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RPP-RPT-55481, Rev. 0

COMPLETION REPORT FOR 241-C TANK FARM 200 SERIES TANK ACTIVITIES

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Richland, WA 99352
U.S. Department of Energy Contract DE-AC27-08RV14800

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Key Words: 241-C Tank farm, Direct Push, Deep electrodes, Spectral Gamma, Neutron Moisture, C-200 tanks

Abstract: Four bore holes were driven near C-200 tanks. Each bore hole was logged with spectral gamma and neutron moisture Snodes. During bore hole decommissioning, deep electrodes were installed.

RPP-RPT-55481
Revision 0

COMPLETION REPORT FOR 241-C TANK FARM 200 SERIES TANK ACTIVITIES

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
Office of River Protection under Contract DE-AC27-08RV14800

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APPENDICES

TABLES

TERMS

bgs	below ground surface
Ecology	State of Washington, Department of Ecology
Energy*Solutions*	Energy*Solutions* Government Group, Inc.
RPP	River Protection Project
WAC	*Washington Administrative Code*
WRPS	Washington River Protection Solutions, LLC

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COMPLETION REPORT FOR 241-C TANK FARM 200 SERIES TANK ACTIVITIES

1.0 INTRODUCTION

The U.S. Department of Energy assigned the River Protection Project (RPP) Washington River Protection Solutions, LLC (WRPS) Richland, Washington, to collect and provide subsurface data from inside and near the C Tank Farm located in the 200 West Area of the Hanford Site. WRPS contracted Energy*Solutions,* Government Group, Inc., (Energy*Solutions*) to perform the field activities required to gather this data. This data was intended to provide information about the distribution and movement of contaminants in the vadose zone under and adjacent to the tank farms, and it will be used for eventual retrieval of stored tank waste and closure planning for the single-shell tanks.

GG-NW-DOW-003, *Description of Work: Tank Farm C-241 200 Series Tanks*, Rev. 0 (see Appendix A) provides a detailed description of the scope of work performed. Energy*Solutions* was responsible for providing equipment and personnel to conduct the direct push activities, geophysical logging services, and safety oversight. Energy*Solutions* also provided technical support and prepared final reports. The following appendices contain copies of documentation generated during the performance of the above work scope.

Appendix A. GG-NW-DOW-003, *Description of Work: Tank Farm C-241 200 Series Tanks*, Rev. 0
Appendix B. Global Positioning System Map
Appendix C. Drilling and Sampling Daily Work Records
Appendix D. *Geophysical Logging in the 241-C Tank Farm*
Appendix E. State of Washington, Department of Ecology Documents

2.0 SUMMARY OF ACTIVITIES

Guidance documentation and preparation for control of field activities were completed with the release of the following documents:

- *Description of Work: Tank Farm C-241 200 Series Tanks*, Rev. 0, (GG-NW-DOW-003)
- Job Hazard Analysis, JHA--GG-NWOP-RO-2118,
- WRPS Work Package, *Four Deep Electrodes* (TFC-WO-12-6118)

Mobilization to C Farm began on March 27, 2013, with the mobilization and staging of a direct push rig and equipment outside the C Farm fence line. All field related activities were completed and all equipment was surveyed and released, or packaged for disposal, on June 5, 2013. There were 40 working field days during this period.

Four exploration holes were driven for this project. Spectral gamma data was collected with a combination Lanthanum Bromide /Bismuth Germinate Oxide instrument and neutron-neutron moisture log data were collected. Multi-level resistivity probes were installed at several depths as the boreholes were decommissioned.

3.0 DIRECT PUSHING, SAMPLING AND LOGGING DETAILS

3.1 DIRECT PUSHING

In accordance with GG-NW-DOW-003, Rev. 0, the placement of exploration holes was accomplished with the use of a hydraulic hammer system. Boreholes are pushed, using a 6.35 cm (2.5-in.) outside diameter x 4.45 cm (1.75-in.) inside diameter casing, at predetermined locations to specified depths, or refusal. See Table 1 for details on the locations and depths each borehole was pushed for this project.

3.2 SOIL SAMPLING

This project did not include taking soil samples.

3.3 GLOBAL POSITIONING SATELLITE SURVEYING

In accordance with GG-NW-DOW-003, Rev. 0, Rogers Surveying, Inc., identified the original locations of the exploratory boreholes using a Trimble[1] 5800 Global Positioning Satellite Survey system (or equivalent), paint and stakes. The coordinates and elevation of the completed push locations/boreholes are provided in Table 1; a map showing relative borehole locations is in Appendix B.

3.4 GEOPHYSICAL LOGGING

Energy*Solutions* and Three Rivers Scientific conducted the geophysical logging data collection and analysis services on the exploration 6.35 cm (2.5-in.) probe boreholes. For the geophysical logging, a portable small diameter logging system was used to collect spectral gamma and moisture data from the bottom of the borehole to the ground surface. Calibration details, survey results, and data interpretation, as well as copies of the collected and processed log data, are provided in Appendix D.

[1] Trimble is a registered trademark of Trimble Navigation Ltd., Sunnyvale, California.

4.0 RESISTIVITY PROBE PLACEMENT

Resistivity probes were placed at pre-determined levels as the boreholes were decommissioned. The drive tip was knocked out of the bottom of the tubing, and the tubing was back-pulled filling the borehole with bentonite until the desired depth was reached. Six inches of silica sand was then added to the borehole. Next, the sensor, which is 18 in. long, was placed in 2½ ft of diatomaceous earth, leaving 6 in. below and above the sensor. Another 6 in. of silica sand was added to the borehole. Bentonite was added next and the installation process continued. Resistivity probes were installed 20 ft apart. After all the probes were placed, bentonite was added to the borehole up to the surface as the tubing was back-pulled. A protective steel casing was cemented in place approximately 30.48 cm (12 in.) deep at the surface to protect the protruding probe wiring.

The State of Washington, Department of Ecology (Ecology) decommissioning documentation is provided in Appendix E.

Table 1 shows the boreholes, coordinates, pushed depths, and depths of resistivity probe placements.[2]

Table 1. Borehole Information.

Borehole # and Type	Northing (meters)	Easting (meters)	Elevation (meters)	Hole Depth (ft)	Probe Depths (ft bgs)
C8763 Logging	136589.938	575178.598	197.745	221	53, 73, 93, 113,133, 153, 173, and 192
C8765 Logging	136629.197	575194.454	194.027	211	30, 50, 70, 90, 110, 130, 150,170, 189
C8766 Logging	136616.347	575205.484	194.742	211	30, 50, 70, 90, 110, 130, 150, 170, 189
C8767 Logging	136609.301	575211.468	195.018	211	30, 50, 70, 90, 110, 130, 150, 170, 189

[2] The coordinates shown in Table 1 are the coordinates as staked and surveyed by Rogers Surveying, Inc. and vary slightly from the coordinates that were used in GG-NW-DOW-003 which were taken from CAD maps of the site.

5.0 ENVIRONMENTAL, SAFETY, AND HEALTH

There was no safety surveillance performed during the 241-C Tank Farm activities. The work scope conducted under the subject Statement of Work was completed with no lost time, reportable *Occupational Safety and Health Act of 1970* injuries, or first aid cases, and there were no incidences of equipment or personnel radiological contamination.

6.0 REFERENCES

GG-NW-DOW-003, *Description of Work: Tank Farm C-241 200 Series Tanks*, Rev. 0, Energy*Solutions* Government Group, Inc., Richland, Washington.

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq.

Occupational Safety and Health Act of 1970, 29 USC 651 et seq.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, as amended.

APPENDIX A

DESCRIPTION OF WORK

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ENERGYSOLUTIONS GG-NW-DOW-003

Description of Work:
Tank Farm C-241 200 Series Tanks

Revision 0

Authored By: P. C. Berlin, Scientist — Date: 3/4/13

Reviewed By: K. D. Reynolds, Scientist III — Date: 3/5/13

Approved By: M. G. Gardner, Manager, Washington Operations — Date: 3/4/13

- [X] New
- [ ] Title Change
- [ ] Revision
- [ ] Rewrite
- [ ] Cancellation

Effective Date 3/4/13

GG-NW-DOW-003
Revision 0

DESCRIPTION OF WORK: TANK FARM C-241 200 SERIES TANKS

March 2013

Prepared for
Washington River Protection Solutions, LLC

by
Technical Services
Energy*Solutions* Government Group, Western Operations

CONTENTS

FIGURES

TABLES

TERMS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
DOE	U.S. Department of Energy
DOW	description of work
Energy*Solutions*	Energy*Solutions* Government Group, Inc.
ES&H	Environmental, Safety, and Health
GPR	ground penetrating radar
JHA	Job Hazard Analysis
RCRA	*Resource Conservation and Recovery Act of 1976*
RPP	River Protection Project
SST	single-shell tank
WAC	*Washington Administrative Code*
Well ID	Well identification
WMA	Waste Management Area
WRPS	Washington River Protection Solutions, LLC

Units

cm	centimeter
ft	feet
gal	gallon
in.	inch
L	liter
m	meter

GG-NW-DOW-003, Rev. 0

DESCRIPTION OF WORK: TANK FARM C-241 200 SERIES (SITES C & D)

1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

To meet the requirements of the *Resource Conservation and Recovery Act of 1976* (RCRA) and to provide for integration of these requirements with the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), an implementation plan (RPP-PLAN-37243, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*) was generated. This implementation plan integrates the RCRA treatment, storage, and disposal unit closure process with the CERCLA groundwater and operable unit remedial investigation/feasibility study process. RPP-RPT-38152, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C Corrective Measures Study* outlines data that is to be collected to support the integration of these two regulatory drivers and meet the unit closure objectives.

Since the issuance of RPP-RPT-38152 in 2008, field investigations have been completed at many of the 23 sites described in the report. Additional tank leak loss studies have yielded new information about Waste Management Area (WMA) C tank history and conditions. These results have prompted efforts to modify and optimize the remaining WMA C site investigation activities. Washington River Protection Solutions, LLC (WRPS) generated a revised work plan (RPP-PLAN-39114, Rev. 2) which describes the remaining borehole investigations near the C-200 Tanks (Sites C and D in the report).

This document provides the work instructions for conducting characterization efforts inside the 241-C Tank Farm at Sites C and D. The sites associated with this document are in the general vicinity of tank C 109 and along the fence line northeast of tanks C 201, C 202, and C 203 of the 241 C Tank Farm. The scope of work includes: providing equipment and personnel to conduct direct push activities; providing safety oversight; providing geophysical logging services; placing resistivity instrumentation in the exploration boreholes during decommissioning; attending meetings and planning sessions; and providing a written report documenting field activities and data collection at the conclusion of field activities. This work is being conducted at the direction of WRPS Closure and Corrective Measures group.

1.2 BACKGROUND

The U.S. Department of Energy (DOE) assigned the River Protection Project (RPP) Single-Shell Tank Program the tasks of transferring waste from the single-shell tanks (SST) to the double-shell tanks, and developing and implementing a strategy to retrieve SST waste and miscellaneous underground storage tank waste. The WRPS Closure and Corrective Measures group was given

responsibility for collecting and providing subsurface data from the SST farm facilities. This contributes to the process for retrieval of the tank waste. The intent of the SST WMA characterization program is to collect and analyze samples to provide an understanding of the distribution and movement of contaminants in the vadose zone under and adjacent to the tank farms. These SST farms are designated as Radiological Buffer Areas or Contamination Areas.

1.3 TANK FARM BACKGROUND

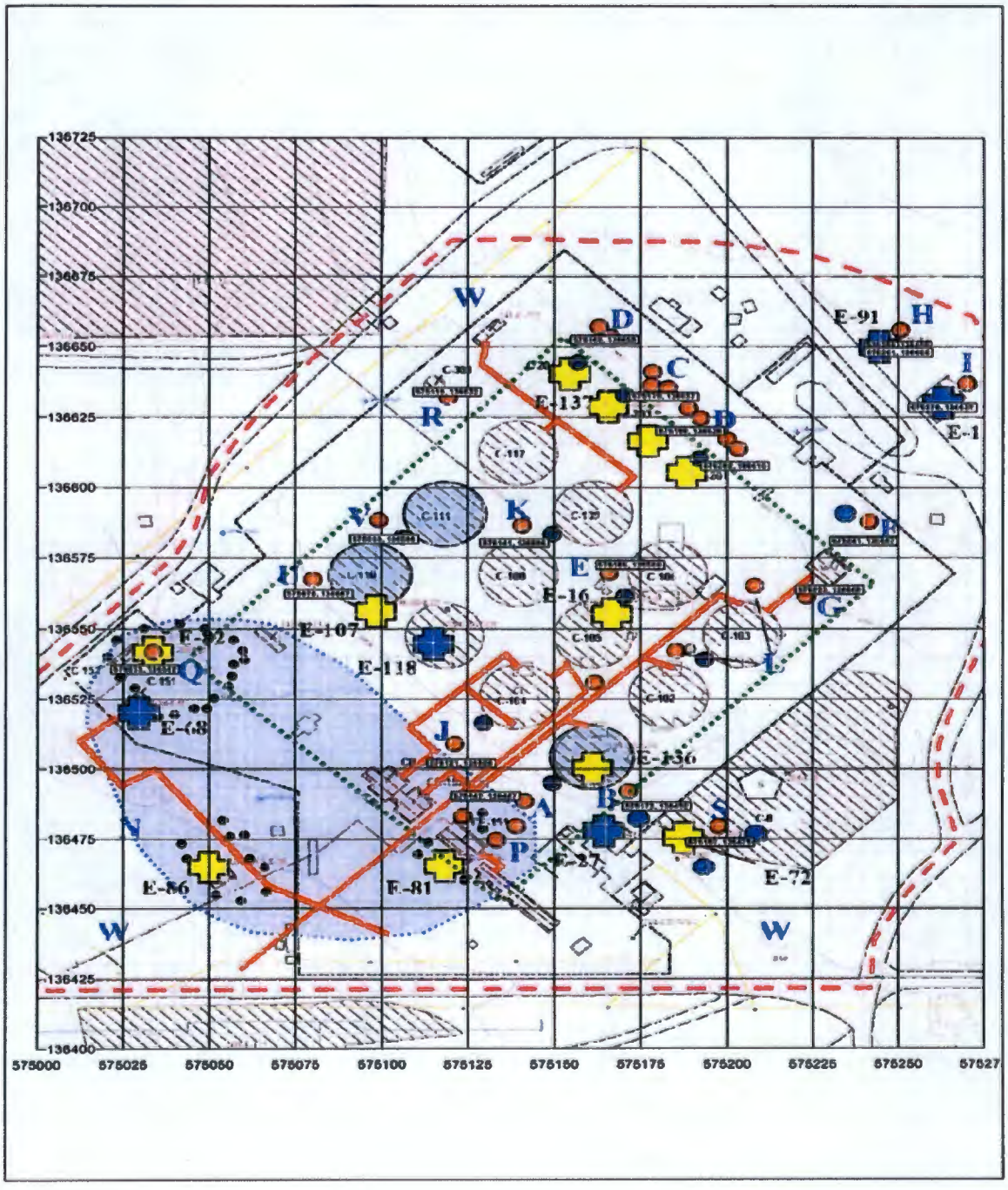
The Hanford Site has 149 underground SSTs that store hazardous radioactive waste. These tanks are grouped into 12 tank farms that are further grouped into eight WMAs and are regulated under RCRA. WMA C encompasses the C Tank Farm (Figure 1) located in the east central portion of the 200 East Area and includes soil and groundwater contaminated by C Tank Farm operations. The C Tank Farm was constructed from 1944 to 1945, and began operations in the late 1940s. In general, the WMA C boundary is represented by the fence line surrounding the C Tank Farm. Many of these tanks have leaked, and there have been leaks in the associated infrastructure (e.g., pipelines, diversion boxes). Some of the leaked waste is known to have impacted the groundwater and exceeded compliance standards.

The C Tank Farm contains twelve 100-series tanks and four 200-series tanks. The 100-series tanks are 23 m (75 ft) in diameter, have a 5 m (15 ft) operating depth, and have an operating capacity of 1,892,700 L (530,000 gal) each. The 200-series tanks are 6 m (20 ft) in diameter with a 7.32 m (24 ft) operating depth and an operating capacity of 208,000 L (55,000 gal) each. The tanks sit below grade with at least 2 m (7 ft) of soil cover that shields operating personnel from radiation exposure. Tank pits are located on top of the tanks and provide access to the tanks, pumps, and monitoring equipment.

1.4 PHYSICAL SETTING

The SST tank farms were constructed in excavations into the near-surface sediments that overlie the Columbia River Basalt Group. The Columbia River basalt forms the basement bedrock. The Hanford formation unconformably overlies the Columbia River Basalt. The Hanford formation includes deposits from Pleistocene-age cataclysmic floods that blanket the area with mostly sandy pebble/cobble gravel facies, capped by a sequence of gravel dominated facies.

Figure 1. 241-C Tank Farm Location Map.



2.0 METHOD

The method selected to outline the vertical and horizontal extent of contamination is a hydraulic hammer-driven push system on a tractor or track mounted type carrier. For this application, the locations for investigation (exploration) are selected through an iterative process as outlined in Section 3.0, "Borehole Locations." Data from the moisture and gamma logs collected from the exploration borehole will be used for characterization of potential leaks from and adjacent to the 200 series tanks.

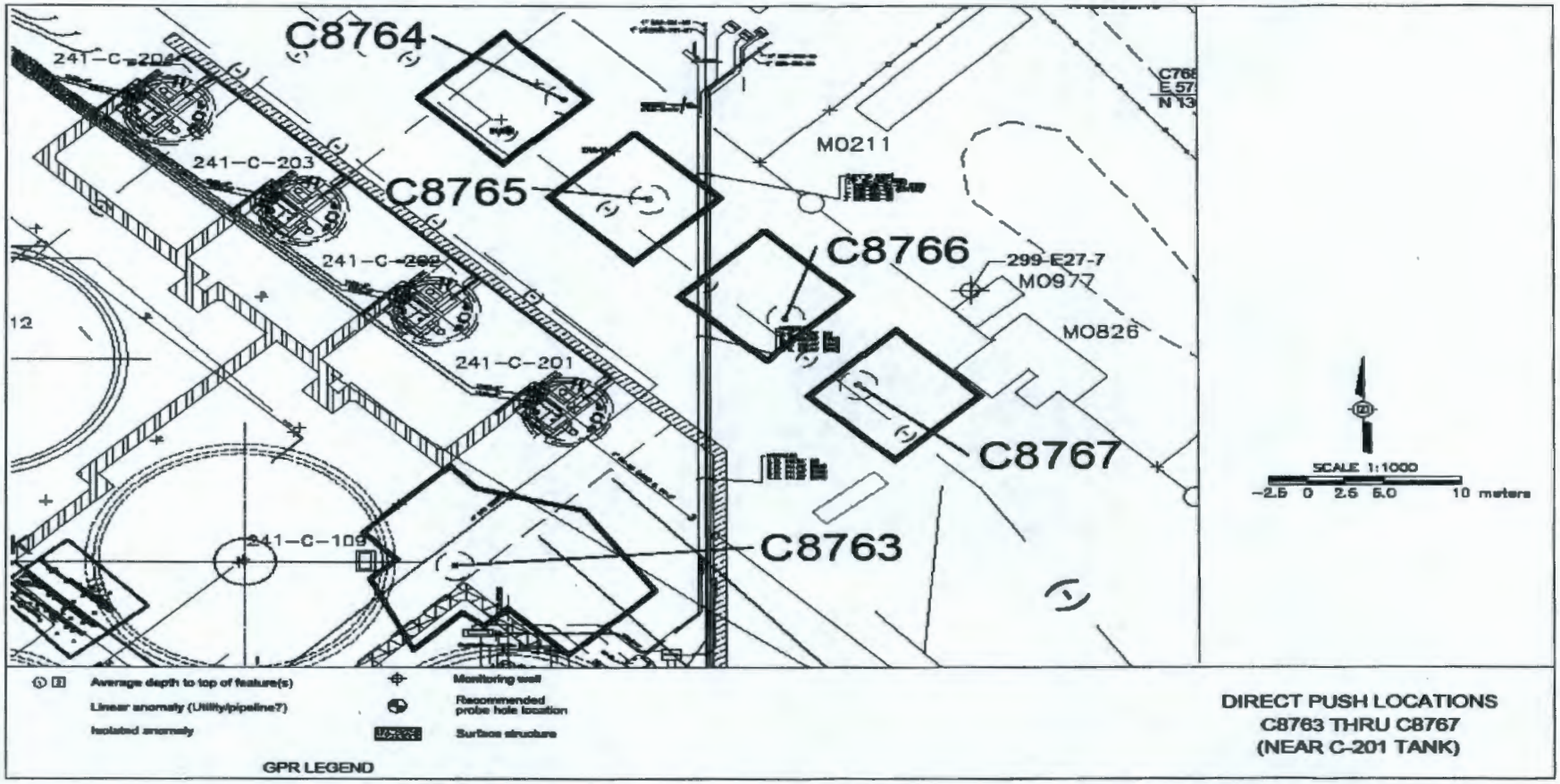
2.1 EXPLORATORY BOREHOLE

The exploratory activities are initiated by placement of a single tubing string that is 6.4 cm (2.5-in.) outside diameter x 4.45 cm (1.75-in.) inside diameter (e.g., the exploratory borehole). This tubing is advanced to the target depth or refusal. Geophysical logging is conducted using a combination tool comprised of a lanthanum bromide detector and bismuth germinate oxide gamma detector and a neutron-neutron moisture instrument. The logging data is reviewed by the WRPS Closure and Corrective Measures and Energy*Solutions* Government Group, Inc. (Energy*Solutions*) technical personnel to determine the acceptability of the collected data and to note the formation/unit changes, where possible. The exploratory borehole will be decommissioned per applicable *Washington Administrative Code* (WAC) 173-160, "Minimum Standards for Construction and Maintenance of Wells," requirements (e.g., filled with bentonite or bentonite/cement grout as required) as the push tubing is extracted. Either multi-level or up to two single point resistivity electrodes may be placed in the exploration boreholes during decommissioning at the direction of the Closure and Corrective Measures Technical Lead. When these actions are taken, sand and diatomaceous earth are placed in layers around the sending/receiving segment of the electrode assembly and bentonite is used for the intervals between the electrode assemblies. Cement seals and surface protection will be placed to protect the wire leads at ground surface.

2.2 PLACEMENT OF BOREHOLES

There are five exploratory borehole locations for Sites C and D as shown on Figure 2. Four boreholes will be pushed (C8763, C8765, C8766, and C8767); one site has been chosen as an alternative (C8764). The borehole locations will be staked by use of Global Positioning Satellite equipment and verified by a licensed land surveyor. There are no sampling boreholes planned for this project.

Figure 2. Direct Push Locations.



3.0 BOREHOLE LOCATIONS

3.1 BOREHOLE LOCATION DOCUMENTATION

Figure 2 is a location map of the area targeted for direct push activities Sites C & D. These locations were selected through an iterative process using ground-penetrating radar (GPR) data and review of as-built infrastructure drawings. The infrastructure interferences were reviewed from available drawings and site walk downs and this data was utilized for review of the GPR data.

The final coordinates of the selected site were then plotted with computer-aided drafting. The borehole locations are documented above (see Figure 2). In addition to the coordinate position of the borehole location, the borehole depth, geophysical log data, and other pertinent information derived during the activity (e.g., depth of contamination as identified from geophysical log interpretation, degree of contamination observed on push rods during extraction) is included in the Field Activity Reports and State of Washington, Department of Ecology-required documentation.

Table 1. Coordinates for Direct Push Locations.

Borehole #	Northing	Easting
C8763	136589.93	575178.59
C8764 (alternate)	136639.84	575187.54
C8765	136629.20	575194.42
C8766	136616.37	575205.53
C8767	136609.27	575211.47

3.2 BOREHOLE LOCATION TABLES AND NUMBERING

The exploratory borehole locations are tracked and documented on Field Activity Reports by referencing the Well identification (Well ID) number, as provided in Figures 2, or assigned during progress of the work. The unique Well ID number for the exploratory boreholes have been assigned and listed for use during this phase of C Tank Farm Characterization investigation by the Hanford Site Well Coordinator.

4.0 WORK TASKS

4.1 SITE SETUP

The push equipment will be mobilized and a controlled work area set up surrounding the preselected and marked location. A radiological pre-survey of the tractor and equipment will be

conducted (per WRPS procedure) prior to moving the equipment into the work zone. As noted above, ground-penetrating radar scans and as-built drawing reviews and comparisons have been completed to properly select the borehole location. The equipment consists of a mobile unit with a hydraulically powered hammer and mast system.

Support equipment to be used during field activities will be mobilized into the work area as needed. A forklift will transport needed support equipment to and from the borehole locations. Tank farm personnel will provide support, as necessary, for guiding the equipment onto location and for subsequent movement of the unit to the listed borehole locations.

WRPS Radiological Control Technicians and Nuclear Chemical Operators will be onsite to support work during activities that create potential personnel exposure. Contamination control measures will consist of laying spill protection material beneath the equipment (when required). Spill protection consists of felt and plastic sheeting placed on and around the direct push unit when necessary and prudent. Control of the work area and control of potential contamination are aided by restricting site entries by unnecessary personnel. WRPS Health Physics personnel will provide direction and support to ensure radiological protection is maintained for all personnel associated with the work.

4.2 PRECAUTIONARY MEASURES

During advancement of the boreholes, casing (push rods) will be driven into the subsurface by use of the hydraulic hammer impact system. The borehole locations have been positioned to avoid impacting known/mapped structures. Careful observation of the push advance rates and resistance will be observed to preclude damage to any tank farm infrastructures should the as-built drawings be erroneous. If rod advance indicates that obstructions are present, push advance will stop, the direct push equipment and work area will be placed in a safe condition, and the Closure and Corrective Measures Technical Lead or his designee, and the WRPS field work supervisor will be notified. If during push operations a borehole is deemed to be "at refusal" as defined by trained operators of the direct push equipment (refusal is defined as a minimum of one inch of advance per minute of impact operations), the length of tubing driven will be noted in the Field Activity Report and the next sequential task as defined in Section 2, "Method," will be performed.

