



March 28, 2013

VIA EMAIL and FEDERAL EXPRESS

Charles Maguire, Director
Radioactive Materials Division
Texas Commission on Environmental Quality
P.O. Box 13087, Mail Code – 233
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References: (1) Radioactive Material License No. R04100, Amendment 18, CN600616890, RN101702439
(2) Radioactive Material License No. R05807, Amendment 05, CN600616890, RN101702439

Subject: Semi-Annual/Annual Radiological Environmental Monitoring Plan Report for January to December of 2012

Dear Mr. Maguire:

Waste Control Specialists LLC (WCS) is submitting the attached Radiological Environmental Monitoring Plan (REMP) Report in accordance with the following License Conditions:

Radioactive Material License (RML) No. R04100, License Condition (LC) 158.H.9 (Reference 1):

158.H.9 The Licensee shall provide a semi-annual environmental monitoring report to the executive director to be submitted before March 31 and September 30 of the preceding six (6) months. The semi-annual report shall include the results of all environmental media samples for all facilities at the Waste Control Specialists LLC, Andrews County, site.

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RML No. R05807, LC 77 (Reference 2):

77. The Licensee shall submit to the Executive Director each year, no later than September 30 for the period of January 1 through June 30 and March 31 for the period of July 1 through December 31, a report specifying the quantity of each principle radionuclide released to unrestricted areas in liquid and in gaseous effluents (including particulates) during the specified semi-annual period of operations.

RML No. R05807, LC 92.C (Reference 2):

92.C. Evaluation of Data. The Licensee shall evaluate monitoring data using a two-tiered environmental monitoring response system (i.e., investigation and action levels) as described in Volume 4, Appendix 4.B, Procedure BP-EV-1.1.0, Section VIII of the Licensee's application. The results of the evaluation must be included in the annual environmental monitoring report to the Executive Director. Annual environmental monitoring reports shall be submitted to the Executive Director no later than April 1 of the year following the monitoring period.

The attached CD contains all the pertinent appendices as per the following list and submitted in electronic format only:

- Appendix A. Comparison Values
- Appendix B. Summary of 2012 Fauna Data
- Appendix C. Summary of 2012 Soil Data
- Appendix D. Summary of 2012 Sediment Data
- Appendix E. Summary of 2012 Vegetation Data
- Appendix F. Summary of 2012 Air, Gasses, and Vapor Data
- Appendix G. Summary of 2012 Groundwater Data
- Appendix H. Summary of 2012 Leachate and Leak Detection Data
- Appendix I. Summary of 2012 Septic Data
- Appendix J. Summary of 2012 CWF Pond Data
- Appendix K. Summary of 2012 Pre-Discharge Sump Data

Mr. Charles Maguire
March 28, 2013
Page 3 of 3

WCS requests that a copy of all correspondence regarding this matter be directly emailed (skirk@valhi.net) to my attention as soon as possible after issuance. If you have any questions or need additional information, please call me at 432-525-8500.

Sincerely,

A handwritten signature in blue ink that reads "J. Scott Kirk". The signature is written in a cursive, flowing style.

J. Scott Kirk, CHP
Vice President, Licensing, Corporate Compliance and Radiation Safety Officer

Enclosure

Cc: Michael S. Aplin, TCEQ
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**Low-Level Radioactive Waste Facility
All Facilities
Semi-Annual/Annual Radiological Environmental
Monitoring Report**

January 1 –December 31, 2012

Andrews County, Texas Site

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Appendix I. Summary of 2012 Septic Data
Appendix J. Summary of 2012 CWF Pond Data
Appendix K. Summary of 2012 Pre-Discharge Sump Data

Waste Control Specialists LLC
Annual/ Semi-Annual Radiological Environmental Monitoring Program Report
For January 1 – December 31, 2012

Executive Summary

Purpose

This report summarizes the radiological and non-radiological results for environmental and effluent monitoring samples collected in and around the Waste Control Specialists LLC (WCS) site in Andrews, County, Texas, for the period of January 1 through December 31, 2012. These data are collected under the Radiological Environmental Monitoring Program (REMP) documents and in accordance with groundwater and effluent monitoring programs of the following permits, licenses, or authorizations:

- Radioactive Material License (RML) No. R04971, Amendment 52, for the radioactive waste processing and storage facility;
- RML No. R05807, Amendment 5, for the Byproduct Material Disposal Facility;
- RML No. R04100, Amendment 18, for the low-level radioactive waste disposal facility, including the Federal Facility Waste Disposal Facility (FWF) and the Compact Waste Disposal Facility (CWF);
- Hazardous waste permit No. 50358 for the Resource Conservation and Recovery Act (RCRA) treatment, storage and disposal facility (TSDF), including the East + West Landfill;
- Hazardous waste permit No. 50397 for the FWF;
- The Toxic Substances Control Act (TSCA) authorization for the site, including the radioactive waste processing and storage facility, the RCRA TSDF, and the FWF; and
- The outfalls and evaporation ponds associated with Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0004857000, TPDES Permit No. WQ0004038000, and Texas Land Application Permit (TLAP) No. WQ0004948000.

All of these authorizations have been issued by the Texas Commission on Environmental Quality (TCEQ), with the exception of the TSCA authorization that has been issued by the U.S. Environmental Protection Agency (EPA).

The results collected under these monitoring programs are used to demonstrate compliance with the radiation protection and environmental standards specified in Title 30 of the Texas Administrative Code (30 TAC), Chapter 336, §336.313, *Dose Limits for Individual Members of the Public* and §336.1133, *Maximum Values for Use in Groundwater Protection*. This report enables a comprehensive annual/semi-annual review and evaluation of potential migration of radiological and non-radiological contaminants from the WCS site.

This report is also intended to fulfill the requirements in License Condition (LC) 158.H.9) of RML No. R04100 (Amendment 18), LC 158.G of RML No. R04100 (Amendment 18), LC 77 of RML No. R05807 (Amendment 5) and LC 92A of RML No. R05807 (Amendment 5). LC 158.H.9) of RML No. R04100 states, "The Licensee shall provide a semi-annual environmental monitoring report to the executive director to be submitted before March 31 and September 30 of the preceding six (6) months. The semi-annual report shall include the results of all environmental media samples for all facilities at the WCS, Andrews County site." LC 158.G of RML No. R04100 states, "The Licensee must evaluate monitoring data using a two (2)-tiered environmental monitoring response system. Investigation levels and action levels will be specified as described in the license application. The results of the evaluations must be included in the annual environmental monitoring report to the executive director conducted during each calendar year." LC 77 of RML No. R05807 requires WCS to "submit to the Executive Director each year, no later than September 30 for the period of January 1 through June 30 and March 31 for the period of July 1 through December 31, a

report specifying the quantity of each principle radionuclide released to unrestricted areas in liquid and in gaseous effluents (including particulates) during the specified semi-annual period of operations.” LC 92.A of RML No. R05807 requires that annual environmental monitoring reports shall be submitted to the Executive Director no later than April 1 of the year following the monitoring period.

Summary of the Environmental and Effluent Monitoring Programs

WCS conducts the environmental and effluent monitoring programs to provide indicators of potential impact to human health and the environment and to demonstrate compliance with applicable regulatory limits. Under these programs, WCS monitors air, aquatic eco-receptors, groundwater, precipitation, surface water, wastewater, soil, sediment, soil moisture, vegetation, and fauna. WCS also operates a meteorological monitoring program that supports several of the environmental monitoring requirements. Environmental media and effluent samples were routinely collected for the reporting period of January 1 through December 31, 2012 in and around the WCS site, and over 90,000 results were collected and analyzed for substances including metals, volatile organic chemicals (VOCs), semi-volatile organic chemicals (SVOCs), radionuclides, pesticides, polychlorinated biphenyls (PCBs) and water quality indicators.

In summary, none of the results in any of the media or effluent tested is indicative of an unauthorized waste or effluent release. With the exception ambient gamma results near radiological operations, all are consistent with natural conditions at WCS. The elevated ambient gamma radiation readings were from Stations 22 (near the LSA pad) and Stations 65, 56, 55, 54 and 52 (located near CWF operations). The elevated readings at these locations are near radiological operations and are in controlled areas. These are temporary and expected conditions that do not suggest that a release occurred.

The air radiological monitoring results for the reporting period of January 1 through December 31, 2012 were consistent with those of previous years. All air results were below the established Investigation Limits (ILs) and Action Limits (ALs). Those ILs and ALs have been previously provided to the TCEQ in REMP documents associated with RML Nos. R04971, R05807, and R04100.

