072371

Meeting Minutes Transmittal/Approval
Unit Managers' Meeting
Remedial Action and Waste Disposal Unit/Source Operable Unit
3350 George Washington Way, Richland, Washington
January 1999

0051899

FROM/APPROVAL: _____ Date 7/22/99
Glenn Goldberg, 100 Area Unit Manager, RL (H0-12)

APPROVAL: _____ Date 8/19/99
~~Wayne Soper, 100 Aggregated Area Unit~~ Manager, Ecology (B5-18)
Jack Donnelly Cleanup Project Manager

APPROVAL: _____ Date 7-22-99
Dennis Faulk, 100 Aggregate Area Unit Manager, EPA (B5-01)

APPROVAL: _____ Date 8/18/99
Bryan Foley, 200 Area Unit Manager, RL (H0-12)

APPROVAL: N/A See above Date N/A
Joan Bartz/Shri Mohan, 200 Area Aggregate Area Unit Managers, Ecology (B5-18)

APPROVAL: N/A See above Date N/A
Ted A. Wooley, 200-B Area Project Manager, Ecology (B5-18)

APPROVAL: _____ Date 5-20-99
Robert G. McLeod, 300 Area Unit Manager, RL (H0-12)

APPROVAL: _____ Date 8-24-99
Alex Stone, 300 Area Project Manager, WDOE (B5-18)

APPROVAL: _____ Date 20 May 99
David R. Einan, 300 Area Aggregated Unit Manager, EPA (B5-01)

APPROVAL: N/A Date N/A
Ted A. Wooley, 300 Area Process Trenches Subproject Manager , Ecology (B5-18)

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

Attachment #1a and b	--	Agendas
Attachment #2	--	Attendance Record
Attachment #3	--	Meeting Minutes
Attachment #4	--	Waste Site Reclassification Form (116-C-1 Closeout Verification Package)
Attachment #5	--	Fiscal Year 1999 100 Areas Closeout Verification Package Schedule
Attachment #6	--	Preliminary BHI "Procedure" for Split Sampling
Attachment #7	--	Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications
Attachment #8	--	Calculation Summary -- PCB Cleanup Levels for Direct Soil Exposure (Revision of the RDR/RAWP for the 100 Area)
Attachment #9	--	Remaining Sites Strategy
Attachment #10	--	RCRA Groundwater Monitoring at the 216-U-12 Crib
Attachment #11	--	Schedules for 200-CS-1 and 200-CW-1
Attachment #12	--	Ecology Contact Information (300 Area Project Management Team Chart and Phone/Contact List)
Attachment #13	--	South Process Pond Test Trench Verification Sample Results and Location Map
Attachment #14	--	Sampling, Analysis, and Closeout Plan for Tanker Spill Area in 300-FF-1 OU

Prepared by: Amy Jones for M Peterson Date 9/9/99
Michelle Peterson (H0-10)/Tamen Rodriguez (H0-17)

Concurrence by: Date 9/13/99
Vern Dronen, BHI Remedial Action and Waste Disposal Project Manager (H0-17)

Attachment 1a

UNIT MANAGERS' MEETING AGENDA

3350 George Washington Way, Room 1B45
January 21, 1999

1:00 p.m. -- 100 Area

100 Area Assessment

- Public Workshop Status
- Burial Ground FFS Status
- 100-N RODs Status
- North Slope Status
- Support for the February 10 Workshop

100 Area Remedial Action

- Updated Potential to Emit Calculations, Meeting with DOE, Other Related Items
- 116-C-1 Closeout Verification Package
- Summary Status of Cr^{6+} Remediation at 100-B/C and 100-D Sites, with Kd Test Plan
- 100-H, Group 4 Startup Status
- Split Samples and Significant Figures -- Data Review
- Remaining Sites ROD -- Confirmatory Sampling Efforts

UNIT MANAGERS' MEETING AGENDA

3350 George Washington Way, Room 1B45
January 21, 1999

3:00 p.m. -- 200 Area

- **200 Area UMM Structure**
  - Proposal to move UMM time from 3:00 p.m. to 8:00-10:00 a.m.
  - Proposal to combine 200 Area UMM to cover groundwater remediation activities, operable unit-specific assessment activities, and RCRA groundwater monitoring associated with the 200 Areas
- **Overview of 200 Areas RCRA Groundwater Monitoring**
  - Status brief on monitoring activities related to 216-U-12 crib
- **200 Area RI/FS Implementation Plan**
  - Status of public review
- **Status of 200-CS-1 Chemical Sewer Waste Group**
  - Review of upcoming DQO schedule
- **200-BP-1 Operable Unit**
  - Protype Barrier Closeout

UNIT MANAGERS' MEETING AGENDA

3350 George Washington Way, Room 2A01
January 21, 1999

10:00 a.m. -- 300 Area

300-FF-2 Area Assessment

- Waste Site Categorization Status
- 300-FF-2 Feasibility Study Status

300-FF-1 Operable Unit

- North Process Pond Remediation Status
- South Process Pond Remediation Strategy
- Landfill 1D Lead Contaminated Soils Waiver
- Disposal of Liquid Wastes to ETF
- Tanker Spill Area Closeout
- TPA Milestone Revision

Remedial Action and Waste Disposal Unit Managers' Meeting
Official Attendance Record – 100 Areas
January 21, 1999

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
Frank M Corpuz	BHI	Proj Engr.	373-1661
Jack Donnelly	Ecology	Cleanup Proj. MNGR	736-3013
Jon Fancher	ERC	Env. Lead	372-9610
Ellen Coverdale	ERC	Proj Support	372-9303
Wayne Soper	Ecology	1D Area	736-3049
Pamela Innis	EPA	Proj. Manager	376-4919
Glenn Goldberg	DOE	Proj. Manager	376-9552
Fred Donahoe	BHI	Task Lead	372-9765
Pam DOCTOR	BHI	ET SUPPORT	372-9107
Alvin Langstaff	BHI	Task lead	373-5876
JEFF ARMATROUT	BHI	TASK LEAD	372-9646
Dennis Faulk	EPA	UM	376-8631
NANCY B. Myers	BHI	Public Involvement	372-9059
FRED ROECK	BHI	Environ Lead	372-9086
John Sands	DOE	S&M	372-2282
JON YERXA	DOE	TPA	376-9628
Dave Holland	Ecology		736-3027
Dave Blumenkranz	CHI		
Basu Mukherjee	BHI		
Barry Vedder	BHI		
Michelle Peterson	BHI	RA/WD Technical Editor	372-9516

Remedial Action and Waste Disposal Unit Managers' Meeting
Official Attendance Record – 200 Areas
January 21, 1999

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
Bryan Foley	DOE RL	200 Areas	376-7087
Jack Donnelly	Ecology	clean-up 100's mNgt	736-3013
Ted Wooley	Ecology	200 CW+ Vadose	736-3012
David Holland	Ecology	-	736-3027
MARV FURMAN	DOE	GWP	373-9630
Stuart Luttrell	PNNL	GW Project	376-6023
Ron Smith	PNNL	GW Monitoring	376-5831
Pamela Innis	EPA	P.M	376-4919
FRED ROECK	BHI	Environ Lead	372-9086
Dennis Faulk	EPA	RPM	376-8631
Curt Wittreich	ERC	200 Area	372-9586
BRUCE A. WILLIAMS	PNNL	V-12CRIB	372-3799
Michelle Peterson	BHI	RA/WD Technical Editor	372-9516

Remedial Action and Waste Disposal Unit Managers' Meeting
Official Attendance Record – 300 Area
January 21, 1999

Please print clearly and use black ink

PRINTED NAME	ORGANIZATION	O.U. ROLE	TELEPHONE
FRED ROECK	BHI	Environ. Lead	372-9086
Bob McLeod	DOE	U.M.	372-0096
Larry Hulstrom	CHI	Technical Support	372-9319
Ken Kraemer	BHI	Proj. Controls	372-9637
Rick Donehar	BHI	Task Lead	372-9565
Dave Einan	EPA	P.M.	376-3483
Tina Masterson-Heggen	Ecology	support	736 5701
Jeff James	BHI	Task LEAD	373-6372
Richard Carlson	BHI	Tech. Lead	373-3008
Ella Cuenenberg	CHI	Technical Support	372-9303
Alex Stone	Ecology	Proj Mgr.	736-3018
ELLEN MATTLIN	DOE-RL-EAP	Reg. SUPPORT	376-2385
Michelle Peterson	BHI	RA/WD Technical Editor	372-9516

MEETING MINUTES
REMEDIAL ACTION AND WASTE DISPOSAL
UNIT MANAGERS' MEETING -- 100 AREA
January 21, 1999

Attendees: See Attachment #2a.

Agenda: See Attachment #1a.

Topics of Discussion:

100 Area Assessment

1. Public Workshop Status -- RL received a copy of the fact sheet from EPA, which EPA had also sent to WDOH for their review. RL commented that the fact sheet looked fine. EPA said they would likely do a local mailing of the fact sheet (also including distribution to the members of the Hanford Advisory Board) by the end of next week.

   The State will take the lead to produce the press release for the workshop, and EPA asked RL to sponsor the advertising for the workshop. RL stated that they would check with their upper management on the permissibility of RL paying for the advertising. RL would let EPA know if they can assist with the distribution of the fact sheet and/or pay for the advertisement.

   A facilitator has been hired for the February 10 workshop. EPA said that the Nez Perce have agreed to attend the workshop. Other groups have been informed of the workshop have not responded as to whether they will attend.

   Columbia River United told EPA they would like to have a workshop in the Hood River area in late March/early April. EPA commented that they have made no commitment regarding that workshop.

2. Burial Ground FFS Status -- Changes are being made to the FFS based on decisions made at a recent meeting. The FFS is tentatively planned to be given to EPA in late February or the first part of March.

3. Remaining Sites and 100-N RODs Status -- EPA stated that the Remaining Sites ROD will not be completed until the end of March. Discussion ensued on the topic. EPA commented that although they did not receive any public comments regarding ROD issuance, they prefer to hold off signing any ROD until after the public workshop (mid-April time frame). Ecology stated that they had no objection to signing the RODs at the end of March.

   In reference to the 100-N RODs, BHI is currently incorporating regulator comments and are tentatively scheduled to provide the draft RODs for regulator legal review by February 8. RL stated that they would likely have additional input at that point. Discussion ensued on review of the RODs by RL's and Ecology's legal departments.

Ecology stated that more specific language on institutional controls would need to be added to the RODs. RL stated that Ecology will need to provide that language. EPA commented that they would like to see the language to be added, as well as any comments that were made by Ecology.

4. North Slope Status -- RL met with the Department of Fish and Wildlife to draft a tolling agreement on two waste sites. The discussion held between these two parties included the sampling of the top 2 inches of soil and then using capping as the alternative for remedial action at the site.

   EPA and Ecology questioned RL, asking if it was supposed to be in relation to **12** sites. RL stated they would clarify the number of sites, as they thought that the agreement was for the H-06 and the horseshoe sites only (per an RL meeting with RL's legal department). RL is not doing a sampling and analysis plan for this work, and the work is not linked to the Tri-Party Agreement. EPA stated that a recent letter on this subject needs to be reviewed. EPA and Ecology stated that they want to be notified whether it is **2** or **12** sites and which scoping document will be used for the sampling.

100 Area Remedial Action

1. Updated Potential-to-Emit Calculations, Meeting with DOE, Other Related Items -- BHI performed additional calculations at 100-D and 100-H and needs to go over the new potentials to emit. A meeting time will be set for early February for BHI to discuss this issue with WDOH and Ecology.

2. 116-C-1 Closeout Verification Package -- The package was brought into the UMM by BHI for RL and EPA sign off. Both parties signed off (see Attachment #4 for copy of signed Waste Site Reclassification form from the package), and copies will be provided to the Administrative Record, regulators, and RL. RL will send copies out to the tribes.

   A handout was provided by BHI listing the upcoming FY 1999 closeout verification package schedule for 100 Area sites (Attachment #5).

3. Summary Status of Cr^{+6} Remediation at 100-B/C and 100-D Sites, with Kd Test Plan -- At the 116-C-5, remediation was started in six sample areas. In one area, fast turnaround sampling was performed at 0.5 meter. One sample analysis result has been returned to date. Discussion ensued on this topic. Also, new excavation was started at D-7. BHI is currently waiting for further sample results to come back from the laboratory.

   The sampling results came back from B-11. EPA stated that they have the results from the split samples they obtained from B-14 and will send the results to BHI.

   Full protocol sampling has been started at DR-9 for all contaminants. It should soon be known if there is a Cr^{+6} problem at that site.

   Discussion ensued on performing borehole sampling at each of the reactor areas. BHI will prepare a detailed schedule and plan for the proposed borehole sampling and forward it to Ecology by February 25. BHI would like to begin as soon as EPA and Ecology concur with the plan (hopefully in April 1999).

A radiological vadose zone plume has been discovered near B-1 in the shallow zone. BHI stated that they would like to leave the plume for now, closeout the site, and pick the plume remediation up during the pipeline remediation in the year 2001. Discussion then ensued on whether plume remediation should occur now or if it can be postponed until the pipeline remediation. RL suggested holding a meeting for BHI, RL, and EPA in the 100-B/C Area so EPA can get a better look at the site. Also, a meeting will be set up to discuss the walkdown to shut down the air monitors.

4. 100-H, Group 4 Sample Startup Status -- BHI will be awarding the subcontract to start the work today. EPA stated that they believe the milestone for this work will be recoverable. The ROD, SAP, and other necessary documentation are all in place for the 100-H Group 4 sites. BHI said that they will be ready to start remediation work likely in early February, and the subcontractor will be geared to start in late February. A readiness assessment will be performed in March, and the second and third weeks in March will involve the startup for removing overburden. 100-H-7 is the first site that will be excavated, and the precedence has been set for lead contamination at this site to be sent to the ERDF.

   RL stated that Dyncorp wants the 100-H-24 site to be redesignated to BHI for remediation.

5. Split Samples and Significant Figures -- Data Review -- BHI is currently dealing with the issue of split sampling and provided a handout (see Attachment #6). The handout describes the "procedure" for how split sampling will be performed. BHI also provided a handout on significant digits (see Attachment #7) in relation to this topic.

   Discussion ensued on this topic. Ecology does not believe that there is a need to use the "newly presented" methodology with significant digits, stating that the "old" methodology is fine for use with the use of conservatively rounding up the numbers.

   A new proposed PCB cleanup standard was discussed (see Attachment #8 for related calculation summary) in relation to the revision of the RDR. Discussion ensued. BHI would like to change the PCB standard to 0.5 in the next revision of the RDR. EPA and Ecology said they would discuss the issue and would provide BHI with a formal response.

   Discussion then ensued on the upcoming revisions to the other 100 Area documents (e.g., SAPs and RDR/RAWPs). The 100 Area SAP revision will cover Group 5 RTD. The 100 Area RDR/RAWP will be revised to include all Group 5 RTD and surveillance and maintenance legacy waste. The CSE SAP will be separate and an entirely different document. Also, the 100-NR-1 SAP and the 100-NR-1 RDR/RAWP will be entirely separate documents. Discussion ensued on legacy waste. EPA said that the ROD should be issued first, then the design document, and then the SAP. EPA recommended developing a stand-alone sampling plan. Work can begin when the SAP is approved, and then work can begin on the RDR/RAWP. It was discussed not to put the standing legacy waste in the 100 Area SAP, and to instead put it in the 100 Area RDR/RAWP, and EPA and Ecology agreed.

   The air monitoring plan and the set up of air monitoring stations were discussed. These items will be addressed in the SAP. Further discussion ensued on this topic. RL and EPA stated that they did not understand why the 100-N Area would need to have an individual, specific SAP and RDR/RAWP. Ecology responded that the separate, specific SAP and RDR/RAWP were necessary for the 100-N Area because the permit condition

was worded that way. RL stated that they want one document for all of the 100 Areas, and the 100-N Area could be a separate appendix in the RDR/RAWP. This topic will be discussed again at a future UMM.

6. Remaining Sites ROD -- Confirmatory Sampling Efforts -- A handout was provided on the Remaining Sites strategy (Attachment #9). EPA said that the information in the handout was exactly what they had wanted to see. EPA stated that the schedule and milestones should be discussed soon (likely within the next month). This topic will be discussed at an upcoming UMM.

MEETING MINUTES
REMEDIAL ACTION AND WASTE DISPOSAL
UNIT MANAGERS' MEETING -- 200 AREA
January 21, 1999

Attendees: See Attachment #2b.

Agenda: See Attachment #1b.

Topics of Discussion:

200 Area UMM Structure

1. It was proposed to move the 200 Area UMM time from 3:00 p.m. to 8:00-10:00 a.m. to allow for more time to discuss agenda items and the change in the time was agreed upon.

2. It was proposed that the 200 Area UMM be combined to cover groundwater remediation activities, operable unit-specific assessment activities, and RCRA groundwater monitoring associated with the 200 Area. The issue was discussed and agreed upon.

Overview of 200 Area RCRA Groundwater Monitoring

1. Status Brief on Monitoring Activities Related to 216-U-12 Crib – PNNL provided a presentation (Attachment #10) on the status of RCRA groundwater monitoring activities at the 216-U-12 crib. Ongoing of trending of data will continue, and monitoring is in interim status now, with closeout scheduled for the year 2003. Six wells are currently being monitored. The compliance issue regarding the water level in these six wells was discussed and how this can be dealt with.

200 Area RI/FS Implementation Plan

1. Status of Public Review – RL stated that they had received a package of all comments that have been provided by the public to date. Comments have not been received from the Yakama Tribe yet. RL would like to try to target a time to meet up with the regulators to discuss the comments and then set up another meeting at a later date to resolve the comments and develop comment responses.

200-CS-1 Chemical Sewer Waste Group

1. Review Upcoming DQO Schedule – Schedules were handed out (Attachment #11) for the DQOs for 200-CS-1 and 200-CW-1. Ecology will review the schedules and will discuss their comments at a later date.

   The 200-CW-1 DQO workbook is done and is currently being distributed. RL will transmit copies to Ecology early next week.

200-BP-1 Operable Unit

1. Prototype Barrier Closeout – Debmobilization was postponed until spring. Two tests remain to be performed in the year 2000. RL asked if EPA is continuing to seek funding to continue the barrier monitoring, and discussion ensued on this topic. RL is checking on the cost every 6 months, which is the minimum perspective to see if there has been any activity. RL would like to meet with EPA to discuss and resolve this issue.

MEETING MINUTES
REMEDIAL ACTION AND WASTE DISPOSAL
UNIT MANAGERS' MEETING -- 300 AREA
January 21, 1999

Attendees: See Attachment #2c.

Agenda: See Attachment #1c.

Topics of Discussion:

300-FF-2 Operable Unit

1. Waste Site Categorization – BHI is finished with six of the eight groups of sites. Meetings are being held and it is hoped that categorization will be finished the first part of February if all goes according to schedule.

   BHI discussed the packages that are ready for RL/EPA review and discussed the schedule of when other packages will be available for review.

   For the SID-2 sites, there are currently no RCRA sites involved. RL will meet with Ecology next week to discuss the WIDS site closures.

2. 300-FF-2 Feasibility Study Status – RL met with the ER Team to discuss ER's draft outline and potential issues. RL discussed the draft agenda and indicated potential items/issue that could possibly be discussed with the regulators. A tentative meeting date was set for next week for RL, BHI, and regulators to discuss the 300-FF-2 feasibility study.

   BHI discussed the remedial action project schedule that highlights regulator review dates for 100 and 300 Area workscope. It was decided that a separate schedule for the 300 Area (including both 300-FF-1 and 300-FF-2) would be provided at a future UMM.

3. Other – Alex Stone (Ecology) said that the email addresses for Ecology will be changing, so any future email correspondence to Ecology staff should be sent to the Ecology email address. An organization chart for Ecology's 300 Area management structure was handed out (Attachment #12).

300-FF-1 Operable Unit

1. North Process Pond Remediation Status – North Pond remediation is nearly complete. An additional plume was found under the old haul road, which added approximately one and a half weeks to the schedule (+1,000 tons extra). The primary haul will soon be shifted to the South Pond. All cleanup standards at the North Pond have been met at this point in time.

   A green spot (indicating potential contamination) was found in one of the ditches, and BHI excavated the spot to 25 ft below grade. Material was collected and the sample results came back at below 25 pCi/g. The spot has been cleaned up.

BHI would like to discuss with EPA the unanticipated contamination areas that have been found and would like to revisit random sample locations based on initial remedial assessment when ready to begin closeout verification sampling.

2. South Process Pond Remediation Strategy – South Pond excavation has begun and stockpiles are being created; however, hauling has not started to date. BHI stated that the timing of shipment of containers has shifted.

   The strategy to remove the dikes was discussed (Attachment #13). Large volumes of material will need to be moved to reach the contamination. BHI discussed using a strategy to "peel off" the overburden to reach the contamination rather than removing the entire dike. BHI said that this "new" strategy will require moving less soils and will lower the cost, while still being able to remove all of the contamination. Also, in regard to the pipelines, the pipelines can be removed now since the filter backwash pond is going to be taken out of service (the 300 Area is tapping into the City of Richland for water supply). The new strategy would involve remediating from inside of the dike to the outside, and when pipelines are encountered, the decision would be made whether to reroute the pipes. BHI stated that the new strategy worked well on the east and south banks of the North Pond, and it believed that the new strategy would be optimal to use at the South Process Pond as well.

   BHI asked for concurrence on this new strategy from RL and EPA. EPA and RL said that the new strategy sounded like a good idea, but one anomaly in test data set #2 made them hesitant to wholesale agree to the new approach. RL asked for BHI to show the results from the radiological control technicians' field screening surveys using this new strategy, then it will be determined if this new approach will be approved to complete remediation of the Sound Pond dike excavation.

   EPA and RL asked to be kept closely informed on this remediation work. Some flexibility will be granted to BHI initially and a final determination will be made after excavation is underway.

3. Landfill 1D Lead-Contaminated Soils Waiver – RL discussed the Landfill 1D lead-contaminated soil waiver at a meeting with upper management. Options for dealing with this issue were discussed. RL stated that if EPA will give an approval for the variance, then sending the soil to ERDF would be approved. EPA and RL will continue to discuss this issue.

4. Disposal of Liquid Wastes at ETF – EPA will need to confirm with Ecology about the disposal of liquid wastes at the ETF. BHI questioned if the ETF was an approved offsite facility for CERCLA waste that is approved by EPA. Discussion continued regarding the need for Landfill 1D documentation. EPA stated that the general consensus was to look at each waste stream individually.

5. Tanker Spill Area Closeout – BHI has prepared a strategy for handling closeout of the tanker spill area (Attachment #14). BHI asked for RL and EPA concurrence on the proposed strategy. BHI is proposing to obtain two samples and average the results, using the RESRAD model.

6. TPA Milestone Revision – Discussion ensued on pulling all burial grounds into a separate milestone. BHI discussed the schedule, stating that since revegetation cannot occur in the winter, the milestone for revegetation could be set in the spring, which would result in irrigating during the summer. Moving revegetation to the fall was also discussed.

7. Decontamination of Equipment – At the September 1998 UMM, the issue of decontamination of equipment was discussed. (Please see the September 1998 UMM minutes for a complete discussion on this issue.) It was noted that one bulleted item was mistakenly omitted from the discussion on this topic, which includes the following item:

   - ***Equipment Decontamination Procedures**: Equipment decontamination procedures were discussed and a draft agreement is attached [see September 1998 UMM minutes for this attachment]. EPA indicated that the proposed equipment decontamination procedure is acceptable for the 300-FF-1 project.*

   EPA and RL agreed with adding the above to this current meeting minutes.

Waste Site Reclassification Form

Date Submitted: 6/15/98 **Originator:** F. M. Corpuz **Phone:** 373-1661	**Operable Unit(s):** 100-BC-1 **Waste Site ID:** 116-C-1 Process Effluent Trench **Type of Reclassification Action:** Rejected ☐ **Closed Out X** No Action ☐	**Control Number:** 98-012 **Lead Agency:** EPA

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the NPL of no action or closed-out sites will occur at a future date.

Description of current waste site condition:

Remedial action at this site has been performed in accordance with remedial action objectives and goals established by the U.S. Environmental Protection Agency and the Washington State Department of Ecology, in concurrence with the U.S. Department of Energy, Richland Operations Office. The selected remedial action was (1) excavating the site to the extent required to meet specified soil cleanup levels, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility (ERDF) at the 200 Area of the Hanford Site, and (3) backfilling the site with clean soil to adjacent grade elevations. The excavation, disposal, and backfill activities have been completed. The site has been revegetated.

