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POST-REMEDIAL ACTION REPORT FOR THE DISPOSAL CELL WORK ZONE (WP-437/RU025)

WELDON SPRING SITE REMEDIAL ACTION PROJECT
WELDON SPRING, MISSOURI

FEBRUARY 2002 **REV. 0**

RECORD

U.S Department of Energy
Oak Ridge Operations Office
Weldon Spring Site Remedial Action Project

Prepared by MK-Ferguson Company and Jacobs Engineering Group

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APPROVALS

Environmental Safety and Health Manager	02-07-02 Date
Data Administration Coordinator	2/12/02 Date
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Project Quality Manager	2/12/02 Date
Project Director	2/14/02 Date

DOE/OR/21548-911

Weldon Spring Site Remedial Action Project

Post-Remedial Action Report for the Disposal Cell Work Zone (WP-437/RU025)

Revision 0

February 2002

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U.S. DEPARTMENT OF ENERGY
Oak Ridge Operations Office
Under Contract DE-AC05-86OR21548

ABSTRACT

Work Package-437 (WP-437) has been divided into twelve work zones. This report details the confirmation field activities and analytical results for contaminated soil removal of the Disposal Cell work zone portion. Most of this 48-acre work zone consists of the site disposal cell with only a few areas requiring remediation.

The Disposal Cell work zone included areas that were deleted from WP-420 confirmation activities, an in-situ soil area, and removal of a temporary haul road. Those areas have been designated as Remedial Unit (RU) 25 and have been subdivided into eleven confirmation units (CUs).

Remediation was designed to achieve surface ALARA goals, and confirmation of soil remediation was required to meet cleanup standards as established in the *Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site*. Final confirmation data verify that the established goals and standards were achieved.

TABLE OF CONTENTS

SECTION **PAGE**

1. INTRODUCTION 1
1.1 Purpose 1
1.2 Scope 1
1.3 Remediation and Confirmation Process 1
2. PRE-REMEDIATION ACTIVITIES 4
2.1 Determining Contaminants of Concern 4
2.2 Data Quality Objectives 4
2.3 Cleanup Standards 4
2.4 Cleanup Confirmation Process 5
3. REMEDIAL ACTIVITIES 7
3.1 Field Activities 7
3.1.1 Walkover Surveys 7
3.1.2 Soil Sampling 8
3.2 Laboratory Activities 8
3.3 Independent Verification Activities 8
4. CONFIRMATION UNITS RESULTS SUMMARY 10
5. DATA EVALUATION 33
5.1 Data Verification 33
5.2 Data Review 33
5.3 Data Validation 34
6. SUMMARY OF CLOSURE REPORT FINDINGS 35
6.1 Data Evaluation 35
6.2 Summary of WP-437 Confirmation Results 35
6.3 Summary of Chemical Plant Confirmation Results 36
6.4 Comparison of Standard Deviations 36
7. REFERENCES 38

APPENDIXES

A Temporary Haul Road Sample IDs
B WP437 RU025 Final Walkover Forms
C WP437 RU025 Final Data
D WP437 RU025 Sample Location Coordinates
E Interoffice Correspondence

LIST OF FIGURES

NUMBER **PAGE**

Figure 1-1 WP-437 Work Zone Designations 2
Figure 1-2 Confirmation Units in Remedial Unit RU025 3
Figure 2-1 Cleanup Confirmation Process 6
Figure 4-1 Sample Locations in Remedial Unit RU025 Confirmation Unit CU378 12
Figure 4-2 Sample Locations in Remedial Unit RU025 Confirmation Unit CU379 14
Figure 4-3 Sample Locations in Remedial Unit RU025 Confirmation Unit CU380 16
Figure 4-4 Sample Locations in Remedial Unit RU025 Confirmation Unit CU381 18
Figure 4-5 Sample Locations in Remedial Unit RU025 Confirmation Unit CU400 20
Figure 4-6 Sample Locations in Remedial Unit RU025 Confirmation Unit CU401 22
Figure 4-7 Sample Locations in Remedial Unit RU025 Confirmation Unit CU402 24
Figure 4-8 Sample Locations in Remedial Unit RU025 Confirmation Unit CU403 26
Figure 4-9 Sample Locations in Remedial Unit RU025 Confirmation Unit CU404 28
Figure 4-10 Sample Locations in Remedial Unit RU025 Confirmation Unit CU405 30
Figure 4-11 Sample Locations in Remedial Unit RU025 Confirmation Unit CU410 32

LIST OF TABLES

NUMBER **PAGE**

Table 2-1 ROD Cleanup Standards for COCs within the WP-437 Disposal Cell Work Zone..... 5
Table 4-1 Summary of CU378..... 11
Table 4-2 Summary of CU379..... 13
Table 4-3 Summary of CU380..... 15
Table 4-4 Summary of CU381..... 17
Table 4-5 Summary of CU400..... 19
Table 4-6 Summary of CU401..... 21
Table 4-7 Summary of CU402..... 23
Table 4-8 Summary of CU403..... 25
Table 4-9 Summary of CU404..... 27
Table 4-10 Summary of CU405..... 29
Table 4-11 Summary of CU410..... 31
Table 6-1 Summary Totals for RU025..... 35
Table 6-2 Summary Totals for Confirmation..... 36
Table 6-3 Comparison of Standard Deviations..... 37

1. INTRODUCTION

1.1 Purpose

Work Package-437 (WP-437) is divided into 12 work zones, 11 of which are identified in Figure 1-1. In addition, there is the Vicinity Property DA-6 work zone off site just west of the Ash Pond work zone. This report details the confirmation field activities and analytical results for contaminated soil removal of the Disposal Cell work zone portion of WP-437.

Soil characterization results, pre-excavation walkovers, and historical process knowledge of the WP-437 work zones determined that the work zones contained contaminant concentrations that exceeded the As Low As Reasonably Achievable (ALARA) goals established in the *Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site* (ROD) (Ref. 1). Remediation was designed to achieve surface ALARA goals, and confirmation of soil remediation to the ROD cleanup standards was required.

The Disposal Cell work zone was subdivided into eleven confirmation units (CUs) that are collectively known as remedial unit (RU) 025 and are identified in Figure 1-2. Individual CU figures are presented in Section 4 of this report.

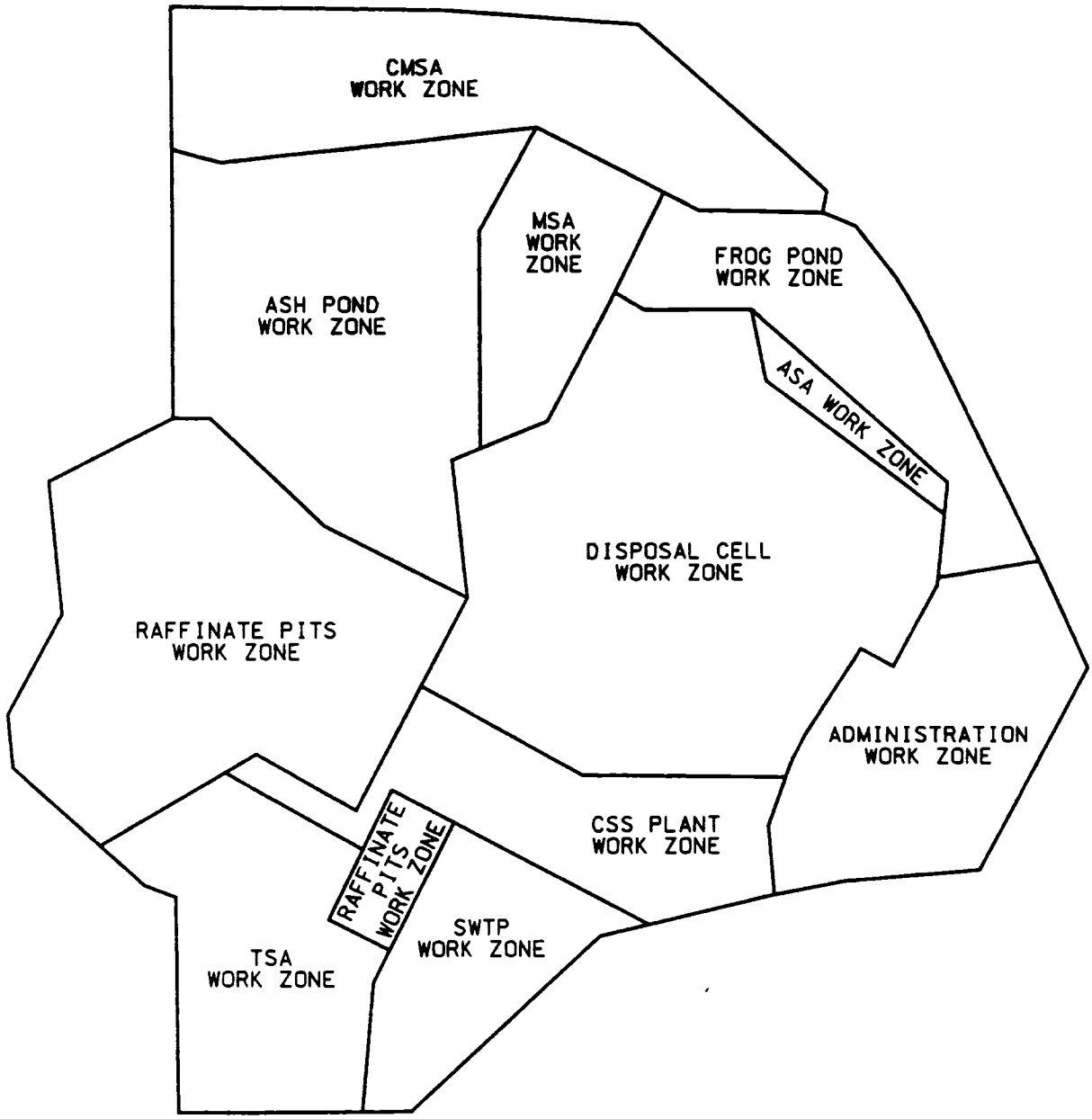
1.2 Scope

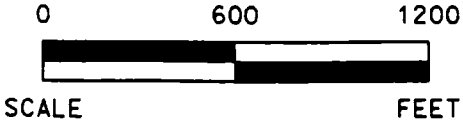
This report describes the remedial activities and confirmation surveying and sampling conducted on contaminated soils within RU025. Confirmation walkovers and soil sampling were conducted in accordance with the *Confirmation Sampling Plan Details for the Disposal Cell Facility (WP-437)* (Ref. 2). This plan was developed to ensure that the objectives identified in the *Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 3) were accomplished and to ensure that the remediation requirements of the ROD were met.

1.3 Remediation and Confirmation Process

This report details the activities conducted to remediate the Disposal Cell portion of WP-437, which consists of CU378 through CU381, CU400 through CU405, and CU410. Remediation consisted of excavation of contaminated soils and removal of a temporary haul road. Following remediation, walkovers were conducted where applicable, and confirmation samples were collected to ensure that all contaminated materials had been remediated.

The entire remediation process included characterization sampling, historical data review, contaminants of concern (COC) identification, confirmation plan development, contaminated soil excavation, radiological walkover surveys, confirmation soil sampling, preliminary and final data review, completion of disposition forms, quality assurance/quality control (QA/QC) review, summary of findings and conclusions, and closure report preparation.

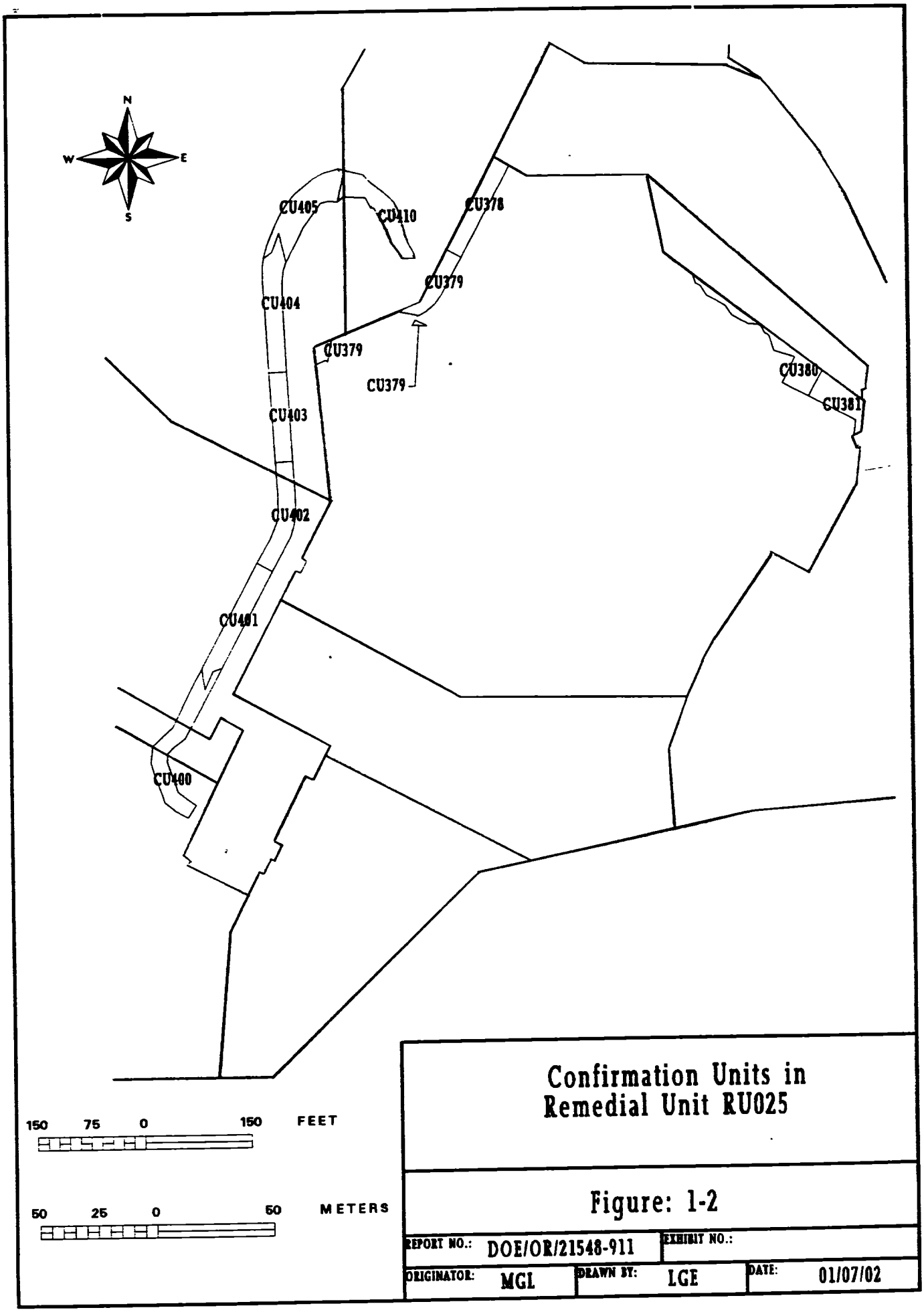




WP-437 WORK ZONE DESIGNATIONS

FIGURE 1-1

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO.: A/CP/001/0101	
ORIGINATOR: LGE	DRAWN BY: GLN	DATE: 1/9/02	



Confirmation Units in Remedial Unit RU025

Figure: 1-2

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO.:	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE: 01/07/02	

2. PRE-REMEDIATION ACTIVITIES

2.1 Determining Contaminants of Concern

Contaminant of concern (COC) determination was dependant upon historical information, characterization results, and visual observation during field activities, and not all COCs were required for all sample locations. The full process for identifying COCs is detailed in the *Confirmation Sampling Plan Details for the Disposal Cell Facility (WP-437)* (Ref. 2). This plan identified COCs for RU025 as arsenic (As), chromium (Cr), lead (Pb), thallium (Tl), polynuclear aromatic hydrocarbon (PAH), polychlorinated biphenyl (PCB), Radium-226 (Ra-226), Radium-228 (Ra-228), Thorium-230 (Th-230), Thorium-232 (Th-232), and Uranium-238 (U-238).

Confirmation units (CUs) in the Disposal Cell work zone included one in-situ contaminated soil area labeled ASAX-2, areas that were deleted from Work Package 420 (WP-420) activities, and a temporary haul road. COCs for all temporary haul roads in this work zone originally included the entire suite of radiological and chemical COCs. Due to the nature of the materials hauled on the road, which was constructed on previously confirmed soil, only radiological parameters were applied to the area. See Interoffice Correspondence dated June 13, 2000 in Appendix E of this report for details. New CUs were created to encompass the length of the roadway. Figure 1-2 shows the final CU configuration and COC lists for each CU can be found in the Summary Forms in Section 4 of this report.

2.2 Data Quality Objectives

Data Quality Objectives (DQOs) were identified to specify quality data and ensure that the data would be sufficient to support the decision making process throughout remedial activities, including the confirmation process. Confirmation DQOs were developed for sampling and analyzing soils during remediation and for the subsequent data evaluation. The DQOs were designed to make statistically defensible decisions regarding attainment of cleanup standards. Sampling and analytical programs for the WP-437 work zones were designed in accordance with DQOs stated in the *Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 3).

2.3 Cleanup Standards

The objective of the Department of Energy (DOE) As Low As Reasonably Achievable (ALARA) process is to reduce exposures and risks associated with residual contamination. The ROD (Ref. 1) established two different sets of cleanup standards: risk-based cleanup criteria and ALARA goals. Remedial activities for WP-437 were designed to remove soil where the COC concentrations were found by characterization or during remediation activities to exceed ALARA goals. Table 2-1 summarizes the cleanup criteria and ALARA goals established in the ROD that are applicable for COCs in the Disposal Cell work zone. Throughout the remedial activities at RU025, COC concentrations were evaluated with the ALARA process.

2.4 Cleanup Confirmation Process

The cleanup confirmation process is used to determine, under the remedial guidelines, if remediation activities have achieved the cleanup standards. Figure 2-1 shows the cleanup confirmation process for remedial activities conducted at the WP-437 area.

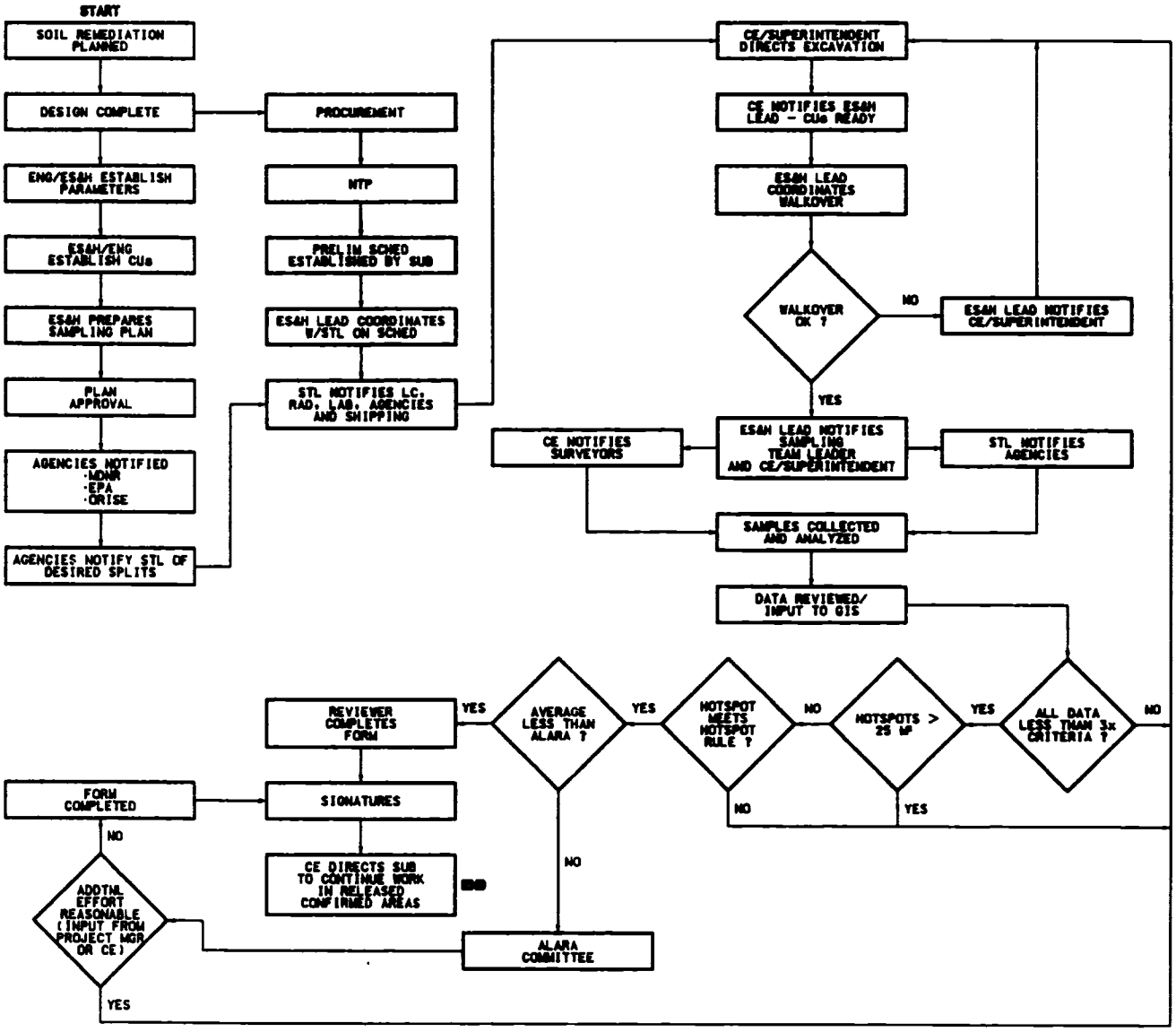
The decision-making process specifies how the data will be applied and evaluated within the cleanup confirmation process. The decision-making process includes provisions for any hot spots that may be encountered by applying a formula to determine the acceptable concentration for the COC.

Table 2-1 ROD Cleanup Standards for COCs within the WP-437 Disposal Cell Work Zone

	SURFACE [a]		SUBSURFACE [b]	
RADIONUCLIDE (pCi/g)	ALARA	CRITERIA	ALARA	CRITERIA
Ra-226	5.0	6.2	5.0	16.2
Ra-228	5.0	6.2	5.0	16.2
Total Radium	5.0	6.2	5.0	16.2
Th-230	5.0	6.2	5.0	16.2
Th-232	5.0	6.2	5.0	16.2
U-238	30.0	120	30.0	120.0
CHEMICAL (mg/kg)				
Arsenic	45	75	75	750
Chromium	90	100	100	1000
Lead	240	450	450	4500
Thallium	16	20	20	200
PAH	0.44	5.6	5.6	56
PCB	0.65	8	8	80

(a) Values listed for surface soils apply to contamination within the upper 15 cm (6 in.) of the soil column.
(b) Values for subsurface apply to contamination in soils below 15 cm (6 in.).

Source: *Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site* (Ref. 1)



CLEANUP CONFIRMATION PROCESS

FIGURE 2-1

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO.: A/PI/031/0601	
ORIGINATOR: LGE	DRAWN BY: GLN	DATE: 1/8/02	

3. REMEDIAL ACTIVITIES

3.1 Field Activities

Contaminated soils and structures were removed from the Disposal Cell work zone and areas were excavated to design depths as detailed in the Disposal Cell work zone specifications (Ref. 4), where applicable. After the initial excavation was complete, or prior to temporary haul road removal, radiological walkover surveys were conducted to evaluate the need for additional excavation. When the surveys indicated no additional excavation was needed, confirmation soil samples were collected.

Confirmation results were then reviewed, and additional excavation and confirmation sampling was conducted in hot spot areas, if necessary. After achieving cleanup standards, a disposition form was completed with preliminary analytical results. The form was reviewed and signed by authorized project personnel. The confirmation unit (CU) was then released back to the subcontractor for final grading.

Field activities completed during remediation, such as walkover surveys and soil sampling, were conducted in accordance with procedures specified in the *Confirmation Sampling Plan Details for the Disposal Cell Facility (WP-437)* (Ref. 2). Field activities were conducted to achieve and document sampling objectives specified in the *Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 3). All sampling and remedial action surveys were conducted and documented in accordance with Weldon Spring Site Remedial Action Project (WSSRAP) Environmental Safety and Health (ES&H) procedures.

3.1.1 Walkover Surveys

For contaminated soil excavations in the Disposal Cell work zone, radiological walkover surveys were conducted after contaminated soil removal was completed to determine if confirmation sample collection could begin. The surveys were conducted using a 2 in. x 2 in. sodium iodide (NaI) scintillation detector. The survey readings were within an acceptable range (less than 1.5 times background) for all applicable CUs in this work zone. Background ranges for each of these CUs are listed in the CU Summary Forms in Section 4 of this report. Copies of Walkover Forms are presented in Appendix B.

One Walkover Form identifying the survey of seventeen of the sample locations in CU401 could not be located. A copy of the page in the survey technician's field book referencing the survey of that area was included in Appendix B.

3.1.2 Soil Sampling

Once the walkovers were completed, or it was determined that confirmation sample collection could begin, soil sampling was conducted as part of the confirmation process. The sampling locations for CUs in RU025 are shown in the figures in Section 4. Analytical suites for the CUs were dependant upon the COC list developed from historical information, characterization data, and visual identification in the field as discussed in Section 2.

One radium and two Th-230 hot spots were encountered during confirmation of RU025. All of these locations were further remediated in accordance with the guidelines established in the *Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 3). Details can be found in the appropriate CU Summary Forms in Section 4 of this report.

The subsequent survey and confirmation sample results indicated that contaminants were below the applicable cleanup standards and the averages were less than the applicable ALARA goals; therefore, no further remediation was conducted for RU025. Disposition forms were completed following the receipt of preliminary analytical data for all CUs within the Disposal Cell work zone.

3.2 Laboratory Activities

Radiological analyses for RU025 were conducted at on-site and off-site laboratories in accordance with the *Project Management Contractor Quality Assurance Program* (Ref. 5) and the *Environmental Quality Assurance Project Plan* (EQAPjP) (Ref. 6). CU releases were based on estimated Ra-226 results. In addition, the concentration of Th-232 was calculated based on the analytical results of Ra-228 and the calculated value was used for CU releases. Both of these calculations are explained in detail in interoffice correspondences (IOCs) in Appendix E. Chemical analyses for RU025 were conducted at subcontracted off-site laboratories using Contract Laboratory Program (CLP) methodologies.

Summaries of the analytical results for each CU can be found in Section 4 of this report. Analytical data were subject to verification, review, and validation upon receipt from the laboratory, as detailed in Section 5 of this report.

3.3 Independent Verification Activities

The Oak Ridge Institute for Science and Education (ORISE) was contracted by the U. S. Department of Energy (DOE) to verify confirmation soil sampling in the chemical plant area. Verification activities included independent walkover radiological surveys and collection and analysis of soil samples to verify proper disposition of CUs. Field verification activities were conducted in accordance with ORISE's final survey plan (Ref. 7).

ORISE visits to verify WP-437 work zones included one CU in the Disposal Cell work zone. Soil samples collected by ORISE are noted on the CU380 Summary Form in Section 4 of this report. A final verification report will be prepared by ORISE. The ORISE report will contain verification of walkover surveys and soil sampling results and will affirm that the remedial action objectives were achieved.

4. CONFIRMATION UNITS RESULTS SUMMARY

This section summarizes the confirmation unit (CU) analytical results for the eleven CUs in RU025. In total, 270 locations were sampled between March 24, 1998, and July 10, 2000. Preliminary results were below cleanup criteria. Average contaminant of concern (COC) concentrations as indicated by preliminary data remained below ALARA goals. All 100 m^2 averages from final data are less than criteria.

After the preliminary data were reviewed, disposition forms were completed and signed by authorized reviewers. Based on the preliminary confirmation data, all eleven CUs in RU025 were fully released as complying with surface cleanup standards.

Note that the preliminary data consisted of the initial results available immediately from the laboratory and were used for releases. These preliminary results could vary from the final results based upon laboratory quality checks or Weldon Spring Site Remedial Action Project (WSSRAP) verification activities. Upon receipt of the data packages, the final data were reviewed and compared to the preliminary data. The final analytical results agreed with or were lower than the preliminary results and indicated that the remedial activities were completed. The final results meet the cleanup standards as detailed in the *Chemical Plant Area Cleanup Area Attainment Confirmation Plan* (Ref. 3) for all CUs in RU025.

Tables 4-1 through 4-11 and associated figures provide the confirmation details for each CU, and all data presented is final data. Copies of the walkover survey information for each CU are presented in Appendix B. The final data are presented in Appendix C. A list of sample location coordinates is presented in Appendix D.

On the following tables in this section, the "Date Released For Unrestricted Use" refers to the date that confirmation activities were completed and the CU was released to the subcontractor to begin final backfilling and/or regrading. The phrase is not synonymous with DOE Order 5400.5 terminology that refers to release without radiological restrictions.

Table 4 - 1 Summary of CU378

CU 378 RU 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232		Tl	
	U-238	X	PAH	
			PCB	
			TNT	

Reference Figure: 4 - 1

DATE RELEASED FOR UNRESTRICTED USE: 4 / 6 / 98

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m^2 < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located in the northwest portion of the disposal cell work zone.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000 - 10,500* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *4/1/98*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : 7

TOTAL # OF UTILITY SAMPLES : 0

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [ ] YES [X] NO

GENERAL COMMENTS - *This CU is partially beneath a gravel road that was previously confirmed under WP420. The road was built with clean material following confirmation, therefore no further confirmation is required and radiological walkovers are considered appropriate in that area. The remaining area requiring confirmation consisted of seven sample locations; SC-37821-S, SC-37802-C, SC-37804-C, SC-37806-C, SC-37810-C, SC-37814-C, and SC-37818-C. All final results are below criteria.*

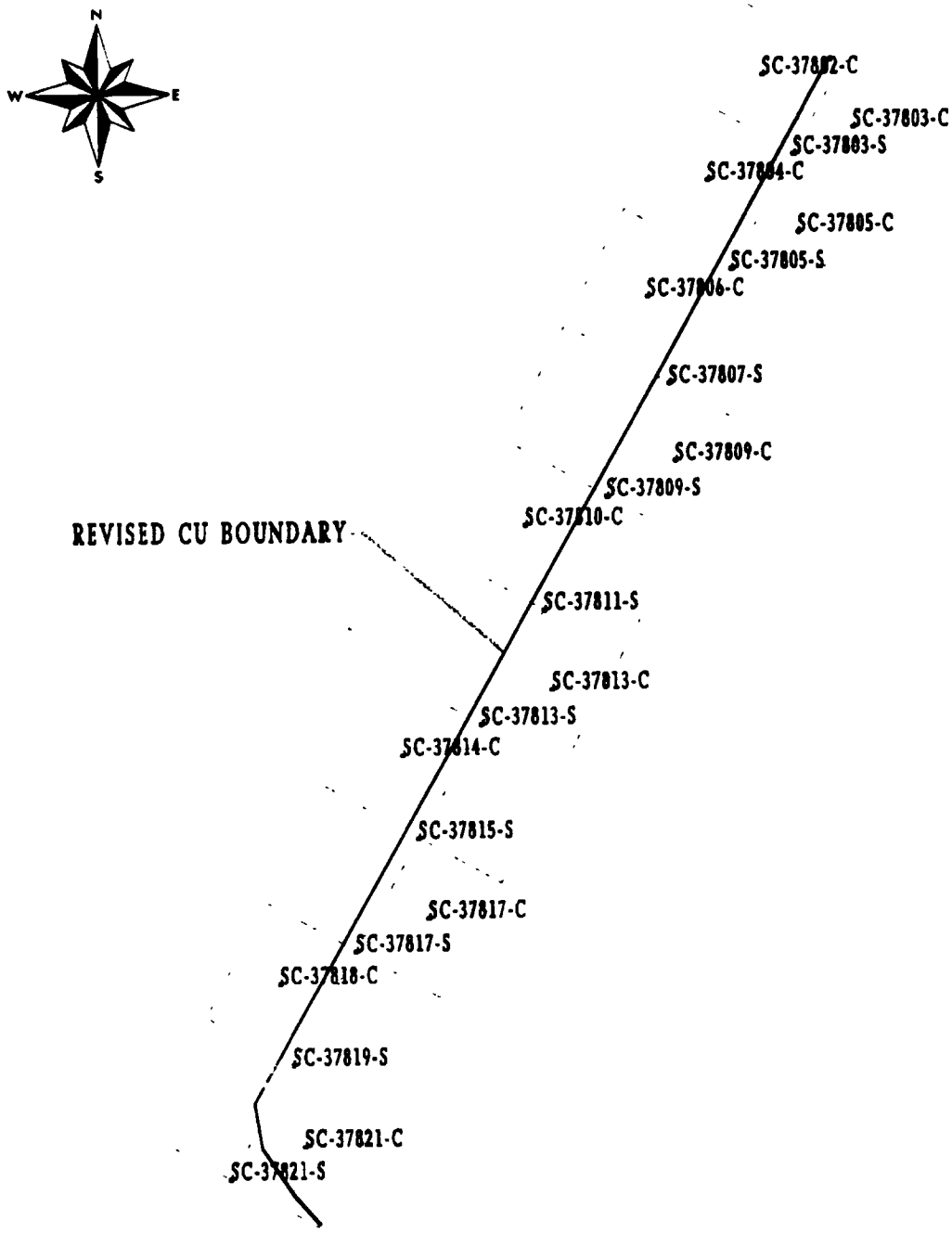
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

Ra-226	7	0.49 - 1.47	1.24	5	6.2	0	0
Ra-228	7	0.28 - 1.45	1.14	5	6.2	0	0
Total Radium	7	0.77 -2.74	2.39	5	6.2	0	0
Th-230	7	0.88 - 2.28	1.27	5	6.2	0	0
U-238	7	0.99 - 2.27	1.76	30	120	0	0

NOTE: Radiological contaminants are listed in pCi/g.



150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025
Confirmation Unit CU378

Figure: 4-1

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO :	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE: 01/09/02	

Table 4 - 2 Summary of CU379

CU: 379 RU: 25

COC				
	Ra-226	X	As	X
	Ra-228	X	Cr	X
	Th-230	X	Pb	
	Th-232		Tl	
	U-238	X	PAH	X
			PCB	X
			TNT	

Reference Figure: 4 - 2

DATE RELEASED FOR UNRESTRICTED USE: 4 / 6 / 98

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m² < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located in the northwest portion of the Disposal Cell work zone.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000 - 12,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *3/23/98 4/1/98*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : *15*

TOTAL # OF UTILITY SAMPLES : *0*

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [ ] YES [X] NO

GENERAL COMMENTS - *This CU is partially beneath a gravel road that was previously confirmed under WP420. The road was built with clean material following confirmation, therefore no further confirmation is required and radiological walkovers are considered appropriate in that area. The area not requiring additional confirmation encompassed SC-37910-C in this CU. Additionally, two sample locations in this CU, SC-37916-C and SC-37920-S, were previously confirmed under WP420. Reconfirmation was not required at either location. SC-37916-C was inadvertently collected a second time under WP437, but the data was not used in summary statistics. All final results are below ALARA.*

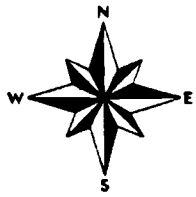
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

As	2	9.1 - 10.7	9.9	45	75	0	0
Cr	2	22.2 - 23.7	22.95	90	110	0	0
Ra-226	15	0.86 - 1.79	1.32	5	6.2	0	0
Ra-228	15	0.56 - 1.67	1.19	5	6.2	0	0
Total Radium	15	1.42 - 3.09	2.51	5	6.2	0	0
Th-230	15	0.97 - 4.68	1.92	5	6.2	0	0
U-238	15	1.26 - 4.07	2.18	30	120	0	0
PAH	2	results < detection limit	N / A	0.44	5.6	0	0
PCB	2	0.05 - 0.08	0.06	0.65	8	0	0

NOTE: Radiological contaminants are listed in pCi/g. Chemical contaminants are listed in mg/kg.



