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POST-REMEDIATION ACTION REPORT FOR VICINITY PROPERTY NO. 9 (WP-461)

Weldon Spring Site Remedial Action Project
Weldon Spring, Missouri

JUNE 1997

REV. 0



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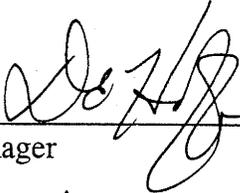
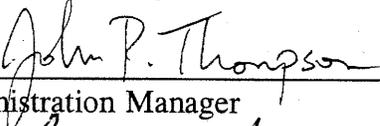
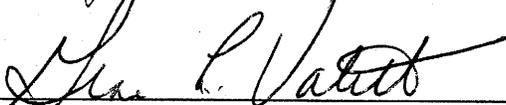
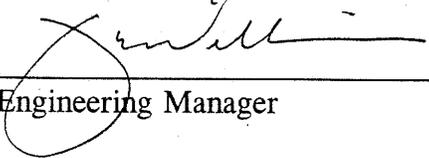
U.S. Department of Energy
Oak Ridge Operations Office
Weldon Spring Site Remedial Action Project

Prepared by MK-Ferguson Company and Jacobs Engineering Group

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APPROVALS

	<u>6/23/97</u>
ES&H Manager	Date
	<u>6/25/97</u>
Data Administration Manager	Date
	<u>25 June 97</u>
Project Manager - Quarry/Vicinity Property	Date
	<u>6-26-97</u>
Engineering Manager	Date
	<u>06/27/97</u>
Project Quality Manager	Date
	<u>06/27/97</u>
Project Director (or Deputy Project Director)	Date

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Weldon Spring Site Remedial Action Project

Post-Remedial Action Report for Vicinity Property No. 9 (WP-461)

Revision 0

June 1997

Prepared by

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for the

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

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EXECUTIVE SUMMARY

Vicinity Property No. 9 (VP 9) is located near the Weldon Spring Quarry between Katy Trail and the Femme Osage Slough. This area was contaminated as a result of past activities at the Weldon Spring Quarry. Contaminated soils were excavated and staged at the Ash Pond Staging area until final placement into the on-site disposal cell. After remedial activities were completed, confirmation soil sampling was required to verify that contaminants of concern were not present above predetermined standards as established in the *Record of Decision (ROD)*.

The methodology for confirmation soil sampling is presented in the *Chemical Plant Area Cleanup Attainment Confirmation Plan*. This methodology was developed to ensure adequate remediation of the contaminants of concern based on statistical parameters. Confirmation sampling ensures that only a 5% probability exists that contamination remains above the cleanup standard concentration for each contaminant of concern in a CU. The methodology allows a 20% probability that the actual average contaminant concentrations are below the criteria for release, while the data indicate that the average concentration is above the criteria. Thus a 20% chance exists that additional remediation has been conducted on a confirmation unit that actually met the criteria for release.

The remediated area of VP 9 (RU011) consisted of approximately 0.9 acres. RU011 was divided into confirmation units (CUs) of approximately 2,000 sq m (about 0.5 acres), based on the *Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 1). The two contiguous CUs in RU011 were designated as CU139 and CU140. Based on the past characterization investigations of the area, U-238 was the only contaminant of concern for VP9 that was identified as elevated above the cleanup standards. The engineering characterization data collected at various depths across the area were used to determine the depth of excavation required to remediate the soil in VP 9. Excavation depths ranged from 1 ft to 4 ft in CU139 and from 1 ft to the capillary fringe (approximately 5 ft to 6 ft) in CU140.

The contaminated soil removal at VP 9 was designed according to site conditions and an As Low As Reasonably Achievable (ALARA) analysis in the *WSSRAP Vicinity Property - MDOC #9 Remediation ALARA Position Paper*. This area, located in the floodplain of the Missouri River, is often inundated for varying periods by the Femme Osage Slough and/or the Missouri River. Depth to groundwater varies from 0 ft to 15 ft, depending upon the river stage

and the ground elevation, with the average depth to groundwater being 3 ft. The effort to remove additional contaminated soils below the groundwater level more than doubles the cost due to groundwater control and excavation efforts. In addition, the soils in this area remain unstable year-round, thus creating additional obstacles when removing contaminated soil. Based upon the above site conditions, the fact that contaminant levels do not exceed the ROD established cleanup criteria below the groundwater level, and the results of the ALARA analysis, it was not considered reasonable to excavate contaminants below the groundwater level. The following remedial design meets cleanup requirements as detailed in the ROD.

The area was cleared, grubbed, and the upper 12 in. of soil were removed across both confirmation units. According to the characterization data, this action was anticipated to result in the removal of all U-238 contamination that exceeded criteria and much that exceeded ALARA. In those areas where U-238 concentrations still exceeded ALARA, soil removal was continued until the average concentration within each CU was less than ALARA or until a point 6 in. above groundwater level was reached.

Surface radiological surveys, also referred to as walkover radiological surveys, were conducted upon initial completion of excavation using a 2x2 in. sodium iodide gamma detector. Further excavation was performed at any locations that reported surface gamma radioactivity more than 1.5 times the background levels. Confirmation sampling locations were surveyed and identified with pin flags only after the entire CU was determined to be less than 1.5 times the background gamma radioactivity. Soil samples were then collected from predetermined sampling grid locations and were analyzed for the contaminant of concern in the CU.

The basic guidelines used for releasing the VP 9 area are detailed below. Release of the CU was unrestricted if the average U238 concentration was below the ALARA goal concentration, and if no single sample exceeded its cleanup criteria concentration. Sample results that exceeded three times the cleanup criteria, and areas larger than 25 sq m that exceeded the cleanup criteria, were further excavated and then resampled.

Both CUs in VP 9 were released for unrestricted use. All U-238 samples were less than criteria, and the average concentration in each CU was less than the ALARA goal. The ranges and averages for U-238 for each CU are listed in the following table.

Summary of Results for VP 9 Confirmation Sampling

CU	PARAMETER	ALARA GOAL/ CLEANUP CRITERIA	AVERAGE CONCENTRATION	RANGE OF CONCENTRATION
CU139	U-238	30/120 pCi/g	8.59 pCi/g	<2.57 - 33.99
CU140	U-238	30/120 pCi/g	20.9 pCi/g	3.9 - 81.12

1 INTRODUCTION

1.1 Purpose

This report details the radiological survey methods and post-remedial action confirmation results for the areas that lie within vicinity property (VP) 9 at the Weldon Spring Site Remedial Action Project (WSSRAP). VP 9 lies within the construction limits of the Work Package-461 (WP-461) area, near the Weldon Spring Quarry between the Katy Trail and the Femme Osage Slough. This area was contaminated as a result of past activities at the quarry.

Soil characterization sampling performed during remedial investigation of the VP 9 area indicated an area that exceeded the as low as reasonably achievable (ALARA) cleanup goal for U-238 stated in the *Record of Decision for Remedial Action at the Chemical Plant Area of the Weldon Spring Site* (ROD) (Ref. 1). Confirmation soil sampling was conducted following excavation of the contaminated soils and walkovers to demonstrate attainment of the cleanup standards as specified in the *Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 2).

1.2 Scope

This report covers confirmation sampling conducted on remediated areas of radiological contamination within the construction boundaries of VP 9. Soil cleanup confirmation sampling of the remediated areas, as directed in the *Confirmation Sampling Plan Details for Vicinity Property No. 9 (WP-461)* (Ref. 3), verified that the objectives of the *Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 2) were met; this ensured that remediation was accomplished to the extent required by the ROD (Ref. 1).

Radiological walkover surveys of the remediated areas were conducted by the WSSRAP Environmental Safety and Health (ES&H) Department and are reported herein.

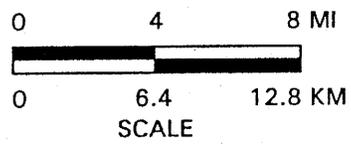
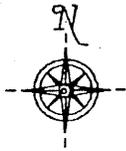
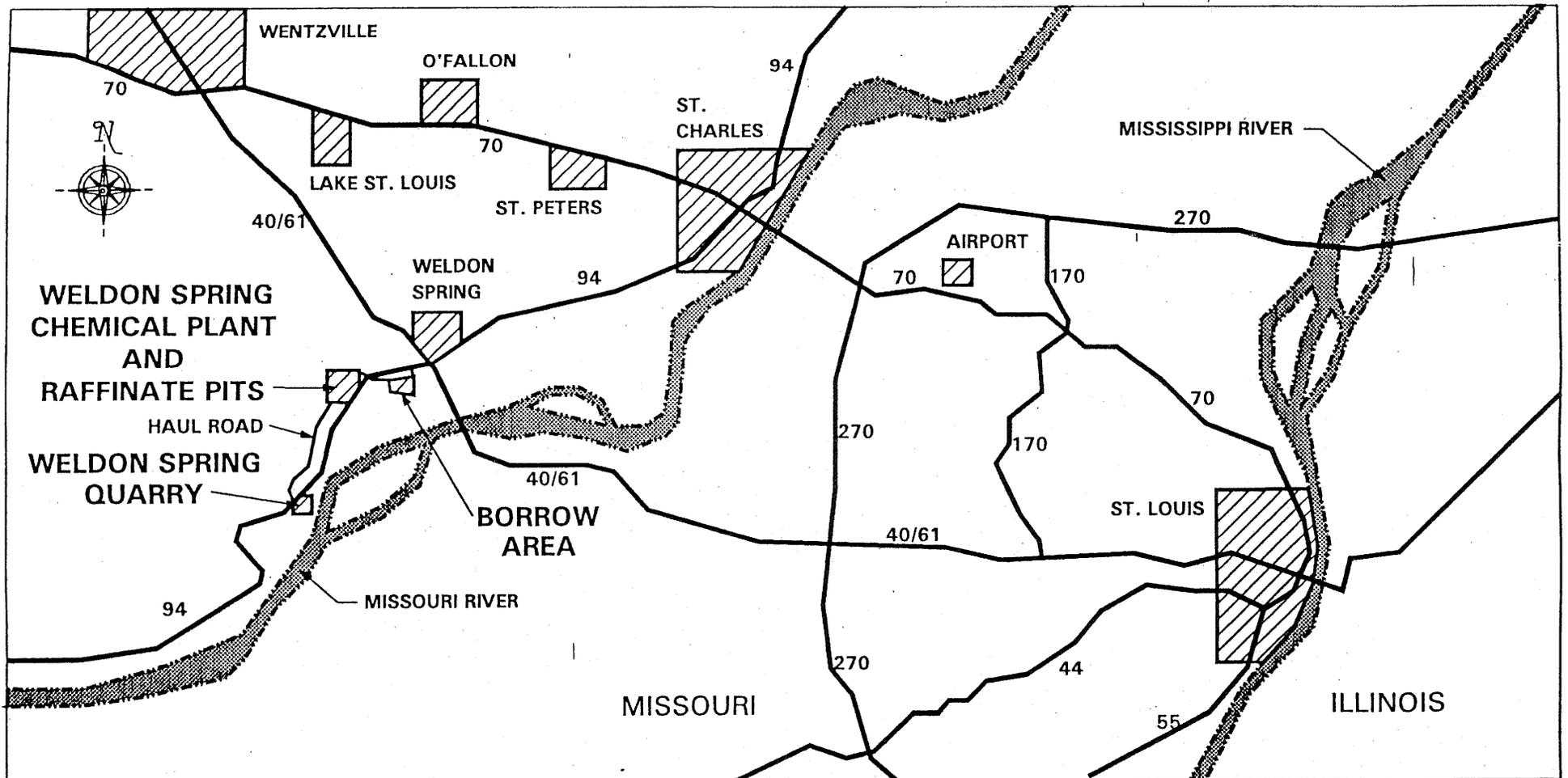
1.3 Site Description and History

The WSSRAP is located in St. Charles County, Missouri, about 48 km (30 mi) west of St. Louis on land formerly used by the U.S. Department of the Army (Army) as a trinitrotoluene (TNT) and dinitrotoluene (DNT) ordnance works (Figure 1-1). The 88-ha (217 acre) chemical plant area is located about 3.2 km (2 mi) southwest of the junction of Missouri State Route 94 and U.S. Route 40/61. The site is accessible from Missouri State Route 94 and is fenced and closed to the public.

