COMPLETION REPORT FOR LEAK DETECTION CHARACTERIZATION NEAR SINGLE-SHELL TANK 241-C-105

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U.S. Department of Energy Contract DE-AC27-08RV14800

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Abstract: This report describes efforts to collect and provide subsurface data inside 241-C Tank Farm near single-shell tank 241-C-105

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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

washingtonriver protectionsolutions

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Richland, Washington 99352

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TERMS

ALARA	as low as reasonably achievable
bgs	below ground surface
Energy*Solutions*	Energy*Solutions* Federal Services, Inc.
GM	Geiger-Mueller
NaI	sodium-iodide
RPP	River Protection Project
WAC	*Washington Administrative Code*
WRPS	Washington River Protection Solutions

COMPLETION REPORT FOR LEAK DETECTION CHARACTERIZATION NEAR SINGLE-SHELL TANK 241-C-105

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 inside C Tank Farm near tank 241-C-105 located in the 200 East Area of the Hanford Site. WRPS contracted Energy*Solutions* Federal Services, Inc. (Energy*Solutions*) to perform the field activities required to gather this data. This data is intended to provide information about the leak site (source) for contamination observed in drywells adjacent to 241-C-105.

FSWO-DOW-029, *Description of Work: Phase 2 Soil Characterization Near Single-Shell Tank 241-C-105*, Rev. 0 (see Appendix A) provides a detailed description of the scope of work performed. Energy*Solutions* was responsible for the provision of equipment and personnel to conduct the direct push activities and safety oversight. The following were included in the overall Energy*Solutions* work scope: providing for global positioning surveys, providing subcontract geophysical logging services, providing technical support and preparing final reports. The following appendices contain copies of documentation generated during the performance of the above work scope.

Appendix A, FSWO-DOW-029, *Description of Work: Phase 2 Soil Characterization Near Single-Shell Tank 241-C-105*, Rev. 0
Appendix B, Global Positioning System Coordinates and Map
Appendix C, Drilling and Sampling Daily Work Records
Appendix D, Small Diameter Geophysical Logging for C Tank Farm Leak Assessment of Tank 241-C-105
Appendix E, Washington State Department of Ecology Documents

2.0 SUMMARY OF ACTIVITIES

FSWO-DOW-029, Rev. 0 was prepared and submitted prior to deployment. The description of work provides detailed work instructions and information for conducting characterization efforts inside C Tank Farm. A hydraulic hammer unit was used for pushing up to two exploration boreholes to a projected depth of 15.24 meters (50 feet) below ground surface (bgs), or refusal, for geophysical logging. The exploratory locations were selected based on ground-penetrating radar data and as-built infrastructure drawings. Each investigative site is approximately 1.22 to 1.52 meters (4 to 5 feet) from the 241-C-105 tank wall, near the tanks cascade overflow pipe line. On September 23, 2009, drilling equipment and support items were staged inside C Tank Farm at borehole C7469. The hydraulic hammer unit crew commenced pushing the first borehole for this task that same day. The work scope was completed October 9, 2009. Including mobilization and demobilization, there were 12 field days that the hydraulic hammer unit and crew were dedicated to the C Tank Farm activities. Because of the contamination encountered and as low as reasonably achievable (ALARA) concerns, there were 69.75 hours of downtime associated with this task. For exact dates and explanations of down time, refer to the Drilling and Sampling (Percussion) Daily Work Records located in Appendix C.

Borehole C7469 met unexpected refusal at 11.0 meters (36.1 feet). Verification of the borehole's depth resulted in an unexpected outcome. The end of the tag tape was contaminated with 750,000 disintegrations per minute beta/gamma radiation, which exceeded the Radiological Work Permit. New Radiological Work Permits had to be prepared for both pushing and logging of the borehole. The Vadose Project Technical Point of Contact chose to log the borehole at this depth.

Geophysical logging was performed October 6 from surface to total depth, using a sodium-iodide (NaI) scintillation gross gamma detector and a moderate sensitivity Geiger-Mueller (GM) gross gamma detector. The borehole was surveyed twice to ensure accurate measurements at the bottom of the borehole. Radiation levels at 7.16 meters (23.5 feet) bgs exceeded the NaI detection range of 68,000 pCi/g eCs-137. Radiation levels continued to increase near the bottom of the borehole. Activity exceeded the detector's detection range of 43,000,000 pCi/g of eCs-137 at 10.7 meters (35 feet) bgs. Detailed results from the geophysical logging efforts are provided in Appendix D.

Because of radiological concerns, the Vadose Project Technical Point of Contact chose not to push the second exploration borehole. With logging completed, borehole C7469 was then decommissioned. The Vadose Project Technical Point of Contact chose to decommission the borehole leaving the contaminated rod in the ground. Ensuring the tubing was below the surface, the borehole was filled with bentonite to the ground surface.

3.0 LOGGING AND DIRECT PUSHING DETAILS

3.1 GLOBAL POSITIONING SATELLITE SURVEYING

With the use of a Trimble[1] 5800 Global Positioning Satellite Survey system and per FSWO-DOW-029, Rev. 0, the original locations of the exploratory boreholes were identified using paint and stakes. Once the task was completed and the borehole decommissioned, the exploratory borehole was recorded for accuracy. The recorded coordinates were placed on a map showing their locations in direct relation to the underground storage tanks in the vicinity. The coordinates, elevation and a map showing completed push location/borehole are provided in Appendix B.

3.2 DIRECT PUSHING

Per FSWO-DOW-029, Rev. 0, the exploration borehole was pushed using a hydraulic hammer system mounted on a tractor-type carrier. A 6.35 centimeter (2.5-inch) outside diameter x 4.45 centimeter (1.75-inch) inside diameter casing was driven at the predetermined location to the specified depth, or refusal. Once the exploration borehole was geophysically logged, the data was reviewed by WRPS personnel to determine a path forward.

3.3 GEOPHYSICAL LOGGING

Pacific Northwest Geophysics and Three Rivers Scientific conducted the geophysical logging data collection and analysis services on the exploration borehole. For the geophysical logging, a portable small diameter logging system was used to collect geophysical data with a NaI detector and a "Green GM" (a Geiger-Muller scintillation type detector) from the surface to the bottom of the borehole. 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 BOREHOLE DECOMMISSIONING

Decommissioning of boreholes is conducted in accordance with the *Washington Administrative Code* (WAC) 173-160 requirements. While decommissioning boreholes, the tubing is back pulled while granular bentonite is simultaneously added to the borehole until bentonite reaches the surface. As mentioned above, contaminated tubing (the bottom assembly and twelve 6.35 cm x 1.22 m [2.5 in. x 4.0 ft] rods) was left in the subsurface of borehole C7469 while filling it with bentonite to surface. Washington State Department of Ecology documentation for borehole installation and decommissioning is located in Appendix E.

5.0 REFERENCES

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

APPENDIX A

FSWO-DOW-029 *DESCRIPTION OF WORK: PHASE 2 SOIL CHARACTERIZATION NEAR SINGLE-SHELL TANK 241-C-105,* REV. 0

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FSWO-DOW-029
Revision 0

DESCRIPTION OF WORK: PHASE 2 SOIL CHARACTERIZATION NEAR SINGLE-SHELL TANK 241-C-105

K. D. Reynolds

September 2009

Prepared for
Washington River Protection Solutions, LLC

by
Remediation and Well Services
Energy*Solutions* Federal Services, Inc., Northwest Operations

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Figure 2. 241-C-105 Push Location. 5

TERMS

DOE	U.S. Department of Energy
DOW	description of work
Energy*Solutions*	Energy*Solutions* Federal Services, Inc., Northwest Operations
ES&H	Environmental, Safety, and Health
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

FSWO-DOW-029, Rev. 0

DESCRIPTION OF WORK: PHASE 2 SOIL CHARACTERIZATION NEAR SINGLE-SHELL TANK 241-C-105

1.0 INTRODUCTION AND BACKGROUND

1.1 INTRODUCTION

The U.S. Department of Energy (DOE) Office of River Protection and the Washington State Department of Ecology (the regulator for *Resource Conservation and Recovery Act of 1976* [RCRA] treatment, storage, and disposal facilities) have agreed to create a RCRA Corrective Action Project with explicit milestones. These milestones are part of the *Hanford Federal Facility Agreement and Consent Order* (part of the M45 milestone series). The Tank Farm Vadose Zone Project is managing the RCRA Corrective Action Program. This program includes collection of subsurface vadose zone data.

The DOE assigned the River Protection Project (RPP) Single-Shell Tank Program the tasks of transferring waste from the single-shell tanks (SST) to double-shell tanks, and developing and implementing a strategy to retrieve SST and miscellaneous underground storage tank waste. The Single-Shell Tank Program Vadose Zone Project was given responsibility for collecting and providing subsurface data from the SST farm facilities. This contributes to preparation for the eventual retrieval of the storage tank waste. The data that is being collected is intended to provide an understanding of the distribution and movement of contaminants in the vadose zone under and adjacent to the tank farms. The intent of the SST Waste Management Area's (WMA) characterization program is to collect samples that have or have not contacted tank waste. These SST farms are designated as Radiological Buffer Areas or Contamination Areas.

This description of work (DOW) describes the field work necessary to collect the data supplementing RPP-ASTM-39801, *241-C-105 Leak Assessment Report.*

1.2 SCOPE

This work is being conducted at the direction of Washington River Protection Solutions, LLC (WRPS) Vadose Zone Characterization Group. This DOW provides the work instructions for conducting direct push and geophysical logging efforts inside the 241-C Tank Farm near tank 241-C-105. The intent is to provide geophysical verification of the leak level (depth) of the assumed leak from 241-C-105. Adjacent dry well data indicates that it is unclear if the leak occurred at or near the cascade line and tank wall or, at or near the base of the tank. Up to two direct push attempts will be made near the tank wall (south by southwest quadrant, see Figure 2). The push location will be approximately 1.22 m to 1.52 m (4 ft to 5 ft) from the tank wall and is intended to pass near the concrete pad tank base to a projected total depth of 15.24 m (50 ft) below ground surface. The scope of work includes: provide equipment and personnel to conduct direct push activities; provide safety oversight; provide geophysical logging services;

attend meeting and planning sessions; and provide a written report documenting field activities and geophysical data collection at the conclusion of activities.