SC-37821-S
SC-37901-C
SC-37902-S
SC-37904-S
SC-37905-C
SC-37906-S
SC-37908-S
SC-37910-C *
SC-37910-S
SC-37911-C
*SC-37911-S
SC-37912-S
*SC-37914-C
SC-37914-S
SC-37916-C *
SC-37919-C
*SC-37919-S
SC-37920-S *

* PREVIOUSLY CONFIRMED
UNDER WP-420

150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025
Confirmation Unit CU379

Figure: 4-2

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO.:	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE 01/09/02	

Table 4 - 3 Summary of CU380

CU: 380 RU: 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232		Tl	
	U-238	X	PAH	X
			PCB	
			TNT	

Reference Figure: 4 - 3

DATE RELEASED FOR UNRESTRICTED USE: 8 / 7 / 98

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m² < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located in the northeast portion of the Disposal Cell work zone.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *9,500 - 14,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *7/16/98 7/24/98*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : 22

TOTAL # OF UTILITY SAMPLES : 0

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [X] YES [ ] NO

GENERAL COMMENTS - *One Radium hotspot was identified at SC-38008-S. Location was further excavated and resampled. All final results are below criteria.*

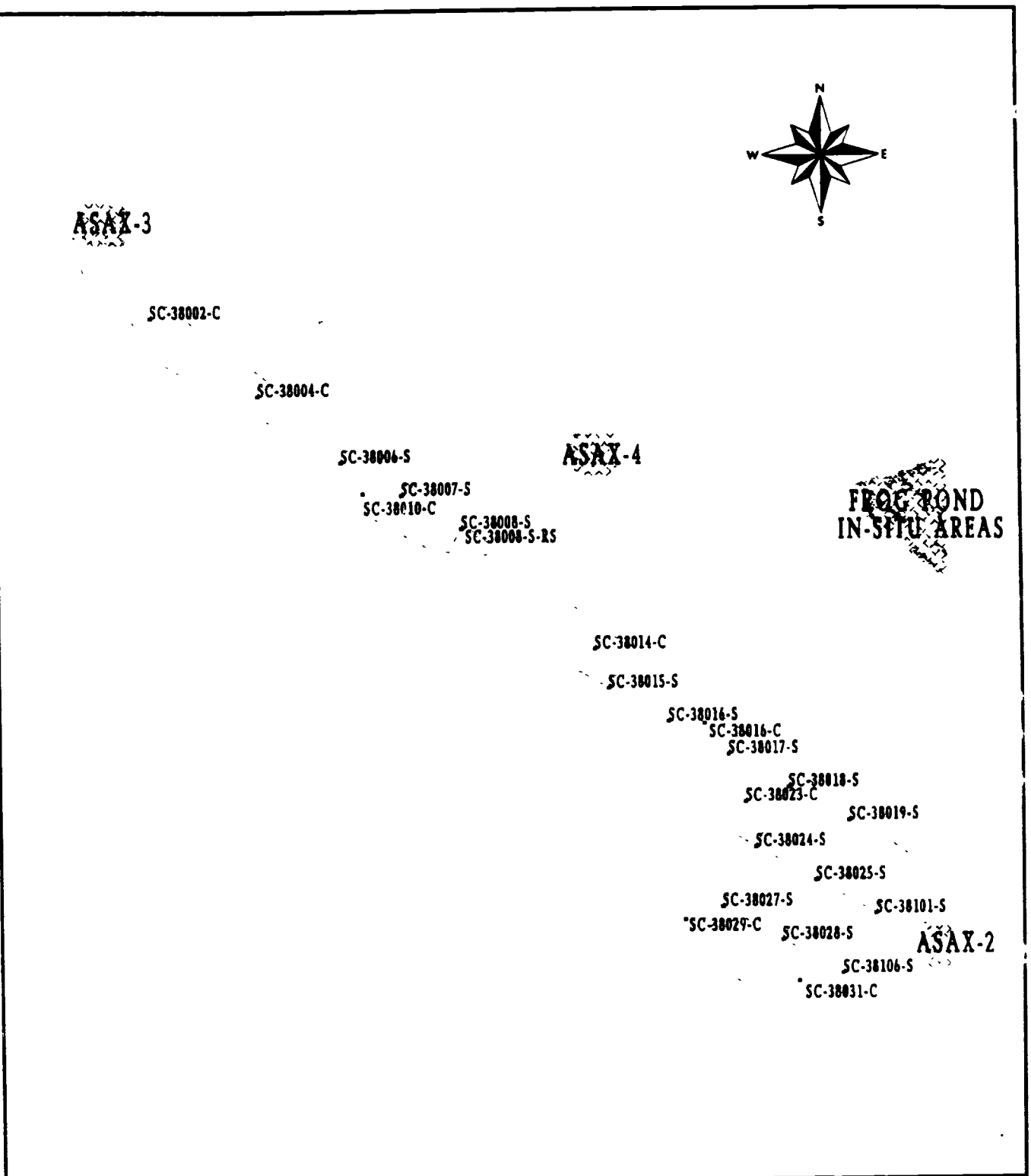
ORISE ACTION - *ORISE collected five soil samples, one at approximately the same location as SC-38010-C and four at approximately 10 ft. away from the first in a grid pattern around it. All results are below ALARA.*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

Ra-226	6	1.19 - 2.37	1.50	5	6.2	0	0
Ra-228	6	0.57 - 1.39	1.09	5	6.2	0	0
Total Radium	6	1.76 - 3.76	2.59	5	6.2	0	0
Th-230	6	0.82 - 3	1.56	5	6.2	0	0
U-238	22	1.31 - 16.4	6.12	30	120	0	0
PAH	6	0 - 0.54	0.18	0.44	5.6	1	0

NOTE: Radiological contaminants are listed in pCi/g. Chemical contaminants are listed in mg/kg.



150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025
Confirmation Unit CU380

Figure: 4-3

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO :	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE	01/07/02

Table 4 - 4 Summary of CU381

CU 381 RU 25

COC				
	Ra-226	X	As	X
	Ra-228	X	Cr	X
	Th-230	X	Pb	X
	Th-232	X	Tl	X
	U-238	X	PAH	
			PCB	X
			TNT	

Reference Figure: 4 - 4

DATE RELEASED FOR UNRESTRICTED USE: 9 / 1 / 98

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m² < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located in the northeast portion of the Disposal Cell work zone.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *12,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *8/24/98*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : *19*

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

TOTAL # OF UTILITY SAMPLES : *0*

ADDITIONAL EXCAVATION REQUIRED? [ ] YES [X] NO

GENERAL COMMENTS - *Planned confirmation grid points represent ASAX-2. All final results are below criteria.*

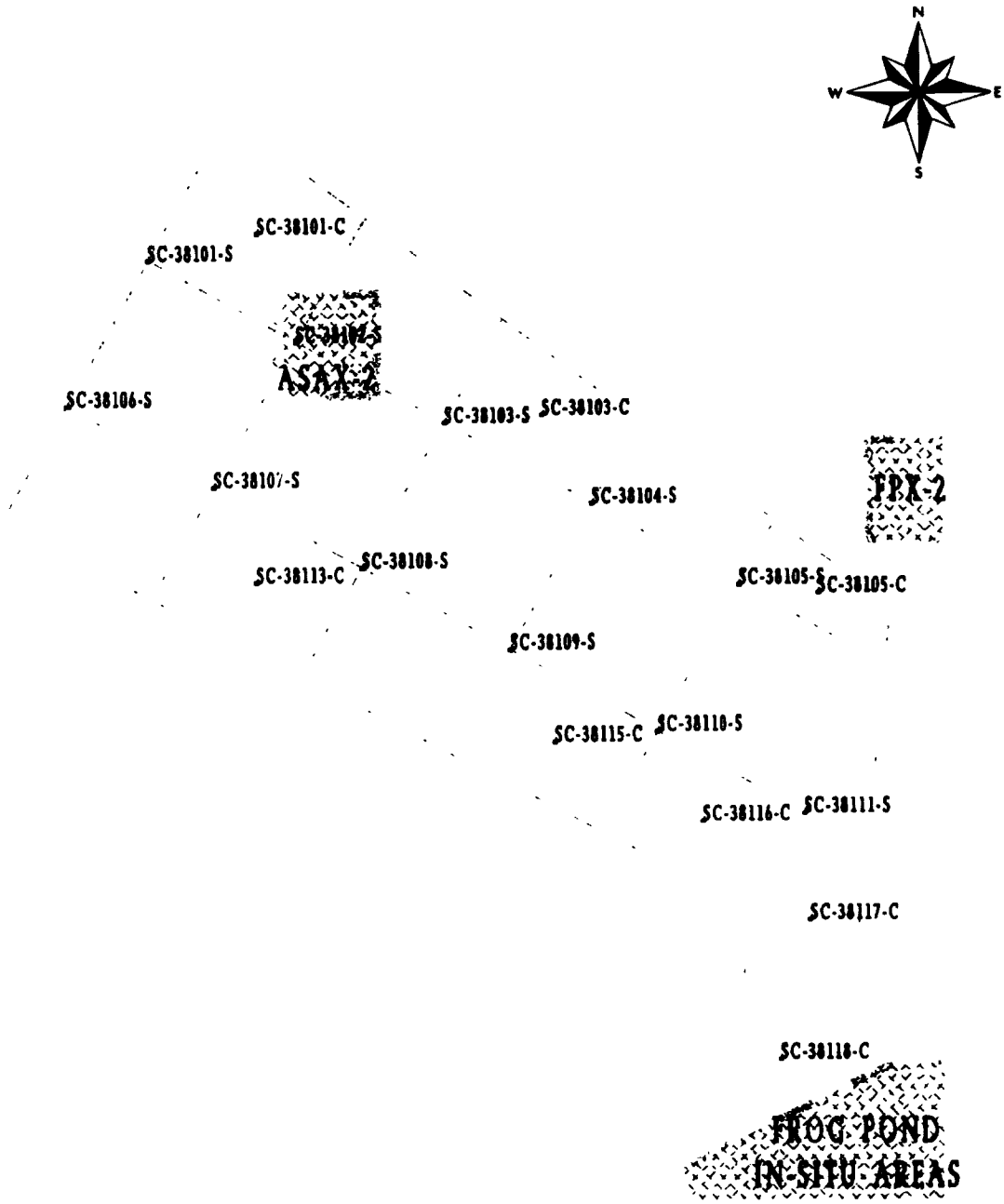
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

As	4	4.2 - 6.6	5.23	45	75	0	0
Cr	4	9.1 - 14.3	11.48	90	110	0	0
Pb	4	11.2 - 20.3	14.58	240	450	0	0
Tl	2	0.5 - 1.8	1.15	16	20	0	0
Ra-226	4	1.1 - 1.38	1.25	5	6.2	0	0
Ra-228	4	1.12 - 1.36	1.27	5	6.2	0	0
Total Radium	4	2.36 - 2.73	2.52	5	6.2	0	0
Th-230	4	1.04 - 1.27	1.14	5	6.2	0	0
Th-232	4	1.15 - 1.39	1.30	5	6.2	0	0
U-238	19	1.11 - 14	3.35	30	120	0	0
PCB	4	0 - 1.3	0.33	0.65	8	1	0

NOTE: Radiological contaminants are listed in pCi/g. Chemical contaminants are listed in mg/kg.



150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025 Confirmation Unit CU381

Figure: 4-4

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO.:	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE 12/31/01	

Table 4 - 5 Summary of CU400

CU: 400 RU: 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232	X	Tl	
	U-238	X	PAH	
			PCB	
Reference Figure:	4 - 5		TNT	

DATE RELEASED FOR UNRESTRICTED USE: 6 / 15 / 00

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m² < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located at the site of a temporary haul road along the west side of the cell footprint.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *6/7/00*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : 35

TOTAL # OF UTILITY SAMPLES : 35

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [ ] YES [X] NO

GENERAL COMMENTS - *This CU is comprised of 35 utility samples along a temporary haul road. Sample locations were numbered consecutively from south to north along this road, using CU400 as the location designator. Due to the large area covered by the haul road, and after radiological walkovers had begun, CU400 was divided into 5 separate CUs and the samples were renumbered to stay consistent with the CU size used throughout the entire confirmation process. Resulting CUs include CU400 through CU405. See Appendix A for clarification of sample IDs used during radiological walkovers. All soil samples were collected using the actual PMC sample ID. All final results are below criteria.*

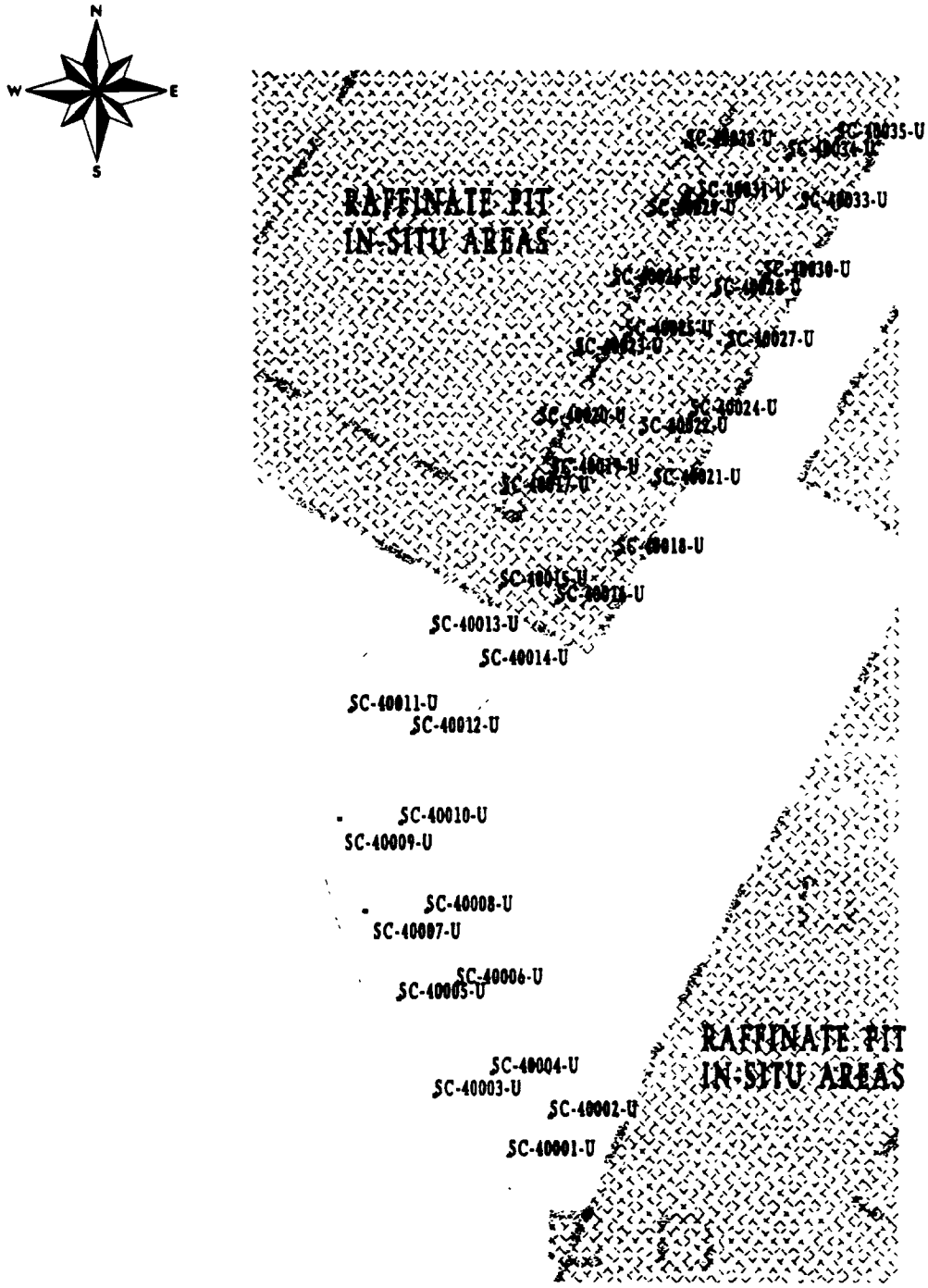
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

Ra-226	35	0.63 - 1.12	0.89	5	6.2	0	0
Ra-228	35	0.37 - 1.34	0.97	5	6.2	0	0
Total Radium	35	1.02 - 2.28	1.86	5	6.2	0	0
Th-230	35	0.79 - 5.06	1.24	5	6.2	1	0
Th-232	35	0.38 - 1.37	0.99	5	6.2	0	0
U-238	35	0.98 - 2.52	1.2	30	120	0	0

NOTE: Radiological contaminants are listed in pCi/g.



150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025 Confirmation Unit CU400

Figure: 4-5

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO :	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE: 01/07/02	

Table 4 - 6 Summary of CU401

CU 401 RU 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232	X	Tl	
	U-238	X	PAH	
			PCB	
			TNT	

Reference Figure: 4 - 6

DATE RELEASED FOR UNRESTRICTED USE: 6 / 26 / 00

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m^2 < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located at the site of a temporary haul road along the west side of the cell footprint.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *6/7/00 6/10/00 (See Section 3.1.1.)*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : 31

TOTAL # OF UTILITY SAMPLES : 31

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [X] YES [ ] NO

GENERAL COMMENTS - *This CU is comprised of 31 utility samples along a temporary haul road. Sample locations were numbered consecutively from south to north along this road, using CU400 as the location designator. Due to the large area covered by the haul road, and after radiological walkovers had begun, CU400 was divided into 5 separate CUs and the samples were renumbered to stay consistent with the CU size used throughout the entire confirmation process. Resulting CUs include CU400 through CU405. See Appendix A for clarification of sample IDs used during radiological walkovers. All soil samples were collected using the actual PMC sample ID. One Th-230 hotspot was identified at SC-40122-U. Area was further excavated and resampled. All final results are below ALARA.*

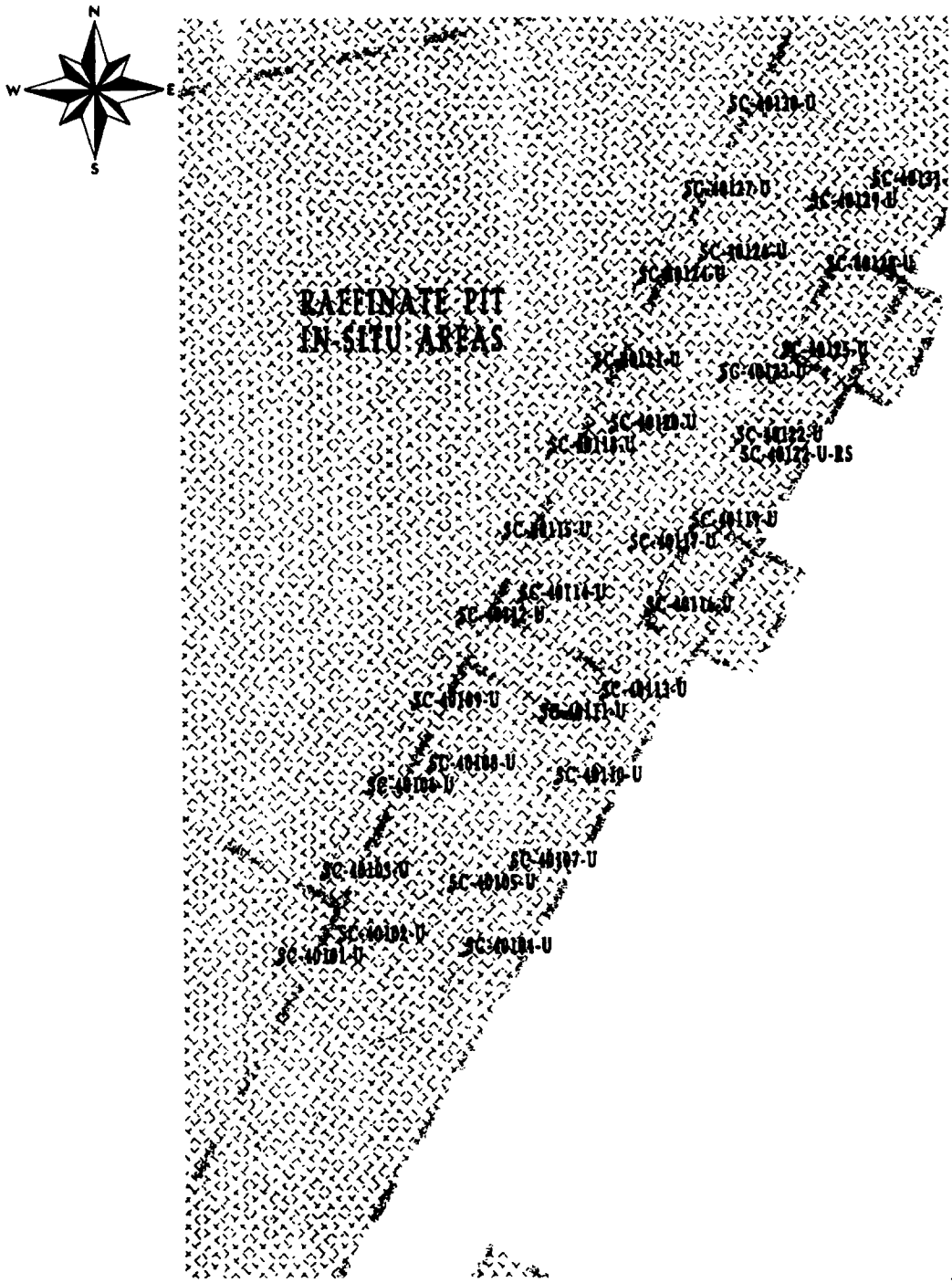
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

Ra-226	31	0.21 - 1.06	0.69	5	6.2	0	0
Ra-228	31	0.37 - 1.36	0.99	5	6.2	0	0
Total Radium	31	1.02 - 2.42	1.68	5	6.2	0	0
Th-230	31	0.74 - 2.05	1.07	5	6.2	0	0
Th-232	31	0.38 - 1.39	1.02	5	6.2	0	0
U-238	31	0.94 - 1.45	1.09	30	120	0	0

NOTE: Radiological contaminants are listed in pCi/g.



150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025
Confirmation Unit CU401

Figure: 4-6

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO :	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE: 01/07/02	

Table 4 - 7 Summary of CU402

CU 402 RU 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232	X	Tl	
	U-238	X	PAH	
			PCB	
			TNT	

Reference Figure: 4 - 7

DATE RELEASED FOR UNRESTRICTED USE: 6 / 20 / 00

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m² < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located at the site of a temporary haul road along the west side of the cell footprint.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *6/10/00*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : *31*

TOTAL # OF UTILITY SAMPLES : *31*

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [ ] YES [X] NO

GENERAL COMMENTS - *This CU is comprised of 31 utility samples along a temporary haul road. Sample locations were numbered consecutively from south to north along this road, using CU400 as the location designator. Due to the large area covered by the haul road, and after radiological walkovers had begun, CU400 was divided into 5 separate CUs and the samples were renumbered to stay consistent with the CU size used throughout the entire confirmation process. Resulting CUs include CU400 through CU405. See Appendix A for clarification of sample IDs used during radiological walkovers. All soil samples were collected using the actual PMC sample ID. All final results are below ALARA.*

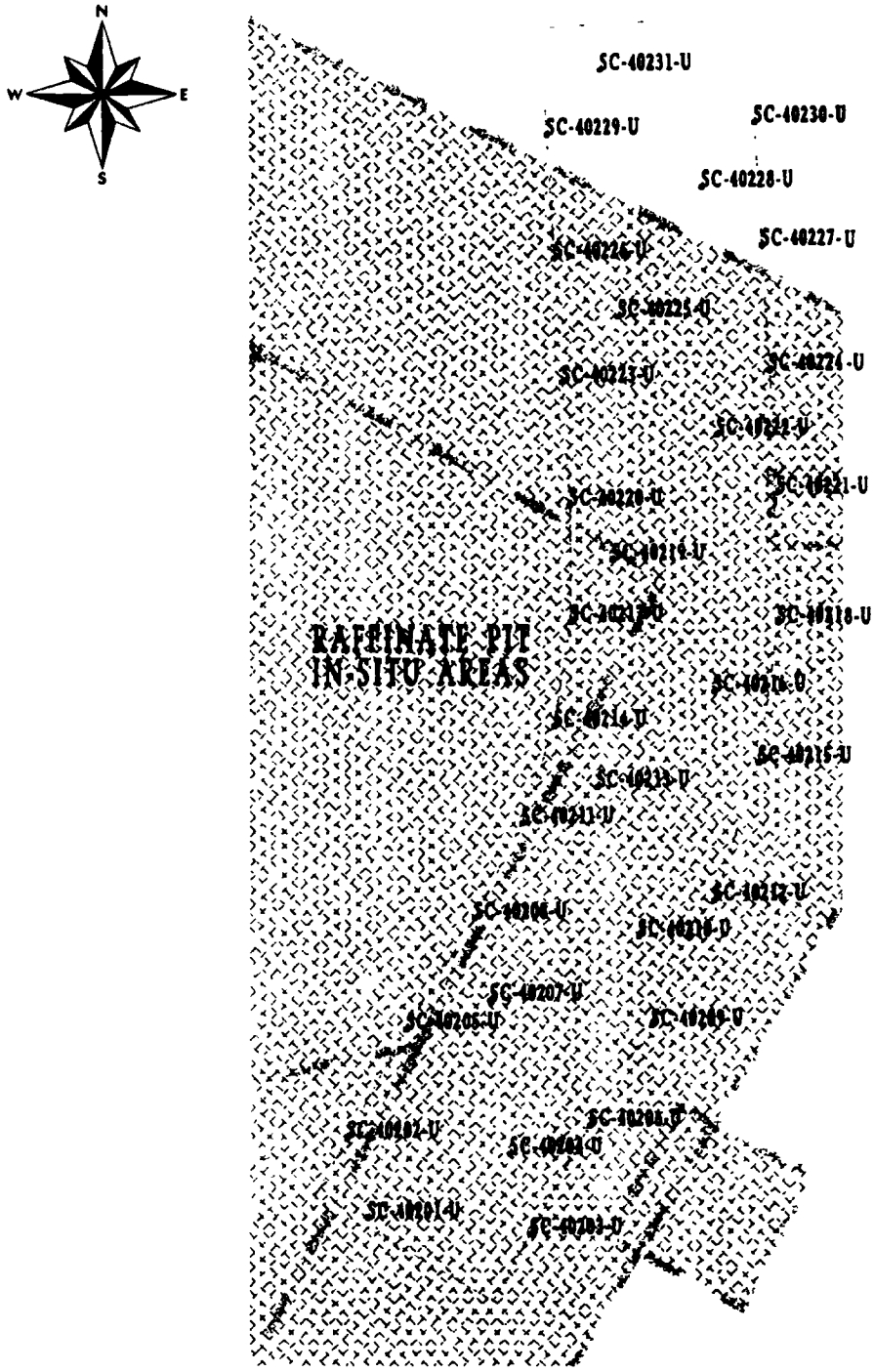
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

Ra-226	31	0.41 - 0.59	0.78	5	6.2	0	0
Ra-228	31	0.36 - 1.4	0.99	5	6.2	0	0
Total Radium	31	1.08 - 2.23	1.76	5	6.2	0	0
Th-230	31	0.69 - 1.45	0.93	5	6.2	0	0
Th-232	31	0.36 - 1.44	1.01	5	6.2	0	0
U-238	31	0.95 - 1.24	1.10	30	120	0	0

NOTE: Radiological contaminants are listed in pCi/g.



150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025 Confirmation Unit CU402

Figure: 4-7

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO.:	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE: 12/31/01	

Table 4 - 8 Summary of CU403

CU 403 RU 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232	X	Tl	
	U-238	X	PAH	
			PCB	
			TNT	

Reference Figure: 4 - 8

DATE RELEASED FOR UNRESTRICTED USE: 6 / 21 / 00

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m² < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located at the site of a temporary haul road along the west side of the cell footprint.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *6/10/00*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : 26

TOTAL # OF UTILITY SAMPLES : 26

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [ ] YES [X] NO

GENERAL COMMENTS - *This CU is comprised of 26 utility samples along a temporary haul road. Sample locations were numbered consecutively from south to north along this road, using CU400 as the location designator. Due to the large area covered by the haul road, and after radiological walkovers had begun, CU400 was divided into 5 separate CUs and the samples were renumbered to stay consistent with the CU size used throughout the entire confirmation process. Resulting CUs include CU400 through CU405. See Appendix A for clarification of sample IDs used during radiological walkovers. All soil samples were collected using the actual PMC sample ID. All final results are below criteria.*

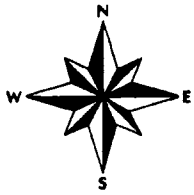
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

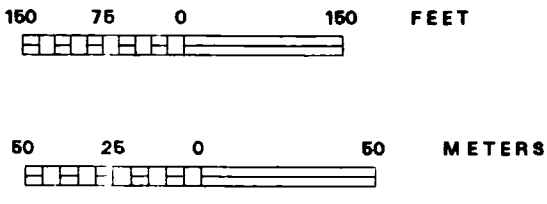
CU SUMMARY DATA

Ra-226	26	0.64 - 1.14	0.90	5	6.2	0	0
Ra-228	26	0.37 - 1.39	0.93	5	6.2	0	0
Total Radium	26	1.11 - 2.42	1.83	5	6.2	0	0
Th-230	26	0.8 - 5.15	1.37	5	6.2	1	0
Th-232	26	0.37 - 1.42	0.95	5	6.2	0	0
U-238	26	1 - 3.19	1.27	30	120	0	0

NOTE: Radiological contaminants are listed in pCi/g.



SC-40325-U
SC-40326-U
SC-40324-U
SC-40322-U
SC-40323-U
SC-40321-U
SC-40319-U
SC-40320-U
SC-40318-U
SC-40316-U
SC-40317-U
SC-40315-U
SC-40313-U
SC-40314-U
SC-40312-U
SC-40310-U
SC-40311 U
SC-40309-U
SC-40307-U
SC-40308-U
SC-40306-U
SC-40304-U
SC-40305-U
SC-40303-U
SC-40301-U
SC-40302-U



Sample Locations in Remedial Unit RU025 Confirmation Unit CU403

Figure: 4-8

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO.:	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE: 01/07/02	

Table 4 - 9 Summary of CU404

CU 404 RU 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232	X	Tl	
	U-238	X	PAH	
			PCB	
			TNT	

Reference Figure: 4 - 9

DATE RELEASED FOR UNRESTRICTED USE: 6 / 21 / 00

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m² < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located at the site of a temporary haul road along the west side of the cell footprint.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *6/10/00 6/15/00*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : 31

TOTAL # OF UTILITY SAMPLES : 31

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [ ] YES [X] NO

GENERAL COMMENTS - *This CU is comprised of 31 utility samples along a temporary haul road. Sample locations were numbered consecutively from south to north along this road, using CU400 as the location designator. Due to the large area covered by the haul road, and after radiological walkovers had begun, CU400 was divided into 5 separate CUs and the samples were renumbered to stay consistent with the CU size used throughout the entire confirmation process. Resulting CUs include CU400 through CU405. See Appendix A for clarification of sample IDs used during radiological walkovers. All soil samples were collected using the actual PMC sample ID. All final results are below ALARA.*

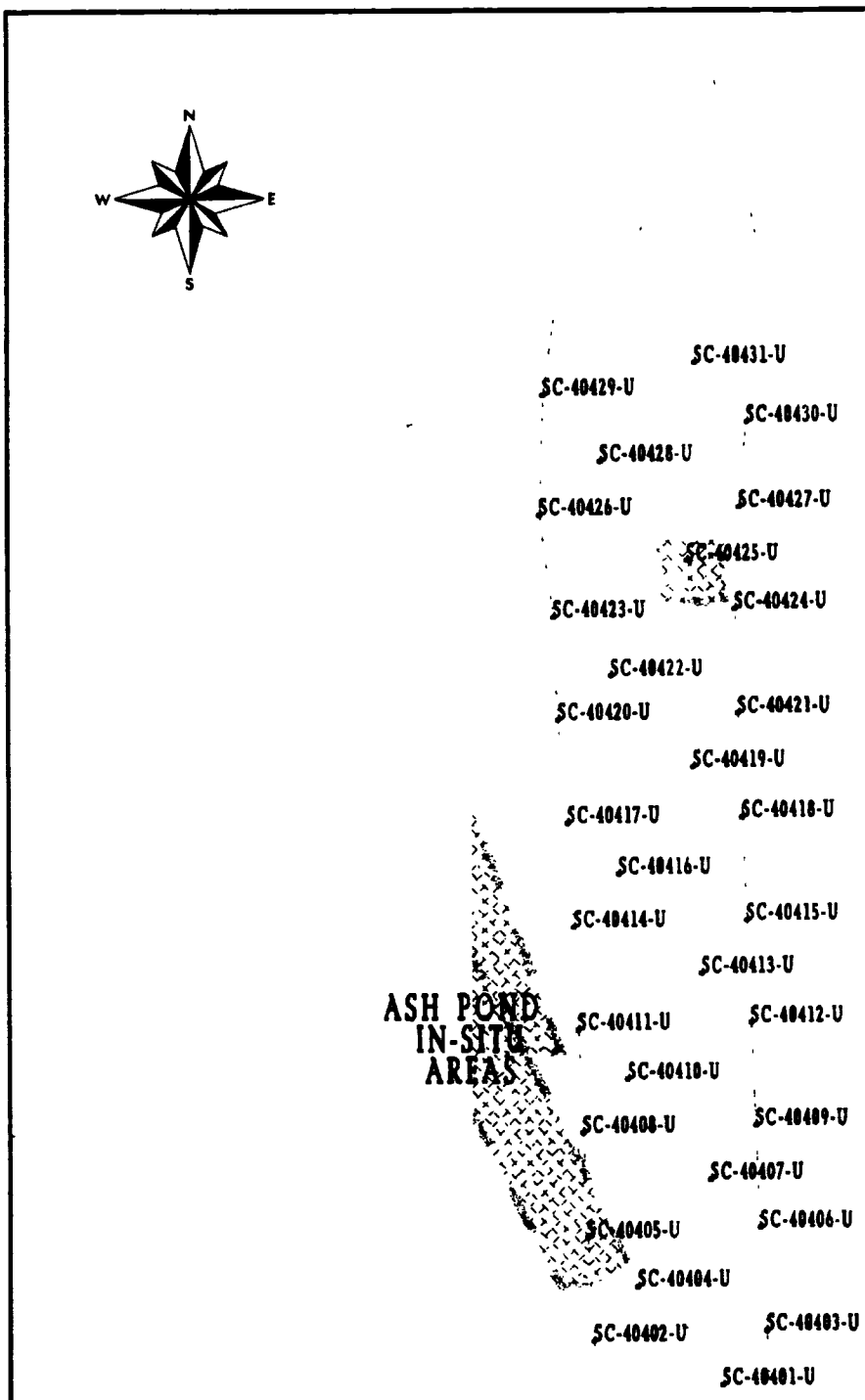
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

Ra-226	31	0.27 - 1.01	0.75	5	6.2	0	0
Ra-228	31	0.35 - 1.45	1.03	5	6.2	0	0
Total Radium	31	0.67 - 2.29	1.77	5	6.2	0	0
Th-230	31	0.64 - 3.11	1.08	5	6.2	0	0
Th-232	31	0.35 - 1.49	1.05	5	6.2	0	0
U-238	31	1.02 - 1.28	1.13	30	120	0	0

NOTE: Radiological contaminants are listed in pCi/g.



150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025 Confirmation Unit CU404

Figure: 4-9

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO.:	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE: 01/07/02	

Table 4 - 10 Summary of CU405

CU 405 RU 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232	X	Tl	
	U-238	X	PAH	
			PCB	
			TNT	

Reference Figure: 4 - 10

DATE RELEASED FOR UNRESTRICTED USE: 6 / 22 / 00

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m² < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located at the site of a temporary haul road along the west side of the cell footprint.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *6/15/00*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : 32

TOTAL # OF UTILITY SAMPLES : 32

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [ ] YES [X] NO

GENERAL COMMENTS - *This CU is comprised of 32 utility samples along a temporary haul road. Sample locations were numbered consecutively from south to north along this road, using CU400 as the location designator. Due to the large area covered by the haul road, and after radiological walkovers had begun, CU400 was divided into 5 separate CUs and the samples were renumbered to stay consistent with the CU size used throughout the entire confirmation process. Resulting CUs include CU400 through CU405. All final results are below ALARA.*

ALARA.