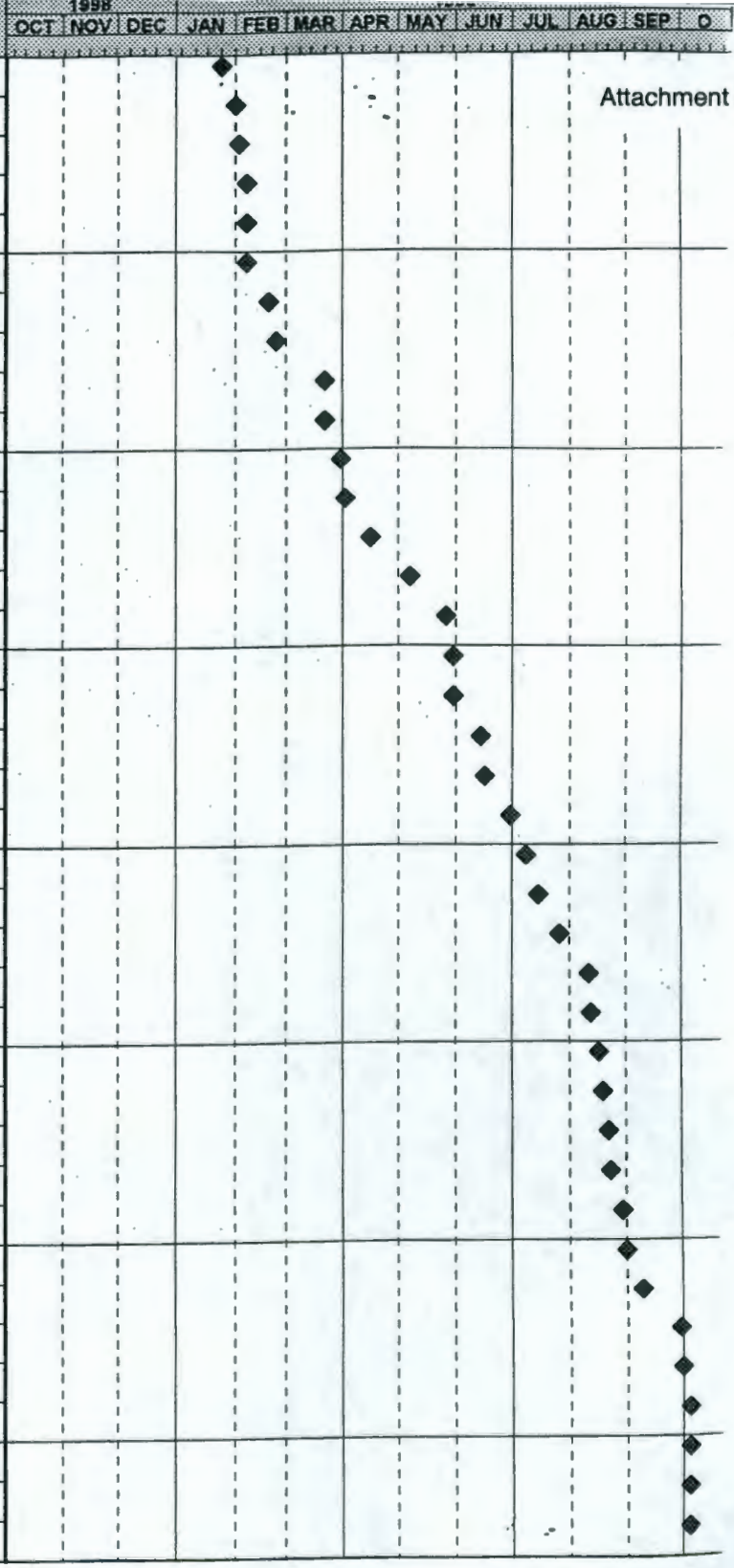
Basis for reclassification:

The 116-C-1 Process Effluent Trench has been remediated to meet the cleanup standards specified in *the Interim Action Record of Decision for the 100-B/C-1, 100-DR-1, and 100-HR-1 Operable Units* (EPA 1995), and *the Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 1998b). The basis for reclassification is described in detail in the attached Cleanup Verification Package for the 116-C-1 Process Effluent Trench.

Glenn I. Goldberg DOE Project Manager	Signature	1/21/99 Date
N/A Ecology Project Manager	Signature	Date
Dennis Faulk EPA Project Manager	Signature	1-21-99 Date

Attachment 5

Activity Description	Ver Pkg	Early Start
EG REVIEW OF VERIFICATION PACKAGE / 107-D2	V	25JAN99*
EG REVIEW OF VERIFICATION PACKAGE / 107-D3	V	01FEB99*
EG REVIEW OF VERIFICATION PACKAGE / 116-C-1	V	04FEB99*
EG REVIEW OF VERIFICATION PACKAGE / 107-D1	V	08FEB99*
INAL DRAFT ROD / TSD TO REG		08FEB99*
INAL DRAFT ROD / 100-NR- 1/2 TO REG		08FEB99*
EGULATOR APPROVAL TO BACKFILL / 1607-D2		19FEB99*
RAFT A FFS TO REG / 100 AREA BURIAL GROUNDS		24FEB99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-13	V	22MAR99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-14	V	22MAR99*
SSUE ROD / 100 AREA REMAINING SITES		31MAR99*
EG REVIEW OF VERIFICATION PACKAGE / 1607-D2	V	02APR99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-11	V	16APR99*
EG REVIEW OF VERIFICATION PACKAGE / 1607-D2	V	07MAY99*
INAL FFS / 100 AREA BURIAL GROUNDS		26MAY99*
DR/RAWP REVISION REVIEW / GROUP 5		31MAY99*
SE SAP REVIEW / GROUP 5		31MAY99*
EG REVIEW OF VERIFICATION PACKAGE / 116-C-5	V	14JUN99*
RAFT A PROPOSED PLAN / 100 AREA BURIAL GROUNDS		17JUN99*
EG REVIEW OF VERIFICATION PACKAGE / 116-D-7	V	30JUN99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-1	V	09JUL99*
AP REVIEW / 100-NR-1 TSD SITES REMEDIAL DESIGN		15JUL99*
EG REVIEW OF VERIFICATION PACKAGE / 116-C-2B	V	27JUL99*
EG REVIEW OF VERIFICATION PACKAGE / 116-D-7	V	12AUG99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-6B	V	13AUG99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-16	V	17AUG99*
EG REVIEW OF VERIFICATION PACKAGE / 116-C-2C	V	19AUG99*
EG REVIEW OF VERIFICATION PACKAGE / 116-C-2A	V	23AUG99*
EV 0 PROPOSED PLAN / 100 AREA BURIAL GROUNDS		24AUG99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-6A	V	30AUG99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-12	V	01SEP99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-2	V	10SEP99*
EG REVIEW OF VERIFICATION PACKAGE / 116-DR-9	V	30SEP99*
DR/RAWP REVIEW / 100-NR-1 TSD SITES REM DESIGN		01OCT99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-4	V	05OCT99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-3	V	05OCT99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-10	V	05OCT99*
EG REVIEW OF VERIFICATION PACKAGE / 116-B-9	V	05OCT99*



Project Start 01OCT98
Project Finish 03APR00
Data Date 01OCT98
Run Date 21JAN99

Early Bar
Progress Bar
Critical Activity

REGR

Sheet 1 of 1

RA Regulator Review Dates

At the November UMM during discussion on split sampling BHI agreed to write up a procedure describing statistical tests used and how they would be implemented. What follows is a working draft of split sample guidance for inclusion in future revisions of the SAP.

New section II.5.4 for DOE/RL-96-22 (SAP)
SPLIT SAMPLES
Split samples will be collected at frequencies described in the Field Sampling Plan (FSP). Split samples may be collected by regulatory agencies at any time deemed appropriate by the agencies.

Verification split sample data (both Hanford and regulator data) will undergo data analysis to assist in determining verification data usability. The EPA Contract Laboratory program (CLP) duplicate sample comparison methodology *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review* (EPA 1994) will be used as an initial first test. Specifically:

A control limit of ±35% for the Relative Percent Difference (RPD) shall be used for samples greater than or equal to 5x the Contract Required Detection Limit (CRDL).

Or

A control limit of ± 2x CRDL shall be used if either the sample or a split sample value is less than 5x the CRDL. In a case where only one result is above the 5x CRDL level and the other is below, the ± 2x CRDL criteria applies. If both samples are less than detectable the RPD is not calculated.

If the data falls within one of the control limits listed above then the split data correlates well and no review is required. If the data does not fall within one of the control limits additional data review is required. A qualified person will review the split sample data in detail. This review will include detection levels, internal lab split and internal lab duplicate values, validation reports, and other data deemed relevant. A narrative will be written describing why the original data should (or should not) be used. This narrative text will be included in the cleanup verification package, and will be one of the elements reviewed by regulators prior to their approval of the cleanup verification package.

Reference:
EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013, U. S. Environmental Protection Agency, Washington, D. C.

VI. DUPLICATE SAMPLE ANALYSIS

A. **Review Items:** Form I-IN, Form VI-IN, instrument printouts, raw data.

B. **Objective:**

Duplicate sample determinations are used to demonstrate acceptable method precision by the laboratory at the time of analysis. Duplicate analyses are also performed to generate data in order to determine the long-term precision of the analytical method on various matrices.

C. **Criteria:**

1. Samples identified as field blanks cannot be used for duplicate sample analysis.

2. One duplicate sample must be prepared and analyzed from each group of samples with a similar matrix type (e.g., water, soil) and concentration (e.g., low, medium), or for each SDG. Duplicates cannot be averaged for reporting on Form I-IN.

   Note: Additional duplicate sample analyses may be required through Regional EPA or Project Officer request. Alternately, EPA may require that a specific sample be used for the duplicate sample analysis.

3. Duplicate sample analyses are required for percent solids determination.

4. If two analytical methods are used to obtain the reported values for the same element within a SDG (e.g., ICP and GFAA, or a soil and a water method), duplicate samples must be run by each method used.

5. A control limit of ± 20% for the Relative Percent Difference (RPD) shall be used for original and duplicate sample values greater than or equal to 5x the CRDL. The absolute value of the control limit (CRDL) shall be entered in the "Control Limit" column on Form VI-IN.

6. A control limit of ± the CRDL shall be used if either the sample or duplicate value is less than 5x CRDL. In the case where only one result is above the 5x the CRDL level and the other is below, the ± the CRDL criteria applies. If both samples values are less than the IDL, the RPD is not calculated of Form VI-IN

   Note: The control limits as specified above (±20% RPD and ± the CRDL) are **method requirements** for duplicate samples, regardless of the sample matrix type. However, it should be noted that laboratory variability arising from the sub-sampling of non-homogeneous soil samples is a common occurrence. Therefore, for **technical review purposes only**, Regional policy may allow the use of less restrictive criteria (e.g., ± 35% RPD, ± 2x the CRDL) to be assessed against duplicate soil samples.

from:
EPA 540/R-94/013

D. Evaluation:

1. Verify from the COVERPAGE-IN, Form VI-IN, and the raw data that the appropriate number of required duplicate samples were prepared and analyzed for the SDG.

2. Evaluate Form VI-IN and the raw data to verify that all duplicate results, for each analyte and method, fall within the established control limits.

3. Verify that the field blank was not used for duplicate analysis.

4. Check the raw data and recalculate one or more of the RPD values using the following equation to verify that the results have been correctly reported on Form VI-IN.

$$RPD = \frac{|S-D|}{(S+D)/2} \times 100$$

Where:

RPD	=	Relative Percent Difference
S	=	First Sample Value (original sample)
D	=	Second Sample Value (duplicate)

E. Action:

1. If the appropriate number of duplicate samples were not analyzed for each matrix, with the correct frequency, then the data reviewer should use professional judgement to determine if the associated sample data should be qualified. The reviewer may need to obtain additional information from the laboratory. The situation should then be recorded in the data review narrative, and noted for TPO action.

2. If the results from a duplicate analysis for a particular analyte fall outside the appropriate fixed control windows, qualify the results for that analyte in all associated samples of the same matrix as estimated (J).

3. It should be noted for TPO action if a laboratory uses a field blank for the duplicate sample analysis. All of the other QC data must then be carefully checked, and professional judgement exercised by the data reviewer when evaluating the data.

   Note: This information must be included on the IRDA form.

4. Whenever possible, the potential effects on the data due to out-of-control duplicate samples results should be noted in the data review narrative.

Designation: E 29 – 93a

Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications[1]

This standard is issued under the fixed designation E 29; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the Department of Defense. Consult the DoD Index of Specifications and Standards for the specific year of issue which has been adopted by the Department of Defense.

1. Scope

1.1 This practice is intended to assist the various technical committees in the use of uniform methods of indicating the number of digits which are to be considered significant in specification limits, for example, specified maximum values and specified minimum values. Its aim is to outline methods which should aid in clarifying the intended meaning of specification limits with which observed values or calculated test results are compared in determining conformance with specifications. Reference to this practice is valid only when a choice of method has been indicated, that is, either *absolute method or rounding method.*

1.2 This practice is intended to be used in determining conformance with specifications when the applicable ASTM specifications or standards make direct reference to this practice.

1.3 This practice describes two commonly accepted methods of rounding data, identified as the Absolute Method and the Rounding Method. In the application of this practice to a specific material or materials it is essential to specify which method is intended to apply. In the absence of such specification, reference to this practice, which expresses no preference as to which method should apply, would be meaningless. The choice of method is arbitrary, depending upon the current practice of the particular branch of industry or technology concerned, and should therefore be specified in the prime publication.

1.4 Section 7 of this practice gives guidelines for use in recording, calculating, and reporting the final result for test data.

2. Referenced Documents

2.1 *ASTM Standards:*

E 456 Terminology Relating to Quality and Statistics[2]

E 380 Practice for Use of the International System of Units (SI) (the Modernized Metric System)[2]

3. Terminology

3.1 *significant digit, n*—any of the figures 0 through 9, excepting leading zeros and some trailing zeros, which is used with its place value to denote a numerical quantity to some desired approximation.

3.1.1 The digit zero may either indicate a specific value or indicate place only. Zeros leading the first nonzero digit of a number indicate order of magnitude only and are not significant digits. For example, the number 0.0034 has two significant digits. Zeros trailing the last nonzero digit for numbers represented with a decimal point are significant digits. For example, the numbers 1270. and 32.00 each have four significant digits. The significance of trailing zeros for numbers represented without use of a decimal point can only be identified from knowledge of the source of the value. For example, a modulus strength, stated as 140 000 Pa, may have as few as two or as many as six significant digits.

3.1.2 To eliminate ambiguity, the exponential notation may be used. Thus, 1.40×10^5 indicates that the modulus is reported to the nearest 0.01×10^5 or 1000 Pa.

3.1.3 Use of appropriate SI prefixes is recommended for metric units to reduce the need for trailing zeros of uncertain significance. Thus, 140 kPa and 0.140 MPa each indicate that the modulus is reported to the nearest 1 kPa or 1000 Pa, while 140 kPa may again have two or three significant digits.

4. Expression of Numerical Requirements

4.1 The unqualified statement of a numerical limit, such as "2.50 in. max," cannot, in view of different established practices and customs, be regarded as carrying a definite operational meaning concerning the number of digits to be retained in an observed or a calculated value for purposes of determining conformance with specifications.

4.2 *Absolute Method*—In some fields, specification limits of 2.5 in. max, 2.50 in. max, and 2.500 in. max are all taken to imply the same absolute limit of exactly two and a half inches and for purposes of determining conformance with specifications, an observed value or a calculated value is to be compared directly with the specified limit. Thus, any deviation, however small, outside the specification limit signifies nonconformance with the specifications. This will be referred to as the *absolute method.*

4.3 *Rounding Method*—In other fields, specification limits of 2.5 in. max, 2.50 in. max, 2.500 in. max are taken to imply that, for the purposes of determining conformance with specifications, an observed value or a calculated value should be rounded to the nearest 0.1 in., 0.01 in., 0.001 in., respectively, and then compared with the specification limit. This will be referred to as the *rounding method.*

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[1] This practice is under the jurisdiction of ASTM Committee E-11 on Quality and Statistics and is the direct responsibility of Subcommittee E11.10 on Sampling and Data Analysis.

Current edition approved March 15, 1993. Published May 1993. Originally published as E 29 – 40. Last previous edition E 29 – 93.

[2] *Annual Book of ASTM Standards*, Vol 14.02.

5. Absolute Method

5.1 *Where Applicable*—The absolute method applies where it is the intent that all digits in an observed value or a calculated value are to be considered significant for purposes of determining conformance with specifications. Under these conditions, the specified limits are referred to as absolute limits.

5.2 *How Applied*—With the absolute method, an observed value or a calculated value is not to be rounded, but is to be compared directly with the specified limiting value. Conformance or nonconformance with the specification is based on this comparison.

5.3 *How Expressed*—This intent may be expressed in the standard in one of the following forms:

5.3.1 If the absolute method is to apply to all specified limits in the standard, this may be indicated by including the following sentence in the standard:

For purposes of determining conformance with these specifications, all specified limits in this standard are absolute limits, as defined in ASTM Practice E 29, for Using Significant Digits in Test Data to Determine Conformance with Specifications.

5.3.2 If the absolute method is to apply to all specified limits of some general type in the standard (such as dimensional tolerance limits), this may be indicated by including the following sentence in the standard:

For purposes of determining conformance with these specifications, all specified (dimensional tolerance) limits are absolute limits, as defined in ASTM Practice E 29, Using Significant Digits in Test Data to Determine Conformance with Specifications.

5.3.3 If the absolute method is to apply to all specified limits given in a table, this may be indicated by including a footnote with the table as follows:

Capacity mL	Volumetric Tolerance[A] ± mL
10	0.02
25	0.03
50	0.05
100	0.10

[A] Tolerance limits specified are absolute limits as defined in ASTM Practice E 29, for Using Significant Digits in Test Data to Determine Conformance with Specifications.

6. Rounding Method

6.1 *Where Applicable*—The rounding method applies where it is the intent that a limited number of digits in an observed value or a calculated value are to be considered significant for purposes of determining conformance with specifications.

6.2 *How Applied*—With the rounding method, an observed value or a calculated value should be rounded by the procedure prescribed in 4.3 to the nearest unit in the designated place of figures stated in the standard, as, for example, "to the nearest kPa," "to the nearest 10 ohms," "to the nearest 0.1 percent," etc. The rounded value should then be compared with the specified limit, and conformance or nonconformance with the specification based on this comparison.

6.3 *How Expressed*—This intent may be expressed in the standard in one of the following forms:

6.3.1 If the rounding method is to apply to all specified limits in the standard, and if all digits expressed in t specification limit are to be considered significant, this m be indicated by including the following statement in t standard:

The following applies to all specified limits in this standard: F purposes of determining conformance with these specifications, observed value or a calculated value shall be rounded "to the near unit" in the last right-hand digit used in expressing the specificati limit, in accordance with the rounding method of ASTM Practice E for Using Significant Digits in Test Data to Determine Conformar with Specifications.

6.3.2 If the rounding method is to apply only to t specified limits for certain selected requirements, this may indicated by including the following statement in the sta dard:

The following applies to specified limits for requirements on (ten strength), (elongation), and (. . .) given in . . ., (applicable secti number and title) and (. . .) of this standard: For purposes of det mining conformance with these specifications, an observed value o calculated value shall be rounded to the nearest 1kPa for (ten strength), to the nearest (1 percent) for (elongation), and to the nea (. . .) for (. . .) in accordance with the rounding-off method of AS Practice E 29 Using Significant Digits in Test Data to Determ Conformance with Specifications.

6.3.3 If the rounding method is to apply to all specif limits in a table, this may be indicated by a note in manner shown in the following examples:

6.3.3.1 *Example 1*—Same significant digits for all iten

	Chemical Composition % mass
Copper	4.5 ± 0.5
Iron	1.0 max
Silicon	2.5 ± 0.5
Other constituents (magnesium + zinc + manganese)	0.5 max
Aluminum	remainder

NOTE 1—For purposes of determining conformance with specifications, an observed value or a calculated value shall be rou to the nearest 0.1 percent, in accordance with the rounding meth ASTM Practice E 29, for Using Significant Digits in Test Da Determine Conformance with Specifications.

6.3.3.2 *Example 2*—Significant digits not the same fc items: similar requirements:

	Chemical Composition, % mass	
	min	max
Nickel	57	...
Chromium	14	18
Manganese	...	3
Silicon	...	0.40
Carbon	...	0.25
Sulfur	...	0.03
Iron	remainder	

NOTE 2—For purposes of determining conformance with specifications, an observed value or a calculated value shall be ro "to the nearest unit" in the last right-hand significant digit u expressing the limiting value, in accordance with the rounding n of ASTM Practice E 29, Using Significant Digits in Test D Determine Conformance with Specifications.

6.3.3.3 *Example 3*—Significant digits not the same items: dissimilar requirements:

	Tensile Requiremen
Tensile strength, psi	60 000 to 72 000
Yield point, min, psi	33 000
Elongation in 2 in., min %	22

NOTE 3—For purposes of determination of conformance with these specifications, an observed value or a calculated value shall be rounded off to the nearest 1000 psi for tensile strength and yield point and to the nearest 1 percent for elongation, in accordance with the rounding method of ASTM Practice E 29 for Using Significant Digits in Test Data to Determine Conformance with Specifications.

6.4 *Rounding Procedure*—The actual rounding procedure[3] shall be as follows:

6.4.1 When the digit next beyond the last place to be retained is less than 5, retain unchanged the digit in the last place retained.

6.4.2 When the digit next beyond the last place to be retained is greater than 5, increase by 1 the digit in the last place retained.

6.4.3 When the digit next beyond the last place to be retained is 5, and there are no digits beyond this 5, or only zeros, increase by 1 the digit in the last place retained if it is odd, leave the digit unchanged if it is even. Increase by 1 the digit in the last place retained, if there are digits beyond this 5.

6.4.4 This rounding procedure may be restated simply as follows: When rounding a number to one having a specified number of significant digits, choose that which is nearest. If two choices are possible, as when the digits dropped are exactly a 5 or a 5 followed only by zeros, choose that ending in an even digit. Table 1 gives examples of applying this rounding-off procedure.

6.5 The rounded value should be obtained in one step by direct rounding of the most precise value available and not in two or more successive roundings. For example: 89 490 rounded to the nearest 1 000 is at once 89 000; it would be incorrect to round first to the nearest 100, giving 89 500 and then to the nearest 1 000, giving 90 000.

6.6 *Special Case, Rounding to the Nearest 50, 5, 0.5, 0.05, etc.*—If in special cases it is desired to specify rounding to the nearest 50, 5, 0.5, 0.05, etc., this may be done by so indicating in the standard. In order to round to the nearest 50, 5, 0.5, 0.05, etc., double the observed or calculated value, round off to the nearest 100, 10, 1.0, 0.10, etc., in accordance with the procedure in 6.4, and divide by 2. For example, in rounding 6 025 to the nearest 50, 6 025 is doubled giving 12 050 which becomes 12 000 when rounded to the nearest 100 (6.4.3). When 12 000 is divided by 2, the resulting number, 6 000, is the rounded value of 6 025. In rounding 6 075 to the nearest 50, 6 075 is doubled giving 12 150 which becomes 12 200 when rounded to the nearest 100 (6.4.3). When 12 200 is divided by 2, the resulting number, 6 100, is the rounded value of 6 075.

7. Guidelines for Retaining Significant Figures in Calculation and Reporting of Test Results

7.1 *General Discussion*—Rounding test results avoids a misleading impression of precision while preventing loss of information due to coarse resolution. Any approach to retention of significant digits of necessity involves some loss of information; therefore, the level of rounding should be carefully selected considering both planned and potential uses for the data. The number of significant digits must, first, be adequate for comparison against specification limits (see 6.2). The following guidelines are intended to preserve the data for statistical summaries. For certain purposes, such as where calculations involve differences of measurements close in magnitude, and for some statistical calculations, such as paired t-tests, autocorrelations, and nonparametric tests, reporting data to a greater number of significant digits may be advisable.

TABLE 1 Examples[A] of Rounding

Specified Limit	Observed Value or Calculated Value	To Be Rounded to Nearest	Rounded Value to be Used for Purposes of Determining Conformance	Conforms with Specified Limit
Yield point, 36 000 psi, min	35 940	100 kPa	35 900	no
	35 950	100 kPa	36 000	yes
	35 960	100 kPa	36 000	yes
Nickel, 57 %, mass, min	56.4	1 %	56	no
	56.5	1 %	56	no
	56.6	1 %	57	yes
Water extract conductivity, 40 ms/m, max	40.4	1 ms/m	40	yes
	40.5	1 ms/m	40	yes
	40.6	1 ms/m	41	no
Sodium bicarbonate 0.5 %, max, dry mass basis	0.54	0.1 %	0.5	yes
	0.55	0.1 %	0.6	no
	0.56	0.1 %	0.6	no

[A] These examples are meant to illustrate rounding rules and do not necessarily reflect the usual number of digits associated with these test methods.

7.2 *Recording Test Data*—When recording direct measurements, as in reading marks on a buret, ruler, or dial, all digits known exactly, plus one digit which may be uncertain due to estimation, should be recorded. For example, if a buret is graduated in units of 0.1 mL, then an observation would be recorded as 9.76 mL where it is observed between 9.7 and 9.8 marks on the buret, and estimated about six tenths of the way between those marks. When the measuring device has a vernier scale, the last digit recorded is the one from the vernier.

7.2.1 The number of significant digits given by a digital display or printout from an instrument should be greater than or equal to those given by the rule for reporting test results in 7.4 below.

7.3 *Calculation of Test Result from Test Data*—When calculating a test result from test data, avoid rounding of intermediate quantities. As far as is practicable with the calculating device or form used, carry out calculations with the test data exactly and round only the final result.