1.3 TANK FARM BACKGROUND

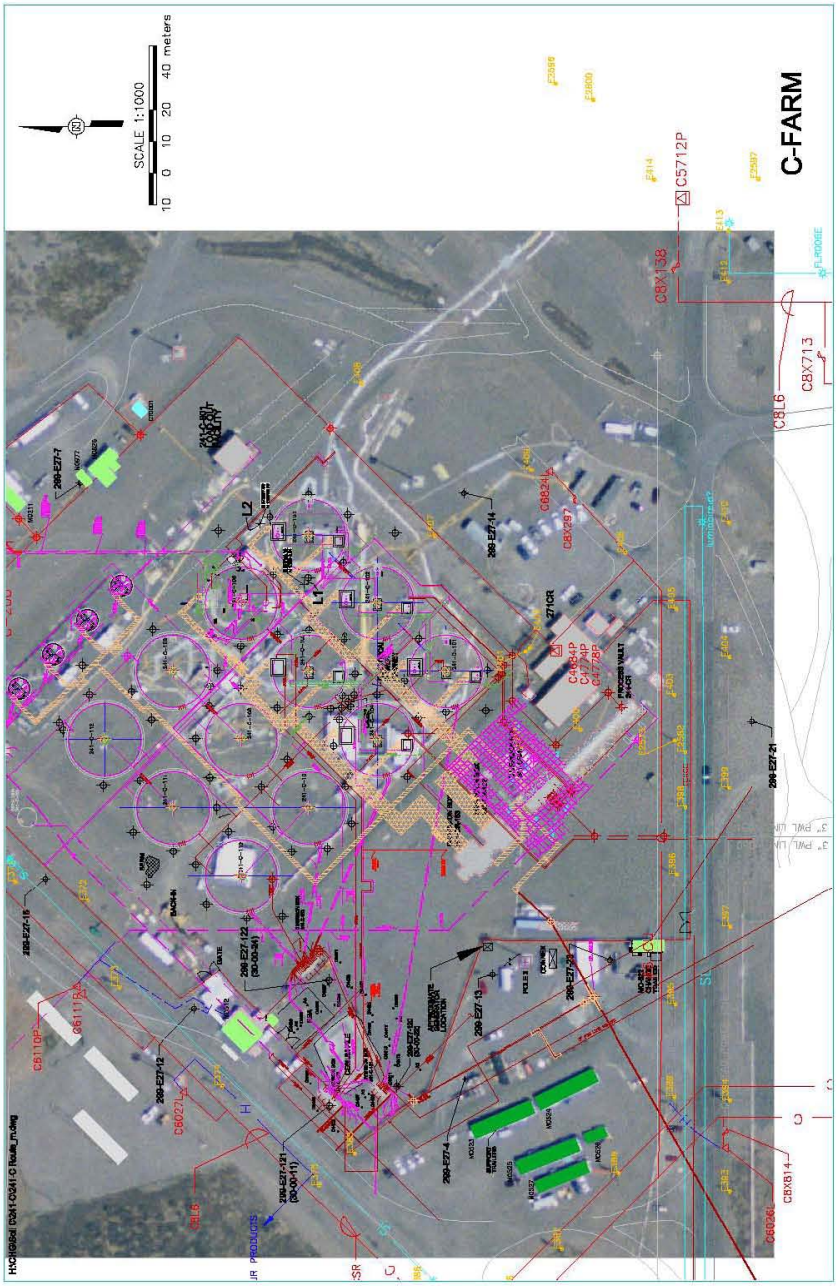
The Hanford Site has 149 underground SSTs that store hazardous radioactive waste. These tanks are grouped into 12 tank farms that are further grouped into eight WMAs and are regulated under RCRA. Many of these tanks have leaked, and there have been leaks in the associated infrastructure (e.g., pipelines, diversion boxes). Some of the leaked waste has entered groundwater. This DOW provides direction for field operations relative to characterization activities near SST 241-C-105 in C Tank Farm.

Since the Hanford Site started operating in the early 1940s, a large volume of information related to WMA C operations has been collected and evaluated. WMA C encompasses the C Farm located in the east central portion of the 200 East Area (Figure 1 and Figure 2) including soil and groundwater contaminated by C Farm operations. C 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 Farm.

The C 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.

FSWO-DOW-029, Rev. 0

Figure 1. 241-C Tank Farm Aerial Photo.



1.4 PHYSICAL SETTING

The SST WMA tank farms were constructed in excavations into the near-surface sediments that overlie the Columbia River Basalt Group. Columbia River basalt forms the basement bedrock. Up to approximately 150 m (500 ft) of continental sediments overlie basalt. From oldest to youngest, these deposits include the following.

- Several facies of the Miocene-to-Pliocene age, fluvial-lacustrine Ringold Formation.
- Variably cemented and pedogenically altered deposits of the Plio-Pleistocene unit, which developed on the eroded and weathered surface of the Ringold Formation.
- A relatively loose, fine-grained silty-to-sandy unit designated the Hanford formation/Plio-Pleistocene unit interval.
- Deposits from Pleistocene age cataclysmic floods (i.e., Hanford formation) that blanket the study area with mostly sand- and silt-dominated facies, capped by a sequence of gravel-dominated facies.

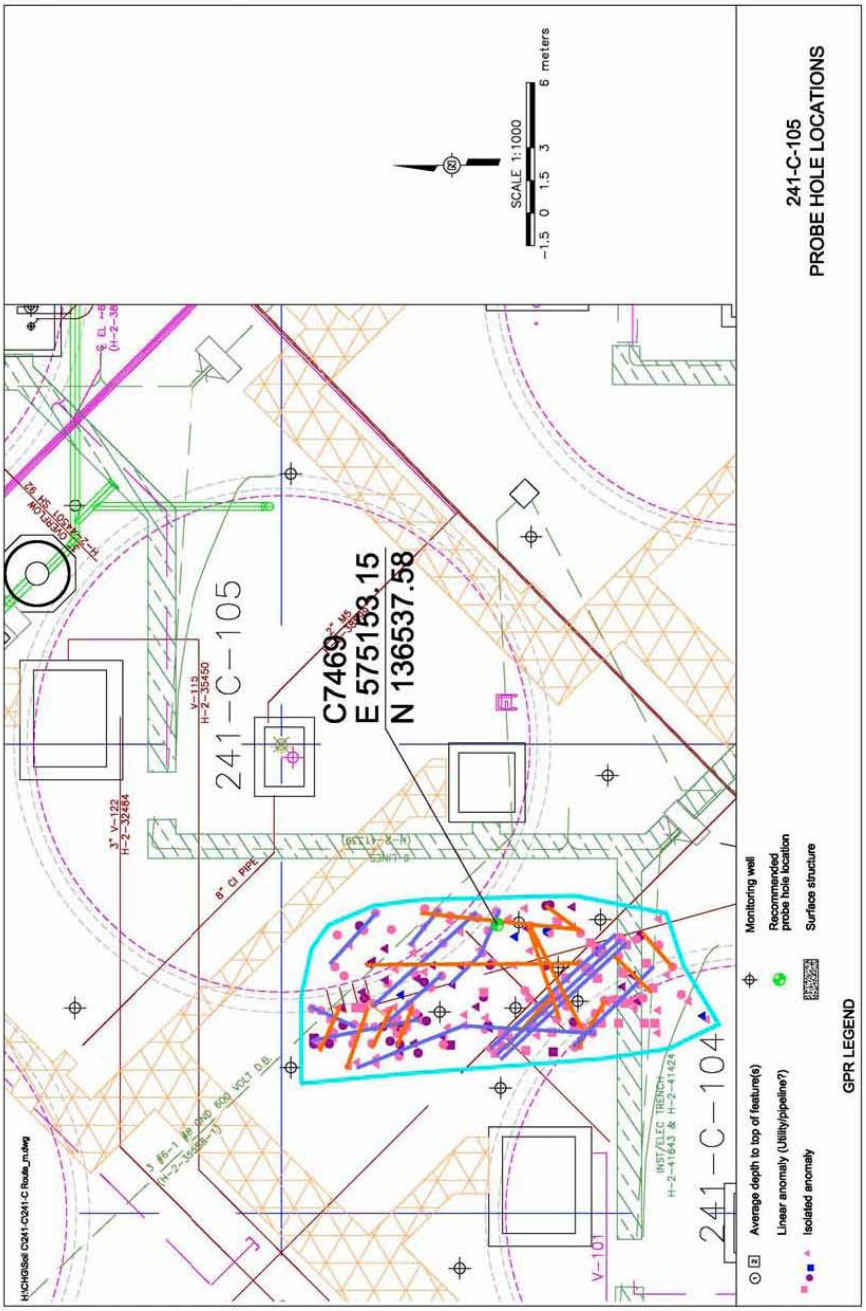
2.0 METHODOLOGY

The method selected to provide access to the subsurface adjacent to 241-C-105 is a hydraulically powered rotational hammer. For this application, the location for investigation (exploration) was selected through an iterative process as outlined in Section 3.0. One direct push is planned and an additional push may be attempted if required.

The planned push will be initially investigated by use 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 push). This tubing is advanced to the target depth of 15.24 m to 18.29 m (50 ft to 60 ft) below ground surface (as directed by the Vadose technical contact) or refusal and will be geophysically logged with a Sodium-iodide gamma (NaI) and neutron-"Green" Geiger-Muller (Green GM) instrumentation. The exploratory push hole 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.

FSWO-DOW-029, Rev. 0

Figure 2. 241-C-105 Push Location.



3.0 PUSH LOCATION

3.1 PUSH LOCATION DOCUMENTATION

Figure 2 above is a location map of the area adjacent to 241-C-105 area in the 241-C Tank Farm. One specific push location (C7469) is identified in Figure 2. One additional location may be operated under this DOW based on the results of the push attempt at C7469. The additional attempt, if required, will be at the direction of the Vadose Technical Point of Contact and would be immediately adjacent to the mapped location (moving north-northwest along the mapped tank base). An appropriate well number will be applied if the option to attempt an additional push at this location is necessary. This location was selected through an iterative process using ground-penetrating radar scan data and as-built infrastructure drawing reviews and adjacent dry well logging information. These data sets were compared and the site deemed to have the highest chance of collection of the desired data was selected. The final location coordinates of the selected site (determined from the dry well logging data, ground-penetrating radar and as-built review) were plotted with computer-aided drafting (see Figure 2 above). The push location effort using the Global Positioning Satellite instrumentation will be documented on Well Information Reports/Field Activity Reports. In addition to the coordinate position of the probe location, the push 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) will be included in the documentation.

3.2 PUSH LOCATION TABLES AND NUMBERING

All push location activities will be tracked and documented on Field Activity Reports by referencing the Well identification (Well ID) number provided in Figure 2. If the optional push is attempted, a unique Well ID number will be used to track the push location on the Field Activity Report.

4.0 WORK TASKS

4.1 SITE SETUP

The push equipment will be mobilized and a controlled work area set up surrounding the pre-selected and marked location (see Figure 2 above). A pre-survey of the tractor and equipment will be conducted (per tank farm 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 push point. The equipment consists of a tractor-mounted 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 push 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 push locations.

Tank farms 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. Spill protection consists of placement of felt and plastic sheeting 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. Tank farms health physics personnel will provide direction and support to ensure radiological protection is maintained for all personnel associated with the work.