The two communities closest to the site are Weldon Spring and Weldon Spring Heights, each about 3.2 km (2 mi) east of the site with a combined population of about 850 persons. The Francis Howell High School is located about 1 km (0.6 mi) east of the site on Missouri State Route 94. An estimated 1,770 persons are on the school campus daily during the school year. The largest city in St. Charles County is St. Charles, which is located approximately 24 km (15 mi) northeast of the site, and which has a population of more than 50,000 persons.

In April 1941, the Army acquired about 7,000 ha (17,000 acres) of land in St. Charles County, Missouri, to construct the Weldon Spring Ordnance Works. This facility produced the explosives TNT and DNT from 1941 until 1946. By 1949, all but about 810 ha (2,000 acres) of the ordnance works property had been transferred to the State of Missouri and the University of Missouri. Most of the remaining property became the chemical plant area of the Weldon Spring site and the adjacent U.S. Army Reserve and National Guard training area.

In May 1955, the U.S. Atomic Energy Commission (AEC) acquired 83 ha (205 acres) to construct a uranium feed materials plant. After extensive demolition, decontamination, and regrading, the chemical plant was built by the AEC to process uranium (U) and thorium (Th) ore concentrates from 1957 until 1966. Radioactively and chemically contaminated waste was disposed of at the site during this period. Radioactive contaminants are primarily radionuclides of the natural uranium and Th-232 decay series; chemical contaminants include heavy metals and inorganic anions in excess of naturally occurring background levels, as well as organics including polychlorinated biphenyls (PCBs) and polynuclear (or polycyclic) aromatic hydrocarbons (PAHs).



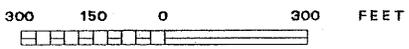
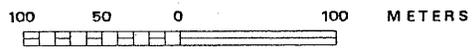
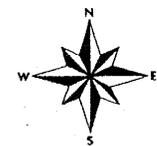
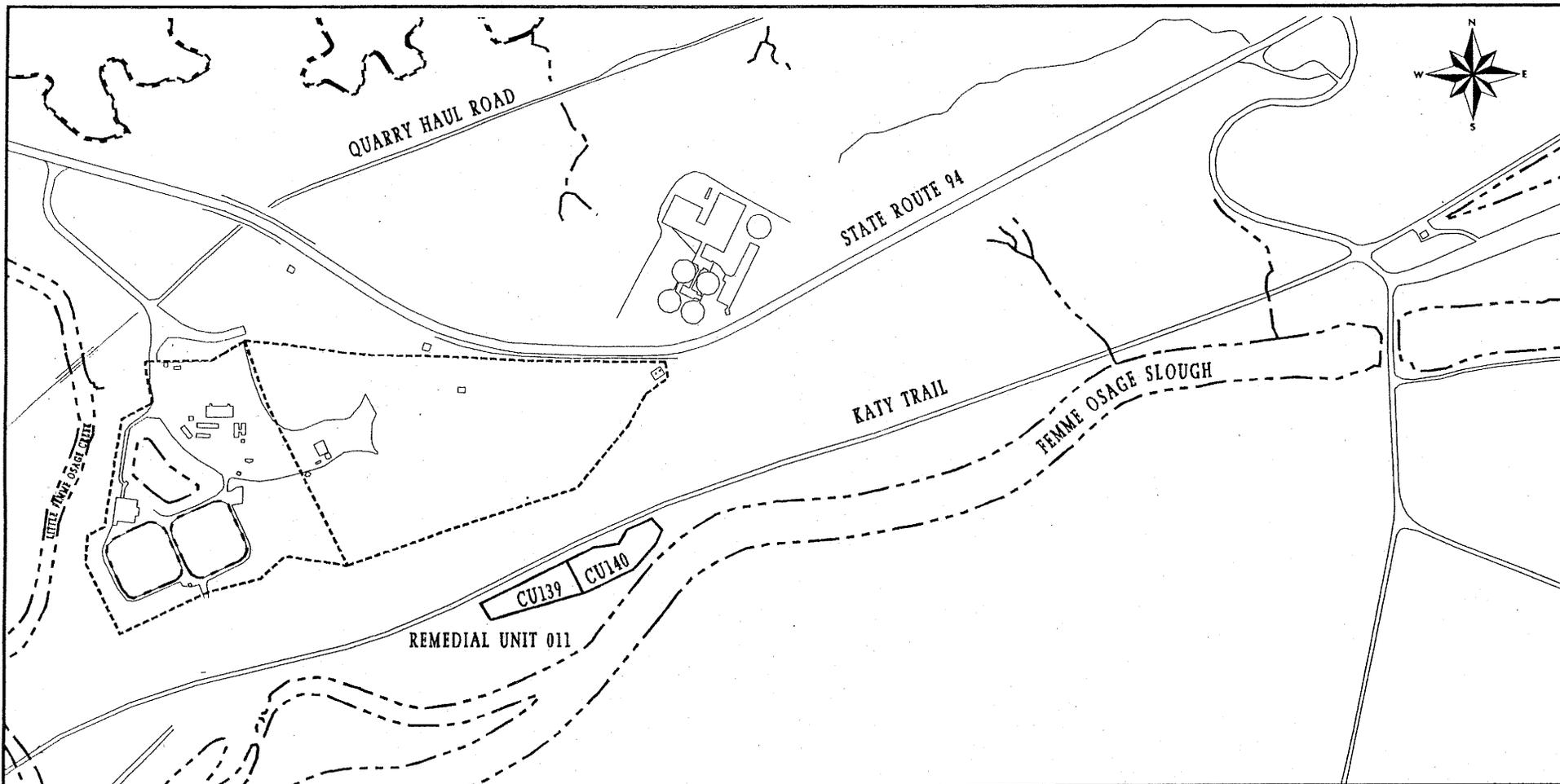
LOCATION OF THE WELDON SPRING SITE			
FIGURE 1-1			
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		DATE:	5/21/96

In 1958, the AEC acquired title to the Weldon Spring Quarry from the Army. The Army had used it since 1942 for burning wastes from the manufacture of TNT and DNT and disposal of TNT-contaminated rubble during the operation of the ordnance works. Prior to 1942, the quarry was mined for limestone aggregate used in the construction of the ordnance works. The AEC used the quarry from 1963 to 1969 as a disposal area for uranium residues and a small amount of thorium residue. Material disposed of in the quarry during this time consisted of building rubble and soils from the demolition of a uranium ore processing facility in Saint Louis. These materials were contaminated with uranium and radium. Other radioactive materials in the quarry include drummed wastes, uncontained wastes, and contaminated process equipment.

The Army reacquired the chemical plant property in 1967 and began decontamination and dismantlement operations in order to prepare the facility for herbicide production. However, this project was cancelled in 1969 before production was initiated, and the Army returned responsibility for the property to the U.S. Department of Energy (DOE), successor to the AEC.

The Weldon Spring site was placed in caretaker status from 1981 through 1985, when custody was transferred from the Army to the Department of Energy. In 1985, the DOE proposed designating control and decontamination of the chemical plant, raffinate pits, and quarry as a major project. A Project Management Contractor (PMC) for the Weldon Spring Site Remedial Action Project was selected in February 1986. The quarry was placed on the Environmental Protection Agency National Priorities List (NPL) in July 1987. The DOE redesignated the site as a Major Acquisition System in May 1988. The chemical plant and raffinate pits was added to the NPL in March 1989.

The VP 9 area was contaminated as a part of past activities at the quarry. This area was originally identified as a vicinity property by Oak Ridge Associated Universities (ORAU) in 1986. Soil characterization of the VP 9 area was conducted by UNC Geotech in 1988, and the results are presented in the *Radiologic Characterization of the Weldon Spring, Missouri, Remedial Action Site* (Ref. 4). Based upon the UNC results, additional characterization sampling was conducted under the *Quarry Residuals Sampling Plan* (Ref. 5). Results from this additional characterization sampling are presented in Appendix B of the *Confirmation Sampling Plan Details for Vicinity Property No. 9 (WP-461)* (Ref. 3). These data show that only U-238



-  Quarry Fence
-  Surface Hydrology
-  Roads, Structures
-  Remedial Unit Boundary

**LOCATION OF REMEDIAL UNIT 011
IN THE QUARRY AREA**

Figure: 1-2

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exceeded the cleanup standards established in the *Record of Decision* (ROD) (Ref. 1). The area that was remediated based upon the characterization results, is shown in Figure 1-2 and was designated as Remedial Unit (RU) 011. Contaminated soils were removed and the area was backfilled with clean soil.

1.4 Remediation and Confirmation Process

Remediation of VP 9 entailed excavation of contaminated soils to depths identified in the work package.

After the contaminated soils were removed, the areas were walked over with a NaI 2x2 gamma detector prior to soil sample collection. Confirmation sampling of the soil remaining after completion of excavation is required to statistically verify that the area has been effectively remediated within predetermined confidence levels. Confirmation sampling of the chemical plant remedial activities was done in compliance with the *Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 2), which presents the methods by which the success of remedial action will be statistically determined. In summary, the sampling was conducted to ensure that the mean concentration of each applicable contaminant in a confirmation unit (CU) was less than the ALARA goal at a specified level of confidence. The desired false positive rate, or the chance that the CU actually has an average concentration of contaminated soil above the cleanup criteria (when the data indicate that the average concentration is below the cleanup criteria) is 5%; the desired false negative rate, or the chance that the CU actually has an average concentration of a contaminant below the cleanup criteria (when the data indicate that the average concentration is above the cleanup criteria) is 20%.

The *Confirmation Sampling Plan Details for Vicinity Property No. 9 (WP-461)* (Ref. 3) provides detailed information for collection of confirmation samples at VP 9 i.e., sampling locations and required analyses.