Groundwater monitoring results for the reporting period of January 1 through December 31, 2012 were consistent with those of previous years. Groundwater was sampled from 120 wells and both radiological and non-radiological analyses were performed when water sufficient for all analyses was present. These results show no significant differences from background. Groundwater results exceeded the established Byproduct IL for radium-228 at wells MW-11Ar, MW-11B and TP-19, and a groundwater result exceeded the established Byproduct IL for radium-226 at well 5EA. These results were reported to the TCEQ within four hours of confirmation in accordance with LC 92.K of RML No. R05807. These results were not indicative of a release, but are instead attributable to spatial variability of naturally occurring radionuclides in groundwater at the site. All groundwater results were below the established ALs.

Liquids that may collect in the Leachate Collection System (LCS) and Leak Detection System (LDS) of the byproduct material landfill are pumped into tanks for consolidation and storage prior to pre-release verification sampling and analysis. Pursuant to RML No. R05807, LC 37.B, Table 37.B, liquid samples are also collected directly from the LCS and LDS sumps and analyzed on a monthly basis. The analytical results were compared with the discharge limit for gross alpha and the reporting limit for beta/gamma emitters (15 pCi/L and 50 pCi/L) respectively, under TPDES Permit No. WQ0004857000. All results were below these limits.

Samples of leachate from the East + West Landfill are also collected under HW-50358. Those data are reported separately to the TCEQ Industrial and Hazardous Waste Division on an annual basis and are not repeated in this report, but are incorporated herein by reference.

Permit-required sampling of wastewater and storm water was conducted for both radiological and non-radiological constituents. Sampling at the WCS Andrews County site was conducted at outfalls and evaporation ponds in accordance with TPDES Permit No. WQ0004857000, TPDES Permit No. WQ0004038000 and TLAP No. WQ0004948000. Results of permit-required sampling are reported in monthly effluent reports submitted to the TCEQ and are not repeated in this document, but are incorporated herein by reference.

Sanitary wastewater generated at the WCS site is collected in above ground tanks and transported to a Publicly Owned Treatment Works (POTW) in Andrews, Texas. All septic results for the reporting period for carbon-14 and tritium were below the Minimum Detectable Concentration (MDC). All calculated results were below the release limits and total quantities in 30 TAC §336.215, *Disposal by Release into Sanitary Sewerage*, allowing release to the POTW in Andrews, Texas. The releases to the Andrews Texas POTW were below regulatory limits for the state of Texas; each radionuclide was below the monthly discharge concentration level, and the total discharge to the POTW was less than 1% of the 1 curie annual limit.

Soil and sediment samples were collected during this reporting period. Although these results do not show any significant differences from historical soil and sediment data, some of the sediment data for naturally occurring radionuclides exceeds currently applicable comparison values. These exceedances are common and are not the result of a release; rather, they are due to ILs and ALs that are inappropriately low when compared against natural conditions. The exceedances consist of the following.

- Sediment samples at GW-2 were reported with concentrations for radium-226, radium-228, thorium-230 and thorium-232 greater than the respective Byproduct ILs for these radionuclides. The concentrations did not exceed the Byproduct ALs for these isotopes. These exceedances were reported to the TCEQ within four hours of confirmation as required by LC 92.K of R05807. None of these concentrations exceeded the more recently proposed ADLs in the Part-B Data Quality Objective (DQO-B) report¹.
- Soil samples at Station 6 and Station 22 were reported with concentrations for thorium-230 greater than the respective Byproduct IL for thorium-230. The concentrations did not exceed the Byproduct ALs for these isotopes. These exceedances were reported to the TCEQ within four hours of confirmation as required by LC 92.K of R05807.

Precipitation, aquatic-eco receptors, soil moisture and surface water samples were not collected during this reporting period due to the unavailability of samples for collection.

WCS calculated an estimate of dose to a general member of the public by adding the doses from the maximum airborne dose from CAP88 to the results from the highest TLD station accessible to a “member of the public.” . The sum of these doses after background correction is 5.70E+00 mrem/year. This dose is well below the annual regulatory limit of 100 mrem.

¹ *Environmental Surveillance Data Quality Objectives Part B – Results of Statistical Analyses, Revision 2*, dated October 14, 2011, and revised DQO-B summary tables that were provided with a May 15, 2012 letter from Scott Kirk (WCS) to Lorraine Council (TCEQ) entitled, *Environmental Monitoring Information in response to Amendment 13 of Radioactive Material License No. R04100*.

