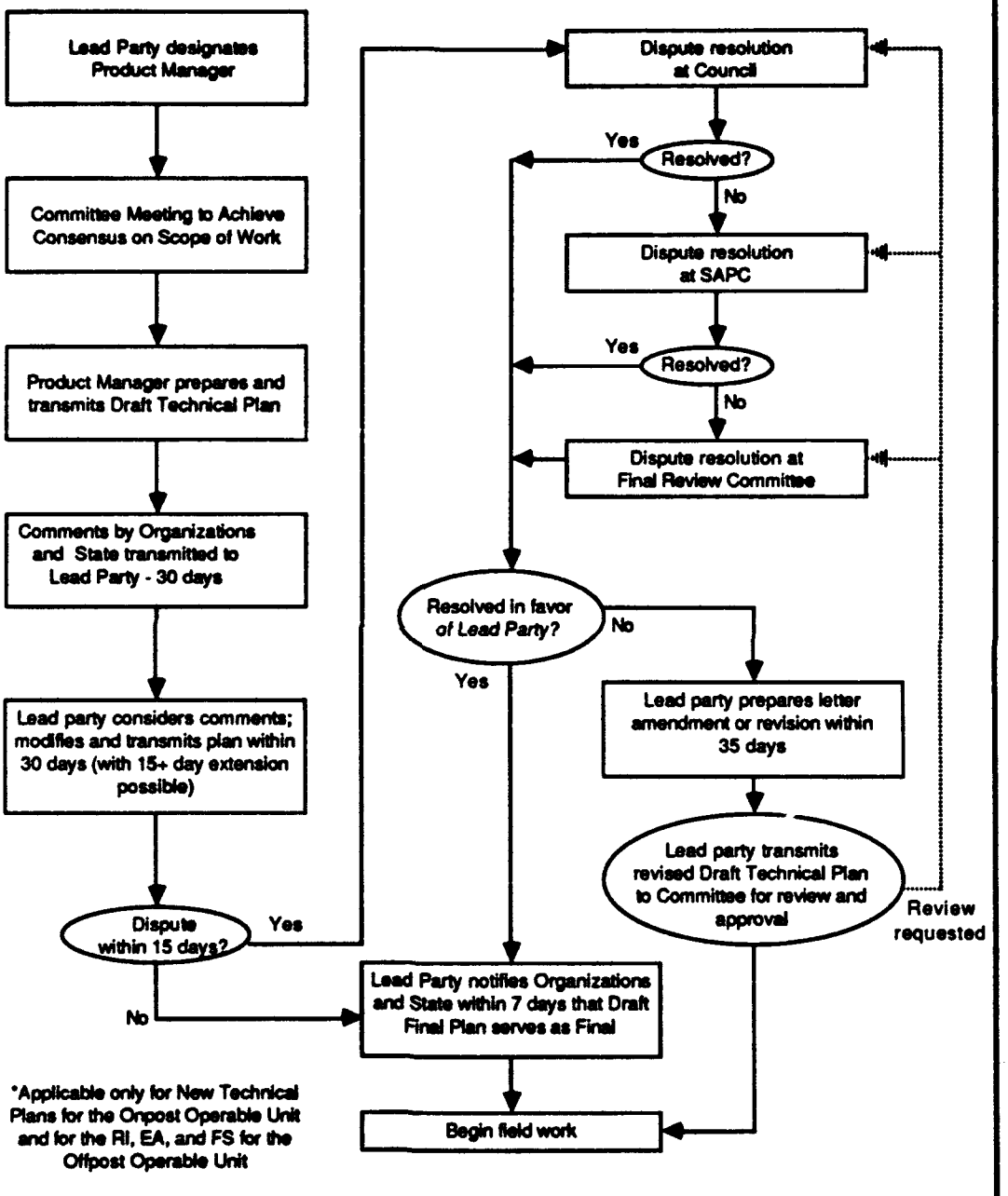

Figure 1-1
RI/FS NEW TECHNICAL PLANS*

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Product Managers for New or Ongoing Products shall meet with the RMA Committee approximately every 60 days to review and discuss their progress.

Prior to the issuance of any draft Product or Subproduct report, counsel for the United States, Shell, and the State (and for the DOI and ATSDR if they elect to participate) will meet to identify potential ARARs. All potential ARARs proposed at this meeting shall be considered by the Army in its preparation of the relevant Product report. The Army, as Lead Agency, shall be responsible for all ARAR determinations for a Product.

ARARs are to be designated in accordance with Section 121(d) of CERCLA, the NCP, and any pertinent EPA guidance that is not inconsistent with CERCLA and the NCP, including but not limited to ambient or chemical-specific requirements, performance, design or other action-specific requirements and location requirements. The identification of ARARs for the RMA CERCLA site shall recognize that ARARs can be identified only on a site-specific basis and that ARARs depend on the specific hazardous substances, pollutants, or contaminants at a site, the particular actions proposed as a remedy, and the characteristics of the site. State ARARs shall also be identified, pursuant to Section 121(d) of CERCLA, where these are pertinent to a Product and not inconsistent with CERCLA and the NCP, and EPA guidance that is itself not inconsistent with CERCLA and the NCP.

For the Onpost Operable Unit, there shall be an opportunity for review and comment (and Dispute Resolution only on draft final Product reports) for the following Products (see Figure 1-2).

RI Products

- Air (results of Arsenal-wide air investigations);
- Buildings (results of Arsenal-wide building investigations);
- Biota (results of Arsenal-wide biota investigations);
- Water (results of Arsenal-wide surface water and ground water investigations);
- Onpost SARs (integration of the results of air, buildings, biota, water, and soils investigations); and
- RI (integration of all RI data presented in the RI Products).

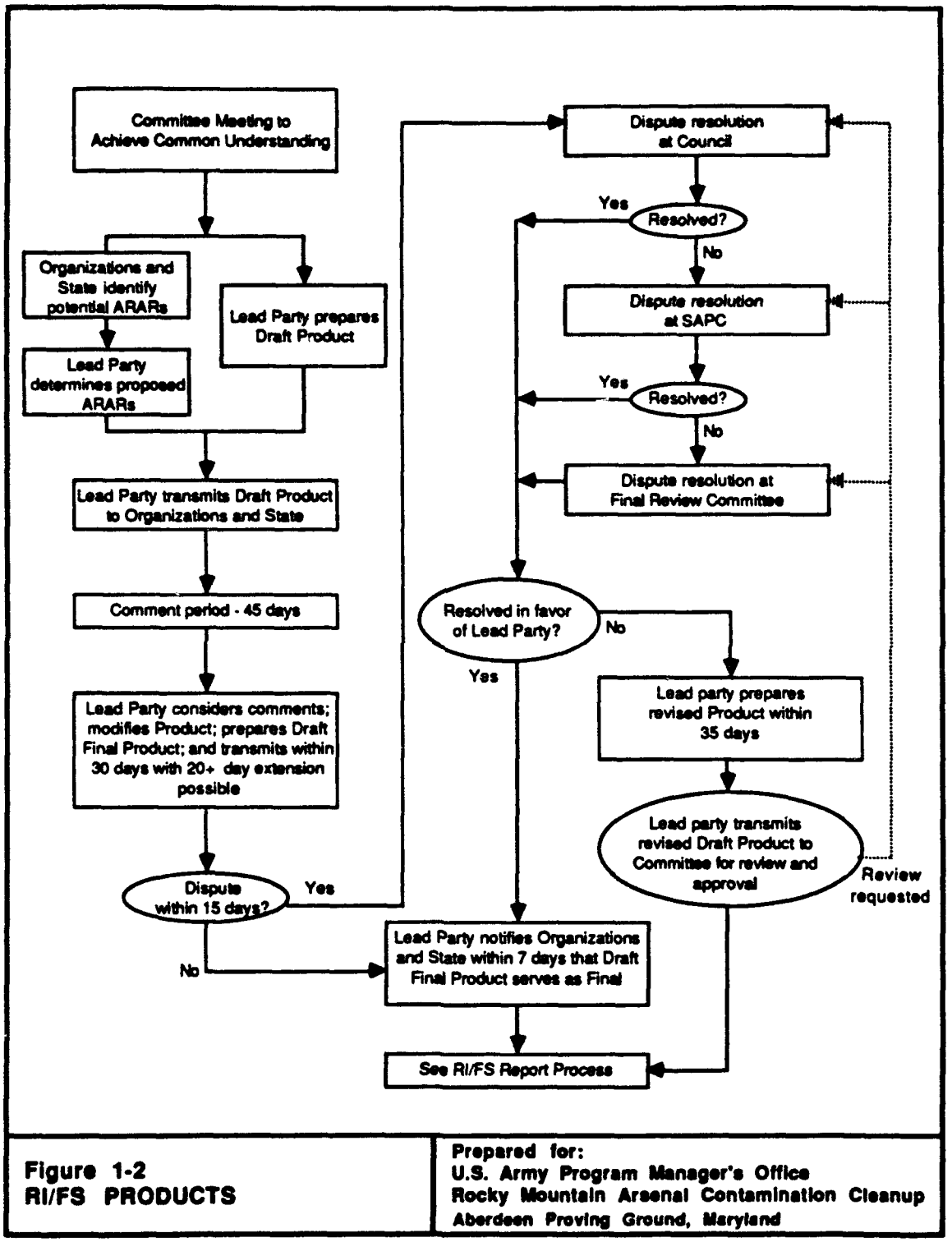

Figure 1-2
RI/FS PRODUCTS

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EA_Products

- o Contaminant Identification, with proposed EA-related ARAR determination (site characterization, selection of target contaminants, and identification of environmental transport and fate mechanisms, and ARARs for target contaminants);
- o Exposure and Toxicity Assessment (identification and analysis of exposure pathways and extent of exposure of human and environmental populations at actual or potential risk; evaluation of toxicological properties of target contaminants); and
- o EA, with revised proposed EA-related ARAR determination (development of target cleanup level ranges based on risk characterization and revised EA-related ARAR identification).

FS_Products

- o Development and Screening of Alternatives, with proposed ARAR determination for each alternative (initial alternative screening process by which certain alternatives are selected for in-depth evaluation);
- o Evaluation of Alternatives, with revised proposed ARAR determination (in-depth evaluation of alternatives resulting from initial screening; refinement of proposed ARAR determination for each alternative evaluated); and
- o FS with revised proposed ARAR determination (development of preferred alternative and final refinement of ARAR determination for that alternative).

For the Onpost Operable Unit, there shall be an opportunity for review and comment (but not Dispute Resolution) for the following Subproducts:

RI_Subproducts

- o All Phase I Contamination Assessment Reports (CARs) for the Onpost Operable Unit (to be used in developing the RI Products described above).

EA_Subproducts

- o Risk Characterization (determination of the likelihood and extent of any harm).

FS_Subproducts

- o Technology Inventories (first step in Development and Screening of Alternatives);

- o Treatment/Incineration Study (for incorporation into Evaluation of Alternatives);
- o Disposal Facility Study (for incorporation into Evaluation of Alternatives): and
- o Advanced Technologies and Pilot Treatment Studies (for incorporation in Evaluation of Alternatives).

For the Offpost Operable Unit, the Army shall make available for review and comment (and Dispute Resolution only on draft final Product reports) the following Products:

- o Proposed RI and EA-related ARAR determination: and
- o EA and FS, with proposed FS-related ARAR determination.

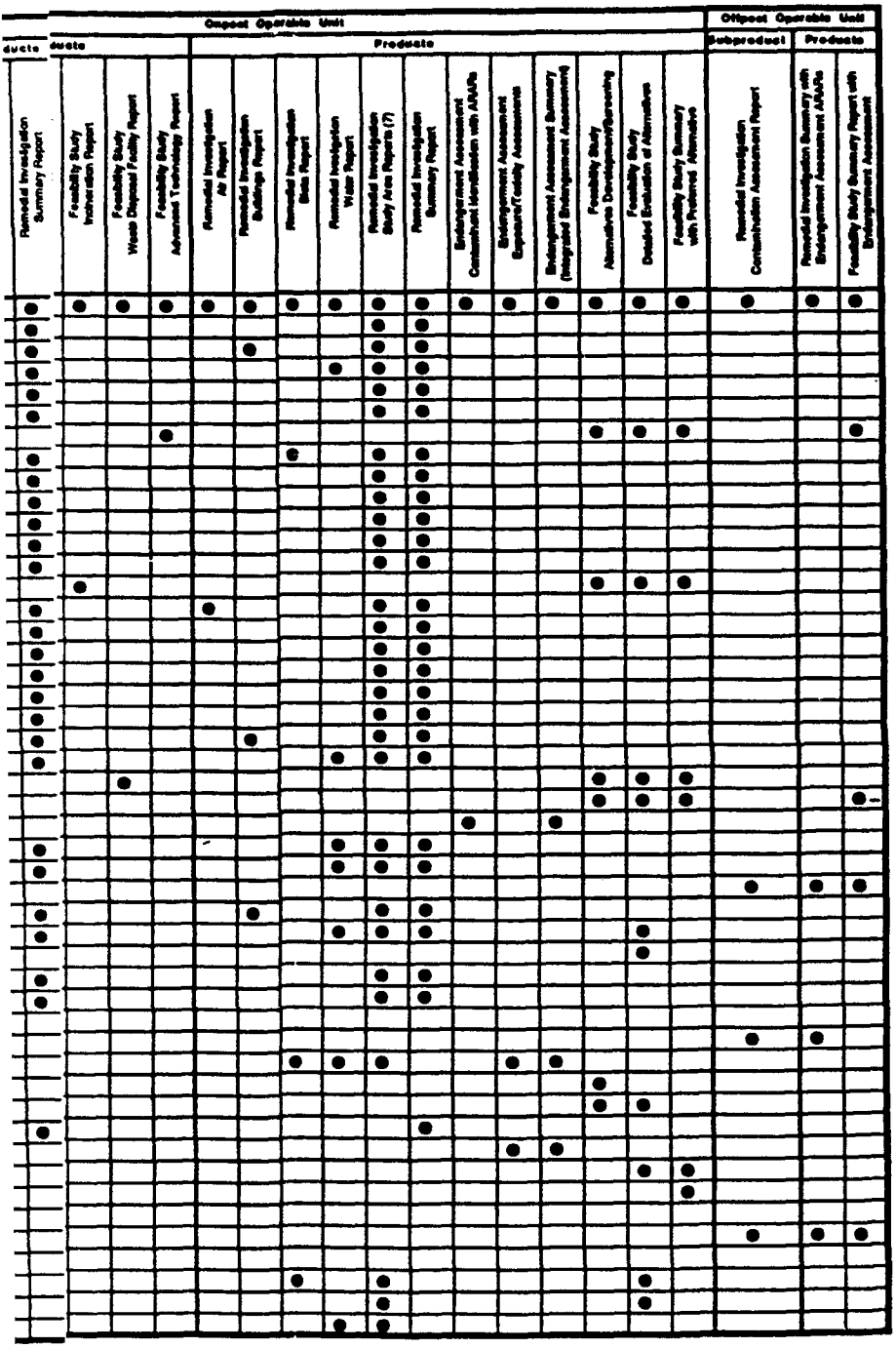
Figure 1-3 presents a matrix linking Onpost and Offpost Operable Units Products and Subproducts to the tasks currently being conducted or planned to be awarded. Following the finalization of all Product reports required for an Operable Unit, the Army shall prepare the RI/FS Report for the Operable Unit. Figure 1-4 illustrates the review process for the RI/FS Reports. Each RI/FS Report shall include the information and methodology used for site characterization, shall have an appendix that summarizes all ARAR determinations applicable to the RI/FS and present any necessary ARAR certification (including State standards compliance), and shall comply with any other CERCLA or NCP requirements or pertinent EPA guidance that is not inconsistent with CERCLA and the NCP. On or before the applicable deadline established in the Plan, the Army shall publish notice in one or more Denver newspapers of the availability of the RI/FS Report (with a brief analysis), invite public comment for at least a 60-day period, and conduct one or more transcribed public meetings at a location near RMA. Upon the close of the public comment period, the Army shall prepare a response to all significant comments which shall be included in the applicable Record of Decision (ROD).

Each ROD shall identify the remedial action selected for that Operable Unit, describe all bases for the selection, summarize and respond to significant public comments received on the draft final RI/FS Report, provide Design Deadlines for response actions addressed in the ROD, provide an appendix of ARARs and an ARAR certification (including State standards compliance), and

Task Number, Name	Sub-Products						Deposit Operable Unit			
	Remedial Investigation Contamination Assessment Reports (Soils, Sewers)	Endangerment Assessment Risk Characterization	Feasibility Study Technology Inventory	Feasibility Study Incineration Report	Feasibility Study Waste Disposal Facility Report	Feasibility Study Advanced Technology Report	Remedial Investigation Air Report	Remedial Investigation Buildings Report	Remedial Investigation Biota Report	Remedial Investigation
0, Research	●	●	●	●	●	●	●	●	●	●
1, Section 36 Investigation	●									
2, South Plants Investigation	●							●		
4, Water Quantity/Quality Survey										●
6, Basins Area, Phase I	●									
7, Lower Lakes, Phase I	●									
TED8,Advanced Technology			●			●				
9, Biota Assessment									●	
10, Sewers Investigation	●									
11, Hydrazine Facility Investigation	●									
12, Derby Lakes, Phase I	●									
14, Army Sites North, Phase I	●									
15, Army Sites South, Phase I	●									
17, Incineration Feasibility Study			●	●						
18, Air Monitoring							●			
19, Basins Area, Phase II	●									
20, Lakes, Phase II	●									
21, Army Sites North, Phase II	●									
22, Army Sites South, Phase II	●									
23, Soil/Water Integration										
24, Army Spills, Buildings	●							●		
25, Boundary Systems Ground Water Monitoring										●
27, Landfill Feasibility Study			●		●					
28, Feasibility Study Alternatives Assessment			●							
35, On-Post Endangerment Assessment		●								
36, North Boundary System Response Action Assessment			●							●
38, Western Tier TCE Study	●									●
39, Off-Post Remedial Action Alternatives Assessment										
42, North Plants Investigation	●							●		
44, Ground/Surface Water Monitoring			●							●
45, Lab/Bench Scale Studies										
47, Supplemental Phase II Surveys, North	●									
48, Supplemental Phase II Surveys, South	●									
RIFS1, Offpost										
RIFS2, RI/EA, Biota, Water, SARs, Exposure Assessment		●							●	●
RIFS3, Development/Screening of Alternatives, Modelling										
RIFS4, Treatability/Pilot Studies										
RIFS5, Remedial Investigation Summary										
RIFS6, Risk Characterization/Endangerment Assessment		●								
RIFS7, Evaluation/Selection of Preferred Alternatives										
RIFS8, RI/FS to Record of Decision										
66, Offpost Water										
Shell, Aquatic Studies									●	
Shell, Remapping of Arsenal Soils										
Shell, Alluvial Formation Interpretation										●

Figure 1-3
RI/FS PRODUCT/TASK MATRIX

(1)



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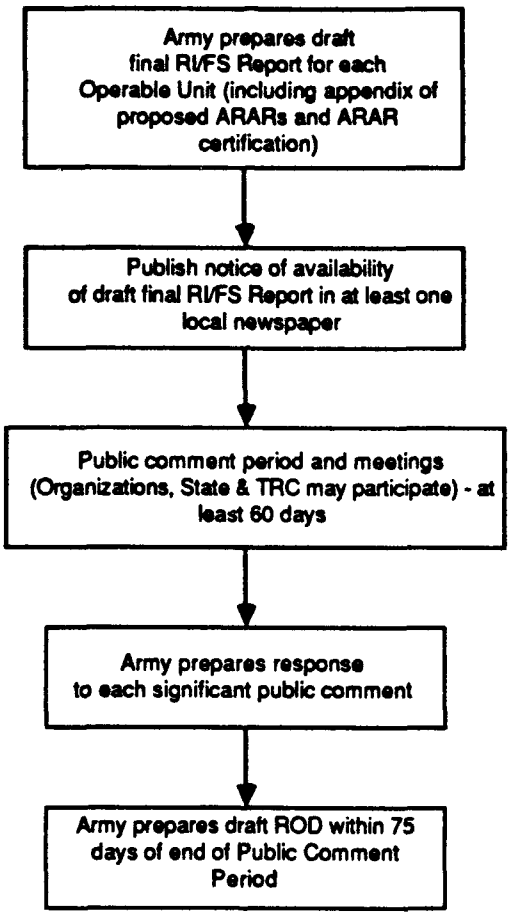

Figure 1-4
RI/FS REPORT(S) PROCESS

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satisfy any other CERCLA or NCP requirement, or EPA guidance that is not inconsistent with CERCLA or the NCP.

Generally, not more than 75 days after the conclusion of the public comment period on the RI/FS Report, the Army shall transmit the draft ROD to EPA, Shell, and the State for 30 days of review and comment (Figure 1-5). Following the close of the comment period and the making of all appropriate modifications by the Army, the draft final ROD shall be available for Dispute Resolution.

The Army shall then transmit a final ROD to EPA, Shell, and the State, shall advise the State that it intends to publicly announce the final ROD within 30 days, and shall submit the final ROD to the Court. The State and Shell may then seek judicial review, in accordance with CERCLA, if they so elect.

If neither the State nor Shell seeks timely judicial review, the Army shall announce the ROD in at least one major Denver newspaper and then proceed with the design and implementation of the response actions addressed in the ROD. If the State or Shell do bring a timely judicial challenge, the Army may nevertheless proceed with any design work that is unrelated or not inconsistent with the relief sought in such action, and may proceed with any other work determined to be appropriate by the Court.

1.4.3 Records of Decision

Also of interest in the context of developing the TPP findings and the Schedules is the need to develop sufficient detail to support the remedy ultimately to be selected. The requisites for a CERCLA ROD may be summarized as follows.

The ROD (declaration statement and supporting documentation) is the centerpiece of the Administrative Record. The ROD will contain an accurate and complete summary of the site, the threat it poses, and the selected remedy(s). The ROD will also describe the relative strengths and weaknesses of each alternative considered and offer a clear justification for the decision that was made.

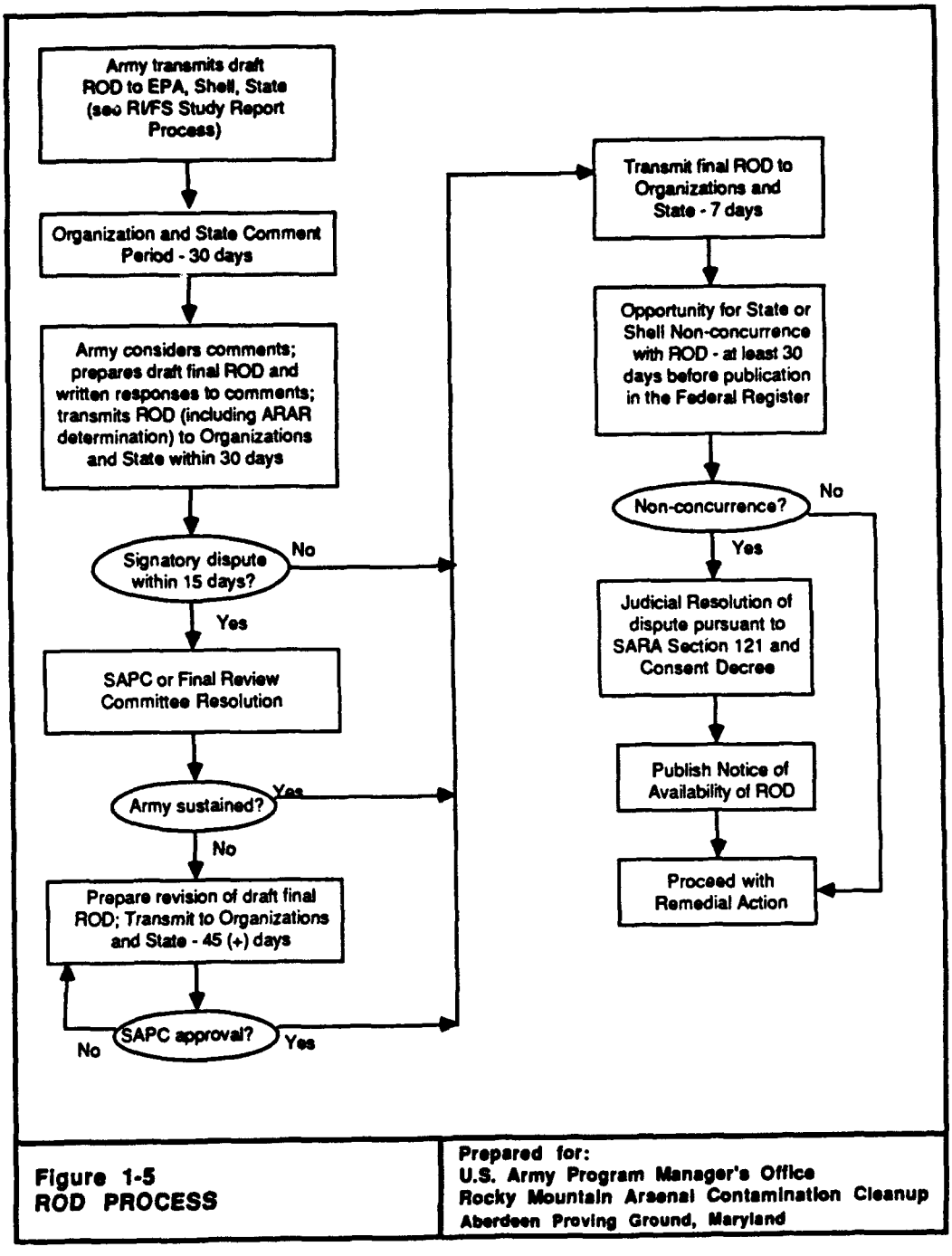

Figure 1-5
ROD PROCESS

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Specific contents of the ROD will include, but will not be limited to:

- o A statement and justification that the selected remedy is protective and cost-effective, attains or waives ARARs, and uses to the extent possible treatment technologies where all statutory requirements and preferences are fully satisfied.
- o A rationale will be provided justifying the preference of an alternative that is not a permanent solution, if an alternative is chosen that does not reduce the toxicity, mobility, or volume of contaminated media.
- o A statement regarding the choice of a final remedy that does not meet the statutory preference for treatment even though the remedy would still be protective and cost-effective. If the remedy is to be followed by a subsequent supplemental response action, a statement will be made regarding the preference for the final remedy and the timeframe for implementation.
- o A description of the Federal and State requirements that were determined to be ARARs for RMA and will be met by the preferred alternative. Where ARARs do not exist for a specific contaminant, a description of the health-based level that will be met will be provided.
- o A statement on any ARARs that will not be met and the waiver that will be invoked to justify the non-attainment.
- o A summary of the responses to significant public comments on the selection of the alternative.
- o A timetable on the design and implementation of the remedial action.

Two RODS are currently envisioned for RMA, one for addressing offpost remediation and one for addressing onpost remediation. The Offpost ROD will provide the information presented in the preceding paragraphs as related to offpost contamination sources and receptors. The Onpost ROD will present similar information for onpost sources and for the control of migration from these sources to onpost and offpost receptors. Issuance of two RODs will permit the expedient selection and implementation of an offpost remedy while

the investigation and procedural requirements for the more lengthy onpost activities proceed. Additional Operable Unit RODs may be created pursuant to the RI/FS Process Document.

As many of the actions that may be implemented for the control of migration of onpost contamination may affect offpost ground and surface water, biota, and air, it will be necessary to consider the impact of all onpost actions on these offpost media as well as on the remedial actions taken offpost. As required, the Offpost ROD will be reopened and revised to incorporate the associated impact of onpost actions. Additionally, and as appropriate, a ROD may be reopened to combine common technology operations to allow cost reduction through economy of scale.

The level of detail that will be presented in the RODs for the description of technologies or of alternatives will be consistent with latest EPA guidance. At a minimum, the RODs will state what technologies will be applied and the location, type, and amount of contaminated materials that will be affected by a particular technology. The desired performance goal that a process within the technology category would achieve will also be stated. Although the selection of the alternative will be at the technology level, the detailed evaluation of the alternatives (effectiveness, implementability, and cost) will be assessed using a specific process within the technology category (Figure 1-6).

For example, if biological treatment of extracted ground water is part of an alternative, then a process such as activated sludge could be used for the detailed evaluation. When the remedial action is proposed in the ROD, then any biological process which could match the performance goals of the process analyzed would also be eligible for final implementation. A list of eligible processes will be included for each of the technology categories included in the preferred alternative.

The contents of the RODs will consist of key findings from the RI/FS program. With respect to the three major components of the program (RI, EA, and FS), the following discussion lists the information within the RODs to be supplied by each of these components.

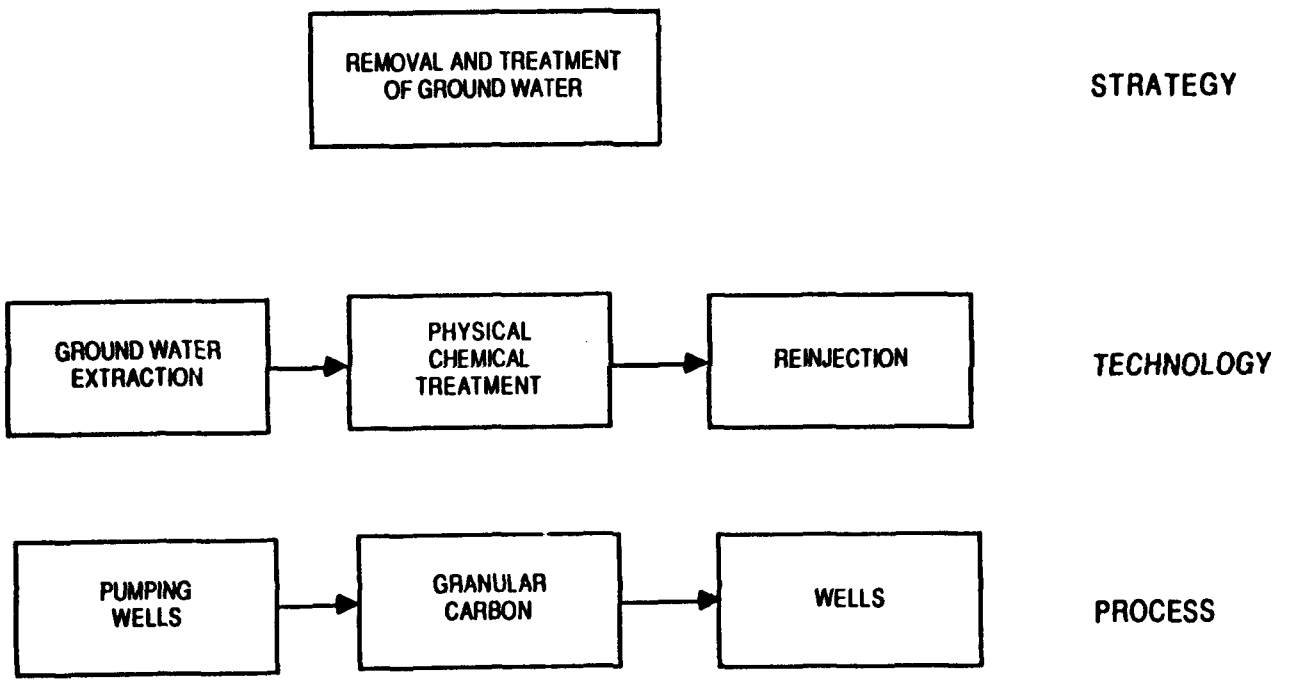

Figure 1-6

LEVEL OF DETAIL IN ALTERNATIVES ANALYSIS

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The RI will provide information to define the nature and extent of contamination at RMA using data depicting the locations and concentration profiles of contaminants. The RI will also contain information regarding the geology underlying RMA, and the hydrology of surface and ground water. The historical information of RMA collected prior to and during the RI will also be available to describe the activities that resulted in contamination.

The EA, in addition to identifying contaminant pathways and receptors, will contain the derivation of health-based criteria for contaminants for which ARARs do not exist. The EA will also provide information necessary to demonstrate the protectiveness of the selected remedial action.

The FS will provide information on the development and evaluation of various alternatives to be used by the decision maker in the selection of the preferred alternative. The FS will discuss how an alternative is protective and cost-effective and will contain the ARARs that will be attained as well as those for which a waiver is sought for each of the alternatives considered.

The FS will provide a detailed description of alternatives including the associated technologies, performance goals, applicable materials and volume, and to what extent mobility, toxicity, or volume are reduced. For each non-treatment alternative considered, the FS will provide a discussion of the benefits of the alternative and the rationale for its consideration even though it does not achieve the statutory preference for treatment.

2.0 RI/EA/FS PROCESS

2.1 OVERVIEW

Although the RI/FS process at RMA is an iterative and interactive process in which information developed under the RI, EA, and FS is freely exchanged, it can also be summarized as a sequential progression of activities, presented in Figure 2-1. The RI data being collected at RMA fall under a large number of discrete task orders that are developed on the basis of contractual requirements. However, all of these data are being integrated and assessed on the basis of geographic (study) areas in the case of soil or sewers or on an arsenal-wide basis in the case of contamination "media", namely air, water, biota, and buildings. These integrated data sets are then compiled into an overall RI for RMA.

The air, biota, and water categories are treated as separate RI entities ("media") because they do not, in a strict sense, represent sources of contamination. Rather, they can be thought of as migration pathways and receptors of contamination. Buildings are treated separately due to their unique character as centers of activities that once housed chemical and waste generation processes, and the building materials are not true contamination sources in themselves (although it is recognized that buildings can contain potential sources such as leaking sumps, spills, etc.). The soils and sewers are so closely linked to one another that they must be considered together. Due to the magnitude and complexity of the information being developed for these categories, they are being handled within discrete geographic subareas (Study Areas) into which RMA has been divided. Figure 2-2 illustrates these Study Areas. Table 2-1 provides a listing of all of the potential contamination sites that have been identified on RMA, and it provides supplemental information such as the Study Area into which each site falls, the original contamination classification of each site as reported on the "tricolor" map, the Phase I and Phase II (as appropriate) tasks under which each site is being investigated, and a brief description of the type of activities that took place at the site.

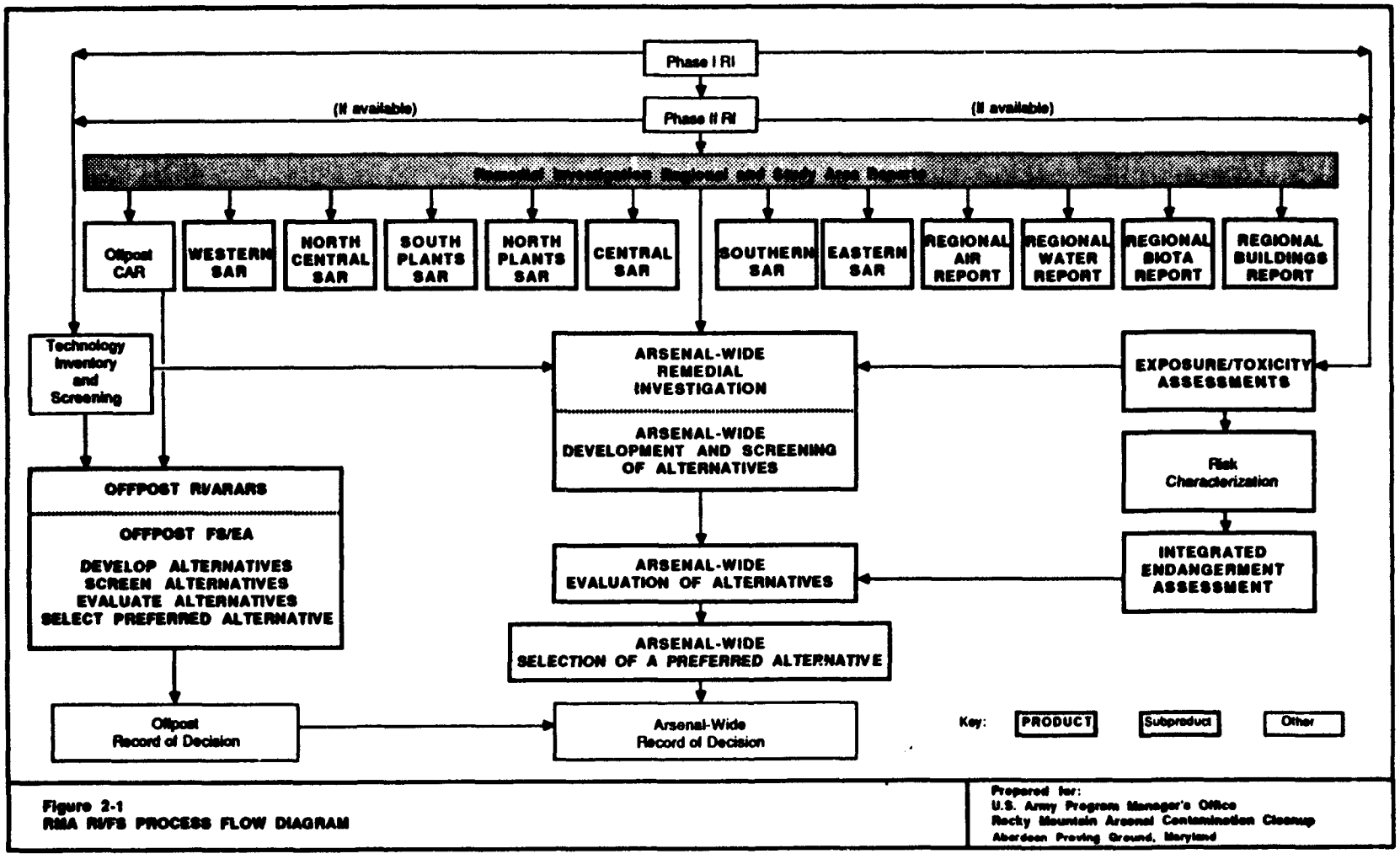

Figure 2-1
RMA RI/FS PROCESS FLOW DIAGRAM

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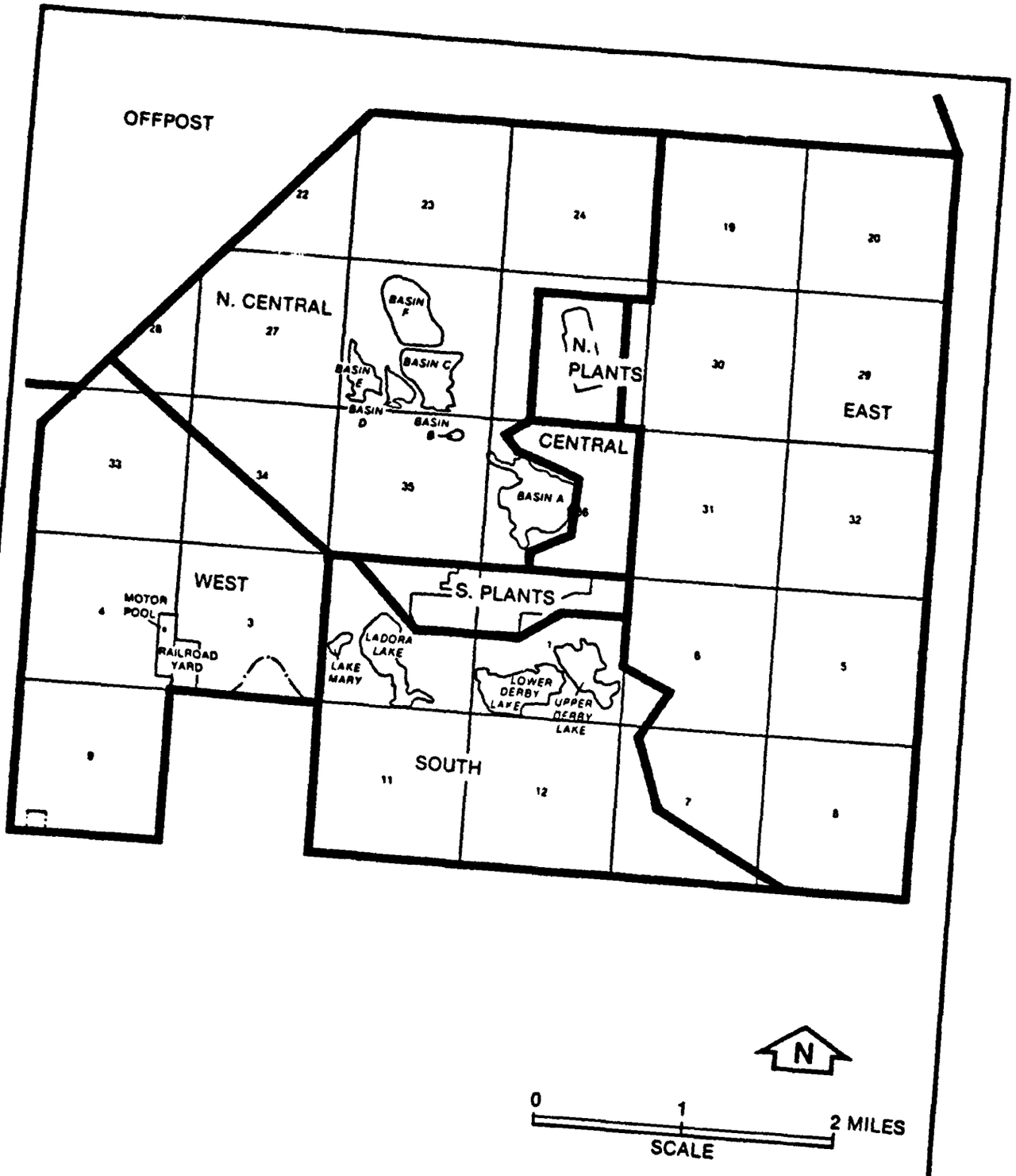

Figure 2-2
OPERABLE UNITS AND STUDY AREAS

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Table 2-1. Site Summary (Page 1 of 4)

Site Number or Designation	Site Name	Tricolor Map Designation	Site Type	RI Study Area	Phase I Task	Phase II Task	Comment	Contractor
1-1	Drainage Ditches	Pink	Ditches, Lakes, Ponds	South Plants/Southern	7	20	Separate CAR	Ebasco
1-2	Upper & Lower Derby Lakes	Pink	Ditches, Lakes, Ponds	Southern	12	20	Separate CAR	Ebasco
1-3	Mounded Material	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
1-4	Borrow Pit	Blue	Excavations, Surface Disturbances	South Plants	2	2	Separate CAR	Ebasco
1-5	Revetted Storage Areas	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
1-7	Hydrazine Blending and Storage	Pink	Storage Sites, Buildings, Equipment	South Plants	11	11	Separate CAR	Ebasco
1-8	Salvage Yard	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
1-9	Open Storage Area	Blue	Storage Sites, Buildings, Equipment	South Plants	7	20	Separate CAR	Ebasco
1-10	South Tank Storage Area	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
1-11	Sanitary Landfill	Blue	Solid Waste Burial Sites	South Plants	2	2	Separate CAR	Ebasco
1-12	Trash Dump	Pink	Solid Waste Burial Sites	Southern	12	20	Separate CAR	Ebasco
1-13	South Plants Area	Pink	Spills	South Plants	2	2	Separate CAR	Ebasco
2-1	Drainage Ditches	Blue	Ditches, Lakes, Ponds	Southern	7	20	Separate CAR	Ebasco
2-2	Firebreak (Burn Site)	Pink	Ordnance Testing and Disposal	South Plants	2	2	Separate CAR	Ebasco
2-3	Lagoon	Pink	Basins, Lagoons	South Plants	2	2	Separate CAR	Ebasco
2-4	Excavation or Ground Scar	Blue	Excavations, Surface Disturbances	South Plants	2	2	Separate CAR	Ebasco
2-5	Trench	Blue	Solid Waste Burial Sites	Southern	2	2	Separate CAR	Ebasco
2-6	Salt Storage Area	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-7	Aeration Basin	Pink	Basins, Lagoons	South Plants	2	2	Separate CAR	Ebasco
2-8	Former Tank Storage Area	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-9	Open Storage Area	Pink	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-12	Location for Former Tanks	Blue	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-13	Former Open Storage Area	Blue	Storage Sites, Buildings, Equipment	South Plants	2	2	Separate CAR	Ebasco
2-14	Sanitary Landfill	Pink	Solid Waste Burial Sites	South Plants	2	2	Separate CAR	Ebasco
2-17	Ladora Lake and Mary Lake	Pink	Ditches, Lakes, Ponds	Southern	7	20	Separate CAR	Ebasco
2-18	South Plants Area	Pink	Spills	South Plants	2	2	Separate CAR	Ebasco
3-2	Drainage Ditch/Overflow Basin (includes 3-3)	Pink	Ditches, Lakes, Ponds	Southern	7	20	Separate CAR	Ebasco
3-3	Overflow Basin	Pink	Ditches, Lakes, Ponds	Southern	7	20	With Site 3-2	Ebasco
3-4	Namagon Spill Area	Pink	Spills	Western	7	20	Separate CAR	Ebasco
4-2	Burning Pit	Pink	Solid Waste Burial Sites	Western	15	22	Separate CAR	Ebasco
4-3	Burning Pit	Pink	Solid Waste Burial Sites	Western	15	22	Separate CAR	Ebasco
4-4	Burning Pits	Pink	Solid Waste Burial Sites	Western	15	22	Separate CAR	Ebasco
4-5	Borrow Pit	Blue	Excavations, Surface Disturbances	Western	15	22	Separate CAR	Ebasco
4-6	Mixer Pool Area	None	Storage Sites, Buildings, Equipment	Western	38	38	Separate CAR	Ebasco
5-2	Area of Potential H and HD Contamination	Pink	Spills	Eastern	15	22	Separate CAR	Ebasco
6-2	Upper Derby Lake	Pink	Ditches, Lakes, Ponds	Southern	12	20	Separate CAR	Ebasco
6-6	Former Toxic Gas Storage Yard	Pink	Storage Sites, Buildings, Equipment	Eastern	15	22	Separate CAR	Ebasco
11-1	Buried Lake Sludge	Pink	Solid Waste Burial Sites	Southern	12	20	Separate CAR	Ebasco
12-1	Buried Lake Sludge	Pink	Solid Waste Burial Sites	Southern	12	20	Separate CAR	Ebasco
12-2	Rod and Gun Club Pond	Pink	Ditches, Lakes, Ponds	Southern	12	20	Separate CAR	Ebasco
19-1	Burn Site	Pink	Solid Waste Burial Sites	Eastern	14	21	Separate CAR	ESE
20-1	Burn Site	Pink	Solid Waste Burial Sites	Eastern	14	21	Separate CAR	ESE
24-6	Sewage Treatment Plant and Ponds	Pink	Ditches, Lakes, Ponds	North Central	7	20	Separate CAR	Ebasco
24-7	North Bog	None	Ditches, Lakes, Ponds	North Central	7	20	"New" Site; Separate CAR Report	Ebasco
26-3	Basin C	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
26-4	Basin D	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
26-5	Basin E	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
26-6	Basin F	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
26-7	Surface Drainage from Basin A	Pink	Ditches, Lakes, Ponds	North Central	6	19	Separate CAR	ESE
26-8	Chemical Sewer Line	Pink	Sewers	North Central	14	21	Separate CAR	ESE
28-1	Burn Site	Pink	Solid Waste Burial Sites	Eastern	14	21	Separate CAR	ESE
28-4	Disposal Area	Pink	Solid Waste Burial Sites	Eastern	14	21	Separate CAR	ESE
28-5	Disposal Site (includes 32.01)	Pink	Solid Waste Burial Sites	Eastern	14	21	Separate CAR	ESE
30-1	Impact Area	Pink	Ordnance Testing and Disposal	Eastern	14	21	Separate CAR	ESE
30-2	Burn Site	Pink	Solid Waste Burial Sites	Eastern	14	21	Separate CAR	ESE
30-3	H Training Area	Pink	Spills	Eastern	14	21	Separate CAR	ESE
30-4	Sanitary Landfill	Pink	Solid Waste Burial Sites	Eastern	7	20	Separate CAR	Ebasco
30-5	Demil Operation Area	Pink	Spills	Eastern	14	21	Separate CAR	ESE
30-6	Trenches	Pink	Solid Waste Burial Sites	Eastern	14	21	Separate CAR	ESE

Table 2-1. Site Summary (Page 2 of 4)

Site Number or Designation	Site Name	Tricolor Map Designation	Site Type	RI Study Area	Phase I Task	Phase II Task	Comment	Contractor
30-7	Ground Disturbance	Pink	Excavations, Surface Disturbances	Eastern	14	21	Separate CAR	ESE
31-4	New Toxic Gas Storage Yard	Pink	Storage Sites, Buildings, Equipment	Eastern	15	22	Separate CAR	Ebasco
31-6	Storage Sheds	Pink	Storage Sites, Buildings, Equipment	Eastern	15	22	Separate CAR	Ebasco
31-7	Storage Shed	Pink	Storage Sites, Buildings, Equipment	Eastern	15	22	Separate CAR	Ebasco
32-5	Burning Pits	Pink	Solid Waste Burial Sites	Eastern	15	22	Separate CAR	Ebasco
32-6	Burning Pits	Pink	Solid Waste Burial Sites	Eastern	15	22	Separate CAR	Ebasco
35-2	Chemical Sewer Line	Pink	Sewers	North Central	10	10	Separate Chemical Sewers CAR(s)	ESE
35-3	Basin B	Pink	Basins, Lagoons	North Central	6	19	Separate CAR	ESE
35-4	Drainage from Basin A	Pink	Ditches, Lakes, Ponds	North Central	6	19	Separate CAR	ESE
35-6	Munitions Test Area	Pink	Ordnance Testing and Disposal	North Central	14	21	Separate CAR	ESE
35-7	Firing Range	Pink	Ordnance Testing and Disposal	North Central	14	21	Separate CAR	ESE
36-1	Basin A	Pink	Basins, Lagoons	North Central	1	1	Separate CAR	ESE
36-2	Incendiary Drop and Munitions Test Area	Pink	Ordnance Testing and Disposal	Central	14	21	Separate CAR	ESE
36-3	Insecticide Pits	Pink	Solid Waste Burial Sites	Central	1	1	Separate CAR	ESE
36-4	Lime Settling Basins	Pink	Basins, Lagoons	North Central	1	1	Separate CAR	ESE
36-5	Mercury Compound Spill	Pink	Spills	North Central	1	1	Separate CAR	ESE
36-6	Probable Test Site	Pink	Ordnance Testing and Disposal	Central	14	21	Separate CAR	ESE
36-7	Sanitary and Shell Disposal Sites	Pink	Solid Waste Burial Sites	Central	1	1	Separate CAR	ESE
36-8	Open Chemical Drainage	Pink	Basins, Lagoons	North Central	1	1	Separate CAR	ESE
36-9	Incendiary or Munitions Test Site	Pink	Ordnance Testing and Disposal	Central	14	21	Separate CAR	ESE
36-10	Large Pit	Pink	Solid Waste Burial Sites	North Central	1	1	Separate CAR	ESE
36-11	Liquid Storage Pools	Pink	Basins, Lagoons	North Central	1	1	Separate CAR	ESE
36-12	Pits or Trenches	Pink	Solid Waste Burial Sites	Central	1	1	Separate CAR	ESE
36-13	Trenches	Pink	Solid Waste Burial Sites	North Central	14	21	Separate CAR	ESE
36-14	Disposal Site	Pink	Solid Waste Burial Sites	North Central	14	21	Separate CAR	ESE
36-15	Burning Site	Pink	Solid Waste Burial Sites	North Central	1	1	Separate CAR	ESE
36-16	Incendiary Burial Site	Pink	Ordnance Testing and Disposal	Central	14	21	Separate CAR	ESE
36-17	Complex Disposal/Activity Sites	Pink	Solid Waste Burial Sites	Central	1	1	Separate CAR	ESE
36-18	Possible Trench Disposal Sites	Pink	Solid Waste Burial Sites	North Central	14	21	Separate CAR	ESE
36-19	Ground Scars	Blue	Excavations, Surface Disturbances	Central	14	21	Separate CAR	ESE
36-20	Chemical Sewer Line	Pink	Sewers	North Central/Central	1	1	Separate CAR	ESE
36-21	Drainage Ditch	None	Ditches, Lakes, Ponds	North Central	1	1	"New" Site; Separate CAR	ESE
36-22	Potential Unlined Basin	None	Basins, Lagoons	North Central	1	1	"New" Site; Separate CAR	ESE
36-23	Debris Pile from Basin A	None	Solid Waste Burial Sites	Central	1	1	"New" Site; Separate CAR	ESE
1-UNC	Uncontaminated Areas	None	None	South Plants/Southern	7	20	Separate CAR	Ebasco
1-6	Open Storage Area	Blue	Storage Sites, Buildings, Equipment	South Plants	7	20	Included in uncontaminated areas	Ebasco
2-UNC	Uncontaminated Areas	None	None	South Plants/Southern	7	20	Separate CAR	Ebasco
2-10	Ground Scar	Blue	Excavations, Surface Disturbances	Southern	7	20	Included in uncontaminated areas	Ebasco
2-11	Open Storage	Blue	Storage Sites, Buildings, Equipment	South Plants	7	20	Included in uncontaminated areas	Ebasco
2-15	Open Storage Area	Blue	Storage Sites, Buildings, Equipment	Southern	7	20	Included in uncontaminated areas	Ebasco
2-16	Pit	Blue	Excavations, Surface Disturbances	Southern	7	20	Included in uncontaminated areas	Ebasco
3-UNC	Uncontaminated Areas	None	None	Western	15	22	Separate CAR	Ebasco
4-UNC	Uncontaminated Areas	None	None	Western	15	22	Separate CAR	Ebasco
5-UNC	Uncontaminated Areas	None	None	Eastern	15	22	Separate CAR	Ebasco
5-1	Bomb Storage Sites	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-UNC	Uncontaminated Areas	None	None	Southern/Eastern	15	22	Separate CAR	Ebasco
6-1	Drainage Ditches	Blue	Ditches, Lakes, Ponds	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-3	Storage Area	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-4	Salt from Mustard Demil	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-5	GB Spill	Pink	Spills	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-7	HE Storage Yard	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-8	Storage Sheds or Bunkers	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-9	Vegetation Stress	Blue	Excavations, Surface Disturbances	Southern/Eastern	15	22	Included in uncontaminated areas	Ebasco
6-10	Trenches	Blue	Solid Waste Burial Sites	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-11	Trench	Blue	Solid Waste Burial Sites	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-12	Possible Excavation	Blue	Excavations, Surface Disturbances	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-13	Excavation	Blue	Excavations, Surface Disturbances	Eastern	15	22	Included in uncontaminated areas	Ebasco
6-14	Open Storage	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco

Table 2-1. Site Summary (Page 3 of 4)

Site Number or Designation	Site Name	Tricolor Map Designation	Site Type	RI Study Area	Phase I Task	Phase II Task	Comment	Contractor
8-15	Storage Sheds	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
7-UNC	Uncontaminated Areas	None	None	Southern/Eastern	15	22	Separate CAR	Ebasco
7-1	Bomb Storage Sheds	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
8-UNC	Uncontaminated Areas	None	None	Eastern	15	22	Separate CAR	Ebasco
8-1	Bomb Storage Sheds	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
9-UNC	Uncontaminated Areas	None	None	Western	15	22	Separate CAR	Ebasco
9-1	Ground Disturbance, Radio Tower	Blue	Excavations, Surface Disturbances	Western	15	22	Included in uncontaminated areas	Ebasco
9-2	Excavation or Mound	Blue	Excavations, Surface Disturbances	Western	15	22	Included in uncontaminated areas	Ebasco
11-UNC	Uncontaminated Areas	None	None	Southern	15	22	Separate CAR	Ebasco
11-2	Disturbed Area	Blue	Excavations, Surface Disturbances	Southern	15	22	Included in uncontaminated areas	Ebasco
12-UNC	Uncontaminated Areas	None	None	Southern	15	22	Separate CAR	Ebasco
19-UNC	Uncontaminated Areas	None	None	Eastern	14	21	Separate CAR	ESE
19-2	TX Production Site	Blue	Excavations, Surface Disturbances	Eastern	14	21	Included in uncontaminated areas	ESE
20-UNC	Uncontaminated Areas	None	None	Eastern	14	21	Separate CAR	ESE
20-2	TX Production Site	Blue	Excavations, Surface Disturbances	Eastern	14	21	Included in uncontaminated areas	ESE
22-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
23-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
23-1	Suspected TX Disposal Well	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
23-2	Suspected TX Disposal Well	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
23-3	TX Production Area	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
24-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
24-1	Suspected TX Burial Site	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
24-2	Suspected TX Disposal Well	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
24-3	Suspected TX Disposal Well	Blue	Solid Waste Burial Sites	North Central	14	21	Included in uncontaminated areas	ESE
24-4	TX Production Area	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
25-UNC	Uncontaminated Areas	None	None	N. Cent./N. Plants/East	14	21	Separate CAR	ESE
25-1	TX Production Area	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
26-UNC	Uncontaminated Areas	None	None	North Central	6	19	Separate CAR	ESE
26-1	Deep Disposal Well	Pink	Solid Waste Burial Sites	North Central	6	19	Included in uncontaminated areas	ESE
26-2	TX Production Area	Blue	Excavations, Surface Disturbances	North Central	6	19	Included in uncontaminated areas	ESE
26-10	Lined Pond	Blue	Basins, Lagoons	North Central	6	19	Included in uncontaminated areas	ESE
27-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
27-1	Basin G	Blue	Basins, Lagoons	North Central	14	21	Included in uncontaminated areas	ESE
27-2	Ground Scar	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
27-3	Ground Scar	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
28-UNC	Uncontaminated Areas	None	None	North Central	14	21	Separate CAR	ESE
29-UNC	Uncontaminated Areas	None	None	Eastern	14	21	Separate CAR	ESE
29-2	Ground Disturbances	Blue	Excavations, Surface Disturbances	Eastern	14	21	Included in uncontaminated areas	ESE
29-3	Burn Site	Blue	Solid Waste Burial Sites	Eastern	14	21	Included in uncontaminated areas	ESE
29-6	Ground Disturbance	Blue	Excavations, Surface Disturbances	Eastern	14	21	Included in uncontaminated areas	ESE
30-UNC	Uncontaminated Areas	None	None	Eastern	14	21	Separate CAR	ESE
31-UNC	Uncontaminated Areas	None	None	Eastern	15	22	Separate CAR	Ebasco
31-1	Storage Sheds	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
31-2	VX and GB Soil Contamination	Pink	Spills	Eastern	15	22	Included in uncontaminated areas	Ebasco
31-3	Warehouse	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
31-5	Disturbed Ground	Blue	Excavations, Surface Disturbances	Eastern	15	22	Included in uncontaminated areas	Ebasco
32-UNC	Uncontaminated Areas	None	None	Eastern	15	22	Separate CAR	Ebasco
32-2	Ground Scars	Blue	Excavations, Surface Disturbances	Eastern	15	22	Included in uncontaminated areas	Ebasco
32-3	Open Storage Areas	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
32-4	Storage Shed	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
32-7	Storage Sheds	Blue	Storage Sites, Buildings, Equipment	Eastern	15	22	Included in uncontaminated areas	Ebasco
32-8	Ground Disturbance	Blue	Excavations, Surface Disturbances	Eastern	15	22	Included in uncontaminated areas	Ebasco
33-UNC	Uncontaminated Areas	None	None	Western	15	22	Separate CAR	Ebasco
34-UNC	Uncontaminated Areas	None	None	Western/North Central	14	21	Separate CAR	ESE
34-1	Scarified Ground	Blue	Excavations, Surface Disturbances	North Central	14	21	Included in uncontaminated areas	ESE
35-UNC	Uncontaminated Areas	None	None	North Central	6	19	Separate CAR	ESE
35-5	Ground Disturbance	Blue	Excavations, Surface Disturbances	North Central	6	19	Included in uncontaminated areas	ESE
35-6	Storage Area	Blue	Storage Sites, Buildings, Equipment	North Central	6	19	Included in uncontaminated areas	ESE
35-9	Caustic Holding Basin	Blue	Basins, Lagoons	North Central	6	19	Included in uncontaminated areas	ESE

Table 2-1. Site Summary (Page 4 of 4)

Site Number or Designation	Site Name	Tricolor Map Designation	Site Type	RI Study Area	Phase I Task	Phase II Task	Comment	Contractor
38-UNC	Uncontaminated Areas	None	None	North Central/Central	1	1	Separate CAR	ESE
Biota	Arsenal-wide	None	Biota	Arsenal-wide	9	9	Separate Biota CAR	ESE
Air Monitoring	Arsenal-wide	None	Air	Arsenal-wide	18	18	Separate Air Monitoring CAR	ESE
South Plants Regional	Manufacturing Area	Misc.	Spills	South Plants	2	2	In South Plants SAR	Ebasco
Spill Sites	Arsenal-wide	Misc.	Spills	South Plants	24	24	In South Plants SAR	Ebasco
Buildings	Arsenal-wide	Misc.	Storage Sites, Buildings, Equipment	Arsenal-wide	24	24	Separate Buildings CAR	Ebasco
25-4	Building 1501	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-5	Building 1503	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-6	Building 1504	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-7	Building 1506	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-8	Building 1601	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-9	Building 1603	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-10	Building 1606	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-11	Building 1614	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-12	Building 1615	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-13	Building 1616	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-14	Building 1703	Pink	Storage Sites, Buildings, Equipment	North Plants	24	24	Separate Buildings CAR	Ebasco
25-15	Building 1727	Pink	Storage Sites, Buildings, Equipment	North Plants	30	30	Separate Task Report	ESE
25-16	Manufacturing Areas	None	Spills	North Plants	42	42	In North Plants SAR	Ebasco
3-1	Sanitary Sewer Line	Blue	Sewers	Western	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
4-1	Sanitary Sewer Line	Blue	Sewers	Western	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
24-5	Sanitary Sewer Line	Pink	Sewers	North Central	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
25-2	Sanitary Sewer Line	Pink	Sewers	N.Cent./N. Plants	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
26-8	Sanitary Sewer Line	Pink	Sewers	North Central	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
34-2	Sanitary Sewer Line	Blue	Sewers	Western/North Central	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
36-1	Sanitary Sewer Line	Pink	Sewers	North Central	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
Misc. Sanitary Sewers	Sanitary Sewer Lines	None	Sewers	Arsenal-wide	10	10	Separate Sanitary Sewers CAR(s)	Ebasco
Misc. Process Water	Process Water System	None	Sewers	SP/NP/Western/N/Cent.	10	10	Separate Process Water System CAR	Ebasco
25-3	Chemical Sewer Line	Pink	Sewers	North Plants	10	10	Separate Chemical Sewers CAR(s)	Ebasco
36-20	Chemical Sewer Line	Pink	Sewers	North Central	10	10	Separate Chemical Sewers CAR(s)	Ebasco
Misc. Chemical Sewers	Chemical Sewer Lines	None	Sewers	S. Plants/N.Central	10	10	Separate Chemical Sewers CAR(s)	Ebasco

Information developed in the RI for each site is used in the EA to select appropriate compounds and elements to be evaluated with respect to their toxicity and potential for exposure to living organisms. It is not logical to perform such assessments for compounds that are not found on RMA; similarly, it is not logical to conduct extensive RI studies for compounds that are nontoxic or that have no possible exposure pathways to humans or other sensitive organisms. Clearly, interaction between the RI and the EA is essential to the preparation of a complete, yet efficient remedial plan for RMA.

Similarly, the information developed in the RI and EA is considered in the preparation of the FS. It is unreasonable to examine remedial technologies to deal with contaminants that are not found on RMA or that have no adverse effects upon humans or the environment. The FS must also have sufficient data available to evaluate all reasonable remediation strategies, so feedback to the RI is critical to ensure that adequate information is collected. The following sections of the Plan describe the ongoing RI, EA, and FS in more detail.

2.2 REMEDIAL INVESTIGATION

2.2.1 Data Collection/Assessment

Historical research and analysis of the RMA site on behalf of the Army and the EPA began in 1983. Documents produced during discovery in United States v. Shell (Civil Action No. 83-C-2379) (D. Colo) were screened and filmed. The filmed documents have been programmed into special data base systems, which currently contain over 307,000 documents. Various manual indexing systems have been developed to augment electronic searching. Deposition transcripts have also been programmed into another computer system, thereby facilitating both simple and complex key-word searches of the, currently, 384 volumes of testimony taken during the depositions of 136 deponents in the consolidated Colorado cases, as well as the Shell insurance case [Shell vs Accident and Casualty Insurance Company of Winterthur, et al. (Cal. Civ. No. 278953)] now pending in California. Additionally, 5,076 deposition exhibits have been identified and reviewed. The 58 Shell Interrogatory Responses, the 205 U.S. Interrogatory Responses, and the

thousands of documents referenced therein, have been reviewed and analyzed. Also various reports, studies and plans, together with the RMA histories, have provided additional information.

For the last two years, a Technical Research Team, comprised of attorneys and paralegals, has organized the data by broad subject matter and date. These Fact Compilations became the basis for the drafting of Proposed Stipulations, and Responses and Comments on Proposed Stipulations as well as thousands of fact statements organized by narrower historical subject. This information was subsequently exchanged among the U.S., Colorado, and Shell. The stipulation process also involved reference to aerial photography (1945-1982), 36 groups of microfiche containing thousands of drawings, plans, and process flow diagrams (the subject of which can be computer-searched), personnel interviews, and onsite observations.

For nearly a year, the team, with the assistance of a chemical expert and in consultation with scientists and engineers, performed a detailed waste stream analysis of Army operations at RMA, and examined and critiqued a waste stream analysis of Shell operations prepared by Shell in 1984. Additionally, the team has been called upon to analyze various historical propositions, as case needs have dictated.

In March 1987, the team began the historical analysis of those sites being investigated for the RMA Cleanup. The focus of research, consequently, shifted from subject matters and operations to geographic locations. Included in this research were the results of fact compilations, stipulations, waste stream analyses, identificaiton of all data bases and computer systems, examination of drawings, plans and photographs, and interviews of personnel as appropriate.

Of particular importance in the ongoing historical research of RMA cleanup sites has been the initiation and performance of the process by a team that has been working with the subject matter and materials over a significant period of time.

The RI is designed to define the nature and extent of contamination on RMA to a degree sufficient to permit an assessment and selection of viable cleanup options for RMA. It is not designed to collect all possible information about contamination or the RMA ecosystem. The RI program is divided into five major categories, namely air, biota, buildings, water, and soils/sewers. In addition, the offpost area has been assessed as a separate program. The air, biota, buildings, and water investigations are being conducted under only a few tasks (18, 9, 2/24, and 4/25/44, respectively), whereas the soils portion of the program is included in 18 separate tasks. Of these 18 soils-related tasks, two are both soils and buildings tasks (2 and 24), five are both soils and water tasks (23, 38, 42, 47, and 48), and the remaining eleven tasks are strictly soils-related. One additional task (10) includes the sewers assessments. Table 2-1 lists all of the potential contamination sites being investigated under the onpost RI/FS program at RMA. This table also contains a listing of the task numbers under which the various investigations are being conducted as well as a description of which reports will contain the results of the investigations.

The approach being used for the air study is the implementation of a regional program in accordance with EPA guidance. The purpose of the program is to establish baseline conditions to determine if there are significant problems resulting from air emissions from RMA to on- or offpost areas, and to establish baseline conditions against which to compare pollutant levels attained during cleanup actions and after completion of cleanup activities. Event conditions are being evaluated to determine airborne contaminant levels during atmospheric situations favorable to high pollution events. Meteorological conditions are being monitored in order to predict the frequency of pollution events during future remedial actions. Shell will provide support in the air program, chiefly through air modelling studies conducted to assist in the evaluation of FS alternatives.

The assessment of contamination in biota is designed to evaluate the types and extent of contamination in plants and animals. This task is integrated with the soil and water tasks to determine chemicals of concern to biota and to define the potential areas of contaminant exposure. Data are collected on the concentrations of contaminants in the tissues of key species selected

because of their importance in regional ecosystems, status as game species, or regulatory status (e.g., endangered). Information on bioaccumulation, bioconcentration, depuration rates, etc. are incorporated into food web models to evaluate potential hazards to consumers and to develop criteria for the cleanup of soils which serve as sources of contamination on RMA. Toxicity data is also acquired on contaminants that do not accumulate in tissues so that all contaminants of concern are addressed. Additional information on food habits, population densities, reproductive success, and other biological parameters are collected and evaluated in order to assess hazards to key species and to the overall structure and function of natural ecosystems. Field studies of raptors (including eagles) are being conducted in order to determine habitat use, distribution, and food habits in relation to RMA contamination.

Both the Army and Shell are conducting biological investigations on and near RMA. Data from these studies will be combined into a single report that assesses the onpost and offpost biota in relations to RMA contamination. Shell will have lead responsibility for preparing sections on vegetation and aquatic ecology. The Army, as governmental trustee of RMA, will be responsible for wildlife sections, contaminant pathways analyses, and overall report content. Shell's investigation focuses on the trophic structure of the lakes and compares the onpost lakes to the offpost control and to literature data available on other similar lakes.

The study of buildings on RMA is complicated because there are no commonly accepted techniques for thoroughly sampling buildings to determine their contamination status. As a result, the program developed for RMA relies principally upon a very thorough analysis of all available historic documentation concerning the buildings to determine their contamination classification. Buildings are grouped into one of three classes: probably contaminated, probably contaminated but cleanable, and unlikely to be contaminated. The program is supplemented with a limited dust and liquids sampling program, as well as with limited asbestos sampling. The output of the buildings investigations is a catalog and inventory of all structures present on RMA, along with a summary of all significant historic

documentation for each of approximately 1,200 structures present or formerly present onpost. Estimates of the volume of materials contained in the buildings are also being made.

As discussed, the sewer systems have been incorporated into the soils/sewers program. There are three sewer systems present on RMA, the sanitary, chemical and process water systems. Portions of the chemical sewer system have been removed to prevent the continued introduction of wastewaters into Basin F.

The sanitary and process water systems remain intact. Sewers act not only as potential contamination sources due to exfiltration of contaminated materials from leaking joints, manholes, and pipe breaks, but also as pathways for contaminant movement. Contaminated ground water can potentially enter the sewer through joints and other discontinuities, travel through the system, and exfiltrate into the soils and ground water in other locations. The approach being used to investigate the sewers is two-fold. First, one of the IRAs will provide for the sewers to be remediated at key locations to cut off contaminant migration routes. Second, the three systems are being investigated as potential soils and ground water contamination sources. Sewers are unique potential contamination sources because they are linear and are likely to leak only at discrete, but difficult to identify, points along their length. There are thousands of possible leak locations, and it is not reasonable under the RI program to sample each of these locations. A "worst case" approach has been developed. Historical documentation and visual inspections are used to identify those lines in the worst condition, and sampling is initiated along these segments. Results from these segments are extrapolated to other portions of the intact and removed sewer systems. Shell has also conducted substantial efforts in the investigation of RMA sewer systems including records research and field testing, and will provide significant support to the Army in the assessment of these systems.

The soils investigations are being conducted in two phases. Phase I programs are designed to identify the types of contaminants present at each site, whereas the Phase II programs are designed to verify the Phase I

information and to better define the spatial extent of contamination. Screening methods (GC/MS for organics) are used in the Phase I program to identify the types of contaminants present. The methods used for Phase I screening are selected based upon a review of the types of compounds used and produced at RMA. A target list of compounds is used to guide the program, but significant man-made nontarget compounds detected under the Phase I program are also investigated further under the Phase II efforts. More sensitive and selective confirmatory analytical methods (GC methods for organics) are used in the Phase II programs to further define the extent of contamination at each site. The Phase II analytical methods for organics are supplemented with further GC/MS efforts to confirm the identity of compounds detected through the GC methods.

Table 2-1 lists the Phase I and, where appropriate, the Phase II task numbers for each potential contamination site. Some sites have no Phase II investigation planned based upon the lack of significant contamination found under the Phase I effort. Included in this table are potential soils contamination sites being investigated onpost under the RI/FS program. These soils sites consist of sites that were determined to have a high likelihood of being contaminated (pink on the tricolor map), sites that were investigated but determined to have a low likelihood of being contaminated (blue on the tricolor map), newly identified sites (not shown on tricolor map), and sites that represent those portions of the 28 sections comprising nonsource areas of RMA for which no historical documentation exists indicating areawide contamination.

The sampling strategy for the suspected contaminated areas consists of vadose zone sampling with a boring spacing determined by the relative size of the site under study. Samples are established on a grid pattern except where there is sufficient information to locate the samples within the most highly contaminated portions of a site, e.g., within waste burial trenches. The vertical distribution of sampling is based upon a regular 5 or 10 foot sample spacing, except where there is visual or other evidence that additional sampling is appropriate. Saturated zone samples are collected at only a few locations where there is evidence that significant amounts of contamination have been emplaced or migrated below the water table. The

"uncontaminated" or nonsource areas presented the greatest challenge in that there is no commonly accepted sampling method that could be accomplished in a reasonable timeframe that would give statistically meaningful proof that the area was indeed free of all possible contamination. As a result, an approach similar to that used for the buildings is employed, i.e., principal reliance upon a thorough search of historical documentation and aerial photographs supplemented with field reconnaissance and a limited soil sampling program. In addition, information collected from the ground water program is used to identify contaminant plumes that have unknown sources.

For the potential soils contamination sites, the results of the Phase I field investigations are presented in CARs. These reports, which are prepared on a site-by-site basis, contain all information that was developed through a search of historical documentation and aerial photographs as well as the results of the field sampling, chemical analysis, geologic interpretations, and analysis of the presence and extent of contamination. Where appropriate, a Phase II program to further define the spatial extent of contamination is also proposed in the Phase I CAR. Finally, a revised estimate of the volume of potentially contaminated soil is presented. Results of Phase II investigations are presented in Phase II Data Packet Addenda. These Phase II addenda are simple data presentations without re-interpretation of the nature and extent of contamination at that particular site. It was believed that a site-by-site interpretation of the complete soils contamination data set to be collected under the RI program would not properly take into consideration the interactions of contaminants among the various sites nor would it elucidate the interrelationships between soils contamination and ground and surface water contamination. Furthermore, the impacts of unique site types such as buildings, spills, and sewers upon contaminant distribution and movement are best addressed in the context of study areas, as discussed below. Shell is supplementing the Army's soil contamination investigations with an extensive effort to remap soils on RMA. This effort was undertaken after it became clear that existing USDA SCS soils maps of the RMA area were not sufficiently detailed or accurate for input to the FS investigations.

Ground water investigations are currently being performed at RMA on both regional and site specific scales. The purpose of the regional monitoring program is to collect water quality and water level data from a large network of wells situated in both onpost and offpost areas. This program is responsible for the identification of the nature and extent of contamination on an Arsenal-wide basis and to provide monitoring of regional water quality. Site-specific ground water investigations and monitoring programs have been designed to accomplish specific objectives within a limited area. The objectives of each of these investigations or programs are different, but data from each of these programs will be merged with the regional water quantity/quality data to provide for comprehensive ground water interpretations. Shell will supplement these studies with Basin A neck faulting investigations as well as detailed interpretations of the alluvial geology and hydrology.

The current regional ground water monitoring program (Task 44) included the measurement of water levels for over 800 monitoring wells and collection of water quality samples from more than 300 monitoring wells. This regional network was designed by evaluating the characteristics of all monitoring wells present in both the onpost and offpost areas of RMA (over 1,500 wells). Well construction, chemical sampling history, well location, and screen placement were factors considered in monitoring network design. Samples taken from wells selected for the past regional program (Task 4) and the current regional program (Task 44) are analyzed for a wide variety of target analytes. A limited number of wells (10 percent) from later sampling events under Task 4 and from the Task 44 program had water samples analyzed for nontarget analytes by GC/MS methodologies. Although GC/MS methods do not achieve the lower detection limits of the GC methods used for target analytes, the use of these methods allows confirmation of many target compounds and tentative identification of nontarget compounds. As appropriate, nontarget compounds are included in the list of target analytes.

In addition to performing regional ground water monitoring, the Task 44 program evaluated new water quality data so future monitoring networks can be modified, as necessary, to more effectively accomplish program

objectives. The regional program also identifies locations and depths for which additional monitoring wells are needed to evaluate specific sites or plumes to achieve the objectives of the RI program. The installation of new monitoring wells on RMA is being coordinated by the "Composite Well Program" which is being conducted as part of Task 44.

Ground water monitoring is performed at both the North Boundary Containment System (NBCS) and Northwest Boundary Containment System (NWBCS) on a quarterly basis under Task 25. Water level and water quality data will be integrated with geologic and hydrologic interpretations for these areas to identify the nature and extent of contamination in the immediate vicinity of the boundary systems and also identify probable contaminant transport pathways.

Ground water monitoring and a hydrogeologic investigation are being performed in the offpost area under Task 39. The data generated under this task will be used to complete the RI for the offpost region, identifying probable contaminant transport pathways.

Another site-specific ground water investigation designed to identify sources of ground water contamination and characterize contaminant transport pathways has been performed for the Western Tier under Task 38. Task 26 has been rescoped to perform an IRA Alternative Assessment and install wells. No sampling and analysis is being conducted.

The Offpost RI is investigating water, air, biota, soils, and sediment media in the area immediately north and northwest of RMA. The primary emphasis is on RMA contaminants in ground water. The geologic, hydrologic, and chemical data will be used in subsequent EA and FS activities.

2.2.2 Data Interpretation

Data generated under both the regional program and site specific investigations will be integrated and interpreted to identify the nature and extent of contamination, probable source areas, and, to the degree possible, contaminant transport pathways.

As a result of these considerations, the final interpretation of the data collected on the individual soil contamination sites is conducted on a regional basis in Study Area Reports (SARs). These seven Study Areas (Southern, South Plants, Western, Eastern, North Plants, North Central, and Central) plus the separate Media reports for air, biota, buildings, and water, will form the basis for the integrated contamination assessment reports to be prepared as final RI Products. The Study Areas are also conveniently divided among the two contractor teams working at RMA in terms of the sites that each is investigating under its respective tasks. As shown below, the division of responsibility is relatively well-defined for each Study Area, except for the Eastern Area where a shared effort will be needed. It should be noted that because some of the sites are included in more than one study area, the total number of sites listed below exceeds the actual number of sites investigated.

Study Area	Number of Ebasco Sites	Number of ESE Sites
Southern	23	0
South Plants	29	0
Western	17	0
Eastern	39	21
North Plants	15	2
North Central	10	52
Central	0	12
Media		
Air	--	Arsenal-wide
Biota	--	Arsenal-wide
Buildings	Arsenal-wide	--
Water	Arsenal-wide	Arsenal-wide

Shell will provide significant support in the development of the South Plants, Central, and North Central SARs. This support will include areas such as geologic and hydrologic interpretations and contamination assessments.

Figure 2-2 illustrates the seven Study Areas that have been designated on RMA. The Study Area boundaries were developed in consideration of geography, geology, past land uses, contaminant classes and distribution patterns, ground and surface water flow patterns, and possible future uses.

