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May 24, 1991

Meeting Minutes Transmittal/Approval
Unit Managers Meeting: 1100-EM-1 Operable Unit
450 Hills, Room 47, Richland, Washington
April 16, 1991

From/
Appvl.: Robert K. Stewart Date: 5/24/91
Robert K. Stewart, 1100-EM-1 Unit Manager, DOE-RL (A6-95)

Appvl.: David R. Einan Date: 24 May 91
David R. Einan, 1100-EM-1 Unit Manager, EPA (B5-01)

Appvl.: [signature] Date May 24, 1991
Rich Hibbard, 1100-EM-1 Unit Manager, WA Department of Ecology

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Meeting Minutes are attached. Minutes are comprised of the following:

Attachment #1 - Meeting Summary/Summary of Commitments and Agreements
Attachment #2 - Attendance List
Attachment #3 - Agenda For 1100-EM-1 Meeting
Attachment #4 - Locations of Proposed New Wells
Attachment #5 - Commitments/Agreements Status List
Attachment #6 - 1100-EM-1 Dates for Deliverables
Attachment #7 - Geophysics Summary: Previous Work, Techniques
Attachment #8 - HRL Geophysics, Forward Modeling
Attachment #9 - Information Paper: Points of Compliance

Prepared by: Bill [signature] Date: 5/24/91
SWEC Support Services

Concurrence by: [signature] Date: May 24, 1991
WHC RI Coordinator

1100-EM-1 Operable Unit Managers Meeting
April 16, 1991

Distribution:

Chuck Cline, WDOE
Ward Staubitz, USGS
Mike Thompson, DOE-RL (A6-95)
Mary Harmon, DOE-HQ, (EM-442)
John Stewart, USACE
Tim Veneziano, WHC (B2-35)
Tom Wintczak, WHC (L4-92)
Mel Adams, WHC (H4-55)
Steven Clark, WHC (H4-55)

Brian Sprouse, WHC (H4-22)
Diane Clark, DOE-RL (A5-55)
Bill Price, WHC (N3-05)
Don Kane, Battelle EMO (K1-74)
Donna Lacombe, PRC
Jim Patterson, WHC

Elizabeth A. Bracken (A5-19)
Director, DOE-RL, ERD
June M. Hennig (A5-21)
DOE-RL, WMD
Roger D. Freeberg (A5-19)
Chief, Rstr. Br., DOE-RL,ERD

Steven H. Wisness
TPA Proj. Mgr.
Richard D. Wojtasek (B2-15)
Prgm. Mgr. WHC

Doug Sherwood, EPA (B5-01)

ADMINISTRATIVE RECORD: 1100-EM-1; Care of Susan Wray, WHC (H4-22)

Please contact Doug Fassett if there are any deletions or additions to this list.

Attachment #1

Meeting Summary and Summary of Commitments and Agreements

1100-EM-1 Unit Managers Meeting
April 16, 1991

1. Bob Stewart asked if anyone had received copies of the UMM minutes since December. A poll of the attendees determined that no one had, and Bob said that he would look into the matter.

2. Steve Clark (WHC) presented the following information on Agenda/Work Progress (also see Attachment #3).

   The Phase I and II Feasibility Study and the Supplemental Work Plan will be finalized by the end of April. Some issues won't be included, mainly the FS I and II report won't include the groundwater at the Horn Rapids Landfill (HRL). This will be covered in a separate issue paper.

   DOE, WHC, USACE and EPA met last Thursday, 4/11/91, to discuss the Change Request Package. A revised package was distributed at the UMM meeting for review, and is being started in the formal transmittal process. The request includes a detailed justification for the additional time requested to do the expanded groundwater investigation, plume definition and possible pump tests. The new schedule extends the delivery date for the RI Phase II report by 22 months. The change request will go from Steve Wisness (DOE-RL) to Tim Nord (Ecology) and Paul Day (EPA). The response would be back through Steve Wisness. Rich Hibbard (Ecology) indicated that he would evaluate the change request relative to the TPA specified procedure. John Stewart (USACE) asked that they (DOE/WHC/USACE) receive an early reading on its acceptability. He explained that he must commit to writing a Phase II report very soon to achieve the present milestone of delivering a draft report to DOE in September 1991. Such a report would be very incomplete because so much of the additional investigation to be done would not be included, and an additional report would then be needed. *Dave Einan (EPA) agreed to informally discuss initial regulator reactions to the Change Request April 23, 1991.*

   The involvement of ANF as a PRP is in progress. DOE-RL will meet with Advanced Nuclear Fuels (ANF) on Friday, and then with EPA, Ecology and DOE/WHC/USACE on Monday per Action Item 11EM1.65F. ANF has been asked to supply information on ANF wells 14, 15, and 16 (between ANF and the HRL), and 23, 24 and 25 (upgradient of ANF). Information supplied to date has been sketchy.

   Steve Clark discussed the locations of the proposed new monitoring wells (see Attachment #4). Two have been added since last month. MW-21 is to be drilled into the confined aquifer directly downgradient of HRL. An existing well, MW-9, is also completed in the confined aquifer upgradient of HRL. MW-22 will be drilled between the ANF lagoons and the south pit to test the theory of upgradient flow due to a "channel". ANF contends that they are not responsible for the south pit even though it is on their property because they have not done anything in that area. It is expected that ANF will go along with drilling this well on their property, but the issue is responsibility for this work. The general arrangement for cooperative work with ANF is that they will do the work on their property and DOE will do the work on DOE property. It is planned that the sonic drilling method will be tested on MW's 19, 20, and 21. Wells 7A and 8A are being drilled in cooperation with the 300 Area investigations because they will serve purposes for both.

The hand-augured vadose-zone sampling for PCB's and in the suspected sludge pit in the HRL will be done this week. It is noted that the regulators are hereby informed, and an activity notification form will be submitted tomorrow. Results are expected per the time allowances in the TPA; 50 days for analysis, 21 days for validation and 15 days for reporting.

3. Bob Anderson of Golder Associates (GAI) made a presentation on the upcoming geophysical investigation at HRL to look for buried drums. Attachment #7 presents information on previous work done by PNL and the characteristics of various geophysical investigation techniques. Attachment #8 is a report of the forward modeling for magnetometer response. The site is already gridded and the investigation will start the week of May 6th. A summary report will be delivered May 15th. A subcontractor, Williamson and Associates, will supply the instruments and a technician. Brian Drost (USGS) asked if GAI was aware of the experience WHC had with the geophysical survey and subsequent excavation at the 300 Area Expedited Response Action for hexone drums. Bob Anderson indicated that he had talked with Joe Kunk about it.

4. Action Item Status (also see Attachment #5)

   11EM1.60 is now closed with the distribution of the Change Request package at this meeting.

   11EM1.67 is now closed with the distribution of the issue paper.

5. John Stewart (USACE) distributed copies of Wendel Greenwald's (USACE) draft information paper <u>Consideration of Natural Attenuation and Points of Compliance as a Remediation Alternative</u> (see Attachment #9). John Stewart is to call Rich Hibbard next week to set-up a meeting to discuss the issues.

Attachment #2

Attendance List

1100-EM-1 Unit Managers Meeting
April 16, 1990

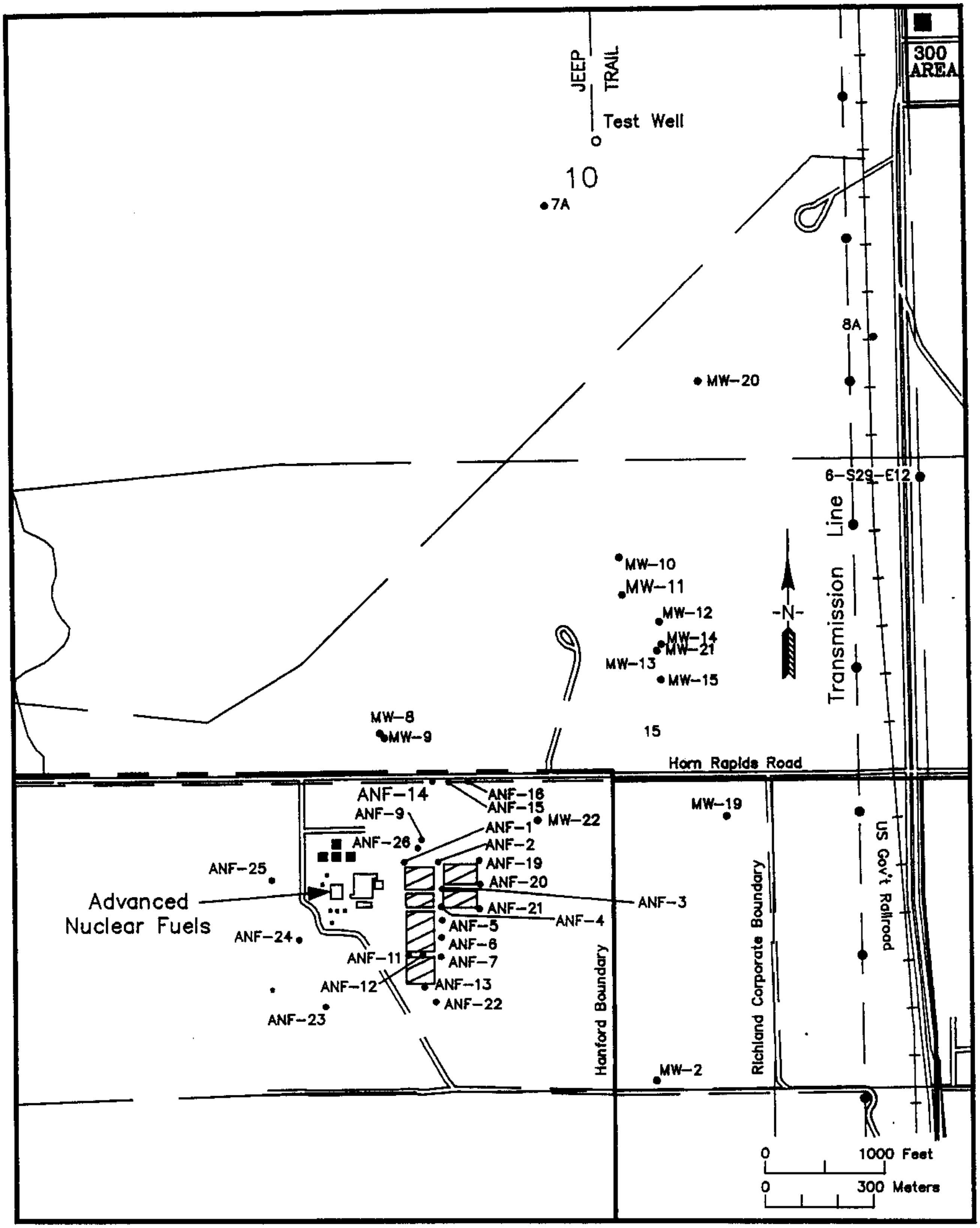
Name	Organization	1100-EM-1 Responsibility	Phone
Stewart, R. K.	DOE-RL	Unit Manager	509-376-6192
Cline, Chuck	Ecology	Geohydrologist	509-438-7556
Hibbard, Richard	Ecology	CERCLA Unit Manager	206-493-9367
Einan, Dave	EPA	Unit Manager	509-376-3883
Anderson, Bob	Golder	WHC Support	206-883-0777
Johnson, Laura	Golder	Consultant to WHC	206-883-0777
Moore, Clyde	PMX	Consultant to Ecology	206-455-2550
Shuster, Jerry	PRC	EPA Consultant	206-624-2692
Fassett, Doug	SWEC	GSSC for DOE/RL	509-376-3136
Fryer, Bill	SWEC	GSSC for DOE/RL	509-376-3136
King, Joe	SWEC	GSSC for DOE/RL	509-376-9707
Foote, Alden	USACE	Technical	509-522-6870
Greenwald, Wendell	USACE	TM	509-376-9698
Stewart, John	USACE	PM	509-376-9101
Drost, Brian	USGS	EPA Consultant	206-593-6510
Staubitz, Ward	USGS	EPA Consultant	206-593-6510
Clark, Steve	WHC	OU Tech. Coord.	509-376-1513
Downey, Hal	WHC	ER Programs	509-376-5539

Attachment #3

Agenda

1100-EM-1 Unit Managers Meeting
April 16, 1990

1. Introduction
2. Work in Progress
   - o Finalizing the Phase I and II Feasibility Study Report
   - o Finalizing the Remedial Investigation Phase 2 Supplemental Work Plan
   - o Vadose Zone Soils Investigation:
     - PCB Anomaly at Borehole HRL-4
     - Suspected Sludge Pit
     - Miscellaneous Disposal Pit
   - o Forward Modeling for Geophysical Surveys
   - o Geophysical Surveys at the Horn Rapids Landfill
   - o Drilling of Ground Water Monitoring Wells at the Horn Rapids Landfill
3. Work Proposed
   - o Cooperative Ground Water Sampling Program with ANF
   - o Additional Ground Water Monitoring Wells at the Horn Rapids Landfill
4. Action Items Status
5. Issues
   - o Request EPA Response to DOE-RL Request of 2/28/91 for "Clarifications and Documentation of Agreements Reached" in regards to EPA directed action letter of 1/23/91.
6. Schedule
7. Activity Notifications
8. Summary of Agreements and Commitments


300 AREA
JEEP TRAIL
Test Well
10
7A
8A
MW-20
6-S29-E12
Transmission Line
MW-10
MW-11
MW-12
MW-14
MW-21
MW-13
MW-15
-N-
MW-8
MW-9
15
Horn Rapids Road
ANF-14
ANF-16
ANF-15
ANF-9
MW-22
ANF-1
ANF-26
ANF-2
ANF-19
ANF-25
ANF-20
ANF-3
Advanced Nuclear Fuels
ANF-21
ANF-4
ANF-5
ANF-24
ANF-6
ANF-11
ANF-7
ANF-12
ANF-13
ANF-22
ANF-23
MW-19
US Gov't Railroad
Hanford Boundary
Richland Corporate Boundary
MW-2
0
1000 Feet
0
300 Meters

SWC\031491-A

Attachment #5

Commitments/Agreements Status List

1100-EM-1 Operable Unit
April 16, 1991

Item No.	Action/Source of Action	Status
11EM1.55	WHC will review the Well Inventory Report to determine if the report is sufficient to send to the City of Richland and obtain an opinion from WHC Legal on the release. Action: Steve Clark (1/23/91, EM1-UMM)	Open. Draft a letter to transmit the report.
11EM1.60	Prepare a change request for changing the schedule for the Phase II RI following the meeting and discussion with EPA. Action: Steve Clark (2/20/91)	Closed. Change request presented. *(at April UMM).*
11EM1.62	EPA and Ecology shall provide direction to WHC on the preferred location of MW-20 by March 29 (via computer mail). Action: Dave Einan (EPA) and Rich Hibbard (Ecology) (3/20/91)	Closed. Location of well agreed upon.
11EM1.63	The minutes for the meeting additional on geophysical investigations at the Horn Rapids Landfill held January 14, 1991 should be finalized, transmitted, and placed in the Administrative Record. Action: Steve Clark (3/20/91)	Closed. Minutes finalized & transmitted.
11EM1.64	Schedule a meeting with the City of Richland in mid-April to brief the city on the groundwater investigation and monitoring results, as they pertain to the city well field. ANF should be apprised of these activities. Action: Bob Stewart (DOE-RL), John Stewart (USACE), and Steve Clark (WHC) (3/20/91)	Open.

Item No.	Action/Source of Action	Status
11EM1.65	Action items from the March 1, 1991, work planning meeting with the EPA shall be added to the 1100-EM-1 action item list and included on the March UMM Flash Report of Action Items as sub-items to this action item. Minutes of this meeting will be attached to the March meeting minutes as Attachment #7. Action: Doug Fassett (SWEC) (3/20/91)	Closed.
11EM1.65A	The Work Plan Supplement will be modified to reflect the hand-augered samples agreed upon for vadose zone characterization in Item No. 1 of the minutes of the 3/1/91 work planning meeting. Action: Steve Clark (WHC) and John Stewart (USACE) (3/1/91)	Closed. Supplement being finalized.
11EM1.65B	The analyte list for continued quarterly ground water sampling will be modified as agreed upon in Item No. 2 of the minutes of the 3/1/91 work planning meeting. Action: Steve Clark (WHC) and John Stewart (USACE) (3/1/91)	Closed. Analyte list modified.
11EM1.65C	Dave Einan (EPA) will provide information regarding sampling and analysis for vinyl chloride, and investigate the handling of vinyl chloride issues on other EPA Region 10 sites. Action: Dave Einan (EPA) (3/1/91)	Open.
11EM1.65D	Contact appropriate DOE-RL and WHC personnel to investigate the possibility of having wells S37-E14, S40-E14, S41-E13A, S41-E13B and S43-E12 monitored under the site-wide monitoring program per section 2. Action Bob Stewart (DOE-RL) and Steve Clark (WHC) (3/1/91)	Open.
11EM1.65E	EPA and USGS shall evaluate the water level information/water table contouring provided by Steve Clark (WHC), per Item No. 2 of the minutes of the 3/1/91 work planning meeting. Action Dave Einan (EPA) and Ward Staubitz (USGS) (3/1/91)	Closed. Plots were evaluated.