All activities using the hammer unit will conform to the manufacturer's operating manual, training of Energy*Solutions* personnel performed by the equipment manufacturer, and applicable procedures and Work Package instructions that relate to the specific phase of work. As the push rods are extracted from the exploratory boreholes, the onsite Health Physics Technician will monitor for radiological contamination. WRPS Tank Farm-qualified Nuclear Chemical Operators will perform any decontamination required. The sealing requirements for decommissioning of the boreholes are defined in the appropriate sections of WAC 173-160.

4.3 GEOPHYSICAL LOGGING

At refusal or target total depth of the exploratory investigations, Energy*Solutions* will conduct logging operations to gather geophysical information. All logging activities will be conducted in accordance with the requirements set forth in the Energy*Solutions* logging procedure GG-NW-FA-PR-001, *Geophysical Logging* and the Energy*Solutions* document ESTP-QA-PN-001, *Engineered Systems and Technology Projects – Quality Assurance Program Plan.* Logging parameters may changed and/or log suites may be added or deleted based on technical needs of the WRPS project, as determined by Closure and Corrective Measures. The following logging suites are planned for deployment at the direction of the WRPS Closure and Corrective Measures Technical Lead.

1. Lanthanum bromide/Bismuth germanium oxide (LaBr/BGO) @ 100 seconds/0.5 ft.
2. Neutron-Neutron (Moisture) logging @ 15 seconds/0.25 ft.
3. Infra Red casing temperature data collected during moisture and gamma logging.

Logging data will be collected from surface to the total depth of the borehole. The logging analyst, Energy*Solutions* personnel, and the WRPS Closure and Corrective Measures Technical Lead will review the field log data.

4.4 CLEANING

Equipment used for push advance purposes (e.g., push rods, tips) will be high-pressure washed using an approved non-phosphate cleaner. If it is not possible to remove the push equipment from the tank farm for cleaning, the State of Washington, Department of Ecology has granted a variance to allow for hand cleaning and wiping of the rods to meet WAC cleaning requirements. The push equipment will be visibly free of dirt, grease, and other possible contamination which would potentially provide for cross-contamination of retrieved samples. After being cleaned, the equipment will be protected from contamination from surface chemicals and push operation-related chemicals. This protection will be accomplished by covering the materials with plastic or other acceptable materials, if necessary. The cleaned and protected equipment will be tracked by use of cleaning certification documentation.

4.5 EXPLORATION BOREHOLE DECOMMISSIONING

Applicable requirements contained in WAC 173-160 will be used to control and guide actions for decommissioning the exploratory boreholes. Each exploratory borehole will be filled with bentonite, a bentonite slurry, and/or grout (neat cement or cement-bentonite mixture) during the push rod extraction process. At the direction of the WRPS Closure and Corrective Measures Technical Lead, subsurface resistivity probes may be placed in the exploratory boreholes. Placement of the resistivity instrumentation and decommissioning materials used will be documented on the daily Field Activity Report and WAC Well Report.

5.0 ENVIRONMENTAL, SAFETY, AND HEALTH PROGRAM

The primary concern for Energy*Solutions* and the client (WRPS) is the safety of personnel assigned to perform activities related to the 241-C Tank Farm Phase 2 work. Field work shall be performed in a manner that meets the safety and health requirements of WRPS Tank Farm procedures, 10 CFR 851, and the Occupational *Safety and Health Act of 1970.* An Energy*Solutions* activity-specific job hazard analysis (JHA-GG-NWOP-RO-2118) outlines the specific activity hazards and the mitigation methodologies associated with the hydraulic hammer unit direct push activities to be conducted during 241-C Tank Farm Phase 2 work. Energy*Solutions* personnel performing these activities have been provided the appropriate training and instruction to mitigate these hazards. A WRPS Job Hazard Analysis (JHA) checklist was prepared in coordination with WRPS Tank Farm Industrial Hygiene and Safety personnel for the project work package. The requirements of the WRPS JHA are communicated to everyone associated with the project (visitors included).

Both Energy*Solutions* Safety personnel and WRPS Tank Farm Industrial Hygiene and Safety personnel may survey the job site for safety and health compliance. Energy*Solutions* safety representatives, in coordination with WRPS Tank Farm Industrial Hygiene and Safety personnel, will provide onsite inspections and visits during the drilling and decommissioning/construction activities to ensure compliance with health and safety regulations and WRPS health and safety procedures. Routine inspection reports will be provided to the WRPS Closure and Corrective Measures Technical Lead.

Energy*Solutions* subscribes to the Integrated Safety Management System and has implemented an Integrated Safety Management System approach into all of its work tasks. These requirements flow down, not only internally to Energy*Solutions* employees but also to Energy*Solutions* subcontractors. All of the following are in effect and will be observed, enforced and followed.

- Safety rules and procedures for safe job performance.
- Radiological Work Permit.
- WAC 173-160, as amended.
- *Occupational Safety and Health Act of 1970.*
- Client-identified standards.

This program encompasses environment, safety, and health, including pollution prevention and waste minimization. All work for this project will be analyzed in accordance with the five core functions of the Energy*Solutions* Integrated Safety Management System.

- Define the scope of work.
- Identify the work hazards and Environmental, Safety, and Health (ES&H) requirements.
- Analyze the work hazards and implement controls.
- Perform the work activity within the developed controls.
- Provide feedback on the adequacy of controls and safety management improvement.

The specific procedures used to accomplish these core functions are found in the Energy*Solutions* ES&H Program.

5.1 ENVIRONMENTAL, SAFETY, AND HEALTH PROGRAM KEY ELEMENTS

- Line management is responsible for the protection of employees, the public, and the environment.
- Clear and unambiguous lines of authority and responsibility for ensuring ES&H are established and maintained at all organizational levels.
- Personnel have "stop work" authority.
- Personnel possess the experience, knowledge, skills, and abilities that are necessary to discharge their responsibilities.
- Resources are effectively allocated to address ES&H, programmatic, and operational considerations. Protecting employees, the public, and the environment is a priority whenever activities are planned and performed.
- Before work is performed, the associated hazards are evaluated and an agreed-upon set of ES&H standards and requirements is established which, if properly implemented, provides adequate assurance that employees, the public, and the environment are protected from adverse consequences.
- Administrative and engineering controls to prevent and mitigate hazards are tailored to the work being performed and associated hazards. Emphasis should be on designing the work and/or controls to reduce or eliminate the hazards and to prevent accidents, unplanned releases, and exposures.

5.2 WRPS-REQUIRED ENVIRONMENTAL, SAFETY, AND HEALTH ELEMENTS

WRPS has provided a comprehensive list of WRPS, DOE, and Hanford Site-specific procedures and requirements for conducting work within the confines of the C Tank Farm. While executing the work scope detailed in this DOW, Energy*Solutions* will comply with all applicable directives and orders resulting from WRPS requirements.

6.0 QUALITY ASSURANCE

All work performed for the WRPS shall be based on the requirements of:

- Title 10 of the Code of Federal Regulations, Part 830, Subpart A (10 CFR 830, Subpart A), *Quality Assurance Requirements.*
- DOE Order 414.1C, *Quality Assurance*, for facilities and projects with the scope of work.
- NQA-1-2004, *Quality Requirements for Nuclear Facility Applications*.

Energy*Solutions* will conduct work in accordance with the Energy*Solutions* Quality Assurance Program, to specific work procedures and to this work plan.

7.0 REFERENCES

10 CFR 830, Subpart A, "Nuclear Safety Management, Quality Assurance Requirements," *Code of Federal Regulations,* as amended.

10 CFR 851, "Worker Safety and Health Program," *Code of Federal Regulations,* as amended.

ASME NQA-1-1994, 2000, and 2004, *Quality Assurance Requirements for Nuclear Facility Applications,* the American Society of Mechanical Engineers, New York, New York.

DOE Order 414.1C, 2005, *Quality Assurance*, U.S. Department of Energy, Washington, D.C.

ESTP-QA-PN-001, 2012, Engineered Systems and Technology Projects – Quality Assurance Program Plan, Rev. 6, Energy*Solutions* Federal Services, Western Operations, Richland, Washington.

GG-NW-FA-PR-001, *Geophysical Logging,* Energy*Solutions* Government Group, Northwest Operation, Richland, Washington.

JHA-GG-NWOP-RO-2118, 2013, Rev 0, Energy*Solutions* Technical Services, Richland, Washington.

Occupational Safety and Health Act of 1970, 29 USC 651 et seq.

Resource Conservation and Recovery Act of 1976, 42 USC 6901 et seq.

RPP-PLAN-37243, 2010, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Master Work Plan for Single-Shell Tank Waste Management Areas*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-PLAN-39114, 2012, *Phase 2 RCRA Facility Investigation/Corrective Measures Study Work Plan for Waste Management Area C*, Rev. 2, Washington River Protection Solutions, LLC, Richland, Washington.

RPP-RPT-38152, 2008, *Data Quality Objectives Report Phase 2 Characterization for Waste Management Area C Corrective Measures Study*, Rev. 0, Cenibark International, Inc., Richland, Washington.

WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells," *Washington Administrative Code*, as amended.

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APPENDIX B

GLOBAL POSITIONING SYSTEM MAP

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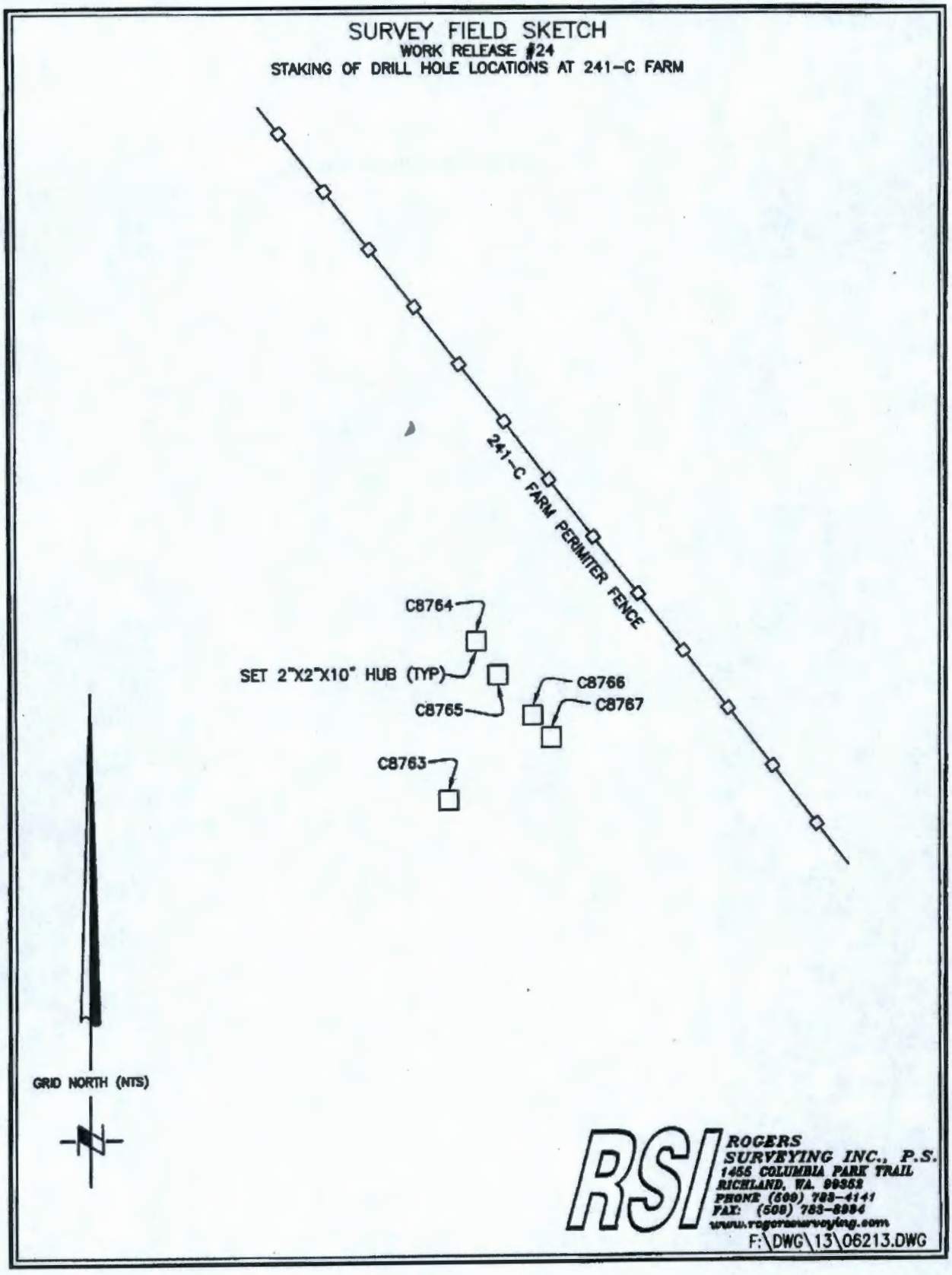
SURVEY FIELD SKETCH
WORK RELEASE #24
STAKING OF DRILL HOLE LOCATIONS AT 241-C FARM
241-C FARM PERIMITER FENCE
C8764
SET 2"X2"X10" HUB (TYP)
C8765
C8766
C8767
C8763
GRID NORTH (NTS)
RSI
ROGERS SURVEYING INC., P.S.
1455 COLUMBIA PARK TRAIL
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PHONE (509) 783-4141
FAX: (509) 783-8994
www.rogerssurveying.com
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APPENDIX C

DRILLING AND SAMPLING DAILY WORK RECORDS

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Mobilize CAT #2 from ENW to "C" Farm and stage outside of farm.		**DATE:** 03-27-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 01
START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY *Sample #'s Interval %* *1.* N/A *2.* N/A *3* N/A *4* N/A.	**SITE/EQUIPMENT INSPECTION:** (Yes) No **BOREHOLE SUMMARY** N/A *Borehole #* _____ *Tubing (* *)@* *to* *ft bgs; S.U.* ____ *Borehole #* _____ *Tubing (* *)@* *to* *ft bgs; S.U.* ____ *Borehole #* _____ *Tubing (* *)@* *to* *ft bgs; S.U.* ____	*HHU CASE#1* (HHU CAT #2) *HHUXL#3* **GEOPHYSICAL LOGGING** *Boring #* *Interval* *Type* *1.* N/A *2.* N/A *3.* N/A

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Avoiding Electrical Shocks.**
0715	Travel to ENW, load CAT #2 and transport to "C" Tank Farm.
0845	ESGG crew on standby for work package to be released.
1100	Lunch.
1130	ESGG crew on standby for work package to be released. Travelled to office. Completed paperwork and timecard.
1530	End of shift.
	N/A

OPERATOR/LICENSE: Ehrgott/3115 *ES SUPPORT: Weakley, Walkup* *NCO: Villarreal, Snook* *HPT: Clayton, Mincy* *FWS: Franzen*	**WEATHER:** 64 F, partly cloudy with winds from the northwest at 5-10 mph. **DOWNTIME:** 6 Hrs. 15 minutes for work package.	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-W-DOW- ECN-13-000136

REPORT BY: MIKE EHRGOTT	**REVIEWED BY:** S. W. WALKUP
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Mike Ehrgott	**SIGNATURE:** _____ **DATE:** 04-05-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Standby for work package to be released.		**DATE:** 03-28-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 02

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** Yes (No)	*HHU CASE#1 HHU CAT #2 HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A

BOREHOLE SUMMARY

Borehole # ~~AAA~~ Tubing ( )@ to ft bgs; S.U. ___
Borehole # ~~AAA~~ Tubing ( )@ to ft bgs; S.U. ___
Borehole # ~~AAA~~ Tubing ( )@ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring # Interval Type

1. N/A
2. N/A
3. N/A

TIME	WORK SUMMARY
0600	Safety meeting at office. Topic: High Voltage Electrical Burns.
0630	Standby for C Farm - waiting for the work package To be released.
11:00	Lunch
11:30	Standby for work package
15:30	End shift
	N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Weakley* *NCO: Villarreal, Snook* *HPT: Clayton, Mincy* *FWS: Franzen*	**WEATHER:** 65 F, partly cloudy with winds from the southwest at 5-10 mph. **DOWNTIME:** 9 hrs. work package	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-W-DOW- ECN-13-000136

REPORT BY: LC (Amos) **TITLE :** *ES TECHNICAL PREPARER* **SIGNATURE:** L C Amos	**REVIEWED BY:** M.W. Walker **TITLE:** *ES TECHNICAL REVIEWER* **SIGNATURE:** M.W. Walker **DATE:** 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Standby for work package release | DATE: 04-01-13

LOCATION: Hanford Site, C Tank Farm | EXCAVATION: 0035 | T-DIG #: 1306744 | REPORT #: 2-A

START CARD NO. SE47759 | DECOMMISSION NO. AE 21189 | RWP: 40-762 R3 AHA-66-WOP-10-21

SAMPLING SUMMARY

Sample #'s	Interval	%
1.		
2.	N/A	
3.		
4.		

SITE/EQUIPMENT INSPECTION: Yes (No) | HHU CASE#1 | HHU CAT #2 | HHUXL#3

BOREHOLE SUMMARY

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1.		
2.	N/A	
3.		

TIME	WORK SUMMARY
0600	Safety meeting at office. Topic: lifting
0630	Standby for C Farm - waiting for the work package to be released.
1100	lunch
1130	Standby for work package
1530	End shift
	N/A

OPERATOR/LICENSE: AMOS/1224
ES SUPPORT: weakley
NCO: villarreal smock
HPT: clayton, mincy
FWS: Franzen

WEATHER: 65° F Partly cloudy

DOWNTIME: 9 hrs. work package

DISCARDED ITEMS: N/A

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 0/36472 Task 6~~ TPC-WO-12-618, RCN-13-000136

REPORT BY: Olin Amos
TITLE: ES TECHNICAL PREPARER
SIGNATURE: Olin Amos

REVIEWED BY: M. [illegible] Wallace
TITLE: ES TECHNICAL REVIEWER
SIGNATURE: [signature] DATE: 04-05-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5 pipe to log and set Probes | DATE: 4-2-13

LOCATION: Hanford Site, C Tank Farm | EXCAVATION: DR-13-0035 | DIG #: 306744 | REPORT #: Rev 3

START CARD NO. SE47754 | DECOMMISSION NO. HE21189 | RWP: CO-762 R.3 | AHA: 66 Rev. Rev 2118

SAMPLING SUMMARY

Sample #'s	Interval	%
1.		
2.	N/A	
3.		
4.		

SITE/EQUIPMENT INSPECTION: (Yes) No | HHU CASE#1 | (HHU CAT #2) | HHUXL#3

BOREHOLE SUMMARY

Borehole # GB763 Tubing (2.5) @ 0 to 0 ft bgs; S.U. —

Borehole # — Tubing ( ) @ to ft bgs; S.U. —

Borehole # — Tubing ( ) @ to ft bgs; S.U. —

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1.	N/A	
2.		
3.		

TIME	WORK SUMMARY
0600	AT office: Safety Meeting (Finger and hand Safety)
0630	Review JSA
0700	Head to C-Farm for POD, (Rec job)
0735	AT C-Farm, waiting for projob
0750	Hold projob, Review Rwp CO-762 R3.
0915	Go Rec in
0935	Back to tower C, do rig inspection, get ready to move equipment into the farm 369.3 hrs.
0910	Safety Briefing on JSA, JHA, By Annette
0950	Dress into C-Farm, Recon site, move rig in and setup
1045	Dress out, Brake for lunch
1100	lunch
1130	waiting for Support
1300	Support on site, move in reds and tooling
1330	Dress into C-Farm to set up site.
1400	Rig set up, Zone setup, Exit farm, (no JHA on site)
1430	out of site, head to Energy Northwest to pickup grease and Materials
1505	Head to office
1530	End shift

OPERATOR/LICENSE: Amos / 1224
ES SUPPORT: Weakley
NCO: Snook, Ruben
HPT: Taff, Jim
FWS: Franzen, IH - Jared

WEATHER: 73° F Sunny

DOWNTIME: 3 hrs. Support personal

DISCARDED ITEMS: N/A

REFERENCE/CONTRACT INFORMATION: ~~FSWO-DOW-028 Rev. 0/36472 Task 6~~ TPC-WO-12-6118, ECN-13-00136

REPORT BY: Olin Amos
TITLE: ES TECHNICAL PREPARER
SIGNATURE: Olin Amos

REVIEWED BY: Mike Walling
TITLE: ES TECHNICAL REVIEWER
SIGNATURE: Mike Walling DATE: 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5 pipe to log and set Probes **DATE:** 4-3-13

LOCATION: Hanford Site, C Tank Farm **EXCAVATION:** ~~DH-13-0035~~ **DIG #** 1306744 **REPORT #:** 2 (Rev 4)

START CARD NO. SE47759 **DECOMMISSION NO.** AE 21189 **RWP:** C0762A.3 **AHA:** 66 ~~mod #0 2118~~

SAMPLING SUMMARY

Sample #'s	Interval	%
1.		
2.	NA	
3.		
4.		

SITE/EQUIPMENT INSPECTION: (Yes) No **HHU CASE#1** (HHU CAT #2) **HHUXL#3**

BOREHOLE SUMMARY

Borehole # C8763 Tubing (2.5) @ 0 to 144 ft bgs; S.U. 2.3

Borehole # — Tubing ( ) @ to ft bgs; S.U. ____

Borehole # — Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1.	NA	
2.		
3		

TIME	WORK SUMMARY
0600	AT office (Safety MTG. Diesel Engine oil) Review MSDS on CAT 15-40
0658	Head to C Farm
0730	ACC in
0745	AT Lower C, waiting for POD
0750	POD, discussed hearing boundarys + Activities for the day
0815	Dress into C Farm, and begin driving 2.5" Rods
0902	Let head cool at 38 FeeT
0925	Drive Pipe
0935	Head hot, exit zone and let head cool
1000	Drive Pipe
1030	Let head cool
1105	Exit Farm for Lunch, AT 88 FeeT
1115	Lunch
1145	Dress into C-Farm and push pipe
1211	Let head cool
1240	Drive pipe
1300	Let head cool at 120 FeeT
1330	Drive pipe
1345	Let head cool
1405	Drive Pipe
1420	Let head cool (at 144 FeeT) Exit Farm
1430	Head to office
1530	End shift 3.71 hrs. on Rig

OPERATOR/LICENSE: Amos / 1224
ES SUPPORT: Weakley
NCO: Snook, Sharp, Izzy
HPT: Jim, Jeff
FWS: Rick Franzen

WEATHER: 69° F
nice sunny / afternoon Clouds

DOWNTIME:
.5 - Support

DISCARDED ITEMS:
2 - Donuts
14 - Lynch Pins

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 0/36472 Task 6~~ TFC-WO-12-6118, ECN-13-00136

REPORT BY: Olin Amos
TITLE: ES TECHNICAL PREPARER
SIGNATURE: Olin Amos

REVIEWED BY: [illegible]
TITLE: ES TECHNICAL REVIEWER
SIGNATURE: [illegible] **DATE:** 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5 pipe to log and set Probes | DATE: 4-4-13

LOCATION: Hanford Site, C Tank Farm | EXCAVATION: ~~DAV-13-0035~~ I-DIG #1306 7441 | REPORT #: 8 5

START CARD NO. SE47759 | DECOMMISSION NO. AB21189 | RWP: CO-762 A.3 AHA: 66-mod-RO-218

SAMPLING SUMMARY

Sample #'s	Interval	%
1.		
2.		
3.	M	
4.		

SITE/EQUIPMENT INSPECTION: (Yes) No | HHU CASE#1 | (HHU CAT #2) | HHUXL#3

BOREHOLE SUMMARY

Borehole # C8763 Tubing (2.5) @ 194 to 221 ft bgs; S.U. 1.3

Borehole # ___ Tubing ( ) @ ___ to ___ ft bgs; S.U. ___

Borehole # ___ Tubing ( ) @ ___ to ___ ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1.		
2.	M	M
3.		

TIME	WORK SUMMARY
0600	AT office : Safety MTG - Rain + slippery surfaces
0630	Head to 200 East, Stop and get Fuel
0705	AT Aces Station, Ace into C Farm.
0720	on site, waiting for Support personal
0815	POD; Stoller logging crew on site and will be Logging during our push activities. Double hearing protection will be worn.
0820	Access into C-Farm, warm up equipment, Rig inspection
0830	Drive pipe
0905	Let head cool
0935	Driving pipe
0950	Let head cool
1010	Drive pipe
1025	Let head cool @ 192 Feet with 2.5 inch pipe
1058	Drive pipe
1115	Let head cool @ 210 Feet, Exit Zone for lunch
1130	lunch
1200	Access into C Farm and finish driving pipe to TD
1238	AT TD @ 221 Feet, Move rig off hole and Stage out of the way for the weekend, clean up site
1300	Exit C-Farm.
1330	Head to office : Tea mat to Survey rig
1530	End shift
	- NM -

OPERATOR/LICENSE: Amos / 1224
ES SUPPORT: Weakley
NCO: Snook, 3224, Ruben
HPT: Saff + Jim
FWS: Franzen

WEATHER: 69° F
Cloudy + Rain

DOWNTIME:
3.5 hrs. Support

DISCARDED ITEMS:
2 - Donuts
5 - Lynch Pins

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 0/36472 Task 6~~ TFC-WO-12-6118, ECR-13-00136

REPORT BY: Olin Amos
TITLE: ES TECHNICAL PREPARER
SIGNATURE: Olin Amos

REVIEWED BY: M. W. Walker
TITLE: ES TECHNICAL REVIEWER
SIGNATURE: M. W. Walker DATE: 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5 pipe to log and set Probes **DATE:** 4-8-13

LOCATION: Hanford Site, C Tank Farm **EXCAVATION:** DH-43-0035 **I-DIG #:** 1306744 **REPORT #:** 6

START CARD NO. SE97759 **DECOMMISSION NO.** AE21189 **RWP:** C0762-R3 **AHA:** CC-Work-Rev.2118

SAMPLING SUMMARY

	Sample #'s	Interval	%
1.			
2.	N/A		
3.			
4.			