7.4 *Reporting Test Results*—A suggested rule relates the significant digits of the test result to the precision of the measurement expressed as the standard deviation σ. The applicable standard deviation is the repeatability standard deviation (see Terminology E 456). Test results should be round to not greater than 0.5 σ nor less than 0.05 σ, provided that this value is not greater than the unit specified in the specification (see 6.2). When only an estimate, s, is available for σ, s may be used in place of σ in the preceding sentence.

Example: A test result is calculated as 1.45729. The standard deviation of the test method is estimated to be, 0.0052. Round to 1.457 or the nearest 0.001 since this rounding unit, 0.001, is between 0.05 σ = 0.00026 and 0.5 σ = 0.0026.

NOTE 4—A rationale for this rule is derived from representing the standard deviation of a rounded test result by $\sqrt{\sigma^2 + w^2/12}$ where σ is

[3] The rounding-off procedure given in this practice is the same as the one given in the *ASTM Manual 7 on Presentation of Data and Control Chart Analysis.*

the standard deviation of the unrounded test result. The quantity $w/\sqrt{12}$ is the standard deviation of an error uniformly distributed over the range w. Rounding so that w is below 0.5 σ ensures that the standard deviation is increased by at most 1 %, while adding more digits would give a misleading impression of precision.

7.4.1 When no estimate of the standard deviation σ is known, then rules for retention of significant digits of computed quantities may be used to derive a number of significant digits to be reported, based on significant digits of test data.

7.4.1.1 The rule when adding or subtracting test data is that the result shall contain no significant digits beyond the place of the last significant digit of any datum.

Examples:

(*1*) 11.24 + 9.3 + 6.32 = 26.9, since the last significant digit of 9.3 is the first following the decimal place.

(*2*) 26.9 is obtained by rounding the exact sum, 26.86, to this place of digits.

(*3*) 926 − 923.4 = 3

140 000 + 91 460 = 231 000 when the first value was recorded to the nearest thousand.

7.4.1.2 The rule when multiplying or dividing is that the result shall contain no more significant digits than the value with the smaller number of significant digits.

Examples:

(*1*) 11.38 × 4.3 = 49, since the factor 4.3 has two siginificant digits

(*2*) (926 − 923.4)/4.3 = 0.6 Only one figure is significant since the numerator difference has only one significant digit.

7.4.1.3 The rules for logarithms and exponentials are: Digits of $ln(x)$ or $\log_{10}(x)$ are significant through the n-th place after the decimal when x has n significant digits. The number of significant digits of e^x or 10^x is equal to the place of the last significant digit in x after the decimal.

Examples: $ln(3.46) = 1.241$ to three places after the decimal, since 3.46 has three significant digits. $10^{3.46} = 2900$ has two significant digits, since 3.46 is given to two places after the decimal.

7.4.1.4 The rule for numbers representing exact counts or mathematical constants is that they are to be treated as having an infinite number of significant digits.

Examples:

(*1*) 1 − 0.23/2 = 0.88 where the numbers 1 and 2 are exact and 0.23 is an approximate quantity.

(*2*) A count of 50 pieces times a measured thickness 0.124 mm is 50 × 0.124 = 6.20 mm, having three significant figures.

(*3*) A measurement of 1.634 in. to the nearest thousandth, is converted to mm. The result, 1.634 × 25.4 = 41.50 mm, has four significant digits. The conversion constant, 25.4, is exact.

NOTE 5—More extensive discussion of dimensional conversion can be found in Practice E 380.

7.5 *Specification Limits*—When the rounding method is to apply to given specified limits, it is desirable that the significant digits of the specified limits should conform to the precision of the test following the rule of 7.3. That is, the rounding unit for the specification limits should be between 0.05 and 0.5 times the standard deviation of the test.

7.6 *Averages and Standard Deviations*—When reporting the average and standard deviation of replicated measurements or repeated samplings of a material, a suggested rule for most cases is to round the standard deviation to two significant digits and round the average to the same last place of significant digits. When the number of observations is large (more than 15 when the lead digit of the standard deviation is 1, more than 50 with lead digit 2, more than 100 in other cases), an additional digit may be advisable.

7.6.1 Alternative approaches for averages include reporting $\bar{x}$ to within 0.05 to 0.5 times the standard deviation of the average $\sigma/\sqrt{n}$, or applying rules for retaining significant digits to the calculation of $\bar{x}$. ASTM Manual 7 provides methods for reporting $\bar{x}$ and s for these applications.[3]

NOTE 6—A rationale for the suggested rule comes from the uncertainty of a calculated standard deviation s. The standard deviation of s based on sampling from a normal distribution with n observations is approximately $\sigma/\sqrt{2n}$. Reporting s to within 0.05 to 0.5 of this value, following the rule of 7.4, leads to two significant digits for most values of σ when the number of observations n is 100 or fewer.

Example: Analyses on six specimens give values of 3.56, 3.88, 3.95, 4.07, 4.21, and 4.47 for a constituent. The average and standard deviation, unrounded, are $\bar{x} = 4.0233\ldots$ and $s = 0.3089\ldots$. The suggested rule would report $\bar{x}$ and s as 4.02 and 0.31.

Bechtel Hanford, Inc.				*ERC TEAM*
ATTACHMENT 1 CALCULATION SUMMARY				
Originator	S. W. Clark		Date	1/18/99
Project	Revision of the RDR/RAWP for the 100 Area		Job No.	22192
Subject	PCB Cleanup Levels for Direct Soil Exposure			

Problem:
The cleanup levels for nonradioactive contaminants in near-surface soil at Hanford are presented in Table 2-1 of the Remedial Design Report/Remedial Action Work Plan for the 100 Area, (RDR/RAWP), DOE/RL-96-17, Rev. 1, May 1998, U.S. Department of Energy, Richland, Washington. The value presented for polychlorinated biphenyls (PCBs) is no longer correct because the U.S. Environmental Protection Agency (EPA) has revised the cancer potency factor for ingestion of PCBs. Based upon the formula for calculation of MTCA Method B soil cleanup levels presented in WAC 173-340-740(3)(a)(iii)(B) the cleanup level for PCBs in Table 2-1 of the RDR/RAWP should be increased to 0.5 mg/kg from its current listing of 0.13 mg/kg.

Given:
1) Revised cancer potency factor of 2.0 kg-day/mg based on EPA/600/P-96/001F and captured in the EPA Region III risk-based concentration tables available on the Internet at www.epa.gov.
2) Formula for calculation of MTCA Method B soil cleanup levels presented in WAC 173-340-740(3)(a)(iii)(B).
3) Current PCB cleanup level of 0.13 mg/kg in Table 2-1 of the RDR/RAWP.

Solution:
The calculation methodology is described in WAC 173-340-740(3)(a)(iii)(B). All input factors with the exception of the cancer potency factor are provided by WAC 173-340-740(3)(a)(iii)(B) and reproduced in Attachment 2. The data were entered into an EXCEL 97 spreadsheet (Attachment 3) and calculations performed creating formulae within the cells.

Results:
The revised cleanup value for PCBs to be presented in Table 2-1 of the RDR/RAWP is calculated to be 0.5 mg/kg.

The following is an index to the Attachments :

DRAFT

Attachment Number	Contents (Worksheets):	Topic:
1	This page	Explanation of problem, methodology
2	Equation, input parameters	Calculation of MTCA Method B Soil Cleanup Levels for PCBs
3	EXCEL 97 spreadsheet	Cleanup level calculation

DRAFT

ATTACHMENT 2

Calculation of MTCA Method B Soil Cleanup Levels for Polychlorinated Biphenyls (PCBs)

The MTCA Method B soil cleanup levels for hazardous substances that present an incremental cancer risk are calculated using the following formula [WAC 173-340-740(3)(a)(iii)(B)]:

$$\text{Soil Cleanup Level (mg/kg)} = \frac{\text{RISK x ABW x LIFE x UCF1}}{\text{CPF x SIR x AB1 x DUR x FOC}}$$

Where RISK = Acceptable cancer risk level (1 in 1,000,000 = 1E-06)
ABW = Average body weight over the period of exposure (16 kg)
LIFE = Lifetime (75 years)
UCF1 = Unit conversion factor (1,000,000 mg/kg)
CPF = the cancer potency (slope) factor with units of kg×day/mg (1/mg/kg/d).
[Values of the cancer potency factor are most easily obtained from the EPA Region 3 Risk-Based Concentration Tables available on the Internet at www.epa.gov. The CSF for ingestion for the most dangerous PCB congeners (Aroclor-1254 and Aroclor-1260) is 2.00 kg×day/mg.]
SIR = Soil ingestion rate (200 mg/day)
AB1 = Gastrointestional absorption rate (1.0)
DUR = Duration of exposure (6 years)
FOC = Frequency of contact (1.0)

Substituting these values in the equation above from MTCA, the Soil Cleanup Level (mg/kg) for Aroclor-1254 and Aroclor-1260 is:

$$SCL(mg/kg) = \frac{1E-06 \times 16(kg) \times 75(yr) \times 1E+06(mg/kg)}{2.00(kg \times day/mg) \times 200(mg/day) \times 1.0 \times 6(yr) \times 1.0} = 0.5(mg/kg)$$

DRAFT

DRAFT

			ATTACHMENT 3					
Calculation of MTCA Method B soil cleanup levels for PCBs using the formula from								
WAC 173-340-740(3)(a)(iii)(B)								
RISK	1E-06							
ABW	16	kg average body weight						
LIFE	75	years lifetime						
UCF1	1000000	mg/kg unit conversion factor						
CPF	2	kg-day/mg cancer potency slope factor						
SIR	200	mg/day soil ingestion rate						
AB1	1	gastrointestinal absoption rate						
DUR	6	years duration of exposure						
FOC	1	frequency of contact						
Soil cleanup level (mg/kg)= (RISK*ABW*LIFE*UCF1)/(CPF*SIR*AB1*DUR*FOC)								
Soil cleanup level (mg/kg)=		0.5						

DRAFT

Remaining Sites Strategy

Waste sites that share a common site profile will plug-in to the standard remedy if they require remedial action due to a risk to human health and the environment. For candidate remaining sites, insufficient information exists to determine whether contamination is above unacceptable levels. At these sites, sampling will be performed to determine contaminant types and concentrations. The general approach to sampling such a site will be documented in a governing sampling and analysis plan (SAP). Site-specific requirements will be developed on an as-needed basis and, following regulator approval, will be incorporated as appendices to the SAP. Judgmental verification samples (discrete samples) will typically be taken at sites where anomalous conditions prevail; randomly located composite samples will typically be taken at sites where non-anomalous conditions are found. A combination of judgmental and randomly located samples may be used if warranted. If contaminants are detected above unacceptable levels in the field, clean site verification sampling will be discontinued and the site will be re-categorized for plug-in to the selected remedy (remove, treat, and dispose [RTD]).

Based on results of the sampling and analysis effort, remedial action will be required for the following categories of remaining sites:

- Sites that contain radioactive contaminants in excess of 15 mrem/yr above natural background.

- Sites that contain chemical contaminants in excess of the cancer risk levels (one in one million for individual constituents and one in one hundred thousand total risk) or a hazard index of 1.

Statistical analyses of verification sample results will be consistent with the approach currently used at Hanford to verify adequacy of cleanup. Typically, the criteria for these evaluations include:

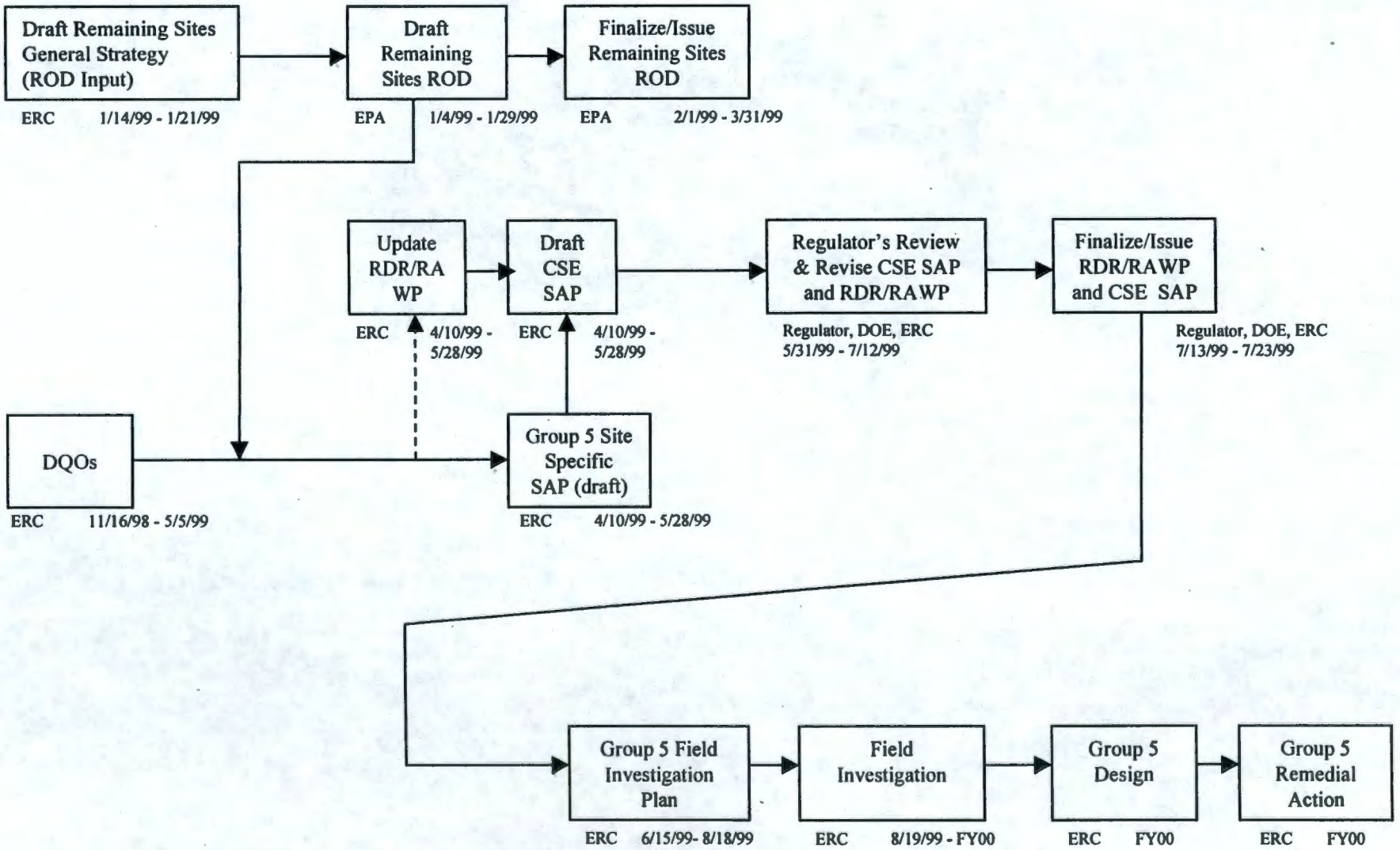
- For non-radioactive contaminants, a demonstration that the 95% upper confidence limit on the mean does not exceed the soil cleanup level, verification that no single soil concentration exceeds two times the soil cleanup level, and verification that less than ten percent of the samples exceed the soil cleanup level.

- For radioactive contaminants, demonstration through the use of RESRAD and comparison to National Bureau of Standards derived concentrations that the soil concentration limits meet the remedial action goals and 15 mrem/yr criteria.

On a site-specific basis, the sum of the ratios of contaminant concentrations to their corresponding MTCA B cleanup levels will be computed to demonstrate an acceptable risk level or compliance with the hazard index.

UMM 1/21/99

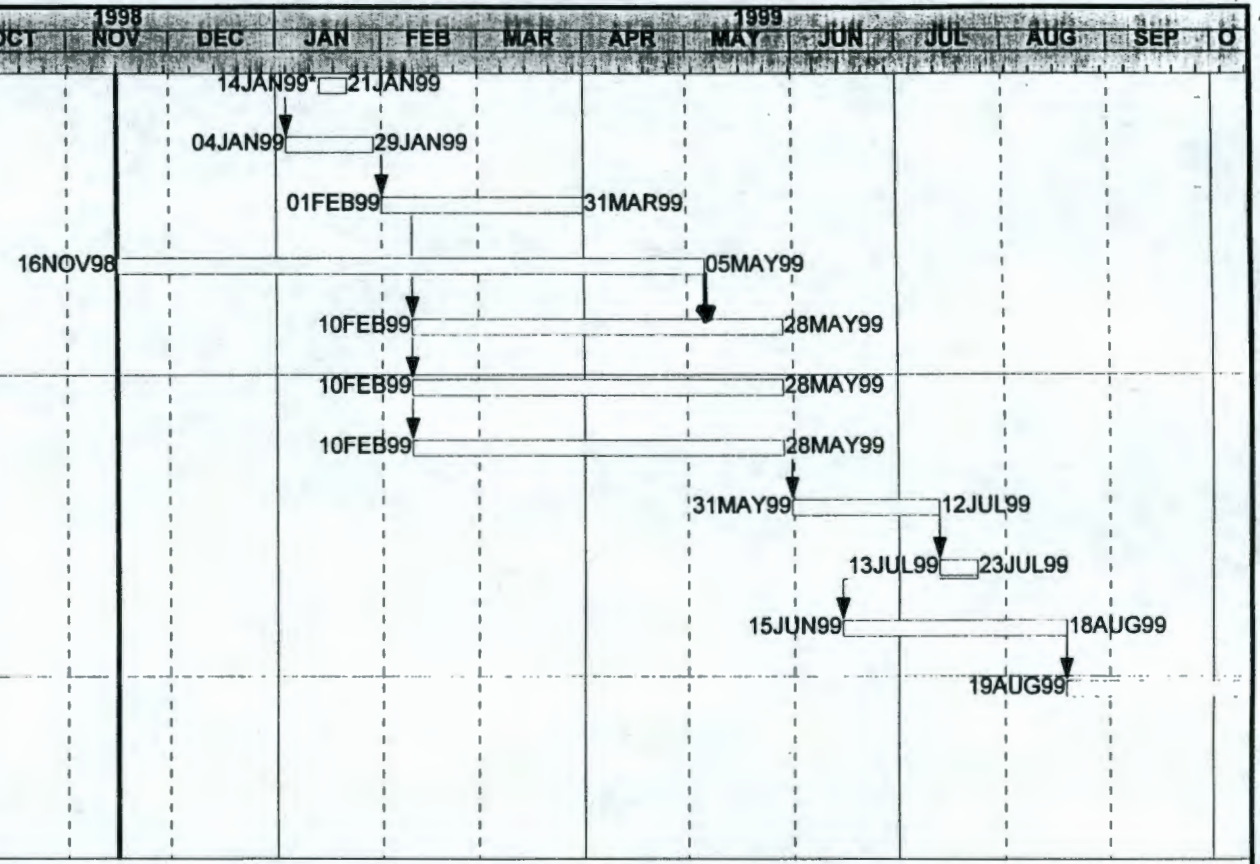
Block Diagram of Group 5 Major Activities



NOTE: 1) The duration (date) of activities is preliminary and subject to change.
2) Dates indicated are the completion dates of the activity.
3) RDR/RAWP and CSE SAP activities will start after draft of the Remaining Sites ROD is done by EPA.

Attachment 9

Activity ID	Activity Description
1000	DRAFT REMAINING SITES GENERAL STRATEGY (ROD INP)
1010	DRAFT REMAINING SITES ROD
1020	FINALIZE/ISSUE REMAINING SITES ROD
1100	DQO'S
1110	GROUP 5 SITE SPECIFIC SAP (DRAFT)
1200	UPDATE RDR/RA WP
1210	DRAFT CSE SAP
1220	REGULATOR'S REVIEW & REVISE CSE SAP AND RDR/RAWP
1230	FINALIZE/ISSUE RDR/RAWP AND CSE SAP
1240	GROUP 5 FIELD INVESTIGATION PLAN
1250	FIELD INVESTIGATION
1260	GROUP 5 DESIGN
1270	GROUP 5 REMEDIAL ACTION



1) The duration (date) of activities is preliminary and subject to change.
2) RDR/RAWP and CSE SAP activities will start after the draft of the Remaining Sites ROD is done by EPA.

Attachment 9

Project Start	16NOV98	Early Bar	GP5A	Sheet 1A of 1B
Project Finish	02FEB00	Progress Bar	GROUP 5 MAJOR ACTIVITIES	
Data Date	16NOV98		FY99	
Run Date	21JAN99			

RCRA GROUNDWATER MONITORING AT THE 216-U-12 CRIB

B.A. WILLIAMS
PACIFIC NORTHWEST NATIONAL LABORATORY

UNIT MANAGERS MEETING
January 21, 1999

Attachment 10

OVERVIEW

- **Located approximately 2,000 ft. south of the U Plant in the 200 West Area. The crib is an unlined, gravel–bottom, percolation crib 10 ft. x 100 ft., and 15 feet deep. (see page 7 and 8)**
  - **Replaced 216-U-8 Crib (~500 ft. north).**
- **Active life: April 1960 to 1972, and November 1981 to February 1988. Replaced in 1988 by 216-U-17 Crib (~1,000 ft. southeast of U Plant). (see page 9)**
- **Received process effluent from UO_3 Plant and 224-Building (Smith and Kasper, 1983).**
  - **1.5×10^8 L (3.96×10^7 gal) effluent disposed to the U-12 Crib from 1960 – 1987 (PNNL - 11574). (see page 9)**
  - **Received nitric acid solutions (pH < 2.5) containing a mixture of radionuclides dominated by uranium, strontium, and ruthenium.**

REGULATORY REQUIREMENTS

- **216-U-12 Crib is a *Resource Conservation and Recovery Act of 1976* (RCRA) interim status dangerous waste facility.**
- **Scheduled to be closed in 2003 under RCRA Final Status regulations (40 CFR 264) in accordance with provisions of the Hanford Site RCRA Facility Permit (DOE 1996a).**
- **Pacific Northwest National Laboratory (PNNL) conducts RCRA groundwater monitoring at the Crib for the U. S. Department of Energy (DOE) regulated under Washington Administrative Code (WAC) 173-303-400 [EPA Federal regulations 40 CFR 265, Subparts F through R].**

MONITORING HISTORY

- **RCRA detection groundwater-monitoring network established in 1990 and monitoring began in 1991. The groundwater-monitoring plan (WHC-SD-EN-AP-019) outlines the program to determine the crib's impact on the quality of groundwater in the uppermost aquifer. (see page 10)**
  - **Initial network consisted of four wells as required by 40 CFR 265.91**
    - **299-W22-43 as the upgradient (background) well**
    - **Wells 299-W22-40, 299-W22-41, and 299-W22-42 as the downgradient (point of compliance) wells.**
    - **Wells were completed as uppermost aquifer (Ringold Unit E Gravel) monitoring wells with 20 ft. screens [WAC 173-160].**

First Year – 1991-1992

- **Background levels for the contaminant indicator parameters were established in accordance with 40 CFR 265.92 between September 1991 until June 1992.**
- **Constituents included RCRA indicator parameters, drinking water standard parameters, groundwater quality parameters, and site specific constituents. (All wells were sampled at least once for the Appendix IX constituents).**

Following Years – 1993 -

- **Replicate averages, collected semi-annually after the first year, were compared against the critical mean for each indictor parameter.**

- **In January 1993, an interim-status groundwater quality assessment program was initiated because of significant exceedances above upgradient concentrations of specific conductivity (nitrate and calcium) in downgradient wells 299-W22-41 and 299-W22-42. (see page 11 and 12)**

MONITORING HISTORY (continued)

- *Interim Status Groundwater Quality Assessment Plan for the 216-U-12 Crib*, WHC-SD-EN-AP-108, was delivered to the Washington State Department of Ecology on February 2, 1993 (letter number 9300848).
  - The assessment plan proposed to determine whether the crib was the source of the contamination (Phase I) and if so, to determine the concentration, rate and extent of migration of the contaminant plumes (Phase II).
  - Monitoring network expanded to six wells in April 1993.
    - Wells 299-W22-22 and 299-W22-23 remediated (perforated 8-inch diameter carbon steel casing well designs - plugged back exposed sampling interval, and redeveloped and installed pumps).
    - Well 299-W22-22 added for source delineation (see page 10).
    - Well 299-W22-23 added as upgradient well supporting source identification (see page 10).
  - Quarterly sampling began 2nd quarter 1993 in accordance with the assessment plan [40 CFR 265.94(d)(4)].
  - A revised constituent list included constituents that support the assessment of groundwater quality (Table, page 16).
  - Current assessment monitoring network reduced to six wells, 299-W22-40, 299-W22-41, 299-W22-42, 299-W22-43, 299-W22-79, and 699-36-70A (see page 7 and 16)
    - Wells 299-W22-22 and 299-W22-23 dropped from the network during Phase II due to problems with excessive turbidity and declining water levels.
    - Well 699-36-70A drilled and added to the network in 1995 (35 ft. well screen) to support determination of rate and extent of migration of the contamination (see page 7).
    - Well 299-W22-79 drilled and added in 1998 (35 ft. well screen) as a replacement for 299-W22-42, which is going dry (see page 10).