Item No.	Action/Source of Action	Status
11EM1.65F	DOE-RL shall schedule a meeting with ANF and EPA/Ecology to coordinate activities to delineate the upgradient portion of the contaminant plumes, per Item No. 3 of the minutes of the 3/1/91 work planning meeting. Action Bob Stewart (DOE-RL) (3/1/91)	Open. Meeting being arranged.
11EM1.65G	Transmit the results of the recently completed soil-gas survey at HRL to EPA prior to the March UMM. Action: Steve Clark (WHC) (3/1/91)	Closed. Report was transmitted.
11EM1.65H	DOE-RL/WHC/USACE will develop responses to non-contentious comments on the Phase I/II FS report and meet with EPA on March 14, 1991, to discuss comment resolution per Item No. 5 of the minutes of the 3/1/91 work planning meeting. Action: Bob Stewart (DOE-RL), Steve Clark, (WHC), John Stewart (USACE) (3/1/91)	Closed. Dispositions to comments transmitted to EPA.
11EM1.66	Dave Einan Will write a letter to DOE-RL and USACE recognizing the problems with TPA scheduled milestones, in particular the 9/91 date for the Phase II RI report, and stating that EPA will work with DOE-RL to determine a new schedule. Action: Dave Einan (EPA) (3/20/91)	*Closed. USACE/DOE have written letters; waiting on EPA's response.*
11EM1.67	The USACE will prepare a position paper discussing <u>points of compliance</u> for the 1100-EM-1 Operable Unit, and provide it to DOE-RL and the regulators at the April UMM. Action Wendel Greenwald (USACE) (3/20/91)	Closed. Issue paper distributed at *April* UMM.

Attachment #6

Dates for Deliverables
Status Date: April 16, 1991

1100-EM-1 Operable Unit
April 16, 1991

	TPA Action Plan Work Schedule	Proposed Revised Schedule
RI Phase 1 Report:		
o RI Phase 1 Report to EPA	(8/31/90)	-
o Regulatory Comments to WHC	(10/15/90)	-
o Disposition EPA Comments	(11/15/90)	-
FS Phase 1 & 2 Report:		
o FS Phase 1 & 2 Report to DOE-RL	(9/07/90)	-
o FS Reviewers Comments to WHC	(10/08/90)	-
o FS Phase 1 & 2 Report to EPA	(*12/31/90)	-
o Regulatory Comments to WHC	(2/28/91)	-
o Finalize FS Phase 1 & 2 Report	4/30/91	-
RI Phase 2 Work Plan Supplement:		
o Work Plan Supplement to EPA	(10/01/90)	-
o RI Phase 2 Field Activities	(10/15/90)	-
o Regulatory Comments to WHC	(11/15/90)	-
o Disposition Regulatory Comments	-	(12/21/90)
o Finalize Work Plan Supplement	1/15/91	4/30/91

Characterization of Buried Waste at the Horn Rapids Landfill:

o Geophysical Survey at HRL Complete	5/15/91
o Soil Sampling at HRL Complete	7/15/91
o Evaluation of Soil Sampling Complete	9/30/91
o Boreholes or Trenching of Buried Waste Sites	3/31/92
o Final Report of Buried Waste Investigation	6/30/92

Ground Water Monitoring in the Vicinity of the Horn Rapids Landfill:

o Phase 1 GW Monitoring Wells Installed	7/31/91
- 1st Round of Sampling Complete	8/31/91
- 2nd Round of Sampling Complete	11/30/91
- Evaluation of Phase 1 Data Complete	2/28/92
o Phase 2 GW Monitoring Wells Installed	4/30/92
- 1st Round of Sampling Complete	5/31/92
- Aquifer Testing Complete	6/30/92
- 2nd Round of Sampling Complete	8/31/92
o Data from GW Monitoring Wells Complete	11/30/92

(1100-EM-1 Operable Unit - Dates for Deliverables, Continued)

RI Phase 2 Report:	TPA Action Plan Work Schedule	Proposed Revised Schedule
o Completion of GW Model Study		1/31/93
o USACE Internal Review		3/31/93
o Draft RI Phase 2 Report to DOE-RL	9/30/91	5/31/93
o Reviewers Comments compiled	10/31/91	7/31/93
o RI Phase 2 Report to EPA	*11/30/91	9/30/93
o Regulatory Comments received	1/15/92	11/15/93
o Revised RI Report to Regulators	2/28/92	12/31/93
o 2nd Regulatory Comments received	3/31/92	1/31/94
o Finalize RI Phase 2 Report	4/30/92	3/31/94
FS Phase 3 Report:		
o USACE Internal Review		5/31/94
o FS Phase 3 Report to DOE-RL	1/31/92	6/30/94
o FS Reviewers Comments compiled	2/28/92	7/31/94
o FS Phase III Report to EPA	*4/30/92	9/30/94
o Public Review of FS Phase III Report	10/31/92	3/31/95

* Milestone from TPA Action Plan Work Schedule
( ) Parentheses Indicate Action Has Been Completed

Outline

- Background/Previous Work - PNL
- Preliminary Analysis - Data Review, Modeling
- Field Survey Approach - EM, Magnetometer, GPR
- Examples of Similar Surveys

Previous Work by PNL

- **100 foot line spacing**
- **Continuous profiling instruments**
  - Electromagnetic (EM)
  - Magnetometer
  - Ground Penetrating Radar (GPR)
- **Survey results appear to define trench boundaries**

Electromagnetic (EM) Technique

- **Sensitive to all conductive materials - clay, water, copper, tin, iron, steel, liquid contaminants**
- **Two components measured**
  - Quadrature - apparent conductivity (mmhos/m)
  - In-phase - most sensitive to metal (ppt)

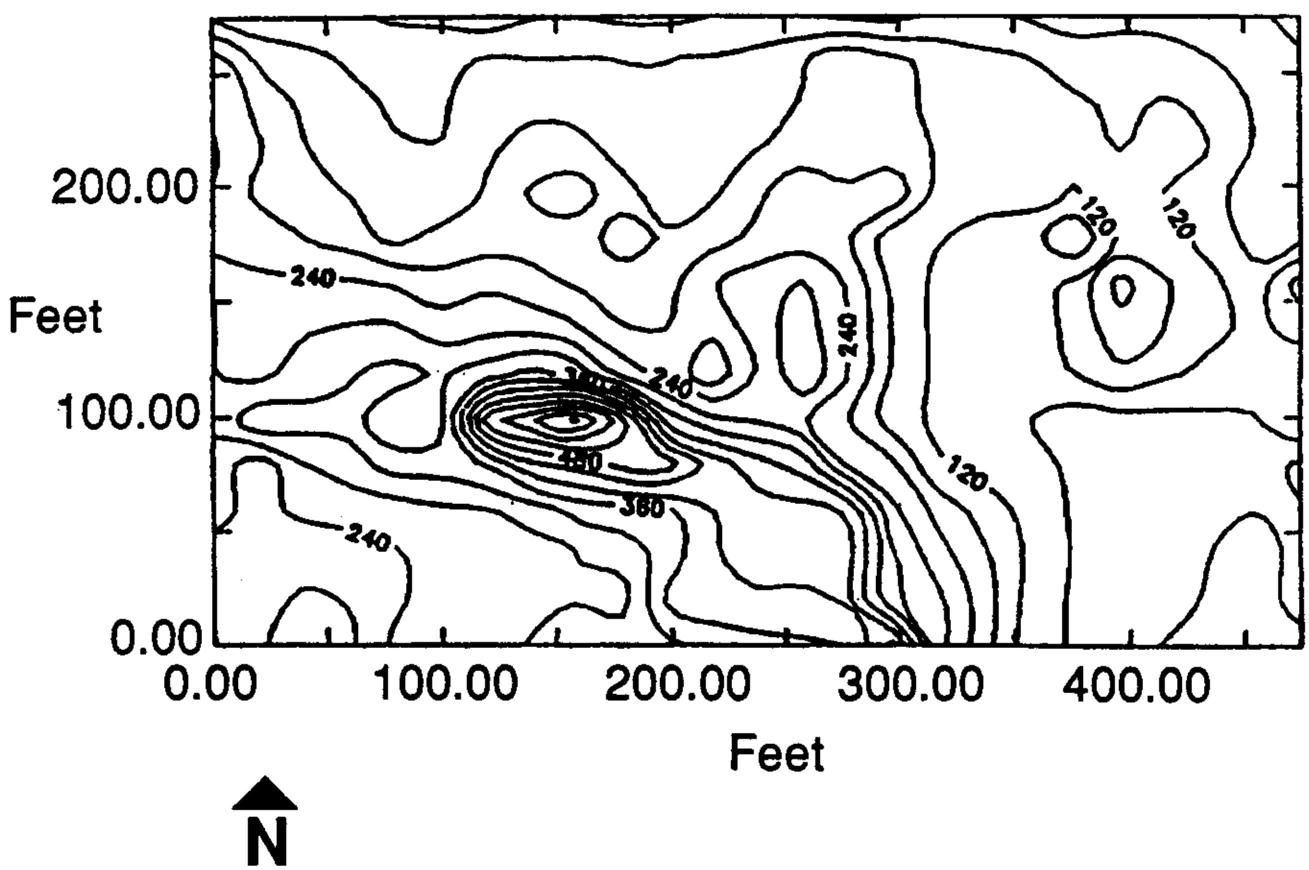
Total Field Magnetometer Technique

- **Sensitive to ferromagnetic materials (iron, steel) which disturb magnetic field of the earth**
- **Two components measured**
  - Total field - sensitive to all magnetic anomalies
  - Gradient of total field - emphasis shallow, local anomalies

Ground Penetrating Radar (GPR)

- Responds to subsurface conductivity contrasts (interfaces)
- Produces "depth/time section" of traverse consisting of radar reflections along profile
- Under ideal conditions, characteristic reflection patterns are produced by pipes and drums
- Produces reflections at conductive (i.e. drums) and non-conductive (i.e. concrete) interfaces
- Can also produce chaotic response in areas with abundant scattered metallic debris

Terrain Conductivity Map



903-1249

Golder Associates Inc.

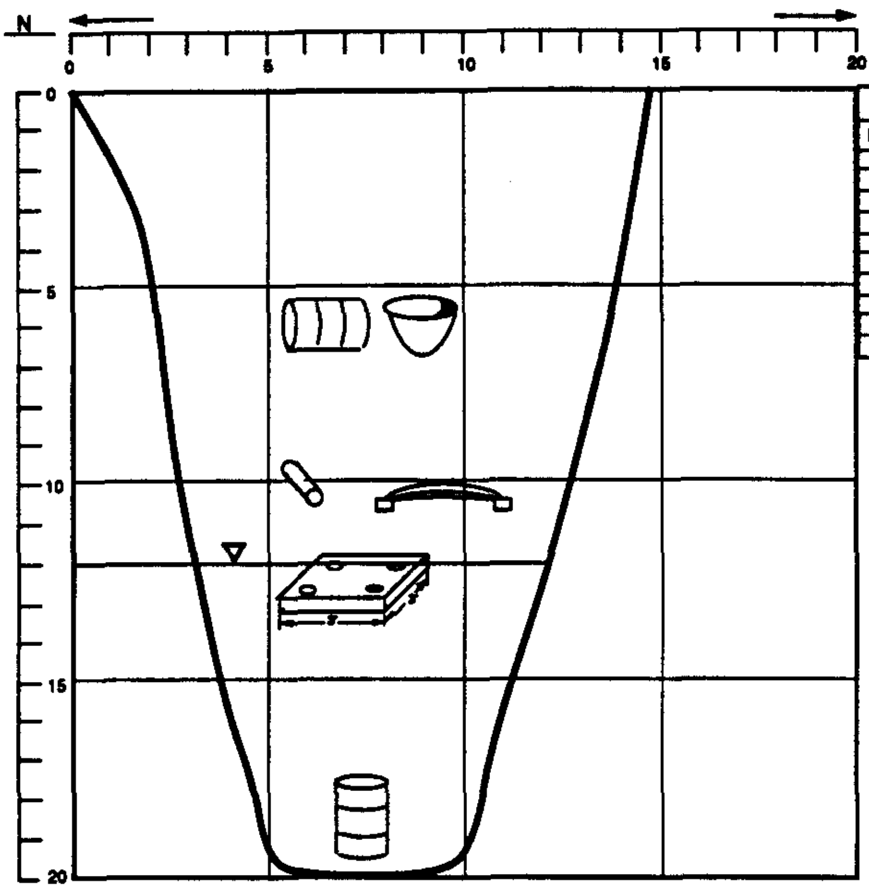
Golder Associates

FIELD TEST PIT LOG

Temp. ______ Weather Rain Engineer Anderson Operator Darryl Test Pit EM-2

Equipment J.Deere 690-B Contractor Wilder Construction Date 5/17/89

Location TRC Elevation ______ Datum ______ Job ______



Samples	
No	Depth

Sample Descriptions and Excavation Notes		Time	Depth of Hole	Depth to W/L
[illegible]	[illegible]	[illegible]	[illegible]	
		[illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	12'	12'
	[illegible]	[illegible]	[illegible]	12'

Sample Descriptions and Excavation Notes		Special Notes
[illegible]	[illegible]	No Samples
	[illegible]	
[illegible]	[illegible]	
[illegible]	[illegible]	
	[illegible]	
	[illegible]	
[illegible]	[illegible]	

903-1249

Golder Associates Inc.

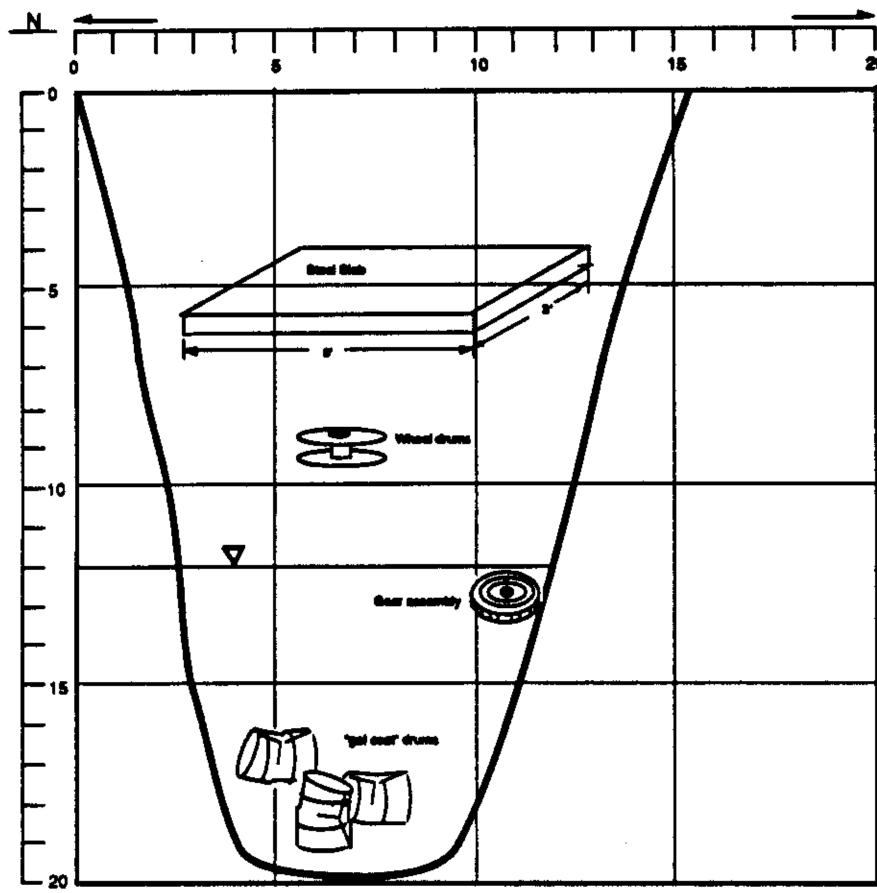
Golder Associates

FIELD TEST PIT LOG

Temp. 48 F. Weather Rain Engineer Anderson Operator Darryl Test Pit EM-1

Equipment J.Deere 690-B Contractor Wilder Construction Date 5/17/89

Location TRC Bellingham Elevation ______ Datum ______ Job ______



Samples	
No	Depth

Sample Descriptions and Excavation Notes		Time	Depth of Hole	Depth to W/L
0-8	loose to compact brown-grey	[illegible]	6'	
		[illegible]	12'	12'
8-21	loose to compact greyish-black Ash and demolition debris	[illegible]	18'	12'
		[illegible]	21'	
21'	Silty clay			

Metal Objects:

6'	[illegible] steel slab
14'	cast metal gear assembly
16'	[illegible]
19'	3 crushed drums partially filled with "gel coat" - solidified