The contaminated soil removal at VP 9 was designed according to site conditions and analysis detailed in the ALARA position paper in *WSSRAP Vicinity Property - MDOC #9 Remediation ALARA Position Paper* (Ref. 6). This area, located in the floodplain of the Missouri River, is often inundated for varying periods by the Femme Osage Slough and/or the Missouri River.

The area was cleared, grubbed, and the upper 12 in. of soil was removed across both confirmation units. According to the characterization data, this action was anticipated to result in the removal of all U-238 contamination that exceeded criteria and much that exceeded ALARA. In those areas where U-238 concentrations still exceeded ALARA, soil removal was continued until the average concentration within each CU was less than ALARA or until a point 6 in. above groundwater level was reached. The excavation soils were staged at the Ash Pond staging area until construction of the disposal cell.

Disposition of each CU was conducted in accordance with ES&H Procedure 1.2.1, *Soil Remediation Disposition Process*. A CU is released for unrestricted use if the average concentration or specific activity for each contaminant of concern within the CU is less than the appropriate ALARA goal, and if no single location has a result above criteria. Areas with contaminant concentrations greater than three times the criteria level, or greater than criteria and larger in area than 25 sq m, were further excavated. Areas smaller than 25 sq m, with concentrations between one- and three-times criteria, were further excavated if the result exceeded the calculated concentration from the hot spot formula.

1.4.1 Remediation Guidelines

Remediation of each CU was conducted in accordance with the work package design. The engineering characterization data collected across the site at various depths were used to estimate concentration contours on site maps. Geochemical modeling was used to plot the data on site maps. This modeling showed that the only contaminant of concern that exceeded the ALARA goals for RU011 was U-238.

After the specified depth of soil had been removed, further excavation was only conducted if either the radiological survey indicated activity more than 1.5 times background or if directed by the ALARA committee because of confirmation soil sample results.

1.4.1.1 Soils Cleanup Guidelines. The chemical plant ROD (Ref. 1) established two different sets of cleanup standards; protective risk-based cleanup criteria, and more restrictive ALARA goals. The intent of remediation is to meet the ALARA goals. As such, remediation has been designed to remove soils where contaminant concentrations are in excess of the ALARA goals established in the ROD (Ref. 1). Table 1-1 presents the cleanup criteria

and ALARA goals for U-238 applied to the Weldon Spring Chemical Plant area. There are different standards for surface and subsurface contamination. Values listed in Table 1-1 include background levels.

1.4.2 Survey Procedures

Walkover radiological surveys using a Ludlum 44-10 (2x2 sodium iodide) gamma radiation detector were conducted in accordance with ES&H Procedure 2.6.2, *Calibration and Use of Ludlum Model 2220 Scalar and the Model 44-10-2 (2x2 NaI) Detector*, after remedial excavation activities were completed in a CU. Any areas in the CU determined to have elevated (> 1.5 times background) direct gamma radiation readings were further excavated. The confirmation sampling locations were only surveyed and staked after the area had been fully gamma surveyed to meet these criteria.

TABLE 1-1 Uranium-238 Cleanup Standards

RADIONUCLIDE (pCi/g)	SURFACE ^(a)		SUBSURFACE ^(b)	
	ALARA	CRITERIA	ALARA	CRITERIA
Uranium-238	30.0	120	30	120

(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.), unless otherwise noted.

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

The sampling locations defined in the *Confirmation Sampling Plan Details for Vicinity Property No. 9 (WP-461)* (Ref. 3) were surveyed and staked using the radial staking survey method. Pin flags marked with the appropriate location code were placed in the survey location. The pin flags were left in place until collection of all confirmation soil sampling was complete and results were obtained from the laboratories.

1.4.3 Preliminary Data For Disposition

In accordance with ES&H Procedure 1.2.1, preliminary data received from the on-site laboratory were used to calculate the average contaminant concentrations and to determine whether any sample location exceeded the cleanup criteria.

1.4.4 Laboratory Services

The WSSRAP on-site radiological laboratory analyzed the soil samples for U-238. The on-site radiological laboratory complies with the *Project Management Contractor Quality Assurance Program* (Ref. 7) and *On-Site Radiological Laboratory Operational and Quality Assurance (QA) Plan* (Ref. 8). U-238 was analyzed by direct count using gamma spectroscopy.

1.5 Overview of Work Package Progression and Special Circumstances

Excavation of the VP 9 area (RU011) commenced on January 12, 1996, and was completed on February 15, 1996. Confirmation sampling of the CUs was conducted in January and February of 1996. Final disposition of all CUs in VP 9 was completed on February 16, 1996.

2 PRE-REMEDIAL ACTIVITIES

Engineering characterization data were collected to aid in the development of a remedial design. These soil samples were collected at various depths.

2.1 Review of Characterization Data

The engineering characterization data were used to estimate concentration contours for Vicinity Property 9 (VP 9). The engineering characterization data and the concentration contours indicated that U-238 exceeding the As Low As Reasonably Achievable (ALARA) goal of 30 pCi/g was found in the surface soils in VP 9. Engineering characterization data for VP 9 did not indicate other contaminants of concern present above *Record of Decision* (ROD) cleanup standards (Ref. 1). Therefore, no other analyses were required.

2.2 Contaminants of Concern for the Work Package

As indicated above, the only radiological contaminant of concern for VP 9 was U-238, which was found during the engineering characterization studies in levels above the cleanup criteria at all confirmation units (CUs).

2.3 Assumptions Used to Develop the Confirmation Plan

For development of the confirmation plan, it was assumed that the engineering characterization soil samples adequately determined the areas of contamination, the concentrations, and the depth of contamination. This information, which was reflected on contaminant contour maps, was then used to determine the boundaries of each CU. Sample locations were selected by superimposing a 10 m grid across the WP-461 work zone. All grid line intersections (nodes), and some center points located within the area targeted for contaminated soil removal, were selected for sampling.

3 REMEDIAL ACTIVITIES

3.1 Pre-Excavation Activities

No pre-excavation activities were required for Vicinity Property 9 (VP 9). Because of the influence of local surface water bodies and shallow groundwater on the feasibility of excavation activities, the timing of the excavation activities was selected to maximize safe access to soils in the VP 9 area.

3.2 Excavation Activities

Remediation of VP 9 included the excavation of soil to the depth defined in the work package, plus additional excavation based upon the radiological walkover surveys. Surveys of the excavation were conducted using a 2x2 NaI gamma detector. The surveys were performed upon completion of excavation activities to determine whether areas with elevated gamma readings remained. These walkover surveys were conducted over each confirmation unit, in accordance with ES&H 2.6.2, *Calibration and Use of Ludlum Model 2220 Scalar and the Model 44-10-2 (2x2 NaI) Detector*. Any area exceeding 1.5 times background activity was excavated until the background activity fell below this criteria. Once these walkover surveys were completed, soil sample collection began.

No areas with elevated gamma reading were identified in CU139. Three areas were identified in confirmation unit (CU) 140. The locations were near the SC-14011-S, SC-14013-S, and SC-14015-S grid locations (see Appendix A). Excavation was continued for three additional feet near Grid Location SC-14013-S. The two other grid location areas were excavated to the capillary fringe. Samples were collected from the hot spot areas following the additional excavation and included with the confirmation data set for CU140. These results are presented in Appendix A.

No building foundations, utilities, or other potentially-contaminated materials were located within VP 9.

Final excavation depths ranged from 1 ft to 4 ft in CU 139 and from 1 ft to the capillary fringe (approximately 5 ft to 6 ft) in CU 140. Approximately 4,450 cu yd of uncompacted soil

were removed from RU011. The contaminated soil was staged at Ash Pond, awaiting final placement in the disposal cell.

3.4 Post-Excavation Activities

A portion of CU140 (zone 1) was addressed in a partial release to provide an alternate route for transporting backfill to the site during excavation activities. The partial release was requested to minimize the time the excavation was left open such that the volume of run-on (requiring treatment) would be minimized. The area denoted as Zone 1 was released for unrestricted use on January 30, 1996. This release was permitted based on Zone 1 sampling data and comparison of the data to criteria outlined in the *Chemical Area Cleanup Attainment Confirmation Plan* (Ref 2). The entire CU was released for unrestricted use on February 13, 1996. All confirmation sampling data were used in the later assessment for the release of the entire CU140. Both the partial release and full release disposition forms are included in Appendix A.

No other post-excavation activities were required for VP 9. All confirmation sampling results permitted unrestricted release of each CU without further excavation.

4 CONFIRMATION ACTIVITIES

Following remediation, *Confirmation Sampling Plan Details for Vicinity Property No. 9* (Ref. 3) dictated field activities for the confirmation units. All remedial action surveys were conducted and documented in accordance with Weldon Spring Site Remedial Action Project (WSSRAP) Environmental Safety and Health (ES&H) procedures. The applicable procedures were as follows:

- ES&H 2.3.8 *Contamination Survey*
- ES&H 2.5.1 *Radiological Soil Sampling*
- ES&H 2.5.2 *In Situ Radiation Measurements*
- ES&H 2.5.5 *Sample Preparation Procedure for Radiological Soil Samples*
- ES&H 2.6.1 *Alpha Detector Calibration and Operational Check*
- ES&H 2.6.2 *Calibration and Use of Ludlum Model 2220 Scalar and the Model 44-10-2 (2x2 NaI) Detector*
- ES&H 2.6.3 *GM Detector Calibration, Operation, and Usage*
- ES&H 2.6.4 *Ludlum Model 2000 Scaler and Model 43-10 Detector: Gross Alpha Measurement Operation and Calibration*
- ES&H 2.6.9 *Instructions for Calibration and Operation of the High Purity Germanium Detector*
- ES&H 4.1.3 *Sampling Equipment Decontamination*
- ES&H 4.4.1 *Numbering System for Environmental Samples*
- ES&H 4.4.5 *Soil/Sediment Sampling*