SITE/EQUIPMENT INSPECTION: (Yes) No **HHU CASE#1** **HHU CAT #2** **HHUXL#3**

BOREHOLE SUMMARY

Borehole # ~~C8768~~ N/A Tubing ( ) @ to ft bgs; S.U. ____

Borehole # C8767 Tubing (2.5) @ 0 to 82 ft bgs; S.U. 6.3

Borehole # ____ Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

	Boring #	Interval	Type
1.			
2.	N/A		
3.			

TIME	WORK SUMMARY
0600	Safety MTG: Crane Failures,
0630	Head to 200-East
0700	Arr in
0715	Waiting on Support
0830	POC: no Forklift to move Rods, trying to locate one
0900	Move rig to C8767 and set up. A Forklift was located
	move in rods and equipment
1030	Rig set up, Tool up and get ready to drive 2.5
1126	Let Head cool @ 32 Feet
1130	lunch
1200	Press into C-Farm to continue pushing pipe
1220	Let head cool
1250	Drive pipe
1305	Let head cool @ 74 Feet
1325	Drive pipe
1355	Let head cool @ 82 Feet
1410	RCT's ran us out of Farm
1430	Head to office
1500	At office, do paper work
1530	End shift
	N/A

OPERATOR/LICENSE: Ames/1224
ES SUPPORT: Weakley
NCO: Snook, Dezy, Rick
HPT: Jim, Jeff
FWS: Franzen

WEATHER: 59° F cloudy

DOWNTIME: 3.5 hrs. Support

DISCARDED ITEMS: 7 Lynch Pins

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 0/36472 Task 6~~ TFC-WO-12-6118, ECN-13-00136

REPORT BY: Olin Ames
TITLE: *ES TECHNICAL PREPARER*
SIGNATURE: Olin Ames

REVIEWED BY: D.W. WALKER
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: [signature] **DATE:** 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5" Pipe to log and set Probes — DATE: 4-9-13

LOCATION: Hanford Site, C Tank Farm — EXCAVATION: DAN-13-0035 / DIG #: 1306741 — REPORT #: 1

START CARD NO. SE47759 — DECOMMISSION NO. AE21189 — RWP: CO-762 R.3 AHA-66-[illegible]-RD-2118

SAMPLING SUMMARY

Sample #'s	Interval	%
1.	N/A	
2.		
3.		
4.		

SITE/EQUIPMENT INSPECTION: (Yes) No — HHU CASE#1 — (HHU CAT #2) — HHUXL#3

BOREHOLE SUMMARY

Borehole # C8767 Tubing (2.5") @ 82 to 192 ft bgs; S.U. 6.3

Borehole # — Tubing ( ) @ to ft bgs; S.U.

Borehole # — Tubing ( ) @ to ft bgs; S.U.

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1.	N/A	
2.		
3.		

TIME	WORK SUMMARY
0600	AT office : Safety MTG
0630	Head to C Farm
0700	on site, waiting for POP
0815	POP : discussed yellow Jackets and line backers
0830	Access into site
0845	Drive pipe on C8767
0905	Lat head cool
0920	Drive pipe
0945	Lat head cool @ 108
1015	Drive pipe
1025	Lat head cool
1055	Drive pipe
1115	Exit farm for lunch
1145	Drive pipe
1206	Lat head cool
1230	Drive pipe
1257	lat head cool
1330	Drive pipe
1345	Lat head cool
1405	Drive pipe
1423	Exit zone @ 192 Feet
1438	Head to office
1500	AT office, do paperwork
1530	End shift

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Weakley
NCO: Sharp, Snook, Izzy
HPT: Jim & Jeff
FWS: Franzen

WEATHER: 68 F Sunny, no wind

DOWNTIME: 1.5 hrs. Support

DISCARDED ITEMS: 7 - Lynch Pins, 1 - Drive Head

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 0/36472 Task 6~~ TFC-WO-12-6118, ECN-13-00136

REPORT BY: Olin Amos
TITLE : ES TECHNICAL PREPARER
SIGNATURE: Olin Amos

REVIEWED BY: [illegible]
TITLE: ES TECHNICAL REVIEWER
SIGNATURE: [illegible] DATE: 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5 pipe to log and set probes		**DATE:** 4-10-13
LOCATION: Hanford Site, C Tank Farm	**EXCAVATION:** DAN-13-Aug3 **UDIG #:** 13067441	**REPORT #:** 8
START CARD NO. SE47759	**DECOMMISSION NO.** AE 21189	**RWP:** CO-762 R3 **AHA:** 66-[illegible]
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	**HHU CASE#1** **(HHU CAT #2)** **HHUXL#3**

SAMPLING SUMMARY

Sample #'s	Interval	%
1.		
2.	N/A	
3.		
4.		

BOREHOLE SUMMARY

Borehole # C8767 Tubing (2.5) @ 192 to 211 ft bgs; S.U. 1.3

Borehole # C8766 Tubing (2.5) @ 0 to 96 ft bgs; S.U. 6.3

Borehole # ____ Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8763	210.3 - 197.3	GEO Lobe
2.		
3.	~~N/A~~	

TIME	WORK SUMMARY
0600	AT office : Safety MTG - Slips, Trips, & Falls
0630	Head to site
0700	on site, waiting for POD, Shanda & Ergett will log C8763
0805	POD
0830	Drive pipe on C8767
0850	At depth of 211 on C8767, Tagged bottom at 212.2 TOC. Tagged C8763 at 220.7 TOC. Move Rig to C8766
0910	Drive 2.5" Pipe at C8766
0943	Let head cool
1020	Drive Pipe
1040	Let head cool
1105	Drive Pipe
1120	Let head cool @ 92 feet. Press out for lunch
1130	lunch (wind is picking up
1200	Enter zone
1210	Begin driving pipe
1225	Shut down due to wind. Exit zone, waiting for Shanda & Ergett.
1300	Head to Energy Northwest to get Lynch pins
1340	Head to offices, Paperwork
1530	End Shift
	~~N/A~~

OPERATOR/LICENSE: Amos / 1224	**WEATHER:** 71°F	**DISCARDED ITEMS:**
ES SUPPORT: Weakley, Shanda, Ergett	Cloudy, windy 25+	7 - Lynch Pins
NCO: Snook, Ezzy, Sharp	**DOWNTIME:** 1 hr. support	
HPT: To FF	3 hrs. wind	
FWS: Franzen		

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 0/36472 Task 6~~ TFC-ENG-12-6118, ECN-13-00136

REPORT BY: Olin Amos	**REVIEWED BY:** [illegible]
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Olin Amos	**SIGNATURE:** [illegible] **DATE:** 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5 pipe to log and set probes | DATE: 4-12-13

LOCATION: Hanford Site, C Tank Farm | EXCAVATION: DAN-13-0035 | DIG #: 1306744 | REPORT #: 9

START CARD NO. SE47759 | DECOMMISSION NO. AE 21189 | RWP: CO-762 R3 AHA: 66-MWOP-10-2019

SAMPLING SUMMARY

Sample #'s	Interval	%
1.	N/A	
2.		
3.		
4.		

SITE/EQUIPMENT INSPECTION: (Yes) No | HHU CASE#1 | (HHU CAT #2) | HHUXL#3

BOREHOLE SUMMARY

Borehole # C8766 Tubing (2.5) @ 96 to 211 ft bgs; S.U. 1.3

Borehole # C8765 Tubing (2.5) @ 0 to 62 ft bgs; S.U. 6.2

Borehole # ____ Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1 C8763	200-151	Geo Labs
2.	N/A	
3.		

TIME	WORK SUMMARY
0600	AT office : Safety MTG (Bentonite crumbles MSDS)
0630	Head to 200 East
0700	On site waiting for POD - Shanda + Engott Logging today
0830	Enter Zone and start driving pipe
0915	Let head cool @ 130 Feet
0945	Drive pipe
1005	Let head cool @ 146 Feet
1035	Drive pipe
1100	Let head cool (lunch) @ 168 Feet
1135	Dr zone Drive Pipe
1210	AT TD @ 211 Feet, Move rig to C8765
1235	Exit Farm. Rig set up and ready on C8765
1300	Enter Farm and push pipe
1330	Eat head cool
1400	Push Pipe
1420	Exit zone, AT 62 Feet
1430	Head to office
1500	Do paperwork
1530	End Shift
	N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Weakley, Engott, Shanda
NCO: Sharp
HPT: Jim
FWS: Franzen

WEATHER: 64° F
cool, sunny, windy

DOWNTIME:
1.5 hrs. Support

DISCARDED ITEMS:
8- Lynch Pins
1-36" wrench Pipe

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 0/36472 Task 6~~ TFC-ENG-12-6118, ECN-13-00136

REPORT BY: Olin Ames
TITLE: ES TECHNICAL PREPARER
SIGNATURE: Olin Ames

REVIEWED BY: M.W. Wallace
TITLE: ES TECHNICAL REVIEWER
SIGNATURE: [signature] DATE: 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5 pipe to log and set probes | DATE: 4-15-13

LOCATION: Hanford Site, C Tank Farm | EXCAVATION: ~~OAN-13-00135~~ | DIG #: 1306744 | REPORT #: 10

START CARD NO. SE47759 | DECOMMISSION NO. AE 21189 | RWP: CO-762 R3 | AHA: 66-~~xxxP-0xxx~~

SAMPLING SUMMARY

Sample #'s	Interval	%
1.		
2.		
3.	N/A	
4.		

SITE/EQUIPMENT INSPECTION: (Yes) No | HHU CASE#1 | (HHU CAT #2) | HHUXL#3

BOREHOLE SUMMARY

Borehole # C-8765 Tubing (2.5) @ 62 to 168 ft bgs; S.U. 6.3

Borehole # ____ Tubing ( ) @ to ft bgs; S.U. ____

Borehole # ____ Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8763	154-100	BGO LABR
2.		
3.		

TIME	WORK SUMMARY
0600	AT office, Safety MTG: MSDS
0635	Head to 200 East
0700	AT C-Farm, waiting for POD, Shonda and Ergott on site to log
0800	POD. Head into Farm, warm up rig, rig inspection
0855	AT 98 Feet, Let head cool, Shonda and Ergott logging on C8763
0925	In zone driving pipe
0950	AT 120' let head cool
1020	Drive pipe
1100	Let Head cool, exit zone for lunch
1115	lunch
1145	RCT's went to a meeting at the 2704 HV, shut down until they return.
1300	RCT on site enter C-Farm and begin driving
1335	Let head cool
1400	Drive pipe
1415	Exit zone AT 168'
1430	Head to office. Do paper work
1500	Paper work
1570	End shift
	NOTE: C-8763 was logged using BGO-LABR from 154'-100'
	C-8765 Pushed from 62'-168'
	N/A

OPERATOR/LICENSE: Amos/11224

ES SUPPORT: Weakley, Ergott, Shonda

NCO: Lacy, Sharp

HPT: Jeff

FWS: N/A

WEATHER: 57°F Slight wind, Sunny

DOWNTIME: 2 hrs. support

DISCARDED ITEMS:
7- Lynch Pins
1- Donut
1- 2.5" Drivehead

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 03/6472 Task 6~~ PFC-wo-12-6118, ECN-13-00136

REPORT BY: LO Amos

TITLE: ES TECHNICAL PREPARER

SIGNATURE: LO Amos

REVIEWED BY: M.W. Wilkins

TITLE: ES TECHNICAL REVIEWER

SIGNATURE: M.W. Wilkins DATE: 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Drive 2.5 pipe to log and set p-obes		**DATE:** 4-16-13
LOCATION: Hanford Site, C Tank Farm	**EXCAVATION:** DAN-13-0033 **DIG #:** 1306744	**REPORT #:** 11

START CARD NO. SE47759	**DECOMMISSION NO.** AE 21189	**RWP:** CO-762 R3 **AHA.** 66-[illegible]
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	**HHU CASE#1** **(HHU CAT #2)** **HHUXL#3**

Sample #'s	Interval	%
1.		
2.	N/A	
3.		
4.		

BOREHOLE SUMMARY

Borehole # C-8765 Tubing (2.5) @ 168 to 211 ft bgs: S.U. 1.3

Borehole # ___ Tubing ( ) @ to ft bgs: S.U. ___

Borehole # ___ Tubing ( ) @ to ft bgs: S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8763	103-47	B60 LABR
2.		
3.		

TIME	WORK SUMMARY
0600	AT Office (Safety MTG) MSDS's (Lensa cleaner)
0630	Head to 200 East
0700	on site, waiting for POD
0930	Dress into C-Farm, Begin pushing on C8765, Ergett logging with B60 + LABR on C8763.
0915	Set head, cool
0945	Drive pipe
1005	AT depth @ 211 Feet, Rig down, move rig to upper level near C8763. Tag C8766 @ 211.8 TOC, C8765 @ 211.5 TOC
	C8766 has .5 of Fill
	C8765 has .8 of Fill
1115	out of Farm go to Energy Northwest to unload back of pickup to make room to pickup a pallet of Bentonite.
12:00	Lunch
12:30	Head to office to get P-card to go pick up Bentonite
13:00	AT office get p-card to go get bentonite.
13:30	Go to perforated pump
14:35	Back at office with bentonite. Do paperwork
1530	End shift

OPERATOR/LICENSE: AMOS / 1224 *ES SUPPORT:* Weakley, Ergett *NCO:* Sharp, 2224 *HPT:* Dion, Joe PE *FWS:* Steve	**WEATHER:** 56°F Sunny, cold **DOWNTIME:** 1.5 hrs. Support 2.5 hrs. waiting for logging	**DISCARDED ITEMS:** 2-Lynch Pins

REFERENCE/CONTRACT INFORMATION: ~~PSWO-DOW-028 Rev. 072472 Task 6~~ TFC-ops-12-6118, ECN-13-00136

REPORT BY: LO Amos	**REVIEWED BY:** M.W. Wilkins
TITLE: *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Lyle O. Amos	**SIGNATURE:** [illegible] **DATE:** 4-17-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue logging activities in #C8763 and drilling crew on standby for logging to be completed		**DATE:** 04-17-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 12

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (HHU CAT #2) *HHUXL#3*

Sample #'s	Interval	%
1. N/A		
2. N/A		
3. N/A		
4 N/A.		

BOREHOLE SUMMARY

Borehole # C8763 Tubing (2.5") @ 221' to ft bgs; S.U. 1.3

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8763	0' To 45.	Combo
2.		
3.		

TIME	WORK SUMMARY
0600	Safety meeting at office. Topic: Excavation Safety
0710	TRAVEL TO C FARM, ACE-IN
0800	PRE-JOB, DRESS AND ENTER FARM.
0845	SET UP Logging, PRE-FORM, PRE-CHECKS on Combo TOOL.
0911	START Logging FROM 50.0'
0931	STOPPED Logging AND RUN DOWN TO 52.0' TO ARE FORM 5' REPEAT 50.0' TO 45.0' AND CONTINUE Logging.
1247	COMPLETED Logging TO E.S.
1330	EXIT FARM
1355	TRAVEL TO E.S. OFFICE, COMPLETE PAPER WORK
1530	END OF SHIFT.
	N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Weakley, Ehrgott, Icayan* *NCO: Villarreal, Snook* SHARP *HPT: Clayton* *FWS: Franzen*	**WEATHER:** 61 F, mostly sunny with light and variable winds **DOWNTIME:** NONE	**DISCARDED ITEMS:** NONE

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-W-DOW- ECN-13-000136

REPORT BY: MIKE EHRGOTT	**REVIEWED BY:** M. W. WALKER
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Mike Ehrgott	**SIGNATURE:** M. W. Walker **DATE:** 4-18-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue logging activities in #C8763 and drilling crew on standby for logging to be completed		**DATE:** 04-18-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 13

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** Yes No	**HHU CASE#1** (HHU CAT #2) HHUXL#3

Sample #'s	Interval	%
1. N/A		
2. N/A		
3. N/A		
4 N/A.		

BOREHOLE SUMMARY

Borehole # C8763 Tubing (2.5") @ G.S. to 221 ft bgs: S.U. 1.3

Borehole # N/A Tubing ( ) @ to ft bgs: S.U. ___

Borehole # N/A Tubing ( ) @ to ft bgs: S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8763	218.5'/210.0'	Moist.
2.		
3.		

TIME	WORK SUMMARY
0600	Safety meeting at office. Topic: Working Together
0720	TRAVEL TO CFARM. 0750 ARE-IN RWP CO-762 REV 3.
0800	PRE-JOB STAND-BY FOR NUTRON SOURCE TO BE PICKED
-	UP BY NCO's & RCT's TO SUPPORT LOGGING
0850	TRAVEL TO SMURF BUILDING PER FWS IN SUPPORT
	OF "TAKE COVER DRILL" FROM 9:30 TO 10:30
1100	DISCUSS ISSUE WITH WRPS RAD-CON ABOUT RADIOACTIVE
-	SOURCE USED FOR PRE-CHECKS & POST CHECKS. WAS ASKED
-	TO TAKE SOURCE OFF-SITE UNTIL PATH FORWARD.
-	K. REYNOLDS & RUSS RAUDEL HAVE BEEN NOTIFIED.
1210	DRESS AND ENTER FARM AND SET UP FOR MOISTURE
	LOGGING.
1300	RCT WITH SOURCE 1315 PERFORM SOURCE mg. CHECK
1320	ZERO CHECK AND RUN DOWN TO 218.5'
1333	START LOGGING FROM 218.5
1344	PERFORM A 5' REPEAT 218.5' TO 210.0' AND CONTINUE
-	LOGGING.
1400	STOP LOGGING AT 210.0'
1414	PERFORM A SOURCE POST CHECK
1430	SECURE WORK AREA AND EXIT FARM.
1450	TRAVEL TO ES OFFICE AND COMPLETE PAPER WORK
1530	END OF SHIFT.
	N/A

OPERATOR/LICENSE: Ehrgott/3115
ES SUPPORT: Amos, Icayan
NCO: Villarreal, Sharp
HPT: Clayton
FWS: Franzen

WEATHER: 66 F, mostly cloudy and becoming breezy this afternoon

DOWNTIME: 3.5 HRS
- TAKE COVER DRILL.
- SOURCE ISSUE.

DISCARDED ITEMS: N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-W-DOW- ECN-13-000136

REPORT BY: MIKE EHRGOTT
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE: Mike Ehrgott

REVIEWED BY: SD W. WALKER
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: [signature] **DATE:** 04-22-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue logging activities in #C8763 and drilling crew on standby for logging to be completed		**DATE:** 04-22-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 14

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (HHU CAT #2) *HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A

BOREHOLE SUMMARY

Borehole # C8763 Tubing (2.5" @ 0.5' to 221' ft bgs: S.U. 1.3

Borehole # N/A Tubing (—) @ to ft bgs: S.U. —

Borehole # N/A Tubing (—) @ to ft bgs: S.U. —

GEOPHYSICAL LOGGING

Boring # Interval Type

1. C8763 ~~0.50 to 208.0'~~ PNNL 213 to 108'
2. N/A
3. N/A

TIME	WORK SUMMARY
0600	Safety meeting at office. Topic: Radiation Exposure In The Workplace
0710	TRAVEL TO C-FARM
0750	ACE-IN
0800	STAND-BY FOR PRE-JOB
0820	DRESS AND ENTER FARM, SET UP FOR LOGGING.
0855	REALIZED DID NOT HAVE MC-1
0900	EXIT FARM AND RETRIEVE MC-1 TOOL
0940	DRESS AND ENTER C-FARM
1005	PRE-CHECK WITH MOISTURE SOURCE @ C8763.
1010	RUN DOWN TO 213.0' (3' OVER LAP) FROM PREVIOUS DAY LOGGING.
1024	START LOGGING FROM 213.0'.
1035	PERFORM 5' REPEAT 213.0' TO 208.0', CONTINUE LOGGING.
1330	STOPPED LOGGING @ 108.0 bgs, RETURN TO ZERO = -0.42'.
1340	POST CHECK.
1405	SP SECURE WORK AREA, EXIT FARM 1530 END OF SHIFT

N/A ARS 4/22/13

OPERATOR/LICENSE: Ehrgott/3115 *ES SUPPORT:* Icayan *NCO:* Villarreal *HPT:* Clayton *FWS:* Franzen	**WEATHER:** 64 F, mostly sunny with winds from the north northwest at 5-10 mph **DOWNTIME:** 1 HR RETRIEVE Logging TOOL	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-W-DOW- ECN-13-000136

REPORT BY: MIKE EHRGOTT	**REVIEWED BY:** MAN. WAIVER
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Mike Ehrgott	**SIGNATURE:** [signature] **DATE:** 04-24-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Complete logging activities in #C8763 and drilling crew on standby for logging to be completed		**DATE:** 04-23-13
LOCATION: "C" Tank Farm—Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #I3067441	**REPORT #:** 15
START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY Sample #'s Interval % 1. N/A 2. N/A 3. N/A 4 N/A.	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (HHU CAT #2) *HHUXL#3*

BOREHOLE SUMMARY

Borehole # C8763 Tubing (2.5") @ 0' to 221' ft bgs; S.U. 1.3

Borehole # N/A Tubing (—) @ — to — ft bgs; S.U. —

Borehole # N/A Tubing (—) @ — to — ft bgs; S.U. —

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8763	111.0' to G.S.	MOIST.
2.		
3.		

TIME	WORK SUMMARY
0600	Safety meeting at office. Topic: Why Take a Chance With Safety Risk?
0715	TRAVEL TO C-FARM
0745	ARRIVE
0800	STAND BY FOR PRE-JOB
0810	PRE JOB by FWS STAND by FOR "KEY" CHANGE TRAILER
0850	NCO'S HAVE KEY. DRESS AND ENTER FARM, SET UP FOR LOGGING
0925	RCT on LOCATION WITH SOURCE, PRE CHECK WITH SOURCE
0938	RUN DOWN
0941	START LOGGING FROM 111.0' bgs
0950	5' REPEAT 111.0' TO 106.0' AND CONTINUE LOGGING.
1238	STOPPED LOGGING @ 80 G.S. 111.0' LOG
1240	POST CHECK WITH SOURCE, PACK UP LOGGING EQUIPMENT
—	AND MOVE TO C8767.
1340	EXIT FARM, TRAVEL TO ES OFFICE, COMPLETE PAPER WORK.
1530	END OF SHIFT

N/A ALL

OPERATOR/LICENSE: Ehrgott/3115 *ES SUPPORT: N/A* *NCO: Villarreal* *HPT: Clayton* *FWS: Franzen*	**WEATHER:** 71 F, partly sunny with winds from the east at ~5 mph **DOWNTIME:** 40 min. waiting for KEY	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-W-DOW- ECN-13-000136

REPORT BY: MIKE EHRGOTT	**REVIEWED BY:** [illegible]
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: [signature]	**SIGNATURE:** [signature] **DATE:** 04-24-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Begin moisture logging in #C8767 and probe installation in #C8763		**DATE: 04-24-13**
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION: DAN-13-0035 U-DIG: #13067441**	**REPORT #: 16**

START CARD NO. SE47759	**DECOMMISSION NO. AE21189**	**RWP: CO-762 Rev.3 JHA-GG-NWOP-RO-2118**
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION: (Yes) No**	***HHU CASE#1 (HHU CAT #2) HHUXL#3***

Sample #'s Interval %

1. *N/A*
2. *N/A*
3. *N/A*
4. *N/A*

BOREHOLE SUMMARY

Borehole # C8763 *Tubing* (2.5") @ 224' to 217 *ft bgs; S.U.* 5.0'

Borehole # N/A *Tubing* ( ) @ to *ft bgs; S.U.* ___

Borehole # N/A *Tubing* ( ) @ to *ft bgs; S.U.* ___

GEOPHYSICAL LOGGING

Boring #	*Interval*	*Type*
1. C8767	209.0'-80.0'	Moisture
2. N/A		
3. N/A		

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Your Hearing: Keep it for a Lifetime.**
0708	Travel to "C" Farm for P.O.D. and "ACE" under RWP CO-762 Rev. 3.
0740	Onsite at "C" Farm. Standby for P.O.D.
0800	P.O.D. held by WRPS FWS S. Withrow.
0835	Dress and enter farm.
0845	Inspect and warm CAT HHU. No problems noted. Set-up CAT HHU on exploratory boring #C8763.
0900	Run inner string in hole and drive out knock-out tip. Pull inner string out of hole. ESGG has began moisture logging in boring #C8767.
------	NOTE: Notified by WRPS FWS S. Withrow to pull CAT HHU and support equipment off of hole for a crane to access the site.
1130	Moved CAT HHU and support equipment off of boring.
1145	Exited far.
1200	Lunch.
1230	Standby for WRPS crane to access site. ESGG crew is continuing to moisture log.
1410	Travelled to office. Completed paperwork and timecard.
1530	End of shift.
	N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Weakley, Ehrgott, Walkup, Icayan* *NCO: Villarreal, Snook, Sharp* *HPT: Clayton, Mincy* *FWS: Franzen, Withrow*	**WEATHER: 72 F, mostly sunny with light and variable winds** **DOWNTIME: 3 Hrs. for crane access and 20 minutes for P.O.D.**	**DISCARDED ITEMS:** 3---Lynch pins 1---Nylatron donut 1---2.5" expendable tip

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: L O AMOS	**REVIEWED BY:** [illegible]
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: L O Amos	**SIGNATURE:** [illegible] **DATE:** 04-25-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Complete moisture logging in #C8767 and possibly continue probe installation in #C8763		**DATE:** 04-25-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 17

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** Yes (No)	HHU CASE#1 (HHU CAT #2) HHUXL#3

SAMPLING SUMMARY

Sample #'s	Interval	%
1. N/A		
2. N/A		
3 .N/A		
4 N/A.		