MONITORING FINDINGS

- **May 1997, *Results of RCRA Groundwater Quality Assessment Program at the 216-U-12 Crib*, PNNL-11574, indicate that the 216-U-12 Crib is the source of elevated specific conductivity (nitrate and calcium), and technetium-99.**

- **The assessment indicates that nitrate and technetium-99 are still present in groundwater beneath the site, indicating continued drainage of vadose zone contamination into the groundwater (see page 12, 13, 17 and 18).**

- **The assessment results also indicate that tritium and iodine-129 are from an upgradient source most likely from past practice disposal of process condensate from the REDOX plant (see page 14, 15, 19, and 20).**

CURRENT STATUS

- **Based on results of the assessment investigation the site has remained in interim-status assessment monitoring because of continuing elevated levels of nitrate and technetium-99, relative to the facility background levels (see page 11, 12, and 13).**

- **Ongoing assessment objectives include:**

  - **Continued groundwater monitoring to determine trends in the groundwater contamination;**

  - **monitoring under interim-status assessment until a final status monitoring plan is implemented during closure of the facility.**

- **The State Department of Ecology and U. S. Environmental Protection Agency (EPA) determined in the interim remedial measure for the 200 UP-1 Operable Unit that nitrate and tritium will not be remediated at Hanford until practical treatment options are available.**

ISSUES

- **Well 299-W22-40 also going dry; not proposing that it be replaced (see page 21).**
- **RCRA Wells 299-W22-41 and 299-W22-43 will go dry in 1999 or early 2000, reducing the network to two downgradient wells, 299-W22-79 and 699-36-70A (see page 22 and 24).**
- **Two existing wells may be used as downgradient replacements but are currently not sampleable and do not meet WAC 173-160 requirements.**
- **No candidate upgradient wells near the crib.**
- **Need to establish appropriate monitoring network in light of existing conditions and future disposition (closure) of crib and groundwater contaminants.**

REFERENCES

40 CFR 264, Code of Federal Regulations, Title 40, Part 264, *Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities.*

40 CFR 265, Code of Federal Regulations, Title 40, Part 265, *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities.*

Maxfield, H. L. 1979. *Hanford – 200 Area Waste Sites.* RHO-CD-673, Rockwell Hanford Operations, Richland, Washington

PNNL-11574, Chou, C. J., and B. A. Williams. 1997. *Results of RCRA Groundwater Quality Assessment Program at the 216-U-12 Crib.* PNNL-11574. Prepared for the U. S. Department of Energy by Pacific Northwest National Laboratory, Richland, Washington.

Smith, R. M., and R. B. Kasper. 1983. *Serviceability of Cribs Affected by PUREX Startup.* PHO-HS-EV-18, Rockwell Hanford Operations, Richland, Washington

U. S. Department of Energy (DOE). 1996a. *Hanford Facility Dangerous Waste Permit Application General Information Portion.* DOE/RL-91-28, Rev. 2, Richland Operations Office, Richland, Washington.

WAC 173-160, State of Washington Department of Ecology, Washington Administrative Code Chapter 173-160, *Minimum Standards for Construction and Maintenance of Wells,* Olympia, Washington.

WAC 173-303-400, State of Washington Department of Ecology, Dangerous Waste Regulations, Washington Administrative Code Chapter 173-303-400, *Interim Status Facility Standards,* Olympia, Washington.

WHC-SD-EN-AP-108, Chou, C. J., and B. A. Williams. 1993. *Interim-Status Groundwater Quality Assessment Plan for the 216-U-12 Crib.* WHC-SD-EN-AP-108, Rev. 0. Westinghouse Hanford Company, Richland, Washington.

WHC-SD-EN-AP-019, Jensen, E. J., M. A. Chamness, S. M. Goodwin, S. H. Hall, and D. R. Newcomer, 1990. *Interim-Status Ground-water Monitoring Plan for the 216-U-12 Crib,* WHC-SD-EN-AP-019, Rev. 0, Prepared by Pacific Northwest Laboratory for Westinghouse Hanford Company, Richland, Washington.

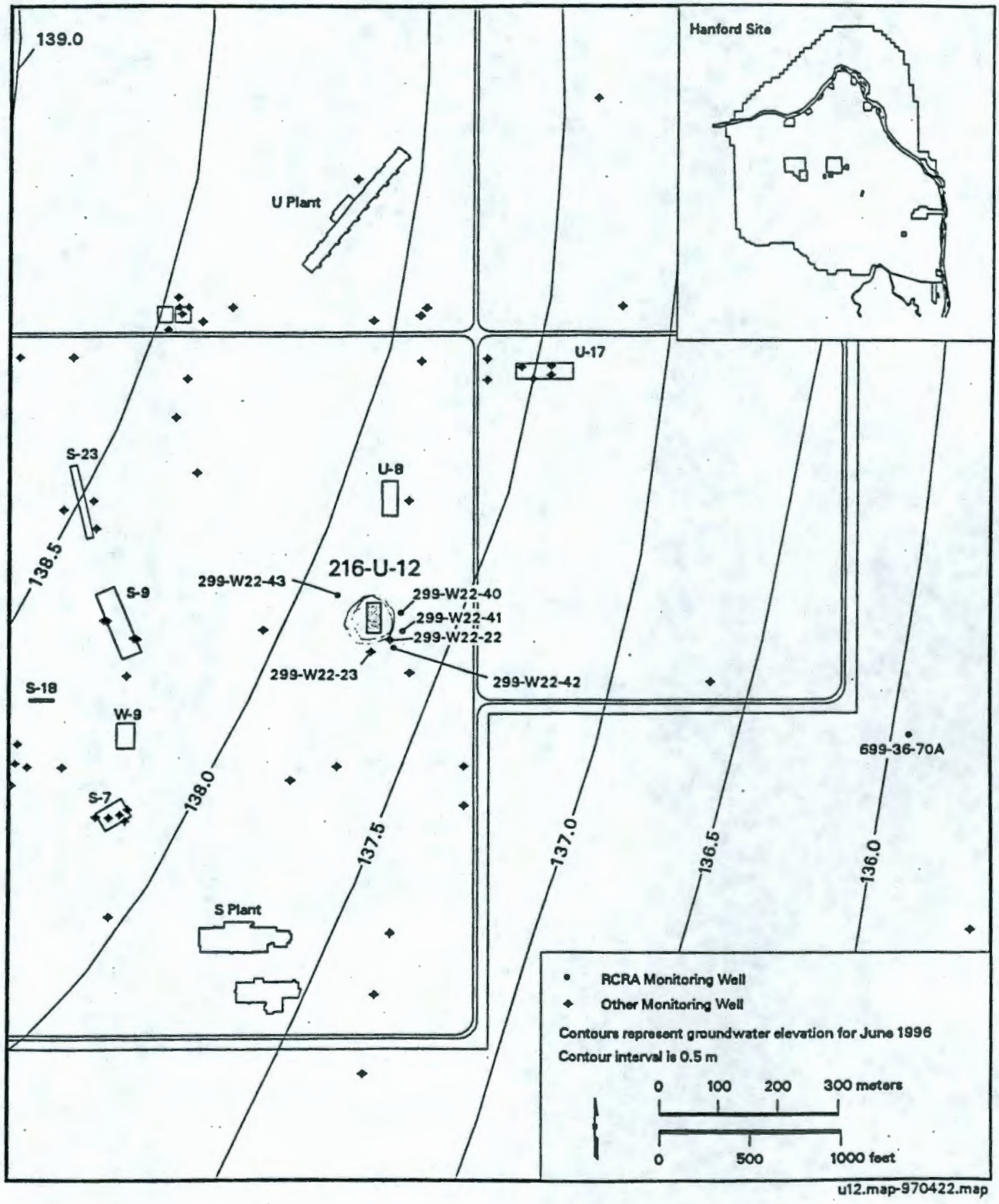
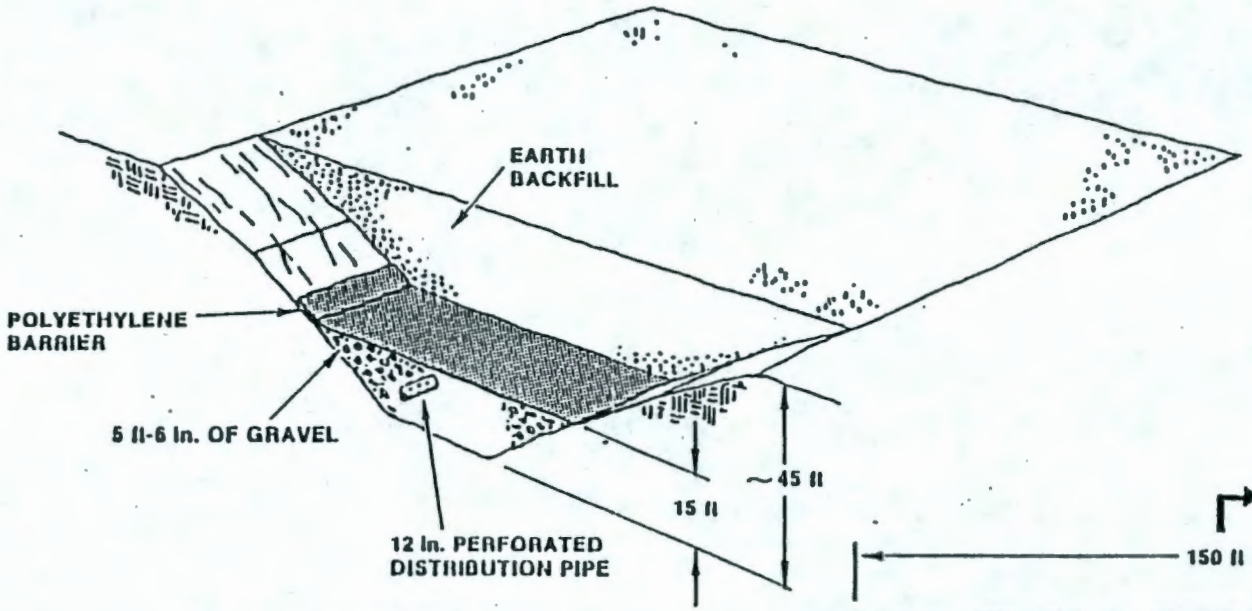
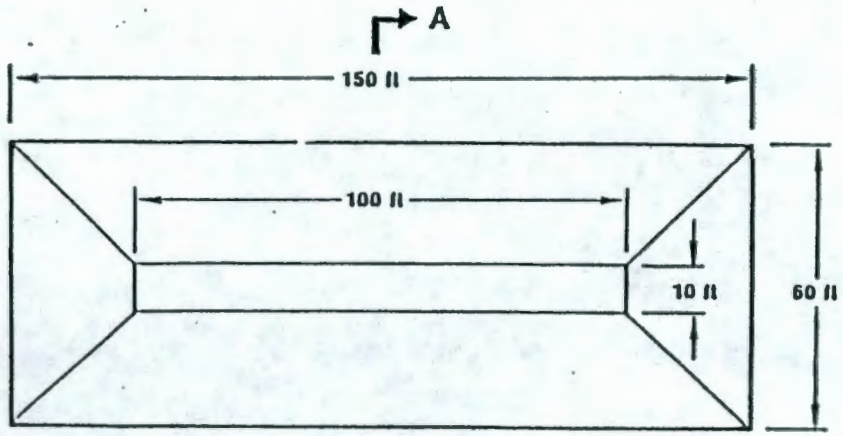


Figure 1. Location Map of 216-U-12 Crib and Surrounding Facilities in 200-West Area

216-U-12 CRIB



SECTION A-A



PLAN

2B8707-13.80

Waste Inventory by Year for the 216-U-12 Crib.

Year[a]	Volume (L)	Pu (g)	Beta (Ci)	^{90}Sr (Ci)	^{106}Ru (Ci)	^{238}U (kg)	^{3}H (Ci)	Alpha (Ci)	U (Ci)	pH	NO_3 (mg/L)	TOC (mg/L)
1960	9.0×10^6	0.1	4.4			176						
1961	1.4×10^7	0.1	56.3			437						
1962	1.4×10^7	0.1	5.0			417						
1963	1.4×10^7	0.1	11.1			129						
1964	1.7×10^7	0.1	3.0			254						
1965	1.4×10^7	0.1	773	104	80	209						
1966	1.1×10^7	0.1	0.1			103						
1967	1.0×10^7	0.1	0.04			69						
1968	8.9×10^6	0.1	0.02			7.6						
1969	7.2×10^6	0.1	0.03			6.0						
1970	3.1×10^6		0.01			1.4						
1971	6.0×10^6		0.06			2.2						
1972	3.8×10^6		0.013			0.061						
1973	0											
1974	0											
1975	0											
1976	0											
1977	0											
1978	0											
1979	0											
1980	0											
1981	1.6×10^4	2.7×10^{-6}	2.1×10^{-3}			2.1	0.009					
1982	(NO DATA AVAILABLE)											
1983	1.3×10^6		0.007			5.5						
1984	5.5×10^6	0.009				3.3		0.0034			0.8 to 2.3	1,602
1985	4.7×10^6		0.007						0.007		1.4 to 2.5	2,9574
1986	3.9×10^6		0.01					0.01	0.02		1.0 to 2.6	3,7606
1987	6.4×10^5	6×10^{-4}						6×10^{-4}	9×10^{-4}			222

(a) Data from 1960 to 1981 was obtained from Smith and Kasper (1983); data from 1983 to 1987 was taken from Aldrich (1984 through 1987).

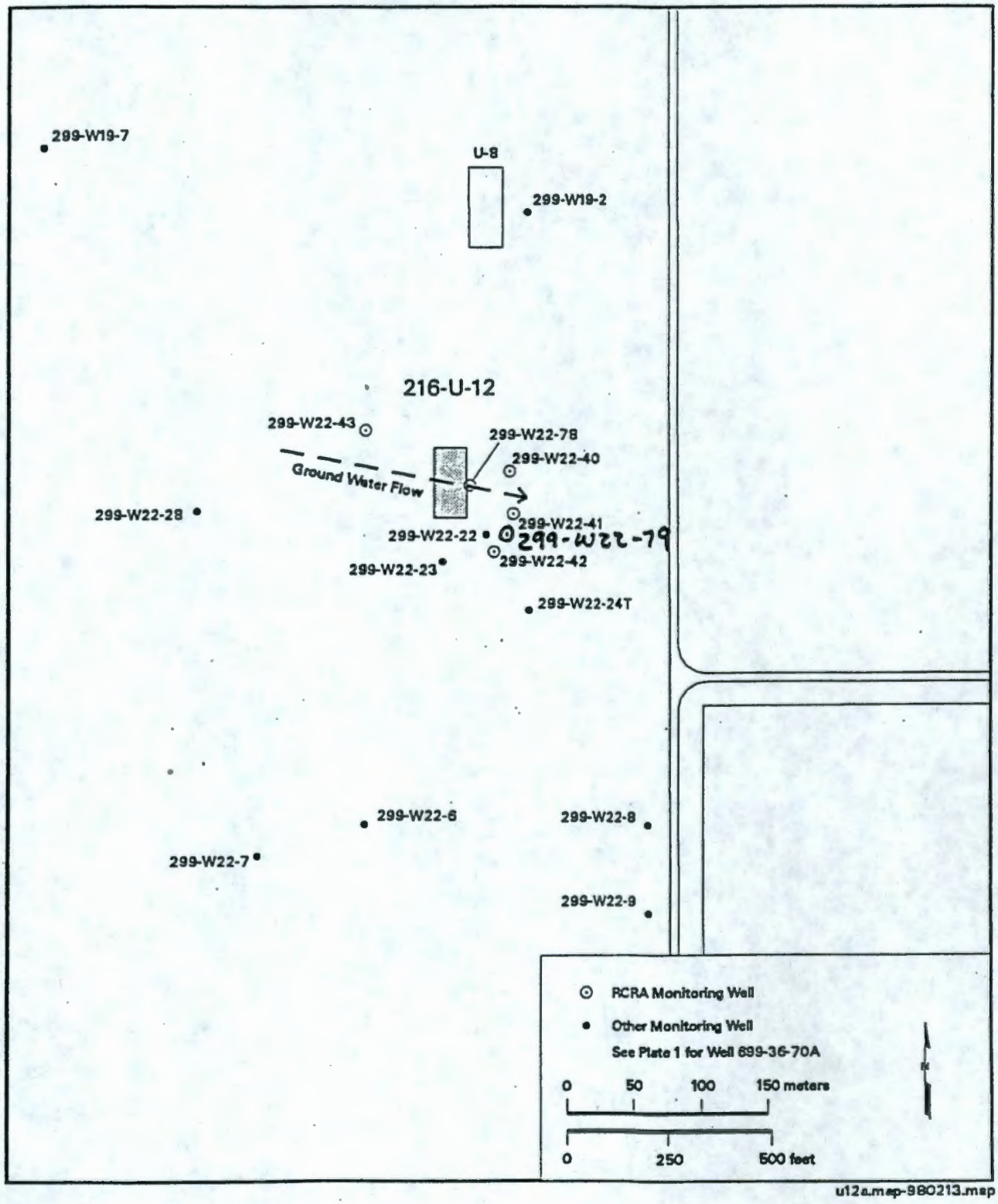
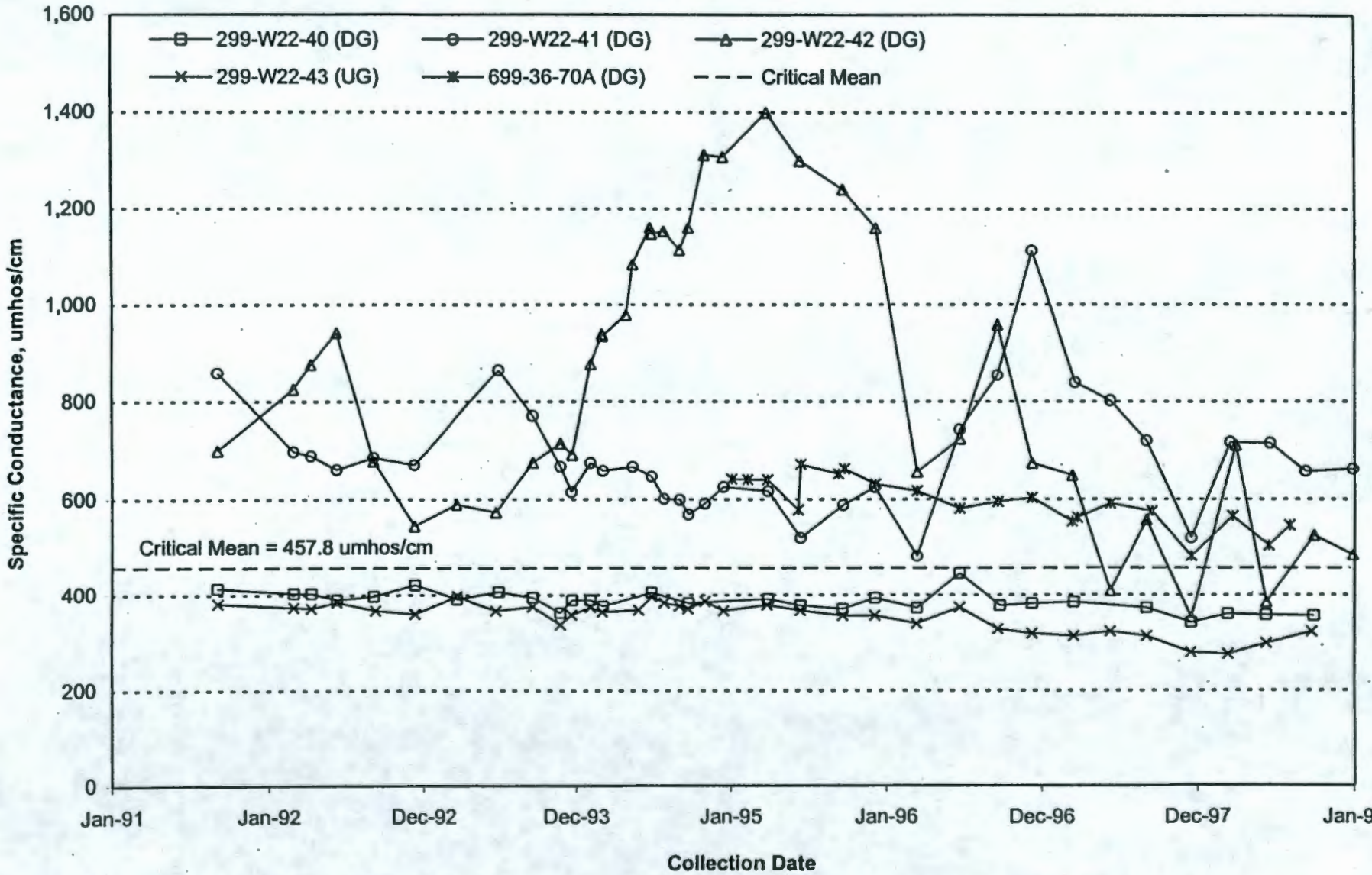
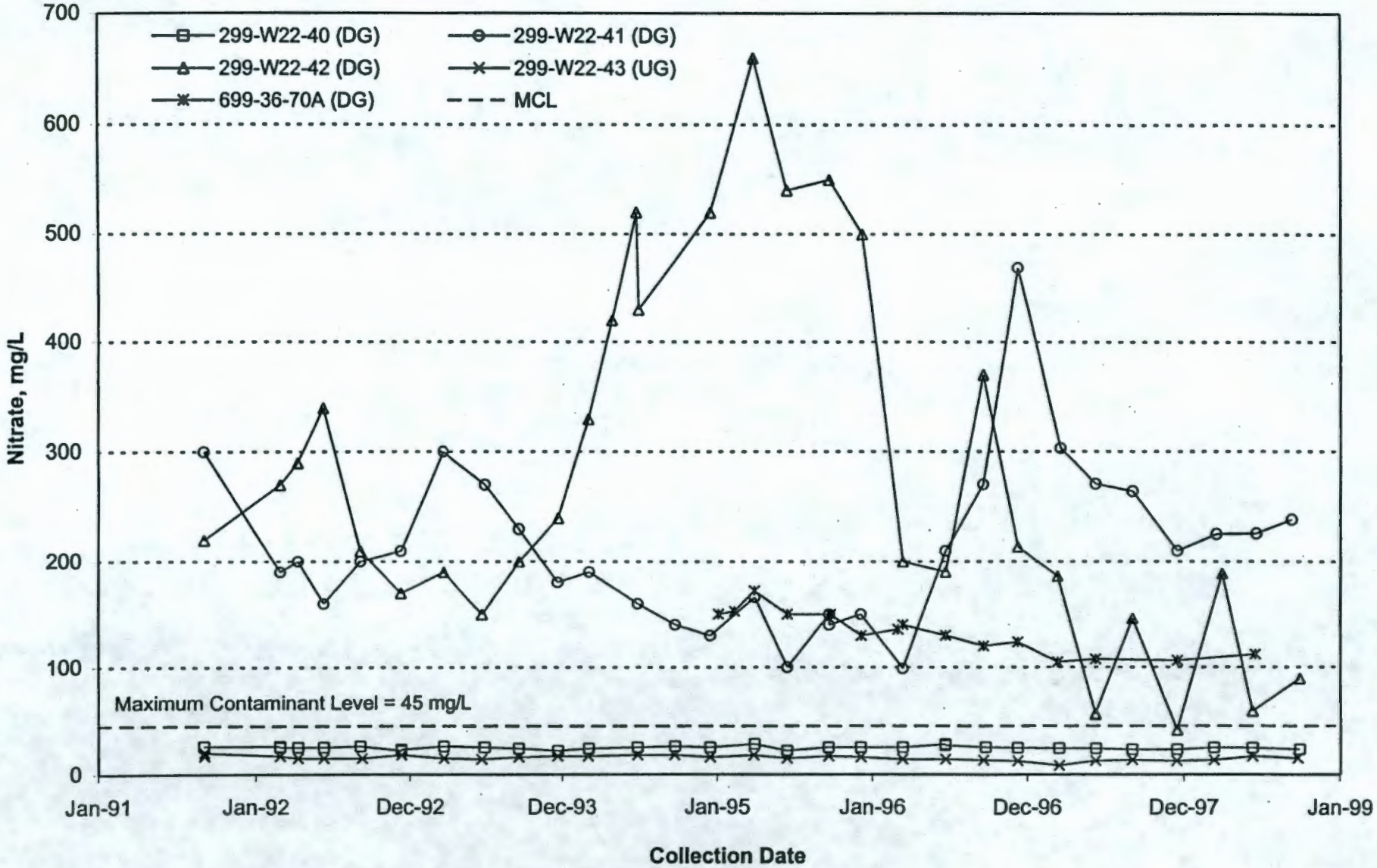