1 Introduction

Waste Control Specialists LLC (WCS) is a Texas-based waste management firm that operates state-of-the-art facilities in Andrews County, Texas. The WCS site is licensed by the Texas Commission on Environmental Quality (TCEQ) for the treatment and storage of radioactive waste and for the disposal of byproduct material, low-level radioactive waste (LLRW), and mixed waste². The site is authorized for land disposal of a large array of radioactive materials under the regulation of the TCEQ. The site can dispose of Class A, B and C low-level radioactive waste. WCS is also authorized for treatment, storage and disposal of hazardous and non-hazardous industrial wastes and polychlorinated biphenyls (PCBs).

1.1 Location

The WCS facility is located on Texas Highway 176 adjacent to the Texas-New Mexico border, approximately 30 miles west of Andrews, Texas (see Figure 1), and about 70 miles east of the DOE Waste Isolation Pilot Plant (WIPP) site which is near Carlsbad, New Mexico.

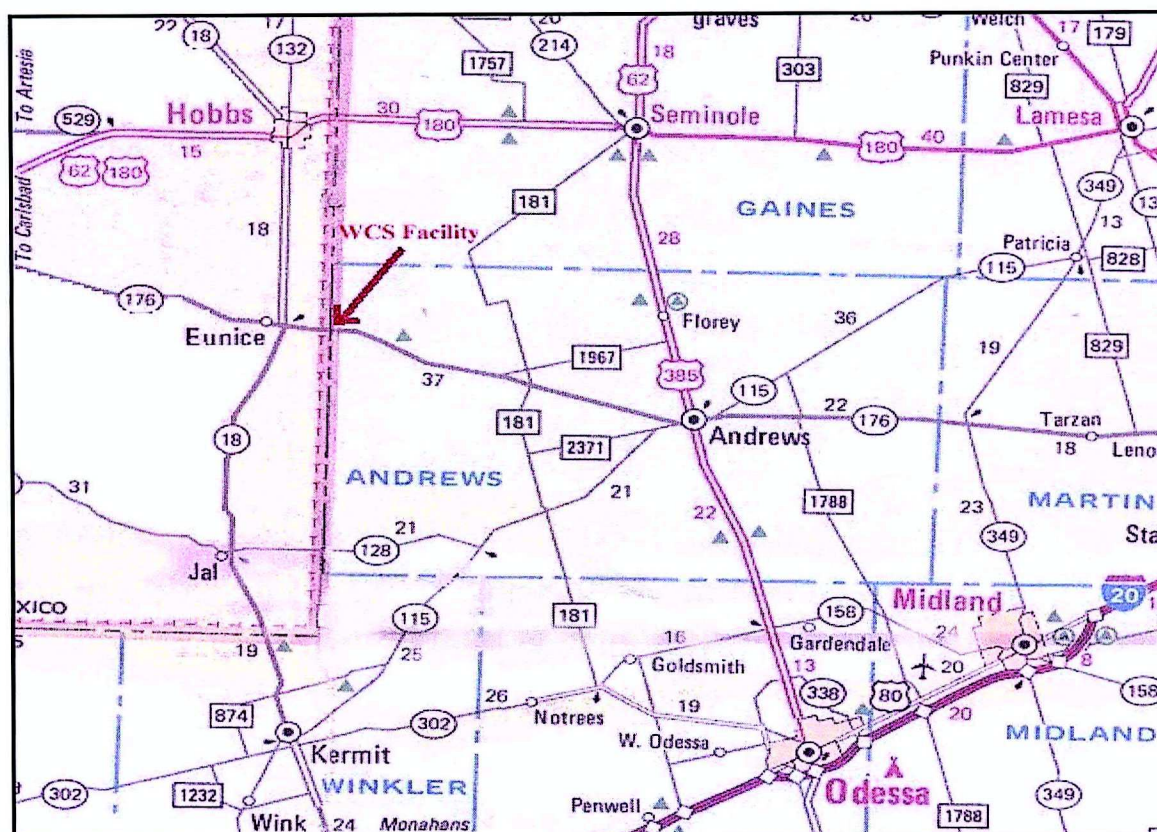


Figure 1 : Location of WCS Facility

The licensed and permitted facilities are situated on approximately 1,338 acres of land on the north side of Highway 176 that is surrounded by another approximately 14,900 acres controlled by WCS. The area is very sparsely populated. The closest community is Eunice, New Mexico, 5 miles to the west of the facility, and the nearest residence is over 3 miles from the facility. The WCS facility shares a fence line that is one half mile west of the Texas border with the URENCO uranium enrichment facility (formerly Louisiana Energy

² Mixed waste is a mixture of LLRW and hazardous waste.