BOREHOLE SUMMARY

Borehole # C8763 Tubing (2.5") @ 250' to N/A ft bgs; S.U. 1

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8767	80.0'-GS	Moisture
2. C8766	209.0'-167.0'	Moisture
3. N/A		

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Driving Safely in Traffic.**
0715	Travel to "C" Farm for P.O.D. and "ACE" under RWP CO-762 Rev. 3.
0745	Onsite at "C" Farm. Standby for P.O.D.
0805	P.O.D. held by WRPS FWS R. Franzen
0845	WRPS crane has not been moved from site next to boring #C8763. WRPS FWS dressed and entered farm to check exactly how close
-----	to the boring the crane is. The crane's outrigger is ~8.0" from our casing. It is too close to re-set the CAT HHU on the boring to
-----	continue multi-level resistivity probe installation.
0905	ESGG logging crew dressed and entered farm. Moisture logging was completed in boring #C8767 from 80.0' BGS to GS.
-----	ESGG drilling crew on standby due to the close proximity of the WRPS crane to boring #C8763.
1100	Lunch.
1130	ESGG drilling crew on standby due to the close proximity of the WRPS crane to boring #C8763. ESGG logging crew began moisture
-----	Logging in boring #C8766. The boring was logged from 209.0' BGS to 167.0' BGS.
1430	ESGG logging crew travelled to office. Completed paperwork and timecard.
1530	End of shift.
	N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Weakley, Walkup, Icayan* *NCO: Villarreal, Snook, Sharp* *HPT: Clayton, Mincy* *FWS: Franzen, Withrow*	**WEATHER:** 77 F, mostly sunny with light and variable winds **DOWNTIME:** 9 Hrs. for WRPS crane	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: Olin Amos	**REVIEWED BY:** M. W. Walkup
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Olin Amos	**SIGNATURE:** M. W. Walkup **DATE:** 04-25-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Complete moisture logging in #C8766 and drilling crew standby for WRPS crane to be moved		**DATE:** 04-29-13
LOCATION: "C" Tank Farm—Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 18

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** *Yes No*	*HHU CASE#1 HHU CAT #2 HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A

BOREHOLE SUMMARY

Borehole # C8763 Tubing (2.5") @ 247.0' to N/A ft bgs; S.U. 1.0'

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8766	167.0'- N/A	Moisture
2. N/A		
3. N/A		

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Hazardous Atmospheres in Confined Spaces.**
0630	On standby for entire shift due to WRPS crane being in very close proximity to boring #C8763 and high winds.
1100	Lunch.
1130	On standby for remainder of shift. Complete paperwork and timecard
1530	End of shift.

N/A

OPERATOR/LICENSE: Ames/1224 *ES SUPPORT: Weakley, Walkup, Icayan, Ehrgott* *NCO: Villarreal, Snook* *HPT: Clayton, Mincy* *FWS: Franzen, Withrow*	**WEATHER:** 68 F, partly cloudy. Winds from the SW at 25-30 mph, gusting 35-50 mph. **DOWNTIME:** 9 Hrs. for WRPS crane and high winds.	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: Olin Ames	**REVIEWED BY:** M.W Walkup
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Olin Ames	**SIGNATURE:** [signature] **DATE:** 04-29-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue moisture logging in #C8766 and drilling crew standby for WRPS crane to be moved		**DATE:** 04-30-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG #:**13067441	**REPORT #:** 19
START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762, Rev. 3 JHA-GG-NWOP-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** Yes (No)	*HHU CASE#1* (*HHU CAT #2*) *HHUXL#3*

Sample #'s Interval %

1. N/A
2.
3.
4.

BOREHOLE SUMMARY

Borehole # N/A *Tubing ( ) @ to ft bgs; S.U.*
Borehole # N/A *Tubing ( ) @ to ft bgs; S.U.*
Borehole # N/A *Tubing ( ) @ to ft bgs; S.U.*

GEOPHYSICAL LOGGING

Boring #	*Interval*	*Type*
1.C8766	*170.0'-60.0'*	*Moisture*
2 N/A.		
3.N/A		

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Jack Safety, How To Use Jacks Safely.**
0630	On standby for entire shift due WRPS crane being in very close proximity to boring #C8763.
0645	ESGG logging crew travelled to "C" Farm and ACED under RWP CO-762 Rev. 3.
0755	P.O.D. by WRPS FWS R. Franzen.
0815	ESGG logging crew dressed and entered farm.
0930	Moisture logging activities began in boring #C8766 from 170.0' BGS.
1100	Lunch.
1130	Moisture logging was completed to 60.0' BGS.
1400	Secured logging equipment and exited farm.
1430	Travelled to office. Completed paperwork and timecard.
1530	End of shift.
	N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT Weakley, Icayan, Ehrgott* *NCO::Villarreal, Snook* *HPT: Clayton, Mincy* *FWS: Franzen, Withrow*	**WEATHER:** 69 F, partly cloudy with light and variable winds. **DOWNTIME:** 9 Hrs. for WRPS crane	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: MIKE EHRGOTT	**REVIEWED BY:** [illegible]
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Mike Ehrgott	**SIGNATURE:** [illegible] **DATE:** 05-05-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Complete moisture logging in #C8766 and continue probe installation in boring #C8763		**DATE:** 05-01-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 20

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (*HHU CAT #2*) *HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A.

BOREHOLE SUMMARY

Borehole # ~~C8764~~ C8766 Tubing (2.5") @ 2.5' to 165' ft bgs; S.U. ~~1.34~~ 1.3'

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8766	~~0.0'~~ 62.0' TO 0.5'	Moisture
2. C8765	209' TO 129.0'	Moist
3. N/A		

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Wheelbarrows**
0740	Travel to "C" Farm and ACE under RWP CO-762 Rev. 3.
0805	Onsite at "C" Farm. Standby for P.O.D.
0820	P.O.D. by WRPS FWS
~~0740~~	~~TRAVEL TO C FARM~~
~~0805~~	~~ACE IN RWP CO-762 REV 3~~ MK 5/1/13
~~0820~~	~~PRE-JOB~~
0900	DRESS AND ENTER FARM
0920	START LOGGING FROM 63.0'
0934	STOPPED LOGGING FOR 5' REPEAT 63.0' TO 58.0' AND
—	CONTINUE LOGGING.
1110	COMPLETED LOGGING TO C.S. COMPLETE RETURN ZERO = -1.26'
	POST CHECK RCT SURVEY CHECK OF SOURCE 1118 MOVE AND SETUP
	ON C8765' 1144 START LOGGING FROM 209.0'.
*	NOTE: DAILY/REPEAT WAS COMPLETED ON C8766
1230	ES DRILLING CREW DRESS & ENTER FARM (WRPS CRANE HAS BEEN
	MOVED) TO CONTINUE PROBE INSTALLATION FROM 217.0' ON C8763
1300	RESUME DECOMMISSIONING & PROBE INSTALL AT C8763.
1400	STOPPED LOGGING @ 129.0'
1415	DECOMMISSION TO 145' FOR TODAY
1430	SECURE WORK AREAS AND EXIT FARM
1440	TRAVEL TO ES OFFICE
1530	END OF SHIFT
	N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Weakley, Walkup, Icayan, Ehrgott* *NCO: Villarreal, Snook* *HPT: Clayton, Mincy* *FWS: Franzen, Withrow*	**WEATHER:** 67 F, mostly sunny with light and variable winds **DOWNTIME:** 0 HR WAITING FOR WRPS CRANE TO MOVE.	**DISCARDED ITEMS:** 2-BENTONITE 200' MULTI TUBE

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: MIKE EHRGOTT	**REVIEWED BY:** M. [illegible]
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Mike Ehrgott	**SIGNATURE:** [signature] **DATE:** 05-01-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Complete moisture logging in #C8765 and continue probe installation in boring #C8763

DATE: 05-02-13

LOCATION: "C" Tank Farm—Near C-200

EXCAVATION: DAN-13-0035
U-DIG: #13067441

REPORT #: 21

START CARD NO. SE47759

DECOMMISSION NO. AE21189

RWP: CO-762 Rev.3 JHA-GG-NWOP-RO-2118

SAMPLING SUMMARY

Sample #'s	Interval	%
1. N/A		
2. N/A		
3. N/A		
4. N/A		

N/A

SITE/EQUIPMENT INSPECTION: (Yes) No

HHU CASE#1 (*HHU CAT #2*) *HHUXL#3*

BOREHOLE SUMMARY

Borehole # C8763 Tubing (3.5") @ 135 to 0 ft bgs; S.U. 0

Borehole # N/A Tubing ( )@ to ft bgs; S.U. ___

Borehole # N/A Tubing ( )@ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8765	132-0	M
2. N/A		
3. N/A		

TIME	WORK SUMMARY
0600	Safety meeting at office. Topic: May is National Electrical Safety Month.
0630	Travel to "C" Farm and ACE under RWP CO-762 Rev. 3.
0700	Onsite at "C" Farm. Standby for P.O.D. / Ergott and Shanda logging C-8765
0930	P.O.D. by WRPS FWS / waiting for RCT
0950	Dress and enter farm. Inspect and warm CAT HHU, no problems noted.
0905	Begin pulling pipe and setting probe.
0915	Get Bentonite in east gate at C-Farm
1030	Exit Farm for lunch
1040	lunch
~~1130~~ 1118	waiting for RCT
1150	Enter site and get ready to pull pipe and set probe
1200	RCT on ~~right~~ site, start pulling pipe
1315	Pipe out of hole, clean up site move rig out of the way and park in usual spot.
1340	Exit Farm
1400	Head to office, RCTs will survey rig. (Monday?)
1435	At office, paper work
1530	End shift
	NOTE: Ergott and Shanda Finished logging C-8765 from 132-0' (moisture)
	Amos and Weakley completed C8763 (multi-probe)
	N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Weakley, Walkup, Icayan, Ehrgott
NCO: Villarreal, Snook
HPT: Clayton, Mincy
FWS: Franzen, Withrow

WEATHER: 76 F, mostly sunny with light and variable winds

DOWNTIME: 3.5 hrs. RCT

DISCARDED ITEMS:
7 - Bags Bentonite
1 - Diatomaceous earth
1 - Sand

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: L O Amos

TITLE: *ES TECHNICAL PREPARER*

SIGNATURE: L O Amos

REVIEWED BY: M. D. Walker

TITLE: *ES TECHNICAL REVIEWER*

SIGNATURE: M D Walker **DATE:** 05-06-13

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200 FT MULTI LEVEL RESISTIVITY PROBE WORK SHEET BOREHOLE NO: C-8763

DIMENSIONS	PRELIMINARY AS-BUILT	CONSTRUCTION MATERIAL/TAG	
PLANNED	ACTUAL	MATERIAL	TAG
0 ft		SURFACE PROTECTION @ 3 FT BGS	
		Bentonite from ____ to ____ Sand from ____ to ____ D.E. from ____ to ____ Sand from ____ to ____	☐
-20 ft-	- 0 ft - 51	51'	
		Bentonite from 0 to 50 Sand from 50 to 50.5 D.E. from 50.5 to 53.5 Sand from 53.5 to 54	☑
-40 ft-	-51 ft - 53	2'	
		18'	
		Bentonite from 54 to 70 Sand from 70 to 70.5 D.E. from 70.5 to 73.5 Sand from 73.5 to 74	☑
-60 ft-	-71 ft - 73	2'	
		18'	
		Bentonite from 74 to 90 Sand from 90 to 90.5 D.E. from 90.5 to 93.5 Sand from 93.5 to 94	☑
-80 ft-	-91 ft - 93	2'	
		18'	
		Bentonite from 94 to 110 Sand from 110 to 110.5 D.E. from 110.5 to 113.5 Sand from 113.5 to 114	☑
-100 ft-	-111 ft - 113	2'	
		18'	
		Bentonite from 114 to 130 Sand from 130 to 130.5 D.E. from 130.5 to 133.5 Sand from 133.5 to 134	☑
-120 ft-	-131 ft - 133	2'	
		18'	
		Bentonite from 134 to 150 Sand from 150 to 150.5 D.E. from 150.5 to 153.5 Sand from 153.5 to 154	☑
-140 ft-	-151 ft - 153	2'	
		18'	
		Bentonite from 154 to 170 Sand from 170 to 170.5 D. E from 170.5 to 173.5 Sand from 173.5 to 174	☑
-160 ft-	-171 ft - 173	2'	
		17.5	
		Bentonite from 174 to 199.5 Sand from 199.5 to 190 D.E. from 190 to 192.5 Sand from 192.5 to 193	☑
-180 ft-	-190.5 ft - 192	____	
		Bentonite 193' - 222'	

NOTE 1: Resistivity Probe measurements are to the bottom of the probe.

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Calibration Models to check WRPS source with Gamma Tools		**DATE:** 05-06-13
LOCATION: "C" Tank Farm ---Near C-200	**EXCAVATION:** DAN-13- 0035 **U-DIG #** 13067441	**REPORT #** 22

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** *Yes* (No)	*HHU CASE#1 HHU CAT #2 HHUXL#3*

SAMPLING SUMMARY

Sample #'s	*Interval*	*%*
1.	N/A	
2.		
3.		
4.		

BOREHOLE SUMMARY

Borehole # N/A *Tubing (* *)@* *to* *ft bgs; S.U.*

Borehole # N/A *Tubing (* *)@* *to* *ft bgs; S.U.*

Borehole # N/A *Tubing (* *)@* *to* *ft bgs; S.U.*

GEOPHYSICAL LOGGING

Boring # *Interval* *Type*

1. *Calibrating with Sources 3&4*
2. N/A
3. N/A

TIME	WORK SUMMARY
0600	Safety meeting at ES office, Topic: Spiders, Bugs, and Hidden Hazards.
0815	Travel to Smurf to Ace-in
0900	Meet at Calibration Models to calibrate WRPS Sources to Gamma tools. Standby for RCT support with WRPS sources. Russ Randall with Three Rivers Scientific on site to support.
1100	RCT onsite with WRPS source.
----------	Calibrate BGO, Pre-Verify-with Source 3/Source 4/Background (Assay Date on both Sources is 5/29/13) SBK @ 17.5'-50 counts @ 10 seconds each. SBT @ 8.5' – 50 counts @ 10 seconds each. Post-Verify- Source 3/Source 4/Background.
----------	Calibrate LaBr, Pre-Verify-Background/Source 3/Source 4. SBK @ 17.5'-50 counts @ 10 seconds each, SBT@ 8.5'-50 counts @ 10 seconds each. Post-Verify – Background/Source3/Source4
----------	Variance testing- Source 3 (Dim:2"L x 1-3/8" H x 1-3/4"W).
1400	Secure Calibration MODs , Exit site for ES office
1530	End of Shift.

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT;Walkup,Weakly,Icayan,* *NCO: Snook, ,Villarreal* *HPT:Mincy* *FWS: Franzan*	**WEATHER:** SUNNY **DOWNTIME:** NONE	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN- 13-000136

REPORT BY: Olin Amos	**REVIEWED BY:** M. W. WALKUP
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Olin Amos	**SIGNATURE:** [signature] **DATE:** 5-24-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Start Gamma Logging on C8767		**DATE:** 05-07-13
LOCATION: "C" Tank Farm ---Near C-200	**EXCAVATION:** DAN-13- 0035 **U-DIG #** 13067441	**REPORT # 23**

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** Yes (No)	*HHU CASE#1 HHU CAT #2 HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A

N/A

BOREHOLE SUMMARY

Borehole # C8767 Tubing (2.5") @ 211.0' to - ft bgs; S.U.1.33'

Borehole # C8767 Tubing ( ) @ to ft bgs; S.U. (no 5/7/13)

Borehole # ____ Tubing ( ) @ to ft bgs; S.U. (no 5/7/13)

GEOPHYSICAL LOGGING

Boring # Interval Type

1. N/A
2.
3.

N/A

TIME	WORK SUMMARY
0600	Safety meeting at ES office, Topic: Back Injury Prevention.
0715	Travel to C-Farm , Acc-in
0800	Stand-by for Pre-Job…
0815	RCT indicated that the Source #3 needs to be transferred from existing custodian to the Tank Farm Custodian and that it would take all day. Waiting to hear back from FWS R. Franzan to confirm…no source will be available.
-------	Standby for logging. No Source available for logging do to transfer of custodianship.
1030	Travel to ENW lay down yard.
1530	End of shift.

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT; Ehrgott,* *NCO: Snook, ,Villarreal* *HPT:Mincy* *FWS: Franzan*	**WEATHER:** Partly Cloudy **DOWNTIME:** 7hr, no source.	**DISCARDED ITEMS:** NONE

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN- 13-000136

REPORT BY: Mike Ehrgott **TITLE :** *ES TECHNICAL PREPARER* **SIGNATURE:** Mike Ehrgott	**REVIEWED BY:** [illegible] **TITLE:** *ES TECHNICAL REVIEWER* **SIGNATURE:** [illegible] **DATE:** 5-24-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Start Gamma Logging on C8767		**DATE:** 05-08-13
LOCATION: "C" Tank Farm —Near C-200	**EXCAVATION:** DAN-13- 0035 U-DIG # 13067441	**REPORT #** 24
START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY *Sample #'s Interval %* *1.N/A* *2 N/A.* *3.N/A* *4.N/A*	**SITE/EQUIPMENT INSPECTION:** *Yes* (No)	*HHU CASE#1 HHU CAT #2 HHUXL#3*
	BOREHOLE SUMMARY *Borehole # C8767__ Tubing (2.5") @ 211.0' to - ft bgs; S.U.1.33'* *Borehole # n/a Tubing ( )@ to ft bgs; S.U.* *Borehole # n/a Tubing ( )@ to ft bgs; S.U.*	**GEOPHYSICAL LOGGING** *Boring # Interval Type* *1.C8767 209.0' to 163.0' Gamma* *2. n/a* *3. n/a*

TIME	WORK SUMMARY
0600	Safety meeting at ES office, Topic: Heat Stress
0700	Travel to C-Farm, Ace-in
0735	Standby for Pre-Job…NCO's have work package and key.
0820	Travel with RCT to pick up and sign out Source #3 from Smurf bldg… Travel back to C-Farm.
0850	Sign work package and dress and enter farm.
0910	Set up for Gamma Logging, Pre-Checks with combo tool.
0957	Start logging from 209.0' on C8767 with Combo tool (BGO/LaBr).
1019	Perform 5' repeat 209.0' to 204.0' and continue logging.
1332	Stopped logging @ 163.0' (46' Logged).
1342	Return to zero = -0.31
1344	Post – Checks with combo tool.
1410	Secure work area and exit farm. Travel to middle C-Farm change trailer to perform whole body survey (Argo).
1440	Leaving C-Farm for ES office, complete paper work, and time card.
1530	End of shift.
	n/a

OPERATOR/LICENSE: Ames/1224 *ES SUPPORT; Ehrgott,* *NCO: Snook, ,Villarreal* *HPT:Mincy, Joe* *FWS: Franzan*	**WEATHER:** sunny **DOWNTIME:** None	**DISCARDED ITEMS:** None
REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118	GG-NW-DOW-003	ECN- 13-000136
REPORT BY: Mike Ehrgott **TITLE :** *ES TECHNICAL PREPARER* **SIGNATURE:** Mike Ehrgott	**REVIEWED BY:** [illegible] **TITLE:** *ES TECHNICAL REVIEWER* **SIGNATURE:** [illegible] **DATE:** 5-21-13	

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue Gamma Logging @ C8767		**DATE:** 05-09-13
LOCATION: "C" Tank Farm ---Near C-200	**EXCAVATION:** DAN-13- 0035 **U-DIG #** 13067441	**REPORT #** 25

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** *Yes* (No)	*HHU CASE#1 HHU CAT #2 HHUXL#3*

Sample #'s Interval %

1.N/A
2.N/A
3.N/A
4.N/A

BOREHOLE SUMMARY

Borehole #C8767 Tubing (2.5") @ 211.0' to ft bgs; S.U.
Borehole # N/A Tubing ( ) @ to ft bgs; S.U.
Borehole # N/A Tubing ( ) @ to ft bgs; S.U.

GEOPHYSICAL LOGGING

Boring # Interval Type
1.C8767 166.0' to 115.0' Gamma
2. N/A
3. N/A

TIME	WORK SUMMARY
0600	Safety meeting at ES office, Topic: Biological Hazards and Heat Stress.
0704	Travel to C-Farm
0733	Ace-in
0804	NCO's arrive with work package and key.
0824	RCT arrives…travel to 2704-HV for Source #3
0852	Return to C-Farm…sign work package, dress and enter farm. Setup and start logging from 166.0'bgs.
1004	Completed 5' repeat 166.0' to 161.0' and continue logging.
1054	FWS R. Franzan off site
1402	Stopped logging at 115.0', logged 51', perform post-checks of gamma tool, Return error = -0.78, exit farm.
1415	Complete whole body survey at middle C- change trailer, travel to ES office.
1447	Complete paper work and time sheet.
1530	End of shift

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT; weakly, Icayan* *NCO: Snook, ,Villarreal* *HPT:Mincy* *FWS: Franzan*	**WEATHER:** Sunny **DOWNTIME:** None	**DISCARDED ITEMS:** None

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN- 13-000136

REPORT BY: Olin Amos	**REVIEWED BY:** M. W. Winkler
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Olin Amos	**SIGNATURE:** [signature] **DATE:** 5-21-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Gamma logging on C8767 | **DATE:** 05-13-13

LOCATION: "C" Tank Farm ---Near C-200 | **EXCAVATION:** DAN-13- 0035, U-DIG # 13067441 | **REPORT # 26**

START CARD NO. SE47759 | **DECOMMISSION NO.** AE21189 | **RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118

SAMPLING SUMMARY

Sample #'s	Interval	%
1. N/A		
2. N/A		
3. N/A		
4. N/A		

SITE/EQUIPMENT INSPECTION: Yes (No) | *HHU CASE#1 HHU CAT #2 HHUXL#3*

BOREHOLE SUMMARY

N/A

Borehole # _____ Tubing ( )@ to ft bgs; S.U.

Borehole # _____ Tubing ( )@ to ft bgs; S.U.

Borehole # _____ Tubing ( )@ to ft bgs; S.U.

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8767	118.0 to 89.0	Gamma
2.		
3.		

TIME	WORK SUMMARY
0600	Safety meeting at ES office, Topic: Radiation exposure in the workplace.
0754	Travel to C Farm
0824	ACE's station, pre-job, waiting on HPT
0840	Travel to 2704-HU For verification Source pick-up with HPT.
0905	Returned with source, dress and enter farm. Started logging at 118'.0
1215	FWS ceased logging due to inclement weather, wind and rain.
1238	AOAP 008 in effect.
1257	Exited farm, site secure, logged from 118.0 to 89.0
1303	Whole body survey, travel to office
1328	Arrived at office, paper work, time card prep.
1530	End of shift.

N/A

OPERATOR/LICENSE: Ehrgott/3115
ES SUPPORT; Weakly, Icayan, Hoopes
NCO: Snook, Villarreal
HPT: Richter
FWS: ~~Emmon~~ Withrow

WEATHER: Lt Rain overcast 72°

DOWNTIME: ~1.5 hr Do to WEATHER

DISCARDED ITEMS: NONE

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 | GG-NW-DOW-003 | ECN- 13-000136

REPORT BY: M.A. Weakley
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE:

REVIEWED BY: R.W. Walker
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: **DATE:** 5-21-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue Gamma Logging @ C8767		**DATE:** 05-14-13
LOCATION: "C" Tank Farm ---Near C-200	**EXCAVATION:** DAN-13- 0035 **U-DIG #** 13067441	**REPORT #** ~~26~~ 27 rev

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1 HHU CAT #2 HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A

N/A

BOREHOLE SUMMARY

Borehole #C8767 Tubing (2.5") @ 211.0' to ft bgs; S.U.

Borehole # _____ Tubing ( ) @ to ft bgs; S.U.

Borehole # _____ Tubing ( ) @ to ft bgs; S.U.

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8767	~~106.0' to 115.0'~~	Gamma
2.	92# to 47.0'	
3.		

TIME	WORK SUMMARY
0600	Paper work and safety meeting at office. Topic: work clothing.
0703	Travel to C Farm.
0731	ACES station, stand by for support to arrive.
0756	FWS arrives - Steve Winthrow, pre-job, topic: safety Expo today, will require earlier shut down.
0823	NCO's arrive.
0839	HPT arrives with verification source.
0840	Dress, enter farm, begin logging at 92.0'
1244	Stopped logging at 47.0' per FWS instructions.
1322	Exited Farm, site secured.
1329	whole body survey, travel to ENW for parts pick-up.
1403	Picked up parts, travel to office
1485	Arrived at office, paper work, time sheets.
1530	End of shift

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT:* Weakly, Icayan, Hoopes *NCO:* Snook, Villarreal *HPT:* ~~Mincy~~ Richter *FWS:* ~~Franzen~~ Winthrow	**WEATHER:** Sunny 84° **DOWNTIME:** ~~None~~	**DISCARDED ITEMS:** ~~None~~ 1 Aluminium 2.5" plug For Source holder

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN- 13-000136

REPORT BY: M A WEAKLEY **TITLE :** *ES TECHNICAL PREPARER* **SIGNATURE:**	**REVIEWED BY:** M. W. WRIGHT **TITLE:** *ES TECHNICAL REVIEWER* **SIGNATURE:** **DATE:** 05-21-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue Gamma Logging @ C8767		**DATE:** 05-15-13
LOCATION: "C" Tank Farm ---Near C-200	**EXCAVATION:** DAN-13- 0035 U-DIG # 13067441	**REPORT # 28**

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1 HHU CAT #2 HHUXL#3*

Sample # 's Interval %

1. N/A
2. N/A
3. N/A
4. N/A

N/A

BOREHOLE SUMMARY

Borehole #C8767 Tubing (2.5") @ 211.0' to ft bgs; S.U.