Figure A.6. Monitoring Well Locations for 216-U-12 Crib



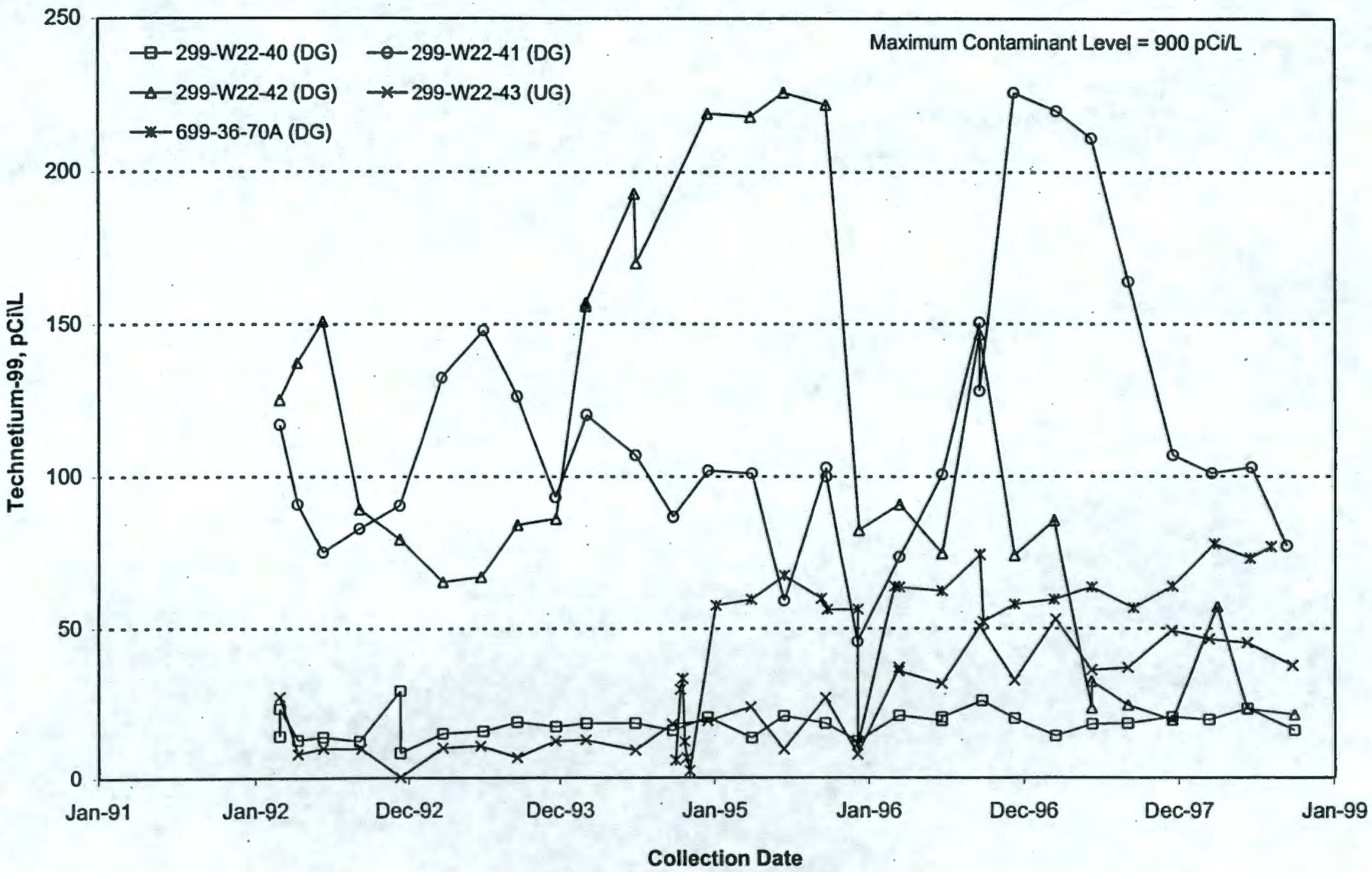
Specific Conductance in Wells Monitoring 216-U-12 Crib (DG = downgradient; UG = upgradient)

Attachment 10

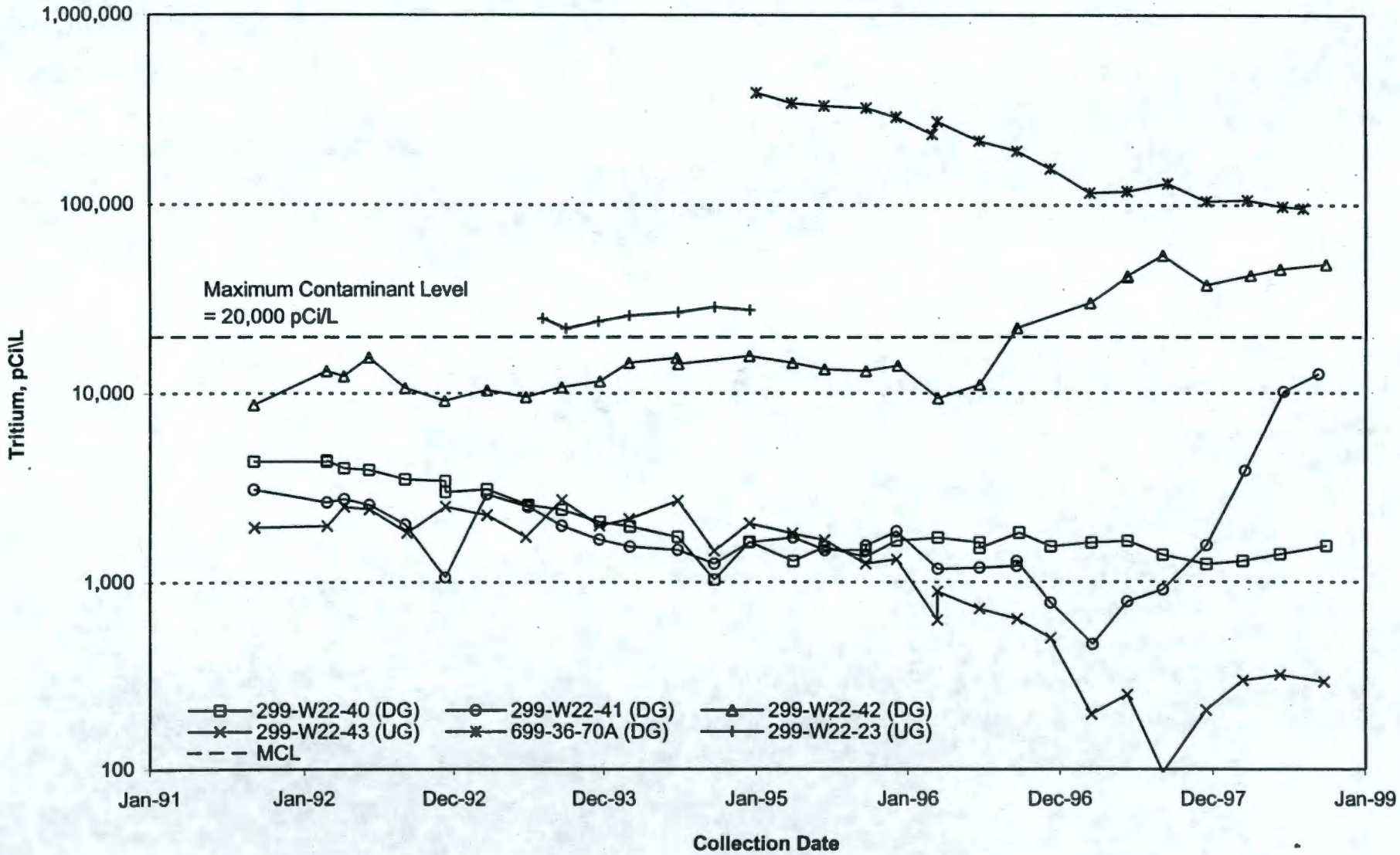


Nitrate in Wells Monitoring 216-U-12 Crib (DG = downgradient; UG = upgradient)

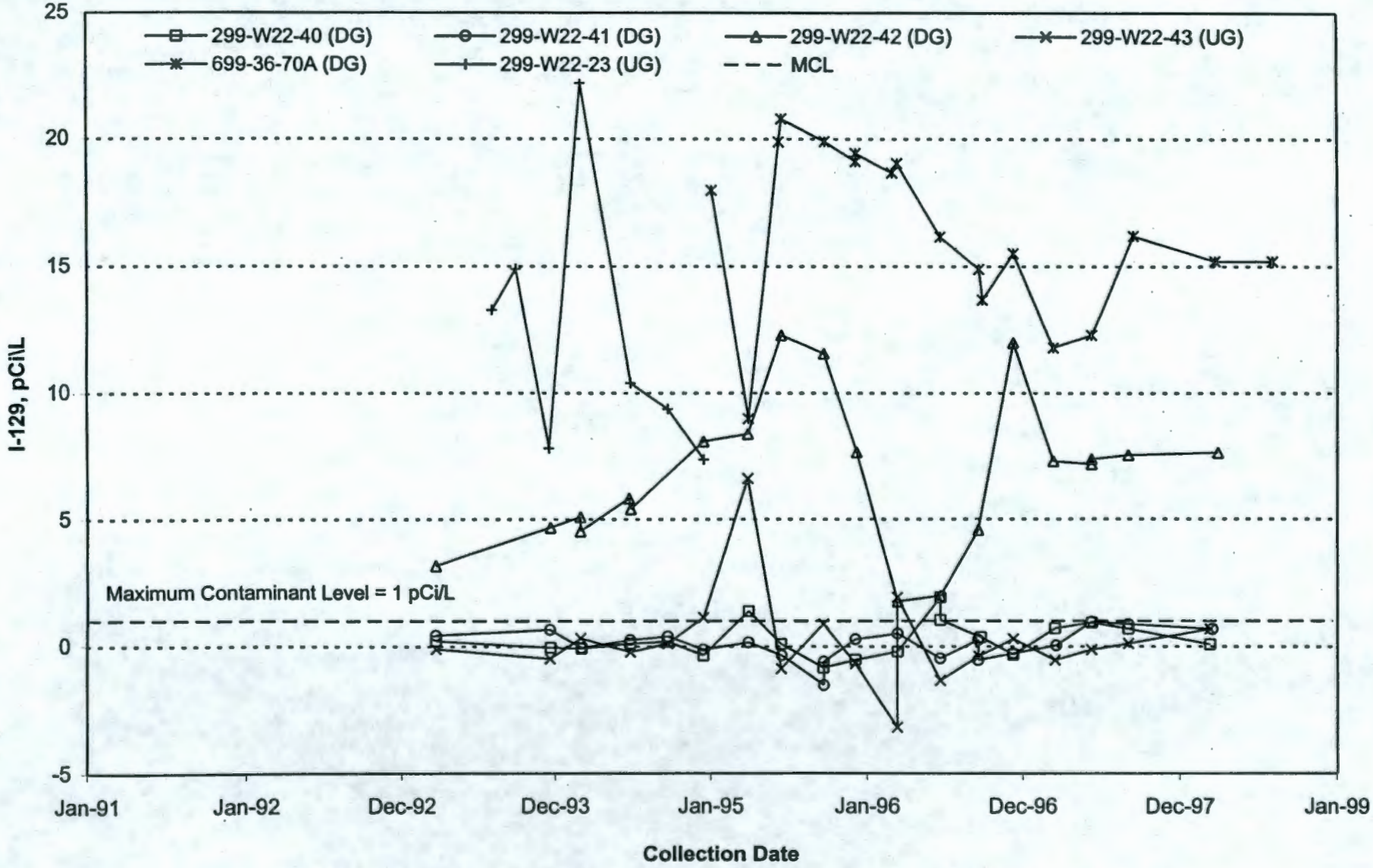
Attachment 10



Technetium-99 in Wells Monitoring 216-U-12 Crib (DG = downgradient; UG = upgradient)



Tritium in Wells Monitoring 216-U-12 Crib (DG = downgradient; UG = upgradient)



Iodine-129 in Wells Monitoring 216-U-12 Crib (DG = downgradient; UG = upgradient)

Attachment 10

Table A.6. Monitoring Wells and Constituents for 216-U-12 Crib (adapted from WHC-SD-EN-AP-019 and WHC-SD-EN-AP-103)

Well	Hydrogeologic Unit Monitored	Sampling Frequency	Water-Level Measurement	Well Standard	Other Networks
299-W22-40[90]	Top of unconfined	Quarterly	Quarterly	RCRA	Surveillance
299-W22-41[90]	Top of unconfined	Quarterly	Quarterly	RCRA	--
299-W22-42[90]	Top of unconfined	Quarterly	Quarterly	RCRA	Surveillance
299-W22-43[90]	Top of unconfined	Quarterly	Quarterly	RCRA	--
699-36-70A[94]	Top of unconfined	Quarterly	Quarterly	RCRA	ERDF, Surveillance

Contamination Indicator Parameters	Site-Specific Parameters	
pH	Alkalinity[(a)]	Iodine-129
Specific conductance	Anions	Technetium-99
Total organic carbon	Gross alpha	Total dissolved solids
Total organic halides	Gross beta	Tritium
	ICP metals (filtered)	Turbidity

(a) Analyzed annually.
Shading = Upgradient well.
Superscript = Year of installation.
ERDF = Environmental Restoration Disposal Facility.
RCRA = Well constructed to RCRA standards.