4.2 PUSH POINT CONTROL

During advancement of the push hole, casing (push rods) will be driven into the subsurface by use of the hydraulic hammer impact system. The push locations have been positioned to avoid impacting known/mapped structures, but pass as close as deemed safe to the tank bottom concrete pad. The mapped point will be investigated with all due caution and 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 safe condition and the Vadose Project Technical Point of Contact (Harold Sydnor) or his designee, and the tank farm shift supervisor will be notified. If during push operations the push point 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 depth will be noted in the Field Activity Report and the Vadose Project Technical Point of Contact (Harold Sydnor) will be notified.

All activities using the hammer unit will conform to the manufacturer's operating manual and applicable procedures that relate to the specific phase of work. As the push rods are extracted from the exploratory and sampling holes, 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 push holes are defined in the appropriate sections of WAC 173-160.

4.3 GEOPHYSICAL LOGGING

At refusal or target total depth of the exploratory investigations, Pacific Northwest Geophysics will conduct logging operations to gather geophysical information. The following logging suites will be used.

1. Sodium-Iodide Gamma logging @ a maximum of 1 min/0.5 ft.
2. Additional logging with the "Green" Geiger/Muller equipment will be conducted. The data collection logging rate will be determined by the observed results from the NaI log data.

Logging data will be collected from the total depth to surface. The logging analyst, Energy*Solutions* Federal Services, Inc., Northwest Operations (Energy*Solutions*) site personnel and the WRPS Vadose Project Engineer will review the field log data to determine any additional data or logging runs necessary to meet the technical goals of the project. Logging activities will be conducted in accordance with applicable Pacific Northwest Geophysics and Energy*Solutions* procedures and the Energy*Solutions* Quality Assurance and Data Management Plans.

4.4 EXPLORATION PUSH HOLE DECOMMISSIONING

Applicable WAC requirements contained in WAC 173-160 will be used to control and guide actions for decommissioning the exploratory probeholes. Each probe hole will be filled with bentonite, a bentonite slurry and/or grout (neat cement or cement-bentonite mixture) during the push rod extraction process.

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-105 investigation. All Energy*Solutions*, WRPS, and applicable *Occupational Safety and Health Act of 1970* safety and health requirements are applied and adhered to during the field operations. An activity-specific Job Hazard Analysis outlines the specific activity hazards and the mitigation methodologies. The documentation governing the operation of the direct push rig, sampling, and decommissioning activities (AHA-09-005, *C-105 Direct Push Hydraulic Hammer Unit Operations,* Rev. 0, or most current revision) is included as a portion of the WRPS Tank Farm Work Package.

Both Energy*Solutions* Safety personnel and WRPS Tank Farm Industrial Hygiene and Safety personnel will survey the job site for safety and health compliance. Energy*Solutions* personnel

and safety representatives will provide onsite inspections and visits during direct push and decommissioning activities to ensure compliance with the guidance outlined in the Activity Hazard Analysis. Any onsite inspection reports prepared during execution of this scope of work will be provided to the WRPS Technical Point of Contact (Harold Sydnor).

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.

These requirements are communicated to everyone associated with the project (visitors included) using the Energy*Solutions* Activity Hazard Analysis. The Activity Hazard Analysis is part of the Energy*Solutions* Environmental, Safety, and Health (ES&H) Program.

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 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 on the Hanford Site is subject to the requirements of DOE Order 5700.6C, *Quality Assurance*. A Quality Assurance program has been described in applicable sections of FS-WO-QAPP-001, *Federal Services Hanford Quality Assurance Program Plan*, and FSWO-QAP-001, *Quality Assurance Procedures*.

All work will be performed in accordance with approved procedures and this work plan.

7.0 REFERENCES

AHA-09-005, *C-105 Direct Push Hydraulic Hammer Unit Operations,* Rev. 0, Energy*Solutions* Technical Services, Richland, Washington.

DOE Order 5700.6C, 1991, *Quality Assurance*, U.S. Department of Energy, Washington, D.C.

Ecology, EPA, and DOE, *Hanford Federal Facility Agreement and Consent Order*, 6 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington, as amended.

FSWO-DOW-029, Rev. 0

FS-WO-QAPP-001, *Federal Services Hanford Quality Assurance Program Plan*, Energy*Solutions* Federal Services, Western Operations, Richland, Washington.

FSWO-QAP-001, *Quality Assurance Procedures*, Energy*Solutions* Federal Services, Western Operations, 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-ASTM-39801, *Tank 241-C-105 Leak Assessment Report*, Rev. 0, Washington River Protection Solutions, LLC, Richland, Washington.

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

APPENDIX B

GLOBAL POSITIONING SYSTEM COORDINATES AND MAP

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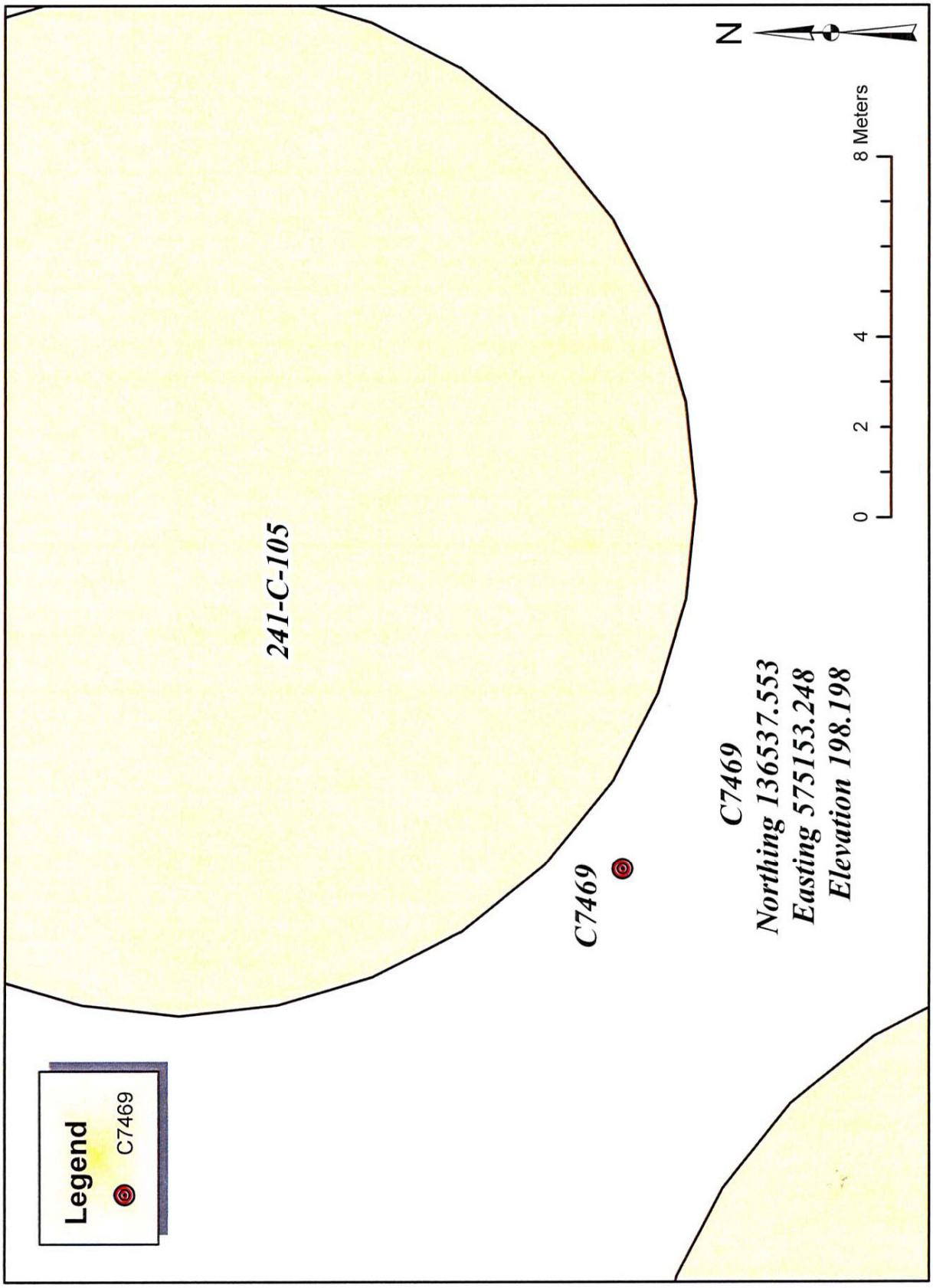
Legend
C7469
241-C-105
C7469
C7469
Northing 136537.553
Easting 575153.248
Elevation 198.198
N
0
2
4
8 Meters

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APPENDIX C

DRILLING AND SAMPLING DAILY WORK RECORDS

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ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS Page 1 of 2

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: START DRILLING BOREHOLE #C7469 FOR LOGGING ACTIVITIES | DATE: 9/25/09

LOCATION: Hanford Site, C Tank Farm | EXCAVATION: U-DIG #: 9214982 DAN-3809 | REPORT #: 1

START CARD NO. SE05352 | DECOMMISSION NO. AE06953 | RWP: AHA - 09-005-REV.0 CO-460-REV.6

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 # C7469 Tubing (2½") @ G.S. to 36.1' ft bgs; S.U. 2.2'

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

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

GEOPHYSICAL LOGGING

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

TIME	WORK SUMMARY
0600	SAFETY MEETING TOPIC: CUTTING ABOVE GROUND UTILITY LINES,
—	DON'T ASSUME THEY ARE DEAD
0625	TRAVEL TO C-FARM MO524
0705	PRE-JOB BY BILL CLARK (FWS), RWP BY PAUL TEMPLTON (RCT)
—	AHA BY ROB ZANE (SAFETY). NO PRE SURVEY ON RIG #1 PER (RCT)
0800	TRAVEL TO SMURF 2704 TO ACE-IN. OLIN AMOS DRD IS OFF-
—	-SCALE HE WILL NEED TO FILL OUT PAPERWORK & BACKTRACK PER
—	RAD-CON
0845	TRAVEL TO SX-FARM TO PICKUP TOOLING & SUPPORT EQUIPMENT.
0915	TRAVEL TO 2704 (SMURF) TO PICKUP OLIN AMOS AND THEN
—	TRAVEL TO C-FARM.
0930	READY RIG #1 & SUPPORT EQUIPMENT TO ENTER C-FARM
0945	DRESS OUT & ENTER C-FARM. SETUP SUPPORT EQUIPMENT.
—	AND RIG #1 ON BOREHOLE #C7469. CLEAN 2½" ROD THREADS
1100	START DRIVING 2½" ROD FROM G.S. TO 36.1' bgs (REFUSAL)
—	DIRECTION FROM H. SYDNOR IS TO STOP AND PREFORM
—	GEOPHYSICAL LOGGING ON C7469.
1210	EXIT FARM FOR LUNCH
1245	DRESS AND ENTER FARM. TO MOVE RIG #1 OFF OF C7469.
—	C7469 TAGGED @ 36' bgs. WHILE REMOVING TAG TAPE RCT
—	FOUND CONTAMINATION 750,000 DPM BETA/GAMMA ON TAG TAPE.
—	10,000 DPM BETA/GAMMA ON JAW TABLE OF RIG. ALPHA - LESS
—	THAN DETECTABLE. NOTIFIED K. REYNOLDS, BILL CLARK NOTIFIED
—	H. SYDNOR & OPS, RAD-CON