Borehole # N/A Tubing ( )@ to ft bgs; S.U.

Borehole # N/A Tubing ( )@ to ft bgs; S.U.

GEOPHYSICAL LOGGING

Boring #	*Interval*	*Type*
1. C8767	to	Gamma
2.	47.00ft	
3.		

TIME	WORK SUMMARY
0600	Safety meeting at ES office, Topic: Preventing Slips, Trips, and Falls.
0730	Travel to C-Farm
0800	ACES STATION
0815	FWS AND NCO's ON SITE ALREADY (STEVE WINTHROW) PRE-JOB AND SAFTEY TOPIC:
0830	HPT ARRIVES @ WORK SITE WITH SOURCE
0845	DRESS DOWN. ENTERED FARM START LOGGING @ 50 wft FOR 5 FOOT REPEAT THEN START WITH THREE FOOT OVERLAP
1300	COMPLETED LOGGING C8767 FROM 50-0. MOVED TO C8766, STARTED LOGGING FROM 209.00 TO 200.00ft.
1450	STOPPED LOGGING, SECURED SITE, EXITED FARM.
1500	PERFORMED HOLE BODY SURVEY, HEADED TO ES.
1580	ARRIVED AT OFFICE, PAPER WORK, TIMESHEETS. END OF SHIFT.

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT;* Hoopes, Icayan *NCO:* Snook, Villarreal *HPT:* ~~Miney~~ Richter *FWS:* ~~Franzan~~ WITHROW	**WEATHER:** ~~Sunny~~ PARTLY CLOUDY **DOWNTIME:** N/A	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN- 13-000136

REPORT BY: A.E HOOPES	**REVIEWED BY:** [illegible] WALKER
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: [signature]	**SIGNATURE:** [signature] **DATE:** 5-24-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue gamma logging in #C8766 and possibly begin probe installation in #C8767		**DATE: 05-16-13**
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION: DAN-13-0035** **U-DIG: #13067441**	**REPORT #: 29**

START CARD NO. SE47759	**DECOMMISSION NO. AE21189**	**RWP: CO-762 Rev.3 JHA-GG-NWOP-RO-2118**
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION: (Yes) No**	***HHU CASE#1 (HHU CAT #2) HHUXL#3***

Sample #'s Interval %

1. N/A

2. N/A

3 .N/A

4 N/A.

BOREHOLE SUMMARY

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring # Interval Type

1. C8766 200.0'-137.0' Gamma

2. N/A

3. N/A

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Industrial Ergonomics.**
0703	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3.
0740	Onsite at change trailer. Standby for P.O.D.
0810	No field work supervisor. P.O.D. was held by NCO S. Snook.
0815	Dress and enter farm. Set-up and continued gamma logging in boring #C8766. CAT HHU was surveyed out of middle "C" Farm
----	gate and re-entered lower "C" Farm gate. CAT HHU was set-up on boring #C8767.
1100	Lunch.
1130	Continued gamma logging in boring #C8766.
1420	Completed gamma logging to 137.0' BGS. Secured site and exited farm.
1440	Traveled to office. Completed paperwork and timecard.
1530	End of shift.

N/A

OPERATOR/LICENSE: Walkup/3005 *ES SUPPORT: Weakley, Icayan* *NCO: Villarreal, Snook* *HPT: Richter* *FWS: N/A*	**WEATHER: 75 F, mostly cloudy with winds from the southwest at 5-10 mph** **DOWNTIME: 30 minutes for P.O.D.**	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: [illegible]	**REVIEWED BY:** MIKE EHRHOTT
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: [signature]	**SIGNATURE:** [signature] **DATE:** 5/21/13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue gamma logging in #C8766 and begin probe installation in #C8767		**DATE:** 05-20-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 30

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (*HHU CAT #2*) *HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A

BOREHOLE SUMMARY

Borehole # C8767 Tubing (2.5) @ 211 to 41 ft bgs; S.U. 6-3

Borehole # ___ Tubing ( ) @ to ft bgs; S.U. ___

Borehole # ___ Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring # Interval Type

1. C8766 137.0'- 80' Gamma
2. N/A
3. N/A

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Good Hygiene on the Job.**
0630	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3. / Shande will be logging C8766
~~0637~~ 0659	ACE in, Load materials to install probe
0715	waiting on support
0815	Support on site, Have POD, discussed activities for the day and weather
0825	Enter C-Farm, Inspect CAT #2, setup on C8767. Begin pulling and installing probe
1053	Exit farm for lunch AT 128-130 foot probe
1100	lunch
1130	waiting for support (RCTs)
1200	RCT on site enter zone and continue setting probe
1400	Exit farm gather up materials
1430	Head to office
1500	AT office, do paperwork
1590	End shift
	NOTE: Completed probes up to the 48' to 50' Level, will finish tomorrow.
	Gamma logging by Shande from 137.0' to 80'. Gamma on C8766.

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Weakley, Icayan, Walkup* *NCO: Villarreal, Snook* *HPT: Richter* *FWS: Withrow*	**WEATHER:** 81 F, mostly sunny with winds from the southwest at 5-10 mph **DOWNTIME:** 2.5 Hrs. support	**DISCARDED ITEMS:** 1 - Probe (200') 6 - Bags Bentonite 1 - Pail 1 - Tip (disposable) 4 Rinses

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: LO AMOS	**REVIEWED BY:** M. W. WALKUP
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Lyle O. Amos	**SIGNATURE:** [signature] **DATE:** 5-21-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue gamma logging in #C8766 and complete probe installation in #C8767 | **DATE:** 05-21-13

LOCATION: "C" Tank Farm---Near C-200 | **EXCAVATION:** DAN-13-0035, U-DIG: #13067441 | **REPORT #:** 31

START CARD NO. SE47759 | **DECOMMISSION NO.** AE21189 | **RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118

SAMPLING SUMMARY

Sample #'s	Interval	%
1. N/A		
2. N/A		
3. N/A		
4 N/A.		

SITE/EQUIPMENT INSPECTION: (Yes) No | *HHU CASE#1* (HHU CAT #2) *HHUXL#3*

BOREHOLE SUMMARY

Borehole # C8767 Tubing (2.5) @ 41 to 0 ft bgs; S.U. 0

Borehole # ____ Tubing ( ) @ ____ to ____ ft bgs; S.U. ____

Borehole # ____ Tubing ( ) @ ____ to ____ ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8766	80.0'.	Gamma
2. N/A	No Logging today	
3. N/A		

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Preventing Heat Stress.**
0630	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3.
0700	Ace in / waiting for Support
0800	POD / no logging until personell shows up.
0830	Enter Farm to finish C8767. Rig hrs. 391.7 Rig inspection
0915	C8767 complete, clean up site and exit zone. Gather up material to do surface completion.
1055	Field Supervisor, Steve Withrow called the day because of weather. Shut down and head to office. Standby for weather
1100	lunch
1130	Standby for weather
1330	End shift.
	NOTE: C8767 completed probe installation (multi-pole) C8766 no logging due to weather and support

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Weakley, Ehrgott, Walkup
NCO: Villarreal, Snook
HPT: Richter
FWS: Withrow

WEATHER: 73 F, partly cloudy and breezy

DOWNTIME: 1 hr. Support
4 hrs. weather

DISCARDED ITEMS: 3 - Bags Bentonite

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: Olin Amos
TITLE: *ES TECHNICAL PREPARER*
SIGNATURE: Olin Amos

REVIEWED BY: D. W. Walkup
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: [signature] **DATE:** 5-21-13

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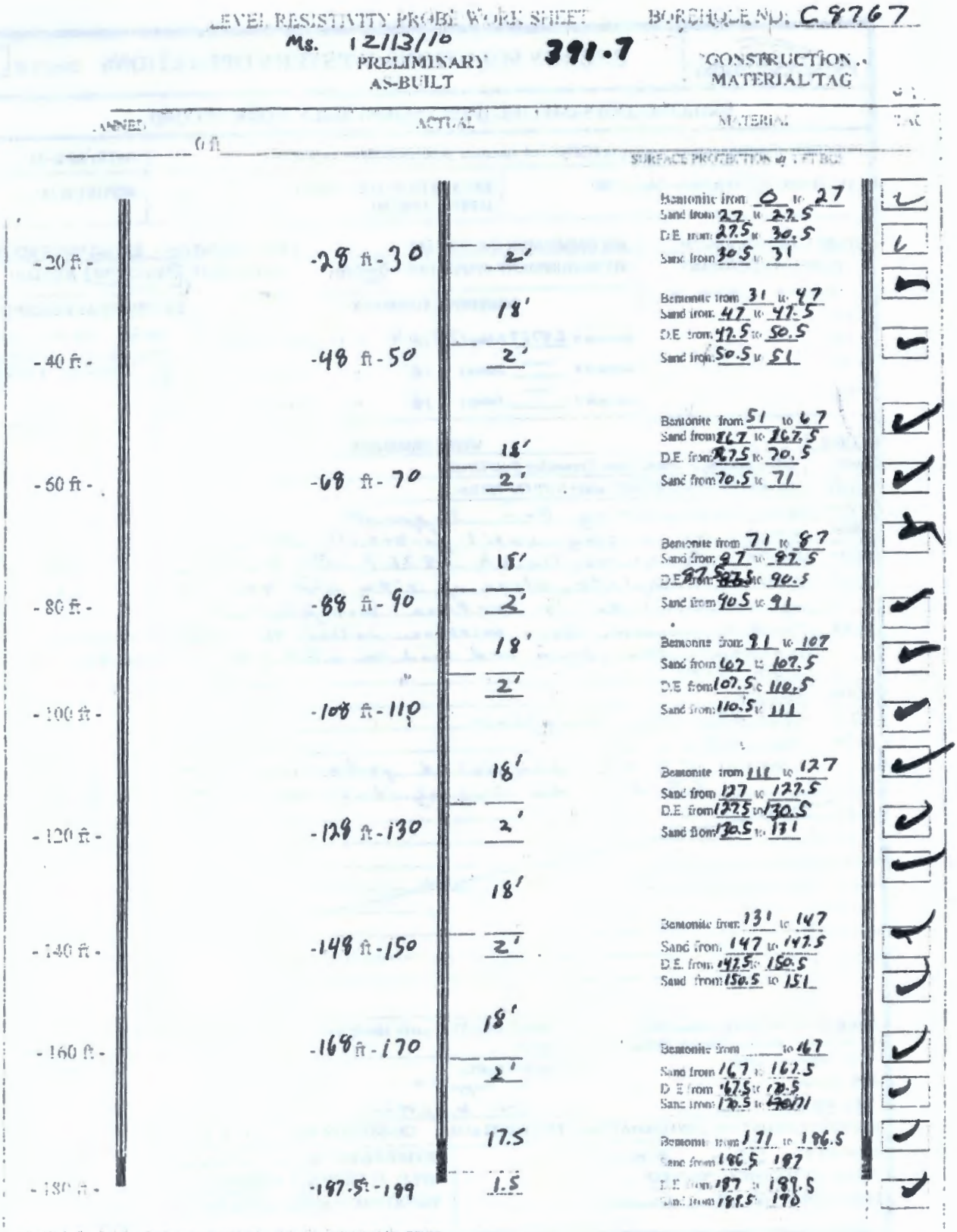

NOTE 1: Resistivity probe measurements are to the bottom of the probe.

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue gamma logging in #C8766		**DATE: 05-22-13**
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG: #13067441**	**REPORT #: 32**

START CARD NO. SE47759	**DECOMMISSION NO. AE21189**	**RWP: CO-762 Rev.3 JHA-GG-NWOP-RO-2118**
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** *Yes* (*No*)	***HHU CASE#1 HHU CAT #2 HHUXL#3***

Sample #'s	*Interval*	*%*
1. N/A		
2. N/A		
3 .N/A		
4 N/A.		

BOREHOLE SUMMARY

Borehole # N/A *Tubing (* *)@* *to* *ft bgs; S.U.* ____

Borehole # N/A *Tubing (* *)@* *to* *ft bgs; S.U.* ____

Borehole # N/A *Tubing (* *)@* *to* *ft bgs; S.U.* ____

GEOPHYSICAL LOGGING

Boring #	*Interval*	*Type*
1. C8766	*80.0'- N/A*	*Gamma*
2. N/A		
3. N/A		

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Back To The Basics.**
0615	Due to the weather the WRPS FWS S. Withrow advised us not to come out to "C" Farm. Placed on standby.
1100	Lunch.
1130	ESGG logging crew on standby per WRPS FWS S. Withrow.
1500	Complete paperwork and timecard.
1530	End of shift.

N/A

OPERATOR/LICENSE: N/A *ES SUPPORT: Hoopes, Icayan* *NCO: Villarreal, Snook* *HPT: Richter* *FWS: Withrow*	**WEATHER: 62 F, mostly cloudy with rain showers. Winds from the southwest at 18 mph with higher gusts.** **DOWNTIME: 9 Hrs. due to weather.**	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: ADULT HOOPES	**REVIEWED BY:** M.C. WSNUS
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE:	**SIGNATURE:** **DATE:** 05-23-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue gamma logging in #C8766		**DATE:** 05-23-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 33

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1 HHU CAT #2 HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A.

BOREHOLE SUMMARY

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____
Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____
Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring # Interval Type
1. C8766 80.0'- 29.0' Gamma
2. N/A
3. N/A

TIME	WORK SUMMARY
0600	**Safety meeting at office. Topic: Don't Take Hand Tools For Granted.**
0644	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3.
0740	Onsite at change trailer. Standby for P.O.D.
0754	P.O.D. by WRPS FWS S. Withrow.
0811	HPT ARRIVES ONSITE AT CHANGE TRAILER (JOE RICHTER)
0815	ENTERING FARM TO SETUP LOGGING EQUIPMENT
0900	STARTED LOGGING C8766 AT 83.0'
1300	STOPPED LOGGING ON C8766 AT 29.0'
1340	EXITED C FARM CHANGE TRAILER
1430	ARRIVED AT ES OFFICE
1530	END OF SHIFT.
NOTE:	LATE ENTRY P/A
1100	LUNCH
1130	END OF LUNCH

OPERATOR/LICENSE: Walkup/3005 *ES SUPPORT: Hoopes, Icayan* *NCO: Villarreal, Snook* *HPT: Richter* *FWS: Withrow*	**WEATHER:** 66 F, partly cloudy with winds from the southwest at 5 mph. **DOWNTIME:** 31 MIN. FOR C FARM LOGGING SUPPORT	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: AQUILA HOOPES	**REVIEWED BY:** [illegible]
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: [signature]	**SIGNATURE:** [signature] **DATE:** 5-28-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Complete gamma logging in #C8766 | **DATE:** 05-28-13

LOCATION: "C" Tank Farm---Near C-200 | **EXCAVATION:** DAN-13-0035, U-DIG: #13067441 | **REPORT #:** 34

START CARD NO. SE47759 | **DECOMMISSION NO.** AE21189 | **RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118

SAMPLING SUMMARY

Sample #'s	Interval	%
1. N/A		
2. N/A		
3. N/A		
4 N/A.		

SITE/EQUIPMENT INSPECTION: (Yes) No | *HHU CASE#1 HHU CAT #2 HHUXL#3*

BOREHOLE SUMMARY

C8766 on 5/28/13

Borehole # ~~N/A~~ Tubing (2.5) @ 211 to N/A ft bgs; S.U. 1.2

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8766	29.0'-0.00'	Gamma
2. ~~N/A~~		
3. N/A		

on 5/28/13

C8765 209.0'-172.0' GAMMA

TIME	WORK SUMMARY
0700	**Safety meeting at office. Topic: Hard Hats.**
0710	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3.
0744	Onsite at change trailer. Standby for P.O.D.
0811	P.O.D. by WRPS FWS S. Withrow.
0840	ENTERED FARM TO STAR LOGGING C8766 FROM 32.6 FT.
1120	FINISHED LOGGING C8766 (REPARKING TO MOVE EQUIPMENT TO C8765
1130	EXITED (FARM) CHANGED) TRAILER
1155	LUNCH
1200	ENTERED FARM MOVED TO NEXT HOLE C8765
1220	STARTED LOGGING AT 209.0'
1530	STOPPED LOGGING AT 172.0 COMPLETED 37.0' FT TODAY
1538	EXITED C FARM CHANGE TRAILER
1600	ARRIVED AT ES OFFICE
1600	END OF SHIFT

N/A

OPERATOR/LICENSE: Walkup/3005
ES SUPPORT: Hoopes, Icayan
NCO: Villarreal, Snook
HPT: Richter
FWS: Withrow

WEATHER: 73 F, mostly cloudy with winds from the southwest at 15 mph, gusting to 30 mph.

DOWNTIME: 27 MIN. FOR HPT

DISCARDED ITEMS: N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: AQUILA HOOPES
TITLE: *ES TECHNICAL PREPARER*
SIGNATURE:

REVIEWED BY: M. W. WALKUP
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: **DATE:** 05-28-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue gamma logging in #C8765. Probe installation in #C8766		**DATE:** 05-29-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 35

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (*HHU CAT #2*) *HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A

BOREHOLE SUMMARY

Borehole # C8766 Tubing (25) @ 210 to 205 ft bgs; S.U. 1-3

Borehole # ___ Tubing ( ) @ to ft bgs; S.U. ___

Borehole # ___ Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8765	172.0'- 134	Gamma
2. N/A		
3. N/A		

TIME	WORK SUMMARY
0700	**Safety meeting at office. Topic: Moving Equipment.**
0745	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3. , Ace in
0740	Onsite at change trailer. Standby for P.O.D.
0910	P.O.D. by WRPS FWS S. Withrow.
0925	Enter farm to start logging and in installing probe. Have to run inner rod to knock out probe.
	Logging on C8765, Installing probe on C8766
1145	Exit farm for lunch. Disposable tip out, ready to pull pipe and install probe.
1200	Lunch
1230	shut down due to weather, Head to office
1630	End shift
	N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Weakley, Walkup, Icayan
NCO: Villarreal, Snook
HPT: Richter
FWS: Withrow

WEATHER: 67 F, mostly cloudy with rain showers. Winds from the northeast at 5-10 mph.

DOWNTIME: ~~2 hrs~~ 6 hrs - weather

DISCARDED ITEMS: 1 - Tip

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: Olin Amos
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE: Olin Amos

REVIEWED BY: M. W. Walkup
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: [signature] **DATE:** 05-30-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue gamma logging in #C8765. Probe installation in #C8766		**DATE:** 05-30-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 36

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	HHU CASE#1 (HHU CAT #2) HHUXL#3

SAMPLING SUMMARY

Sample #'s	Interval	%
1. N/A		
2. N/A		
3. N/A		
4 N/A.		

BOREHOLE SUMMARY

Borehole # C8766 Tubing (2.5 @ 205) to 5 ft bgs; S.U. 1.3

Borehole # ~~—~~ Tubing ( ) @ to ft bgs; S.U. ___

Borehole # ~~—~~ Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8765	134.0'- 51	Gamma
2. N/A		
3. N/A		

TIME	WORK SUMMARY
0700	Safety meeting at office. Topic: Off The Job Safety
0730	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3.
0800	Onsite at change trailer. Standby for P.O.D.
0815	P.O.D. by WRPS FWS S. Withrow.
0930	Enter C-Farm to continue probe installation on C-8766
	Also Gamma logging on C-8765
1115	Exit Farm for lunch
1270	Enter Farm and continue pulling and installing probe
1	RCT on site
1515	Exit Farm for the day, Survey out equipment,
1530	Head to office
1600	At office, Paper work
1630	End shift
	NOTE: C8766 - Probe installed and decomissioned to -5 feet
	C8765 - Gamma logged from 134.0 to 51 feet.
	N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Weakley, Walkup, Ehrgott* *NCO: Villarreal, Snook* *HPT: Richter* *FWS: Withrow*	**WEATHER:** 74 F, partly cloudy. Winds from the southwest at 10 mph. **DOWNTIME:** 1.5 hrs Support	**DISCARDED ITEMS:** 1 - Disposable Tip 1 - 200' multi probe 8 - Bentonite 1 - dirt

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: Olin Amos	**REVIEWED BY:** M.D. Linker
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Olin Amos	**SIGNATURE:** [signature] **DATE:** 05-31-13

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LEVEL RESISTIVITY PROBE WORK SHEET BOREHOLE NO: C 8766

PRELIMINARY AS-BUILT

CONSTRUCTION MATERIAL/TAG

ANNED	ACTUAL		MATERIAL	TAG
0 ft			SURFACE PROTECTION @ 1 FT BGS	
- 20 ft -	-28 ft - 30	2'	Bentonite from 0 to 27 Sand from 27 to 27.5 D.E from 27.5 to 30.5 Sand from 30.5 to 31	1 2 3
- 40 ft -	-48 ft - 50	18' 2'	Bentonite from 31 to 47 Sand from 47 to 47.5 D.E from 47.5 to 50.5 Sand from 50.5 to 51	4 5
- 60 ft -	-68 ft - 70	18' 2'	Bentonite from 51 to 67 Sand from 67 to 67.5 D.E. from 67.5 to 70.5 Sand from 70.5 to 71	6 7
- 80 ft -	-88 ft - 90	18' 2'	Bentonite from 71 to 87 Sand from 87 to 87.5 D.E from 87.5 to 90.5 Sand from 90.5 to 91	8 9
- 100 ft -	-108 ft - 110	18' 2'	Bentonite from 91 to 107 Sand from 107 to 107.5 D.E. from 107.5 to 110.5 Sand from 110.5 to 111	10 11
- 120 ft -	-128 ft - 130	18' 2'	Bentonite from 111 to 127 Sand from 127 to 127.5 D.E. from 127.5 to 130.5 Sand from 130.5 to 131	12 13 14
- 140 ft -	-148 ft - 150	18' 2'	Bentonite from 131 to 147 Sand from 147 to 147.5 D.E. from 147.5 to 150.5 Sand from 150.5 to 151	15 16
- 160 ft -	-168 ft - 170	18' 2'	Bentonite from ____ to 167 Sand from 167 to 167.5 D E from 167.5 to 170.5 Sand from 170.5 to 170/171	17 18
- 180 ft -	-187.5 ft - 189	17.5 1.5	Bentonite from 171 to 186.5 Sand from 186.5 to 187 D.E from 187 to 189.5 Sand from 189.5 to 190	19 20

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue gamma logging in #C8765. Probe installation in #C8766		**DATE:** 06-03-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 37

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY *Sample #'s Interval %* 1. N/A 2. N/A 3. N/A 4 N/A.	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (*HHU CAT #2*) *HHUXL#3*

BOREHOLE SUMMARY

Borehole # C8766 Tubing (2.5) @ 4 to 0 ft bgs; S.U. —

Borehole # C8765 Tubing (2.5) @ 210. to 201 ft bgs; S.U. 1.3

Borehole # ~~N/A~~ Tubing ( ) @ to ft bgs; S.U. ___

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C8765	51.0'- 0	Gamma
2. N/A		
3. N/A		

TIME	WORK SUMMARY
0700	**Safety meeting at office. Topic: Minor Injuries.**
0730	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3.
0800	Onsite at change trailer. Standby for P.O.D.
0810	POD, Finish logging C8765, Finish decommissioning C8766 and installing probe. SET Monuments on C8767, C8763, C8766
1200	lunch
1230	logging complete on C8765, move off hole and Survey out equipment (logging).
1245	Move cat to C8765 and run inner rods in hole to knock out tip.
1345	Tip out. Trip out rods
1435	Inner rod out, pull 2 rods of 2.5".
1500	Exit Perm, waiting for probe depths.
1515	Head to office.
1545	Paper work
1630	End shift
	N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Weakley, Walkup, ~~Bergou~~ Skoda
NCO: Villarreal, Snook
HPT: Richter
FWS: Withrow

WEATHER: 82 F, mostly sunny. Winds from the southwest at 5 mph.