Table 2-1 lists the Study Areas into which each of the potentially contaminated sites falls. The SARs are developed in a more flexible format than the CARs due to the diversity of characteristics within each Study Area. In general, the following general format will be employed:

EXECUTIVE SUMMARY

1.0 STUDY AREA CHARACTERIZATION
- PHYSIOGRAPHIC CHARACTERISTICS
- SCOPE OF REPORT
- HISTORY OF USE
- GEOLOGY
- HYDROLOGY
- BIOTA
- AIR

2.0 CONTAMINANT DISTRIBUTION
- SOILS AND SEDIMENTS
- SURFACE WATER
- GROUND WATER
- BIOTA
- AIR

3.0 CONTAMINATION ASSESSMENT
- INTRODUCTION
- MIGRATION PATHWAYS
- VOLUME OF POTENTIALLY CONTAMINATED SOILS
- FLUX OF POTENTIALLY CONTAMINATED GROUND WATER
- VOLUME OF POTENTIALLY CONTAMINATED BUILDINGS
- BIOTA IMPACT
- AIR IMPACT
- CONCLUSIONS AND RECOMMENDATIONS

The Study Area characterization is developed based upon information contained in the CARs for sites within the Study Area, as well as upon information developed in related activities such as ground water sampling and analysis for that area (and adjacent areas), sewers investigations, and buildings assessments. The discussion of contaminant distribution correlates data from adjacent or similar sites, and it correlates soils contaminant data with ground and surface water contaminant data. The

correlations are conducted in graphical or statistical forms, depending upon the nature of the contamination and the area in question. The contamination assessment contains an interpretation of the observed contaminant distribution patterns, and a discussion of how these patterns may have originated, as well as how contamination patterns at adjacent sites might be related. Consideration is given to grouping sites by type. For example, as shown in Table 2-1, sites have been classified into nine general categories, depending upon the types of uses or activities that took place, as follows:

Site Type	Number of Sites
Basins, Lagoons	15
Ditches, Lakes, Ponds	14
Excavations, Surface Disturbances	28
Ordnance Testing and Disposal	8
Solid Waste Burial	38
Spills	12
Storage Sites, Buildings, Equipment	46
Nonsource Areas	28
Sewers	13

The number of sites include areas that were not previously defined in the tricolor map. These site types are used on a Study Area basis to group similar contamination areas or patterns of migration. Other approaches to grouping contamination patterns are developed on a case-by-case basis to better understand the relationships between contaminant sources and migration and distribution patterns. The outcome of the SARs will be a comprehensive picture of the possible exposure routes and transport mechanisms for contaminants present on RMA. They also provide a basis upon which to evaluate various cleanup options, and thus form the principal input to the FS process.

2.3 ENDANGERMENT ASSESSMENT

The goals of the EA for RMA are to quantify the magnitude and probability of actual and potential damage to human health and the environment from contaminated soils at RMA, and to determine in-place concentrations of contaminants that will be protective of human health and the environment following cleanup.

The EA approach used for RMA is consistent with the Superfund Health Evaluation Process and consists of a series of analytical steps which

include the review of adjacent and site specific demographic data to determine the land use patterns and exposed populations; the determination of the magnitude and extent of contamination from the assessments performed in the RI; the identification of the contaminants present in soils and their toxicological properties; the development of numerical criteria for specific exposure pathways and potential surface use options; the determination of the extent of exposure and endangerment to the target receptors; and the interpretation of the criteria data base to assist the FS in establishing response objectives.

The analytical steps presented above are performed under six discrete study elements (sub-tasks) as shown in Figure 2-3. The method used to determine contaminant specific soil criteria has been developed by the United States Army Biomedical Research and Development Laboratory (USABRDL) and has been extensively used by the Department of the Army at a number of sites among which are the West Virginia Ordnance Works, Alabama Army Ammunition Plant, Savannah Army Depot, and Cornhusker Army Ammunition Plant.

The Preliminary Pollutant Limit Value (PPLV) method is quantitative and involves the estimation of acceptable intake rates for the site contaminants, definition of exposure pathways applicable to RMA, development of conceptual transport/exposure models for each pathway and mathematical representation of each model, quantification of each model parameter, and computation of contaminant specific numerical criteria, i.e., the soil PPLVs. The acceptable human intake for a given contaminant is computed for carcinogens as the ratio of the risk level to the potency slope (EPA Cancer Assessment Group Value). For non-carcinogens, it is calculated at the ratio of the no-observed-effect-level (NOEL) to a predesignated uncertainty factor. The soil concentration below which transport of a contaminant to humans through appropriate exposure routes does not exceed the acceptable intake rate is defined as the PPLV and therefore constitutes a numerical criterion for the contaminant in soil, specific to the pathways of exposure.

The transport of contaminants within pathway compartments is illustrated conceptually in Figure 2-4 in terms of box models. The conceptual models are then expressed in terms of a mathematical representation which relates the PPLV to the acceptable dose and to the applicable transfer coefficients and pathway specific parameters.

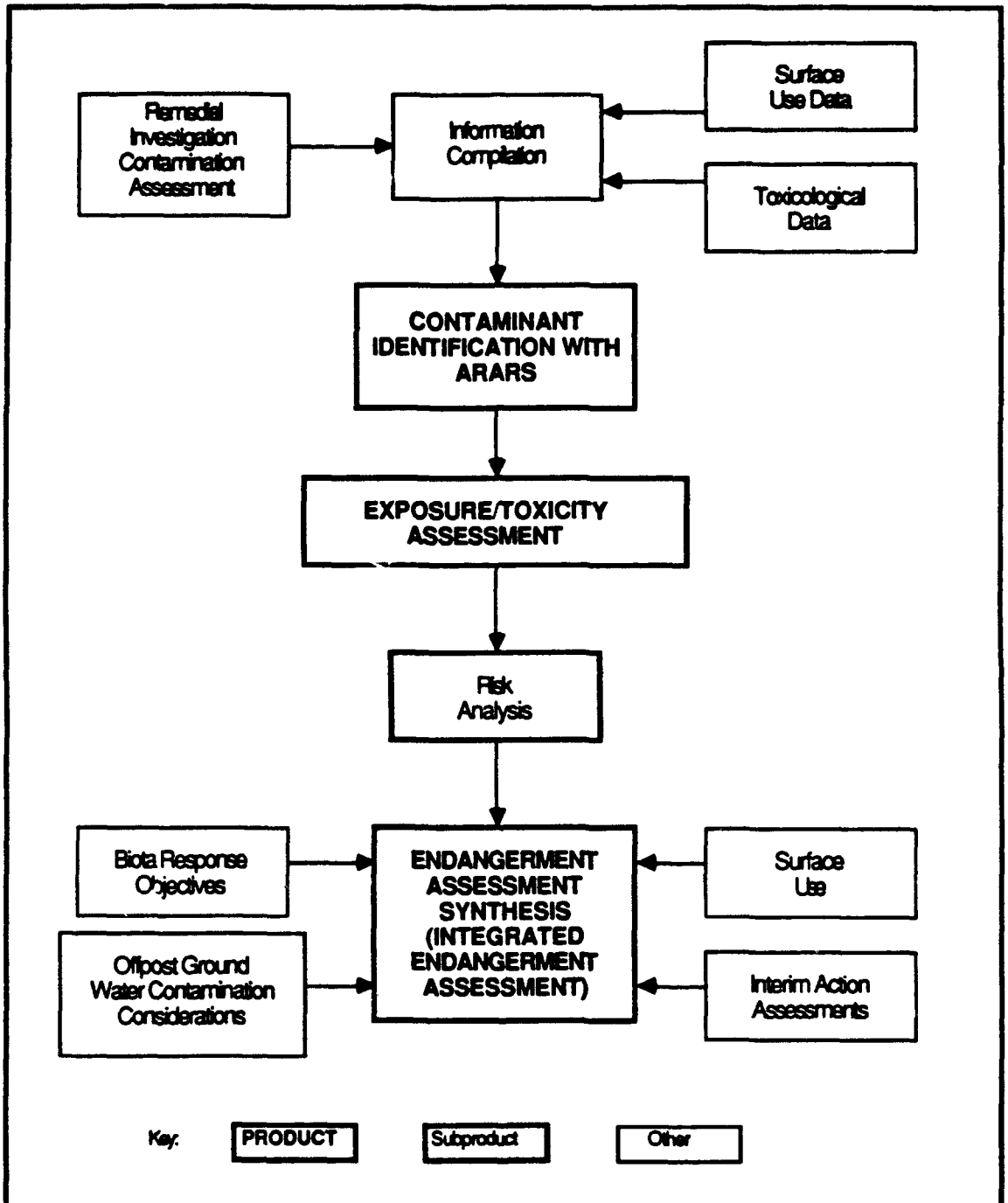

Figure 2-3
ENDANGERMENT ASSESSMENT FLOW DIAGRAM

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

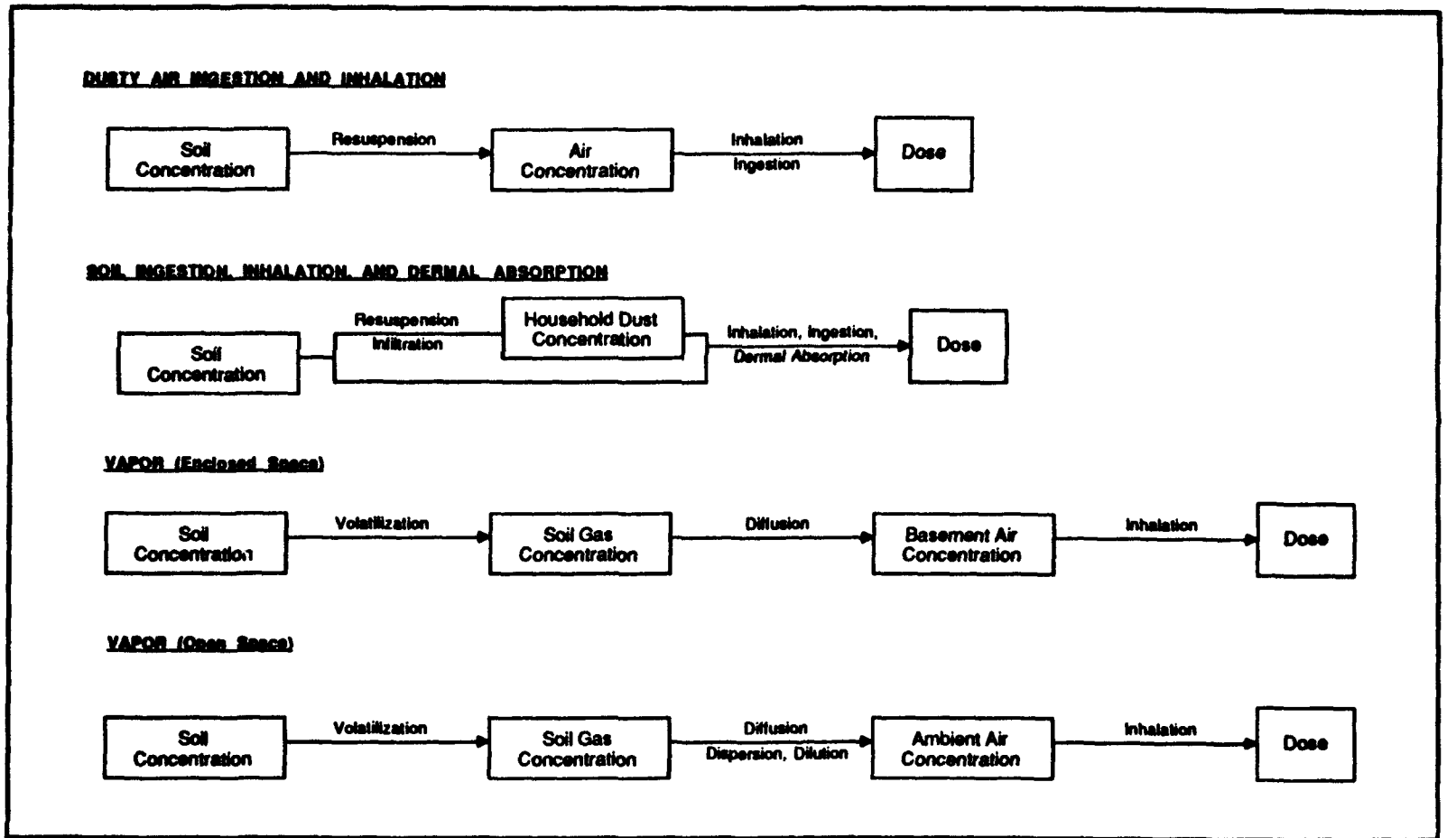

Figure 2-4
PATHWAY MODELS

Prepared for:
U.S. Army Program manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

Numerical soil criteria are computed for the applicable exposure pathways and potential surface use options. Exposure pathways applicable to RMA include soil ingestion, dust inhalation, and vapor inhalation. Designated potential surface uses for RMA are open space, recreational, commercial, and industrial. The manner in which these pathways combine under each surface use element is shown in Figure 2-5. For each surface use, the cumulative pathway PPLV results from the contribution of each single pathway PPLV. The cumulative PPLV value is controlled by the most critical pathway, i.e., the one with the lowest PPLV.

To determine the significance of the measured contamination at a given source or area within RMA as related to human health and environmental protection, concentrations of contaminants in soils measured during the RI program are compared to their cumulative PPLV computed for each of the surface use options. In this manner, the severity of the contamination is inferred and therefore the decision process regarding the development of action levels and response objectives is triggered. The significance and severity of contamination can be determined from a quantitative indicator, the Exposure Index. The Exposure Index is defined as the ratio of the maximum contaminant concentration measured at the site to the applicable surface use PPLV. The significance of the contamination is measured by whether the maximum concentration exceeds the PPLV and the severity is indicated by the magnitude of the exceedence. The frequency of exceedence provides a measure of which contaminants will be driving the cleanup. The spatial distribution of exceedences indicates the extent to which remediation may be required.

In combination, therefore, the RI and EA characterize the contamination in each potential exposure media, the pathways through which contaminants reach the target receptors (humans and biota), the acceptable contaminant dose and equivalent acceptable soil concentration, the significance and severity of contamination in soils and associated transport media, and the designation of areas of spatial extent which will necessitate remediation based upon health-based criteria. The interaction of these two program elements leads to an Integrated Endangerment Assessment (IEA) for RMA as shown diagrammatically in Figure 2-6.

SITE PATHWAYS	SURFACE USE: Open Space	Recreational	Commercial	Industrial
Soil Ingestion	●	●	●	
Dust Inhalation				●
Vapor Inhalation (Enclosed Space)			●	●
Vapor Inhalation (Open)	●	●	●	●

Figure 2-6
SURFACE USE/EXPOSURE PATHWAY MATRIX

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

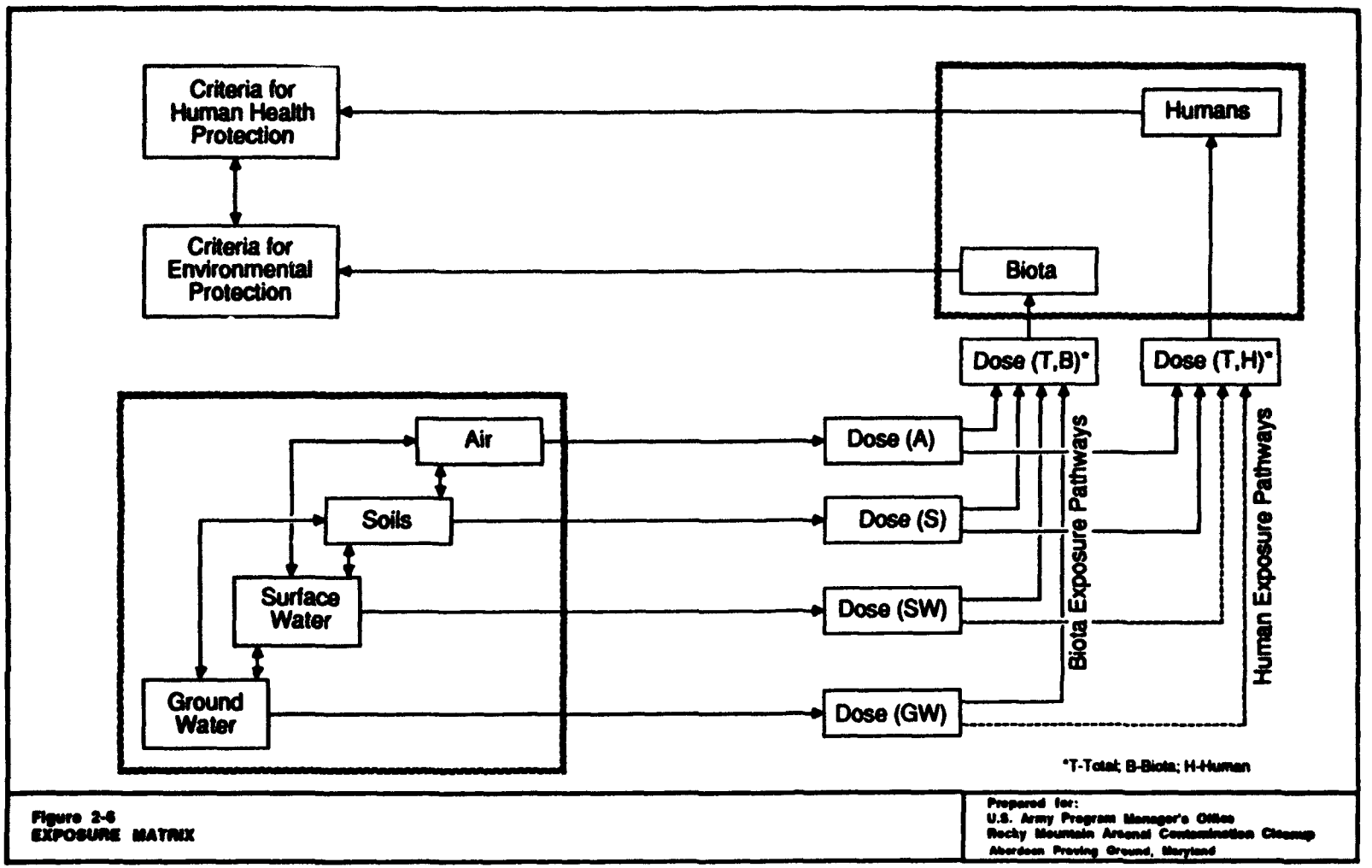

Figure 2-6
EXPOSURE MATRIX

Prepared for:
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Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

In performing an IEA, it is assumed that contaminants are distributed and equilibrated among all media (air, water, soils). Therefore, the total dose received by both humans and biota reflects a cumulative media dose through all applicable exposure pathways. For humans, the PPLV methodology accounts for the dose received from soils and air. Exposure to surface waters is accounted for indirectly through the vapor pathway. It should be noted, however, that vapor inhalation as addressed in the PPLV methodology applies to both closed conditions (basement air) and to the open environment.

Direct exposure to ground water is not considered in the onpost EA because the Army will continue use restrictions. However, to ensure that the soil PPLVs are protective of both surface and ground water contamination, equivalent soil criteria are calculated and compared with the PPLV and biota criteria as a screening tool only. The FS will evaluate each site individually in the alternatives analysis.

As part of the EA, elements of the FS are addressed particularly regarding the screening of technologies towards options appropriate to the remediation of critical pathways and contaminants, detection levels, and remedial alternatives that can attain treatment levels compatible with the range of contaminant specific criteria developed under the EA. In addition to the remedial considerations provided above, site restrictions (including the potential for human contact), site conditions, and ARARs are considered to determine the action level for a site or area. Therefore, action levels may be ARARs, PPLVs, detection limits, background concentrations, or other criteria as deemed appropriate based on health, technology, statutory, or site management requirements. Once action levels are established, the development of response objectives or remedial measures necessary to meet the preset action levels may proceed. The integration of the RI/EA/FS program elements are presented in terms of an interactive and information flow scheme in Figure 2-7.

Shell will provide significant support to the Army in the development of the EA. Specifically, they will assist in the interpretation of toxicological data and in the selection of partition coefficients and related factors.

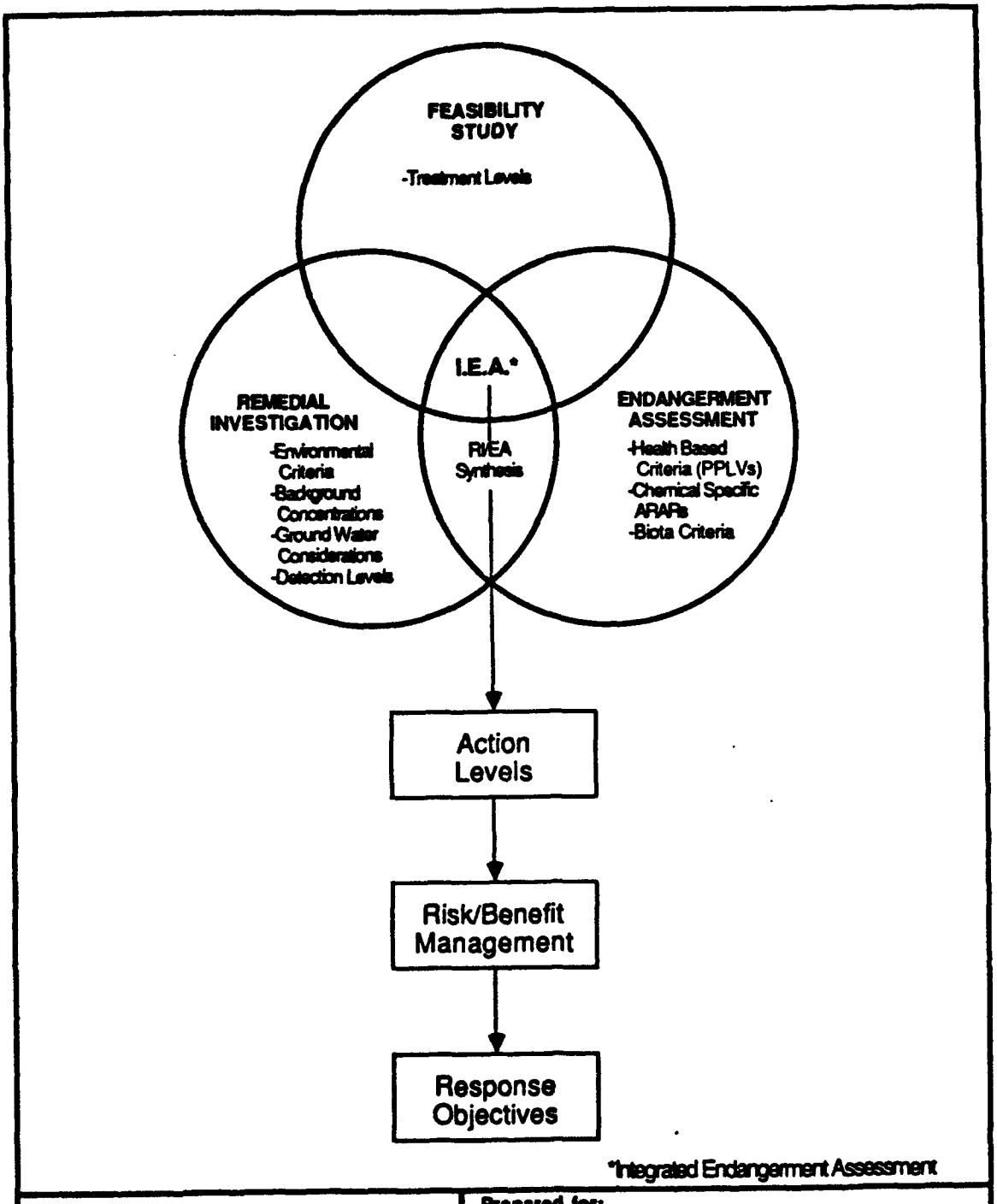


Figure 2-7
EA INTERACTIVE FLOW SCHEME

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

However, the Army will remain exclusively responsible for the development of proposed cleanup standards, and of EAs for each RMA environmental medium, as well as the IEA.

2.4 FEASIBILITY STUDY

2.4.1 Overview of Process

The purpose of the FS is to select one or more remedial actions for RMA, through a rigorous screening and evaluation process which will lead to selection of a remedy(s) which is protective, cost-effective, and implementable. The FS process that will be used for selection of the alternatives for each of the Operable Units.

Figure 2-8 represents the process that will be used in performing the FS resulting in the selection of a preferred alternative(s). Overall, the process consists of 5 major steps:

- Identification and screening of available technologies;
- Development of a set of alternatives that provide a range of remediation;
- Screening of the set of alternatives to minimize the number that will be evaluated in detail;
- A detailed analysis of alternatives; and
- Selection of a preferred alternative and a rationale for its selection.

These five major steps of the FS will be documented to support the ROD.

The process is integrated with and dependent upon inputs from the RI and the EA. The RI will provide data with respect to the type of contaminants, location, and the concentration profiles of these contaminants in the media in which they were found. The exposure assessment (part of the EA) will provide the pathways by which human or environmental receptors are exposed to the contamination. In addition, where ARARs are not available for specific contaminants in a medium, the EA will provide a health-based criteria that will be used as a basis for consideration of an action level.

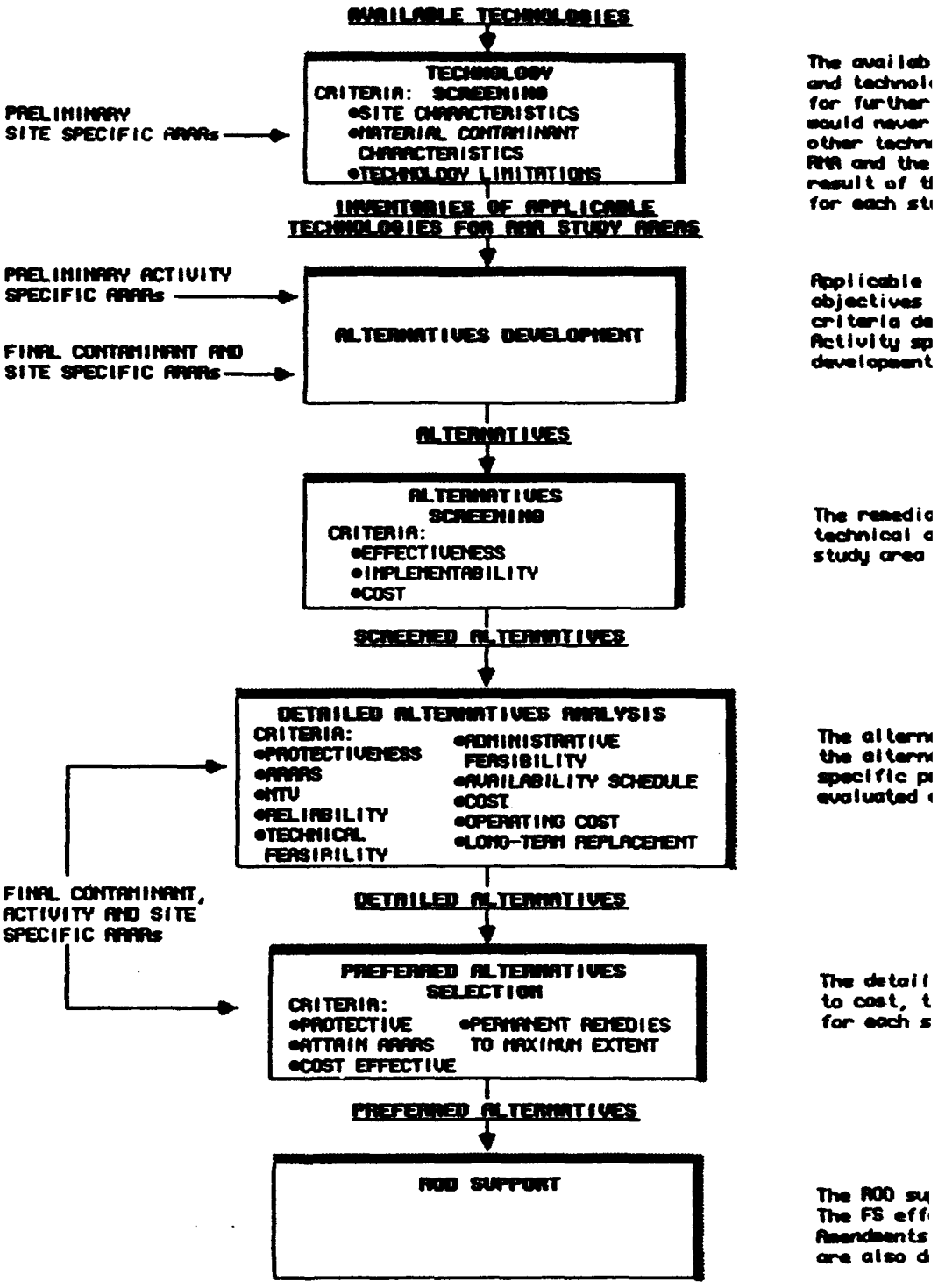
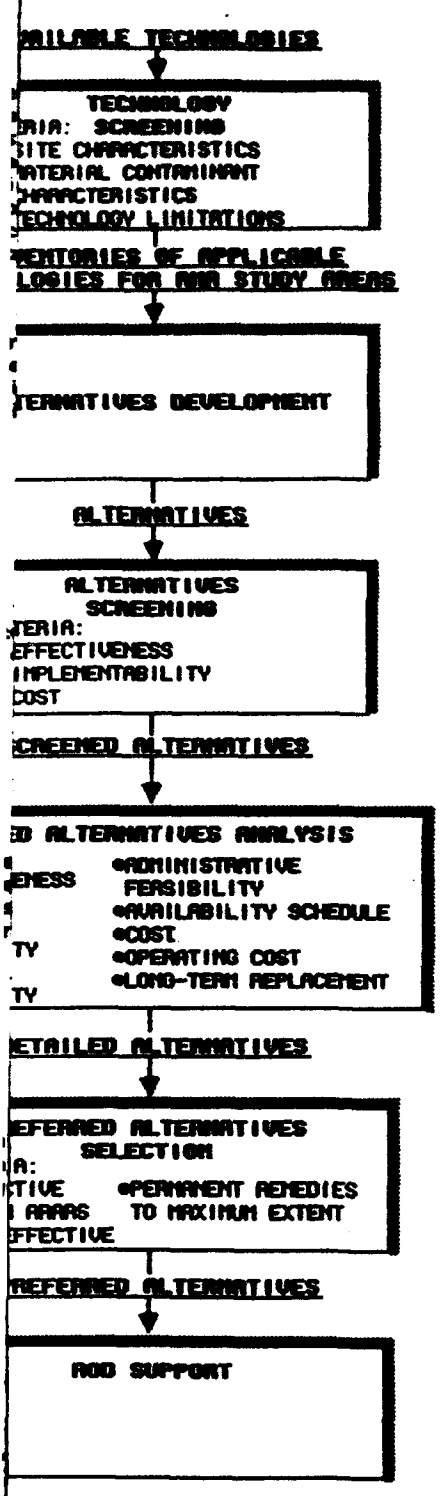


Figure 2-8
FS PROCESS FLOW DIAGRAM



FS PROCESS DESCRIPTION

The available technologies are screened in a two step process against site, contaminant and technological criteria in order to determine the technologies which are appropriate for further consideration. The two step screening process eliminates technologies which would never be employed for cleanup of RAA either individually or in conjunction with other technologies. The first screening step eliminates technologies not compatable with RAA and the second step eliminates technologies not compatable with each study area. The result of the screening step is a list of applicable technologies for each study area.

Applicable technologies are considered in developing alternatives to address response objectives for each study area. Response objectives are established from health-based criteria determined in the EA and from the contaminant and site specific ARARs. Activity specific ARARs are identified for technologies considered in alternatives development.

The remedial alternatives for each study area are compared and evaluated against technical and cost criteria. The most applicable remedial alternatives for each study area are determined and passed on for further detailed evaluation.

The alternatives developed in the previous step, are developed in detail. That is, the alternatives within a study area are more clearly defined by incorporating specific processes and site condition. The detailed alternatives are compared and evaluated against the technical, regulatory, financial and cost criteria shown.

The detailed alternatives that reach this stage are evaluated and compared relative to cost, technical effectiveness and regulatory compliance. A preferred alternative for each study area is selected.

The ROD support involves summarization and documentation of preferred alternatives. The FS efforts conducted to develop and evaluate the alternatives are documented. Amendments to the ROD, resulting from public review and comment and court decisions are also documented here.

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FS PROCESS DESCRIPTION

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For Rocky Mountain Arsenal
Aberdeen Proving Ground, Maryland

(3)

These outputs from the EA will be used in the development of specific response objectives which will set the goals for the alternatives to meet.

Other inputs to the FS process include the determination of the ARARs for the identified contaminants and the site specific ARARs associated with RMA. The action specific ARARs will also be an input to the FS, however these ARARs will be determined for the specific technologies that are considered within the FS.

As the FS proceeds, data gaps will be identified and appropriate steps will be taken to obtain the necessary information. Specifically, as the FS identifies data needs, possible sources for obtaining the information will be evaluated. Methods of collection of the data will also be recommended. The actual collection of necessary information will be conducted under current and future FS efforts.

2.4.2 Approach

For the purposes of the identification of contamination and the development and implementation of remedial actions, RMA and the surrounding impacted area are currently being considered as two Operable Units, Onpost and Offpost. The rationale, as described previously, is to expedite the cleanup of the Offpost Media which have a direct impact on local residents and not impede this process because of the complexity and diversity of evaluating the Onpost Operable Unit. The FS process for each Operable Unit will be conducted independently to arrive at a selection of the preferred alternative for that Operable Unit. Since the ROD for the Offpost Operable Unit will be issued prior to the completion of the Onpost FS, consideration of the affect of Onpost actions on Offpost receptors and remedial actions will be a necessary component in the evaluation of Onpost alternatives. The complexity and diversity of the Onpost Operable Unit may require that the FS process be conducted for each Study Area and that the preferred alternative developed for each Study Area be combined in the Onpost ROD.

In the FS, technologies will be identified for each of the impacted media within the operable unit. The media considered are soils/sewers, water, buildings, air, and biota. Alternatives for each of the Operable Units will

also be developed on an overall operable unit basis for each of the media. In order to address site or area specific contamination problems that involve more than one media, it may be necessary to develop alternatives that are site and not individual media oriented. In all cases, however, the analysis will be conducted in such a way that individual media within a site may be remediated separately from other media within the same site. These media and site-specific actions will then be considered within the context of the Arsenal-wide remedial actions for each media.

2.4.3 Technology Inventory and Screening

2.4.3.1 Technology Inventory

The available technologies are intended to be a compilation of all the technologies that can be used in the remediation of hazardous waste. This inventory will be obtained from multiple sources including:

- The published literature;
- PMO and USATHAMA literature searches and evaluations;
- Vendor literature and interviews;
- Trade shows and exhibitions;
- The EPA SITE program;
- University and research programs; and
- EPA, Shell, and the State.

Technologies will be classified by media and response actions. Some of the response actions that represent different methods of remediation include: removal, disposal, storage, direct treatment, in-situ, containment, and reclamation. Innovative technologies will be incorporated into the inventory, with technologies that remediate the same media through similar response actions.

2.4.3.2 Technology Screening

The purpose of the technology screening is to develop a list of technologies for each study area that, either independently or in combination with other technologies, will provide a reduction in the mobility, toxicity, or volume of the contamination. These lists will be developed through a two step screening process. The first step eliminates technologies that are not compatible with RMA or material/contaminants characteristics, or are limited

by technological considerations. The second step will repeat this screening but will be done for each study area. Specific criteria will be developed for each of these three screening standards.

Three major screening criteria will, therefore, be considered:

- o Site characteristics;
- o Material/Contaminant characteristics; and
- o Technology limitations

The screening procedure is sequential following the order of the criteria listed. Technologies that pass through the site screening will be carried forward. Likewise, technologies will be screened for compatibility with contaminant characteristics and, finally, remaining technologies will be screened for technological limitations. The reasons for the elimination of a technology will be provided.

Site characteristics criteria will include the following factors: hydrologic conditions, geologic conditions, site/area configuration, and preliminary site-specific ARARs.

Contaminant characteristic criteria will include the following considerations: physical condition, quantity, concentration, chemical composition, treatability, and contaminant-specific ARARs.

The criteria to assess technological limitations will include the following factors: implementation, operation and maintenance, extent of experience, level of development, and action-specific ARARs.

CERCLA emphasizes the need to consider to the extent possible innovative technologies. Innovative technologies will be "carried through the screen if there is reasonable belief that they offer potential for better treatment performance or implementability, few or lesser adverse impacts than other available approaches, or lower costs than demonstrated technologies."

2.4.3.3 Level_of_Detail

Technologies will be identified at the process level and inventoried at this level within the various technology categories. For example, centrifuges, gravity thickening, belt presses, plate and frame, drying beds, and vacuum filtration are all processes that can be utilized for dewatering materials. Each of these processes, following identification, would then be inventoried under the technology of dewatering.

Similarly, the screening procedure will also be performed at the process level. Processes which remain following the screening will be again inventoried with a technology category. The remaining processes will also be listed by the media in which they remediate.

2.4.3.4 Data_Needs

As a result of the technology screening process, information gaps on various processes, especially innovative processes, will be identified. Sources for these data needs will be evaluated and recommendations for acquiring the data will be made. Additional literature search and vendor contact may be sufficient to fill these voids. This additional information will assist and be used in the development of alternatives. Knowledge of the list of remaining technologies that may be used in the development of alternatives will be used as a basis to identify and determine the action specific ARARs. As necessary, laboratory or bench-scale treatability studies will be initiated to fill information gaps. A recommendation for potential treatability tests will also be made at this stage. Collection of additional data will be conducted under FS tasks.

2.4.4 Alternative Development and Screening

2.4.4.1 Alternative_Development

In the FS process, a set of alternatives representing a range of remedial actions will be developed from the inventories of applicable technologies.

The alternatives developed will span the range from "No Action" to "No Further Action Required After Remediation". In addition to the range of

treatment alternatives a containment option involving little or no treatment will be developed. This process is not inconsistent with SARA and EPA Interim Guidance on Remedy Selection.

Alternatives will also be developed to meet the intent of the response objectives. Response objectives which will be developed as part of the FS will provide a specific objective to be met in the remediation of each of the media, sites, or areas on RMA. The response objectives will consider the exposure pathways and risks developed in the EA and available criteria, standards, or limitations contained within the proposed ARARs or health-based criteria. An example of a response objective would be the protection of humans against contact with a soil containing a contaminant above the health-based criteria determined for that pathway.

A range of alternatives will be developed for each Study Area by combining the technologies that when grouped will meet the response objective. Contained within each alternative will be the following information:

- o A description of the technologies that comprise the alternative;
- o The volume or area of material that would be remediated by this alternative;
- o Approximate location where the remedial action, disposal, or treatment system would be placed;
- o The ARARs that are associated with the alternative; and
- o A description of how the alternative would be implemented.

All technologies that pass through the technology screening process may not become part of an alternative.

2.4.4.2 Alternative Screening

Following the development of alternatives, all alternatives will be screened to reduce the number of alternatives that would be analyzed in detail in the next step of the process. However, in accordance with the NCP, a range of alternatives will remain. The criteria that will be employed in the screen are effectiveness, implementability, and cost. The screen for each of the criteria is independent of the other criteria and failure to pass one or more screens may not be cause to eliminate an alternative from further consideration.

The effectiveness criteria considers the ability of the alternative to reduce the mobility, toxicity, or volume of the contamination as well as the ability to meet the response objective.

The implementability criteria considers the technical feasibility of utilizing the alternative at RMA. Considered also is the reliability of the alternative to meet the associated performance requirements and the continued control of RMA following remediation.

Cost will not be used to compare alternatives which provide similar results between categories. The cost screen will be used to eliminate alternatives which are at least an order of magnitude more costly than the other alternatives which provide similar results. The degree of cost estimation accuracy for this screen is expected to be within a -50% to +100% range.

Innovative technologies will be carried through the screening process if they offer a potential for better treatment *performance or* implementability, less cost, or few or less adverse impacts than other available alternatives.

2.4.4.3 Level_of_Detail

The alternatives that will be developed will be comprised of a string of technologies which when combined will meet response objectives and represent a range from no action to no further action required. The objective of the screening is to reduce the number of alternatives comprised of these technologies which will be considered in the detailed analysis of alternatives. In order to evaluate the alternative, it will be necessary to select processes which are representative of the technologies. This will allow consideration of the performance, cost, and implementability of the alternative based on these factors for the representative process selected.

Since it is likely that more than one process is representative of a technology, if an alternative is eliminated by one or more of the criteria, the processes chosen will be reconsidered and the alternative reevaluated to prevent the elimination of a viable alternative because of the choice of the representative process.

2.4.4.4 Data_Needs

The alternative screening process will identify areas where additional site or technology performance data are required in order to further develop and evaluate alternatives. The data needs will be identified and recommendations will be made for acquiring the information. Means for collecting additional data may include:

- o Bench or field treatability studies on specific technologies to demonstrate performance and to prepare more reasonable cost estimates in the detailed analysis of alternatives;
- o Bench or field studies on innovative technologies; and
- o Additional site investigation on the contaminant extent, or to perform modeling or other simulation.

2.4.5 Detailed Analysis of Alternatives

A detailed analysis of each alternative that passes through the initial screen will be performed in order to provide the decision-maker with supporting documentation to select the preferred alternative. Each alternative will be evaluated independently for effectiveness, implementability, and costs which will further be divided for detailed analysis into 10 criteria. These criteria which are described below address all the considerations within EPA 1987 Interim Guidance. Following the analysis of the alternatives against each of the individual criteria, the alternatives will be assessed from the standpoint that they provide protection of human health and the environment.

The criteria that will be evaluated in this analysis are:

- o Protectiveness - This criterion involves a determination of whether the alternative provides the degree of removal or treatment necessary to reduce exposure to or migration of contamination to levels which adequately protect human health and the environment. The ability of the alternative to maintain long term protectiveness, the time required to reach the required level, and the protection afforded workers during remediation are considered.
- o Compliance_with_ARARs - This factor evaluates the ability of a given alternative to meet the substantitive requirements of ARARs. This includes ARARs associated with the contaminants, the site, or

the specific activity. In cases where an ARAR will not be met, reasons for such determination, including a technical justification or other justification for any waiver, will be provided.

- o Reduction of Mobility, Toxicity, and Volume - Although an alternative may be protective and meets ARARs, CERCLA further requires an evaluation of the alternative for ability to reduce the toxicity, volume, or mobility of contaminants. This factor reflects CERCLA's preference for permanent destruction or isolation of contaminants, thus eliminating potential future threats to the environment. Therefore, removal/treatment alternatives are considered preferable to containment, particularly landfilling of untreated, unstabilized hazardous wastes.
- o Reliability - Factors considered in assessing reliability are the ability of an alternative to deliver and maintain an adequate level of protection. This includes assessment of the potential need for replacement and the consequences of failure of the original action. For example, a slurry wall may initially prevent migration of contaminated ground water, but may deteriorate with time, allowing migration to resume. This could create new exposure and require more complex actions to regain the required level of protection, which must be considered in evaluating the original action.
- o Technical Feasibility - This factor considers the ability of the alternative to be constructed or implemented for the specific site and provide the required level of protection. This includes evaluation of site or technological limitations that have been identified or should be further considered as possible limitations to performance.
- o Administrative Feasibility - Administrative factors may operate to increase significantly the cost of a certain potential remedy or the ease or speed by which it can be implemented. For example, whether an otherwise convenient offsite waste facility warranted consideration as a possible waste disposal location would largely

depend on whether it was permitted to receive such waste by the proper EPA or State authority.

- o Availability and Schedule - Although an alternative may meet all other criteria, the system size or required level of development may limit availability. The time required to design and construct suitable equipment will be compared against the time required to remediate using existing equipment. For example, large scale incineration systems capable of processing contaminated soils from RMA do not currently exist. The time required to remediate the site using existing equipment will be evaluated against the time required to design, construct, and remediate with larger units built specifically for RMA.
- o Cost, Construction and Developmental - Capital cost will be developed on a unit cost basis considering all elements of the alternative. Investigative, developmental, or design costs necessary to implement the alternative will be considered. In accordance with CERCLA, capital costs will also include the first 10 years of operating and maintenance costs.
- o Operating Costs - This factor will include all labor, materials, and utility costs necessary to operate the system and maintain the desired level of protection. Operation and maintenance includes the replacement costs for materials with a limited lifetime. Also included is the cost for monitoring and/or reinvestigating areas where complete removal or destruction is not performed, to see if additional future actions are required. Present worth will be calculated for a 30 year period reflecting both capital and operating costs.
- o Long-Term Replacement - In cases where complete removal or destruction is not provided, replacement of containment systems may be required following failure or at the end of the systems design life. Capital and operating costs for such replacement will be included in evaluation of the original system.

2.4.5.1 Level of Detail

The alternatives analysis will evaluate alternatives as a composite group of technologies and not be individual technologies or processes. However, in

order to determine the protectiveness and cost of an alternative it will be necessary to compute and calculate performance and cost data by technology. The overall cost of the alternative will be a summation of the individual technologies. Furthermore, a process representative of the technology will be utilized to calculate this information. As previously stated, if an alternative is to be eliminated because of cost or performance, then the processes which were chosen would be reevaluated and a reevaluation would be performed using a different process.

2.4.5.2 Data Needs

From the alternatives analysis, additional data needs will be identified to complete the analysis and to support the selection of a preferred alternative. These data needs will be similar to those identified at the end of the Screening of Alternatives, however the focus will be specific to addressing specific alternatives and the scope of the resulting efforts may be significantly larger. Specific needs which will be identified during or at completion of the *Detailed Analysis of Alternatives* will be pilot studies and modeling. Recommendations for collection of data will be made and the information will be gathered as part of the FS.

Pilot studies which may be conducted in support or as a result of the Detailed Analysis of Alternatives may include various treatability studies to determine the effectiveness of various technologies within an alternative or to develop design criteria necessary to cost the alternative. The pilot studies could be of a bench or field scale depending upon the need and the type of technology. Pilot studies may also be conducted to demonstrate the performance of an innovative technology or to demonstrate that an ARAR could be met by an alternative.

Modeling may be a necessary component in the evaluation of alternatives and in the design of remedial systems. Because RMA is an extremely large and complex site and contamination on RMA is contributing to offpost contamination, a regional hydrologic and contaminant transport model may aid

in determining the effectiveness of various alternatives in the control or mitigation of the contamination. Likewise to determine the influence of and evaluate alternatives for remediation of specific site problems, additional localized models may be of interest.

3.0 INTERIM RESPONSE ACTIONS

3.1 OVERVIEW

The IRA facet of the RMA environmental program involves those response actions to be commenced prior to the decisions on final remediation for the RMA Sites. The Army, in cooperation with the EPA, the State, and Shell, has identified 13 specific IRAs that are considered necessary and appropriate to commence in advance of issuance of the RODs for the Onpost and Offpost Operable Units. The IRAs are "removal" actions as provided in the CERCLA Section 101(23), 42 U.S.C. Section 9601(23), and are to be carried out in accordance with CERCLA Section 104, 42 U.S.C Section 9604. See also 40 CFR Sections 300.6 and 300.65. IRAs themselves are to be consistent with and contribute to the efficient performance of the Final Response Actions for the Onpost and Offpost Operable Units. The IRAs set forth in the proposed Consent Decree are:

- Ground Water Intercept and Treatment System(s) North of RMA;
- North Boundary System--Recharge Trench Construction and Boundary System Evaluations and Improvements;
- Ground Water Intercept and Treatment Systems North of Basin F;
- Abandoned Well Closure;
- Ground Water Intercept and Treatment System in the Basin A Neck Area;
- Basin F--Liquids, Sludges, and Soil Removal and Liquids Treatment;
- Building 1727 Sump Liquid Remediation;
- Hydrazine Facility Remediation;
- Fugitive Dust Control;
- Sanitary Sewer Remediation;
- Asbestos Removal;
- Other "Hot Spot" Contamination Source Remediation; and
- Pretreatment of CERCLA Liquid Wastes.

The IRAs listed above are to be governed by the process set forth in Section IX of the proposed Consent Decree. Except for the North Boundary System Recharge Trench Construction, Abandoned Wells Closure, Basin F Liquids, Sludges and Soils Removal and Basin F Liquids Treatment, and

Fugitive Dust Control IRAs, the IRA implementation sequence will generally proceed in the following manner:

- o Army's Initial Evaluation of IRA;
- o Army's Preparation of Draft ARAR Selection Document;
- o Army's Preparation of Draft IRA Assessment;
- o Army's Issuance of Draft IRA Assessment ARARs to the Organizations and the State;
- o Comment Period on Draft IRA Assessment ARARs by the Organizations and the State;
- o Army's Issuance of Proposed IRA Decision Document;
- o 30-Day Public Comment Period on Proposed IRA Decision Document;
- o Army's Issuance of Draft Final IRA Decision Document;
- o Dispute Resolution May Be Invoked within 15 days of Issuance of Draft Final IRA Decision Document;
- o Army's Issuance of Final IRA Decision Document;
- o Within 30 days of Issuance of Final IRA Decision Document, Judicial Review May Be Sought;
- o Performance by Lead Party of Design Work Specified in IRA Decision Document;
- o Issuance by Lead Party of IRA Implementation Document, including IRA Deadlines; and
- o Implementation by Lead Party of IRA.

The basic IRA process is shown diagrammatically in Figure 3-1. Since the IRA process does not identify all of the timeframes for the various steps in the IRA process, approximate times have been utilized in the IRA Schedule for the purpose of the TPP. While the review times in the IRA process can be established with some sense of certainty, it should be noted the time required for conducting an IRA assessment is highly variable, depending on the nature of the IRA. The assessment period of performance can be determined with greater reliability at the time of preparation of the scope-of-work for the assessment.

The IRA Assessment shall have as its goal the evaluation of appropriate alternatives and the selection of the most cost-effective alternative for obtaining the objective by the IRA. The evaluation of alternatives may be

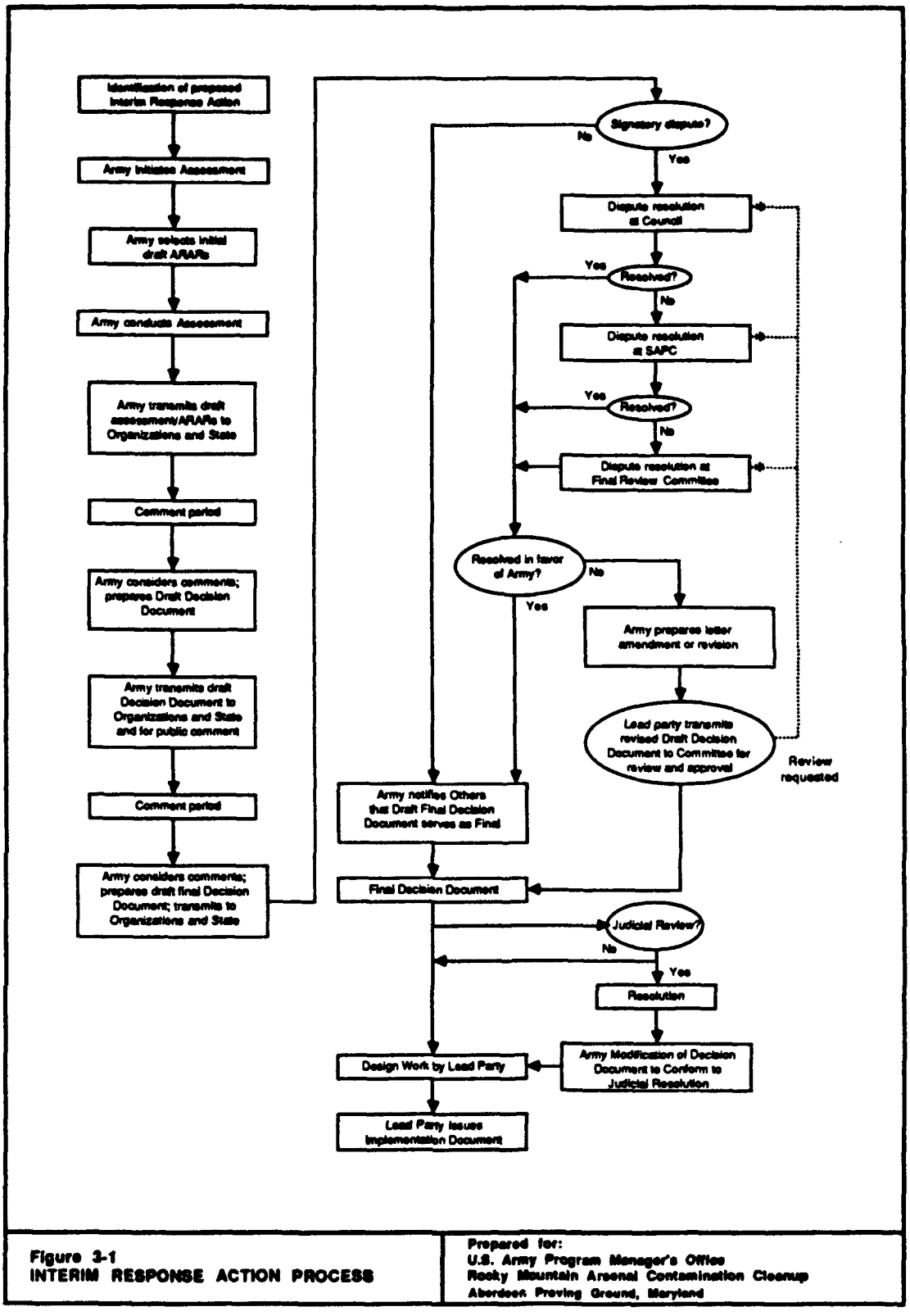


Figure 2-1
INTERIM RESPONSE ACTION PROCESS

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

based upon, but not limited to, such factors as protection of human health and the environment, mitigation of any threat to human health and the environment, technical feasibility, institutional consideration, and reasonableness of cost and timeliness. Studies initiated or completed by the effective date of the proposed Consent Decree may be used, if appropriate, to satisfy the data needs of such assessment.

IRAs shall, to the maximum extent practicable, attain ARARs. The Army shall generally issue a proposed IRA Decision Document promptly after issuance of the final assessment. A proposed IRA Decision Document shall be a concise document that (a) states the objective of the IRA; (b) discusses alternatives, if any, that were considered; (c) provides the rationale for the alternative selected; (d) presents the Army's final ARAR decision; (e) summarizes the significant comments received regarding the IRA and the Army's responses to comments; and (f) establishes the IRA Deadline for completion of the IRA, if appropriate. If the Army is not Lead Party for an IRA, the Army shall consult with the Lead Party prior to issuing the proposed IRA Decision Document.

The mechanism by which the Army will carry out the assessment and, ultimately, the implementation and construction of the IRAs is through contractual arrangements with independent architecture/engineering firms either directly or with the assistance of Shell. Entities that will be involved in contracting for such services include the PMO-RMA, the Army Corps of Engineers, USATHAMA, and Shell.

Constraints and assumptions which underlie this IRA process and the IRA Deadlines include the following:

- The Army will be the Lead Agency for all IRAs, except where Shell is separately identified as the Lead Party;
- Adequate resources (i.e, funding, contracts, and personnel) will be available; and
- Schedules assume that no dispute resolution will be sought.

3.2 INTERFACE WITH RI/EA/FS

As mentioned previously, IRAs are to be consistent with and contribute to the efficient performance of the Final Response Actions for the Onpost and Offpost Operable Units. Additionally, if an IRA will not fully address the threat posed by a release and a further response is required, an orderly transition shall be ensured from the IRA to the Final Response Actions. In order to ensure the accomplishment of the these requirements, it is essential to provide for the maximum exchange of information between the RI/EA/FS and the IRA.

The time sequence between IRAs and the FS process is important. If an IRA is identified, planned and executed, the FS alternatives analysis will take into account the IRA. If, however, the IRA is not executed by the time the FS is ready to propose a final response action, such proposed final response action will consider the IRA but will not be driven by the IRA. An IRA, in any event, will be consistent with the proposed final response action.

The PMO-RMA will take steps to ensure that IRAs make maximum use of existing RI and EA data, and that the FS program element is aware of the status of the IRAs and any data generated that may be of use to the FS. While the IRAs have separate assessment activities which may parallel RI/EA/FS efforts, every effort will be made to avoid duplication of work between Interim and Final Response Action activities.

3.3 IRA DESCRIPTIONS

The IRAs discussed in the following sections incorporate the assumptions and constraints previously mentioned, as well as rely on the terms of the proposed Consent Decree. The IRA Deadlines set forth in Section 5.0 represent the Army's most realistic assessment of the date when of the Draft IRA Decision Document can be issued.

3.3.1 Ground Water

3.3.1.1 Ground Water Intercept System North of RMA

- Objective

  Eliminate much of the potential for any future exposure from contaminated ground water plumes north of RMA.

- Description

  This IRA consists of the assessment and, as necessary, the selection, and implementation of one or more ground water intercept and treatment systems north of RMA. One candidate location for such a system is the First Creek/Highway 2 area. Task 39 will provide information to assess and select an appropriate location and type of system.

3.3.1.2 Boundary System Evaluations and Improvements

- Objective

  Evaluate and improve, as necessary, all RMA boundary systems.

- Description

  This IRA involves an assessment of the need for improvements (such as expansion to the NBCS and of the selection and implementation of any necessary improvements); the assessment of the other two boundary systems (Irondale and NWBCS) on RMA and the selection and implementation of any appropriate improvements to these systems, as necessary; and the construction of ground water recharge trenches to increase the rate of reinjection of treated ground water at the NBCS.

  Evaluation of the NBCS will be accomplished through Task 36, Task 25, and data from the Annual Operation Assessment. The NWBCS will be evaluated using data from the Annual Operational Assessment. Shell will continue to evaluate the performance of Irondale Boundary System via data from the Annual Operational Assessment as well as perform quarterly sampling for trichloroethylene in addition to the normal sampling for dibromochloropropane. Improvements will be implemented as required.

3.3.1.3 Ground Water Intercept and Treatment System North of Basin F

- Objective

  Treat contaminated alluvial ground water found in the Basin F area.

- Description

  This IRA consists of the assessment and selection of an alluvial ground water intercept and treatment system north of Basin F and the implementation of such a system, as necessary. The Omaha District COE has been tasked to conduct the assessment.

3.3.1.4 Closure_of_Abandoned_Wells_on_RMA

- Objective

  Identify, locate, examine, and properly close old or unused wells on RMA to prevent migration of contamination through them.

- Description

  This IRA consists of the sampling, plugging, and closing of candidate wells initially identified through Tasks 4 and 44 and updated by data from the RI/FS. The Abandoned Well IRA has been initiated under Task 37. Wells located within the Task 37 study area will be prioritized for field searching, examination, and selective sampling. After completion of the Task 37 effort in late FY88, the second phase of the Abandoned Well IRA will begin. This phase will include closing all remaining candidate wells consistent with data from the RI/FS. Criteria and procedures similar to those used in the Task 37 effort will be used during the second phase.

3.3.1.5 Basin_A-Neck_Ground_Water_Intercept_and_Treatment_System

- Objective

  Treat contaminated ground water in the alluvial aquifer between Basin A and Basin F.

- Description

  This IRA consists of the design and construction of an alluvial ground water intercept and treatment system in the Basin A-Neck area on RMA. Utilizing the Task 26 assessment along with other pertinent information that may be available, the proposed locations and type of system will be identified.

3.3.2 Soils and Other Contamination Sources

3.3.2.1 Basin F Liquids, Sludges, and Soils Removal and Basin F Liquids Treatment

- Objectives

  Abate any potential for infiltration of contaminants to the ground water, preclude potential for volatile emissions, and eliminate any potential impact of Basin F on wildlife.

- Description

  The Basin F Liquids, Sludges, and Soil Removal segment of this IRA consists of the remediation of contaminated liquids, sludges, and soils from and under Basin F. Once liquids are removed to temporary storage tanks (constructed by Shell pursuant to a Memorandum of Understanding with the Army), the soils and sludges remaining in the basin and those down to a specified depth beneath the basin liner will be solidified, as necessary, and transported to a temporary storage area where they will be properly stored prior to treatment or disposal. Work began on this IRA on January 29, 1988, after issuance of the Final Decision Document.

  The second segment of this IRA will investigate treatment/disposal (and temporary storage, if appropriate) of the Basin F liquids due to the probability that implementation of the final remedial action for RMA may exceed the service life of the storage tanks. The first step for this portion of the IRA involves the completion of a screening of technologies for their applicability to remediation of the Basin F liquid. This work is underway by the Technology Division of the USATHAMA. Those technologies that pass the screening process will then be used in the Development, Screening, and Evaluation of Alternatives which will be conducted under the new PMO contract. After completion of this assessment process, the Army shall issue a draft plan for comment by the Organizations, DOI, and the State. The Army shall then issue

a draft IRA Decision Document. Review and coordination of this IRA Decision Document will be consistent with other IRAs currently ongoing.

3.3.2.2 Building 1727 Sump Liquid

- Objective

  Remediate contaminated liquid in the Building 1727 sump to mitigate any remaining threat of release of liquids from this sump.

- Description

  This IRA involves the temporary storage and treatment of contaminated liquid from the sump to prevent a release of contaminants while the Task 30 assessment is in progress. Pilot-scale treatment systems have previously been tested under Task 30 to evaluate alternative processes for remediation of contaminated liquid in the sump. The final assessment will determine what actions need to be implemented to eliminate any remaining threat of a release in the future.

3.3.2.3 Hydrazine Blending and Storage Facility (HBSF) Remediation

- Objective

  Mitigate any threat of release of wastewater stored at the HBSF and remediate the above-ground structures.

- Description

  This IRA consists of the treatment and disposal of pretreated liquids in tanks used for storage of waste products from the blending of rocket fuels and the dismantling and disposal of all remaining aboveground structures associated with the Hydrazine Facility.

  Extensive use will be made of the Task 34 Assessment Report, and the implementation is contemplated to be performed by the Omaha District, COE.

3.3.2.4 Fugitive Dust_Control

- Objective

  Mitigate as expeditiously as possible any threat of the release of windblown contaminated dust.

- Description

  Unvegetated areas in Sections 26 and 36 are the two primary areas which are likely sources of contaminated windblown dust. Application of dust suppressants in or around Basins C and F in Section 26 are not advisable at this time, since the Basin F interim response action is in progress. Application of dust suppressants to unvegetated areas of Basin A is warranted and is planned in two phases. The first phase is to begin February 1988 and the second in April 1988. A natural humate organic binder, applied in 1984 around Basin F is the dust suppressant used for this IRA. The application rate of the dust suppressant concentrate will be increased from the 807 gallons per acre used in 1984 around Basin F to 1,200 gallons per acre in Basin A because of the lower clay content of the Basin A soil.

3.3.2.5 Sanitary_Sewer_Remediation

- Objective

  Eliminate the RMA sanitary sewer as a potential conduit for contaminant flow.

- Description

  This IRA will involve prioritizing different sewer system segments as candidates for remediation (e.g., plugging, removal, etc). The result of Task 10 (Sewer System Remedial Investigation) will be the basis for the prioritizing effort. The priority list of sewer systems segments for this IRA will focus initially on those segments located below the ground water table. All plans for sewer segment remediation will be coordinated with RMA plans for maintenance, improvement, and replacement of the affected sewer system segments.

3.3.2.6 Asbestos Removal

- Objective

  Remove and dispose of friable (i.e., flaking) asbestos on RMA where any potential for human exposure exists.

- Description

  This IRA consists of an assessment to identify candidate locations and the subsequent removal and disposal of all such friable asbestos. Information from Task 24 (Buildings Remedial Investigation) and the RMA Asbestos Abatement Program will be the basis for selecting appropriate sources for remediation.

3.3.2.7 Remediation of Other Contamination Sources

- Objective

  Mitigate the threat of releases from selected "hot spot" contamination sources.

- Description

  This IRA consists of the assessment, selection, and implementation, as necessary, of interim response actions for the Section 36 Trenches, the Section 36 Lime Pits, the M-1 Settling Basins, the Motorpool Area, the Railroad Holding Track, and, where appropriate, the placement of such material in a properly constructed temporary storage area or areas on RMA. This IRA may be expanded to add other source areas as warranted.

3.3.2.8 Pretreatment of CERCLA Liquid Wastes

- Objective

  Treatment of wastewater resulting from assessment and implementation of Response Actions for the site.

- Description

  Development and implementation of a program to treat wastewater resulting from CERCLA Response Actions at the Site. These include treatment of wastewater from the RMA laboratory and treatment of decontamination water prior to discharge into the RMA Sanitary

Sewer, or the development of other appropriate measures for the disposal or reuse of such water. The assessment phase of this IRA is scheduled for initiation early in FY89 due to current budgetary constraints.

4.0 IMPLEMENTATION

4.1 INTRODUCTION

All of the work described in Sections 2.0 and 3.0 of this TPP will be implemented under the control and oversight of the Program Manager's Office for the Rocky Mountain Arsenal Contamination Cleanup (PMO). A variety of mechanisms will be utilized by the PMO to actually accomplish the work including contractors to PMO, Shell Oil Company (including their contractors), the U.S. Army Corps of Engineers (COE), and the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA). The sections below briefly describe the division of work among the various entities, and also provide a summary of the areas in which the various entities will provide support to PMO.

4.2 PMO CONTRACTS

The PMO has implemented a contract mechanism whereby contracts for services supporting the RI/FS program and the implementation of IRAs can be readily obtained. Currently, two contractor teams headed by Ebasco Services Inc. (Ebasco) and Environmental Science and Engineering, Inc. (ESE) are performing work under separate task order contracts to PMO. Each of the contracts are Cost Plus Fixed Fee, indefinite delivery order contracts with a 3- to 4-year period of performance. This type of contract initially takes 6 to 8 months to competitively award, including time for release of a request for proposals, submittal of proposals, evaluation of proposals, requests for additional information from the proposers, submittal of best and final offers from the proposers, selection of the best qualified, most cost-efficient contractor, cost negotiations, and finally the award of the contract. This type of contract allows the PMO to quickly award individual task orders under an umbrella scope-of-work. These individual task orders must go through a process of issuance of a detailed task order scope-of-work, submission of a cost estimate by the contractor, and negotiation and award of the task order. This process typically takes only 4 to 6 weeks. The task orders awarded under the existing contracts to Ebasco and ESE can be identified in the schedules and graphics by their numbers, which range from Tasks 1 through 48. The task descriptions in the Appendix give a brief

summary of each of these tasks as well as a complete listing of the subcontractors used for each task. These task order contracts will end in September 1988, but many of the Products and Subproducts to be developed for the RI/FS program will not yet have been completed. In order to complete these Products and Subproducts, additional contracts will be competitively procured during 1988 so that work can continue on the RMA RI/FS and IRA programs. Specifically, the tasks identified with the prefix "RIFS" will be awarded under these new contracts. The existing contractor teams have been asked to prepare interim deliverables by the end of September that can be readily provided to the new contractors. In addition, the IRA activities will be continued under these new contracts, at least through the development of the Decision Documents. Further work on the IRAs (design, construction, and operation) will likely be carried out by other parties such as the COE and Shell.

4.3 SHELL OIL COMPANY

Shell has conducted extensive remedial investigation efforts in support of their litigation proceedings, as well as the RI/FS and IRA programs at RMA. Much of this work will be utilized by the Army in the development of the RI/FS. The role of Shell in the program can be separated into four categories, namely, as a Lead Party, as providing significant support, as providing support and review, and as providing review and comment.

The lead role indicates that Shell will have responsibility for conducting the field work, program management, and completion of any reports required to describe the work accomplished and conclusions and recommendations proposed. Areas of the RI program in which Shell will be Lead Party include the aquatic studies in the lower lakes, the remapping of RMA soils, and the interpretation of the alluvial formation across RMA. Under the FS portion of this program, Shell will be the Lead Party for selected treatability studies as well as air modeling. Other areas of the program for which Shell will assume a lead role include the design and construction of select IRAs.

Significant support will require direct participation with the Lead Agency and includes conducting portions of the field work and writing sections of reports. Portions of the RI program in which Shell will provide this

support include the Vegetation report, Soil/Water interaction assessment, and Study Area evaluation and report preparation for the South, Central, and North Central study areas of RMA. Shell will provide significant support to the FS program in the areas of alternative screening, evaluation, and modeling. Significant support is also planned for the integration of the RI/FS data base and the design and construction of select IRAs.

The category of support and review will require Shell to be on call to support field studies, design, construction, and operation. This support will be provided for the remainder of Product and the Subproduct development for the program.

The final category requires Shell to provide the standard review and comment on draft final deliverables consistent with the proposed Consent Decree.

4.4 U.S. ARMY CORPS OF ENGINEERS

The U.S. Army Corps of Engineers (COE) is responsible principally for the design and construction of Interim Response Actions not undertaken by Shell. The COE has no direct involvement in the RI/FS program at RMA. Design work is typically tasked to one of several Architect-Engineer firms with which COE has already developed contractual arrangements. Design includes development of design criteria (e.g., treatability studies, field tests), conceptual design (35 percent), draft final design (90 percent), and final construction specifications. Construction activities are competitively procured, with the procurement process typically consisting of a solicitation for bids or proposals, evaluation of proposals, solicitation of best and final offers from those firms in the competitive range, selection of a contractor, award of the work, submission of bonding and plans, notice to proceed, and actual construction. This is the process that has been used to undertake the Basin F IRA.

4.5 U.S. ARMY TOXIC AND HAZARDOUS MATERIALS AGENCY

As a sister agency to the PMO, the U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) typically provides support on call to the PMO in the areas of FS development and of IRA evaluation through the development of the IRA Decision Document. Support is provided by the two key organizations within

USATHAMA, namely the Technology Division (TED) and the Installation Restoration Division (IRD). The TED has an Army-wide mission for advanced technology development. In essence, the TED is charged with bringing infant technologies up to large scale state-of-the-art status for application to Installation Restoration sites. The TED acts as the Chairman of the Department of Defense Installation Restoration Technology Coordinating Committee for these innovative studies. In addition, the TED is the principal point of contact for the Army/EPA Memorandum of Understanding regarding technology development. The PMO coordinates with TED to keep abreast of emerging technologies that may have some application to the remediation efforts at RMA. For example, Task TED8, described briefly in Appendix A, involved an examination of a variety of innovative treatment techniques for Basin F materials. The IRD has an Army-wide mission for carrying out the Installation Restoration Program at all sites except RMA. They have their own task order contracts to carry out RI/FS and IRA work at these sites. Occasionally, the PMO may utilize these existing contracts if they can provide a more timely response than the PMO's own contracts. As an example, the asbestos removal IRA at RMA was conducted through IRD contracts, and it is anticipated that several IRA Decision Documents will be prepared through the IRD.

4.6 SUMMARY

As the Lead Agency in the RI/FS and IRA programs at RMA, the PMO oversees all efforts related to the remediation of contamination at RMA. This centralized management ensures that all efforts will be integrated and nonduplicative. Lead Party responsibility for carrying out various aspects of the work is divided between 4 sources, namely the PMO contractors, Shell, COE, and USATHAMA. As noted earlier, a lead role indicates that the Party is responsible for the content and schedule associated with that activity or deliverable. Significant support indicates that the Party will provide substantial input to the activity or deliverable, including but not limited to conducting field work and writing report sections. Support/review is the third role that a Party may take, and it indicates that the Party will review and comment upon the activity or deliverable, including the planning phases of each work element.

5.0 SCHEDULES

The primary objective of the Schedules is to provide the basis for the establishment of deadlines for the completion of draft IRA Decision Documents, RI/FS Deadlines, and identified Other Deliverables. The failure of an Organization to meet a deadline in the absence of good cause shall, at the request of EPA, result in the assessment of stipulated civil penalties. A secondary objective is to provide program management and resource information to the Organizations and the State.

The Schedules have been developed in accordance with the terms of the proposed Consent Decree filed in U.S. v. Shell Oil Company (including the RI/FS Process Document). The software used is Microsoft Project, Version 3.0. The file is RMATPP.ACT for the RI/FS schedule and IRATPP.ACT for the Interim Response Action schedule. A data disk with these files is provided to each Organization and State in a protective sleeve at the end of this TPP. A glossary and Gantt charts of both schedules are included in Appendix B.

Conceptually, this process reflected in the Schedules is much more linear than the process outlined in the Army's March 4, 1987 schedule. Events have been scheduled as modules, reflecting two major changes to the program: process and penalties. The RI/FS process influences the RI/FS Schedule and RI/FS Deadlines because comment and response activities have been formalized. The result is that elements which are dependant on prior work can not be finalized until the prior work is completed. Penalties affect the amount of time assumed for the each step in the program. All Organizations and the State are assumed to take the maximum amount of time possible under the process. This changed approach leads to an end date that is much later than originally anticipated. Figure 5-1 illustrates major products in the plan in time sequence with precedence.

The critical path for the onpost RI/FS process is: Soils Investigations - SARs - Media Reports - RI - Endangerment Assessment - Development and Screening of Alternatives - Evaluation of Alternatives - FS with Preferred Alternative.

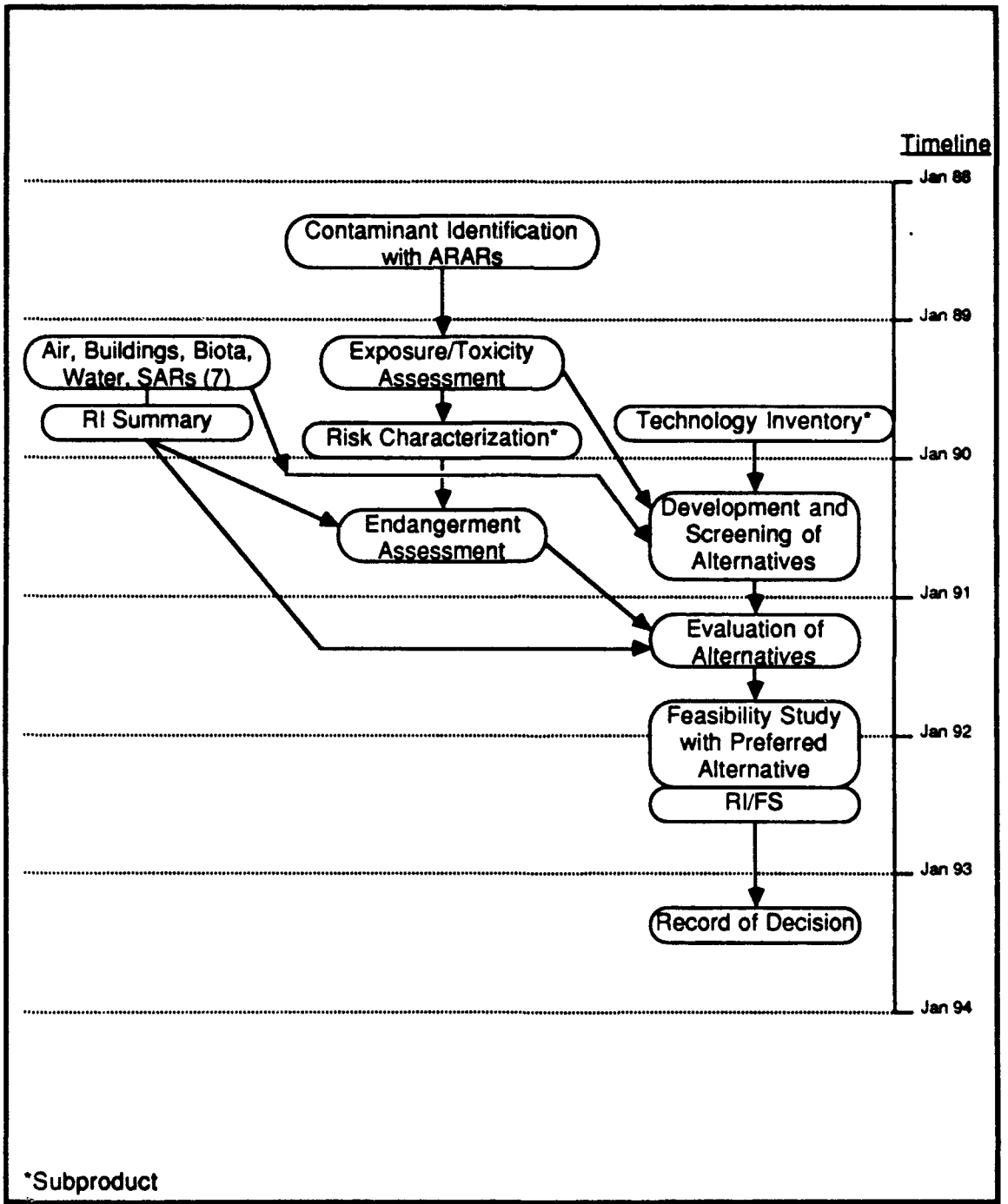


Figure 5-1
PLAN PRODUCTS AND TIME SEQUENCE

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

The offpost critical path is: Offpost CAR - RI/EA - FS with Preferred Alternative. Figure 5-2 illustrates major products in the plan.

The IRAs do not impact on the progress of the RI/FS and thus are treated completely separately from the RI/FS. IRAs are included in the context of this TPP in connection with the IRA Schedule and draft IRA Decision Document deadlines. A complete discussion of the IRAs can be found in Section 3.0.

5.1 SCHEDULE STRUCTURE AND ASSUMPTIONS

As noted above, the RI/FS Schedule is basically a linear analysis containing the blocks or modules described in the RI/FS Process Document and proposed Consent Decree. There are six different types of modules in the schedule: Technical Plans, Products, Subproducts, Other Deliverables, Dispute Resolution, and the RI/FS/ROD. Each of these has been computed without allowing any time for disputes, although categories for such activity appear in the Schedules as dummies in order to facilitate updates.

This Schedule also reflects the addition of the SARs, and the addition of an ARAR Document in the EA. The RI/FS process has been incorporated into the RI/FS Schedules as described in Section 1.0.

5.1.1 Technical Plans

Technical plans follow an eight step process and are subject to dispute resolution. The approach followed throughout the RI/FS Schedule assumes that wherever the possibility exists for more time to be used for comment or review, it is taken (e.g., if a 30-day comment period has the potential for a 15-day extension, the Schedule uses 45 days). The process applies only to Technical Plans which describe new Products or Subproducts. Task Plans, which are created only for the purpose of resource management, are not subject to dispute (e.g., Phase II Tasks). There are currently no new Technical Plans contemplated.