Services National Enrichment Facility). A municipal landfill occupies land to the south of Highway 176 in New Mexico.

1.2 Overview of Geology

The Andrews County setting is arid, receiving about 16 inches of rainfall annually on the average with an evaporation potential exceeding 63 inches annually. Temperatures are characterized as hot in the summer and relatively mild to cool in the winter. The annual mean temperature is 63°F. The prevailing wind direction is from the south and southeast with occasional shifts to the southwest during the winter months.

The facility is situated near the southwestern edge of the Southern High Plains, a stable geomorphic and relatively featureless landscape with very subtle topographic relief. There are no perennial surface waters³, prominent natural drainage features, major aquifers, wetlands, or food crops within 3 miles of the facility.

The facility sits on a thick (about 800 to 1,000 feet) layer of impermeable red-bed clay (Triassic Dockum group) that comes to within about 20 feet of the surface in the vicinity of the land disposal units. All waste that is authorized for disposal is placed in disposal cells with engineered liner systems that include leachate and leak detection systems. The bottom of these cells extends well into the natural clay formation. The first usable groundwater below the clay layer is not used at or near the site, and there is no evidence that any migration of waterborne materials near the site has ever reached this groundwater.

1.3 Overview of Processes, Permits, and Licenses

WCS is authorized, licensed, or permitted to treat, store, and/or dispose of waste containing PCBs, hazardous and non-hazardous waste, LLRW, mixed waste, exempt radioactive waste, and byproduct material under the following permits, licenses, or authorizations:

- Radioactive Material License (RML) No. R04971, Amendment 52, for the radioactive waste processing and storage facility;
- RML No. R05807, Amendment 5, for the Byproduct Material Disposal Facility;
- RML No. R04100, Amendment 18, for the LLRW disposal facility, which includes the Federal Facility Waste Disposal Facility (FWF) and the Compact Waste Disposal Facility (CWF);
- Hazardous waste permit No. 50358 (hereinafter, HW-50358) for the Resource Conservation and Recovery Act (RCRA) treatment, storage and disposal facility (TSDF), including the East and West Landfill;
- Hazardous waste permit No. 50397 (hereinafter, HW-50397) for the FWF;
- The Toxic Substances Control Act (TSCA) authorization for the site (U.S. Environmental Protection Agency (EPA) I.D. No. TX988088464), including the radioactive waste processing and storage facility, the RCRA TSDF, and the FWF; and
- The outfalls and evaporation ponds associated with Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0004857000, TPDES Permit No. WQ0004038000, and Texas Land Application Permit (TLAP) No. WQ0004948000.

All of these authorizations have been issued by the Texas Commission on Environmental Quality (TCEQ), with the exception of the TSCA authorization that has been issued by the EPA.

³ LC 161 of RML No. R04100, Amendment 18 states that Baker Spring must be recognized as a perennial water body; however, this man-made feature does not contain sufficient surface water for routine monitoring on a consistent, year-round basis. No surface water samples could be collected during the routine quarterly monitoring events during the report period.

The radioactive waste processing and storage facility and the RCRA TSDF are integrated facilities, with most of the storage and treatment units being authorized under RML No. R04971 and HW-50358, as well as the TSCA authorization. The RCRA TSDF/radioactive waste processing and storage facility, the Byproduct Material Disposal Facility, the FWF, and the CWF are adjacent to each other, but are separate facilities segregated by fencing.

1.3.1 Waste Receipt and Testing Facilities

WCS receives each specific type of waste at the site in accordance with the governing license(s), permit(s) and/or authorization(s). There is rail access directly to the site, with railcar unloading capabilities for bulk and containerized waste shipments, as well as easy truck access to the site from nearby major interstate highways. WCS has on-site analytical facilities for performing various chemical and radiological testing to confirm the identity of incoming waste shipments and control/verify treatment processes. Separate areas for receiving and testing incoming wastes are maintained within the RCRA TSDF/radioactive waste processing and storage facility and at the LLRW disposal facility. A separate receiving area within the Byproduct Material Disposal Facility has been designated for a later developmental stage.