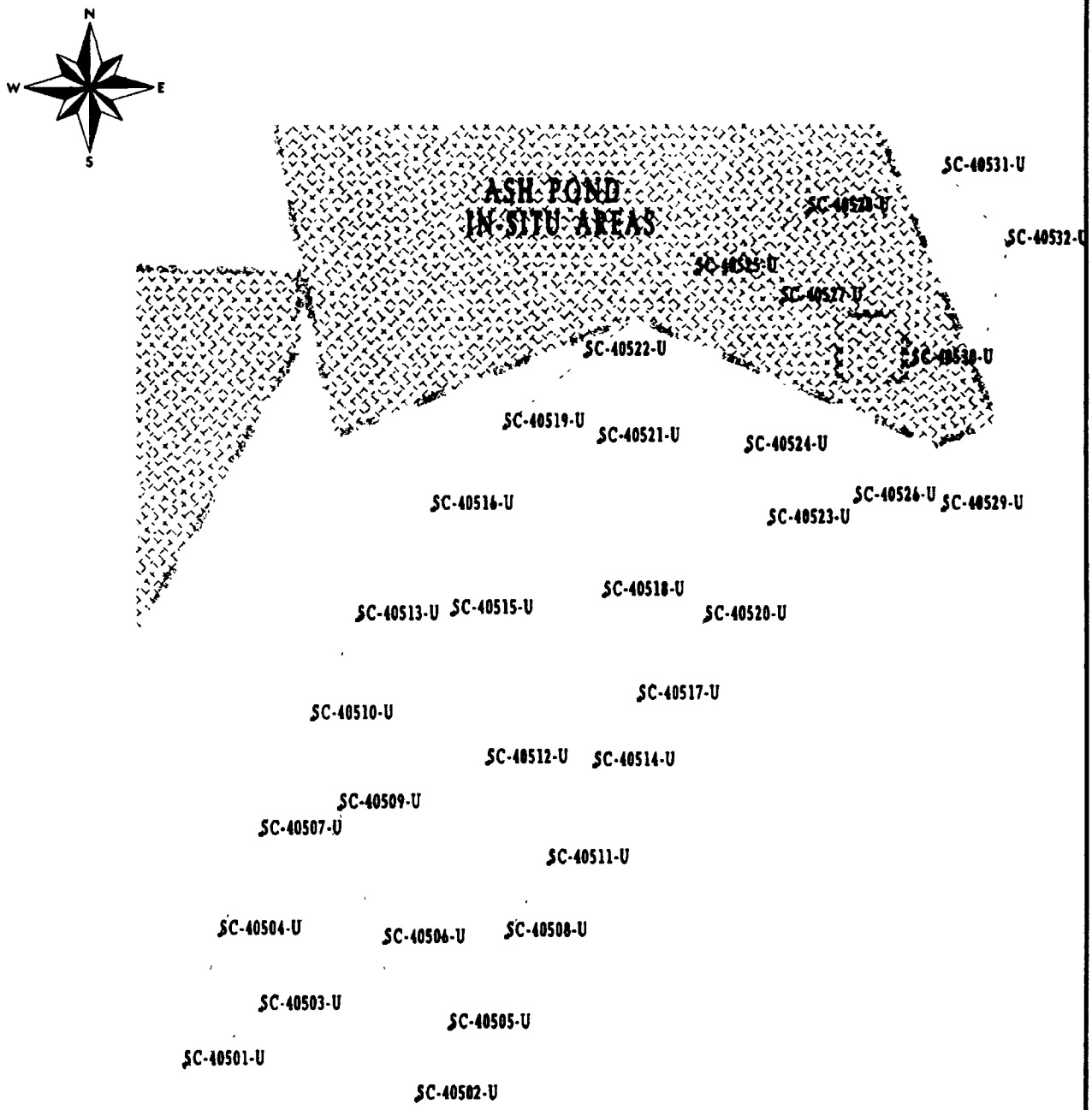
ORISE ACTION - *None*

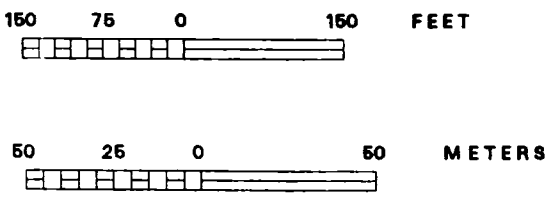
ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

Ra-226	32	0.54 - 1.02	0.74	5	6.2	0	0
Ra-228	32	0.39 - 1.35	0.96	5	6.2	0	0
Total Radium	32	1.12 - 2.18	1.71	5	6.2	0	0
Th-230	32	0.64 - 1.35	0.98	5	6.2	0	0
Th-232	32	0.40 - 1.38	0.99	5	6.2	0	0
U-238	32	0.98 - 2.56	1.16	30	120	0	0

NOTE: Radiological contaminants are listed in pCi/g.





Sample Locations in Remedial Unit RU025
Confirmation Unit CU405

Figure: 4-10

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO :	
ORIGINATOR MGL	DRAWN BY: LGE	DATE 01/07/02	

Table 4 - 11 Summary of CU410

CU 410 RU 25

COC				
	Ra-226	X	As	
	Ra-228	X	Cr	
	Th-230	X	Pb	
	Th-232	X	Tl	
	U-238	X	PAH	
			PCB	
			TNT	

Reference Figure: 4 - 11

DATE RELEASED FOR UNRESTRICTED USE: 7 / 13 / 00

CLEANUP STANDARD [X] SURFACE [ ] SUBSURFACE

EACH 100m^2 < CRITERIA? [X] YES [ ] NO

LOCATION DESCRIPTION *This CU is located at the site of a temporary haul road along the west side of the cell footprint.*

WALKOVER SURVEY INFORMATION

BACKGROUND: *10,000* cpm
(shielding may have been used on a case-by-case basis)

FINAL SURVEY(S) BELOW 1.5 X BACKGROUND ? [X] YES [ ] NO

DATE(S) SCANNED: *7/5/00*

CONFIRMATION SAMPLING INFORMATION

TOTAL # OF SAMPLE LOCATIONS : *24*

TOTAL # OF UTILITY SAMPLES : *24*

AVERAGES < ALARA? [X] YES [ ] NO

HOTSPOTS REMAINING? [ ] YES [X] NO

ADDITIONAL EXCAVATION REQUIRED? [X] YES [ ] NO

GENERAL COMMENTS - *One Th-230 hotspot was identified at SC-41022-U. Area was further excavated and resampled. All final results are below ALARA.*

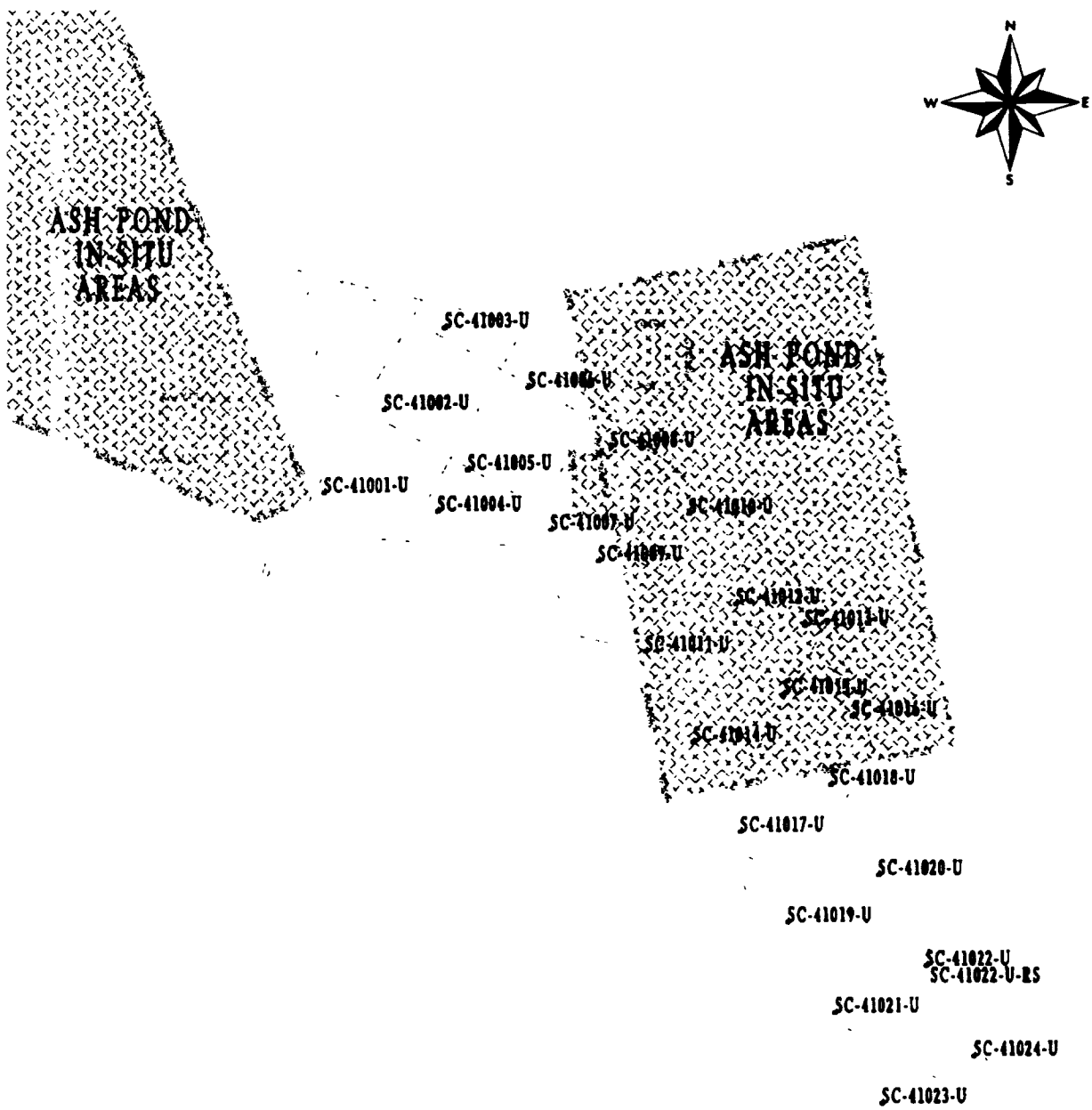
ORISE ACTION - *None*

ALARA COMMITTEE ACTION - *None*

CU SUMMARY DATA

Ra-226	24	0.24 - 0.97	0.60	5	6.2	0	0
Ra-228	24	0.37 - 1.33	0.90	5	6.2	0	0
Total Radium	24	0.63 - 2.2	1.50	5	6.2	0	0
Th-230	24	0.72 - 3.26	1.27	5	6.2	0	0
Th-232	24	0.38 - 1.36	0.92	5	6.2	0	0
U-238	24	0.91 - 1.23	1.10	30	120	0	0

NOTE: Radiological contaminants are listed in pCi/g.



150 75 0 150 FEET

50 25 0 50 METERS

Sample Locations in Remedial Unit RU025
Confirmation Unit CU410

Figure: 4-11

REPORT NO.: DOE/OR/21548-911		EXHIBIT NO:	
ORIGINATOR: MGL	DRAWN BY: LGE	DATE: 01/07/02	

5. DATA EVALUATION

Work Package-437 (WP-437) final analytical data were evaluated to determine whether data quality objectives developed for the Weldon Spring Site Remedial Action Project (WSSRAP) were met and to ensure that overall data quality results were generated from these remedial activities. The data were evaluated in accordance with the *Project Management Contractor Quality Assurance Program* (Ref. 5) and the *Environmental Quality Assurance Project Plan* (Ref. 6). The data evaluation process was completed by data verification, data review, data validation, and data management activities as stated in the *Chemical Plant Area Cleanup Area Attainment Confirmation Plan* (Ref. 3).

5.1 Data Verification

Data verification was conducted in accordance with ES&H 4.9.1, *Environmental Monitoring Data Verification*, to ensure that documentation and data were reported in compliance with established reporting requirements and standard operating procedures (SOPs), and to ensure that all analyses were performed. All analytical results received from the laboratory were reviewed to verify that samples were properly handled according to WSSRAP protocol. The following factors were reviewed and evaluated: sample identification, chain of custody, holding times, sample preservation requirements, sample analysis request forms, data reviews, laboratory tracking, data reporting requirements, and the database transfer.

5.2 Data Review

Data packages were reviewed to ensure that final data were properly identified, analyzed, reported, and that they met data quality requirements (DQRs). The data were also reviewed to check for inconsistencies with the field quality control (QC) samples. Final analytical results were also compared to the preliminary results to identify any changes in data.

During confirmation of WP-437 areas, which included RU025, soil samples were obtained in accordance with the details provided in the *Confirmation Sampling Plan Details for the Disposal Cell Facility* (WP-437) (Ref. 2). This plan indicates that quality control samples were to be taken at a frequency of 1 per 20 samples or 5%. The quality control samples collected included duplicates, field replicates, secondary duplicates, matrix spikes/matrix spike duplicates, and equipment blanks. Since the 5% requirement was based on all WP-437 confirmation sampling, the quality control data will be discussed in a separate report entitled *WP-437 Confirmation Quality Control Results Report*.

5.3 Data Validation

Data validation was performed on 10% of all analytical data generated from the confirmation sampling activities. Data validation was conducted in accordance with ES&H 4.9.2, *Environmental Monitoring Data Validation.* Note that the validation of 10% of the data is based upon all confirmation data collected for WP-437, and not 10% of each work zone. The percentage of confirmation validated will be discussed in the *WP-437 Confirmation Quality Control Results Report.*

6. SUMMARY OF CLOSURE REPORT FINDINGS

The Disposal Cell work zone portion requiring confirmation under WP-437 consisted of the eleven confirmation units within RU025. Summary information regarding the remedial activities is presented in Section 4 of this report.

6.1 Data Evaluation

Upon completion of remediation activities, preliminary results were used to complete disposition forms in accordance with ES&H 1.2.1, *Soil Remediation Disposition Process*. Based on the preliminary results, each CU was released when disposition forms were reviewed and signed by authorized project personnel.

6.2 Summary of WP-437 Confirmation Results

Table 6-1 provides a summary of the total number of samples collected and analyzed for each contaminant during remedial activities in RU025. The number of results and the minimum, maximum, and average concentrations are also provided for each contaminant. The table was generated using final data sets compiled from all samples that represented soils left in place.

Table 6-1 Summary Totals for RU025

CONTAMINANT	NO. OF SAMPLES	CONCENTRATION RANGE	AVERAGE CONCENTRATION	SURFACE ALARA	SURFACE CRITERIA	RESULTS > ALARA
As (mg/kg)	6	4.2 - 10 7	6.78	45	75	0
Cr (mg/kg)	6	9.1 - 23.7	15.3	90	110	0
Pb (mg/kg)	4	11.2 - 20.3	14.58	240	450	0
Tl (mg/kg)	2	0.5 - 1.8	1.15	16	20	0
PAH (mg/kg)	8	0 - 0.54	0.14	0.44	5.60	1
PCB (mg/kg)	6	0 - 1.3	0.24	0.65	8.00	1
Ra-226 (pCi/g)	241	0.21 - 2.37	0.84	5.00	6.20	0
Ra-228 (pCi/g)	241	0.28 - 1.67	1.00	5.00	6.20	0
Total Radium* (pCi/g)	241	0.63 - 3.76	1.84	5.00	6.20	0
Th-230 (pCi/g)	241	0.64 - 5.15	1.18	5.00	6.20	2
Th-232 (pCi/g)	214	0.35 - 1.49	1.00	5.00	6.20	0
U-238 (pCi/g)	270	0.91 - 16.4	1.71	30.00	120.00	0

* Total Radium consists of Ra-226 values plus Ra-228 values.

Final analytical results generated from the remedial activities indicated that the RU025 average concentrations for each COC were below the ALARA goal. For each of the eleven CUs, COC averages are also below ALARA. All 100 m^2 averages were less than criteria.

6.3 Summary of Chemical Plant Confirmation Results

To meet the requirements of the ROD, more than 50% of the results for each parameter had to be less than the ALARA goal. Table 6-2 summarizes the cumulative results to date.

Table 6-2 Summary Totals for Confirmation

CONTAMINANT	NO. OF SAMPLES	MINIMUM CONCENTRATION	MAXIMUM CONCENTRATION	AVERAGE CONCENTRATION	RESULTS > ALARA
Arsenic (mg/kg)	2232	0.48	123	8.22	1
Chromium (mg/kg)	2603	1.4	76.2	17.33	0
Pb (mg/kg)	2206	1.8	817	19.18	8
Thallium (mg/kg)	998	0.12	20.3	1.77	2
PAH (mg/kg)	2040	0	14.1	0.12	128
PCB (mg/kg)	2830	0	6.4	0.05	45
TNT (mg/kg)	1192	0.003	34	0.17	2
Ra-226 (pCi/g)	4534	0.13	9.43	1.15	4
Ra-228 (pCi/g)	4343	0.2	6.6	1.12	3
Th-230 (pCi/g)	3798	0.09	23.1	1.57	72
Th-232 (pCi/g)	3793	0.21	6.77	1.11	2
Toluene (mg/kg)	4	0.00	3.40	0.85	0
U-238 (pCi/g)	6413	0.26	228	3.46	76

NOTE: This table contains summary results from cumulative confirmation including WP-253, WP-399, WP-420, WP-458, WP-461, WP-471, WP-437 (RU015, RU016, RU017, RU018, RU019, RU020, RU023, and RU025), and WP-551/Task D (RU026)

6.4 Comparison of Standard Deviations

This section compares the estimated standard deviations calculated following U. S. Environmental Protection Agency (EPA) guidance with deviations calculated using confirmation results. Since there were no existing remediation data available to calculate the standard deviation (sigma), the *Chemical Plant Area Cleanup Area Attainment Confirmation Plan* (Ref. 3) estimated sigma using the range (assuming the average concentration remaining after remediation would not exceed cleanup criteria) divided by six. To determine whether the

specified level of precision was obtained, a comparison was made between the estimated sigma and the calculated sigma using the RU025 results.

The comparison indicated that the specified level of precision (a false positive = 0.05 and a false negative = 0.20) had been obtained. All of the RU025 calculations were less than estimated sigmas, indicating that the minimum specified precision was met. Table 6-3 presents the estimated sigma and calculated sigmas for each COC.

The cumulative sigma for Th-230 exceeded the estimated sigma. This is a factor of hot spots left in place based upon subsurface criteria in previous CUs. The estimated standard deviation, recalculated for Th-230 using subsurface criteria, was 2.7. The cumulative sigma was less than the estimated subsurface sigma.

Table 6-3 Comparison of Standard Deviations

COC	Estimated Sigma(a)	RU025 Sigma (b)	Cumulative Sigma (c)
Arsenic (mg/kg)	12.5	2.63	4.42
Chromium (mg/kg)	18.3	6.27	5.09
Lead (mg/kg)	75	3.96	28.84
Thallium (mg/kg)	3.3	0.92	1.65
PAH (mg/kg)	0.93	0.20	0.51
PCB (mg/kg)	1.33	0.52	0.31
TNT (ug/g)	23.3	N / A	1.33
Ra-226 (pCi/g)	1.03	0.27	0.45
Ra-228 (pCi/g)	1.03	0.31	0.40
Th-230 (pCi/g)	1.03	0.66	1.19
Th-232 (pCi/g)	1.03	0.31	0.42
U-238 (pCi/g)	20	1.99	7.71

(a) Sigma estimated in the *Attainment Plan* (Ref. 3).
(b) Sigma calculated using only the WP437 (RU025) confirmation results.
(c) Sigma calculated using cumulative confirmation results (WP-253, WP-399, WP-458, WP-461, WP-471, WP-437 (RU015, RU016, RU017, RU018, RU019, RU020, RU023, and RU025), and WP-551/Task D (RU026).

7. REFERENCES

1. Department of Energy. *Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site*. DOE/OR/21548-376. Oak Ridge Field Office. St. Charles, MO. September 1993.

2. MK-Ferguson and Jacobs Engineering Group. *Confirmation Sampling Plan Details for the Disposal Cell Facility (WP-437)*, Rev 0. DOE/OR/21548-706. Prepared for the U.S. Department of Energy, Oak Ridge Field Office. St. Charles, MO. January 1998.

3. MK-Ferguson and Jacobs Engineering Group. *Chemical Plant Area Cleanup Attainment Confirmation Plan,* Rev. 3. DOE/OR/21548-491. Prepared for the U.S. Department of Energy, Oak Ridge Field Office. St. Charles, MO. December 1995.

4. MK-Ferguson Company. *Disposal Cell Work Zone Specifications*, Rev. 8. Specification Document No. 3840-7-437-02311. Prepared for the U.S. Department of Energy Weldon Spring Site Remedial Action Project. St. Charles, MO. August 1996.

5. MK-Ferguson Company and Jacobs Engineering Group. *Project Management Contractor Quality Assurance Program*, Rev. 3. DOE/OR/21548-506. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. November 2000.

6. MK-Ferguson and Jacobs Engineering Group. *Environmental Quality Assurance Project Plan*, Rev. 5. DOE/OR/21548-352. Prepared for the U.S. Department of Energy, Oak Ridge Field Office. St. Charles, MO. November 2000.

7. Oak Ridge Institute for Science and Education. *Final Verification Survey Plan for the Chemical Plant Area Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri*. Prepared by the Environmental Survey and Site Assessment Program, Energy/Environment Systems Division, for the U. S. Department of Energy. Weldon Spring, Missouri. December 7, 1995.

PROCEDURES

ES&H 1.2.1 *Soil Remediation Disposition Process*
ES&H 4.9.1 *Environmental Monitoring Data Verification*
ES&H 4.9.2 *Environmental Monitoring Data Validation*

ACRONYMS

ALARA	as low as reasonably achievable
CLP	Contract Laboratory Program
COC	contaminant of concern
CPM	counts per minute
CU	confirmation unit
DOE	Department of Energy
DQO	Data Quality Objectives
DQR	Data Quality Requirements
EPA	Environmental Protection Agency
EQAPjP	Environmental Quality Assurance Project Plan
ES&H	Environmental Safety and Health
IOC	Interoffice Correspondence
MDNR	Missouri Department of Natural Resources
NaI	sodium iodide
ORISE	Oak Ridge Institute for Science and Education
PMC	Project Management Contractor
QA	quality assurance
QC	quality control
ROD	Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site
RU	remedial unit
SOP	standard operating procedure
WP	work package
WSSRAP	Weldon Spring Site Remedial Action Project

APPENDIX A
Temporary Haul Road Sample IDs

APPENDIX A - TEMPORARY HAUL ROAD SAMPLE IDS

INITIAL FIELD ID	ACTUAL PMC SAMPLE ID
SC-40005-U	SC-40001-U
SC-40006-U	SC-40002-U
SC-40007-U	SC-40003-U
SC-40008-U	SC-40004-U
SC-40009-U	SC-40005-U
SC-40010-U	SC-40006-U
SC-40011-U	SC-40007-U
SC-40012-U	SC-40008-U
SC-40013-U	SC-40009-U
SC-40014-U	SC-40010-U
SC-40015-U	SC-40011-U
SC-40016-U	SC-40012-U
SC-40017-U	SC-40013-U
SC-40018-U	SC-40014-U
SC-40019-U	SC-40015-U
SC-40020-U	SC-40016-U
SC-40021-U	SC-40017-U
SC-40022-U	SC-40018-U
SC-40023-U	SC-40019-U
SC-40024-U	SC-40020-U
SC-40025-U	SC-40021-U
SC-40026-U	SC-40022-U
SC-40027-U	SC-40023-U
SC-40028-U	SC-40024-U
SC-40029-U	SC-40025-U
SC-40030-U	SC-40026-U
SC-40031-U	SC-40027-U
SC-40032-U	SC-40028-U
SC-40033-U	SC-40029-U
SC-40034-U	SC-40030-U
SC-40035-U	SC-40031-U
SC-40036-U	SC-40032-U
SC-40037-U	SC-40033-U
SC-40038-U	SC-40034-U
SC-40039-U	SC-40101-U
SC-40040-U	SC-40035-U
SC-40041-U	SC-40102-U
SC-40042-U	SC-40103-U
SC-40043-U	SC-40104-U
SC-40044-U	SC-40105-U
SC-40045-U	SC-40106-U
SC-40046-U	SC-40107-U
SC-40047-U	SC-40108-U
SC-40048-U	SC-40109-U
SC-40049-U	SC-40110-U
SC-40050-U	SC-40111-U
SC-40051-U	SC-40112-U
SC-40052-U	SC-40113-U
SC-40053-U	SC-40114-U
SC-40054-U	SC-40115-U
SC-40055-U	SC-40116-U
SC-40056-U	SC-40117-U
SC-40057-U	SC-40118-U
SC-40058-U	SC-40119-U
SC-40059-U	SC-40120-U

INITIAL FIELD ID	ACTUAL PMC SAMPLE ID
SC-40060-U	SC-40121-U
SC-40061-U	SC-40122-U
SC-40062-U	SC-40123-U
SC-40063-U	SC-40124-U
SC-40064-U	SC-40125-U
SC-40065-U	SC-40126-U
SC-40066-U	SC-40127-U
SC-40067-U	SC-40128-U
SC-40068-U	SC-40129-U
SC-40069-U	SC-40130-U
SC-40070-U	SC-40131-U
SC-40071-U	SC-40201-U
SC-40072-U	SC-40202-U
SC-40073-U	SC-40203-U
SC-40074-U	SC-40204-U
SC-40075-U	SC-40205-U
SC-40076-U	SC-40206-U
SC-40077-U	SC-40207-U
SC-40078-U	SC-40208-U
SC-40079-U	SC-40209-U
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SC-40082-U	SC-40212-U
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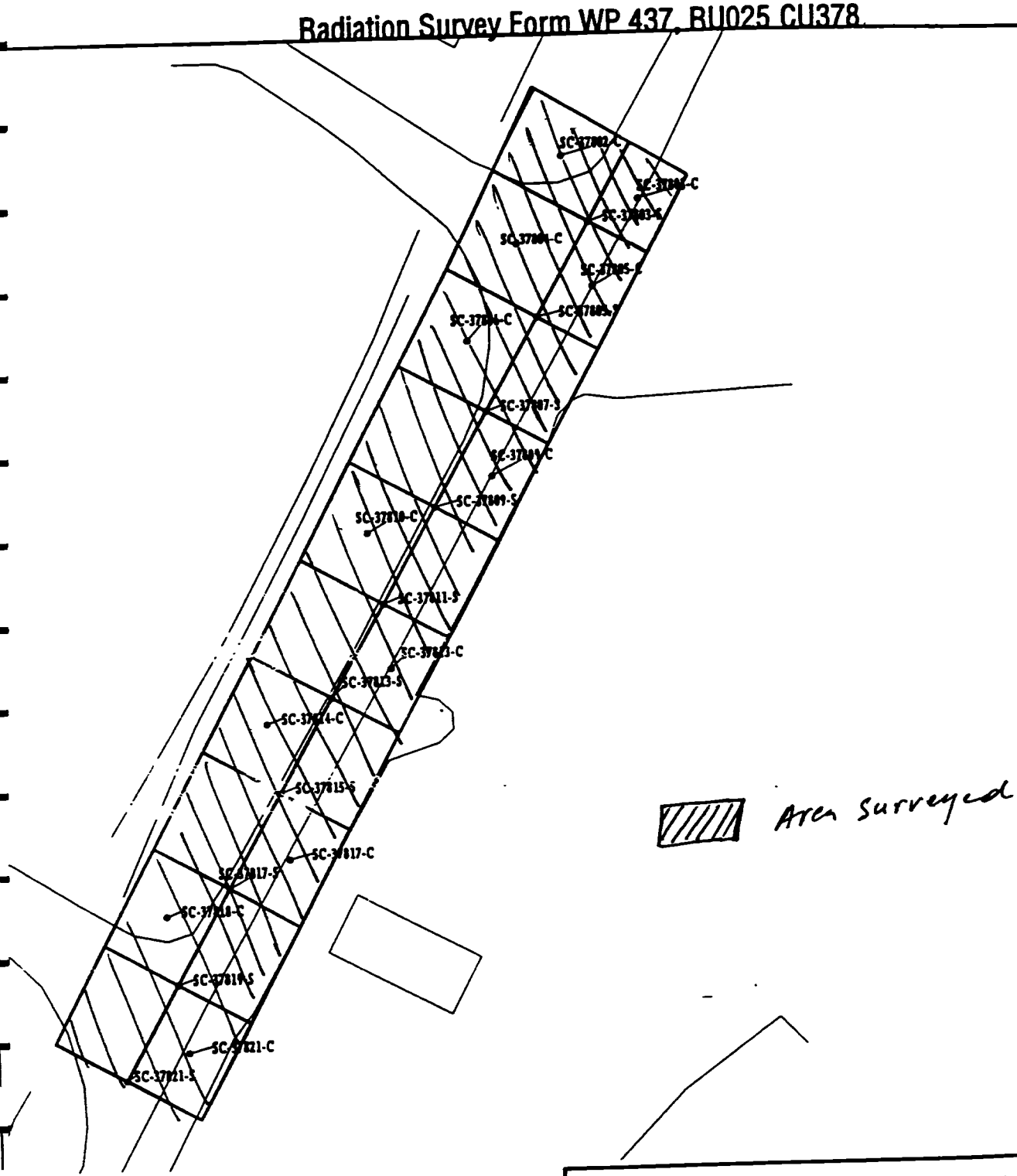
SC-40089-U	SC-40219-U
SC-40090-U	SC-40220-U
SC-40091-U	SC-40221-U
SC-40092-U	SC-40222-U
SC-40093-U	SC-40223-U
SC-40094-U	SC-40224-U
SC-40095-U	SC-40225-U
SC-40096-U	SC-40226-U
SC-40097-U	SC-40227-U
SC-40098-U	SC-40228-U
SC-40099-U	SC-40229-U
SC-40100-U	SC-40230-U
SC-40101-U	SC-40231-U
SC-40102-U	SC-40301-U
SC-40103-U	SC-40302-U
SC-40104-U	SC-40303-U
SC-40105-U	SC-40304-U
SC-40106-U	SC-40305-U
SC-40107-U	SC-40306-U
SC-40108-U	SC-40307-U
SC-40109-U	SC-40308-U
SC-40110-U	SC-40309-U
SC-40111-U	SC-40310-U
SC-40112-U	SC-40311-U
SC-40113-U	SC-40312-U
SC-40114-U	SC-40313-U

APPENDIX A - TEMPORARY HAUL ROAD SAMPLE IDS

INITIAL FIELD ID	ACTUAL PMC SAMPLE ID
SC-40115-U	SC-40314-U
SC-40116-U	SC-40315-U
SC-40117-U	SC-40316-U
SC-40118-U	SC-40317-U
SC-40119-U	SC-40318-U
SC-40120-U	SC-40319-U
SC-40121-U	SC-40320-U
SC-40122-U	SC-40321-U
SC-40123-U	SC-40322-U
SC-40124-U	SC-40323-U
SC-40125-U	SC-40324-U
SC-40126-U	SC-40325-U
SC-40127-U	SC-40326-U
SC-40128-U	SC-40401-U
SC-40129-U	SC-40403-U
SC-40130-U	SC-40402-U
SC-40131-U	SC-40404-U
SC-40132-U	SC-40405-U
SC-40133-U	SC-40406-U
SC-40134-U	SC-40407-U
SC-40135-U	SC-40409-U
SC-40136-U	SC-40408-U

APPENDIX B
WP437 RU025 Final Walkover Forms

Radiation Survey Form WP 437, BU025 CU378



15 7.5 0 METERS

45 22.5 0 FEET

N E S W

Meter Model#: Ludlum 2221 Detector Model#: 2X2 NaI

Meter Serial#: 126506 / 125470 Detector Serial#: 122191 F / 122608 I

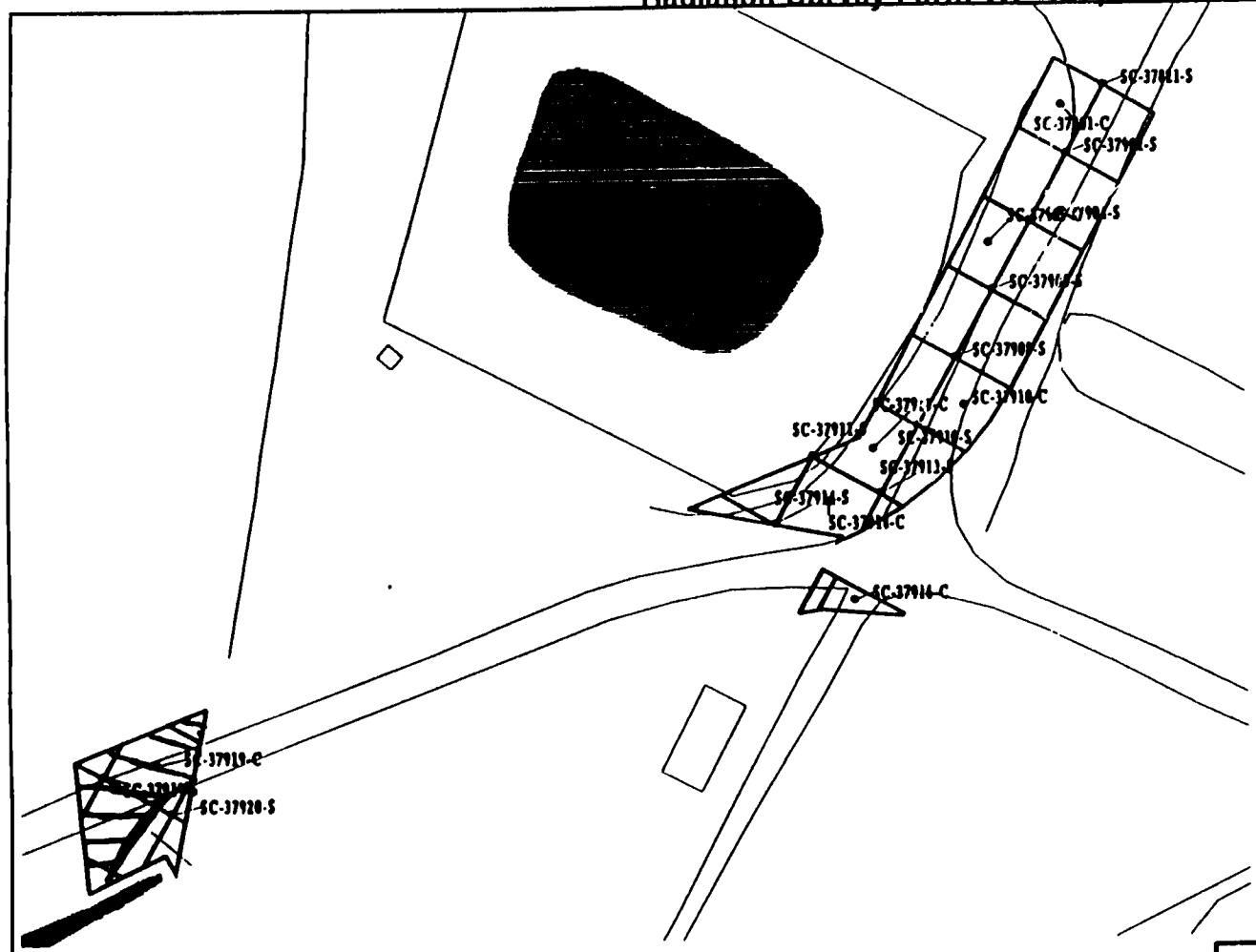
Calibration Due: 6-25-98 / 11-20-98 Calibration Due: 7-24-98 / 5-5-98

Survey Date/Time: 4-1-98 (0500-1200) Field Bkg.: 10500 cpm / 10000 cpm

Surveyor(s): L. Hagoss / M. Pacheco

Comments: The above area surveyed and found to be less than 1½ back ground.

Radiation Survey Form WP 437, RU025CU379



WSSRAP GIS

15 7.5 0 15 METERS

45 22.5 0 45 FEET

Meter Model#: 2221 Detector Model#: NaI (2x2)

Meter Serial#: 89636 Detector Serial#: 130764

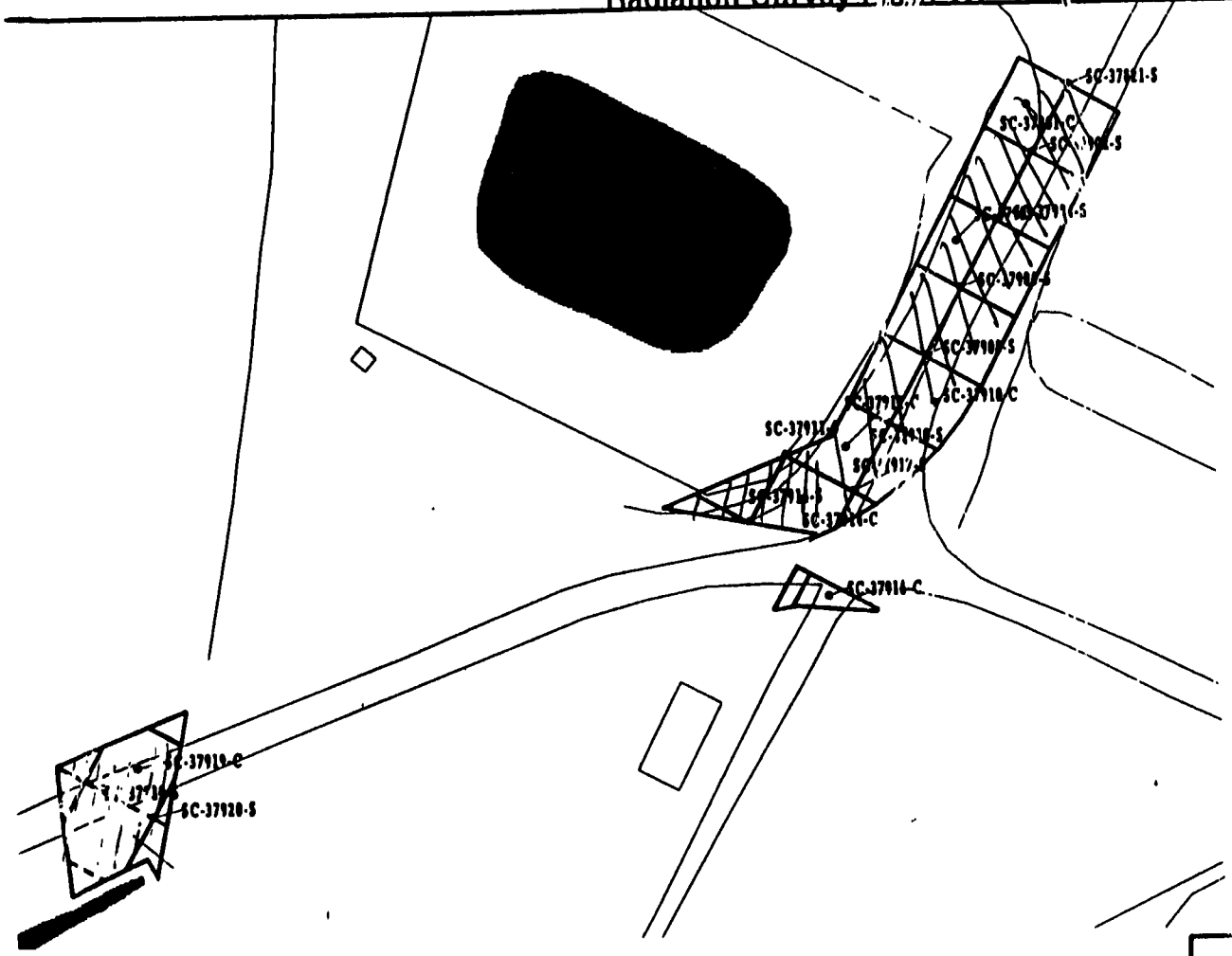
Calibration Due: 11-20-98 Calibration Due: 6-18-98

Survey Date/Time: 3-23-98/1100 Field Bkg.: 12,000 cpm

Surveyor(s): M. Pacheco

Comments: Area surveyed was found to be less than 1½ times background.