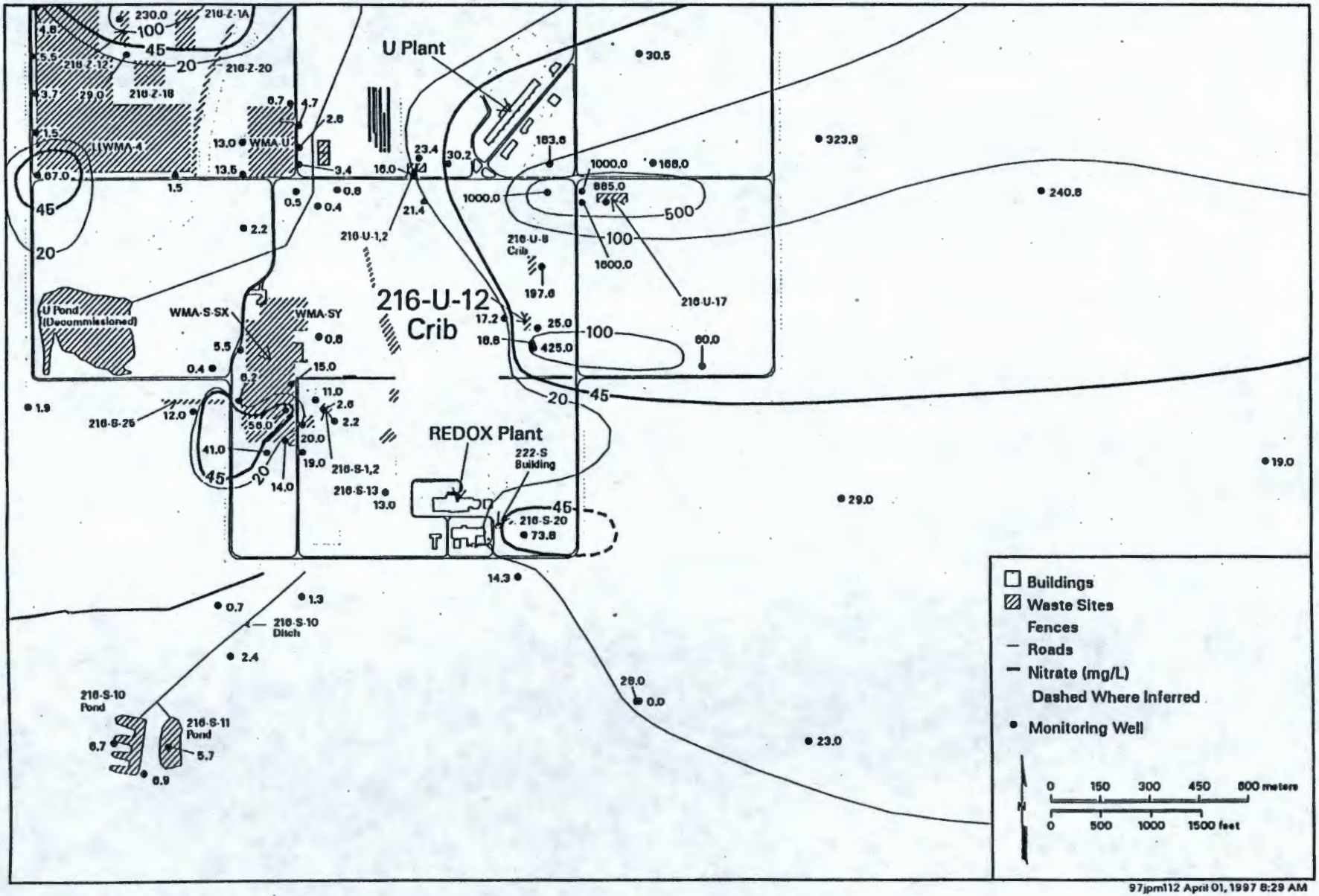


Figure 14. 1994 Nitrate Activity Near 216-U-12 Crib

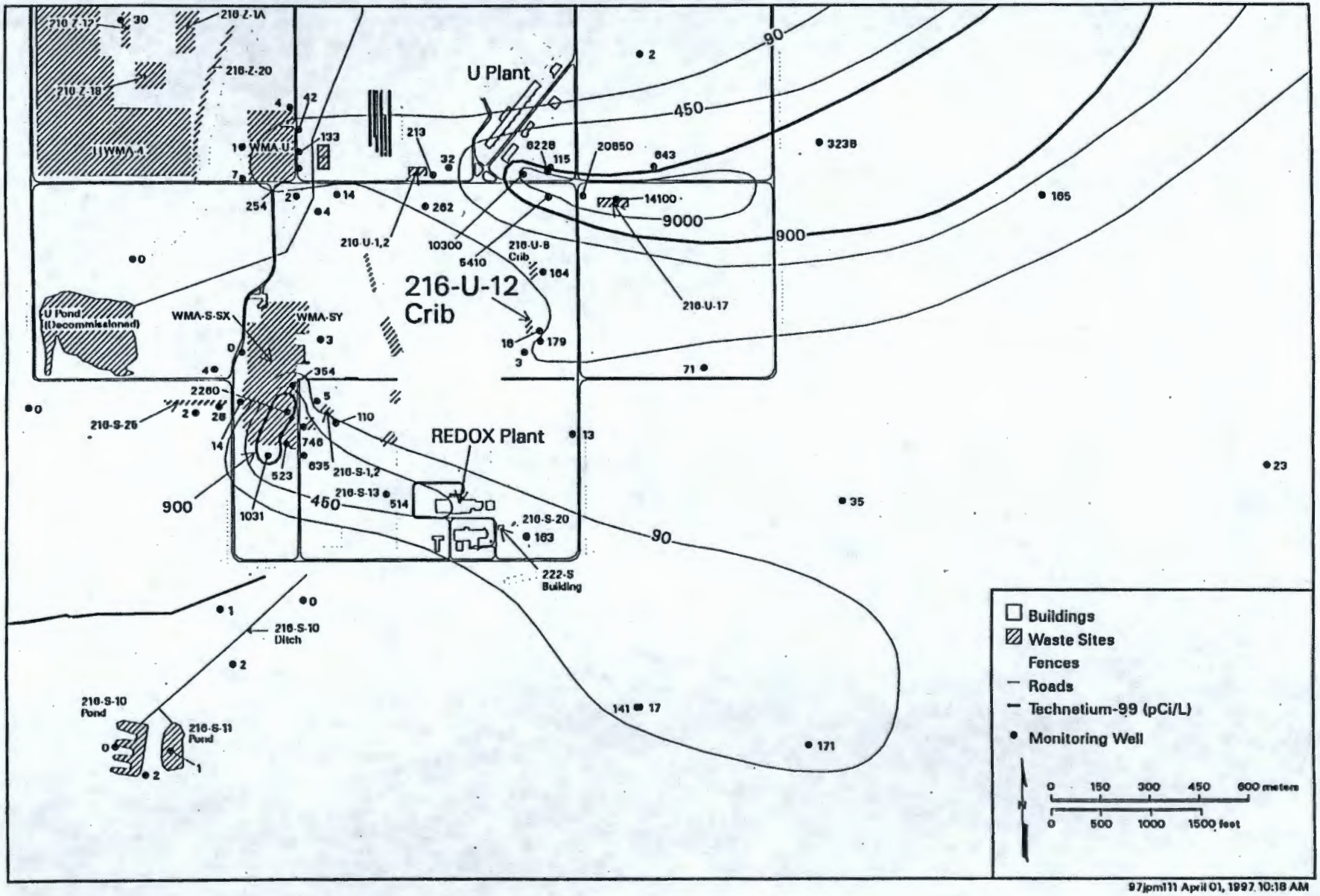


Figure 15. 1994 Technetium-99 Activity Near 216-U-12 Crib

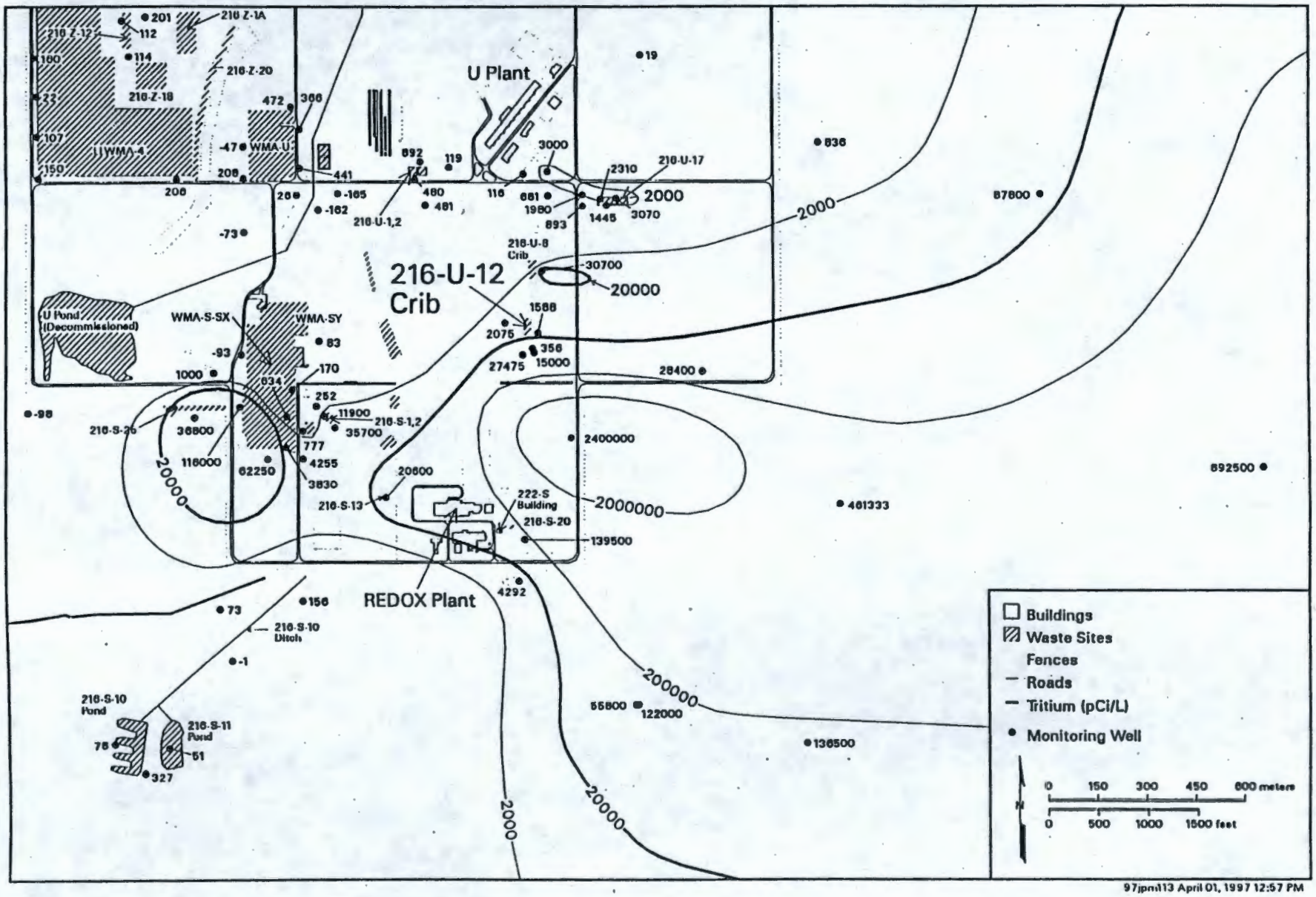


Figure 16. 1994 Tritium Activity Near 216-U-12 Crib

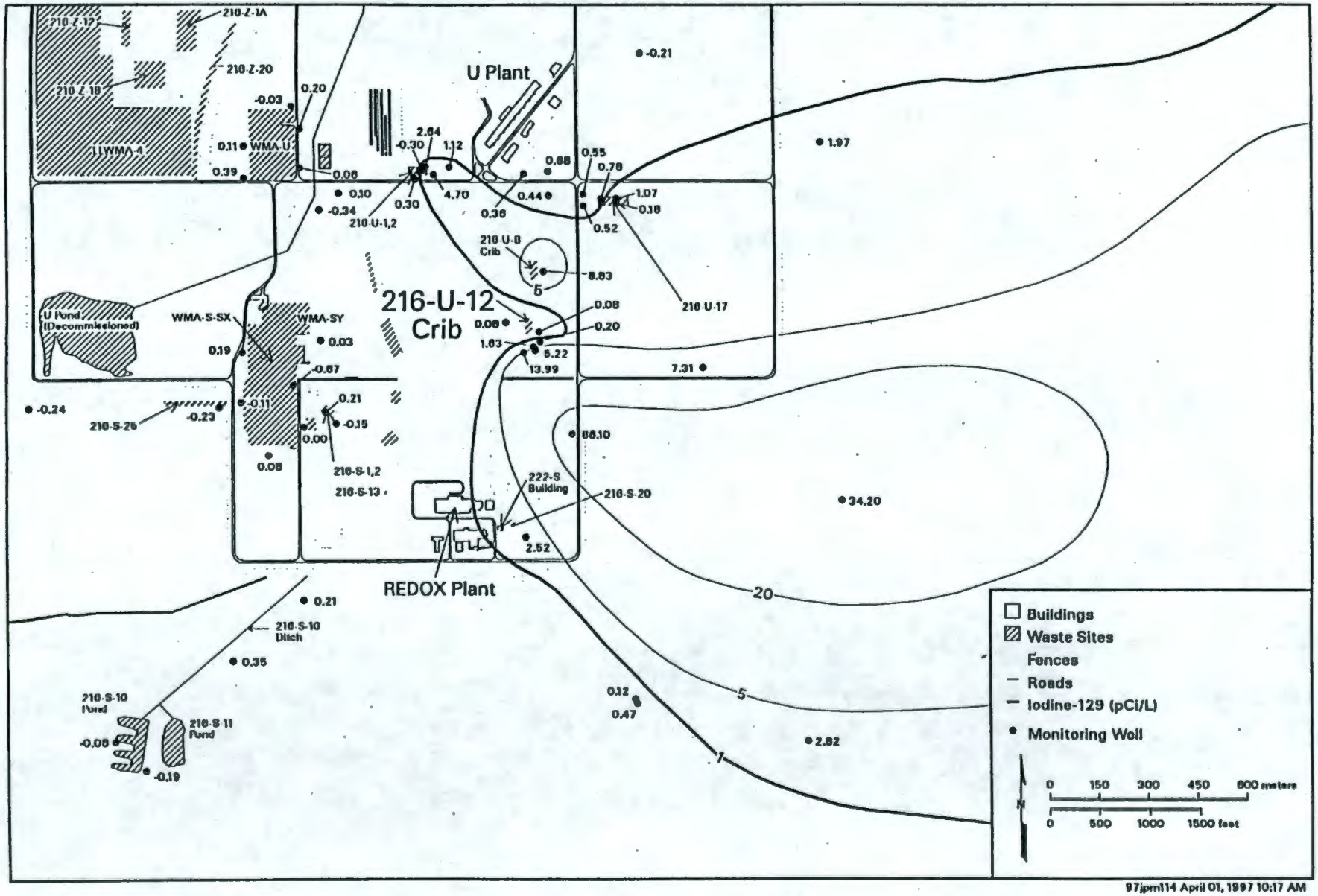
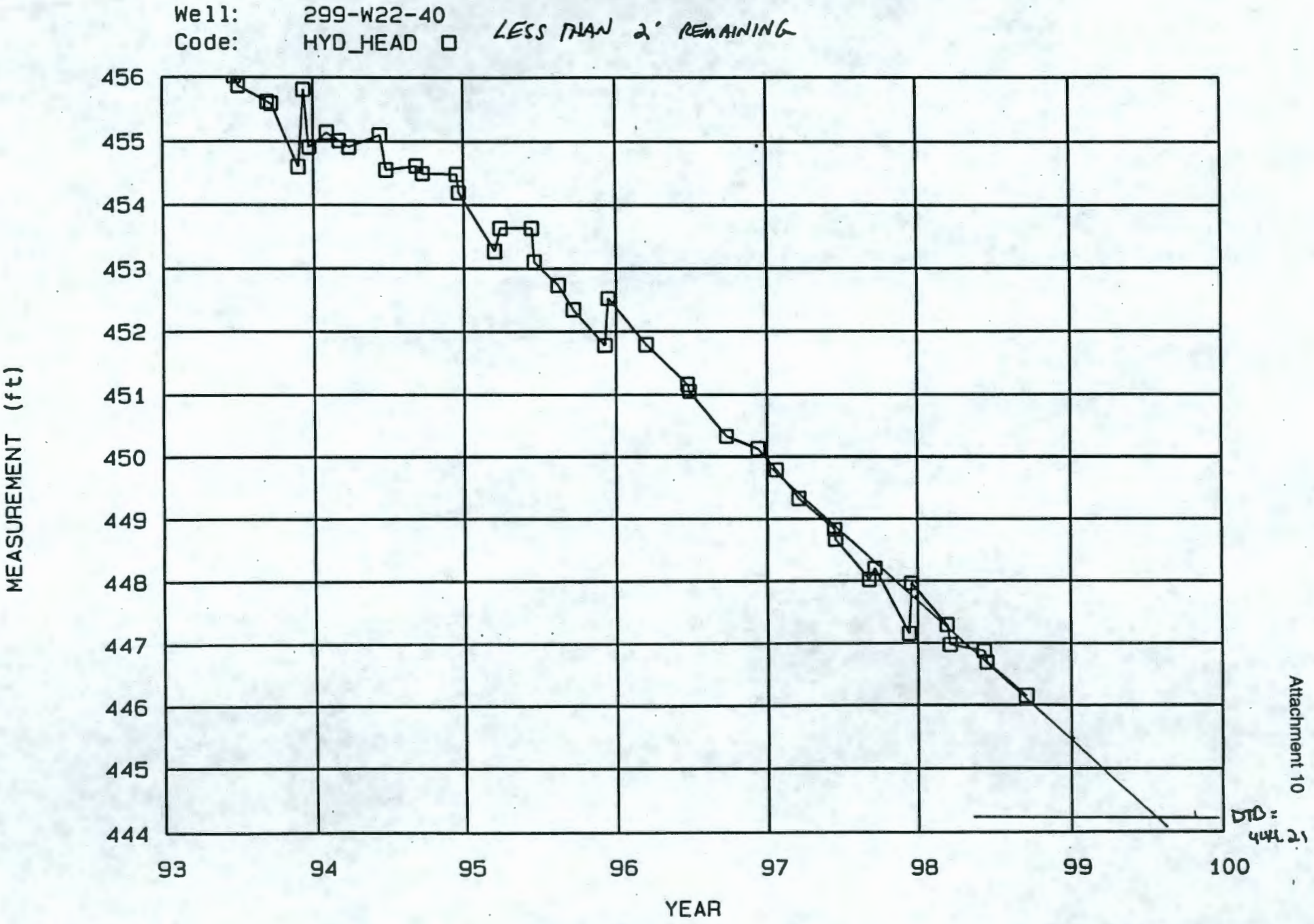


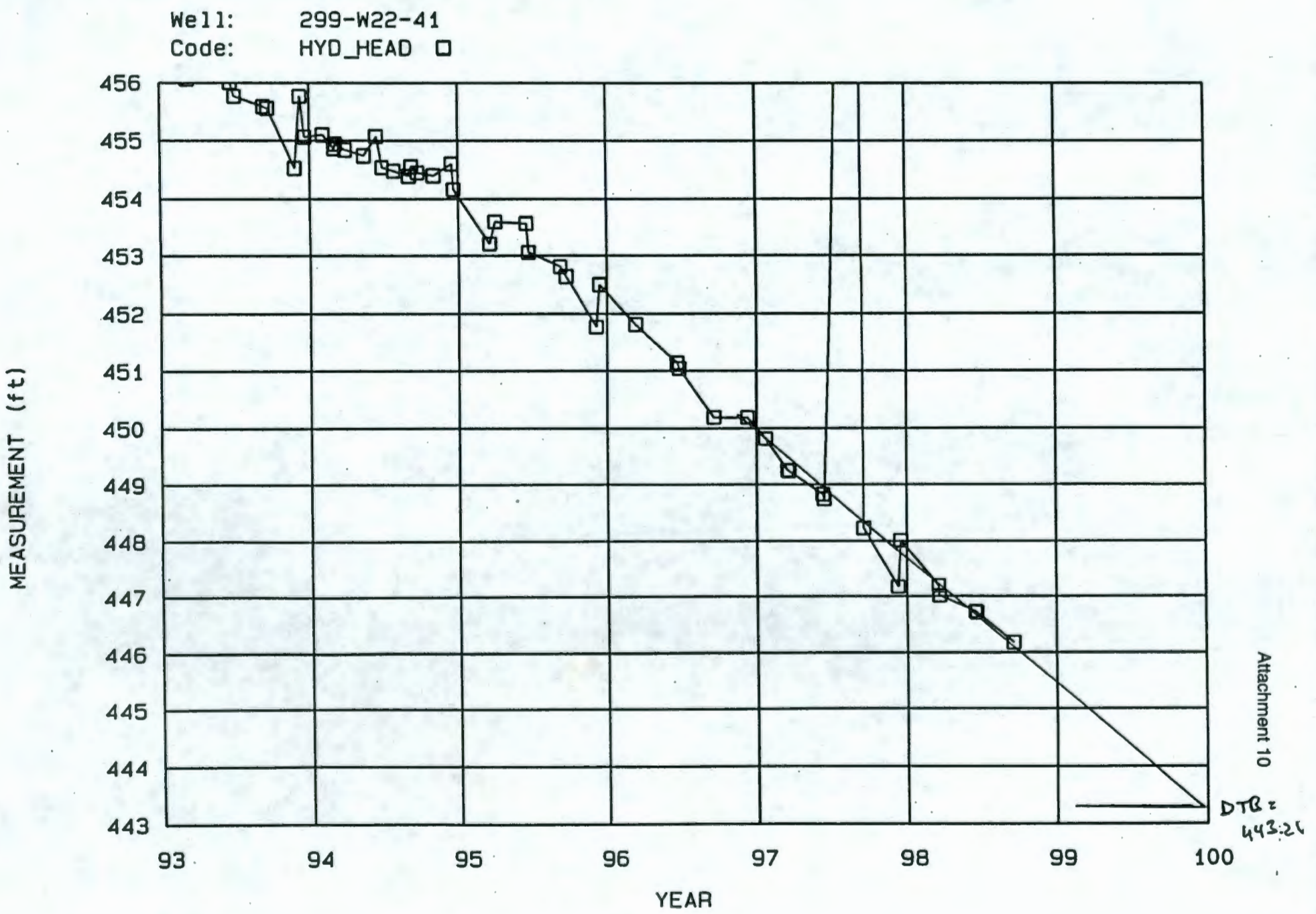
Figure 17. 1994 Iodine-129 Activity Near 216-U-12 Crib

299-W22-40



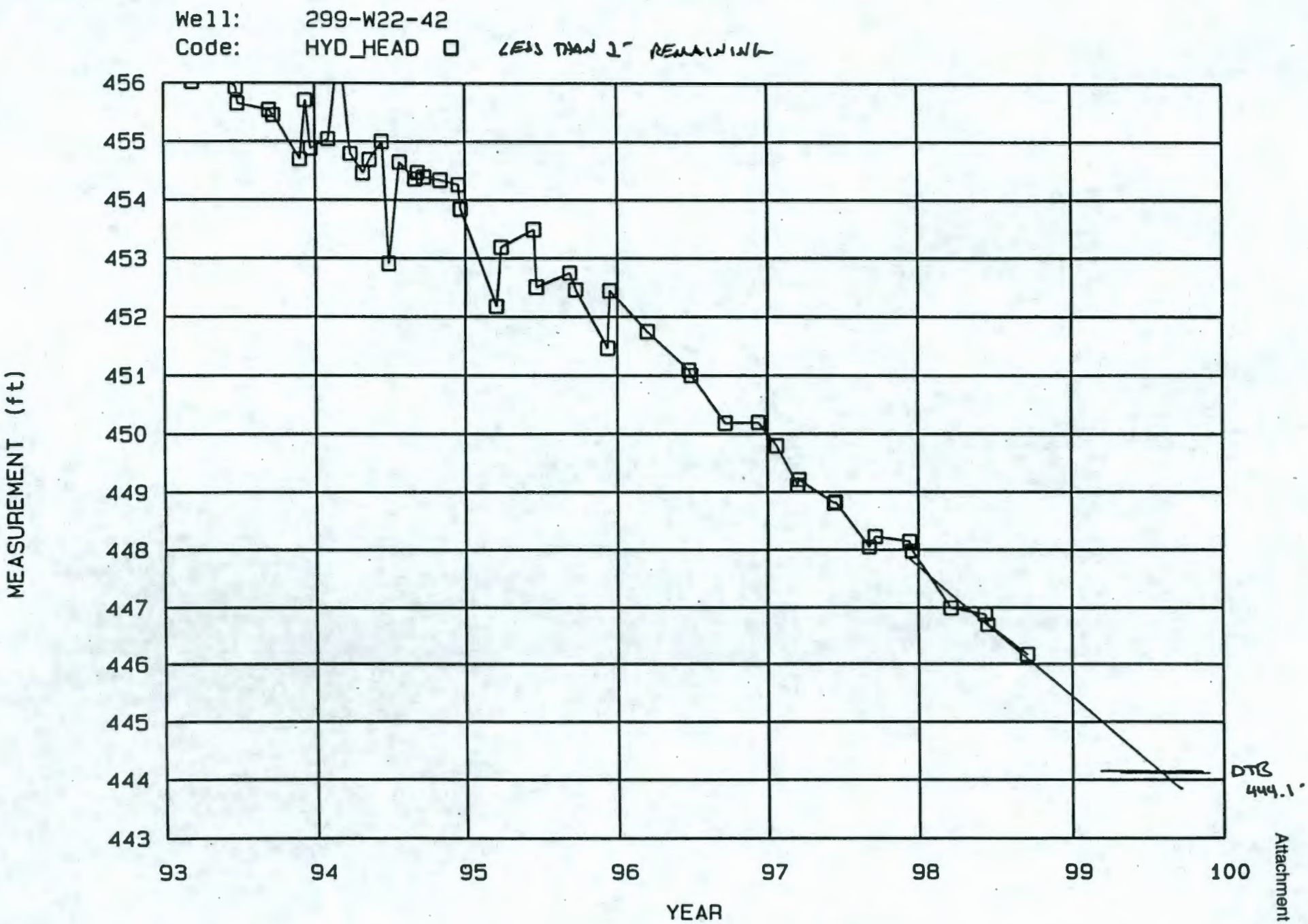
Attachment 10

299-W22-41



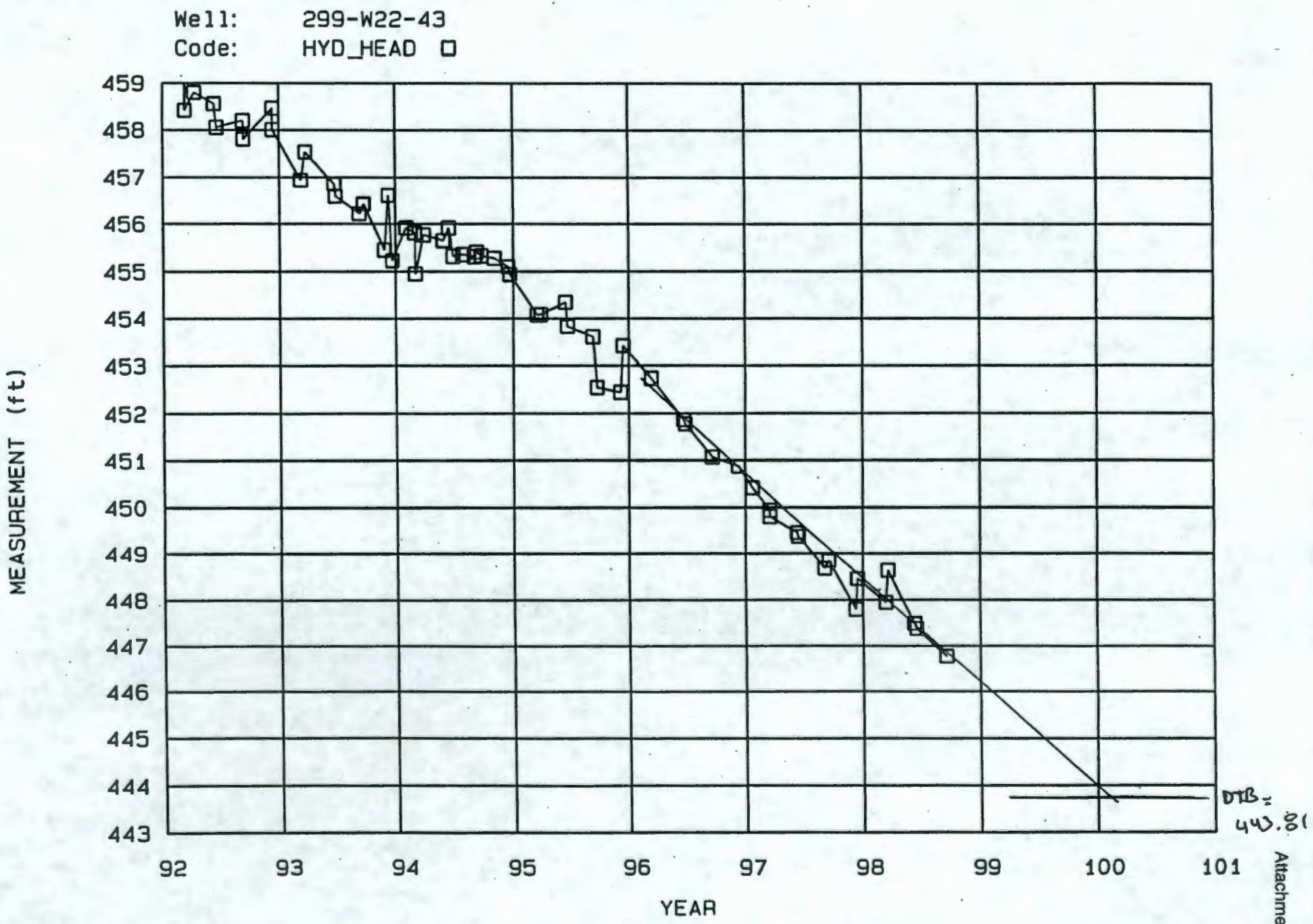
Attachment 10

299-W22-42



Attachment 10

299-W22-43



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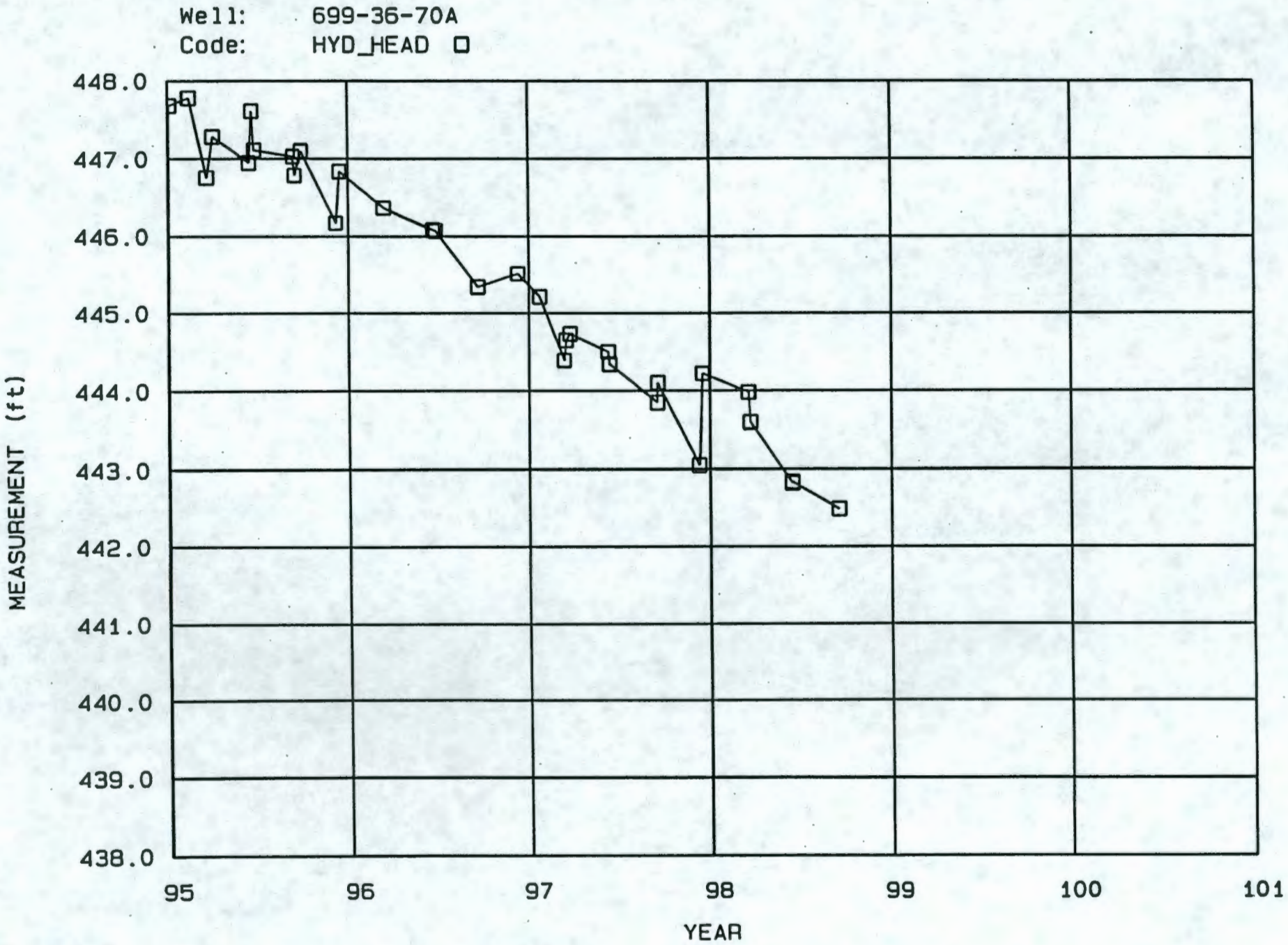
699-W36-70