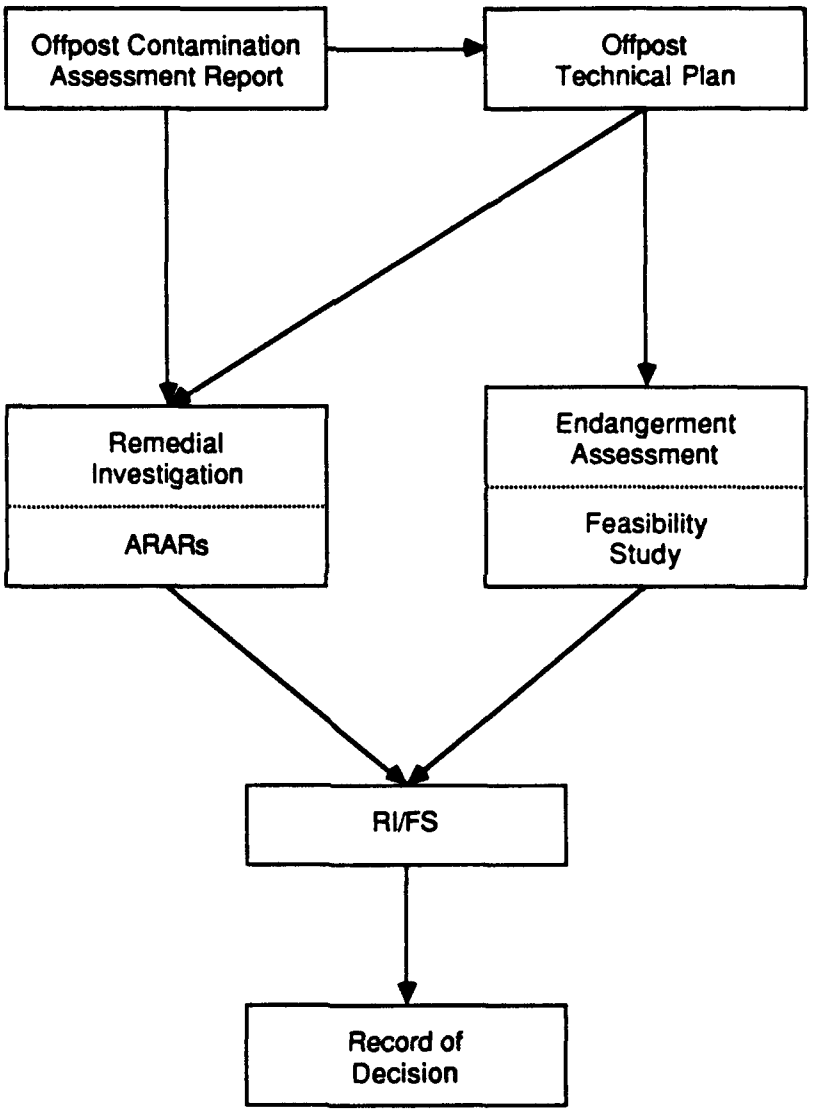


Figure 5-2
OFFPOST ROD FLOW DIAGRAM

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

The step-by-step process is as follows:

	Activity	Duration
1.	Prepare Technical Plan	Varies
2.	Internal Review (Blue Technical Plan)	45 days
3.	Parties and State (PAS) Comments (Brown Technical Plan)	30 days
4.	Prepare White Technical Plan	45 days
5.	Dispute or Finalize	15 days
6.	Dispute	(14/49/79 days)
7.	Rewrite and Reissue	(35 days)
8.	Finalize Plan (White Technical Plan)	7 days
	Total (without dispute)	142 days

Note that those activities associated with dispute resolution (numbers 6 and 7) are not quantified because it is impossible to do so within indulging in speculation. Moreover, the affected Schedule would have to be recalculated in such circumstances in any event. Also note that there is a "second review" afforded by the dispute resolution process that is not recorded in the RI/FS Schedules because its utilization is also only a matter of conjecture at this time.

5.1.2 Products

Products follow an eight-step process and are subject to dispute resolution. The time allowed for the final preparation of the product varies with the difficulty and complexity of the document and is usually 60, 90, or 120 days unless otherwise mandated by the RI/FS Process Document or proposed Consent Decree. All of the Products have a proposed ARAR determination of varying complexity included in the process. The internal review step of 45 days includes the legal review necessary to match a technical report with a legal determination.

The step-by-step process is as follows:

	Activity	Duration
1.	Prepare Document	60/90/120 days
2.	Internal Review (Blue Product)	45 days
3.	PAS Comments (Brown Product)	45 days

4.	Prepare White Product	50 days
5.	Dispute or Finalize	15 days
6.	Dispute Meetings	(14/49/79 days)
7.	Rewrite or Reissue	(35 days)
8.	Finalize (White Product)	7 days
Total (without disputes)		252 days

As before, activities 6 and 7 are not invoked unless there is dispute resolution. The RI/FS deadlines set forth in this TPP are those associated with the issuance of the draft Product (the end of activity 2).

5.1.3 Subproducts and Other Deliverables

Subproducts are structured in the same way as Products except that these are not subject to dispute resolution. The process is exactly the same as the first four activities in Products above. The step-by-step process is as follows:

	Activity	Duration
1.	Prepare Document	30/60/90 days
2.	Internal Review (Blue Subproduct)	45 days
3.	PAS Comments (Brown Subproduct)	45 days
4.	Prepare White Subproduct	50 days
	Total	200 days

As can be seen, even if the Products set forth in the RI/FS Process Document were reclassified as Subproducts, this would only save 52 days, because formal comment and response are still required. However, preparation of the Subproducts or Products is assumed to begin immediately after Organizations and the State comments are received, a real time saving of 92 days. Other Deliverables are provided for Organizations and the State review only and do not require a formal response. The preparation of the subsequent Subproducts and Products is assumed to begin immediately after the issuance of the Other Deliverables to the Organizations and the State.

5.1.4 Dispute Resolution

Dispute Resolution is a very tightly managed process as set forth in the proposed Consent Decree. Only Parties to the proposed Consent Decree may raise issues to Dispute Resolution.

Three outcomes are possible depending on the level at which the dispute is resolved. The step-by-step process is as follows:

	Activity	Duration
1.	RI/FS Council	14 days
2.	SAPC	30 days
3.	Send to FRC	5 days
4.	FRC Resolution	30 days
5.	Rewrite and Reissue Document	35 days

In the RI/FS Schedule, activities 1-4 are combined and called "Dispute Meetings". Disputes can be resolved at the end of activities 1, 3, and 4. While the RI/FS Schedule has categories for Dispute Resolution, these are not quantified because the instances, levels, and duration of Dispute Resolution are purely speculative at this time.

5.1.5 RI/FS/ROD Process

The assumptions for this process are completely described by the RI/FS Process Document and are not repeated here. The step-by-step process is as follows:

	Activity	Duration
1.	Prepare RI/FS Report	30 days
2.	Publication of RI/FS Report Availability	10 days
3.	Public Comment	60 days
4.	Revise RI/FS into Draft ROD	75 days
5.	PAS Comment Draft ROD	30 days
6.	Rewrite/Reissue ROD	30 days
7.	PAS Concurrence	15 days
8.	Dispute Meetings (FRC)	(79 days)
9.	Rewrite/Reissue Final ROD	(45 days)

10. Finalize Final ROD	7 days
11. State and Shell Concur or Seek Judicial Review	30 days
12. ROD Notice of Availability	7 days
13. Begin Remedial Action	7 days
Total (without dispute)	298 days
Total (with dispute)	422 days

Activity numbers 8 and 9 are dispute resolution steps and are included in the RI/FS Schedule as categories. If should be noted that for purposes of the RI/FS Deadlines provided as part of this TPP, only activity numbers 1 and 2 are relevant.

5.2 ONPOST REMEDIAL INVESTIGATION SCHEDULE

5.2.1 Onpost Remedial Investigation

The RI contains 12 Products, shown below. All Phase I CARs are considered Subproducts. Structurally, the RI has not changed significantly from the Army's March 4, 1987 schedule (see Figure 5-3). Task 23, Soils/Ground Water Integration, has been replaced by seven SARs which take an equivalent amount of time to produce. The SARs and the RI Summary Report are on the critical path.

Unfortunately, the current Task Order contract will not be able to complete the RI program (or the EA or FS) using this Schedule. The Schedule contains several additional tasks assumed to begin on October 1, 1988 or later, and are designated "RIFS#". These tasks (as well as the overall Schedule) attempt to reflect the contract procurement realities of the program. Section 2 designates the current tasks being considered under the new contract. If the new contract is delayed, substantial slips could occur throughout the RMA program.

5.2.2 Onpost Remedial Investigation Deadlines

The Onpost RI Deadlines enforceable pursuant to paragraphs 19.1-19.5 of the RI/FS Process Document and subject to the civil penalty provisions in

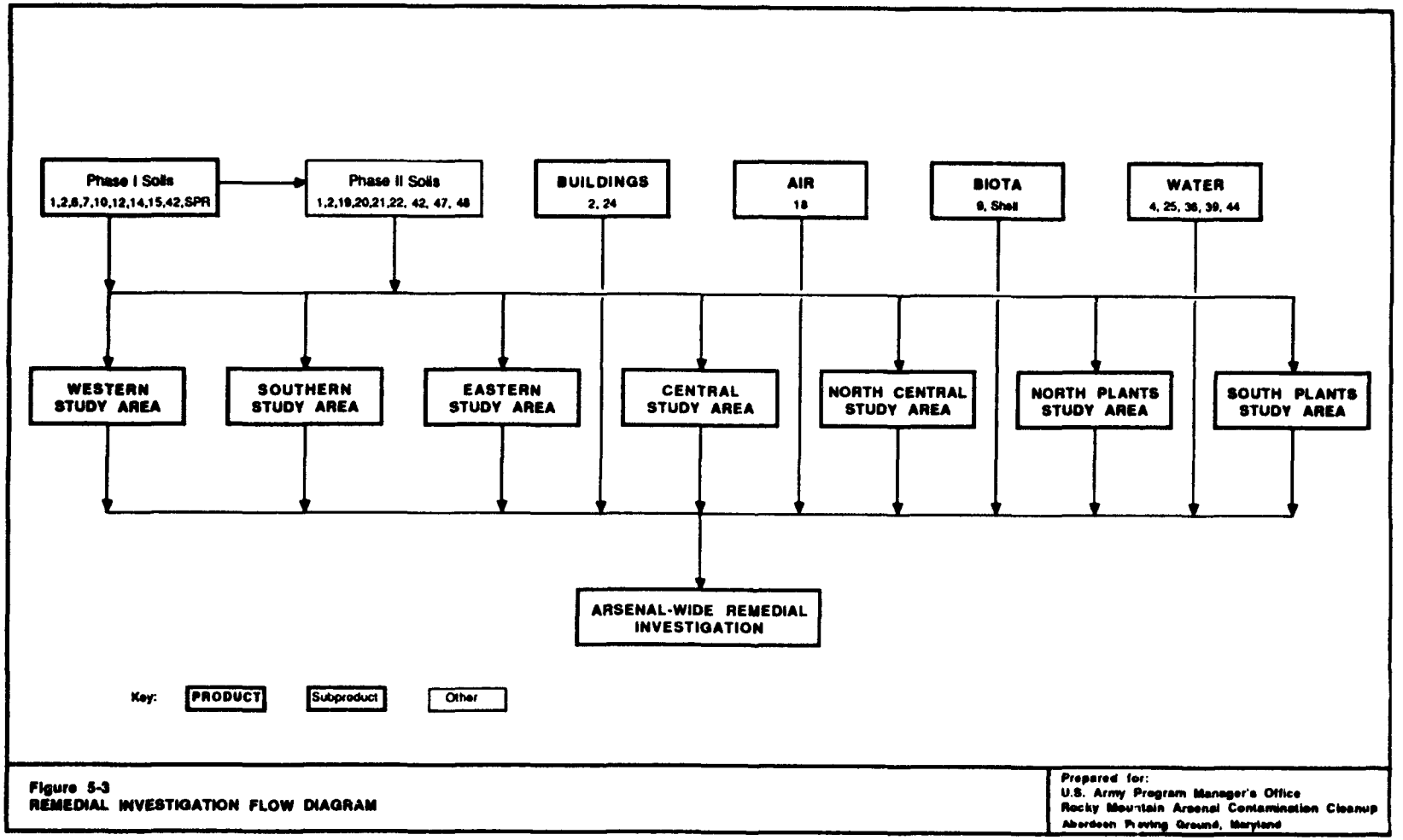


Figure 5-3
REMEDIAL INVESTIGATION FLOW DIAGRAM

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

paragraphs 20.1-20.5 of the RI/FS Process Document are the following dates for issuance of the designated draft RI Product reports:

PRODUCTS	DATE
Air RI	15 Mar 89
Buildings RI	15 Mar 89
Water RI	15 Mar 89
Biota RI	15 Mar 89
Western SAR	15 Mar 89
South Plants SAR	15 Mar 89
Central SAR	15 Mar 89
North Central SAR	15 Mar 89
North Plants SAR	15 Mar 89
Eastern SAR	15 Mar 89
Southern SAR	15 Mar 89
Final RI	8 Oct 89

5.3 ONPOST_ENDANGERMENT_ASSESSMENT_SCHEDULE

5.3.1 Onpost Endangerment Assessment

The EA has three Products and one Subproduct. The final EA is on the critical path.

The EA process had a significant addition since the March 4, 1987 schedule: a comprehensive chemical-specific ARAR determination is included with the Contaminant Identification. The process is essentially linear. Figure 5-4 outlines the process.

5.3.2 Onpost Endangerment Assessment Deadlines

The Onpost EA Deadlines enforceable pursuant to paragraphs 19.1-19.5 of the RI/FS Process Document and subject to the civil penalty provision in paragraphs 20.1-20.5 of the RI/FS Process Document are the following dates for issuance of the designated Draft EA Product Reports.

PRODUCTS	DATE
Contaminant Identification/ARAR Determination	6 Jun 88
Exposure Assessment	15 Mar 89
Endangerment Assessment	17 Jul 90

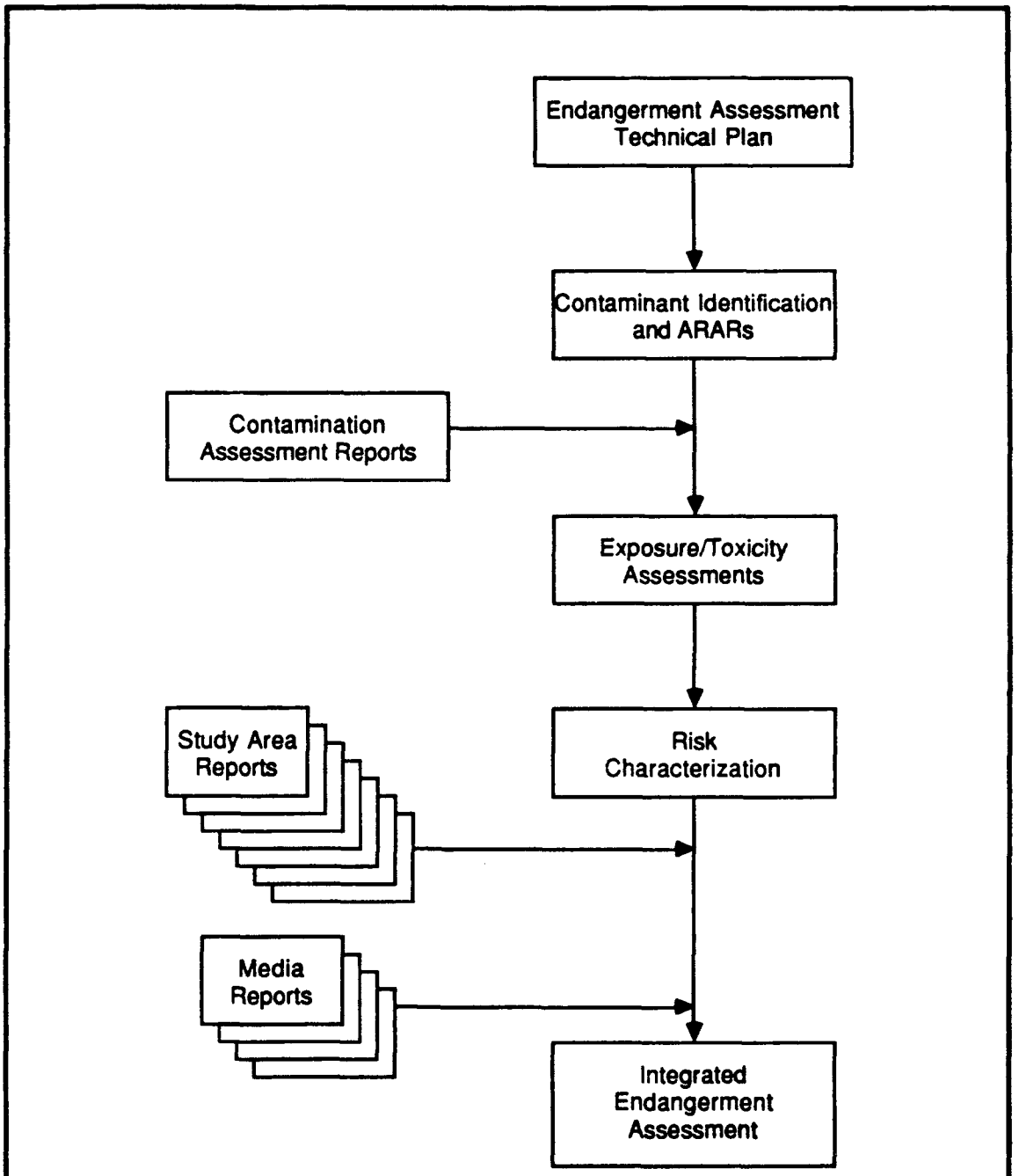


Figure 5-4
ENDANGERMENT ASSESSMENT FLOW DIAGRAM

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

5.4 FEASIBILITY_STUDY_SCHEDULE

5.4.1 Onpost Feasibility Study

The Feasibility Study contains three Products and four Subproducts. The process is linear and is displayed in Figure 5-5. The FS approach will incorporate the SARs produced in the RI as separate chapters beginning with the Development and Screening of Alternatives Report (DSA). Advanced Technologies, Incineration, Disposal Facility, and the Technology Inventory are Subproducts.

The critical path switches from the EA to the FS at the Development and Screening of Alternatives Report (DSA) step.

5.4.2 Onpost Feasibility Study Deadlines

The Onpost FS Deadlines enforceable pursuant to paragraphs 19.1-19.5 of the RI/FS Process Document and subject to civil penalty provisions is paragraphs 20.1-20.5 of the RI/FS Process Document are the following dates for issuance of the designated FS Draft Product Reports:

PRODUCT	DATE
Development/Screening of Alternatives	17 Jul 90
Evaluation of Alternatives	10 Apr 91
FS Report (with Preferred Alternative)	1 Feb 92

5.4.3 Onpost RI/FS Report Deadline

The Onpost RI/FS Report Deadline enforceable pursuant to paragraphs 19.1-19.5 of the RI/FS Process Document and subject to the civil penalty provisions in paragraphs 20.1-20.5 of the RI/FS Process Document he following date:

Publication of Availability of RI/FS Report 7 July 92

It should be noted that according to the Schedule, the Onpost RI/FS Report will be issued on 27 June 92.

5.5 OFFPOST_RI/FS_DEADLINES_AND_SCHEDULE

5.5.1 Offpost RI/FS

The Offpost Operable Unit is subject to a separate ROD and is substantially different than the onpost RI/FS. The program contains two Products and one Subproduct (refer to Figure 5-2).

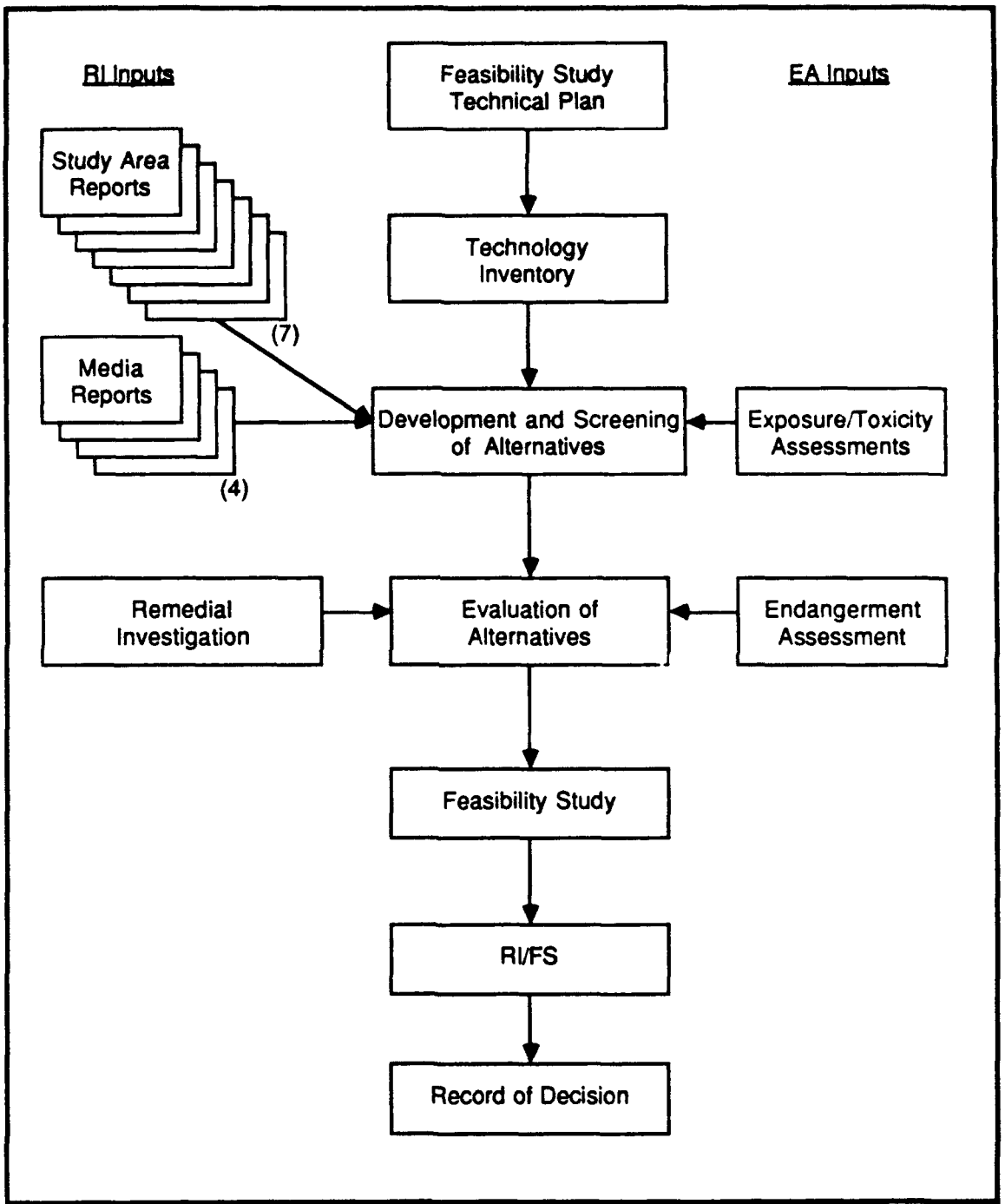


Figure 5-5
FEASIBILITY STUDY FLOW DIAGRAM

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

The most important structural difference of this operable unit from the Onpost is that the RI and the ARAR determination are combined, as are the EA and FS Reports. Also significant is the much smaller size of the program, which allows for single Product review rather than the series of Product and Subproducts found in the onpost program.

5.5.2 Offpost RI/FS Deadlines

The Offpost RI/FS Deadlines enforceable pursuant to paragraphs 19.1-19.5 of the RI/FS Process Document and subject to the civil penalty provisions in paragraphs 20.1-20.5 of the RI/FS Process Document are the following dates:

RI Report with EA ARARs	30 Sept 88
FS with Preferred Alternative and EA	29 Mar 89

5.5.3 Offpost RI/FS Report

The Offpost RI/FS Report Deadline enforceable pursuant to paragraphs 19.1-19.5 of the RI/FS Process Document and subject to the civil penality provisions in paragraph 20.1-20.5 of the RI/FS Process Document is the following date:

Publication of Availability of RI/FS Report	2 Sept 89

It should be noted that in accordance with the Schedule, the Offpost RI/FS Report will be issued on 23 Aug 89.

5.6 INTERIM RESPONSE ACTION DEADLINES AND SCHEDULE

5.6.1 Interim Response Actions

The IRA process provided in the proposed Consent Decree is displayed by Figure 5-6. There are currently 13 IRAs included in the IRA process. Two original IRAs for the South Adams County Water Treatment System were turned over to the SACWSD following the signing of an agreement with the Army, EPA, Colorado, and SACWSD on October 30, 1987.

The North Boundary System, Basin F, and Hot Spot (i.e., Remediation of other contamination sources) IRAs will be performed in separate segments with each resulting in a draft Decision Document. The IRA schedule is separate from the RI/FS program because of the capacity limitations of the MS Project software.

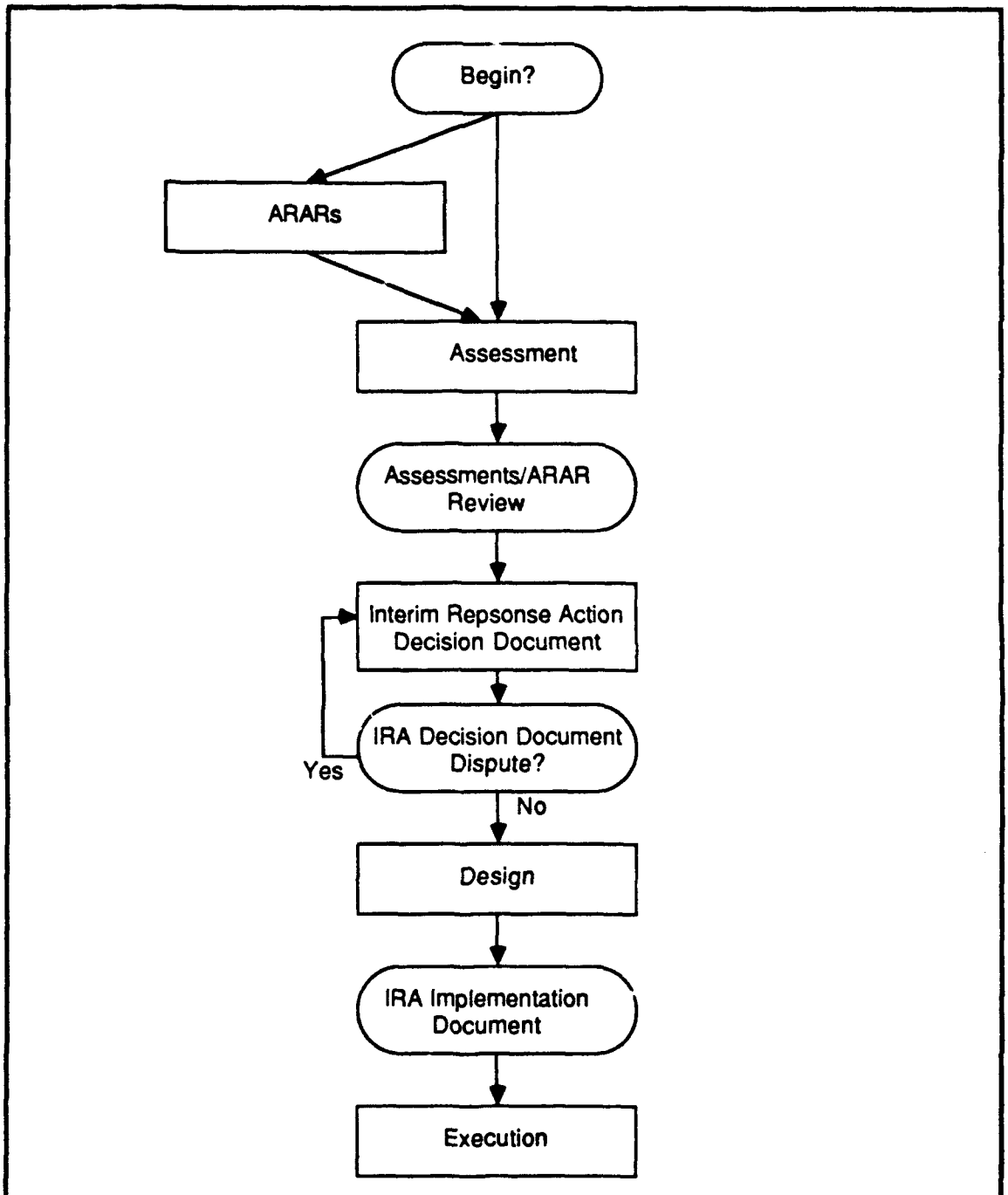


Figure 5-6
INTERIM RESPONSE ACTION FLOW DIAGRAM

Prepared for:
U.S. Army Program Manager's Office
Rocky Mountain Arsenal Contamination Cleanup
Aberdeen Proving Ground, Maryland

The proposed Consent Decree provides for accelerated development and implementation of five IRAs, Basin F, Abandoned Wells, Asbestos Removal, Fugitive Dust, and the North Boundary System.

5.6.2 Interim Response Action Deadlines

The IRA Deadlines enforceable and subject to the stipulated civil penalties provided by paragraphs 19.2-19.10 of the proposed Consent Decree are the following dates for issuance of draft IRA Decision Documents:

Draft IRA Decision Document	Date
Basin F IRA--Liquids, Sludges, and Soils Removal (IR-07-07)	4 Dec 87
Fugitive Dust IRA	N/A
Asbestos Removal	N/A
Well Closure IRA (IR-05-19)	28 Mar 88
North Boundary System IRA--Trench (IR-03-12)	15 Apr 88
Hydrazine Facility IRA (IR-09-26)	28 July 88
Building 1727 Sump IRA (IR-08-26)	28 Aug 88
Basin F Ground Water IRA (IR-04-26)	28 Aug 88
Ground Water System North of RMA IRA (IR-02-22)	29 Aug 88
Basin A Neck Ground Water IRA (IR-06-26)	25 Sept 88
North Boundary System IRA--System Improvements (IR-03-42)	7 Dec 88
Sanitary Sewer Removal IRA (IR-11-26)	27 Jan 89
CERCLA Liquid Wastes (IR-14-26)	25 Sept 89
Hot Spot Removal IRA (Each discrete "hot spot" removal action will be subject to a separate IRA Decision Document after it is determined whether removal is warranted for that contamination source. While the Army hopes to issue at least one such Decision Document between November 1988 through March 1989, this will depend on the progress of the assessment process, the Army's contractual process and the assistance available from Shell) (IR-13-26) Final "Hot Spot" Removal, Draft IRA Decision Document To Be Issued	27 Nov 89
Basin F IRA--Liquids Remediation (IR-07-43)	28 Jan 90

APPENDIX A
TASK SUMMARIES

APPENDIX A
TASK SUMMARIES
INTRODUCTION

The following collection of task summaries represents those activities which are currently underway or proposed to be undertaken in the near future toward the development of the Remedial Investigation/Feasibility Study (RI/FS) for RMA. As brief summaries, they cannot convey the very complex nature of these tasks, nor can they describe all of the differing points of view regarding the details of how the tasks should be carried out. Nevertheless, these summaries do serve to condense the overall program into a manageable number of pages to assist in presenting to the reader the nature and extent of the efforts being undertaken.

It should be further noted that each of the Organizations and the State provided many valuable and insightful comments that have been considered throughout the course of development of these tasks. Responses to these comments can be found in the appropriate task deliverables. The reader is encouraged to examine the Technical Plans, task reports, as well as the corresponding comments and the responses to them as found in the Appendices to them, to gain a more complete understanding of the RI/FS program at RMA.

RI SUMMARY

Task Number:	1	**Date:** 02/21/88
Task Name:	Section 36 Contamination Assessment - Phases I and II	
PMO Contact:	Darryl Borrelli	
Medium:	Soils	
Award Date:	September 1984	
Budget:	$4.8 million with modifications	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

Phase I investigated the extent of contamination in Section 36 soils, specifically for Shell and joint sites. Phase II is revisiting most of these areas, the boundaries of which were revised based on Phase I data. Phase II investigation will further define the extent of contamination and estimate the volume of contaminated soil in Section 36 (see figure). It will penetrate the saturated zone in selected areas, and include soil/water analyses for determination of partition coefficients (K_d).

Scope-of-Work

Task 1 incorporates a Phase I and II Remedial Investigation. It includes a soils survey of Section 36 on the Rocky Mountain Arsenal (RMA) which involves sampling 15 identified sites (36-1, 36-3, 36-4, 36-5, 36-7, 36-8, 36-10, 36-11, 36-12, 36-15, 36-17, 36-20, 36-21, and 36-22), and the uncontaminated area of Section (36-UNC). Chemical analyses were performed on samples for organic and inorganic (metals) analytes.

There were 435 samples taken form 207 borings during Phase I. During Phase II, 853 samples will be taken from 435 borings. Twelve wells are being installed for the long-term network and soil/water samples were taken for K_d investigation. Five additional borings are being performed to support the K_d investigation.

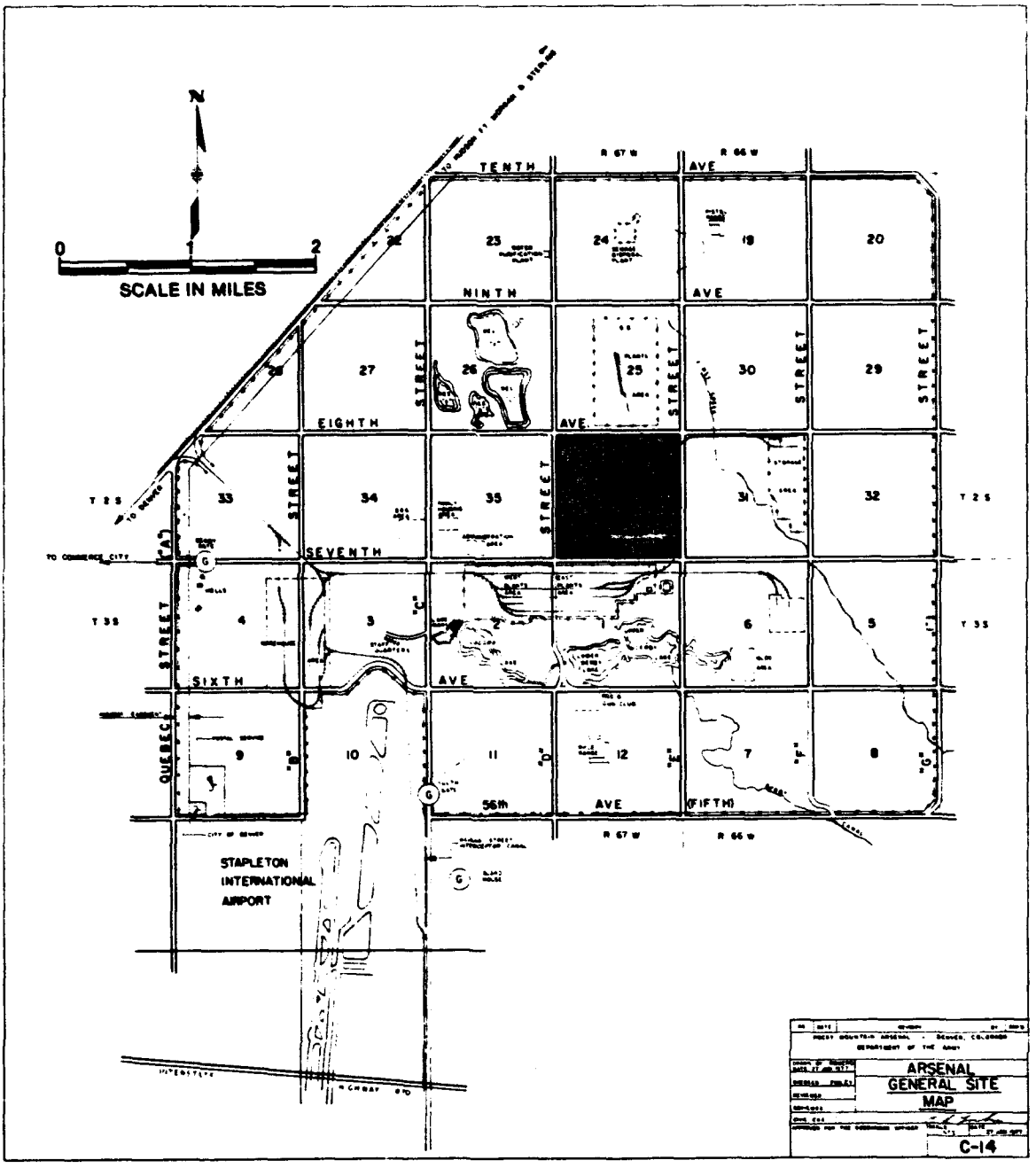
The samples are being analyzed for the standard Phase I compounds including: ICP metals, mercury, arsenic, semivolatile and volatile organics (GC/MS), and DBCP (GC). Analytical parameters for Phase II soil samples are organochlorine pesticides (GC/EC), organophosphorus pesticides (GC/NPD), mercury and arsenic (AA), ICP metals, organosulfur compounds (GC/FP), organophosphorus compounds (GC/FPD), hydrocarbons (GC/FID), volatile aromatic compounds (GC/PID), volatile halogenated compounds (GC/CON), and Army agent degradation products in suspect areas.

Consultants

Harding Lawson Associates (HLA)	- field work, report preparation
Midwest Research Institute (MRI)	- chemical analyses
FOX	- drilling
ITECH	- surveying

Reports		RIC_#	Date_Produced
Technical Plan, Final		85127R07	06/85
Field Actions Taken by Contractor for Detection of Chemical Agents			08/87
Contamination Assessment Reports - Phase I:			
Site	Name		
36-1	Basin A	87203R07	07/87
36-3	Insecticide Pits	87203R01	06/87
36-4	Lime Settling Basins	87203R02	06/87
36-5	Mercury Spill		ongoing*
36-7	Solid Waste Burial Sanitary Pits	87014R22C	ongoing*
36-8	Chemical Drainage Ditches	87113R01	04/87
36-10	Pit		ongoing*
36-11	Liquid Storage Pool	87133R01	05/87
36-12	Pits/Trenches		ongoing*
36-15	Burning Sites	87203R03	07/87
36-17	Complex Disposal Activity	87014R21C	ongoing*
36-20	Chemical Sewer	87133R02	04/87
36-21	Drainage Ditch	87133R03	04/87
36-22	Liquid Storage Pool		ongoing*
36-UNC	Section 36-Uncontaminated Areas	87014R21A	ongoing*
Contamination Assessment Reports, Phase II Addenda			ongoing

* - Draft Final



TASK 1 STUDY AREA

RI SUMMARY

Task Number:	2	Date: 2/18/88
Task Name:	South Plants Contamination Assessment - Phase I and II	
PMO Contact:	Darryl Borrelli	
Medium:	Soils, structures	
Award Date:	October 1984	
Budget:	$4,201,560	
Prime Contractor	Ebasco Services Incorporated	

Objectives

Phase I investigated the extent of soils contamination in sources in the South Plants area of Sections 1 and 2. Phase I also investigated a limited number of South Plants buildings for their potential as contamination sources. Phase II is revisiting most of these areas, boundaries of which may have been revised based on Phase I data. Phase II investigations will further define the extent of contamination and estimate the volume of contaminated soil.

Scope-of-Work

Task 2 incorporates a Phase I and II Remedial Investigation. It includes a soil survey of Sections 1 and 2 on the Rocky Mountain Arsenal which involves sampling 19 identified sources (1-3, 1-4, 1-5, 1-8, 1-10, 1-11, 1-13, 2-2, 2-3, 2-4, 2-5, 2-6, 2-7, 2-8, 2-9, 2-12, 2-13, 2-14, 2-18) and a Regional Study throughout areas of the manufacturing complex which were not specifically designated by a source number, and chemical analyses of these samples for organic and inorganic (metals) analytes. The study focuses on Shell and joint areas.

Soil in Sections 1 and 2 is being investigated to determine the extent of contamination. 263 Phase I borings were completed and an estimated 119 Phase II borings will be drilled. A soil gas survey to investigate the source of a benzene plume (Sites 2-2, 2-13, and 1-10) will be performed.

Task 2 also includes the compilation of historical information regarding activities in 89 buildings in Sections 1 and 2, and limited dust sampling and reconnaissance of these buildings.

The soil samples are being analyzed for the standard Phase I compounds including: volatile and semivolatile organics (GC/MS), DBCP (GC), ICP metals, mercury, and arsenic. Analytical parameters for Phase I building (composite dust) samples include semivolatile organics (GC/MS), asbestos, ICP metals, mercury, and arsenic. Analytical parameters for air monitoring samples obtained in buildings are volatile organics (GC/MS). Analytical parameters for Phase II soil samples are organochlorine pesticides (GCEC), organophosphorus pesticides (GCNPD), mercury and arsenic (AA), ICP metals, organosulfur compounds (GCFP), organophosphorus compounds (GCFPD), hydrocarbons (GC/FID), volatile aromatic compounds (GCPID), volatile halogenated compounds (GCCON), and Army agent degradation products in suspect agent areas.

0086R
Rev. 2/18/88

Consultants

R.L Stollar and Associates	-	field work, reports
Geraghty and Miller	-	field work
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
Technos, Inc.	-	geophysics
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying

Reports

	RIC#	Date Produced
Technical Plan, Final	87006R01	08/85
Procedures Manual, Vol. 1	86241R01	08/85
Procedures Manual, Vol. 2	86241R02	08/85
Procedures Manual, Vol. 3	87006R02	08/86
Procedures Manual, Vol. 4	86241R04	08/85
Regional Study Technical Plan	87275R01	12/86

Contamination Assessment Reports:

Site	Name	RIC#	Date Produced
1-3	Mounded Area	87097R09	04/87*
1-4	Borrow Pit	87097R08	04/87
1-5	Lime Pits	87006R15	02/87
1-8	Salvage Yard	87127R05	05/87
1-10	South Tank Farm	87127R01	04/87
1-11	Sanitary Landfill	87216R01	07/87
1-13	So. Plants Mfg. Area - Spills		ongoing
2-2	Test Site	87216R02	07/87
2-3	Lagoon	87006R16	02/87
2-4	Excavation Pit	87006R17	02/87
2-5	Trench	87216R03	07/87
2-6	Salt Storage Pad	87127R02	04/87
2-7	Aeration Basin	87006R18	02/87
2-8	Former Tank Storage		ongoing
2-9	Open Storage Area	87006R19	02/87
2-12	Revetted Tank Storage Area	87006R20	02/87
2-13	Open Storage Area	87216R04	07/87
2-14	Sanitary Landfill	87216R05	07/87
2-18	So. Plants Mfg. Area - Spills		ongoing

* - draft final

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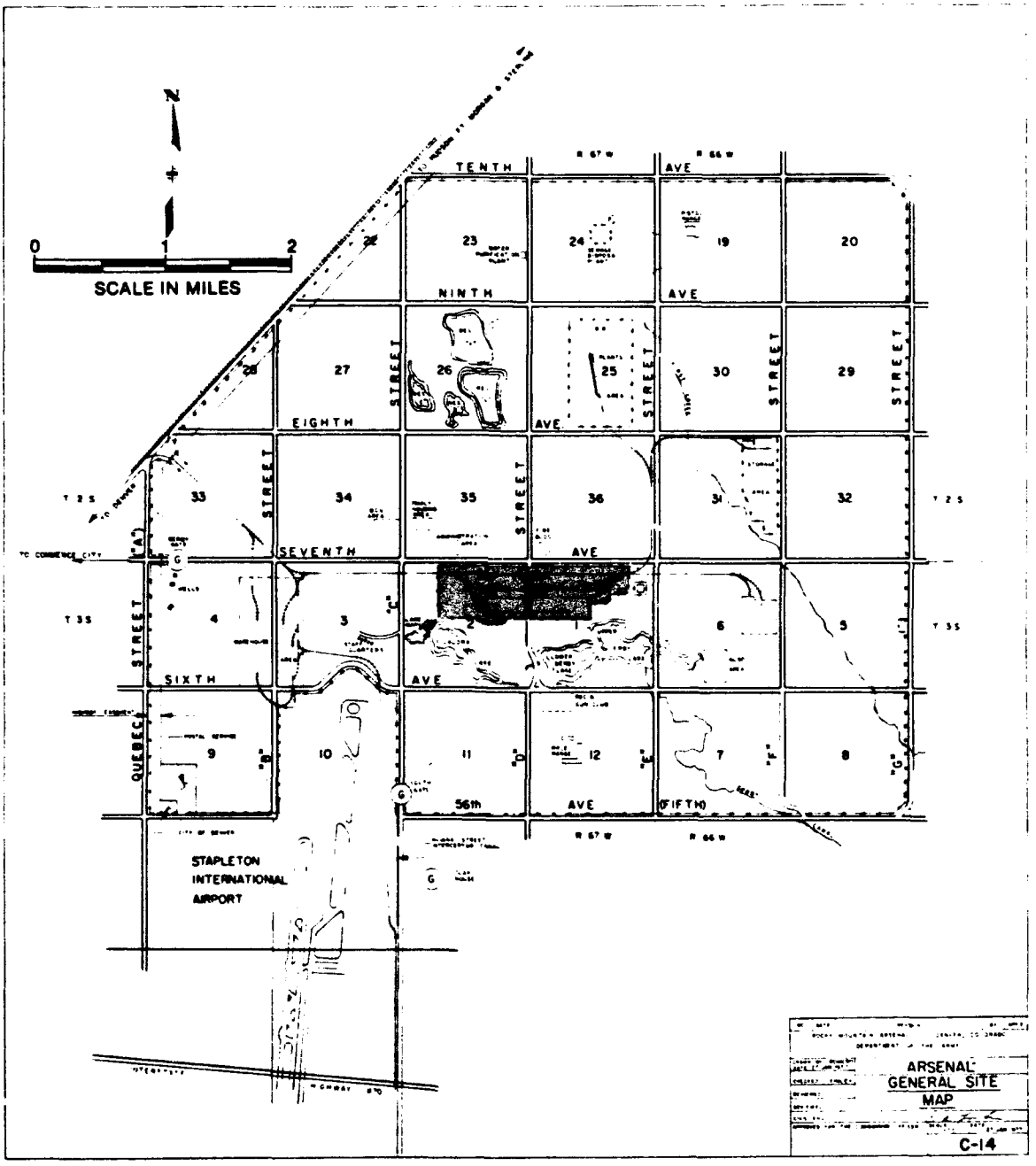


TASK 2 STUDY AREA

RI SUMMARY

Task Number:	4	**Date:** 02/21/88
Task Name:	RMA Water Quantity/Quality Survey	
PMO Contact:	Charlie Scharmann	
Medium:	Water	
Award Date:	May 13, 1985	
Budget:	$3.7 million with modifications	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

Under this task a one-year ground water and surface water surveillance program was performed at RMA to achieve the following objectives:

- o Satisfy the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the substantive requirements of all applicable or relevant and appropriate Federal and State requirements that have application through CERCLA;
- o Confirm the existence and chemical nature of known contamination and monitor any changes in the lateral and vertical extent of contaminant migration; and
- o Develop a core data base for use in upcoming litigation and RI/FS analyses for RMA.

Scope-of-Work

The purpose of the Task 4 Water Quantity/Quality Survey is to execute a one-year ground water and surface water surveillance program capable of satisfying the various regulatory requirements, developing a litigation quality data base, and verifying the extent and nature of known contamination. In order to achieve these objectives, five distinct technical elements are anticipated. These are as follows:

- o Review historical data;
- o Develop a monitoring program to achieve the above objectives;
- o Execute the monitoring program utilizing litigation quality sampling and analytical procedures;
- o Assess data quarterly for possible adjustments in the monitoring program; and
- o Compile the accumulated data at the end of the one-year program.

Currently there are over 2,000 monitoring wells on RMA. During the review of historical data, a large number of these wells were evaluated with respect to construction detail, sampling history, and location. Criteria for evaluating these wells are described in Sections 3.1.1.1 through 3.1.1.3 of the Task 4 Technical Plan (RIC#87013R01).

Based on the results of the review of historical data, a monitoring program was designed, resulting in an extensive Initial Screening Program. Based on an evaluation of the results obtained during the Initial Screening Program, the proposed monitoring program for the third and fourth quarters was designed and implemented.

All ground water monitoring wells and surface water sampling sites will be sampled using uniform sampling methodologies. Ground water and surface water samples will be analyzed for a predetermined list of analytes including numerous organic and inorganic parameters. Sample collection, measurement of field parameters, and analysis of samples will be performed in accordance with USATHAMA Quality Assurance/Quality Control procedures. These procedures include collection of field quality control samples and decontamination of all sampling equipment.

All studies under this task were performed in accordance with the requirements and technical specifications discussed in Section C-3 and Appendices A [U.S. Army Toxic and Hazardous Materials Agency (USATHAMA) Quality Assurance Program, 1982] and B (USATHAMA Geotechnical Requirement, 1983), except where modified as required for technical/litigation standardization. Standardized methods, protocols, and criteria will be consistent with those proposed in Tasks 1 and 2, and as standardized during subsequent meetings between the government and contractors. Services will consist of collection, analysis, reduction, and compilation of environmental data for both surface and ground water. Data will be collected during a 12-month period and will include stream flow, ground water level, and water quality evaluations.

Consultants

HLA - technical support-ground water
RCI - technical support-surface water
ITECH - surveying

Reports	RIC_#	Date_Produced
Technical Plan, Final	87013R01	09/86
Initial Screening Program Report	87253R01	08/87
Final Screening Program Report		ongoing

RI SUMMARY

Task Number:	6	**Date:**	02/21/88
Task Name:	Sections 26 and 35 - Phase I		
PMO Contact:	Kevin Blose		
Medium:	Soil		
Award Date:	April 30, 1985		
Budget:	$1.16 million		
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)		

Objectives

The objectives of this task included the development and execution of a Phase I soil RI for sites contained within Sections 26 and 35 (see figure) on RMA. This investigation was to provide site-specific physical and chemical information to serve as a basis for Phase II surveys, which will further define chemicals present and the estimate volumes of soil affected.

Scope-of-Work

The scope-of-work of this task included a detailed historical records search to develop a picture of the past use of Sections 26 and 35 at RMA. A detailed Technical Plan outlining the remedial investigation of eight sites was developed. These sites were designated as 26-1, 26-3, 26-4, 26-5, 26-6, 26-7, 35-3, and 35-4. The sites investigated included unlined and lined waste basins and other various ditches, as well as the undisturbed areas of Sections 26 and 35 (26-UNC and 35-UNC).

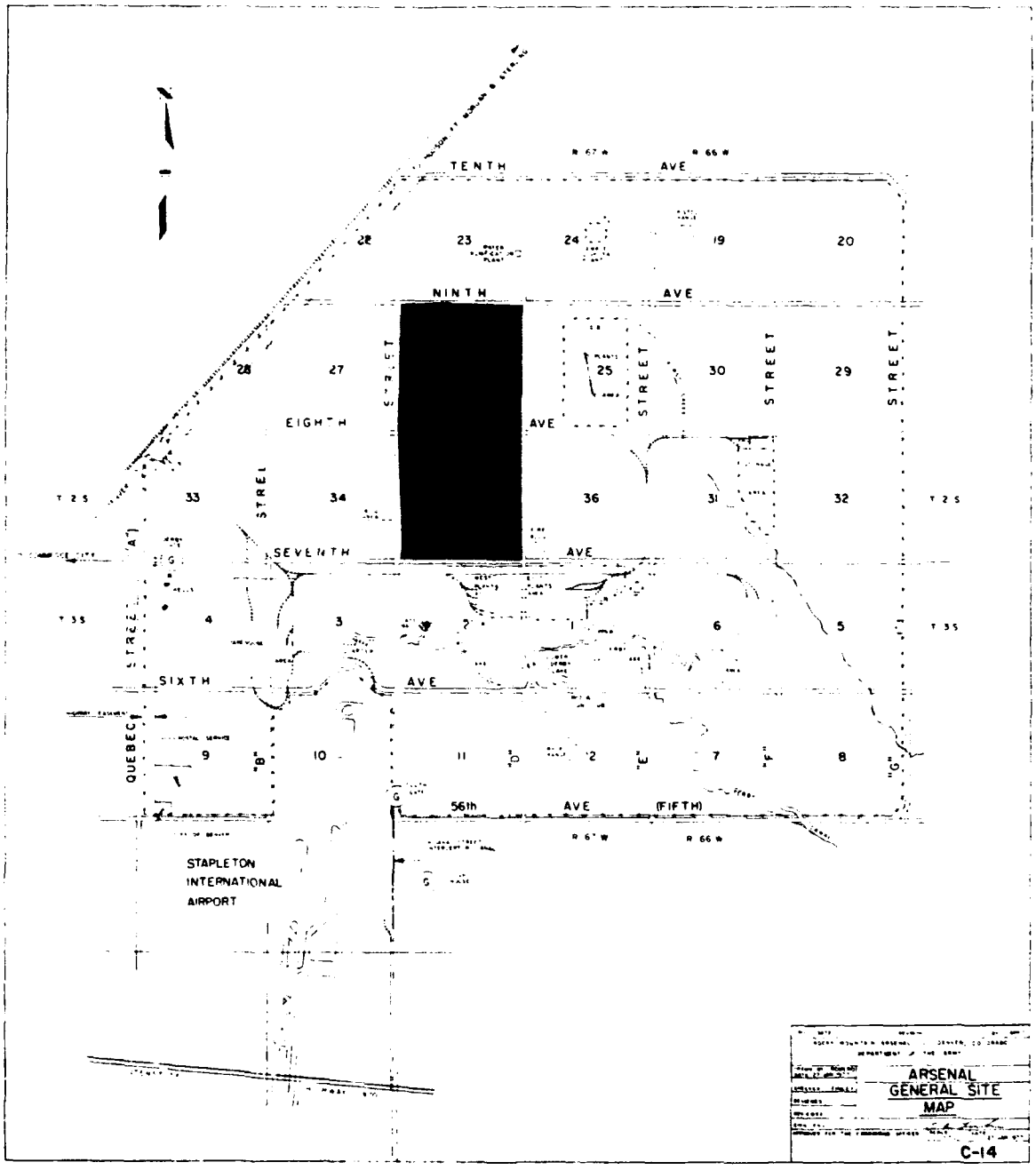
A total of 441 soil samples were collected from 220 borings. The samples were analyzed for a standard target list of Phase I compounds including: volatile and semivolatile organics by GC/MS; nemagon (DBCP) by GC; cadmium, copper, lead, and zinc by ICP; as well as arsenic and mercury. In addition to the target organic compounds, all nontarget organic compounds found to be present were tentatively identified and their concentrations estimated. Geophysical techniques were also employed to ensure boring sites were clear of metal debris before drilling began.

Consultants

HLA - field support, geophysics, report preparation, general support
ITECH - surveying
MRI - chemical analyses
FOX - drilling

Reports		RIC_#	Date_Produced
Technical Plan, Draft Final		86238R05	9/85
Contamination Assessment Reports - Phase I:			
Site	Name		
26-1	Deep Injection Well	87114R01	10/86*
26-3	Basin C	87014R19	10/86*
26-4	Basin D	87014R15	8/86*
26-5	Basin E	87014R16	8/86*
26-6	Basin F	87104R23	10/86*
26-7	Basins B & C Drainage Ditch (combined with 35-4)	87114R02	3/87*
35-3	Basin B	87014R18	8/86*
35-4	Basin A Drainage Ditch	87114R02	3/87*
26-UNC	Section 26-Uncontaminated Areas	87014R14	8/86*
35-UNC	Section 35-Uncontaminated Areas	87014R17	8/86*

* - Draft Final



TASK 6 STUDY AREA

RI SUMMARY

Task Number:	7	**Date:** 2/18/88
Task Name:	Lower Lakes - Phase I Contamination Assessment	
PMO Contact:	Juan Lopez	
Medium:	Soils, sediment	
Award Date:	April, 1985	
Budget:	$1,374,852	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

Phase I investigated the extent of soils contamination at miscellaneous sites in Sections 1, 2, 3, 24, and 30. Phase I also investigated the extent of sediment contamination in Lakes Mary and Ladora. Task 7 comprises Phase I work only.

Scope-of-Work

Task 7 is a Phase I remedial investigaion task. It includes soil and sediment surveys in miscellaneous sections of Rocky Mountain Arsenal which involves sampling 10 identified sources (1-1, 1-9, 2-1, 2-17, 3-2, 3-3, 3-4, 24-6, 24-7, 30-4) and 2 uncontaminated areas (UNC-1, UNC-2). These sites are lakes, drainage ditches, open storage areas, landfills, and a sewage treatment plant.

Soils and sediments in these areas will be investigated to determine the magnitude and extent of contamination in source and uncontaminated areas covered under Task 7. 250 borings were drilled. Task 7 also included a compilation of all historical activities occurring in the subject areas, which were used in the development and refinement of sampling strategies.

The soil samples are being analyzed for the standard Phase I compounds, including: volatile and semivolatile organics (GC/MS), DBCP (GC), ICP metals, and mercury and arsenic (AA).

The results of the Phase I investigation will be analyzed in a manner upon which to base the Task 20 Phase II investigations.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Technos, Inc.	-	geophysics
ITECH	-	surveying

0086R
Rev. 2/18/88

Reports

		RIC#	Date Produced
Technical Plan, Final		86238R02	02/86
Contamination Assessment Reports:			
Site	Name	RIC#	Date Produced
1-1	Drainage Ditches	87196R01	05/87
1-9	Open Storage Area	87127R07	05/87
2-1	Drainage Ditches	87216R06	07/87
2-17	Lakes Ladora and Mary	87216R07	07/87
3-2/3-3	Drainage Ditch and Overflow Basin	87197R01	05/87*
3-4	Nemagon Spill Area		09/87*
24-6	Sewage Treatment Plant	87216R08	07/87
24-7	North Bog	87097R10	04/87*
30-4	Sanitary Landfill	87216R09	07/87
1-UNC	Section 1, Uncontaminated Area	87127R06	04/87
2-UNC	Section 2, Uncontaminated Area	87127R08	05/87

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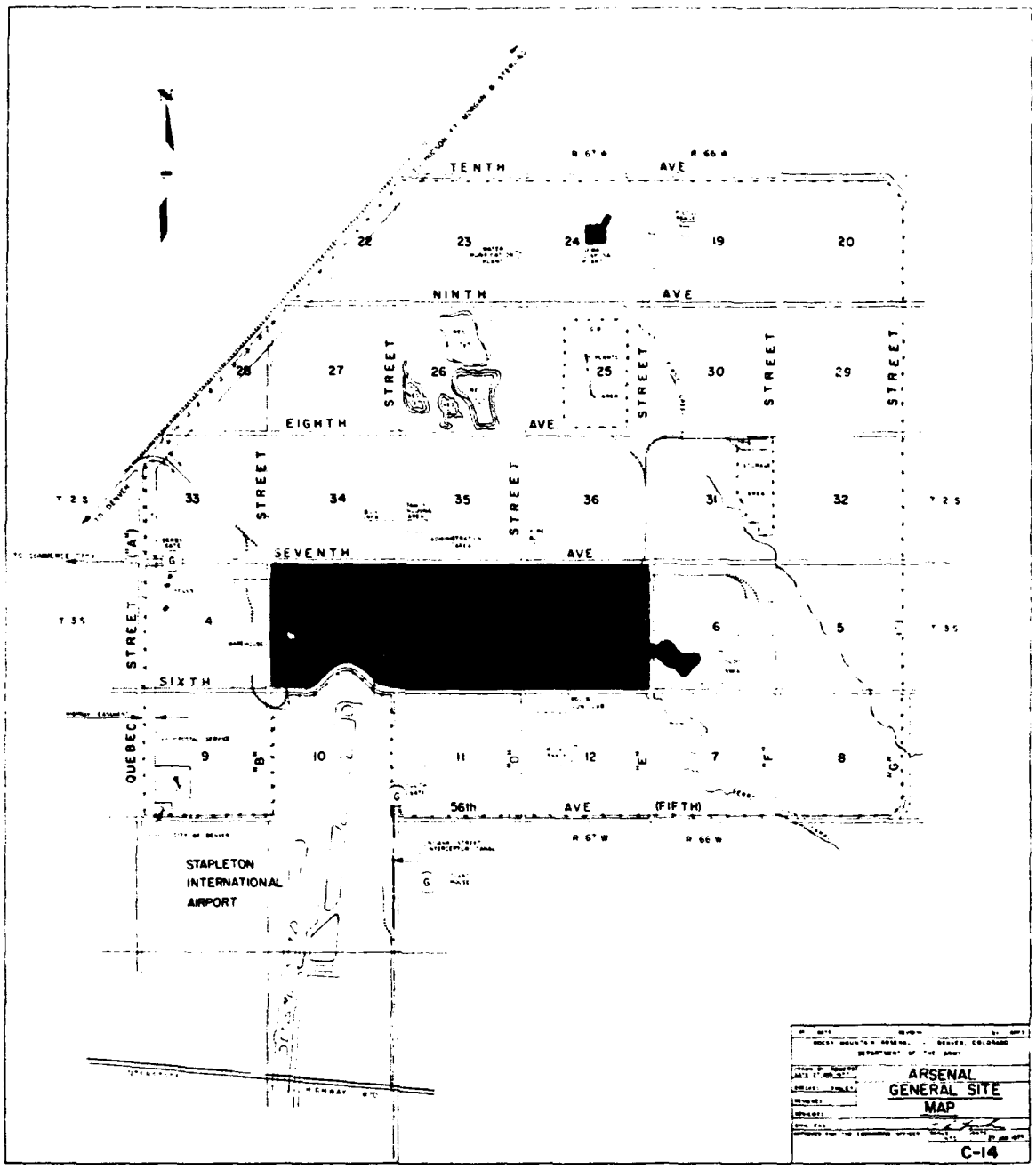
Rev. 2/18/88



TASK 7 STUDY AREA

RI SUMMARY

Task Number:	9	**Date:**	02/21/88
Task Name:	Biota Assessment - Phases I and II		
PMO Contact:	Andrew Kingery		
Medium:	Biota (Flora and Fauna)		
Award Date:	July 1985		
Budget:	$1.60 million		
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)		

Objectives

Phase I studies were designed to gather pertinent information on chemical contamination of plants and animals at RMA (see figure), to identify any data gaps, initiate the development of cleanup criteria, and to produce a summary report with scope-of-work for any additional field studies to be conducted in a later phase.

Phase II studies were designed to collect pertinent data on the chemical contamination in plants and animals at major sources of contamination, to identify pathways of contamination movement, continue the development of cleanup criteria in relation to plants and animals in natural ecosystems, and to produce a final biota report addressing RI topics for chemical contamination on and off of RMA.

Scope-of-Work

Phase I consisted of literature surveys, contacts with regional experts, a brief field reconnaissance survey, compilation of available information into a summary document, and the preparation of a Phase II study plan to fill data gaps identified in Phase I.

Phase II consists of several discrete subtasks designed to address data needs for the completion of the RI for biota in relation to contamination on and off of RMA. Additional investigations are considered as information from other tasks, primarily soil and water, to identify other potential sources of contamination for biota. The discovery of a winter roost for bald eagles on RMA in December 1986 precipitated intense studies of this endangered species in relation to RMA contamination, and in support of studies being conducted by the U.S. Fish and Wildlife Service (USFWS).

The combined workscope of Phase II studies includes the following subtasks:

- SITE CHARACTERIZATION--Quantitative vegetation studies and brief faunal surveys, including the collection of voucher specimens, are conducted at major sites of contamination and in onpost and offpost control sites to detect potential contaminant related effects. A vegetation map is being prepared showing the current distribution of vegetation types on RMA.

- AVIAN REPRODUCTIVE SUCCESS--Field studies were conducted on RMA and at offpost control sites to evaluate contaminant related effects in mallards, pheasants, and kestrels. Eggs, fledglings, and adults were collected for subsequent contaminant analysis.

- TISSUE ANALYSIS FOR CONTAMINANTS--Tissues were collected from key species of plants and animals for subsequent analysis for major contaminants of concern (dieldrin, aldrin, endrin, DDE, DDT, mercury, and arsenic). USATHAMA-certified methods were developed, and samples are being processed. Additional chemicals may be added, pending the development of additional data on the concentration and distribution of contaminants in Phase II water and soil tasks. Specimens for analysis include specimens of chance (e.g., raptors and larger mammal predators) found dead on and off of RMA.

- ACETYLCHOLINESTERASE INHIBITION--Brains of animals collected for other contaminant analyses from sites of potential contamination and from control sites will be analyzed for evidence of acetylcholinesterase inhibition.

- FOOD CHAIN DEFINITION--The gut contents from specimens collected for tissue analysis will be examined and identified to supplement data from the literature on food habits in order to provide a better data base for evaluating contaminants in regional food webs.

- INVERTEBRATE POPULATION STUDIES--Population studies of earthworms, grasshoppers, and aquatic snails will be conducted at potential sites of contamination and in control areas.

- PHYSICAL MALFORMATIONS--Any malformations in embryos or fledgling birds observed during the avian reproductive success subtask will be recorded and evaluated in relation to potential RMA contamination.

- CRITERIA DEVELOPMENT--Pathways analyses will be conducted to identify and quantify food chains in terrestrial and aquatic food webs. These data will be used to evaluate the need for interim actions and site remediation, and for the development of possible site-specific cleanup criteria in relation to key species and major ecosystems on and near RMA.

- DOMESTICATED PLANTS AND ANIMALS--Incidental information on potential pathways of contamination in domesticated plants and animals will be identified. This information will be provided to the appropriate Endangerment Assessment (EA) tasks for incorporation into human food chains.

- o BALD EAGLE STUDIES--These investigations will be conducted in cooperation with the USFWS to study the timing, habitat use, food habits, and movement of bald eagles in relation to sites of known and potential contamination at RMA. Integration with offpost efforts is a part of this subtask.

- o BLACK-FOOTED FERRET SURVEYS--At the request of the USFWS, studies have been conducted at all prairie dog towns on RMA for black-footed ferrets by certified personnel using approved techniques.

- o PRAIRIE DOG PREY BASE STUDIES--Because prairie dogs support populations of burrowing owls, ferruginous hawks, Swainsons hawks, and bald eagles, the USFWS and MOA parties have requested a survey of the prairie dog prey base in relation to sites of contamination, the RMA proposed maintenance plan, interim cleanup actions, and future remediation.

- o ANALYSIS OF ADDITIONAL SAMPLES--Additional samples collected by the USFWS and others can provide additional data pertinent to the RI investigation and will be analyzed under this subtask.

- o AQUATIC SAMPLING--Additional sampling of biota in the Offpost Study Area may be collected for contamination analysis, pending the results of offpost water and sediment studies. This subtask will be scoped in coordination with the EA tasks.

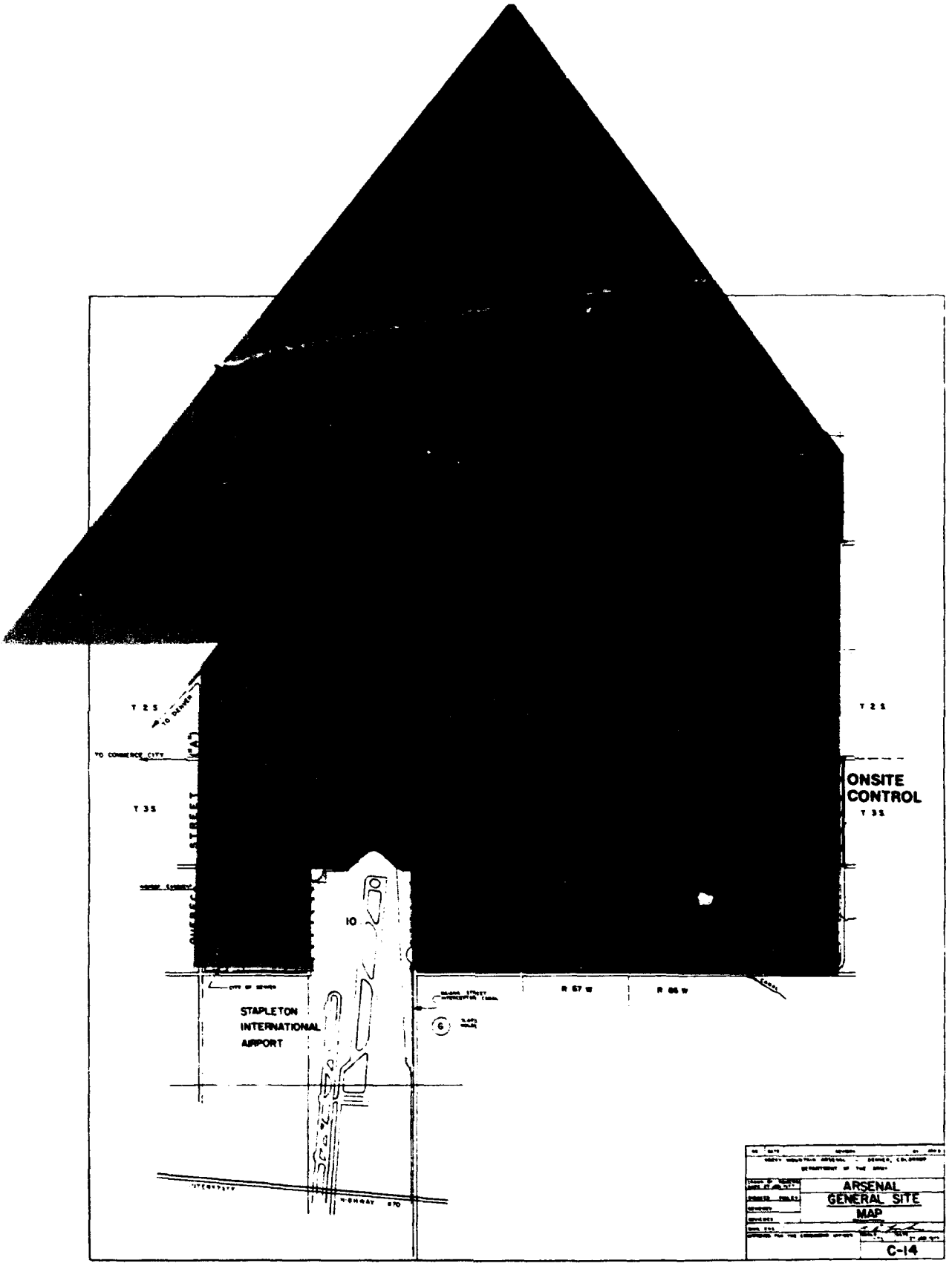
Consultants

Dr. Lowell McEwen (Colorado State University) - Avian Reproductive Success and Acetylcholinesterase Inhibition Subtasks.

Miscellaneous consultants for field study support.

Reports Produced	**RIC #**	**Date**
Phase I Technical Plan, Draft Final	86238R06	11/85
Phase II Technical Plan, Draft Final	86251R01	8/86
Phase I and Phase II Technical Plans, Final		8/87
Phase I Report		ongoing
Remedial Investigation Report on Biota		ongoing
Bald Eagle Reports		ongoing
Black-footed Ferret Report	87271R02	10/87*
Pathways Reports for Selected Contaminants		ongoing

* - One study report, serves as final document.



ONSITE CONTROL

SAMPLING SITES

TASK 9 STUDY AREAS

RI SUMMARY

Task Number:	10	**Date:** 2/18/88
Task Name:	Sewer Systems Investigation	
PMO Contact:	Kevin Blose	
Medium:	Soil	
Award Date:	September, 1985	
Budget:	$1,040,727	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

The purpose of this task is to investigate the soil contamination resulting from the use or misuse of the Rocky Mountain Arsenal chemical and sanitary sewer systems and the process water system. An assessment of the nature and extent of this contamination will be made.

The specific objectives are the following:

- Determine which segments of the sanitary sewer system, the chemical sewer system, and the process water system are contaminated;
- Identify specific and generic leak locations in the three systems; and
- Evaluate the extent of soil contamination resulting from leaks in the system.

Scope-of-Work

Task 10 is investigating the potentially contaminated soil surrounding the sanitary and chemical sewer systems and the process water system. The areas being investigated include South Plants, North Plants, Administration Area, Rail Classification Yard, and connecting sections.

99 Borings were drilled along the 3 systems beneath manholes, in trenches along sections of pipe which had been dye tested, and near suspected leaks. 11 sediment samples were taken from inside manholes in the sanitary sewer system. Task 10 also includes the compilation of historical information regarding activities of the chemical and sanitary sewers and the process water system throughout the RMA.

The soil and sediment samples are being analyzed for the standard Phase I compounds including: volatile and semivolatile organics (GC/MS), ICP metals; arsenic and mecury (AA); thiodiglycol; and IMPA (HPLC).

0086R
Rev. 2/18/88

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying

Reports

	RIC#	Date Produced
Technical Plan, Draft Final	87007R38	10/86
Technical Plan, Final		ongoing
Contamination Assessment Reports:		
Sanitary Sewer - North Plants		ongoing
Sanitary Sewer - South Plants		ongoing
Sanitary Sewer - Interceptor Line		ongoing
Sanitary Sewer - Railyard and Administrative Areas		ongoing
Chemical Sewer System		ongoing
Process Water System		ongoing

0086R
Rev. 2/18/88

RI SUMMARY

Task Number:	11	**Date:** 2/18/88
Task Name:	Hydrazine Blending and Storage Facility (HBSF) Contamination Assessment	
PMO Contact:	Darryl Borrelli	
Medium:	Soils, water	
Award Date:	August, 1985	
Budget:	$298,976	
Company:	Ebasco Services Incorporated	

Objectives

The objective of Task 11 is to conduct a Phase I remedial investigation at Site 1-7, Hydrazine facility, to determine the nature and extent of contamination in soils and groundwater.

Scope-of-Work

Task 11 is a Phase I remedial investigation. It includes a soil survey of Site 1-7, a groundwater investigation, and chemical analyses of these samples for organic and inorganic (metals) analytes.

15 soil borings were drilled and sampled. Two groundwater monitoring wells were drilled and sampled. An additional 11 monitoring wells in the vicinity of the HBSF were sampled.

Soil samples were analyzed for the standard Phase I compounds including: volatile and semivolatile organics (GC/MS), ICP metals, mercury, arsenic, hydrazine, and nitrosamines. Water samples were analyzed for volatile and semivolatile organics (GC/MS), ICP metals, mercury, arsenic, hydrazines (GCNP), and nitrosamines (GCNP).

Consultants

Geraghty and Miller	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Technos, Inc.	-	geophysics
ITECH	-	surveying

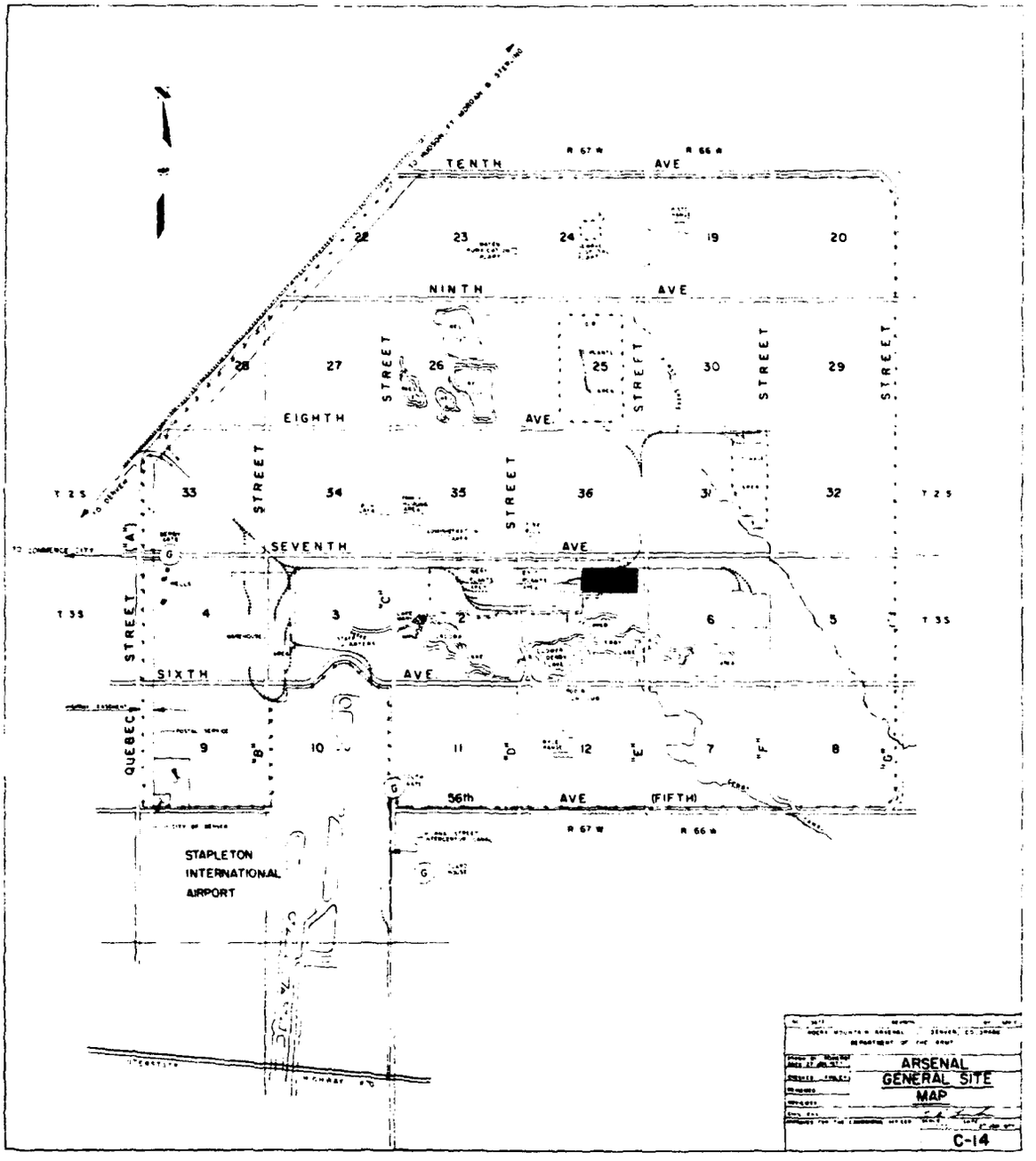
Reports

	RIC#	Date Produced
Technical Plan, Final	86238R03	03/86

Contamination Assessment Report:

Site	Name	RIC#	Date Produced
1-7	Hydrazine facility		ongoing

0086R
Rev. 2/18/88



TASK 11 STUDY AREA

RI SUMMARY

Task Number:	12	**Date:**	2/18/88
Task Name:	Derby Lakes Phase I Contamination Assessment		
PMO Contact:	Juan Lopez		
Medium:	Soils, sediments		
Award Date:	September, 1985		
Budget:	$510,230		
Prime Contractor:	Ebasco Services Incorporated		

Objectives

Phase I investigated the extent of soils contamination near the Derby Lakes area of RMA, in Sections 1, 6, 11, and 12. Phase I also investigated the extent of sediment contamination in Upper and Lower Derby Lakes, and Rod and Gun Club Pond. Task 12 comprised Phase I work only.

Scope-of-Work

Task 12 is a Phase I remedial investigation task. It includes a soil and sediment investigation in the Derby Lakes region of Rocky Mountain Arsenal. The following six sources were investigated under Task 12: 1-2, 1-12, 6-2, 11-1, 12-1, and 12-2. These sites are lakes, trash dumps, and buried lake sludge.

Soils and sediments in these areas will be investigated to determine the magnitude and extent of contamination in source areas covered under Task 12. 81 borings were drilled during the Phase I investigation. Task 12 also included a compilation of all historical activities occurring in the subject areas, which were used in the development and refinement of sampling strategies.

The soil samples are being analyzed for the standard Phase I compounds, including: volatile and semivolatile organics (GC/MS), DBCP (GC), ICP metals, and mercury and arsenic (AA).