Special Notes

No Samples

983-1378.020

903-1249

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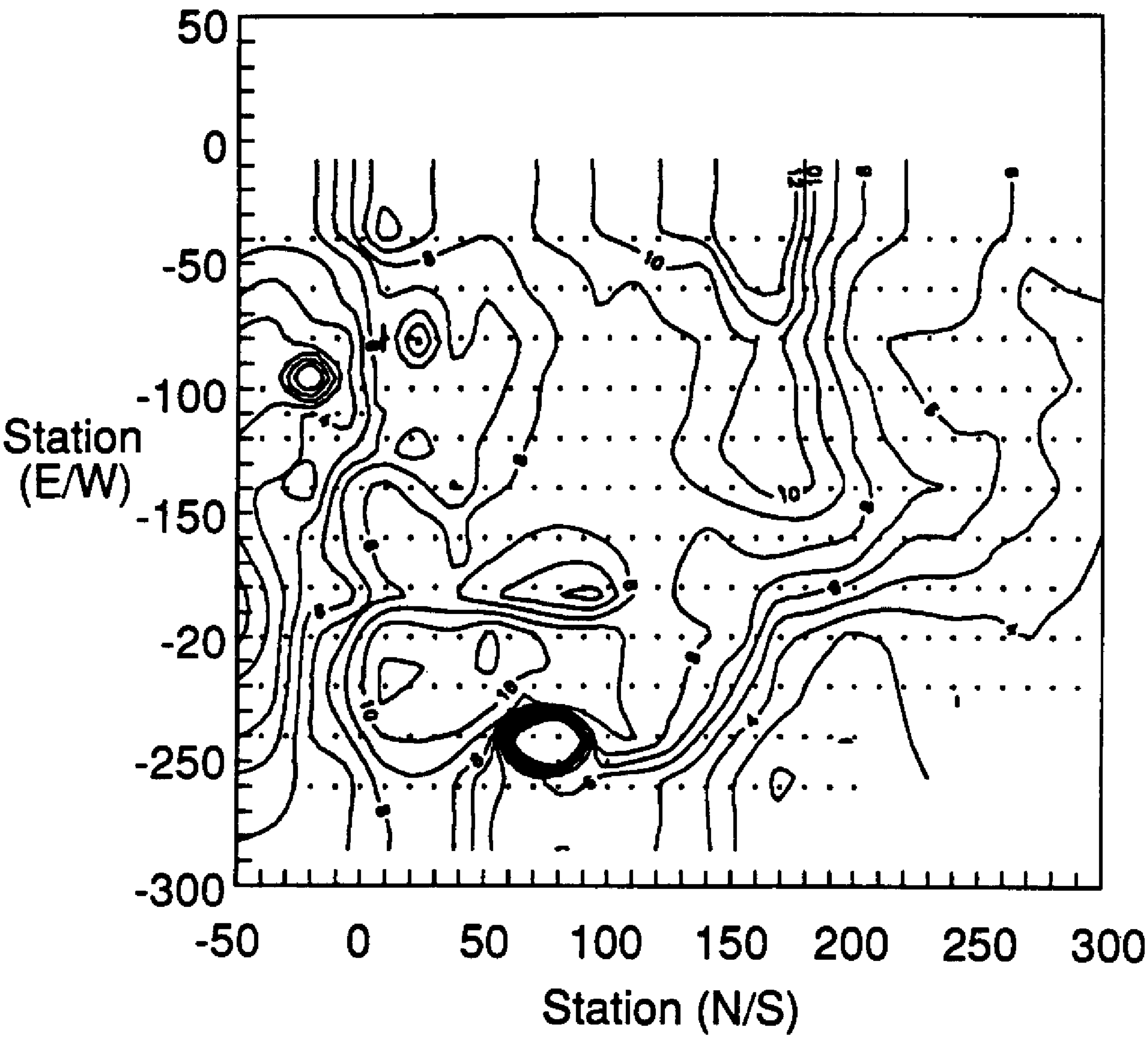
Ground Conductivity Map



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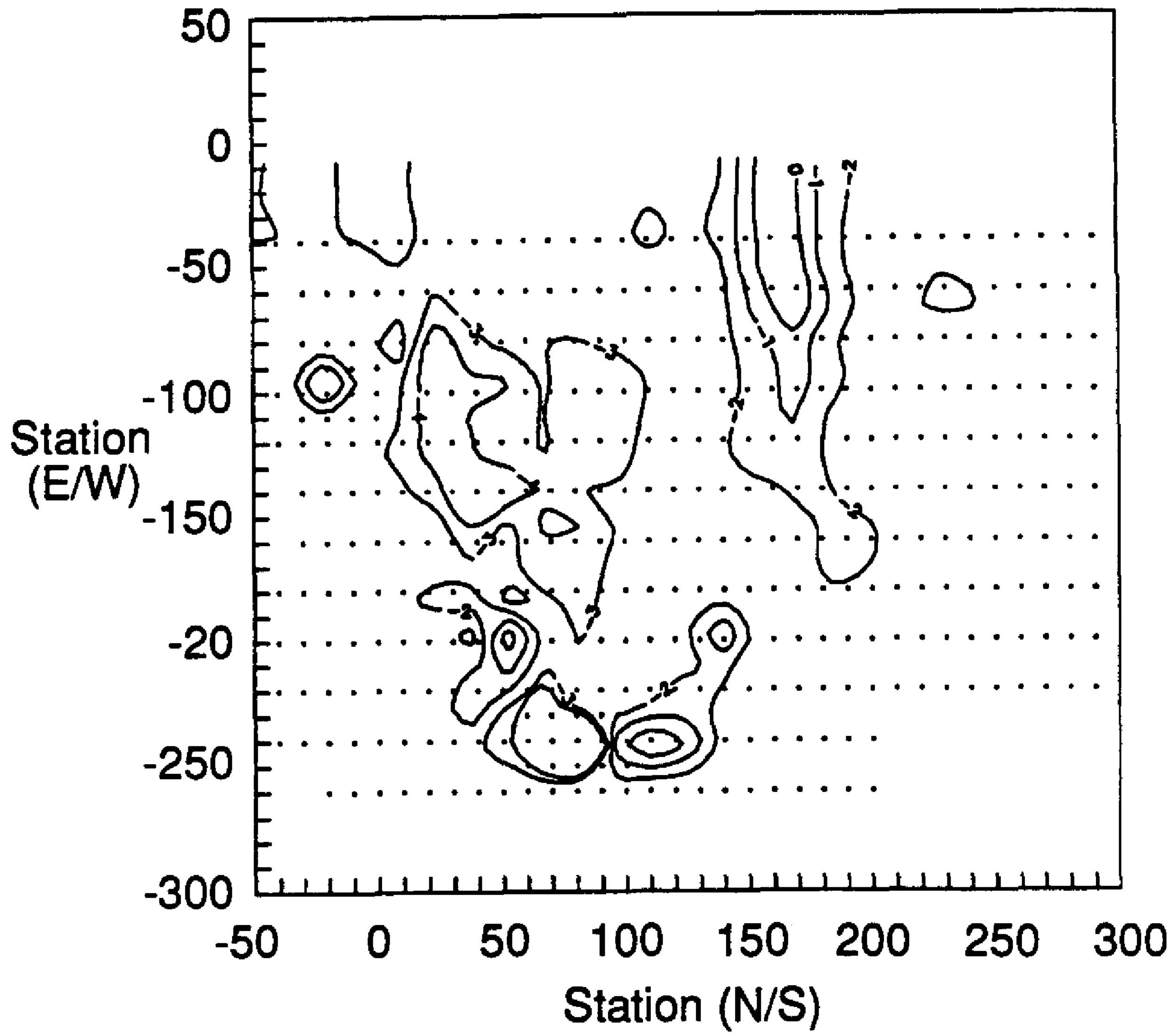
In-Phase Component Map



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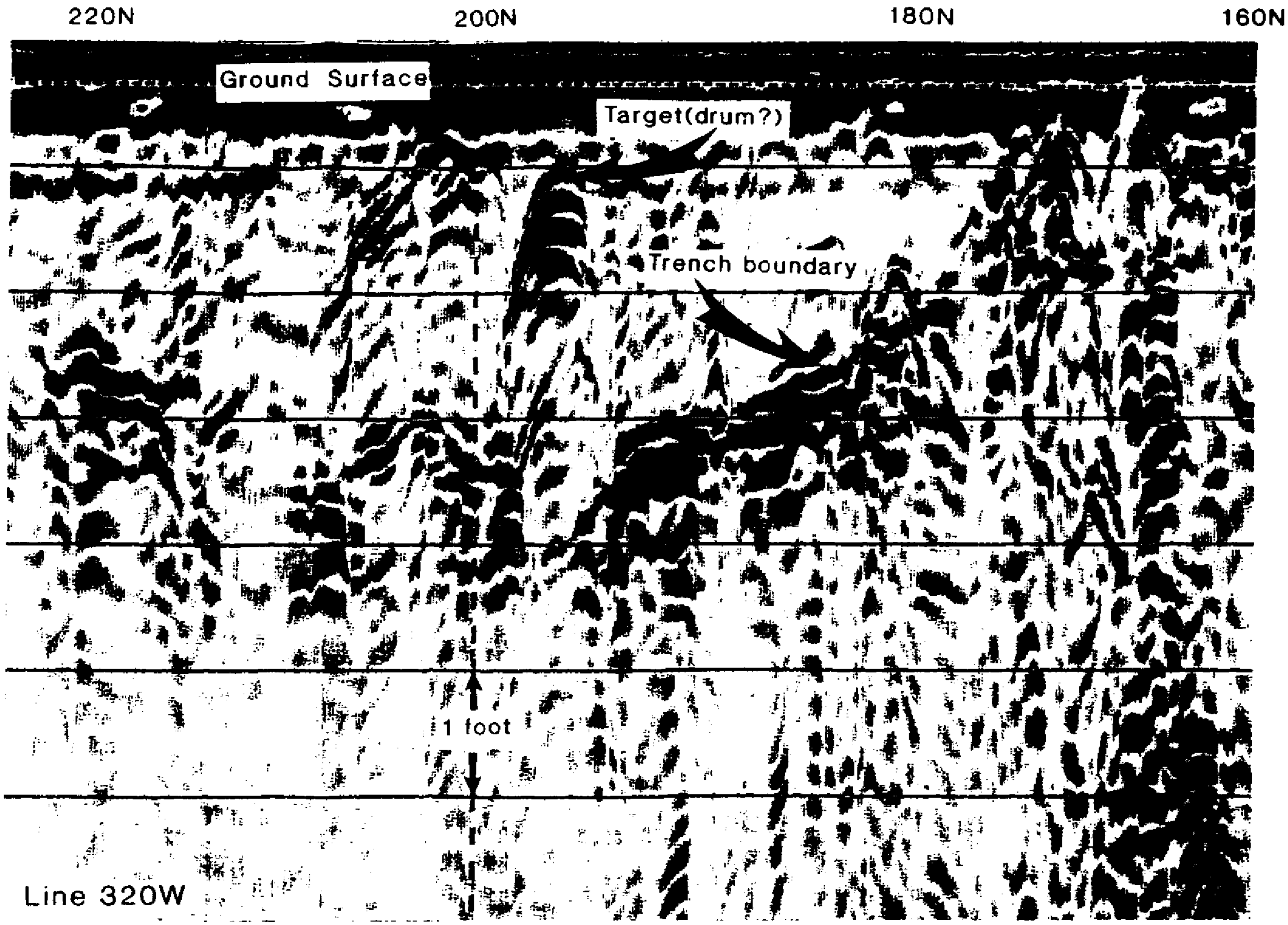
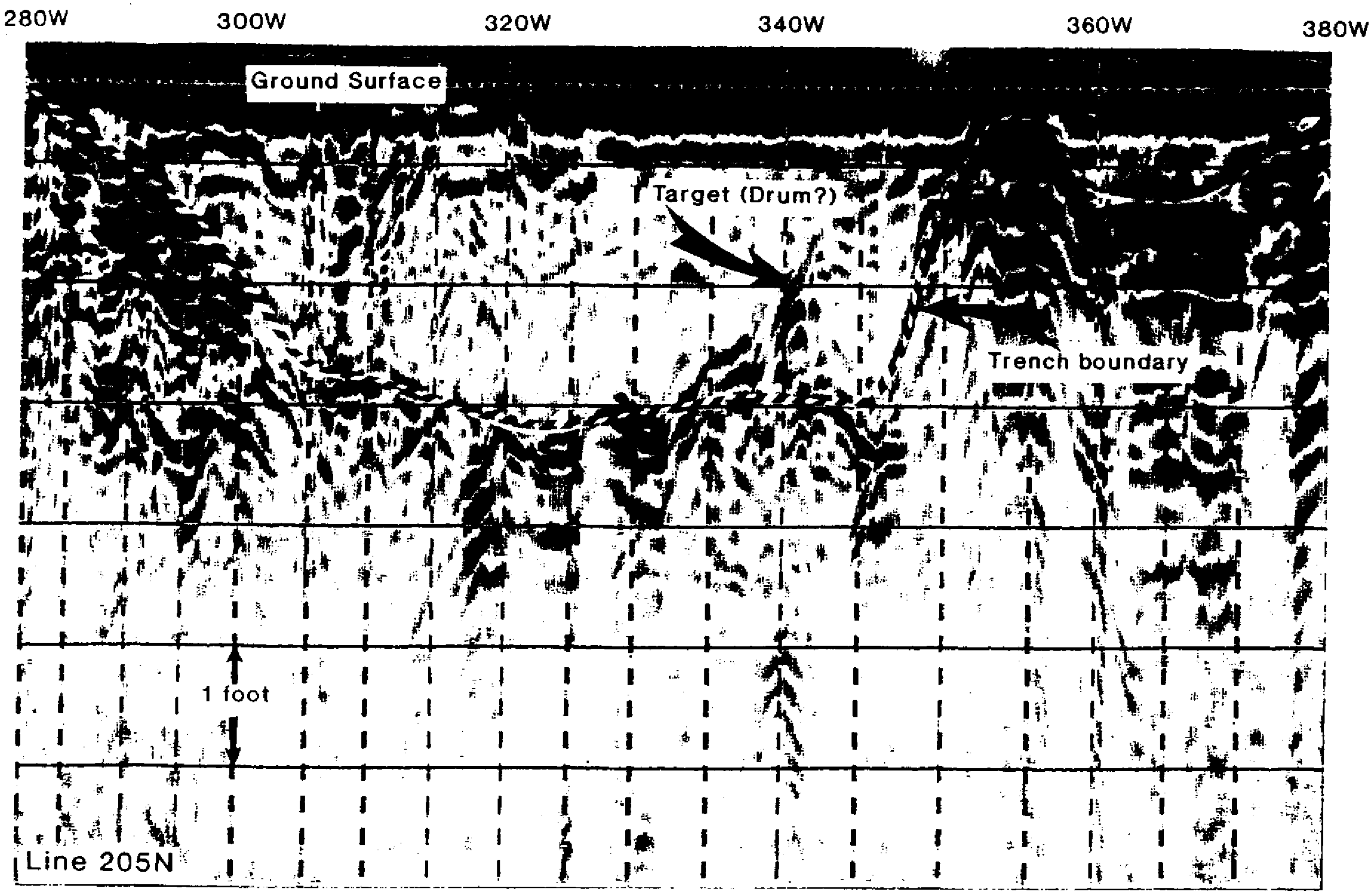


Radargram showing buried drum. Target was identified as an anomaly on the magnetometer survey.



Radar profile across EM-31 and magnetometer anomaly.