DOWNTIME:
1 hr waiting on probe depths

DISCARDED ITEMS:
1 - Tip (disposable)
1 - 4 - Rivets
3 - Monuments
3 - Bags cement
1 - Sand

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: Olin Amos
TITLE: *ES TECHNICAL PREPARER*
SIGNATURE: Olin Amos

REVIEWED BY: M.W Weakley
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: [signature] **DATE:** 06-04-13

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Continue probe installation in #C8765 and begin cleaning pipe for transport to "TX" Farm.		**DATE:** 06-04-13
LOCATION: "C" Tank Farm---Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 38

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY *Sample #'s Interval %* 1. N/A 2. N/A 3. N/A 4 N/A.	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (HHU CAT #2) *HHUXL#3*
	BOREHOLE SUMMARY Borehole # C8765 Tubing (2.5) @ 20' to 0 ft bgs; S.U. ____ Borehole # _____ Tubing ( ) @ to ft bgs; S.U. ____ Borehole # _____ Tubing ( ) @ to ft bgs; S.U. ____	**GEOPHYSICAL LOGGING** *Boring # Interval Type* 1. N/A 2. N/A 3. N/A

TIME	WORK SUMMARY
0700	**Safety meeting at office. Topic: Sprains & Strains In The Construction Industry**
0710	Travel to "C" Farm and "ACE" under RWP CO-762 Rev. 3.
0735	Onsite at change trailer. Standby for P.O.D.
0805	Enter Farm to set probe in C8765 also a crew will clean pipe. Rig inspection 3968 hrs.
1130	Lunch! Pipe has been cleaned and moved to the RMA
1200	waiting on Support to finish installing probe on C8765
1330	Enter zone begin completing C-8765
1420	C-8765 complete with probe installed, move equipment To gate to be surveyed out.
1530	Head to office
1600	Paper work
1630	End shift

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Weakley, Walkup, Hoopes ,Steffler* *NCO: Villarreal, Snook* *HPT: Richter* *FWS: Withrow*	**WEATHER:** 87 F, mostly sunny. Winds from the southwest at 5 mph. **DOWNTIME:** 1hr - Support	**DISCARDED ITEMS:** 9 - Bentonite 1 - Sand 1 - Cement 1 - Monument 1-4'x2 1/2' rod 1 - split probe 200

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: Olin Amos	**REVIEWED BY:** M.W. WALKUP
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: Olin Amos	**SIGNATURE:** _____ **DATE:** 06-05-13

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Hrs. 3968

LEVEL RESISTIVITY PROBE WORK SHEET BOREHOLE NO: C8765 -605

PLANNED	PRELIMINARY AS-BUILT ACTUAL		CONSTRUCTION MATERIAL/TAG MATERIAL	TAG
	0 ft		SURFACE PROTECTION @ 1 FT BGS	
- 20 ft -	-28 ft - 30	2'	Bentonite from 0 to 27 Sand from 27 to 27.5 D.E. from 27.5 to 30.5 Sand from 30.5 to 31	1 6
		18'	Bentonite from 31 to 47 Sand from 47 to 47.5	5
- 40 ft -	-48 ft - 50	2'	D.E. from 47.5 to 50.5 Sand from 50.5 to 51	6
		18'	Bentonite from 51 to 67 Sand from 67 to 67.5	7
- 60 ft -	-68 ft - 70	2'	D.E. from 67.5 to 70.5 Sand from 70.5 to 71	8
		18'	Bentonite from 71 to 87 Sand from 87 to 87.5	9
- 80 ft -	-88 ft - 90	2'	D.E. from 87.5 to 90.5 Sand from 90.5 to 91	10
		18'	Bentonite from 91 to 107 Sand from 107 to 107.5	11
- 100 ft -	-108 ft - 110	2'	D.E. from 107.5 to 110.5 Sand from 110.5 to 111	12
		18'	Bentonite from 111 to 127 Sand from 127 to 127.5	13
- 120 ft -	-128 ft - 130	2'	D.E. from 127.5 to 130.5 Sand from 130.5 to 131	14
		18'	Bentonite from 131 to 147 Sand from 147 to 147.5	15
- 140 ft -	-148 ft - 150	2'	D.E. from 147.5 to 150.5 Sand from 150.5 to 151	16
		18'	Bentonite from ____ to 167 Sand from 167 to 167.5	17
- 160 ft -	-168 ft - 170	2'	D.E. from 167.5 to 170.5 Sand from 170.5 to 171	18
		17.5	Bentonite from 171 to 196.5 Sand from 196.5 to 197	19
- 180 ft -	-187.5 ft - 189	1.5	D.E. from 187 to 189.5 Sand from 189.5 to 190	20

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Complete demobilization out of farm.		**DATE:** 06-05-13
LOCATION: "C" Tank Farm—Near C-200	**EXCAVATION:** DAN-13-0035 **U-DIG:** #13067441	**REPORT #:** 39

START CARD NO. SE47759	**DECOMMISSION NO.** AE21189	**RWP:** CO-762 Rev.3 JHA-GG-NWOP-RO-2118
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU CASE#1* (*HHU CAT #2*) *HHUXL#3*

Sample #'s Interval %

1. N/A
2. N/A
3. N/A
4. N/A

BOREHOLE SUMMARY

Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____
Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____
Borehole # N/A Tubing ( ) @ to ft bgs; S.U. ____

GEOPHYSICAL LOGGING

Boring # Interval Type

1. N/A
2. N/A
3. N/A

TIME	WORK SUMMARY
0700	Safety meeting at office. Topic: Make Shift Work Safe Work
1215	STAND BY FOR RIG REMOVAL OF PUSH RIG EQUIPMENT OUT OF C-FARM
1230	FWS ARRIVES FOR ADD
1245	ENTERED C-FARM TO REMOVE RIG AND RIG SUPPORT EQUIPMENT
~~1345~~ 1415-1500	LUNCH
1330 1445	END OF LUNCH
1450	FINISHED C-FARM WORK, HEADING TO ENERGY NORTHWEST
1800	ARRIVED AT ES OFFICE
1630	END OF SHIFT

AM 6/6/13

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Hoopes, Steffler* *NCO: Villarreal, Snook* *HPT: Richter* *FWS: Withrow*	**WEATHER:** 93 F, mostly sunny. Winds from the south at 5 mph. **DOWNTIME:** 5.5 HOURS FOR C-FARM WORK	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: TFC-WO-12-6118 GG-NW-DOW-003 ECN-13-000136

REPORT BY: AQUILA HOOPES	**REVIEWED BY:** [illegible]
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: [signature]	**SIGNATURE:** [signature] **DATE:** 06-06-13

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APPENDIX D

SMALL DIAMETER GEOPHYSICAL LOGGING FOR C TANK FARM

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Geophysical Logging in the 241-C Tank Farm

by

Russ Randall, PhD

to

Energy*Solutions*
Richland, Washington 99354

June 2013

Three Rivers Scientific
3740 Grant Court
West Richland, Washington 99353

Geophysical Logging in the 241-C Tank Farm

1 Introduction

Energy*Solutions* (ES) and Three Rivers Scientific provided small diameter (slim hole) logging in support of field activities at the 241-C Tank Farm. Logging surveys were conducted with three detectors: BGO and LaBr (both scintillation), and a neutron-neutron moisture tool. This report includes the results of these surveys for the 4 probe holes installed at the investigation site (see Appendix A).

The BGO and LaBr instruments were run in combination during the logging run, and spectral data were recorded for both. The energy resolution of the LaBr is superior to the BGO, but the BGO efficiency for KUT naturals is superior to the LaBr. Thus the data from the BGO are used to measure gross gamma and concentrations of KUT, and the LaBr data are used to identify and measure the concentrations of other selected radionuclides. The targeted radionuclides for this project were ^{137}Cs and enriched ^{238}U.

Both of the gamma tools were calibrated for the probe hole conditions present at the investigation site. The moisture tool was calibrated in the 6 and 8 inch cased calibration standards. Casing thickness correction is applied to the extrapolated casing diameter calibrations for the moisture response.

2 Survey Results

Log surveys were recorded from the bottom of the probe hole (maximum survey depth) to the ground surface. Zero depth reference is at ground surface. A daily repeat measurement was acquired to verify instrument repeatability. The main log and repeat intervals are presented on the same plot. The computed results of the main and repeat intervals were reviewed and the results agree within the uncertainty of the measurement counting statistics.

The survey results for each probe hole are presented as a depth versus concentration plot in Appendix A. The plots are in numeric order of the probe holes (C8763, C8765, C8766 and C8767).

3 Geophysical Logging System

The logging system is a portable unit powered by either an on-site generator (120v AC) or site-supplied power. A laptop computer allocated to the logging unit was used to monitor encoder depth positions, control the winch motor, and record detector responses.

3.1 Gross Gamma Calibration and Surveys

The gross gamma is obtained using the efficiency superior BGO instrument response. The settings of the detector components are fixed (i.e., set up during assembly, prior to calibration) and are not adjustable by the field-logging engineer. The detector gain and lower threshold are set to record gamma ray activity with energies between 20 and 3000 keV. By comparison, the highest gamma ray from naturally occurring radionuclides is from ^{232}Th and occurs at 2614 keV. A ^{60}Co was used as a field verifier at the beginning and ending of each day's logging activities to check detector resolution (integrity) and energy calibration (amplifier gain).

The BGO detector is calibrated in gross gamma borehole calibration models located at the U.S.-DOE Hanford site near Richland, Washington. Calibration data were collected in the two most appropriate (lowest concentration) gross gamma calibration zones (SBA and SBU). The detector was covered with a 4-ft long section of the probe/drill tubing (0.37-inch thick). The calibration data are summarized in Table 1. The calibration units are pCi/g of equivalent Radium-226 ($e^{226}Ra$). See Appendix B for the calibration certificate.

Table 1. Gross Gamma Calibration Data

Calibration Model	Concentration $e^{226}Ra$ (pCi/g)	Dead-Time Corrected Gross Gamma Count-Rate[1] (cps)
SBA	61.2	2517 ± 2
SBU	186	7347 ± 3.5
Count rates are mean of 50 sample measurements at 10-sec each. 1-BGO Detector system dead time is 7.2 microsec		

The BGO/LaBr gamma surveys were logged at 0.5 ft depth increments and 100 sec per station.. A spectrum of 1024 channels was collected each 0.5 ft from the bottom of the probe hole to the surface. The spectra were recorded in comma delimited format with all spectra per file. Detector count rates were dead-time corrected and the gamma survey data were processed as gross gamma response to determine the concentration of $e^{226}Ra$ in pCi/g.

The dead time correction is a nonparalyzeable relationship (Knoll, 1979) and described by the following equation:

$$C_t = \frac{C_{obs}}{1 - \varepsilon \cdot C_{obs}}$$

where C_t is the true or dead time corrected count rate in c/s, C_{obs} is the observed count rate in c/s, and ε is the dead time factor of 7.2μs.

3.2 Spectral Gamma Calibrations and Surveys

Calibration of the BGO logging system was performed in the four spectral gamma borehole calibration models located at the U.S.-DOE Hanford Site near Richland, Washington and according to Hanford Site procedures for scintillation-type spectral gamma ray borehole detectors (Randall & Stromswold, 1995). The four calibration models contain elevated concentrations of the naturally occurring radionuclides (potassium, uranium or radium in secular equilibrium with uranium, and thorium, aka KUT). The radionuclide concentrations are traceable to NIST standards, (Steele & George, 1986). Table 2 lists the radionuclide concentration in each of the gamma calibration models. The uncertainty is quoted at the 2-sigma (95%) confidence level.

Table 2. Hanford Calibration Model Values for KUT

Model	^{40}K Concentration (pCi/g)	^{226}Ra Concentration (pCi/g)	^{232}Th Concentration (pCi/g)
SBK	53.50 ± 1.67	1.16 ± 0.11	0.11 ± 0.02
SBU	10.72 ± 0.84	190.52 ± 5.81	0.66 ± 0.06
SBT	10.63 ± 1.34	10.02 ± 0.48	58.11 ± 1.44
SBM	41.78 ± 1.84	125.79 ± 4.00	39.12 ± 1.07

Calibration was performed with a section of the steel drill tubing (4-ft long) 0.37-in. thick (2.5-in. OD) installed over detector (4-in. long) during calibration measurements. Calibration with the casing installed over the detector is more

rigorous than calibration in an open hole and applying correction factor to the probe hole survey to correct for the presence of casing.

During logging, the gamma peak at 1461 keV from potassium (^{40}K) is almost always present as the dominant peak in each spectra. The second best peak is the 2614 keV peak from ^{232}Th. Both of these peaks are used to monitor for spectra gain changes. During data processing the spectra gain is adjusted to track the reference gamma peaks.

Borehole survey spectra (100 seconds each) were measured each 0.5 ft between the selected depth intervals in move-stop-acquire logging mode, the results are presented on the plot for each of the corresponding probe holes. (Refer to Appendix A for logging results).

3.3 Spectral Photo Peak Calibrations and Surveys

The LaBr spectral data are processed differently than the BGO data, and thus the LaBr calibration is different. The LaBr calibration and data processing is performed in the same manner that the HPGe log data are calibrated and processed (Randall, 1994). The basic concept involves the non-linear least square fitting of a linear background plus a Gaussian photo peak over a small region of the spectra containing the target gamma ray. The discussion in this report will cover the target gamma ray of ^{137}Cs (661 keV), but the same technique can be applied to any other gamma ray.

The SBU calibration model was used to measure the LaBr detector efficiency for the 609 keV peak from a daughter product of ^{238}U. It is known that the gamma ray detection efficiency of LaBr is a function of energy, thus a method of correcting the measured efficiency at 609 to the efficiency at 661 keV was developed. MCNP (Monte Carlo N-Particle) (RSICC) code for making Monte Carlo gamma transport calculations was used to compute the ratio of detector efficiencies between 609 and 661 keV. This ratio is then applied to the measure efficiency at 609 keV to obtain the ^{137}Cs gamma ray efficiency. The tool geometry of the modeling was the same used in the SBU calibration, and the source was set to both a 609 and 661 keV distributed throughout an SBU matrix.

The dead time for the LaBr instrument was measured to be 1.06 μs. The measured detector efficiency for the 661 keV is 0.588 (c/s)/pCi/g (Appendix B contains the calibration certificate). The measured Full Width at Half Maximum (FWHM) % for the ^{137}Cs photo peak is 4.17% at 661 keV.

The log data processing for ^{137}Cs is performed using a MathCad file. The steps to process data are the following:

1. The energy calibration is established.
2. Based upon the 661 keV energy, the predicted peak channel is computed from the energy calibration.
3. A MathCad file is used to fit a linear background plus a Gaussian (with the energy computed centroid, and established peak width) to each spectral record.
4. Within the same MathCad file the photo peak count rate is computed, dead time corrected, and calibration coefficients applied and the ^{137}Cs concentrations and depths output to a comma delimited file.
5. Survey plots are made with only those computed ^{137}Cs that are above minimum detect levels (MDL), which is conservatively set at 0.7 pCi/g, based upon statistical merits of the fitting.

4 Conclusion

Scintillation gross, spectral gamma, and moisture survey logs were collected in four probe holes installed in the 241-C Tank Farm. All probe holes were pushed to their target depth. All four probe holes were pushed to approximately 210 feet in depth, with well C8763 going to 218 feet in depth.

The man-made contaminant ^{137}Cs was identified above MDL, in the probe holes logged. All detections of ^{137}Cs were near the surface. No ^{238}U was detected above MDL (using only the 1001keV gamma); but some zones looked like possible candidates for the uranium contamination.

5 References

Knoll, G., 1979, "Radiation Detection and Measurement", Copyright 1979 by John Wiley & Sons, Inc. ISBN "0-471-49545-X"

Randall, Russel R. PhD and Stromswold, David C. PhD, 1995, "Procedures for Calibrating Scintillation Gamma-Ray Well Logging Tools Using Hanford Formation Models", Westinghouse Hanford Co., Richland, WA.

Steele, W. Douglas and George, David C., 1986, "Field Calibration Facilities for Environmental Measurement of Radium, Thorium, and Potassium", Bendix Field Engineering Corp., Grand Junction, CO.

Randall, Russel R., 1994 "Calibration of the Radionuclide Logging System Germanium Detector", Westinghouse Hanford Co., Richland, WA

RSICC Computer Code Collection, MCNP4B2, "Monte Carlo N-Particle Transport Code System," Transport Methods Group Los Alamos National Lab, Los Alamos, New Mexico, distributed by Oak Ridge Nat Lab.

Appendix A Gamma Survey Results

Gross gamma, KUT spectral, ^{137}Cs, and moisture responses are shown in the survey plots follow for the four probe holes installed in the 241-C Tank Farm. All detector count rates were dead-time corrected and the results are converted using the calibration coefficients. The plots with header information follow.

C-Farm C8763 Header Information

Small Diameter –Moisture Survey

Probehole:	C8763	Log Date:	Apr 2013
Project:	C Farm	Depth Ref:	Ground Surface
Point#:	2845	Northing(Y):	136589.938
Easting(X):	575178.598	Elevation(Z):	648.77 ft

Repeat/Overlap Interval

Gamma:	215-210	Moisture:	218.5-213.5
	196.5-191.5		213-208
	150.5-145.5		111-106
	99.5-94.5		
	46.5-41.5		

Observations

Gamma:

Cs-137 is observed from surface to 3 ft, with a peak concentration of 23.7 pCig at surface in this probe hole.

Moisture:

Moisture values range from 4-23%. There are numerous thin bed responses throughout the entire logged interval.

Calibration Certificates

Moisture

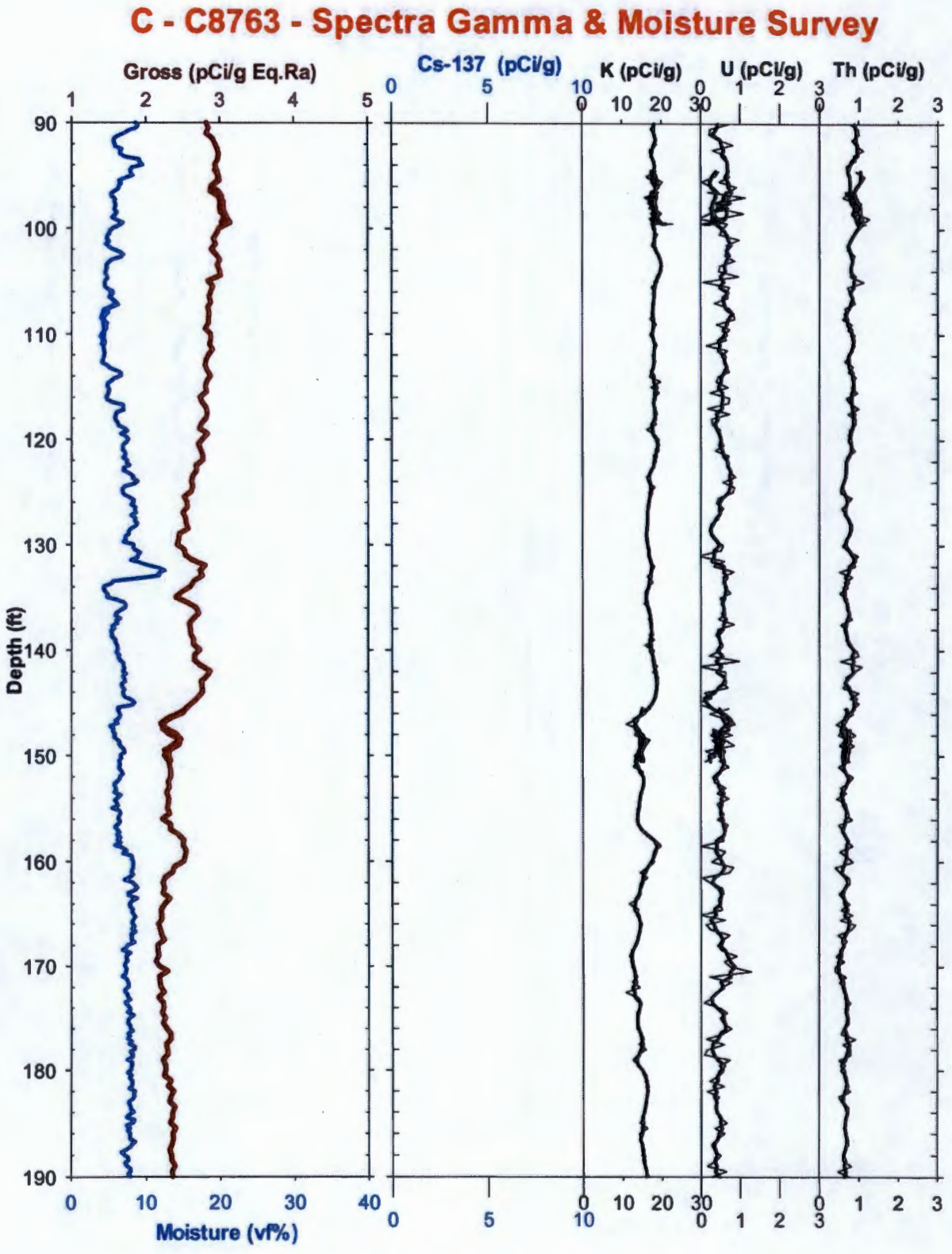
Date:	Jan 25, 2013
Electronic File:	N2_097_2013-v0.zip

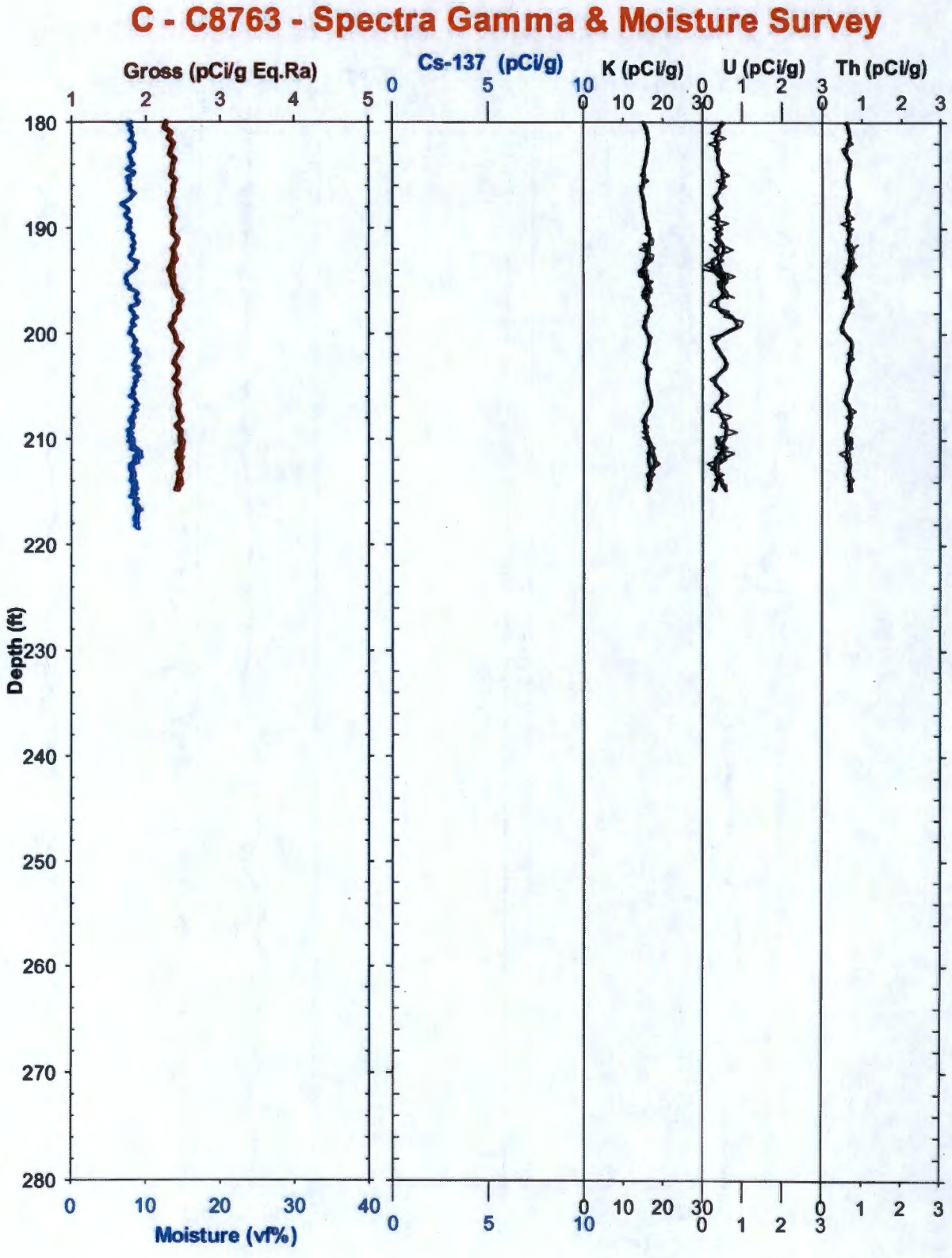
Gamma BGO

Date:	Feb 4, 2013
Electronic File:	BGO-1_2013-v0.zip

LaBr

Date:	Sep 13, 2012
Electronic File:	LaBr-1 2013-v0.zip


C - C8763 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)


C - C8763 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)

C-Farm C8765 Header Information

Small Diameter –Moisture Survey

Probehole:	C8765	Log Date:	June 2013
Project:	C Farm	Depth Ref:	Ground Surface
Point#:	2841	Northing(Y):	136629.197
Easting(X):	575194.454	Elevation(Z):	636.58ft

Repeat/Overlap Intervals

Gamma:	166.5-171.5 128.5-133.5 45.5-50.5	Moisture:	132-127

Observations

Gamma:

Cs-137 is observed in this probe hole from surface to 17 ft with a peak concentration of 11.7 pCig at 0.5 ft.

Moisture:

Moisture values range from 4-22%. There are numerous thin bed responses throughout the entire logged interval.