1.3.2 Waste Treatment/Processing and Storage

As noted above, the radioactive waste processing and storage facility and the RCRA TSDF are integrated facilities with shared storage and treatment units authorized under RML No. R04971, HW-50358, and the TSCA authorization. There are no storage or processing units authorized by RML No. R05807 for the Byproduct Material Disposal Facility other than the tanks for storage of contact water removed from the landfill. At the LLRW facility, staging buildings are primarily used for receipt and transfer of incoming waste shipments to the landfills, although capacity is also provided in these buildings for limited storage (greater than 24 hours) of wastes requiring intrusive sampling as part of the incoming waste verification process. There are no processing units at the LLRW facility, although the routine method of waste disposal constitutes “macroencapsulation” for hazardous debris and certain batteries under the RCRA regulations.

RML No. R04971 allows WCS to possess a broad range of radionuclides in various forms; authorized wastes include LLRW and mixed waste, including greater than Class C waste, transuranic waste (TRU), and sealed sources. The current storage capabilities include a container storage building (CSB) and two storage areas known as bin storage units (BSU-1 and BSU-2) that can accommodate larger containers, such as rolloff bins and tanker trucks. A portion of BSU-1 is enclosed within a building; the remainder of BSU-1 and BSU-2 are open storage areas. These units are also authorized by HW-50358 for storage of hazardous and non-hazardous industrial waste, including virtually all types of hazardous and non-hazardous industrial wastes, including most hazardous wastes identified and listed in 40 Code of Federal Regulations (CFR) Part 261. The CSB and the enclosed portion of BSU-1 are also authorized under TSCA for storage of wastes containing PCBs. Another open storage area known as the Low Specific Activity (LSA) Pad is authorized by RML No. R04971; this unit is not authorized for storage of industrial wastes or wastes containing PCBs.

Processing capabilities authorized by RML No. R04971, HW-50358, and the TSCA authorization are housed within the Mixed Waste Treatment Facility/Stabilization Building (MWTF/Stab Building). This building contains two separate and distinct treatment areas isolated from one another by a fire wall and separate ventilation systems. The portion of the building comprising the Stab Building is used for treatment of a variety of bulk and containerized RCRA/TSCA wastes to render them physically and chemically stable in accordance with the Land Disposal Restrictions (LDRs) of RCRA. The MWTF is dedicated to the treatment of LLRW and mixed waste, including wastes containing regulated levels of PCBs, in bulk and containerized form. Treatment processes authorized within the MWTF include physical and chemical stabilization, waste sizing (shredding and compacting), consolidation, and repackaging. Limited storage capacity is also provided in the MWTF/Stab Building.

1.3.3 Waste Disposal

The East + West Landfill was the first disposal unit constructed at the WCS site. The landfill is authorized by HW-50358 for disposal of virtually all types of hazardous and non-hazardous industrial wastes, including most hazardous wastes identified and listed in 40 CFR Part 261, that have been treated as necessary to comply with the RCRA LDRs. Wastes that are not authorized for receipt include: (1) explosive material, as defined by the Department of Transportation under 49 CFR Part 173; (2) compressed gases except aerosol cans; and (3) putrescible wastes as defined in Title 30 of the Texas Administrative Code (30 TAC) §330.2(108) [unless specific prior authorization is obtained from TCEQ]. In addition, WCS does not currently accept special waste from health care-related facilities as defined in 30 TAC §335.2(138), hereinafter referred to as "regulated medical waste".

WCS can dispose of low activity radioactive materials in the East + West Landfill that are classified as exempt⁴ from licensing under Texas regulations. These materials include: (1) source material from licensed or unlicensed facilities in any physical or chemical form in which the uranium and thorium content is < 0.05% by weight; (2) rare earth metals, compounds, mixtures, or products containing less than 0.25% by weight Thorium (Th) or Uranium (U); (3) any finished product or part containing metal thorium alloys with Th < 4% by weight; (4) depleted U in counterweights removed from aircraft, rockets, projectiles, missiles, or previously used as a shielding material; and (5) Naturally Occurring Radioactive Materials (NORM) containing technologically enhanced Radium-226 (²²⁶Ra) or Radium-228(²²⁸Ra) at less than 30 pCi/g, or any other NORM radionuclide less than 150 pCi/g.