The results of the Phase I investigation will be analyzed in a manner upon which to base the Task 20 Phase II investigations.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Technos, Inc.	-	geophysics
ITECH	-	surveying

0086R
Rev. 2/18/88

Reports

	RIC#	Date Produced
Technical Plan, Final	86238R01	02/86

Contamination Assessment Reports:

Site	Name	RIC#	Date Produced
1-2	Upper and Lower Derby Lakes	87196R02	07/87
1-12	Trash Dump	87127R03	04/87
6-2	Eastern Upper Derby Lake	87196R03	06/87
12-1	Buried Lake Sludge	87197R02	05/87*
11-1	Buried Lake Sludge	87196R04	06/87
12-2	Rod and Gun Club Pond	87127R04	05/87

* - draft final report

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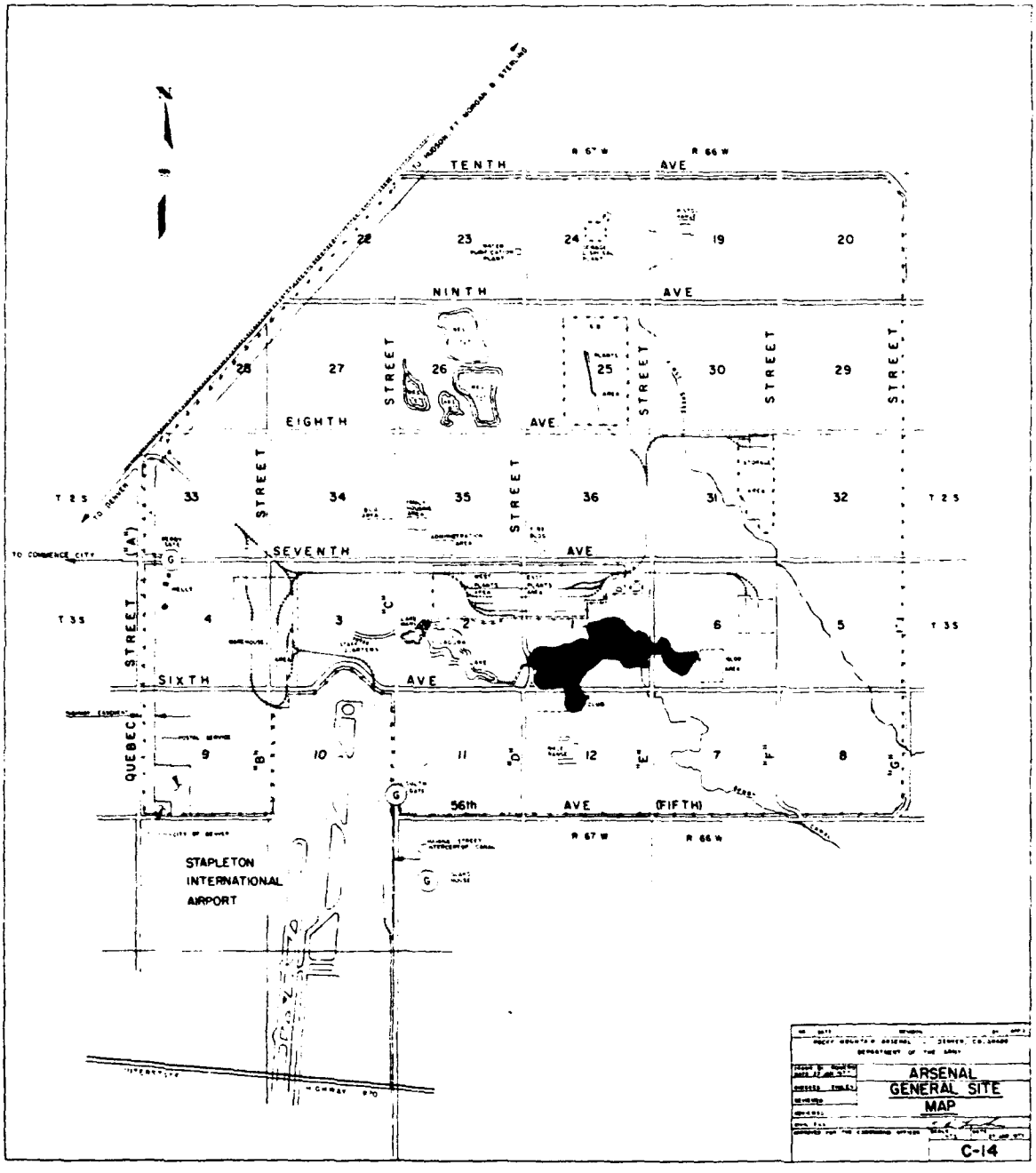
Rev. 2/18/88



TASK 12 STUDY AREA

RI SUMMARY

Task Number:	14	**Date:**	02/21/88
Task Name:	Army Sites North - Phase I		
PMO Contact:	Darryl Borrelli		
Medium:	Soil		
Award Date:	September 30, 1985		
Budget:	$2.95 million		
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)		

Objectives

The objectives of the task included the development and execution of a Phase I soil remedial investigation for sites contained within Sections 19, 20, 22, 23, 24, 25, 26, 27, 28, 29, 30, 32, 34, 35, and 36 on RMA (see figure). The investigation will provide site-specific physical and chemical information on which to base the development of any required Phase II survey, which will further define chemicals present and the estimated volumes of soil affected.

Scope-of-Work

The work on this task included a detailed historical records search to develop a picture of the past use of the 15 sections studied. A detailed Technical Plan outlining the remedial investigation was developed to study the 24 sites identified and 11 sections thought to be undisturbed as determined from the records search. The sites investigated include areas designated as:

19-1	30-1	32-1	36-9
20-1	30-2	35-2	36-13
26-9	30-3	35-6	36-14
29-1	30-5	35-7	36-16
29-4	30-6	36-2	36-18
29-5	30-7	36-6	36-19

These sites included burn sites, burial sites, impact ranges, ditches, and miscellaneous ground scars. Also studied are areas designated as 19-UNC, 20-UNC, 22-UNC, 23-UNC, 24-UNC, 25-UNC, 27-UNC, 28-UNC, 29-UNC, 30-UNC, and 34-UNC.

A total of 1,031 soil samples were collected from 562 borings. The samples were analyzed for a list of Phase I analytes that included: volatile and semivolatile organics by GC/MS; nemagon (DBCP) by GC; cadmium, copper, lead, and zinc by ICP: as well as arsenic and mercury. In addition to the target compounds, all nontarget organic compounds found were tentatively identified and their concentrations estimated.

More detailed geophysics were performed at selected sites because of the ordnance that was burned or buried at the site. These techniques were used to complement the soil sampling to best define the areas where buried metal may be present.

Consultants

HLA - field support, geophysics, report preparation, general support
ITECH - surveying
MRI - chemical analyses
FOX - drilling

Reports	RIC_#	Date_Produced
Technical Plan, Draft Final	86238R04	6/86

Contamination Assessment Reports - Phase I:

Site	Name	
19-1	Burn Site, Incendiaries	03/87*
20-1	Burn Site, Incendiaries	03/87*
26-9	Chemical Sewer (combined with 35-2)	10/87*
29-1	Burn Site, Incendiaries	03/87*
29-4	Disposal Site for Explosives and Incendiaries	10/87*
29-5	Bomb Disposal Site	03/87*
30-1	Impact Area	04/87*
30-2	Burn Site, Incendiaries	03/87*
30-3	"H" Training Area	10/87*
30-5	M-34 Demilitarization Operations Area	06/87*
30-6	Liquid Disposal Trenches	04/87*
30-7	Ground Disturbances (combined with 30-1)	04/87*
32-1	Bomb Disposal Site (combined with 29-5)	03/87*
35-2	Chemical Sewer	10/87*
35-6	Possible Munitions Test Area	03/87*
35-7	Firing Range	10/87*
36-2	Munitions Test Area and Incendiary Drop Site	08/87*
36-6	Trenches	09/87*
36-9	Incendiary or Munitions Test Area	08/87*
36-13	Trenches	06/87*
36-14	Mustard Plant Disposal Site	08/87*
36-16	Incendiary Burial Site	08/87*
36-18	Possible Trench Disposal Site	09/87*
36-19	Grading Scars	06/87*
19-UNC	Section 19-Uncontaminated Areas	04/87*
20-UNC	Section 20-Uncontaminated Areas	08/87*
22-UNC	Section 22-Uncontaminated Areas	05/87*
23-UNC	Section 23-Uncontaminated Areas	08/87*

24-UNC	Section 24-Uncontaminated Areas	05/87*
25-UNC	Section 25-Uncontaminated Areas	09/87*
27-UNC	Section 27-Uncontaminated Areas	05/87*
28-UNC	Section 28-Uncontaminated Areas	05/87*
29-UNC	Section 29-Uncontaminated Areas	06/87*
30-UNC	Section 30-Uncontaminated Areas	06/87*
34-UNC	Section 34-Uncontaminated Areas	05/87*

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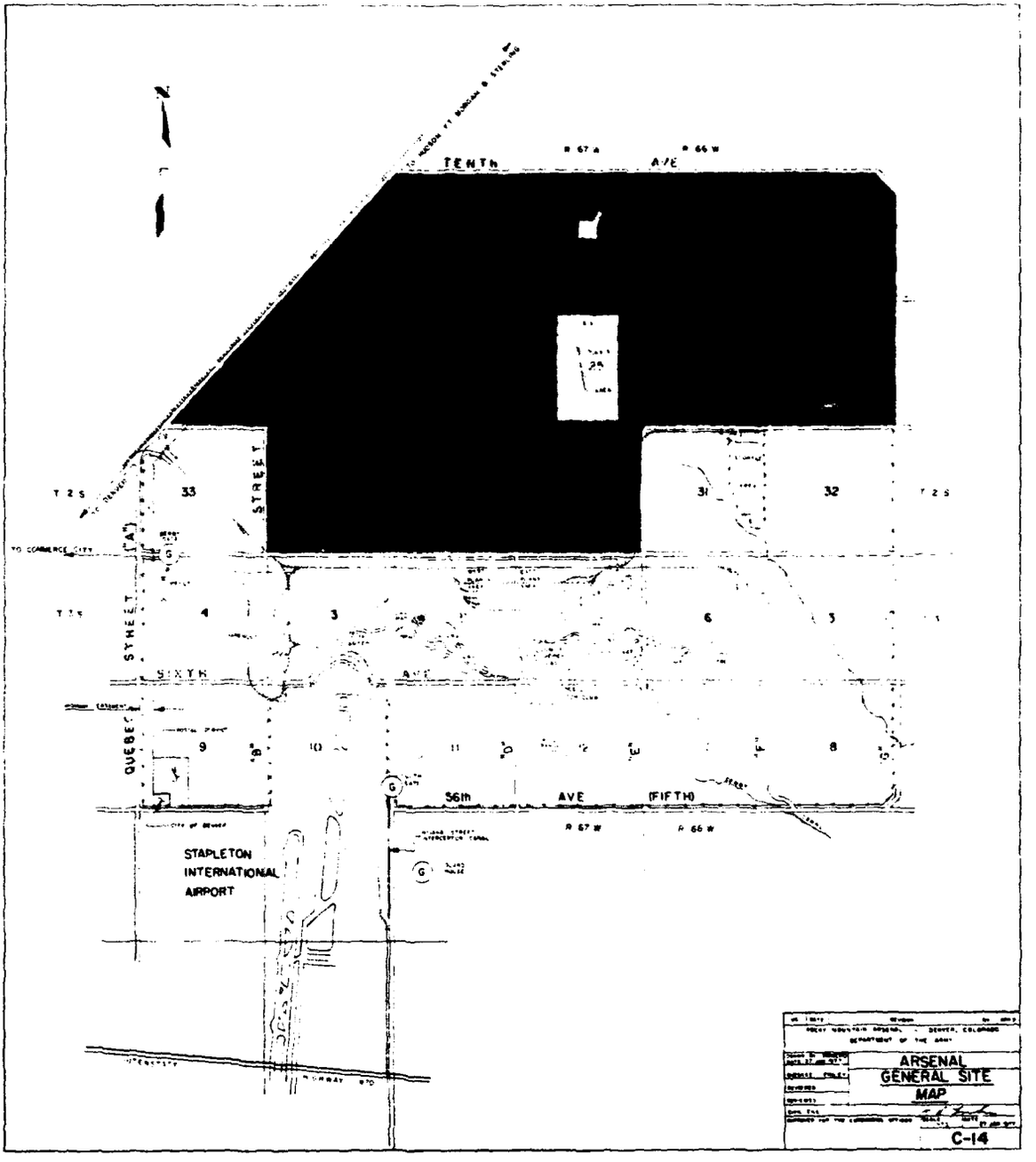

TASK 14 STUDY AREA

RI SUMMARY

Task Number:	15	**Date:** 2/18/88
Task Name:	Army Sites South - Phase I Contamination Assessment	
PMO Contact:	Darryl Borrelli	
Medium:	Soil	
Award Date:	January, 1986	
Budget:	$4,181,323	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

Task 15 investigated the extent of soils contamination in the southern portion of Rocky Mountain Arsenal at Army sites and in the portions of section which were outside designated contaminated site boundaries.

Scope-of-Work

Task 15 is a Phase I remedial investigation which consisted of a historical investigation and a soil survey of Sections 3, 4, 5, 6, 7, 8, 9, 11, 12, 31, 32, and 33. The historical investigation was used to determine the past uses of identified source areas and possible additional source areas not previously identified. For the soil survey, soil samples were taken in 11 identified source areas (4-2, 4-3, 4-4, 4-5, 5-2, 6-6, 31-4, 31-6, 31-7, 32-5, and 32-6), and in the portions of the sections listed above which were outside of these identified source areas. These samples analyzed for organic and inorganic (metal) analytes, including volatile and semivolatile organic compounds (GC/MS), DBCP (GC), ICP metals, mercury, arsenic (AA), organophosphorous pesticides (GCNPD), and army agent degradation products. Not all samples were analyzed by all methods. Samples analyzed from outside identified source areas were generally composites of the 0 to 1 and 4 to 5 ft intervals of a single boring.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
Technos, Inc.	-	geophysics
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying
UXB	-	ordnance sites

0086R
Rev. 2/18/88

Reports

	RIC#	Date Produced
Technical Plan, Draft Final	87007R40	06/86
Technical Plan, Final		ongoing

Contamination Assessment Reports:

Site	Name	RIC#	Date Produced
3-UNC	Uncontaminated Areas	87217R02	08/87*
4-UNC	Uncontaminated Areas	87217R03	08/87*
4-2	Burning Pit	87197R03	06/87*
4-3	Burning Pit		ongoing
4-4	Burning Pits		ongoing
4-5	Borrow Pit	87217R01	07/87*
5-UNC	Uncontaminated Areas		ongoing
5-2	Potential H/HD Contamination		ongoing
6-UNC	Uncontaminated Areas		ongoing
6-6	Former Toxic Gas Storage Yard		ongoing
7-UNC	Uncontaminated Areas	87097R03	04/87*
8-UNC	Uncontaminated Areas	87097R04	04/87*
9-UNC	Uncontaminated Areas	87097R05	04/87*
11-UNC	Uncontaminated Areas	87216R10	07/87
12-UNC	Uncontaminated Areas	87216R11	07/87
31-UNC	Uncontaminated Areas	87097R07	04/87*
31-4	New Toxic Gas Storage Yard		ongoing
31-6	Storage Sheds		ongoing
31-7	Storage Sheds		ongoing
32-UNC	Uncontaminated Areas		ongoing
32-5	Burning Pits		ongoing
32-6	Burning Pits		ongoing
33-UNC	Uncontaminated Areas		ongoing

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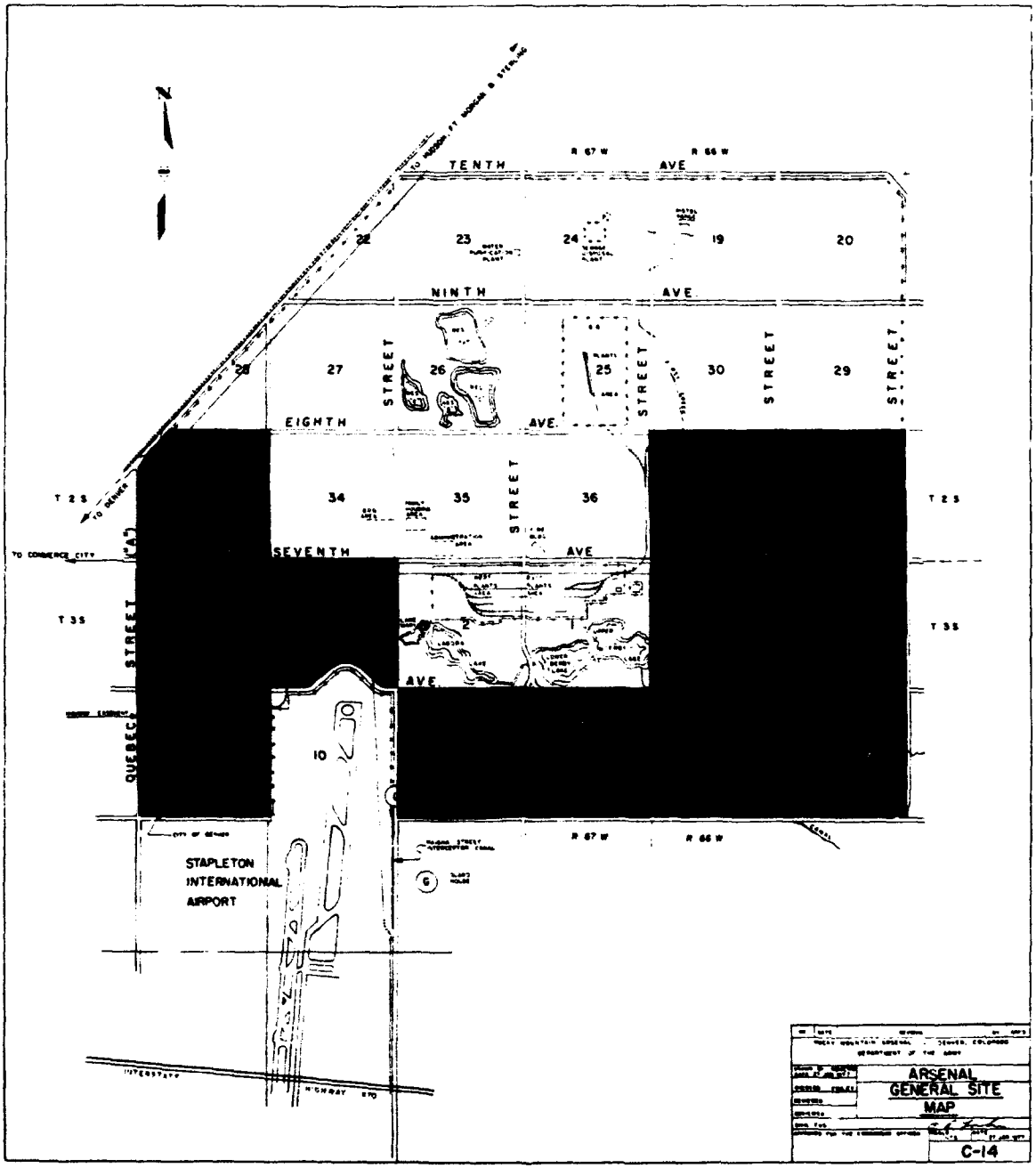
0086R
Rev. 2/18/88



TASK 15 STUDY AREA

RI SUMMARY

Task Number:	18	**Date:** 02/21/88
Task Name:	Air Quality	
PMO Contact:	Bill Trautmann	
Medium:	Air	
Award Date:	Fall 1985	
Budget:	$500,000 with modification	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

Evaluation of air quality and meteorological parameters to define current conditions at RMA and to anticipate potential problems during future remedial actions.

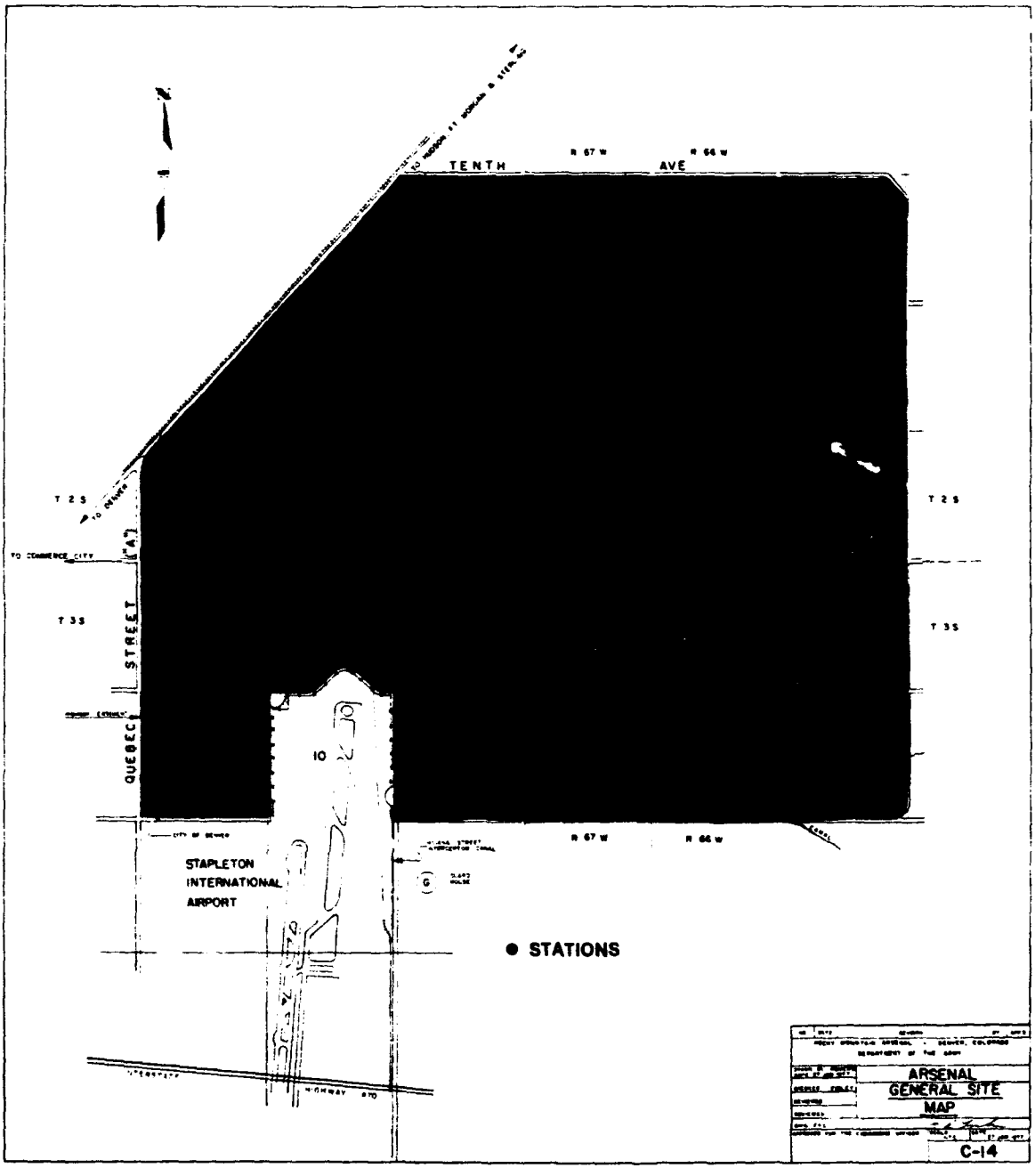
Scope-of-Work

Air quality parameters were monitored at 12 stations for TSP, PM-10, asbestos, VOC, SVOC, and metals. Meteorological parameters were monitored at three stations for wind speed and direction, atmospheric stability, temperature, pressure, and precipitation. These parameters were monitored for one year (see figure for station locations).

Consultants

None

Reports	**RIC #**	**Date Produced**
Technical Plan, Draft Final	86238R07	5/86
Technical Plan, Final		2/87
Air Medium Report		ongoing



TASK 18 STUDY AREA

RI SUMMARY

Task Number:	19	**Date:**	02/21/88
Task Name:	Phase II Survey Sections 26 and 35		
PMO Contact:	Darrel Smith		
Medium:	Soil		
Award Date:	September 30, 1986		
Budget:	$1.2 million		
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)		

Objectives

Task 19 is designed to complement the Task 6 (Phase I) soil investigation of Sections 26 and 35 (see figure). During Task 6, chemical analysis of sediment samples from soil borings at discrete contaminated sites (basins, associated ditches, deep injection well) and "uncontaminated" areas identified isolated points of potential contamination and provided enough data to roughly estimate the volume of potentially contaminated soil at each site. Task 19 will allow for more precise quantification and characterization of the contamination present at each site. Soil borings will be drilled and sampled at each site in areas where Phase I data were not collected or are incomplete. All samples will be analyzed by Phase II methods which yield lower detection limits.

Scope-of-Work

Task 19 is the Phase II continuation of Task 6. This investigation will include a survey of soil contamination at discrete sites and the installation of ten alluvial ground water monitoring wells in Sections 26 and 35. The sites to be addressed are: 26-1 (Deep Injection Well), 26-3 (Basin C), 26-4 (Basin D), 26-5 (Basin E), 26-6 (Basin F), 35-4 (Basins A-B-C Drainage Ditches), 35-3 (Basin B), and possible point sources in "uncontaminated" areas of Sections 26 and 35 (26-UNC and 35-UNC).

Soil samples will be collected at each site from continuous hollow-stem auger borings. Sample depths will vary from boring to boring according to site geology/hydrology and depths of contamination estimated from Phase I data. Several samples will be obtained at the water table at each site. In addition, 25 surficial soil samples will be taken using hand tools outside of Site 26-6 along prevailing wind vectors. The Task 19 soil sampling program will obtain a total of 669 samples (including the 25 surficial soil samples) from 200 boring locations.

The soil samples will be analyzed by specific Phase II methods for: organochlorine pesticides (GC), organosulfur compounds (GCFP), organophosphorus compounds (GCFPD), ICP metals, arsenic, mercury, purgeable aromatics (GC), DBCP (GC), DCPD, and Army agent degradation products. In addition, selected samples will also be analyzed by Phase I methods for semivolatile and volatile organic compounds.

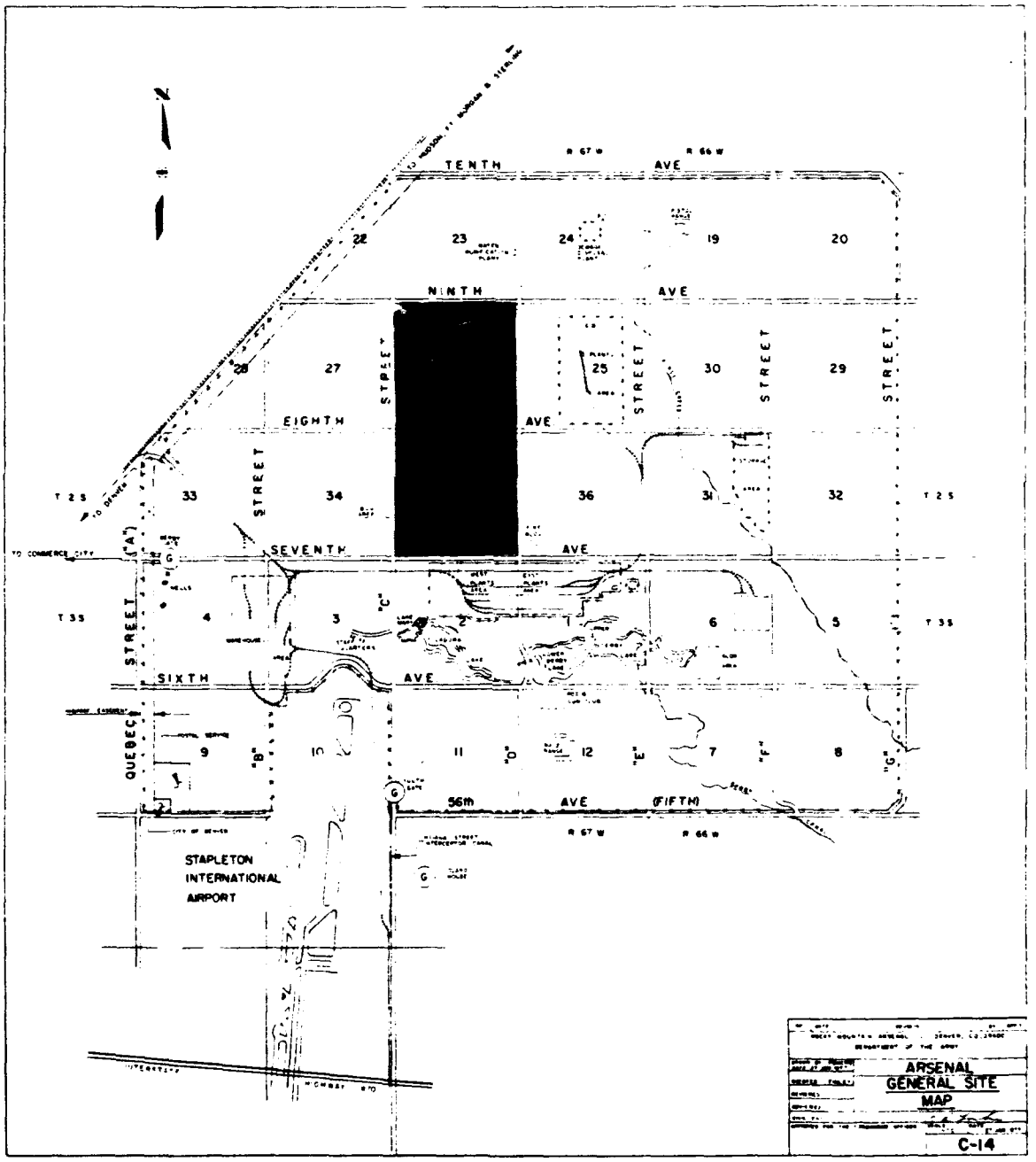
Water samples will be obtained from the 10 alluvial wells to be drilled. Well sites will be located to complement other ongoing ground water investigations. These samples will be analyzed for the standard Phase I compounds including: pesticides, metals, semivolatile and volatile organics, and sulfur compounds.

Consultants

HLA - field Work
Boyles Brothers - drilling
ITECH - surveying

Reports Produced		**RIC_#**	**Date**
Task 6 Contamination Assessment Reports - Phase I:			
Site	**Name**		
26-1	Deep Injection Well		ongoing*
26-3	Basin C		ongoing*
26-4	Basin D	87293R01	10/87
26-5	Basin E	87203R04	7/87
26-6	Basin F		ongoing*
35-3	Basin B	87203R05	7/87
35-4	Basins A-B-C Drainage	87203R06	7/87
26-UNC	Section 26-Uncontaminated Areas		10/87
35-UNC	Section 35-Uncontaminated Areas		ongoing*
Contamination Assessment Reports, Phase II Addenda			ongoing

* - Draft Final



TASK 19 STUDY AREA

RI SUMMARY

Task Number:	20	**Date:** 2/18/88
Task Name:	Lakes Area - Phase II Contamination Assessment	
PMO Contact.	Juan Lopez	
Medium:	Soils, sediments, water	
Award Date:	September, 1986	
Budget:	$1,139,426	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

The Task 20 Phase II investigation will verify and correlate Tasks 7 and 12 Phase I soil sampling results in the Lower Lakes Region and other miscellaneous areas of RMA , such as landfills, ditches, and sewage treatment plants in Sections 1, 2, 3, 24, and 30. The Phase II investigation will revisit most of the contaminated and uncontaminated areas identified and investigated under Tasks 7 nd 12. Phase II investigations will further define soil contamination in sites or areas investigated under Tasks 7 and 12. This information will be used to estimate the volume of contaminated soil in these areas.

Scope-of-Work

Task 20 is the Phase II investigation in the Lower Lakes Region and miscellaneous areas of RMA, and is a follow-on program to the Phase I investigations for Tasks 7 and 12. As of this date, 12 sites have been identified as contaminant sources and were sampled in Task 20. These sites are: 1-1, 1-9, 2-1, 2-17, 24-6, 30-4, 1-UNC, 1-2, 1-12, 6-2, 11-1, and 12-2. Sites 3-4, 3-2/3-3, 12-1, 24-7, and 1-6 are ongoing programs and have not yet been investigated under Task 20.

A total of 224 borings will or have been drilled. In addition, 3 trenches were excavated at Site 1-12, yielding 3 additional samples. A soil gas survey to investigate the source of a benzene plume (Sites 1-9 and 1-11) will be performed.

The soil samples are being analyzed for compounds such as volatile and semivolatile organics (GC/MS), hydrazine (SPECT), ICP metals, arsenic and mercury (AA), volatile halogenated organics (GCCON), organochlorine pesticides (GCEC), Army Agent degradation products, dibromochloropropane (GC), and hydrocarbons (GC/FID). Additional analyses will be conducted in the lakes region sediments for the following: total organic carbon, particle size analyses, percent moisture, pH, electrical conductance, and redox potential.

0086R
Rev. 2/18/88

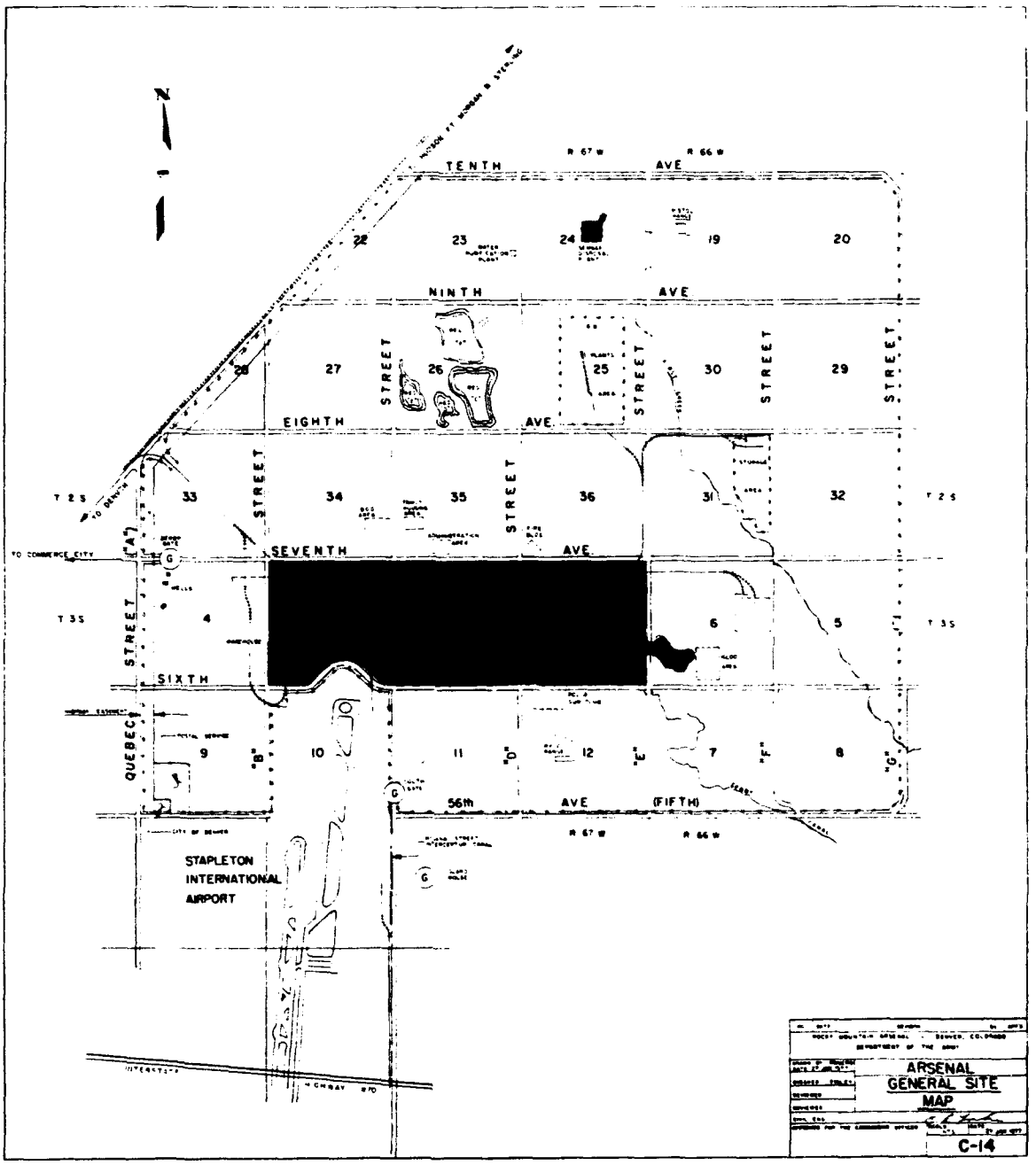
Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Earth Technology Corporation	-	physical lab analyses
PETREX, Inc.	-	soil gas lab analyses
Professional Service Industries, Inc. (PSI)	-	lakes drilling
ITECH	-	surveying

Reports

	RIC#	Date Produced
Technical Plan, Draft Final		09/87
Technical Plan, Final		ongoing
Phase II Addendums		ongoing

0086R
Rev. 2/18/88



TASK 20 STUDY AREA

RI SUMMARY

Task Number:	21	**Date:** 02/21/88
Task Name:	Phase II Survey of Army Sites North	
PMO Contact:	Darryl Borrelli	
Medium:	Soil	
Award Date:	September 30, 1986	
Budget:	$1.59 million	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

Task 21 is designed to complement the Task 14 (Phase I) soil investigation of the northern sections of RMA (see figure). This task provides technical support in the form of a final (white cover) document for each site investigated under Task 14. Task 21 will further define the extent of contaminated areas as well as provide volume estimates of potentially contaminated soil. Soil borings will be drilled and sampled at each site in areas where Phase I data were not collected or are incomplete. All samples will be analyzed by Phase II methods which yield lower detection limits.

Scope-of-Work

Task 21 will incorporate Task 14 results and includes a survey of soil contamination at 12 sites: 29-4, 30-1, 30-3, 30-5, 30-6, 35-2/26-9, 35-7, 36-2, 36-6, 36-9, 36-18, and 36-19. The "uncontaminated" areas of Sections 20, 23, 25, 29, and 30 (20-UNC, 23-UNC, 25-UNC, 29-UNC, and 30-UNC) will also be investigated further. Approximately 292 samples from 140 borings are proposed for chemical analyses, consisting of arsenic, mercury, ICP metals, organochlorine pesticides, DIMP, DCPD, thiodiglycol (mustard degradation product), IMPA (GB degradation product), and volatile and semivolatile organics depending on the site. Additional physical investigations are proposed for trenching programs for possible unexploded ordnance, as well as installation of six monitor wells in the vicinity of Section 25. The boring and chemical analysis procedures follow the approved QA/QC, safety, data management, contamination assessment, and management plans. Final CARs will be prepared for each Task 14 site.

Consultants

HLA - field work
MRI - chemical Analysis
Fox - drilling
Boyles Brothers - drilling
ITECH - surveying

Reports		RIC_#	Date Produced
Task 14 Contamination Assessment Reports - Phase I:			
Site	**Name**		
19-1	Burn Site, Incendiaries	87204R02	ongoing*
20-1	Burn Site, Incendiaries	87204R03	ongoing*
26-9/35-2	Chemical Sewer		ongoing*
29-1	Burn Site, Incendiaries	87204R06	ongoing*
29-4	Disposal Site for Explosive and Incendiaries		ongoing*
29-5/32-1	Bomb Site for Explosive and Incendiaries	87204R07	ongoing*
30-1/30-7	Impact Area/Ground Disturbance	87204R08	ongoing*
30-2	Burn Site, Incendiaries	87204R09	ongoing*
30-3	"H" Training Area		ongoing*
30-5	M-34 Demilitarization Operation Area	87254R01	ongoing*
30-6	Liquid Disposal Trenches	87204R10	ongoing*
35-6	Possible Munitions Test Area	87204R11	ongoing*
35-7	Firing Range		ongoing*
36-2	Munitions Test Area and Site Incendiary Drop		ongoing*
36-6	Possible Test Site with Trench		ongoing*
36-9	Incendiary or Munitions Test Area		ongoing*
36-13	Trenches	87204R14	ongoing*
36-14	Mustard Plant Disposal Site	87254R02	ongoing*
36-16	Incendiary Burial Site		ongoing*
36-18	Possible Trench Disposal Sites		ongoing*
36-19	Ground Scars, History unknown	87224R01	ongoing*
19-UNC	Section 19, Uncontaminated Areas	87204R01	ongoing*
20-UNC	Section 20, Uncontaminated Areas		ongoing*
22-UNC	Section 22, Uncontaminated Areas	87204R04	ongoing*
23-UNC	Section 23, Uncontaminated Areas		ongoing*
24-UNC	Section 24, Uncontaminated Areas	87224R02	ongoing*
25-UNC	Section 25, Uncontaminated Areas		ongoing*
27-UNC	Section 27, Uncontaminated Areas	87204R12	ongoing*
28-UNC	Section 28, Uncontaminated Areas	87204R05	ongoing*
29-UNC	Section 29, Uncontaminated Areas		ongoing*
30-UNC	Section 30, Uncontaminated Areas		ongoing*
34-UNC	Section 34, Uncontaminated Areas	87204R13	ongoing*
Contamination Assessment Reports, Phase II Addenda			ongoing

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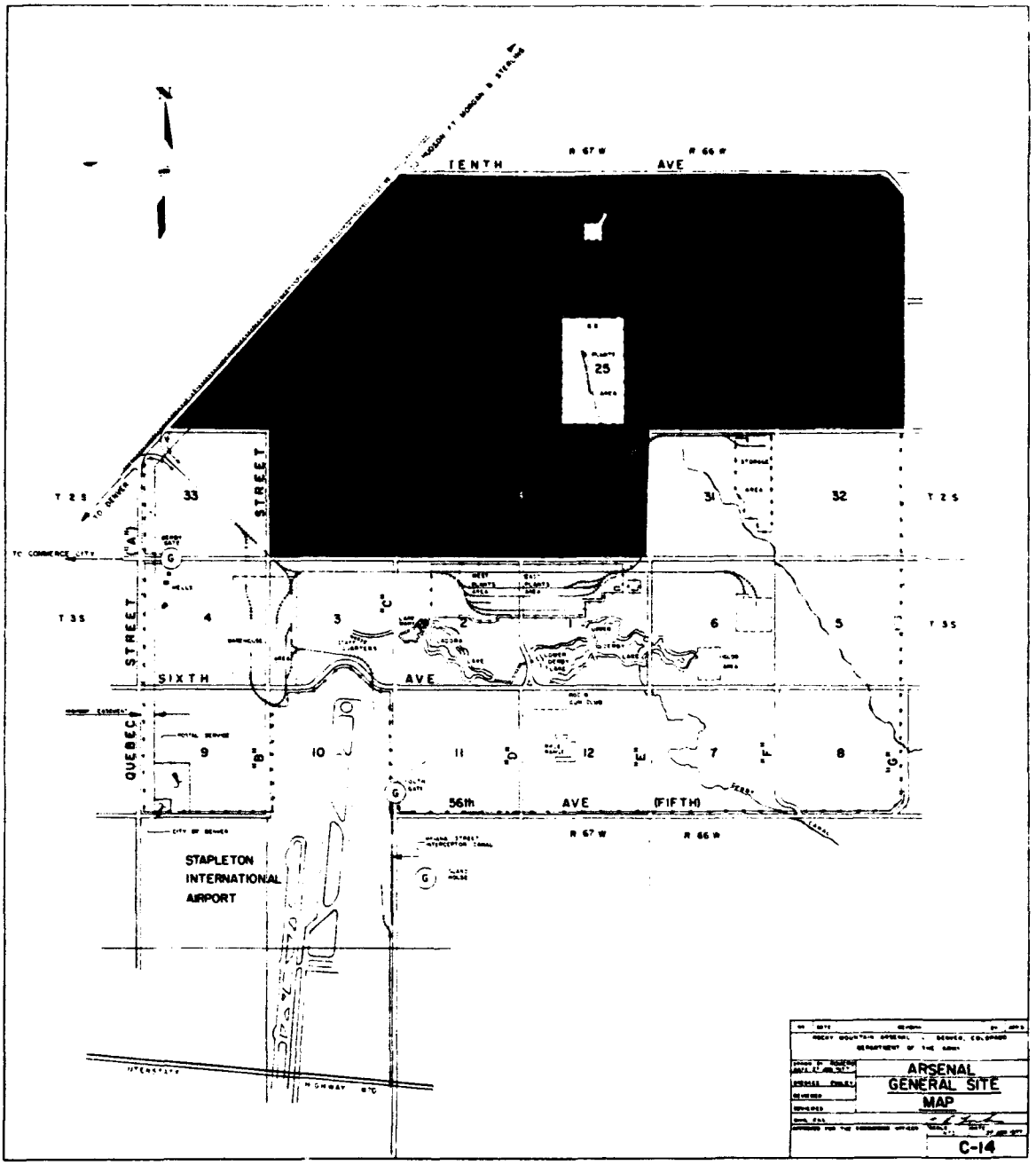


TASK 21 STUDY AREA

RI SUMMARY

Task Number:	22	**Date:** 2/18/88
Task Name:	Army Sites South - Phase II Contamination Assessment	
PMO Contact:	Darryl Borrelli	
Medium:	Soils	
Award Date:	September, 1986	
Budget:	$1,731,369	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

Task 22 is continuing the investigation of source areas and sections initially investigated under Task 15, as deemed necessary after review of the Task 15 Phase I results. This continued investigation will be used in the Regional Study Area Reports to futher define the extent of contamination and estimate the volume of potentially contaminated soil.

Scope-of-Work

Task 22 is a Phase II remedial investigation. It is a further investigation of those areas investigated under Task 15 (identified source areas and remaining portions of Sections 3, 4, 5, 6, 7, 8, 9, 11, 12, 31, 32, and 33) as required based on the results of the Phase I investigation.

The Task 22 field program includes soil borings, geophysical reconnaissance, and trenching. Soil samples are being analyzed for volatile and semivolatile organics (GC/MS), ICP metals, mercury and arsenic (AA), organochlorine pesticides (GCEC), organophosphorous pesticides (GCNPD), army agent degradation products, volatile aromatic compounds (GCPID), and volatile halogenated compounds. Not all samples will be analyzed by all methods.

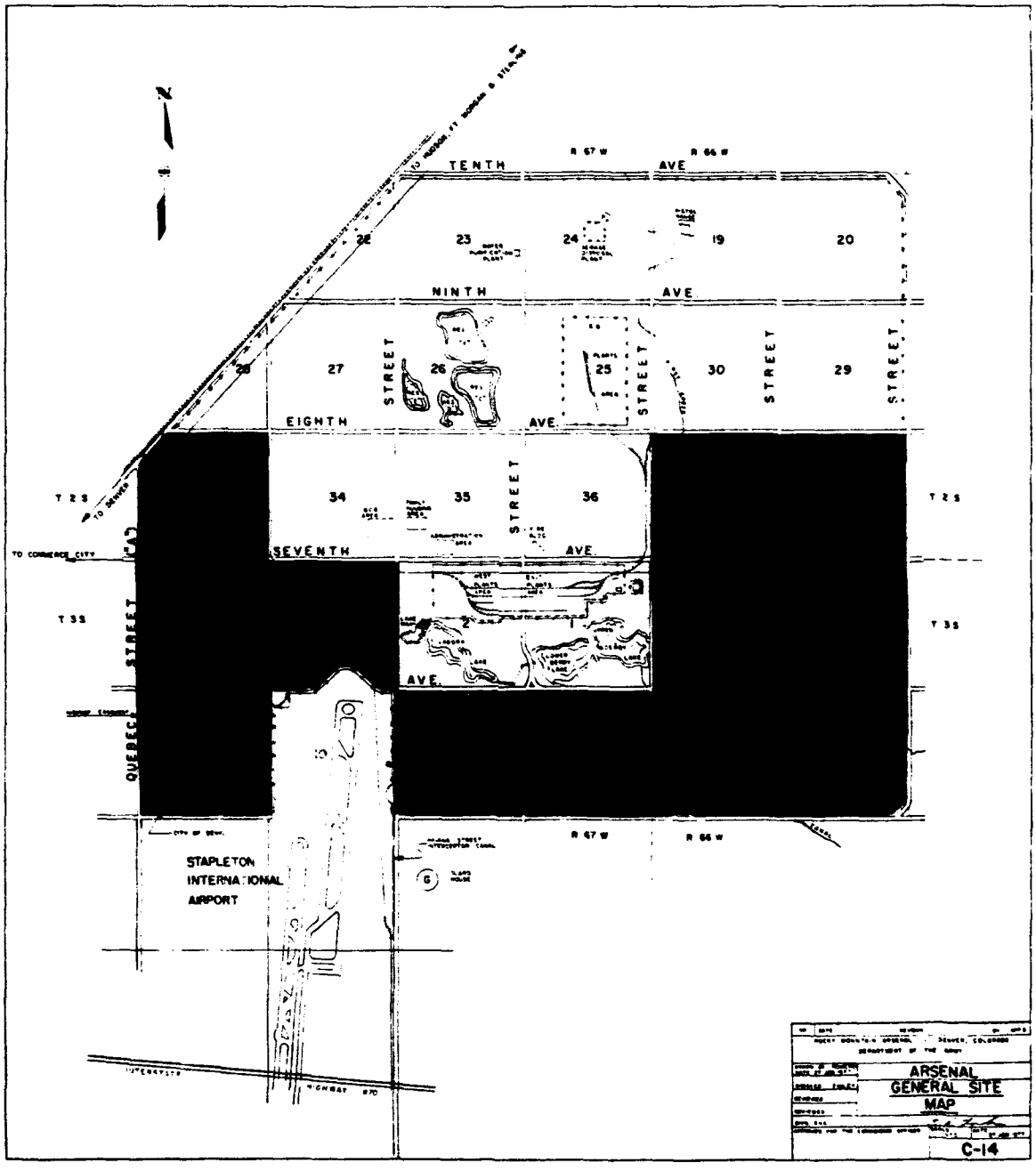
Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying

Reports

	RIC#	Date Produced
Phase II Addendums		ongoing

0086R
Rev. 2/18/88



TASK 22 STUDY AREA

RI SUMMARY

Task Number:	23	**Date:**	02/21/88
Task Name:	Overall Soils/Ground Water Integration		
PMO Contact:	Kevin Blose		
Medium:	Soils, Water		
Award Date:	September 23, 1986		
Budget:	$626,007 with modifications		
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)		

Objectives

Task 23 will develop the methodology to integrate soil/ground water/surface water results and coordinate this integration among the various study area reports. Semiquantitative methodologies to describe contaminant flux from soil sources to ground water, as well as contaminant transport and attenuation mechanisms in ground water will be investigated. The requirements of the EA and FS will be coordinated with preparation of RI work products.

Scope-of-Work

Task 23 will compile and evaluate soil and water data on an arsenal wide and study area basis in conjunction with other RI tasks. Critical sites will be identified and segregated for further detailed investigation. Coordination with the EA and FS groups will allow evaluation of the adequacy of existing data and the respective impacts of any data deficiencies. Recommendations regarding the technical feasibility of collecting data desired by these groups will be provided. Special work products, such as the CAR Introduction and the revised site map will be generated in support of the study area investigations.

The purpose of the task is to provide a means to relate soil and ground water contaminant concentrations and to devise an empirical approach for describing contaminant migration. Best professional judgement and reasonable assumptions will be used to generate a conceptual understanding of contaminant transport. A complex, numerical contamination transport model is not envisioned. Methods of evaluating and describing contaminant occurrence and transport in the unsaturated and saturated zones will be developed. These methodologies will rely on a generally simplified approach, and will attempt to provide a relatively uniform mechanism for integrating soil and water contaminant assessment results into a comprehensive RI. Requirements of the EA and FS groups will be an essential factor in determining the nature of the soil-water integration. Task 23 will provide support to the groups assembling RMA study area reports by assisting in the assembly, presentation, and interpretation of soil and water data. This interpretive process must be directed towards addressing the needs of eventual site remediation and documentation of the processes leading to the ROD.

Previous investigations at RMA and other contaminated sites have demonstrated the difficulty in simulating contaminant migration in a quantitative manner. Efforts to quantify contaminant flux at RMA would be costly and time consuming, and would be likely to yield little useful information. The quantification process would be useful in establishing the uncertainty of parameters such as partition coefficients, but the range of uncertainty is likely to be so large as to preclude accurate conclusions. In addition, one generalized approach would not be appropriate for all sites, nor would all sites require similar expenditure of effort. Those sites exhibiting unsaturated zone contamination down to the water table would require most intensive investigation, while those sites with low level or undetectable surface contamination would require minimal integration effort. Sites will require categorization and prioritization for Task 23 investigation based on existing contamination assessment results and the requirements of the FS.

The inadequacy of a quantitative evaluation of contaminant flux has led to semiquantitative descriptions of contaminant migration potential. For instance, contaminants could be ranked in terms of high, medium, and low Henry's Law coefficients or affinities for soil organic carbon. Similarly, sites could be ranked by factors such as unsaturated zone contaminant proximity to the water table and relative permeability of soils. Semiquantitative ranking schemes such as these could then be combined and used to evaluate the potential for contaminant leaching at sites of interest. The relative mobility of contaminants in the unsaturated zone would also be described in a semiquantitative manner. Relative affinity of dissolved contaminants for the solid aquifer matrix is an important consideration in the evaluation of no-action alternatives and remedial system design life.

Consultants

HLA - development of methodology, report preparation
EBASCO - development of methodology, report preparation
Stollar & Associates - development of methodology, report preparation
Geraghty & Miller - development of methodology, report preparation

Reports	**RIC_#**	**Date_Produced**
Technical Plan, Draft Final		ongoing
Technical Plan for Determination of Partition Coefficients	87013R10	10/86
Determination of Partition Coefficients for the Primary Contaminant Sources of Section 36, Interpretive Report		ongoing

RI SUMMARY

Task Number:	24	**Date:**	2/18/88
Task Name:	Structures Survey and Army Spill Sites, Phase I Contamination Assessment		
PMO Contact:	Darryl Borrelli		
Medium:	Buildings, structures, soils, liquids		
Award Date:	September, 1986		
Budget:	$947,044		
Prime Contractor:	Ebasco Services Incorporated		

Objectives

The objectives of the Structure Survey portion of Task 24 is to develop physical inventories of all structures on RMA, estimate the volume of materials contained in the structures, and assess the nature of contamination in RMA structures based primarily on historical research. The objective of the Army spill sites portion of Task 24 is to conduct Phase I investigations of reported Army spill sites at RMA additional to those investigated under other tasks. No Phase II investigations are planned.

Scope-of-Work

Task 24 (Structures) has verified the location and physical description of all structures on RMA through literature searches, examination of aerial photography, and field reconnaissance. It has prepared updated Basic Information Maps and built a database containing basic physical information, use, status and contamination classification for each structure. Ongoing work includes preparing uniform profiles of each building and tank emphazing history of ownership, use, and associated chemicals. The task has also assigned contamination classifications for buildings and tanks based on the history of use, provided quantitative volume estimates of materials comprising the structures, and provided an estimate of the volume of asbestos present in RMA structures. Limited sampling of standing liquid in structures and of materials suspected of containing asbestos was conducted.

Task 24 (Spills) includes the compilation of historical information regarding potential soil contamination associated with 41 possible Army spill sites, 39 in the South Plants area of Sections 1 and 2 and 2 in the North Plants area of Section 25. Soil borings and soil gas investigations have been conducted where historical information indicates a likelihood of soil contamination.

Twenty-nine of these sites were identified in a letter dated May 1985 by Shell Chemical Company to the Army; additional sites were identified through research conducted by Ebasco.

0086R
Rev. 2/18/88

The following table lists the 21 sites actually sampled and the studies conducted under Task 24 (Spills). Site numbers are those originally listed in the Shell letter (Sites 1-29); for additional sites identified by Ebasco, the Shell numbering system has been continued in sequence (Sites 30-41).

Army Spill Site No.	Location	Study
2	Section 1; Building 513 and unlined basins north of Building 512.	Phase I soils
5	Section 1; Lewisite production area (includes Buildings 511, 512, 514, 515, and 516 and surrounding areas).	Phase I soils
6	Section 1; an area west Buildings 536 and 537.	Phase I soils
7	Section 1; northeast of Building 536 and south of Building 537.	Phase I soils
8	Section 1; area between Buildings 514 and 529.	Phase I soils
9	Section 1; area south of Building 732.	Phase I soils; soil gas
10	Section 1; Building 753.	Phase I soils
12	Section 1; holding pits outside of Building 522; M-1 settling ponds (Army Spill Site No. 2); Building 514 (SO_2 disposal plant).	Phase I soils
13	Section 1; arsenic trioxide storage silos 523C, 523D, 523E, 523F, 523G, and associated conveyance and loading areas.	Phase I soils
14	Section 1; mustard decontamination pits, Buildings 417 and 427.	Phase I soils
15	Section 1; decontamination pit near the southeast corner of Building 514.	Phase I soils

0086R
Rev. 2/18/88

Army Spill Site No.	Location	Study
16	Section 1; laundry and clothing treatment facility (Building 314), unlined surface ditch east of Building 314.	Phase I soils
17	Section 1; Building 313 and open ditch east of Building 313.	Phase I soils
18	Section 1; areas in and around the maintenance shops (Buildings 533 and 534).	Phase I soils; soil gas
19	Section 1; areas in and around the heavy industrial equipment renovation facilities in Building 751.	Phase I soils
20	Section 1; flow from caustic tank east of Building 536 into drainage ditch west of the tank.	Phase I soils
25	Section 1; drainage ditch north of Building 541.	Phase I soils
29	Section 1; former settling basin now beneath Building 523.	Phase I soils
37	Section 1; ditch beginning of SE corner of Building 742.	Phase I soils
40	Section 1; between Buildings 512 and 514.	Phase I soils (includes 3 trenches)
41	Section 2; chlorine plant (locations to be determined).	Phase I soils

Analytical parameters for Phase I soil samples are volatile and semivolatile organics (GC/MS), ICP metals, mercury and arsenic (AA), and thiodiglycol.

0086R
Rev. 2/18/88

Consultants

R.L Stollar and Associates	-	field work, reports, structure histories
Custom Auger	-	drilling
Phoenix Safety	-	field health & safety
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
ESE	-	chemical analyses
QC Data	-	GIS/AutoCAD RMA map updating
ITECH	-	surveying
MTA Remedial Resources, Inc.	-	field work
EHRT	-	earth moving
Target Environmental Services	-	soil gas

Reports

	RIC#	Date Produced
Spills		
Technical Plan, Draft Final	87007R18	01/87
Technical Plan, Final		ongoing
Structures		
Technical Plan, Draft Final		02/87
Technical Plan, Final		ongoing
CAR, Volume I		ongoing
CAR, Volume II		ongoing
CAR, Volume III		ongoing

0086R
Rev. 2/18/88

RT SUMMARY

Task Number:	25	**Date:** 02/21/88
Task Name:	RMA Boundary Systems Monitoring	
PMO Contact:	Brian Anderson	
Medium:	Water	
Award Date:	July 1986	
Budget:	$4.5 million with modifications	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

The objectives of Task 25 are to monitor ground water flow and contaminant transport in and around the North and Northwest Boundary Containment Systems, to define contaminant pathways in these areas, and to provide chemical and hydrologic data for the operation of the North and Northwest Boundary Containment Systems (see figure). The Irondale Containment System will be monitored by Shell Chemical Company. The means by which the objectives of Task 25 will be achieved are set forth in Section 1.4 of the Task 25 Technical Plan (RIC#87 14R24).

Scope-of-Work

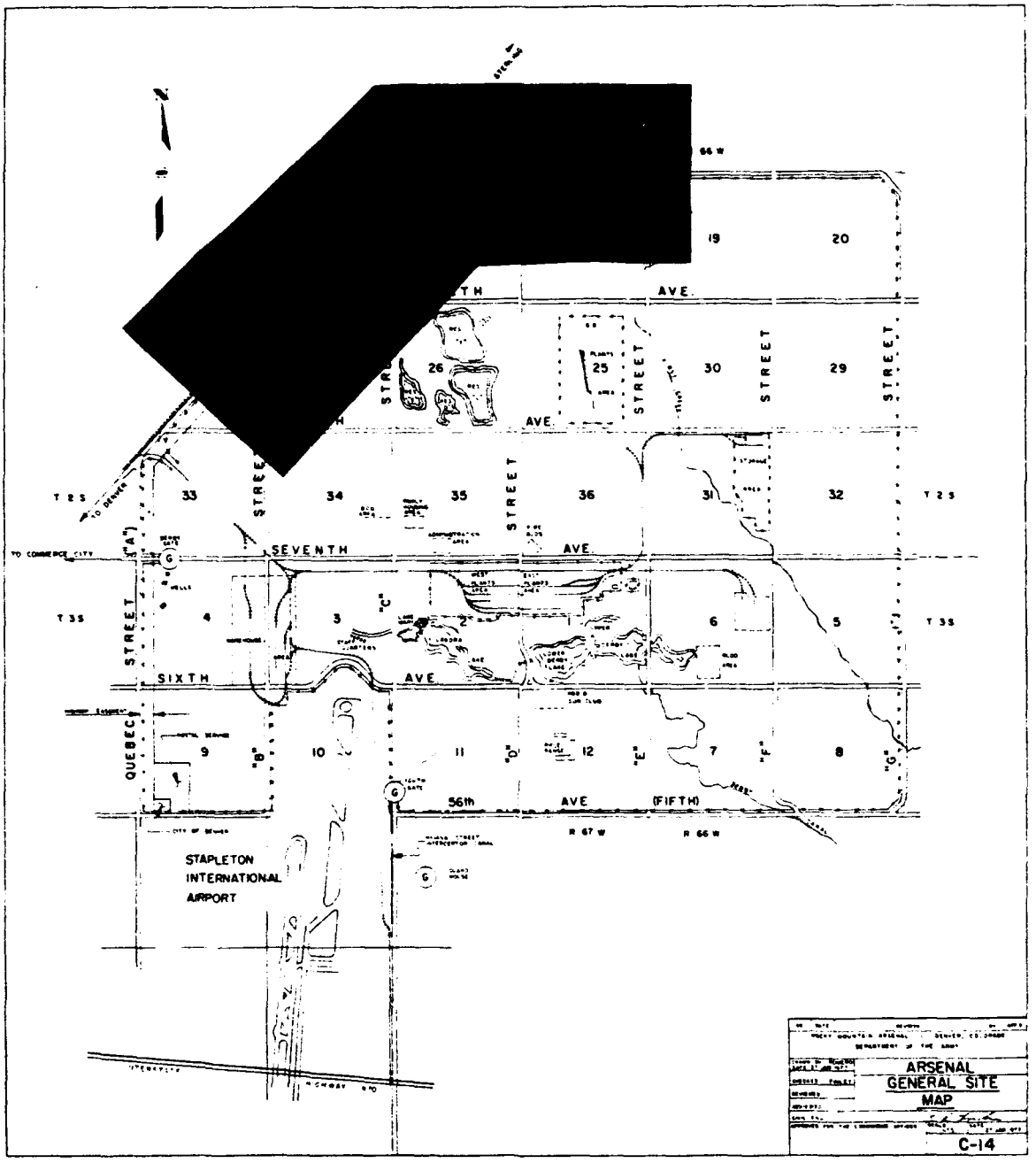
The scope-of-work for Task 25 includes:

- o A detailed geologic study of the Denver Formation and the alluvial aquifer. This study will entail the construction of isopach maps, cross sections, structure contour maps, and other types of diagrams. It will attempt to define the geometry and extent of various rock and soil units that may be important to the hydrogeologic framework of the boundary area and the migration of contaminants;
- o Long-term monitoring of wells on a quarterly basis to determine the distribution and concentration of contaminants and the configuration of piezometric surfaces associated with specific aquifers. For the first quarter of sampling which was completed during September 1986, a network of 155 wells was employed to collect chemical data. Water levels were taken from all wells sampled and from an additional 214 wells where no water samples were collected. After an interpretation of the first quarter sampling results, the initial monitor well network may be adjusted to ensure a more complete coverage of the contaminant plumes. This adjustment phase may include the installation of additional monitor wells. Changes in the monitoring network, including any new well installations, will be documented in letter technical plans which will act as amendments to the Technical Plan; and
- o Maps showing contaminants distribution and the configurations of piezometric heads along with pertinent geologic and hydrologic data will be prepared to support the operations of the North and Northwest Boundary Containment Systems enabling them to increase operating efficiencies.

Consultants

HLA - field work
ITECH - surveying
Boyles Brothers - drilling

Reports	**BIC_#**	**Date_Produced**
Technical Plan, Draft Final	87014R24	02/87
Final Report		ongoing



TASK 25 STUDY AREA

RI SUMMARY

Task Number:	32	**Date:** 2/18/88
Task Name:	Waste Handling	
PMO Contact:	Ed Berry	
Medium:	Water, soil, contaminated trash, etc.	
Award Date:	September, 1986	
Budget:	$683,634	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

The objective of Task 32 is to provide technical support to both Ebasco and Environmental Science and Engineering, Inc. to transport from a central location and handle any liquid and solid waste generated as part of the Remedial Investigation Feasibility Study (RI/FS) field efforts at the Rocky Mountain Arsenal (RMA). Rinse wastewater, monitoring well development and purge water, soil cuttings, soil cores, contaminated clothing and other trash will be drummed or boxed, sampled, analyzed, disposed and/or stored according to all applicable State and Federal regulations. In addition, providing, maintaining, and making storage space for the liquid and solid waste will be included in this task. Disposal of all noncontaminated waste generated as part of the RI/FS efforts also will be performed.

Scope-of-Work

Task 32 encompasses all work associated with handling liquid or solid waste generated as part of the RI/FS field efforts. It will provide support to other RI/FS tasks for the collection, identification, storage, and possible disposal of potentially contaminated wastes generated during field activities.

All waste will be stored in drums or bulk holding tanks, sampled and analyzed, and then stored or disposed according to established procedures. The drums will be stored in designated/approved buildings until on-post or off-post disposal sites can be identified. When approval is given, purge water with known contaminant concentrations will be disposed into the appropriate boundary containment system or into the South Plants Laboratory Waste Treatment Facility (SPLWTF) according to influent limitations. All uncontaminated soils and soils which will have contaminant concentration under the final remediation action levels will be disposed into the north section of the RMA sanitary landfill. All other contaminated wastes will be stored until final disposal can be determined. All waste containers will be labeled with generator, task number, drum/tank number, date, contents, section, sites, and well/boring number. Analysis will be performed on all liquid/solid wastes for which no data exists, before storage occurs.

0086R
Rev. 2/18/88

Ebasco will maintain several databases including an existing drum waste inventory, disposed drum waste inventory, disposed purge water inventory, and the chemical analyses of material from bulk holding tanks.

The soil and water samples are being analyzed for the Phase I compounds including: volatile and semivolatile organics (GC/MS), DBCP (GC), ICP metals, mercury, and arsenic (AA), and thiodiglycol (HPLC).

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	labor
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
ITECH	-	surveying

Reports

	RIC#	Date Produced
Technical Plan, Draft Final		March, 1987
Technical Plan, Final		ongoing

0086R
Rev. 2/18/88

RI SUMMARY

Task Number:	35	**Date:** 2/18/88
Task Name:	Endangerment Assessment	
PMO Contact:	Andrew Kingery	
Medium:	N/A	
Award Date:	June, 1986	
Budget:	$955,557	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

The objective of Task 35 is to develop an Endangerment Assessment (EA) for Rocky Mountain Arsenal (RMA) that quantifies the magnitude and probability of actual and potential harm to public health and the environment by threatened or actual release of hazardous substances from the Arsenal under this task the no-action alternative is evaluated throughout the development of cleanup criteria. This assessment will be performed consiatent with CERCLA as amended, the NCP, and the pertinent EPA guidelines for performing an Endangerment Assessment (The Endangerment Assessment Handbook, USEPA 1985a).

The Endangerment Assessment will investigate to what extent the original soil contamination poses a potential threat to human health for the applicable land use scenarios considered.

Scope-of-Work

Under Task 35 existing, ongoing or planned studies within the RMA/RI program of relevance to the EA task will be compiled and integrated. Contaminants will be identified and target constituents will be selected for detailed risk evaluation based on their toxicity, magnitude of concentration and frequency of occurrence at RMA. For these contaminants toxicity profiles will be generated and acceptable intake rates will be computed. A quantitative risk analysis will be performed and "safe" exposure levels computed consistent with applicable exposure pathways and land use. The potential for unacceptable exposure will be determined by comparing site contaminant concentrations to the predicted "safe" levels. Areas where exceedances occur will be designated for consideration for remedial action.

Consultants

Geraghty & Miller, Inc. - reports

0086R
Rev. 2/18/88

Reports

	RIC#	Date Produced
Technical Plan, Draft Final	87097R02	01/87
Technical Plan, Final		ongoing
Contaminant Identification		
Chemical Index		ongoing
Exposure/Toxicity Assessments		
PPLV Methodology as Applied to RMA	87197R04	06/87*
Toxicity Assessment for RMA Target Contaminants	87197R04	06/87*
Land Use Scenario Summary		ongoing
Exposed Population Description		ongoing
PPLVs		ongoing
Source-by-Source Exposure Assessment		ongoing
Risk Characterization		
Documentation of the Uncertainty Analysis Procedures		ongoing
Executable Computer Models and Manuals		ongoing
Probability of Exceedance Curves		ongoing
EA Synthesis Report		ongoing

* - draft final

0086R
Rev. 2/18/88

RI SUMMARY

Task Number:	36	**Date:** 02/21/88
Task Name:	North Boundary System Component Response Assessment	
PMO Contact:	Brian Anderson	
Medium:	Ground Water	
Award Date:	October 1, 1986	
Budget:	$722,634 with modifications	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

Evaluate the adequacy of the dewatering and recharge components of the North Boundary System (see figure) through a review of the operational data, performance testing of the components, and evaluation of additional geotechnical data. Assess the configuration of the Denver Formation sandstones and evaluate their hydrologic characteristics, especially in the area of the Pilot System, through the acquisition and evaluation of additional geologic and hydrologic data. Assess the physical condition of the soil-bentonite barrier through in-situ and laboratory testing, especially in areas suspected of having problems. The testing will consider physical and chemical degradation of the wall. Assess the adequacy of the carbon-adsorption type treatment system to effectively remove contaminants to appropriate cleanup goals through the analysis of effluent water samples.

Scope-of-Work

Task 36 will further characterize the geologic regime in the vicinity of the NBCS using data from previous investigations and additional data to be collected as part of this task. Where historical data is lacking, additional soil borings will be constructed and soil and rock samples collected. Particular attention will be directed to the areal extent and position of Denver sand units.

In addition to the geologic characterization, a hydrologic evaluation will be performed using primarily water level and quality data. Much of this data is being collected as part of the regional Water Quality/Water Quantity Survey (Tasks 4 and 44) and the Boundary System Monitoring (Task 25) task. To complement the information available from these tasks and fill data deficiencies, the scope-of-work includes installation, development, and sampling of new ground water monitoring wells in selected locations. As these new wells are completed and developed, they will be sampled for water quality parameters to aid in the identification of other locations for which monitoring wells may provide valuable information and will be sampled in coordination with Tasks 25 and 44 sampling events to provide integrated data sets.

Using the data described above, an assessment of the hydrologic conditions in the vicinity of the NBCS will be performed. This will include an assessment of both dewatering and recharge components of the NBCS and the hydrologic relationship between saturated portions of the alluvium and the Denver Formation, using such tools as the ground water management flow model developed by Jim Warner.

The carbon-adsorption type water treatment plant will be evaluated to ensure that contaminants intercepted can be treated to appropriate cleanup goals. This evaluation will include the analysis of effluent water samples for water quality. In addition, turbidity tests on the effluent water will be conducted to evaluate what effect carbon fines may have on plugging of the recharge wells.

To complete the assessment of the NBCS, the Task 36 scope-of-work will include an evaluation of the physical condition, integrity, and hydrologic properties of the soil-bentonite barrier. Samples of the barrier will be collected and subjected to both physical and hydrologic testing. This data in conjunction with results of the geologic and hydrologic assessment should allow evaluations of the effectiveness of the barrier.

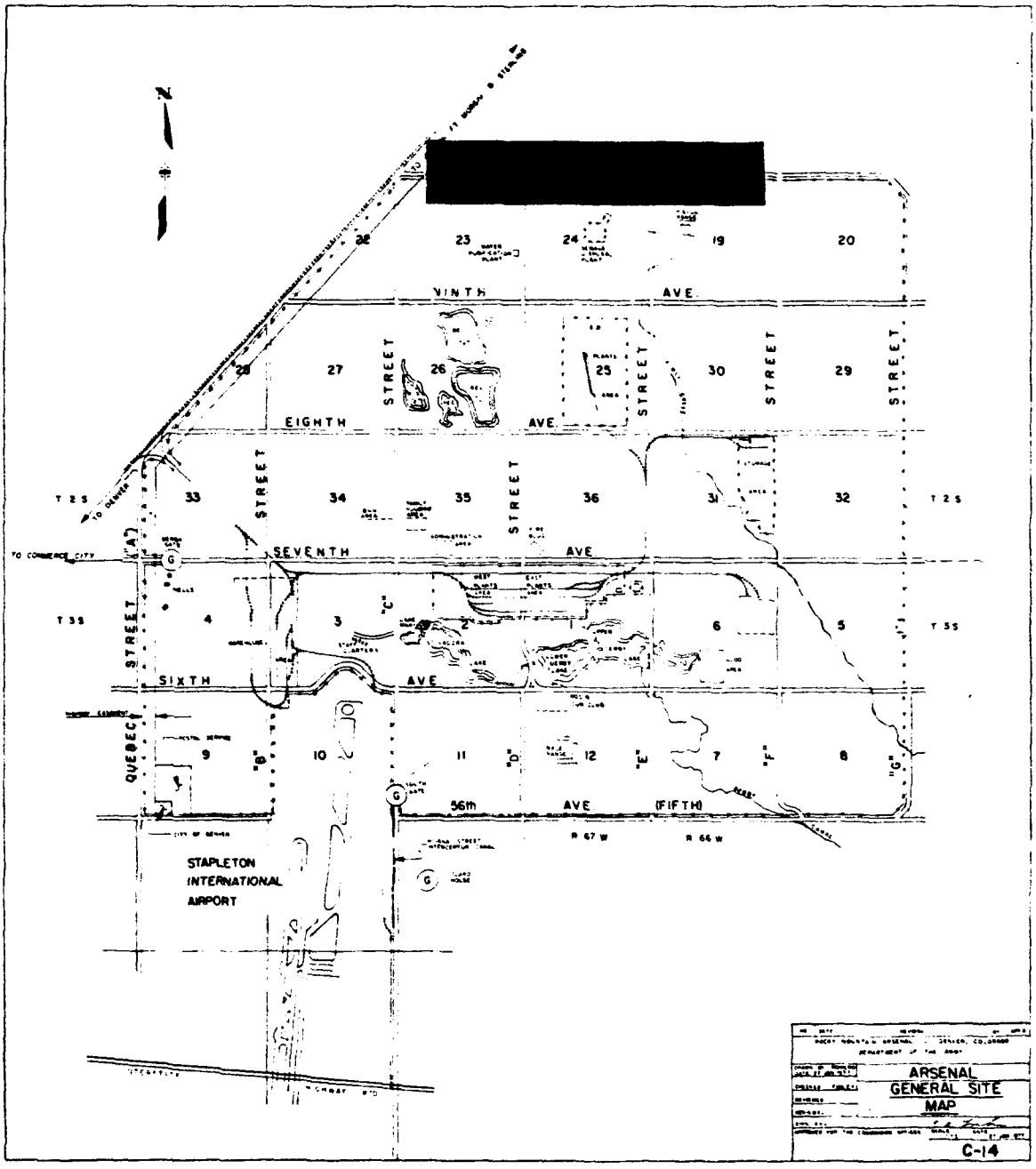
Upon completion of data assessment, conceptual response actions which may enhance system performance will be developed and evaluated. These actions may include physical modification to the NBCS and/or modifications to the NBCS operational procedures.

Consultants

Jim Warner (Colorado State University) - modeling of the North Boundary System

HLA - hydrologic and geochemical assessment and review of reports and Technical Plan

Reports Produced	**RIC_#**	**Date**
Technical Plan, Draft Final	87014R25	3/87
Technical Plan, Final		ongoing
Response Actions		forthcoming



TASK 36 STUDY AREA

RI SUMMARY

Task Number:	38	**Date:** 2/18/88
Task Name:	Western Tier TCE Study	
PMO Contact:	Charlie Scharmann	
Medium:	Soils, water	
Award Date:	July, 1986	
Budget:	$1,361,952	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

The objectives of Task 38 are to perform field and literature investigations of the Western Tier of RMA in order to support current litigation between the United States and the state of Colorado; determine the source(s), if any, of TCE in the Western Tier of RMA; if a source exists, define the contaminant plume between the source and the RMA boundary; and estimate the precent contribution of TCE concentration from RMA to the offpost South Adams County TCE contamination.

Scope-of-Work

Task 38 includes the compilation of all historical information regarding TCE storage and usage in the western third of the arsenal, sampling of 36 soil borings, installation of 32 groundwater monitoring wells, 2 separate soil gas surveys, a geophysical program, water level measurements from 45 wells, and groundwater sampling. Site 4-6 was also investigated under Task 38.

Petrex static tube soil gas samplers were placed at about 1,000 locations throughout the Western Tier. 256 Tracer Research soil gas samples were collected and analyzed for TCA, TCE, and PCE. 27 of these were analyzed for benzene, toluene, ethyl benzene, and xylenes.

Soil samples are being analyzed for standard Phase I compounds including volatile and semivolatile organics (GC/MS), ICP metals, mercury and arsenic (AA). Water samples are being analyzed for volatile halogenated organics (GC/COM), volatile aromatic organics (GC/PID), DBCP (GC/ECD), and nitrates (technicon).