Scope of Modeling

- Ideal response of "10-drum" target - Model A
- Ideal response of "1-drum" target - Model B
- Ideal response of 10 "1-drum" targets - Model C
- Non-ideal conditions
  - random noise
  - bulk susceptibility of trench

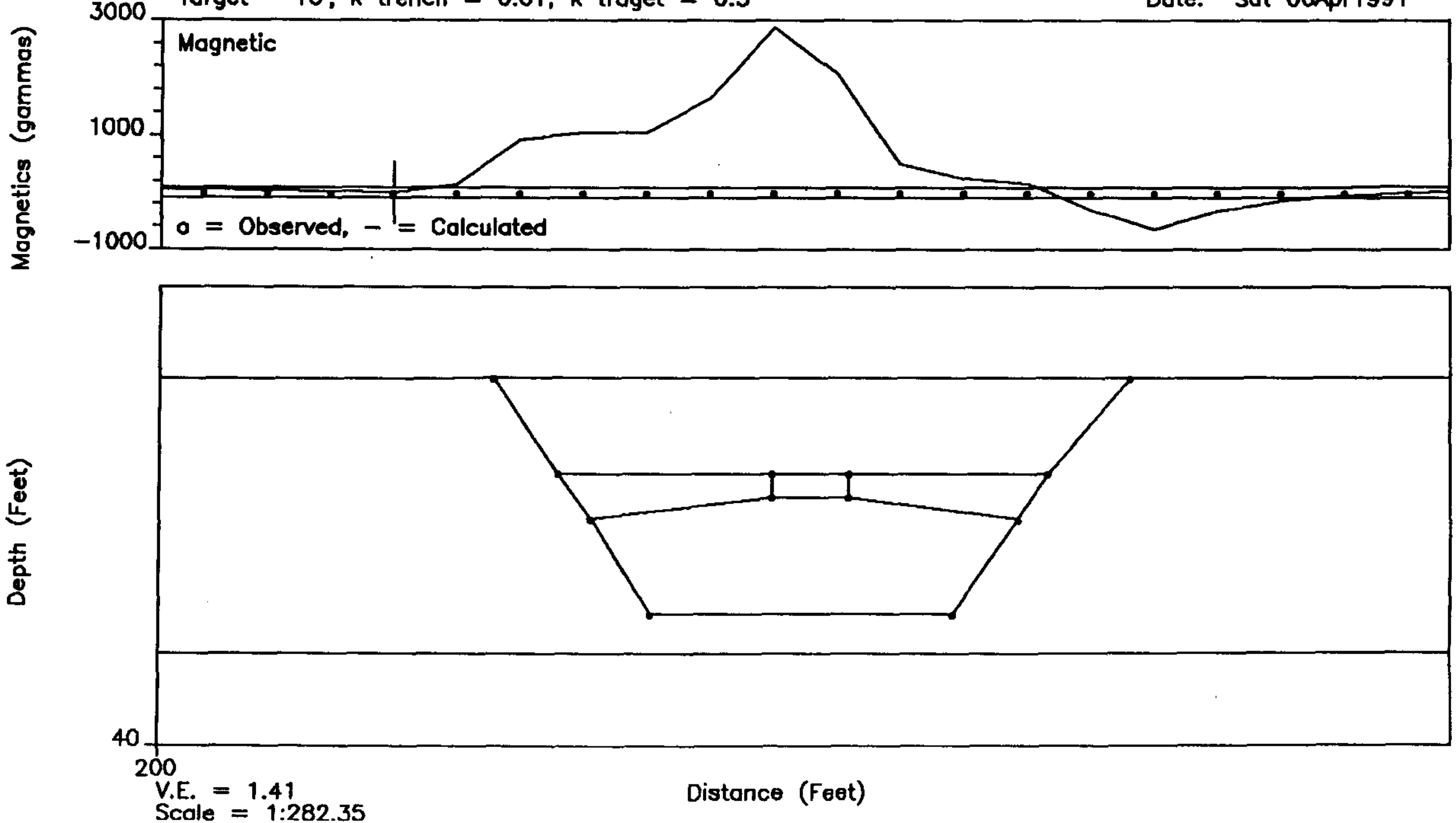
Magnetometer Modeling

- **GMSYS - Interactive Graphical Display**
- **Range of target magnetic susceptibilities (0.1-0.5 cgs)**
- **10-foot station spacing, 6.5 foot station elevation**
- **Target dimensions (LxWxH)**
  - single drum 5x2.5x2.5
  - 10-drums 12.5x10x2.5
  - 10 drums (scattered) variable

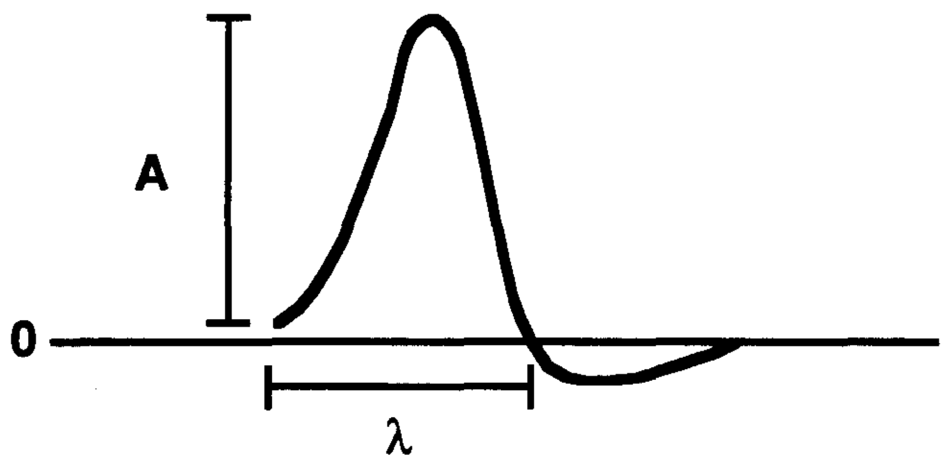
RESULTS OF MODEL D3

Target 10', k trench = 0.01, k traget = 0.5

Time: 02:03:58 PM
Date: Sat 06Apr1991



Magnetometer Response



A = Amplitude (gammas)

λ = Wavelength (ft)

Response of 1-Drum Target

	K_{eff} (egs)		
Target Depth	0.1	0.2	0.5
5 ft	120,40	230,40	550,40
10 ft	50,40	100,40	250,40
20 ft	15,40	35,40	80,40

Response of 10-Drum Target (Model A)

	K_{eff} (egs)		
Target Depth	0.1	0.2	0.5
5 ft	1000,40	1700,50	4000,60
10 ft	400,40	700,50	2000,60
20 ft	100,40	300,50	600,60

Non-Ideal Conditions

Depth	Near Surface Objects k = 0.5 (drums) k = 0.2 (surface objects)	Scattered Targets (k = 0.2)	
		5 ft	10 ft
5 ft	-	-	-
10 ft	950,50	600,80	250,100
20 ft	500,50	-	-

Summary

- Integrated geophysical survey (EM, magnetometer, GPR) can identify areas containing buried metallic debris (targets)
- Ability to characterize targets (location, depth, type) highly dependant on field conditions
- Theoretical magnetometer response to 10-drum target may range from wavelengths of 40-80 ft and amplitudes of less than 100 to over 2000 gammas
- Theoretical response will likely not correspond to actual field response
- Insure sufficient field evaluation of data (contouring/plotting)

Survey Approach

- EM/Magnetometer Surveys at 10-foot grid with 4-man crew
- Preliminary field analysis of data
  - simple contouring (SURFER)
  - simple magnetometer modeling (GMSYS)
- GPR Surveys of "Hot Spots"

Differences Between Previous Reconnaissance Survey and Proposed Detailed Survey

- Grid measurements for EM and magnetometer, not continuous profiles
- 10-foot grid spacing throughout survey area
- Quadrature and In-phase EM measurements
- Total Field and Total Field Gradient magnetometer measurements
- 5-foot GPR line spacing
- Possibly include EM-34, variable coil EM measurements

Golder Associates Inc.
CONSULTING ENGINEERS

HORN RAPIDS GEOPHYSICAL SURVEY
STAGE 1 PRELIMINARY ANALYSIS
SUMMARY REPORT

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1. INTRODUCTION

This summary report summarizes the results of the preliminary analysis for the geophysical survey at the Horn Rapids Landfill (HRL). The preliminary analysis consisted of:

- An evaluation of previous work by Pacific Northwest Laboratory (PNL) at the HRL;
- A review of similar surveys conducted elsewhere;
- Forward modeling of possible magnetometer responses to buried drums.

A previous geophysical survey at the Horn Rapids Landfill identified four main burial trenches that may contain up to 200 buried drums of carbon tetrachloride. Two main concerns were expressed by Department of Energy (DOE) and Environmental Protection Agency (EPA) at a meeting in January, 1991 as to (1) whether the trenches contain drums and (2) whether it is safe to drill in the burial trenches. As a result, a work plan for further detailed geophysical surveys of the main burial trenches was developed. It was agreed that anomalies corresponding to concentrations of 10 or more drums would be the focus of further investigation, and anomalies smaller than 10 drums would not be investigated further. The initial work plan specified that a preliminary pre-survey analysis of the magnetic response of a "threshold deposit" of 10 drums be evaluated prior to initiation of field work, including an evaluation of the effects of the distribution (i.e., stacked or scattered) of drums. Golder Associates Inc. were not involved in either the meeting or in developing the work plan.

The final task order plan for the geophysical surveys included two interim deliverables corresponding to the preliminary pre-survey analysis and a field survey summary prior to the final report. The following sections summarize the results of the preliminary analysis and recommendations for the field survey.

2. PRELIMINARY ANALYSIS

2.1 Evaluation of Previous Surveys

Previous geophysical surveys (EM, MAG, and GPR) were carried out by Pacific Northwest Laboratory (PNL) at the HRL using continuous recording instruments on a 100-foot line interval. The EM and MAG data were presented as a series of profiles corresponding to each trackline. Although this method of presentation is useful in observing the geophysical response along a trackline it is difficult to evaluate the aerial extent of anomalies without a map-view contour plot of the data. Plan view maps of "buried waste materials" are provided as rather indistinct hatch-marks on tracklines that showed anomalous responses, but the magnitude of the response is not presented. Positive magnetometer peaks of up to 4000 gammas were observed over portions of the trenches, which suggests that ferromagnetic materials do exist within the trenches. EM anomalies reach maximum relative amplitudes of over 2000 also suggesting highly conductive, metallic materials. It appears that only one component (quadrature) of the EM field was acquired during the survey. The EM-31 instrument used has the capability to acquire both quadrature and in-phase components of the EM field, and the in-phase component is more sensitive to metallic objects.

The GPR data was provided to us in the form of 3" by 5" photographic transparencies of processed GPR records. The data was acquired and stored using PNL file format that is now obsolete and cannot be interpreted by our computers. The photographic transparencies were of limited use because:

- There was no vertical depth/time scale;
- There was no indication of the antennae frequency used;
- The records had been processed to remove high amplitude reflections, and ground-surface reflections;
- The profiles were difficult to read because of their size.

GPR surveys were preformed by WHC at the 300-area site to investigate a known deposit of drums. Their survey was performed with a 300 MHz antennae, and the acquired data was apparently good with adequate signal response throughout the record. The drums were not identified from the GPR records because they were thought to be buried at a depth of less than 10-feet, and were actually buried at 12 feet. During the survey, the instrument was scaled to display only to a depth/time of 10 feet.

2.2 Review of Similar Surveys

2.2.1 Background

Geophysical surveys are common at landfills, hazardous waste sites, and for other shallow engineering studies where definition of shallow subsurface characteristics is required. Location of metallic objects is particularly suited to geophysical methods because of the high contrast in electrical properties. EM, magnetometer, and GPR techniques are routinely used for this purpose and it is well documented that they can, under many circumstances, identify trench boundaries, locate pipelines, and identify areas containing drums or other metallic debris. Qualitative evaluation of EM and magnetometer data with respect to metallic debris is relatively straightforward. In cases where the targets are well defined, and where excavation at anomalous areas is feasible and desirable, geophysical surveys are an excellent method for delineating potential problem areas. However, quantitative evaluation of EM and magnetometer data with respect to depth and exact location of metallic objects is not always simple, especially if there is abundant cultural or subsurface noise. The magnetic and electromagnetic response of highly conductive objects such as iron and steel is highly variable and influenced by a number of parameters that are not easily defined. Barrows (1988) discusses a number of potential complications to magnetometer responses in highly conductive environments such as landfills. Discrimination of drums from other iron or steel objects can therefore be very difficult except under highly controlled conditions.

Ground penetrating radar (GPR) is often very useful in discriminating targets. Depth, location, and extent of conductive targets can be determined from GPR data. Under ideal conditions, drums or pipes produce a characteristic parabolic or arcuate reflection pattern. Flat-lying reflectors that produce "ringing" or multiple reflections often correspond to crushed drums or plate-like steel objects.

2.2.2 Examples

An EM survey conducted at a landfill near Bellingham Washington (Ecology and Environment, 1988) indicated a conductive target that was thought to correspond to a concentration of buried drums. Excavation of the anomaly (Golder Associates, 1988) revealed four crushed drums and a number of steel objects, including automobile parts and a steel slab. Quantitative characterization of the geophysical response would likely not have predicted the actual contents revealed in the excavation. Integrated EM/magnetometer/GPR surveys at several sites in Western Washington (Williamson and Associates, 1991) were very successful in locating concentrations of buried drums, which were later excavated and removed. Similar integrated surveys (Williamson and Associates, 1991) at other sites indicated conductive targets that did not appear to be drums based on the GPR data. Excavation was required to verify the interpretation, but no drums were found. From these experiences it appears that an integrated survey approach including a detailed GPR survey is most likely to identify the nature of buried materials. However, excavation is the only means of positively identifying an anomaly detected with any geophysical survey.

2.3 Forward Modeling

2.3.1 Description and Scope

The model GMSYS, developed by Northwest Geophysical Associates, Inc. (1991), was used to produce theoretical magnetometer profiles over various configurations of drums within a trench. The software is simple and effective to use because the geologic model and magnetometer response are displayed simultaneously on the computer screen, providing immediate correlation of the model to the response. The model can be modified on the screen using a mouse and the magnetic response re-calculated to observe and compare a number of configurations or parameters. In addition to magnetic susceptibility parameters, the model can incorporate remnant magnetization (field strength, inclination, and declination), and survey azimuth. The model is 2 1/2-dimensional, which means that the 2-dimensional theoretical magnetometer profile is calculated using the third dimension (or strike length) of the geologic model. This is particularly important for modeling drums, which have a finite strike length. The calculations are based on an algorithm developed by Rasmussen and Pederson, 1979. The model uses Gaussian (cgs) units.

In developing the model, the following target types were defined:

- An "10-drum target" is a collection of 10 closely spaced or stacked drums or large metallic objects;
- A "single target" corresponds to a single drum or metallic object.
- A "dispersed target is a scattered collection of 10 drums or metallic objects;

The modeling attempted to address several response types. Each model was assigned an identifier for clarity, and these identifiers are referred to later in the text. The responses (with a model identifier) that were evaluated are summarized as follows:

- The ideal response of 10-drum target at various depths (Model A);
- The ideal response of a single target at various depths (Model B);
- The ideal response of a collection of 10 single targets or metallic objects (Model C);
- The effect of non-ideal situations including: noise created by smaller discrete objects above a 10-drum target, and bulk magnetic susceptibility of the burial trench (Model D). Remnant magnetization was not evaluated for the preliminary analysis.

2.3.2 Model Parameters

There are a number of parameters to consider when attempting to model metallic objects in the subsurface. Constant parameters used throughout the modeling exercise are summarized as follows:

Magnetic field strength (H)	56,000 gammas
Magnetic field inclination (I)	70 degrees
Magnetic field declination (D)	19 degrees
Magnetometer station spacing (X)	10 feet (3.3 m)
Magnetometer station elevation (h)	6.5 feet (2 m)
Single Drum Target Dimensions (Length, Diameter (width, height)	5, 2.5 feet
10-drum target dimensions (Length, Width, Height)	12.5, 10, 2.5 feet

Calculated, estimated, or varied parameters included:

- Magnetic susceptibility (k)
- Target strike length (+Y,-Y)
- Target depth (Z)

A range of magnetic susceptibility (k) was estimated for the modeling exercise based on theoretical and reported values. These values are summarized below:

k_{eff} (cgs)	Reference
0.5	Relative volume calculation (EG&G, 1988)
0.2	Demagnetization Factor (Grant and West, 1965)
0.1	Reported value (Barrows, 1988; Gilkeson et al., 1986)

Other parameters were assigned as follows:

Target strike length (+Y,-Y)	+Y : 0 - 5 feet -Y : 0 - 5 feet
Target Depth (Z)	5, 10, 20 feet

2.3.3 Model Results

Typical output from the GMSYS program is shown on Figure 1. Since the objective of the modeling was to identify ranges of potential responses of targets, and because a number of model runs were generated, the modeling results are presented as tables, corresponding to the specific model identifiers shown above.

The results of model A, a 10-drum target, are presented in Table 1. This table shows the effect of burial depth and magnetic susceptibility with respect to the amplitude and wavelength of an anomaly created by a 10-drum target.

TABLE 1

THEORETICAL MAGNETOMETER RESPONSE TO 10-DRUM TARGETS (MODEL A)

Target Depth (ft)	keff (cgs)		
	0.1	0.2	0.5
5	(1000, 40)	(1700, 50)	(4000, 60)
10	(400, 40)	(700, 50)	(2000, 60)
20	(100, 40)	(300, 50)	(600, 60)

Note: Tables show magnetometer response (A, W) in terms of amplitude (A, in gammas) and wavelength (W, in feet) of a theoretical magnetometer anomaly.

The results of model B, a single-drum target, are presented in Table 2. This table shows the effect of burial depth and magnetic susceptibility with respect to the amplitude and wavelength of an anomaly created by a single-drum target.