Radiation Survey Form WP 437, RU025CU379



Area surveyed

WSSRAP GIS

15 7.5 0 15 METERS

45 22.5 0 45 FEET

S

Meter Model#: Ludlum 2221 Detector Model#: 2x2 NaI

Meter Serial#: 126506/125470 Detector Serial#: 122191F/122608I

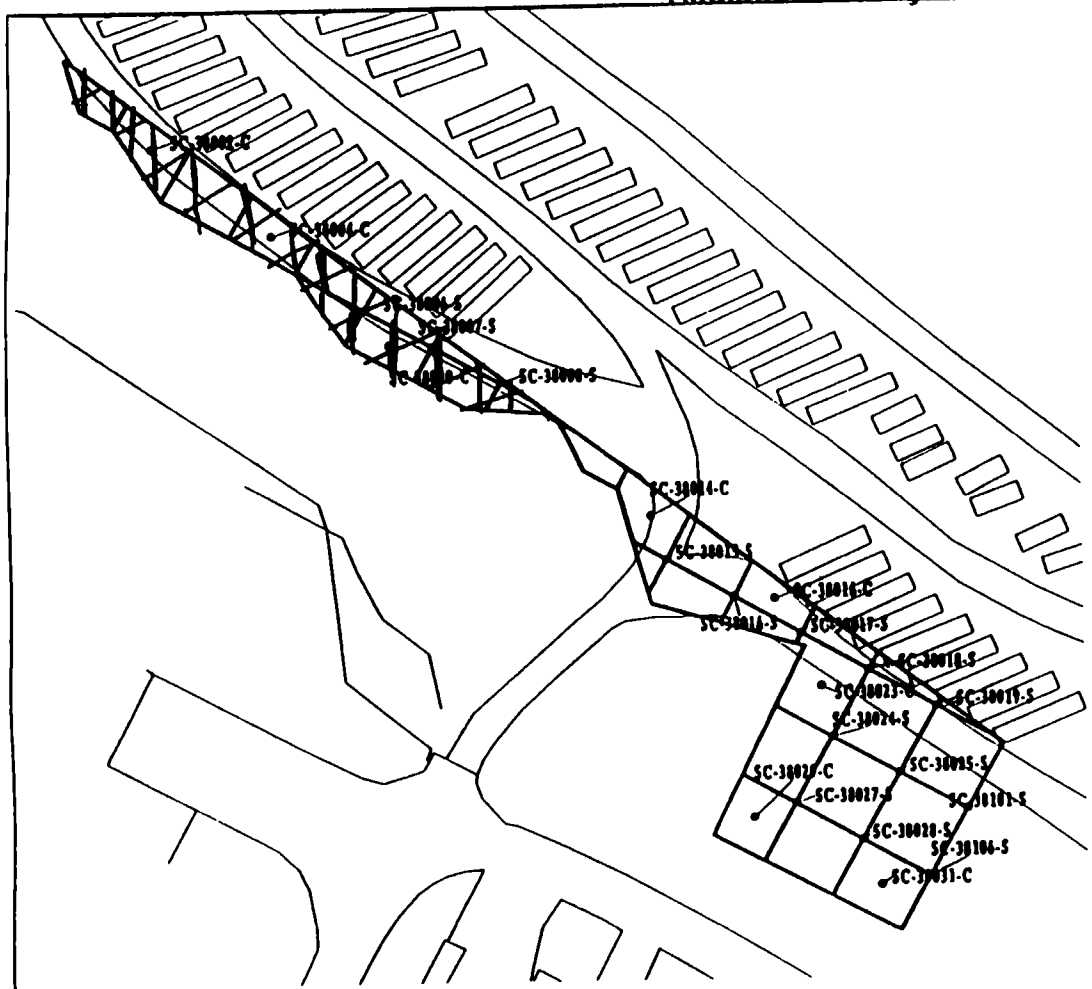
Calibration Due: 6-25-98/11-20-98 Calibration Due: 7-24-98/5-5-98

Survey Date/Time: 4-1-98 (1000-1730) Field Bkg.: 105000 cpm/10000cpm

Surveyor(s): L. Hagoss / M. Pacheco

Comments: The above area surveyed and found to be less than 1½ back-ground.

Radiation Survey Form WP 437, RU025CU380



Surveyed Area

WSSRAP GIS

15 7.5 0 15 METERS

45 22.5 0 45 FEET

N W E S

Meter Model#: ~~2x2 NaI J/G~~ CDV 2220/2221

Detector Model#: 2x2 NaI G/J

Meter Serial#: 48407 / 127427

Detector Serial#: 122912 / 126402

Calibration Due: 11-20-98 / 8-8-98

Calibration Due: 11-17-98 / 1-22-99

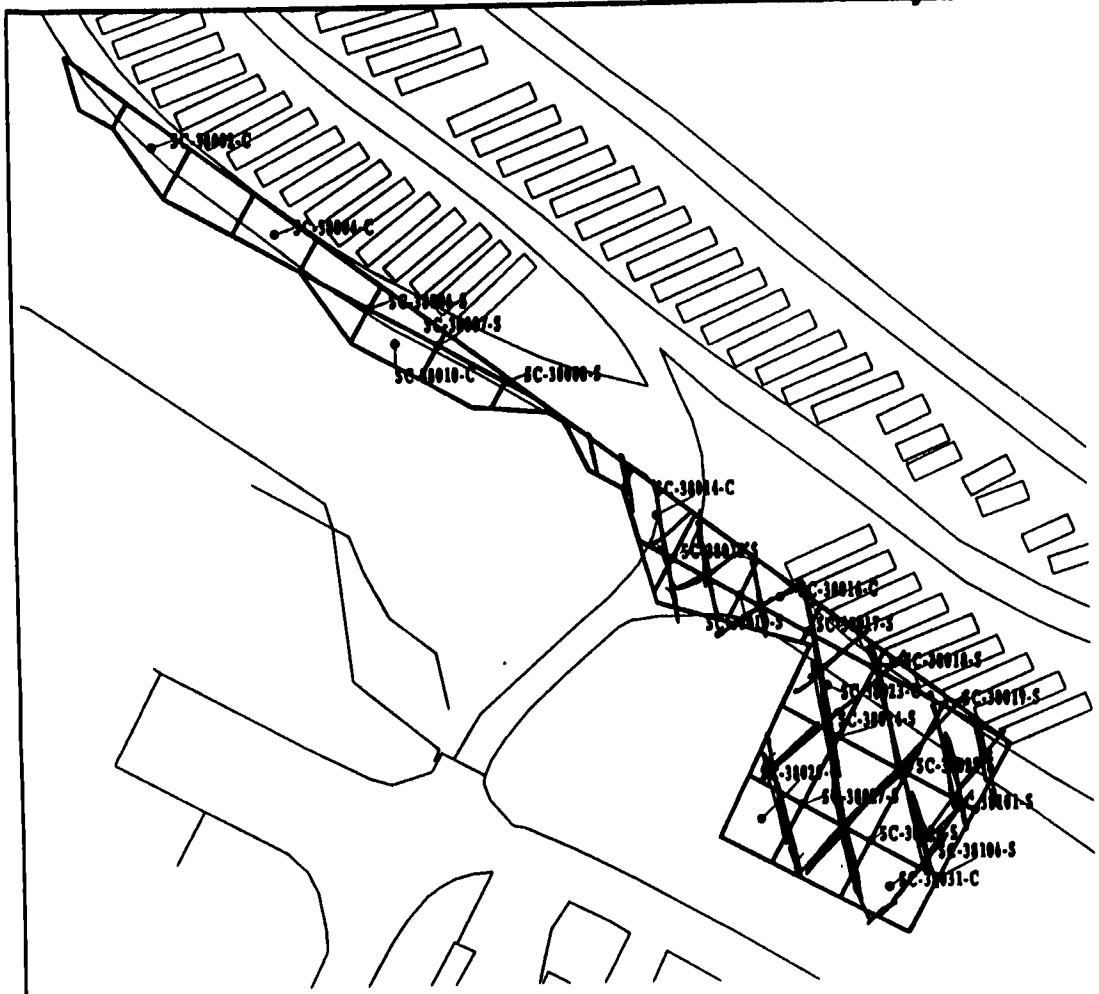
Survey Date/Time: 7/16/98

Field Bkg.: 9500

Surveyor(s): C. Hanner & L. Hagoss

Comments: Area surveyed and found to be below 1½ times above background

Radiation Survey Form WP 437, RU025CU380



Surveyed Area

WSSRAP GIS

15 7.5 0 15 METERS

45 22.5 0 45 FEET

N W E S

Meter Model#: 2221 Detector Model#: "K" 4530 (DOE #)

Meter Serial#: 89636 Detector Serial#: 126403

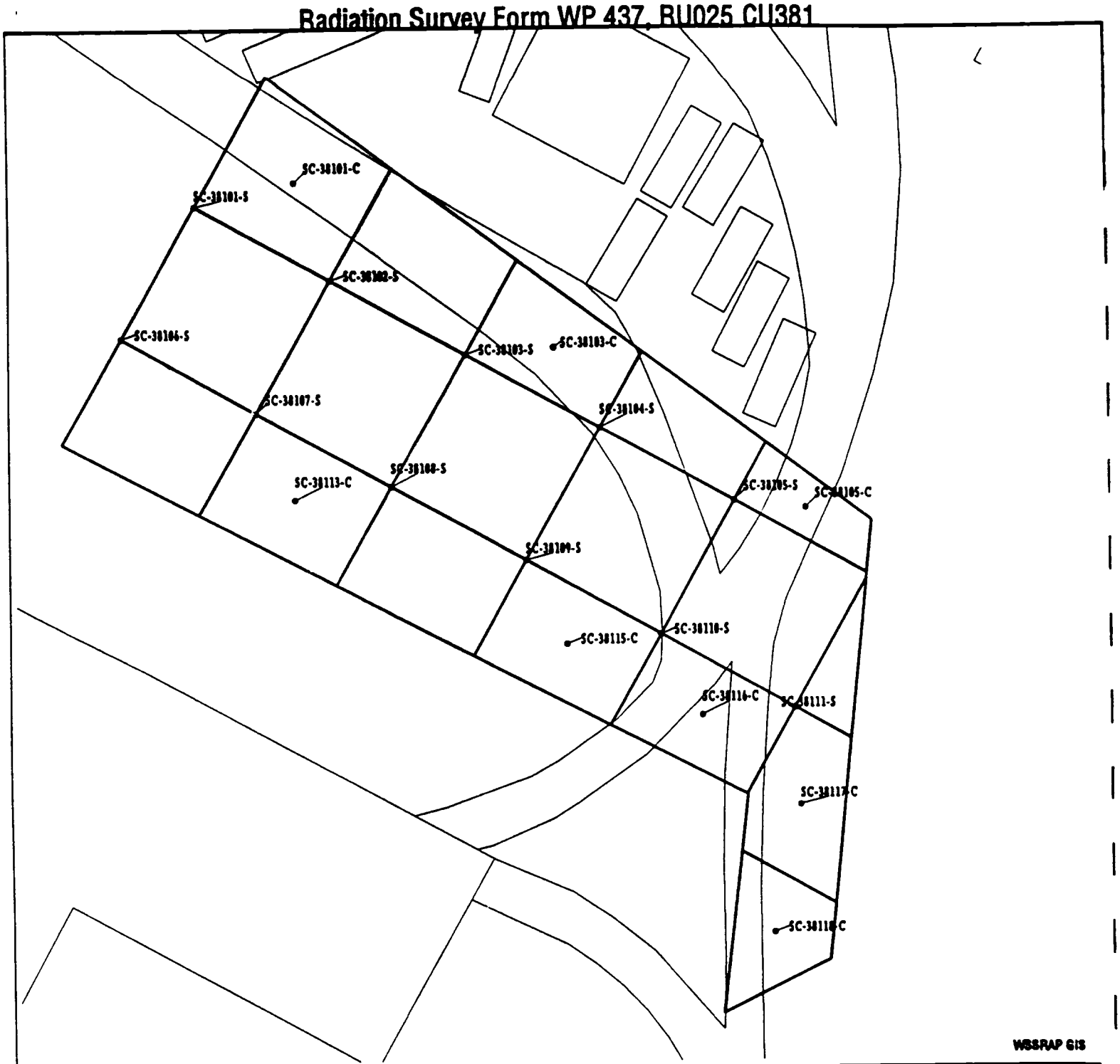
Calibration Due: 11-20-98 Calibration Due: 1-21-99

Survey Date/Time: 7-24-98 / 1000 Field Bkg.: 14,000 cpm

Surveyor(s): Jonathan Rankin

Comments: The above area was surveyed and found to be a 1.5X Background.

Radiation Survey Form WP 437, RU025 CU381



15 7.5 0 METERS

45 22.5 0 FEET

N W E S

Meter Model#: 2221

Meter Serial#: 126402

Calibration Due: 01-08-99

Survey Date/Time: 8-24-98 / 1100

Surveyor(s): J. Rankin

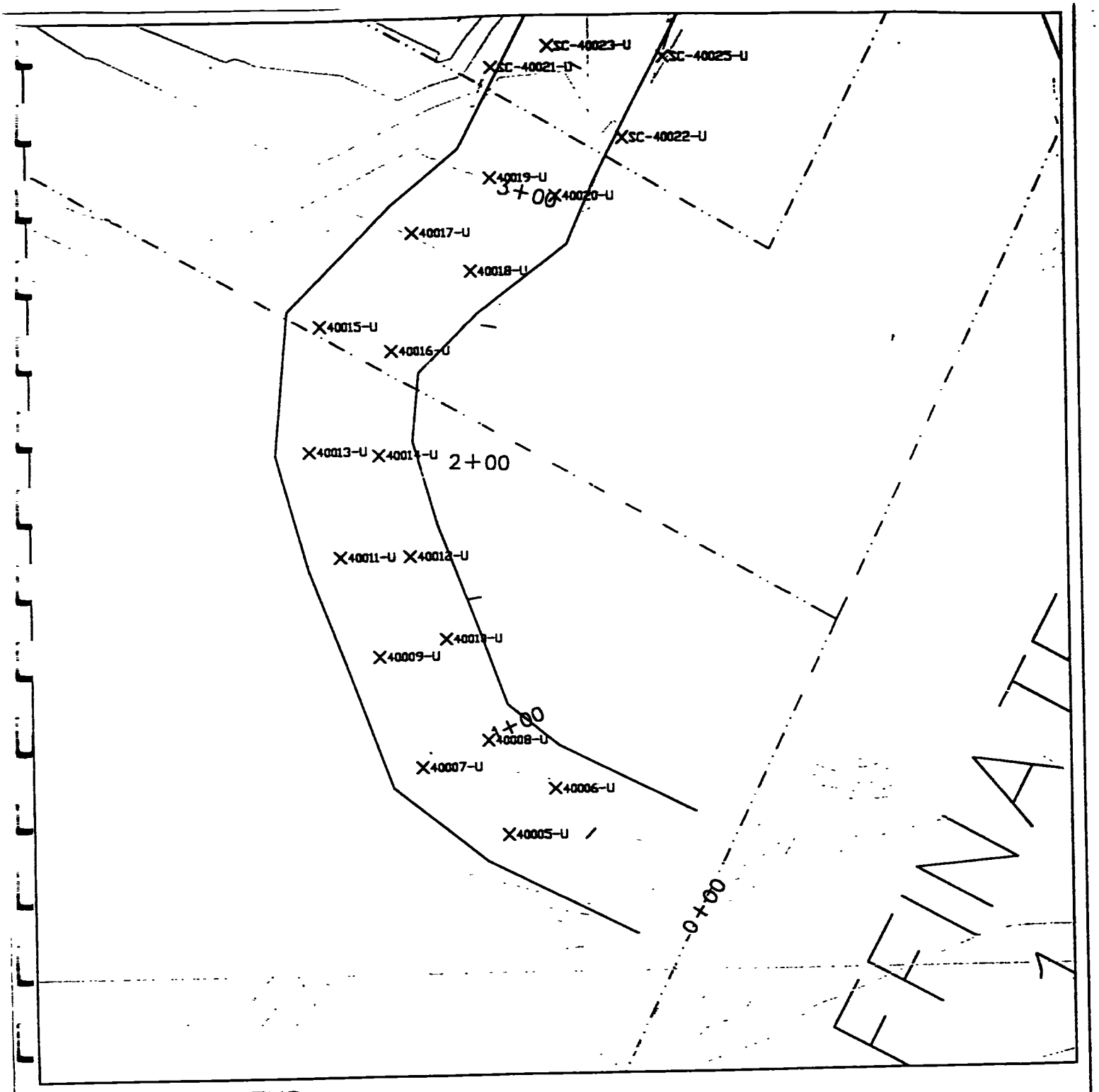
Detector Model#: 44-10

Detector Serial#: 117611

Calibration Due: 1-27-99

Field Bkg.: 12000 cpm

Comments: Area Surveyed less than 1.5 times bkg.



LEGEND

• 'SC-32606-S' SAMPLE POINTS PINNED

— · — · — PINNING LIMITS

N

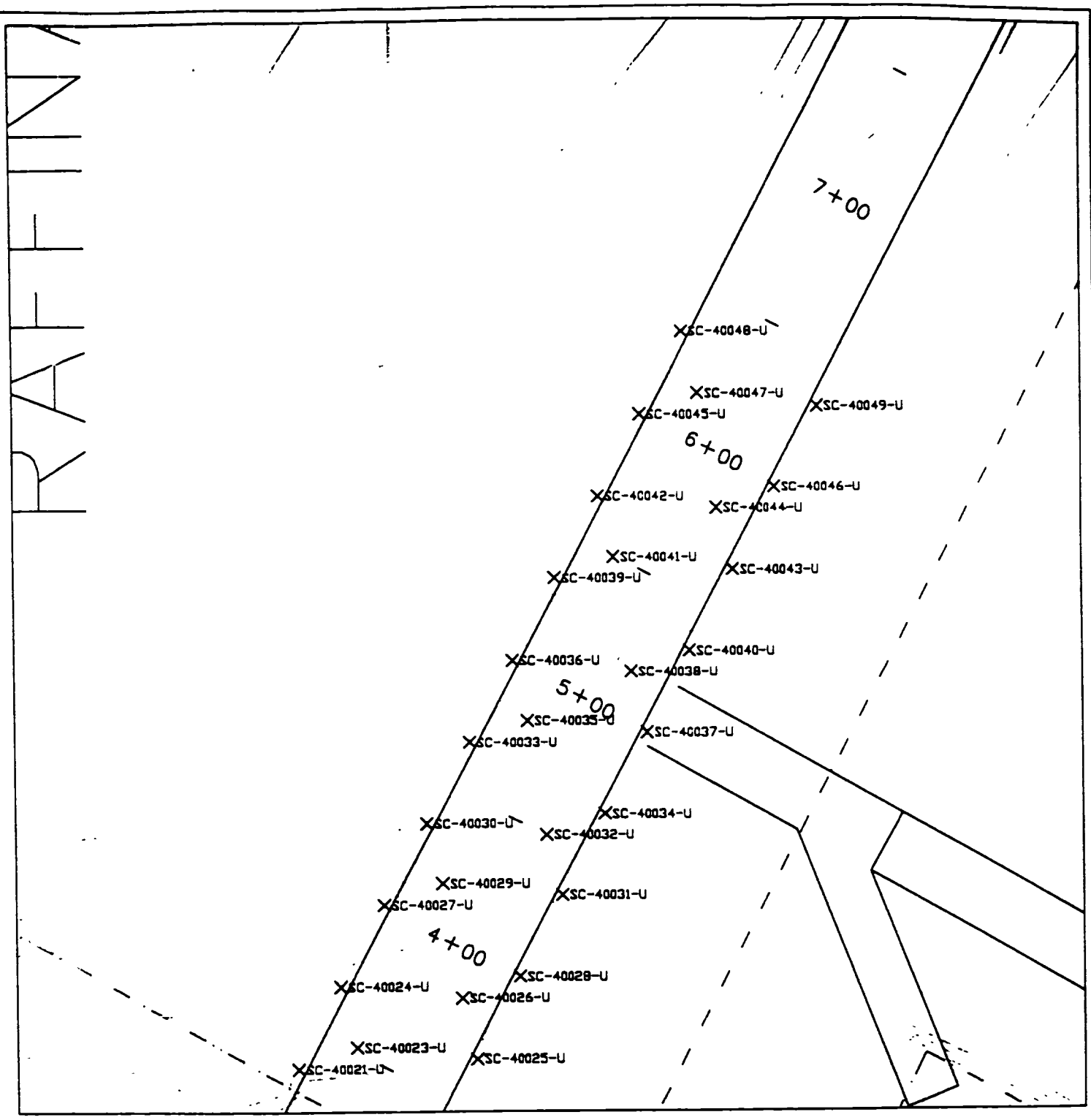
Radiation Survey Form WP 437, RU 21,22,23 CU 400

Date Plotted 6/08/00

DBD CAD

Meter Model #:	2221	Detector Model #:	2x2 NaI "P"
Meter Serial #:	154197	Detector Serial #:	17606
Calibration Date:	2/9/00	Calibration Date:	1/21/01
Survey Date / Time:	6/7/00	Field Bkg.:	10,000 cpm
Surveyor(s):	C. Hanner		

Comments: Area was surveyed and found to be less than 1.5 times background



LEGEND

• 'SC-32606-S' SAMPLE POINTS PINNED

— · — · — PINNING LIMITS

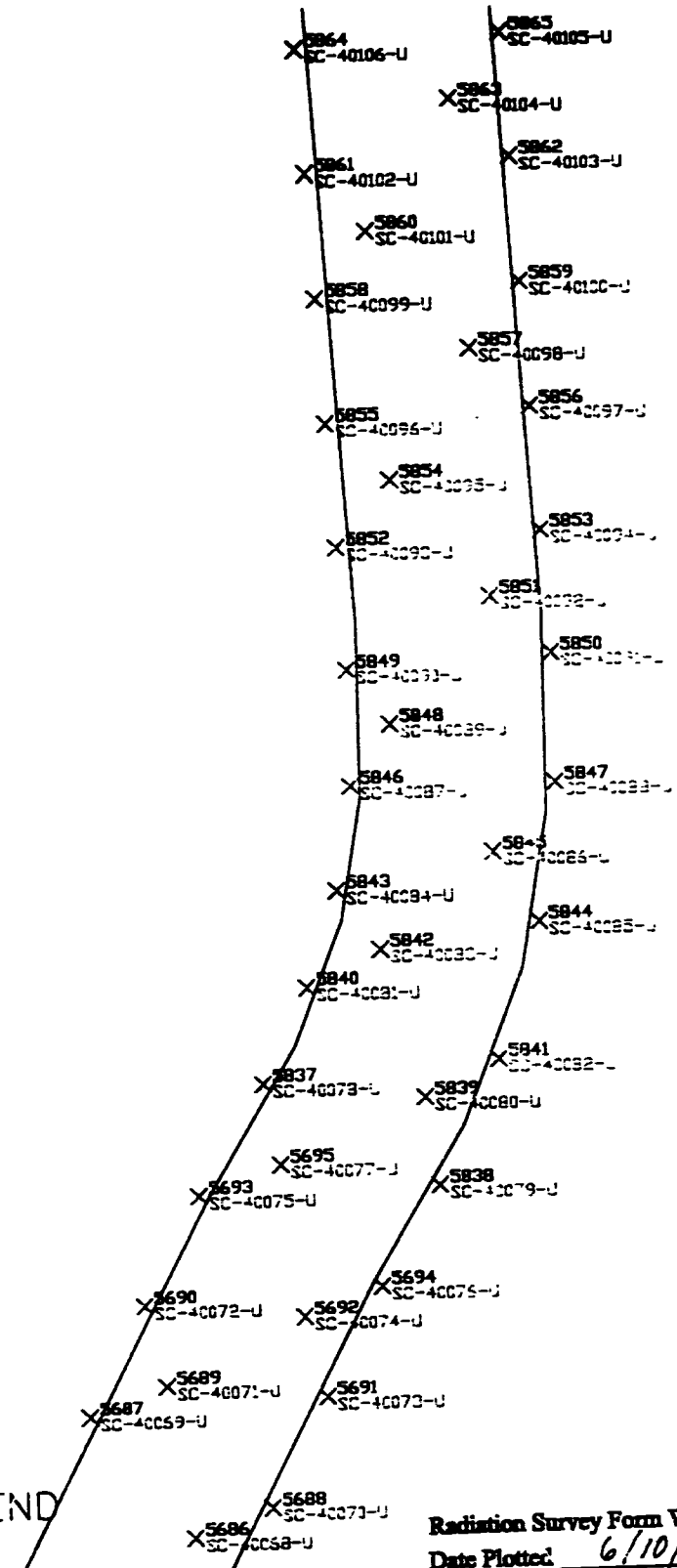
N

Radiation Survey Form WP 437, RU 21 **CU** 400

Date Plotted 6/08/00 **DBD CAD**

Meter Model #:	2221	**Detector Model #:**	2x2 NaI "P"
Meter Serial #:	154199	**Detector Serial #:**	17606
Calibration Date:	2/9/01	**Calibration Date:**	1/21/01
Survey Date / Time:	6/7/00	**Field Bkg.:**	10,000 cpm
Surveyor(s):	C. Hanner		

Comments: Area was surveyed and found to be less than 1.5 times background



LEGEND

SAMPLE POINTS PINNED

PINNING LIMITS

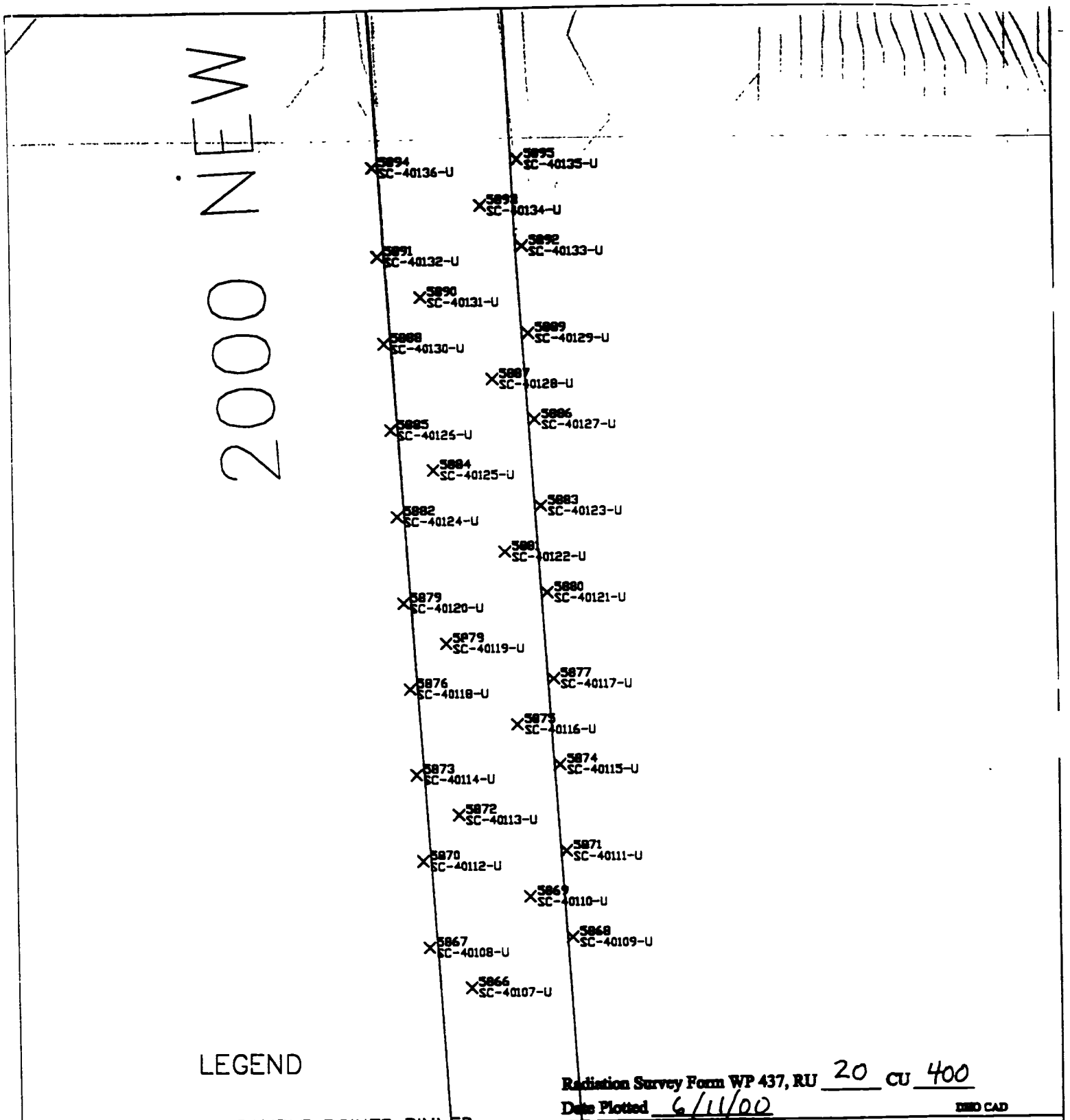
N

Radiation Survey Form WP 437, RU 2021 **CU** 400

Date Plotted 6/10/00

DBO CAD

Meter Model #:	2221	**Detector Model #:**	2x2 "P"
Meter Serial #:	154199	**Detector Serial #:**	17606
Calibration Date:	2/9/01	**Calibration Date:**	1/12/01
Survey Date / Time:	6/10/00	**Field Bkg.:**	10,000 CPM
Surveyor(s):	T. Brown		
Comments:	All readings <1.5 Bkg.		



LEGEND

SAMPLE POINTS PINNED

PINNING LIMITS

N

Radiation Survey Form WP 437, RU 20 **CU** 400

Date Plotted 6/11/00

DBD CAD

Meter Model #:	2221	**Detector Model #:**	2x2 "P"
Meter Serial #:	159199	**Detector Serial #:**	17606
Calibration Due:	2/9/01	**Calibration Date:**	1/12/01
Survey Date / Time:	6/10/00	**Field Bkg.:**	10,000 cpm
Surveyor(s):	T. Brewer		
Comments:	All readings <1.5 Bkg		

PROJECT DHO (WP 437)

Saturday 6-10-00 "Day Shift"

600- Decon pad crew setting up for today's activities.
615- Leoul out starting up GA monitors
630- Two laborers powerwashing Volvo A-40 #9. Two laborers located & A in the process of removing grease found yesterday. Afterward they'll perform final rinse for survey.
9 1- Mike & Leoul begin surveying Volvo A-35 water truck; tires & outside body. Some grease found on undercarriage, driveshaft, & transmission. Areas marked & shown to laborers. Two "hotspots" found on rear axle. Grit needs to be washed off.
130- Lunch
215- Crew back to work. Activity the same from this morning. Fiberglass sample pump placed with Clyde Lacey while he demolition CMSA maintenance shop. Tim performed walkover on haul road removed; < 1.5 × bkg.
4 2- Mike & Leoul resume final survey on Volvo A-35 water truck. More grease located; articular gear area, middle of frame (inside) articular). Also front (inside) wheel. Rear axle still "hot"
5 1- Clean water truck on decon pad to suppress dust inside the work zone. Three laborers powerwashed tires on water truck.
5 7- Leoul surveyed tires; no contam. detected.
600- Mike took swipes from articular area on grease; > 20 dpm (7 cpm)
~~Infor~~ Informed laborers of marked area.
635- Leoul collecting GA samples
7 1- Done for today.

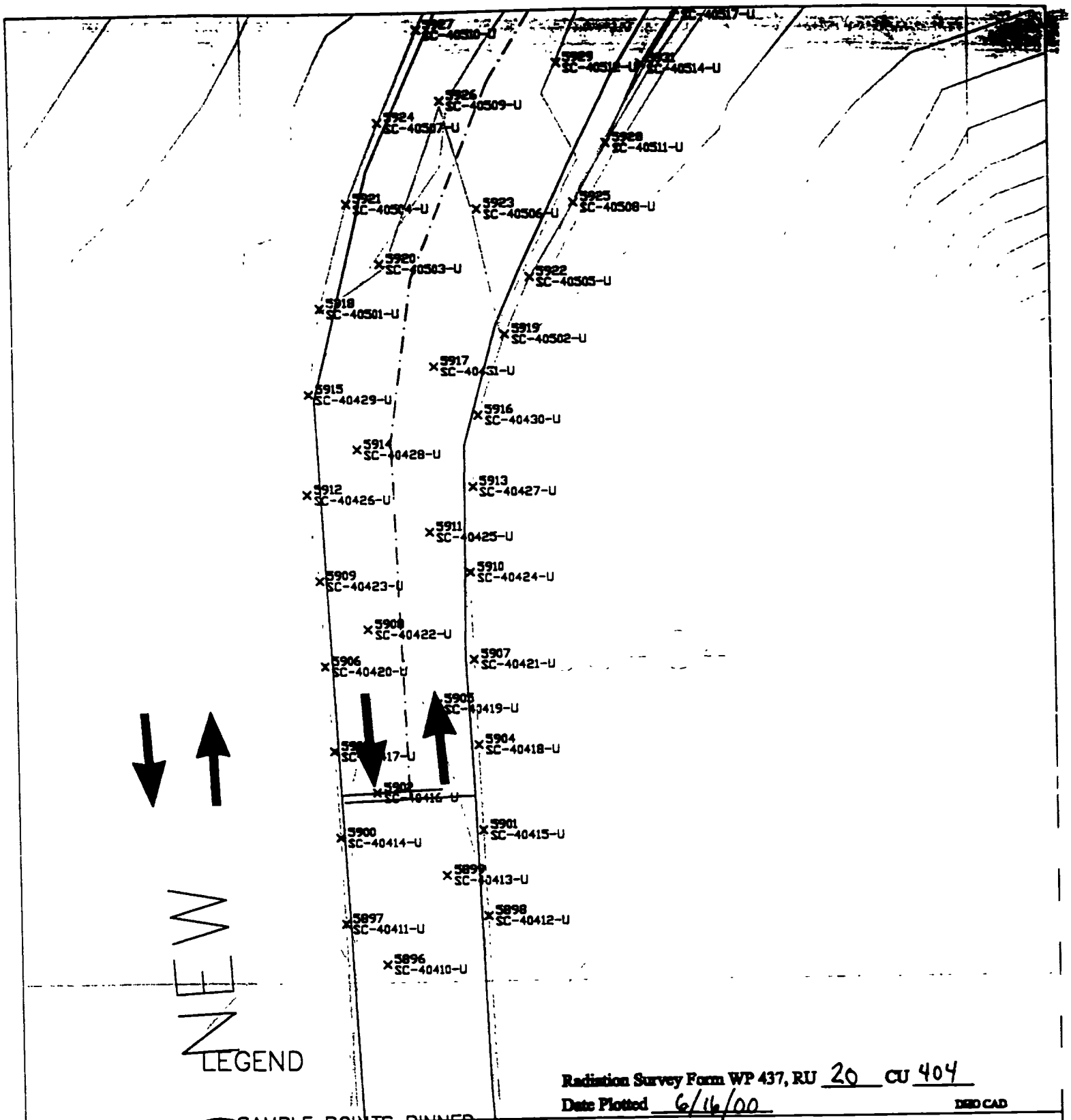
Ed.