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
Arrow Drilling	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Technos, Inc.	-	geophysics
Petrex, Inc.	-	soil gas
Tracer Research, Inc.	-	soil gas
ITECH	-	surveying

0086R
Rev. 2/18/88

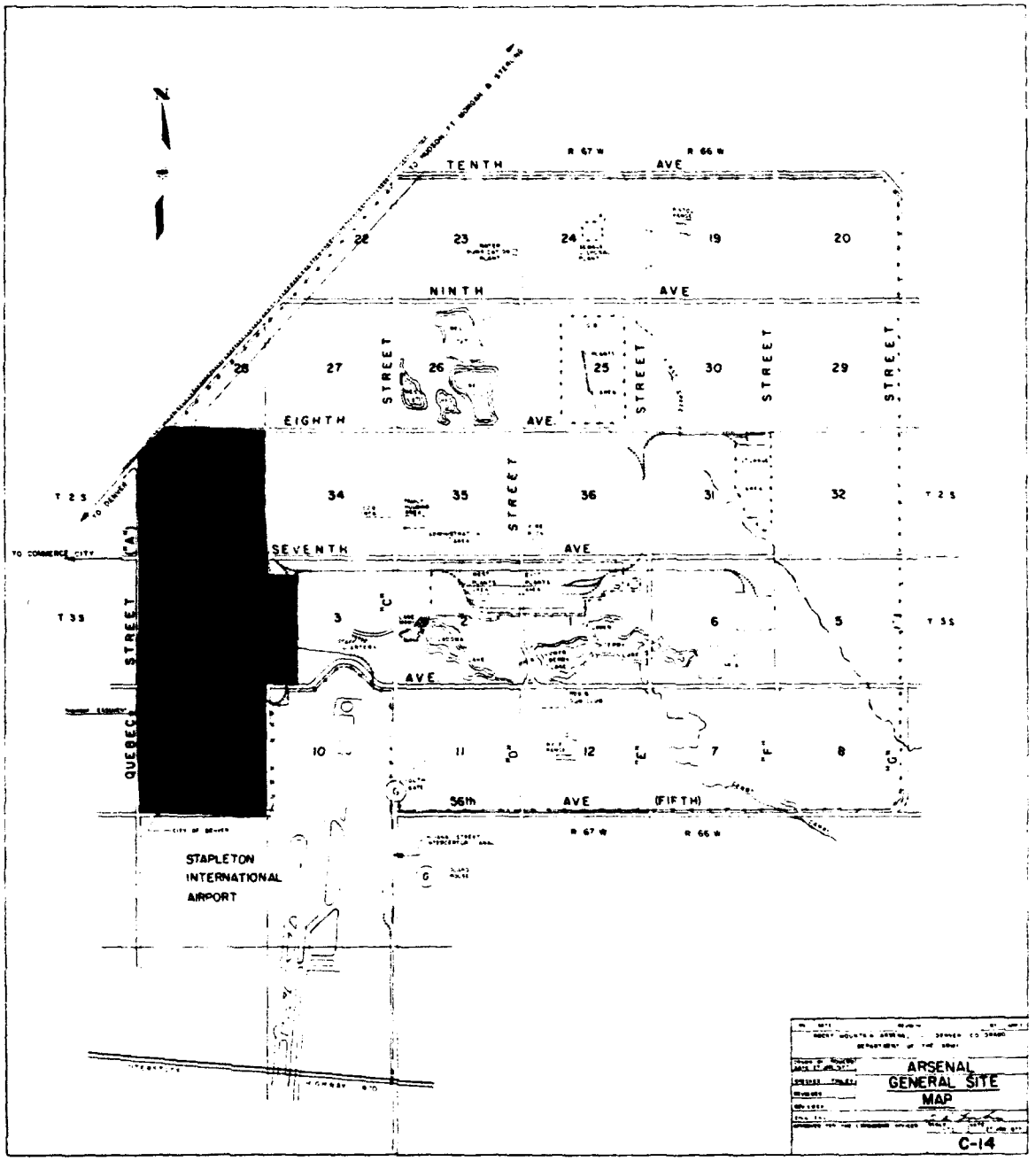
Reports

	RIC#	Date Produced
Technical Plan, Final		ongoing
Report on Soil Gas Results, Final		ongoing

Contamination Assessment Report:

Site	Name	RIC#	Date Produced
4-6	Motor Pool Area		ongoing

0086R
Rev. 2/18/88



TASK 38 STUDY AREA

RI SUMMARY

Task Number:	42	**Date:** 02/18/88
Task Name:	North Plants Contamination Assessment	
PMO Contact:	Juan Lopez	
Medium:	Soils, groundwater	
Award Date:	September, 1986	
Budget:	$744,347	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

A Phase I and Phase II investigation will be conducted at the North Plants complex to assess if spill sites may have contaminated soils and/or groundwater in North Plants, and, if so, what chemicals are present.

Specific Phase I objectives are:

- To assess whether potential soil or groundwater contamination exists in the North Plants area and to identify the constituents present;
- To conduct a preliminary evaluation of the vertical and horizontal extent of contamination present within the main manufacturing and demilitarization area of the North Plants; and
- To provide the basis for design of a quantitative Phase II (if necessary) contamination assessment program, to be conducted under a separate contract.

Specific Phase II objectives are:

- To conduct a more accurate quantitative assessment of the vertical and areal extent of contamination; and
- To provide site-specific information upon which to base the upcoming feasibility studies for eventual remediation.

Scope-of-Work

The Task 42 investigation includes the compilation of all historical information regarding potential soil and groundwater contamination in the North Plants area; collection of additional data from soil borings; installation and sampling of groundwater monitoring wells; and evaluation of all data and information collected to assess the magnitude and extent of contamination in sources and uncontaminated areas within the fenced area of North Plants. Efforts will be concentrated on locating spill sites, but the effort will also include a regional study of this area.

In the Phase I program, a total of 54 soil borings and six monitoring wells will be drilled with the fenced boundaries of the North Plants. Approximately 26% of the 54 soil borings will be drilled to the top of the uppermost saturated zone. In the Phase II program, a total of 48 additional soil borings will be drilled. Monitoring wells may also be drilled under the Phase II program, depending on the analytical results from the groundwater samples collected under Phase I.

The Phase I soil samples will be analyzed for the standard Phase I compounds, in addition to chemical agent degradation products. Phase II soil samples will be analyzed for the Phase II analytes, plus army agent degradation products. The groundwater samples will be analyzed for the standard Phase II liquid analytes, excluding specific pesticide-related analyses.

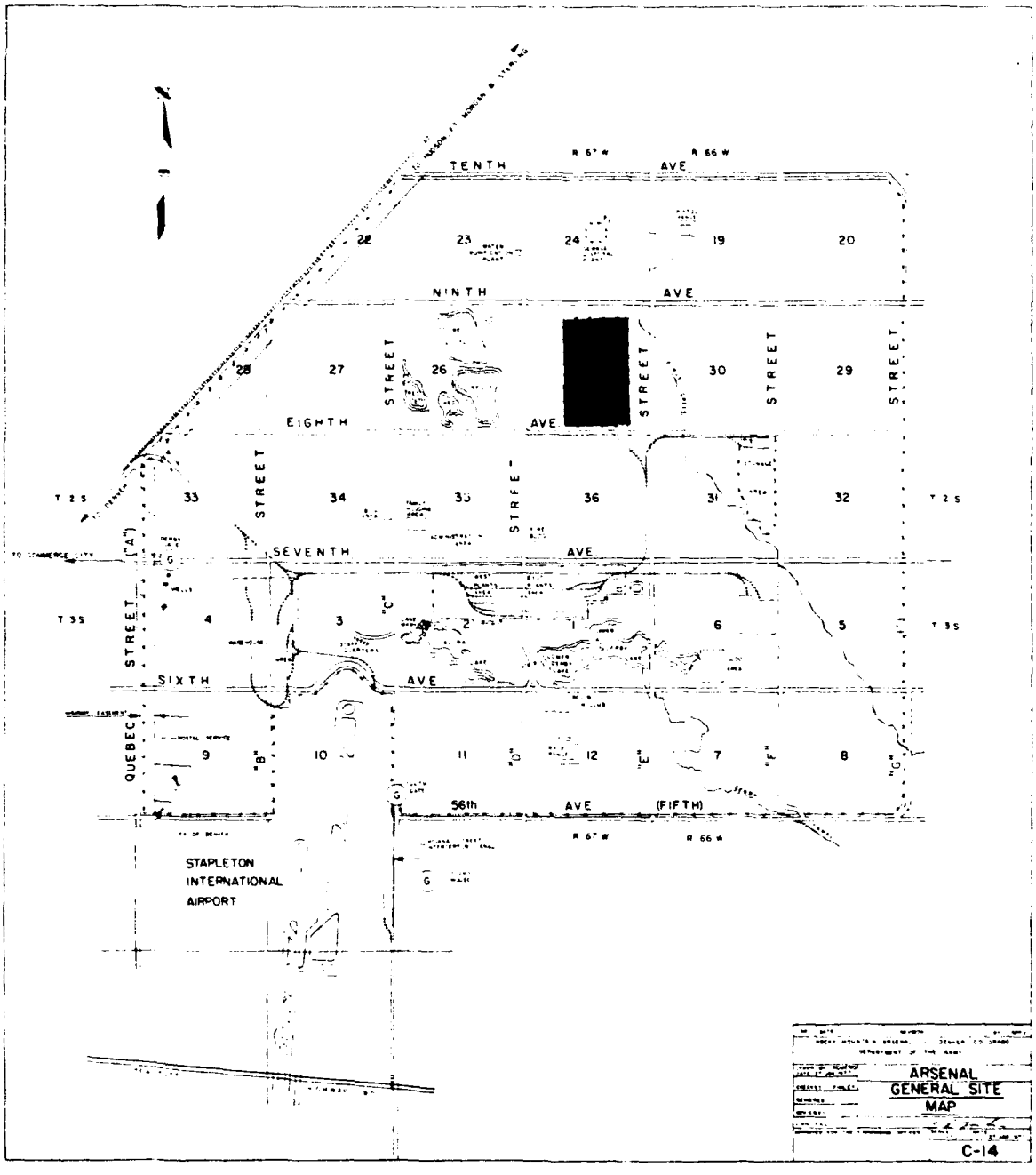
Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
Harding-Lawson Associates	-	geophysics
ITECH	-	surveying

Reports

	RIC#	Date Produced
Technical Plan, Final	87336R01	11/17/88
Contamination Assessment Report		ongoing

0086R
Rev. 2/18/88



TASK 42 STUDY AREA

RI SUMMARY

Task Number:	44	**Date:**	02/21/88
Task Name:	RMA Onpost/Offpost Ground/Surface Water Monitoring Program		
PMO Contact:	Darrel Smith		
Medium:	Water		
Award Date:	March 19, 1987		
Budget:	$3.6 million		
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)		

Objectives

As part of the environmental investigation at RMA, the necessity of establishing a litigation-quality data base for surface and ground water has been recognized. Task 4 addressed part of this need by providing baseline data to assess contaminant distributions at RMA.

Under Task 4, three rounds of water samples were collected over a 1-year period within RMA to achieve the following objectives:

- Satisfy the requirements under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the substantive requirements of all applicable or relevant and appropriate Federal and State requirements that have application through CERCLA;
- Confirm the existence and chemical nature of contamination and monitor any changes in the lateral and vertical extent of contamination; and
- Develop a core data base for use in upcoming litigation and Remedial Investigation/Feasibility Study analyses for RMA.

Task 44 was developed using the core Task 4 objectives; however, the scope of the task has been broadened to address other salient items that were beyond the scope of Task 4.

The objectives of Task 44 as detailed in the Delivery Order are to:

- Assess the distribution and concentration levels of ground water contaminants and monitor changes in water quality with respect to these contaminants for both the onpost and offpost areas using established contaminant guidance levels:
- Monitor and evaluate changes in water levels;
- Evaluate data and recommend program modifications to this or other water monitoring tasks; and
- Identify areas of significant public exposure by comparison of offpost water quality results with current guidance levels.

In order to satisfy the primary goals of the task, certain ancillary objectives will be accomplished. Additionally, these efforts will further define the Task 44 scope-of-work (SOW):

- Utilize available geologic data to further define the current understanding of the geologic conditions present at RMA;

- o Summarize the hydrogeologic conditions in the onpost and offpost areas by integrating existing hydrologic, geologic, and water quality data;
- o Assess the distribution of contaminants in aqueous media and identify the primary hydrogeologic pathways by which contaminants are being transported to the RMA boundary or the offpost area;
- o Evaluate the existing monitoring program for data deficiencies and assess the need for additional wells; and
- o Integrate all data from water related tasks and supply appropriate information to Task 23 efforts including data bases, contaminant plume maps, and hydrogeologic assessments.

Task 44 will establish the hydrologic core data base for and provide to the EA and FS groups adequate interpretation and characterization of hydrologic, geologic, and geochemical data so that their specified goals can be achieved.

The overall Task 44 program will be designed to be dynamic in nature and will be modified, as required, in response to ongoing data evaluation and/or changes in the SOW or task objectives. Task 44 will form the base or trunk hydrologic program, while other efforts (Tasks 25, 36, 38, 39, etc.) will be tributary or branch efforts which will satisfy specific individual task needs, as well as augment the Task 44 program.

In addition to 27 sq mi of onpost area covered by Task 44, 14 sq mi of the offpost area are being monitored (see figure). The offpost area extends northwestward from RMA to the South Platte River. Several other detailed ground water tasks address localized areas within the Task 44 study area.

Scope-of-Work

The purpose of this task is to perform a hydrologic assessment for the RMA onpost and offpost areas. This assessment includes development of a baseline program for hydrologic and contamination surveillance. Network design is followed by collection of surface water and ground water samples, measurement of hydrologic parameters, and chemical analysis of water samples. These data will be evaluated to document the extent of contamination, the hydrologic and geologic conditions of the site, areas of public health exposure, potential contaminant migration pathways, and areas where additional data are required.

The scope of the Task 44 water quantity/quality survey includes completing a semiannual and/or quarterly ground water and surface water monitoring program capable of satisfying the various regulatory requirements, developing litigation-quality data to be added to the current data base, and assessing the extent and nature of contamination. In order to achieve these objectives, work in six distinct technical areas is anticipated. These areas are as follows:

- o Review the historical data;
- o Develop a monitoring program to achieve the objectives in Section 1.2 of the Task 44 Technical Plan;
- o Execute the monitoring program utilizing litigation-quality sampling and analytical procedures;

- o Assess data after the first sampling event for possible adjustments in the sampling and/or analytical scheme;
- o Compile and interpret the accumulated data at the end of the sampling program; and
- o Coordinate with and integrate data from other current ground water tasks such as Tasks 25, 26, 36, 38, and 39.

During review of the historical data, a large number of wells were evaluated with respect to construction detail, sampling history, and location. Criteria for evaluating these wells are described in Sections 3.1.1 through 3.1.2 of the Task 44 Technical Plan.

The following work was conducted to help design the Task 44 monitoring network. As previously discussed, this network will include wells from the 360° Monitoring Program, Basin F, and offpost sampling programs. Borehole logs and geologic cross sections were examined to establish a preliminary evaluation of subsurface geology. Water-level data from the Task 4 program were examined to establish directions of ground water flow within the alluvium and to aid in the correlation of permeable units within the Denver Formation. Water-quality information from Task 4 and, as appropriate, from the historical data base were examined to formulate an assessment of the distribution of contaminants within the RMA ground water system. These contaminant distribution assessments will be modified as additional information is obtained and interpreted. A preliminary assessment of hydrogeologic conditions was used to design the proposed Task 44 well network. A detailed review of well selection methodology is discussed in Section 3.1.1 of the Task 44 Technical Plan.

All ground water monitoring wells and surface water sampling sites will be sampled using uniform sampling methods. Ground water and surface water samples will be analyzed for a predetermined list of analytes including numerous organic and inorganic parameters (see table). Sample collection, measurement of field parameters, and analysis of samples will be performed in accordance with USATHAMA Quality Assurance/Quality Control procedures. These procedures include collection of field quality control samples and decontamination of all sampling equipment. Collection procedures are presented in Section 3.2 of the Task 44 Technical Plan.

All studies under Task 44 will be performed in accordance with the requirements and technical specifications discussed in Section C-3 and Appendices A (USATHAMA Quality Assurance Program, 1982, RIC#87048R03) and B (USATHAMA Geotechnical Requirement, 1983), except where modified as required for technical/litigation standardization. Standardized methods, protocols, and criteria will be consistent with those performed in Tasks 1, 2, and 4 and as established during subsequent meetings between the Army and contractors. Services conducted under Task 44 will include collection, analysis, reduction, compilation, and assessment of environmental data for both surface water and ground water. Ground water elevation and water quality data will be collected on a quarterly and/or semiannual basis. Stream flow evaluations and surface water event sampling will also be conducted.

Consultants

HLA - technical support
Boyles Brothers - drilling
Frontier Logging - downhole geophysics
ITECH - surveying

Reports	**RIC #**	**Date Produced**
Technical Plan		ongoing
Composite Well Program Report		ongoing
Final Report		forthcoming

Table of Target Analytes - Task 44

Organochlorine Pesticides

- Aldrin
- Endrin
- Dieldrin
- Isodrin
- Hexachlorocyclopentadiene (CL6CP)
- PPDDE
- PPDDT

Volatile Organohalogens

- Chlorobenzene (CLC6H5)
- Chloroform (CHCL3)
- Carbon Tetrachloride (CCLA)
- trans-1,2-Dichloroethylene (T12DCE)
- Trichloroethylene (TRCLE)
- 1,1 Dichloroethylene (11DCE)
- 1,1 Dichloroethane (11DCLE)
- 1,2 Dichloroethane (12DCLE)
- 1,1,1 Trichloroethane (111TCE)
- 1,1,2 Trichloroethane (112TCE)
- Methylene Chloride (CH2CL2)
- Tetrachloroethylene (TCLEE)

Organosulfur Compounds

- P-Chlorophenylmethylsulfone ($CPMSO_2$)
- P-Chlorophenylmethylsulfoxide (CPMSO)
- P-Chlorophenylmethylsulfide (CPMS)
- 1,4-Dithiane
- Oxathiane
- Dimethyldisulfide (DMDS)

Volatile Aromatics

- Toluene
- Benzene
- Xylene (m-)
- Ethylbenzene
- Xylene (o,p)

DCPD/MIBK

- Dicyclopentadiene
- Methylisobutyl Ketone

DIMP/DMMP

- Diisopropylmethylphosphonate
- Dimethylmethylphosphonate

DBCP

- Dibromochloropropane

Metals

- Mercury
- Arsenic
- Cadmium
- Chromium
- Copper
- Lead
- Zinc

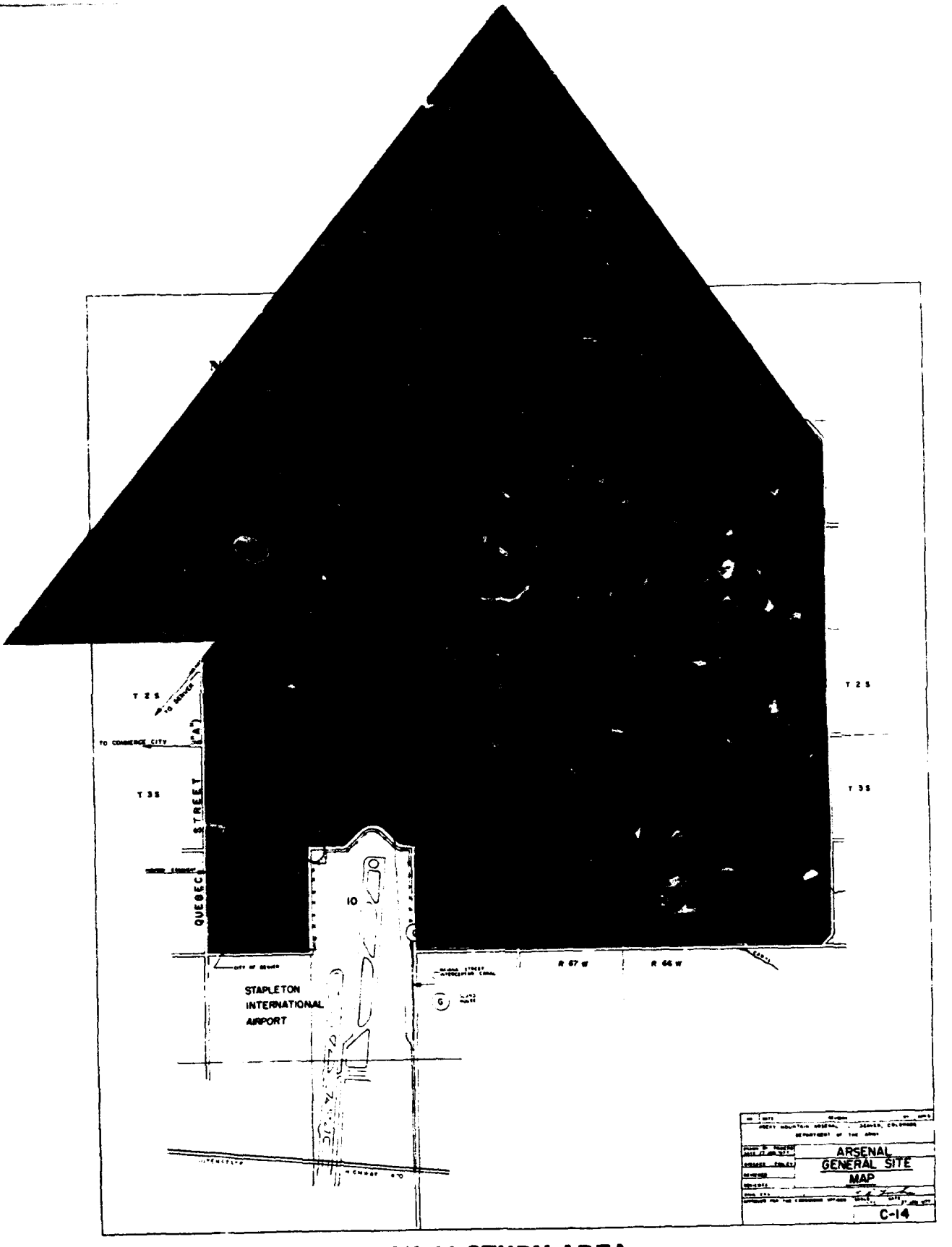
Major Cations

- Potassium
- Calcium
- Magnesium
- Sodium

Major Anions

- Chloride
- Fluoride
- Sulfate
- Nitrate+Nitrite
- Alkalinity (as $CaCO_3$)

Source: ESE, 1987



TASK 44 STUDY AREA

RI SUMMARY

Task Number:	47	**Date:** 02/21/88
Task Name:	Supplementary Phase II Surveys on the Northern Sections of RMA	
PMO Contact:	Kevin Blose	
Medium:	Soil/Water/Air	
Award Date:	June 26, 1977	
Budget:	$1.99 million	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

This task will provide additional site-specific and media-specific support for both the ongoing Remedial Investigation and the Feasibility Study.

Scope-of-Work

This task will provide overall program management support for both ESE and HLA key personnel. The development of the RI/FS Plan will be managed and produced under this project.

The three study area reports for the Central, North Central, and Eastern areas will be managed and funded by this task.

Other special requirements for support will also be managed as they are defined by the earlier tasks. These efforts will be documented in letter technical plans as they are defined and approved.

Consultants

HLA - general and project specific management, report generation, and documentation support

Reports	**RIC_#**	**Date_Produced**
Central Area Report		forthcoming
North Central Area Report		forthcoming
Eastern Area Report		forthcoming

RI SUMMARY

Task Number:	48	**Date:** 2/18/88
Task Name:	Supplementary Phase II Surveys on the Southern Sections of RMA	
PMO Contact:	Kevin Blose	
Medium:	Soils, water	
Award Date:	June, 1987	
Budget:	$2,263,254	
Prime Contractor:	Ebasco Services Incorporated	

Objectives

The objective of Task 48 is to perform supplementary Phase II surveys of sites located in North Plants, the southern sections, and the western tier of RMA. Area-wide reports for the eastern, southern, and western areas, North Plants, and South Plants will be developed. Another objective is to develop a master computer database for use by all RI/FS contractors.

Scope-of-Work

Task 48 will collect site-specific information upon which to base upcoming conceptual design studies for remedial action. These studies will be conducted at sites in the Western Tier, South Plants, Hydrazine Facility, North Plants, Basin A, Army Sites on the Southern portion of the arsenal, and structures and spills throughout RMA. Both soils and groundwater investigations will be conducted. A special study on the western tier is being performed in connection with UCLA.

An estimated 20 borings and 18 wells will be drilled. Soil and groundwater samples will be collected.,

The soil samples are being analyzed for volatile organics (GC/MS), volatile halogenated organics (GC), ICP metals, mercury, and arsenic. The water samples are being analyzed for volatile halogenated organics (GC), volatile aromatic organics (GC), organosulfur compounds (GC/FP). phosphonates (GC/FPD), metals (AA and ICP), thiodiglycol (HPLC), and anoins (IC).

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
Arrow Drilling	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
ITECH	-	surveying

0086R
Rev. 2/18/88

Reports	RIC#	Date Produced
Technical Plan, Final		ongoing
Phase II Addendums for All Tasks		ongoing
Special UCLA Study Report		ongoing
Regional Study Area Reports:		ongoing
Eastern SAR		ongoing
Southern SAR		ongoing
Western SAR		ongoing
North Plants SAR		ongoing
South Plants SAR		ongoing

0086R
Rev. 2/18/88

RI SUMMARY

Task Number:	Shell 2
Task Name:	Soils Re-mapping of the RMA
Shell Contact:	Chris Hahn
Medium:	Soils
Award Date:	February 1988
Budget:	Final budget figures to be established
Prime Contractor:	MKE

Objective To identify and delineate soil types on the RMA. The purpose of this work is to establish correlations between contaminant distribution and soil type.

Scope of Work

Shell/MKE is refining the soils map of the Rocky Mountain Arsenal at the equivalent of SCS Order 1. The primary focus is on the central 9 sections of the RMA, with a secondary effort on the remaining 18 sections. In addition to the remapping, clay mineralogy and agronomic properties will be assessed for a portion of the soil samples. Knowledge of these properties will contribute to an understanding of the vertical distribution, mobility, and fate of contaminants in the soil, and will aid in planning for revegetation.

Reports

Soils Map of the RMA

RI SUMMARY

Task Number:	Shell 3
Task Name:	Aquatic Studies
Shell Contact:	Chris Hahn
Medium:	South Lakes
Award Date:	1986
Budget:	Final budget to be established
Prime Contractor:	MKE

Objective

The objective of the aquatic studies is to define the population characteristics of the on-site lakes (Derby, Ladora, and Mary) as related to an offsite control for identification of possible aquatic resource impacts.

Scope of Work

The analysis will focus on the trophic structure of the lakes and will compare the on-post lakes to the off-post control and to literature data available on other similar lakes. Tissue analyses and evaluation of existing chemical data will be used to assess the contaminant status of the lakes.

Reports

Aquatics Report

RI SUMMARY

Task Number:	Shell 4
Task Name:	Alluvial Geologic Analysis
Shell Contact:	Chris Hahn
Medium:	Soil
Award Date:	February 15, 1988 (Work has been ongoing since September 1984)
Budget:	Final budget to be established
Prime Contractor:	MKE

Objective

Shell/MKE, in concert with the other parties, will prepare the geologic interpretation of the alluvial strata (incorporating all sediments which occur above the Denver Formation contact) for inclusion in the overall geologic analysis of the RMA.

Scope of Work

- Establishment of the working committee to perform the analysis
- Collection of all available geologic logs and completion of their interpretation
- Development and preparation of geologic maps and cross sections which depict the various alluvial and aeolian units present at RMA
- Transmission of the above maps and summary text to the lead agency for inclusion in the SARS and RI/FS documents

Reports

Arsenal Alluvial Geologic Interpretation

RI SUMMARY

Task Number: Shell 6 **Date:** 03/23/88
Task Name: Sewer Investigation
Shell Contact: Glen Rasmussen
Medium: Soil/Sewer
Award Date: 1986
Budget: Final budget figures to be established
Prime Contractor: Morrison-Knudsen Engineers, Inc. (MKE)

Objectives

The objective of this task is to provide sufficient information to select sites for excavation, observation, and soil sampling. This task will also provide chemical sample analysis to assess historical leakage from the sewers and provide a basis for determining construction techniques.

Scope-of-Work

An investigation of both the Sanitary and Chemical Sewers was conducted. All available maps describing the RMA waste collection system were compiled. Field reconnaissance was done to verify mapped structures, and a comprehensive sewer system map will be prepared. Water level measurements and samples were collected from the flooded portions of the lines and manholes. Low pressure air testing and internal TV inspections of selected portions of the lines was attempted to assist in the selection of candidate sites for excavation.

In 1986, twelve sites (two sanitary, ten chemical) were excavated, and adjacent and underlying soil samples were taken for chemical analysis. A final report summarizing field sampling procedures, locations, site details, and analytical results will be prepared.

Reports

Sewer Investigation, Interim Report	April 1986
Sewer Investigation, Final Report	forthcoming

RI SUMMARY

Task Number:	RIFS2	**Date:**	03/23/88
Task Name:	Remedial Investigation/Endangerment Assessment (Biota, Water, SAR's, Exposure Assessment)		
PMO Contact:	Kevin Blose		
Medium:	N/A		
Award Date:	To be determined		
Budget:	To be determined		
Prime Contractor:	To be determined		

Scope-of-Work

Phase II work is being performed at sites located in North Plants, South Plants, the North Central, Central, Eastern, Southern, and Western areas of RMA under Tasks 47 and 48 of the existing RI/FS contract. RIFS2, which will be awarded under a new contract, is the contractual mechanism by which the seven Study Area Reports (SARs) will be completed and finalized utilizing all Phase II data. The Biota and Water Media Reports also will be contractually completed under this task. As data gaps in relation to soils, biota, and water are identified, sampling and analysis efforts will be undertaken consistent with the current RI program to address these requirements. These reports will be compiled as part of the final RI document, which will be used to base conceptual design studies of remedial action.

An exposure assessment of contaminated sites at RMA which evaluates various pathway models and exposure potential is being performed under Task 35 of the existing RI/FS contract. RIFS2 will provide the contractual mechanism by which these studies may be completed. The final report will be a source-by-source exposure assessment, which will be compiled as part of the EA synthesis report.

Reports

Biota Medium Report
Water Medium Report
South Plants Study Area Report
North Plants Study Area Report
Central Plants Study Area Report
South Plants Study Area Report
East Plants Study Area Report
West Plants Study Area Report
North Central Study Area Report

RI SUMMARY

Task Number:	RIFS5	**Date:** 03/23/88
Task Name:	Remedial Investigation Final Report Preparation	
PMO Contact:	Kevin Blose	
Medium:	N/A	
Award Date:	To be determined	
Budget:	To be determined	
Prime Contractor:	To be determined	

Scope-of-Work

This task will prepare the final Remedial Investigation Summary Report for the RI program at RMA. This will include compilation of the seven Study Area Reports, the RI Water Report, the RI Biota Report, the RI Building Report, and the RI Air Report into one summary document. It will also include an introduction section and comprehensive soils discussion.

Reports

Remedial Investigation Summary Report

RI SUMMARY

Task Number:	RIFS6	**Date:**	03/23/88
Task Name:	Risk Characterization/Endangerment Assessment		
PMO Contact:	Andrew Kingery		
Medium:	N/A		
Award Date:	To be determined		
Budget:	To be determined		
Prime Contractor:	To be determined		

Scope-of-Work

A risk assessment, which analyzes and quantifies risks associated with the presence of contaminants at RMA, is being performed under Task 35 of the existing RI/FS contract. RIFS6, which will be awarded under a new contract, will provide the contractual mechanism by which these studies may be completed. The final Risk Characterization Report will be used in compiling the final Endangerment Assessment (EA) Report.

Task 35 of the existing RI/FS contract is compiling and integrating existing, ongoing, and planned studies within the RMA RI program of direct relevance to the EA task. Contaminant identification, source-by-source exposure assessments, toxicity assessments, and risk characterizations are also being performed. RIFS6 will also serve as the contractual mechanism by which the final EA Report will be completed.

Reports

Endangerment Assessment Final Report

FS SUMMARY

Task Number:	17	**Date:** 2/18/88
Task Name:	Incineration Feasibility Study	
PMO Contact:	Bruce Huenefeld	
Medium:	Basin F Materials	
Award Date:	February, 1986	
Budget:	$765,305	
Prime Contact:	Ebasco Services Incorporated	

Objectives

The objectives of Task 17 are to: (1) determine the incinerability of Basin F soils using a nonflame mode incinerator; (2) select an appropriate incineration technology; (3) make recommendations on the utilization of a pilot plant; and (4) develop a conceptual design for an incineration facility capable of thermally treating Basin F soils. A laboratory expansion program is also underway to determine the incinerability of Section 36 soils, including those in Basin A.

Scope-of-Work

The scope of work involves the development of technical reports for the laboratory determination of soil incinerability, technology selection, pilot plant recommendations, and conceptual design. In addition, a management plan, technical plan, and laboratory plan were prepared. The scope of the four technical reports is summarized below.

The laboratory determination of soil incinerability is utilized to determine the incinerability of the Basin F soils using a bench scale incinerator consisting of a primary chamber, afterburner, and a gas cooling and sampling system. Incinerability tests are conducted on the Basin F soils at various temperatures, residence times, and levels of excess air in both the primary chamber and afterburner.

The technology selection report reviews all current incineration technologies including rotary kiln, fluidized bed, multiple hearth, plasma, molten salt, molten glass, and other systems. From these systems, technologies are ultimately selected for a detailed investigation of their applicability to Basin F soils.

The pilot plant report evaluates the advantages and disadvantages of the following options: (1) constructing the full scale facility directly from laboratory testing without a pilot plant, (2) using Building 1611 as a pilot plant, (3) using an off-site pilot plant, and (4) constructing an on-site pilot plant.

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Rev. 2/18/88

The design report includes a conceptual level evaluation of a full-scale hazardous waste incinerator for the treatment of Basin F soils. The report includes a method of excavation; flow diagrams; general arrangement, elevation, and plot plan; a detailed facility description; a capital and O&M cost estimate; and a schedule. All engineering calculations are provided in extensive appendices. Facility alternatives, including the use of an indirect fired kiln, different kiln conditions, various fuel types, and various equipment concerns are also presented.

Besides the four reports described above, another laboratory report is under development for Section 36 soils including Basin A soils. The purpose of this report is to evaluate the incinerability of Section 36 wastes and also to evaluate low temperature volatilization in the primary chamber. Preliminary experimental results indicate the complete volatilization does occur at conditions less than 900°C in the primary chamber.

Consultants

Hittman-Ebasco	-	laboratory analyses
New Enterprise Technologies	-	thermal destruction unit
Dr. Barry Dillinger - Midwest Research Institute	-	results interpretation

Reports

	RIC#	Date Produced
Technical Plan, Final	86239R01	06/86
Laboratory Test Plan for Incineration of Basin F Wastes at RMA	86239R02	06/86
Selection of Incineration Technology for Basin F Wastes of Rocky Mountain Arsenal	87007R17	09/86*
Analysis of Pilot Plant Alternatives for the Incineration of Basin F Wastes		03/87*
Bench Scale Laboratory Incineration of Basin F Wastes		05/87*
Full Scale Incineration System Concept Design for Basin F Wastes		04/87*
Technical Plan Task 17 Expansion Program		03/87*
Bench Scale Laboratory Incineration of Section 36 Wastes at Rocky Mountain Arsenal		ongoing

* - draft final

FS SUMMARY

Task Number:	27	**Date:**	2/18/88
Task Name:	Hazardous Waste Land Disposal Facility		
PMO Contact:	Greg Briggs		
Medium:	N/A		
Award Date:	March, 1986		
Budget:	$476,222		
Prime Contractor:	Ebasco Services Incorporated		

Objectives

The objective of Task 27 is to identify a site or sites within the Arsenal boundaries, and develop a concept for a land disposal facility capable of containing all contaminated material at RMA. An additional objective is to provide an assessment of compliance with regulatory requirements and an estimate of cost of such a facility.

Scope-of-Work

The scope of work for Task 27 is as follows:

- Review available literature and documents, including the most current data available in the remedial investigation (RI), to define and characterize the volumes and types of wastes requiring remediation;
- Select the most suitable site(s) available on RMA based upon the optimum combination of geologic, geographic, health, environmental, and economic considerations consistent with the requirements of the National Contingency Plan (NCP);
- Select design criteria to be used for the assessment;
- Review literature to consider the technology available for waste cells, evaluate the various concepts, and select optimum waste cell concepts;
- Evaluate various land disposal facility layouts and select the layouts best suited to each specific disposal site;
- Prepare an assessment to provide a basis for construction schedules and cost estimates;
- Develop a preliminary schedule and cost estimate for the construction of the facility;
- Develop guidelines for waste cell construction specifications, and quality assurance procedures;

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Rev. 2/18/88

- Prepare a report describing the waste sources, site selection rationale, facility and waste cell concept configurations, estimated construction quantities and costs, guideline construction specifications and quality control procedures.

Consultants

QC Data – computer database

Reports

	RIC#	Date Produced
Technical Plan, Final	87196R07	07/87
Draft Final Report		09/87
Final Report		ongoing

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Rev. 2/18/88

FS SUMMARY

Task Number:	28	**Date:**	03/23/88
Task Name:	Feasibility Study-Alternative Analysis		
PMO Contact:	Charlie Scharmann		
Medium:	N/A		
Award Date:	June 1986		
Budget:	$694,450		
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)		

Objectives

Task 28 will identify candidate technologies, candidate alternatives, selected alternatives, preferred alternatives, and the final recommended response action for remediation of the regional areas located at RMA. The recommended response action will be made after screening of available technologies, and screening and evaluation of alternatives are completed.

Scope-of-Work

Literature searches of available technologies will be performed. Sources to be considered will include manufacturers literature and other FS studies. Once the literature search has been completed and available technologies identified, screening of the technologies will be performed. Alternatives will be developed using the accepted technologies. Alternative screening will be done in order to eliminate inappropriate actions for the different study areas based on media and contaminants present at RMA. Alternative evaluation will examine the screened alternatives in more detail using a more extensive set of criteria. The alternatives selection process will culminate with a report presenting Recommended Response Actions.

Consultants

None

Reports	**RIC_#**	**Date_Produced**
Technical Plan, Draft Final	87014R12	10/86
FS Technical Plan, Final		forthcoming
Technology Screening, Draft Final		forthcoming
Alternatives Development		forthcoming
Alternatives Screening Criteria Development		forthcoming

FS SUMMARY

Task Number: Shell 1
Task Name: Air Modeling
Shell Contact: Chris Hahn
Medium: Air
Award Date: February 15, 1988
Budget: Not established at this time
Prime Contractor: MKE

Objective To model air quality impacts at RMA for alternative remediation concepts

Scope of Work

Establishment of the modeling coordination team

Compilation of the necessary meteorologic data

- Selection of the appropriate models (numeric codes)
- Development of the input files for modeling
- Resolution of the modeling assumptions
- Completion of the modeling runs
- Dissemination of the modeling analyses
- Coordination of the necessary meetings for the modeling analysis
- Interaction with the endangerment assessment team

Reports

Synopsis of modeling efforts
Input to RI/FS as required

FS SUMMARY

Task Number: Shell 5
Task Name: Alternative Technologies Studies
Shell Contact: Chris Hahn
Medium: Soil/Groundwater
Award Date: February, 1988 (Some preliminary work completed prior to submitting proposal to Army
Budget: Final budget to be established
Prime Contractor: MKE

Objectives The Shell/MKE team will be conducting a series of studies related to alternative technologies which may be applicable to the remediation of RMA. Studies will focus principally on two areas - remediation of Basin F (liquids and solids) and bioremediation of soils and groundwater containing organic compounds (with emphasis on organochlorine pesticides).

Scope of Work

Studies which are anticipated at this time are:

1) Treatment of Basin F solids:

   - Low temperature thermal desorption analysis

   - Compatibility of Basin F solids and fly ash

2) Treatment of Basin F liquids:

   - Thermal treatments

   - Wet air oxidation

   - Biotreatment of liquids, either before or after some other type of treatment

   - Brine well disposal of treated or untreated liquids

3) Studies into the feasibility of in-situ biodegradation as a groundwater treatment option. Problems being considered include the South Tank Farm plume, the Irondale Nemagon plume, and groundwater containing low-level contamination by multiple compounds. Current emphasis predominantly is in the South Tank Farm area. Laboratory studies of saturated sediments from all

three plume types will consider addition of oxygen and/or nutrients to stimulate existing bacterial populations and enhance natural biodegradation. The goal of field studies is to assess hydrologic site feasibility for in-situ treatment.

4) Studies related to the in-situ treatment of organochlorine pesticides in surface soils. These include field studies in Basin C and laboratory studies. The studies will address biodegradation using various microbes and alternative enhancement techniques, as well as other mechanisms such as chemical degradation and volatilization.

Reports

Field Studies Reports
Laboratory Studies Reports

FS SUMMARY

Task Number:	RIFS3 **Date:** 02/21/88
Task Name:	Development/Screening of Alternatives and Modeling
PMO Contact:	Charles Scharmann
Medium:	N/A
Award Date:	September 1988
Budget:	N/A
Prime Contractor:	To be determined

Objectives

There are two objectives of this task: to perform a portion of the RMA Feasibility Study (FS), and to conduct modeling to support the FS. The major component of the task is to conduct a significant portion of the Rocky Mountain Arsenal Feasibility Study including the finalization of the Development and Screening of Alternatives and the initiation of the Detailed Evaluation of Alternatives (DEA). Modeling has been included with this task because of its intended use as a tool in the evaluation of remedial action alternatives for the FS. Because of the role modeling will play in the FS, it is necessary that the two efforts be closely coordinated. The specific objective of the modeling program is to formulate mathematical descriptions of the physical and chemical processes affecting the soil and water quality within RMA with the purpose of increasing understanding, forecasting changes, and suggesting control methods or strategies in support of the ongoing restoration program.

Scope-of-Work

Prior to this task, the Technology Inventory and Screening will have been completed by media for each Study Area on RMA and a draft Development of Alternatives will have been performed for some of the RMA Study Areas. This task will involve the completion of the Development of Alternatives for all Study Areas on RMA and the performance of the Screening of Alternatives for inclusion in the next phase of the FS, the DEA. The alternatives will be screened according to the following general criteria: effectiveness, implementability, and cost. Those alternatives passing the screening process will be evaluated against 10 specific criteria which are a subset of the Alternative Screening criteria listed above. The DEA criteria include: protectiveness; compliance with ARAR's; reduction of mobility, toxicity, and volume; reliability; technical feasibility; administrative feasibility; availability and schedule; capital costs; operating costs; and long-term replacement costs. This task will initiate the DEA for portions of RMA. As data gaps are identified, sampling and analysis efforts will be undertaken consistent with the current RI program to address these requirements. To assist in the DEA, modeling will be conducted on a regional, area, and site specific basis.

One of the techniques available to assist in the detailed evaluation of potential remedial action alternatives, and predicting the effectiveness of these alternatives, is computer modeling. This task will allow for the development and evaluation of various models (on a regional, area, and/or site specific basis) for use in the evaluation of alternative remedial actions and the prediction of future contaminant conditions (before and after remediation). The types of models expected to be useful include geostatistic, stochastic, analytical, and numerical models.

Reports

Development and Screening of
  Alternatives
Documentation of Modeling Effort

FS SUMMARY

Task Number:	RIFS4	**Date:**	02/21/88
Task Name:	Treatability/Pilot Studies		
PMO Contact:	Charles Scharmann		
Medium:	Potentially any/all media		
Award Date:	September 1988		
Budget:	N/A		
Prime Contractor:	To be determined		

Objectives

The objective of this task is to collect test data for potential remedial action alternatives in support the RMA Feasibility Study Program. As the Feasibility Study Program progresses, it is expected that data gaps will be identified concerning the operational performance of potential remedial action alternatives. These data will likely be required to complete the Detailed Evaluation of Alternatives. This task will be responsible for conducting treatability/pilot tests to collect the operational performance data necessary to complete the Detailed Evaluation of Alternatives.

Scope-of-Work

The exact number and nature of the tests to be performed under this task have yet to be identified. It is expected that the scope of the task will be determined by the requirements of the FS and that additional clarification on the type of tests to be performed under the task will be identified during the upcoming stages of the FS (i.e., Screening of Alternatives and Detailed Evaluation of Alternatives). As data gaps are identified, sampling and analysis efforts will be undertaken consistent with the current RI program to address these requirements. Tests may be conducted in-situ, at a remote location onsite, and/or at an offsite facility. Data collected will allow for the detailed evaluation of the alternative with respect to the following criteria: protectiveness; compliance with ARAR's; reduction of mobility, toxicity, and volume; reliability; technical feasibility; administrative feasibility; availability and schedule; capital costs; operating costs; and long-term replacement costs. Collection of test data on some of the above criteria for some of the alternatives passing the screening process is expected to be necessary to allow for the alternatives to be evaluated on an equivalent level of detail. Tests will be conducted in accordance with protocol to be developed specifically for the Treatability/Pilot Test Program.

Reports

It is expected that a report will be prepared for each test program conducted.

FS SUMMARY

Task Number:	RIFS7	**Date:** 02/21/88
Task Name:	Evaluation/Selection of Preferred Alternatives	
PMO Contact:	Charles Scharmann	
Medium:	N/A	
Award Date:	N/A	
Budget:	N/A	
Prime Contractor:	To be determined	

Objectives

This task will complete the Detailed Evaluation of Alternatives (DEA) process initiated under Task RIFS3 and involve the preparation, review, and finalization of the DEA Report. A draft FS Summary Report will also be prepared which will include the Selection of Preferred Alternative(s).

Scope-of-Work

Alternatives which pass through the Alternatives Screening process conducted under Task RIFS3 will be evaluated with respect to the following criteria: protectiveness; compliance with ARAR's; reduction of mobility, toxicity, and volume; reliability; technical feasibility; administrative feasibility; availability and schedule; capital costs; operating costs; and long-term replacement costs. As data gaps are identified, sampling and analysis efforts will be undertaken consistent with the current RI program to address these requirements. After completion of the evaluation process, a report will be prepared summarizing each alternative and its respective performance against the screening criteria. Upon completion of the DEA Report, a preferred alternative(s) will be selected based on the following criteria which are a subset of the criteria outlined for the DEA above:

- o Remedies must be protective of human health and the environment.
- o Remedies should attain ARAR's identified for the site.
- o Remedies must be cost-effective.
- o Remedies must utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The preferred alternative(s) will be outlined in a report that will summarize and compare alternatives with respect to the above criteria and provide the decision-maker sufficient supporting information on which the recommendation of the preferred alternative is based. This report will be referred to as the FS Summary Report.

Reports

Detailed Evaluation of Alternatives
FS Summary Report (Selection of a Preferred Alternative(s)

FS SUMMARY

Task Number:	RIFS8	**Date:** 02/21/88
Task Name:	Remedial Investigation/Feasibility Study Report	
PMO Contact:	Kevin Blose	
Medium:	N/A	
Award Date:	To be determined	
Budget:	To be determined	
Prime Contractor:	To be determined	

Scope-of-Work

RIFS8 will prepare the final Report for the RI/FS program at RMA. This will include compilation of the RI Summary Report and the FS Summary Report. It will support assessment and comment response of the preferred alternate and prepare and provide support to defend the ROD.

Reports

RI/FS Final Report
Record of Decision

RI SUMMARY

Task Number:	Not Applicable (Listed as Task 66 on Schedule)	**Date:** 02/21/88
Task Name:	Offpost Remedial Investigation	
PMO Contact:	Charlie Scharmann	
Medium:	Biota, Surface Water, Ground Water, Soil	
Award Date:	August 1984	
Budget:	$1.6 million	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

The Offpost RI was designed to determine the persistance and rate of movement of RMA contaminants offpost (see figure) along pathways that could lead to significant human exposure. The pathways investigated include: ground water, surface water, soil, and biota. The investigative techniques attempted to quantify the amount and variety of contaminants present in each pathway and assess the risk to the indigenous population potentially affected. The completed study will be used to determine whether offsite remedial actions are required, and, if so, provide an adequate data base for the development of remedial action alternatives.

Scope-of-Work

The overall scope-of-work can be delineated into five programs:

1) Consumptive Use Sampling Phase I.
2) Consumptive Use Sampling Phase II.
3) Monitor Well Installation and Sampling, Surface Water Sampling.
4) Biota Monitoring.
5) Long-term Monitoring.

The first phase of consumptive use well sampling investigated 117 alluvial and Denver Formation wells offpost. These wells were all located within projected ground water contaminant plumes migrating offpost and primarily used for domestic or commercial water supply. Water samples were collected from each well in January and February 1985 and analyzed for organochlorine pesticides, organosulphur compounds, volatile organics, organophosphorus compounds, chloride, and fluoride.

The second phase of consumptive use well sampling was performed in September and October 1985. Forty alluvial and Denver Formation wells were sampled. Wells selected for this phase of sampling were located in areas of high level contamination identified during Phase I. Most of the wells sampled during Phase II had not been sampled during Phase I. All Phase II samples collected were analyzed for Phase I analytes.

Thirty ground water monitoring wells were installed. Twenty-nine wells (28 alluvial and 1 Denver Formation) were drilled in the Offpost Contamination Study Area north and northwest of RMA, and one shallow alluvial background well was emplaced near the southwest corner of RMA.

All wells were installed and constructed to maximize the probability of obtaining representative hydrogeologic data, intercepting contaminant plume(s), and determining the interrelationships between irrigation ditches, surface water, alluvial ground water, and Denver Formation ground water. During well installation, selected sediment samples were analyzed for physical properties including: grain size, moisture content, and plasticity. Completed wells were slug tested to determine aquifer characteristics.

After completion and development, each well and 11 surface water sites were sampled for water quality analysis. The analytical suite was the same as that for consumptive use wells described above. Two quarterly sampling programs were performed.

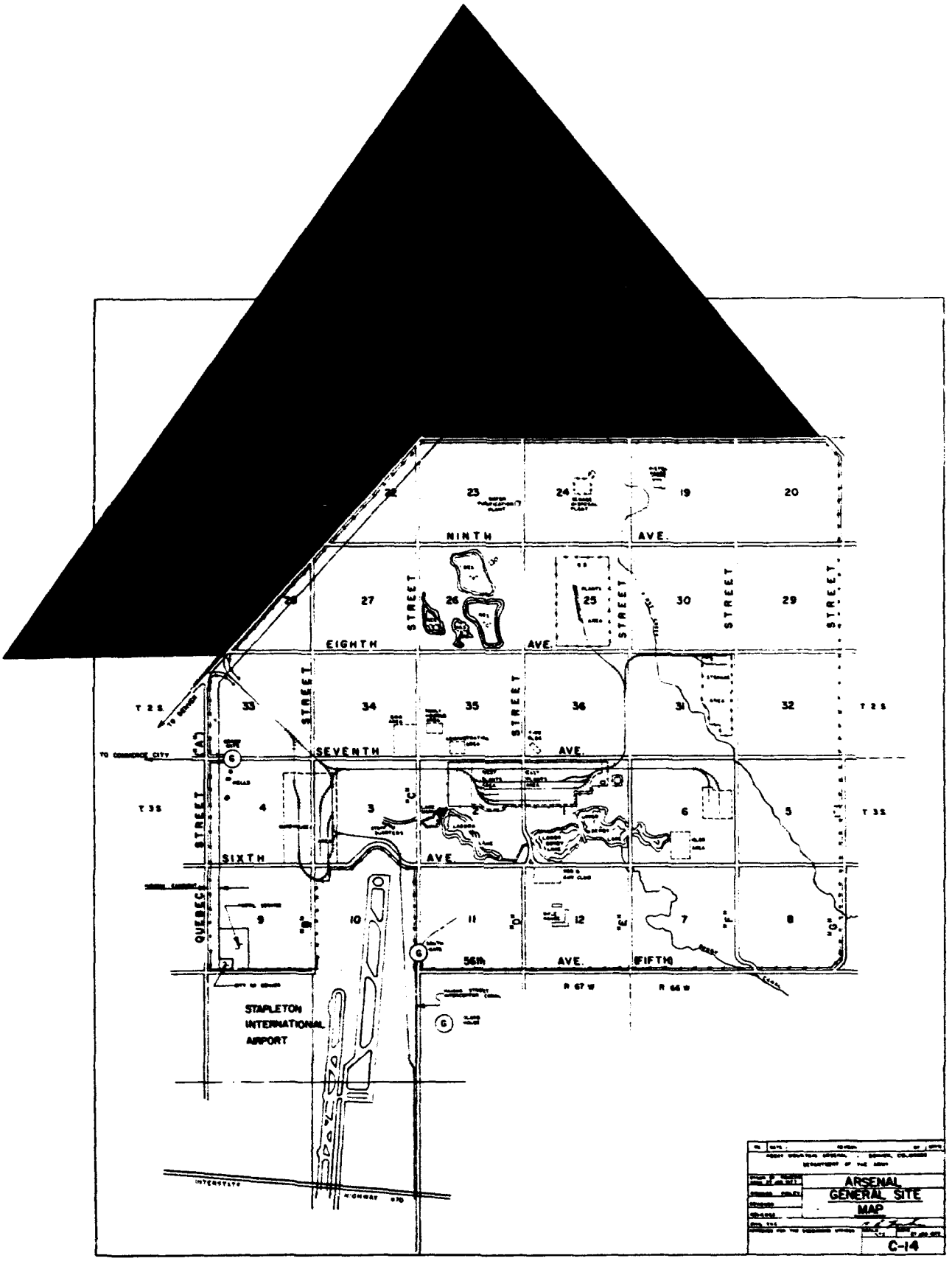
Cottontail rabbits and ring-necked pheasants were targeted as species of concern for biota monitoring as individuals migrating offpost may be captured and eaten. Field crews began capturing and marking rabbits and pheasants onpost in mid-summer 1985. Pheasants were captured at night. Age, sex, date of capture, and precise location was recorded for each bird. Each bird was marked with a non-toxic dye and selected birds were fitted with radio transmitter. Rabbits were captured using live traps. The sex, age, date of capture, and precise location were noted for each individual. In addition, all rabbits trapped were marked with metal ear tags and/or non-toxic dye. Recapture and resight studies were performed in September and October 1985. Resight studies consisted of walking along transects through the biota study area and identifying and locating individual rabbits or pheasants encountered. In addition, radiotracking of several individuals was performed. This program was repeated in January and February 1986.

The 30 offpost monitoring wells installed during this task and 43 wells incorporated by the Army, state, and county departments into the 360° Monitoring Program now comprise a network of wells designated for long-term monitoring of contaminant migration offpost. These wells will be included in the Task 39 RI/FS.

Consultants

MRI - chemical analysis
D.P. Associates - litigation/documentation support
Arrow Drilling - drilling/well installation
ITECH - surveying

Reports	RIC_#	Date_Produced
Monitor Well Locations for the Geotechnical Program	87016R11	5/85
New Well Siting Report	87016R12	7/85
Technical Plan	87016R04	08/85
Consumptive Use - Phase I Report	87016R02	10/85
Revision III - 360° Monitoring Program Report	87016R05	2/86
Ground Water Flow and Contaminant Transport Models	87016R10	2/86
Consumptive Use - Phase II Report	87016R03	8/86
Contamination Assessment Report Draft Final	87202R01	4/87



TASK 6 OFFPOST STUDY AREA

RI SUMMARY

Task Number:	39	**Date:** 02/21/88
Task Name:	Offpost RI/FS	
PMO Contact:	Charlie Scharmann	
Medium:	Air, Soil/Sediment, Biota, Ground Water, Surface Water	
Award Date:	Fall 1986	
Budget:	$1.89 million	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

Conduct an RI/EA/FS in the offpost study area (see figure). Determination of contaminant distribution for input to an EA as support for the FS. Primarily concerned with ground water contamination although air, soil/sediment, biota, and surface water will be considered. Product of task will be support for a Record of Decision.

Scope-of-Work

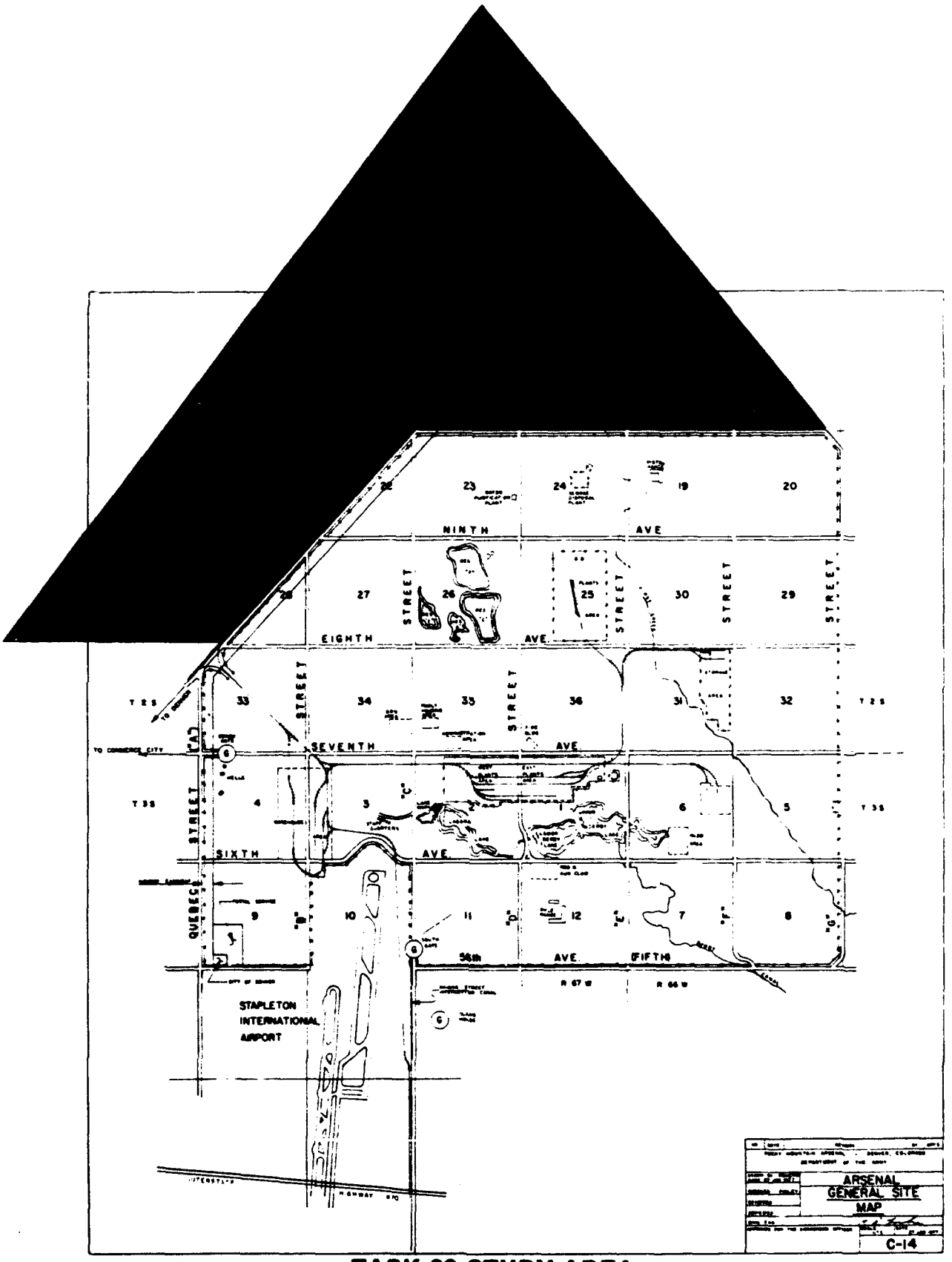
Approximately 15 to 20 wells and coreholes will be drilled in the offpost study area north of RMA. The wells will be drilled into the alluvial and deeper aquifers. Two sampling events will be conducted and the samples will be analyzed for target analytes. Surface water, soils, and sediments will be sampled during future investigations. Air and biota sampling are not anticipated at this time.

Based upon the results of the sample analyses during the RI, an EA and FS will be conducted. The FS will be oriented toward protection of human health and the environment by remediation of contaminated ground water. If during the RI other exposure pathways indicate danger to the public or environment, the EA and FS will address these exposure routes.

Consultants

HLA - field work, report preparation
Boyles Brothers - drilling
ITECH - surveying

Reports	RIC_#	Date Produced
Technical Plan		ongoing
Offpost Interim Action Assessment Report, Draft Final		07/87
RMA Offpost Assessment, Ground Water Quality Report (Domestic Use Phase III) for Sampling Period September through October 1986 and February 1987		08/87
Technology Screening, Draft Interim Report		09/87
RI Contamination Assessment Report		forthcoming
EA Contamination Assessment Report		forthcoming
FS Contamination Assessment Report		forthcoming



TASK 39 STUDY AREA

FS SUMMARY

Task Number:	RIFS1 **Date:** 02/21/88
Task Name:	Offpost Interim Response Action (IRA) and Remedial Investigation/Feasibility Study (RI/FS) Record of Decision (ROD)
PMO Contact:	Charles Scharmann
Medium:	Ground Water (IRA) and All Media (RI/FS ROD)
Award Date:	September 1988
Budget:	N/A
Prime Contractor:	To be determined

Objectives

This task will involve the completion of the following elements of the Offpost IRA: decision document, final design, and implementation document. The task will also include the revision of the Offpost FS Summary Report (Selection of a Preferred Alternative) and preparation and finalization, based on public comment, of the Offpost ROD.

Scope-of-Work

At this time, plans have been initiated to complete an Interim Response Action (IRA) offpost of RMA with the purpose of cleaning up shallow alluvial ground water that has been contaminated with RMA-related compounds. The IRA currently conceptualized includes the construction and operation of a treatment system(s) in the area immediately north of RMA that would intercept contaminated ground water, treat it, and reinject the treated ground water downgradient of the system. For this action to take place, it will first be necessary to prepare the following items:

- o IRA_Decision_Document--This document generally describes the conceptual plans for the IRA. Preparation of this document includes public comment and revisions to the document based on these comments.
- o Final_Design--Includes all levels of design leading up to the Final Design Package (i.e., 35%, 65%, and 95%).
- o Implementation_Document--This document is considered the Final Design Package that includes the implementation schedule used for assessing stipulated penalties.

This task will be responsible for the complete preparation of all of the above items. Although the implementation for the IRA is not projected to be much faster than the Final ROD, the IRA will continue to be pursued because of the potential for delays in the Final ROD due to private and/or public litigation.

The Offpost RI and FS Summary Reports will be produced concurrently with the design and implementation of the Offpost IRA. This task involves the finalization of the RI and FS Summary Reports based on public comments and the preparation and finalization of the Offpost ROD.

Reports

IRA

IRA Decision Document
Final Design/Implementation Document

RI/ES

RI/FS Summary Report
ROD

IRA SUMMARY

Task Number:	26	**Date:** 2/18/88
Task Name:	Groundwater Treatment Study/Interim Action Assessment, South Plants Area and Basin A Neck	
PMO Contact:	Greg Briggs	
Medium:	Groundwater	
Award Date:	July, 1986	
Budget:	$478,965	
Prime Contractor	Ebasco Services Incorporated	

Objectives

The objectives of Task 26 are to evaluate the groundwater flow systems in the South Plants, Basin A, and Basin A Neck region; to identify areas in this region for implementing Interim Response Actions; and, to prepare an assessment of alternatives for the design and construction of an alluvial groundwater intercept and treatment system in the Basin A Neck area.

Scope-of-Work

The focus of the task has been revised twice: Originally a feasibility study evaluating the groundwater flow systems and developing conceptual groundwater collection and treatment systems for the South Plants and Basin A areas, the task was changed to an Interim Action Assessment in these two areas. The assessment of possible interim response actions in these two areas led to the selection of Basin A Neck as the site for an interim response action groundwater intercept and treatment system. The present focus of the task is to evaluate appropriate alternatives for a groundwater intercept and treatment system in the Basin A Neck area, and to select the most cost effective alternative for attaining the objective of the Interim Response Action.

Consultants

R.L Stollar and Associates	-	field work, reports
Arrow Drilling	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
COLOG	-	borehole geophysics
ITECH	-	surveying

Reports

	RIC#	Date Produced
Technical Plan, Draft Final	87007R42	12/86
Interim Response Action Assessment, Draft Report		09/87

0086R
Rev. 2/18/88

IRA SUMMARY

Task Number:	30	**Date:** 02/21/88
Task Name:	Building 1727 Sump Interim Response Action Assessment	
PMO Contact:	Greg Briggs	
Medium:	Structures	
Award Date:	September 1986	
Budget:	$150,143	
Prime Contractor:	Environmental Science and Engineering, Inc. (ESE)	

Objectives

Develop interim response action for treating and disposing of the water contained in Sump 1727 while a longer term solution is developed for handling the water inflow to the sump. Determine cost-effective measures for eliminating or minimizing inflow to the sump, and conditions of the sump relative to the possible future use of the sump in demilitarization activities. Develop long-term solution for handling water inflow to the sump.

Scope-of-Work

Review existing information concerning potential sources of inflow to Sump 1727 (e.g., construction plans of chemical sewers leading to the sump). Perform treatability study of the Sump 1727 water to develop design of interim response action for treating and disposing of the water until a longer term solution can be developed. Conduct an engineering field survey to identify sources of inflow to the sump and develop recommended measures for eliminating or minimizing the inflow. In addition, the condition of the sump will be assessed in the survey relative to possible future use of the sump in demilitarization activities.

Consultants

None

Reports	**RIC_Number**	**Date_Produced**
Technical Plan		ongoing
Draft Final Treatability Study Report		7/87

IRA SUMMARY

Task Number:	31	**Date:**	2/18/88
Task Name:	Basin F Interim Response Action Support		
PMO Contact:	Ali Alavi		
Medium:	Soil, liquid, water		
Award Date:	June, 1987		
Budget:	$108,743		
Prime Contactor:	Ebasco Services Incorporated		

Objectives

The purpose of Task 31 is to provide support for the supplemental Basin F interim action activities conducted by the PM-RMA. Specific work assignments are performed at the request of PM-RMA.

Scope-of-Work

Task 31 will include, but may not be limited to, the following activities: sampling and analysis of soil, liquid, surface water and groundwater in and around Basin F; technical assessments of proposed Basin F Interim Response Actions; measurement of the liquid level and estimation of the volume in Basin F; assessment of liquid in the southern pools of Basin F to determine if that liquid can be treated by conventional means, and not as Basin F liquid; and assessment of the risk to human health resulting from off-gassing during Basin F Interim Response Actions.

Consultants

R.L Stollar and Associates	-	field work, reports
Custom Auger	-	drilling
DataChem	-	chemical analyses
Enseco-CAL	-	chemical analyses
EHRT	-	earth moving
ITECH	-	surveying

Reports

	RIC#	Date Produced
Technical Plan, Draft Final		09/87
Technical Plan, Final		ongoing
Southern Pool Assessment Report		ongoing
Basin F Volume Report		ongoing

0086R
Rev. 2/18/88

IRA SUMMARY

Task Number:	34	**Date:**	2/18/88
Task Name:	Hydrazine Facility Wastewater Treatment and Decommissioning Assessment		
PMO Contact:	Bruce Huenefeld		
Medium:	Wastewater		
Award Date:	May, 1986		
Budget:	$201,363		
Prime Contractor:	Ebasco Services Incorporated		

Objectives

The objective of Task 34 is to determine the best technology available for treating hydrazine contaminated water, and provide a plan and cost estimate to decommission the facility. Criteria of technical feasibility, level of treatment, institutional requirements, and cost were used to compare the options for wastewater treatment.

Scope-of-Work

The scope of Task 34 is to prepare a detailed decommissioning plan for the facility and alternatives for treating and disposing of wastes and wastewater. Four candidate technologies were evaluated in detail: ozone/UV, hydrogen peroxide/UV, evaporation pond, and incineration.

Consultants

Illinois Insitute of Technology Research Institute	-	treatability studies
DataChem	-	chemical analyses

Reports

	RIC#	Date Produced
Technical Plan, Draft Final	87007R33	12/86
Draft Final Report		9/87
Final Report		ongoing

0086R
Rev. 2/18/88

Task Number: TED-8 **Date:** 02/21/88
Task Name: Evaluation/Selection/Testing of Innovative Technologies for Basin F Materials
PMO Contact: Charles Scharmann
Medium: Basin F Liquid/Sludges/Soils
Award Date: July 1986
Budget: $532,750
Prime Contractor: Arthur D. Little, Inc.

Objectives:

The objectives of this task were to: review the industrial data base for promising hazardous materials treatment technologies; evaluate the candidate technologies for use in the treatment of Basin F material; select and complete laboratory testing for the most promising technologies; and prepare a preliminary process design and cost estimate for the technologies tested.

Scope-of-Work

Task TED-8 evaluated 18 different innovative treatment technologies for their application to Basin F waste. The technologies evaluated included: advanced combustion, biochemical, circulating bed combustion, electropyrolysis, encapsulation, extraction, fluidized bed combustion, glassification, infrared radiation, in-situ vitrification, organic stripping, pyroplasma, rotary kiln incineration, sintering, soil washing, supercritical water, synfuels technology, and wet-air oxidation. Of these technologies, three (glassification, soil washing, and circulating bed combustion) were selected for laboratory testing and further evaluation.

Due to permitting problems at the circulating bed combustion test facility, laboratory tests were not able to be completed for the technology; however, laboratory tests were successfully completed for glassification and soil washing. Data resulting from these tests will be incorporated into a final report which will provide a preliminary process design and cost estimate for each technology tested and a recommendation on whether these technologies are feasible for the treatment of Basin F wastes.

Consultants

Battelle Pacific Northwest Laboratories - glassification
MTA Remedial Resources, Inc. - soil washing

Reports	**Date Produced**
Evaluation/Selection of Innovative Technologies for Testing with Basin F Materials	02/87
Evaluation of Three Leading Innovative Technologies for Potential Application to Basin F Materials	ongoing

APPENDIX B
RMA RI/FS SCHEDULE, GLOSSARY AND GANTT CHARTS

RMA RI/FS SCHEDULE GLOSSARY

Addendum:	Analytical data from Phase 2 activities.
ARAR:	Applicable or Relevant and Appropriate Requirements.
BLUE:	Draft version of a document subject to internal government review.
BROWN:	Draft final document subject to comment by PAS.
CAR:	Contamination Assessment Report. A document describing the history, remedial investigation, and potential contamination present at a particular site.
Cont_ID_w/ARARs:	Contaminant identification with chemical-specific ARAR determination.
Data_Assessment:	Analysis of analytical data for the purpose of planning future activities.
Data_Compilation:	Organizing and presenting analytical data.
Data_Integration:	Assembling data from other documents or reports.
Dispute/Finalize:	The 15-day period in which the dispute resolution process may be invoked. If dispute resolution is not invoked, the product can be finalized.
Dispute_Meetings:	In the event that the dispute/finalize step in the dispute resolution precess does not result in a document satisfactory to all parties, the dispute will be resolved in higher level meetings (see Section 5.1.4).
EA:	Endangerment Assessment.
ExpA:	Exposure Assessment.
Fed_Register:	Preparation and submittal of a notice to the Federal Register.
Finalize:	Notification given to the other Parties and the State that a document is final.
FS:	Feasibility Study.
Internal_Review:	Review of a document by the government.
Interim_SAR:	Interim Study Area Report.

IRADD:	Interim Response Action Decision Document.
Media_Report:	Report describing the potential contamination of the air, water, biota, and buildings.
NTP:	Notice to proceed with work.
PAS:	Parties and State. Parties include Shell Oil Company and the United States (including Department of the Army, Environmental Protection Agency, Department of the Interior, and Agency for Toxic Substances and Disease Registry).
PAS_Comment:	PAS review of a document. Issues raised during this review period must be formally addressed.
PAS_Review:	PAS review of a document. Issues raised during this review may be informally addressed.
Ph1:	Phase 1 activities for a particular task.
Ph2:	Phase 2 activities for a particular task. Phase 2 activities are based on the results from Phase 1 activities.
PMO:	Program Manager's Office for Rocky Mountain Arsenal Contamination Cleanup.
Resource:	The following resources are used in the Microsoft Project 3.0 file RMAOK1 for the RI/FS Schedule: D - used for any activity with a significant date: DEAD - used for the activity which contains a deadline; and X - used for any activity with three or more predecessors.
Rewrite/Review:	Steps taken at the conclusion of the dispute meeting phase of the dispute resolution process. Rewriting and review of the subject document takes place until the document reflects the final decision determined by the dispute resolution process.
RI:	Remedial Investigation.
RIFS#:	RI/FS task number designation under new contract.
Risk_Char:	Risk Characterization.

ROD:	Record of Decision.
SAR:	Study Area Report.
IED#:	Task number designation for Technology Division/USATHAMA effort.
White:	Final document.