OPERATOR/LICENSE: OLIN AMOS #1224
ES SUPPORT: AMOS, WEAKLEY, EHRBOTT
NCO: SNOOK, VILLAREAL
HPT: TEMPLTON, BARNARD
FWS: CLARK

WEATHER: 90 F SUNNY
DOWNTIME: 1 HR

DISCARDED ITEMS:
2-PAIR LEATHER GLOVES
1-COMPLETE TAG TAPE

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 PHASE 2 TANK 241-C-105

REPORT BY: MIKE EHRBOTT
TITLE: ES TECHNICAL PREPARER
SIGNATURE: Mike Ehrbott

REVIEWED BY: D.E. Skoglie
TITLE: ES TECHNICAL REVIEWER
SIGNATURE: David E. Skoglie DATE: 09/24/09

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DAILY WORK RECORD – CONTINUATION PAGE

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Date	Boring #	Continuation of Report No.
9/23/09	C7469	1

TIME	DESCRIPTION OF OPERATIONS/REMARKS
1347	SECURE SITE, SLEEVING WAS PLACED OVER 2 1/2" ROD
—	STICKUP AND TAPED OFF, EXIT FARM.
1425	LEAVING SITE FOR ES. OFFICE.
1530	END OF SHIFT

N/A

Report By	MIKE EHRGOTT	Reviewed By	D.E. Skoglie		
Title	ES Technical Preparer	Title	ES Technical reviewer	Date	09/24/09
Signature	Mike Ehrgott	Signature	David E. Skoglie		

ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: C7469 GEOPHYSICAL LOGGING DATE: 9/24/09

LOCATION: Hanford Site, C Tank Farm EXCAVATION: U-DIG #: 9214982 DAN-3609 REPORT #: 2

START CARD NO. SED5352 DECOMMISSION NO. AE06953 RWP: 20-460-REV.6 AHA 09-005-REV.0

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 # C7469 Tubing (2½") @ — to 36.1' ft bgs; S.U. 2.2'

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

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

GEOPHYSICAL LOGGING

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

TIME	WORK SUMMARY
0600	SAFETY MEETING TOPIC: SYNTHETIC SLING SOFTNERS
—	REF: IB-09-056
0635	TRAVEL TO C-FARM MO 524
0710	ARRIVED ON SITE
0730	RANDY PRICE ON SITE
0745	BILL CLARK AND HAROLD SYDNOR ON SITE
—	RAD-CON WORKING ON ISR
0830	RANDY PRICE OFF SITE.
0900	ON STANDBY WAITING FOR INVESTIGATIVE SURVEY REPORT (ISR)
—	FROM RAD-CON.
1100	ATTEND PRE-JOB at SMURF RAD-CON OFFICE
—	PRE-JOB WAS FOR RCT'S NCO'S IH
1200	RCT'S, NCO'S, IH ENTER C-FARM TO TAKE TECH SMEAR
—	AND AIR SAMPLES AND REMOVE TAG TAPE FROM C7469 RISER.
1200	E.S. CREW TAKING LUNCH.
1230	E.S. CREW ON STANDBY
1345	RCT'S NCO'S IH EXIT FARM.
—	RCT'S TAKING TECH SMEARS & AIR SAMPLES TO BE COUNTED.
1430	LEAVING SITE FOR OFFICE.
1530	END OF SHIFT
	N/A

OPERATOR/LICENSE: AMOS #1224
ES SUPPORT: AMOS, WEAKLEY, EHRGOTT
NCO: SNOOK, VILLAREAL
HPT: TEMPLTON, BARNARD
FWS: CLARK

WEATHER: 89°F SUNNY

DOWNTIME: 9 HR

DISCARDED ITEMS: NONE

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 PHASE 2 TANK 241-C-105

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

REVIEWED BY: D.E. Skoglie
TITLE: ES TECHNICAL REVIEWER
SIGNATURE: David E. Skoglie DATE: 09/25/09

ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: CONDUCT ALARA MEETING AND PLAN TO PROCEED | **DATE:** 09/25/09

LOCATION: Hanford Site, C Tank Farm | **EXCAVATION:** DAN-3809 **U-DIG #:** 9214982 | **REPORT #:** 3

START CARD NO. SE05352 | **DECOMMISSION NO.** AE06953 | **RWP:** CO-460 **AHA**-09-005 Rev 0

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 # _____ *Tubing (* n/a *)* @ *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.
2. n/a
3.

TIME	WORK SUMMARY
0600	Personnel conduct daily safety meeting.
07:30	Personnel evaluate process to recover.
09:00	Conduct support as needed to initiate work.
10:00	An ALARA meeting was conducted for the 241-C-105 Phase 2 project at the SMURF building. The Investigative Survey Report (ISR) was discussed. The RWP had been exceeded, therefore a radiological event occurred and work stopped. After decon the tip of the tag tape read 400 – 450 k dpm. The work package was defined med risk after air samples and tech smears were analyzed. A plan to proceed was initiated. The work package/RWP will be changed prior to in-hole work. Further evaluation of the foot-clamp will be conducted and if needed decontamination/removal will be performed. The plan to proceed will be written. A sequential list of upcoming tasks are as follows: 1) No swab will be sent down-hole; 2) The drive point will not be removed; 3) The boring will be geophysically logged (the tooling and cable be will sleeved (inverted for cable) and cable cut off and discarded at end of logging); 4) bentonite will be placed (~1 gallon) inside the tubing (before/after measurement will tell us if bentonite dropped out of the tubing); 5) 3 sections of tubing will be back-pulled unless radiological contamination is encountered (sleeving will be utilized on tubing removed from this boring); 6) tubing will be pushed back to bottom and tubing unscrewed; 7) The boring will be filled with bentonite to the point where the tubing unscrewed (personnel will be on mask for this task); and 8) the remaining tubing will be back-pulled as bentonite is added to complete the decommissioning process. Other items of interest when conducting high energy work are: 1) sleeving will be used on tag weight/line; 2) Survey every couple feet; and 3) utilize a solid tip if possible. Lunch conducted from 12:00 - 12:30
14:00	
14:30	Travel to office and complete documentation.
	N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Weakly
NCO: Snook, Villareal
HPT: Barnard
FWS: Clark

WEATHER: 87 F clear

DOWNTIME: n/a

DISCARDED ITEMS: n/a

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: D. E. Skoglie
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE: Daniel E. Skoglie

REVIEWED BY: Kent Reynolds
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: [signature] **DATE:** 9/28/09

ENERGYSOLUTIONS

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Planning for PNG to log boring #C7469		**DATE: 09/28/09**
LOCATION: Hanford Site, C Tank Farm	**EXCAVATION:** DAN-3809 **U-DIG #:** 9214982	**REPORT #: 4**
START CARD NO. SE05352	**DECOMMISSION NO.** AE06953	**RWP:** CO-460 **AHA**-09-005 Rev 0

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 # _____ *Tubing (* *) @* N/A *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. N/A
2.
3.

TIME	WORK SUMMARY
0530	Safety meeting was conducted at office. Topic: Working with rad. contaminated materials.
0640	Traveled to "C" Tank Farm.
0710	Pre-job at "C" Tank Farm for ESFS personnel.
0750	Standby for HPT's and Operators.
0830	Operators onsite. Standby for HPT's.
0855	HPT's onsite. WRPS conducted pre-job for HPT's and Operators.
0925	Dressed and entered "C" Tank Farm. Case HHU #1 was moved off of boring #C7469 to facilitate logging by PNG. HPT's and Operators completed decon. of table and jaws on Case HHU #1. Plastic and felt were removed from under rig and replaced with new. Secured site and exited site.
1020	Standby for new RWP for PNG to begin logging.
1100	Lunch
1130	Standby for new RWP for PNG to begin logging. R. Price of PNG onsite at 1232 Hrs. to discuss sleeving of logging tools.
1410	R. Price offsite.
1415	Traveled to office. Completed documentation and timecard.
1500	End of shift.
	N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Walkup, Ehrgott
NCO: Snook, Villareal
HPT: Templeton, Barnard
FWS: Clark

WEATHER: 79 F, winds 5-15 mph

DOWNTIME: Operators—40 minutes, HPT's--- 1 Hr. and 5 minutes,---RWP 4 Hrs. and 40 minutes.

DISCARDED ITEMS: N/A

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: M. W. Walkup
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE: Mike Walkup

REVIEWED BY: D.E. Skoglie
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: David E. Skoglie **DATE:** 09/29/09

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ENERGY SOLUTIONS, WESTERN OPERATIONS Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Standby for RWP and Bio-Assays | **DATE:** 09/29/09

LOCATION: Hanford Site, C Tank Farm | **EXCAVATION:** DAN-3809 **U-DIG #:** 9214982 | **REPORT #:** 5

START CARD NO. SE05352 | **DECOMMISSION NO.** AE06953 | **RWP:** CO-460 **AHA**-09-005 Rev 0

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 # _____ *Tubing (* N/A *)@* *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. N/A
2.
3.

TIME	WORK SUMMARY
0530	SAFETY MEETING AT OFFICE. TOPIC: SWINE FLU.
0650	TRAVEL TO "C" FARM.
0725	STANDBY FOR RWP AND BIO-ASSAY. TRAVELED TO E.W.D. STARTED
—	DEMOB. OF HHU.XL #3 AND SUPPORT EQUIPMENT FROM SAMPLING
—	MOCK-UP SITE TO LAYDOWN YARD.
1100	LUNCH
1130	STANDBY FOR RWP AND BIO-ASSAY. COMPLETED DEMOB. OF EQUIPMENT.
1300	WASHED PICK-UP, PICKED UP BIO-ASSAY BOTTLES
1400	TRAVELED TO OFFICE. COMPLETED DOCUMENTATION AND TIMECARD.
1500	END OF SHIFT.

N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Walkup, Ehrgott
NCO: Snook, Villareal
HPT: Templeton, Barnard
FWS: Clark

WEATHER: 67 F, winds 5-15 mph

DOWNTIME: a. HRS. - RWP

DISCARDED ITEMS: N/A

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: MIKE WALKUP
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE: [signature]

REVIEWED BY: D.E. Skoglie
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: David E. Skoglie **DATE:** 093009

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ENERGY SOLUTIONS, WESTERN OPERATIONS

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Move Case HHU#1 to upper farm and standby for RWP and work package. **DATE:** 09/30/09

LOCATION: Hanford Site, C Tank Farm | **EXCAVATION:** DAN-3809 **U-DIG #:** 9214982 | **REPORT #:** 6

START CARD NO. SE05352 | **DECOMMISSION NO.** AE06953 | **RWP:** CO-460 **AHA**-09-005 Rev 0

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

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

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

N/A

GEOPHYSICAL LOGGING

Boring # *Interval* *Type*

1. N/A
2.
3.

TIME	WORK SUMMARY
0530	SAFETY MEETING AT OFFICE. TALK: LOADING HHU LOADS.
0645	TRAVEL TO SMART AND ACE UNDER RWP CO-001
0740	TRAVEL TO "C" FARM.
0750	STANDBY FOR RWP, WORK PACKAGE AND BIO-ASSAY.
1100	LUNCH.
1130	STANDBY FOR RWP, WORK PACKAGE AND BIO-ASSAY.
1335	TRAVELED TO OFFICE. COMPLETED DOCUMENTATION AND TIMECARD.
1500	END OF SHIFT.