Continued on Page

Read and Understood By

Signed: [signature] Date: 6-10-00

Signed: [signature] Date: 6/28/00



LEGEND

SAMPLE POINTS PINNED

PINNING LIMITS

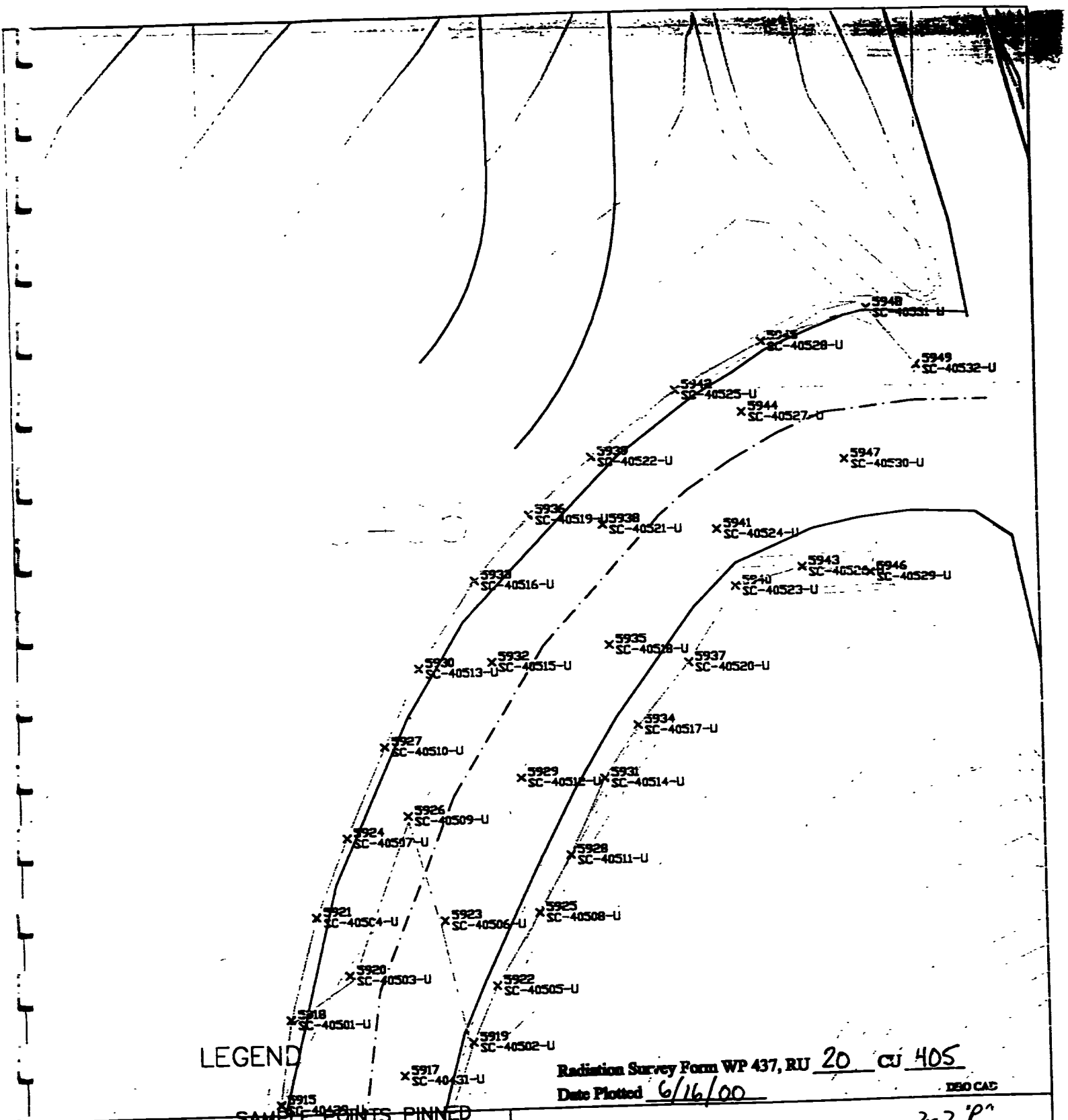
N

Radiation Survey Form WP 437, RU 20 CU 404

Date Plotted 6/16/00

DEID CAD

Meter Model #:	2221	Detector Model #:	2x2 'P'
Meter Serial #:	154199	Detector Serial #:	17606
Calibration Due:	2/9/01	Calibration Due:	1/21/01
Survey Date / Time:	6/15/00	Field Bkg.:	10,000 cpm
Surveyor(s):	T. Browne		
Comments:	All readings 41.5 BKg		



LEGEND

SAMPLE POINTS PINNED

PINNING LIMITS

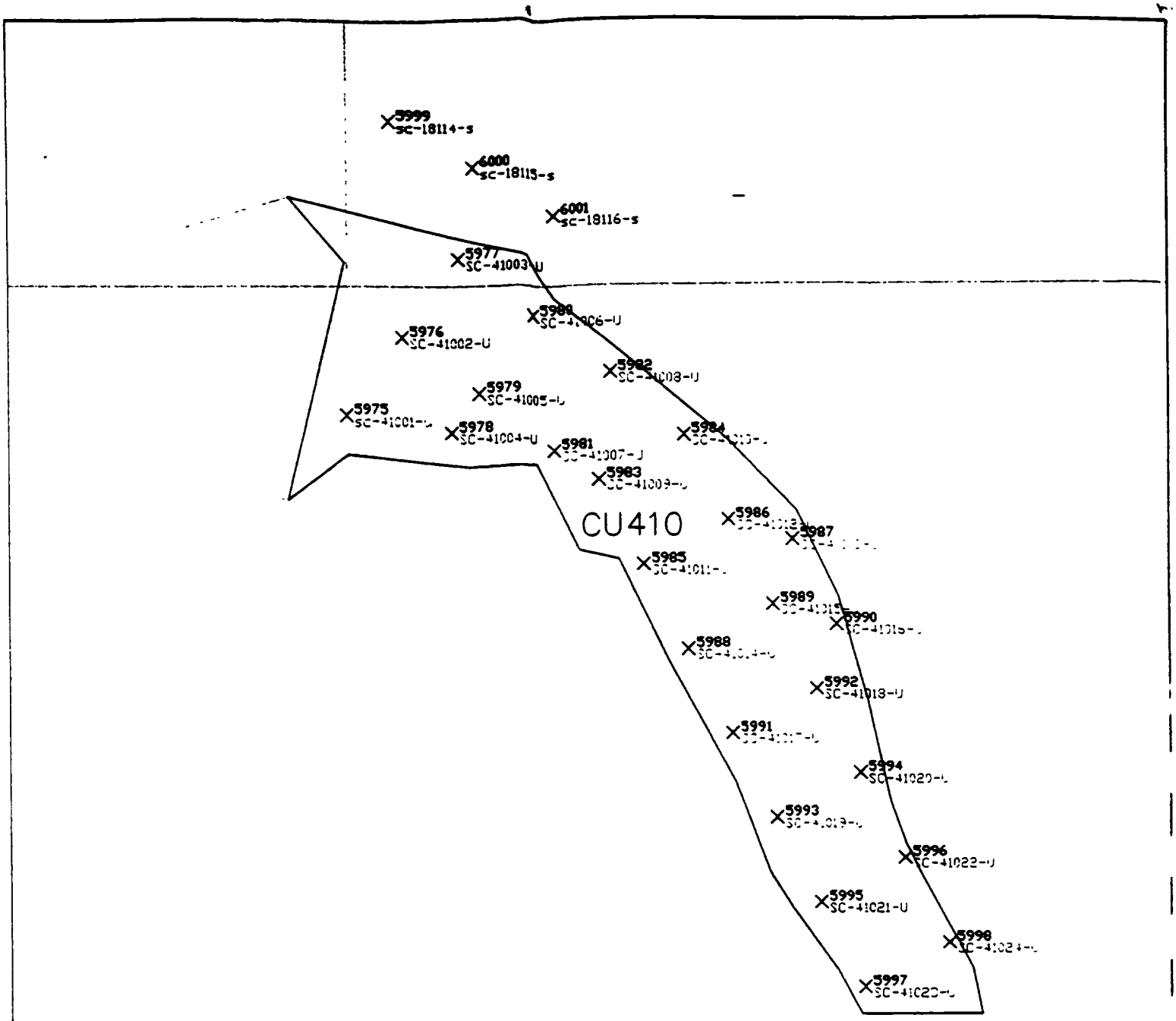
N

Radiation Survey Form WP 437, RU 20 CU 405

Date Plotted 6/16/00

DEO CAD

Meter Model #:	2221	Detector Model #:	2x2 "P"
Meter Serial #:	154199	Detector Serial #:	17606
Calibration Due:	2/9/01	Calibration Due:	1/21/01
Survey Date / Time:	6/15/00	Field Bkg.:	10,000 cpm
Surveyor(s):	T. Brown		
Comments:	All readings <1.5 Bkg		



LEGEND

SAMPLE POINTS PINNED

PINNING LIMITS

N

Radiation Survey Form WP 437, RU 25 CU 410

Date Plotted 7/6/00

DHO CAD

Meter Model #:	2221	Detector Model #:	2x2 "P"
Meter Serial #:	154199	Detector Serial #:	17606
Calibration Due:	2/9/01	Calibration Due:	1/21/01
Survey Date / Time:	7/5/00	Field Bkg.:	10,000 CPM
Surveyor(s):	T. Brower		
Comments:	All readings <1.5 BKg		

APPENDIX C
WP437 RU025 Final Data

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-37919-C	3/24/1998	AROCLOR-1248	21	42	UG/KG
SC-37919-S	3/24/1998	AROCLOR-1248	22	44	UG/KG
SC-38103-S	8/25/1998	AROCLOR-1248	19	38	UG/KG
SC-38107-S	8/25/1998	AROCLOR-1248	190	380	UG/KG
SC-38108-S	8/25/1998	AROCLOR-1248	19	38	UG/KG
SC-38113-C	8/25/1998	AROCLOR-1248	20.5	41	UG/KG
SC-37919-C	3/24/1998	AROCLOR-1254	78	42	UG/KG
SC-37919-S	3/24/1998	AROCLOR-1254	46	44	UG/KG
SC-38103-S	8/25/1998	AROCLOR-1254	19	38	UG/KG
SC-38107-S	8/25/1998	AROCLOR-1254	190	380	UG/KG
SC-38108-S	8/25/1998	AROCLOR-1254	19	38	UG/KG
SC-38113-C	8/25/1998	AROCLOR-1254	20.5	41	UG/KG
SC-37919-C	3/24/1998	AROCLOR-1260	21	42	UG/KG
SC-37919-S	3/24/1998	AROCLOR-1260	22	44	UG/KG
SC-38103-S	8/25/1998	AROCLOR-1260	19	38	UG/KG
SC-38107-S	8/25/1998	AROCLOR-1260	1300	380	UG/KG
SC-38108-S	8/25/1998	AROCLOR-1260	19	38	UG/KG
SC-38113-C	8/25/1998	AROCLOR-1260	20.5	41	UG/KG
SC-37919-C	3/24/1998	ARSENIC	10.7	0.33	UG/G
SC-37919-S	3/24/1998	ARSENIC	9.1	0.34	UG/G
SC-38103-S	8/25/1998	ARSENIC	4.3	0.54	UG/G
SC-38107-S	8/25/1998	ARSENIC	5.8	0.47	UG/G
SC-38108-S	8/25/1998	ARSENIC	4.2	0.45	UG/G
SC-38113-C	8/25/1998	ARSENIC	6.6	0.55	UG/G
SC-37919-C	3/24/1998	BENZO(A)ANTHRACENE	22	44	UG/KG
SC-37919-S	3/24/1998	BENZO(A)ANTHRACENE	23	46	UG/KG
SC-38002-C	7/17/1998	BENZO(A)ANTHRACENE	10	10	UG/KG
SC-38004-C	7/17/1998	BENZO(A)ANTHRACENE	65	11	UG/KG
SC-38006-S	7/17/1998	BENZO(A)ANTHRACENE	4.65	9.3	UG/KG
SC-38007-S	7/17/1998	BENZO(A)ANTHRACENE	11	11	UG/KG
SC-38008-S	7/17/1998	BENZO(A)ANTHRACENE	86	11	UG/KG
SC-38010-C	7/17/1998	BENZO(A)ANTHRACENE	5.5	11	UG/KG
SC-37919-C	3/24/1998	BENZO(A)PYRENE	22	44	UG/KG
SC-37919-S	3/24/1998	BENZO(A)PYRENE	23	46	UG/KG
SC-38002-C	7/17/1998	BENZO(A)PYRENE	20	17	UG/KG
SC-38004-C	7/17/1998	BENZO(A)PYRENE	77	18	UG/KG
SC-38006-S	7/17/1998	BENZO(A)PYRENE	8	16	UG/KG
SC-38007-S	7/17/1998	BENZO(A)PYRENE	18	18	UG/KG
SC-38008-S	7/17/1998	BENZO(A)PYRENE	90	18	UG/KG
SC-38010-C	7/17/1998	BENZO(A)PYRENE	9	18	UG/KG
SC-37919-C	3/24/1998	BENZO(B)FLUORANTHENE	22	44	UG/KG
SC-37919-S	3/24/1998	BENZO(B)FLUORANTHENE	23	46	UG/KG
SC-38002-C	7/17/1998	BENZO(B)FLUORANTHENE	15	14	UG/KG
SC-38004-C	7/17/1998	BENZO(B)FLUORANTHENE	62	14	UG/KG
SC-38006-S	7/17/1998	BENZO(B)FLUORANTHENE	6	12	UG/KG
SC-38007-S	7/17/1998	BENZO(B)FLUORANTHENE	7	14	UG/KG
SC-38008-S	7/17/1998	BENZO(B)FLUORANTHENE	84	14	UG/KG
SC-38010-C	7/17/1998	BENZO(B)FLUORANTHENE	7.5	15	UG/KG
SC-37919-C	3/24/1998	BENZO(K)FLUORANTHENE	22	44	UG/KG