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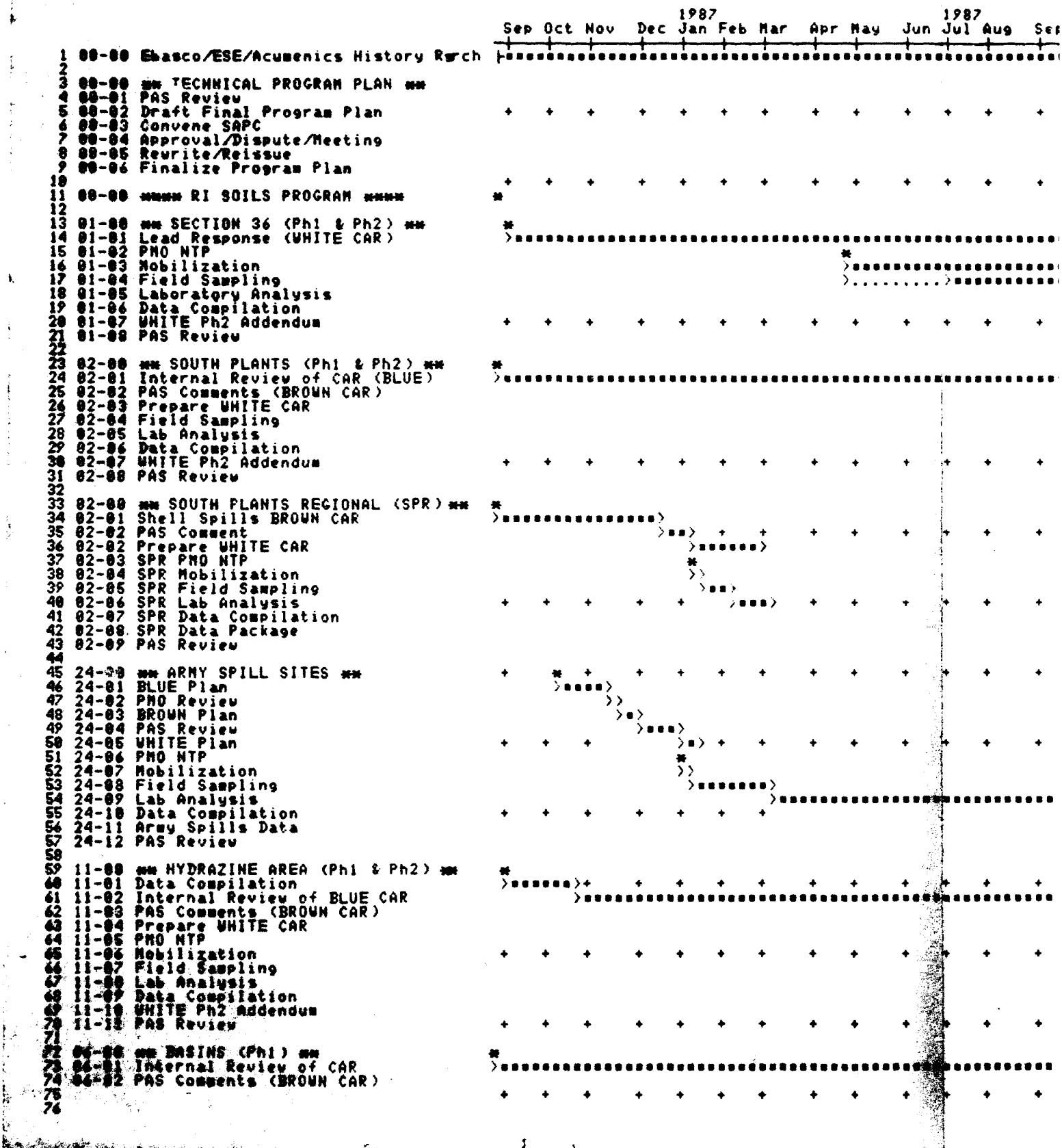

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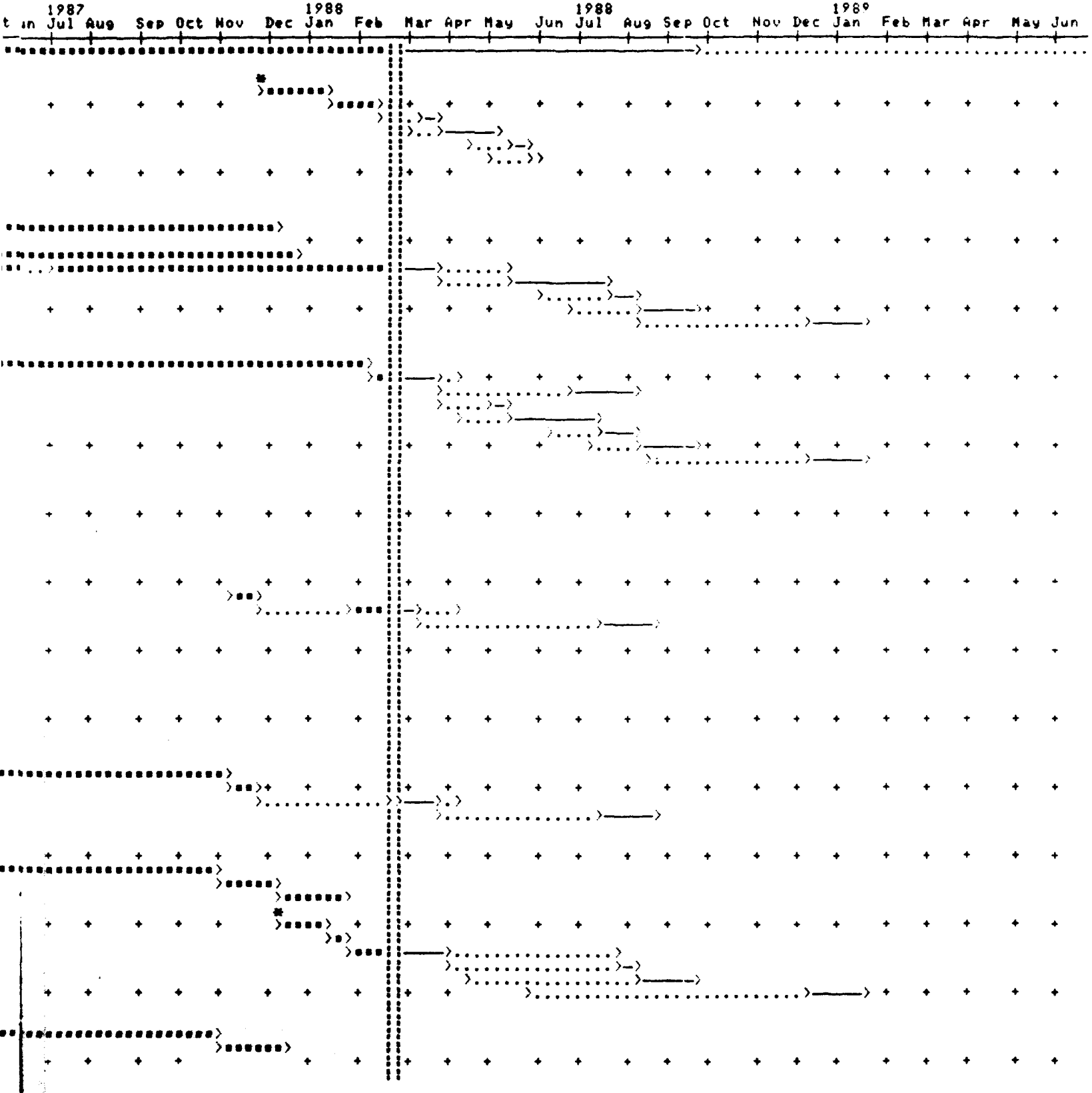

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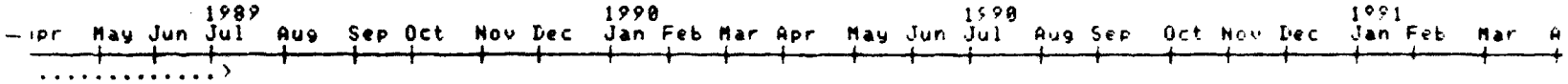

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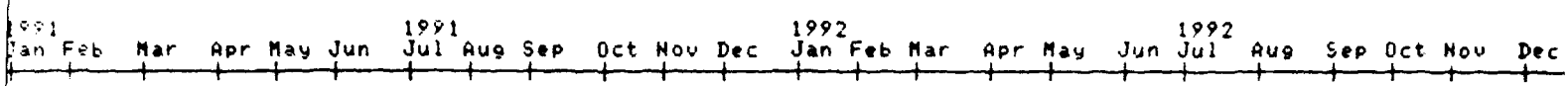

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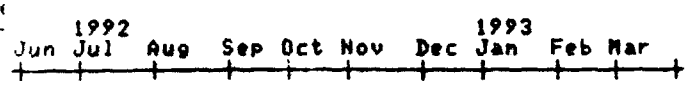

00-00 Ebasco/ESE/Acumenics History Rsrch 1
2
00-00 ** TECHNICAL PROGRAM PLAN ** 3
00-01 PAS Review 4
00-02 Draft Final Program Plan 5
00-03 Convene SAPC 6
00-04 Approval/Dispute/Meeting 7
00-05 Rewrite/Reissue 8
00-06 Finalize Program Plan 9
10
00-00 ***** RI SOILS PROGRAM ***** 11
12
01-00 ** SECTION 36 (Ph1 & Ph2) ** 13
01-01 Lead Response (WHITE CAR) 14
01-02 PMO NTP 15
01-03 Mobilization 16
01-04 Field Sampling 17
01-05 Laboratory Analysis 18
01-06 Data Compilation 19
01-07 WHITE Ph2 Addendum 20
01-08 PAS Review 21
22
02-00 ** SOUTH PLANTS (Ph1 & Ph2) ** 23
02-01 Internal Review of CAR (BLUE) 24
02-02 PAS Comments (BROWN CAR) 25
02-03 Prepare WHITE CAR 26
02-04 Field Sampling 27
02-05 Lab Analysis 28
02-06 Data Compilation 29
02-07 WHITE Ph2 Addendum 30
02-08 PAS Review 31
32
02-00 ** SOUTH PLANTS REGIONAL (SPR) ** 33
02-01 Shell Spills BROWN CAR 34
02-02 PAS Comment 35
02-02 Prepare WHITE CAR 36
02-03 SPR PMO NTP 37
02-04 SPR Mobilization 38
02-05 SPR Field Sampling 39
02-06 SPR Lab Analysis 40
02-07 SPR Data Compilation 41
02-08 SPR Data Package 42
02-09 PAS Review 43
44
24-00 ** ARMY SPILL SITES ** 45
24-01 BLUE Plan 46
24-02 PMO Review 47
24-03 BROWN Plan 48
24-04 PAS Review 49
24-05 WHITE Plan 50
24-06 PMO NTP 51
24-07 Mobilization 52
24-08 Field Sampling 53
24-09 Lab Analysis 54
24-10 Data Compilation 55
24-11 Army Spills Data 56
24-12 PAS Review 57
58
11-00 ** HYDRAZINE AREA (Ph1 & Ph2) ** 59
11-01 Data Compilation 60
11-02 Internal Review of BLUE CAR 61
11-03 PAS Comments (BROWN CAR) 62
11-04 Prepare WHITE CAR 63
11-05 PMO NTP 64
11-06 Mobilization 65
11-07 Field Sampling 66
11-08 Lab Analysis 67
11-09 Data Compilation 68
11-10 WHITE Ph2 Addendum 69
11-11 PAS Review 70
71
06-00 ** BASINS (Ph1 & Ph2) ** 72
06-01 Internal Review of CAR 73
06-02 PAS Comments (BROWN CAR) 74
75

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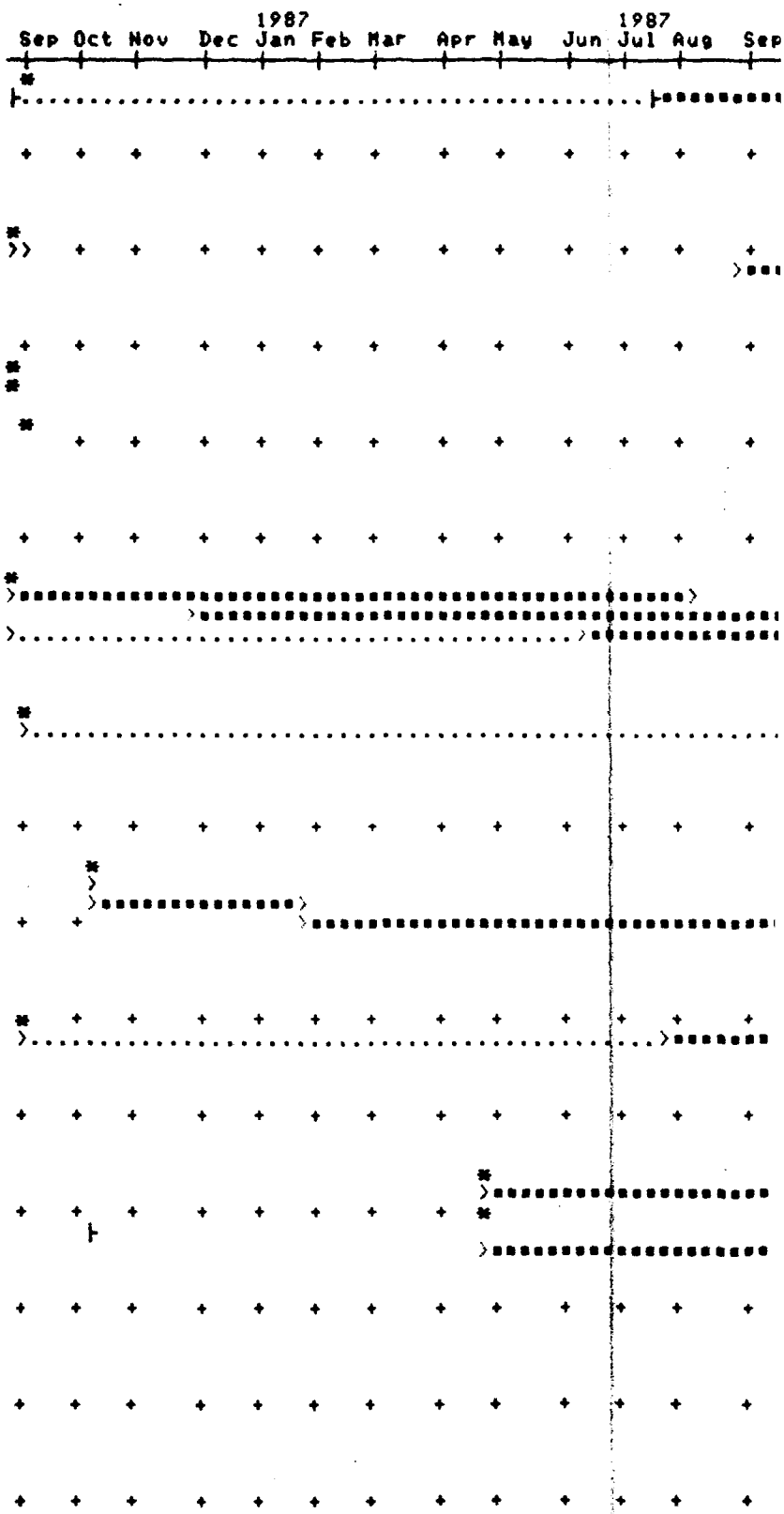

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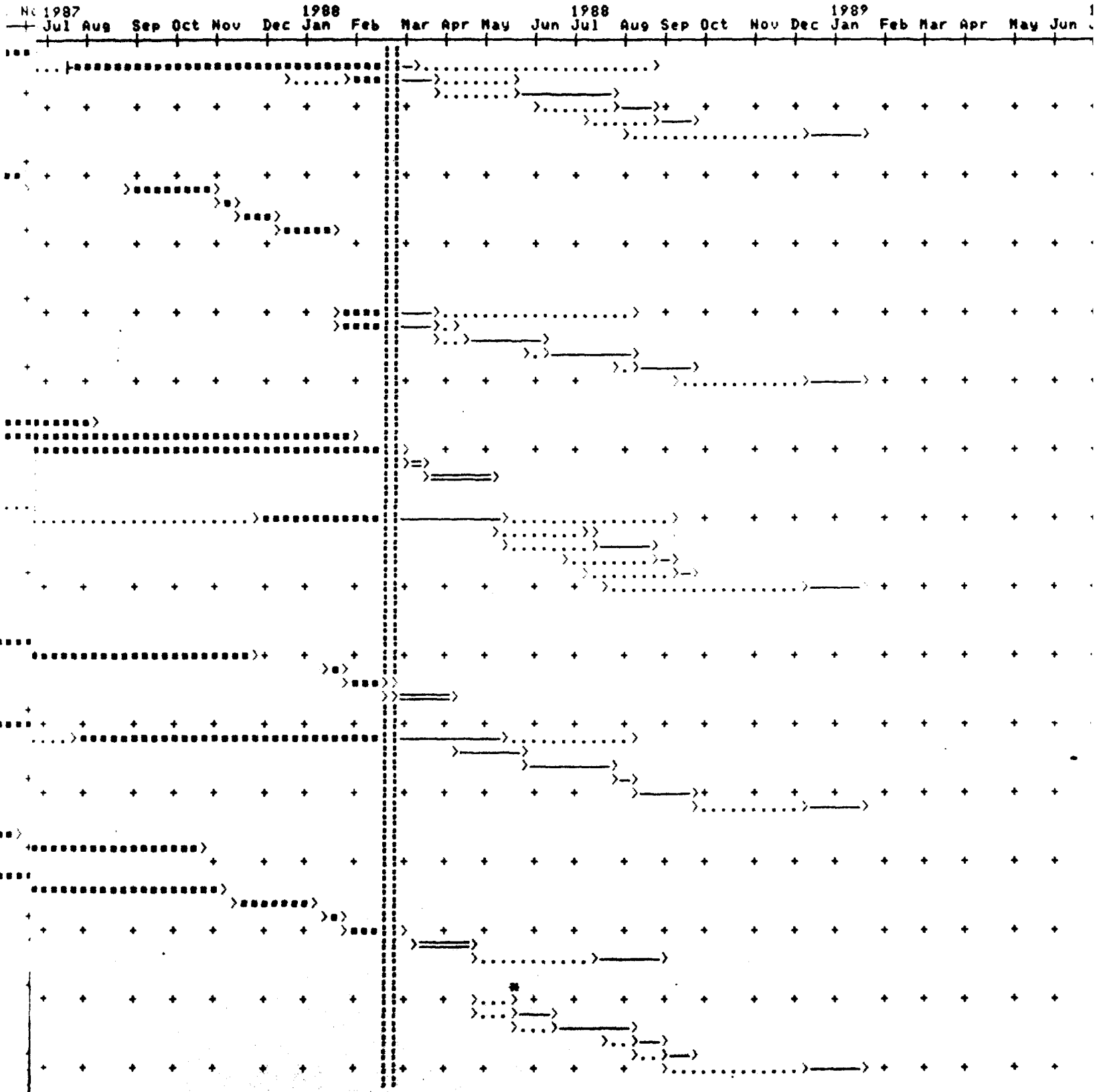

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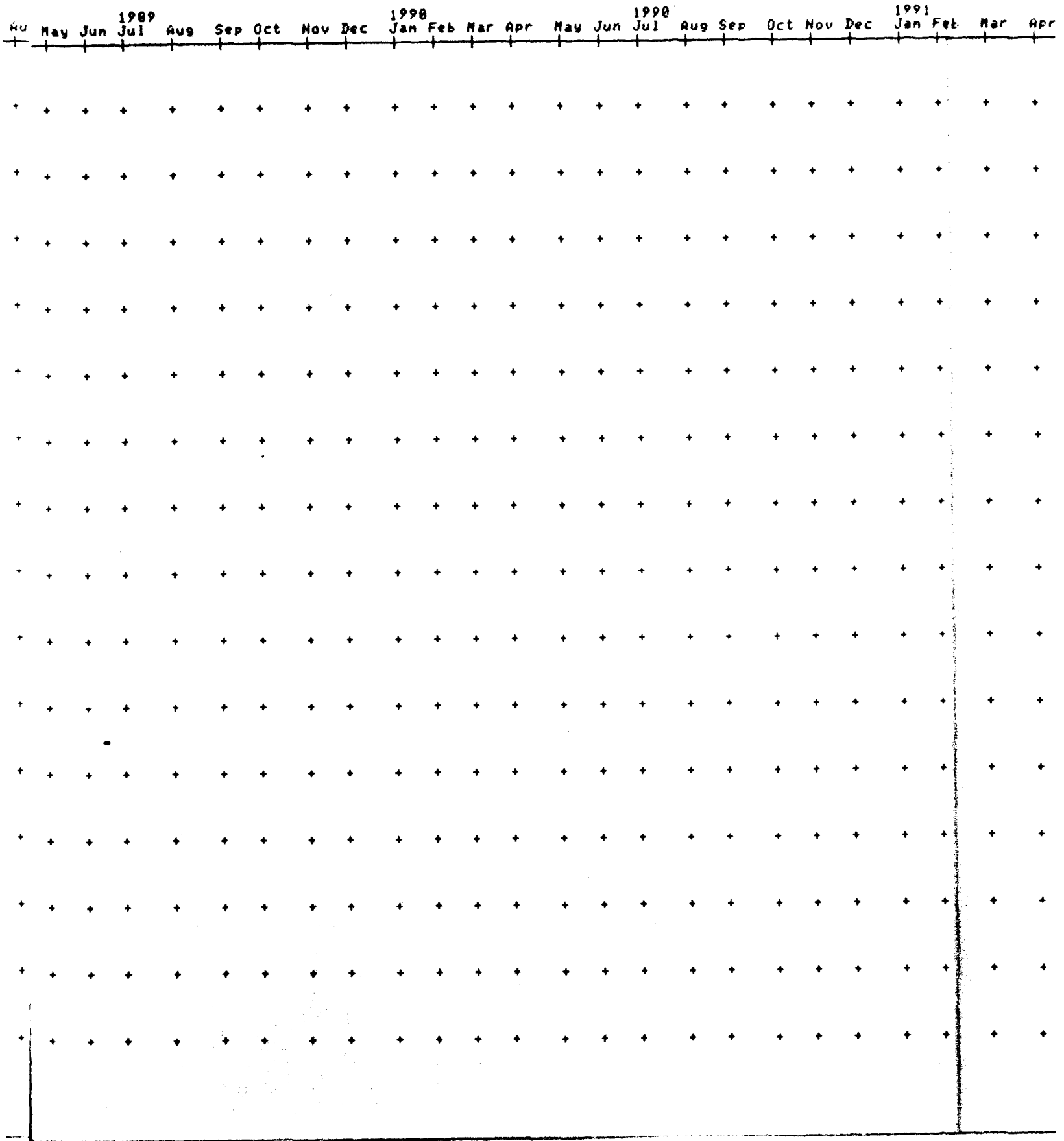

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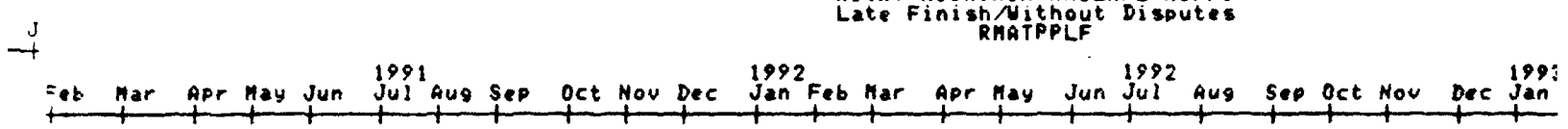

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19-00 BASINS (Ph2)
19-01 Prepare WHITE CARs
19-02 Field Sampling
19-03 Lab Analysis
19-04 Data Compilation
19-05 WHITE Ph2 Addendum
19-06 PAS Review

07-00 LOWER LAKES (Ph1)
07-01 Site 3-4 Field Sampling
07-02 Lab Analysis
07-03 Data Assessment
07-04 Internal Review (BLUE)
07-05 PAS Comments (BROWN CAR)

12-00 DERBY LAKES (Ph1)
12-01 INCORPORATED INTO TASK 7

20-00 LOWER LAKES (Ph2)
20-01 Prepare WHITE CARs
20-02 Field Sampling
20-03 Lab Analysis
20-04 Data Compilation
20-05 WHITE Ph2 Addendum
20-06 PAS Review

14-00 ARMY SITES NORTH (Ph1)
14-01 Lab Analysis
14-02 Data Assessment
14-03 BLUE CAR
14-04 Internal Review of CARs
14-05 PAS Comments (BROWN CAR)

21-00 ARMY SITES NORTH (Ph2)
21-01 Prepare WHITE CAR
21-02 Field Sampling
21-03 Lab Analysis
21-04 Data Compilation
21-05 WHITE Ph2 Addendum
21-06 PAS Review

15-00 ARMY SITES SOUTH (Ph1)
15-01 Mobilization
15-02 Field Sampling
15-03 Lab Analysis
15-04 Data Assessment
15-05 Internal Review of BLUE CAR
15-06 PAS Comments (BROWN CAR)

22-00 ARMY SITES SOUTH (Ph2)
22-01 Prepare WHITE CAR
22-02 Field Sampling
22-03 Lab Analysis
22-04 Data Compilation
22-05 WHITE Ph2 Addendum
22-06 PAS Review

42-00 NORTH PLANTS (Ph1 & Ph2)
42-01 Prepare WHITE TP
42-02 PHD NTP
42-03 Mobilization
42-04 Field Sampling
42-05 Lab Analysis
42-06 Data Assessment
42-07 Internal Review of CAR (BLUE)
42-08 PAS Comment (BROWN CAR)
42-09 Prepare WHITE CAR

42-10 PHD NTP Ph II
42-11 Mobilization
42-12 Field Sampling
42-13 Lab Analysis
42-14 Data Compilation
42-15 WHITE Ph2 Addendum
42-16 PAS Review

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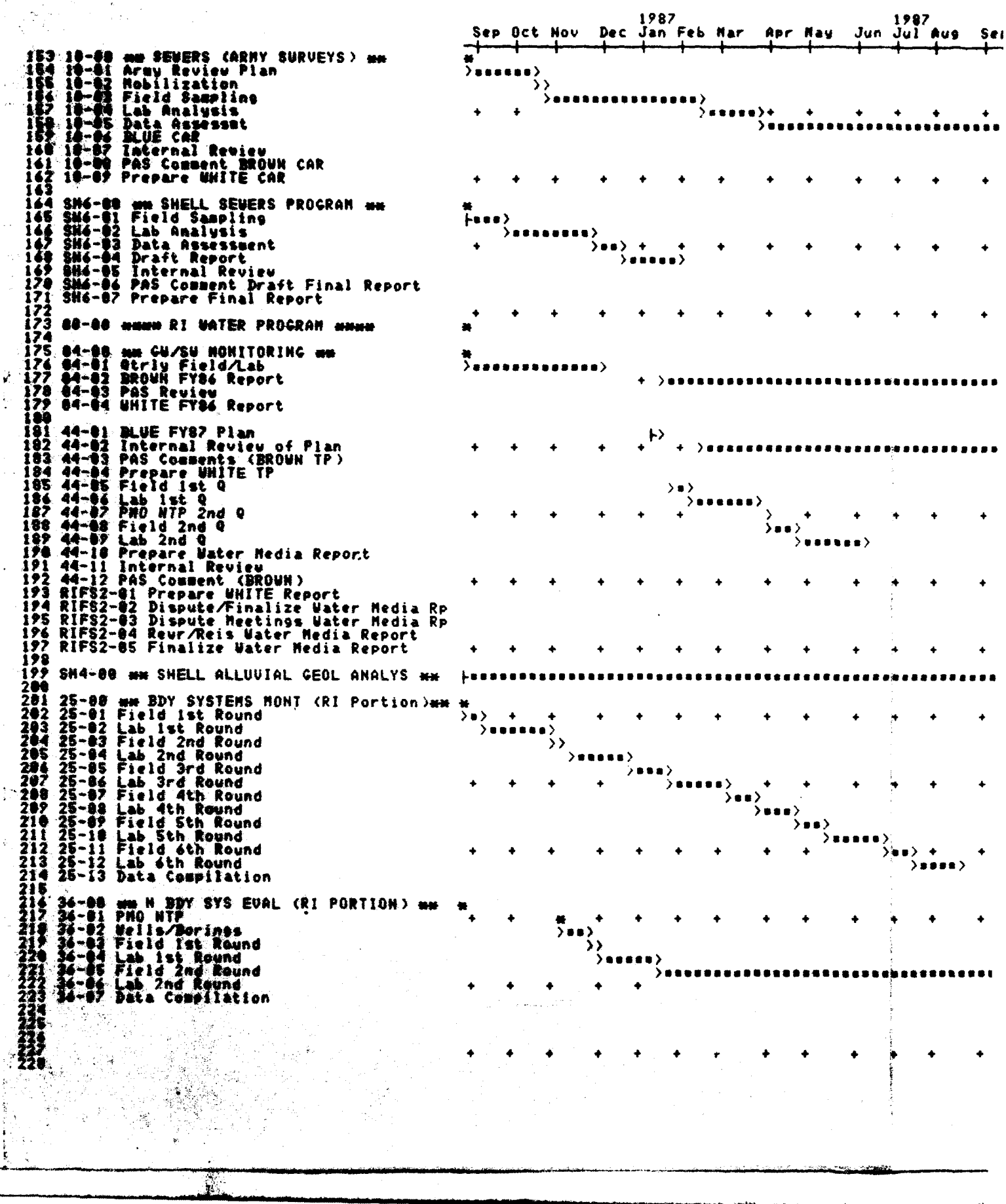

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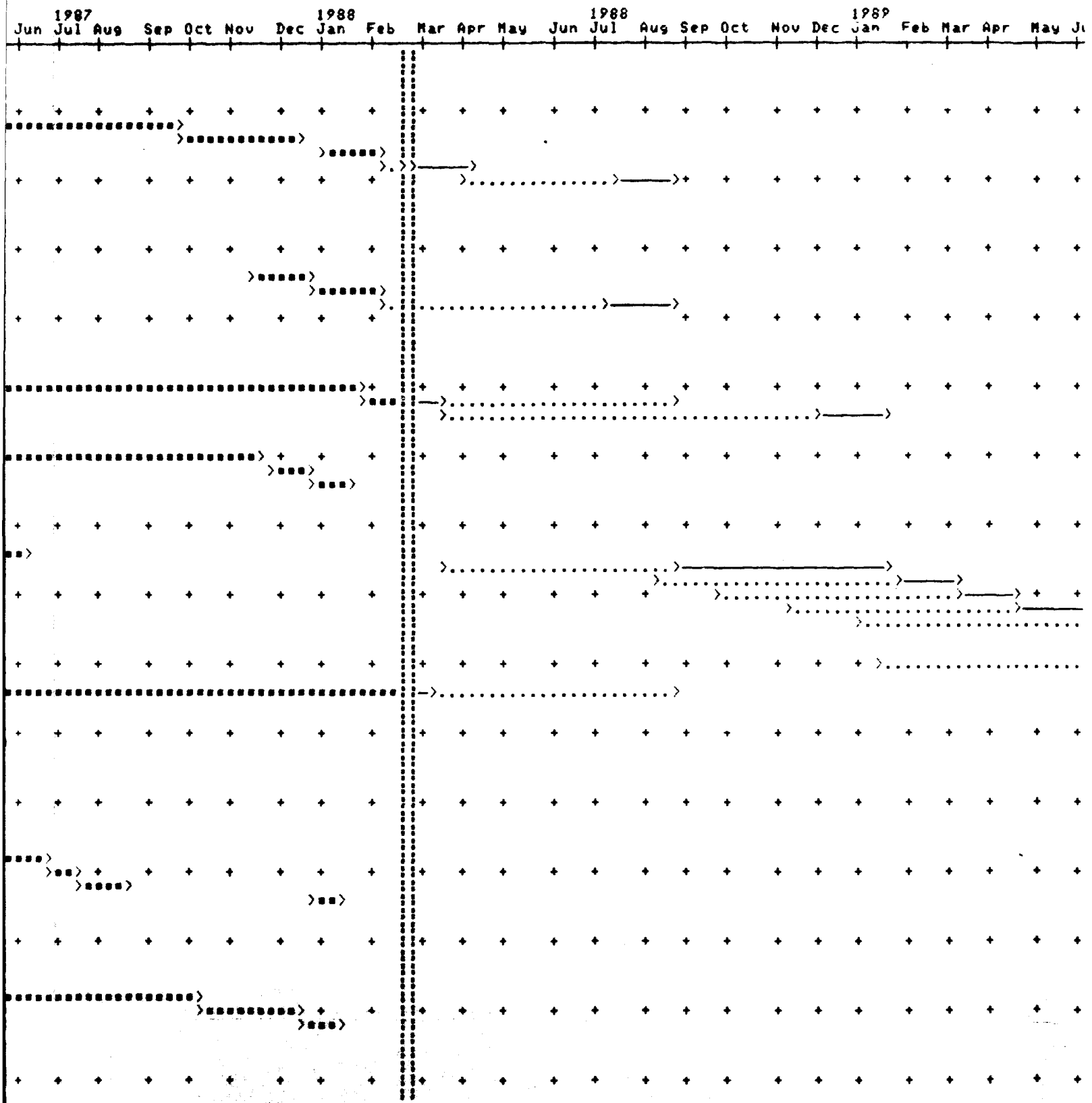

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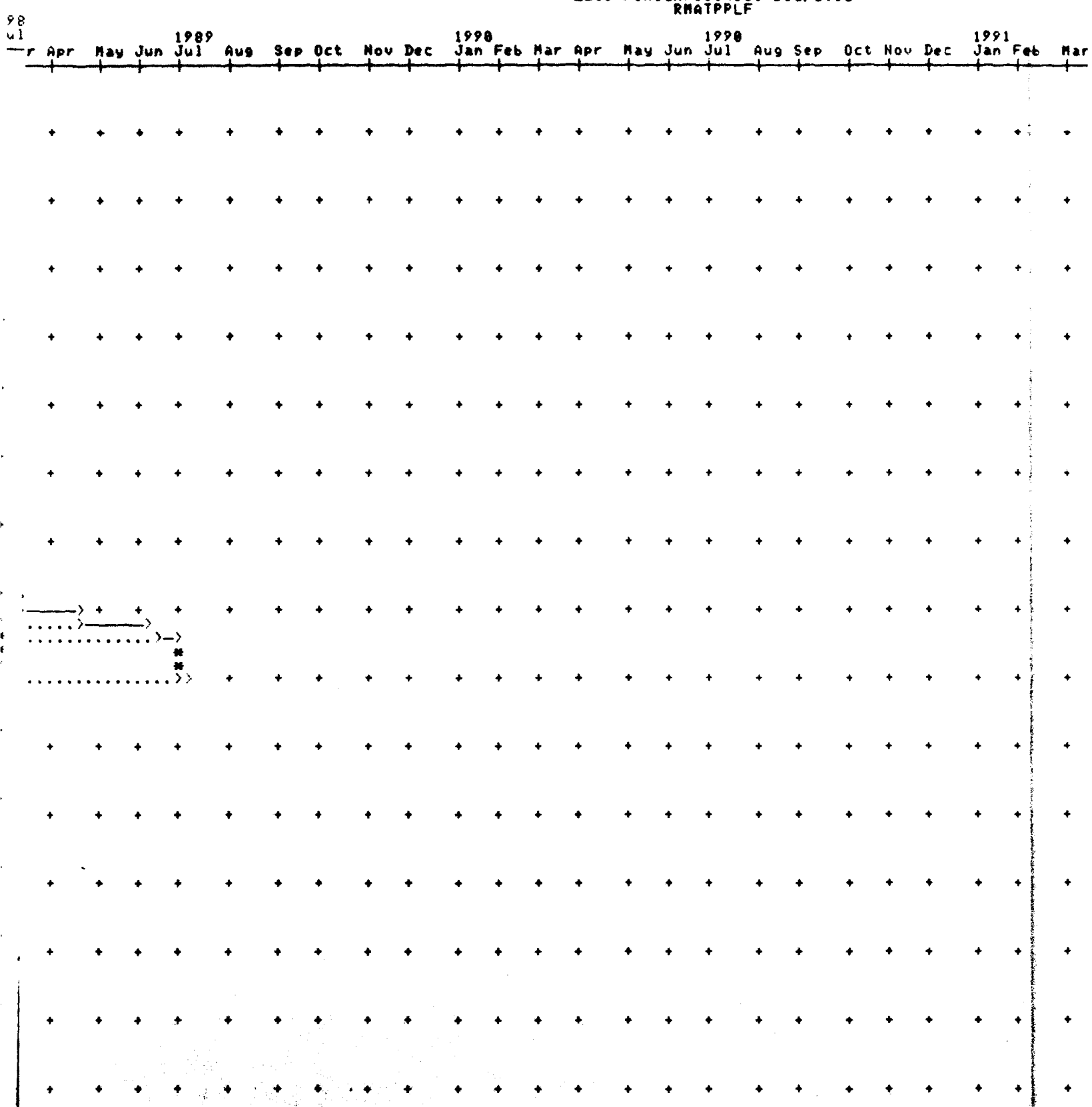

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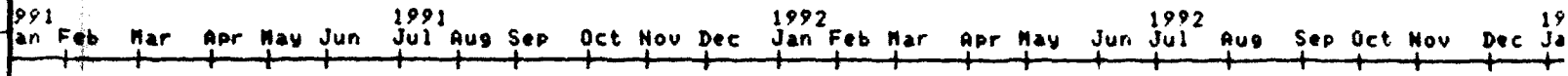

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10-00 *** SEWERS (ARMY SURVEYS) *** 153
10-01 Army Review Plan 154
10-02 Mobilization 155
10-03 Field Sampling 156
10-04 Lab Analysis 157
10-05 Data Assessment 158
10-06 BLUE CAR 159
10-07 Internal Review 160
10-08 PAS Comment BROWN CAR 161
10-09 Prepare WHITE CAR 162
163
SH6-00 *** SHELL SEWERS PROGRAM *** 164
SH6-01 Field Sampling 165
SH6-02 Lab Analysis 166
SH6-03 Data Assessment 167
SH6-04 Draft Report 168
SH6-05 Internal Review 169
SH6-06 PAS Comment Draft Final Report 170
SH6-07 Prepare Final Report 171
172
00-00 ***** RI WATER PROGRAM ***** 173
174
04-00 *** GW/SW MONITORING *** 176
04-01 Qtrly Field/Lab 176
04-02 BROWN FY86 Report 177
04-03 PAS Review 178
04-04 WHITE FY86 Report 179
180
44-01 BLUE FY87 Plan 181
44-02 Internal Review of Plan 182
44-03 PAS Comments (BROWN TP) 183
44-04 Prepare WHITE TP 184
44-05 Field 1st Q 185
44-06 Lab 1st Q 186
44-07 PMO NTP 2nd Q 187
44-08 Field 2nd Q 188
44-09 Lab 2nd Q 189
44-10 Prepare Water Media Report 190
44-11 Internal Review 191
44-12 PAS Comment (BROWN) 192
RIFS2-01 Prepare WHITE Report 193
RIFS2-02 Dispute/Finalize Water Media Rp 194
RIFS2-03 Dispute Meetings Water Media Rp 195
RIFS2-04 Revr/Revs Water Media Report 196
RIFS2-05 Finalize Water Media Report 197
198
SH4-00 *** SHELL ALLUVIAL GEOL ANALYS *** 199
200
25-00 *** BDY SYSTEMS MONT (RI Portion)*** 201
25-01 Field 1st Round 202
25-02 Lab 1st Round 203
25-03 Field 2nd Round 204
25-04 Lab 2nd Round 205
25-05 Field 3rd Round 206
25-06 Lab 3rd Round 207
25-07 Field 4th Round 208
25-08 Lab 4th Round 209
25-09 Field 5th Round 210
25-10 Lab 5th Round 211
25-11 Field 6th Round 212
25-12 Lab 6th Round 213
25-13 Data Compilation 214
215
36-00 *** N BDY SYS EVAL (RI PORTION) *** 216
36-01 PMO NTP 217
36-02 Wells/Boreholes 218
36-03 Field 1st Round 219
36-04 Lab 1st Round 220
36-05 Field 2nd Round 221
36-06 Lab 2nd Round 222
36-07 Data Compilation 223

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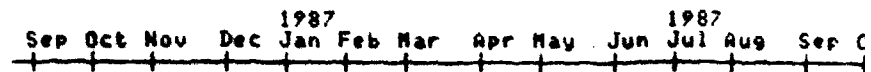

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230	38-01	PMO MTP
231	38-02	TCE Field Rd 1
232	38-03	TCE Lab Rd 1
233	38-04	TCE Field Rd 2
234	38-05	TCE Lab Rd 2
235	38-06	Data Assessment
236	38-07	Internal Review Soil Gas
237	38-08	PAS Review (Soil Gas)
238	38-09	WHITE Report
239		
240	00-00	INTERIM SOILS/WATER INTEGRATION
241		
242	23-00	GW/SW/SO INTEGRATION PLANNING
243	23-01	RI/FS Committee Meeting
244	23-02	Internal Review of Plan BLUE
245	23-03	PAS Comments (BROWN TP)
246	23-04	Prepare WHITE TP
247		
248	SH2-00	SHELL SOILS RE-MAPPING
249		
250	SH2-01	Remapping Field Work
251	SH2-02	Prepare Remapping Report (BLUE)
252	SH2-03	Internal Review
253	SH2-04	PAS Review
254		
255	47-10	INTERIM EASTERN SAR
256	47-11	Data Integration
257	47-12	Contamination Assessment
258	47-13	Interim SAR Preparation (BLUE)
259	47-14	Internal Review
260		
261	47-30	INTERIM CENTRAL SAR
262	47-31	Data Integration
263	47-32	Contamination Assessment
264	47-33	Interim SAR Preparation (BLUE)
265	47-34	Internal Review
266		
267	47-40	INTERIM NORTH-CENTRAL SAR
268	47-41	Data Integration
269	47-42	Contamination Assessment
270	47-43	Interim SAR Preparation (BLUE)
271	47-44	Internal Review
272		
273	48-10	INTERIM WESTERN SAR
274	48-11	Data Integration
275	48-12	Contamination Assessment
276	48-13	Interim SAR Preparation (BLUE)
277	48-14	Internal Review
278		
279	48-20	INTERIM SOUTHERN SAR
280	48-21	Data Integration
281	48-22	Contamination Assessment
282	48-23	Interim SAR Preparation (BLUE)
283	48-24	Internal Review
284		
285	48-30	INTERIM SOUTH PLANTS SAR
286	48-31	Data Integration
287	48-32	Contamination Assessment
288	48-33	Interim SAR Preparation (BLUE)
289	48-34	Internal Review
290		
291	48-40	INTERIM NORTH PLANTS SAR
292	48-41	Data Integration
293	48-42	Contamination Assessment
294	48-43	Interim SAR Preparation (BLUE)
295	48-44	Internal Review
296		
297		
298		
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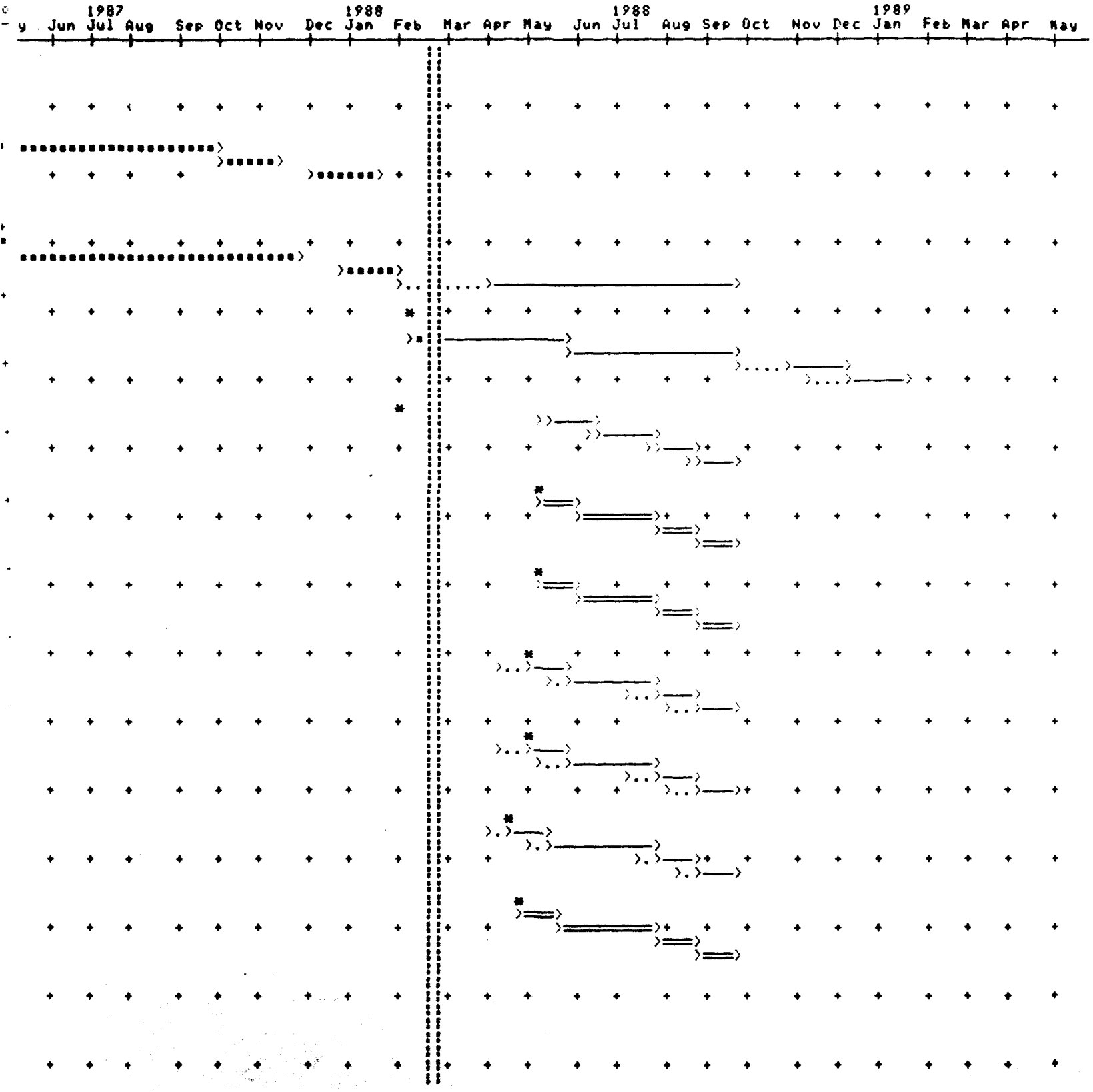

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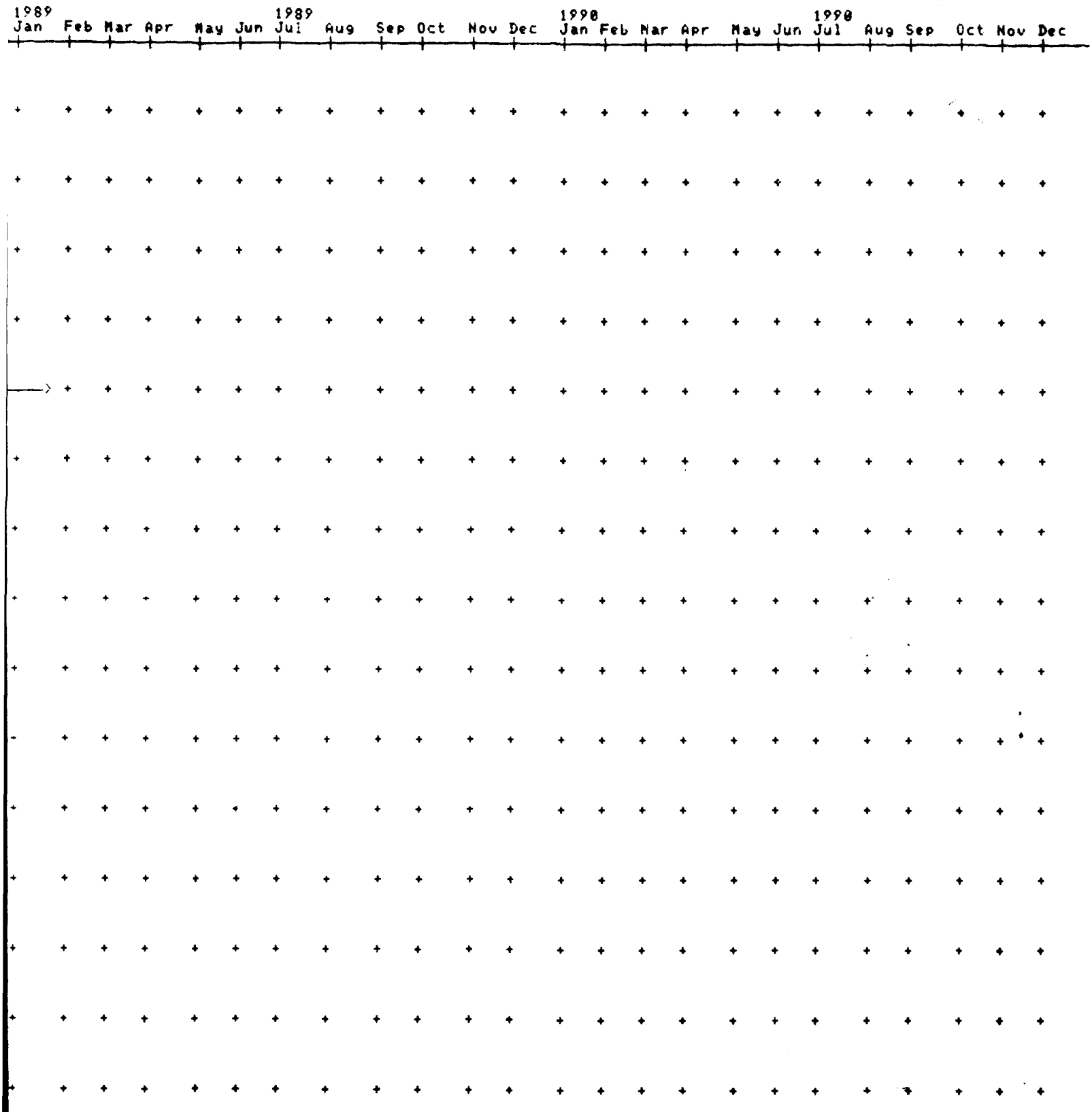

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Fe	Oct	Nov	Dec	1991 Jan	Feb	Mar	Apr	May	Jun	1991 Jul	Aug	Sep	Oct	Nov	Dec	1992 Jan	Feb	Mar	Apr	May	Jun	1992 Jul	Aug	Sep

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SENAL RI/FS
ut Disputes
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	1992						1993		
un	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar

30-00 ** [illegible] 237
30-02 [illegible]
30-04 [illegible]
30-06 Data [illegible]
30-07 Internal [illegible]
30-08 PAS Review [illegible]
30-09 [illegible]

00-00 **INTERIM SOILS/WATER [illegible]

23-00 ** GW/SW/SO INTEGRATION [illegible]
23-01 [illegible] Committee [illegible]
23-02 Internal Review of [illegible]
23-03 PAS Comments [illegible]
23-04 Prepare [illegible] TP

SH2-00 ** SHELL SOILS RE-MAPPING ** 249
SH2-01 Remapping Field Work 250
SH2-02 Prepare Remapping Report (BLUE) 251
SH2-03 Internal Review 252
SH2-04 PAS Review 253
254
47-10 ** INTERIM EASTERN SAR ** 255
47-11 Data Integration 256
47-12 Contamination Assessment 257
47-13 Interim SAR Preparation (BLUE) 258
47-14 Internal Review 259
260
47-30 ** INTERIM CENTRAL SAR ** 261
47-31 Data Integration 262
47-32 Contamination Assessment 263
47-33 Interim SAR Preparation (BLUE) 264
47-34 Internal Review 265
266
47-40 ** INTERIM NORTH-CENTRAL SAR ** 267
47-41 Data Integration 268
47-42 Contamination Assessment 269
47-43 Interim SAR Preparation (BLUE) 270
47-44 Internal Review 271
272
48-10 ** INTERIM WESTERN SAR ** 273
48-11 Data Integration 274
48-12 Contamination Assessment 275
48-13 Interim SAR Preparation (BLUE) 276
48-14 Internal Review 277
278
48-20 ** INTERIM SOUTHERN SAR ** 279
48-21 Data Integration 280
48-22 Contamination Assessment 281
48-23 Interim SAR Preparation (BLUE) 282
48-24 Internal Review 283
284
48-30 ** INTERIM SOUTH PLANTS SAR ** [illegible]
48-31 Data Integration [illegible]
48-32 Contamination Assessment [illegible]
48-33 Interim SAR Preparation [illegible]
48-34 Internal Review [illegible]

48-40 ** INTERIM NORTH PLANTS [illegible]
48-41 Data [illegible]
48-42 [illegible]
48-43 Interim [illegible]
48-44 Internal [illegible]

ROCKY MOUNTAIN ARSENAL RI/FS
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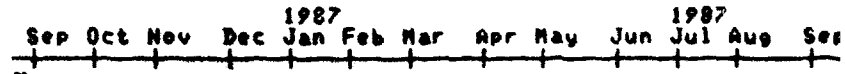

305	00-00	*****	RI AIR PROGRAM *****
306			
307	10-00	***	AIR MONITORING ***
308	10-01		Field Sampling
309	10-02		Lab Analysis
310	10-03		Data Assessmt
311	10-04		Prepare Air Media Report (BLUE)
312	10-05		Internal Review
313	10-06		PAS Comment (BROWN Media Report)
314	10-07		Prepare WHITE Report
315	10-08		Dispute/Finalize Media Report
316	10-09		Dispute Meetings Media Report
317	10-10		Rewrite/Reissue Media Report
318	10-11		Finalize Air Media Report
319			
320	00-00	*****	RI BIOTA PROGRAM *****
321			
322	09-00	***	BIOTA (Army) ***
323	09-01		PMO NTP
324	09-02		Amend TECH PLAN
325	09-03		PMO Review
326	09-04		BROWN Tech Plan
327	09-05		PAS Review
328	09-06		Prepare WHITE TP
329	09-07		Finalize WHITE Plan
330	09-08		Biota Evaluation
331	09-09		Addl Chem Certif
332	09-10		PMO Approval
333	09-11		Start Proc 86 Samples
334	09-12		Finish Proc 86 Samples
335	09-13		Complete 1986-1988 Analyses
336	09-14		1987 Eagle Field Studies
337	09-15		Eagle Return
338	09-16		1988 Eagle Field Studies
339	09-17		1988 Eagle Report
340	09-18		PAS Review
341	09-19		Ache Inhibition Testing
342	09-20		Ache Data Compilation
343	09-21		PAS Review
344	09-22		Avian Data Compilation
345	09-23		PAS Review
346	09-24		Data Integration
347	09-25		Prepare Biota Media Report
348	09-26		Internal Review of Media Report
349	RIFS2-06		PAS Comment(BROWN Media Report)
350	RIFS2-07		Prepare WHITE Report
351	RIFS2-08		Dispute/Finalize Media Report
352	RIFS2-09		Dispute Meetings Media Report
353	RIFS2-10		Rewrite/Reissue Media Report
354	RIFS2-11		Finalize Biota Media Report
355			
356	SH3-10	***	SHELL AQUATIC STUDIES ***
357	SH3-11		Acquire Contract Lab
358	SH3-12		Lab Analysis
359	SH3-13		Data Assessment
360	SH3-14		Internal Review of Draft Report
361	SH3-15		PAS Review
362			
363			
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ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
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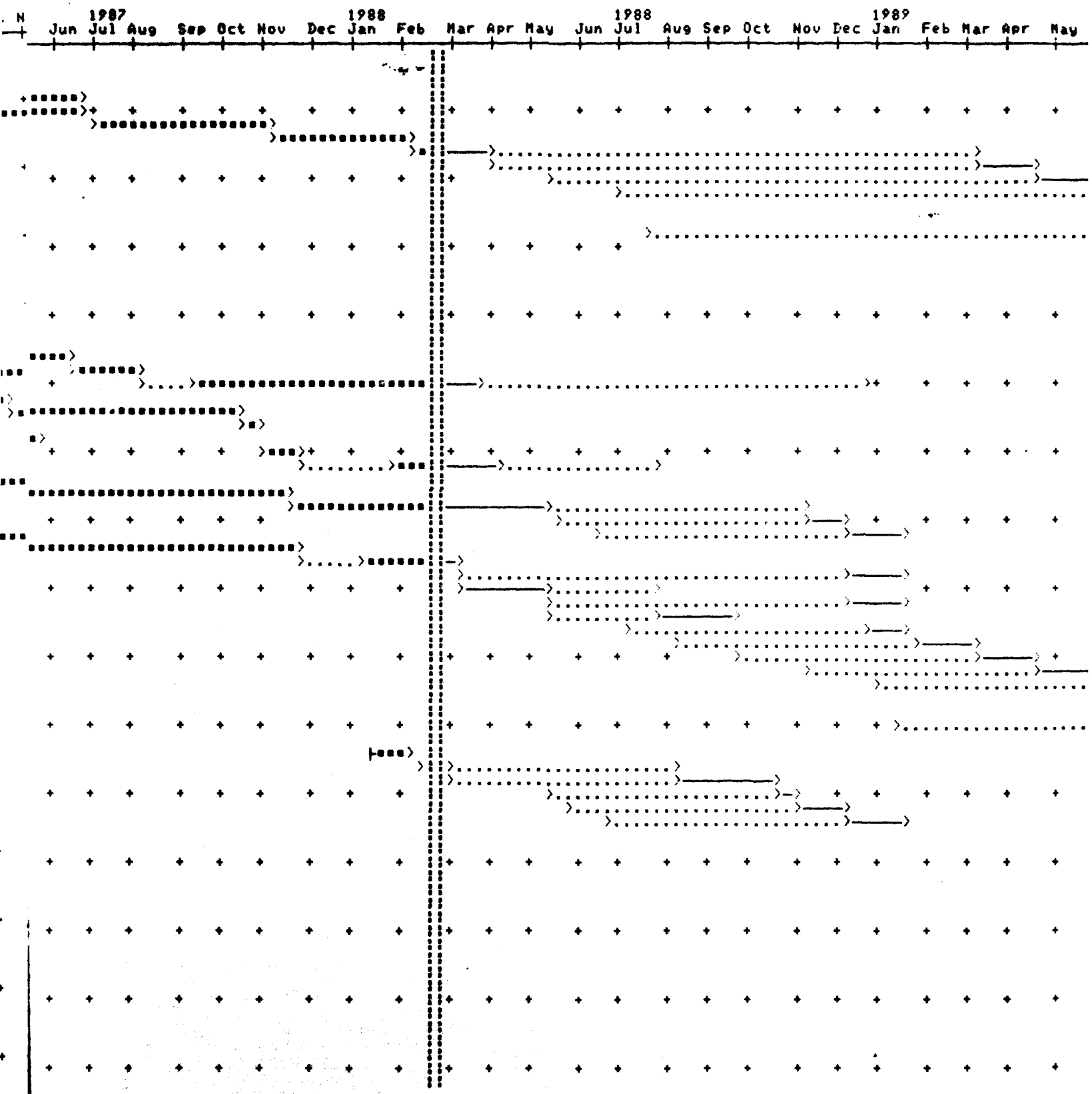

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Late Finish/Without Disputes
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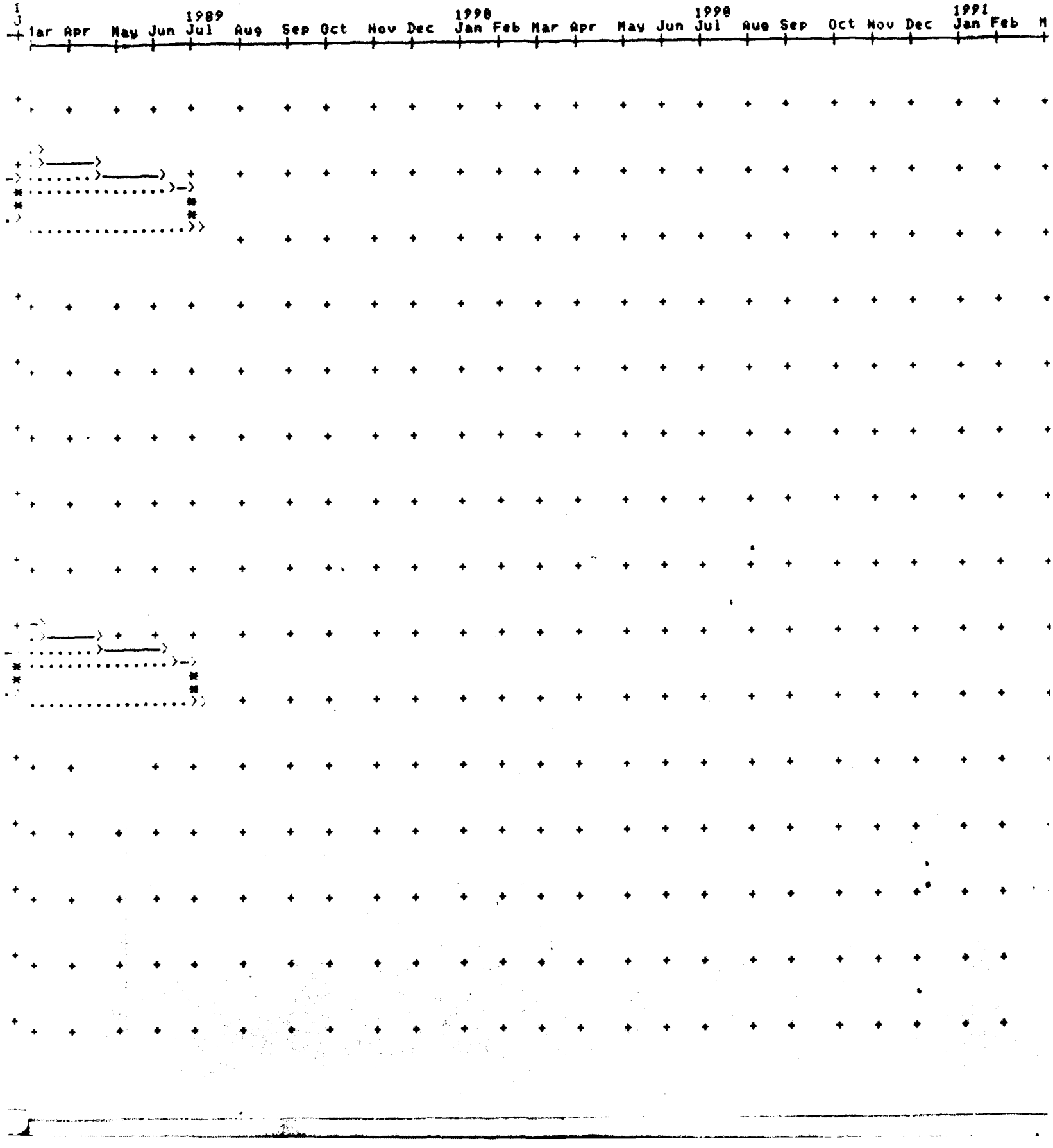
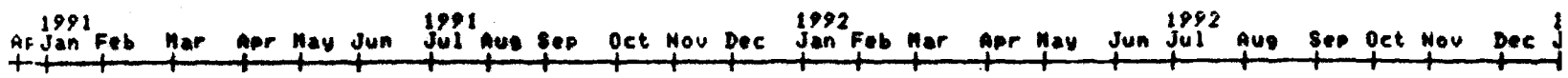
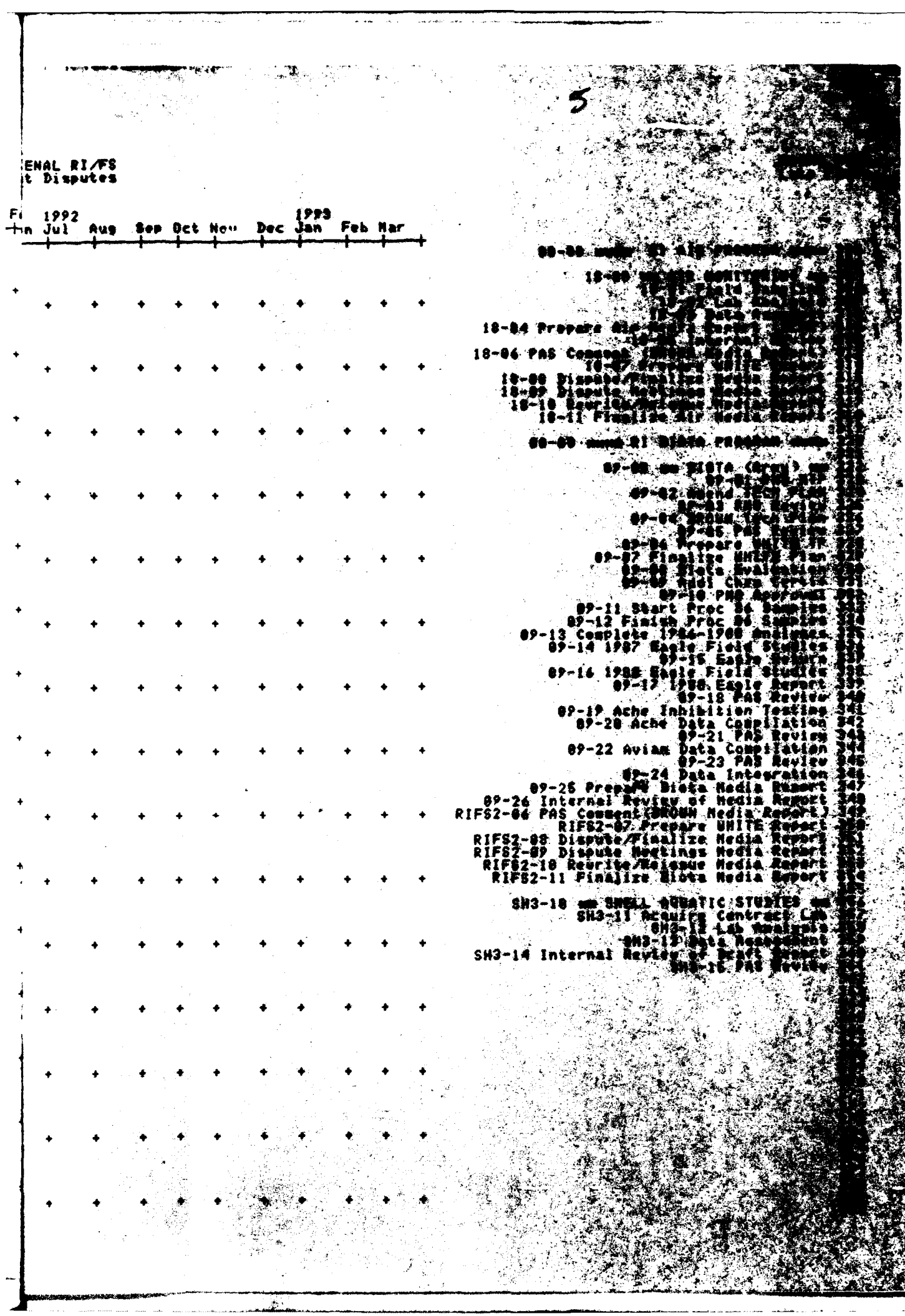


ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



ENAL RI/FS
t Disputes



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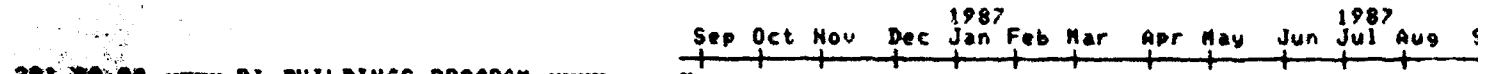
ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



381	00-00	***** RI BUILDINGS PROGRAM *****	
382			
383	24-00	*** ARMY BUILDINGS ***	
384	24-01	BLUE Tech Plan Preparation	
385	24-02	CAR Committee Review	
386	24-03	BROWN Tech Plan Preparation	
387	24-04	PMO Review	
388	24-05	Transmittal to PAS Committee	
389	24-06	PAS Review/Comment	
390	24-07	Lead Response (BROWN TP)	
391	24-08	PMO Notice to Proceed	
392	24-09	Mobilization	
393	24-10	Training, Field Crews, Tech Suppor	
394	24-11	Records Search	
395	24-12	Field Surveys	
396	24-13	Field Sampling	
397	24-14	Laboratory Analysis	
398	24-15	Data Compilation/Review	
399	24-16	Prepare Bldg Media Report	
400	24-17	Internal Review of Media Report	
401	24-18	PAS Comment (BROWN Media Report)	
402	24-19	Prepare WHITE Report	
403	24-20	Dispute/Finalize Media Report	
404	24-21	Dispute Meetings Bldg	
405	24-22	Rewrite/Reissue Bldg	
406	24-23	Finalize Bldg Media Report	
407			
408	00-00	***** FINAL STUDY AREA REPORTS *****	
409			
410	RIFS2-020	*** FINAL EASTERN SAR ***	
411	RIFS2-021	Eastern SAR Preparation	
412	RIFS2-022	Internal Review of SAR	
413	RIFS2-023	PAS Comments (BROWN SAR)	
414	RIFS2-024	Prepare WHITE SAR	
415	RIFS2-025	Dispute/Finalize SAR	
416	RIFS2-026	Dispute Meeting SAR	
417	RIFS2-027	Rewrite/Reissue SAR	
418	RIFS2-028	Finalize SAR	
419			
420	RIFS2-030	*** FINAL CENTRAL SAR ***	
421	RIFS2-031	Central SAR Preparation	
422	RIFS2-032	Internal Review of SAR	
423	RIFS2-033	PAS Comments (BROWN SAR)	
424	RIFS2-034	Prepare WHITE SAR	
425	RIFS2-035	Dispute/Finalize SAR	
426	RIFS2-036	Dispute Meeting SAR	
427	RIFS2-037	Rewrite/Reissue SAR	
428	RIFS2-038	Finalize SAR	
429			
430	RIFS2-040	*** FINAL NORTH CENTRAL SAR ***	
431	RIFS2-041	North Central SAR Preparation	
432	RIFS2-042	Internal Review of SAR	
433	RIFS2-043	PAS Comments (BROWN SAR)	
434	RIFS2-044	Prepare WHITE SAR	
435	RIFS2-045	Dispute/Finalize SAR	
436	RIFS2-046	Dispute Meeting SAR	
437	RIFS2-047	Rewrite/Reissue SAR	
438	RIFS2-048	Finalize SAR	
439			
440	RIFS2-050	*** FINAL SOUTHERN SAR ***	
441	RIFS2-051	Southern SAR Preparation	
442	RIFS2-052	Internal Review of SAR	
443	RIFS2-053	PAS Comments (BROWN SAR)	
444	RIFS2-054	Prepare WHITE SAR	
445	RIFS2-055	Dispute/Finalize SAR	
446	RIFS2-056	Dispute Meeting SAR	
447	RIFS2-057	Rewrite/Reissue SAR	
448	RIFS2-058	Finalize SAR	
449			
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ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
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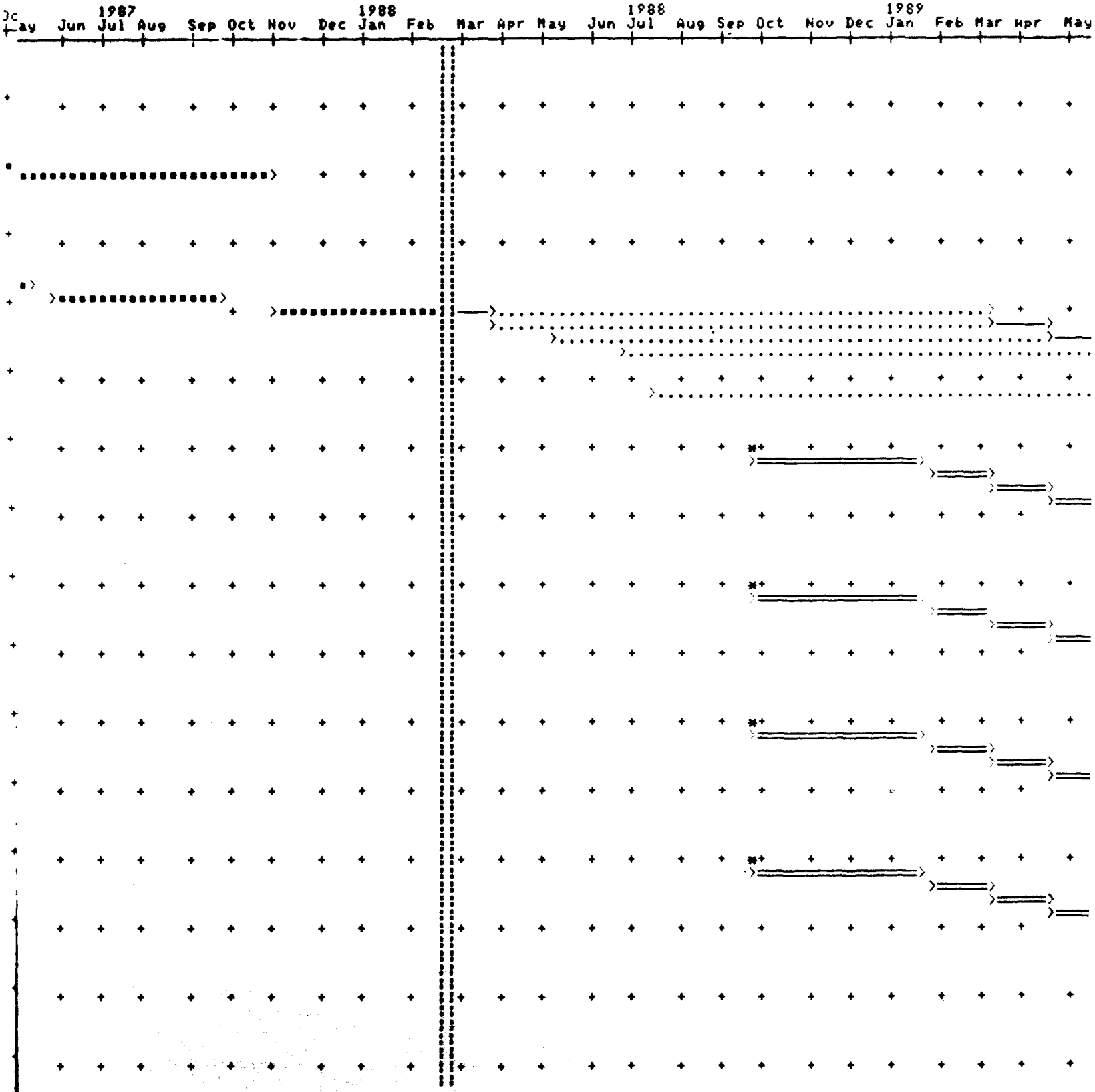
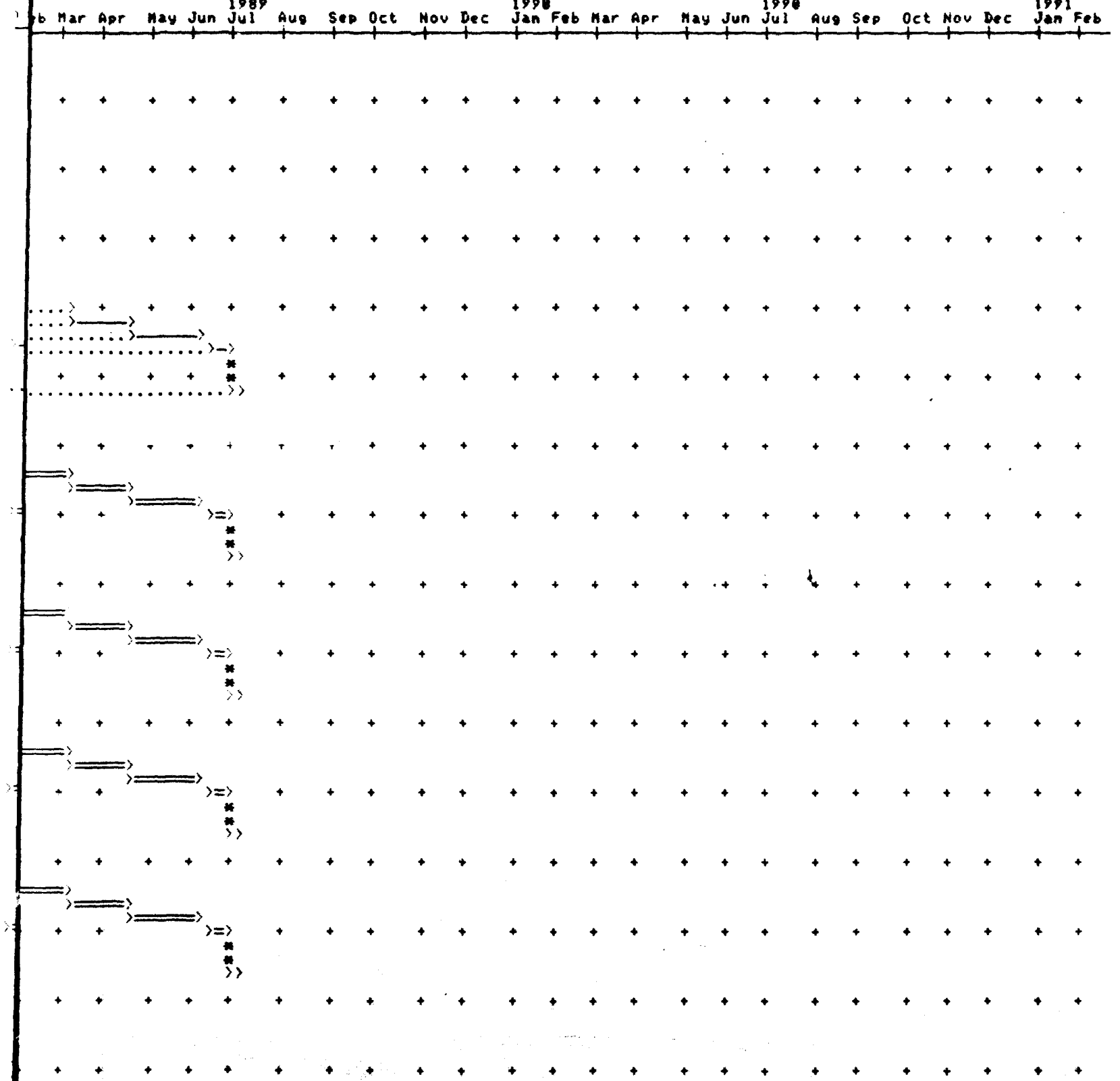
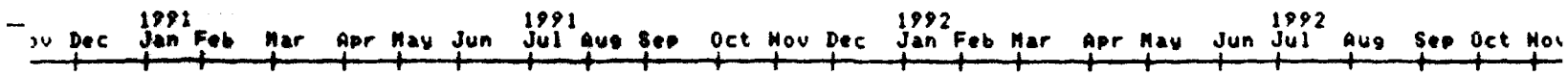


ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



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...ENAL RI/FS
... Disputes

	1992 Jul	Aug	Sep	Oct	Nov	Dec	1993 Jan	Feb	Mar

00-00 **** RI BUILDING PROGRAM ****

24-00 ** ... **
24-01 BLUE Tech Plan Preparation
24-02 CAR Committee Review
24-03 BROWN Tech Plan Preparation
24-04 AND Review
24-05 Transmittal to PAS Committee
24-06 PAS Review/Comment
24-07 Lead Response (BROWN ...)
24-08 AND Notice to Proceed
24-09 Mobilization
24-10 Training, Field Crews, Tech ...
24-11 Records Search
24-12 Field Surveys
24-13 Field Sampling
24-14 Laboratory Analysis
24-15 Data Compilation/Review
24-16 Prepare Bldg Media Report
24-17 Internal Review of Media Report
24-18 PAS Comment (BROWN Media Report)
24-19 Prepare WHITE Report
24-20 Dispute/Finalize Media Report
24-21 Dispute Meetings Bldg
24-22 Rewrite/Reissue Bldg
24-23 Finalize Bldg Media Report

00-00 **** FINAL STUDY AREA REPORTS ****

RIFS2-020 ** FINAL EASTERN SAR **
RIFS2-021 Eastern SAR Preparation
RIFS2-022 Internal Review of SAR
RIFS2-023 PAS Comments (BROWN SAR)
RIFS2-024 Prepare WHITE SAR
RIFS2-025 Dispute/Finalize SAR
RIFS2-026 Dispute Meeting SAR
RIFS2-027 Rewrite/Reissue SAR
RIFS2-028 Finalize SAR

RIFS2-030 ** FINAL CENTRAL SAR **
RIFS2-031 Central SAR Preparation
RIFS2-032 Internal Review of SAR
RIFS2-033 PAS Comments (BROWN SAR)
RIFS2-034 Prepare WHITE SAR
RIFS2-035 Dispute/Finalize SAR
RIFS2-036 Dispute Meeting SAR
RIFS2-037 Rewrite/Reissue SAR
RIFS2-038 Finalize SAR

RIFS2-040 ** FINAL NORTH CENTRAL SAR **
RIFS2-041 North Central SAR Preparation
RIFS2-042 Internal Review of SAR
RIFS2-043 PAS Comments (BROWN SAR)
RIFS2-044 Prepare WHITE SAR
RIFS2-045 Dispute/Finalize SAR
RIFS2-046 Dispute Meeting SAR
RIFS2-047 Rewrite/Reissue SAR
RIFS2-048 Finalize SAR

RIFS2-050 ** FINAL SOUTHERN SAR **
RIFS2-051 Southern SAR Preparation
RIFS2-052 Internal Review of SAR
RIFS2-053 PAS Comments (BROWN SAR)
RIFS2-054 Prepare WHITE SAR
RIFS2-055 Dispute/Finalize SAR
RIFS2-056 Dispute Meeting SAR
RIFS2-057 Rewrite/Reissue SAR
RIFS2-058 Finalize SAR

ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF

			1987 Sep	Oct	Nov	Dec	1988 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
457	RIFS2-060	** FINAL WESTERN SAR **													
458	RIFS2-061	Western SAR Preparation													
459	RIFS2-062	Internal Review of SAR													
460	RIFS2-063	PAS Comments (BROWN SAR)													
461	RIFS2-064	Prepare WHITE SAR	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
462	RIFS2-065	Dispute/Finalize SAR															
463	RIFS2-066	Dispute Meeting SAR															
464	RIFS2-067	Rewrite/Reissue SAR															
465	RIFS2-068	Finalize SAR															
466			+	+	+	+	+	+	+	+	+	+	+	+	+	+	
467	RIFS2-070	** FINAL SOUTH PLANTS SAR **															
468	RIFS2-071	South Plants SAR Preparation															
469	RIFS2-072	Internal Review of SAR															
470	RIFS2-073	PAS Comments (BROWN SAR)															
471	RIFS2-074	Prepare WHITE SAR	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
472	RIFS2-075	Dispute/Finalize SAR															
473	RIFS2-076	Dispute Meeting SAR															
474	RIFS2-077	Rewrite/Reissue SAR															
475	RIFS2-078	Finalize SAR															
476			+	+	+	+	+	+	+	+	+	+	+	+	+	+	
477	RIFS2-080	** FINAL NORTH PLANTS SAR **															
478	RIFS2-081	North Plants SAR Preparation															
479	RIFS2-082	Internal Review of SAR															
480	RIFS2-083	PAS Comments (BROWN SAR)															
481	RIFS2-084	Prepare WHITE SAR	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
482	RIFS2-085	Dispute/Finalize SAR															
483	RIFS2-086	Dispute Meeting SAR															
484	RIFS2-087	Rewrite/Reissue SAR															
485	RIFS2-088	Finalize SAR															
486			+	+	+	+	+	+	+	+	+	+	+	+	+	+	
487	RIFS5-00	***** PREPARE RI *****															
488																	
489	RIFS5-01	** Prepare RI **															
490	RIFS5-02	Internal Review of RI															
491	RIFS5-03	PAS Comments (BROWN RI)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
492	RIFS5-04	Prepare WHITE RI															
493	RIFS5-05	Dispute/Finalize RI															
494	RIFS5-06	Dispute Meetings RI															
495	RIFS5-07	Rewrite/Reissue RI															
496	RIFS5-08	Finalize RI	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
497																	
498	00-00	***** ENDANGERMENT ASSESSMENT *****	*														
499																	
500	35-00	** ENDANGERMENT ASSESSMENT **	*														
501	35-01	RI/FS Committee Meeting	>a>	+	+	+	+	+	+	+	+	+	+	+	+	+	
502	35-02	Internal Review of Plan		>==========>													
503	35-03	PAS Comments (BROWN TP)															
504	35-04	Prepare WHITE TP															
505																	
506	35-05	Prepare Contamination ID w/ARARs	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
507	35-06	Internal Review of Cont ID w/ARARs															
508	35-07	PAS Comments (BROWN)															
509	35-08	Prepare WHITE Cont ID w/ARARs															
510	35-09	Dispute/Finalize Cont ID w/ARARs															
511	35-10	Dispute Meetings	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
512	35-11	Rewrite/Reissue															
513	35-12	Finalize Contamination ID w/ARARs															
514																	
515	RIFS2-090	Prepare Exposure Assessment															
516	RIFS2-091	Internal Review of ExpA	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
517	RIFS2-092	PAS Comments (BROWN ExpA)															
518	RIFS2-093	Prepare WHITE ExpA															
519	RIFS2-094	Dispute/Finalize ExpA															
520	RIFS2-095	Dispute Meeting ExpA															
521	RIFS2-096	Rewrite/Reissue ExpA	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
522	RIFS2-097	Finalize ExpA															
523																	
524	RIFS6-01	Prepare Risk Characterization															
525	RIFS6-02	Internal Review of Risk Char															
526	RIFS6-03	PAS Comments (BROWN Risk Char)	+	+	+	+	+	+	+	+	+	+	+	+	+	+	
527	RIFS6-04	Prepare WHITE Risk Char															
528																	
529																	
530																	
531			+	+	+	+	+	+	+	+	+	+	+	+	+	+	
532																	