N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Walkup, Ehrgott, WERNEY
NCO: Snook, Villareal
HPT: Templeton, Barnard
FWS: Clark

WEATHER: 65 F, winds 10-15 mph and it is cooling off.

DOWNTIME: 9 HRS. - RWP, PACKAGE

DISCARDED ITEMS: N/A

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: MIKEY WERNEY
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE: [signature]

REVIEWED BY: D.E. Skoglie
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: David E. Skoglie **DATE:** 10/01/09

ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Standby for RWP, work package and bio-assay | **DATE:** 10/01/09

LOCATION: Hanford Site, C Tank Farm | **EXCAVATION:** DAN-3809 **U-DIG #:** 9214982 | **REPORT #:** 7

START CARD NO. SE05352 | **DECOMMISSION NO.** AE06953 | **RWP:** CO-460 **AHA**-09-005 Rev 0

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

N/A

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
0530	Safety meeting at office. Topic: Distracted driving---Texting and talking on the cell phone while driving. DON'T DO IT!
0650	Standby for RWP, work package and bio-assay.
1130	Lunch Ribs and pea salad.....Yummy!
1200	Standby for RWP, work package and bio-assay. Completed paperwork and timecard at office.
1500	End of shift.

N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Walkup, Ehrgott, Weakley
NCO: Snook, Villareal
HPT: Templeton, Barnard
FWS: Clark

WEATHER: 67 F, winds 5-10 mph

DOWNTIME: 9 Hrs.-RWP, work package and bio-assay.

DISCARDED ITEMS: N/A

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: Mike Walkup
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE: Mike Walkup

REVIEWED BY: D.E. Skoglie
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: David E Skoglie **DATE:** 10/01/09

ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Standby for contract for PNG to log #C7469		**DATE:** 10/05/09
LOCATION: Hanford Site, C Tank Farm	**EXCAVATION:** DAN-3809 **U-DIG #:** 9214982	**REPORT #:** 8
START CARD NO. SE05352	**DECOMMISSION NO.** AE06953	**RWP:** CO-460 AHA-09-005 Rev 0
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 # _____ *Tubing (* *)* *@* *to* *ft bgs; S.U.* ____

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

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

N/A

GEOPHYSICAL LOGGING

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

TIME	WORK SUMMARY
0530	Safety meeting at office. Topic: Driving in adverse weather conditions. Wind and blowing dust.
0650	Travel to ENW and load two generators for power in "C" Farm.
0745	Travel to "C" Farm and unload generators. SEE NOTE: 1
0830	Travel to ENW and take cargo van to "C" Farm.
1000	Standby for contract for PNG to begin logging #C7469.
1100	Lunch.
1130	Standby for contract for PNG to begin logging #C7469. Travel to office, complete documentation and timecard.
1500	End of shift.
	NOTE 1: Power was shut off @ C Tank Farm and support trailer. This will last about a week. Generators were hauled/set-up to support work.

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Walkup, Ehrgott,* *NCO: Snook, Villareal* *HPT: Templeton, Barnard* *FWS: Clark*	**WEATHER:** 61 F, winds 10-15 mph **DOWNTIME:** 9 Hrs.-Contract for PNG to log #C7469	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: Mike C. Walkup	**REVIEWED BY:** D.E. Skoglie
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: [signature]	**SIGNATURE:** David E. Skoglie **DATE:** 10/06/09

ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Log #C7469 and begin decommissioning. **DATE:** 10/06/09

LOCATION: Hanford Site, C Tank Farm **EXCAVATION:** DAN-3809 **U-DIG #:** 9214982 **REPORT #:** 9

START CARD NO. SE05352 **DECOMMISSION NO.** AE06953 **RWP:** ~~CO-460~~ CO-541 AHA-09-005 Rev ~~0~~ 1

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

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

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

N/A

GEOPHYSICAL LOGGING

Boring #	*Interval*	*Type*
1. C7469	GS-355'	GM
2.		
3.		

TIME	WORK SUMMARY
0530	Safety meeting at office. Topic: Fall prevention and protection.
0640	Travel to "C" Farm.
0710	Standby for pre-job for logging and decommissioning boring #C7469.
0800	PRE-JOB AT "C" FARM. SEE ATTACHED ROSTER.
0840	TRAVEL TO SINGLE TO ACE UNDER CO-541 AND PICK-UP MASKS.
0950	PNG, HPT'S AND OPERATORS DRESS AND ENTER FARM. BORING #C7469
—	AND SURROUNDING AREA ARE PREPARED FOR LOGGING.
1052	PNG LOGGING #C7469 FROM G.S. TO 355' BGS. SECURED SITE AND EXITED
—	FARM.
1200	LUNCH.
1300	STANDBY FOR LOGGING RESULTS. TRAVEL TO OFFICE. COMPLETED
—	DOCUMENTATION AND TIMECARD.
1500	END OF SHIFT.

N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Walkup, Ehrgott,
NCO: Snook, Villareal
HPT: Templeton, Barnard
FWS: Clark

WEATHER: 68 F, winds 5-10 mph

DOWNTIME: N/A

DISCARDED ITEMS: NONE

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: MICHAEL WALKUP
TITLE: *ES TECHNICAL PREPARER*
SIGNATURE: Michael Walkup

REVIEWED BY: D.E. Skoglie
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: Dan E. Skoglie **DATE:** 10/06/09

WRPS
ATTENDANCE ROSTER

Subject: 241-C Vadose Direct Push

Date: 10-6-09

Leader: W Clark / Tom Graff

NAME (Print)	Signature	Position/Title	Organization
W Clark			
Ron Irwin		HPT	WRPS
L A Barnard		HPT	WRPS
S J Eberlein		manager	WRPS
Scott Snook		NCO	WRPS
J A. Clayton		HPT	WRPS
H Sydnor		Vadose	WRPS
J.I. Villarreal		NCO	WRPS
Shelley Huddleston		HPT	WRPS
L O Amos		~~ESFS~~ OP	ESFS
Rob Zane		H+S	ESFS
Randall Price		Logging	PNG / ESFS
Grant Randall		Logger	PNG
M. Warner		GIR	ESFS
Mike Ehrhardt		OP	ESFS
NL Templeton		HPT	WRPS
J Clark		FWS	WRPS

A-6002-893 (REV 2)

ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS Page 1 of 2

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Geophysical logging and Borehole Decommissioning **DATE:** 10/07/09

LOCATION: Hanford Site, C Tank Farm **EXCAVATION:** DAN-3809 **U-DIG #:** 9214982 **REPORT #:** 10

START CARD NO. SE05352 **DECOMMISSION NO.** AE06953 **RWP:** CO-541 **AHA-09-005 Rev** DES 1

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 # C7469 Tubing (2½) @ 36.' to 0 ft bgs; S.U. N/A

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

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

N/A

GEOPHYSICAL LOGGING

Boring #	Interval	Type
1. C7469	25-35.5	G
2.	N/A	
3.		

TIME	WORK SUMMARY
06:00	Conduct daily safety meeting. Discussed air sampler operation and
—	monitoring. Review training report and evaluate for due dates.
07:40	Travel to Smurf for Safety meeting (Pre-job).
8:10	Attend Pre-job for geophysical logging and bore-hole decommissioning.
—	Discussed actions per stepped approach and HHU release plan.
09:00	Per Health physics work was stepped (on-hold) for air monitor flow
—	rate vs calibration.
09:50	Personnel have dressed and enter C tank Farm. Down post ARA
—	and set-up air samplers. Don masks (NCO & HPT) and set-up bag &
—	sleeving, after posting as ARA. NOTE: 15 personnel onsite.
10:20	Set-up and conduct geophysical logging (bottom 10 ft). Pack 3
—	joints 2½ tubing from support zone to work location.
11:10	Logging is completed and surveyed out. Wind is starting to pick-up
—	(~ 5-8 mph).
11:15	Energy Solutions personnel Don masks. Place 3/4 sack bentonite granular.
—	Move the HHU and set-up on boring. Place sleeving over tubing.
11:35	The HHU head was screwed into tubing, 1st joint out and sleeved 11:45.
—	2nd joint out and sleeved 11:52. 3rd joint out and sleeved 11:55.
—	Tripped/push 2 joints (8 ft) Add 3rd joint and hammer to a
—	depth of 9 ft bgs. Add ½ sk bentonite to (6 ft tagged).
12:10	Place 1/4 sack bentonite to surface.
12:30	Clean and secure site. take air samples for counting.
12:40	Exit C tank Farm. Travel to AN to go through PCM.
—	NOTE: The HHU Case will be surveyed for release and mob out

OPERATOR/LICENSE: Olin Amos
ES SUPPORT: Walkup/Englott/Zane
NCO: Izzy/Snook/Rueban
HPT: Templeton/Clayton/Bill Bernard
FWS: Clark/Craft IH: Ron

WEATHER: 68 F wind 5-8 mph

DOWNTIME: N/A

DISCARDED ITEMS:
1- wire brush 1-2 bxb
1- tape measure 25' 1- tip holder
1- 2½ bit pulling head 1- knock out tip
12-2½ inch 4' tubing

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 PHASE 2 TANK 241-C-105

REPORT BY: D. E. Skoglie
TITLE: *ES TECHNICAL PREPARER*
SIGNATURE: David E. Skoglie

REVIEWED BY: Olin Amos
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: Olin Amos **DATE:** 10/08/09

10/06/09 Rev 1

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DAILY WORK RECORD – CONTINUATION PAGE

Page 2 of 2

Date	Boring #	Continuation of Report No.
10/07/09	C7469	10

TIME	WORK SUMMARY
–	of C tank farm.
1330	Discuss operations and complete documentation of todays events
14:10	Travel to office. PLAN for new day. 15:30

N/A

Report By	D.E. Skoglie	Reviewed By	LO AMOS		
Title	ES Technical Preparer	Title	ES Technical Reviewer	Date	10/08/09
Signature	David E. Skoglie	Signature	Zle O. Amos		100609 Rev 1

ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS

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DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Demobilize equipment from boring #C7469 | **DATE: 10/08/09**

LOCATION: Hanford Site. "C" Tank Farm | **EXCAVATION:** DAN-3809 **U-DIG #: 9214982** | **REPORT #: 11**

START CARD NO. SE05352 | **DECOMMISSION NO. AE06953** | **RWP: CO-541** **AHA-** 09-005 Rev.01

SAMPLING SUMMARY

Sample #'s *Interval* *%*

1.
2.
3.
4.