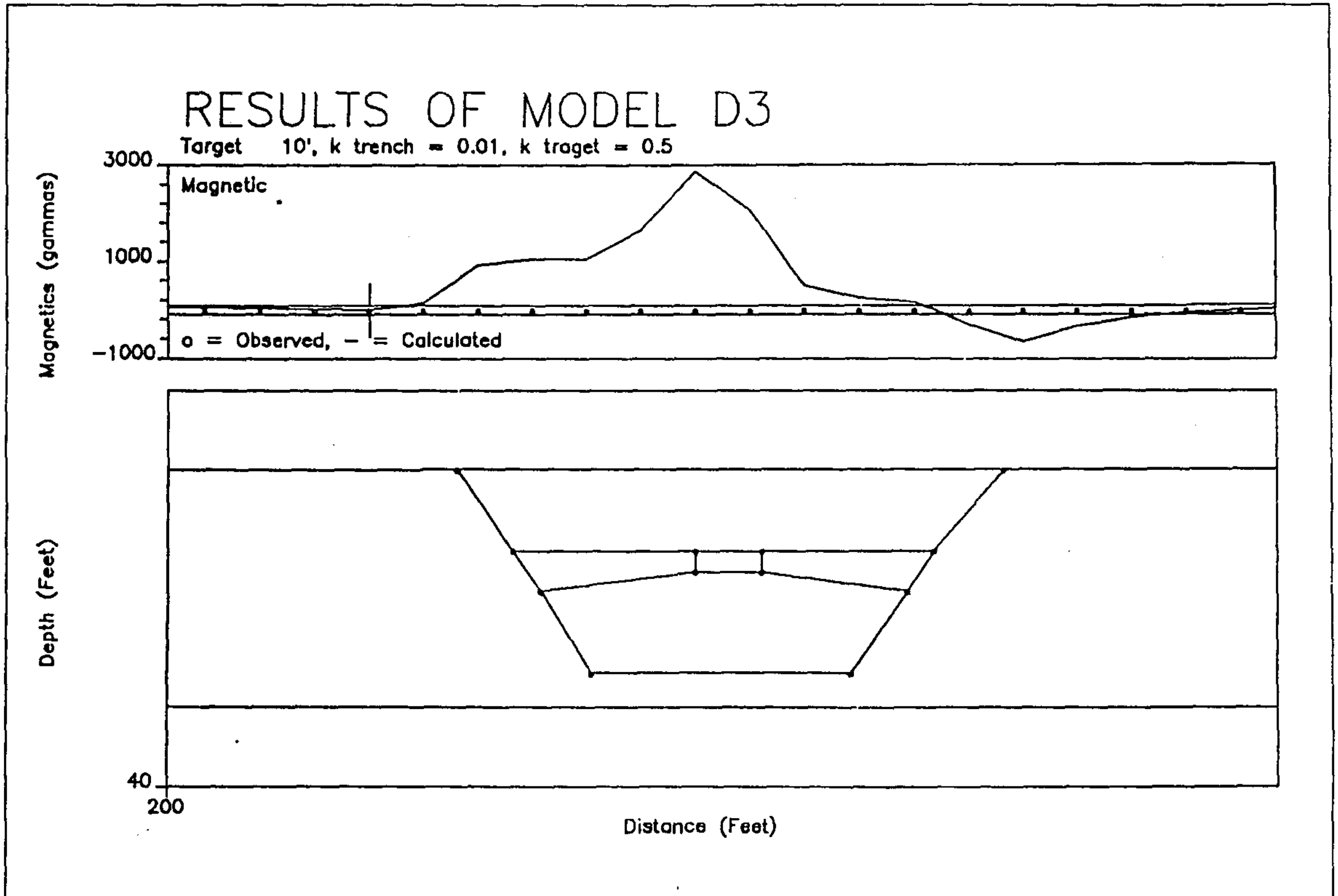

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Figure 1. Typical Output Display of Magnetometer Model

TABLE 2

THEORETICAL MAGNETOMETER RESPONSE TO 1 DRUM TARGETS (MODEL B)

Target Depth (ft)	keff (cgs)		
	0.1	0.2	0.5
5	(120, 40)	(230, 40)	(550, 40)
10	(50, 40)	(100, 40)	(250, 40)
20	(15, 40)	(35, 40)	(80, 40)

Note: Tables show magnetometer response (A, W) in terms of amplitude (A, in gammas) and wavelength (W, in feet) of a theoretical magnetometer anomaly.

Comparison of these two tables shows that the amplitude of a 10-drum target may range from 100 to 4,000 gammas, while its wavelength may vary between 40 and 60 feet. A single drum target has a range of amplitudes of 15 to 120 gammas, with high amplitudes corresponding to shallow burial depths. Comparison of these model results suggests that short wavelength anomalies (40 feet or less) do not likely correspond to drum targets and that low amplitude anomalies, (300 gammas or less) do not likely correspond to collections of 10 drums.

The results of model C, a collection of 10 single drum targets, are presented in Table 3. This table shows the anomaly produced by a collection of ten 1-drum targets spaced at 5-foot and 10-foot intervals, with a magnetic susceptibility of 0.2 and a burial depth of 10 feet. Other burial depths were not evaluated for the preliminary analysis. The effect of spacing the drums apart is to increase the wavelength and decrease the amplitude of the anomaly. Compared to an ideal 10-drum target buried at 10 feet, the amplitude of the anomaly is decreased by 15 percent for a 5-foot target spacing and by 66 percent for a 10-foot target spacing. The wavelength of the anomaly increases, but the anomaly does not separate into discrete peaks caused by the individual targets. Therefore, the model predicts that targets spaced by 10 feet or less will still appear as singular anomalies using grid spacing of 10 feet.

TABLE 3

THEORETICAL MAGNETOMETER RESPONSE TO TEN 1-DRUM TARGETS AT DIFFERENT SPACINGS (MODEL C)

Target Depth (ft) (K_{eff} = 0.2 cgs)	Target Spacing (ft)	
	5 ft	10 ft
10	(600, 80)	(250, 100)

Note: Tables show magnetometer response (A, W) in terms of amplitude (A, in gammas) and wavelength (W, in feet) of a theoretical magnetometer anomaly.

It is likely that in performing and interpreting the survey that actual conditions at the HRL will not correspond to the ideal conditions evaluated in the model. The trenches have received considerable amounts of construction debris, some of which is visible at the ground surface. This debris will likely contribute a significant amount of noise to the survey which must be carefully evaluated in determining the location of targets. It is beyond the scope of a preliminary modeling exercise to evaluate numerous configurations of targets and other debris within the trench. However, two simple configurations were evaluated with the model. The effect of placing two small objects above a larger 10-drum target is shown on Table 4. The effect of the surface objects is to increase the amplitude of the anomaly, but the wavelength remains similar.

TABLE 4

THEORETICAL MAGNETOMETER RESPONSE UNDER NON-IDEAL CONDITIONS

Target Depth	Near Surface Objects k = 0.5 Target k = 0.2 Surface Object	Trench Susceptibility k = 0.5 Target k = 0.01 Trench		Trench Susceptibility k = 0.5 Target k = 0.05 Trench	
		Trench Amplitude	Target Amplitude	Trench Amplitude	Target Amplitude
5	-	-	-	-	-
10	(950, 50)	1000	3000	5000	6000
20	(500, 50)	-	-	-	-

The second configuration evaluated the effect of bulk trench susceptibility. There is the possibility that enough ferromagnetic material is distributed throughout the trenches, such that the trench will act as a large target and mask the response of other targets (i.e. drums) within the trench. Barrows (1991) suggests that a bulk volume of 1 percent ferromagnetic material disseminated throughout a trench is sufficient to produce saturation susceptibility, such that the trench itself may mask all other magnetic targets. The effect of a small amount of metal disseminated throughout the trench was evaluated with GMSYS by applying a susceptibility of 0.01 (50 times less than the target), but a strike length of 100 feet (50 times greater than the target). The resulting anomaly (see Figure 1) shows high total field gradients both at the edge of the trench and also near the target. The amplitude of the anomaly increases at the edge of the trench and increases further over the target. Assigning a trench susceptibility of 0.05 cgs increases the amplitude of the responses significantly; and masks the response of the target. Table 4 shows the amplitudes of the anomalies produced over the trench and over the target.

3. SUMMARY AND CONCLUSIONS

The results of the preliminary analysis are summarized as follows:

- Previous surveys at the HRL suggest that buried metallic debris exists within the burial trenches. However, the reconnaissance nature of the survey (100-foot line spacing) limited the ability of the survey to delineate areas likely to contain discrete metallic objects. The previous survey did not collect EM data at long coil spacing (EM-34 instrument) which limits the depth of penetration of the EM survey data to about 18 feet. The previous survey did not collect EM in-phase measurements, and total magnetic field gradient measurements, which would be useful in detecting metallic objects.

- Integrated surveys consisting of EM, magnetometer and GPR surveys are effective in delineating areas containing metallic objects, and often in characterizing the types of objects buried in the subsurface. However, the HRL may contain abundant metallic debris which may create numerous geophysical targets which may or may not correspond to buried drums.

- Forward modeling of potential magnetometer responses suggests that a collection of 10 drums will have an anomaly wavelength of between 40 and 80 feet, depending on whether the drums are closely spaced or scattered. The amplitude of the anomaly may range from less than 100 gammas to over 2000 gammas depending on the depth of burial and the effective susceptibility of the drums. Total magnetic field gradient will produce smaller wavelength anomalies which would be useful in providing a more accurate target location and for discriminating near surface noise from deeper target responses. Electromagnetic and GPR responses were not quantitatively modeled as part of the preliminary evaluation.

- The range of magnetometer responses indicated from the model are a preliminary estimate only, and actual field responses are likely to differ from the model responses. GPR data should provide suitable data for characterizing targets identified with the EM and magnetometer. If the GPR is not successful in characterizing the targets, a 10-foot grid spacing will be useful for additional processing of the EM/magnetometer data.

4. RECOMMENDATIONS

Based on the results of the preliminary analysis, we will carry out the geophysical survey as follows:

- Perform EM and MAG surveys at a 10-foot grid spacing;

- Perform the EM survey in accordance with Golder Associates Technical Procedures and insure that both quadrature and in-phase components of the EM field are recorded and that instrument is oriented both north-south and east-west at each station;

- Perform the MAG survey in accordance with Golder Associates Technical Procedures and insure that both total field and total field vertical gradient data are acquired at each station;

- Contour EM and magnetometer data in the field using a simple contouring program such as SURFER to identify "hot spots". These hot-spots will be surveyed with the GPR instrument immediately after the EM/MAG data is processed. If numerous "hot spots" are identified, anomalies of lower amplitude or wavelength will not be investigated with the GPR. For the purposes of the field survey, a threshold amplitude of 300 gammas, and a threshold wavelength of 40 feet will be established. Anomalies less that 300 gammas and 40 foot dimensions will not be surveyed with the GPR unless GPR data quality is good and there is sufficient time.

- Anomalous areas delineated with the EM and MAG survey will be surveyed with the GPR at 5 foot interval, recording both a paper record and digital tape. A field calibration exercise will be carried out using a 500 MHz, 300 MHz and 120 MHz antennae to determine the optimum antennae for depth penetration and horizontal resolution for the soil conditions at the HRL. Based on past WHC experience, a 300 MHz antennae should be adequate. Parabolic or arcuate reflective patterns will be given a high probability of being drums. Flatlying reflectors that produce multiple reflections will be assigned a moderate probability of being drums. A minimum GPR target area of 25 x 25 feet will be established as a potential "10-drum" target.

- If there are numerous or large target areas that cannot be discriminated as to their nature or contents using the GPR data, two steps may be taken:

  1. Additional data collection using an EM-34 electromagnetic instrument at 10 m and 20 m coil separations may be used to characterize the vertical extent of large targets and of the trench itself. Larger coil separations may reduce the effects of near surface noise which may influence the shallow EM-31 data. If field evaluation suggests that EM-34 data is desirable, an EM-34 instrument should be mobilized to the site.

2. Further processing of the EM and magnetometer data may also be necessary to filter the data. GEOSOFT software may be used to apply modeled magnetometer anomalies to the field data as a filter. High frequency or low amplitude anomalies will therefore be filtered out of the data to emphasize anomalies that correspond (based on the model response) to concentrations of 10 drums. Other filters may also be designed and applied to the EM and magnetometer data based on the dynamic range and frequency characteristics of the data.

Further characterization of large or numerous targets identified in the field was not specified in the initial task order plan (GAI, 1991). It is our intent to fully characterize anomalies using the field techniques specified in the task order. We anticipate that additional survey time and costs using the EM-34 (if necessary) will not exceed the initial schedule and budget. However, additional data processing is beyond the initial task order plan, and, if required, would require a change order. We will defer final decision to proceed with more detailed data processing and analysis to WHC.

5. REFERENCES

Barrows, L., 1991, Personal Communication.

Barrows, L. and J.E. Rocchio, 1988, Magnetic Surveying for Hazardous Waste Site Investigations, Groundwater Monitoring Review, Vol. 8, No. 4.

Breiner, S., 1973, Applications Manual for Portable Magnetometers, Geometrics, 58 p.

Ecology and Environment, 1988, Memorandum to EPA on Geophysical Data Report Thermal Reduction Company, Ferndale, Washington.

EG&G Geometrics Inc., 1988, Magnetic Data Processing and Interpretation Program (MAGPAC Version 4.1) Users Manual, EG&G Geometrics, 37 p.

Gilkeson, R., P. Heigold, and D. Laymon, 1986, Practical Application of Theoretical Models to Magnetometer Surveys on Hazardous Waste Disposal Sites - A Case History, Groundwater Monitoring Review, Vol. 6, No. 1, pp. 54-61.

Golder Associates, 1988, Letter Report to Thermal Reduction Company on Test Pits at TRC Landfill.

Golder Associates 1991, Draft Task Order Plan for the Phase 2 Geophysical Investigations of the Horn Rapids Landfill.

Grant, F.S. and G.F. West, 1965, Interpretation Theory in Applied Geophysics, McGraw Hill Book Co.

Northwest Geophysical Associates, Inc., 1991, GM-SYS Version 1.8 Users Manual.

Rasmusson, R. and L. Pederson, 1979, End Corrections in Potential Field Modeling Geophysical Prospecting, v. 27, pp. 749-760.

Williamson and Associates, 1991. Personal Communication with R. Sylwester regarding survey experiences.

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INFORMATION PAPER

CONSIDERATION OF NATURAL ATTENUATION

AND

POINTS OF COMPLIANCE

AS A REMEDIATION ALTERNATIVE

16 April 1991

Prepared by:
U.S. Army Corps of Engineers
Walla Walla District

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Consideration of Natural Attenuation and Points of Compliance as a Remediation Alternative

Background

The remediation alternative consisting of institutional control, natural attenuation and points of compliance for ground water contamination at the Advanced Nuclear Fuels/Horn Rapids Landfill is a contentious issue with the Environmental Protection Agency (EPA) and the Department of Ecology (Ecology). This alternative would leave contaminated ground water in place and provide reduction in contaminant concentrations to MCL's by natural degradation and attenuation. Protection of human health and safety would be provided by institutional controls until concentrations had naturally decreased to safe levels. If there were points of exposure or areas of special concern down gradient of the contaminant plume, points of compliance (some agreed upon boundary) could be established. Any unsafe levels of contamination crossing this boundary would require remediation to meet MCL's. There has been very little progress to date on establishing the legitimacy of this alternative and the criteria by which it may be selected as the recommended action over other more active alternatives.

Purpose.

The objective of this paper is to identify pertinent regulations and criteria regarding natural attenuation and points of compliance for ground water, evaluate the appropriateness of this alternative for this site (considering these criteria) and discuss associated issues. This alternative is a critical issue for Hanford because of the potential volume of contaminated groundwater (a total estimate of 439,000,000,000 gallons (see attachment 1 for explanation of the computed quantity) at various locations across Hanford) which exceed maximum contaminant levels (MCL's) and may require pumping and treatment at an exorbitant cost. For this reason, it is important that this alternative be given proper attention and that it is properly applied to the environmental restoration program at Hanford.

Pertinent Regulations

Both the Model Toxics Control Act (MTCA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) acknowledge that leaving contamination in place and establishing points of compliance may be the most practicable method of addressing certain groundwater contamination cases (see Attachment 2 for excerpts from each). Criteria pertinent to selecting this alternative as the recommended action and a discussion of how this requirement pertains to the site follows:

MTCA Requirement 1. The site must meet the definition of an industrial site (WAC 173-340-745).

Discussion: WAC 173-340-745 lists 5 criteria for qualification as an industrial site as follows:

I) The site is zoned or has been otherwise officially designated for industrial use. **The Hanford Site Development Plan (DOE/RL 89-15) designates the site as industrial. Areas adjacent to the site, which are controlled by the city of Richland, are also designated as industrial. EPA is questioning the classification of industrial for the 1100-EM-1 Operable Unit and this issue is currently being negotiated.**

II) The Site is currently used for industrial purposes or has a history of use for industrial purposes. **The 1100-EM-1 Operable Unit is currently used as an industrial site. This is indicated in the Well Inventory Report and in the Issue Paper: Future Land Use Assumption for the 1100-EM-1 Operable Unit, December 12, 1990.**

III) Adjacent properties are currently used or designated for use for industrial purposes. **Properties adjacent to the 1100-EM-1 Operable Unit are administered by the city of Richland and are currently designated for industrial use.**

IV) The site is expected to be used for industrial purposes for the foreseeable future due to site zoning, statutory or regulatory restrictions, comprehensive plans, adjacent land use, and other relevant factors. **The Issue Paper: Future Land Use Assumption for the 1100-EM-1 Operable Unit, December 12, 1990, and the Hanford Site Development Plan (DOE/RL 89-15) indicate that the 1100-EM-1 Operable Unit will continue to be an industrial land use. This point is questioned by EPA and is currently being negotiated.**

V) The clean up action provides for institutional controls implemented in accordance with WAC 173-340-440. **Both the city of Richland and DOE have institutional controls in place that protect against human exposure from the contaminated ground water. Within the Hanford Works Boundary, access and development are closely controlled.**

The city of Richland also controls exposure to the ground water by means of water well permits.

MTCA Requirement 2. All practicable methods of treatment are utilized in the site clean up (WAC 173-340-720).

Discussion: There are a number of treatment technologies that could be attempted at the site, but these technologies are not considered to be practicable given the conditions at the site for the following reasons:

I) Removing nitrates, TCE and radionuclides from the ground water at ANF/HRL will require sophisticated, multistaged systems which will be very expensive to operate. The method of removal for the radionuclides may vary depending upon the isotope ultimately identified, but ion exchange is a likely treatment method. Ion exchange is a low volume operation and many years could be required to treat the estimated 123,000,000 gallons of contaminated ground water at ANF/HRL (see Attachment 3 for computation of contaminated ground water volume). A more complete study of this issue may determine that any minor benefits from a reduction in risk to human health and the environment may not be worth the expense of this remediation.