Calibration Certificates

Moisture

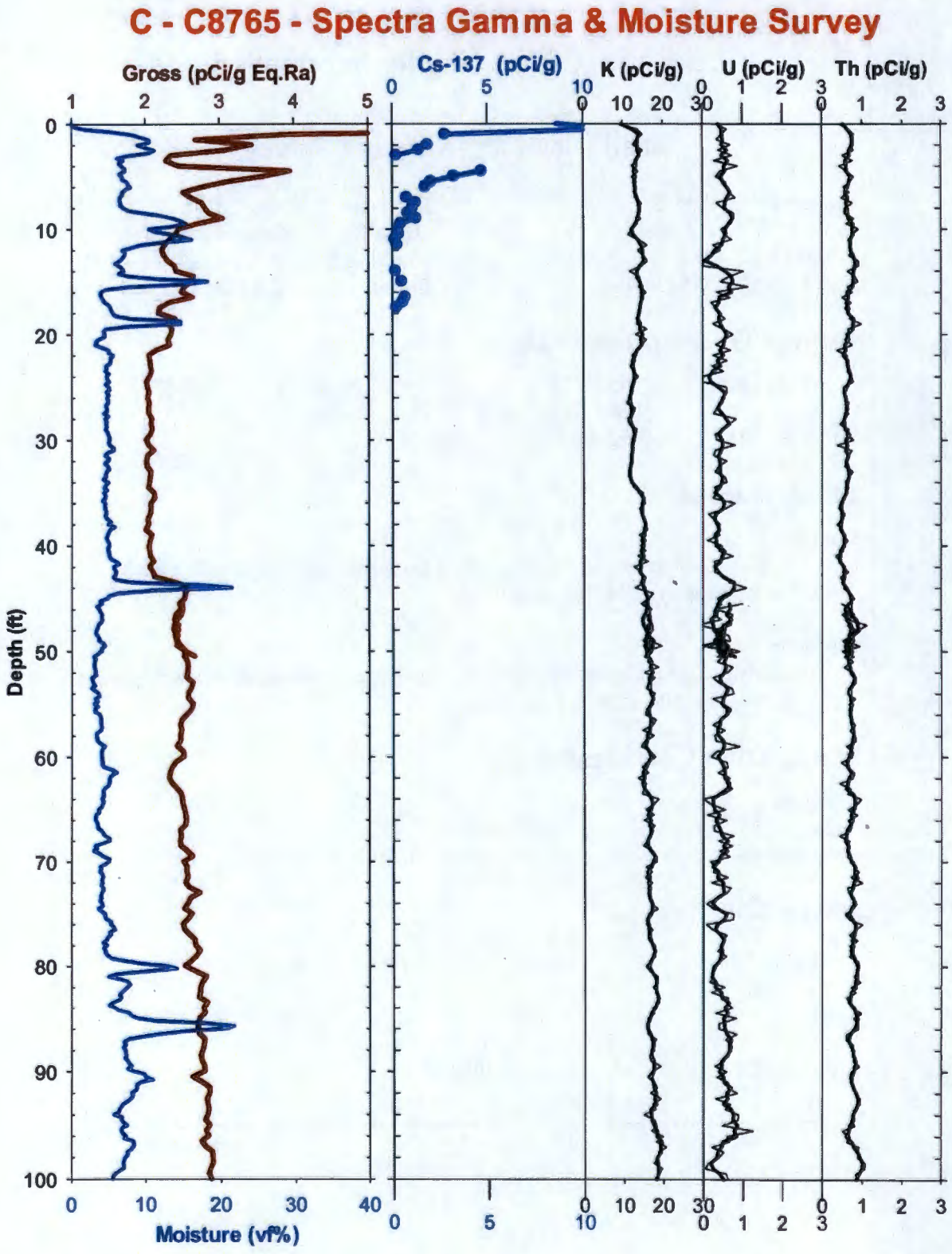
Date:	Jan 25, 2013
Electronic File:	N2_097_2013-v0.zip

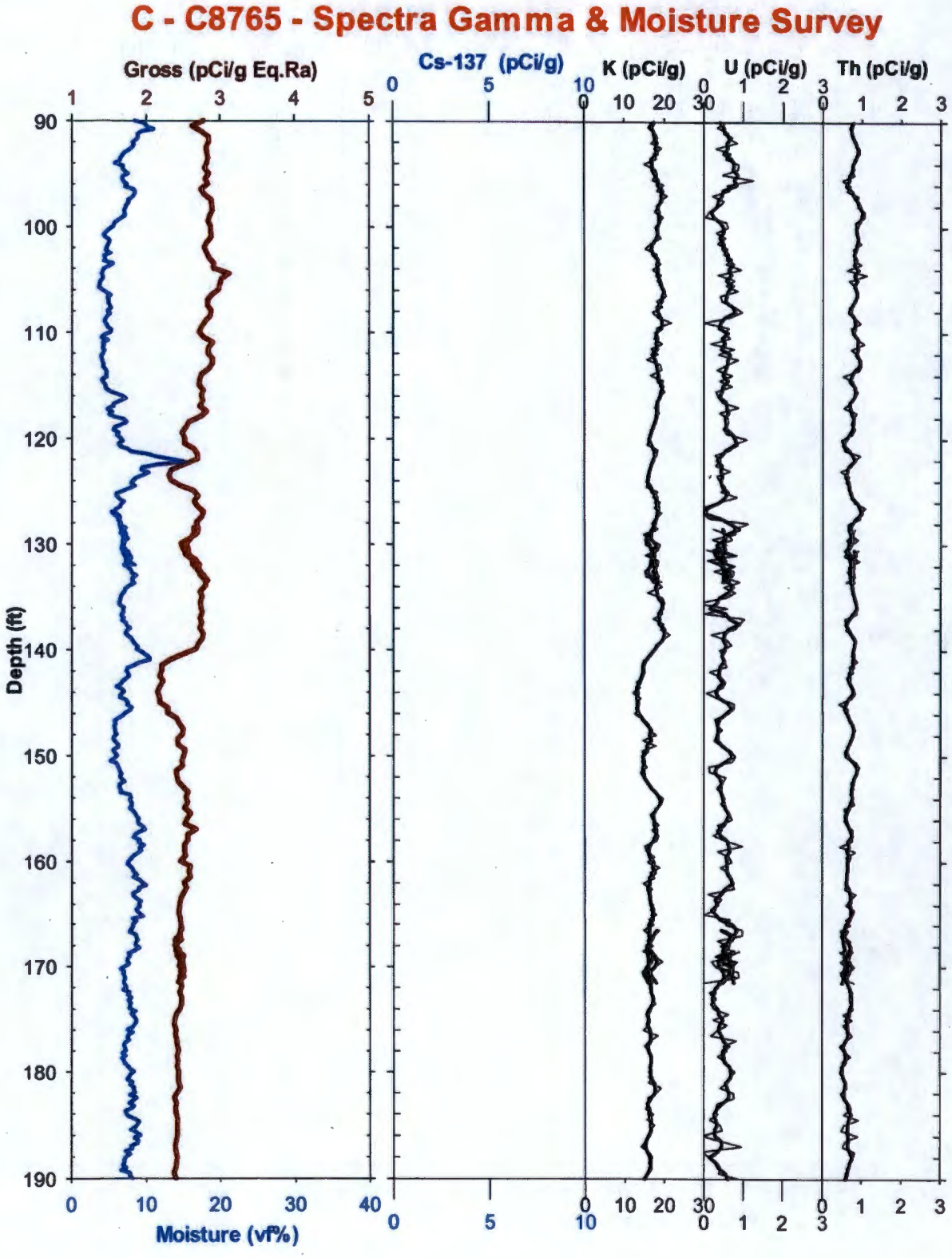
Gamma BGO

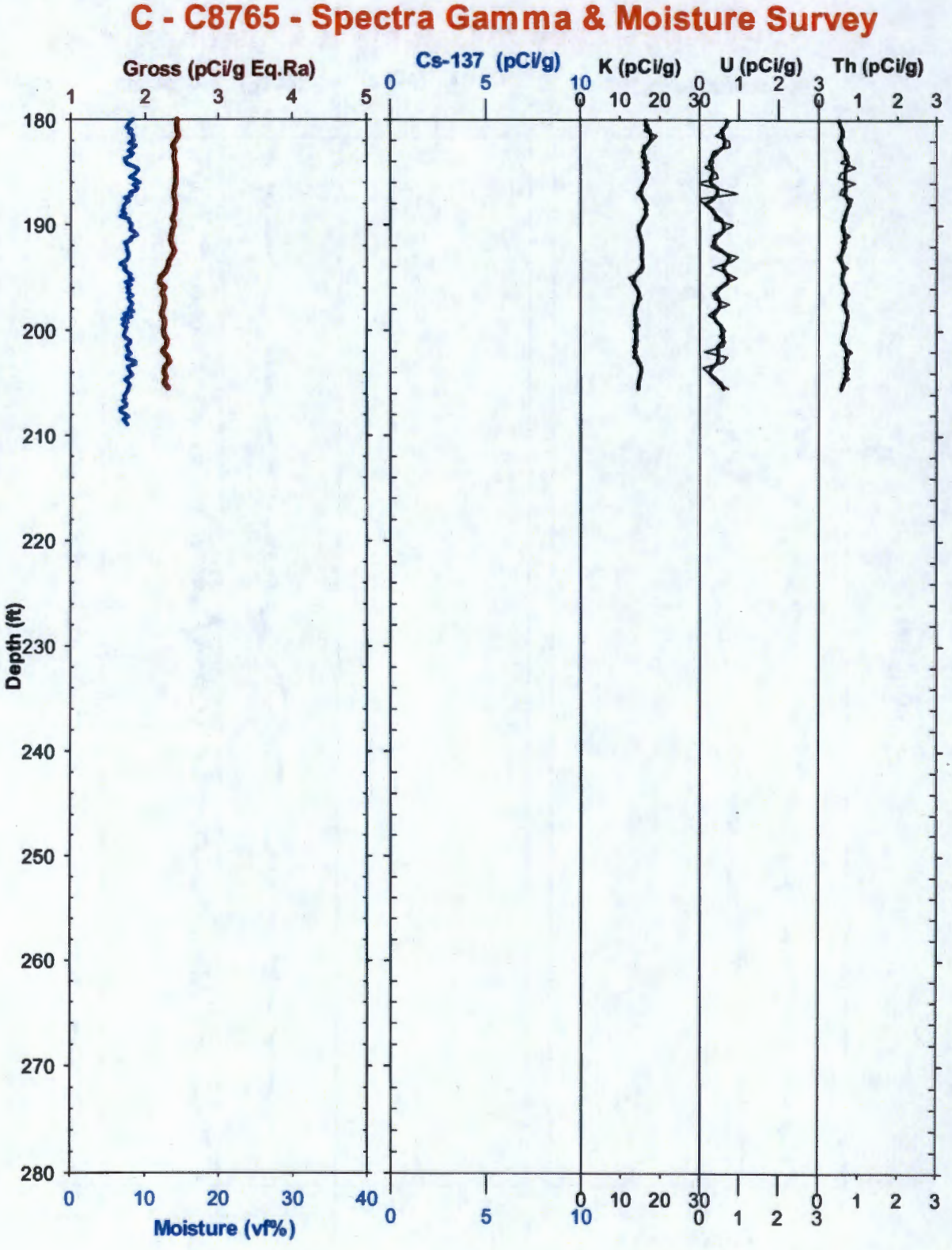
Date:	Feb 4, 2013
Electronic File:	BGO-1_2013-v0.zip

LaBr

Date:	Sep 13, 2012
Electronic File:	LaBr-1_2013-v0.zip


C - C8765 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)


C - C8765 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)


C - C8765 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)

C-Farm C8766 Header Information

Small Diameter –Moisture Survey

Probehole:	C8766	Log Date:	May 2013
Project:	C Farm	Depth Ref:	Ground Surface
Point#:	2836	Northing(Y):	136616.347
Easting(X):	575205.484	Elevation(Z):	638.91

Repeat/Overlap Intervals

Gamma:	Moisture:
197-205	204-209
195-200	165-170
133-137	58-63
65-70	
23-28	

Observations

Gamma:

Cs-137 is observed in this probe hole for surface to 7 ft, with a peak concentration of 67.6 pCig at 1 ft.

Moisture:

Moisture values range from 4-23%. There are numerous thin bed responses throughout the entire logged interval.

Calibration Certificates

Moisture

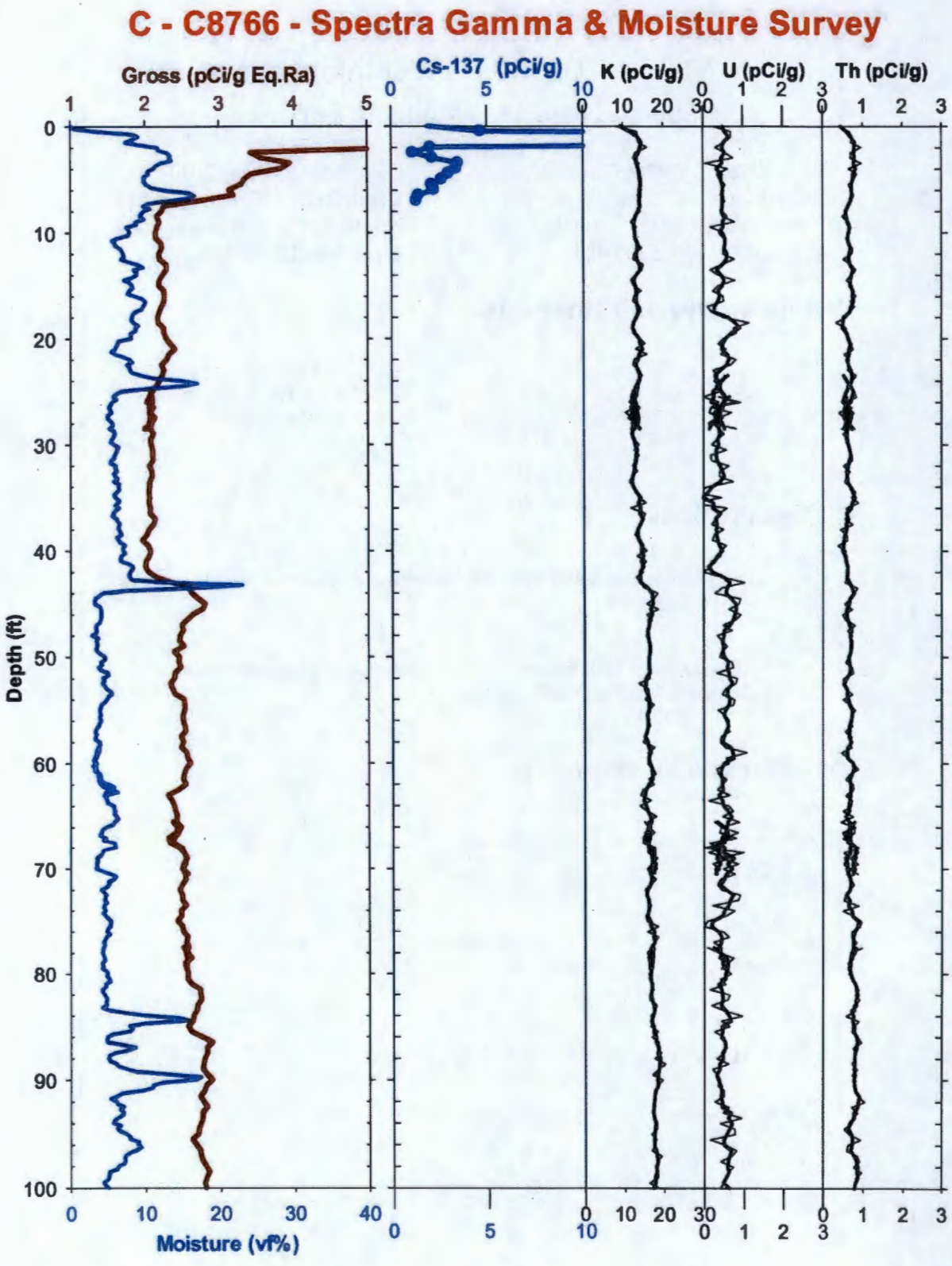
Date: Jan 25, 2013
Electronic File: N2_097_2013-v0.zip

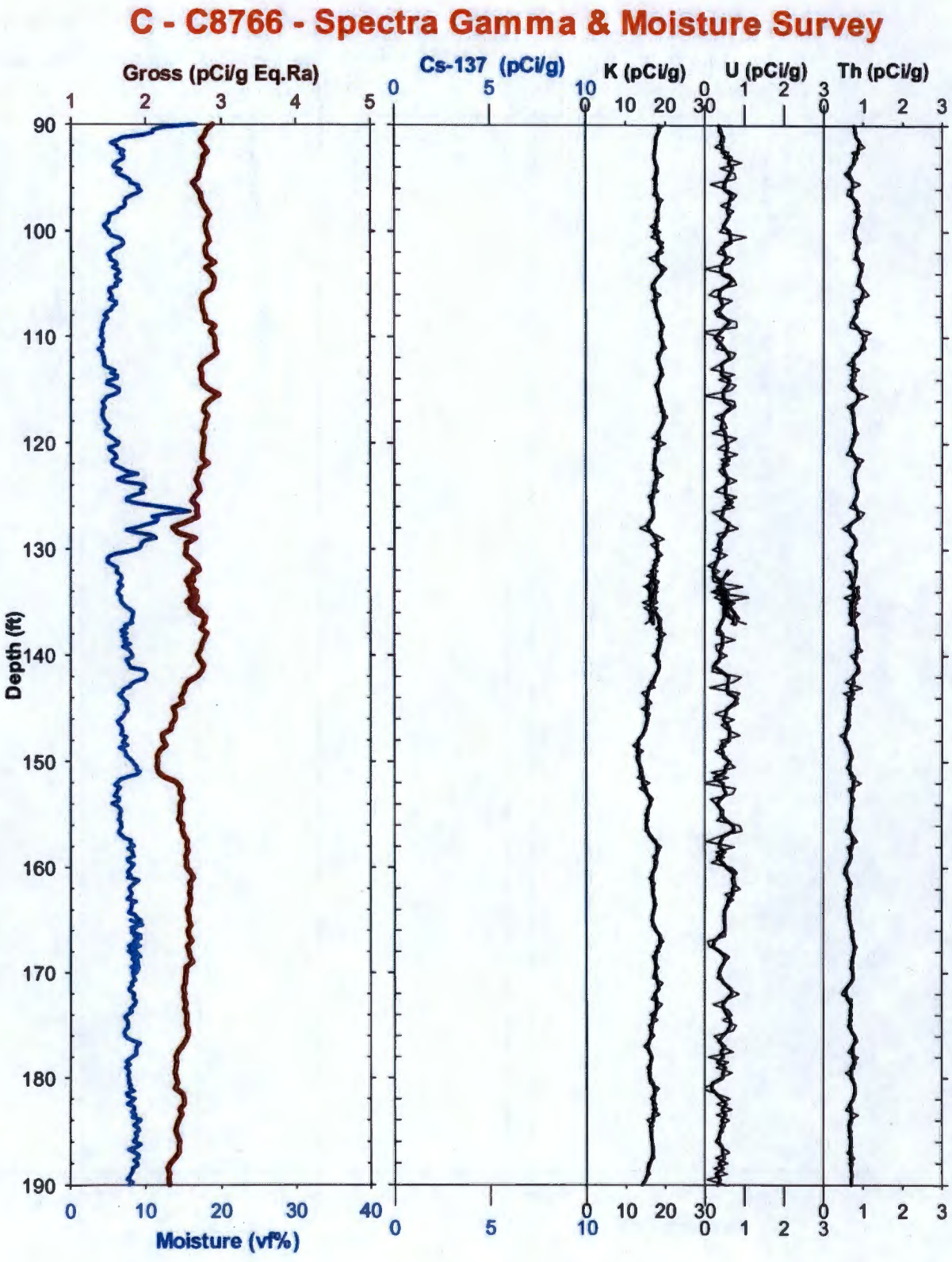
Gamma BGO

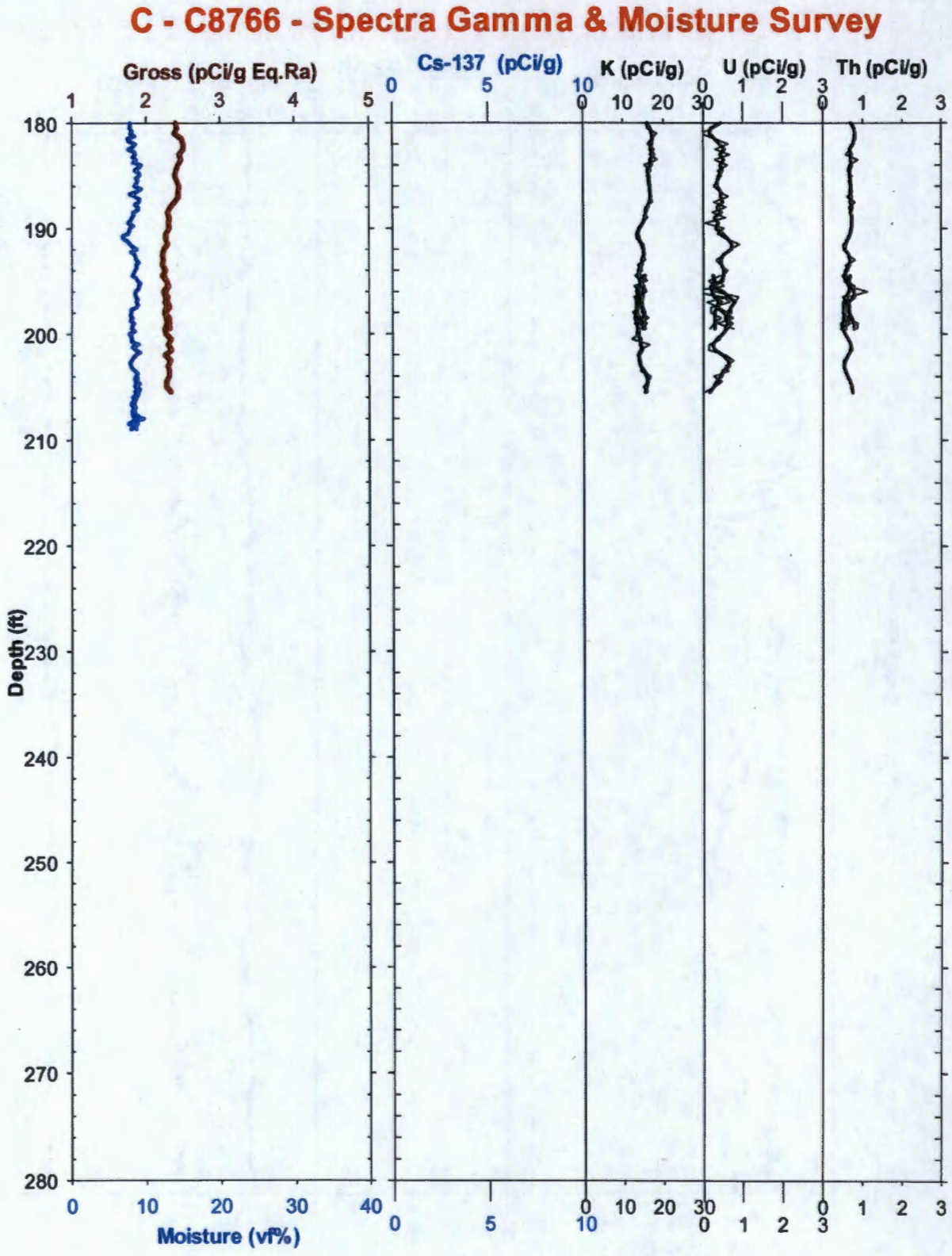
Date: Feb 4, 2013
Electronic File: BGO-1_2013-v0.zip

LaBr

Date: Sep 13, 2012
Electronic File: LaBr-1_2013-v0.zip


C - C8766 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)


C - C8766 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)


C - C8766 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)

C-Farm C8767 Header Information

Small Diameter –Moisture Survey

Probehole:	C8767	Log Date:	May 2013
Project:	C Farm	Depth Ref:	Ground Surface
Point#:	2835	Northing(Y):	136609.301
Easting(X):	575211.468	Elevation(Z):	639.83ft

Repeat/Overlap Intervals

Gamma:	200-205 157-162 110-115 83-88 41-46	Moisture:	204-209 78-83

Observations

Gamma:

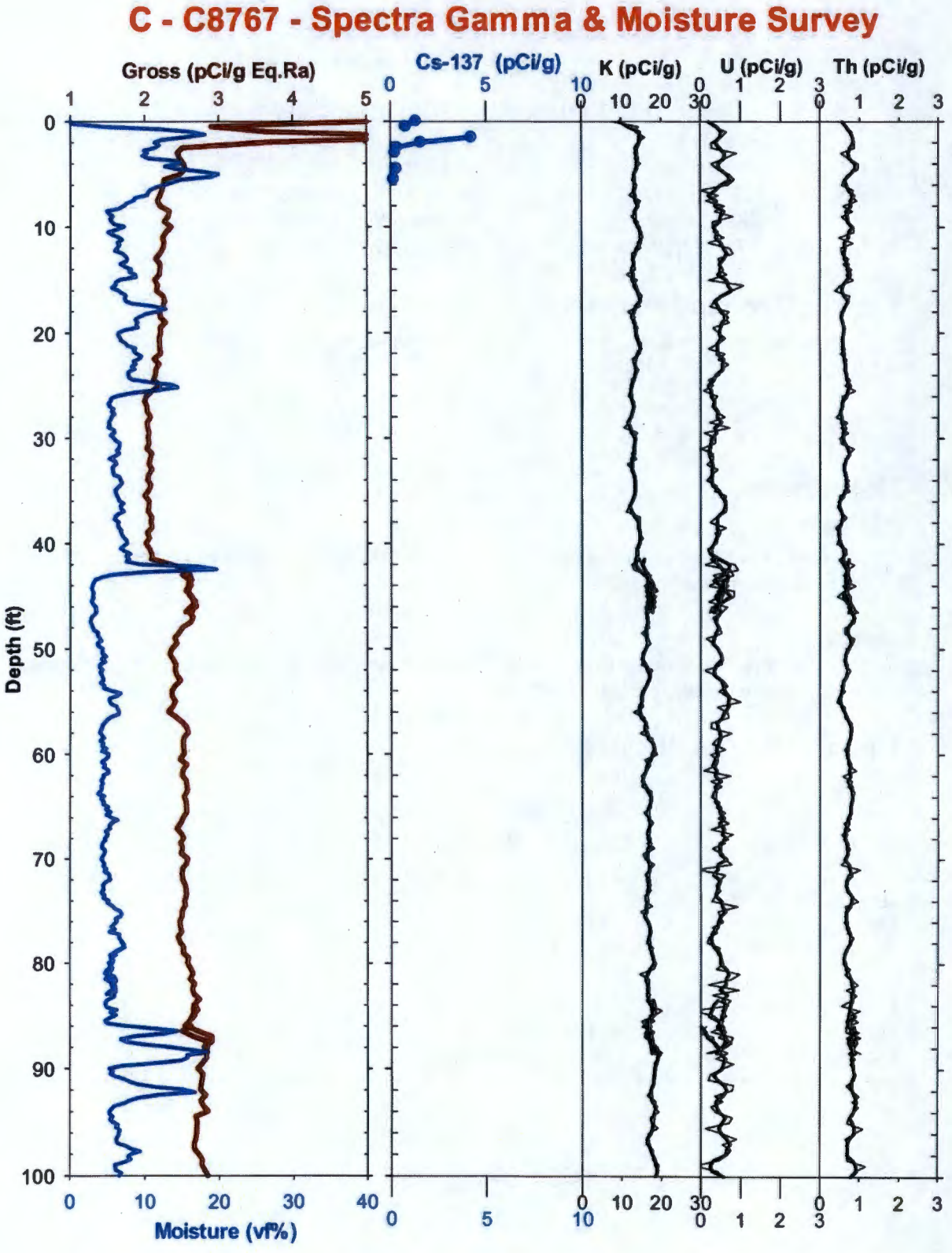
Cs-137 is observed in this probe hole from surface to 5.5 ft, with a maximum concentration of 4.2 pCig.