N/A

SITE/EQUIPMENT INSPECTION: *Yes* *No*

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

BOREHOLE SUMMARY

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

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

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

N/A

GEOPHYSICAL LOGGING

Boring # *Interval* *Type*

1.
2.
3.

N/A

TIME	WORK SUMMARY
0530	Safety meeting at office. Topic: Use of spotters in tank farms.
0650	Travel to "C" Tank Farm.
0710	Standby for operators to downpost ARA.
0750	Pre-job at "C" Tank Farm.
0800	Dress and enter "C" Tank Farm. Move Case HHU #1 and support equipment from boring #C7469 to staging area in farm. Secure and exit farm..
0900	Standby for review of release plan for Case HHU #1 from farm.
1100	Lunch.
1130	Standby for review of release plan for Case HHU #1 from farm. Travel to office. Complete documentation and timecard.
1500	End of shift.

N/A

OPERATOR/LICENSE: Amos/1224
ES SUPPORT: Walkup, Ehrgott
NCO: Snook, Villareal
HPT: Templeton
FWS: Clark

WEATHER: 66 F, winds 5-10 mph

DOWNTIME: 5 ½ Hrs.---Release plan. 40 minutes---Operators.

DISCARDED ITEMS:

N/A

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: M. W. Walkup
TITLE : *ES TECHNICAL PREPARER*
SIGNATURE: [signature]

REVIEWED BY: D.E. Skoglie
TITLE: *ES TECHNICAL REVIEWER*
SIGNATURE: David E. Skoglie **DATE:** 10/09/09

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ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS

Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Survey Case HHU #1 out of farm		**DATE:** 10/09/09
LOCATION: Hanford Site. "C" Tank Farm	**EXCAVATION:** DAN-3809 **U-DIG #:** 9214982	**REPORT #:** 12

START CARD NO. SE05352	**DECOMMISSION NO.** AE06953	**RWP:** CO-541	**AHA-** 09-005 Rev.01
SAMPLING SUMMARY	**SITE/EQUIPMENT INSPECTION:** (Yes) No	*HHU (CASE#1) HHU CAT #2 HHUXL#3*	

Sample #'s Interval %

1.
2.
3.
4.

N/A

BOREHOLE SUMMARY

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

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

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

N/A

GEOPHYSICAL LOGGING

Boring # *Interval* *Type*

1.
2.
3.

N/A

TIME	WORK SUMMARY
0530	Safety meeting at office. Topic: Review of two near misses onsite involving drilling operations.
0710	Travel to "C" Tank Farm.
0745	Standby for HPT's.
0900	Pre-job.
0915	HPT's dress and enter farm and completed preliminary survey of CASE HHU #1.
0930	ESFS personnel dress and enter farm. Move CASE HHU#1 to RBA for HPT's to complete tech. smears for release from farm.
0952	HPT's completing tech. smears on CASE HHU #1.
1050	CASE HHU #1 is free released from "C" Tank Farm.
1115	Mobilized CASE HHU #1 to wash pad.
1130	Traveled to office. Completed documentation and timecard.
1200	Lunch.
1230	Standby to demob. HHU units to ENW laydown yard.
1400	End of shift.

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Walkup, Ehrgott* *NCO: None* *HPT: Templeton, Clayton, Huddleston* *FWS: Clark*	**WEATHER:** 57 F, winds 10-15 mph **DOWNTIME:** 1 1/4 HRS - HPT'S. 1 1/2 HRS - DEMOB.	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: M. W. Walkup	**REVIEWED BY:** D.E. Skoglie
TITLE : *ES TECHNICAL PREPARER*	**TITLE:** *ES TECHNICAL REVIEWER*
SIGNATURE: [signature]	**SIGNATURE:** [signature] **DATE:** 10/12/09

10/06/09 Rev 1

ENERGYSOLUTIONS

ENERGY SOLUTIONS, WESTERN OPERATIONS

Page 1 of 1

DRILLING AND SAMPLING (PERCUSSION) DAILY WORK RECORD

PURPOSE: Pressure wash CASE HHU #1 at wash pad and begin demob. to ENW		**DATE:** 10/12/09
LOCATION: Hanford Site. "C" Tank Farm	**EXCAVATION:** DAN-3809 **U-DIG #:** 9214982	**REPORT #:** 13
START CARD NO. SE05352	**DECOMMISSION NO.** AE06953	**RWP:** CO-541 AHA- 09-005 Rev.01
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 # _____ *Tubing (* N/A *) @* *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. N/A
2.
3.

TIME	WORK SUMMARY
0530	**Safety meeting at office. Topic: Vehicle maintenance.**
0720	Travel to HERTZ equipment rental and obtain 14 yard dump truck for transporting HHU's to ENW.
0940	Travel to wash pad with rental truck.
1015	Obtain water and air compressor for pressure washing equipment.
1100	Pressure wash CASE HHU #1 and load for transport to ENW.
1230	Lunch
1300	Transport CASE HHU #1 to ENW and off load.
1410	Travel to office. Complete documentation and timecard.
1500	End of shift.

N/A

OPERATOR/LICENSE: Amos/1224 *ES SUPPORT: Walkup, Ehrgott* *NCO: Snook, Villareal* *HPT: Templeton* *FWS: Clark*	**WEATHER:** 51 F, cold. **DOWNTIME:** None	**DISCARDED ITEMS:** N/A

REFERENCE/CONTRACT INFORMATION: FSWO-DOW-029 Phase 2/36472 Task 8

REPORT BY: [illegible] **TITLE :** *ES TECHNICAL PREPARER* **SIGNATURE:** [illegible]	**REVIEWED BY:** D.E. Skoglie **TITLE:** *ES TECHNICAL REVIEWER* **SIGNATURE:** David E. Skoglie **DATE:** 10/13/09

10/06/09 Rev 1

ENERGYSOLUTIONS

FIELD CLEANING AND/OR DECONTAMINATION

Page 1 of 1

PROJECT: "C" TANK FARM TASK 5

LOCATION OF CLEANING/DECONTAMINATION: WRPS WASH PAD BEHIND SOURCE BUILDING.

THE FOLLOWING EQUIPMENT HAS BEEN CLEANED AND/OR DECONTAMINATED

LIST TYPE OF DETERGENT: ☐ Non-phosphate ☐ Other N/A

EQUIPMENT	ID NUMBER			
☒ CASE HHA	#1	CLEANING	☒ YES	☐ NO
☐ N/A		DECONTAMINATION	☐ YES	☒ NO
☐ N/A				
☐ N/A				

DOWNHOLE EQUIPMENT			SIZE	DATE
☐		Ea		
☐		Ea		
☐		Ea		
☐		Ea		
☐		Ea		
☐		Ea		
☐		Ea		
☐		Ea		
☐	N/A	Ea		
☐		Ea		
☐		Ea		

REMARKS/OBSERVATIONS:

[signature] 10-12-09

Person Conducting Cleaning and/or Decontamination — Date — Reviewed by — Date

100609 Rev. 0

TANK FARM CONTRACTOR RADIOLOGICAL SURVEY REPORT

RSR No. COO 005977

Page 1 of 74 pg 10/9/09

Date	10/9/09
Start/Stop Time	0800 / 1130
Area/Location	200 EAST 241-C
RWP/Rev.	CO-541.0

Purpose of Survey

- ☐ Material Release – Confidence Level
  - ☐ 67% ☐ 95%
- ☐ RAM Shipment:
- ☐ Required Task:
- ☐ Job Coverage:
- ☒ Other: Survey plan 2009-CO-001 REV 2

Description of Work/Comments:

Survey Case backhoe (Rig #1) Serial # JJG0272270
Procedure # 2009-CO-001 Rev 2
80 Technical smears Taken on listed Areas and other misc.
Surfaces. Large Area wipes Taken on All Accessible Surfaces
NO Contamination Detected.

No.	Description	Dose Rate Measurements: Note[1] F = Field (≥30 cm) C = Contact (≤1 cm)								Contamination Measurements: Direct Gross cpm/PA		Background cpm		Total dpm/100 cm²		Removable dpm/100 cm²	
		Dist. (cm) Note[1]	WO mR/hr	WC mR/hr	CF β	CF γ	Neutron Dose mrem/hr	Shallow Dose mrem/hr	Deep Dose mrem/hr	βγ	α	βγ	α	βγ	α	βγ	α
1	Engine fan	N/A							N/A	100	Ø	100	Ø	<5k	<100	<1k	<20
2	Radiator									100	Ø	100	Ø	<5k	<100	<1k	<20
3	Air filter									100	Ø	100	Ø	<5k	<100	<1k	<20
4	Cab floor									100	Ø	100	Ø	<5k	<100	<1k	<20
5	Seats									100	Ø	100	Ø	<5k	<100	<1k	<20
6	levers & Controls									100	Ø	100	Ø	<5k	<100	<1k	<20
7	Hyd. level pads									100	Ø	100	Ø	<5k	<100	<1k	<20
8	oil filter									100	Ø	100	Ø	<5k	<100	<1k	<20
9	Hyd. pump fan									100	Ø	100	Ø	<5k	<100	<1k	<20
10	Hyd. fill points									100	Ø	100	Ø	<5k	<100	<1k	<20
11	fluid fill Caps									100	Ø	100	Ø	<5k	<100	<1k	<20
12	Vehicle underCar									100	Ø	100	Ø	<5k	<100	<1k	<20
13	Steering wheel									100	Ø	100	Ø	<5k	<100	<1k	<20
14	Tires/wheel wells	N/A							N/A	100	Ø	100	Ø	<5k	<100	<1k	<20

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BD-6003-343 (REV 3)

TANK FARM CONTRACTOR RADIOLOGICAL SURVEY REPORT	RSR No. C00 005977	Page 2 of 4

Map/Sketch

N/A

COPY

Legend:	# Direct Measurement	Air Sample	Smear	LAW	Neutron	Field Dose Rate * Contact Dose Rate	Note: Dose Rates in mrem/hr unless otherwise noted.
	-------- (designation inside) -------- Radiological Area Boundary						

Instruments

Instrument/Probe Model	RO-20	GM Model g-m Probe	PAM Probe	gm / probe				
Serial No.	N/A	CMEB63-0243	ACHN2-0331	CMEB3-0085	N/A			
		DTHNC-1083	DTHN3-0468	DTE09-0529				
Efficiency (used)	N/A	.10	.17	.10				

	Air Sample Log Number		Smear Log Number
1	N/A	☐ Breathing Zone ☐ General Area	→
2	N/A	☐ Breathing Zone ☐ General Area	→

HPT: Date: 10/9/09 Payroll No: 81060

Name (Print): PC TEMPLETON

Signature:

Initial Review Date & Initials: 10.12.09

Final Review Date & Payroll No.: 10.12.09 8687

Name (Print): CINDY PAMENTER

Signature:

BD-60[illegible]3 (REV 3)

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APPENDIX D

SMALL DIAMETER GEOPHYSICAL LOGGING FOR C TANK FARM LEAK ASSESSMENT OF TANK 241-C-105

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SMALL DIAMETER GEOPHYSICAL LOGGING FOR C TANK FARM LEAK ASSESMENT OF TANK 241-C-105

by

Russel Randall, PhD and Randall Price

to

EnergySolutions Federal Services, Inc.
2345 Stevens Drive
Richland, Washington 99354

November 2009

Pacific Northwest Geophysics
4200 West 19th Avenue
Kennewick, Washington 99338

Three Rivers Scientific
3740 Grant Court
West Richland, Washington 99353

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TERMS

GM	Geiger Mueller
KUT	potassium, uranium and thorium
NaI	sodium-iodide
PNG	Pacific Northwest Geophysics

SMALL DIAMETER GEOPHYSICAL LOGGING
FOR C TANK FARM LEAK ASSESMENT OF TANK 241-C-105

1.0 PROBEHOLE SURVEYS

Pacific Northwest Geophysics (PNG) and Three Rivers Scientific provided small diameter logging in a probehole installed near the cascade overflow pipe line of single-shell tank 241-C-105, in C Tank Farm.