4.1 Walkover Surveys

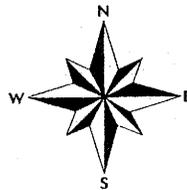
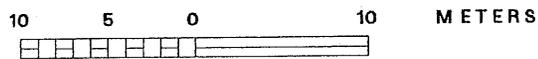
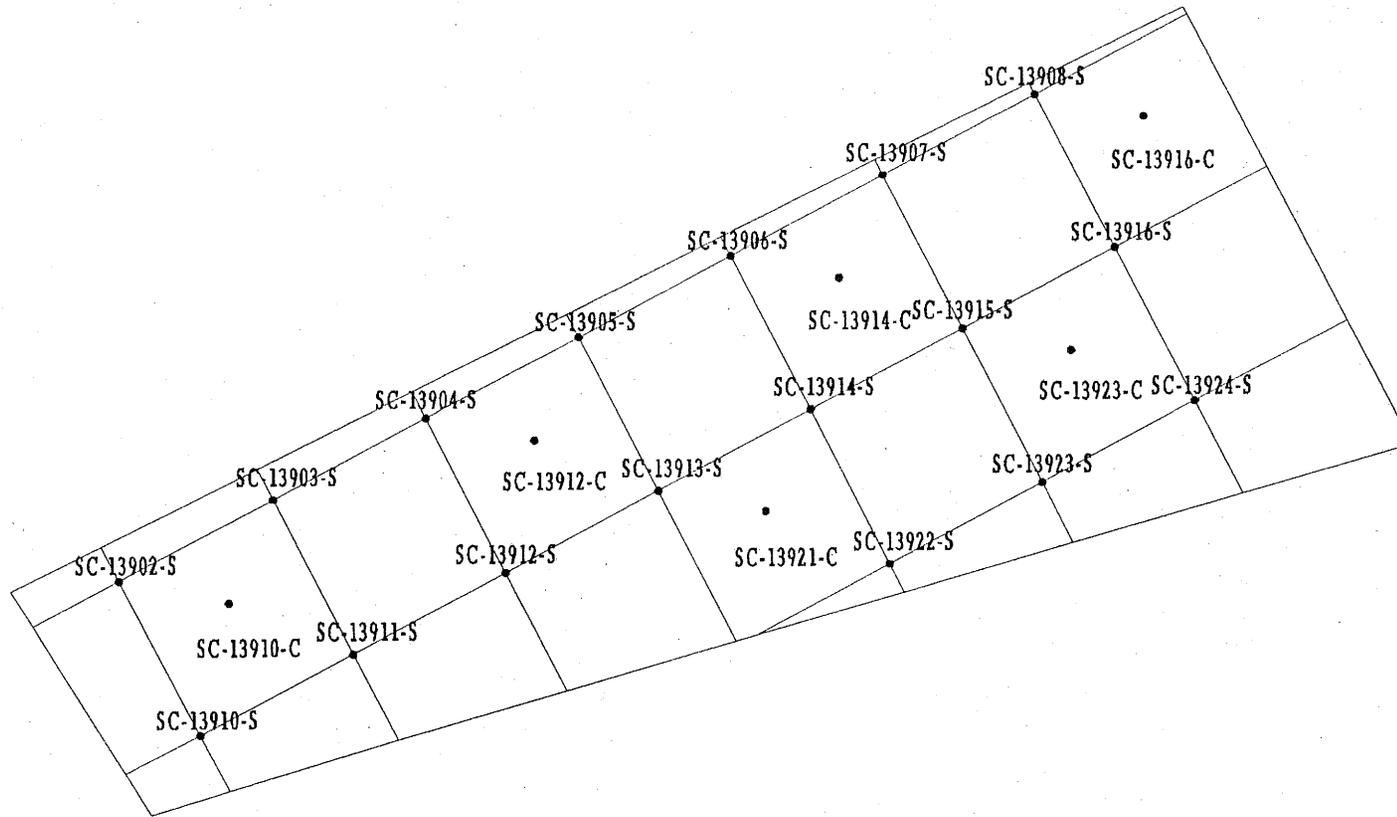
Portable 2x2 sodium iodide (NaI) gamma detectors were used to measure qualitative surface radioactivity as identified in Section 3.3. Walkovers were performed with the instrument probe close to the ground. Surface scans were conducted over each confirmation unit (CU), in accordance with the procedures in ES&H 2.6.2, *Calibration and Use of Ludlum Model 2220 Scalar and the Model 44-10-2 (2x2 NaI) Detector*. As discussed in Section 3.3, any area exceeding 1.5 times background was further excavated. Sample location surveying and sample collection proceeded only after all areas within a confirmation unit (CU) reported surface gamma radioactivity below this level.

Gamma radiation measurements were collected at background locations with a 2X2 sodium iodide (NaI) detector. The surface NaI background gamma radiation levels ranged between 8,000 cpm and 10,000 cpm.

4.2 Soil Confirmation Sample Results

Figures 4-1 and 4-2 present the sample locations for CUs 139 and 140, respectively. There were no significant deviations from the *Confirmation Sampling Plan Details for Vicinity Property No. 9* (Ref. 3) during the execution of this plan, and all locations were sampled in accordance with the plan.

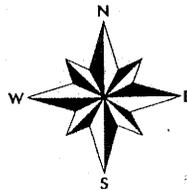
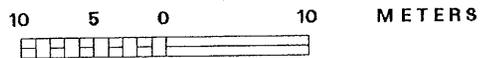
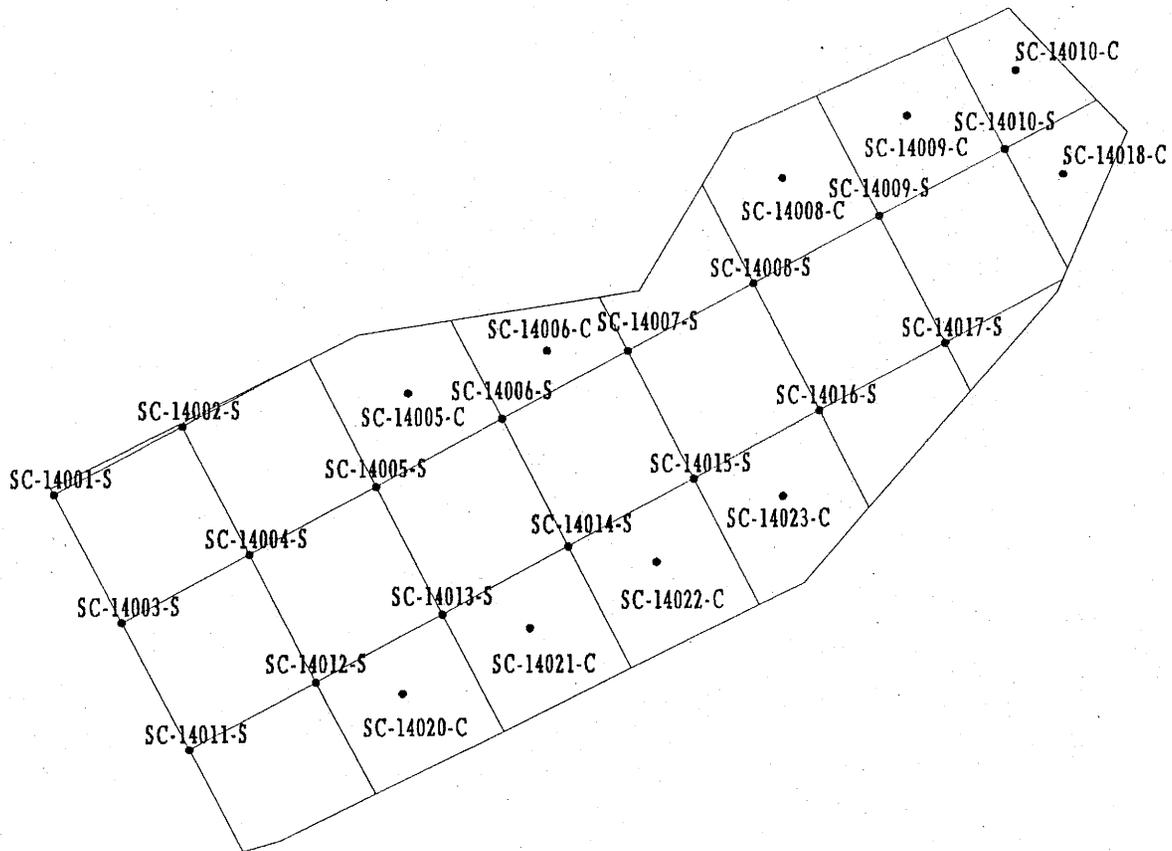
Table 4-1 shows the average U-238 concentration and the range of concentration for each CU. Copies of the disposition packets, including the disposition form and sample results, are included in Appendix A.



Sample Locations in Remedial Unit RU011
Confirmation Unit CU139

Figure 4-1

EXHIBIT NO.: A/QY/042/1295		REPORT NO.: DOE/OR/21548-685	
ORIGINATOR: MGL	DRAWN BY: LGB	DATE: 3/97	



Sample Locations in Remedial Unit RU011
Confirmation Unit CU140

Figure 4-2

EXHIBIT NO.: A/QY/043/1295		REPORT NO.: DOE/OR/21548-685	
ORIGINATOR: MGL	DRAWN BY: LGB	DATE: 3/97	

TABLE 4-1 Uranium-238 Specific Activity in VP 9

CONFIRMATION UNIT	U-238 ALARA GOAL/SURFACE CLEANUP CRITERIA	AVERAGE U-238 CONCENTRATION	RANGE OF U-238 CONCENTRATIONS
CU139	30 / 120 pCi/g	8.59 pCi/g	<2.57 - 33.99 pCi/g
CU140	30 / 120 pCi/g	20.9 pCi/g	3.9 - 81.12 pCi/g

4.3 Data Evaluation

Data evaluation was performed on VP 9 analytical data to determine whether data quality objectives developed for the WSSRAP were met, and to ensure overall data quality results were generated from RU011 remedial activities. The data evaluation process was completed through data verification and data review activities as stated in *the Chemical Plant Area Cleanup Attainment Confirmation Plan* (Ref. 2). These activities pertinent to VP 9 are summarized below.

4.3.1 Data Verification

Data verification was conducted to ensure that documentation and data were reported in compliance with established reporting requirements and standard operating procedures (SOPs), and to ensure that all planned analyses were performed. All sample analytical results received from the laboratory were reviewed to verify that the 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 form data, data review laboratory tracking, data reporting requirements, and the database transfer operations.

The final data verification packages were received within 30 days of sample delivery to the laboratory.

4.3.2 Data Review

The data were reviewed to ensure the data were properly identified, analyzed, reported and met data quality requirements (DQRs).

Specific DQRs for the WSSRAP were developed according to U.S. Environmental Protection Agency (EPA) guidance. Quality control sample results were compared to DQR goals to assess the precision and accuracy of the data and to identify samples which may require further validation activities.

4.3.2.1 Precision. Precision is a measurement, expressed as a percentage, which represents the repeatability of the result by the analytical system. This measurement is based on the relative percent differences (RPDs) between laboratory duplicates and their respective parent analysis. Zero percent precision is the best precision. The RPD is calculated using the following formula:

$$\text{RPD} = | \text{PA} - \text{DU} | / ((\text{PA} + \text{DU}) / 2) * 100$$

where:

PA = respective parent analysis

DU = duplicate analysis

RPDs were evaluated in a similar manner to evaluate the precision of field replicate analyses (FR) to parent analyses (PA).

As the analytical concentration approaches the detection limit for a given parameter, the confidence levels decreases. For this reason, the RPD is generally only calculated for those analyses where both the parent and comparison sample analysis results are greater than five times the detection limit.