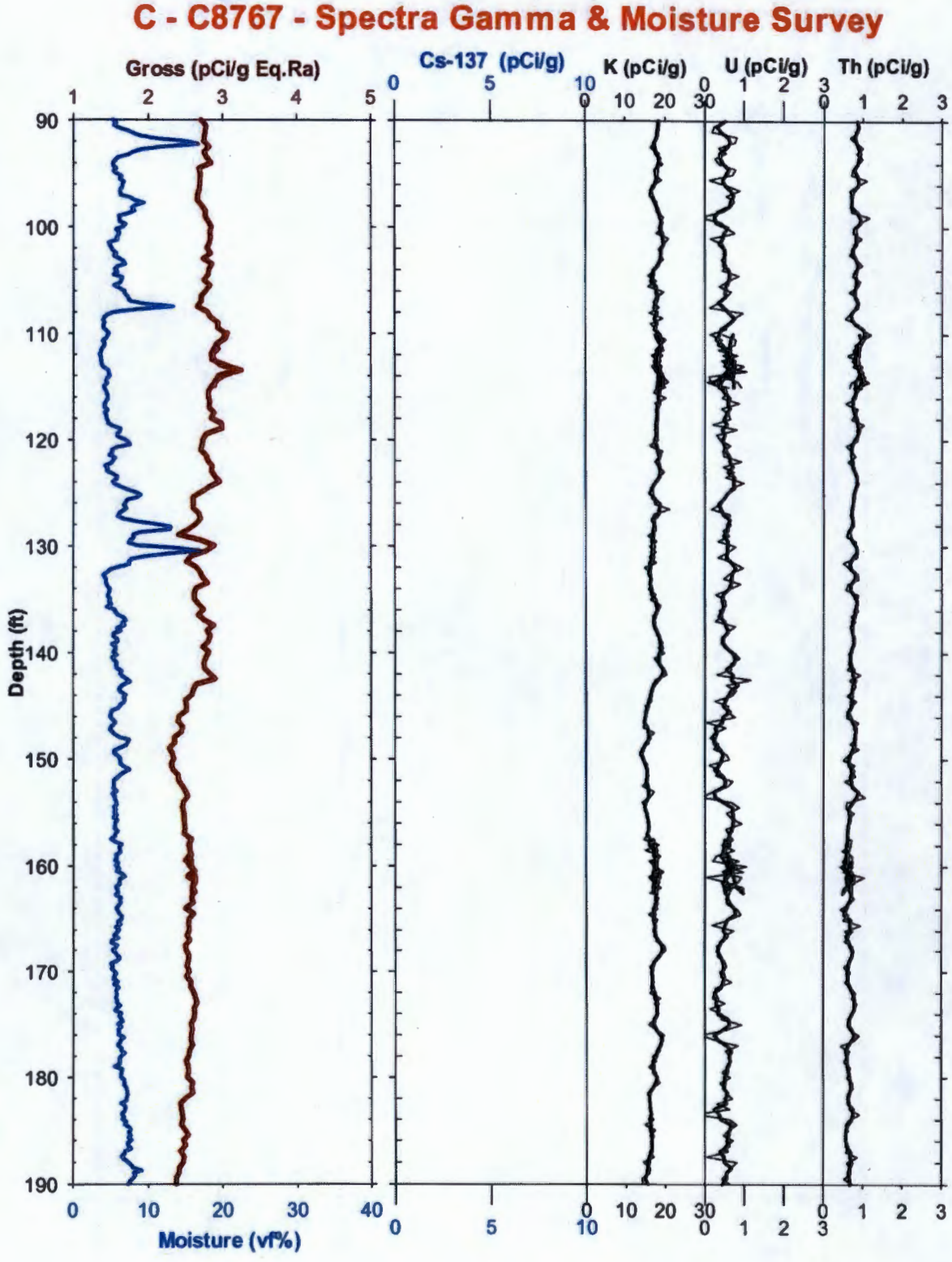
Moisture:

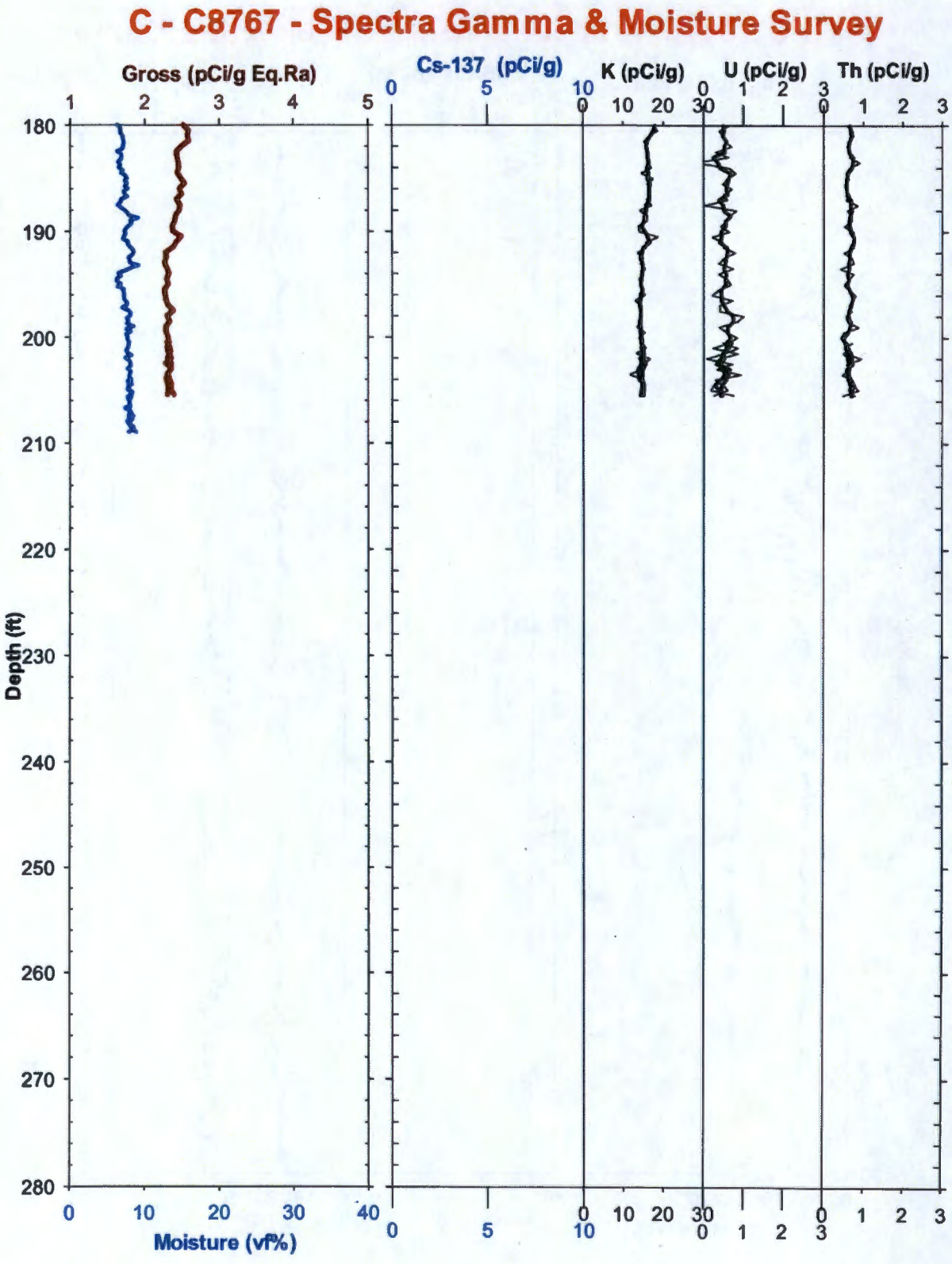
Moisture values range from 4-20%. There are numerous thin bed responses throughout the entire logged interval.

Calibration Certificates

Moisture	
Date:	Jan 25, 2013
Electronic File:	N2_097_2013-v0.zip
Gamma BGO	
Date:	Feb 4, 2013
Electronic File:	BGO-1_2013-v0.zip
LaBr	
Date:	Sep 13, 2012
Electronic File:	LaBr-1_2013-v0.zip


C - C8767 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)


C - C8767 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)


C - C8767 - Spectra Gamma & Moisture Survey
Gross (pCi/g Eq.Ra)
Cs-137 (pCi/g)
K (pCi/g)
U (pCi/g)
Th (pCi/g)
Depth (ft)
Moisture (vf%)

Appendix B Calibration Certificates

The following pages contain the following calibration certificates:

1. BGO gross gamma
2. BGO KUT spectral
3. LaBr Cs-137 spectral
4. Neutron-neutron moisture
5. Moisture calibration extrapolated to push tubing size
6. Hoist unit-depth calibration

Certificate of Calibration
BGO-1
Feb 4, 2013

COPY

Data were taken at the Hanford KUT models on Feb 4, 2013. BGO-1 is the designated Scintillator tool. The SBA model was used for the gross gamma calibration. Fifty spectra were recorded for the model in order to perform statistical analysis. The observed deviations were seen to be near the theoretically predicted variation, refer to the files compressed: Stats.xls for this analysis.

The instrument was covered with 0.37 inch wall-thickness probe-tubing.

The coefficient analysis is determined by the algorithm described in the document WHC-SD-EN-TI-293, Rev. 0. The gross gamma calibration for equivalent ^{226}Ra in pCi/g is a regression function and is generally defined by:

$$Ra = a*GR + b$$

Where Ra is the Eq. ^{226}Ra in pCi/g, and GR is the observed gross gamma count rate (c/s), dead time corrected. The coefficients of a & b are the fit coefficients. A more physical relationship constrains the intercept (b) to a zero value. This computation yields improved response extrapolated to low concentrations of K, U, and Th (clean zones). The coefficients were determined to be:

$$a = .0243 \quad Eq.^{226}Ra\ pCi/g\ /\ (c/s)$$
$$b \equiv 0$$
at energy threshold of 0keV

$$a = .194 \quad Eq.^{226}Ra\ pCi/g\ /\ (c/s)$$
$$b \equiv 0$$
at energy threshold of 800keV

Digital files condensed as Cal_SD-GR-2_2010-v0.zip. This compressed file contains:

- Calibration raw data
- Spreadsheet data formatting

The undersigned certifies that the data archived in the file "Cal_BGO-1_2013-v0.zip" were collected and evaluated in accordance with procedures WHC-SD-EN-TI-293, "Procedures for Calibrating Scintillation Gamma-Ray Well Logging Tools Using Hanford Formation Models" and that the above stated calibration coefficients are correct and applicable for the tool BGO-1 effective Feb 4, 2013.

Signature: Russel Randall Date: Feb 5, 2013

Russel Randall PhD

Company: Three Rivers Scientific

Certificate of Calibration
BGO-1
Feb 4, 2013

Data were taken at the Hanford KUT models on Feb 4, 2013. BGO-1 is the designated Scintillator tool. Four models were used for Spectral KUT calibration. Fifty spectra were recorded for each model in order to perform statistical analysis. The observed statistical deviations were seen to be within the theoretically predicted variation, refer to the files compressed: Stats.XLS for this analysis. The instrument was covered with 0.37 inch wall thickness probe tubing.

The algorithm described in the document WHC-SD-EN-TI-293, Rev. 0, determines the coefficient analysis. Three energy windows are used for each potassium, uranium and thorium (K U & T), and these are:

K: 1320-1575 keV **U: 1650-2390 keV** **T: 2475-2765 keV**

The concentration for each of the three elements is a linear combination of the count rates in the three windows. The resulting coefficients for each of the three elements are:

Concentration-K =	**4.077*K**	**-3.382*U**	**2.957*T**
Concentration-U =	**0.0*K**	**1.351*U**	**-2.585*T**
Concentration-T =	**0.0*K**	**-0.034*U**	**1.655*T**

Where K U & T are the count rates (c/s) in the listed energy windows and the resulting concentration values are in pCi/g.

Digital files condensed as Cal_BGO-1_2013-v0.zip. This compressed file contains:

- Calibration raw data
- MathCad data analysis files
- Spreadsheet data formatting

The undersigned certifies that the data archived in the file "Cal_BGO-1_2013-v0.zip" were collected and evaluated in accordance with procedures WHC-SD-EN-TI-293, "Procedures for Calibrating Scintillation Gamma-Ray Well Logging Tools Using Hanford Formation Models" and that the above stated calibration coefficients are correct and applicable for the tool BGO-1 effective Feb 4, 2013.

Signature: _____ Date: Feb 5, 2013

Company: Three Rivers Scientific

Certificate of Calibration
LaBr-1
Cs-137 Photo Peak
Sep 13, 2012

Data were taken at the Hanford KUT models on Sep 13, 2012. LaBr-1 is the designated Scintillator tool. The SBA and SBU models were used for the gross gamma calibration. Ten spectra were recorded for each model in order to perform statistical analysis. The observed deviations were seen to be near the theoretically predicted variation, refer to the files compressed: Stats.xls for this analysis.

The instrument was covered with 0.33 inch wall-thickness probe-tubing.

The coefficient analysis is determined by the algorithm described in the document WHC-SD-EN-TI-292, Rev. 0. The photo peak stripping method of radionuclide calibration is generally defined by:

$$C = A/(\varepsilon * N)$$

Where C is the radionuclide concentration in pCi/g, A is the deadtime corrected photo peak count rate, ε is the detector efficiency, and N is the number of gamma rays emitted per decay. The coefficient ε is the fit coefficient. The LaBr scintillator has superior energy resolution, but internal to the crystal a small but observable radioactivity that produces a background. This background does not affect the photo peak stripping method. The coefficient was determined to be:

$$\varepsilon = .588 \quad (c/s) \ / \ pCi/g$$

Digital files condensed as Cal_ES-Cs-1_2012-v0.zip. This compressed file contains:

- Calibration raw data
- Spreadsheet data formatting
- MCNP output
- Mathcad files

The undersigned certifies that the data archived in the file "Cal_ES-Cs-1_2012-v0.zip" were collected and evaluated in accordance with procedures WHC-SD-EN-TI-292, "Calibration of the Radionuclide Logging System Germanium Detector" and that the above stated calibration coefficient is correct and applicable for the tool LaBr-1 effective Sep 13, 2012.

Signature: _____ Date: Sep 16, 2012

Russel Randall PhD

Company: Three Rivers Scientific

Certificate of Calibration for
Instrument N-2_097
Jan 25, 2013

Data were taken in the Moisture models on Jan 25, 2013 for N-2_097 neutron-neutron moisture tool. The neutron source from DOE moisture tool ID of 78-1097 was used with the passive neutron detector probe from PNG.

Six models were used for moisture calibration, 3 for 6"casing and 3 for 8" casing. Repeated spectra were recorded for each model in order to perform statistical analysis. The observed statistical variation agreed with the theoretically predicted variation; refer to the file Stats.xls for this analysis.

The coefficient generation is determined by the algorithm described in the document WHC-SD-EN-TI-306, Rev. 0. The regression function used is a power law form and defined by:

$$V = a \cdot CR^{\alpha}$$

Where V is the formation moisture content in volume fraction water in vf units. One vf unit is 1% by volume water. The coefficients a and α are fit coefficients, and CR is the deadtime corrected observed total count rate, (c/s).

6" casing	8" casing
a = .0001671	a = .00009656
α = 2.202	α = 2.44

The undersigned certifies that the data archived in data file "N-2_097_2013.zip" were collected and evaluated in accordance with procedures WHC-SD-EN-TI-306, "Radionuclide Logging System In Situ Vadose Zone Moisture Measurement Calibration" and that the above stated calibration coefficients are correct and applicable for tool N-2_097, effective Jan 25, 2013.

Signature: Date:

Russel Randall Jan 30, 2013

Russel Randall, PhD
Three Rivers Scientific

Moisture Calibration Extrapolation to 2.5 Inch Borehole
Instrument N-2_097

Jan 25, 2013

Moisture calibration was performed in the Hanford physical models. These standards have 6 and 8 inch ID casings. The Tank Farm Direct Push borehole is cased with a 2.5 inch OD iron casing. The calibration for the moisture response is a function of borehole diameter.

The coefficient generation is determined by the algorithm described in the document WHC-SD-EN-TI-306, Rev. 0. The regression function used is a power law form and defined by:

$$V = a \cdot CR^{\alpha}$$

Where V is the formation moisture content in volume fraction water in vf units. One vf unit is 1% by volume water. The coefficients a and α are fit coefficients, and CR is the deadtime corrected observed total count rate, (c/s). A linear extrapolation was applied to determine the 2.5 inch borehole diameter.

2.51" borehole
a = .0002184
α = 2.00

The undersigned certifies that the analysis files are archived in the file "N-2_097_2013.zip" was evaluated in accordance with Energy Solutions procedures and that the above stated calibration coefficients are correct and applicable for tool N-2_097, effective Jan 25, 2013.

Signature: Date:

Russel Randall

Jan 30, 2013

Russel Randall, PhD
Three Rivers Scientific

Certificate of Depth Calibration

Unit ES-hoist1

Sep 15, 2012

Calibration data were taken at a test push on Energy Northwest property on Sep 15, 2012 for logging unit ES-hoist1. This calibration is the required yearly quality performance.

A standard steel tape was used to measure at selected depths into and out of the borehole, recording steel tape points and previous logging unit (computer generated) log depths. Standard encoder coefficient analysis results in a new value of depth coefficient.

The coefficient analysis is determined by the algorithm described in the Pacific Northwest Geophysics operating procedures. The depth encoder function is defined by

$$D = E * a$$

Where D is the depth in feet, E are the encoder pulses delivered to the computer unit. The coefficient, a, is the fit coefficient in units of pulses per foot. The new result for a is:

a=0.001304322

The previous coefficient was 0.001316801 for a change of nearly 1%. The rms of the new fit and the collected data is 0.18 inches over the 50 foot interval, both logging down and logging up to repeat the zero reference.

The undersigned certifies that the data archived in file "dep-ES-Sep-12.zip" were collected and evaluated in accordance with rigorous scientific principals and that the above stated calibration coefficient is correct and applicable for PNG-02 logging unit effective Sep 15, 2012.

Signature **Sep 16, 2012**

Russel Randall, PhD

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APPENDIX E

STATE OF WASHINGTON, DEPARTMENT OF ECOLOGY DOCUMENTS

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DEPARTMENT OF ECOLOGY
State of Washington

Notice of Intent to Construct a
Soil Boring or Soil Sampling or Vapor Sampling Well

This form and required fees **MUST BE RECEIVED** by the Department of Ecology **72 HOURS BEFORE** you construct a well.

Notification Number **SE47759**

Submit one completed form for each job site and required fee (check or money order only) to: Department of Ecology Cashiering Unit, P.O. Box 47611, Olympia, WA 98504-7611

NOTE: Please print. Processing your Notice of Intent may be delayed if all fields are not filled in completely.

1. Property Owner: U.S. Department Of Energy			Phone Number
Mailing Address: 825 Jadwin Avenue	City: Richland	State: WA	Zip Code: 99352
2. Agent (if different from above): Energy Solutions Inc.			Phone Number: (509) 727-4203
Mailing Address: 2521 Stevens Dr.	City: Richland	State: WA	Zip Code: 99353

3. Well Location

Tax Parcel Number, Township, Range, Section, ¼, and ¼ ¼ are Required. Latitude and longitude (if available).

County Name: Benton - 3					
Well Site Street Address			City	State: WA	Zip Code
Tax Parcel Number	Township: 12N	Range: 26E	Section: 2	¼ (within 160 acres): NE	¼ -¼ (within 40 acres): SE
Latitude Degrees	Latitude Time: min	sec		Horizontal Collection Method	
Longitude Degrees	Longitude Time: min	sec			

4. Well Construction Type: Geotechnical Soil Boring — Project Name: Vadose Direct Push Near C-200

5. Estimated Start Date: 4/1/2013 12:00:00 AM

6. Professional's License Number

7. Well Drilling Company Name: ENERGY SOLUTIONS INC	Phone Number: 509-375-9800
8. Well Driller Name: LYLE AMOS	Driller License Number: 1224

9. **Send the entire form.**
Please copy the notification number (located in the upper and lower right corners) and keep in a safe place. Use this reference number when communicating with the Department of Ecology.

Total Number of wells to be constructed 4

This notification number must be provided to your driller:

SE47759

No fees are associated with this type of well construction.

mwwalkup@energysolutions.com

Your Notice of Intent has been processed as of 3/26/2013 This message being sent at (3/26/2013)

DEPARTMENT OF ECOLOGY
State of Washington

Notice of Intent to Decommission a Well

Notification Number AE21189

This form and required fees **MUST BE RECEIVED** by the Department of Ecology **72 HOURS BEFORE** you construct a well.

Submit one completed form for each job site and required fee (check or money order only) to:
Department of Ecology Cashiering Unit, P.O. Box 47611, Olympia, WA 98504-7611

NOTE: Please print. Processing your Notice of Intent may be delayed if all fields are not filled in completely.

1. Property Owner: U.S. Department Of Energy			Phone Number	
Mailing Address: 825 Jadwin Avenue	City: Richland	State: WA	Zip Code: 99352	
2. Agent (if different from above): Energy Solutions Inc.			Phone Number: (509) 727-4203	
Mailing Address: 2521 Stevens Dr.	City: Richland	State: WA	Zip Code: 99353	

3. Well Location

Tax Parcel Number, Township, Range, Section, ¼, and ¼ ¼ are Required. Latitude and longitude (if available).

County Name: Benton - 3					
Well Site Street Address	City	State: WA	Zip Code		
Tax Parcel Number	Township: 12N	Range: 26E	Section: 2	¼ (within 160 acres): NE	¼ -¼ (within 40 acres): SE
Latitude Degrees	Latitude Time: min sec	Horizontal Collection Method			
Longitude Degrees	Longitude Time: min sec				

4. Notice of Intent Number of well being decomissioned: SE47759
Unique Well Tag Number of well being decomissioned (if applicable)

5. Well Type to Decommission: Geotech Soil Boring/Sampling Well - No Fee — How Many? 4

6. Estimated Decommission Start Date: 4/1/2013 12:00:00 — Project Name: Vadose Direct Push Near C-200

7. Professional's License Number

8. Well Drilling Company Name: ENERGY SOLUTIONS INC	Phone Number: 509-375-9800
9. Well Driller Name: LYLE AMOS	Driller License Number: 1224

10. **Send the entire form.**

Please copy the notification number (located in the upper and lower right corners) and keep in a safe place. Use this reference number when communicating with the Department of Ecology.

Water Well : $50.00
Soil Sampling, Dewatering,
Environmental investigation wells: No Fee
All other wells: $20.00 each

Amount Enclosed $ $0

This notification number must be provided to your driller:

AE21189

mwwalkup@energysolutions.com

Your Notice of Intent has been processed as of 3/26/2013 This message being sent at (3/26/2013)

ENERGYSOLUTIONS

March 26, 2013 FS-NW-LT-5621

Mr. Jeff Ayres
State of Washington
Department Of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

Subject: Request for Variance to Washington Administrative Code 173-160-451 for Direct Push Resource Protection Wells

Dear Mr. Ayres,

Energy*Solutions* Government Group, Inc. (Energy*Solutions*), under contract to Washington River Protection Solutions (WRPS), will be using direct push technology for conducting vadose zone characterization in the 241-C Tank Farm on the Hanford Site, Washington. These direct pushes are for the purpose of characterizing contaminants in the vadose zone beneath the tank farm.

A Notice of Intent to Construct a Soil Boring or Soil Sampling or Vapor Sampling Well, No: SE47759 was submitted and processed on March 26, 2013 for conducting four direct pushes. The current schedule is to initiate the field activities by April 1, 2013. A total of four locations have been selected. A characterization push will be made at each location, for a total of four direct pushes. Geophysical logging will be conducted in each of the four characterization pushes. No soil samples will be collected. At the completion of the characterization activities, moisture probes will be installed in all four direct push probe holes and the holes will be decommissioned in accordance with the Washington Administrative Code (WAC) 173-160 requirements.

The target depth for these direct pushes is 220.0 ft. A variance to the WAC 173-160-451 is being requested as these direct pushes will be greater than 30 ft in depth. Please provide your concurrence in the space provided below and return a copy for our project files. Please contact me at (509) 375-9587 should you require additional information.

Sincerely,

Martin G. Gardner, Manager
Washington Operations

jmr

Energy*Solutions* – MGG File/LB

2345 Stevens Drive, Suite 240 • Richland, Washington 99354 • 509.371.8008
Fax: 509.375.9986 / 509.371.1906 / 509.375.9500 • www.energysolutions.com

State of Washington, Department of Ecology Variance Concurrence/Approval:

Print Name	Signature	Title	Date
Jeff Ayres		Hydrogeologist	3/26/13
Cheryl Whalen		Section Manager	5/26/13