II) The removal process will generate wastes which must be handled and disposed of. This will provide a greater opportunity for exposure to the contaminants and more health risks than if the contaminants had been left in place. It is assumed that all of the contaminants of concern will naturally decrease in concentration because of degradation or half life to a level that is safe (additional studies will be required to confirm this assumption). Because of the present land use and institutional controls at the site, the contaminants of concern do not pose a threat to human health and the environment (Ecology, 1986). If treatment is performed, the short term disposal of the radionuclide wastes would be burial at Hanford. A remediation treatment which moves the contamination from one location in the ground at Hanford to another is not effective or desirable.

III) The treatment of ground water contamination at ANF/HRL may not be effective because of migration of off site ground water contaminant plumes into the 1100-EM-1 area. Plumes from both the ANF and 300 area are moving into the 1100-EM-1 area and considering the potential cost of ground water clean up over all of Hanford (assuming of ground water clean up over all of Hanford (assuming 439,000,000,000 gal may require remediation) it is uncertain that these plumes will be remediated. The movement of the contaminant plume in the 300 area varies during the year, but at times flows towards the 1100-EM-1 area as shown on Attachment 4 (PNL, 1989). TCE has been measured at concentrations above MCL's for the 300 area well 399-4-1 (located at the south boundary at the 300 area) and the TCE found in the 1100-EM-1 monitoring well S27 E14 may originate from the 300 area. The potential migration of contaminants from off site is not well known at this time and further investigation is needed. Also, the potential for future remediation of any off site plumes of contaminants must be evaluated.

Treatment of the ANF/HRL ground water may not be practicable because of the high costs, increased opportunity for exposure, and contamination of the site from off site sources. Additional investigation is required before a definitive evaluation of the practicability of these treatment methods can be made.

<u>MTCA Requirement 3</u>. Where contaminated groundwater flows into surface water, use of a dilution zone under WAC 173-201-045 to demonstrate compliance with surface water clean up levels shall not be allowed (WAC 173-340-720).

Discussion: Presently, the plume of contaminants does not extend to the Columbia River. The RI I report included a limited amount of ground water modeling to investigate the potential transport of contaminants to the river. The results of the modeling vary depending upon the assumptions used in the model and are shown in the following table and includes a list of the surface water MCL's:

Contaminant	**Max. Concentr. from Model @ River (mg/l)**	**MCL (mg/l)**	**MCL Source**
Nitrate	120-180		
Fish		90	a
Human Ingestion		10	a
Nitrite	*		
Fish		5	a
Salmonid		.06	a
Trichloroethylene	0.001-0.05		

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(Continued)

Contaminant	Max. Concentr. from Model @ River (mg/l)	MCL (mg/l)	MCL Source
Fish		22	a
Human Ingestion		.0027	a
Sulfate	*	250	b
Fluorides	*	4	c
Gross Alpha	*	15 pCi/l	b
Gross Beta	*	50 Pci/l	b

* Not Computed
a Quality Criteria for Water, EPA PB 87-226759,May 1986
b Secondary MCL, WAC 248-54-175
c National Revised Primary Drinking Water Regulations

None of the ANF/HRL ground water contaminants are addressed in WAC 173-201-045. The code directs that Quality Criteria for Water (EPA PB 87-226759,May 1986) or other relative information be used to determine MCL's for contaminants not not listed in WAC 173-201-045.

The modeling performed for the RI Phase I report indicates that the nitrate concentrations of ground water entering the Columbia River from the ANF/HRL area exceed MCL values. But, these concentrations were computed assuming a continuous source and it is possible that a more sophisticated analysis assuming a discrete release would predict concentrations at or below background (54.4 mg/l, DOE, 1990). Nitrites were not detected in any wells other than MW-12 and MW-14. Concentrations of nitrites in these two wells is approximately 8 mg/l. Considering the limited quantity of this contaminant and the relatively low levels, Nitrite should not be a concern. It is anticipated that the RI II ground water modeling will confirm this. Fluorides, Sulfates, and gross alpha concentrations are, on average, below MCL's in the HRL monitoring wells. Gross beta concentrations at the HRL monitoring wells range from 50 pCi/l to 91 pCi/l and MCL's are 50 pCi/l. Considering the relatively small amount by which the gross beta exceeds the MCL, it is very likely that the ground water modeling would indicate the concentrations would drop to MCL levels or below at the river.

MTCA Requirement 4. Ground water discharges into surface water shall be provided with all known available and reasonable methods of treatment prior to release into the surface waters (WAC 173-340-710).

Discussion: There are a number of treatment technologies that could be attempted at the site, but these technologies are not considered to be practicable given the conditions at the site. This item is similar to MTCA Requirement 2 and is discussed in detail there.

MTCA Requirement 5. Ground water discharges shall not result in violations of sediment quality values published in chapter WAC 173-204 (WAC 173-340-710).

Discussion: The portion of WAC 173-204 dealing with fresh water sediments has not been completed (as of this date) and standards are on a case by case basis. Although guidelines have not been established, it is reasonable to assume that the ANF/HRL ground water contaminants reaching the river will result in sediment contamination levels below those required by WAC 173-204 or background. This assumption is based on the low levels of contamination, limited volume of contamination and degradation or half life of the contaminants. Presently, the plume of contaminants does not extend to the river. Ground water studies and modeling for the RI II report will investigate the long term potential for transporting contaminants to the Columbia River.

MTCA Requirement 6. Ground water monitoring shall be performed to estimate contaminant flux rates and to address potential bioaccumulation problems resulting from surface water concentrations below method detection limits (WAC 173-340-720).

Discussion: The potential for bioaccumulation will be addressed in the RI II report. The minimal concentrations of the contaminants should preclude bioaccumulation problems. Additionally, the half life of the gross alpha and beta and the degradation of the TCE and nitrate would reduce the long term threat of bioaccumulation. Ground water monitoring requirements for remediation of the Horn Rapids Landfill will be addressed in the FS III report.

Institutional controls, natural attenuation of contamination and points of compliance can be selected over other alternatives for ground water clean up if the following criteria from the NCP are met:

NCP Requirement 1. Ensure protection at all points of potential exposure (Federal Register Vol. 55, No. 46, March 8, 1990, page 8753, middle column, last paragraph).

Discussion: The potential threat to human health and the environment will be evaluated in the RI II report for the ground water at the ANF/Horn Rapids Landfill. Preliminary investigations into the land use (**Well Inventory Report and in the Issue Paper: Future Land Use Assumption for the 1100-E-1 Operable Unit, December 12, 1990**) indicates that there are no receptors to ground water contamination. Because of the land use, the institutional controls and relatively low level of contamination it is anticipated that the RI II investigation will confirm that a threat does not exist.

NCP Requirement 2. Demonstrate that there are no other more active remediation measures which provide greater protection and reliability in the long term which are practicable (Federal Register Vol. 55, No. 46, March 8, 1990, page 8753, right column, top paragraph).

Discussion: There are a number of treatment technologies that could be attempted at the site, but these technologies are not considered to be practicable given the conditions at the site. This item is similar to MTCA Requirement 2 and is discussed in detail there.

NCP Requirement 3. Demonstrate that active restoration is not practicable, cost-effective or warranted because of site specific conditions (e.g., Class III ground water or ground water which is unlikely to be used in the foreseeable future and therefore can be remediated over an extended period of time) (Federal Register Vol. 55, No. 46, March 8, 1990, page 8734, left column, second paragraph).

Discussion: This item is similar to MTCA Requirement 2 and is discussed in detail there.

NCP Requirement 4. Demonstrate that biodegradation, dispersion, dilution, and adsorption will effectively reduce contaminants in the groundwater to concentrations protective of human health in a time frame comparable to that which could be achieved through active restoration (Federal Register Vol. 55, No. 46, March 8, 1990, page 8734, middle column, top paragraph).

Discussion: Ground water contamination at the HRL, other than nitrates, are below the clean drinking water standard MCL levels or exceeds these MCL's by relatively small amounts. Contaminant concentrations at HRL (monitoring wells MW-10 through MW-15) and clean drinking water standard MCL's are shown below:

Contaminant	Observed Concentration (mg/l)	MCL (mg/l)
Nitrate	270-186	10 *
Nitrite	0-2.3	1 *
Fluorite	0.3-0.5	4 +
Sulfate	59-89	250 °
Trichloroethene	0.0006-0.09	0 .005 +
Gross Alpha	1.6-12.2	15 pCi/l °
Gross Beta	23.2-91	50 pCi/l °

* Federal Register, Vol 54, May 22, 1989, pg 22070
\+ 40 CFR 141.62
° WAC 248-54-175

Because of the relatively low levels of contamination, natural attenuation and dispersion should reduce the contamination to MCL levels in a reasonable period of time for nitrite, trichloroethene, gross alpha, and gross beta. Nitrate has a higher concentration making it more difficult to achieve MCL's, but reduction to background levels (54.4) could be achieved in a reasonable period of time. In the RI II report, the dispersion of contaminants as a function of time will be considered by means of ground water modeling. The degradation and half-life of the contaminants will be considered in the final results of this investigation to predict the future contaminant concentrations. It is anticipated that the results of this investigation will show attenuation of the contamination levels to below MCL's within a reasonable period of time.

Summary

Natural attenuation and points of compliance is a potential remediation alternative for the ANF/HRL ground water contamination. The NCP and MTCA have established criteria for selection of this alternative as the recommended action. Additional study is required to insure that these criteria will be met. Evaluating the practicality of ground water treatment is key to selecting natural attenuation as the recommended action. Treatment of the ground water may not be practical because of the complexity of the treatment process, time required to accomplish treatment, increased risk to human health and the environment and treatment cost. Additionally, migration of contaminants into the 1100-EM-1 area may continue despite attempts at remediation because of off site plumes.

REFERENCES

DOE, 1990, Phase 1 Remedial Investigation Report for the Hanford Site 1100-EM-1 operable Unit, DOE/RL-90-18, United States Department of Energy, Richland Operations Office, Richland, Washington.

Ecology, 1986, Memo from J. Milton and D. Bowhay to R. Taylor, Washington Department of Ecology,October 31, 1986.

PNL, 1989, Ground Water Monitoring Compliance Projects for Hanford Site Facilities, Progress Report for the Period January to March 1989, PNL-6315-2, Pacific Northwest Laboratory, Richland, Washington.

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Computation of Contaminated Ground Water at the Hanford Site

An estimate of the potential volume of contaminated ground water at Hanford, which might require remediation, was computed based upon one indicator contaminant and information provided in Hanford Site Ground-Water Surveillance for 1989, Pacific Northwest Laboratory, PNL-7396, June 1990. Tritium was selected as the indicator chemical because of its presence in many waste streams at the site. The distribution of tritium at the site is shown on Attachment 1b. Approximately 1,957,844,200 square feet of the Hanford site have ground water contamination exceeding Tritium MCL's of 20,000 pC/l. Assuming the depth of contamination in the aquifer is 30 feet (a conservative assumption) then the total volume of tritium contaminated ground water exceeding MCL's is estimated as 439 X 10^9 gallons.

Hanford Site Ground-Water Surveillance for 1989, Pacific Northwest Laboratory , Richland Washington, PNL-7396, June 89.

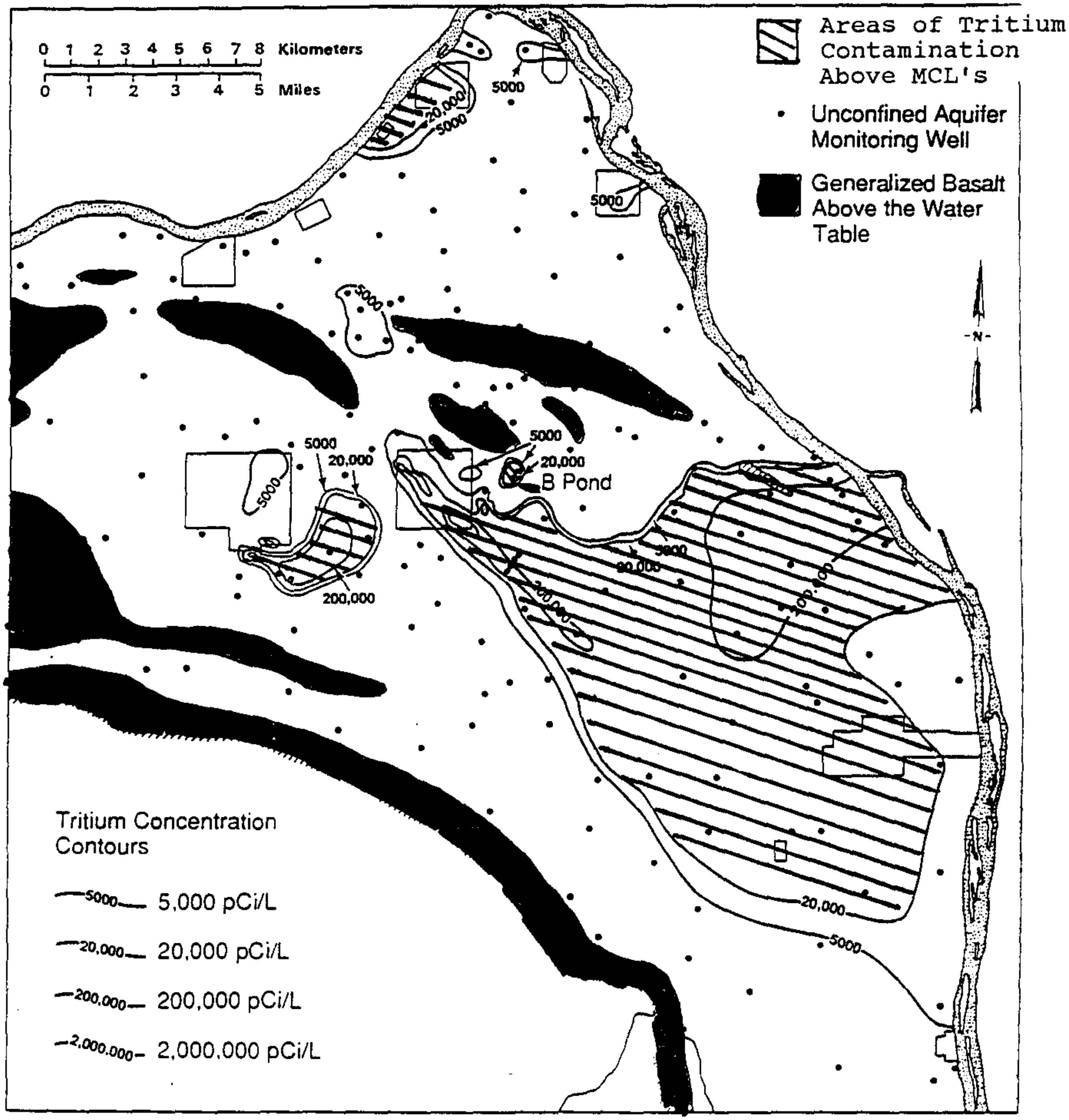

FIGURE 2.14. Distribution of Tritium on the Hanford Site

WAC 173-340-720

(ii) For hazardous substances for which sufficiently protective, health-based standards or criteria have not been established under applicable state and federal laws those concentrations that protect human health as determined using the following methods:

(A) Concentrations which are estimated to result in no significant acute or chronic toxic effects on human health and are estimated in accordance with WAC 173-340-720(3)(a)(ii)(A) except that the average body weight shall be 70 kg and the drinking water intake rate shall be 2 liters/day;

(B) Concentrations for which the upper bound on the estimated excess cancer risk is less than or equal to 1 in 100,000 and are estimated in accordance with WAC 173-340-720(3)(a)(ii)(B);

(c) The department may establish method C cleanup levels that are more stringent than those required by subsection (4)(b) of this section when, based on a site-specific evaluation, the department determines such levels are necessary to protect human health and the environment. This may include consideration of those factors listed in subsection (3)(b) of this section.

(d) Method C cleanup levels that protect beneficial uses of ground water other than drinking water shall be established by the department on a case-by-case basis.

(5) Multiple hazardous substances/multiple pathways of exposure.

(a) Ground water cleanup levels for individual hazardous substances developed in accordance with subsections (3) and (4) of this section, including those based on applicable state and federal laws, shall be adjusted downward to take into account exposure to multiple hazardous substances and/or exposure resulting from more than one pathway of exposure. These adjustments shall be made in accordance with the procedures in WAC 173-340-708 (5) and (6). In making these adjustments, the hazard index shall not exceed one (1) and the total excess cancer risk shall not exceed 1 in 100,000.

(b) The overall limits on the hazard index and total excess cancer risk shall also apply to sites where there is exposure to a single hazardous substance by one exposure pathway, including cleanup levels based on applicable state and federal laws.

(6) Point of Compliance.

(a) For ground water, the point of compliance is the point or points where the ground water cleanup levels established under subsections (2), (3), (4), and (5) of this section must be attained. Ground water cleanup levels shall be attained in all ground waters from the point of compliance to the outer boundary of the hazardous substance plume.

(b) The point of compliance shall be established throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site.

(c) Where hazardous substances remain on-site as part of the cleanup action, the department may approve a conditional point of compliance which shall be as close as practicable to the source of hazardous substances, not to exceed the property boundary. Where a conditional point of compliance is proposed, the person responsible for undertaking the cleanup action shall demonstrate that all practicable methods of treatment are to be utilized in the site cleanup.