Due to the chemical properties of radionuclides, the calculated RPD has a greater variance compared to that of nonradionuclides. To assist in evaluating the precision in radionuclides, the duplicate error ratio (DER) is also calculated. A zero value for DER is the best precision. The DER is calculated using the following formula:

$$\text{DER} = | \text{PA-DU} | / (2\sigma_p + 2\sigma_d)$$

where:

PA=respective parent analysis

DU=duplicate analysis

$2\sigma_p$ =parent analysis (2 sigma) uncertainty

$2\sigma_d$ =duplicate analysis (2 sigma) uncertainty

Five duplicate soil samples and one field replicate soil sample were collected to assess the precision of the VP 9 data set. Field replicate samples are similar to duplicate (split) soil samples, except they also incorporate environmental variability measurement through collection of the soil sample at a location immediately adjacent to the parent sample.

No secondary duplicate samples (samples submitted to a secondary laboratory) were collected in conjunction with the VP 9 sampling activities.

RPD and DER values were calculated for the duplicate samples and field replicate samples. These RPD and DER values are presented in Appendix B, Table B-1. The DQR precision goals for the analytical data are presented in Appendix C, Table C-1. Summary tables for precision are presented in Appendix C, Tables C-2 and C-3. As shown in Tables C-2 and C-3, the DQR goals for precision were met for VP 9.

4.3.2.2 Accuracy. Accuracy is a statistical measurement, expressed as a percentage, which represents how close the analytical data are to the "true" value. The measurement is based on the present recoveries (RECs) associated with the laboratory analytical matrix spikes. The best accuracy is 100%.

No matrix spike samples were collected during sampling activities for VP 9. Matrix spike samples were collected during sampling activities associated with Work Package (WP) 253 to satisfy the overall quality program requirements for accuracy.

Accuracy goals for analytical data are presented in Appendix C, Table C-1. The DQRs for accuracy were met for VP 9. Documentation of attainment of the accuracy goals was

included in the data verification package for the on-site laboratory, Laboratory Requests 48 through 52 and 54.

4.3.2.3 Potential Cross Contamination. Two equipment blank samples were submitted with samples collected from VP 9 to check for potential cross contamination due to field and laboratory procedures. No contamination was detected in either of these samples. Therefore, the reported U-238 data was viewed as representative of the media sampled.

4.4 ORISE Verification

The Oak Ridge Institute for Science and Education (ORISE) was contracted by the U.S. Department of Energy to audit the confirmation soil sampling in the chemical plant area of the Weldon Spring site. This audit included walkover radiological surveys and independent collection and analysis of soil samples to verify proper disposition of the CUs. The surveys and sampling were conducted in accordance with ORISE's *Final Verification Survey Plan for the Chemical Plant Area* (Ref. 9).

4.4.1 Walkover Surveys

ORISE conducted radiological walkover surveys on the western portion of CU 140 using a 1.25 in. x 1.5 in. NaI detector. The walkover surveys conducted by ORISE found no elevated direct gamma radiation and confirmed the results obtained by WSSRAP personnel.

4.4.2 Soil Samples

ORISE collected soil samples at random from co-located sample points and also analyzed a portion of WSSRAP archived samples. These samples verified the results obtained for disposition of the CU. Sample collection procedures and analysis were similar to those used by the WSSRAP. ORISE sample results ranged between 3.8 pCi/g to 43.4 pCi/g.

All data from the ORISE samples confirmed the results of the WSSRAP sampling.

4.4.3 ORISE's Disposition of Area

In response to the verification sampling results, ORISE drafted correspondence titled, *Letter Report-Verification Survey of Vicinity Property No. 9, Remedial Unit 001 (Work Package 461), Weldon Spring Site Remedial Action Project, St. Charles County, Missouri*, dated April 1996 (Ref. 10). Verification surveys were conducted within each of the CUs as well as in other areas within the WP461 area. This ORISE letter report "verifies the PMCs findings that remedial action objectives for these areas have been met (Ref. 10)."

5 WORK PACKAGE DISPOSITION

5.1 Confirmation Units Released For Unrestricted Use

All of the confirmation units (CUs) in Vicinity Property (VP) 9 met the requirements for unrestricted use. The disposition packet for each CU in VP 9 is included in Appendix A.

5.2 Future Confirmation

No other areas within the WP461 work zone are scheduled for remediation.

5.3 Summary of Chemical Plant Confirmation Results

To meet the requirements of the *Record of Decision* (Ref. 1), more than 50% of the results for each parameter must be less than the As Low As Reasonably Achievable (ALARA) goal. Table 5-1 summarizes the cumulative results to date. This table includes results from WP-399, WP-420 (RU6), and VP 9.

TABLE 5-1 Cumulative Confirmation Results

CONTAMINANT	NUMBER OF SAMPLES	MINIMUM CONCENTRATION	MAXIMUM CONCENTRATION	AVERAGE CONCENTRATION	SAMPLES GREATER THAN ALARA
Arsenic (mg/kg)	332	0.97	21.10	6.78	0
Chromium (mg/kg)	314	7.10	41.60	17.82	0
Lead (mg/kg)	420	5.40	433	16.54	1
PAH (mg/kg)	35	ND	2.46	0.88	14
PCB (mg/kg)	466	ND	2.20	0.02	4
Ra-226 (pCi/g)	455	0.37	2.24	1.36	0
Ra-228 (pCi/g)	464	0.46	6.60	1.28	1
Combined Radium	NA	0.97	8.84	2.65	2
Th-230 (pCi/g)	456	0.09	23.10	1.75	3

TABLE 5-1 Cumulative Confirmation Results (Continued)

Th-232 (pCi/g)	465	0.46	6.60	1.29	1
Thallium (mg/kg)	87	0.12	2.20	0.68	0
TNT	0	NA	NA	NA	NA
U-238 (pCi/g)	855	0.4	196	4.4	16

ND Non Detect

NA Not analyzed, no TNT analyses collected to date.

5.4 Comparison of Standard Deviations

This section presents a comparison of the estimated standard deviations calculated following EPA guidance and presented in the *Attainment Plan* with those deviations calculated using confirmation results. Since there were no existing remediation data available to calculate the standard deviation (sigma), the *Attainment Plan* 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 had been obtained, a comparison was made between the estimated sigma and the calculated sigma using the RU11 results, and cumulative results to date.

The comparison indicated that the specified level of precision (a false positive = 0.05 and a false negative = 0.20) had been obtained. With one exception Th-230, all of the calculated sigmas were less than the estimated sigmas, indicating that the minimum specified precision was met in these contaminants. Table 5-2 presents the estimated sigma and calculated sigmas for each contaminant of concern (COC).

The calculated cumulative Th-230 sigma exceeded the estimated sigma. One hot spot area used subsurface criteria in WP-420 (RU6); therefore, the estimated standard deviation (sigma) was recalculated using subsurface criteria. The recalculated estimated Th-230 sigma is 2.7. The cumulative sigma for Th-230 is below the subsurface criteria sigma.

TABLE 5-2 Comparison of Standard Deviations

COC	ESTIMATED SIGMA ^(a)	RU11 SIGMA ^(b)	CUMULATIVE SIGMA ^(c)
Arsenic	12.5	N/A	2.90
Chromium	18.3	N/A	6.14
Lead	75	N/A	22.86
Thallium	3.3	N/A	0.64
PAHs	0.93	N/A	0.76
PCBs	1.33	N/A	0.14
TNT	23.3	N/A	N/A
Ra-226	1.03	N/A	0.20
Ra-228	1.03	N/A	0.39
Th-230	1.03/2.7 ^(d)	N/A	1.31
Th-232	1.03	N/A	0.39
U-238	20	14.68	10.95

(a) Sigma estimated in the *Attainment Plan* (Ref. 2).

(b) Sigma calculated using only the RU6 confirmation results.

(c) Sigma calculated using cumulative confirmation results (WP-399, WP-420 RU6 and WP-461).

(d) Estimated sigma using subsurface criteria.

N/A Not applicable.

6 REFERENCES

1. U.S. 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 Company 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 Operations Office. St. Charles, MO. December 1995.
3. MK-Ferguson Company and Jacobs Engineering Group. *Confirmation Sampling Plan Details for Vicinity Property No. 9 (WP-461)*. Rev. 0. DOE/OR/21548-598. Prepared for the U. S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. December 1995.
4. Marutzky, S.J., R. Colby, and L.S. Cahn. *Radiologic Characterization of the Weldon Spring, Missouri, Remedial Action Site*, DOE/ID/12548-22. Prepared for the U.S. Department of Energy, by UNC Geotech. Grand Junction, CO. February 1988.
5. MK-Ferguson Company and Jacobs Engineering Group. *Quarry Residuals Sampling Plan*, Rev. 1. DOE/OR/21548-382. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. January 1994.
6. MK-Environmental Services. *WSSRAP Vicinity Property - MDOC #9 Remediation ALARA Position Paper*. Rev. 0. Technical Memorandum No. 3840 TM-6001-0. Prepared for M-K Ferguson Group, St. Charles, MO. January 1996.
7. MK-Ferguson Company and Jacobs Engineering Group. *Project Management Contractor Quality Assurance Program*, Rev. 2. DOE/OR/21548-333. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. December 1995.

8. MK-Ferguson Company and Jacobs Engineering Group. *On-Site Radiological Laboratory Operational and Quality Assurance Plan*. Rev. 0. DOE/OR/21548-593. Prepared for the U. S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. November 1996.
9. Oak Ridge Institute for Science and Education, Environmental Survey and Site Assessment Program, Energy/Environment Systems Division. *Final Verification Survey Plan for the Chemical Plant Area, Weldon Spring Site Remedial Action Project, Weldon Spring, Missouri*. Prepared for the U.S. Department of Energy, Oak Ridge Operations Office. St. Charles, MO. December 7, 1995.
10. Oak Ridge Institute for Science and Education. *Letter Report - Verification Survey of Vicinity Property 9 Remedial Unit 011 (Work Package-461)*. Weldon Spring Site Remedial Action Project, St. Charles, Missouri. April 1996.

RELATED DOCUMENTS

MK-Ferguson Company and Jacobs Engineering Group. *Remedial Investigation for the Chemical Plant Area of the Weldon Spring Site*, Rev. 0, 2 Vols. DOE/OR/21548-074. Prepared for the U.S. Department of Energy, Oak Ridge Field Office, Weldon Spring Site Remedial Action Project. St. Charles, MO. November 1992.

U.S. Department of Energy. *Proposed Plan for Remedial Action at the Chemical Plant Area of the Weldon Spring Site*. DOE/OR/21548-160. November 1992.