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-37919-S	3/24/1998	BENZO(K)FLUORANTHENE	23	46	UG/KG
SC-38002-C	7/17/1998	BENZO(K)FLUORANTHENE	14	12	UG/KG
SC-38004-C	7/17/1998	BENZO(K)FLUORANTHENE	36	13	UG/KG
SC-38006-S	7/17/1998	BENZO(K)FLUORANTHENE	5.5	11	UG/KG
SC-38007-S	7/17/1998	BENZO(K)FLUORANTHENE	6.5	13	UG/KG
SC-38008-S	7/17/1998	BENZO(K)FLUORANTHENE	43	13	UG/KG
SC-38010-C	7/17/1998	BENZO(K)FLUORANTHENE	7	14	UG/KG
SC-37919-C	3/24/1998	CHROMIUM	23.7	0.15	UG/G
SC-37919-S	3/24/1998	CHROMIUM	22.2	0.16	UG/G
SC-38103-S	8/25/1998	CHROMIUM	9.1	0.17	UG/G
SC-38107-S	8/25/1998	CHROMIUM	13	0.15	UG/G
SC-38108-S	8/25/1998	CHROMIUM	9.5	0.14	UG/G
SC-38113-C	8/25/1998	CHROMIUM	14.3	0.17	UG/G
SC-37919-C	3/24/1998	CHRYSENE	22	44	UG/KG
SC-37919-S	3/24/1998	CHRYSENE	23	46	UG/KG
SC-38002-C	7/17/1998	CHRYSENE	110	110	UG/KG
SC-38004-C	7/17/1998	CHRYSENE	60	120	UG/KG
SC-38006-S	7/17/1998	CHRYSENE	50	100	UG/KG
SC-38007-S	7/17/1998	CHRYSENE	60	120	UG/KG
SC-38008-S	7/17/1998	CHRYSENE	150	120	UG/KG
SC-38010-C	7/17/1998	CHRYSENE	60	120	UG/KG
SC-37919-C	3/24/1998	INDENO(1,2,3-CD)PYRENE	22	44	UG/KG
SC-37919-S	3/24/1998	INDENO(1,2,3-CD)PYRENE	23	46	UG/KG
SC-38002-C	7/17/1998	INDENO(1,2,3-CD)PYRENE	42	33	UG/KG
SC-38004-C	7/17/1998	INDENO(1,2,3-CD)PYRENE	63	34	UG/KG
SC-38006-S	7/17/1998	INDENO(1,2,3-CD)PYRENE	15	30	UG/KG
SC-38007-S	7/17/1998	INDENO(1,2,3-CD)PYRENE	17.5	35	UG/KG
SC-38008-S	7/17/1998	INDENO(1,2,3-CD)PYRENE	87	34	UG/KG
SC-38010-C	7/17/1998	INDENO(1,2,3-CD)PYRENE	18	36	UG/KG
SC-38103-S	8/25/1998	LEAD	11.2	0.39	UG/G
SC-38107-S	8/25/1998	LEAD	20.3	0.35	UG/G
SC-38108-S	8/25/1998	LEAD	13.3	0.33	UG/G
SC-38113-C	8/25/1998	LEAD	13.5	0.4	UG/G
SC-37802-C	4/3/1998	RADIUM-226	1.37	0.33	PCI/G
SC-37804-C	4/3/1998	RADIUM-226	0.49	0.22	PCI/G
SC-37806-C	4/3/1998	RADIUM-226	1.46	0.34	PCI/G
SC-37810-C	4/3/1998	RADIUM-226	1.47	0.28	PCI/G
SC-37814-C	4/3/1998	RADIUM-226	1.32	0.27	PCI/G
SC-37818-C	4/3/1998	RADIUM-226	1.25	0 28	PCI/G
SC-37821-S	4/3/1998	RADIUM-226	1.33	0.39	PCI/G
SC-37901-C	4/3/1998	RADIUM-226	1.31	0.44	PCI/G
SC-37902-S	4/3/1998	RADIUM-226	1.3	0.26	PCI/G
SC-37904-S	4/3/1998	RADIUM-226	1.79	0.34	PCI/G
SC-37905-C	4/3/1998	RADIUM-226	1.46	0.25	PCI/G
SC-37906-S	4/3/1998	RADIUM-226	1.19	0.21	PCI/G
SC-37908-S	4/3/1998	RADIUM-226	1.26	0.29	PCI/G
SC-37910-S	4/3/1998	RADIUM-226	0.86	0.34	PCI/G
SC-37911-C	4/3/1998	RADIUM-226	1.54	0.28	PCI/G
SC-37911-S	4/3/1998	RADIUM-226	1.33	0.35	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-37912-S	4/3/1998	RADIUM-226	0.89	0.26	PCI/G
SC-37914-C	4/3/1998	RADIUM-226	1.41	0.34	PCI/G
SC-37914-S	4/3/1998	RADIUM-226	1.41	0.33	PCI/G
SC-37919-C	3/24/1998	RADIUM-226	1.21	0.25	PCI/G
SC-37919-S	3/24/1998	RADIUM-226	1.54	0.18	PCI/G
SC-38002-C	7/17/1998	RADIUM-226	1.25	0.29	PCI/G
SC-38004-C	7/17/1998	RADIUM-226	2.37	0.42	PCI/G
SC-38006-S	7/17/1998	RADIUM-226	1.45	0.28	PCI/G
SC-38007-S	7/17/1998	RADIUM-226	1.28	0.31	PCI/G
SC-38008-S	7/17/1998	RADIUM-226	3.52	0.22	PCI/G
SC-38008-S-RS	7/22/1998	RADIUM-226	1.48	0.29	PCI/G
SC-38010-C	7/17/1998	RADIUM-226	1.19	0.37	PCI/G
SC-38103-S	8/25/1998	RADIUM-226	1.1	0.41	PCI/G
SC-38107-S	8/25/1998	RADIUM-226	1.24	0.19	PCI/G
SC-38108-S	8/25/1998	RADIUM-226	1.27	0.36	PCI/G
SC-38113-C	8/25/1998	RADIUM-226	1.38	0.24	PCI/G
SC-40001-U	6/9/2000	RADIUM-226	1.1	0.25	PCI/G
SC-40002-U	6/9/2000	RADIUM-226	1.12	0.25	PCI/G
SC-40003-U	6/9/2000	RADIUM-226	0.91	0.27	PCI/G
SC-40004-U	6/9/2000	RADIUM-226	0.95	0.25	PCI/G
SC-40005-U	6/9/2000	RADIUM-226	1.04	0.29	PCI/G
SC-40006-U	6/9/2000	RADIUM-226	1.1	0.24	PCI/G
SC-40007-U	6/9/2000	RADIUM-226	1.04	0.27	PCI/G
SC-40008-U	6/9/2000	RADIUM-226	0.97	0.26	PCI/G
SC-40009-U	6/9/2000	RADIUM-226	0.98	0.27	PCI/G
SC-40010-U	6/9/2000	RADIUM-226	1.01	0.27	PCI/G
SC-40011-U	6/9/2000	RADIUM-226	0.89	0.29	PCI/G
SC-40012-U	6/9/2000	RADIUM-226	1.06	0.26	PCI/G
SC-40013-U	6/9/2000	RADIUM-226	0.97	0.25	PCI/G
SC-40014-U	6/9/2000	RADIUM-226	0.89	0.25	PCI/G
SC-40015-U	6/9/2000	RADIUM-226	0.93	0.26	PCI/G
SC-40016-U	6/9/2000	RADIUM-226	0.83	0.2	PCI/G
SC-40017-U	6/9/2000	RADIUM-226	0.89	0.29	PCI/G
SC-40018-U	6/9/2000	RADIUM-226	0.92	0.28	PCI/G
SC-40019-U	6/9/2000	RADIUM-226	0.85	0.28	PCI/G
SC-40020-U	6/9/2000	RADIUM-226	0.79	0.25	PCI/G
SC-40021-U	6/9/2000	RADIUM-226	0.74	0.27	PCI/G
SC-40022-U	6/9/2000	RADIUM-226	0.95	0.26	PCI/G
SC-40023-U	6/9/2000	RADIUM-226	0.95	0.27	PCI/G
SC-40024-U	6/9/2000	RADIUM-226	0.91	0.24	PCI/G
SC-40025-U	6/9/2000	RADIUM-226	0.86	0.26	PCI/G
SC-40026-U	6/9/2000	RADIUM-226	0.88	0.24	PCI/G
SC-40027-U	6/9/2000	RADIUM-226	0.91	0.26	PCI/G
SC-40028-U	6/9/2000	RADIUM-226	0.72	0.24	PCI/G
SC-40029-U	6/9/2000	RADIUM-226	0.65	0.27	PCI/G
SC-40030-U	6/9/2000	RADIUM-226	0.81	0.25	PCI/G
SC-40031-U	6/9/2000	RADIUM-226	0.71	0.27	PCI/G
SC-40032-U	6/9/2000	RADIUM-226	0.73	0.26	PCI/G
SC-40033-U	6/9/2000	RADIUM-226	0.63	0.28	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40034-U	6/9/2000	RADIUM-226	0.76	0.21	PCI/G
SC-40035-U	6/9/2000	RADIUM-226	0.72	0.24	PCI/G
SC-40101-U	6/9/2000	RADIUM-226	0.78	0.25	PCI/G
SC-40102-U	6/9/2000	RADIUM-226	0.57	0.27	PCI/G
SC-40103-U	6/9/2000	RADIUM-226	0.7	0.24	PCI/G
SC-40104-U	6/9/2000	RADIUM-226	0.68	0.28	PCI/G
SC-40105-U	6/9/2000	RADIUM-226	0.71	0.24	PCI/G
SC-40106-U	6/9/2000	RADIUM-226	0.62	0.28	PCI/G
SC-40107-U	6/9/2000	RADIUM-226	0.86	0.23	PCI/G
SC-40108-U	6/9/2000	RADIUM-226	0.7	0.25	PCI/G
SC-40109-U	6/9/2000	RADIUM-226	0.56	0.25	PCI/G
SC-40110-U	6/9/2000	RADIUM-226	0.63	0.27	PCI/G
SC-40111-U	6/10/2000	RADIUM-226	0.63	0.25	PCI/G
SC-40112-U	6/10/2000	RADIUM-226	0.75	0.22	PCI/G
SC-40113-U	6/10/2000	RADIUM-226	0.71	0.24	PCI/G
SC-40114-U	6/10/2000	RADIUM-226	0.21	0.42	PCI/G
SC-40115-U	6/10/2000	RADIUM-226	0.81	0.25	PCI/G
SC-40116-U	6/10/2000	RADIUM-226	0.7	0.26	PCI/G
SC-40117-U	6/10/2000	RADIUM-226	0.71	0.24	PCI/G
SC-40118-U	6/10/2000	RADIUM-226	0.58	0.28	PCI/G
SC-40119-U	6/10/2000	RADIUM-226	0.65	0.27	PCI/G
SC-40120-U	6/10/2000	RADIUM-226	0.69	0.26	PCI/G
SC-40121-U	6/10/2000	RADIUM-226	0.64	0.24	PCI/G
SC-40122-U	6/10/2000	RADIUM-226	1.06	0.21	PCI/G
SC-40123-U	6/10/2000	RADIUM-226	0.58	0.27	PCI/G
SC-40124-U	6/10/2000	RADIUM-226	0.83	0.22	PCI/G
SC-40125-U	6/10/2000	RADIUM-226	0 73	0.23	PCI/G
SC-40126-U	6/10/2000	RADIUM-226	0.76	0.26	PCI/G
SC-40127-U	6/10/2000	RADIUM-226	0.54	0.29	PCI/G
SC-40128-U	6/10/2000	RADIUM-226	0.62	0.22	PCI/G
SC-40129-U	6/10/2000	RADIUM-226	0.71	0.24	PCI/G
SC-40130-U	6/10/2000	RADIUM-226	0.72	0.22	PCI/G
SC-40131-U	6/10/2000	RADIUM-226	0.84	0.25	PCI/G
SC-40201-U	6/10/2000	RADIUM-226	0 73	0.26	PCI/G
SC-40202-U	6/10/2000	RADIUM-226	0.67	0.26	PCI/G
SC-40203-U	6/10/2000	RADIUM-226	0.7	0.24	PCI/G
SC-40204-U	6/10/2000	RADIUM-226	0.72	0.26	PCI/G
SC-40205-U	6/10/2000	RADIUM-226	0.62	0.25	PCI/G
SC-40206-U	6/10/2000	RADIUM-226	0.8	0.26	PCI/G
SC-40207-U	6/10/2000	RADIUM-226	0.78	0.23	PCI/G
SC-40208-U	6/10/2000	RADIUM-226	0.72	0.23	PCI/G
SC-40209-U	6/10/2000	RADIUM-226	0.59	0.23	PCI/G
SC-40210-U	6/10/2000	RADIUM-226	0.88	0.26	PCI/G
SC-40211-U	6/10/2000	RADIUM-226	0.66	0.25	PCI/G
SC-40212-U	6/10/2000	RADIUM-226	0.71	0.26	PCI/G
SC-40213-U	6/10/2000	RADIUM-226	0.77	0.25	PCI/G
SC-40214-U	6/10/2000	RADIUM-226	0.83	0.25	PCI/G
SC-40215-U	6/10/2000	RADIUM-226	0.79	0.25	PCI/G
SC-40216-U	6/10/2000	RADIUM-226	0.87	0.22	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40217-U	6/10/2000	RADIUM-226	0.75	0.23	PCI/G
SC-40218-U	6/10/2000	RADIUM-226	0.88	0.28	PCI/G
SC-40219-U	6/10/2000	RADIUM-226	0.79	0.23	PCI/G
SC-40220-U	6/12/2000	RADIUM-226	0.81	0.24	PCI/G
SC-40221-U	6/12/2000	RADIUM-226	0.72	0.25	PCI/G
SC-40222-U	6/12/2000	RADIUM-226	0.79	0.25	PCI/G
SC-40223-U	6/12/2000	RADIUM-226	1	0.25	PCI/G
SC-40224-U	6/12/2000	RADIUM-226	0.74	0.29	PCI/G
SC-40225-U	6/12/2000	RADIUM-226	0.75	0.25	PCI/G
SC-40226-U	6/12/2000	RADIUM-226	0.92	0.24	PCI/G
SC-40227-U	6/12/2000	RADIUM-226	0.74	0.25	PCI/G
SC-40228-U	6/12/2000	RADIUM-226	0.77	0.25	PCI/G
SC-40229-U	6/12/2000	RADIUM-226	0.92	0.27	PCI/G
SC-40230-U	6/12/2000	RADIUM-226	0.85	0.26	PCI/G
SC-40231-U	6/12/2000	RADIUM-226	0.81	0.28	PCI/G
SC-40301-U	6/12/2000	RADIUM-226	0.76	0.27	PCI/G
SC-40302-U	6/12/2000	RADIUM-226	1.05	0.26	PCI/G
SC-40303-U	6/12/2000	RADIUM-226	0.85	0.25	PCI/G
SC-40304-U	6/12/2000	RADIUM-226	0.75	0.25	PCI/G
SC-40305-U	6/12/2000	RADIUM-226	0.94	0.23	PCI/G
SC-40306-U	6/12/2000	RADIUM-226	1.04	0.31	PCI/G
SC-40307-U	6/12/2000	RADIUM-226	0.98	0.27	PCI/G
SC-40308-U	6/12/2000	RADIUM-226	0.87	0.3	PCI/G
SC-40309-U	6/12/2000	RADIUM-226	0.64	0.26	PCI/G
SC-40310-U	6/12/2000	RADIUM-226	0.86	0.27	PCI/G
SC-40311-U	6/12/2000	RADIUM-226	0.95	0.26	PCI/G
SC-40312-U	6/12/2000	RADIUM-226	0.73	0.29	PCI/G
SC-40313-U	6/12/2000	RADIUM-226	0.81	0.26	PCI/G
SC-40314-U	6/12/2000	RADIUM-226	0.92	0.23	PCI/G
SC-40315-U	6/12/2000	RADIUM-226	1.03	0.26	PCI/G
SC-40316-U	6/14/2000	RADIUM-226	1.03	0.25	PCI/G
SC-40317-U	6/14/2000	RADIUM-226	0.98	0.25	PCI/G
SC-40318-U	6/12/2000	RADIUM-226	0.92	0.28	PCI/G
SC-40319-U	6/14/2000	RADIUM-226	0.92	0.24	PCI/G
SC-40320-U	6/14/2000	RADIUM-226	1.02	0.24	PCI/G
SC-40321-U	6/14/2000	RADIUM-226	0.7	0.27	PCI/G
SC-40322-U	6/14/2000	RADIUM-226	0.92	0.25	PCI/G
SC-40323-U	6/14/2000	RADIUM-226	0.83	0.25	PCI/G
SC-40324-U	6/14/2000	RADIUM-226	1.14	0.25	PCI/G
SC-40325-U	6/14/2000	RADIUM-226	0.76	0.26	PCI/G
SC-40326-U	6/14/2000	RADIUM-226	1.01	0.25	PCI/G
SC-40401-U	6/14/2000	RADIUM-226	0.84	0.24	PCI/G
SC-40402-U	6/14/2000	RADIUM-226	0.75	0.24	PCI/G
SC-40403-U	6/14/2000	RADIUM-226	0.83	0.24	PCI/G
SC-40404-U	6/14/2000	RADIUM-226	0.78	0.24	PCI/G
SC-40405-U	6/14/2000	RADIUM-226	0.86	0.27	PCI/G
SC-40406-U	6/14/2000	RADIUM-226	0.96	0.24	PCI/G
SC-40407-U	6/14/2000	RADIUM-226	0.76	0.26	PCI/G
SC-40408-U	6/14/2000	RADIUM-226	0.88	0.25	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40409-U	6/14/2000	RADIUM-226	0.71	0.27	PCI/G
SC-40410-U	6/14/2000	RADIUM-226	0.91	0.24	PCI/G
SC-40411-U	6/14/2000	RADIUM-226	0.275	0.55	PCI/G
SC-40412-U	6/14/2000	RADIUM-226	1.01	0.24	PCI/G
SC-40413-U	6/14/2000	RADIUM-226	0.72	0.25	PCI/G
SC-40414-U	6/14/2000	RADIUM-226	0.82	0.27	PCI/G
SC-40415-U	6/14/2000	RADIUM-226	0.99	0.25	PCI/G
SC-40416-U	6/14/2000	RADIUM-226	0.88	0.25	PCI/G
SC-40417-U	6/14/2000	RADIUM-226	0.86	0.25	PCI/G
SC-40418-U	6/14/2000	RADIUM-226	0.82	0.22	PCI/G
SC-40419-U	6/14/2000	RADIUM-226	0.84	0.25	PCI/G
SC-40420-U	6/14/2000	RADIUM-226	0.66	0.23	PCI/G
SC-40421-U	6/14/2000	RADIUM-226	0.62	0.26	PCI/G
SC-40422-U	6/14/2000	RADIUM-226	0.69	0.22	PCI/G
SC-40423-U	6/14/2000	RADIUM-226	0.65	0.23	PCI/G
SC-40424-U	6/14/2000	RADIUM-226	0.77	0.25	PCI/G
SC-40425-U	6/14/2000	RADIUM-226	0.265	0.53	PCI/G
SC-40426-U	6/14/2000	RADIUM-226	0.71	0.23	PCI/G
SC-40427-U	6/14/2000	RADIUM-226	0.56	0.26	PCI/G
SC-40428-U	6/14/2000	RADIUM-226	0 55	0.23	PCI/G
SC-40429-U	6/14/2000	RADIUM-226	0 66	0.27	PCI/G
SC-40430-U	6/14/2000	RADIUM-226	0 73	0.26	PCI/G
SC-40431-U	6/14/2000	RADIUM-226	0 79	0.23	PCI/G
SC-40501-U	6/14/2000	RADIUM-226	0.63	0.26	PCI/G
SC-40502-U	6/14/2000	RADIUM-226	1.02	0.22	PCI/G
SC-40503-U	6/14/2000	RADIUM-226	0.89	0.28	PCI/G
SC-40504-U	6/14/2000	RADIUM-226	0.68	0.26	PCI/G
SC-40505-U	6/14/2000	RADIUM-226	0.85	0 28	PCI/G
SC-40506-U	6/14/2000	RADIUM-226	0.59	0.24	PCI/G
SC-40507-U	6/14/2000	RADIUM-226	0 79	0.24	PCI/G
SC-40508-U	6/14/2000	RADIUM-226	0.83	0.22	PCI/G
SC-40509-U	6/14/2000	RADIUM-226	0.93	0.24	PCI/G
SC-40510-U	6/14/2000	RADIUM-226	0.69	0.22	PCI/G
SC-40511-U	6/14/2000	RADIUM-226	0 81	0.26	PCI/G
SC-40512-U	6/14/2000	RADIUM-226	0.76	0.26	PCI/G
SC-40513-U	6/14/2000	RADIUM-226	0.71	0.27	PCI/G
SC-40514-U	6/14/2000	RADIUM-226	0.74	0.26	PCI/G
SC-40515-U	6/14/2000	RADIUM-226	0.71	0.24	PCI/G
SC-40516-U	6/14/2000	RADIUM-226	0.68	0.21	PCI/G
SC-40517-U	6/14/2000	RADIUM-226	0 77	0.25	PCI/G
SC-40518-U	6/14/2000	RADIUM-226	0.73	0.22	PCI/G
SC-40519-U	6/14/2000	RADIUM-226	0.73	0.24	PCI/G
SC-40520-U	6/14/2000	RADIUM-226	0.83	0.26	PCI/G
SC-40521-U	6/14/2000	RADIUM-226	0.61	0.24	PCI/G
SC-40522-U	6/14/2000	RADIUM-226	0.77	0.24	PCI/G
SC-40523-U	6/14/2000	RADIUM-226	0.79	0.28	PCI/G
SC-40524-U	6/14/2000	RADIUM-226	0.68	0.23	PCI/G
SC-40525-U	6/14/2000	RADIUM-226	0.74	0.26	PCI/G
SC-40526-U	6/14/2000	RADIUM-226	0.54	0.26	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40527-U	6/14/2000	RADIUM-226	0.75	0.26	PCI/G
SC-40528-U	6/14/2000	RADIUM-226	0.69	0.27	PCI/G
SC-40529-U	6/14/2000	RADIUM-226	0.73	0.27	PCI/G
SC-40530-U	6/14/2000	RADIUM-226	0.7	0.21	PCI/G
SC-40531-U	6/14/2000	RADIUM-226	0.66	0.28	PCI/G
SC-40532-U	6/14/2000	RADIUM-226	0.72	0.23	PCI/G
SC-41001-U	7/7/2000	RADIUM-226	0.61	0.28	PCI/G
SC-41002-U	7/7/2000	RADIUM-226	0.62	0.24	PCI/G
SC-41003-U	7/7/2000	RADIUM-226	0.265	0.53	PCI/G
SC-41004-U	7/7/2000	RADIUM-226	0.63	0.23	PCI/G
SC-41005-U	7/7/2000	RADIUM-226	0.69	0.27	PCI/G
SC-41006-U	7/7/2000	RADIUM-226	0.75	0.24	PCI/G
SC-41007-U	7/7/2000	RADIUM-226	0.9	0.27	PCI/G
SC-41008-U	7/7/2000	RADIUM-226	0.79	0.28	PCI/G
SC-41009-U	7/7/2000	RADIUM-226	0.65	0.25	PCI/G
SC-41010-U	7/7/2000	RADIUM-226	0.47	0.24	PCI/G
SC-41011-U	7/7/2000	RADIUM-226	0.24	0.48	PCI/G
SC-41012-U	7/7/2000	RADIUM-226	0.71	0.18	PCI/G
SC-41013-U	7/7/2000	RADIUM-226	0.73	0.26	PCI/G
SC-41014-U	7/7/2000	RADIUM-226	0.87	0.27	PCI/G
SC-41015-U	7/7/2000	RADIUM-226	0.62	0.25	PCI/G
SC-41016-U	7/7/2000	RADIUM-226	0.65	0.22	PCI/G
SC-41017-U	7/7/2000	RADIUM-226	0.56	0.25	PCI/G
SC-41018-U	7/7/2000	RADIUM-226	0.26	0.52	PCI/G
SC-41019-U	7/7/2000	RADIUM-226	0.74	0.28	PCI/G
SC-41020-U	7/7/2000	RADIUM-226	0.56	0.25	PCI/G
SC-41021-U	7/7/2000	RADIUM-226	0.26	0.52	PCI/G
SC-41022-U	7/7/2000	RADIUM-226	0.97	0.21	PCI/G
SC-41023-U	7/7/2000	RADIUM-226	0.26	0.52	PCI/G
SC-41024-U	7/7/2000	RADIUM-226	0.68	0.25	PCI/G
SC-37802-C	4/3/1998	RADIUM-228	1.3	0.42	PCI/G
SC-37804-C	4/3/1998	RADIUM-228	0.28	0.56	PCI/G
SC-37806-C	4/3/1998	RADIUM-228	1.28	0.45	PCI/G
SC-37810-C	4/3/1998	RADIUM-228	1.15	0.42	PCI/G
SC-37814-C	4/3/1998	RADIUM-228	1.2	0.44	PCI/G
SC-37818-C	4/3/1998	RADIUM-228	1.45	0.45	PCI/G
SC-37821-S	4/3/1998	RADIUM-228	1.35	0.26	PCI/G
SC-37901-C	4/3/1998	RADIUM-228	1.63	0.42	PCI/G
SC-37902-S	4/3/1998	RADIUM-228	1.2	0.39	PCI/G
SC-37904-S	4/3/1998	RADIUM-228	1.3	0.58	PCI/G
SC-37905-C	4/3/1998	RADIUM-228	1.48	0.45	PCI/G
SC-37906-S	4/3/1998	RADIUM-228	1.41	0.46	PCI/G
SC-37908-S	4/3/1998	RADIUM-228	1.25	0.28	PCI/G
SC-37910-S	4/3/1998	RADIUM-228	0.56	1.12	PCI/G
SC-37911-C	4/3/1998	RADIUM-228	1.07	0.33	PCI/G
SC-37911-S	4/3/1998	RADIUM-228	1.67	0.49	PCI/G
SC-37912-S	4/3/1998	RADIUM-228	0.76	0.39	PCI/G
SC-37914-C	4/3/1998	RADIUM-228	0.67	1.34	PCI/G
SC-37914-S	4/3/1998	RADIUM-228	1.35	0.4	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-37919-C	3/24/1998	RADIUM-228	1.12	0.34	PCI/G
SC-37919-S	3/24/1998	RADIUM-228	1.07	0.46	PCI/G
SC-38002-C	7/17/1998	RADIUM-228	1.13	0.46	PCI/G
SC-38004-C	7/17/1998	RADIUM-228	1 39	0.61	PCI/G
SC-38006-S	7/17/1998	RADIUM-228	1.05	0.35	PCI/G
SC-38007-S	7/17/1998	RADIUM-228	1.07	0.24	PCI/G
SC-38008-S	7/17/1998	RADIUM-228	1.33	0 31	PCI/G
SC-38008-S-RS	7/22/1998	RADIUM-228	1.3	0.27	PCI/G
SC-38010-C	7/17/1998	RADIUM-228	0.57	1.14	PCI/G
SC-38103-S	8/25/1998	RADIUM-228	1.36	0.42	PCI/G
SC-38107-S	8/25/1998	RADIUM-228	1.12	0.33	PCI/G
SC-38108-S	8/25/1998	RADIUM-228	1.25	0.56	PCI/G
SC-38113-C	8/25/1998	RADIUM-228	1.35	0.4	PCI/G
SC-40001-U	6/9/2000	RADIUM-228	1.18	0.47	PCI/G
SC-40002-U	6/9/2000	RADIUM-228	0.94	0 41	PCI/G
SC-40003-U	6/9/2000	RADIUM-228	0.92	0.4	PCI/G
SC-40004-U	6/9/2000	RADIUM-228	1.1	0.41	PCI/G
SC-40005-U	6/9/2000	RADIUM-228	0.95	0 44	PCI/G
SC-40006-U	6/9/2000	RADIUM-228	1.08	0.41	PCI/G
SC-40007-U	6/9/2000	RADIUM-228	1.19	0.42	PCI/G
SC-40008-U	6/9/2000	RADIUM-228	1.24	0.36	PCI/G
SC-40009-U	6/9/2000	RADIUM-228	0.415	0 83	PCI/G
SC-40010-U	6/9/2000	RADIUM-228	1.15	0.37	PCI/G
SC-40011-U	6/9/2000	RADIUM-228	0 95	0.51	PCI/G
SC-40012-U	6/9/2000	RADIUM-228	1.13	0.48	PCI/G
SC-40013-U	6/9/2000	RADIUM-228	0.425	0 85	PCI/G
SC-40014-U	6/9/2000	RADIUM-228	1.02	0.35	PCI/G
SC-40015-U	6/9/2000	RADIUM-228	0 37	0.74	PCI/G
SC-40016-U	6/9/2000	RADIUM-228	1.23	0.33	PCI/G
SC-40017-U	6/9/2000	RADIUM-228	1.34	0.34	PCI/G
SC-40018-U	6/9/2000	RADIUM-228	1.01	0.36	PCI/G
SC-40019-U	6/9/2000	RADIUM-228	1.02	0.39	PCI/G
SC-40020-U	6/9/2000	RADIUM-228	1.23	0.33	PCI/G
SC-40021-U	6/9/2000	RADIUM-228	1.2	0.41	PCI/G
SC-40022-U	6/9/2000	RADIUM-228	1.11	0.37	PCI/G
SC-40023-U	6/9/2000	RADIUM-228	0 93	0.57	PCI/G
SC-40024-U	6/9/2000	RADIUM-228	1 1	0.32	PCI/G
SC-40025-U	6/9/2000	RADIUM-228	0.415	0 83	PCI/G
SC-40026-U	6/9/2000	RADIUM-228	1.14	0.37	PCI/G
SC-40027-U	6/9/2000	RADIUM-228	0.92	0 52	PCI/G
SC-40028-U	6/9/2000	RADIUM-228	1.05	0.33	PCI/G
SC-40029-U	6/9/2000	RADIUM-228	0.37	0 74	PCI/G
SC-40030-U	6/9/2000	RADIUM-228	1 12	0.41	PCI/G
SC-40031-U	6/9/2000	RADIUM-228	0.385	0.77	PCI/G
SC-40032-U	6/9/2000	RADIUM-228	1.08	0.32	PCI/G
SC-40033-U	6/9/2000	RADIUM-228	1 03	0 43	PCI/G
SC-40034-U	6/9/2000	RADIUM-228	1 21	0.33	PCI/G
SC-40035-U	6/9/2000	RADIUM-228	0.88	0 36	PCI/G
SC-40101-U	6/9/2000	RADIUM-228	1.22	0 32	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40102-U	6/9/2000	RADIUM-228	1.06	0.41	PCI/G
SC-40103-U	6/9/2000	RADIUM-228	1.22	0.32	PCI/G
SC-40104-U	6/9/2000	RADIUM-228	0.82	0.46	PCI/G
SC-40105-U	6/9/2000	RADIUM-228	1.09	0.35	PCI/G
SC-40106-U	6/9/2000	RADIUM-228	0.99	0.37	PCI/G
SC-40107-U	6/9/2000	RADIUM-228	1.01	0.35	PCI/G
SC-40108-U	6/9/2000	RADIUM-228	1.12	0.5	PCI/G
SC-40109-U	6/9/2000	RADIUM-228	1.07	0.35	PCI/G
SC-40110-U	6/9/2000	RADIUM-228	0.435	0.87	PCI/G
SC-40111-U	6/10/2000	RADIUM-228	1.2	0.36	PCI/G
SC-40112-U	6/10/2000	RADIUM-228	1.06	0.46	PCI/G
SC-40113-U	6/10/2000	RADIUM-228	1.01	0.36	PCI/G
SC-40114-U	6/10/2000	RADIUM-228	0.98	0.46	PCI/G
SC-40115-U	6/10/2000	RADIUM-228	0.88	0.36	PCI/G
SC-40116-U	6/10/2000	RADIUM-228	0.425	0.85	PCI/G
SC-40117-U	6/10/2000	RADIUM-228	1.11	0.32	PCI/G
SC-40118-U	6/10/2000	RADIUM-228	1.3	0.38	PCI/G
SC-40119-U	6/10/2000	RADIUM-228	0.37	0.74	PCI/G
SC-40120-U	6/10/2000	RADIUM-228	1.04	0.37	PCI/G
SC-40121-U	6/10/2000	RADIUM-228	1.23	0.32	PCI/G
SC-40122-U	6/10/2000	RADIUM-228	1.36	0.31	PCI/G
SC-40123-U	6/10/2000	RADIUM-228	1.23	0.38	PCI/G
SC-40124-U	6/10/2000	RADIUM-228	0.83	0.36	PCI/G
SC-40125-U	6/10/2000	RADIUM-228	1.16	0.43	PCI/G
SC-40126-U	6/10/2000	RADIUM-228	1.09	0.32	PCI/G
SC-40127-U	6/10/2000	RADIUM-228	1.24	0.36	PCI/G
SC-40128-U	6/10/2000	RADIUM-228	1.19	0.34	PCI/G
SC-40129-U	6/10/2000	RADIUM-228	0.39	0.78	PCI/G
SC-40130-U	6/10/2000	RADIUM-228	1.24	0.35	PCI/G
SC-40131-U	6/10/2000	RADIUM-228	0.405	0.81	PCI/G
SC-40201-U	6/10/2000	RADIUM-228	1.13	0.35	PCI/G
SC-40202-U	6/10/2000	RADIUM-228	0.97	0.42	PCI/G
SC-40203-U	6/10/2000	RADIUM-228	1.19	0.36	PCI/G
SC-40204-U	6/10/2000	RADIUM-228	0.38	0.76	PCI/G
SC-40205-U	6/10/2000	RADIUM-228	1.09	0.34	PCI/G
SC-40206-U	6/10/2000	RADIUM-228	0.77	0.48	PCI/G
SC-40207-U	6/10/2000	RADIUM-228	1.18	0.36	PCI/G
SC-40208-U	6/10/2000	RADIUM-228	0.355	0.71	PCI/G
SC-40209-U	6/10/2000	RADIUM-228	1	0.36	PCI/G
SC-40210-U	6/10/2000	RADIUM-228	1.09	0.45	PCI/G
SC-40211-U	6/10/2000	RADIUM-228	0.97	0.38	PCI/G
SC-40212-U	6/10/2000	RADIUM-228	0.97	0.4	PCI/G
SC-40213-U	6/10/2000	RADIUM-228	1.03	0.39	PCI/G
SC-40214-U	6/10/2000	RADIUM-228	1.13	0.4	PCI/G
SC-40215-U	6/10/2000	RADIUM-228	1.03	0.33	PCI/G
SC-40216-U	6/10/2000	RADIUM-228	1.2	0.45	PCI/G
SC-40217-U	6/10/2000	RADIUM-228	1.2	0.36	PCI/G
SC-40218-U	6/10/2000	RADIUM-228	1.18	0.46	PCI/G
SC-40219-U	6/10/2000	RADIUM-228	1.2	0.33	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40220-U	6/12/2000	RADIUM-228	0.92	0.45	PCI/G
SC-40221-U	6/12/2000	RADIUM-228	0.92	0.32	PCI/G
SC-40222-U	6/12/2000	RADIUM-228	1.32	0.47	PCI/G
SC-40223-U	6/12/2000	RADIUM-228	1.23	0.36	PCI/G
SC-40224-U	6/12/2000	RADIUM-228	0.88	0.51	PCI/G
SC-40225-U	6/12/2000	RADIUM-228	1.07	0.38	PCI/G
SC-40226-U	6/12/2000	RADIUM-228	0.395	0.79	PCI/G
SC-40227-U	6/12/2000	RADIUM-228	0.84	0.38	PCI/G
SC-40228-U	6/12/2000	RADIUM-228	1 4	0.42	PCI/G
SC-40229-U	6/12/2000	RADIUM-228	0.4	0.8	PCI/G
SC-40230-U	6/12/2000	RADIUM-228	1.14	0.37	PCI/G
SC-40231-U	6/12/2000	RADIUM-228	1.03	0.42	PCI/G
SC-40301-U	6/12/2000	RADIUM-228	1.23	0.47	PCI/G
SC-40302-U	6/12/2000	RADIUM-228	1.29	0.43	PCI/G
SC-40303-U	6/12/2000	RADIUM-228	0.445	0.89	PCI/G
SC-40304-U	6/12/2000	RADIUM-228	1.14	0.45	PCI/G
SC-40305-U	6/12/2000	RADIUM-228	0.91	0.44	PCI/G
SC-40306-U	6/12/2000	RADIUM-228	1.12	0.47	PCI/G
SC-40307-U	6/12/2000	RADIUM-228	0.365	0.73	PCI/G
SC-40308-U	6/12/2000	RADIUM-228	1.21	0.43	PCI/G
SC-40309-U	6/12/2000	RADIUM-228	1.2	0.43	PCI/G
SC-40310-U	6/12/2000	RADIUM-228	0.97	0.53	PCI/G
SC-40311-U	6/12/2000	RADIUM-228	0.43	0.86	PCI/G
SC-40312-U	6/12/2000	RADIUM-228	0.375	0.75	PCI/G
SC-40313-U	6/12/2000	RADIUM-228	0.4	0.8	PCI/G
SC-40314-U	6/12/2000	RADIUM-228	1.08	0.45	PCI/G
SC-40315-U	6/12/2000	RADIUM-228	1.39	0.34	PCI/G
SC-40316-U	6/14/2000	RADIUM-228	0.98	0.41	PCI/G
SC-40317-U	6/14/2000	RADIUM-228	1.22	0.35	PCI/G
SC-40318-U	6/12/2000	RADIUM-228	1.28	0.4	PCI/G
SC-40319-U	6/14/2000	RADIUM-228	0 42	0.84	PCI/G
SC-40320-U	6/14/2000	RADIUM-228	1.05	0.39	PCI/G
SC-40321-U	6/14/2000	RADIUM-228	1 33	0.43	PCI/G
SC-40322-U	6/14/2000	RADIUM-228	0.93	0.36	PCI/G
SC-40323-U	6/14/2000	RADIUM-228	0 96	0.34	PCI/G
SC-40324-U	6/14/2000	RADIUM-228	1.01	0.34	PCI/G
SC-40325-U	6/14/2000	RADIUM-228	0.43	0.86	PCI/G
SC-40326-U	6/14/2000	RADIUM-228	1.04	0.35	PCI/G
SC-40401-U	6/14/2000	RADIUM-228	0.395	0.79	PCI/G
SC-40402-U	6/14/2000	RADIUM-228	1.06	0.35	PCI/G
SC-40403-U	6/14/2000	RADIUM-228	0.44	0.88	PCI/G
SC-40404-U	6/14/2000	RADIUM-228	1.15	0.35	PCI/G
SC-40405-U	6/14/2000	RADIUM-228	1.04	0.44	PCI/G
SC-40406-U	6/14/2000	RADIUM-228	1.12	0.33	PCI/G
SC-40407-U	6/14/2000	RADIUM-228	1.36	0.44	PCI/G
SC-40408-U	6/14/2000	RADIUM-228	1.25	0.31	PCI/G
SC-40409-U	6/14/2000	RADIUM-228	1.25	0 45	PCI/G
SC-40410-U	6/14/2000	RADIUM-228	1.12	0 4	PCI/G
SC-40411-U	6/14/2000	RADIUM-228	0.39	0 78	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40412-U	6/14/2000	RADIUM-228	1.18	0.34	PCI/G
SC-40413-U	6/14/2000	RADIUM-228	1.14	0.44	PCI/G
SC-40414-U	6/14/2000	RADIUM-228	1.28	0.34	PCI/G
SC-40415-U	6/14/2000	RADIUM-228	1.15	0.37	PCI/G
SC-40416-U	6/14/2000	RADIUM-228	1.1	0.31	PCI/G
SC-40417-U	6/14/2000	RADIUM-228	0.91	0.62	PCI/G
SC-40418-U	6/14/2000	RADIUM-228	1.17	0.39	PCI/G
SC-40419-U	6/14/2000	RADIUM-228	1.45	0.41	PCI/G
SC-40420-U	6/14/2000	RADIUM-228	1.16	0.38	PCI/G
SC-40421-U	6/14/2000	RADIUM-228	0.39	0.78	PCI/G
SC-40422-U	6/14/2000	RADIUM-228	1.26	0.32	PCI/G
SC-40423-U	6/14/2000	RADIUM-228	0.92	0.44	PCI/G
SC-40424-U	6/14/2000	RADIUM-228	1.32	0.36	PCI/G
SC-40425-U	6/14/2000	RADIUM-228	1.12	0.47	PCI/G
SC-40426-U	6/14/2000	RADIUM-228	1.08	0.35	PCI/G
SC-40427-U	6/14/2000	RADIUM-228	0.345	0.69	PCI/G
SC-40428-U	6/14/2000	RADIUM-228	1.11	0.34	PCI/G
SC-40429-U	6/14/2000	RADIUM-228	1.02	0.45	PCI/G
SC-40430-U	6/14/2000	RADIUM-228	1.15	0.38	PCI/G
SC-40431-U	6/14/2000	RADIUM-228	0.96	0.36	PCI/G
SC-40501-U	6/14/2000	RADIUM-228	1.25	0.35	PCI/G
SC-40502-U	6/14/2000	RADIUM-228	1.16	0.35	PCI/G
SC-40503-U	6/14/2000	RADIUM-228	0.405	0.81	PCI/G
SC-40504-U	6/14/2000	RADIUM-228	0.91	0.34	PCI/G
SC-40505-U	6/14/2000	RADIUM-228	0.39	0.78	PCI/G
SC-40506-U	6/14/2000	RADIUM-228	1.03	0.34	PCI/G
SC-40507-U	6/14/2000	RADIUM-228	0.405	0.81	PCI/G
SC-40508-U	6/14/2000	RADIUM-228	1.16	0.35	PCI/G
SC-40509-U	6/14/2000	RADIUM-228	1.02	0.39	PCI/G
SC-40510-U	6/14/2000	RADIUM-228	1.03	0.35	PCI/G
SC-40511-U	6/14/2000	RADIUM-228	0.93	0.48	PCI/G
SC-40512-U	6/14/2000	RADIUM-228	0.98	0.36	PCI/G
SC-40513-U	6/14/2000	RADIUM-228	0.41	0.82	PCI/G
SC-40514-U	6/14/2000	RADIUM-228	1.17	0.3	PCI/G
SC-40515-U	6/14/2000	RADIUM-228	1.05	0.4	PCI/G
SC-40516-U	6/14/2000	RADIUM-228	1.19	0.32	PCI/G
SC-40517-U	6/14/2000	RADIUM-228	1.2	0.44	PCI/G
SC-40518-U	6/14/2000	RADIUM-228	1.03	0.34	PCI/G
SC-40519-U	6/14/2000	RADIUM-228	0.98	0.44	PCI/G
SC-40520-U	6/14/2000	RADIUM-228	1.12	0.35	PCI/G
SC-40521-U	6/14/2000	RADIUM-228	1.07	0.46	PCI/G
SC-40522-U	6/14/2000	RADIUM-228	1.27	0.24	PCI/G
SC-40523-U	6/14/2000	RADIUM-228	0.415	0.83	PCI/G
SC-40524-U	6/14/2000	RADIUM-228	1.35	0.29	PCI/G
SC-40525-U	6/14/2000	RADIUM-228	1.18	0.41	PCI/G
SC-40526-U	6/14/2000	RADIUM-228	1.02	0.3	PCI/G
SC-40527-U	6/14/2000	RADIUM-228	0.415	0.83	PCI/G
SC-40528-U	6/14/2000	RADIUM-228	1.04	0.35	PCI/G
SC-40529-U	6/14/2000	RADIUM-228	1.11	0.48	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40530-U	6/14/2000	RADIUM-228	1.1	0.39	PCI/G
SC-40531-U	6/14/2000	RADIUM-228	1.24	0.48	PCI/G
SC-40532-U	6/14/2000	RADIUM-228	0.84	0.34	PCI/G
SC-41001-U	7/7/2000	RADIUM-228	1.14	0.41	PCI/G
SC-41002-U	7/7/2000	RADIUM-228	1	0.34	PCI/G
SC-41003-U	7/7/2000	RADIUM-228	0.39	0.78	PCI/G
SC-41004-U	7/7/2000	RADIUM-228	1.06	0.27	PCI/G
SC-41005-U	7/7/2000	RADIUM-228	0.8	0.44	PCI/G
SC-41006-U	7/7/2000	RADIUM-228	1.2	0.38	PCI/G
SC-41007-U	7/7/2000	RADIUM-228	0.92	0.37	PCI/G
SC-41008-U	7/7/2000	RADIUM-228	1 32	0.36	PCI/G
SC-41009-U	7/7/2000	RADIUM-228	0 42	0.84	PCI/G
SC-41010-U	7/7/2000	RADIUM-228	1.15	0.31	PCI/G
SC-41011-U	7/7/2000	RADIUM-228	0.81	0.44	PCI/G
SC-41012-U	7/7/2000	RADIUM-228	1.2	0.3	PCI/G
SC-41013-U	7/7/2000	RADIUM-228	1.07	0.39	PCI/G
SC-41014-U	7/7/2000	RADIUM-228	1.33	0.34	PCI/G
SC-41015-U	7/7/2000	RADIUM-228	1.23	0.42	PCI/G
SC-41016-U	7/7/2000	RADIUM-228	1.18	0.34	PCI/G
SC-41017-U	7/7/2000	RADIUM-228	0.39	0 78	PCI/G
SC-41018-U	7/7/2000	RADIUM-228	0.42	0.84	PCI/G
SC-41019-U	7/7/2000	RADIUM-228	0 37	0.74	PCI/G
SC-41020-U	7/7/2000	RADIUM-228	1 04	0.34	PCI/G
SC-41021-U	7/7/2000	RADIUM-228	0 37	0.74	PCI/G
SC-41022-U	7/7/2000	RADIUM-228	1 1	0.36	PCI/G
SC-41023-U	7/7/2000	RADIUM-228	0 41	0.82	PCI/G
SC-41024-U	7/7/2000	RADIUM-228	1.26	0.34	PCI/G
SC-38101-C	8/25/1998	THALLIUM	1.8	0.82	UG/G
SC-38101-C	8/25/1998	THALLIUM	1 8	0.82	UG/G
SC-38102-S	8/25/1998	THALLIUM	0 5	1	UG/G
SC-38102-S	8/25/1998	THALLIUM	0 5	1	UG/G
SC-37802-C	4/3/1998	THORIUM-230	1 28	0.62	PCI/G
SC-37802-C	4/3/1998	THORIUM-230	1.28	0.62	PCI/G
SC-37804-C	4/3/1998	THORIUM-230	0.93	0.62	PCI/G
SC-37804-C	4/3/1998	THORIUM-230	0.93	0.62	PCI/G
SC-37806-C	4/3/1998	THORIUM-230	1.18	0.62	PCI/G
SC-37806-C	4/3/1998	THORIUM-230	1.18	0.62	PCI/G
SC-37810-C	4/3/1998	THORIUM-230	1 27	0.62	PCI/G
SC-37810-C	4/3/1998	THORIUM-230	1.27	0.62	PCI/G
SC-37814-C	4/3/1998	THORIUM-230	1 08	0.62	PCI/G
SC-37814-C	4/3/1998	THORIUM-230	1 08	0.62	PCI/G
SC-37818-C	4/3/1998	THORIUM-230	0.88	0.62	PCI/G
SC-37818-C	4/3/1998	THORIUM-230	0.88	0.62	PCI/G
SC-37821-S	4/3/1998	THORIUM-230	2.28	0.62	PCI/G
SC-37821-S	4/3/1998	THORIUM-230	2.28	0.62	PCI/G
SC-37901-C	4/3/1998	THORIUM-230	4.68	0.62	PCI/G
SC-37901-C	4/3/1998	THORIUM-230	4 68	0.62	PCI/G
SC-37902-S	4/3/1998	THORIUM-230	3 17	0.62	PCI/G
SC-37902-S	4/3/1998	THORIUM-230	3 17	0.62	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-37904-S	4/3/1998	THORIUM-230	4.6	0.62	PCI/G
SC-37904-S	4/3/1998	THORIUM-230	4.6	0.62	PCI/G
SC-37905-C	4/3/1998	THORIUM-230	1.12	0.62	PCI/G
SC-37905-C	4/3/1998	THORIUM-230	1.12	0.62	PCI/G
SC-37906-S	4/3/1998	THORIUM-230	0.97	0.62	PCI/G
SC-37906-S	4/3/1998	THORIUM-230	0.97	0.62	PCI/G
SC-37908-S	4/3/1998	THORIUM-230	1.52	0.62	PCI/G
SC-37908-S	4/3/1998	THORIUM-230	1.52	0.62	PCI/G
SC-37910-S	4/3/1998	THORIUM-230	1.1	0.62	PCI/G
SC-37910-S	4/3/1998	THORIUM-230	1.1	0.62	PCI/G
SC-37911-C	4/3/1998	THORIUM-230	1.27	0.62	PCI/G
SC-37911-C	4/3/1998	THORIUM-230	1.27	0.62	PCI/G
SC-37911-S	4/3/1998	THORIUM-230	1.45	0.62	PCI/G
SC-37911-S	4/3/1998	THORIUM-230	1.45	0.62	PCI/G
SC-37912-S	4/3/1998	THORIUM-230	1.37	0.62	PCI/G
SC-37912-S	4/3/1998	THORIUM-230	1.37	0.62	PCI/G
SC-37914-C	4/3/1998	THORIUM-230	1.14	0.62	PCI/G
SC-37914-C	4/3/1998	THORIUM-230	1.14	0.62	PCI/G
SC-37914-S	4/3/1998	THORIUM-230	1.83	0.62	PCI/G
SC-37914-S	4/3/1998	THORIUM-230	1.83	0.62	PCI/G
SC-37919-C	3/24/1998	THORIUM-230	1.11	0.62	PCI/G
SC-37919-C	3/24/1998	THORIUM-230	1.11	0.62	PCI/G
SC-37919-S	3/24/1998	THORIUM-230	1.2	0.62	PCI/G
SC-37919-S	3/24/1998	THORIUM-230	1.2	0.62	PCI/G
SC-38002-C	7/17/1998	THORIUM-230	0.82	0.62	PCI/G
SC-38002-C	7/17/1998	THORIUM-230	0.82	0.62	PCI/G
SC-38004-C	7/17/1998	THORIUM-230	2.34	0.62	PCI/G
SC-38004-C	7/17/1998	THORIUM-230	2.34	0.62	PCI/G
SC-38006-S	7/17/1998	THORIUM-230	1.21	0.62	PCI/G
SC-38006-S	7/17/1998	THORIUM-230	1.21	0.62	PCI/G
SC-38007-S	7/17/1998	THORIUM-230	1.06	0.62	PCI/G
SC-38007-S	7/17/1998	THORIUM-230	1.06	0.62	PCI/G
SC-38008-S	7/17/1998	THORIUM-230	3	0.62	PCI/G
SC-38008-S	7/17/1998	THORIUM-230	3	0.62	PCI/G
SC-38010-C	7/17/1998	THORIUM-230	0.91	0.62	PCI/G
SC-38010-C	7/17/1998	THORIUM-230	0.91	0.62	PCI/G
SC-38103-S	8/25/1998	THORIUM-230	1.04	0.62	PCI/G
SC-38103-S	8/25/1998	THORIUM-230	1.04	0.62	PCI/G
SC-38107-S	8/25/1998	THORIUM-230	1.13	0.62	PCI/G
SC-38107-S	8/25/1998	THORIUM-230	1.13	0.62	PCI/G
SC-38108-S	8/25/1998	THORIUM-230	1.27	0.62	PCI/G
SC-38108-S	8/25/1998	THORIUM-230	1.27	0.62	PCI/G
SC-38113-C	8/25/1998	THORIUM-230	1.12	0.62	PCI/G
SC-38113-C	8/25/1998	THORIUM-230	1.12	0.62	PCI/G
SC-40001-U	6/9/2000	THORIUM-230	1	0.64	PCI/G
SC-40002-U	6/9/2000	THORIUM-230	5.06	0.62	PCI/G
SC-40003-U	6/9/2000	THORIUM-230	1.05	0.64	PCI/G
SC-40004-U	6/9/2000	THORIUM-230	1	0.64	PCI/G
SC-40005-U	6/9/2000	THORIUM-230	0.81	0.64	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40006-U	6/9/2000	THORIUM-230	1.1	0.62	PCI/G
SC-40007-U	6/9/2000	THORIUM-230	1.29	0.64	PCI/G
SC-40008-U	6/9/2000	THORIUM-230	1.14	0.64	PCI/G
SC-40009-U	6/9/2000	THORIUM-230	1.04	0.64	PCI/G
SC-40010-U	6/9/2000	THORIUM-230	1.18	0.62	PCI/G
SC-40011-U	6/9/2000	THORIUM-230	1.25	0.64	PCI/G
SC-40012-U	6/9/2000	THORIUM-230	1.61	0.62	PCI/G
SC-40013-U	6/9/2000	THORIUM-230	1.41	0.64	PCI/G
SC-40014-U	6/9/2000	THORIUM-230	2 13	0.64	PCI/G
SC-40015-U	6/9/2000	THORIUM-230	0.91	0.64	PCI/G
SC-40016-U	6/9/2000	THORIUM-230	0 87	0.62	PCI/G
SC-40017-U	6/9/2000	THORIUM-230	1 36	0.64	PCI/G
SC-40018-U	6/9/2000	THORIUM-230	1.03	0.64	PCI/G
SC-40019-U	6/9/2000	THORIUM-230	1.05	0.64	PCI/G
SC-40020-U	6/9/2000	THORIUM-230	0.93	0.62	PCI/G
SC-40021-U	6/9/2000	THORIUM-230	1.2	0.64	PCI/G
SC-40022-U	6/9/2000	THORIUM-230	1.08	0.64	PCI/G
SC-40023-U	6/9/2000	THORIUM-230	1 02	0.64	PCI/G
SC-40024-U	6/9/2000	THORIUM-230	1.1	0.62	PCI/G
SC-40025-U	6/9/2000	THORIUM-230	1 21	0.64	PCI/G
SC-40026-U	6/9/2000	THORIUM-230	1.13	0.64	PCI/G
SC-40027-U	6/9/2000	THORIUM-230	0.79	0.64	PCI/G
SC-40028-U	6/9/2000	THORIUM-230	1.2	0.62	PCI/G
SC-40029-U	6/9/2000	THORIUM-230	1 05	0.64	PCI/G
SC-40030-U	6/9/2000	THORIUM-230	1.11	0.64	PCI/G
SC-40031-U	6/9/2000	THORIUM-230	0.98	0.64	PCI/G
SC-40032-U	6/9/2000	THORIUM-230	1.04	0.64	PCI/G
SC-40033-U	6/9/2000	THORIUM-230	0.9	0.64	PCI/G
SC-40034-U	6/9/2000	THORIUM-230	0.88	0 64	PCI/G
SC-40035-U	6/9/2000	THORIUM-230	1.58	0.64	PCI/G
SC-40101-U	6/9/2000	THORIUM-230	0.98	0 64	PCI/G
SC-40102-U	6/9/2000	THORIUM-230	0.98	0.64	PCI/G
SC-40103-U	6/9/2000	THORIUM-230	1.77	0.64	PCI/G
SC-40104-U	6/9/2000	THORIUM-230	1.03	0.64	PCI/G
SC-40105-U	6/9/2000	THORIUM-230	0.95	0.64	PCI/G
SC-40106-U	6/9/2000	THORIUM-230	0 95	0.64	PCI/G
SC-40107-U	6/9/2000	THORIUM-230	1.54	0.64	PCI/G
SC-40108-U	6/9/2000	THORIUM-230	0.95	0.64	PCI/G
SC-40109-U	6/9/2000	THORIUM-230	0.9	0.62	PCI/G
SC-40110-U	6/9/2000	THORIUM-230	1.03	0.64	PCI/G
SC-40111-U	6/10/2000	THORIUM-230	0.84	0.64	PCI/G
SC-40112-U	6/10/2000	THORIUM-230	1.19	0.64	PCI/G
SC-40113-U	6/10/2000	THORIUM-230	0.91	0.62	PCI/G
SC-40114-U	6/10/2000	THORIUM-230	0.86	0.64	PCI/G
SC-40115-U	6/10/2000	THORIUM-230	0.98	0.62	PCI/G
SC-40116-U	6/10/2000	THORIUM-230	0.77	0.64	PCI/G
SC-40117-U	6/10/2000	THORIUM-230	1.14	0 64	PCI/G
SC-40118-U	6/10/2000	THORIUM-230	1	0.62	PCI/G
SC-40119-U	6/10/2000	THORIUM-230	0.96	0 64	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40120-U	6/10/2000	THORIUM-230	1.15	0.64	PCI/G
SC-40121-U	6/10/2000	THORIUM-230	0.95	0.64	PCI/G
SC-40122-U	6/10/2000	THORIUM-230	12	0.62	PCI/G
SC-40122-U-RS	6/22/2000	THORIUM-230	1.03	0.64	PCI/G
SC-40123-U	6/10/2000	THORIUM-230	1.23	0.64	PCI/G
SC-40124-U	6/10/2000	THORIUM-230	0.74	0.64	PCI/G
SC-40125-U	6/10/2000	THORIUM-230	2.05	0.64	PCI/G
SC-40126-U	6/10/2000	THORIUM-230	1.04	0.62	PCI/G
SC-40127-U	6/10/2000	THORIUM-230	0.82	0.64	PCI/G
SC-40128-U	6/10/2000	THORIUM-230	0.91	0.64	PCI/G
SC-40129-U	6/10/2000	THORIUM-230	0.86	0.64	PCI/G
SC-40130-U	6/10/2000	THORIUM-230	1.59	0.62	PCI/G
SC-40131-U	6/10/2000	THORIUM-230	1.05	0.64	PCI/G
SC-40201-U	6/10/2000	THORIUM-230	0.97	0.64	PCI/G
SC-40202-U	6/10/2000	THORIUM-230	1.16	0.64	PCI/G
SC-40203-U	6/10/2000	THORIUM-230	0.93	0.62	PCI/G
SC-40204-U	6/10/2000	THORIUM-230	0.97	0.64	PCI/G
SC-40205-U	6/10/2000	THORIUM-230	0.79	0.64	PCI/G
SC-40206-U	6/10/2000	THORIUM-230	1.03	0.64	PCI/G
SC-40207-U	6/10/2000	THORIUM-230	0.86	0.62	PCI/G
SC-40208-U	6/10/2000	THORIUM-230	0.7	0.64	PCI/G
SC-40209-U	6/10/2000	THORIUM-230	0.83	0.64	PCI/G
SC-40210-U	6/10/2000	THORIUM-230	1	0.64	PCI/G
SC-40211-U	6/10/2000	THORIUM-230	1.01	0.62	PCI/G
SC-40212-U	6/10/2000	THORIUM-230	0.99	0.64	PCI/G
SC-40213-U	6/10/2000	THORIUM-230	0.91	0.62	PCI/G
SC-40214-U	6/10/2000	THORIUM-230	0.69	0.64	PCI/G
SC-40215-U	6/10/2000	THORIUM-230	0.85	0.64	PCI/G
SC-40216-U	6/10/2000	THORIUM-230	0.76	0.64	PCI/G
SC-40217-U	6/10/2000	THORIUM-230	0.77	0.62	PCI/G
SC-40218-U	6/10/2000	THORIUM-230	0.95	0.64	PCI/G
SC-40219-U	6/10/2000	THORIUM-230	0.96	0.64	PCI/G
SC-40220-U	6/12/2000	THORIUM-230	0.98	0.64	PCI/G
SC-40221-U	6/12/2000	THORIUM-230	0.95	0.62	PCI/G
SC-40222-U	6/12/2000	THORIUM-230	0.77	0.64	PCI/G
SC-40223-U	6/12/2000	THORIUM-230	1.45	0.64	PCI/G
SC-40224-U	6/12/2000	THORIUM-230	0.69	0.64	PCI/G
SC-40225-U	6/12/2000	THORIUM-230	0.78	0.62	PCI/G
SC-40226-U	6/12/2000	THORIUM-230	0.89	0.64	PCI/G
SC-40227-U	6/12/2000	THORIUM-230	0.84	0.64	PCI/G
SC-40228-U	6/12/2000	THORIUM-230	1	0.64	PCI/G
SC-40229-U	6/12/2000	THORIUM-230	1.02	0.62	PCI/G
SC-40230-U	6/12/2000	THORIUM-230	0.92	0.64	PCI/G
SC-40231-U	6/12/2000	THORIUM-230	1.42	0.64	PCI/G
SC-40301-U	6/12/2000	THORIUM-230	1.06	0.64	PCI/G
SC-40302-U	6/12/2000	THORIUM-230	4.34	0.62	PCI/G
SC-40303-U	6/12/2000	THORIUM-230	0.98	0.64	PCI/G
SC-40304-U	6/12/2000	THORIUM-230	5.15	0.64	PCI/G
SC-40305-U	6/12/2000	THORIUM-230	0.8	0.64	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40306-U	6/12/2000	THORIUM-230	1.18	0.62	PCI/G
SC-40307-U	6/12/2000	THORIUM-230	1.06	0.64	PCI/G
SC-40308-U	6/12/2000	THORIUM-230	1.6	0.64	PCI/G
SC-40309-U	6/12/2000	THORIUM-230	0.82	0.64	PCI/G
SC-40310-U	6/12/2000	THORIUM-230	1 1	0.64	PCI/G
SC-40311-U	6/12/2000	THORIUM-230	0.81	0.64	PCI/G
SC-40312-U	6/12/2000	THORIUM-230	0.89	0.62	PCI/G
SC-40313-U	6/12/2000	THORIUM-230	1.08	0.64	PCI/G
SC-40314-U	6/12/2000	THORIUM-230	0.88	0.64	PCI/G
SC-40315-U	6/12/2000	THORIUM-230	1.49	0.64	PCI/G
SC-40316-U	6/14/2000	THORIUM-230	1.92	0.64	PCI/G
SC-40317-U	6/14/2000	THORIUM-230	1.21	0.62	PCI/G
SC-40318-U	6/12/2000	THORIUM-230	1.24	0.62	PCI/G
SC-40319-U	6/14/2000	THORIUM-230	1.02	0.64	PCI/G
SC-40320-U	6/14/2000	THORIUM-230	0.97	0.64	PCI/G
SC-40321-U	6/14/2000	THORIUM-230	0.99	0.64	PCI/G
SC-40322-U	6/14/2000	THORIUM-230	1.11	0.64	PCI/G
SC-40323-U	6/14/2000	THORIUM-230	0.87	0.64	PCI/G
SC-40324-U	6/14/2000	THORIUM-230	0 82	0.62	PCI/G
SC-40325-U	6/14/2000	THORIUM-230	1.03	0.64	PCI/G
SC-40326-U	6/14/2000	THORIUM-230	1.15	0.64	PCI/G
SC-40401-U	6/14/2000	THORIUM-230	1 72	0.64	PCI/G
SC-40402-U	6/14/2000	THORIUM-230	0.74	0.62	PCI/G
SC-40403-U	6/14/2000	THORIUM-230	0 93	0.64	PCI/G
SC-40404-U	6/14/2000	THORIUM-230	1 79	0.64	PCI/G
SC-40405-U	6/14/2000	THORIUM-230	3.11	0.64	PCI/G
SC-40406-U	6/14/2000	THORIUM-230	1.08	0.62	PCI/G
SC-40407-U	6/14/2000	THORIUM-230	0 8	0 64	PCI/G
SC-40408-U	6/14/2000	THORIUM-230	0.95	0.64	PCI/G
SC-40409-U	6/14/2000	THORIUM-230	0.89	0.64	PCI/G
SC-40410-U	6/14/2000	THORIUM-230	1.19	0.62	PCI/G
SC-40411-U	6/14/2000	THORIUM-230	0.85	0.64	PCI/G
SC-40412-U	6/14/2000	THORIUM-230	1.46	0.64	PCI/G
SC-40413-U	6/14/2000	THORIUM-230	1.5	0.64	PCI/G
SC-40414-U	6/14/2000	THORIUM-230	1.18	0.62	PCI/G
SC-40415-U	6/14/2000	THORIUM-230	0.92	0.64	PCI/G
SC-40416-U	6/14/2000	THORIUM-230	1.12	0.64	PCI/G
SC-40417-U	6/14/2000	THORIUM-230	0.83	0 64	PCI/G
SC-40418-U	6/14/2000	THORIUM-230	0.94	0.62	PCI/G
SC-40419-U	6/14/2000	THORIUM-230	0.8	0.64	PCI/G
SC-40420-U	6/14/2000	THORIUM-230	1.04	0.64	PCI/G
SC-40421-U	6/14/2000	THORIUM-230	0.64	0.64	PCI/G
SC-40422-U	6/14/2000	THORIUM-230	0.89	0.62	PCI/G
SC-40423-U	6/14/2000	THORIUM-230	0.82	0.64	PCI/G
SC-40424-U	6/14/2000	THORIUM-230	0.72	0.64	PCI/G
SC-40425-U	6/14/2000	THORIUM-230	0.86	0.64	PCI/G
SC-40426-U	6/14/2000	THORIUM-230	0.97	0.62	PCI/G
SC-40427-U	6/14/2000	THORIUM-230	0.75	0.64	PCI/G
SC-40428-U	6/14/2000	THORIUM-230	0 78	0.64	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40429-U	6/14/2000	THORIUM-230	1.08	0.64	PCI/G
SC-40430-U	6/14/2000	THORIUM-230	1.13	0.62	PCI/G
SC-40431-U	6/14/2000	THORIUM-230	0.91	0.64	PCI/G
SC-40501-U	6/14/2000	THORIUM-230	0.89	0.64	PCI/G
SC-40502-U	6/14/2000	THORIUM-230	1.2	0.64	PCI/G
SC-40503-U	6/14/2000	THORIUM-230	0.94	0.64	PCI/G
SC-40504-U	6/14/2000	THORIUM-230	0.83	0.62	PCI/G
SC-40505-U	6/14/2000	THORIUM-230	0.64	0.64	PCI/G
SC-40506-U	6/14/2000	THORIUM-230	1.18	0.64	PCI/G
SC-40507-U	6/14/2000	THORIUM-230	1.24	0.64	PCI/G
SC-40508-U	6/14/2000	THORIUM-230	0.78	0.62	PCI/G
SC-40509-U	6/14/2000	THORIUM-230	1.15	0.64	PCI/G
SC-40510-U	6/14/2000	THORIUM-230	0.78	0.64	PCI/G
SC-40511-U	6/14/2000	THORIUM-230	1.02	0.64	PCI/G
SC-40512-U	6/14/2000	THORIUM-230	0.89	0.62	PCI/G
SC-40513-U	6/14/2000	THORIUM-230	0.92	0.64	PCI/G
SC-40514-U	6/14/2000	THORIUM-230	1.08	0.64	PCI/G
SC-40515-U	6/14/2000	THORIUM-230	0.68	0.64	PCI/G
SC-40516-U	6/14/2000	THORIUM-230	1.34	0.62	PCI/G
SC-40517-U	6/14/2000	THORIUM-230	1.11	0.64	PCI/G
SC-40518-U	6/14/2000	THORIUM-230	1.13	0.64	PCI/G
SC-40519-U	6/14/2000	THORIUM-230	0.94	0.64	PCI/G
SC-40520-U	6/14/2000	THORIUM-230	1.06	0.64	PCI/G
SC-40521-U	6/14/2000	THORIUM-230	0.69	0.64	PCI/G
SC-40522-U	6/14/2000	THORIUM-230	0.96	0.64	PCI/G
SC-40523-U	6/14/2000	THORIUM-230	1.04	0.64	PCI/G
SC-40524-U	6/14/2000	THORIUM-230	0.71	0.62	PCI/G
SC-40525-U	6/14/2000	THORIUM-230	1.14	0.64	PCI/G
SC-40526-U	6/14/2000	THORIUM-230	0.92	0.64	PCI/G
SC-40527-U	6/14/2000	THORIUM-230	0.87	0.64	PCI/G
SC-40528-U	6/14/2000	THORIUM-230	0.94	0.62	PCI/G
SC-40529-U	6/14/2000	THORIUM-230	1.01	0.64	PCI/G
SC-40530-U	6/14/2000	THORIUM-230	1.12	0.62	PCI/G
SC-40531-U	6/14/2000	THORIUM-230	0.7	0.64	PCI/G
SC-40532-U	6/14/2000	THORIUM-230	1.35	0.64	PCI/G
SC-41001-U	7/7/2000	THORIUM-230	0.87	0.64	
SC-41002-U	7/7/2000	THORIUM-230	1.93	0.64	PCI/G
SC-41003-U	7/7/2000	THORIUM-230	1.32	0.64	PCI/G
SC-41004-U	7/7/2000	THORIUM-230	0.94	0.62	PCI/G
SC-41005-U	7/7/2000	THORIUM-230	0.99	0.64	PCI/G
SC-41006-U	7/7/2000	THORIUM-230	1.46	0.62	PCI/G
SC-41007-U	7/7/2000	THORIUM-230	2.3	0.64	PCI/G
SC-41008-U	7/7/2000	THORIUM-230	1.55	0.64	PCI/G
SC-41009-U	7/7/2000	THORIUM-230	1.38	0.64	PCI/G
SC-41010-U	7/7/2000	THORIUM-230	0.76	0.62	PCI/G
SC-41011-U	7/7/2000	THORIUM-230	0.78	0.64	PCI/G
SC-41012-U	7/7/2000	THORIUM-230	1.06	0.64	PCI/G
SC-41013-U	7/7/2000	THORIUM-230	0.91	0.64	PCI/G
SC-41014-U	7/7/2000	THORIUM-230	3.26	0.62	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-41015-U	7/7/2000	THORIUM-230	1.35	0 64	PCI/G
SC-41016-U	7/7/2000	THORIUM-230	0.96	0.64	PCI/G
SC-41017-U	7/7/2000	THORIUM-230	0 72	0.64	PCI/G
SC-41018-U	7/7/2000	THORIUM-230	0.88	0.64	PCI/G
SC-41019-U	7/7/2000	THORIUM-230	1.17	0.64	PCI/G
SC-41020-U	7/7/2000	THORIUM-230	1.03	0.62	PCI/G
SC-41021-U	7/7/2000	THORIUM-230	0.85	0.64	PCI/G
SC-41022-U	7/7/2000	THORIUM-230	8.93	0.64	PCI/G
SC-41022-U-RS	7/10/2000	THORIUM-230	0.99	0.64	PCI/G
SC-41023-U	7/7/2000	THORIUM-230	0.92	0.64	PCI/G
SC-41024-U	7/7/2000	THORIUM-230	2.17	0.62	PCI/G
SC-37802-C	4/3/1998	URANIUM-238	2.27	2.43	PCI/G
SC-37804-C	4/3/1998	URANIUM-238	0.99	1.98	PCI/G
SC-37806-C	4/3/1998	URANIUM-238	2.075	4 15	PCI/G
SC-37810-C	4/3/1998	URANIUM-238	1.525	3 05	PCI/G
SC-37814-C	4/3/1998	URANIUM-238	2.02	1.84	PCI/G
SC-37818-C	4/3/1998	URANIUM-238	1.35	2 7	PCI/G
SC-37821-S	4/3/1998	URANIUM-238	2.08	4.16	PCI/G
SC-37901-C	4/3/1998	URANIUM-238	2.275	4.55	PCI/G
SC-37902-S	4/3/1998	URANIUM-238	1.44	2.88	PCI/G
SC-37904-S	4/3/1998	URANIUM-238	4.07	3.28	PCI/G
SC-37905-C	4/3/1998	URANIUM-238	3.22	1.84	PCI/G
SC-37906-S	4/3/1998	URANIUM-238	2.1	4.2	PCI/G
SC-37908-S	4/3/1998	URANIUM-238	1.44	2.88	PCI/G
SC-37910-S	4/3/1998	URANIUM-238	1.87	3.74	PCI/G
SC-37911-C	4/3/1998	URANIUM-238	2.99	2.48	PCI/G
SC-37911-S	4/3/1998	URANIUM-238	2.31	4.62	PCI/G
SC-37912-S	4/3/1998	URANIUM-238	1.26	2.52	PCI/G
SC-37914-C	4/3/1998	URANIUM-238	2 035	4.07	PCI/G
SC-37914-S	4/3/1998	URANIUM-238	1.475	2.95	PCI/G
SC-37919-C	3/24/1998	URANIUM-238	2.7	2.5	PCI/G
SC-37919-S	3/24/1998	URANIUM-238	1 505	3.01	PCI/G
SC-38002-C	7/17/1998	URANIUM-238	1.305	2.61	PCI/G
SC-38004-C	7/17/1998	URANIUM-238	5.11	3.12	PCI/G
SC-38006-S	7/17/1998	URANIUM-238	5.75	2.57	PCI/G
SC-38007-S	7/17/1998	URANIUM-238	2.115	4 23	PCI/G
SC-38008-S	7/17/1998	URANIUM-238	8.57	2 31	PCI/G
SC-38010-C	7/17/1998	URANIUM-238	2.055	4 11	PCI/G
SC-38014-C	7/25/1998	URANIUM-238	3.25	2 03	PCI/G
SC-38015-S	7/25/1998	URANIUM-238	1.99	3 98	PCI/G
SC-38016-C	7/25/1998	URANIUM-238	11.1	3.44	PCI/G
SC-38016-S	7/25/1998	URANIUM-238	11.7	4.81	PCI/G
SC-38017-S	7/25/1998	URANIUM-238	1 465	2.93	PCI/G
SC-38018-S	7/25/1998	URANIUM-238	6.53	4.11	PCI/G
SC-38019-S	7/25/1998	URANIUM-238	1.81	1 95	PCI/G
SC-38023-C	7/25/1998	URANIUM-238	11.5	4 61	PCI/G
SC-38024-S	7/25/1998	URANIUM-238	16 4	3.53	PCI/G
SC-38025-S	7/25/1998	URANIUM-238	2.14	4.28	PCI/G
SC-38027-S	7/25/1998	URANIUM-238	2.79	2.51	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-38028-S	7/25/1998	URANIUM-238	4.87	2.46	PCI/G
SC-38029-C	7/25/1998	URANIUM-238	13.3	4.42	PCI/G
SC-38031-C	7/25/1998	URANIUM-238	1.44	2.88	PCI/G
SC-38101-C	8/25/1998	URANIUM-238	1.815	3.63	PCI/G
SC-38101-S	7/25/1998	URANIUM-238	14	3.45	PCI/G
SC-38102-S	8/25/1998	URANIUM-238	1.31	2.62	PCI/G
SC-38103-C	8/25/1998	URANIUM-238	2.105	4.21	PCI/G
SC-38103-S	8/25/1998	URANIUM-238	1.91	3.82	PCI/G
SC-38104-S	8/25/1998	URANIUM-238	2.145	4.29	PCI/G
SC-38105-C	8/25/1998	URANIUM-238	1.435	2.87	PCI/G
SC-38105-S	8/25/1998	URANIUM-238	4.42	3.82	PCI/G
SC-38106-S	7/25/1998	URANIUM-238	5.42	2.76	PCI/G
SC-38107-S	8/25/1998	URANIUM-238	1.45	1.88	PCI/G
SC-38108-S	8/25/1998	URANIUM-238	1.11	1.61	PCI/G
SC-38109-S	8/25/1998	URANIUM-238	4.26	2.78	PCI/G
SC-38110-S	8/25/1998	URANIUM-238	5.89	3.25	PCI/G
SC-38111-S	8/25/1998	URANIUM-238	1.375	2.75	PCI/G
SC-38113-C	8/25/1998	URANIUM-238	1.35	2.7	PCI/G
SC-38115-C	8/25/1998	URANIUM-238	6	3.19	PCI/G
SC-38116-C	8/25/1998	URANIUM-238	4.86	3.68	PCI/G
SC-38117-C	8/25/1998	URANIUM-238	1.375	2.75	PCI/G
SC-38118-C	8/25/1998	URANIUM-238	1.36	2.72	PCI/G
SC-40001-U	6/9/2000	URANIUM-238	1.145	2.29	PCI/G
SC-40002-U	6/9/2000	URANIUM-238	1.155	2.31	PCI/G
SC-40003-U	6/9/2000	URANIUM-238	1.05	2.1	PCI/G
SC-40004-U	6/9/2000	URANIUM-238	1.155	2.31	PCI/G
SC-40005-U	6/9/2000	URANIUM-238	1.08	2.16	PCI/G
SC-40006-U	6/9/2000	URANIUM-238	1.2	2.4	PCI/G
SC-40007-U	6/9/2000	URANIUM-238	1.7	2.62	PCI/G
SC-40008-U	6/9/2000	URANIUM-238	1.195	2.39	PCI/G
SC-40009-U	6/9/2000	URANIUM-238	1.21	2.42	PCI/G
SC-40010-U	6/9/2000	URANIUM-238	1.53	2.07	PCI/G
SC-40011-U	6/9/2000	URANIUM-238	1.22	2.44	PCI/G
SC-40012-U	6/9/2000	URANIUM-238	1.215	2.43	PCI/G
SC-40013-U	6/9/2000	URANIUM-238	1.165	2.33	PCI/G
SC-40014-U	6/9/2000	URANIUM-238	1.17	2.34	PCI/G
SC-40015-U	6/9/2000	URANIUM-238	1.09	2.18	PCI/G
SC-40016-U	6/9/2000	URANIUM-238	1.17	2.34	PCI/G
SC-40017-U	6/9/2000	URANIUM-238	1.1	2.2	PCI/G
SC-40018-U	6/9/2000	URANIUM-238	1.08	2.16	PCI/G
SC-40019-U	6/9/2000	URANIUM-238	1.21	2.42	PCI/G
SC-40020-U	6/9/2000	URANIUM-238	1.19	2.38	PCI/G
SC-40021-U	6/9/2000	URANIUM-238	1.1	2.2	PCI/G
SC-40022-U	6/9/2000	URANIUM-238	1.21	2.42	PCI/G
SC-40023-U	6/9/2000	URANIUM-238	1.1	2.2	PCI/G
SC-40024-U	6/9/2000	URANIUM-238	1.165	2.33	PCI/G
SC-40025-U	6/9/2000	URANIUM-238	1.09	2.18	PCI/G
SC-40026-U	6/9/2000	URANIUM-238	1.17	2.34	PCI/G
SC-40027-U	6/9/2000	URANIUM-238	1.16	2.32	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40028-U	6/9/2000	URANIUM-238	1.14	2.28	PCI/G
SC-40029-U	6/9/2000	URANIUM-238	1.03	2.06	PCI/G
SC-40030-U	6/9/2000	URANIUM-238	1.105	2.21	PCI/G
SC-40031-U	6/9/2000	URANIUM-238	1.075	2.15	PCI/G
SC-40032-U	6/9/2000	URANIUM-238	2.515	5.03	PCI/G
SC-40033-U	6/9/2000	URANIUM-238	0.975	1.95	PCI/G
SC-40034-U	6/9/2000	URANIUM-238	1.065	2.13	PCI/G
SC-40035-U	6/9/2000	URANIUM-238	1.09	2.18	PCI/G
SC-40101-U	6/9/2000	URANIUM-238	1.06	2.12	PCI/G
SC-40102-U	6/9/2000	URANIUM-238	0.935	1.87	PCI/G
SC-40103-U	6/9/2000	URANIUM-238	1.09	2.18	PCI/G
SC-40104-U	6/9/2000	URANIUM-238	1.085	2.17	PCI/G
SC-40105-U	6/9/2000	URANIUM-238	1.115	2.23	PCI/G
SC-40106-U	6/9/2000	URANIUM-238	1.035	2.07	PCI/G
SC-40107-U	6/9/2000	URANIUM-238	1.11	2.22	PCI/G
SC-40108-U	6/9/2000	URANIUM-238	1.075	2.15	PCI/G
SC-40109-U	6/9/2000	URANIUM-238	1.455	2.91	PCI/G
SC-40110-U	6/9/2000	URANIUM-238	1.05	2.1	PCI/G
SC-40111-U	6/10/2000	URANIUM-238	1.105	2.21	PCI/G
SC-40112-U	6/10/2000	URANIUM-238	1 17	2.34	PCI/G
SC-40113-U	6/10/2000	URANIUM-238	1.075	2.15	PCI/G
SC-40114-U	6/10/2000	URANIUM-238	0.98	1.96	PCI/G
SC-40115-U	6/10/2000	URANIUM-238	1.11	2.22	PCI/G
SC-40116-U	6/10/2000	URANIUM-238	1.03	2.06	PCI/G
SC-40117-U	6/10/2000	URANIUM-238	1 105	2.21	PCI/G
SC-40118-U	6/10/2000	URANIUM-238	1.035	2.07	PCI/G
SC-40119-U	6/10/2000	URANIUM-238	1.105	2.21	PCI/G
SC-40120-U	6/10/2000	URANIUM-238	1 08	2.16	PCI/G
SC-40121-U	6/10/2000	URANIUM-238	1	2	PCI/G
SC-40122-U	6/10/2000	URANIUM-238	1.245	2.49	PCI/G
SC-40123-U	6/10/2000	URANIUM-238	1.03	2.06	PCI/G
SC-40124-U	6/10/2000	URANIUM-238	1.105	2.21	PCI/G
SC-40125-U	6/10/2000	URANIUM-238	1.005	2.01	PCI/G
SC-40126-U	6/10/2000	URANIUM-238	1.1	2.2	PCI/G
SC-40127-U	6/10/2000	URANIUM-238	0.975	1.95	PCI/G
SC-40128-U	6/10/2000	URANIUM-238	1 09	2.18	PCI/G
SC-40129-U	6/10/2000	URANIUM-238	1 05	2.1	PCI/G
SC-40130-U	6/10/2000	URANIUM-238	1 11	2.22	PCI/G
SC-40131-U	6/10/2000	URANIUM-238	1.14	2.28	PCI/G
SC-40201-U	6/10/2000	URANIUM-238	1.125	2.25	PCI/G
SC-40202-U	6/10/2000	URANIUM-238	1.07	2.14	PCI/G
SC-40203-U	6/10/2000	URANIUM-238	1.13	2.26	PCI/G
SC-40204-U	6/10/2000	URANIUM-238	1 07	2.14	PCI/G
SC-40205-U	6/10/2000	URANIUM-238	1.08	2.16	PCI/G
SC-40206-U	6/10/2000	URANIUM-238	1 01	2.02	PCI/G
SC-40207-U	6/10/2000	URANIUM-238	1.205	2.41	PCI/G
SC-40208-U	6/10/2000	URANIUM-238	1 07	2.14	PCI/G
SC-40209-U	6/10/2000	URANIUM-238	1 08	2.16	PCI/G
SC-40210-U	6/10/2000	URANIUM-238	1 075	2 15	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40211-U	6/10/2000	URANIUM-238	1.13	2.26	PCI/G
SC-40212-U	6/10/2000	URANIUM-238	1.07	2.14	PCI/G
SC-40213-U	6/10/2000	URANIUM-238	1.06	2.12	PCI/G
SC-40214-U	6/10/2000	URANIUM-238	0.945	1.89	PCI/G
SC-40215-U	6/10/2000	URANIUM-238	1.24	2.48	PCI/G
SC-40216-U	6/10/2000	URANIUM-238	1.205	2.41	PCI/G
SC-40217-U	6/10/2000	URANIUM-238	1.075	2.15	PCI/G
SC-40218-U	6/10/2000	URANIUM-238	1.06	2.12	PCI/G
SC-40219-U	6/10/2000	URANIUM-238	1.095	2.19	PCI/G
SC-40220-U	6/12/2000	URANIUM-238	1.035	2.07	PCI/G
SC-40221-U	6/12/2000	URANIUM-238	1.13	2.26	PCI/G
SC-40222-U	6/12/2000	URANIUM-238	1.07	2.14	PCI/G
SC-40223-U	6/12/2000	URANIUM-238	1.21	2.42	PCI/G
SC-40224-U	6/12/2000	URANIUM-238	1.05	2.1	PCI/G
SC-40225-U	6/12/2000	URANIUM-238	1.175	2.35	PCI/G
SC-40226-U	6/12/2000	URANIUM-238	1.085	2.17	PCI/G
SC-40227-U	6/12/2000	URANIUM-238	1.16	2.32	PCI/G
SC-40228-U	6/12/2000	URANIUM-238	1.17	2.34	PCI/G
SC-40229-U	6/12/2000	URANIUM-238	1.14	2.28	PCI/G
SC-40230-U	6/12/2000	URANIUM-238	1.07	2.14	PCI/G
SC-40231-U	6/12/2000	URANIUM-238	1.045	2.09	PCI/G
SC-40301-U	6/12/2000	URANIUM-238	1	2	PCI/G
SC-40302-U	6/12/2000	URANIUM-238	1.115	2.23	PCI/G
SC-40303-U	6/12/2000	URANIUM-238	1.13	2.26	PCI/G
SC-40304-U	6/12/2000	URANIUM-238	1.03	2.06	PCI/G
SC-40305-U	6/12/2000	URANIUM-238	2.47	2.21	PCI/G
SC-40306-U	6/12/2000	URANIUM-238	1.24	2.48	PCI/G
SC-40307-U	6/12/2000	URANIUM-238	1.07	2.14	PCI/G
SC-40308-U	6/12/2000	URANIUM-238	1.095	2.19	PCI/G
SC-40309-U	6/12/2000	URANIUM-238	1.08	2.16	PCI/G
SC-40310-U	6/12/2000	URANIUM-238	1.105	2.21	PCI/G
SC-40311-U	6/12/2000	URANIUM-238	1.115	2.23	PCI/G
SC-40312-U	6/12/2000	URANIUM-238	1.145	2.29	PCI/G
SC-40313-U	6/12/2000	URANIUM-238	1.095	2.19	PCI/G
SC-40314-U	6/12/2000	URANIUM-238	1.04	2.08	PCI/G
SC-40315-U	6/12/2000	URANIUM-238	1.08	2.16	PCI/G
SC-40316-U	6/14/2000	URANIUM-238	1.14	2.28	PCI/G
SC-40317-U	6/14/2000	URANIUM-238	1.2	1.65	PCI/G
SC-40318-U	6/12/2000	URANIUM-238	1.035	2.07	PCI/G
SC-40319-U	6/14/2000	URANIUM-238	1.085	2.17	PCI/G
SC-40320-U	6/14/2000	URANIUM-238	1.175	2.35	PCI/G
SC-40321-U	6/14/2000	URANIUM-238	1.05	2.1	PCI/G
SC-40322-U	6/14/2000	URANIUM-238	1.14	2.28	PCI/G
SC-40323-U	6/14/2000	URANIUM-238	1.165	2.33	PCI/G
SC-40324-U	6/14/2000	URANIUM-238	1.75	3.5	PCI/G
SC-40325-U	6/14/2000	URANIUM-238	3.19	2.86	PCI/G
SC-40326-U	6/14/2000	URANIUM-238	1.155	2.31	PCI/G
SC-40401-U	6/14/2000	URANIUM-238	1.05	2.1	PCI/G
SC-40402-U	6/14/2000	URANIUM-238	1.095	2.19	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40403-U	6/14/2000	URANIUM-238	1.19	2.38	PCI/G
SC-40404-U	6/14/2000	URANIUM-238	1.185	2.37	PCI/G
SC-40405-U	6/14/2000	URANIUM-238	1.08	2.16	PCI/G
SC-40406-U	6/14/2000	URANIUM-238	1.15	2.3	PCI/G
SC-40407-U	6/14/2000	URANIUM-238	1.1	2.2	PCI/G
SC-40408-U	6/14/2000	URANIUM-238	1.145	2.29	PCI/G
SC-40409-U	6/14/2000	URANIUM-238	1.015	2.03	PCI/G
SC-40410-U	6/14/2000	URANIUM-238	1.11	2.22	PCI/G
SC-40411-U	6/14/2000	URANIUM-238	1.145	2.29	PCI/G
SC-40412-U	6/14/2000	URANIUM-238	1.17	2.34	PCI/G
SC-40413-U	6/14/2000	URANIUM-238	1.135	2.27	PCI/G
SC-40414-U	6/14/2000	URANIUM-238	1 165	2.33	PCI/G
SC-40415-U	6/14/2000	URANIUM-238	1.18	2.36	PCI/G
SC-40416-U	6/14/2000	URANIUM-238	1.075	2.15	PCI/G
SC-40417-U	6/14/2000	URANIUM-238	1.115	2.23	PCI/G
SC-40418-U	6/14/2000	URANIUM-238	1.165	2.33	PCI/G
SC-40419-U	6/14/2000	URANIUM-238	1 1	2.2	PCI/G
SC-40420-U	6/14/2000	URANIUM-238	1 115	2.23	PCI/G
SC-40421-U	6/14/2000	URANIUM-238	1.135	2.27	PCI/G
SC-40422-U	6/14/2000	URANIUM-238	1 135	2.27	PCI/G
SC-40423-U	6/14/2000	URANIUM-238	1.13	2.26	PCI/G
SC-40424-U	6/14/2000	URANIUM-238	1.185	2.37	PCI/G
SC-40425-U	6/14/2000	URANIUM-238	1.045	2.09	PCI/G
SC-40426-U	6/14/2000	URANIUM-238	1.14	2.28	PCI/G
SC-40427-U	6/14/2000	URANIUM-238	1.04	2.08	PCI/G
SC-40428-U	6/14/2000	URANIUM-238	1.275	2.55	PCI/G
SC-40429-U	6/14/2000	URANIUM-238	1 085	2.17	PCI/G
SC-40430-U	6/14/2000	URANIUM-238	1 14	2.28	PCI/G
SC-40431-U	6/14/2000	URANIUM-238	1 12	2.24	PCI/G
SC-40501-U	6/14/2000	URANIUM-238	1.145	2.29	PCI/G
SC-40502-U	6/14/2000	URANIUM-238	1.255	2.51	PCI/G
SC-40503-U	6/14/2000	URANIUM-238	1.05	2 1	PCI/G
SC-40504-U	6/14/2000	URANIUM-238	1 055	2.11	PCI/G
SC-40505-U	6/14/2000	URANIUM-238	1.69	2 42	PCI/G
SC-40506-U	6/14/2000	URANIUM-238	1.09	2.18	PCI/G
SC-40507-U	6/14/2000	URANIUM-238	1 035	2.07	PCI/G
SC-40508-U	6/14/2000	URANIUM-238	1 145	2.29	PCI/G
SC-40509-U	6/14/2000	URANIUM-238	1.19	2.38	PCI/G
SC-40510-U	6/14/2000	URANIUM-238	1 105	2.21	PCI/G
SC-40511-U	6/14/2000	URANIUM-238	1.05	2.1	PCI/G
SC-40512-U	6/14/2000	URANIUM-238	1.11	2.22	PCI/G
SC-40513-U	6/14/2000	URANIUM-238	1.03	2.06	PCI/G
SC-40514-U	6/14/2000	URANIUM-238	1.085	2.17	PCI/G
SC-40515-U	6/14/2000	URANIUM-238	1.015	2.03	PCI/G
SC-40516-U	6/14/2000	URANIUM-238	1.19	2.38	PCI/G
SC-40517-U	6/14/2000	URANIUM-238	1.13	2.26	PCI/G
SC-40518-U	6/14/2000	URANIUM-238	1.125	2.25	PCI/G
SC-40519-U	6/14/2000	URANIUM-238	1.05	2.1	PCI/G
SC-40520-U	6/14/2000	URANIUM-238	1.155	2 31	PCI/G