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ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
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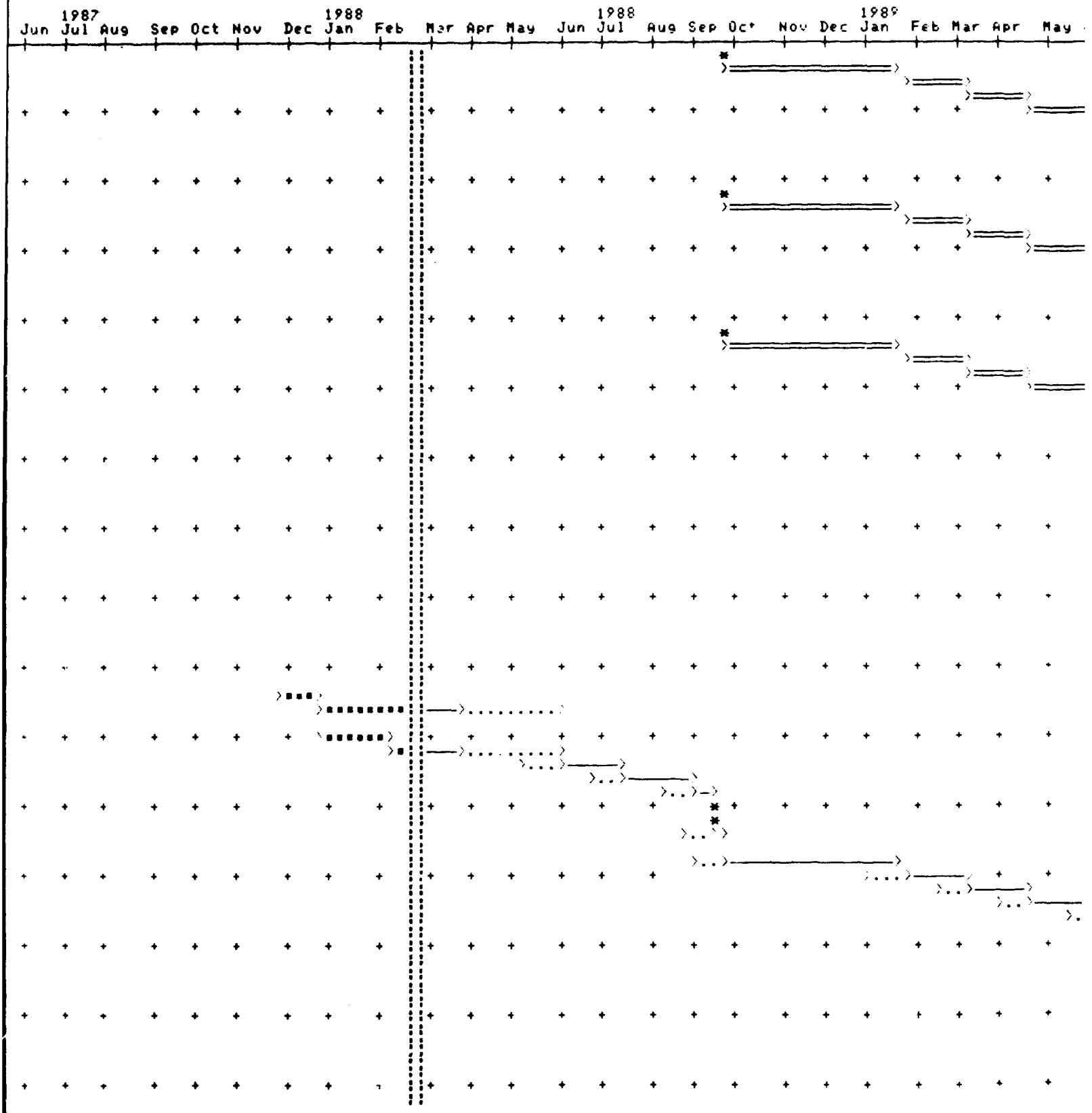
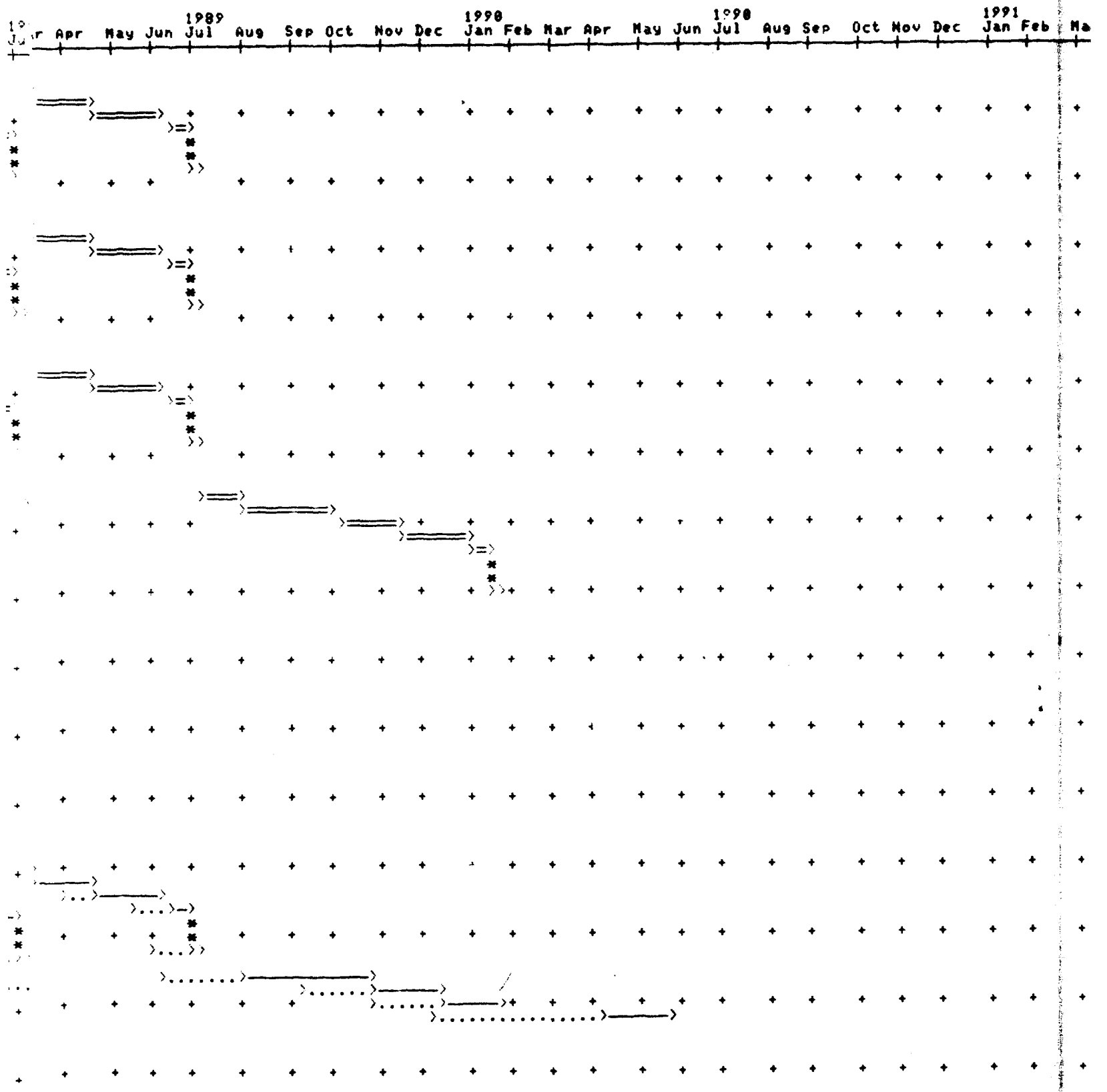


ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF

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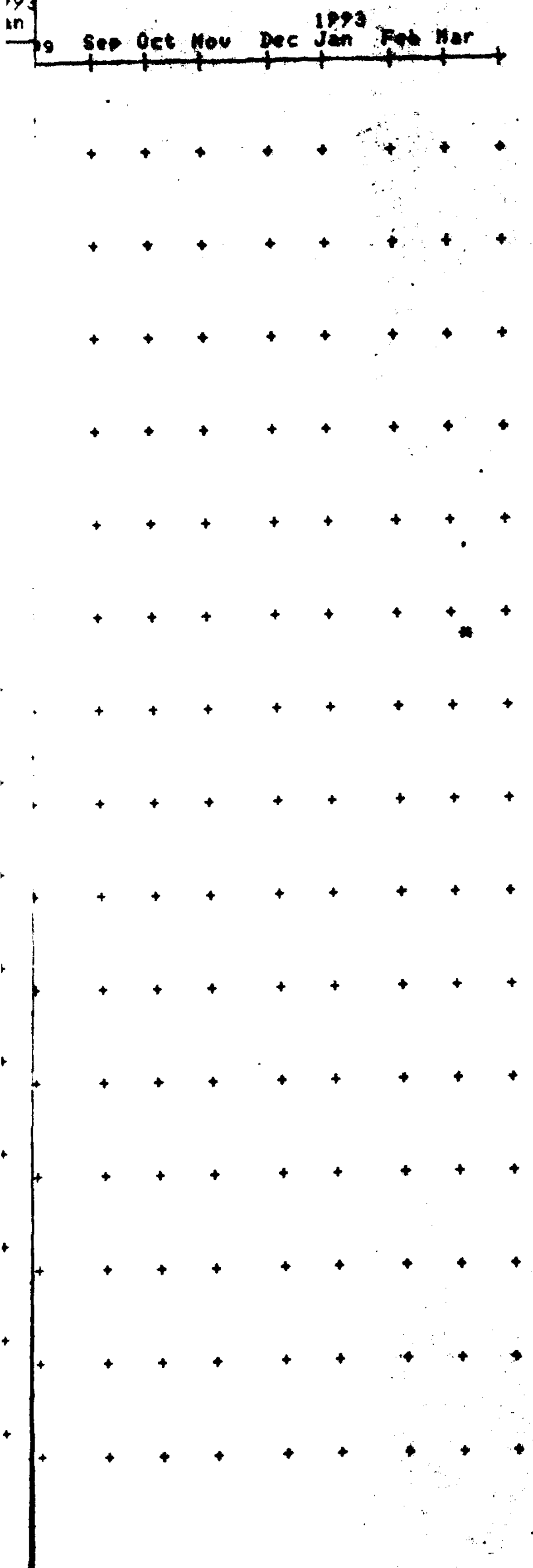


RIFS2-060 ** FINAL [illegible] SAR **
RIFS2-061 Western [illegible]
RIFS2-062 Internal [illegible]
RIFS2-063 PAS Comments [illegible]
RIFS2-064 Prepare [illegible]
RIFS2-065 Dispute/Finalize [illegible]
RIFS2-066 Dispute [illegible]
RIFS2-067 Rewrite/Reissue [illegible]
RIFS2-068 Finalize SAR

RIFS2-070 ** FINAL SOUTH PLANTS SAR **
RIFS2-071 South Plants SAR Preparation
RIFS2-072 Internal Review of SAR
RIFS2-073 PAS Comments (BROWN SAR)
RIFS2-074 Prepare WHITE SAR
RIFS2-075 Dispute/Finalize SAR
RIFS2-076 Dispute Meeting SAR
RIFS2-077 Rewrite/Reissue SAR 475
RIFS2-078 Finalize SAR 476

RIFS2-080 ** FINAL NORTH PLANTS SAR ** 477
RIFS2-081 North Plants SAR Preparation 478
RIFS2-082 Internal Review of SAR 479
RIFS2-083 PAS Comments (BROWN SAR) 480
RIFS2-084 Prepare WHITE SAR 481
RIFS2-085 Dispute/Finalize SAR 482
RIFS2-086 Dispute Meeting SAR 483
RIFS2-087 Rewrite/Reissue SAR 484
RIFS2-088 Finalize SAR 485

486

RIFS5-00 **** PREPARE RI **** 487

488

RIFS5-01 ** Prepare RI ** 489
RIFS5-02 Internal Review of RI 490
RIFS5-03 PAS Comments (BROWN RI) 491
RIFS5-04 Prepare WHITE RI 492
RIFS5-05 Dispute/Finalize RI 493
RIFS5-06 Dispute Meetings RI 494
RIFS5-07 Rewrite/Reissue RI 495
RIFS5-08 Finalize RI 496

497

00-00 **** ENDANGERMENT ASSESSMENT **** 498

499

35-00 ** ENDANGERMENT ASSESSMENT ** 500
35-01 RI/FS Committee Meeting 501
35-02 Internal Review of Plan 502
35-03 PAS Comments (BROWN TP) 503
35-04 Prepare WHITE TP 504

505

35-05 Prepare Contamination ID w/ARARs 506
35-06 Internal Review of Cont ID w/ARARs 507
35-07 PAS Comments (BROWN) 508
35-08 Prepare WHITE Cont ID w/ARARs 509
35-09 Dispute/Finalize Cont ID w/ARARs 510
35-10 Dispute Meetings 511
35-11 Rewrite/Reissue 512
35-12 Finalize Contamination ID w/ARARs 513

514

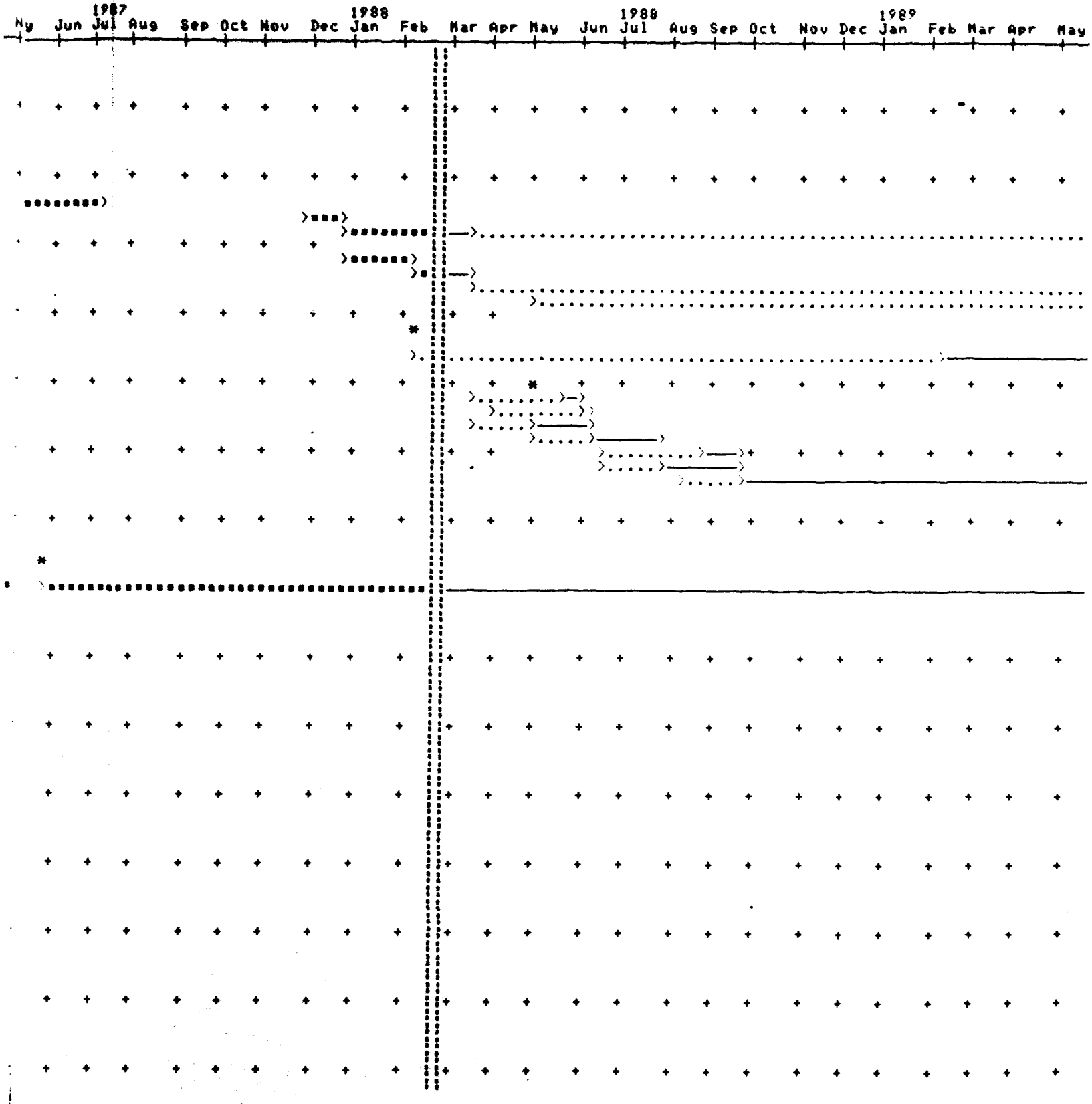
RIFS2-090 Prepare Exposure Assessment 515
RIFS2-091 Internal Review of ExpA 516
RIFS2-092 PAS Comments (BROWN ExpA) 517
RIFS2-093 Prepare WHITE ExpA 518
RIFS2-094 Dispute/Finalize ExpA [illegible]
RIFS2-095 Dispute Meetings ExpA [illegible]
RIFS2-096 Rewrite/Reissue ExpA [illegible]
RIFS2-097 Finalize ExpA [illegible]

RIFS6-01 Prepare Risk Characterization [illegible]
RIFS6-02 Internal Review of Risk Char [illegible]
RIFS6-03 PAS Comments (BROWN Risk Char) [illegible]
RIFS6-04 Prepare WHITE Risk Char [illegible]

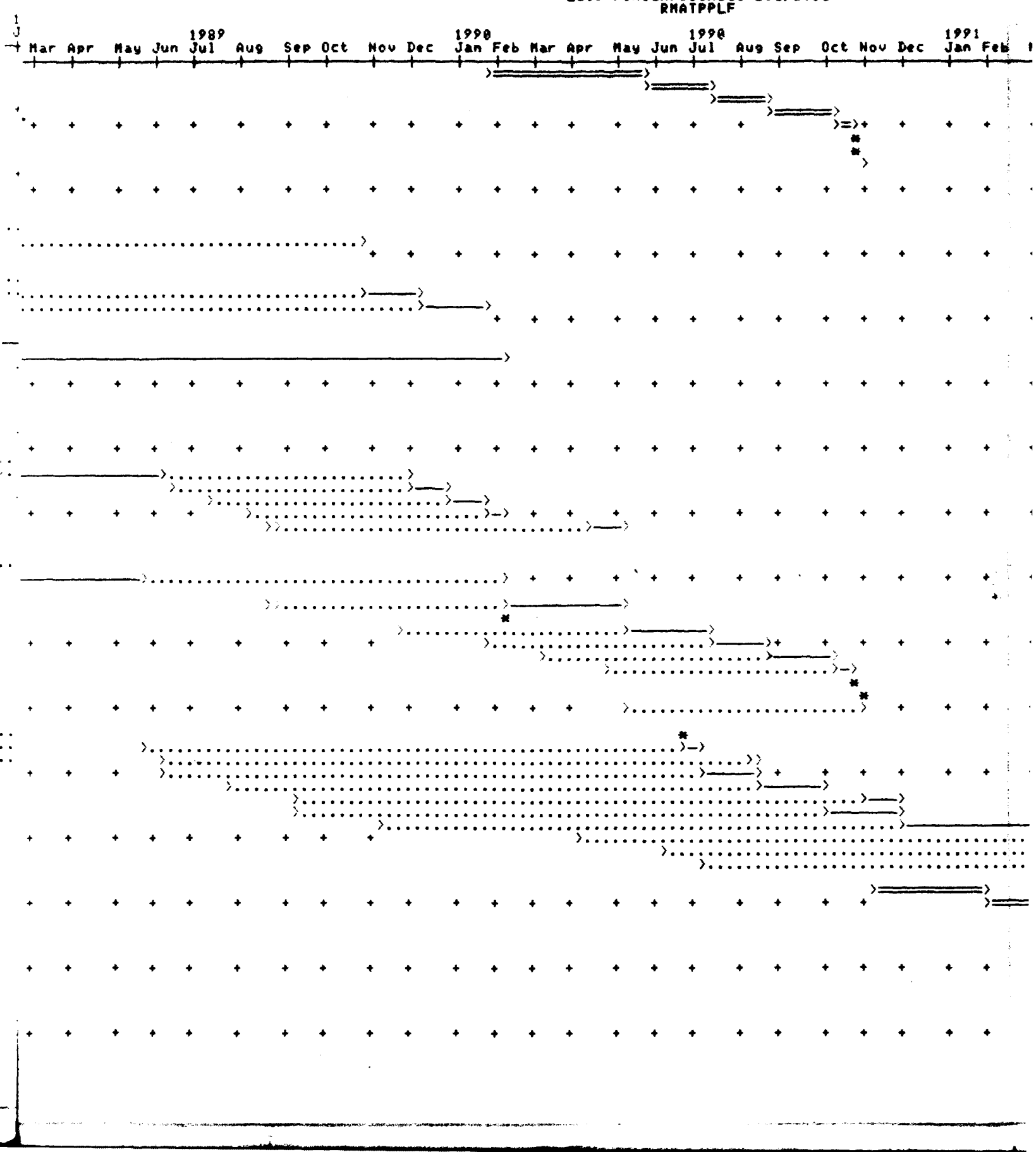
ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF

		1987 Sep	Oct	Nov	Dec	1988 Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
532	RIFS6-05 Prepare EA													
534	RIFS6-06 Internal Review of EA													
535	RIFS6-07 PAS Comment (BROWN EA)													
536	RIFS6-08 Prepare WHITE EA													
537	RIFS6-09 Dispute/Finalize EA	+	+	+	+	+	+	+	+	+	+	+	+	+
538	RIFS6-10 Dispute Meetings EA													
539	RIFS6-11 Rewrite/Reissue EA													
540	RIFS6-12 Finalize EA													
541														
542	28-100 ** FEASIBILITY STUDY **	*+	+	+	+	+	+	+	+	+	+	+	+	+
543	28-101 RI/FS Committee Meeting	+=)												
544	28-102 Internal Review of Plan	>==========	==========	==========	==========	==========	==========	==========	==========	==========	==========	==========	)	
545	28-103 PAS Comments (BROWN)													
546	28-104 Prepare WHITE TP													
547		+	+	+	+	+	+	+	+	+	+	+	+	+
548	28-201 Prepare Tech Inventory													
549	28-202 Internal Review of Tech Inv													
550	28-203 PAS Comment (BROWN)													
551	28-204 Prepare WHITE Tech Inventory													
552		+	+	+	+	+	+	+	+	+	+	+	+	+
553	SH1-00 ** AIR MODELLING **													
554														
555	SH1-01 Air Modelling													
556														
557	45-00 ** TREATABILITY STUDIES **	+	+	+	+	+	+	+	+	+	+	+	+	+
558	45-01 RI/FS Committee Meeting													
559	45-02 Decision on Treatability Studies													
560	45-03 Develop Lab/Bench Test Plan													
561	45-04 Internal Review													
562	RIFS4-07 PAS Review BROWN	+	+	+	+	+	+	+	+	+	+	+	+	+
563	RIFS4-07a Mobilize													
564	RIFS4-07b Lab/Bench Treatability St													
565	RIFS4-08 Data Assessment													
566	RIFS4-09 Prepare Draft Report													
567	RIFS4-10 Internal Review	+	+	+	+	+	+	+	+	+	+	+	+	+
568	RIFS4-11 PAS Review													
569														
570	SH5-00 ** SHELL ALT TECH STUDIES **										*			
571														
572	SH5-01 Shell Alt Tech Studies	+	+	+	+	+	+	+	+	+	>==========	==========	==========	==========
573														
574	RIFS3-300 ** PREPARE DSA **													
575	RIFS3-301 Finish Media Dummy													
576	RIFS3-302 Internal Review of DSA													
577	RIFS3-303 PAS Comments (BROWN DSA)	+	+	+	+	+	+	+	+	+	+	+	+	+
578	RIFS3-304 Prepare WHITE DSA													
579	RIFS3-305 Dispute/Finalize DSA													
580	RIFS3-306 Dispute Meetings DSA													
581	RIFS3-307 Rewrite/Reissue DSA													
582	RIFS3-308 Finalize DSA	+	+	+	+	+	+	+	+	+	+	+	+	+
583														
584	RIFS4-100 ** PILOT STUDIES **													
585	RIFS4-101 RI/FS Committee Meeting													
586	RIFS4-102 Decision on Pilot Studies													
587	RIFS4-103 Prepare Test Plan	+	+	+	+	+	+	+	+	+	+	+	+	+
588	RIFS4-104 Internal Review													
589	RIFS4-105 PAS Review (BROWN)													
590	RIFS4-106 Mobilize													
591	RIFS4-107 Conduct Final Pilot Studies													
592	RIFS4-108 Data Assessment	+	+	+	+	+	+	+	+	+	+	+	+	+
593	RIFS4-109 Prepare Draft Report													
594	RIFS4-110 PAS Review													
595														
596	RIFS7-100 ** Prepare EOA **													
597	RIFS7-101 Internal Review of EOA	+	+	+	+	+	+	+	+	+	+	+	+	+
598	RIFS7-102 PAS Comments (BROWN EOA)													
599	RIFS7-103 Prepare WHITE EOA													
600	RIFS7-104 Dispute/Finalize EOA													
601	RIFS7-105 Dispute Meetings EOA													
602	RIFS7-106 Rewrite/Reissue EOA	+	+	+	+	+	+	+	+	+	+	+	+	+
603	RIFS7-107 Finalize EOA													
604														
605														
606														
607		+	+	+	+	+	+	+	+	+	+	+	+	+
608														

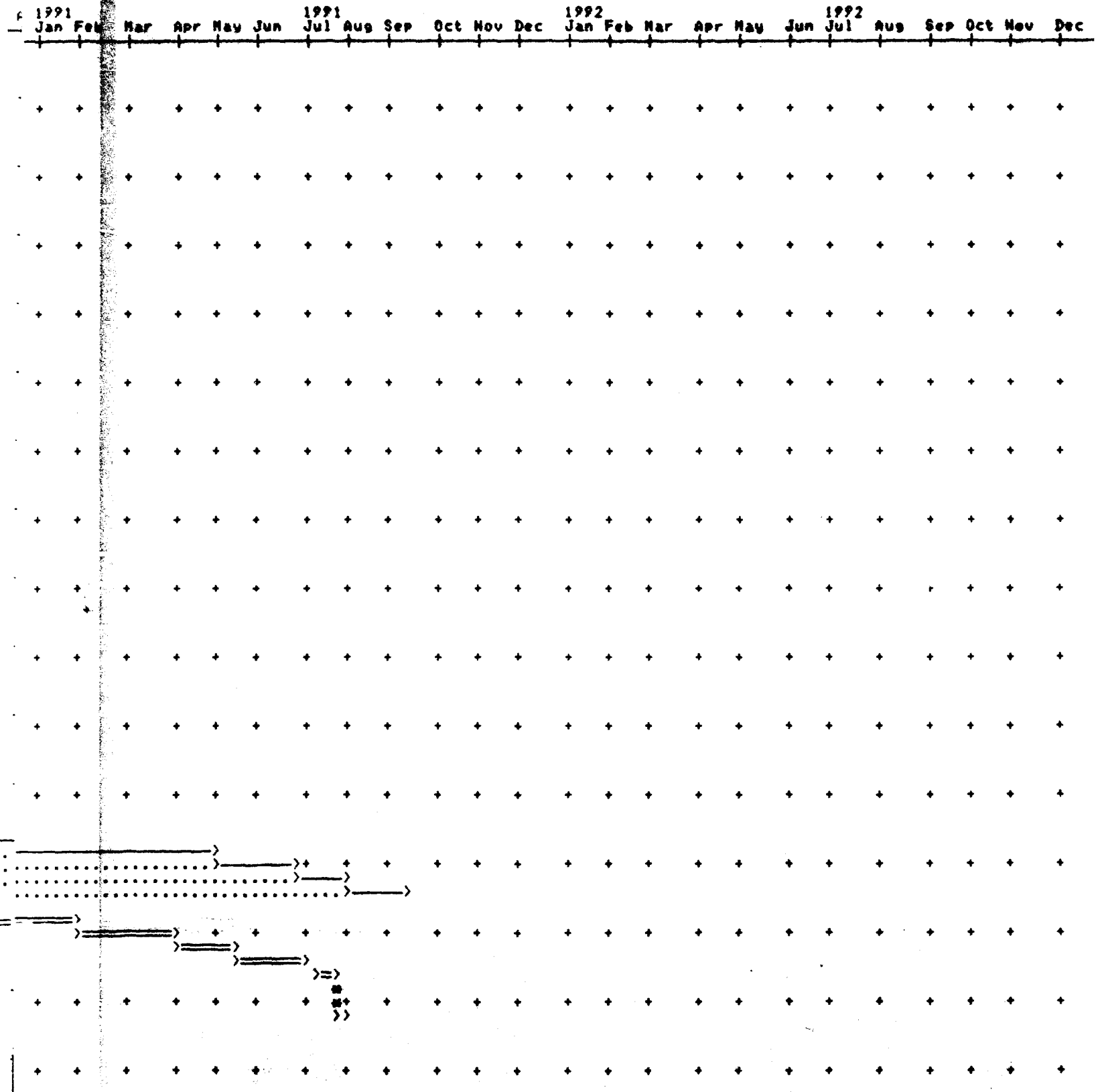
ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



ENAL RI/FS
t Disputes

n	1992 Jul	Aug	Sep	Oct	Nov	Dec	1993 Jan	Feb	Mar

RIFS6-06 Internal [illegible]
RIFS6-07 PAS Comment [illegible]
RIFS6-08 [illegible]
RIFS6-09 [illegible]
RIFS6-10 [illegible]
RIFS6-11 [illegible]
RIFS6-12 [illegible]

28-100 ** FEASIBILITY [illegible]
28-101 RI/FS Committee [illegible]
28-102 Internal Review of [illegible]
28-103 PAS Comment (BROWN) 545
28-104 Prepare WHITE FP 546
547
28-201 Prepare Tech Inventory 548
28-202 Internal Review of Tech Inv 549
28-203 PAS Comment (BROWN) 550
28-204 Prepare WHITE Tech Inventory 551
552
SH1-00 ** AIR MODELLING ** 553
554
SH1-01 Air Modelling 555
556
45-00 ** TREATABILITY STUDIES ** 557
45-01 RI/FS Committee Meeting 558
45-02 Decision on Treatability Studies 559
45-03 Develop Lab/Bench Test Plan 560
45-04 Internal Review 561
RIFS4-07 PAS Review BROWN 562
RIFS4-07a Mobilize 563
RIFS4-07b Lab/Bench Treatability St 564
RIFS4-08 Data Assessment 565
RIFS4-09 Prepare Draft Report 566
RIFS4-10 Internal Review 567
RIFS4-11 PAS Review 568
569
SH5-00 ** SHELL ALT TECH STUDIES ** 570
571
SH5-01 Shell Alt Tech Studies 572
573
RIFS3-300 ** PREPARE DSA ** 574
RIFS3-301 Finish Media Dummy 575
RIFS3-302 Internal Review of DSA 576
RIFS3-303 PAS Comments (BROWN DSA) 577
RIFS3-304 Prepare WHITE DSA 578
RIFS3-305 Dispute/Finalize DSA 579
RIFS3-306 Dispute Meetings DSA 580
RIFS3-307 Rewrite/Reissue DSA 581
RIFS3-308 Finalize DSA 582
583
RIFS4-100 ** PILOT STUDIES ** 584
RIFS4-101 RI/FS Committee Meeting 585
RIFS4-102 Decision on Pilot Studies 586
RIFS4-103 Prepare Test Plan 587
RIFS4-104 Internal Review [illegible]
RIFS4-105 PAS Review (BROWN) [illegible]
RIFS4-106 Mobilize [illegible]
RIFS4-107 Conduct Final Pilot Studies [illegible]
RIFS4-108 Data Assessment [illegible]
RIFS4-109 Prepare Draft Report [illegible]
RIFS4-110 PAS Review [illegible]

RIFS7-100 ** Prepare [illegible]
RIFS7-101 Internal Review [illegible]
RIFS7-102 PAS Comments [illegible]
RIFS7-103 Prepare WHITE [illegible]
RIFS7-104 Dispute/Finalize [illegible]
RIFS7-105 Dispute Meetings [illegible]
RIFS7-106 Rewrite/Reissue [illegible]
RIFS7-107 Finalize [illegible]

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ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
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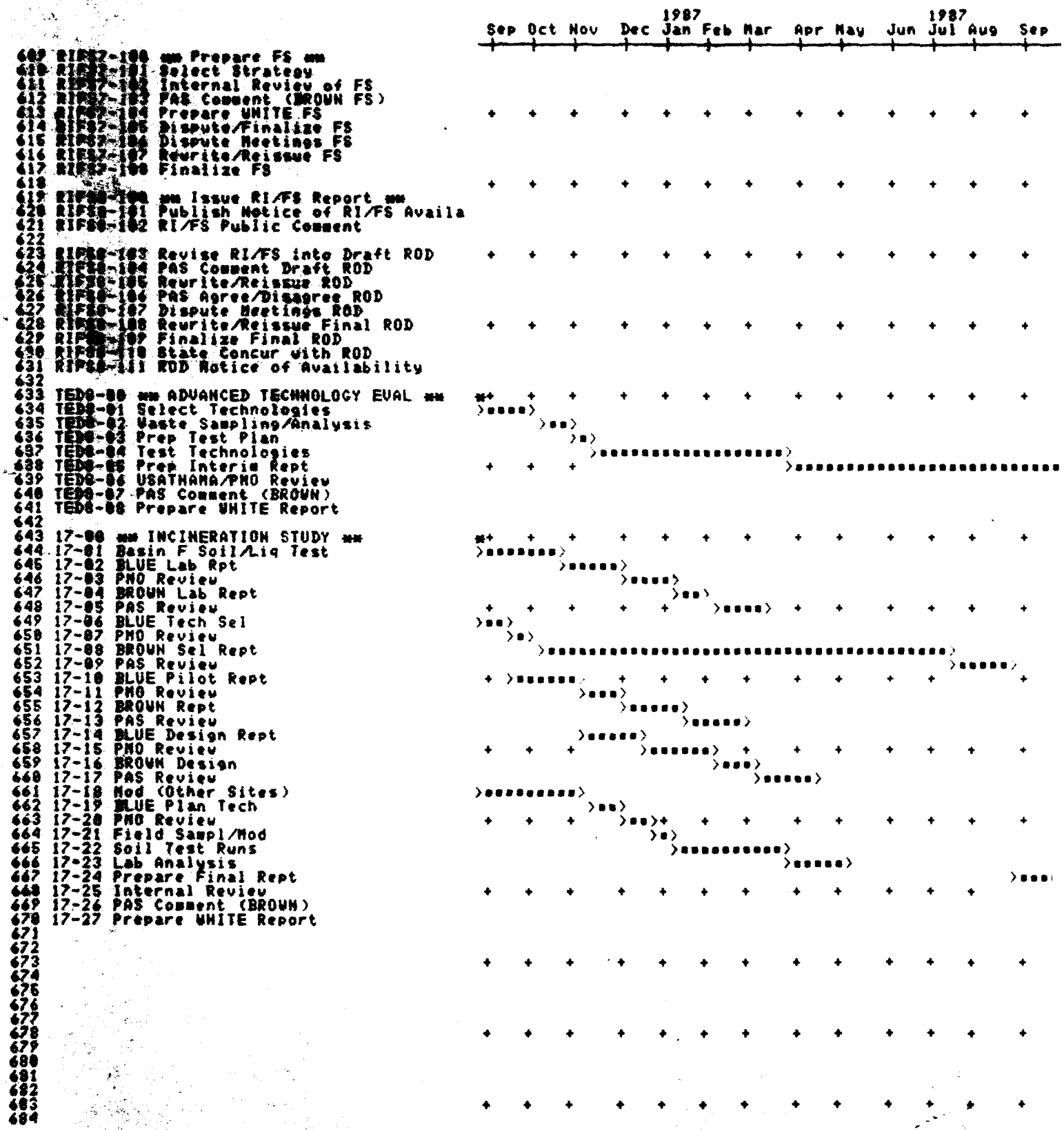

ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
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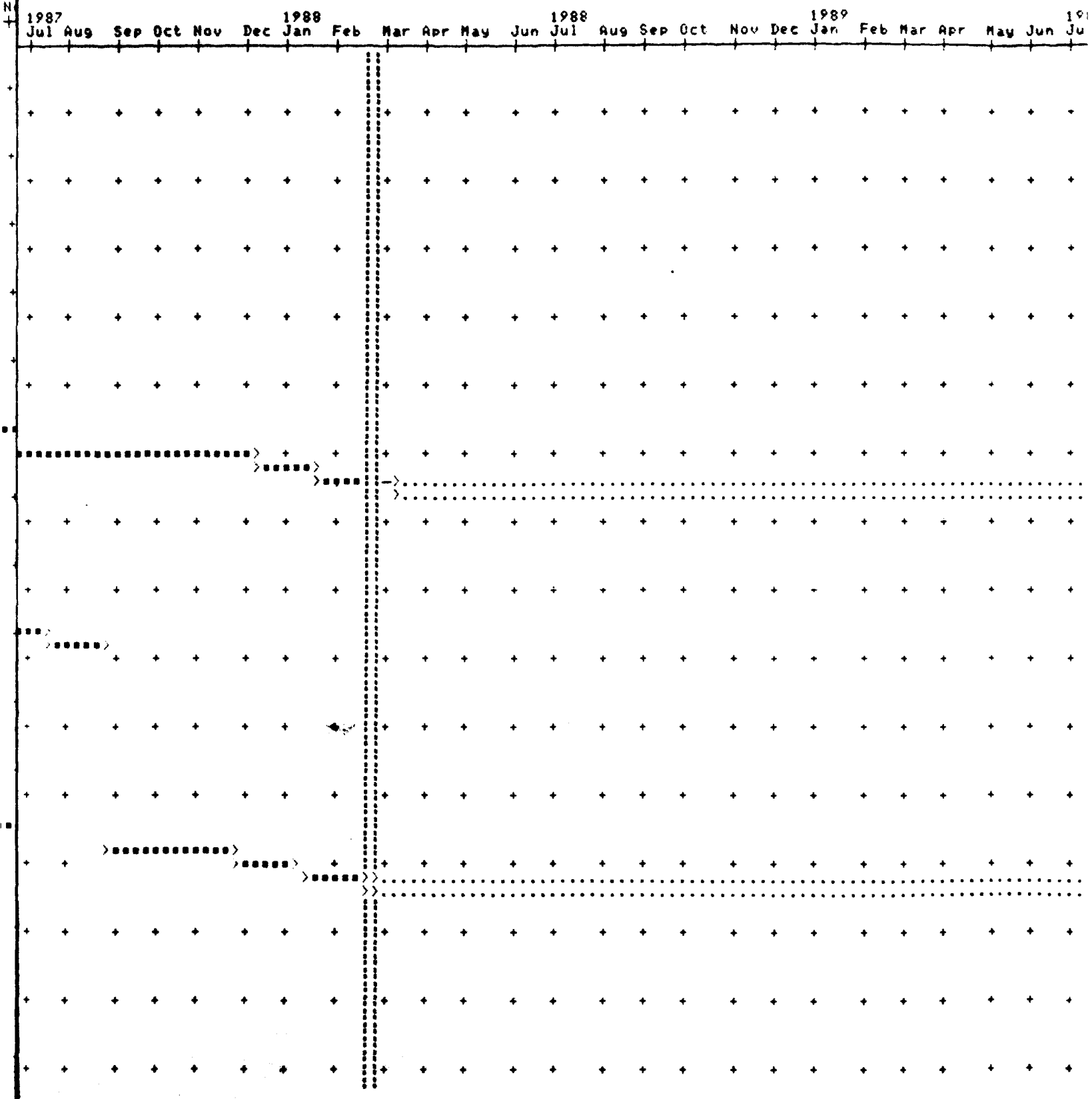

ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
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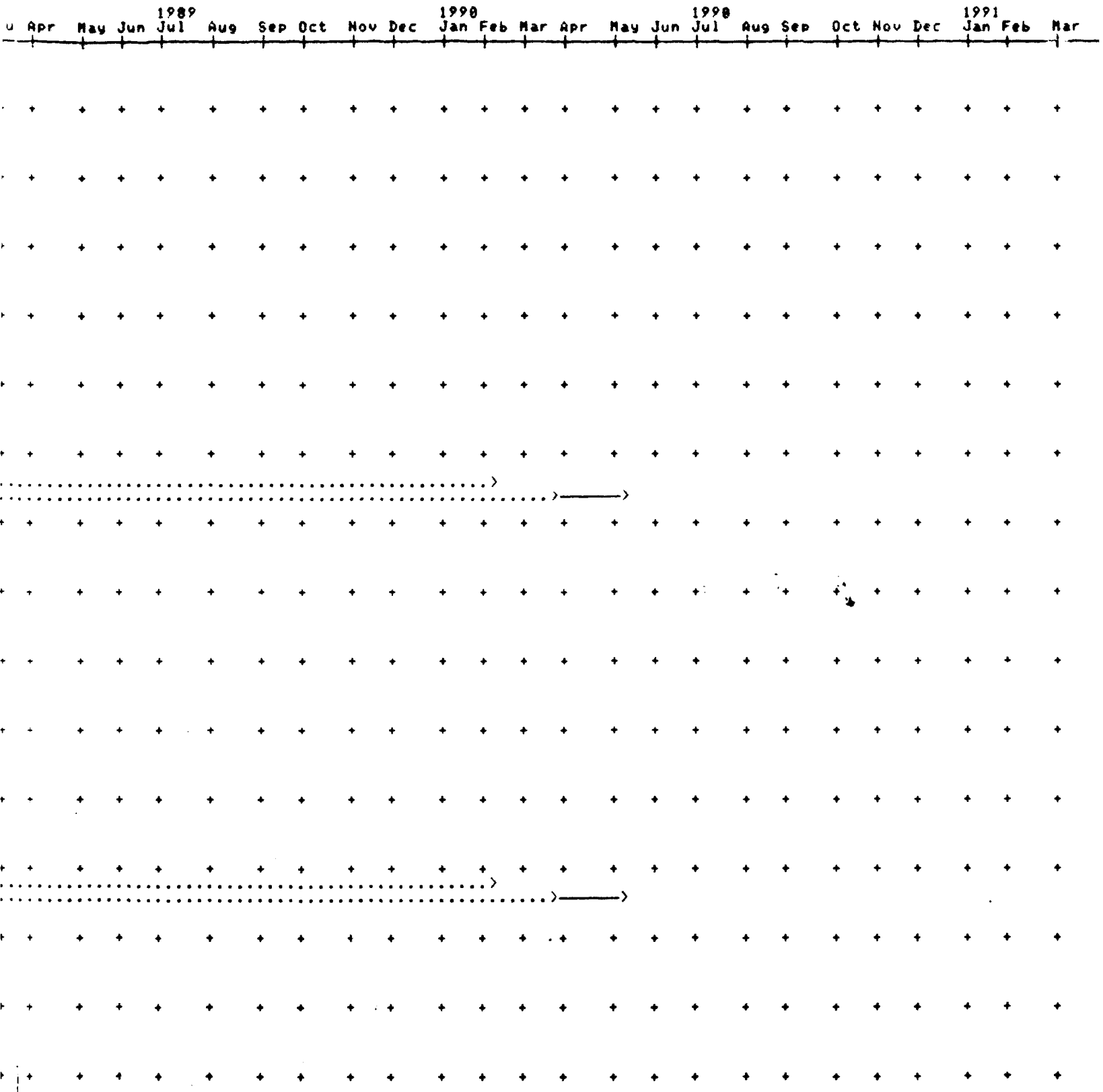

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ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
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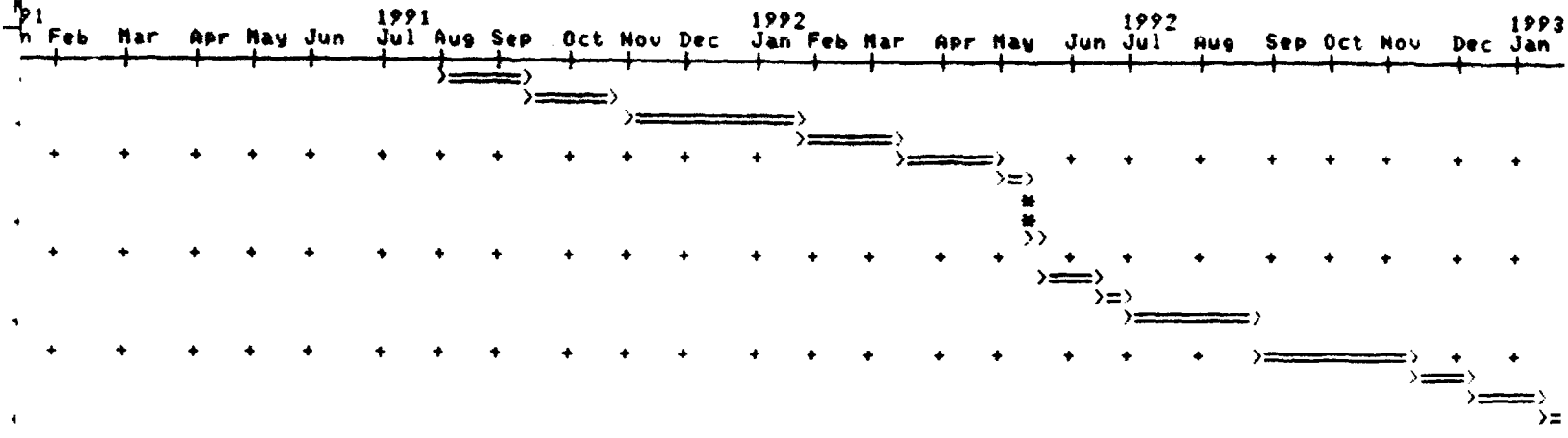

RSENAL RI/FS
out Disputes
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Late Finis

RIFS7-100 ** Prepare FS ** 609
RIFS7-101 Select Strategy 610
RIFS7-102 Internal Review of FS 611
RIFS7-103 PAS Comment (BROWN FS) 612
RIFS7-104 Prepare WHITE FS 613
RIFS7-105 Dispute/Finalize FS 614
RIFS7-106 Dispute Meetings FS 615
RIFS7-107 Rewrite/Reissue FS 616
RIFS7-108 Finalize FS 617
618
RIFS8-100 ** Issue RI/FS Report ** 619
RIFS8-101 Publish Notice of RI/FS Availa 620
RIFS8-102 RI/FS Public Comment 621
622
RIFS8-103 Revise RI/FS into Draft ROD 623
RIFS8-104 PAS Comment Draft ROD 624
RIFS8-105 Rewrite/Reissue ROD 625
RIFS8-106 PAS Agree/Disagree ROD 626
RIFS8-107 Dispute Meetings ROD 627
RIFS8-108 Rewrite/Reissue Final ROD 628
RIFS8-109 Finalize Final ROD 629
RIFS8-110 State Concur with ROD 630
RIFS8-111 ROD Notice of Availability 631
632
TED8-00 ** ADVANCED TECHNOLOGY EVAL ** 633
TED8-01 Select Technologies 634
TED8-02 Waste Sampling/Analysis 635
TED8-03 Prep Test Plan 636
TED8-04 Test Technologies 637
TED8-05 Prep Interim Rept 638
TED8-06 USATHAMA/PMO Review 639
TED8-07 PAS Comment (BROWN) 640
TED8-08 Prepare WHITE Report 641
642
17-00 ** INCINERATION STUDY ** 643
17-01 Basin F Soil/Liq Test 644
17-02 BLUE Lab Rpt 645
17-03 PMO Review 646
17-04 BROWN Lab Rept 647
17-05 PAS Review 648
17-06 BLUE Tech Sel 649
17-07 PMO Review 650
17-08 BROWN Sel Rept 651
17-09 PAS Review 652
17-10 BLUE Pilot Rept 653
17-11 PMO Review 654
17-12 BROWN Rept 655
17-13 PAS Review 656
17-14 BLUE Design Rept 657
17-15 PMO Review 658
17-16 BROWN Design 659
17-17 PAS Review 660
17-18 Mod (Other Sites) 661
17-19 BLUE Plan Tech 662
17-20 PMO Review 663
17-21 Field Sampl/Mod 664
17-22 Soil Test Runs 665
17-23 Lab Analysis 666
17-24 Prepare Final Rept 667
17-25 Internal Review 668
17-26 PAS Comment (BROWN) 669
17-27 Prepare WHITE Report 670
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ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
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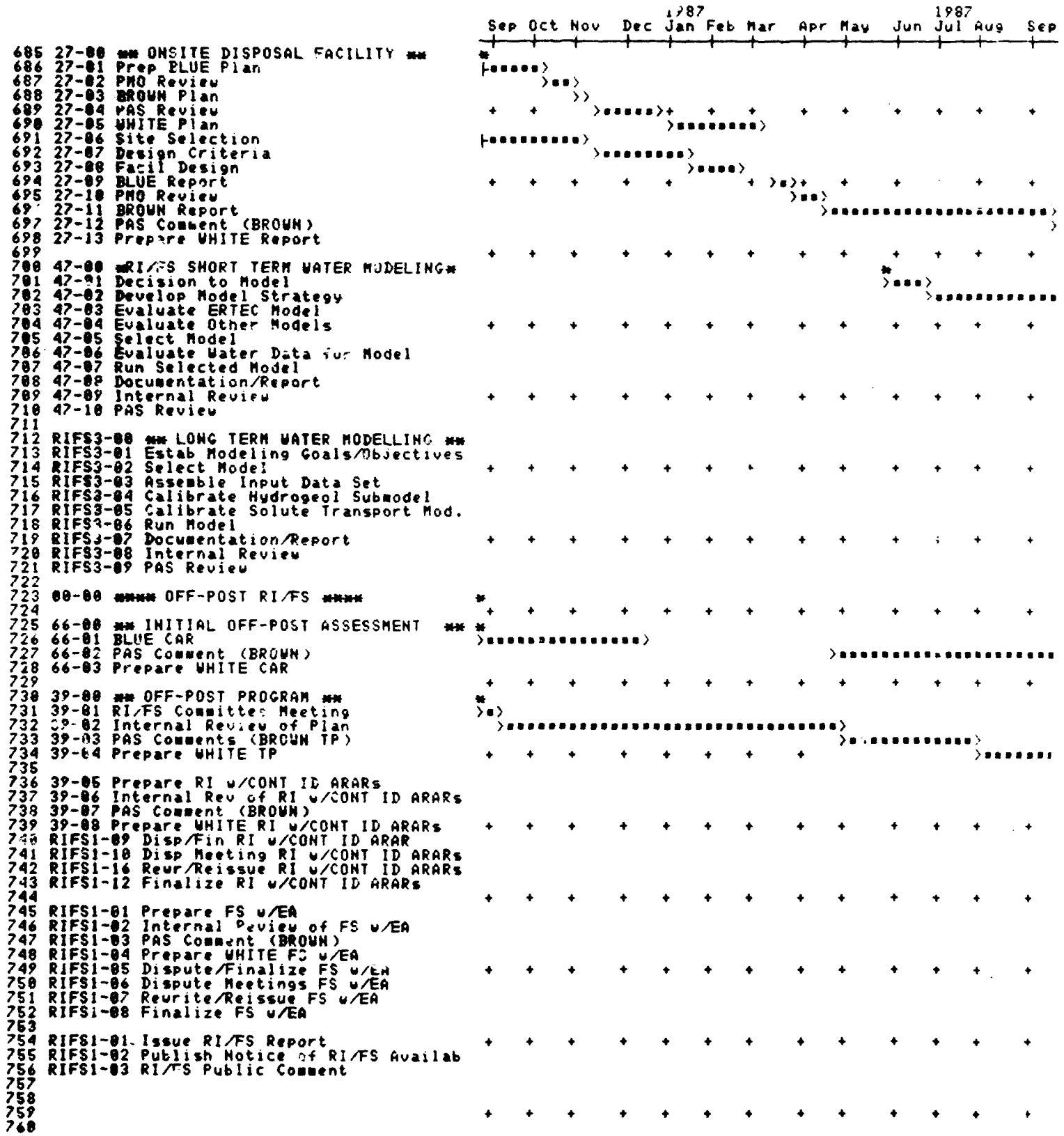

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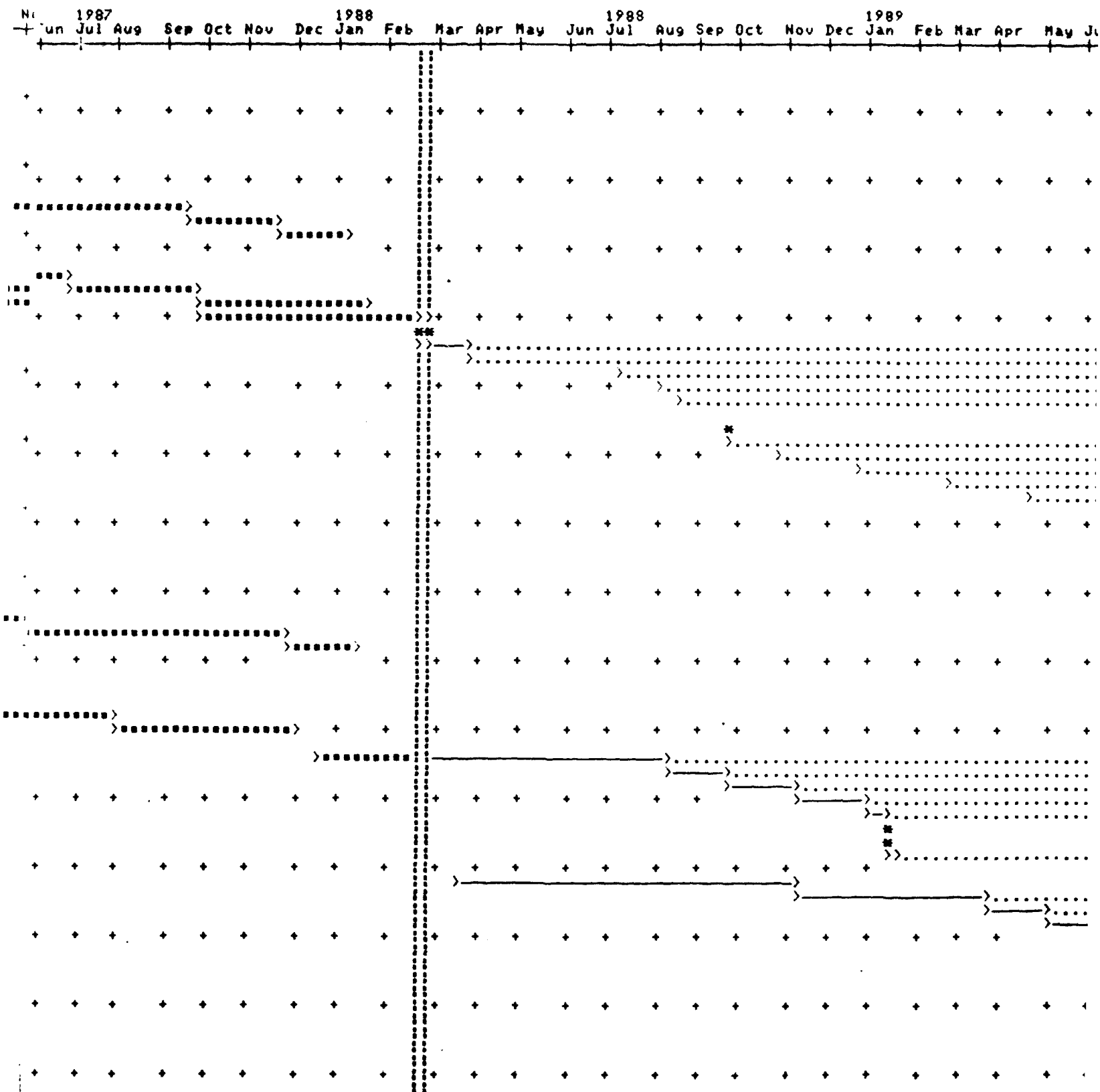
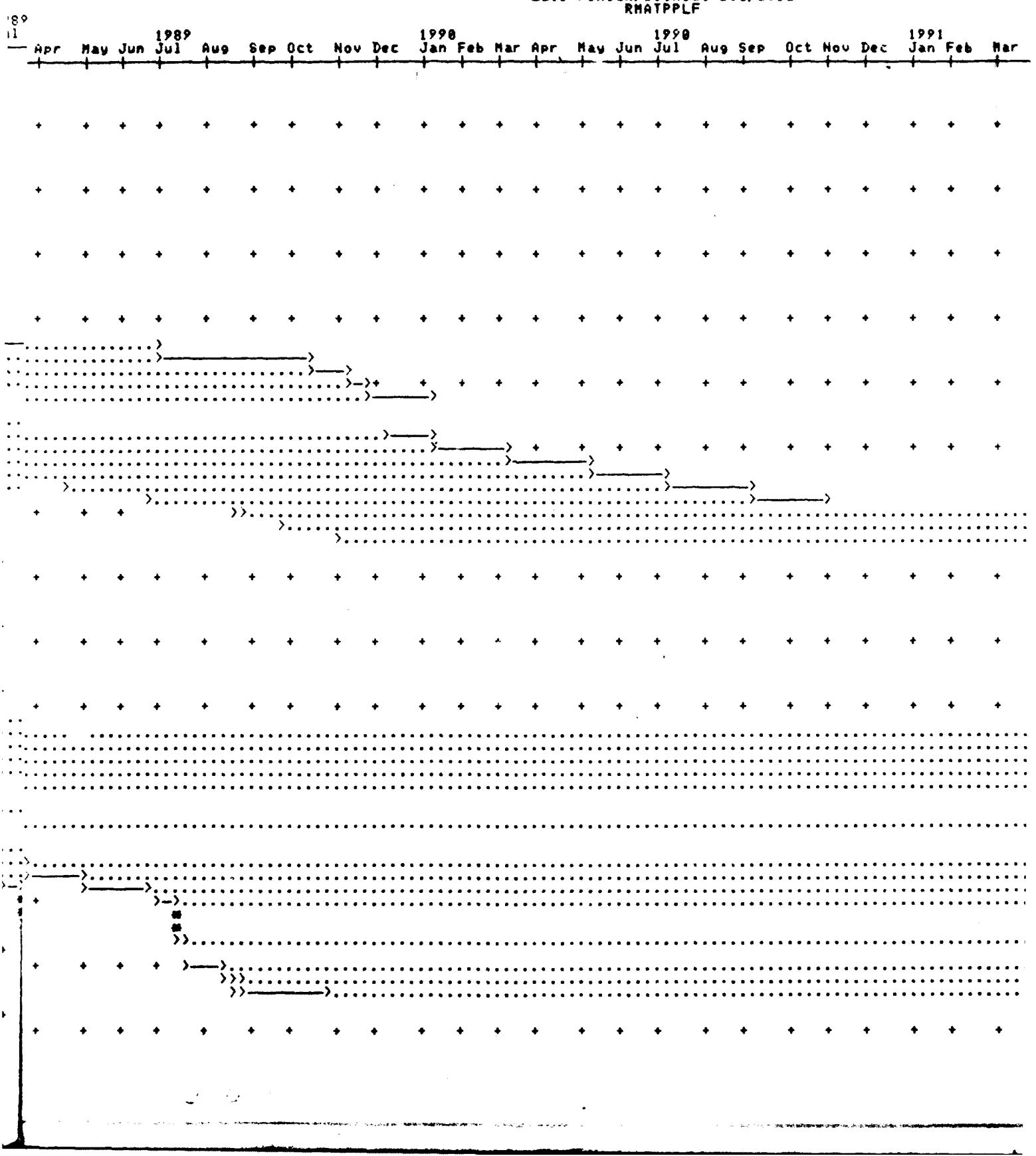
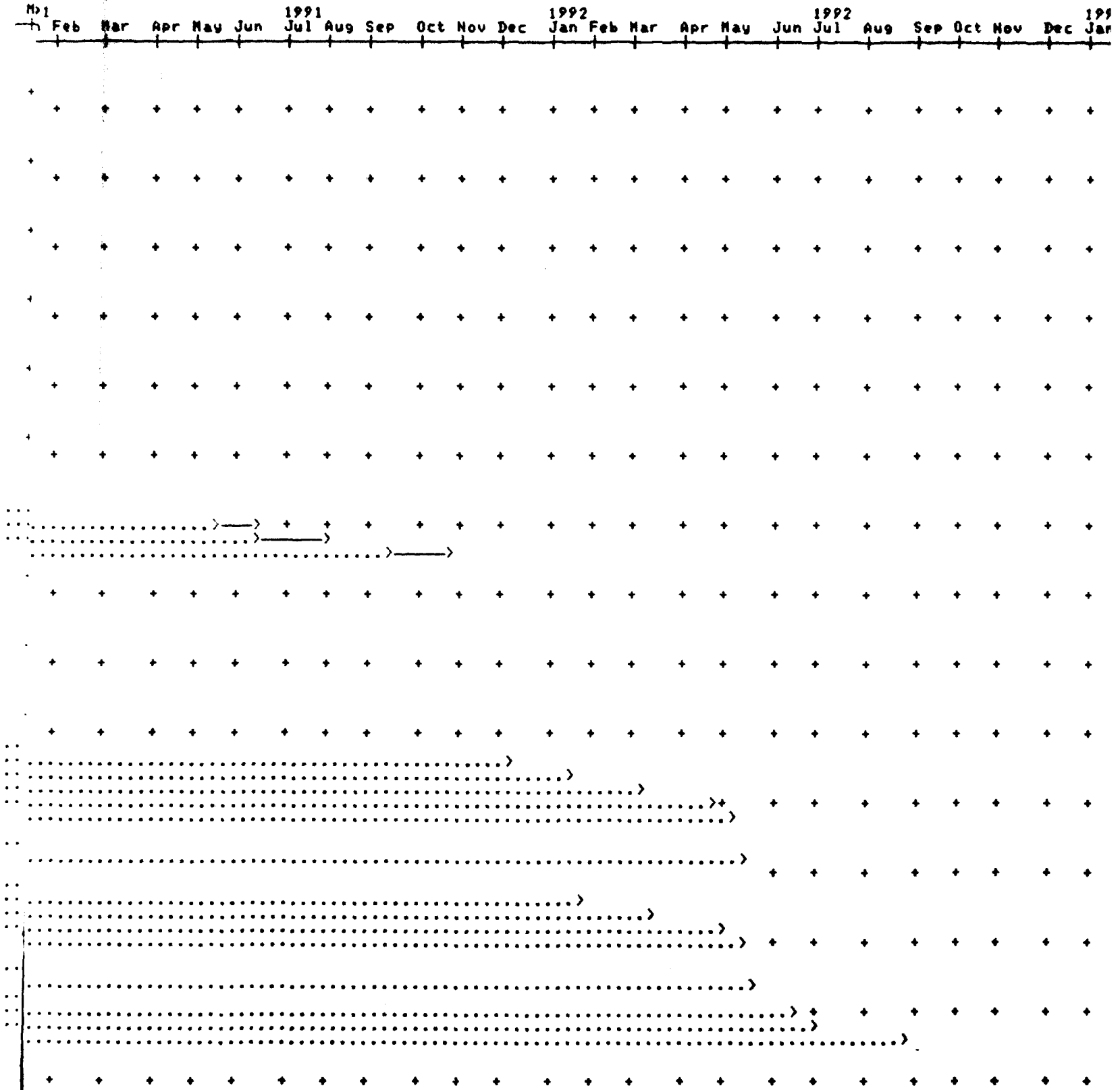
ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



5

ENAL RI/FS
t Disputes

ROCKY
Late Start

1992						1993			
n Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	

27-00 ** ONSITE DISPOSAL FACILITY **
27-01 Prep
27-02 PAS
27-03 BROWN
27-04 PAS
27-05 WHITE
27-06 Alts Selection
27-07 Design Criteria
27-08 Facil Design
27-09 RCRA Report
27-10 PAS Review
27-11 BROWN Report
27-12 PAS Comment (BROWN)
27-13 Prepare WHITE Report

47-00 *RI/FS SHORT TERM WATER MODELLING*
47-01 Decision to Model
47-02 Develop Model Strategy
47-03 Evaluate BRTEC Model
47-04 Evaluate Other Models
47-05 Select Model
47-06 Evaluate Water Data for Model
47-07 Run Selected Model
47-08 Documentation/Report
47-09 Internal Review
47-10 PAS Review

RIFS3-00 ** LONG TERM WATER MODELLING **
RIFS3-01 Estab Modeling Goals/Objectives
RIFS3-02 Select Model
RIFS3-03 Assemble Input Data Set
RIFS3-04 Calibrate Hydrogeol Submodel
RIFS3-05 Calibrate Solute Transport Mod.
RIFS3-06 Run Model
RIFS3-07 Documentation/Report
RIFS3-08 Internal Review
RIFS3-09 PAS Review

00-00 ***** OFF-POST RI/FS *****

66-00 ** INITIAL OFF-POST ASSESSMENT **
66-01 BLUE CAR
66-02 PAS Comment (BROWN)
66-03 Prepare WHITE CAR

39-00 ** OFF-POST PROGRAM **
39-01 RI/FS Committee Meeting
39-02 Internal Review of Plan
39-03 PAS Comments (BROWN TP)
39-04 Prepare WHITE TP
39-05 Prepare RI w/CONT ID ARARs
39-06 Internal Rev of RI w/CONT ID ARARs
39-07 PAS Comment (BROWN)
39-08 Prepare WHITE RI w/CONT ID ARARs
RIFS1-09 Disp/Fin RI w/CONT ID ARAR
RIFS1-10 Disp Meeting RI w/CONT ID ARARs
RIFS1-16 Revr/Reissue RI w/CONT ID ARARs
RIFS1-12 Finalize RI w/CONT ID ARARs

RIFS1-01 Prepare FS w/EA
RIFS1-02 Internal Review of FS w/EA
RIFS1-03 PAS Comment (BROWN)
RIFS1-04 Prepare WHITE FS w/EA
RIFS1-05 Dispute/Finalize FS w/EA
RIFS1-06 Dispute Meetings FS w/EA
RIFS1-07 Revr/Reissue FS w/EA
RIFS1-08 Finalize FS w/EA

RIFS1-01 Issue RI/FS Report
RIFS1-02 Publish Notice of RI/FS Availab
RIFS1-03 RI/FS Public Comment

7

ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF

			1987										1987		
			Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oc
761	RIFS1-04	Revise RI/FS into Draft ROD														
762	RIFS1-05	PAS Comment Draft ROD														
763	RIFS1-06	Rewrite/Reissue ROD														
764	RIFS1-07	PAS Agree/Disagree ROD														
765	RIFS1-08	Dispute Meetings ROD	+	+	+	+	+	+	+	+	+	+	+	+	+	+
766	RIFS1-09	Rewrite/Reissue Final ROD														
767	RIFS1-10	Finalize Final ROD														
768	RIFS1-11	State Concur with ROD														
769	RIFS1-12	ROD Notice of Availability														

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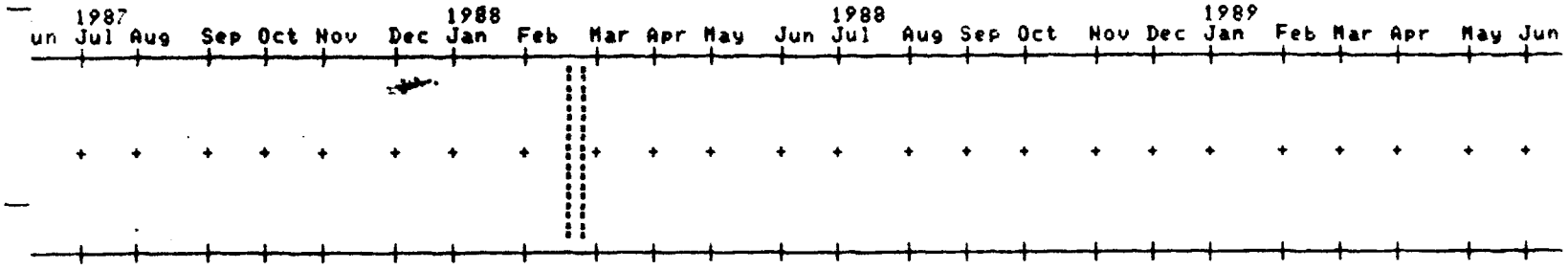
ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



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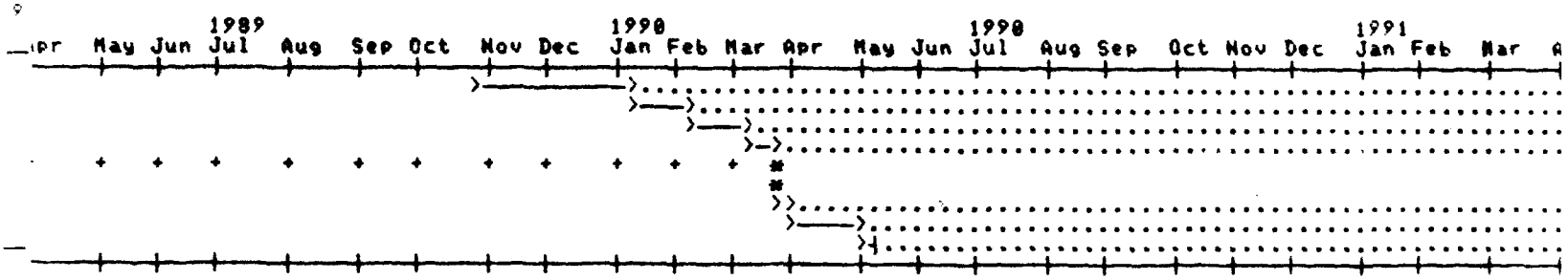
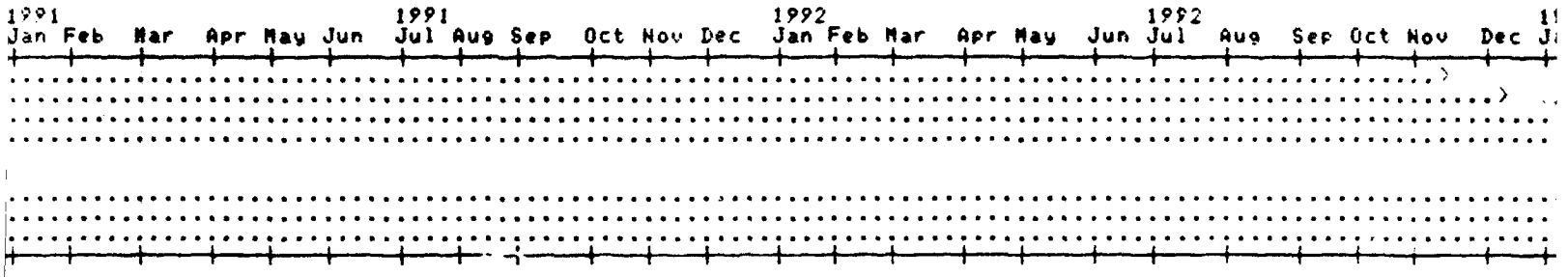
Late Finish/Without Disputes
RMWTPPLF



ROCKY MOUNTAIN ARSENAL RI/FS
Late Finish/Without Disputes
RMATPPLF



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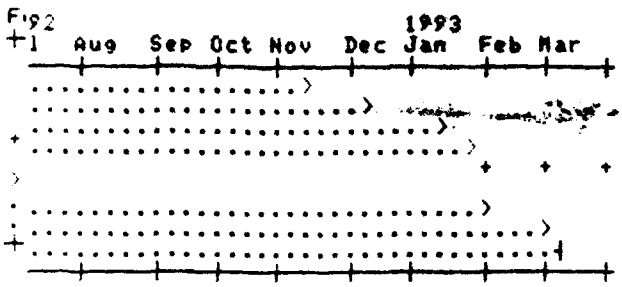
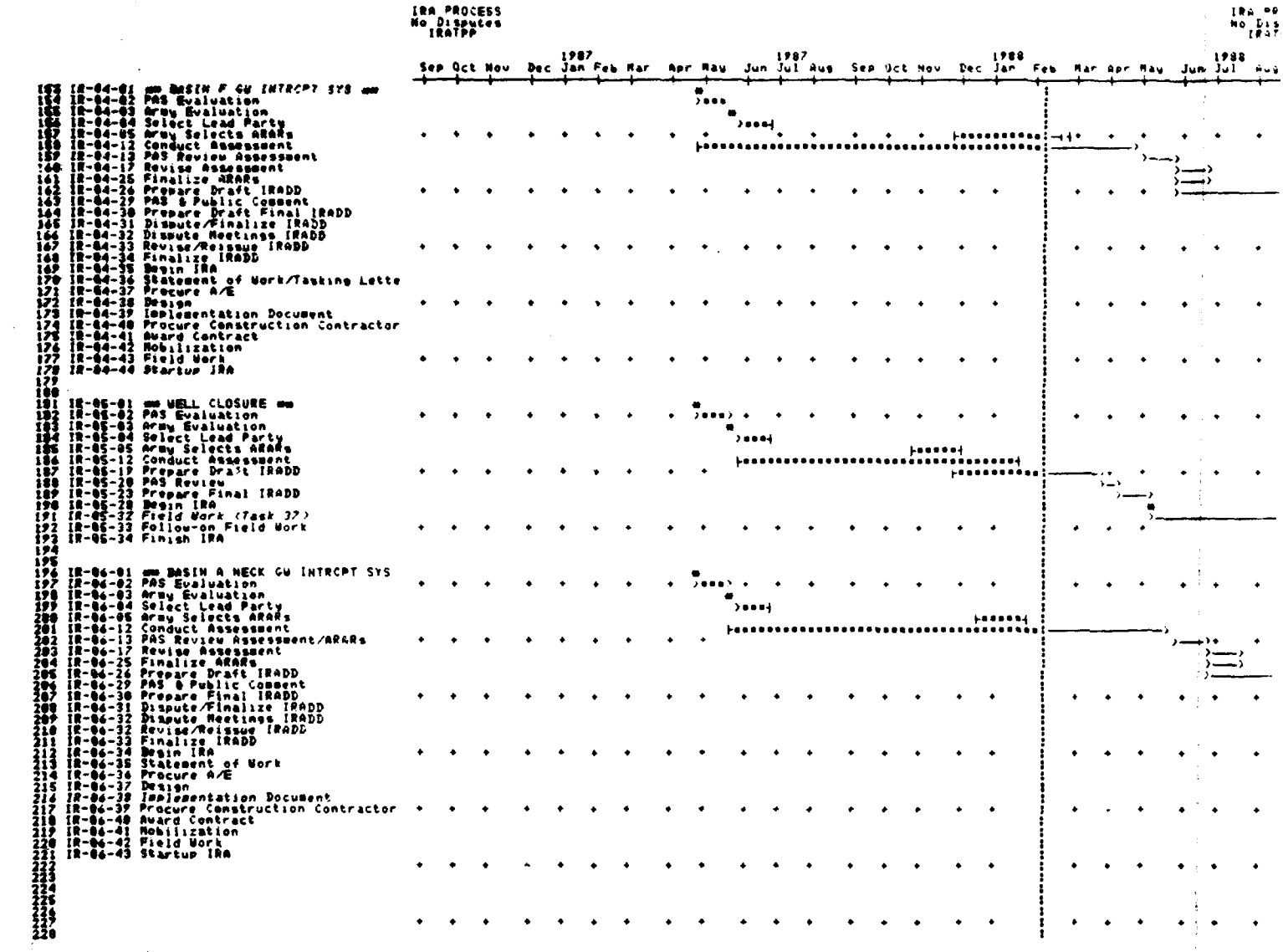
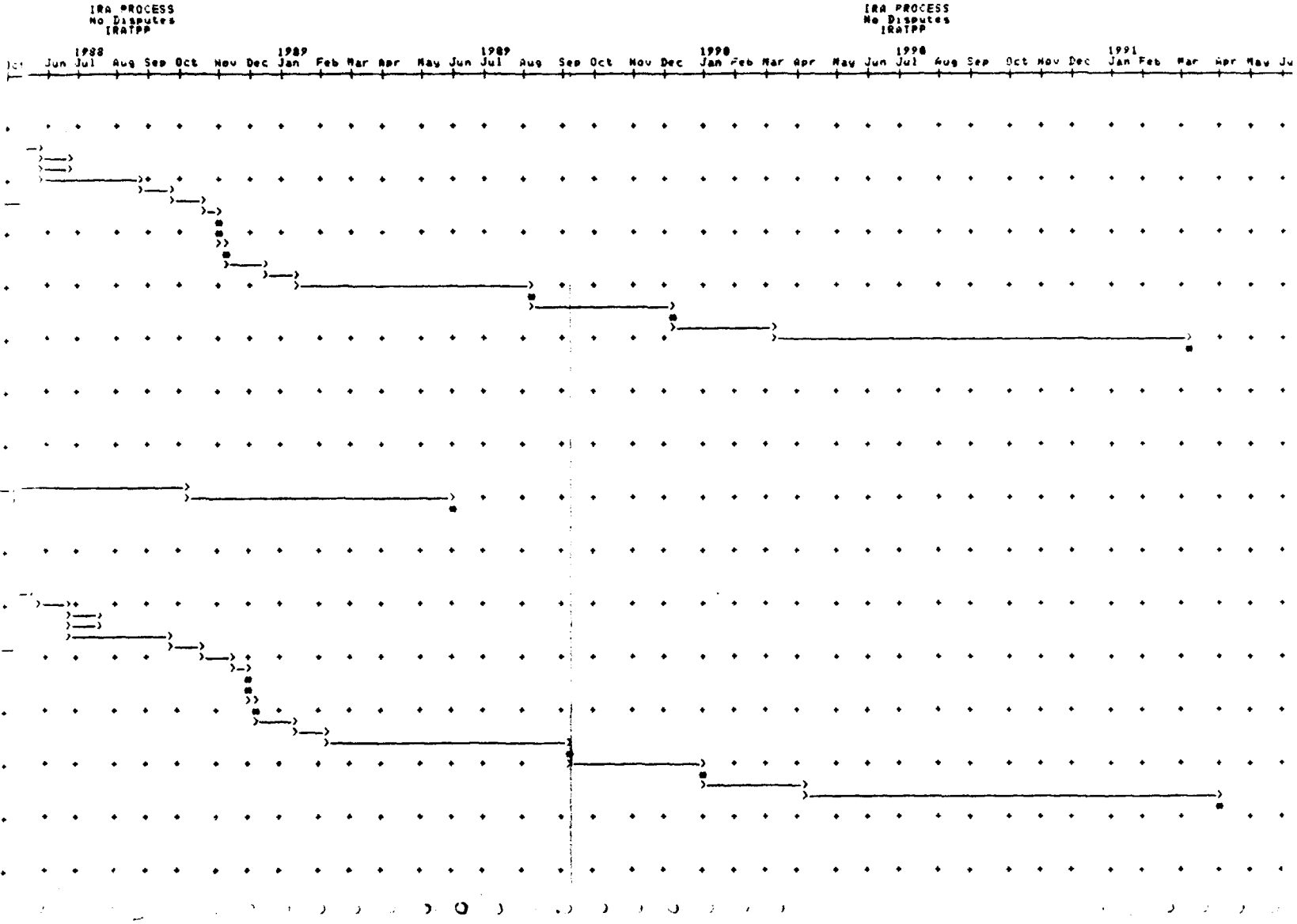
ROCKY MOUN
Late Finis

Fig2



RIFS1-04 Revise RI/FS into Draft ROD 761
RIFS1-05 PRP Comment Draft ROD 762
RIFS1-06 Rewrite/Reissue ROD 763
RIFS1-07 PRP Agree/Disagree ROD 764
RIFS1-08 Dispute Meetings ROD 765
RIFS1-09 Rewrite/Reissue Final ROD 766
RIFS1-10 Finalize Final ROD 767
RIFS1-11 State Concur with ROD 768
RIFS1-12 ROD Notice of Availability 769