Logging surveys were conducted with the sodium-iodide (NaI) scintillation gross gamma detector and the moderate sensitivity Geiger Mueller (GM) gross gamma detector. The logs were collected according to approved procedures (PNG 2009). Detector calibration certificates for the NaI and Green-GM detectors are presented in Section 2.0, "Gamma Detector Calibrations."

Nonstandard logging conditions were provided because radioactive contamination was encountered inside the probehole. The survey was acquired (as requested) from the top of the probehole (ground surface) down to the bottom. Logging was halted before the probe touched the bottom of the casing, which was at 11 m (36 ft). The probehole was surveyed twice. The first survey was conducted with the Green GM detector positioned above the NaI detector. The second survey was conducted with the Green GM detector positioned at the bottom of the tool string, so that the gamma activity at the bottom of the probehole could be measured.

Due to concerns about contamination control, the log repeat measurement could only be acquired at the beginning of the survey. The computed results of the main and repeat intervals were reviewed and the results agree within the uncertainty of the measurement counting statistics. The repeat log data are presented with the main log plot.

The gross gamma survey data were deadtime corrected and the results were converted to the eCs-137 calibration units. Zero depth reference is at the ground surface. The survey results for the probehole are presented as a depth-versus-concentration plot.

The survey results for the NaI detector are shown as an orange solid line (_____) and the results for the Green GM detector are shown as a green dotted line (.....). The plot scale for eCs-137 is logarithmic from 10 to 100,000,000 pCi/g (i.e., 10^1 to 10^8 or seven orders of magnitude).

The radiation levels within subsurface exceeded the NaI detection range of 68,000 pCi/g (eCs-137) at 7.16 m (23.5 ft) below ground surface. The radiation levels in the probehole continued to increase toward the bottom of the probehole, and activity exceeded the Green GM detection range of 43,000,000 pCi/g of eCs-137 at 10.7 m (35 ft) below ground surface. The deadtime limit for measuring gamma radiation activity is 80% for both the NaI and Green GM detectors.

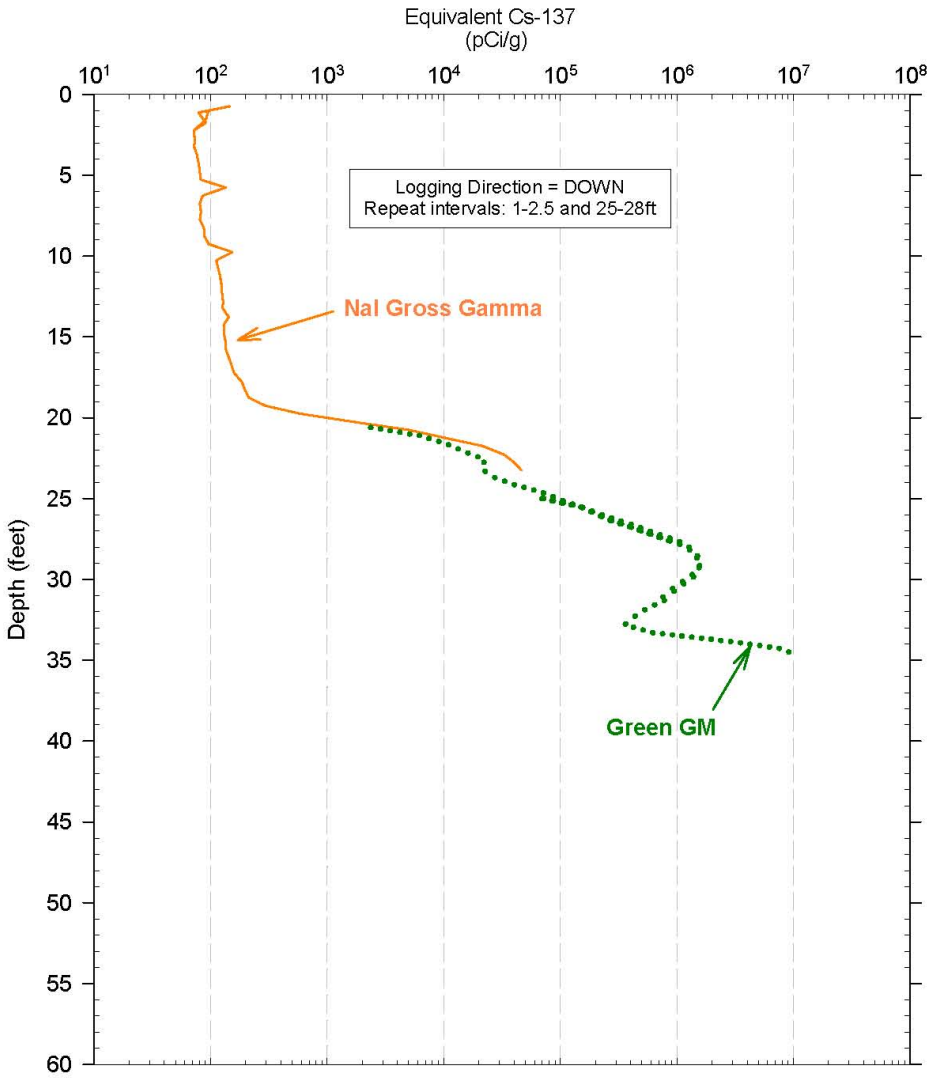
The log survey results for probehole C7469 are shown in the following plot.

Small Diameter - Gamma Survey

Energy Solutions & Pacific Northwest Geophysics

Project: C Tank Farm Push
Probehole: C7469

Log Date: October 2009
Depth Ref: Ground Level



2.0 GAMMA DETECTOR CALIBRATIONS

The gross gamma detectors were calibrated for both eRa-226 and eCs-137. In the geophysical logging industry, eRa-226 is a measurement standard used in gross gamma detectors to establish the activity levels of the naturally occurring radionuclides (potassium, uranium and thorium [KUT]). The calibration for eCs-137 assumes that all of the gammas are due to the presence of Cs-137. The gamma activity encountered in this probehole exceeded the levels of the naturally occurring radionuclides; consequently, the plot shows only eCs-137.

The calibration for the NaI detector is discussed first, followed by the Green GM calibration.

The gross gamma scintillation detector uses a NaI crystal. The NaI crystal (2.54 cm [1 in.] long) is hydroscopic and is enclosed in a hermetically sealed can (2.54 cm [1 in.] diameter) to maintain its integrity.

The NaI gamma surveys were logged at 0.30 m (2 ft) per minute. A spectrum of 256 channels was collected each 0.15 m (0.5 ft) from the top of the probehole to the bottom. Detector count rates were deadtime corrected and the gamma survey data was processed as gross gamma response to determine the concentration of eRa-226 in pCi/g.

The deadtime correction is a nonparalysable relationship (Knoll 1979) and is described by the following equation:

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

where C_t is the true or deadtime corrected count rate in c/s, C_{obs} is the observed count rate in c/s, and ε is the deadtime factor of 8.92 μs. The deadtime factor was determined when the detector was calibrated for eCs-137 in the Hanford vadose well 299-W10-72.

The NaI gross gamma detector was also calibrated for eCs-137 (pCi/g). Calibration for eCs-137 was performed in Hanford vadose well 299-W10-72 (Cs-137 calibration standard). The Cs-137 in the well is stable, except for the 30 year half-life decay of the radioisotope. Also, distribution of Cs-137 ranges from less than 1 pCi/g to 40,000 pCi/g along the well path (depth). The concentrations of Cs-137 were established by two high-purity germanium detectors (70% and high rate tools, operated by Stoller Corporation). Casing in the well is 0.732 cm (0.288 in.) thick. In order to duplicate the 0.97 cm (0.38-in.) casing of the small diameter probeholes, a section of steel tubing 0.241 cm (0.095 in.) thick was installed over the detector for calibration. The conversion factor from detector count rate (counts per second) to eCs-137 is 0.384 pCi/g per counts per second for casing thickness of 0.97 cm (0.38 in.) See Figure 1 for the NaI calibration certificate.

The Green GM detector has lower sensitivity than the NaI detector and is designed to measure high gamma ray flux. The Green GM detector count rates were deadtime corrected (as described above for the NaI detector).and the gamma survey data was processed to determine the concentration of eCs-137 in pCi/g. The deadtime factor for the Green GM detector is 160 μs. The Green GM calibration certificate is shown in Figure 2.

Figure 1. NaI Calibration Certificate.

Certificate of Calibration
SD.NaI.1
March 17, 2009

Data were taken at the Hanford KUT models on March 17, 2009. SD.NaI.1 is the designated Scintillator tool. Two models were used for the gross gamma calibration (SBU and SBL). 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: StatisticsNaI.xls for this analysis.

The instrument was covered with 0.97 cm (0.38-in.) wall-thickness probe tubing.

The coefficient analysis is determined by the algorithm described in WHC-SD-EN-TI-293, *Procedures for Calibrating Scintillation Gamma-Ray Well Logging Tools Using Hanford Formation Models*, Rev. 0 (Randall and Stromswold 1995). The gross gamma calibration for equivalent Ra-226 in pCi/g is a regression function and is generally defined by:

$$Ra = a*GR + b$$

where Ra is the eRa-226 in pCi/g, and GR is the observed gross gamma count rate (c/s), deadtime 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:

$$a = .1078 \quad Eq.^{226}Ra\ pCi/g\ /\ (c/s)$$
$$b \equiv 0$$

The calibration for eCs-137 in pCi/g for the SD.NaI.1 instrument is described in RPP-RPT-27605, *Gamma Surveys of Single Shell Tank Laterals for A and SX Tank Farm* (Randall and Price 2006). The gross gamma calibration for equivalent Cs-137 in pCi/g is a regression function and is generally defined by:

$$Cs = \alpha*GR$$

where Cs is the eCs-137 in pCi/g, and GR is the observed gross gamma count rate (c/s), deadtime corrected. The coefficient α is the fit coefficient.