PROCEDURES

- ES&H 1.2.1 *Disposition of CUs*
- ES&H 2.3.8 *Contamination Survey*
- ES&H 2.5.1 *Radiological Soil Sampling*
- ES&H 2.5.2 *In Situ Radiation Measurements*
- ES&H 2.5.5 *Sample Preparation Procedure for Radiological Soil Samples*
- ES&H 2.5.8 *Th-230 Determinations in Soils by the UNC Method*
- ES&H 2.6.1 *Alpha Detector Calibration and Operational Check*

-
- ES&H 2.6.2 *Calibration and Use of Ludlum Model 2220 Scalar and the Model 44-10-2 (2x2 NaI) Detector*
- ES&H 2.6.3 *GM Detector Calibration, Operation, and Usage*
- ES&H 2.6.4 *Ludlum Model 2000 Scalar and Model 43-10 Detector: Gross Alpha Measurement Operation and Calibration*
- ES&H 2.6.9 *Instructions for Calibration and Operation of the High Purity Germanium Detector*

DOE ORDERS

- 5400.5 *Radiation Protection of the Public and the Environment*

APPENDIX A
Disposition Packets with Data

SOIL CONFIRMATION REMEDIATION DISPOSITION FORM

SECTION I

1. Work Package Number: WP461 2. Date: 02/16/96 3. Review Form #: 96-002
 4. Remediation Unit Number: RU011 5. Confirmation Unit Number: CU139 (map attached)
 6. Contaminants of Concern: X U-238 _____ Th-230 _____ Th-232 _____ Ra-226 _____ Ra-228
 _____ TNT _____ PCB _____ PAH _____ As _____ Cr _____ Pb _____ Tl

7. Results average below ALARA goal(s)? [U238] = 8.59pCi/g Yes _____ No
 8. All results below cleanup criteria? Yes _____ No
 9. Any results greater than 3X criteria? _____ Yes No
 10. Hotspots present (less than 3X criteria)? _____ Yes No

Parameter	Size	Concentration	Complies with Plan?
_____	_____	_____	_____ Yes _____ No
_____	_____	_____	_____ Yes _____ No
_____	_____	_____	_____ Yes _____ No
_____	_____	_____	_____ Yes _____ No

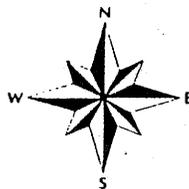
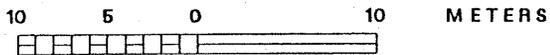
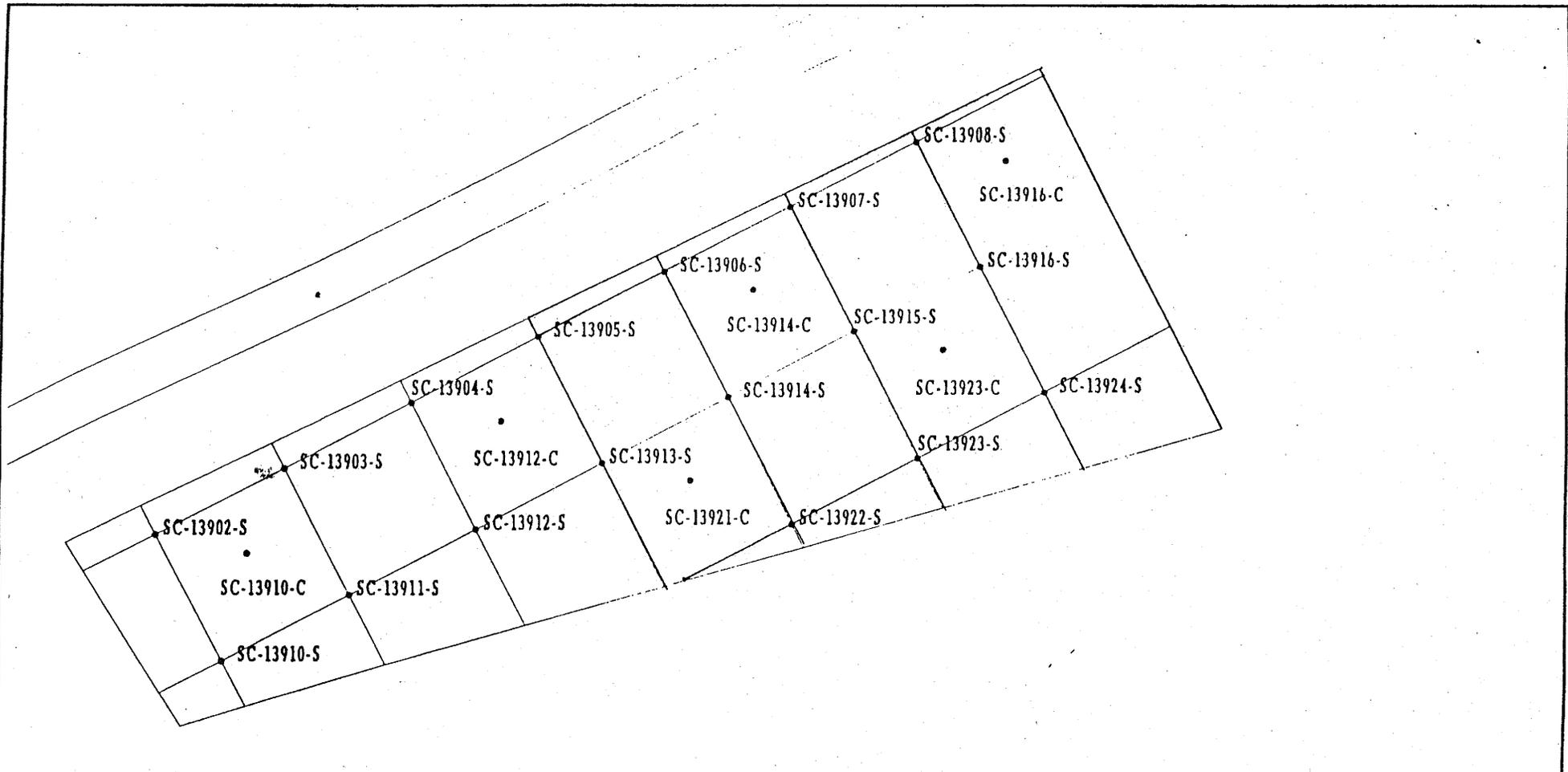
11. Reviewer: James A. Stein Date: 2/16/96

12. Reviewer Disposition Recommendation: Release for Unrestricted Use (Section II)
 _____ Additional Excavation Required (Section IV)
 _____ ALARA Committee Required (Section III)

SECTION II *Results are ALARA. CU is released for unrestricted use.*

14. ES&H Manager: D. Meyer Date: 2/16/96
 15. DOE Project Manager/Engineer: Thomas C. Pawley Date: 2/16/96
 16. Project Manager: Steve V. Vetter Date: 2-16-96
 17. Construction Engineer: MTM Date: 2/16/96

SEE ATTACHED RESULTS AND MAP



Sample Locations in Remedial Unit RU011
Confirmation Unit CU139

Figure 2-1

EXHIBIT NO.: A/QY/042/1295	REPORT NO.: DOE/OR/21548-598
ORIGINATOR: MGL	DRAWN BY: WSSRAP GIS DATE: 12/95

Review Form #96-002
07/16/01

VICINITY PROPERTY #9
Soil Confirmation Results for CU139

WSSRAP_ID	DATE SAMPLED	PARAMETER	CONCENTRATION	UNITS	DL	COMMENTS
SC-13902-S	02/15/96	U-238	8.45	pCi/g	5.00	none
SC-13903-S	02/15/96	U-238	2.96	pCi/g	4.36	none
SC-13904-S	02/15/96	U-238	ND	pCi/g	4.11	none
SC-13905-S	02/13/96	U-238	10.38	pCi/g	4.77	none
SC-13906-S	02/13/96	U-238	ND	pCi/g	4.39	none
SC-13907-S	02/13/96	U-238	ND	pCi/g	4.35	none
SC-13908-S	02/13/96	U-238	ND	pCi/g	2.57	none
SC-13910-C	02/15/96	U-238	33.99	pCi/g	7.02	Exceeds ALARA
SC-13910-S	02/15/96	U-238	5.09	pCi/g	2.43	none
SC-13911-C	02/15/96	U-238	11.54	pCi/g	4.28	none
SC-13912-C	02/15/96	U-238	4.56	pCi/g	2.29	none
SC-13912-S	02/15/96	U-238	ND	pCi/g	2.76	none
SC-13913-S	02/15/96	U-238	13.02	pCi/g	3.13	none
SC-13914-C	02/13/96	U-238	9.43	pCi/g	5.28	none
SC-13914-S	02/13/96	U-238	12.21	pCi/g	2.46	none
SC-13915-S	02/13/96	U-238	14.58	pCi/g	2.77	none
SC-13916-C	02/08/96	U-238	ND	pCi/g	4.50	none
SC-13916-S	02/13/96	U-238	16.62	pCi/g	5.54	none
SC-13921-C	02/15/96	U-238	3.00	pCi/g	3.01	none
SC-13922-S	02/13/96	U-238	ND	pCi/g	4.79	none
SC-13923-C	02/13/96	U-238	4.01	pCi/g	2.00	none
SC-13923-S	02/13/96	U-238	8.06	pCi/g	2.03	none
SC-13924-S	02/13/96	U-238	25.87	pCi/g	6.80	none

Average [U238] = 8.59 pCi/g

Review Form 96-002
02/16/96

SOIL CONFIRMATION REMEDIATION DISPOSITION FORM

SECTION I

1. Work Package Number: WP461 2. Date: 02/13/96 3. Review Form #: 96-001
 4. Remediation Unit Number: RU011 5. Confirmation Unit Number: CU140 (map attached)
 6. Contaminants of Concern: U-238 Th-230 Th-232 Ra-226 Ra-228
 TNT PCB PAH As Cr Pb TI

7. Results average below ALARA goal(s)? [U238] Avg = 20.9 pCi/g Yes No
 8. All results below cleanup criteria? Yes No
 9. Any results greater than 3X criteria? Yes No
 10. Hotspots present (less than 3X criteria)? Yes No

Parameter	Size	Concentration	Complies with Plan?
N/A	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No
	_____	_____	<input type="checkbox"/> Yes <input type="checkbox"/> No