APPENDIX C WP-437 RU025 FINAL DATA

WSSRAP_ID	DATE_SAM	PARAMETER	CONC	DL	UNITS
SC-40521-U	6/14/2000	URANIUM-238	0.975	1.95	PCI/G
SC-40522-U	6/14/2000	URANIUM-238	1.095	2.19	PCI/G
SC-40523-U	6/14/2000	URANIUM-238	1.225	2.45	PCI/G
SC-40524-U	6/14/2000	URANIUM-238	1.035	2.07	PCI/G
SC-40525-U	6/14/2000	URANIUM-238	1.095	2.19	PCI/G
SC-40526-U	6/14/2000	URANIUM-238	1.07	2.14	PCI/G
SC-40527-U	6/14/2000	URANIUM-238	1.02	2.04	PCI/G
SC-40528-U	6/14/2000	URANIUM-238	1.05	2.1	PCI/G
SC-40529-U	6/14/2000	URANIUM-238	2.56	2.19	PCI/G
SC-40530-U	6/14/2000	URANIUM-238	1.085	2.17	PCI/G
SC-40531-U	6/14/2000	URANIUM-238	1.075	2.15	PCI/G
SC-40532-U	6/14/2000	URANIUM-238	1.135	2.27	PCI/G
SC-41001-U	7/7/2000	URANIUM-238	0.975	1.95	PCI/G
SC-41002-U	7/7/2000	URANIUM-238	1.135	2.27	PCI/G
SC-41003-U	7/7/2000	URANIUM-238	1.07	2.14	PCI/G
SC-41004-U	7/7/2000	URANIUM-238	1.11	2.22	PCI/G
SC-41005-U	7/7/2000	URANIUM-238	1.195	2.39	PCI/G
SC-41006-U	7/7/2000	URANIUM-238	1.13	2.26	PCI/G
SC-41007-U	7/7/2000	URANIUM-238	1.185	2.37	PCI/G
SC-41008-U	7/7/2000	URANIUM-238	1.125	2.25	PCI/G
SC-41009-U	7/7/2000	URANIUM-238	1.14	2.28	PCI/G
SC-41010-U	7/7/2000	URANIUM-238	1.12	2.24	PCI/G
SC-41011-U	7/7/2000	URANIUM-238	1.075	2.15	PCI/G
SC-41012-U	7/7/2000	URANIUM-238	1.12	2.24	PCI/G
SC-41013-U	7/7/2000	URANIUM-238	1.07	2.14	PCI/G
SC-41014-U	7/7/2000	URANIUM-238	1.11	2.22	PCI/G
SC-41015-U	7/7/2000	URANIUM-238	0.935	1.87	PCI/G
SC-41016-U	7/7/2000	URANIUM-238	1.11	2.22	PCI/G
SC-41017-U	7/7/2000	URANIUM-238	1.105	2.21	PCI/G
SC-41018-U	7/7/2000	URANIUM-238	1.06	2.12	PCI/G
SC-41019-U	7/7/2000	URANIUM-238	0.905	1.81	PCI/G
SC-41020-U	7/7/2000	URANIUM-238	1.065	2.13	PCI/G
SC-41021-U	7/7/2000	URANIUM-238	1.045	2.09	PCI/G
SC-41022-U	7/7/2000	URANIUM-238	1.23	2.46	PCI/G
SC-41023-U	7/7/2000	URANIUM-238	1.115	2.23	PCI/G
SC-41024-U	7/7/2000	URANIUM-238	1.16	2.32	PCI/G