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area-wide problem, to the extent it can be determined, EPA may also take any ction necessary to protect human ealth and the environment, such as providing alternate water supplies o, wellhead treatment, if there is a threa to human health and the environment.

Response to comments: The use of the Ground-Water Protection Strategy as a framework for Superfund ground-water response actions was the subject of many comments. Some commenters stated that the use of the strategy, and the Guidelines for Ground-Water Classification that support the strategy was ill-advised and possibly illegal. Others supported the use of the strategy and classification guidelines, and a third group supported their use, provided site-specific decision-making concerning appropriate remediation was maintained. In response, part of the strategy is a scheme for classifying ground waters according to their beneficial uses. The Superfund program uses this scheme as a framework to help decide the level of remediation that is appropriate for that ground water. For the most highly valued uses, such as drinking water, the most rapid remediation will be employed, to the extent practicable. Ground water that is naturally unusable because of characteristics such as high salinity may not be actively remediated.

Commenters questioning or objecting to the use of the Guidelines for Ground-Water Classification noted that the guidelines have not received adequate notice and comment for rulemaking and have not been formally promulgated. One of those commenters stated that the proposed NCP improperly makes the Ground-Water Protection Strategy into a "super ARAR." EPA disagrees that either the Ground-Water Protection Strategy or the Guidelines for Ground-Water Classification are an ARAR. The strategy provides overarching guidance that EPA considers in deciding how best to protect human health and critical environmental systems threatened by contaminated ground water. EPA developed guidelines, consistent with the strategy, as guidance to apply the classification system. The guidelines are used by the Superfund program as guidance to help make decisions on the level of cleanup necessary for ground water at Superfund sites. The guidelines are not used as strict requirements.

As noted above, the strategy, and the guidelines that help implement the strategy, are not ARARs. Rather, they help define situations for which standards may be applicable or relevant and appropriate and help set goals for ground-water remediation. At every site, EPA must decide the appropriate level of remediation necessary to protect human health and the environment and determine what requirements are ARARs based on the beneficial use of the ground water and specific conditions of the site. The guidelines are not a means of circumventing the selection of a remedy that will protect human health and the environment; they are only tools to apply the ground-water strategy. Site-specific decisions will need to be justified in the proposed plan and the public will have an opportunity to comment on EPA's findings and proposed actions at that time.

One commenter said that the use of a ground-water classification system would inappropriately insert cost into cleanup decisions. EPA disagrees. The cost of remediation does not affect the determination of the highest beneficial use of the ground water and consequently does not affect the classification. However, all remedies must be cost-effective, which may affect the effort exerted to achieve the remediation goals in a shorter timeframe. A commenter requested that EPA include cost as an explicit factor in determining when aggressive measures will be used to address ground-water contamination. EPA believes this is unnecessary. Cost-effectiveness is sufficiently addressed through the determination that remedies, including ground-water actions, are cost-effective.

One commenter opposed the classification guidelines stating that the use of the guidelines is to argue against restoring Class III ground waters. Unfortunately, EPA has a limited budget to clean up the many sites for which it has responsibility. Because Class III ground waters already contain high levels of salinity, hardness, or other chemicals; have no beneficial use to humans or environmental ecosystems; and have a low degree of interconnection with Class I or II ground waters (i.e., neither humans nor the environment are threatened by contamination in these ground waters), EPA believes that scarce resources can better be spent cleaning up sites and ground waters that do pose a threat to human health and the environment.

Several commenters supported the use of the differential ground-water protection and noted that CERCLA section 121(d)(2)(B)(i) refers to "the designated or potential use" of the ground water in determining cleanup levels, reflecting Congress' intent to apply varying cleanup standards to different kinds of ground water.

Several commenters, while supporting EPA's position that remediation levels for ground water will depend on the beneficial use of the ground waters, expressed concern about the implementation of the ground-water guidelines. Several commenters said that ground-water classification should only be done by the states (which for these purposes includes federally recognized Indian tribes or local governments). Another commenter stated that classification by a state should supersede EPA's classification of ground water unless EPA's classification would require a more stringent cleanup. EPA basically agrees; and to the degree that the state or local governments have classified their ground water, EPA will consider these classifications and their applicability to the selection of an appropriate remedy.

EPA will make use of state classifications when determining appropriate remediation approaches for ground water. When EPA must classify ground water for a Superfund action, that classification is only used to determine the scope of site-specific remedial actions and has no bearing outside of the Superfund action. It is not used by Superfund to provide regional classification of ground waters. Classification of ground waters is only done to the extent it guides remedy selection.

If a state classification would lead to a less stringent solution than the EPA classification scheme, then the remediation goals will generally be based on EPA classification. Superfund remedies must be protective. If the use of state classification would result in the selection of a nonprotective remedy, EPA would not follow the state scheme.

Two commenters argued that ground-water classification and remediation decisions should be based on current uses of the ground water, not just ground-water characteristics (i.e., potential use of the ground water). EPA disagrees. It is EPA policy to consider the beneficial use of the water and to protect against current and future exposures. Ground water is a valuable resource and should be protected and restored if necessary and practicable. Ground water that is not currently used may be a drinking water supply in the future.

Another major focus of comments was the issue of whether natural attenuation was an appropriate method for dealing with ground-water contamination. The comments reflect two points of view: one that supports natural attenuation as a reasonable and cost-effective means of remediating contaminated ground water and another that believes natural

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attenuation is an inadequate method of cleanup.

Those commenters supportive of the use of natural attenuation as a method of addressing ground water recognize that ground-water extraction and treatment ("pump and treat") is generally the most effective method of reducing concentrations of highly contaminated ground water, but note that pump and treat systems are less effective in further reducing low levels of contamination to achieve remediation goals. These commenters suggest that natural attenuation may play a vital role in achieving the final increment of cleanup once pump and treat systems reach the point of diminishing returns. EPA agrees with the understanding reflected in these comments that active ground-water restoration may not always be able to achieve the final increment of cleanup in a timeframe that is reasonable. It is in recognition of the possible limitations on the effectiveness of pump and treat systems that EPA's approach provides for periodic evaluation of such systems and allows for the use of natural attenuation to complete cleanup actions in some circumstances. In some cases, proposed ground-water remediation goals may not be achievable. In these cases, it will be appropriate to modify the remediation goal to reflect limitations of the response action.

Several commenters suggested that EPA use institutional controls and natural attenuation to address ground-water contamination where human exposure to contaminated ground water is not currently occurring but potentially may occur. One commenter suggested that, in this situation, all ground-water remedies should be compared with natural attenuation. In response, during the analysis of remedial alternatives and remedy selection, EPA considers the current and potential use of the ground water. Natural attenuation is generally recommended only when active restoration is not practicable, cost-effective or warranted because of site-specific conditions (e.g., Class III ground water or ground water which is unlikely to be used in the foreseeable future and therefore can be remediated over an extended period of time) or where natural attenuation is expected to reduce the concentration of contaminants in the ground water to the remediation goals—levels determined to be protective of human health and sensitive ecological environments—in a reasonable timeframe. Further, in situations where there would be little likelihood of exposure due to the remoteness of the site, alternate points of compliance may be considered, provided contamination in the aquifer is controlled from further migration. The selection of natural attenuation by EPA does not mean that the ground water has been written off and not cleaned up but rather that biodegradation, dispersion, dilution, and adsorption will effectively reduce contaminants in the ground water to concentrations protective of human health in a timeframe comparable to that which could be achieved through active restoration. Institutional controls may be necessary to ensure that such ground waters are not used before levels protective of human health are reached.

Commenters opposed to natural attenuation do not find this method an acceptable substitute for treatment, noting that many contaminants at Superfund sites are not readily degraded in the subsurface. EPA agrees that natural attenuation will not provide contaminant reduction in all cases and that in many situations natural attenuation will not be appropriate as the sole remedial action. Factors that affect the ability of natural attenuation to effectively reduce contaminant concentrations include the biological and chemical degradability of the contaminants, the physical and chemical characteristics of the ground water, and physical characteristics of the geological medium.

In addition to objecting to the use of natural attenuation, some commentors provided specific examples of where they would consider rapid restoration of ground water to be necessary, such as water that feeds into, or that is interconnected with, sensitive or vulnerable aquatic ecosystems or where contaminated ground water results in vapors that impact nearby buildings. Under current policy, EPA determines remediation timeframes that are reasonable given particular site circumstances. Some "ecologically vital" ground water that feeds into or is interconnected with sensitive or vulnerable aquatic ecosystems is treated as a Class I ground water and actively restored, to the extent practicable. In addition, ground waters in designated wellhead protection areas are also to be treated as Class I ground waters and will be rapidly restored, to the extent practicable. Contamination of buildings due to soil vapors from ground water will be addressed on a site-specific basis and, if determined to be a continuing source of contamination, contaminated ground water will be actively restored, to the extent practicable. In contrast, such factors as location, proximity to population, and likelihood of exposure may allow much more extended timeframes for remediating ground water.

One commenter felt that more realistic assumptions and models were needed to calculate restoration times. The commenter believes EPA uses unrealistic and unproven models that result in overly optimistic estimates of restoration timeframes. Another commenter requested clarification on the technical feasibility of active ground-water restoration.

In response, EPA notes that it is engaged in ongoing research and evaluation of the effectiveness of ground-water pump and treat systems. This analysis has confirmed the effectiveness of plume containment measures in preventing further migration and of pump and treat systems in achieving significant reductions of ground-water contamination. "Evaluation of Ground-Water Extraction Remedies," EPA No. 540.2–89 (October 1989). However, this analysis also indicates the significant uncertainty involved in predicting the ultimate effectiveness of ground-water pump and treat systems. In many cases, this uncertainty warrants inclusion of contingencies in remedy selection decisions for contaminated ground water. Where uncertainty is great, a phased approach to remediation may be most appropriate. Such phasing might involve initial measures to contain the contaminant plume followed by operation of a pump and treat system to initiate contaminant removal from the ground water and to gain a better understanding of the ground-water system at the site. The decision as to the ultimate remediation achievable in the ground water would be made on the basis of an evaluation of the effectiveness of the pump and treat system conducted after a defined period of time. EPA's "Guidance on Remedial Action for Contaminated Ground Water at Superfund Sites" (December 1988) discusses factors that may be considered in establishing restoration timeframes.

To reflect the fact that restoration of ground water to beneficial use may not be practicable, the expectation from the preamble to the proposal that will be incorporated in today's rule has been modified. The expectation concerning ground-water remediation now indicates that when ground-water restoration is not practicable, remedial action will focus on plume containment to prevent contaminant migration and further contamination of the ground water, prevention of exposures, and evaluation of further risk reduction.

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where relevant and appropriate to the circumstances of the release.

(C) Where the MCLG for a contaminant has been set at a level of zero, the MCL promulgated for that contaminant under the Safe Drinking Water Act shall be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water, where the MCL is relevant and appropriate under the circumstances of the release based on the factors in § 300.400(g)(2).

(D) In cases involving multiple contaminants or pathways where attainment of chemical-specific ARARs will result in cumulative risk in excess of 10^{-4}, criteria in paragraph (e)(2)(i)(A) of this section may also be considered when determining the cleanup level to be attained.

Name: Section 300.430(f)(5)(iii)(A). Location of point of compliance for ground-water cleanup standards.

Proposed rule: Section 300.430(e)(2)(i)(B) specified the standards that shall generally be considered relevant and appropriate when determining acceptable exposure levels for ground water or surface water that is a current or potential source of drinking water. Proposed § 300.430(f)(4)(iii)(A) (renumbered as final § 300.430(f)(5)(iii)(A)) states that performance shall be measured at appropriate locations in the ground water, etc. The preamble to the proposed rule explained that for ground water, remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area when waste is left in place (53 FR 51426). (The preamble also discussed points of compliance for other media (*Id.*); see today's preamble to § 300.430(e), "Feasibility study, 1. Remedial action objectives and remediation goals," for discussion of these other points of compliance.)

Response to comments: Several commenters essentially supported the proposed policy regarding point of compliance, but emphasized that the ground-water classification scheme should not be used to delay cleanup or to "write-off" aquifers.

Several other commenters opposed the proposal that cleanup standards, specifically MCLs or MCLGs, should be met throughout the ground water. Most proposed alternatively that the standards be met only at the tap or other realistic point of use, based on a site-specific exposure or risk assessment, and that higher levels be allowed in the ground water, especially immediately downgradient from a waste management area, to take into account natural attenuation. Some proposed that compliance should be at the facility property boundary, or beyond if exposure is precluded under CERCLA alternate concentration limits. One commenter argued that point of compliance is a site specific, case-by-case determination that should not be specified in the preamble, while another sought the same level of flexibility for ground-water contamination cleanup as there is for contaminant source areas.

These commenters felt that if compliance is not linked to actual or realistic future exposure, the resulting cleanups would be unnecessary or not cost-effective. They also maintained that using actual or likely points of exposure would be more appropriate to ensure that actual drinking water meets standards. Also, they argued that the proposed point of compliance violates the intent of "relevant and appropriate" in that it is inconsistent with and more stringent than the compliance point under SDWA itself, which is at the tap.

EPA disagrees fundamentally with these commenters. MCLs, which are enforceable drinking water standards, and MCLGs above zero, are indeed relevant in considering cleanup levels for water that is or may be used for drinking. Although SDWA does not focus on general ground-water contamination, EPA believes that the MCL standards and non-zero MCLGs promulgated under SDWA are potentially relevant and appropriate to ground-water contamination. CERCLA sets out a mandate for remedies that are protective of use of ground water by private or public users. For example, section 104(c)(6) reflects Congress's expectation that ground water should be restored to protective levels. If ground water can be used for drinking water, CERCLA remedies should, where practicable, restore the ground water to such levels. Such restoration may be achieved by attaining MCLs or non-zero MCLGs in the ground water itself, excluding the area underneath any waste left in place. Thus, these standards and goals may appropriately be used as cleanup levels in the ground water as well as for the delivery of drinking water by public water systems.

Furthermore, as stated in the preamble to the proposed rule, "EPA's policy is to attain ARARs * * * so as to ensure protection at all points of potential exposure" (53 FR 51440). Under the approach proposed by many of these commenters—meeting standards only at the tap—most ground water would not be restored or remediated, since meeting standards through wellhead treatment could conceivably always be substituted for restoration of the ground water itself. This approach, however, would not protect many potential future users, particularly those with private wells, who may be unaware of the need to treat the contaminated ground water before using it for drinking water. Moreover, this approach depends entirely on institutional controls, which should not be used as the primary remedy when more active remediation measures, which provide greater reliability in the long term, are practicable.

Using the facility property boundary as a point of compliance for MCLs, non-zero MCLGs, or alternate concentration limits raises similar problems. At many CERCLA sites, the concept of a facility property boundary is not meaningful because a facility is not in operation (CERCLA defines the concept in terms of an area where contamination has come to be located). Also, allowing higher ACLs to be set at the boundary in the hope that MCLs or non-zero MCLGs will be achieved at a downgradient well through attenuation does not meet the statutory prerequisites for ACLs in CERCLA section 121(d)(2)(B)(ii), which requires (among other things) surface discharge of the ground water and enforceable means of protecting against use of the contaminated ground water.

One commenter objected that the proposed policy was vague and failed to give criteria for determining point of compliance. The commenter specifically cited the word "generally" in the policy as a source of confusion. EPA believes that the policy as reiterated above gives clear direction, considering that there will be situations, such as where waivers are needed, where cleanup levels cannot be attained throughout the plume.

EPA believes that remediation levels should generally be attained throughout the contaminated plume, or at and beyond the edge of the waste management area, when the waste is left in place. However, EPA acknowledges that an alternative point of compliance may also be protective of public health and the environment under site-specific circumstances.

In particular, there may be certain circumstances where a plume of ground water contamination is caused by releases from several distinct sources that are in close geographical proximity. In such cases, the most feasible and effective ground-water cleanup strategy may be to address the problem as a whole, rather than source-by-source, and to draw the point of compliance to encompass the sources of release. In determining where to draw the point of compliance in such situations, the lead agency will consider factors such as the proximity of the sources, the technical practicability of ground-water

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remediation at that specific site, the vulnerability of the ground water and its possible uses, exposure and likelihood of exposure and similar considerations. Additional guidance on dealing with remote sites is provided in the preamble section above on ground-water policy.

Final rule: EPA is promulgating in final § 300.430(f)(5)(iii)(A) the statement on points of compliance ("performance shall be measured at appropriate locations in the ground water, * * *") that was in proposed § 300.430(f)(4)(iii)(A).

Name: Section 300.430(e)(2)(i)(F). Use of alternate concentration limits (ACLs).

Proposed rule: The preamble to the proposed NCP (53 FR 51434) discussed conditions under which alternate concentration limits (ACLs) specified under CERCLA may be used as cleanup standards. The preamble explained that CERCLA ACLs may be used if the conditions of CERCLA section 121(d)(2)(B)(ii) are met and cleanup to MCLs or other protective levels is not practicable.

Response to comments: Several comments were made on the proposed preamble section explaining the use of CERCLA ACLs. Some commenters supported the proposed use of ACLs as is; others suggested that EPA should do more to emphasize their utility, particularly within a facility; and one commenter maintained that ACLs should not be less stringent than other standards.