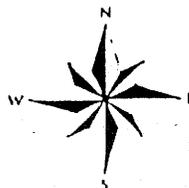
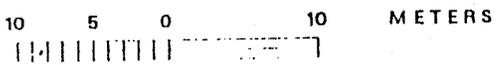
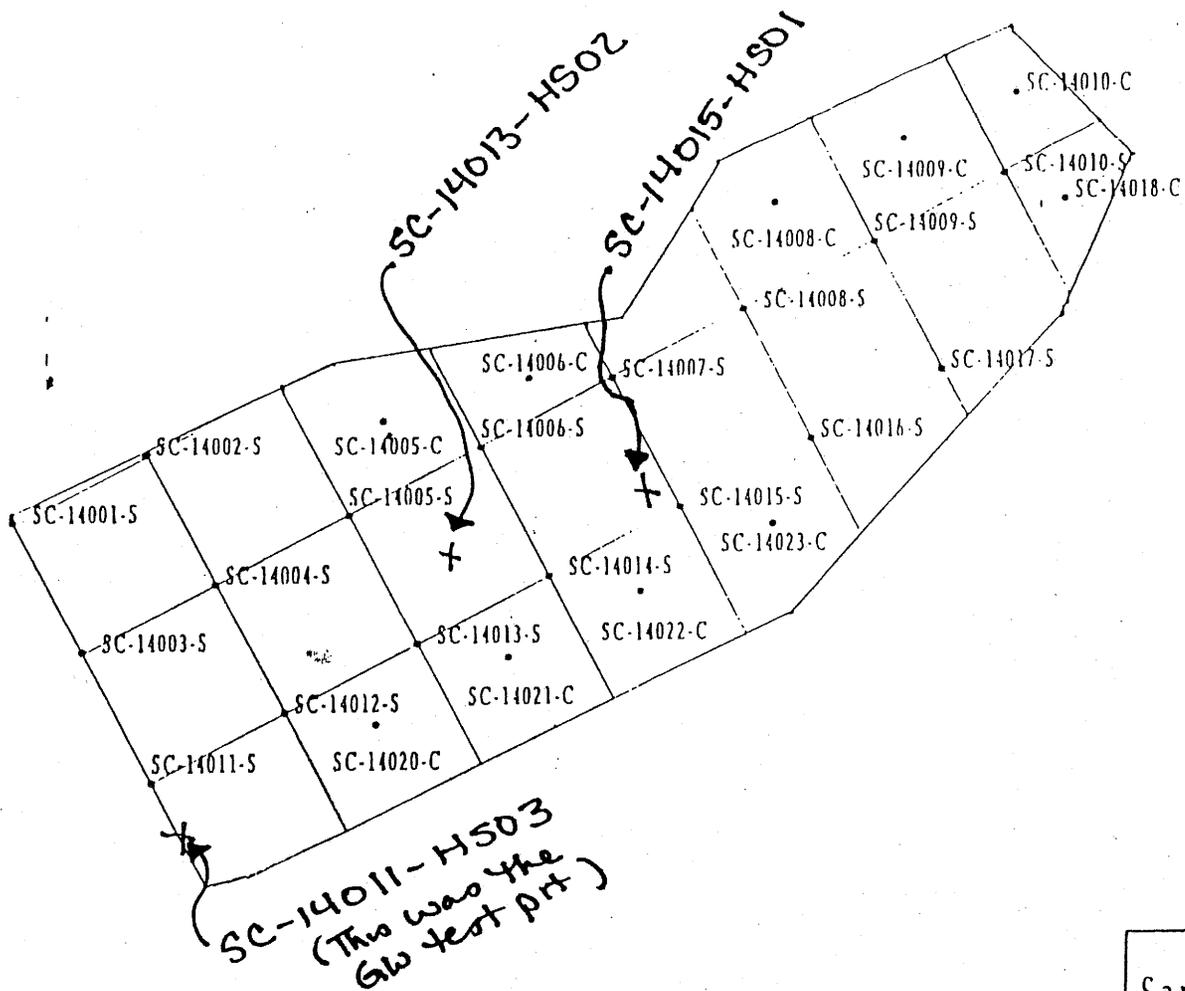
11. Reviewer: Mel A. Kelly Date: 2/13/96

12. Reviewer Disposition Recommendation: Release for Unrestricted Use (Section II)
 Additional Excavation Required (Section IV)
 ALARA Committee Required (Section III)

SECTION II *Results are ALARA. CU is released for unrestricted use.*

14. ES&H Manager: [Signature] Date: 2/13/96
 15. DOE Project Manager/Engineer: [Signature] Date: 2/13/96
 16. Project Manager: [Signature] Date: 2-13-96
 17. Construction Engineer: [Signature] Date: 2/13/96

SEE ATTACHED RESULTS AND MAP



Sample Locations in Remedial Unit RU011
Confirmation Unit CU140

Figure 2-2

EXHIBIT NO.: A/QY/043/1295	REPORT NO.: DOE/OR/21548-598
ORIGINATOR: MGL	DRAWN BY: WSSRAP GIS DATE: 12/95

Review Form 96-00
07/13/96

VICINITY PROPERTY #9
Soil Confirmation Results for CU140

WSSRAP_ID	DATE SAMPLED	PARAMETER	CONCENTRATION	UNITS	DL	COMMENTS
SC-14001-S	02/08/96	U-238	ND	pCi/g	4.50	
SC-14002-S	02/08/96	U-238	2.99	pCi/g	2.35	
SC-14003-S	02/08/96	U-238	12.34	pCi/g	2.97	
SC-14004-S	02/08/96	U-238	55.12	pCi/g	7.81	Exceeds ALARA
SC-14005-C	02/05/96	U-238	26.5	pCi/g	5.56	
SC-14005-S	02/05/96	U-238	37.1	pCi/g	6.95	Exceeds ALARA
SC-14006-C	02/05/96	U-238	33.7	pCi/g	3.70	Exceeds ALARA
SC-14006-S	02/05/96	U-238	16.6	pCi/g	3.00	
SC-14007-S	02/05/96	U-238	6.79	pCi/g	2.84	
SC-14008-C	01/25/96	U-238	11.2	pCi/g	4.42	
SC-14008-S	01/25/96	U-238	15.9	pCi/g	3.28	
SC-14009-C	01/25/96	U-238	14.3	pCi/g	5.07	
SC-14009-S	01/26/96	U-238	19.0	pCi/g	3.25	
SC-14010-C	01/25/96	U-238	3.9	pCi/g	3.00	
SC-14010-S	01/25/96	U-238	30.1	pCi/g	6.48	Exceeds ALARA
SC-14011-S	02/08/96	U-238	15.31	pCi/g	2.89	
SC-14012-S	02/08/96	U-238	21.17	pCi/g	6.31	
SC-14013-S	02/08/96	U-238	22.84	pCi/g	3.98	
SC-14014-S	02/08/96	U-238	24.26	pCi/g	5.81	
SC-14015-S	02/05/96	U-238	12.3	pCi/g	3.38	
SC-14016-S	01/26/96	U-238	19.0	pCi/g	5.48	
SC-14017-S	01/25/96	U-238	31.7	pCi/g	5.27	Exceeds ALARA
SC-14018-C	01/25/96	U-238	18.5	pCi/g	5.55	
SC-14020-C	02/05/96	U-238	14.7	pCi/g	4.91	
SC-14021-C	02/05/96	U-238	9.08	pCi/g	2.83	
SC-14022-C	02/05/96	U-238	4.51	pCi/g	2.77	
SC-14023-C	02/05/96	U-238	18.0	pCi/g	4.22	
SC-14011-HS03	02/08/96	U-238	13.47	pCi/g	5.32	
SC-14013-HS02	02/08/96	U-238	81.12	pCi/g	4.02	Exceeds ALARA
SC-14015-HS01	02/08/96	U-238	34.71	pCi/g	3.96	Exceeds ALARA

Average [U238] = 20.9 pCi/g

Review Form 96-001
02/13/96

APPENDIX B
QA/QC Comparison To Analytical Data

APPENDIX B TABLE B-1
Summary of Parent And Quality Control Sample Data

WSSRAP ID	PARAMETER	CONC	ERROR (2σ)	DL	UNITS	%RPD	DER	VAL QUAL	MATRIX	CATEGORY	DATE SAMPLED
SC-13904-S	Uranium-238	ND		4.11	PCI/G	N/A	N/A	*	Soil	Radiochemical	2/15/96
SC-13904-S-DU	Uranium-238	2.21	0.48	1.67	PCI/G	Note 1	Note 1	*	Soil	Radiochemical	2/15/96
SC-13905-S	Uranium-238	10.4	1.74	4.77	PCI/G	N/A	N/A	*	Soil	Radiochemical	2/13/96
SC-13905-S-DU	Uranium-238	8.09	1.13	2.33	PCI/G	25.0	0.80	*	Soil	Radiochemical	2/13/96
SC-13911-C	Uranium-238	11.5	1.90	4.28	PCI/G	N/A	N/A	*	Soil	Radiochemical	2/15/96
SC-13911-EB	Uranium, total	ND		0.150	PCI/L	N/A	N/A	*	Water	Radiochemical	2/15/96
SC-13912-C	Uranium-238	4.56	0.77	2.29	PCI/G	N/A	N/A	*	Soil	Radiochemical	2/15/96
SC-13912-C-DU	Uranium-238	(4.31)	1.51	4.45	PCI/G	5.6	0.11	*	Soil	Radiochemical	2/15/96
SC-14005-C	Uranium-238	26.5	3.14	5.36	PCI/G	N/A	N/A	*	Soil	Radiochemical	2/5/96
SC-14005-C-DU	Uranium-238	28	3.50	5.02	PCI/G	5.5	0.23	*	Soil	Radiochemical	2/5/96
SC-14006-C	Uranium-238	33.7	3.41	3.70	PCI/G	N/A	N/A	*	Soil	Radiochemical	2/5/96
SC-14006-C-FR	Uranium-238	28.7	3.58	6.83	PCI/G	16.0	0.72	*	Soil	Radiochemical	2/5/96
SC-14011-S	Uranium-238	15.3	1.7	2.89	PCI/G	N/A	N/A	*	Soil	Radiochemical	2/8/96
SC-14011-S-EB	Uranium, total	ND		0.150	PCI/L	N/A	N/A	*	Water	Radiochemical	2/8/96
SC-14020-C	Uranium 238	14.7	2.05	4.91	PCI/G	N/A	N/A	*	Soil	Radiochemical	2/5/96
SC-14020-C-DU	Uranium 238	15.3	2.35	5.57	PCI/G	4.0	0.14	*	Soil	Radiochemical	2/5/96

* Not selected for validation

Note 1: The RPD/DER cannot be calculated if the Parent or Quality Control Sample is non-detected.