RML No. R05807 allows WCS to handle and dispose of containerized byproduct material; currently, authorized wastes are limited to the stabilized residues from Fernald Silos 1 and 2 that are contained in custom steel canisters. The Fernald canisters were emplaced within the byproduct material landfill in October and November of 2009. No other byproduct materials have been placed in the byproduct material landfill either before or after the placement of the Fernald Silo canisters. No waste management operations were conducted at the Byproduct Material Disposal Facility during this reporting period.

WCS has recently completed construction of the initial portion of the LLRW authorized by RML No. R04100, including the CWF and the FWF. The CWF can accept LLRW commercially-generated in the Texas Compact party states of Texas and Vermont. WCS can also accept LLRW that has been commercially-generated in other states for disposal at the CWF if pre-approved to do so by the Texas Low Level Radioactive Waste Compact Commission. The FWF can accept LLRW and mixed waste generated at federal facilities. No waste management operations were conducted at the CWF until April 27, 2012, and no waste management operations have been conducted at the FWF to date.

1.3.4 Stormwater/Wastewater Management

At the RCRA TSDF/radioactive waste processing and storage facility, stormwater and wastewater is managed in accordance with TPDES Permit No. WQ0004038000 and RML No. R04971. Stormwater potentially contacting waste (contact water) in the active area of the landfill (the area without final or interim cover) is segregated from stormwater falling outside the active area (non-contact water). Stormwater falling within uncovered containment areas is normally non-contact water since containers must be maintained in good condition and kept closed except when necessary to inspect and/or sample the waste or to add or remove materials. However, if a spill or similar release of waste materials were to occur during or prior to a rainfall event, and the spill had not yet been fully cleaned up, the resultant stormwater would be considered contact

⁴ Materials are classified as "exempt" due to their relative low radioactivity levels; control for purposes of protecting the public health and safety is not considered necessary.

water. Contact water, leachate, and fluids from the leak detection system for the East + West landfill are routed to the Leachate Treatment Unit (LTU) for treatment and discharge through internal outfall 101 in accordance with TPDES Permit No. WQ0004038000. Treated wastewater would eventually reach outfall 001 if the quantity were sufficient. Uncontaminated stormwater is routed through drainage features and, when the quantity is sufficient, drains to the permitted outfalls 001, 002, and/or 003.

Each of the open container storage areas at the RCRA TSDF/radioactive waste processing and storage facility is designed with a catch basin to capture the first flush of rainfall runoff. Stormwater runoff collected in the catch basins is sampled and analyzed in accordance with RML No. R04971.

Stormwater and wastewater at the Byproduct Material Disposal Facility is managed in accordance with TPDES Permit No. WQ0004857000 and RML No. R05807. Contact water from the active area of the landfill is segregated from non-contact stormwater. Stormwater falling within the containment area for the contact water tanks is non-contact water unless contact water has been released into the containment and not yet fully cleaned up. In this unlikely scenario, the resultant stormwater would be considered contact water. Contact water, leachate, and fluids from the leak detection system for the byproduct material landfill are routed to the contact water tanks located to the north of the landfill. The water is typically held pending receipt of acceptable analytical results from a pre-discharge sample. Contact water is discharged through internal outfall 103 in accordance with TPDES Permit No. WQ0004857000. Uncontaminated stormwater is routed through drainage features that flow to the permitted outfalls 004 and 005. Contact water that discharges through internal outfall 103 will flow through external outfall 005.

At the LLRW disposal facility, stormwater and wastewater are managed in accordance with TLAP No. WQ0004948000 and RML No. R04100. Stormwater and wastewater generated at the CWF are segregated from stormwater and wastewater generated at the FWF, and landfill contact water and other wastewater generated at each facility are segregated from non-contact stormwater generated at that facility. Sources of wastewater at each facility include contact water from the landfills as well as other wastewaters that have the potential to have contacted waste (laboratory wastewater, decontamination water, and post-emergency wastewater from the laboratory shower water tank). All stormwater and wastewater generated at the LLRW disposal facility is disposed by evaporation in lined evaporation ponds, and/or, if necessary, by disposal off-site.

Non-contact stormwater runoff from the FWF and CWF is routed to the appropriate sedimentation pond dedicated to the facility from which the stormwater was generated. Collected stormwater from both of the sedimentation ponds is routed to a single evaporation pond located within the 1,338-acre facilities area, south of the active waste management operations.