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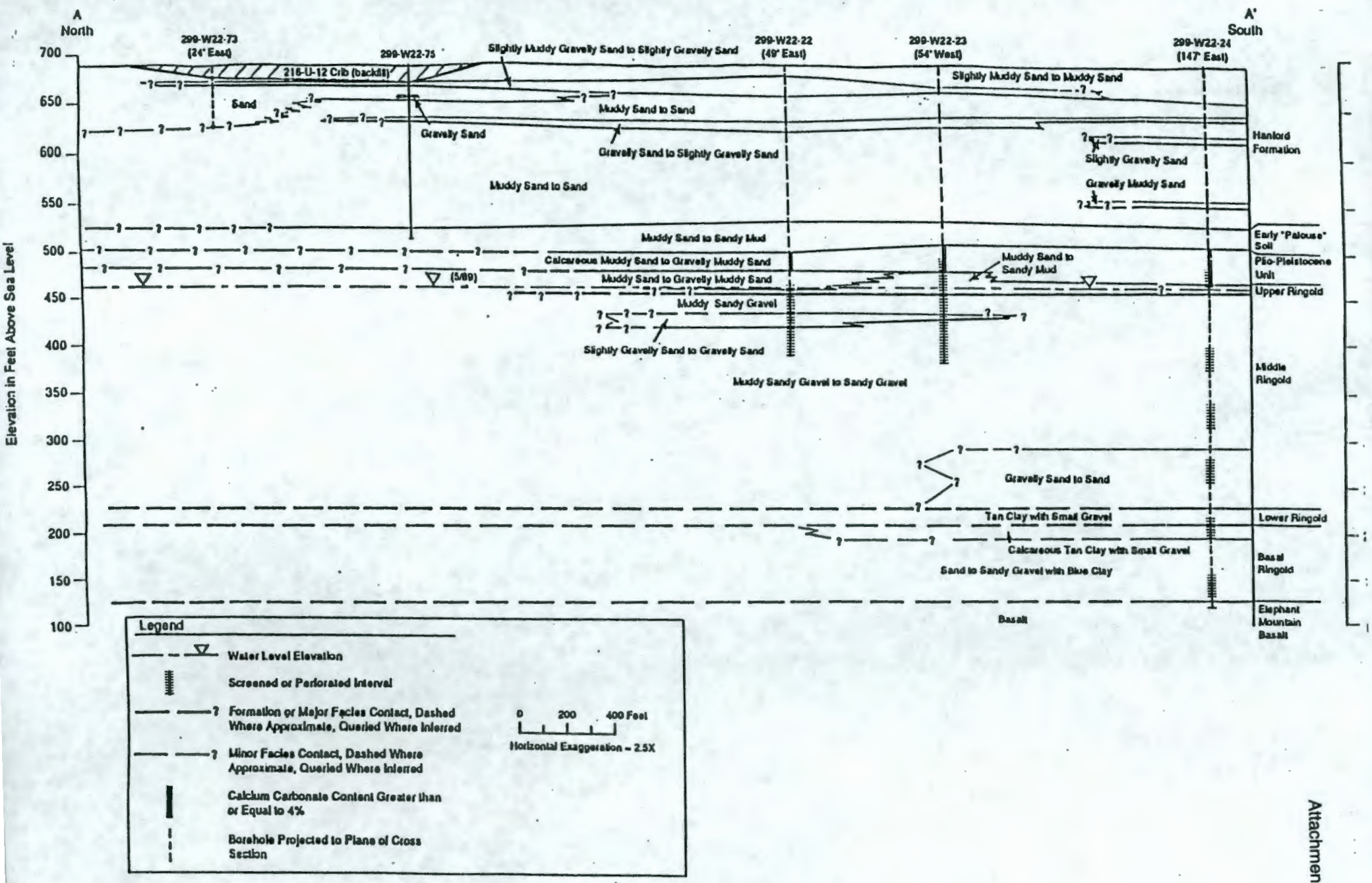
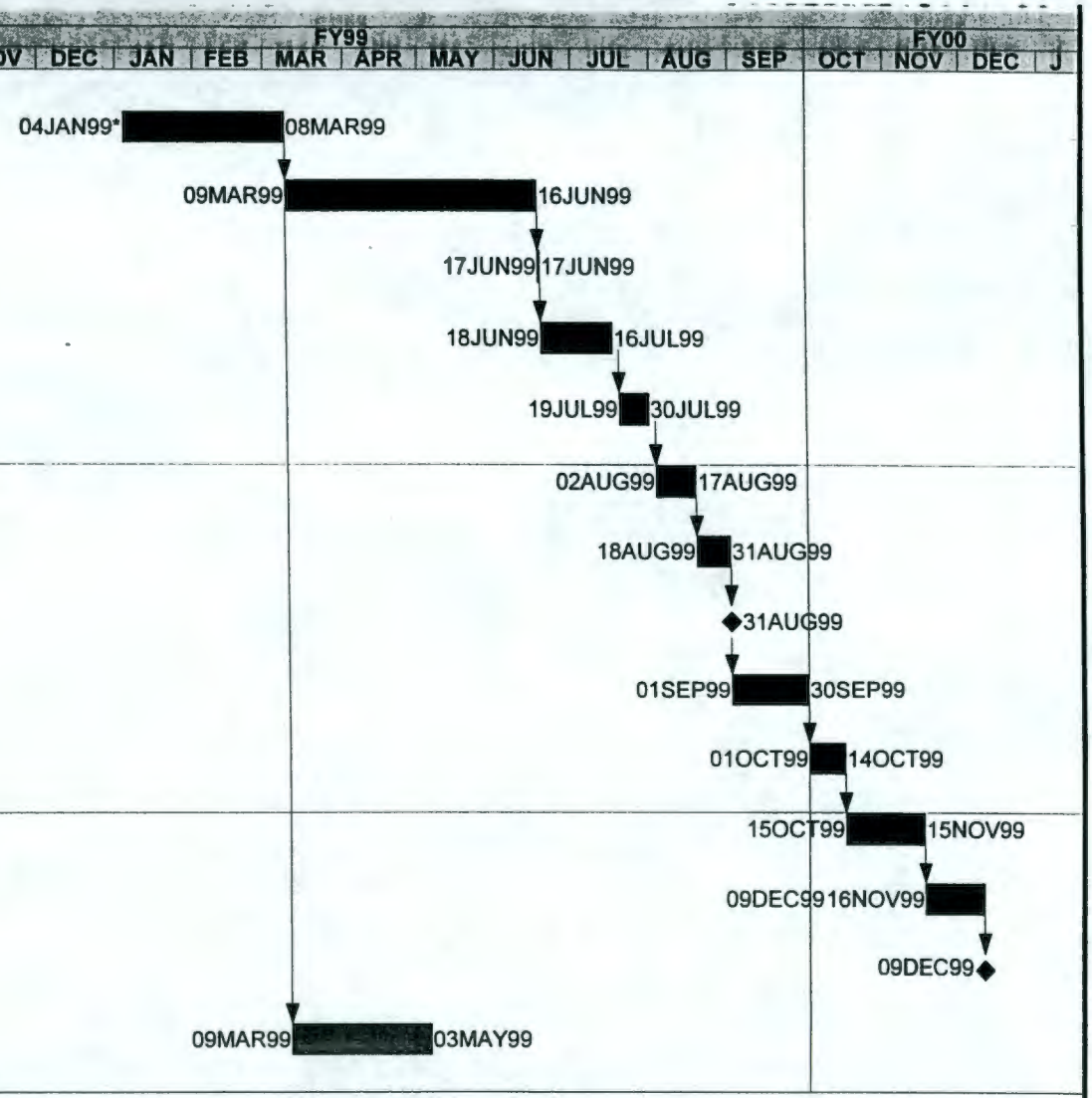


Stratigraphic Cross Section

Attachment 10

Activity Description	Early Start	Early Finish
PROJECT 200-CS-1		
DRAFT SECTIONS 2 AND 3 OF WORK PLAN	04JAN99	08MAR99
COMPLETE DRAFT WORK PLAN	09MAR99	16JUN99
ISSUE ERC DRAFT WORK PLAN	17JUN99	17JUN99
ERC REVIEW, REVISE & ISSUE DECISIONAL DRAFT WP	18JUN99	16JUL99
DOE REVIEW OF DECISIONAL DRAFT WORK PLAN	19JUL99	30JUL99
REVISE WORK PLAN AND ISSUE DRAFT A TO RL	02AUG99	17AUG99
RL CONC. AND TRANS. OF DRAFT A TO REGULATORS	18AUG99	31AUG99
TPA MILESTONE (M-13-21)		31AUG99
REGULATOR REVIEW OF DRAFT A WORK PLAN	01SEP99	30SEP99
REVISE WORK PLAN & ISSUE REV 0 FOR PUBLIC REVIEW	01OCT99	14OCT99
PUBLIC REVIEW OF WORK PLAN	15OCT99	15NOV99
FINALIZE WORK PLAN	16NOV99	09DEC99
WORK PLAN COMPLETE		09DEC99
COMPLETE WASTE GROUP DQOs	09MAR99	03MAY99



Project Start 01OCT98
Project Finish 28MAR05
Data Date 01OCT98
Run Date 21JAN99

Early Bar
Progress Bar
Critical Activity

RA00

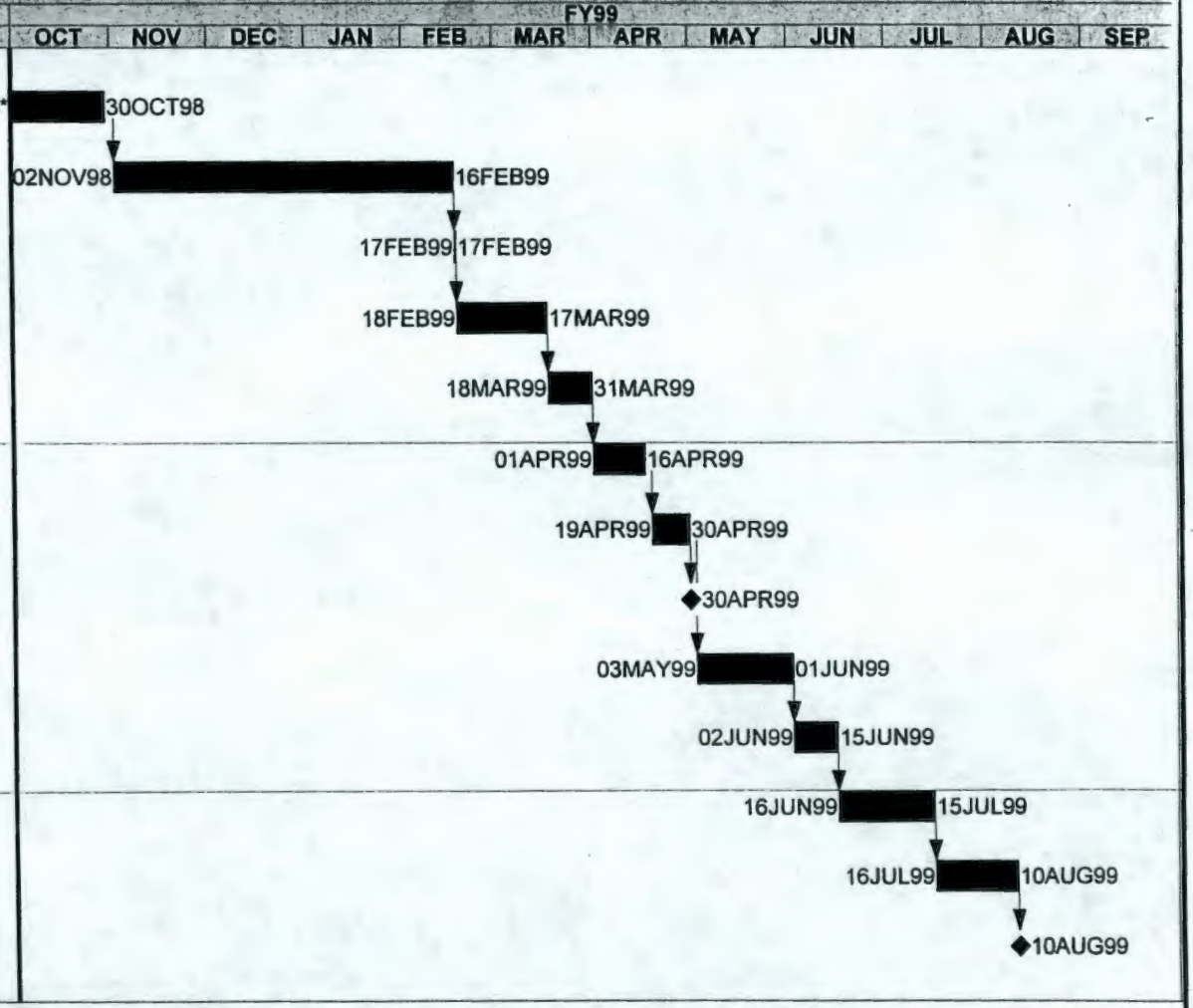
Sheet 1 of 1

200-CS-1

200 Area

Attachment 11

Activity Description	Early Start	Early Finish
PRC10R: 200-CW-1		
DRAFT SECTIONS 2 AND 3 OF WORK PLAN	01OCT98	30OCT98
COMPLETE DRAFT WORK PLAN	02NOV98	16FEB99
ISSUE ERC DRAFT WORK PLAN	17FEB99	17FEB99
ERC REVIEW, REVISE & ISSUE DECISIONAL DRAFT WP	18FEB99	17MAR99
DOE REVIEW OF DECISIONAL DRAFT WORK PLAN	18MAR99	31MAR99
REVISE WORK PLAN AND ISSUE DRAFT A TO RL	01APR99	16APR99
RL CONC. AND TRANS. OF DRAFT A TO REGULATORS	19APR99	30APR99
TPA MILESTONE (M-13-20)		30APR99
REGULATOR REVIEW OF DRAFT A WORK PLAN	03MAY99	01JUN99
REVISE WORK PLAN & ISSUE REV 0 FOR PUBLIC REVIEW	02JUN99	15JUN99
PUBLIC REVIEW OF WORK PLAN	16JUN99	15JUL99
FINALIZE WORK PLAN	16JUL99	10AUG99
WORK PLAN COMPLETE		10AUG99



Project Start 01OCT98
Project Finish 28MAR05
Data Date 01OCT98
Run Date 21JAN99

Early Bar
Progress Bar
Critical Activity

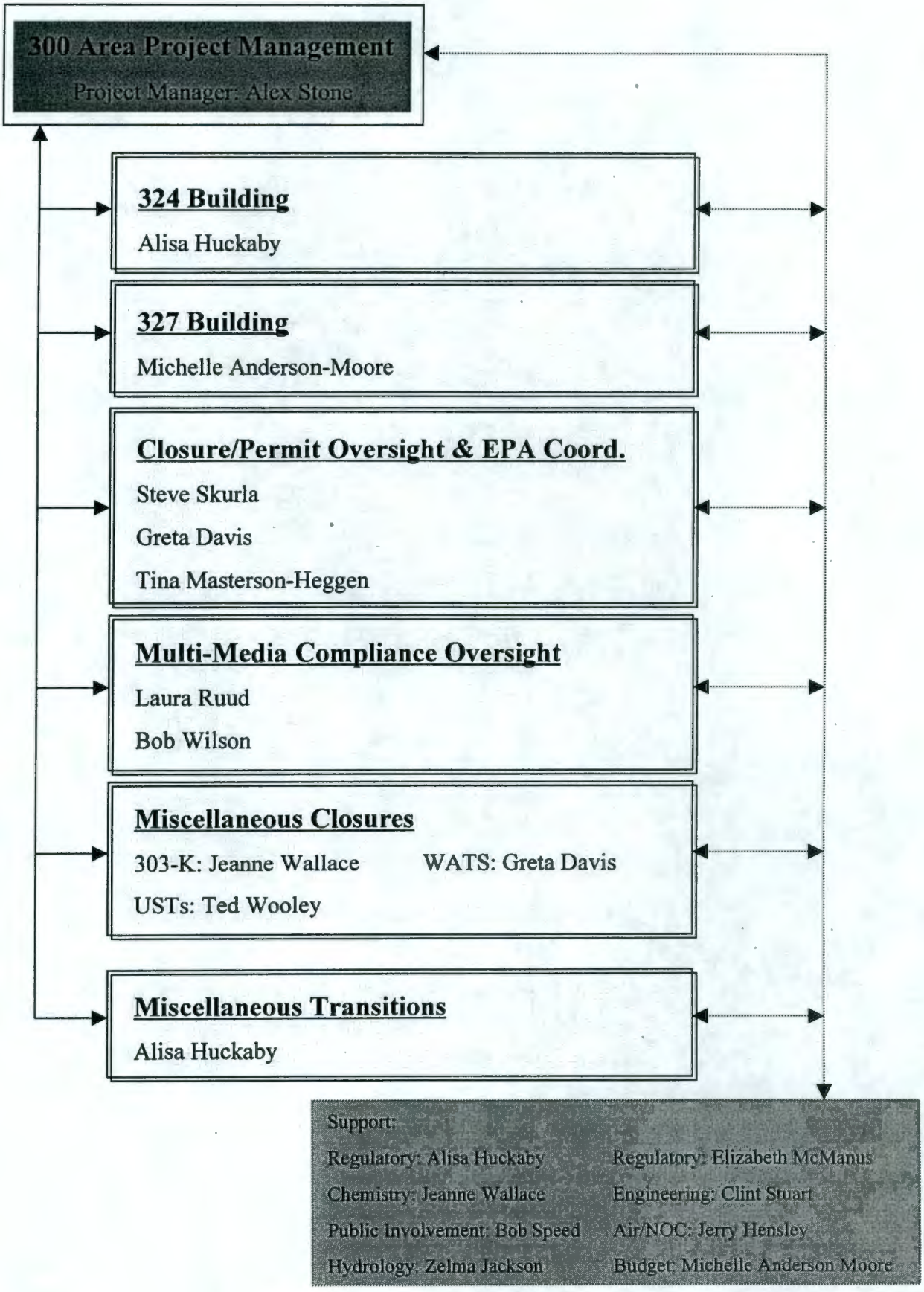
RA00

Sheet 1 of 1

200-CW-1

200 Area

Attachment 11


300 Area Project Management
Project Manager: Alex Stone
324 Building
Alisa Huckaby
327 Building
Michelle Anderson-Moore
Closure/Permit Oversight & EPA Coord.
Steve Skurla
Greta Davis
Tina Masterson-Heggen
Multi-Media Compliance Oversight
Laura Ruud
Bob Wilson
Miscellaneous Closures
303-K: Jeanne Wallace
WATS: Greta Davis
USTs: Ted Wooley
Miscellaneous Transitions
Alisa Huckaby
Support:
Regulatory: Alisa Huckaby
Regulatory: Elizabeth McManus
Chemistry: Jeanne Wallace
Engineering: Clint Stuart
Public Involvement: Bob Speed
Air/NOC: Jerry Hensley
Hydrology: Zelma Jackson
Budget: Michelle Anderson Moore

January 21, 1999

300 Area Project Phone List

Name:	Job Duties	Phone Nr.:	Email Address:
Anderson-Moore, Michelle	327 Building/Budget Support	736-5714	MAND461@ecy.wa.gov
Davis, Greta	325 & 305-B/WATS	736-3025	GDAV461@ecy.wa.gov
Hensley, Jerry	Air permitting/NOCs	736-3017	JHEN461@ecy.wa.gov
Huckaby, Alisa	324 Building/Reg. Support	736-3034	AHUC461@ecy.wa.gov
Jackson, Zelma	Hydrogeology Support	736-3024	ZJAC461@ecy.wa.gov
Masterson-Heggen, Tina	EPA Coordination	736-5701	TMAS461@ecy.wa.gov
McManus, Elizabeth	Regulatory Support	360/407-6524	EMCM461@ecy.wa.gov
Ruud, Laura	Inspector	736-5715	LRUS461@ecy.wa.gov
Skurla, Steve	Closure/Permit Oversight	736-3011	SSKU461@ecy.wa.gov
Speed, Bob	PI Support	736-3037	BSPE461@ecy.wa.gov
Stone, Alex	Project Manager	736-3018 542-3366 (pager)	ALST461@ecy.wa.gov
Stuart, Clint	Engineering Support	736-3010	CSTU461@ecy.wa.gov
Wallace, Jeanne	303-K/Chem. Support	736-3019	JEWA461@ecy.wa.gov
Wilson, Bob	Inspector	736-3031	BOWI461@ecy.wa.gov
Wooley, Ted	UST Closures	736-3012	TWOO461@ecy.wa.gov

Attachment 12

SOUTH PROCESS POND TEST TRENCH #1 RAD SCREENING PROFILE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	593	125	350	36	3	88	8	17	12	17	14	18	nd	nd	nd	nd	3	42
B	10	4	50	35	nd	42	6	12	6	17	23	18	nd	nd	15	nd	3	nd
C		6	50	17	nd	9	5	10	15	23	23	15	nd	nd	17	nd	nd	21
D		11	50	21	35	5	4	18	9	19	18	68	nd	nd	11	15	22	nd
E			50	41	37 B0L884	14	9	12	9	21	22	10	nd	nd	14	8	nd	nd

12/97 UPDATE - Revised Correction Factors Ranging From 3-10.5 to 4. The correction factor used for the GM instrument (1) was not changed.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	1557	328	350	27	2	66	21	45	32	30	25	32	nd	nd	nd	nd	5	77
B	26	11	50	26	nd	32	16	32	16	30	41	32	nd	nd	27	nd	5	nd
C		6	50	13	nd	7	13	26	39	41	41	27	nd	nd	34	nd	nd	38
D		6	50	16	26	4	11	47	24	34	32	121	nd	nd	22	30	40	nd
E			50	31	28 B0L884	11	24	32	24	37	39	18	nd	nd	28	16	nd	nd

SPPTT #1 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.

Attachment 13

SOUTH PROCESS POND TEST TRENCH #2 RAD SCREENING PROFILE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A	295	1537	814	10	50	50		21	8	62	18	118	33	98	50	25	107	1675
B	958	503	85	82	nd	nd		19	35	11	9	102	235	103	nd	100	623	607
C		545	147	33	50	50		12	12	20	n/a	8	19	90	50	nd	80	255
D		48	30	37	nd	nd		26	29	36	n/a	47	18	30	nd	50	68	74
E			45	17 B0L891	nd	nd		28	12	26		32	9	66	11	4	15	17

SPPTT #2 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.

12/97 UPDATE - No changes. Orginal correction factors were 4 for the Ludlum instrument and 1 for the GM.

Attachment 13

SOUTH PROCESS POND TEST TRENCH #3 RAD SCREEING PROFILE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A	176	52	51	45	45	80	139	nd	1	10				11	53	13	2
B		48	59	35	131	73	45	nd	4	23				4	3	18	8
C		96	100	178	86	997	16	9	21	12				12	15	na	nd
D		32	52	155	404	268	46	16	6	13				nd	nd	12	13
E			8	119	165 B0L887	244	87	29	27	17				9	4	13	13

SPPTT #3 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.
7. Error was made in measurment of trench. Cells in columns 11-13 do not exist.

12/97 UPDATE - No Changes. Original correction factor was 4.

Attachment 13

SOUTH PROCESS TEST TRENCH #4 RAD SCREENING PROFILE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
A	60	33	nd	14	31	nd	34	9	5	36	59	1	12	7	21	17	19	9	11	8	8	6	17	15	7	1
B		50	7	13	68	23	23	25	nd	54	52	108	9	9	19	5	25	nd	nd	6	18	nd	19	20	9	22
C		11	47	67	166	239	17	nd	nd	45	55	22	25	5	14	13	11	11	10	5	7	6	16	34		
D		16	20	4	287	138	33	nd	3	35	42	32	29	20	40	20	17	2	24	6	25	10	6	28		
E		4	13	11	21	52	21	5 B0L890	nd	33	46	26	19	31	25	22	15	15	25	24	7	15	15	30		
			22																				24			

SPPTT #4 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.

12/97 UPDATE - No Changes. Original correction factor was 4.

Attachment 13

SOUTH PROCESS POND TEST TRENCH #5 RAD SCREENING PROFILE

	1	2	3	4	5	6	7	8	9	10
A	30	369	17	61	60	66	13	24	37	28
B		76	24	88	72	102	45	32	54	83
C		59	17	59	57	77	31	59	57	43
D			29	85	45	39	30	35	64	25
E			36	41	22	45 B0L889	35	51	27	35

SPPTT #5 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.

12/97 UPDATE - No Changes. Original correction factor was 4.

SOUTH PROCESS POND TEST TRENCH #6 RAD SCREENING PROFILE

	1	2	3	4	5	6	7	8
A							35	17
B							2	25
C							13	57
D							103	407
E							596	92 B0L888

SPPTT #6 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.
7. Decision not to dig cells in column 1-6 documented in logbook EL-1395 on 9/9/97.

12/97 UPDATE - No Changes. Original correction factor was 4.

Attachment 13

SOUTH PROCESS POND TEST TRENCH #7 RAD SCREENING PROFILE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A		36	330	23	41	69	72	32	58	50	nd	15	61	50	50	100	100	550
B		33	154	30	22	42	58	52	47	50	65	132	84	100	50	50	50	50
C		27	25	12	34	46	32	38	32	100	62	75	104	100	50	50	50	50
D		25	21	24	16	37	37	39	35	50	37	41	20	50	nd	nd	50	50
E				28 B0L886	30	39	35	29	36	nd	22	nd	23	50	50	nd	nd	nd

SPPTT #7 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.

12/97 UPDATE - No changes. Orginal correction factors were 4 for the Ludlum instrument and 1 for the GM.

Attachment 13

SOUTH PROCESS POND TEST TRENCH #8 RAD SCREENING PROFILE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A		33	795	28	26	3	13	17	264	86	37	150	269	31	34	29	22	39
B		56	112	41	45	21	6	61	214	145	64	100	98	508	4	90	163	130
C		4	60	35	32	19	19	6	95	144	160	50	n/a	44	277	68	48	81
D			102	32	37	24	1	12		76	100	50	136	115	104	93	83	45
E			62	40 B0L885	32	12	nd	5		27	100	50	74	84	49	20	17	20

12/97 UPDATE - Revised Correction Factor From 3 to 4. The correction factor used for the GM instrument (1) was not changed.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A		25	596	28	26	3	13	13	198	65	28	**150**	202	23	26	22	17	29
B		42	84	41	45	21	6	46	161	109	48	**100**	74	381	3	68	122	98
C		3	45	35	32	19	19	5	71	108	120	**50**	n/a	33	208	51	36	61
D			77	32	37	24	1	9		57	**100**	**50**	102	86	78	70	62	34
E			47	40 B0L885	32	12	nd	4		20	**100**	**50**	56	63	37	15	13	15

SPPTT #8 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.

Attachment 13

SOUTH PROCESS POND TEST TRENCH #8 RAD SCREENING PROFILE

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A		33	795	28	26	3	13	17	264	86	37	150	269	31	34	29	22	39
B		56	112	41	45	21	6	61	214	145	64	100	98	508	4	90	163	130
C		4	60	35	32	19	19	6	95	144	160	50	n/a	44	277	68	48	81
D			102	32	37	24	1	12		76	100	50	136	115	104	93	83	45
E			62	40 B0L885	32	12	nd	5		27	100	50	74	84	49	20	17	20

12/97 UPDATE - Revised Correction Factor From 3 to 4. The correction factor used for the GM instrument (1) was not changed.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
A		25	596	28	26	3	13	13	198	65	28	150	202	23	26	22	17	29
B		42	84	41	45	21	6	46	161	109	48	100	74	381	3	68	122	98
C		3	45	35	32	19	19	5	71	108	120	50	n/a	33	208	51	36	61
D			77	32	37	24	1	9		57	100	50	102	86	78	70	62	34
E			47	40 B0L885	32	12	nd	4		20	100	50	56	63	37	15	13	15

SPPTT #8 NOTES:

1. Cell size is approximately 10 feet wide by 3 feet deep.
2. Cell numbers increase with distance away from the pond side of the trench.
3. Survey measurements collected in accordance with BHI-01010, "Method for Radiological Surveys of the 300-FF-1 Operable Unit Soil and Materials".
4. All screening values reported in pCi/g. Background has been subtracted from all reported screening values.
5. "nd" indicates that measured screening value was not above background.
6. Values < 50 pCi/g should be considered estimated.