APPENDIX D
WP437 RU025 Sample Location Coordinates

WP437 RU25 SAMPLE LOCATION COORDINATES

SAMPLE LOCATION	SAMPLE DATE	NORTHING	EASTING	ELEVATION
SC-37802-C	4/3/1998	1044039.35	754975.37	652.35
SC-37804-C	4/3/1998	1044013.07	754961.29	651.18
SC-37806-C	4/3/1998	1043984.01	754945.89	649.01
SC-37810-C	4/3/1998	1043926.53	754914.33	649.75
SC-37814-C	4/3/1998	1043868.76	754883.15	648.79
SC-37818-C	4/3/1998	1043811.07	754851.71	646.74
SC-37821-C	4/3/1998	1043761.91	754838.78	648.35
SC-37901-C	4/3/1998	1043753.48	754820.44	647.72
SC-37902-S	4/3/1998	1043733.28	754822.83	648.09
SC-37904-S	4/3/1998	1043704.62	754806.91	647.49
SC-37905-C	4/3/1998	1043695.82	754789.15	645.29
SC-37906-S	4/3/1998	1043676.02	754790.76	646.88
SC-37908-S	4/3/1998	1043647.40	754774.69	646.10
SC-37910-C	4/3/1998	1043627.10	754778.80	647.31
SC-37910-S	4/3/1998	1043618.78	754758.54	646.31
SC-37911-C	4/3/1998	1043608.92	754739.35	644.56
SC-37911-S	4/3/1998	1043606.05	754714.47	636.77
SC-37912-S	4/3/1998	1043590.18	754742.49	646.87
SC-37914-C	4/3/1998	1043586.79	754720.58	642.85
SC-37914-S	4/3/1998	1043577.73	754697.87	645.01
SC-37916-C	4/3/1998	1043545.59	754731.30	649.38
SC-37919-C	3/24/1998	1043478.34	754436.19	639.78
SC-37919-S	3/24/1998	1043473.30	754413.97	640.37
SC-38002-C	7/17/1998	1043643.92	755620.88	646.10
SC-38004-C	7/17/1998	1043606.31	755672.08	645.94
SC-38006-S	7/17/1998	1043574.19	755711.32	645.63
SC-38007-S	7/17/1998	1043558.08	755739.99	645.47
SC-38008-S	7/17/1998	1043542.31	755768.48	645.51
SC-38008-S-RS	7/22/1998	1043539.29	755776.64	644.32
SC-38010-C	7/17/1998	1043558.87	755721.71	645.82
SC-38014-C	7/25/1998	1043484.40	755831.93	645.88
SC-38015-S	7/25/1998	1043465.52	755838.39	646.41
SC-38016-C	7/25/1998	1043448.03	755884.53	644.33
SC-38016-S	7/25/1998	1043449.44	755867.04	645.55
SC-38017-S	7/25/1998	1043433.28	755895.78	643.65
SC-38018-S	7/25/1998	1043417.58	755924.17	642.54
SC-38019-S	7/25/1998	1043400.95	755953.24	640.11
SC-38023-C	7/25/1998	1043410.95	755903.48	644.11
SC-38024-S	7/25/1998	1043388.99	755908.13	644.52
SC-38025-S	7/25/1998	1043372.98	755936.73	641.76
SC-38027-S	7/25/1998	1043360.03	755892.31	646.94
SC-38028-S	7/25/1998	1043344.28	755920.76	645.07
SC-38029-C	7/25/1998	1043354.21	755874.21	647.93
SC-38031-C	7/25/1998	1043324.58	755928.52	646.25
SC-38101-C	8/25/1998	1043361.94	755986.88	637.09
SC-38101-S	7/25/1998	1043357.08	755965.25	640.09
SC-38102-S	8/25/1998	1043340.72	755993.99	628.56
SC-38103-C	8/25/1998	1043326.13	756041.71	636.34
SC-38103-S	8/25/1998	1043324.70	756022.58	632.78
SC-38104-S	8/25/1998	1043308.67	756051.28	638.19
SC-38105-C	8/25/1998	1043290.94	756095.54	638.10
SC-38105-S	8/25/1998	1043292.62	756079.97	639.02
SC-38106-S	7/25/1998	1043328.07	755949.50	643.51
SC-38107-S	8/25/1998	1043311.98	755978.12	642.08
SC-38108-S	8/25/1998	1043296.17	756005.20	627.03
SC-38109-S	8/25/1998	1043279.93	756035.53	642.28
SC-38110-S	8/25/1998	1043263.99	756064.03	642.33
SC-38111-S	8/25/1998	1043248.06	756092.36	643.19
SC-38113-C	8/25/1998	1043293.33	755986.07	636.31
SC-38115-C	8/25/1998	1043262.06	756043.87	644.75
SC-38116-C	8/25/1998	1043246.41	756072.76	643.40
SC-38117-C	8/25/1998	1043226.94	756093.74	644.49
SC-38118-C	8/25/1998	1043199.60	756087.79	645.94
SC-40001-U	6/9/2000	1042050.90	753966.73	660.96
SC-40002-U	6/9/2000	1042067.59	753984.27	659.38
SC-40003-U	6/9/2000	1042076.24	753935.31	660.20
SC-40004-U	6/9/2000	1042085.84	753959.66	661.25
SC-40005-U	6/9/2000	1042117.37	753920.21	661.23

WP437 RU25 SAMPLE LOCATION COORDINATES

SC-40006-U	6/9/2000	1042123.50	753944.52	661.70
SC-40007-U	6/9/2000	1042154.31	753906 18	663 76
SC-40008-U	6/9/2000	1042154.23	753931.73	663.22
SC-40009-U	6/9/2000	1042193.20	753895.24	663.27
SC-40010-U	6/9/2000	1042191.54	753920.90	663.46
SC-40011-U	6/9/2000	1042238.88	753899 76	663.27
SC-40012-U	6/9/2000	1042229.64	753925.97	663.09
SC-40013-U	6/9/2000	1042272.37	753934.06	661.64
SC-40014-U	6/9/2000	1042258.22	753955.25	661 60
SC-40015-U	6/9/2000	1042291.52	753962.91	662.28
SC-40016-U	6/9/2000	1042284.76	753987 18	662.47
SC-40017-U	6/9/2000	1042331.24	753963 75	661.30
SC-40018-U	6/9/2000	1042305.35	754012 34	660.52
SC-40019-U	6/9/2000	1042338.74	753984 75	660.97
SC-40020-U	6/9/2000	1042360.37	753979.04	659.63
SC-40021-U	6/9/2000	1042334.46	754027.74	659.25
SC-40022-U	6/9/2000	1042356.09	754022 49	659.50
SC-40023-U	6/9/2000	1042389 46	753994.99	658.14
SC-40024-U	6/9/2000	1042363.58	754043.36	657.92
SC-40025-U	6/9/2000	1042396.98	754015.82	658 51
SC-40026-U	6/9/2000	1042418.60	754010.40	658.28
SC-40027-U	6/9/2000	1042392.72	754058.86	655 32
SC-40028-U	6/9/2000	1042414.35	754053.37	657.21
SC-40029-U	6/9/2000	1042447.71	754025 95	656 36
SC-40030-U	6/9/2000	1042421.85	754074 37	655.00
SC-40031-U	6/9/2000	1042455.30	754046 75	656 04
SC-40032-U	6/9/2000	1042476.80	754041.54	655.87
SC-40033-U	6/9/2000	1042450.99	754089 91	654.08
SC-40034-U	6/9/2000	1042472.73	754084.28	655.32
SC-40035-U	6/9/2000	1042480.09	754105.50	653.59
SC-40101-U	6/9/2000	1042506.11	754056.79	655.93
SC-40102-U	6/9/2000	1042513 44	754078.03	654 77
SC-40103-U	6/9/2000	1042535.04	754072.58	654.28
SC-40104-U	6/9/2000	1042508.96	754121 30	652.94
SC-40105-U	6/9/2000	1042530.90	754115.52	654 63
SC-40106-U	6/9/2000	1042564.30	754087 97	654.80
SC-40107-U	6/9/2000	1042538.36	754136.57	653.19
SC-40108-U	6/9/2000	1042571.72	754109.05	654.35
SC-40109-U	6/9/2000	1042593.62	754103.40	653.94
SC-40110-U	6/9/2000	1042567.14	754152.30	653.18
SC-40111-U	6/10/2000	1042588.89	754146.77	654.12
SC-40112-U	6/10/2000	1042622.44	754119.14	653.82
SC-40113-U	6/10/2000	1042596.62	754167.65	652.85
SC-40114-U	6/10/2000	1042630.41	754139.92	653.32
SC-40115-U	6/10/2000	1042651 52	754134.70	652.25
SC-40116-U	6/10/2000	1042625.62	754183.23	652.19
SC-40117-U	6/10/2000	1042647.26	754177.75	652 99
SC-40118-U	6/10/2000	1042680.41	754150.32	651.36
SC-40119-U	6/10/2000	1042654.51	754198.81	651.82
SC-40120-U	6/10/2000	1042688.16	754171.23	652.45
SC-40121-U	6/10/2000	1042709.70	754165 79	651.25
SC-40122-U	6/10/2000	1042709.70	754165 79	651.25
SC-40122-U-RS	6/22/2000	1042684.39	754214 08	650.87
SC-40123-U	6/10/2000	1042705.22	754208.87	652 51
SC-40124-U	6/10/2000	1042738 71	754181.35	650.63
SC-40125-U	6/10/2000	1042712.81	754229.85	651 13
SC-40126-U	6/10/2000	1042746.51	754202.28	652.27
SC-40127-U	6/10/2000	1042767.93	754196.85	650.02
SC-40128-U	6/10/2000	1042742.01	754245.36	650.59
SC-40129-U	6/10/2000	1042763.51	754239.91	651.58
SC-40130-U	6/10/2000	1042797.03	754212.38	650.58
SC-40131-U	6/10/2000	1042771 25	754260.90	650.16
SC-40201-U	6/10/2000	1042804 67	754233.37	651.27
SC-40202-U	6/10/2000	1042825.81	754227.94	650.08
SC-40203-U	6/10/2000	1042799.50	754276.42	650.14
SC-40204-U	6/10/2000	1042821.85	754270.96	651.07
SC-40205-U	6/10/2000	1042855.40	754243.43	649.44
SC-40206-U	6/10/2000	1042829.39	754291.96	649 47
SC-40207-U	6/10/2000	1042863.02	754265.58	650 74

WP437 RU25 SAMPLE LOCATION COORDINATES

SC-40208-U	6/10/2000	1042884.81	754261.38	649.00
SC-40209-U	6/10/2000	1042856.25	754308.31	649.28
SC-40210-U	6/10/2000	1042880.21	754304.84	650.15
SC-40211-U	6/10/2000	1042910.32	754273.84	649.00
SC-40212-U	6/10/2000	1042889.73	754324.87	648.97
SC-40213-U	6/10/2000	1042920.20	754293.78	649.80
SC-40214-U	6/10/2000	1042935.28	754283.14	648.86
SC-40215-U	6/10/2000	1042926.60	754336.58	648.80
SC-40216-U	6/10/2000	1042945.24	754324.87	649.63
SC-40217-U	6/10/2000	1042963.89	754286.90	649.25
SC-40218-U	6/10/2000	1042963.72	754341.90	647.98
SC-40219-U	6/10/2000	1042980.45	754297.90	649.16
SC-40220-U	6/12/2000	1042994.30	754287.41	648.38
SC-40221-U	6/12/2000	1042998.60	754341.46	647.64
SC-40222-U	6/12/2000	1043014.07	754325.57	648.49
SC-40223-U	6/12/2000	1043026.29	754286.42	647.33
SC-40224-U	6/12/2000	1043031.48	754339.50	647.02
SC-40225-U	6/12/2000	1043045.54	754299.48	648.20
SC-40226-U	6/12/2000	1043060.37	754283.34	646.59
SC-40227-U	6/12/2000	1043063.77	754338.30	646.12
SC-40228-U	6/12/2000	1043079.92	754321.57	646.99
SC-40229-U	6/12/2000	1043094.02	754280.56	646.10
SC-40230-U	6/12/2000	1043097.58	754335.19	645.73
SC-40231-U	6/12/2000	1043111.35	754294.58	646.35
SC-40301-U	6/12/2000	1043126.97	754278.53	645.51
SC-40302-U	6/12/2000	1043130.01	754333.88	645.55
SC-40303-U	6/12/2000	1043145.69	754317.75	645.98
SC-40304-U	6/12/2000	1043163.31	754331.33	645.00
SC-40305-U	6/12/2000	1043177.33	754290.41	646.02
SC-40306-U	6/12/2000	1043184.27	754354.84	644.76
SC-40307-U	6/12/2000	1043192.55	754274.99	644.61
SC-40308-U	6/12/2000	1043196.18	754329.43	645.21
SC-40309-U	6/12/2000	1043211.81	754313.28	645.37
SC-40310-U	6/12/2000	1043229.10	754327.46	644.73
SC-40311-U	6/12/2000	1043225.44	754273.15	644.20
SC-40312-U	6/12/2000	1043243.22	754286.33	645.45
SC-40313-U	6/12/2000	1043258.59	754270.77	643.82
SC-40314-U	6/12/2000	1043262.01	754325.54	644.04
SC-40315-U	6/12/2000	1043277.70	754309.16	644.58
SC-40316-U	6/14/2000	1043294.98	754323.45	643.67
SC-40317-U	6/14/2000	1043291.63	754268.54	643.05
SC-40318-U	6/12/2000	1043309.05	754282.36	644.53
SC-40319-U	6/14/2000	1043324.57	754266.55	642.74
SC-40320-U	6/14/2000	1043327.94	754321.36	643.26
SC-40321-U	6/14/2000	1043343.49	754305.40	643.54
SC-40322-U	6/14/2000	1043360.87	754319.40	642.84
SC-40323-U	6/14/2000	1043357.52	754264.45	642.25
SC-40324-U	6/14/2000	1043374.91	754278.40	643.10
SC-40325-U	6/14/2000	1043390.45	754262.45	641.92
SC-40326-U	6/14/2000	1043393.81	754317.30	642.29
SC-40401-U	6/14/2000	1043409.38	754301.57	642.94
SC-40402-U	6/14/2000	1043426.75	754315.33	641.99
SC-40403-U	6/14/2000	1043423.39	754260.42	641.71
SC-40404-U	6/14/2000	1043440.79	754274.42	642.20
SC-40405-U	6/14/2000	1043456.35	754258.54	641.53
SC-40406-U	6/14/2000	1043459.70	754313.36	641.39
SC-40407-U	6/14/2000	1043475.01	754297.56	641.88
SC-40408-U	6/14/2000	1043492.12	754311.83	640.89
SC-40409-U	6/14/2000	1043489.78	754256.71	640.96
SC-40410-U	6/14/2000	1043509.67	754270.87	641.64
SC-40411-U	6/14/2000	1043522.94	754255.64	641.35
SC-40412-U	6/14/2000	1043525.08	754310.53	640.42
SC-40413-U	6/14/2000	1043540.90	754294.84	640.84
SC-40414-U	6/14/2000	1043556.29	754253.98	641.33
SC-40415-U	6/14/2000	1043558.51	754309.18	639.86
SC-40416-U	6/14/2000	1043572.70	754268.49	641.31
SC-40417-U	6/14/2000	1043589.01	754252.35	640.40
SC-40418-U	6/14/2000	1043590.72	754307.88	639.25
SC-40419-U	6/14/2000	1043606.61	754292.27	641.06

WP437 RU25 SAMPLE LOCATION COORDINATES

SC-40420-U	6/14/2000	1043621.59	754249.31	639.86
SC-40421-U	6/14/2000	1043623.65	754306.59	639.25
SC-40422-U	6/14/2000	1043635.69	754266.11	641.01
SC-40423-U	6/14/2000	1043654.48	754247.85	639.82
SC-40424-U	6/14/2000	1043657.15	754305.62	638.80
SC-40425-U	6/14/2000	1043672.48	754290.13	640.29
SC-40426-U	6/14/2000	1043687.43	754243.61	639.38
SC-40427-U	6/14/2000	1043689.93	754307.08	639.43
SC-40428-U	6/14/2000	1043704.66	754263.04	639.85
SC-40429-U	6/14/2000	1043725.82	754244.78	638.78
SC-40430-U	6/14/2000	1043717.20	754309.58	638.27
SC-40431-U	6/14/2000	1043736.04	754292.87	639.52
SC-40501-U	6/14/2000	1043758.66	754249.48	638.64
SC-40502-U	6/14/2000	1043748.05	754320.13	637.99
SC-40503-U	6/14/2000	1043775.42	754272.62	638.92
SC-40504-U	6/14/2000	1043798.18	754260.62	638.81
SC-40505-U	6/14/2000	1043769.75	754330.10	638.02
SC-40506-U	6/14/2000	1043795.41	754310.53	639.14
SC-40507-U	6/14/2000	1043828.78	745273.00	639.01
SC-40508-U	6/14/2000	1043797.54	754347.25	637 56
SC-40509-U	6/14/2000	1043836.92	754296.80	638.91
SC-40510-U	6/14/2000	1043864.09	754288.55	638.92
SC-40511-U	6/14/2000	1043819.86	754360.12	637.18
SC-40512-U	6/14/2000	1043850.48	754341.41	638.37
SC-40513-U	6/14/2000	1043894.37	754302.31	637.63
SC-40514-U	6/14/2000	1043849.55	754373.87	636.94
SC-40515-U	6/14/2000	1043896.07	754330.92	638.63
SC-40516-U	6/14/2000	1043927.49	754324.92	637.49
SC-40517-U	6/14/2000	1043870.07	754387.45	636.95
SC-40518-U	6/14/2000	1043901.12	754376.77	638.47
SC-40519-U	6/14/2000	1043952.73	754346.53	637.36
SC-40520-U	6/14/2000	1043894.09	754407.69	636.56
SC-40521-U	6/14/2000	1043948.27	754375.35	638.77
SC-40522-U	6/14/2000	1043974.72	754371.31	637.33
SC-40523-U	6/14/2000	1043923.41	754426.81	636.35
SC-40524-U	6/14/2000	1043945.50	754419.91	638.57
SC-40525-U	6/14/2000	1044000.18	754404.74	636.72
SC-40526-U	6/14/2000	1043930.19	754452.74	635.58
SC-40527-U	6/14/2000	1043991.01	754430.53	639.56
SC-40528-U	6/14/2000	1044018.11	754438.63	636.80
SC-40529-U	6/14/2000	1043927.51	754479.19	635.26
SC-40530-U	6/14/2000	1043971.89	754469.98	639.99
SC-40531-U	6/14/2000	1044030.45	754479.90	638.14
SC-40532-U	6/14/2000	1043997.76	754490.21	640.16
SC-41001-U	7/7/2000	1043956.68	754501.39	637.99
SC-41002-U	7/7/2000	1043982.10	754519.06	631.10
SC-41003-U	7/7/2000	1044009.53	754538.13	628.86
SC-41004-U	7/7/2000	1043950.14	754535.64	637.31
SC-41005-U	7/7/2000	1043963.35	754545.34	635 48
SC-41006-U	7/7/2000	1043989.78	754564.71	636.83
SC-41007-U	7/7/2000	1043944.21	754571.82	639.86
SC-41008-U	7/7/2000	1043970.31	754591.20	639.75
SC-41009-U	7/7/2000	1043934.00	754587.10	637.77
SC-41010-U	7/7/2000	1043953.79	754613.15	645.64
SC-41011-U	7/7/2000	1043904.82	754602.27	646.44
SC-41012-U	7/7/2000	1043919.83	754631.32	648.10
SC-41013-U	7/7/2000	1043912.69	754653.32	650.71
SC-41014-U	7/7/2000	1043875.79	754617.48	650.78
SC-41015-U	7/7/2000	1043891.09	754646.70	651.54
SC-41016-U	7/7/2000	1043883.95	754668.74	653.89
SC-41017-U	7/7/2000	1043846.94	754633.00	654.74
SC-41018-U	7/7/2000	1043861.78	754661.74	654 80
SC-41019-U	7/7/2000	1043817.45	754647.69	657.38
SC-41020-U	7/7/2000	1043832.67	754676.97	657.46
SC-41021-U	7/7/2000	1043788.32	754663.17	659 46
SC-41022-U	7/7/2000	1043802.93	754692.33	662.30
SC-41022-U-RS	7/10/2000	1043803.53	754691.84	660.67
SC-41023-U	7/7/2000	1043759.26	754678.08	662.24
SC-41024-U	7/7/2000	1043774.31	754707 14	663 39

APPENDIX E
Interoffice Correspondence

MORRISON KNUDSEN CORPORATION

MK-FERGUSON GROUP

INTER-OFFICE CORRESPONDENCE

DATE: November 17, 1995

TO: ALARA Committee

FROM: Michelle French/Richard Machado

SUBJECT: **RA-226 DETERMINATION FOR SITE CONFIRMATION SAMPLES**

Background

The issue surrounding Ra-226 analysis via gamma spectroscopy arises due to the fact that the Ra-226 soil concentration is determined by using the following energy peaks: 295 keV and 352 keV for Pb-214; and 609 keV, 1120 keV, and 1764 keV for Bi-214. These radionuclides are both short-lived daughters of Rn-222. The drying and grinding processes are known to drive off Rn-222 that is trapped in the soil pores and moisture held in the soil. In order to quantitatively identify Ra-226 using gamma spectroscopy, Rn-222 and its short-lived progeny must be allowed to grow into secular equilibrium following such sample preparation techniques. The following alternatives were evaluated for estimating the Ra-226 concentration in soil given gamma spectroscopy analysis within five working days of sample collection.

Alternative 1

Send all samples requiring Ra-226 analysis to an offsite laboratory. At offsite facilities, Ra-226 is typically analyzed through alpha spectroscopy which does not rely on the Ra-222 daughter products to provide a quantitative result. The minimum turnaround time that can be provided for alpha spectroscopy analysis for Ra-226 is four days. At one and two day turnaround times, the method for analysis is modified to use Gas Flow Proportional Counting for total alpha counting yielding a total radium number with no separation of isotopic contributions. Given the four day turnaround time and an estimate of 750 samples (WP-253 and WP-420), the total analytical costs will be $95,250.

The major disadvantage in this approach is the tight schedule involved with sample collection, packaging, shipping, data receipt, data review, and ALARA committee action. It may be impossible to accomplish this within five working days given the four day turnaround requirement.

Alternative 2

As stated above, the drying and grinding processes are known to drive off radon that is trapped in the soil matrix. However, the amount of radon removed from these processes is not quantified. If you were to assume that all the radon is removed during these processes and the time of final preparation was recorded, a correction factor can be applied based upon the secular equilibrium condition equation. For example, the following table summarizes the ratio of activity of Rn-222 to the activity of Ra-226.

A(Rn-222)/A(Ra-226)	Time Post Canning (Days)
0.167	1
0.306	2
0.422	3
0.665	6
0.807	9
0.888	12
0.935	15
0.963	18
0.978	21
0.987	24
0.993	27
0.996	30

Thus, if the samples were counted three days post canning, a correction factor of 0.422 would be used to determine the estimated final Ra-226 concentration. Given this approach, any concentration determined three days post preparation would be divided by 0.422 to arrive at the final concentration. For a 5 pCi/g ALARA goal, any result above 2.1 pCi/g would be rejected.

The major limitation with this approach is the assumption that the drying and grinding processes remove 100% of the radon. Samples that have been analyzed within one day of preparation have never yielded results much below expected background concentrations (0.8-1.0 pCi/g).

Thus, the use of a correction factor on the order of 0.167 could result in a very conservative approach for estimating the final Ra-226 soil concentration in background soils (in fact all samples analyzed one day after canning would equal or exceed 5 pCi/g).

Alternative 3

All samples that are collected to support confirmation can be analyzed as wet samples to virtually eliminate the radon removal that occurs during sample preparation. However, there are numerous considerations, such as sample homogeneity, particle size, moisture content variability, etc., that can produce error in such analyses. If the samples are analyzed wet, they would also be prepared and analyzed to provide final concentrations for each radionuclide of interest for the sample. This dry evaluation would require an analysis within the confirmation cleanup turnaround period and a second analysis within 20-30 days later to finalize Ra-226 concentrations to an acceptable quality level. This approach would involve three analyses of every sample. The initial wet analysis can be used to estimate the final Ra-226 concentration. However, this estimate must be made on a case by case basis through moisture corrections, etc.

The major limitation for this approach is the reduction in lab productivity as an extra canning effort would be needed to generate a wet and a dry sample for each sample and count time for each sample would increase by a factor of three.

Alternative 4

Over the last several months, the onsite radiological laboratory has been recounting samples that were analyzed during the months of April - September 1995. These reanalyses were done in order to support final analyses of SE Drainage and Quarry characterization samples. The graph on the attached page illustrates a portion of the recount results versus the initial results. The graph includes those samples that had initial Ra-226 results < 5 pCi/g. As illustrated, the background - 2.2 pCi/g sample range had 100% of all sample recounts fall less than 5 pCi/g. For those in the range of 2.2 - 3.2 pCi/g, the likelihood of exceeding 5 pCi/g was approximately 50%. All of the samples with initial results greater than 3.2 pCi/g had final Ra-226 results > 5 pCi/g.

This information can be used to establish a criteria about which samples can be said to meet the ALARA goal of 5 pCi/g within the five working day turnaround window.

Given the current study findings, it is recommended that any sample with an initial Ra-226 result > 2.2 pCi/g be expected to exceed the ALARA goal of 5 pCi/g. In addition, the estimated final Ra-226 soil concentration should be found by multiplying the initial result by 2.27 (2.2 pCi/g x 2.27 = 5 pCi/g). This correction factor is very close to the maximum increase from initial results to recount results (e.g., 2.56) in the background to 2.2 pCi/g concentration range. The average increase from initial results to recount results for this range was 1.51. However, use of a value closer to the maximum value affords less risk in exceeding expected confirmation goals. The laboratory will work to refine these numbers to further minimize the risk as they continue to recount samples collected over the last few months. The major limitation with this alternative is the potential to over excavate, increasing disposal costs.

Alternative 5

This alternative involves a combination of alternatives 3 and 4. Samples that do not have elevated direct survey results via a 2x2 NaI or a 44-9 survey should be prepared and evaluated in accordance with alternative 4. Samples that do have above background survey results will be analyzed wet and evaluated accordingly to determine the estimated final Ra-226 concentration. The sample will then be prepared and analyzed a second time to provide quality level data for the other radionuclides of interest. In addition, each prepared sample would be analyzed within 30 days after preparation to finalize the Ra-226 concentration to an acceptable quality level.

The major limitation with this approach is the loss in productivity as a result of the double canning needs and increased count times for a portion of the samples.

Recommendation

The Onsite Radiological Laboratory recommends the use of alternative 4. This alternative minimizes risk of failing to meet expected cleanup ALARA goals and provides for maximum efficiency/productivity within the laboratory. The second favorable alternative is number 5. This alternative would increase the workload in the laboratory, but would further reduce the risk of over excavation and failure to meet desired cleanup objectives.

In all of the above alternatives, the estimated final Ra-226 concentration will be used in conjunction with the measured Ra-228 concentration as follows to determine if the mixture rule for the ALARA goals as described in the Record of Decision is achieved.

$$\frac{\text{Est. Final Ra-226 (pCi/g)}}{5\ \text{pCi/g}} + \frac{\text{Ra-228 (pCi/g)}}{5\ \text{pCi/g}} = \text{Mixture Ratio}$$

If mixture ratio <= 1, then the sample meets cleanup confirmation design. If mixture ratio > 1, then the sample must be considered by the ALARA committee.

MLF/RM/pr

Attachment

Distribution:

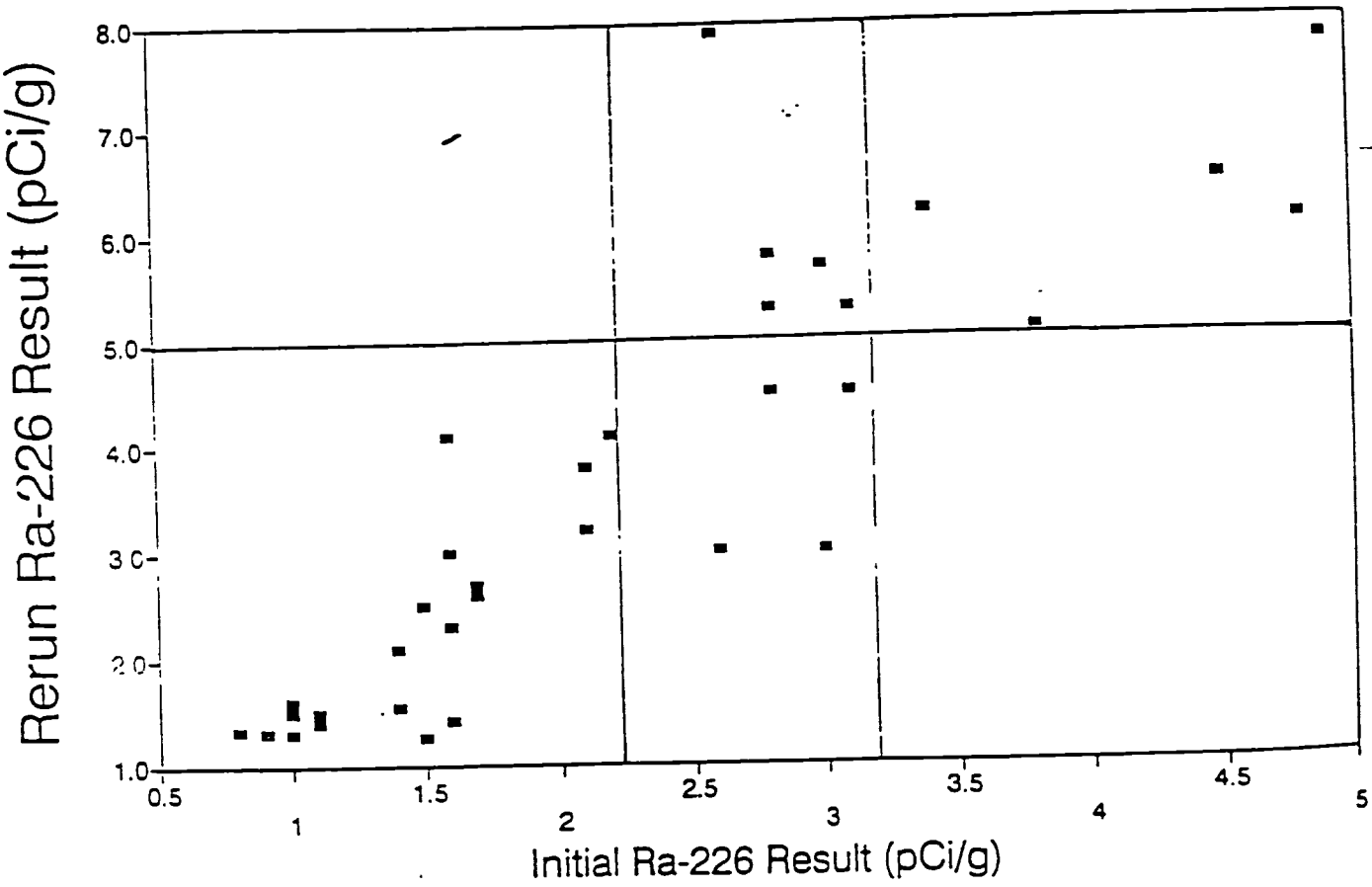
Ken Meyer
Steve Warren
Ken Greenwell
Jim Meier

Alternates:
Marj Wesley
Jack Cooney
Dan Hoffman

cc: Melissa Lutz

Ra226 Concentration Range

Background - 5.0 pCi/g



MORRISON KNUDSEN CORPORATION
MK-FERGUSON GROUP

INTER-OFFICE CORRESPONDENCE

DATE: November 20, 1995

TO: ALARA Committee

FROM: Richard Machado/Michelle French MF

SUBJECT: TH232 DETERMINATION FOR SITE CONFIRMATION SAMPLES

Th232 can occur in two forms at the site: (1) naturally and (2) processed to purify Th232. Both of these forms are subject to the same transformation equation. Given a Th232 half life of 1.39 x 10^{10} years and a Ra228 half life of 5.75 years, a condition known as secular equilibrium occurs. Secular equilibrium occurs when the half life of the parent is very much greater than that of the daughter. If an initially pure parent (Th232) is formed, its radioactive transformation will result in accumulation of the daughter (Ra228). Since the daughter (Ra228) decays very much faster than the parent (Th232), a point is soon reached at which the amount of parent (Th232) present is equal to that of the daughter (Ra228).

The equation that represents this condition of secular equilibrium is:

$$Q_B = Q_A (1 - e^{-\lambda_B t})$$

where Q_A=parent (Th232) activity, Q_B=daughter (Ra228) activity, t=time since placement of material, and λ_B=decay constant for daughter (Ra228). Therefore, the fraction of daughter activity to parent activity

$$\left(\frac{A(RA\text{-}228)}{A(Th\text{-}232)}\right)$$

present at the WSSRAP in 1995 can be calculated.

Assume that production ceased at the site on January 1, 1965, and that all Th232 was produced on that very last day (t=30.9 years). Given a half life for Ra228 of 5.75 years, the decay constant would equal

$$(\lambda_B = 0.121\ Y^{-1})$$

11-30-95

Given this information, the ratio of Ra228 activity to Th232 activity can be calculated as follows:

$$\frac{Q_B}{Q_A} = \frac{A\,(Ra\text{-}228)}{A\,(Th\text{-}232)} = 1 - e^{-\lambda_B t}$$

$$\frac{A\,(Ra228)}{A\,(Th232)} = 1 - e^{-(0.121Y^{-1})\,(30.9Y)} = 1 - 0.024 = 0.976$$

$$\therefore \frac{A\,(Ra\text{-}228)}{A\,(Th\text{-}232)} = 0.976 \quad or \quad A\,(Th\text{-}232) = 1.025\,A\,(Ra\text{-}228)$$

This representation will be true for both naturally occurring Th232 and processed Th232. The other situation to be addressed includes the circumstance when Ra228 and associated decay products were placed as a waste material after purification of Th232. In this situation, the amount of Ra228 present will be much greater than the Th232 present. This information is illustrated in a previous assessment of the ratio of Ra228 concentrations to that of Th232 in raffinate pit wastes. The average ratio was reported as 7.02 in the *Concentration Ratios of Radionuclides* in the U238, U235, and Th232 *Decay Series* (DOE/OR/21548-250), indicating that the average activity concentration for Th232 is 0.14 of the activity concentration for Ra228.

The Record of Decision states that if Th232 and Ra228 are present and not in secular equilibrium, the cleanup criteria apply for the radionuclide with the higher concentration. Thus, for determination of successful cleanup, the use of a Ra-228 ALARA goal of 4.88 pCi/g and a criteria of 6.05 pCi/g will result in removing Th232 to within 5 pCi/g (ALARA) and 6.2 pCi/g (criteria), respectively.

Given this practice, it is recommended that the on-site radiological analyses for Ra-228 concentrations in soil be used to determine attainment of Th-232 cleanup. It is also recommended that 2% of the samples (1 of every 50) that are independently analyzed via an off-site facility be used as a quality check for all radionuclides of interest (U238, Th230, Th232, Ra228, and Ra226). In addition, these numbers should be summarized in post remediation reports for each work package to support the decision to use Ra228 to determine successful cleanup of Th232.

RM/MF/jn

Distribution: ALARA Committee

Steve Warren
Ken Meyer
Ken Greenwell
Jim Meier

Alternates:
Marj Wesley
Jack Cooney
Dan Hoffman
Melissa Lutz

MORRISON KNUDSEN CORPORATION
MK-FERGUSON GROUP

INTER-OFFICE CORRESPONDENCE

DATE: April 27, 1999

TO: Dan Hoffman

FROM: Dave Cowell DC

SUBJECT: RA-226 RECOUNTS

In an effort to eliminate repetitive work, the on-site lab performed a study to determine if recounts 30 days after sealing sample cans was necessary for samples that have background or near background Ra-226 concentrations. As a result of the study, the lab will now only perform Ra-226 recounts for samples that fail the Radium ALARA preliminary calculation.

This calculation will involve multiplying the Ra-226 result by a correction factor of 2.27 (established in an IOC dated 11/17/95) and adding it to the Ra-228 result. If this result is greater than 5 pCi/g then that sample will be held and recounted 30 days later with the intention of reducing the final reported value.

This approach is conservative because the correction factor of 2.27 was established using samples with concentrations of up to 8 pCi/g. Samples having near background concentrations of Ra-226 do not ingrow to that level. Additionally, the correction factor was intended identify samples with Ra-226 levels that could exceed 5 pCi/g and did not account for the contribution from Ra-228, which we will include in this new calculation.

The attached page is included to illustrate the results of the study.

DC/jn

Attachment

Cc: Jim Meier
Steve Warren
Dave Hixson
John Coniglio
Melissa Lutz
Randy Thompson

MORRISON KNUDSEN CORPORATION
Federal Programs Division

INTER-OFFICE CORRESPONDENCE

DATE: **June 13, 2000**

TO: **Distribution**

FROM: **Melissa Lutz**

SUBJECT: **ADDITION OF NEW CONFIRMATION UNITS TO THE DISPOSAL CELL WORK ZONE**

Six new confirmation units (CUs) have been created to confirm the contaminated haul road just west of the Disposal Cell. This haul road was used during remediation activities to transport contaminated material from the TSA, Raffinate Pits, and Site Water Treatment Plant to the Disposal Cell. The road has now been scraped in preparation for confirmation.

The attached figures identify the new CUs in relation to other areas and also the individual sample locations within each CU. These sample locations have been designated as utility samples as described in the *Confirmation Sampling Plan Details for the Disposal Cell Facility (WP437)*, Rev 0. The attached tables provide the sample location coordinates. All samples will be analyzed for radium-226, radium-228, thorium-230, thorium-232, and uranium-238. Although the haul road crosses the boundaries of 5 work zones, for tracking purposes, these six CUs are being assigned to the Disposal Cell Work Zone - Remedial Unit 25.

If you have any questions, please contact myself at extension 3544, or Linda Broody at extension 2937.

Attachments

Distribution:

Dan Boss	Linda Broody
Terry Caldwell	Dave Fleming (w/o attachments)
Clark Oberlag	Confirmation File
Nick Twesten	

ML/lac