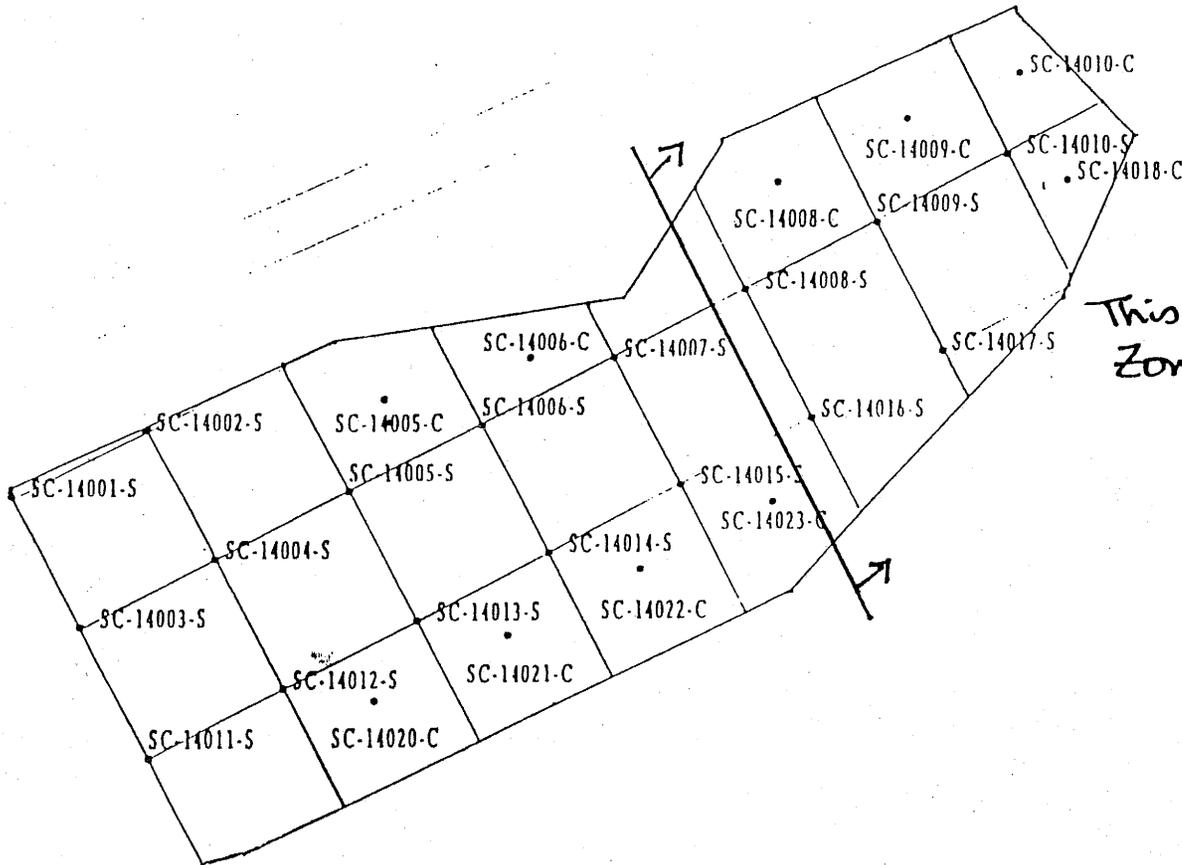
(): Estimated Value

N/A: Not Applicable

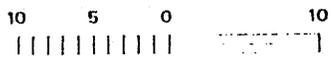
Soil Confirmation Results for CU140 - Partial Release

WSSRAP_ID	DATE SAMPLED	PARAMETER	CONCENTRATION	UNITS	DL	COMMENTS
SC-14008-C	01/25/96	U-238	11.2	pCi/g	4.42	
SC-14008-S	01/25/96	U-238	15.9	pCi/g	3.28	
SC-14009-C	01/25/96	U-238	14.3	pCi/g	5.07	
SC-14009-S	01/26/96	U-238	19	pCi/g	3.25	
SC-14010-C	01/25/96	U-238	3.9	pCi/g	3.00	
SC-14010-S	01/25/96	U-238	30.1	pCi/g	6.48	Exceeds ALARA
SC-14016-S	01/26/96	U-238	19	pCi/g	5.48	
SC-14017-S	01/25/96	U-238	31.7	pCi/g	5.27	Exceeds ALARA
SC-14018-C	01/25/96	U-238	18.5	pCi/g	5.55	

P96-0C

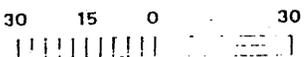


This area is considered Zone 1 (see attached map).



METERS

Samples collected from the following locations:



FEET

- SC-14008-C
- SC-14008-S
- SC-14009-C
- SC-14009-S
- SC-14010-C
- SC-14010-S
- SC-14016-S
- SC-14017-S
- SC-14018-C

Sample Locations in Remedial Unit RU011
Confirmation Unit CU140

Figure 2-2

EXHIBIT NO.: AIQY/043/1295	REPORT NO.: DOE/OR/21548-598
ORIGINATOR: MGL	DRAWN BY: WSSRAP GIS DATE: 12/95

PALE-00
01.30.96

OKAY
ARRY

EXCAVATE AND BACKFILL
ZONES 1, 2 & 3
(BOUNDARIES BETWEEN
ZONES ARE APPROXIMATE)

IMPROVE AND UTILIZE EXISTING
ROUGH ROADCUT FOR ACCESS TO
PROVIDE BACKFILL

PLAN 1
3840-VP-6004

ZONE 1
ZONE 2
ZONE 3

EXISTING CULVERT

SEE GENERAL
NOTE 2

SEE GENERAL
NOTE 2

EAST RAMP
N 1020563

TEMPORARY SACRIFICE
SEE GENERAL

CONTROLLED AREA
LIMITS OF
WORK PACKAGE 461
SEE GENERAL NOTE 1

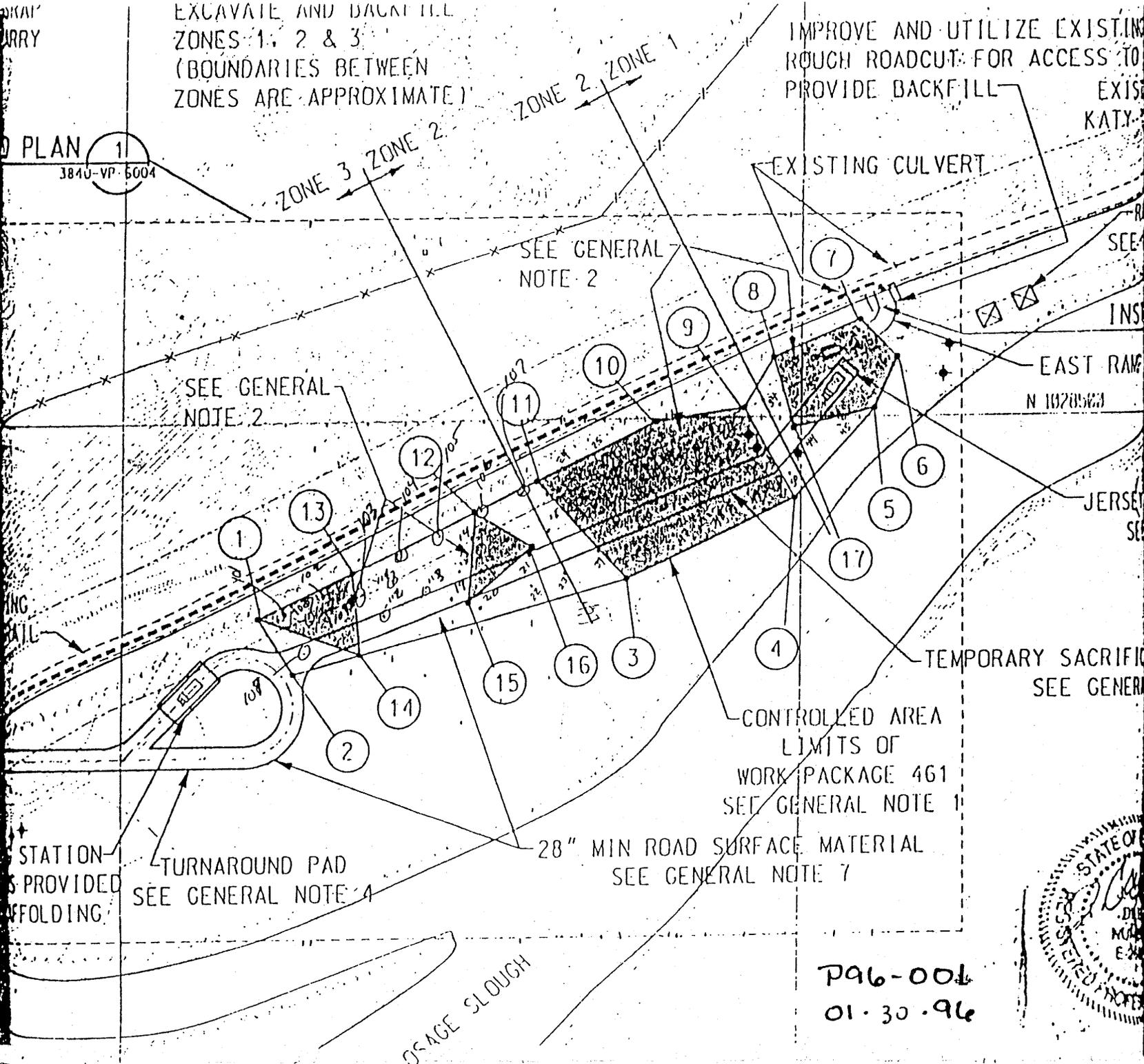
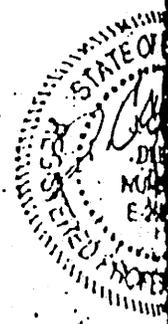
28" MIN ROAD SURFACE MATERIAL
SEE GENERAL NOTE 7

STATION
S PROVIDED
FOLDING

TURNAROUND PAD
SEE GENERAL NOTE 4

DRAINAGE SLOUGH

P96-004
01-30-96



APPENDIX C
Precision And Accuracy Comparison Tables

**APPENDIX C TABLE C-1
DATA QUALITY REQUIREMENT GOALS FOR ANALYTICAL DATA**

Category	Analytical Parameter	*Precision (soil) RPD (%)	*Precision (soil) DER	Accuracy (soil) REC (%)	*Precision (water) RPD (%)	*Precision (water) DER (%)	Accuracy (water) REC (%)
Radiological	U-238	<=50	1.00	+/- 30	<=20	1.00	+/- 25

** Not valid for values <= 5 * Detection Limit*

APPENDIX C TABLE C-2
Comparison of Data Quality Requirements Goals with Duplicate Samples

Parameter	Number of		%RPD		DER		Evaluation and Summary of Detects
	Samples	Detects	Range	Average	Range	Average	
URANIUM- 238	10	9	4.0-25.0	10.0	0.11-0.80	0.32	10 PA OR DU \leq 5*DL, OR =ND
							0 PA&DU $>$ 5*DL, RPD \leq 50%, DER \leq 1
							0 PA&DU $>$ 5*DL, RPD $>$ 50%, DER \leq 1
							0 PA&DU $>$ 5*DL, RPD \leq 50%, DER $>$ 1
0 PA&DU $>$ 5*DL, RPD $>$ 50%, DER $>$ 1							

PA = RESPECTIVE PARENT SAMPLE
DU = DUPLICATE SAMPLE
DER = DUPLICATE ERROR RATIO
RPD = RELATIVE PERCENT DIFFERENCE
DL = DETECTION LIMIT

APPENDIX C TABLE C-3

Comparison of Data Quality Requirements Goals with Field Replicate Samples

Parameter	Number of		%RPD		DER		Evaluation and Summary of Detects
	Samples	Detects	Range	Average	Range	Average	
URANIUM-238	2	2	16.0*	16.0*	0.72*	0.72*	2 PA OR FR \leq 5*DL, OR =ND 0 PA&FR $>$ 5*DL, RPD \leq 50%, DER \leq 1 0 PA&FR $>$ 5*DL, RPD $>$ 50%, DER \leq 1 0 PA&FR $>$ 5*DL, RPD \leq 50%, DER $>$ 1 0 PA&FR $>$ 5*DL, RPD $>$ 50%, DER $>$ 1

PA = RESPECTIVE PARENT SAMPLE

FR = FIELD REPLICATE SAMPLE

DER = DUPLICATE ERROR RATIO

RPD = RELATIVE PERCENT DIFFERENCE

DL = DETECTION LIMIT

* One Field Replicate Sample Collected