There is a ratio of eRa-226 calibration coefficient to the eCs-137 calibration coefficient for each instrument. The ratio between the two coefficients in Randall and Price 2006 is 2.27. Thus a factor of 2.27 times the eRa-226 calibration will yield the eCs-137 calibration coefficient. Thus: α=0.245 eCs-137 (pCi/g)/(c/s)

Digital files condensed as Cal_SDGR-NaI_2009-v0.zip. This compressed file contains:

- Calibration raw data
- Spreadsheet data formatting

The undersigned certifies that the data archived in Cal_SDGR-NaI_2009-v0.zip were collected and evaluated in accordance with WHC-SD-EN-TI-293 (Randall and Stromswold 1995) and that the above-stated calibration coefficients are correct and applicable for the tool SD.NaI.1 effective March 21, 2009.

Signature:	Date:
/s/ Russel Randall, PhD	March 25, 2009
Three Rivers Scientific	

Figure 2. Green GM Calibration Certificate.

Certificate of Calibration
SD.Green.GM
March 17, 2009

Data were taken at the Hanford KUT models on March 17, 2009. SD.Green.GM is the designated Green GM tool. One model was used for the gross gamma calibration (SBH). Ten spectra were recorded in order to perform statistical analysis. The observed deviations were seen to be near the theoretically predicted variation, refer to the files compressed: "StatisticsGGM.xls" for this analysis.

The instrument was covered with 0.38 inch wall-thickness probe-tubing.

The coefficient analysis is determined by the algorithm described in WHC-SD-EN-TI-293, *Procedures for Calibrating Scintillation Gamma-Ray Well Logging Tools Using Hanford Formation Models*, Rev. 0 (Randall and Stromswold 1995). The gross gamma calibration for equivalent Ra-226 in pCi/g is a regression function and is generally defined by:

$$Ra = a*GR + b$$

where Ra is the eRa-226 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:

$$a = 363.9 \quad Eq.^{226}Ra\ pCi/g\ /\ (c/s)$$
$$b \equiv 0$$

The calibration for eCs-137 in pCi/g for the SD.Green.GM instrument is described in RPP-RPT-27605, *Gamma Surveys of Single Shell Tank Laterals for A and SX Tank Farm* (Randall and Price 2006). The gross gamma calibration for equivalent Cs-137 in pCi/g is a regression function and is generally defined by:

$$Cs = \alpha*GR$$

where Cs is the eCs-137 in pCi/g, and GR is the observed gross gamma count rate (c/s), dead time corrected. The coefficient α is the fit coefficient.

There is a ratio of eRa-226 calibration coefficient to the eCs-137 calibration coefficient for each instrument. The ratio between the two coefficients is 4.81 (*Small Diameter Geophysical Logging In the 241-U Tank Farm,* Randall and Price 2008). Thus a factor of 4.81 times the eRa-226 calibration will yield the eCs-137 calibration coefficient and α=1746 eCs-137 (pCi/g)/(c/s)

Digital files condensed as Cal_SDGR-GrGM_2009-v0.zip. This compressed file contains:

- Calibration raw data
- Spreadsheet data formatting

The undersigned certifies that the data archived in the file "Cal_SDGR-GrGM_2009-v0.zip" were collected and evaluated in accordance with WHC-SD-EN-TI-293 (Randall and Stromswold 1995), and that the above-stated calibration coefficients are correct and applicable for the tool SD.Green.GM effective March 17, 2009.

Signature:	Date:
/s/ Russel Randall, PhD	March 25, 2009
Three Rivers Scientific	

3.0 REFERENCES

Knoll, G., 1979, *Radiation Detection and Measurement*, John Wiley & Sons, Inc., New York, New York.

PNG, 2009, *Procedures: Calibration, Logging, Quality Assurance and Data Management*, Pacific Northwest Geophysics, Kennewick, Washington.

Randall, R. and D. Stromswold, 1995, *Procedures for Calibrating Scintillation Gamma-Ray Well Logging Tools Using Hanford Formation Models*, WHC-SD-EN-TI-293, Rev. 0, Westinghouse Hanford Company, Richland, Washington.

Randall, R. and R. Price, 2006, *Gamma Surveys of Single-Shell Tank Laterals for A and SX Tank Farm,* RPP-RPT-27605, Rev. 0, Pacific Northwest Geophysics, Kennewick, Washington.

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APPENDIX E

WASHINGTON STATE DEPARTMENT OF ECOLOGY DOCUMENTS

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ENERGYSOLUTIONS

October 12, 2009 MGG-09-5282

State of Washington
Department of Ecology
Nuclear Waste Program
Hanford Project
3100 Port of Benton Boulevard
Richland, Washington 99354

Subject: Water Well Report

To Whom It May Concern,

Attached is a Water Well Report form addressing decommissioning operations for one geotechnical boring. This Water Well Report form has been completed with information from field operations (reference Notice of Intent Start Card SE05352 and Abandonment Start Card AE06953). This geotechnical boring is located on the Hanford Site, 200 East Area, C Tank Farm and is designated as C7469 (Hanford Site well number system).

The fractional section system topographical location for these geotechnical borings is SW ¼ NE ¼, Section 2, Township 12N, Range 26EWM

If you have any questions, please contact me at 375-9587.

Very truly yours,

Martin G. Gardner, Manager
Remediation and Well Services

jmr

Attachments

WRPS	- H. A. Sydnor	S7-66
CHPRC	- S. H. Worley	R3-60
Energy*Solutions*	- K. D. Reynolds	G2-02
	D. E. Skoglie	G2-02
	R. Z. Steffler	G2-02
	MGG File/LB	

2345 Stevens Drive, Suite 240 • Richland, WA 99354
509.371.8006 • Fax: 509.375.9500 • www.energysolutions.com

ENERGYSOLUTIONS

MGG-09-5282

ATTACHMENT

Water Well Report

Consisting of 2 pages
including cover sheet

WATER WELL REPORT

Original & 1st copy – Ecology, 2nd copy – owner, 3rd copy – driller

ECOLOGY

Construction/Decommission *("x" in circle)*

☐ Construction

☒ Decommission *ORIGINAL INSTALLATION*

Notice of Intent Number AE06953

PROPOSED USE: ☐ Domestic ☐ Industrial ☐ Municipal ☐ DeWater ☐ Irrigation ☐ Test Well ☒ Other Geotech

TYPE OF WORK: Owner's number of well (if more than one) C7469

☐ New well ☐ Reconditioned *Method*: ☐ Dug ☐ Bored ☒ Driven ☐ Deepened ☐ Cable ☐ Rotary ☐ Jetted

DIMENSIONS: Diameter of well 3.0 inches, drilled 36.1 ft. Depth of completed well N/A ft.

CONSTRUCTION DETAILS

Casing Installed: ☐ Welded ____" Diam. from ____ ft. to ____ ft.
☐ Liner installed ____" Diam. from ____ ft. to ____ ft
☒ Threaded 2.5" Diam. From 0 ft. to 36.1 ft.

Perforations: ☐ Yes ☒ No

Type of perforator used ____

SIZE of perfs ____ in. by ____ in. and no. of perfs ____ from ____ ft. to ____ ft.

Screens: ☐ Yes ☒ No ☐ K-Pac Location ____

Manufacturer's Name ____

Type ____ Model No. ____

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Diam. ____ Slot size ____ from ____ ft. to ____ ft.

Gravel/Filter packed: ☐ Yes ☒ No Size of gravel/sand ____

Materials placed from ____ ft. to ____ ft.

Surface Seal: ☐ Yes ☒ No To what depth? ____ ft.

Material used in seal ____

Did any strata contain unusable water? ☐ Yes ☐ No

Type of water? ____ Depth of strata ____

Method of sealing strata off ____

~~**PUMP:** Manufacturer's Name ____~~

~~Type: ____ H.P. ____~~

WATER LEVELS: ~~Land-surface elevation above mean sea level ____ ft.~~

Static level ____ ft. below top of well N/A Date ____

Artesian pressure ____ lbs. per square inch Date ____

Artesian water is controlled by ____ (cap, valve, etc.)

WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☐ Yes ☒ No If yes, by whom? ____

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Yield: ____ gal./min. with ____ ft. drawdown after ____ hrs.

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test Bailer test ____ gal./min. with ____ ft. drawdown after ____ hrs.

Airtest gal./min. with stem set at ____ ft. for ____ hrs.

Artesian flow ____ g.p.m. Date ____

Temperature of water ____ Was a chemical analysis made? ☐ Yes ☐ No

CURRENT

Notice of Intent No. SE05352

Unique Ecology Well ID Tag No. N/A

Water Right Permit No. N/A

Property Owner Name U.S. Department of Energy

Well Street Address 825 Jadwin Ave.

City Richland County Benton

Location SW 1/4-1/4 NE 1/4 Sec 2 Twn 12N R 26

EWM ☒ Or WWM ☐

Lat/Long (s, t, r Still REQUIRED) Lat Deg ____ Min ____ Sec ____ Long Deg ____ Min ____ Sec ____

CONSTRUCTION OR DECOMMISSION PROCEDURE

Formation: Describe by color, character, size of material and structure, and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of information. (USE ADDITIONAL SHEETS IF NECESSARY.)

MATERIAL	FROM	TO
Casing was drove utilizing a	0	36.1
hydraulic hammer unit mounted		
on a backhoe.		
Borehole was drove vertical.		
Geophysical logging (Gamma)		
was conducted		
Bentonite (granular) was	36.1	0.0
placed to ~3 ft bgs. Tubing		
was back-pulled 12 ft,		
sleeved and discarded.		
Three sections of tubing were		
added and the tubing pushed		
into the granular bentonite.		
Granular bentonite was added		
and three sections of tubing		
removed. The bore-hole was		
topped off with bentonite.		
Top of tubing is ~9 ft bgs.		
Used 1 1/2 sacks bentonite.		
Reference: Variance for		
Direct Push Borings, dated		
03/11/09.		
NOTE 1: This boring is C7469		
located on the Hanford Site,		
(C Tank Farm).		

Start Date 09/23/09 Completed Date 10/07/09

Tax Parcel No. N/A

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☐ Driller ☒ Engineer ☐ Trainee Driller or trainee License No. 1580

Name (Print Last, First) Skoglie . David

Driller/Engineer/Trainee Signature

IF TRAINEE: Driller's License No:

Driller's Signature: David E. Skoglie

Drilling Company Energy Solutions

Address 2345 Stevens Dr.

City, State, Zip Richland , Washington, 99353

Contractor's Registration No. DURATFS990K5 Date 10/09/09

ECY 050-1-20 (Rev 3/05)

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