In support of the proposal, one commenter pointed out that use of institutional controls and ACLs are appropriate for the same reason, that is, when use of treatment to attain drinking water standards is not practicable. Other commenters noted that ACLs provide desirable flexibility and are already well established under the RCRA program. One commenter pointed out that use of an ACL at a site should not require a new risk assessment in addition to that done during the RI/FS.

Some commenters suggested ways to expand the use of ACLs at CERCLA cleanups. One commenter wanted EPA to include the use of ACLs in the NCP's regulatory language. Another commenter, noting that Congress's concern was primarily with use of ACLs for exposure points outside a facility, suggested that ACLs could be expected to have great utility within the boundaries of a CERCLA facility; they could be granted when contaminants in ground water will attenuate to ARAR-compliant levels at the leading edge of the plume. With this in mind the commenter suggested that ACLs should be an intrinsic consideration in the initial step of ARARs identification. In a similar vein another commenter suggested that the facility boundary should be defined to include the area covered by institutional controls for the purpose of the statutory criteria and for defining the point of exposure.

EPA disagrees generally with those commenters who would extend the use of CERCLA ACLs set above drinking water standards to areas within the facility boundary or areas covered by institutional controls. EPA interprets the CERCLA section on ACLs not as an entitlement, but rather as a limitation on the use of levels in excess of standards that would otherwise be appropriate for a site. Although the limitation refers only to areas outside the facility boundary, EPA maintains that the same principle holds within the boundary (to the edge of any waste management area left at the site), namely, that such ACLs should only be used when active restoration of the ground water to MCLs or non-zero MCLGs is not practicable. Clearly, the availability of institutional controls in itself is not sufficient reason to extend the allowance for levels above drinking water standards or non-zero goals; rather, as discussed elsewhere in the preamble, institutional controls are considered as the sole remedy only where active remediation is not practicable.

EPA also disagrees with a commenter who asserted that ACLs cannot be less stringent than state or tribal ARARs or MCLGs. There is clearly no point to the ACL described in CERCLA unless it is above the standard normally applied to ground water of a given class. EPA does, however, believe that the policy described above should mitigate the commenter's fears that ground water will be sacrificed.

These comments suggest some confusion as to when MCLs or MCLGs need to be waived under CERCLA section 121(d)(4). EPA's policy is that MCLs or MCLGs above zero should generally be the relevant and appropriate requirement for ground water that is or may be used for drinking, and that a waiver is generally needed in situations where a relevant and appropriate MCL or non-zero MCLG cannot be attained. If, however, a situation fulfills the CERCLA statutory criteria for ACLs, including a finding that active restoration of the groundwater to MCLs or non-zero MCLGs is deemed not to be practicable, documentation of these conditions for the ACL is sufficient and additional documentation of a waiver of the MCL or MCLG is not necessary.

In determining that a CERCLA ACL may be used outside the facility boundary, the risk assessment and other analysis conducted in the RI/FS generally should provide the information required for the documentation that the statutory criteria and other guidelines given above are satisfied. EPA has added a reference to use of ACLs as prescribed in CERCLA in § 300.430(e)(2)(i)(F).

Final rule: EPA has added a § 300.430(e)(2)(i)(F) to the rule to reference the language in CERCLA section 121(d)(2)(B)(ii) on alternate concentration limits.

Name: Section 300.430(e)(2). Use of federal water quality criteria (FWQC).

Proposed rule: The preamble to the proposed rule discussed when federal water quality criteria are likely to be relevant and appropriate (53 FR 51442). EPA stated that a FWQC, or a component of a FWQC, may be relevant and appropriate when the FWQC is intended to protect the uses designated for the water body at the site, or when the exposures for which the FWQC are protective are likely to occur. In addition, whether a FWQC is relevant and appropriate depends on the availability of standards, such as an MCL or state water quality standard, specific for the constituent and use. In particular, when a promulgated MCL exists, an FWQC would not be relevant and appropriate for a current or potential drinking water supply.

Response to comments: One commenter opposed EPA's policy on the relevance and appropriateness of federal water quality criteria (FWQC) for current or potential drinking water sources when both FWQC and MCLs are available for a contaminant. The commenter stated that the test for relevance and appropriateness of an FWQC was whether it is protective of humans or aquatic organisms and whether that kind of exposure is an issue at the site. The commenter maintained that if an FWQC is more stringent than an MCL, the FWQC should apply, consistent with the policy that the most stringent ARAR must be complied with.

In response, FWQC are to be attained "where relevant and appropriate under the circumstances of the release or threatened release," as provided in CERCLA section 121(d)(2)(B). Final rule § 300.430(e)(2)(i)(E) reflects this fact. However, EPA believes that at many sites, FWQC will not be both relevant and appropriate in light of other potential ARARs.

EPA agrees with the commenter that the more stringent ARAR should generally be attained, especially in the

Attachment 2

DRAFT

Computation of Contaminated Ground Water at the ANF/Horn Rapids Landfill Site

An estimate of the potential volume of contaminated ground water at the ANF/HRL site, which might require remediation, was computed based upon the TCE plume as delineated by soil gas surveys (see Attachment 3b). Based upon this plume, 8,238,000 square feet of the ANF/HRL area may have ground water contamination. Assuming the depth of contamination in the aquifer is 20 feet (see Attachment 3c for geologic section through HRL) then the total volume of tritium contaminated ground water exceeding MCL's is estimated as 123,000,000 gallons.

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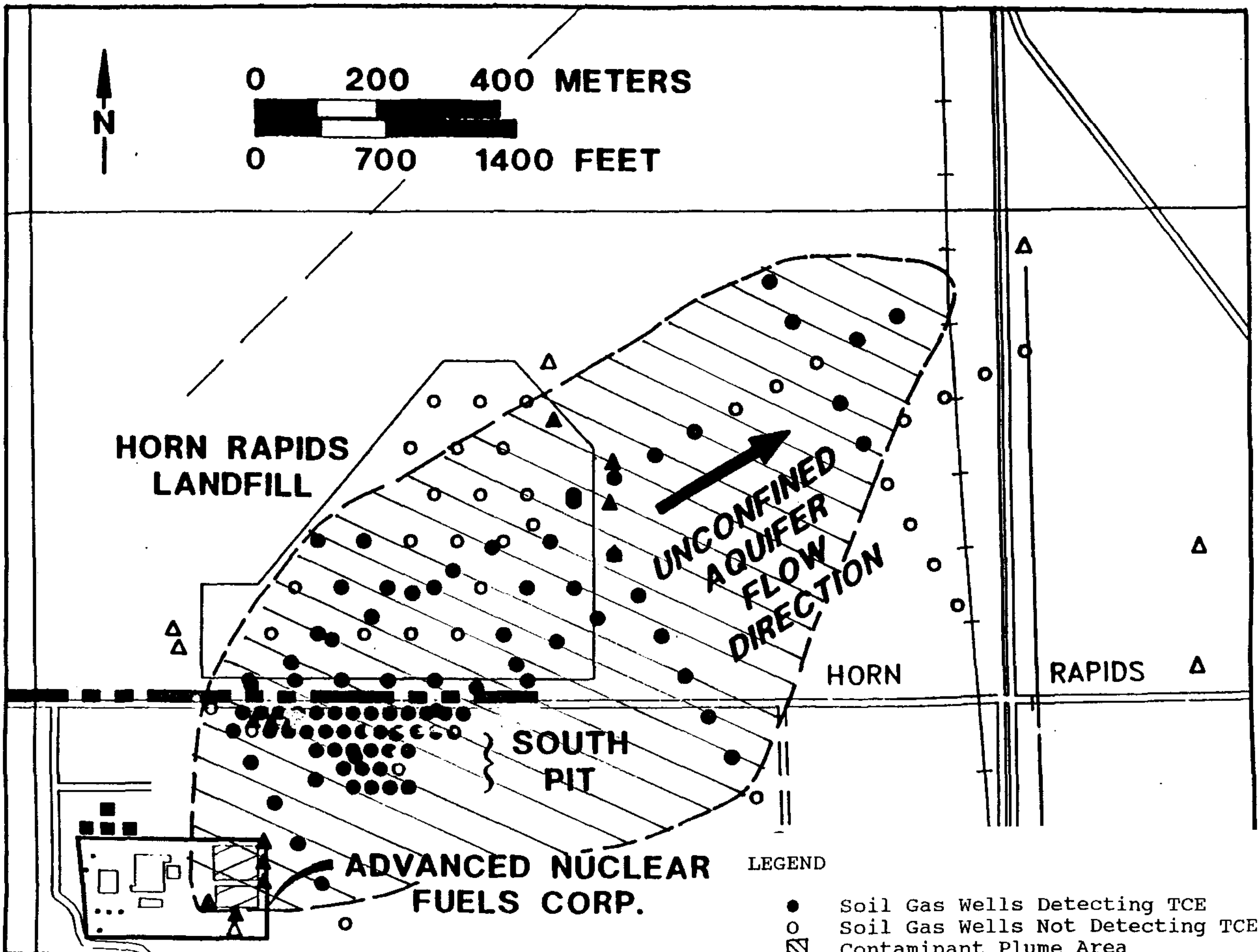

Attachment 3b

903-1221\

Phase I Remedial Investigation Report

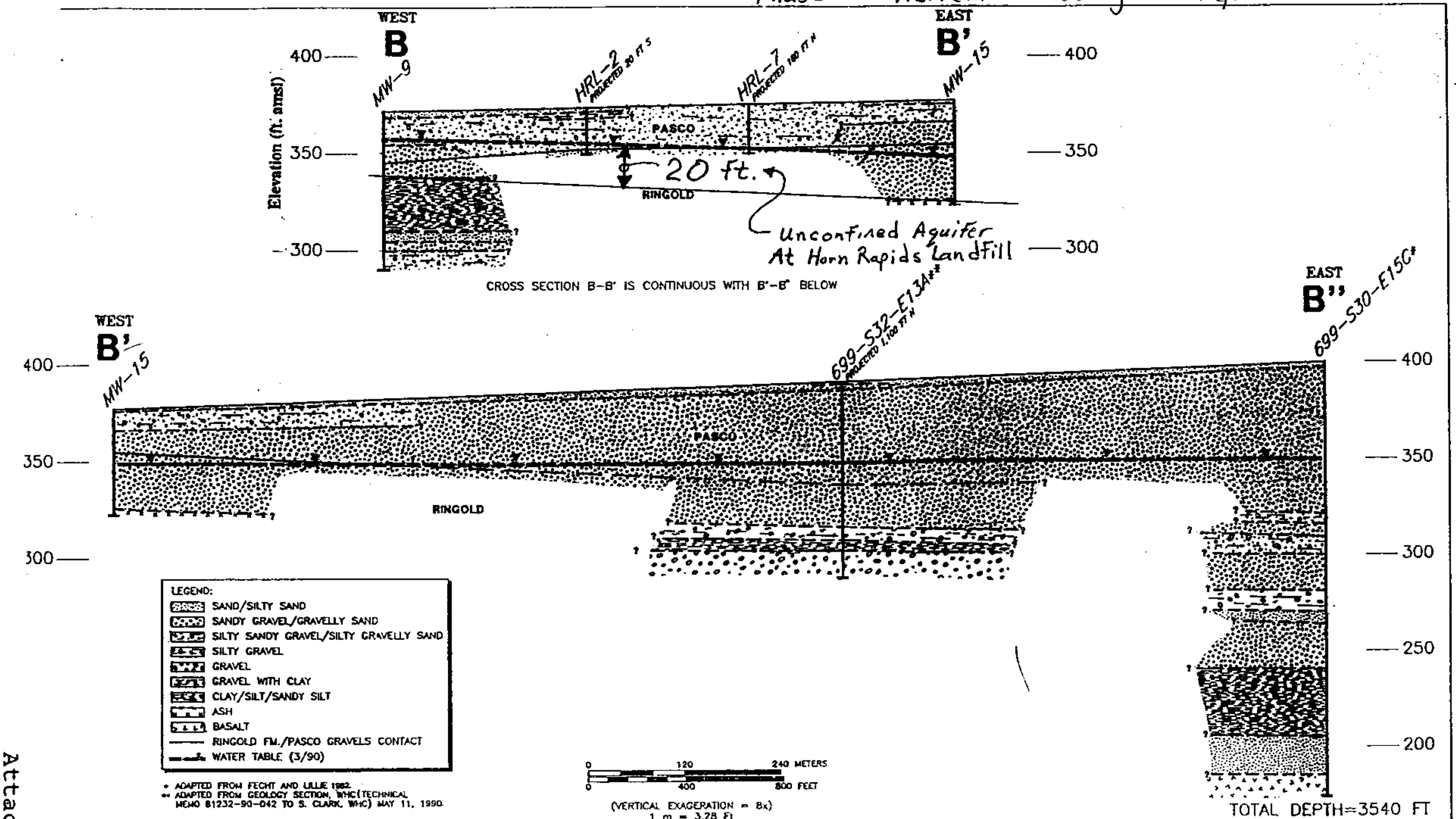

Figure 3-24. Cross Section B-B" (See Figure 3-22).

Attachment 3C

Ground Water Monitoring Compliance Projects for Hanford Site Facilities, Progress Report for the Period Jan. to Mar. 1989, PNL-6315-2.

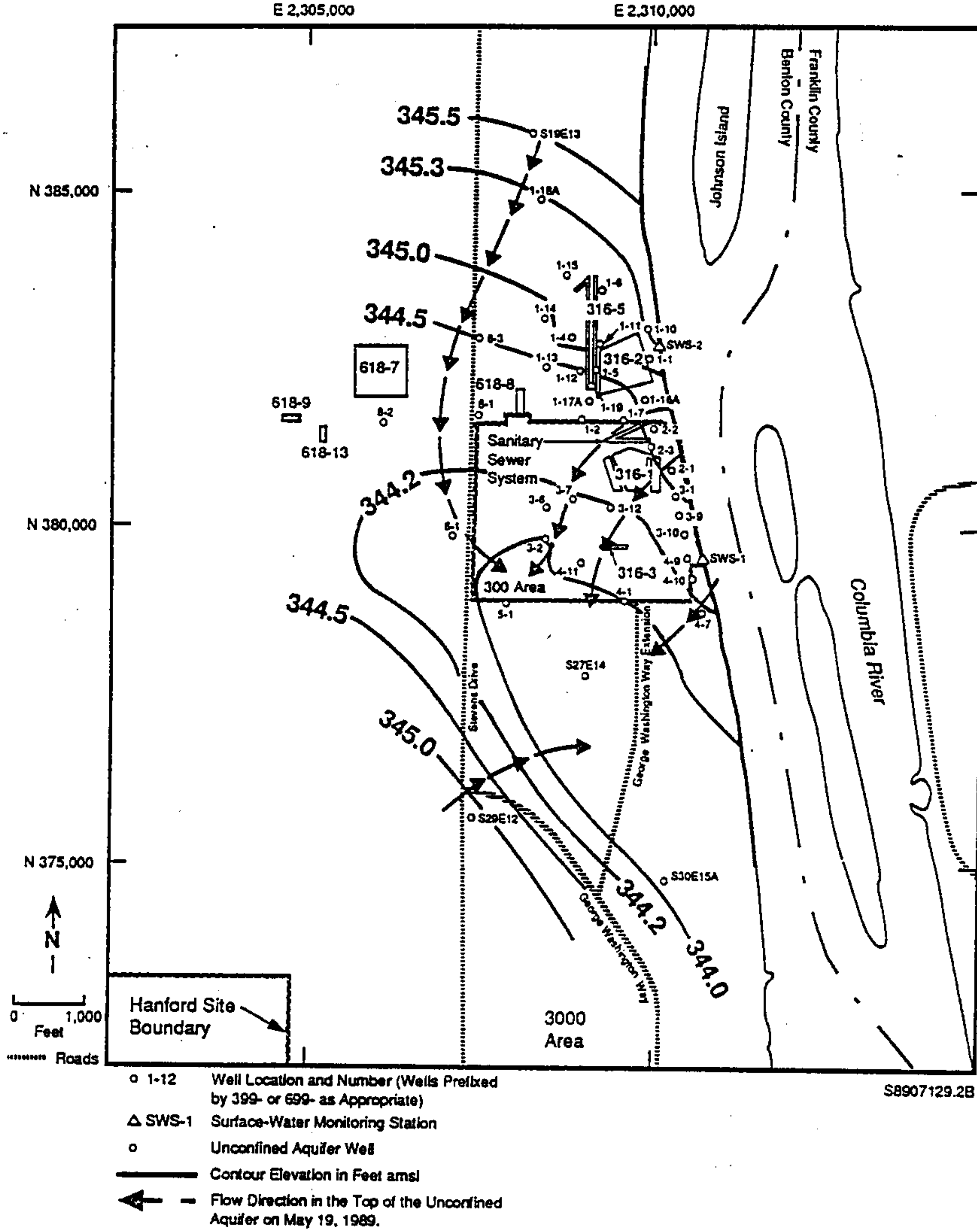

FIGURE 2.2. Water-Levels and Ground-Water Flow Pattern in the Top of the Unconfined Aquifer, May 1989

1100-EM-1 Operable Unit Managers Meeting
April 16, 1991

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Please contact Doug Fassett if there are any deletions or additions to this list.