Attachment 13

SOUTH PROCESS POND TEST TRENCH VERIFICATION SAMPLE RESULTS

			Trench 1	Trench 2	Trench 3	Trench 4	Trench 5	Trench 6	Trench 7	Trench 8
		Sample Location	5E	4E	5E	8E	6E	8E	4D	4E
		field survey (pCi/g)	28	17	165	5	45	12	28	40
		RCF total activitiy (pCi/g)								
Constituent	***Cleanup Level***	***Unit***	***B0L884***	***B0L891***	***B0L887***	***B0L890***	***B0L889***	***B0L888***	***B0L886***	***B0L885***
arsenic	219	mg/kg	3.6	17.9	17	19.3	13.8	18.7	9.4	20.9
thallium	245	mg/kg	4	3.3 U	3.4 U	3.4 U	3.3 U	3.6 U	3.3 U	3.4 U
benzo(a)pyrene	18	mg/kg	0.35 U	0.33 U	0.35 U	0.35 U	0.34 U	0.37 U	0.34 U	0.35 U
chrysene	18	mg/kg	0.35 U	0.33 U	0.35 U	0.35 U	0.34 U	0.37 U	0.34 U	0.35 U
PCBs[a]	17	mg/kg	0.25 U	0.84	0.23 U	3.11	0.23 U	0.23 U	0.23 U	0.23 U
uranium[b]	350	pCi/g	4.36	6.7	24.63	2.27	2.34	83.27	16.76	32.92
cobalt-60	c	p/Ci/g	0.018	0.021 U	0.021 U	0.02	0.019 U	0.024 U	0.024 U	0.023 U

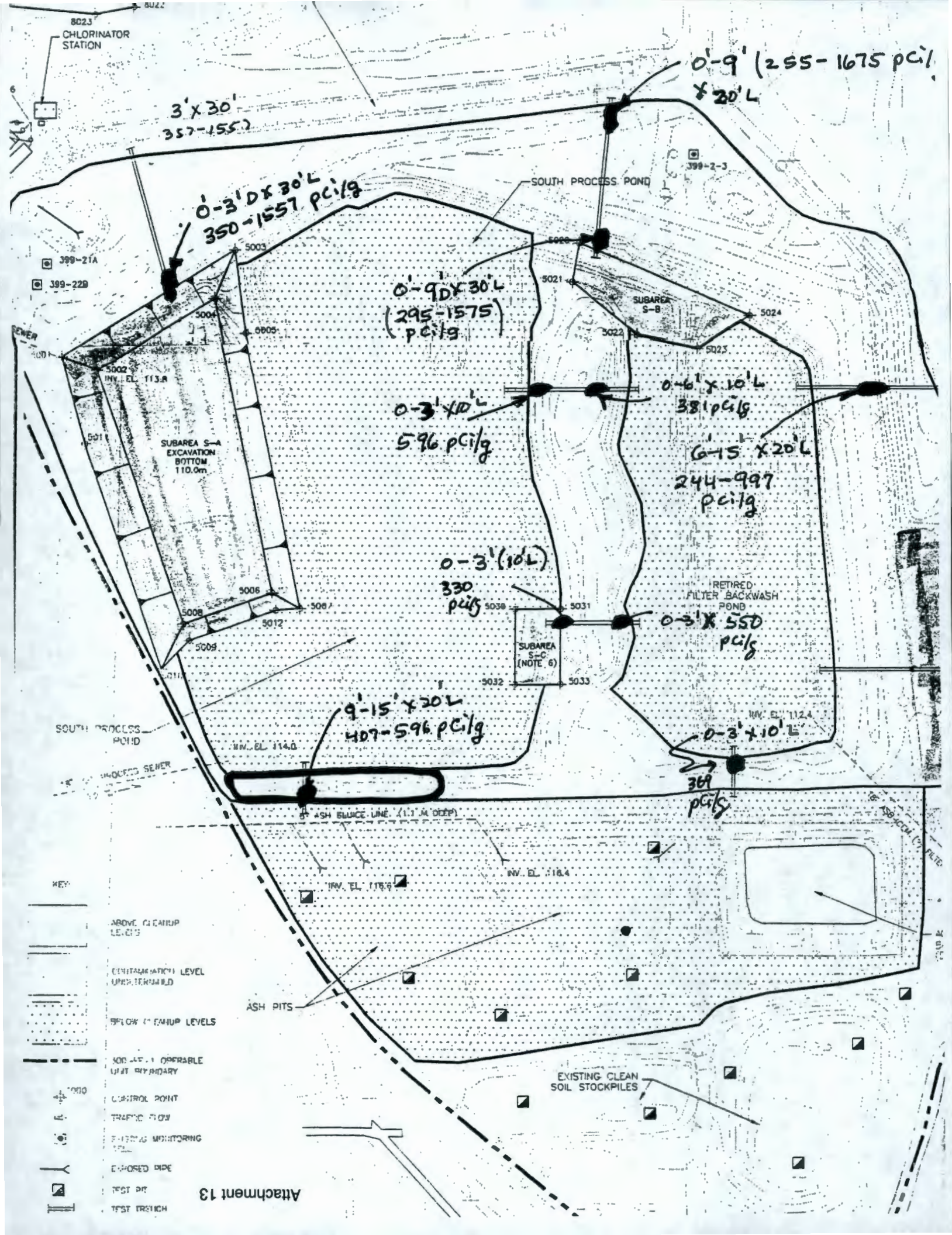
NOTE: U indicates that the constituent was not detected. The associated value is the quantitation limit/minium detectable activity for the sample.

[a] Reported result calculated as a sum of aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

[b] Reported result calculated as a sum of U-234, U-235, and U-238.

[c] The RESRAD model used only uranium in development of the radiation cleanup standard because cobalt-60 is of concern only in the 300-FF-1 South Process Pond and also has a short half-life (5.26 years). No other radionuclides contribute significantly to the total dose.

Attachment 13


CHLORINATOR STATION
0'-9' (255-1675 pCi/g
& 20'L
3'X30'
357-1557
0'-3'DX30'L
350-1557 pCi/g
SOUTH PROCESS POND
399-2-3
399-21A
399-22B
0'-9'DX30'L
(295-1575
pCi/g
SUBAREA S-B
SUBAREA S-A EXCAVATION BOTTOM 110.0m
0'-3'X10'L
596 pCi/g
0'-6'X10'L
381 pCi/g
6'-15'X20'L
244-997
pCi/g
0'-3'(10'L)
330
pCi/g
RETIRED FILTER BACKWASH POND
0'-3'X 550
pCi/g
SUBAREA S-C (NOTE 6)
9'-15'X20'L
407-596 pCi/g
INV. EL. 114.0
INV. EL. 112.4
0'-3'X10'L
369
pCi/g
ASH SLUICE LINE (1.1 M DEEP)
INV. EL. 116.4
INV. EL. 115.6
ASH PITS
EXISTING CLEAN SOIL STOCKPILES
KEY:
CONTROL POINT
TRAFFIC FLOW
EXPOSED PIPE
TEST PIT
TEST TRENCH
Attachment 13

Sampling, Analysis, and Closeout Plan for Tanker Spill Area in 300-FF-1 OU

1.0 Purpose

The purpose of this document is to describe a plan to perform additional remediation (if needed), sample, and closeout a small surface area where investigation derived waste was stored and a small spill occurred at the 300-FF-1 Operable Unit. Additionally, this plan will document Department of Energy and Environmental Protection Agency concurrence with the approach via approvals in Section 7.0.

2.0 History

Investigation Derived Waste generated during remedial investigation of CERCLA OU's was initially being stored within the OU where the waste was generated. A project was initiated prior to 300-FF-1 remedial action to dispose of the stored IDW. Solid waste disposal had already been completed and disposal of liquid IDW was underway when a small spill occurred at the 300-FF-1 OU. IDW liquids were spilled from a tanker truck onto the soil column after transfer from drums was completed and the tanker started pulling away. The spilled IDW consisted of wastewater collected from the 100, 200 and 300 Area OU's. A surface area approximately 4 ft by 3 ft was contaminated. The spill area was radiologically posted, the tanker was decontaminated, and wet soil was picked up and removed. It is estimated that only a few gallons had spilled into the soil. The spill area soil was surveyed after the initial spill cleanup and again in December 1998 (Attachments 1 and 2).

To support processing the tanker wastewater at the Effluent Treatment Facility located at the Hanford Site 200 Area, a sample (BOL370), duplicate (BOL372), and VOA trip blank (BOL374) were taken from the tanker wastewater under SAF-B97-130. The samples were analyzed in June 1997 and the results are discussed in Section 3.0.

IDW waste from the 300-FF-1 OU is authorized for disposal to the ERDF in the 300-FF-1 OU record of decision (ROD). The spill occurred after issuance of the 300-FF-1 ROD and Remedial Design Report/Remedial Action Workplan (RDR/RAWP – which includes the Sampling and Analysis Plan) and was not specifically addressed in those documents. Regulatory approval of this document and incorporation in the administrative record obviate the need to revise the 300-FF-1 SAP and RDR/RAWP for this specific topic.

3.0 Tanker Wastewater Sample Results

The tanker wastewater sample summary results are presented in Table 1. Most chemical constituents were not detected. Those that were detected are compared to Site Background and State of Washington, MTCA Method C Industrial Cleanup Values for soils in Table 2. MTCA Method C is the 300-FF-1 ROD chemical contaminant cleanup standard. All chemical constituents were either below MTCA Method C cleanup values, below background, or were non-detects. Detected radionuclides included tritium, cesium-137, strontium-90 and total uranium. Gross alpha results were all non-detects.

Gross beta readings were also reported and should be related to the isotopes identified by specific analysis. It is clear that verification samples should be analyzed for the 300-FF-1 contaminants of concern. The analytical results will be compared to the 15 mrem/year industrial cleanup standard and MTCA cleanup standards required in the 300-FF-1 OU ROD.

4.0 Remediation

Further remediaton, if required, is consistent with the 300-FF-1 ROD and will include soil excavation and disposal to ERDF. An excavator will remove approximate 6 inch lifts if required, until radiological field surveys indicate readiness for verification sampling as described in Section 5.0.

5.0 Verification Sampling and Analysis

Two surface samples shall be taken in the remediated spill area at the locations with the highest surface radiation readings (Figure 1). Two samples are considered an adequate representation of the remediated area because the area is small and the sample locations will be biased. This will be determined by applying results from a field screening radiological survey of the remediated area using 300-FF-1 remedial action field screening instrumentation. Based on the tanker sample results and 300-FF-1 specific contaminants, the samples will be analyzed for tritium, cesium-137, strontium-90, cobalt-60, isotopic uranium, arsenic, benzo(a)pyrene, chrysene, and thallium Sampling methods and custody procedures will be followed as per the 300-FF-1 Sampling and Analysis Plan (Appendix C of the 300-FF-1 RDR/RAWP). Data Quality Objectives for the soils are listed in Table 3.

6.0 Spill Area Closeout

Results from the two samples will be averaged for each of the radionuclides. The average value for each radionuclide will be input to the RESRAD model using the 300-FF-1 project specific input parameters, with minor changes to adjust for the very small size of the spill area. (Appendix B of the 300-FF-1 RDR/RAWP). The RESRAD results will be compared to the 15 mrem/year cleanup standard. If below 15 mrem/yr, the area is remediated. The closeout results will be published in the closeout report for the North or South Process Pond depending on timing of remediation/sampling.

Table 1. Tanker Wastewater Sample Summary Results

Constituent Name	Value	Units	Qual.	Constituent Name	Value	Units	Qual.	Constituent Name	Value	Units	Qual.
1,1,1-Trichloroethane	5	ug/L	U	Carbon disulfide	3	ug/L	J	Nitrogen in ammonia	50	ug/L	U
1,1,2-Trichloroethane	5	ug/L	U	Carbon tetrachloride	5	ug/L	U	Nitrogen, Kjeldahl total	2020	ug/L	
1,1-Dichloroethane	5	ug/L	U	Cesium-137	182000	pCi/L		Phosphate	20	mg/L	
1,1-Dichloroethene	5	ug/L	U	Chloride	11.6	mg/L		Plutonium-238	-8.57	pCi/L	U
1,2-Dichloroethane	5	ug/L	U	Chlorobenzene	5	ug/L	U	Plutonium-239/240	-8.37	pCi/L	U
1,4-Dichlorobenzene	5	ug/L	U	Chloroform	2	ug/L	J	Potassium	56700	ug/L	
1-Butanol	1000	ug/L	U	Chromium	2.7	ug/L	U	Selenium	55	ug/L	U
2,4-Dimethylphenol	30	ug/L	J	Cobalt	5.8	ug/L	B	Silicon	12400	ug/L	
2-Butanone	100	ug/L	U	Cobalt-60	414	pCi/L	U	Silver	3.6	ug/L	U
2-Butoxyethanol	5000	ug/L	U	Copper	42	ug/L		Sodium	40100	ug/L	
2-Hexanone	50	ug/L	U	Cyanide	5	ug/L	U	Sulfate	20.3	mg/L	
2-Methylphenol (cresol, o-)	10	ug/L	U	Di-n-octylphthalate	6	ug/L	J	Sulfide	1.91	mg/L	
2-Pentanone	50	ug/L	U	Ethyl cyanide	100	ug/L	U	Tetrachloroethene	5	ug/L	U
4-Methyl-2-Pentanone	50	ug/L	U	Europium-152	259	pCi/L	U	Tetradecane	120	ug/L	J
4-Methylphenol (cresol, p-)	10	ug/L	U	Europium-154	2980	pCi/L	U	Tetrahydrofuran	100	ug/L	U
Acetone	14	ug/L	J	Europium-155	441	pCi/L	U	Thallium	26.5	ug/L	U
Acetophenone	20	ug/L	U	Fluoride	0.28	mg/L		Toluene	5	ug/L	U
Aluminum	383	ug/L		Gross alpha	26.2	pCi/L	U	Total beta radiostrontium	989000	pCi/L	
Americium-241	440	pCi/L	U	Gross beta	1770000	pCi/L		Tributyl phosphate	10	ug/L	J
Antimony	20.2	ug/L	U	Hexachloroethane	10	ug/L	U	Trichloroethene	5	ug/L	U
Antimony-125	434	pCi/L	U	Iron	9270	ug/L		Tridecane	60	ug/L	J
Arsenic	38.9	ug/L	U	Lead	26	ug/L	U	Tritium	3540000	pCi/L	
Barium	241	ug/L		Magnesium	4810	ug/L	B	Undecane	59	ug/L	J
Benzene	5	ug/L	U	Manganese	264	ug/L		Uranium	23.1	ug/L	
Benzyl alcohol	20	ug/L	U	Mercury	5	ug/L		Vanadium	2.9	ug/L	U
Beryllium	0.4	ug/L	U	Methylenechloride	11	ug/L	B	Vinyl chloride	10	ug/L	U
Bis(2-ethylhexyl) phthalate	100	ug/L	J	N-Nitrosodimethylamine	10	ug/L	U	Xylenes (total)	5	ug/L	U
Bromide	0.25	mg/L	U	Naphthalene	10	ug/L	U	Zinc	261	ug/L	E
Cadmium	3.4	ug/L	U	Nickel	26	ug/L	B	cis-1,2-Dichloroethylene	5	ug/L	U
Calcium	42900	ug/L		Nitrogen in Nitrate	0.02	mg/L	U	trans-1,2-Dichloroethylene	5	ug/L	U

Table 2. Detects Compared to Background and MTCA Method C Cleanup Values

Constituent Name	Highest Value (ug/L)	Site Background (mg/kg)	MTCA C Cleanup Value for Soils (mg/kg)
2,4-Dimethylphenol	30		70000
Acetone	14		350000
Aluminum	383	12134	none
Barium	241	137.6	245000
Bis(2-ethylhexyl) phthalate	100		9370
Calcium	42900	17572	none
Carbon disulfide	3		350000
Chloride	11600	121.34	none
Chloroform	2		21500
Cobalt	5.8	16.28	none
Copper	42		130000
Di-n-octylphthalate	6		70000
Fluoride	280	2.58	none
Iron	9270	33076	none
Magnesium	4810		none
Manganese	264	510	490000
Mercury	5	0.2808	1050
Methylenechloride	11		none
Nickel	26	19.66	70000
Nitrogen, Kjeldahl total	2020		none
Phosphate	20000		none
Potassium	56700	2277	
Silicon	12400	51	none
Sodium	40100	712	486
Sulfate	20300	242.6	
Sulfide	1910		none
Tributyl phosphate	10		none
Uranium	23.1		10500
Zinc	261	70.1	1050000

Footnotes:

1. State of Washington, MTCA Method C, "Industrial Cleanup Values for Soils" (MTCA Cleanup Values and Risk Calculations, update February 26, 1996).
2. 90% value calculated from random data set using Weibull distribution as documented in the sitewide background (DOE-RL 1994).

Figure 1. Spill Area

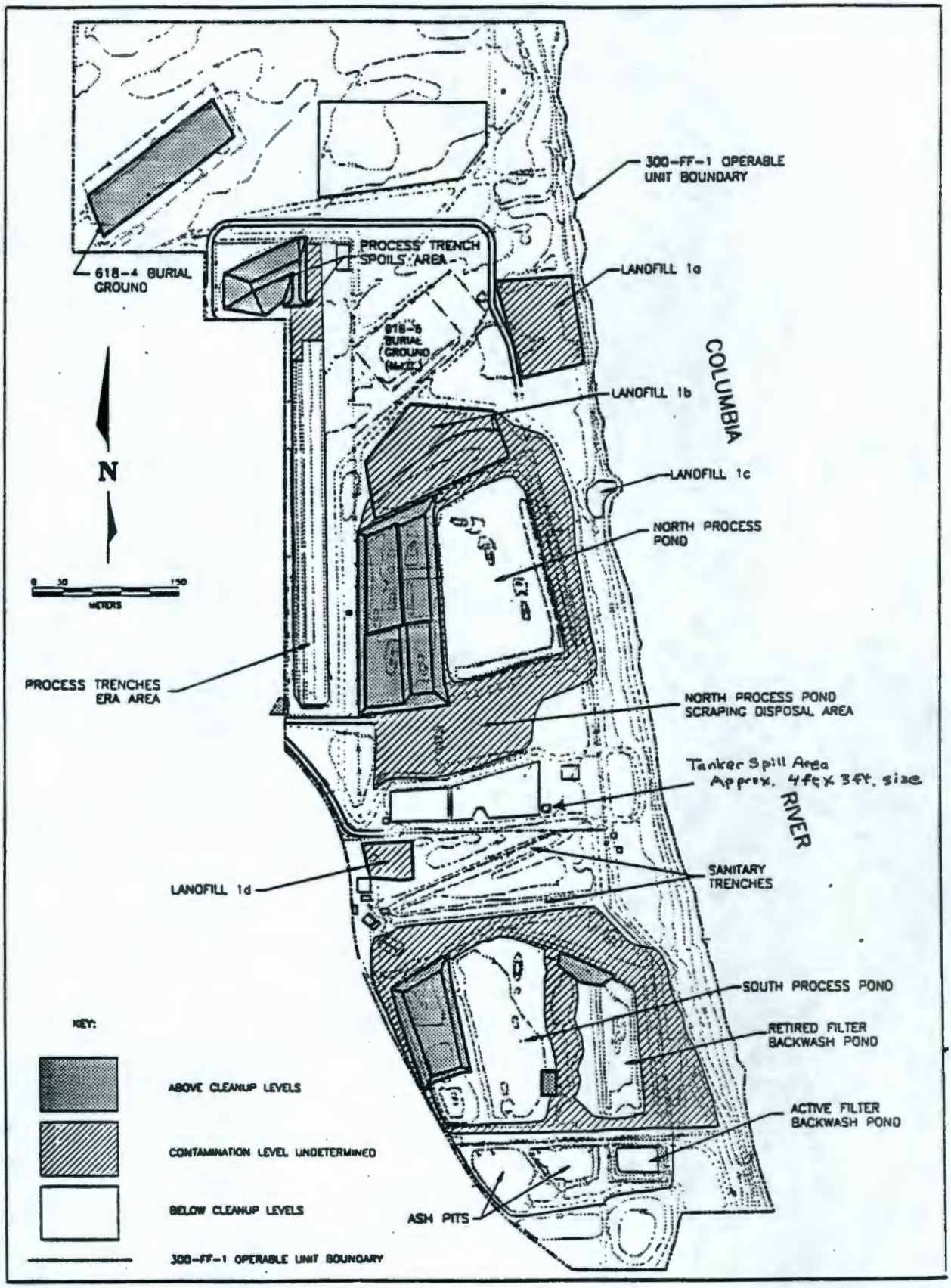


Table 3. Data Quality Objectives

Analytical Parameter	Analytical Method	Target Detection Limit	Accuracy (Percent Recovery)	Precision (RPD)	Completeness (Percent)
^{234}U	Alpha Spec.	1 pCi/g	70-130	35	90
^{235}U	Alpha Spec.	1 pCi/g	70-130	35	90
^{238}U	Alpha Spec.	1 pCi/g	70-130	35	90
^{60}Co	Gamma Spec.	1 pCi/g	70-130	35	90
^{137}Cs	Gamma Spec.	1 pCi/g	70-130	35	90
^{90}Sr	Gas Proportional Counting	5 pCi/g	70-130	35	90
Tritium	Liquid Scintillation	5 pCi/g[a]	70-130	35	90

a. Varies depending on soil moisture content.

7.0 Authorization

_____ Date:_____

R. G. McLeod, DOE/RL, 300-FF-1 OU
Project Manager

_____ Date:_____

D. R. Einan, EPA, 300-FF-1 OU
Project Manager

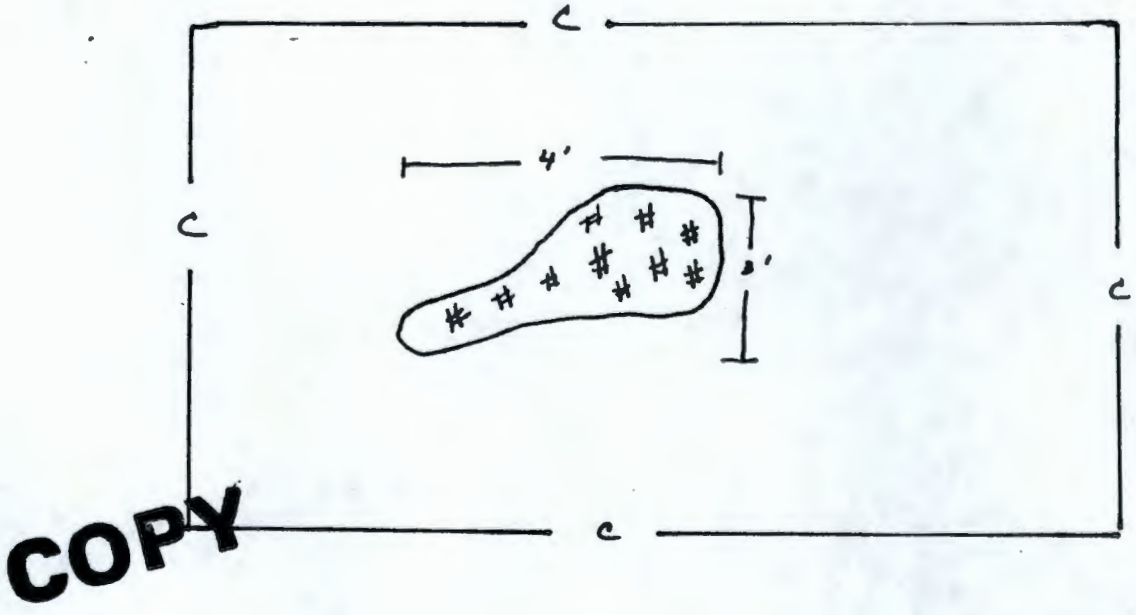
ATTACHMENTS

ERC RADIOLOGICAL SURVEY RECORD
Contamination

Type of Survey (check one only)
☐ Release ☐ Routine ☒ Work Progress ☐ Shipment

Survey # RSR - FF½-98-2498

RWP # / Rev. #	Date	Time	Location
FF½-004 / Rev 1	12.29.98	1300	FF1



* Survey of Tanker spill area.

Unless noted, contamination levels are below the levels listed in Project Technical Assessment #: TA-96-17

-C- Contamination Area	-H- High Contamination Area	-B- Radiological Buffer Area	-AR- Airborne Radioactivity Area	-RM- Radioactive Materials Area	-R- Radiation Area	-HR- High Radiation Area	
○ Technical Smear	# Direct	M Large Area Wipe	[AS] Air Sample Location	-SCA- Soil Contamination Area	-VHR- Very High Radiation Area		

Instruments

Model	Serial #	Source ✓ (Initial)	Cal Due Date	Model	Serial #	Source ✓ (Initial)	Cal Due Date
E600	1000	GLH	8.7.99	E600	1074		6.19.99
380	439	GLH	9.29.99	380	167		4.18.99

RCT Name/Signature/Date:
John Tufford / [signature] / 12-29-98
Annette L Howell / Annette L Howell 12.29.98

RCT Supervisor Name/Signature/Date:

RSR completed in accordance with BHI-SH-04, Procedure 3.1.

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