IRA PROCESS
No Disputes
IRATPP
1987
1988
Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul
IR-04-01 == BASIN F GW INTRCPT SYS ==
IR-04-02 PAS Evaluation
IR-04-03 Army Evaluation
IR-04-04 Select Lead Party
IR-04-05 Army Selects ARARs
IR-04-12 Conduct Assessment
IR-04-13 PAS Review Assessment
IR-04-17 Revise Assessment
IR-04-25 Finalize ARARs
IR-04-26 Prepare Draft IRADD
IR-04-29 PAS & Public Comment
IR-04-30 Prepare Draft Final IRADD
IR-04-31 Dispute/Finalize IRADD
IR-04-32 Dispute Meetings IRADD
IR-04-33 Revise/Reissue IRADD
IR-04-34 Finalize IRADD
IR-04-35 Begin IRA
IR-04-36 Statement of Work/Tasking Lette
IR-04-37 Procure A/E
IR-04-38 Design
IR-04-39 Implementation Document
IR-04-40 Procure Construction Contractor
IR-04-41 Award Contract
IR-04-42 Mobilization
IR-04-43 Field Work
IR-04-44 Startup IRA
IR-05-01 == WELL CLOSURE ==
IR-05-02 PAS Evaluation
IR-05-03 Army Evaluation
IR-05-04 Select Lead Party
IR-05-05 Army Selects ARARs
IR-05-12 Conduct Assessment
IR-05-19 Prepare Draft IRADD
IR-05-20 PAS Review
IR-05-23 Prepare Final IRADD
IR-05-28 Begin IRA
IR-05-32 Field Work (Task 37)
IR-05-33 Follow-on Field Work
IR-05-34 Finish IRA
IR-06-01 == BASIN A NECK GW INTRCPT SYS
IR-06-02 PAS Evaluation
IR-06-03 Army Evaluation
IR-06-04 Select Lead Party
IR-06-05 Army Selects ARARs
IR-06-12 Conduct Assessment
IR-06-13 PAS Review Assessment/ARARs
IR-06-17 Revise Assessment
IR-06-25 Finalize ARARs
IR-06-26 Prepare Draft IRADD
IR-06-29 PAS & Public Comment
IR-06-30 Prepare Final IRADD
IR-06-31 Dispute/Finalize IRADD
IR-06-32 Dispute Meetings IRADD
IR-06-32 Revise/Reissue IRADD
IR-06-33 Finalize IRADD
IR-06-34 Begin IRA
IR-06-35 Statement of Work
IR-06-36 Procure A/E
IR-06-37 Design
IR-06-38 Implementation Document
IR-06-39 Procure Construction Contractor
IR-06-40 Award Contract
IR-06-41 Mobilization
IR-06-42 Field Work
IR-06-43 Startup IRA


IRA PROCESS
No Disputes
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IRA PROCESS
No Disputes
IRATPP
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1989
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Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May

IRA PROCESS
No Disputes
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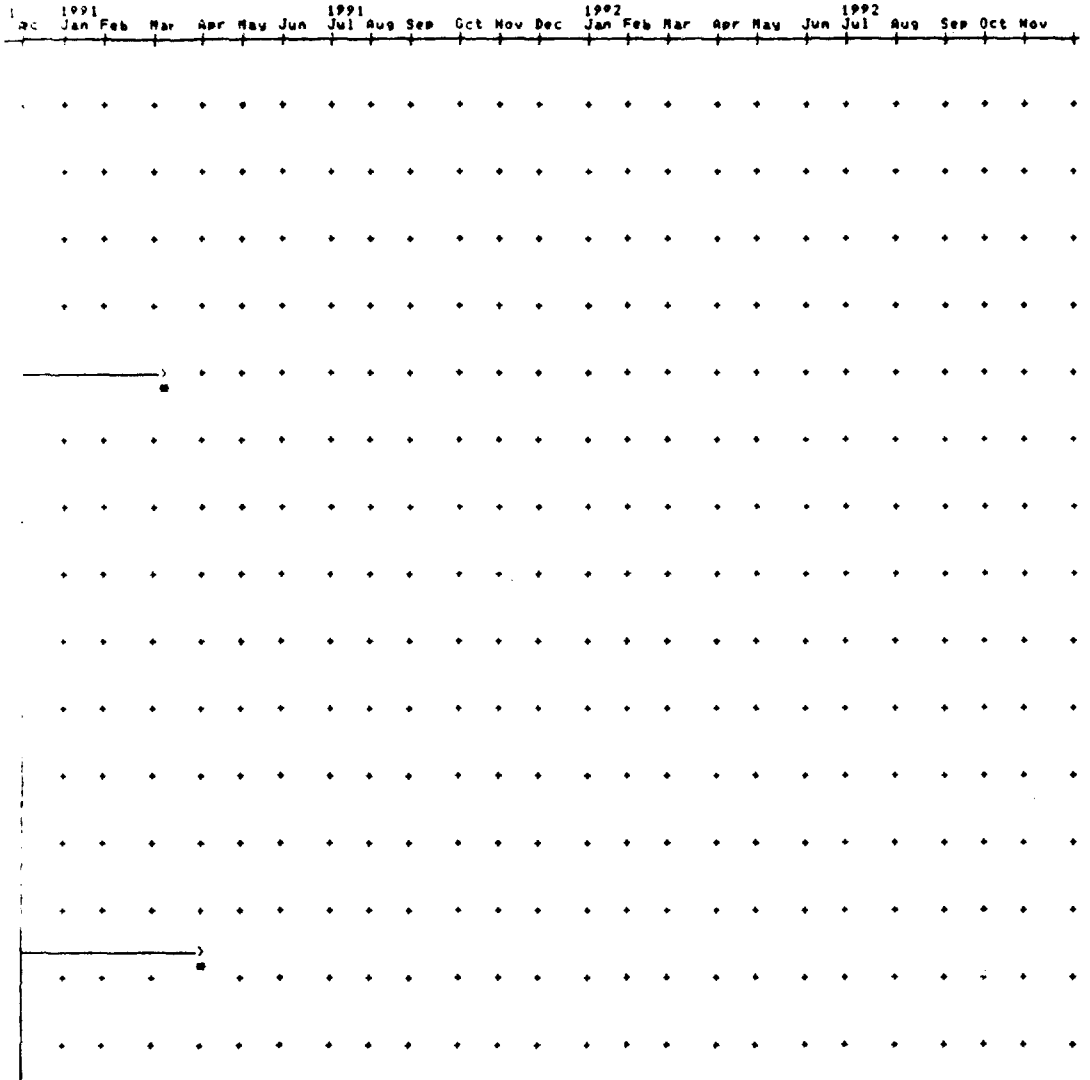

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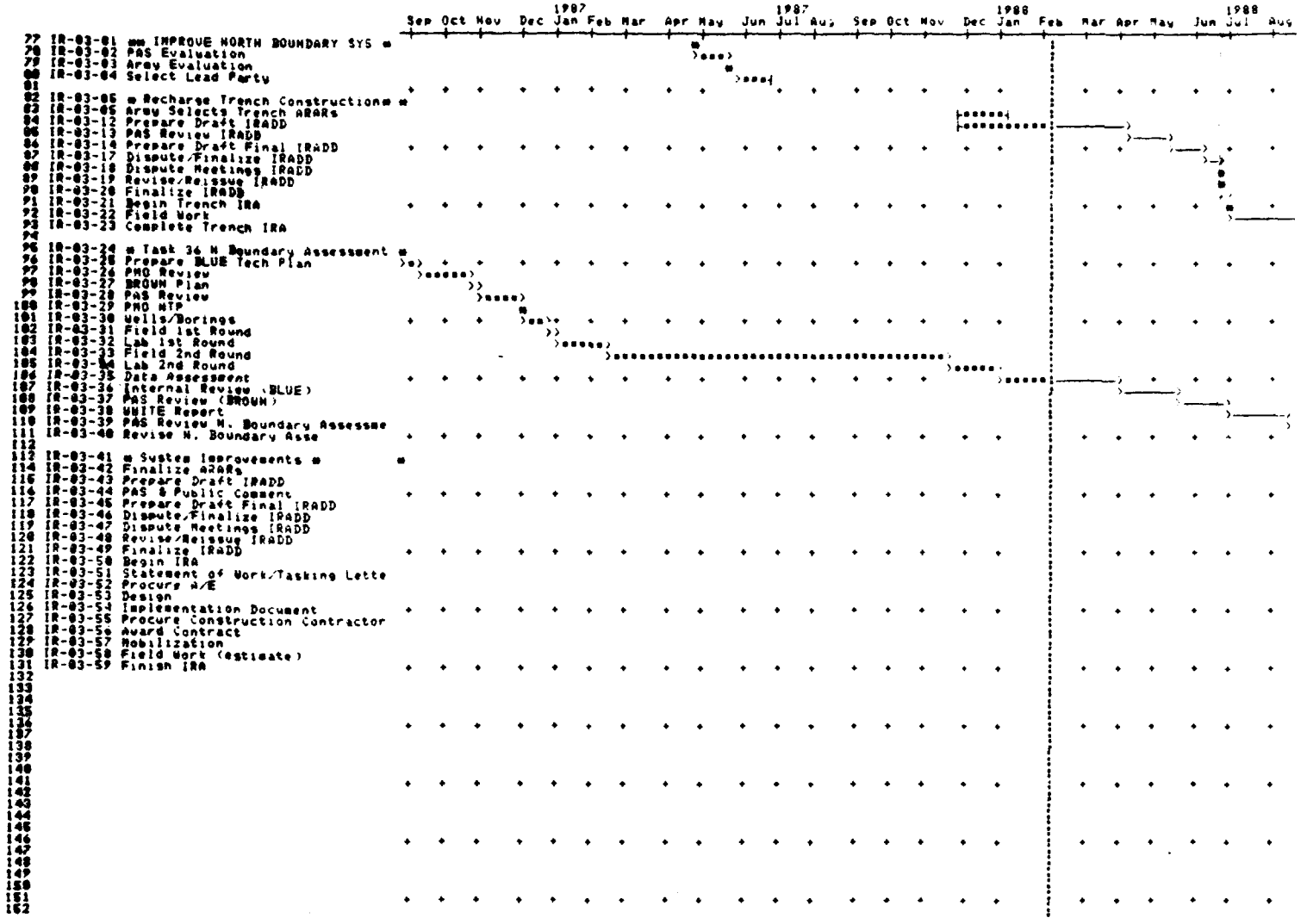

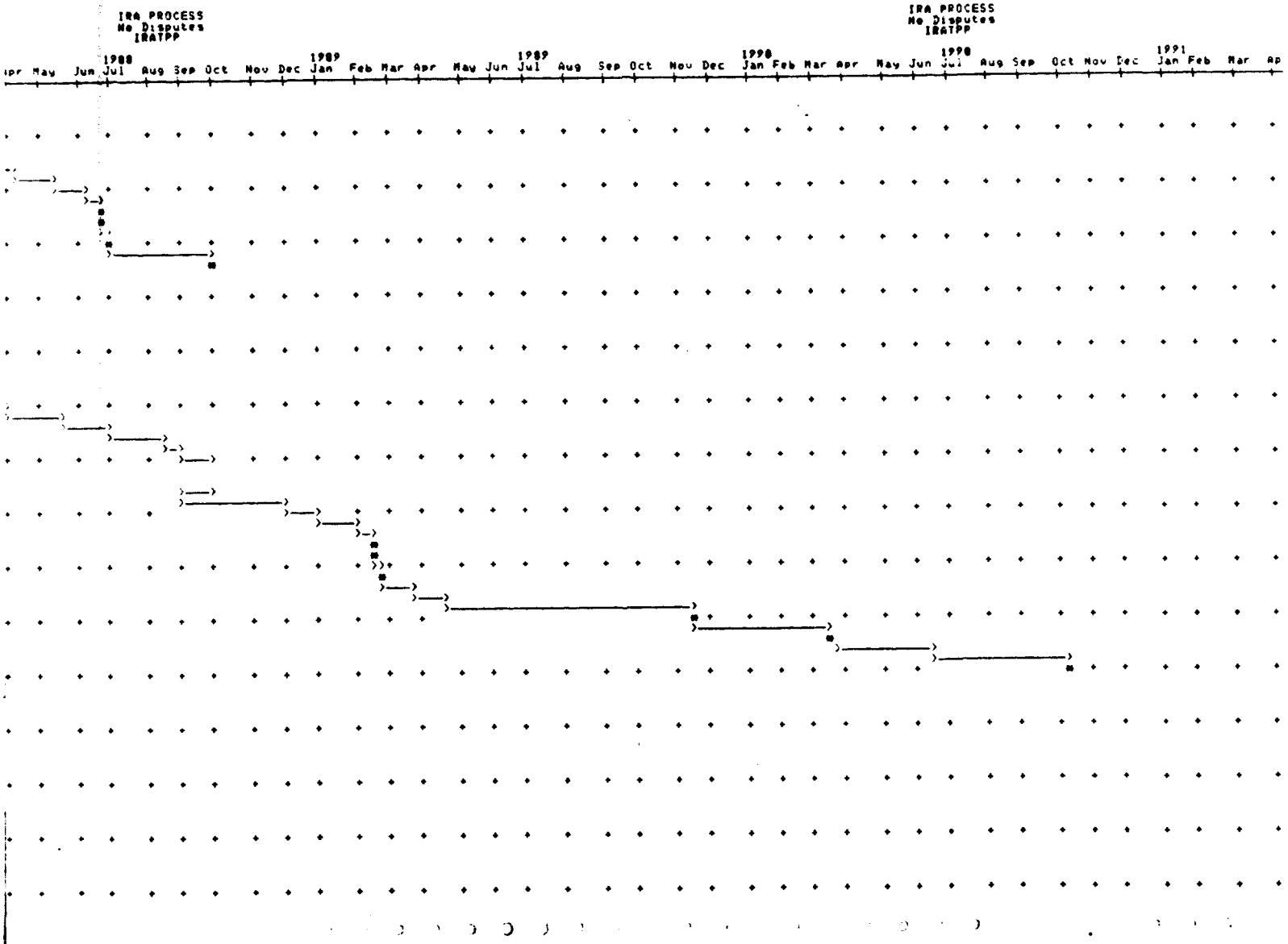
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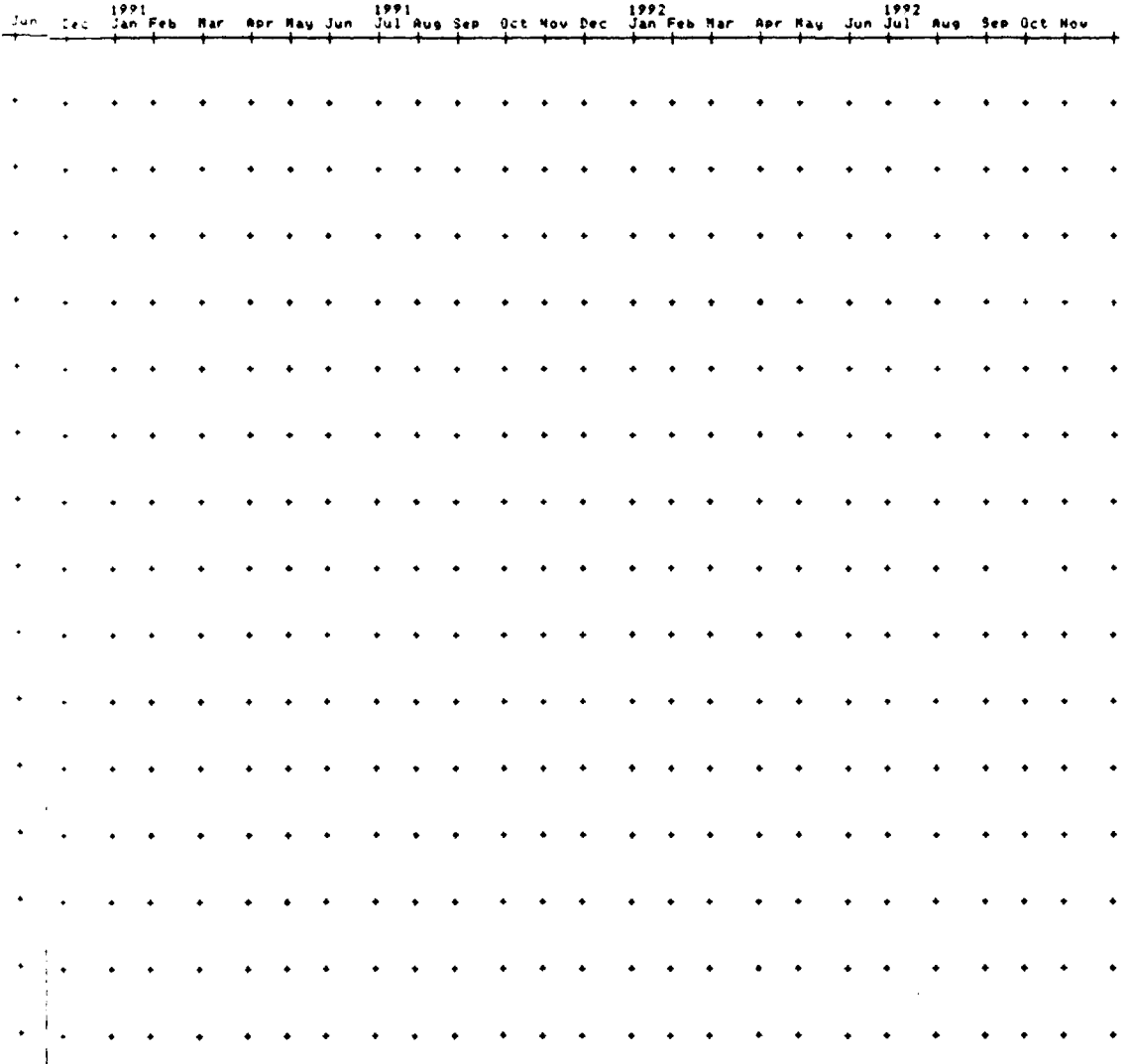

IR-03-01 mm IMPROVE NORTH BOUNDARY SYS m	77
IR-03-02 PAS Evaluation	78
IR-03-03 Array Evaluation	79
IR-03-04 Select Lead Party	80
	81
IR-03-05 m Recharge Trench Constructionm	82
IR-03-06 Array Selects Trench #RARs	83
IR-03-12 Prepare Draft IRAL	84
IR-03-13 PAS Review IRADD	85
IR-03-14 Prepare Draft Final IRADD	86
IR-03-17 Dispute/Finalize IRADD	87
IR-03-18 Dispute Meetings IRADD	88
IR-03-19 Revise/Reissue IRADD	89
IR-03-20 Finalize IRADD	90
IR-03-21 Begin Trench IRA	91
IR-03-22 Field Work	92
IR-03-23 Complete Trench IRA	93
	94
IR-03-24 m Task 36 N Boundary Assessment	95
IR-03-25 Prepare BLUE Team Plan	96
IR-03-26 PMO Review	97
IR-03-27 BROWN Plan	98
IR-03-28 PAS Review	99
IR-03-29 PMO MTP	100
IR-03-30 Wells/Borings	101
IR-03-31 Field 1st Round	102
IR-03-32 Lab 1st Round	103
IR-03-33 Field 2nd Round	104
IR-03-34 Lab 2nd Round	105
IR-03-35 Data Assessment	106
IR-03-36 Internal Review (BLUE)	107
IR-03-37 PAS Review (BROWN)	108
IR-03-38 WHITE Report	109
IR-03-39 PAS Review N. Boundary Assessme	110
IR-03-40 Revise N. Boundary Asse	111
	112
IR-03-41 m System Improvements m	113
IR-03-42 Finalize #RARs	114
IR-03-43 Prepare Draft IRADD	115
IR-03-44 PAS & Public Comment	116
IR-03-45 Prepare Draft Final IRADD	117
IR-03-46 Dispute/Finalize IRADD	118
IR-03-47 Dispute Meetings IRADD	119
IR-03-48 Revise/Reissue IRADD	120
IR-03-49 Finalize IRADD	121
IR-03-50 Begin IRA	122
IR-03-51 Statement of Work/Tasking Lette	123
IR-03-52 Procure A/E	124
IR-03-53 Design	125
IR-03-54 Implementation Document	126
IR-03-55 Procure Construction Contractor	127
IR-03-56 Award Contract	128
IR-03-57 Mobilization	129
IR-03-58 Field Work (estimate)	130
IR-03-59 Finish IRA	131
	132
	133
	134
	135
	136
	137
	138
	139
	140
	141
	142
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IRA PROCESS
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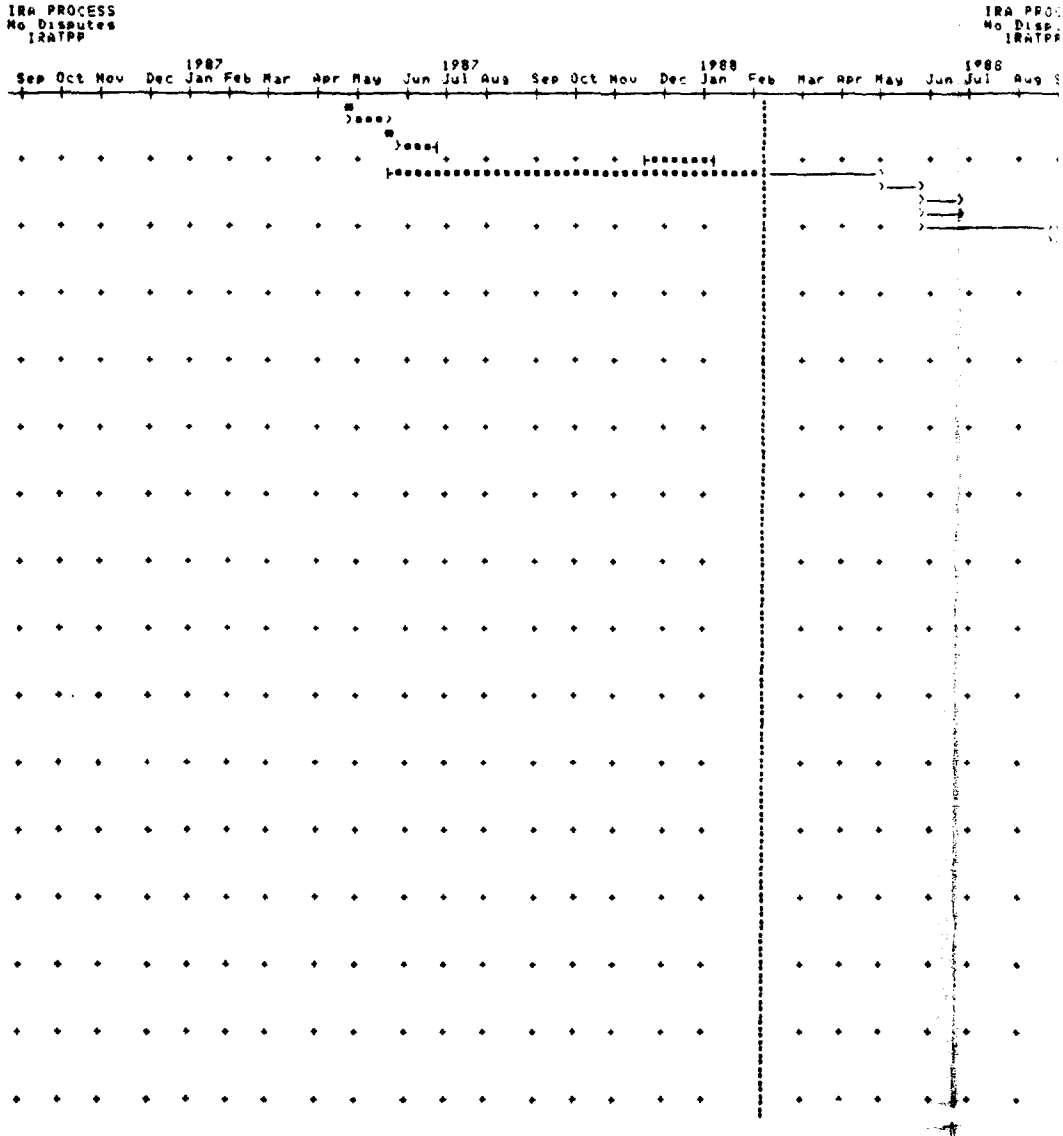

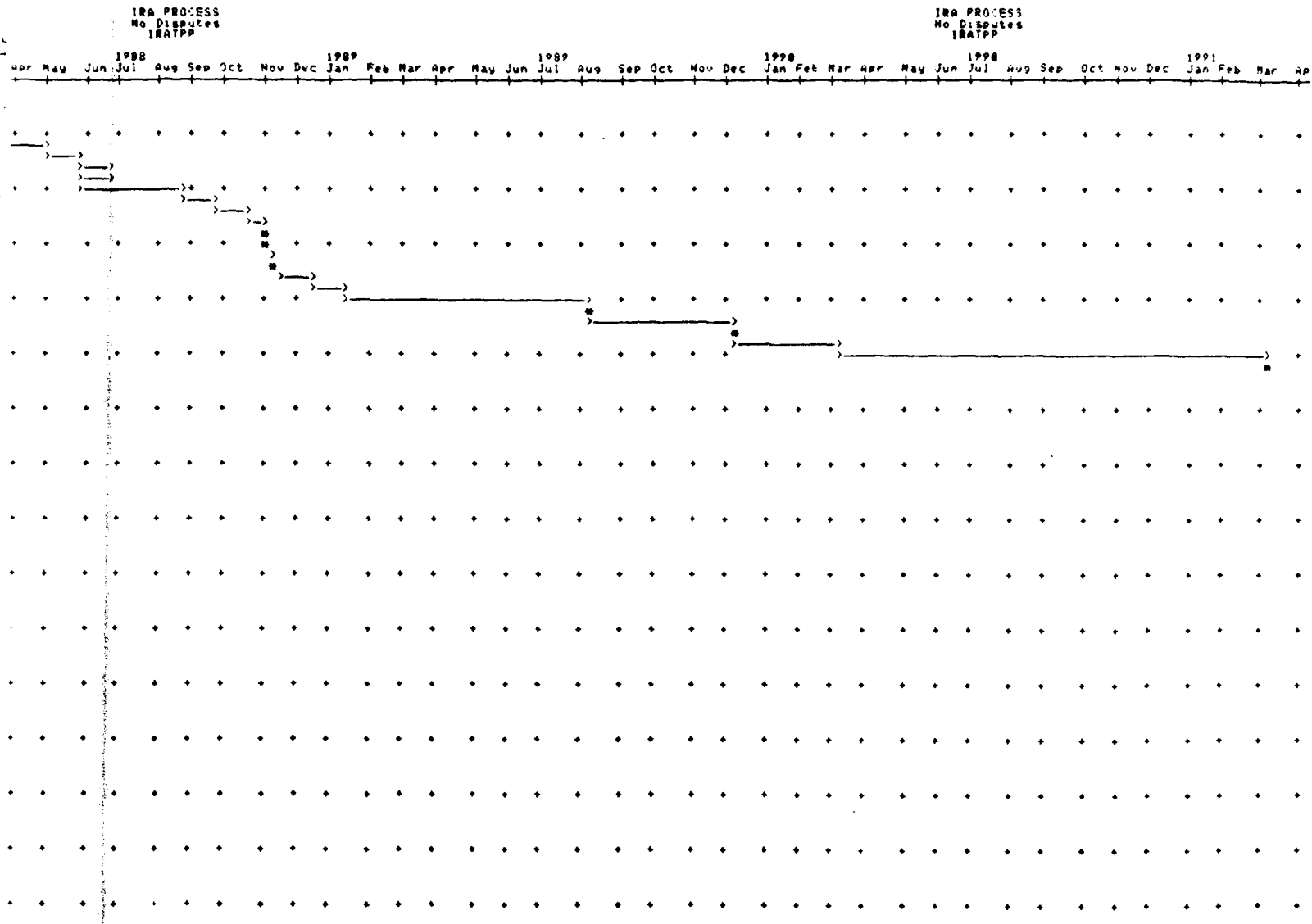
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IRA PROCESS
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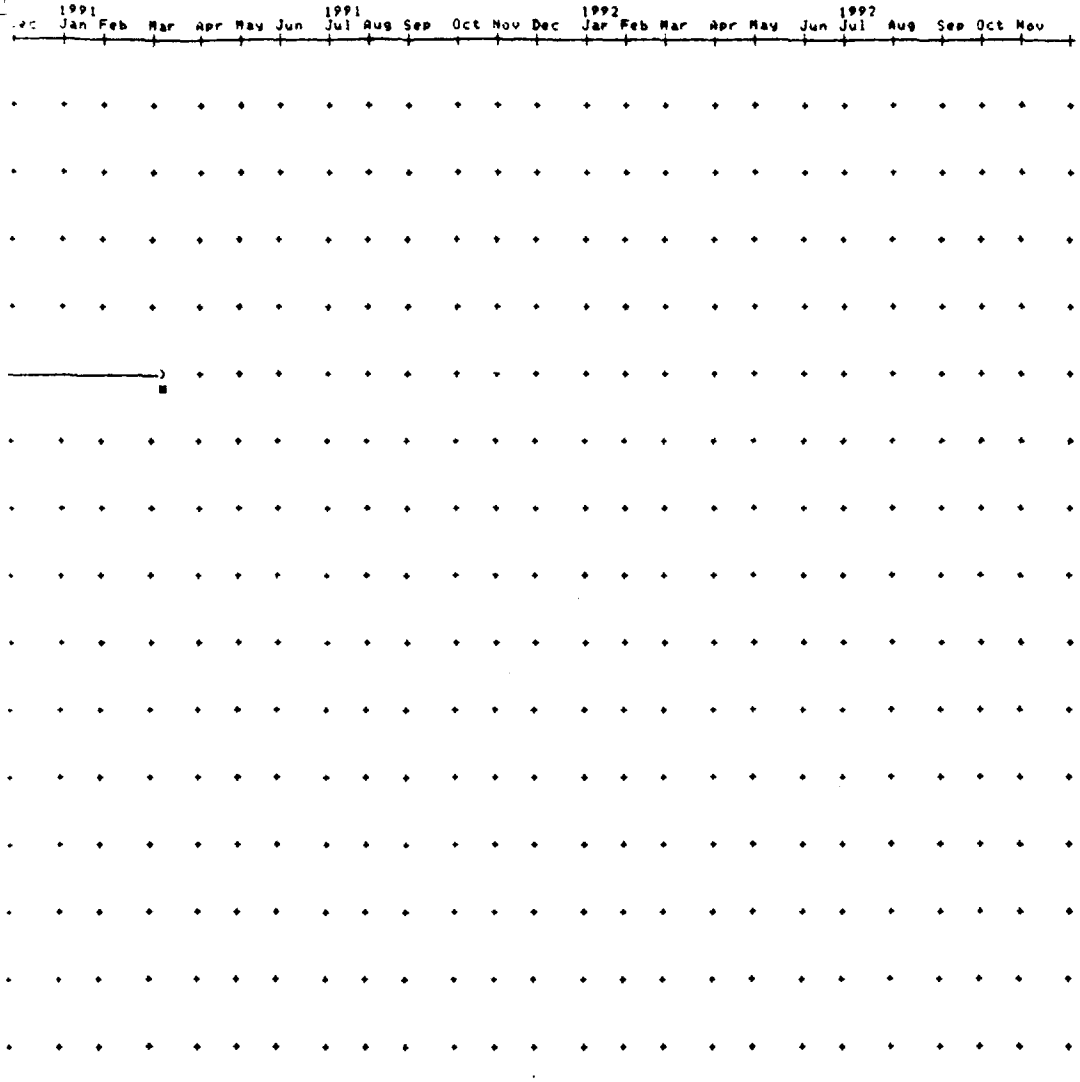
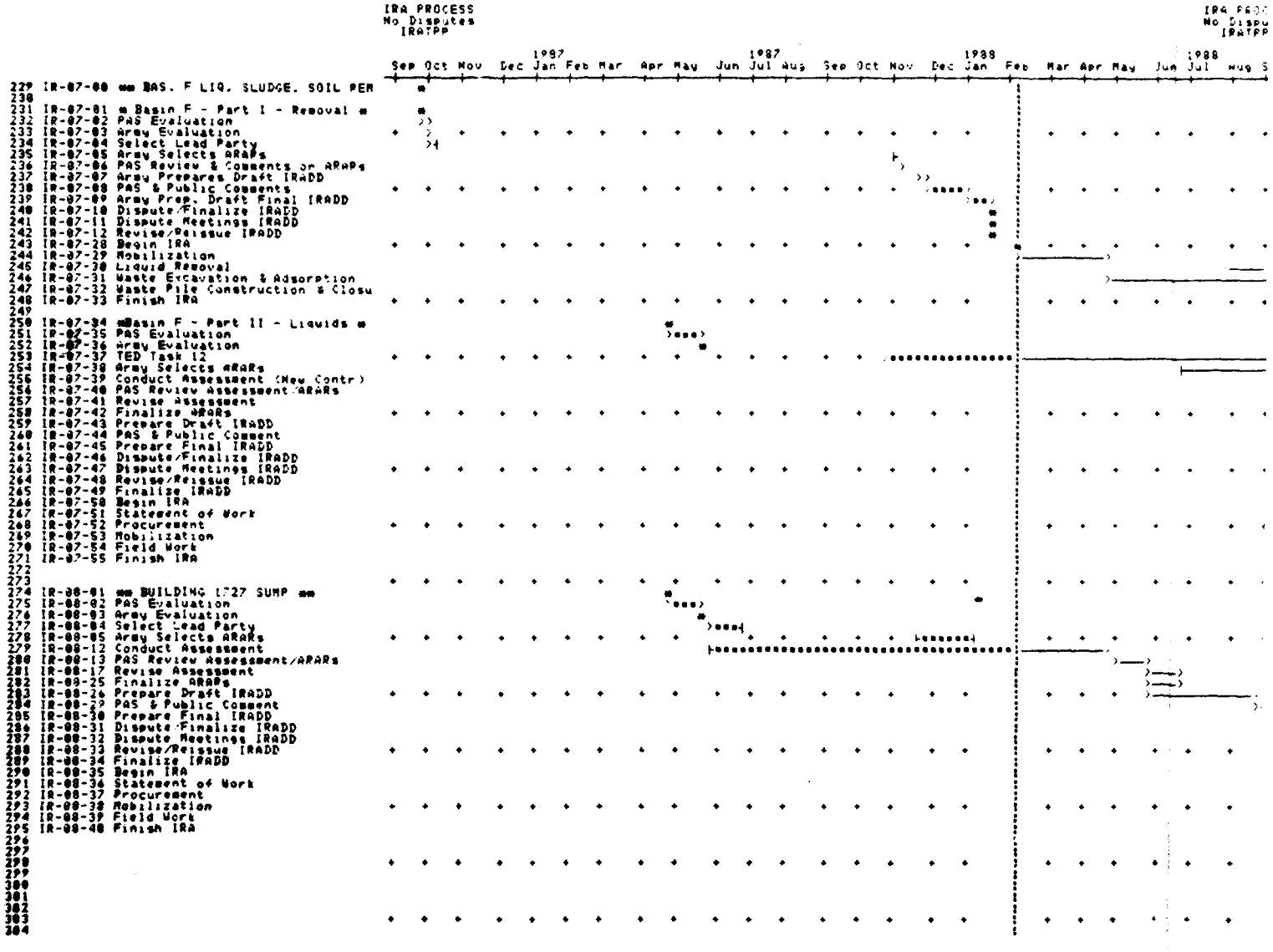


IRA PROCESS
No Disputes
IRATPP

IR-02-01 GW INT SYS NORTH OF RRA	1
IR-02-02 PAS Evaluation	2
IR-02-03 Army Evaluation	3
IR-02-04 Select Lead Party	4
IR-02-05 Army Selects ARARs	5
IR-02-11 Conduct Assessment	6
IR-02-12 PAS Review Assessment/ARARs	7
IR-02-13 Revise Assessment	8
IR-02-21 Finalize ARARs	9
IR-02-22 Prepare Draft IRADD	10
IR-02-25 PAS & Public Comment	11
IR-02-26 Prepare Draft Final IRADD	12
IR-02-27 Dispute/Finalize IRADD	13
IR-02-28 Dispute Meetings IRADD	14
IR-02-29 Revise/Reissue IRADD	15
IR-02-30 Finalize IRADD	16
IR-02-31 Begin IRA	17
IR-02-32 Statement of Work/Tasking Lette	18
IR-02-33 Procure A/E	19
IR-02-34 Design	20
IR-02-35 Implementation Document	21
IR-02-36 Procure Construction Contractor	22
IR-02-37 Award Contract	23
IR-02-38 Mobilization	24
IR-02-39 Field Work	25
IR-02-40 Startup IRA	26

7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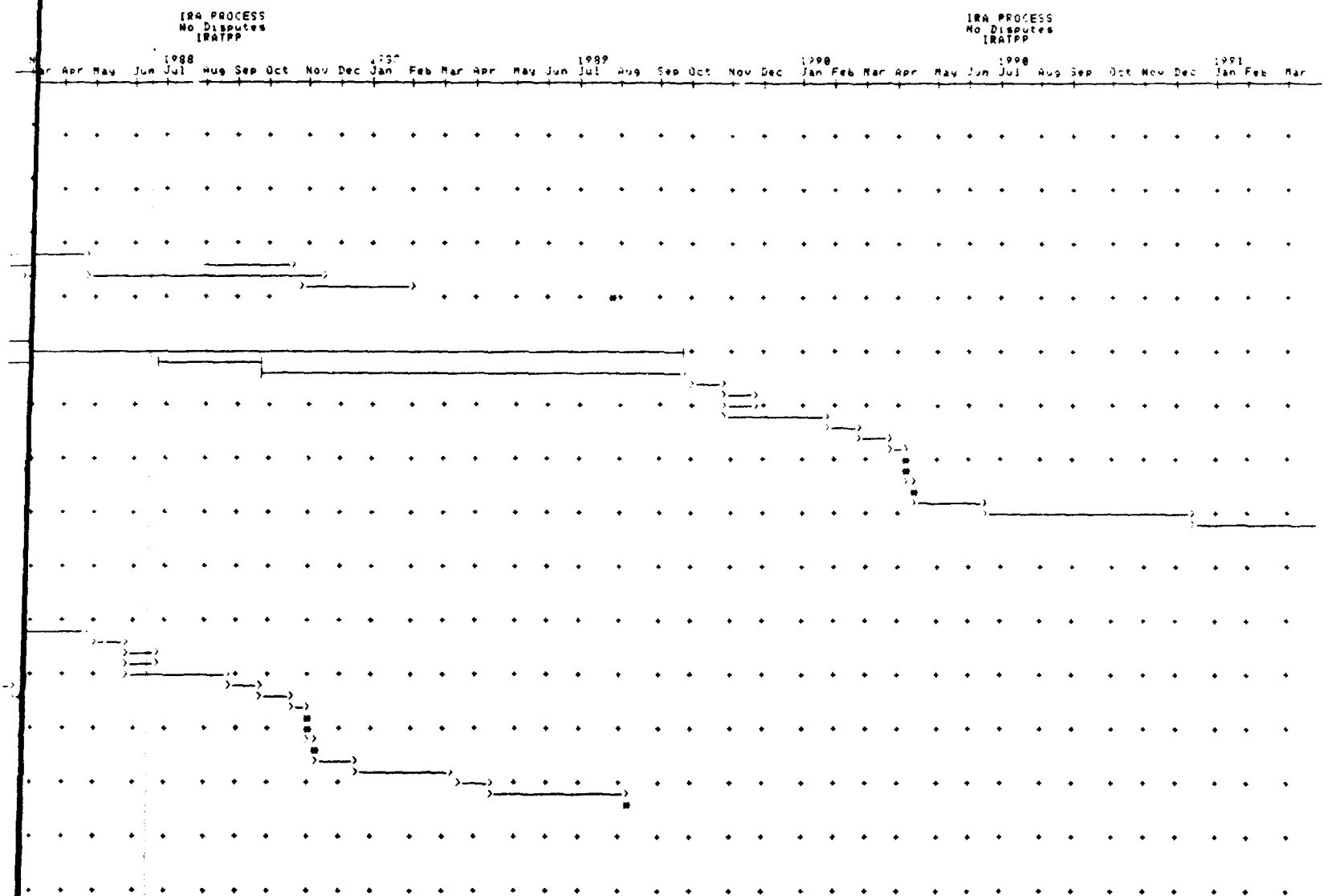
231 IR-07-01 Basin F - Part I - Removal
232 IR-07-02 PAS Evaluation
233 IR-07-03 Army Evaluation
234 IR-07-04 Select Lead Party
235 IR-07-05 Army Selects ARARs
236 IR-07-06 PAS Review & Comments on ARARs
237 IR-07-07 Army Prepares Draft IRADD
238 IR-07-08 PAS & Public Comments
239 IR-07-09 Army Prep. Draft Final IRADD
240 IR-07-10 Dispute/Finalize IRADD
241 IR-07-11 Dispute Meetings IRADD
242 IR-07-12 Revise/Reissue IRADD
243 IR-07-28 Begin IRA
244 IR-07-29 Mobilization
245 IR-07-30 Liquid Removal
246 IR-07-31 Waste Excavation & Adsorption
247 IR-07-32 Waste Pile Construction & Closu
248 IR-07-33 Finish IRA
250 IR-07-34 Basin F - Part II - Liquids
251 IR-07-35 PAS Evaluation
252 IR-07-36 Army Evaluation
253 IR-07-37 TED Task 12
254 IR-07-38 Army Selects ARARs
256 IR-07-39 Conduct Assessment (New Contr)
256 IR-07-40 PAS Review Assessment/ARARs
257 IR-07-41 Revise Assessment
258 IR-07-42 Finalize ARARs
259 IR-07-43 Prepare Draft IRADD
260 IR-07-44 PAS & Public Comment
261 IR-07-45 Prepare Final IRADD
262 IR-07-46 Dispute/Finalize IRADD
263 IR-07-47 Dispute Meetings IRADD
264 IR-07-48 Revise/Reissue IRADD
265 IR-07-49 Finalize IRADD
266 IR-07-50 Begin IRA
267 IR-07-51 Statement of Work
268 IR-07-52 Procurement
269 IR-07-53 Mobilization
270 IR-07-54 Field Work
271 IR-07-55 Finish IRA
274 IR-08-01 BUILDING 1727 SUMP
275 IR-08-02 PAS Evaluation
276 IR-08-03 Army Evaluation
277 IR-08-04 Select Lead Party
278 IR-08-05 Army Selects ARARs
279 IR-08-12 Conduct Assessment
280 IR-08-13 PAS Review Assessment/ARARs
281 IR-08-17 Revise Assessment
282 IR-08-25 Finalize ARARs
283 IR-08-26 Prepare Draft IRADD
284 IR-08-27 PAS & Public Comment
285 IR-08-30 Prepare Final IRADD
286 IR-08-31 Dispute/Finalize IRADD
287 IR-08-32 Dispute Meetings IRADD
288 IR-08-33 Revise/Reissue IRADD
289 IR-08-34 Finalize IRADD
290 IR-08-35 Begin IRA
291 IR-08-36 Statement of Work
292 IR-08-37 Procurement
293 IR-08-38 Mobilization
294 IR-08-39 Field Work
295 IR-08-40 Finish IRA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IRA PROCESS
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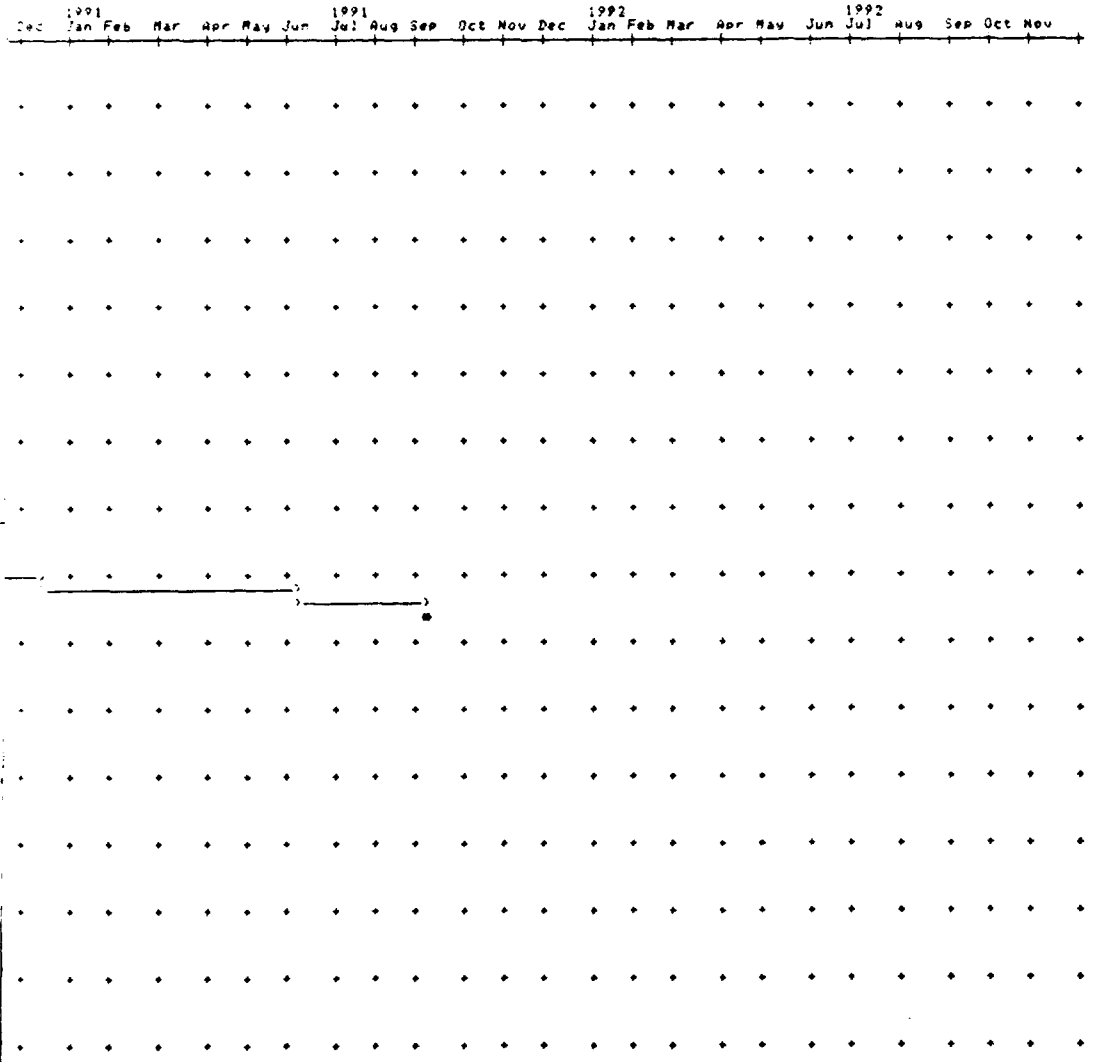

IR-07-00 ## BAS. F LIQ. SLUDGE, SOIL REM 229
230
IR-07-01 # Basin F - Part I - Removal # 231
IR-07-02 PAS Evaluation 232
IR-07-03 Army Evaluation 233
IR-07-04 Select Lead Party 234
IR-07-05 Army Selects ARARs 235
IR-07-06 PAS Review & Comments on ARARs 236
IR-07-07 Army Prepares Draft IRADD 237
IR-07-08 PAS & Public Comments 238
IR-07-09 Army Prep. Draft Final IRADD 239
IR-07-10 Dispute/Finalize IRADD 240
IR-07-11 Dispute Meetings IRADD 241
IR-07-12 Revise/Reissue IRADD 242
IR-07-28 Begin IRA 243
IR-07-29 Mobilization 244
IR-07-30 Liquid Removal 245
IR-07-31 Waste Excavation & Adsorption 246
IR-07-32 Waste Pile Construction & Closu 247
IR-07-33 Finish IRA 248
249
IR-07-34 #Basin F - Part II - Liquids # 250
IR-07-35 PAS Evaluation 251
IR-07-36 Army Evaluation 252
IR-07-37 IED Task 12 253
IR-07-38 Army Selects ARARs 254
IR-07-39 Conduct Assessment (New Contr) 255
IR-07-40 PAS Review Assessment/ARARs 256
IR-07-41 Revise Assessment 257
IR-07-42 Finalize #RARs 258
IR-07-43 Prepare Draft IRADD 259
IR-07-44 PAS & Public Comment 260
IR-07-45 Prepare Final IRADD 261
IR-07-46 Dispute/Finalize IRADD 262
IR-07-47 Dispute Meetings IRADD 263
IR-07-48 Revise/Reissue IRADD 264
IR-07-49 Finalize IRADD 265
IR-07-50 Begin IRA 266
IR-07-51 Statement of Work 267
IR-07-52 Procurement 268
IR-07-53 Mobilization 269
IR-07-54 Field Work 270
IR-07-55 Finish IRA 271
272
273
IR-08-01 ## BUILDING 1727 SUMP ## 274
IR-08-02 PAS Evaluation 275
IR-08-03 Army Evaluation 276
IR-08-04 Select Lead Party 277
IR-08-05 Army Selects ARARs 278
IR-08-12 Conduct Assessment 279
IR-08-13 PAS Review Assessment/ARARs 280
IR-08-17 Revise Assessment 281
IR-08-25 Finalize ARARs 282
IR-08-26 Prepare Draft IRADD 283
IR-08-29 PAS & Public Comment 284
IR-08-30 Prepare Final IRADD 285
IR-08-31 Dispute/Finalize IRADD 286
IR-08-32 Dispute Meetings IRADD 287
IR-08-33 Revise/Reissue IRADD 288
IR-08-34 Finalize IRADD 289
IR-08-35 Begin IRA 290
IR-08-36 Statement of Work 291
IR-08-37 Procurement 292
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IR-08-39 Field Work 294
IR-08-40 Finish IRA 295
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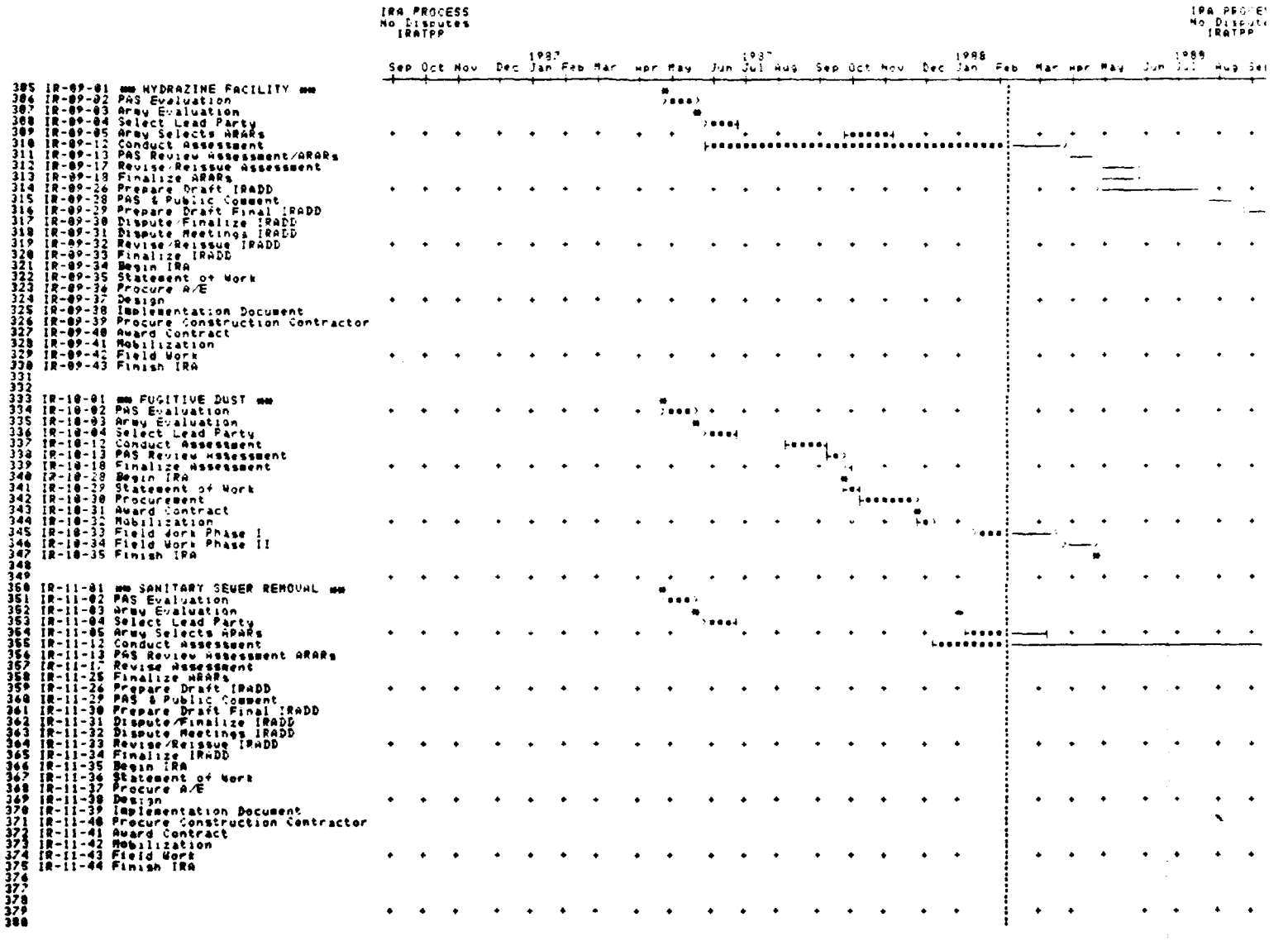
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385 IR-09-01 ** HYDRAZINE FACILITY **
386 IR-09-02 PAS Evaluation
387 IR-09-03 Army Evaluation
388 IR-09-04 Select Lead Party
389 IR-09-05 Army Selects ARARs
390 IR-09-12 Conduct Assessment
391 IR-09-13 PAS Review Assessment/ARARs
392 IR-09-17 Revise/Reissue Assessment
393 IR-09-18 Finalize ARARs
394 IR-09-26 Prepare Draft IRADD
395 IR-09-28 PAS & Public Comment
396 IR-09-29 Prepare Draft Final IRADD
397 IR-09-30 Dispute/Finalize IRADD
398 IR-09-31 Dispute Meetings IRADD
399 IR-09-32 Revise/Reissue IRADD
400 IR-09-33 Finalize IRADD
401 IR-09-34 Begin IRA
402 IR-09-35 Statement of Work
403 IR-09-36 Procure A/E
404 IR-09-37 Design
405 IR-09-38 Implementation Document
406 IR-09-39 Procure Construction Contractor
407 IR-09-40 Award Contract
408 IR-09-41 Mobilization
409 IR-09-42 Field Work
410 IR-09-43 Finish IRA
411
412
413 IR-10-01 ** FUGITIVE DUST **
414 IR-10-02 PAS Evaluation
415 IR-10-03 Army Evaluation
416 IR-10-04 Select Lead Party
417 IR-10-12 Conduct Assessment
418 IR-10-13 PAS Review Assessment
419 IR-10-18 Finalize Assessment
420 IR-10-28 Begin IRA
421 IR-10-29 Statement of Work
422 IR-10-30 Procurement
423 IR-10-31 Award Contract
424 IR-10-32 Mobilization
425 IR-10-33 Field Work Phase I
426 IR-10-34 Field Work Phase II
427 IR-10-35 Finish IRA
428
429
430 IR-11-01 ** SANITARY SEWER REMOVAL **
431 IR-11-02 PAS Evaluation
432 IR-11-03 Army Evaluation
433 IR-11-04 Select Lead Party
434 IR-11-05 Army Selects ARARs
435 IR-11-12 Conduct Assessment
436 IR-11-13 PAS Review Assessment ARARs
437 IR-11-17 Revise Assessment
438 IR-11-25 Finalize ARARs
439 IR-11-26 Prepare Draft IRADD
440 IR-11-29 PAS & Public Comment
441 IR-11-30 Prepare Draft Final IRADD
442 IR-11-31 Dispute/Finalize IRADD
443 IR-11-32 Dispute Meetings IRADD
444 IR-11-33 Revise/Reissue IRADD
445 IR-11-34 Finalize IRADD
446 IR-11-35 Begin IRA
447 IR-11-36 Statement of Work
448 IR-11-37 Procure A/E
449 IR-11-38 Design
450 IR-11-39 Implementation Document
451 IR-11-40 Procure Construction Contractor
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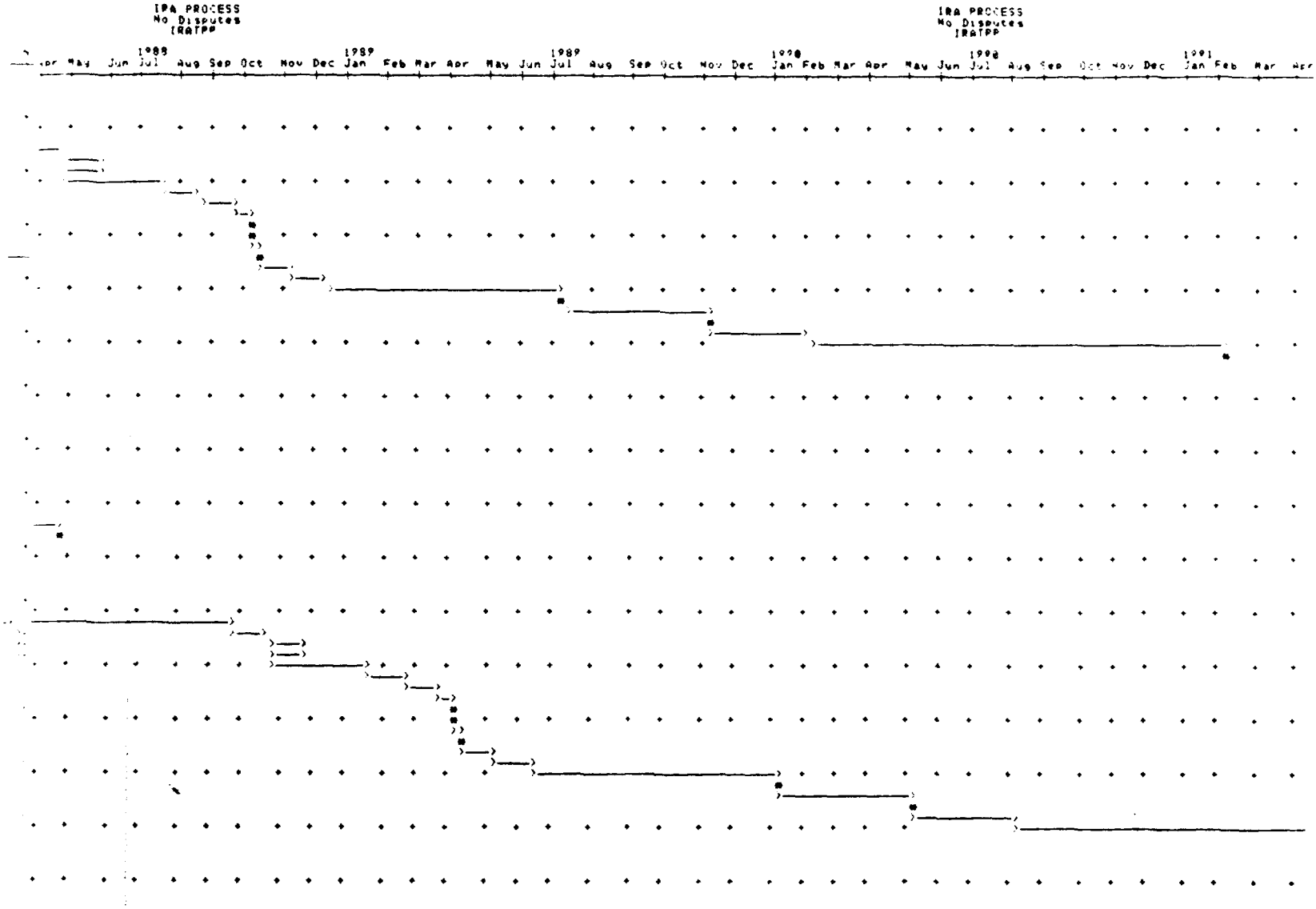
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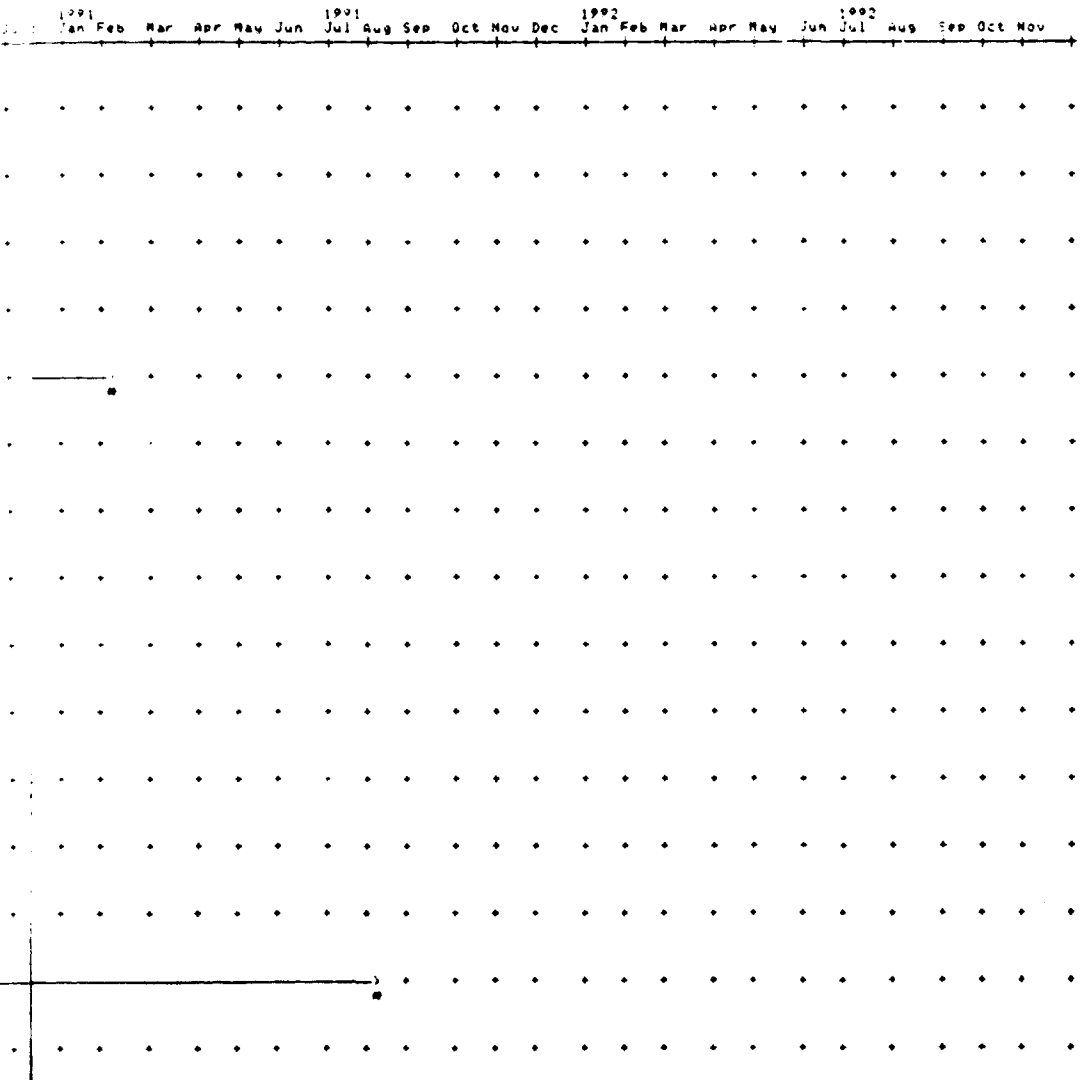

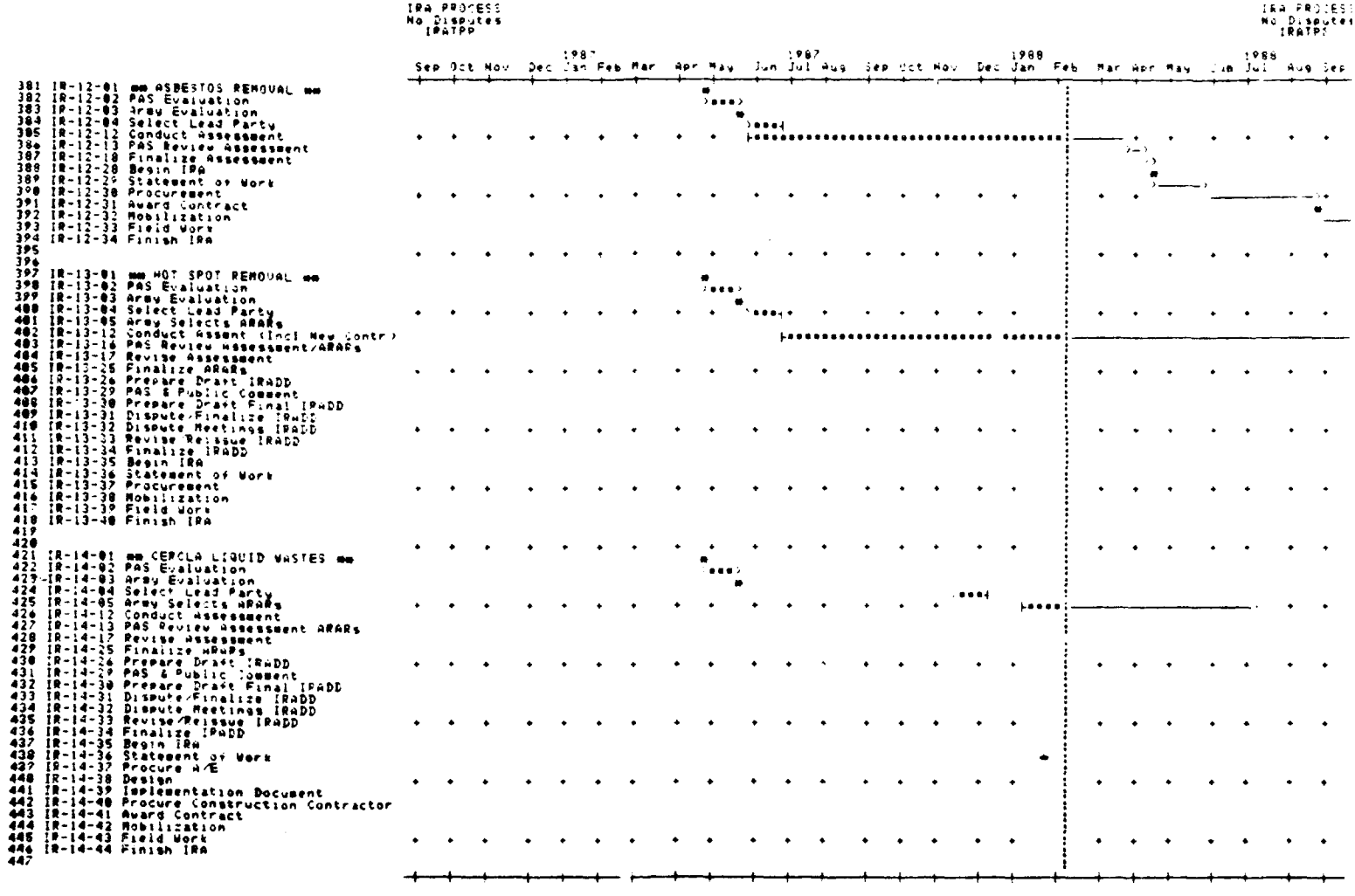
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381 IR-12-01 ■■ ASBESTOS REMOVAL ■■
382 IR-12-02 PAS Evaluation
383 IR-12-03 Army Evaluation
384 IR-12-04 Select Lead Party
385 IR-12-12 Conduct Assessment
386 IR-12-13 PAS Review Assessment
387 IR-12-18 Finalize Assessment
388 IR-12-28 Begin IRA
389 IR-12-29 Statement of Work
390 IR-12-30 Procurement
391 IR-12-31 Award Contract
392 IR-12-32 Mobilization
393 IR-12-33 Field Work
394 IR-12-34 Finish IRA
395
396
397 IR-13-01 ■■ HOT SPOT REMOVAL ■■
398 IR-13-02 PAS Evaluation
399 IR-13-03 Army Evaluation
400 IR-13-04 Select Lead Party
401 IR-13-05 Army Selects ARARs
402 IR-13-12 Conduct Assmt (Incl New Contr)
403 IR-13-16 PAS Review Assessment/ARARs
404 IR-13-17 Revise Assessment
405 IR-13-25 Finalize ARARs
406 IR-13-26 Prepare Draft IRADD
407 IR-13-29 PAS & Public Comment
408 IR-13-30 Prepare Draft Final IRADD
409 IR-13-31 Dispute/Finalize IRADD
410 IR-13-32 Dispute Meetings IRADD
411 IR-13-33 Revise Reissue IRADD
412 IR-13-34 Finalize IRADD
413 IR-13-35 Begin IRA
414 IR-13-36 Statement of Work
415 IR-13-37 Procurement
416 IR-13-38 Mobilization
417 IR-13-39 Field Work
418 IR-13-40 Finish IRA
419
420
421 IR-14-01 ■■ CERCLA LIQUID WASTES ■■
422 IR-14-02 PAS Evaluation
423 IR-14-03 Army Evaluation
424 IR-14-04 Select Lead Party
425 IR-14-05 Army Selects ARARs
426 IR-14-12 Conduct Assessment
427 IR-14-13 PAS Review Assessment ARARs
428 IR-14-17 Revise Assessment
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431 IR-14-29 PAS & Public Comment
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433 IR-14-31 Dispute/Finalize IRADD
434 IR-14-32 Dispute Meetings IRADD
435 IR-14-33 Revise/Reissue IRADD
436 IR-14-34 Finalize IRADD
437 IR-14-35 Begin IRA
438 IR-14-36 Statement of Work
439 IR-14-37 Procure A/E
440 IR-14-38 Design
441 IR-14-39 Implementation Document
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445 IR-14-43 Field Work
446 IR-14-44 Finish IRA
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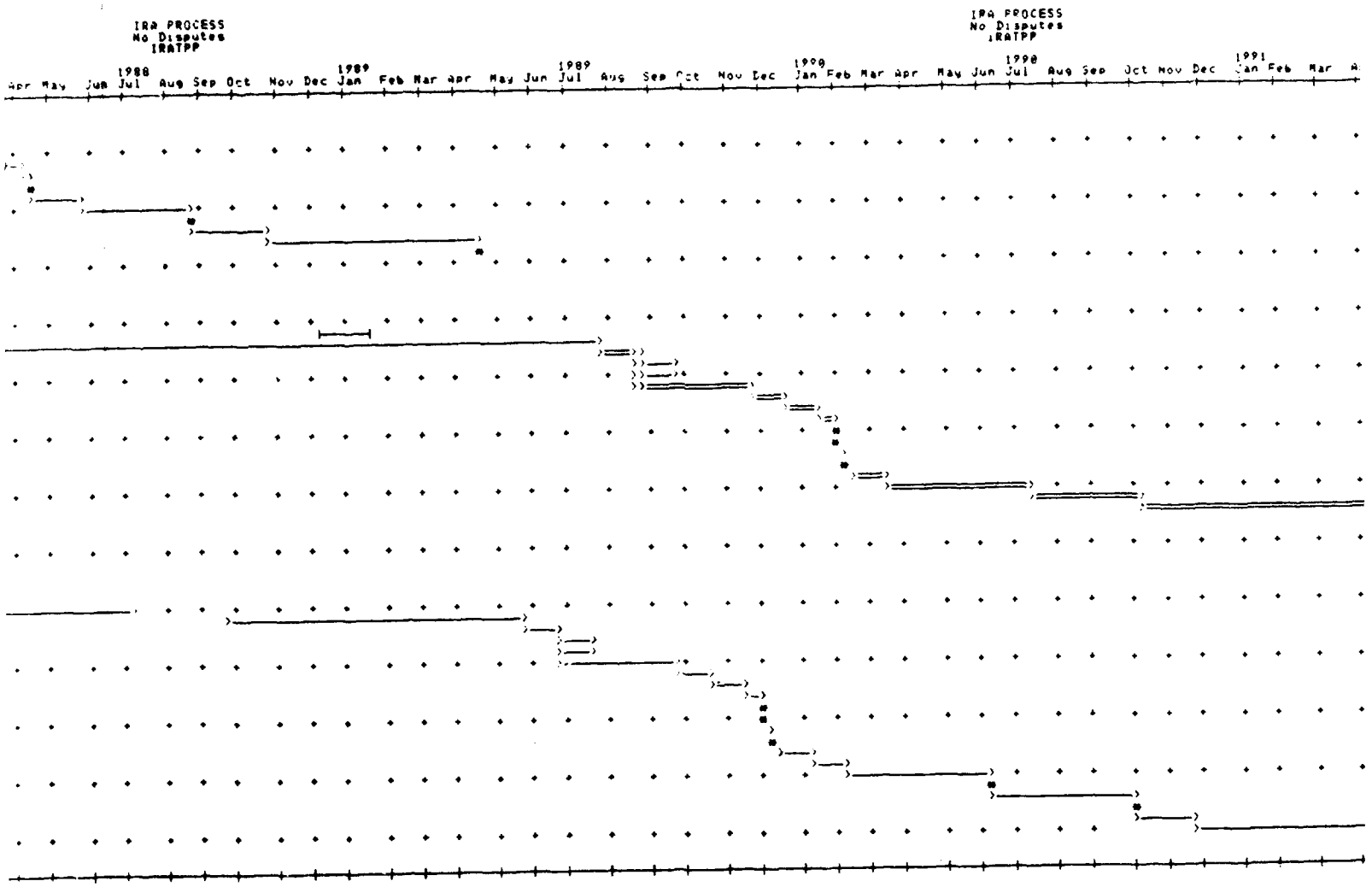
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IRA PROCESS
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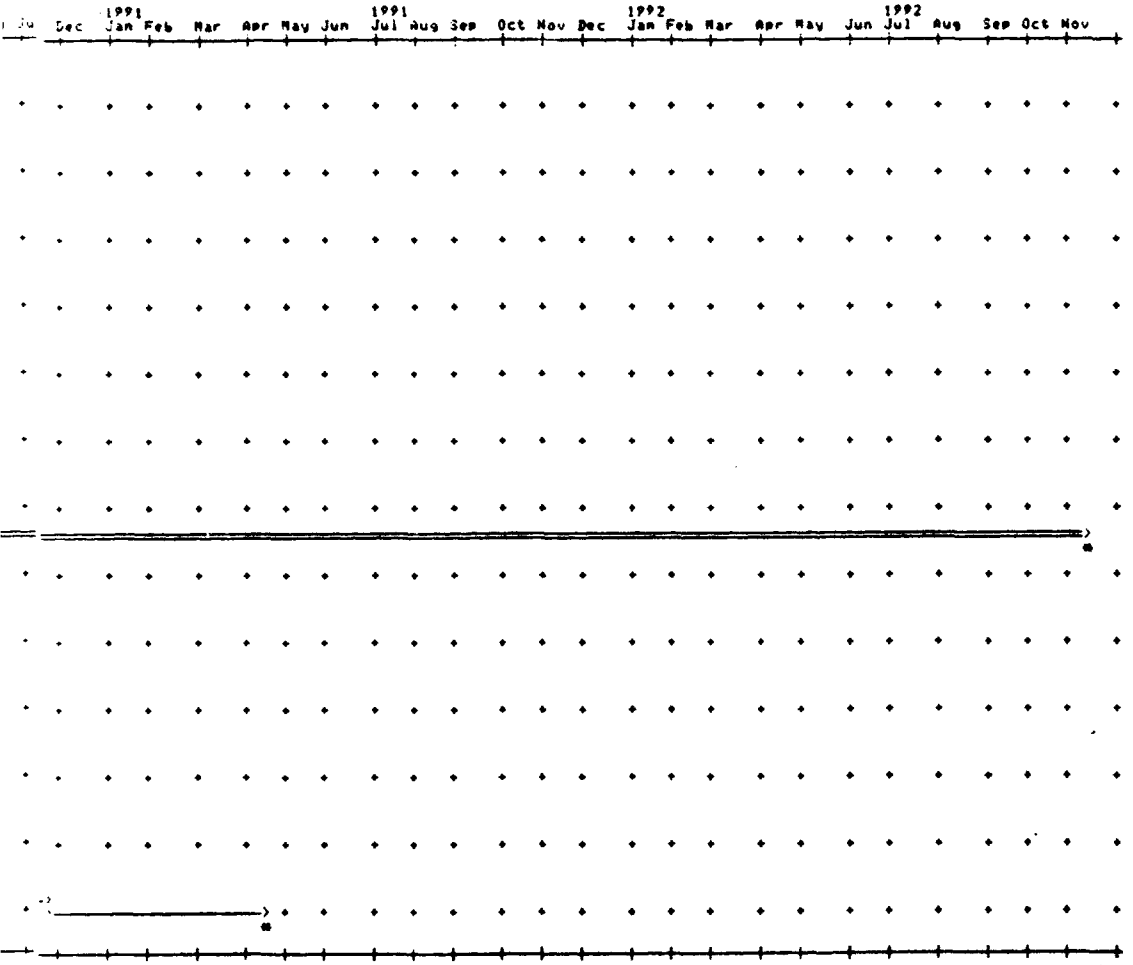

IR-12-01 ** ASBESTOS REMOVAL ** 381
IR-12-02 PAS Evaluation 382
IR-12-03 Army Evaluation 383
IR-12-04 Select Lead Party 384
IR-12-12 Conduct Assessment 385
IR-12 ,3 PAS Review Assessment 386
IR-12-18 Finalize Assessment 387
IR-12-20 Begin IRA 388
IR-12-29 Statement of Work 389
IR-12-30 Procurement 390
IR-12-31 Award Contract 391
IR-12-32 Mobilization 392
IR-12-33 Field Work 393
IR-12-34 Finish IRA 394
395
396
IR-13-01 ** HOT SPOT REMOVAL ** 397
IR-13-02 PAS Evaluation 398
IR-13-03 Army Evaluation 399
IR-13-04 Select Lead Party 400
IR-13-05 Army Selects ARARs 401
IR-13-12 Conduct Assmnt (Incl New Contr) 402
IR-13-16 PAS Review Assessment/ARARs 403
IR-13-17 Revise Assessment 404
IR-13-25 Finalize ARARs 405
IR-13-26 Prepare Draft IRADD 406
IR-13-29 PAS & Public Comment 407
IR-13-30 Prepare Draft Final IRADD 408
IR-13-31 Dispute/Finalize IRADD 409
IR-13-32 Dispute Meetings IRADD 410
IR-13-33 Revise/Reissue IRADD 411
IR-13-34 Finalize IRADD 412
IR-13-35 Begin IRA 413
IR-13-36 Statement of Work 414
IR-13-37 Procurement 415
IR-13-38 Mobilization 416
IR-13-39 Field Work 417
IR-13-40 Finish IRA 418
419
420
IR-14-01 ** CERCLA LIQUID WASTES ** 421
IR-14-02 PAS Evaluation 422
IR-14-03 Army Evaluation 423
IR-14-04 Select Lead Party 424
IR-14-05 Army Selects ARARs 425
IR-14-12 Conduct Assessment 426
IR-14-13 PAS Review Assessment ARARs 427
IR-14-17 Revise Assessment 428
IR-14-25 Finalize ARARs 429
IR-14-26 Prepare Draft IRADD 430
IR-14-29 PAS & Public Comment 431
IR-14-30 Prepare Draft Final IRADD 432
IR-14-31 Dispute/Finalize IRADD 433
IR-14-32 Dispute Meetings IRADD 434
IR-14-33 Revise/Reissue IRADD 435
IR-14-34 Finalize IRADD 436
IR-14-35 Begin IRA 437
IR-14-36 Statement of Work 438
IR-14-37 Procure A/E 439
IR-14-38 Design 440
IR-14-39 Implementation Document 441
IR-14-40 Procure Construction Contractor 442
IR-14-41 Award Contract 443
IR-14-42 Mobilization 444
IR-14-43 Field Work 445
IR-14-44 Finish IRA 446
447