All wastewater from each facility that is presumed or has the potential to have contacted waste is routed to the on-site waste water treatment plant (WWTP) located within each facility for treatment. Contact water, leachate, and fluids from the leak detection system for the FWF landfill are collected directly in two of the three FWF contact water tanks designated for untreated wastewater (the FWF pre-treatment contact water tanks). Wastewater from the Laboratory FWF Holding Tank and the FWF Decontamination Building Holding Tank is transferred to the FWF pre-treatment contact water tanks. Similarly, contact water and leachate from the CWF landfill⁵ are collected directly in the CWF contact water tank designated for untreated wastewater (the CWF pre-treatment contact water tank). Wastewater from the Laboratory CWF Holding Tank and the CWF Decontamination Building Holding Tank is transferred to the CWF pre-treatment contact water tank.

⁵ Leak detection systems for the CWF consist of below-liner, remote sensing systems that do not produce liquids.

Wastewater is accumulated in a pre-treatment contact water tank at each facility until the quantity is sufficient for treatment in that facility's WWTP. The accumulated wastewater is then treated via the WWTP and routed to the treated contact water tank for each facility. The treated contact water tank is sampled, and the treated wastewater is held pending receipt of acceptable analytical results. Upon receipt of acceptable analytical results, the treated wastewater is discharged to the contact water evaporation pond designated for that facility. In the event that analytical results indicate the treated wastewater is not acceptable for disposal in the appropriate contact water evaporation pond, the wastewater will be sent to an appropriate off-site facility for disposal.

Results of stormwater and wastewater monitoring under the facility's TPDES and TLAP permits are provided to the TCEQ in monthly effluent reports and are not repeated in this document. Rather, the monthly effluent reports have been incorporated herein by reference.

1.4 Purpose

The permits, licenses and other authorizations under which the WCS site operates (see Section 1.3) establish numerous requirements for the monitoring of environmental media and effluents. The most comprehensive monitoring requirements are established in the RMLs, involving monitoring of effluents and all types of environmental media that may be present in the vicinity of the WCS site for radiological as well as non-radiological constituents. Other permits and authorizations establish monitoring requirements that target specific types of environmental media, due to the more limited exposure pathways for the non-radiological constituents of concern, or that target specific effluents, due to the regulatory program under which the authorization has been issued. Due to the more comprehensive nature of the radiological monitoring requirements under the RMLs, the monitoring programs conducted at the site are commonly referred to as the Radiological Environmental Monitoring Program (REMP).

The results collected under these monitoring programs are used to demonstrate compliance with the radiation protection and environmental standards specified in 30 TAC §336.313, *Dose Limits for Individual Members of the Public* and 30 TAC §336.1133, *Maximum Values for Use in Groundwater Protection*. This report enables a comprehensive semi-annual/annual review and evaluation of potential migration of radiological and non-radiological contaminants from the WCS site.

This report is also intended to fulfill the requirements in License Condition (LC) 158.H.9) of RML No. R04100 (Amendment 18), LC 158.G of RML No. R04100 (Amendment 18), LC 77 of RML No. R05807 (Amendment 5) and LC 92A of RML No. R05807 (Amendment 5). LC 158.H.9) of RML No. R04100 states, "The Licensee shall provide a semi-annual environmental monitoring report to the executive director to be submitted before March 31 and September 30 of the preceding six (6) months. The semi-annual report shall include the results of all environmental media samples for all facilities at the WCS, Andrews County site." LC 158.G of RML No. R04100 states, "The Licensee must evaluate monitoring data using a two (2)-tiered environmental monitoring response system. Investigation levels and action levels will be specified as described in the license application. The results of the evaluations must be included in the annual environmental monitoring report to the executive director conducted during each calendar year." LC 77 of RML No. R05807 requires WCS to "submit to the Executive Director each year, no later than September 30 for the period of January 1 through June 30 and March 31 for the period of July 1 through December 31, a report specifying the quantity of each principle radionuclide released to unrestricted areas in liquid and in gaseous effluents (including particulates) during the specified semi-annual period of operations." LC 92.A of RML No. R05807 requires that annual environmental monitoring reports shall be submitted to the Executive Director no later than April 1 of the year following the monitoring period.

2 Radiological Environmental Monitoring Program

As discussed in Section 1.5, WCS conducts a comprehensive program, commonly referred to as the REMP, at its Andrews County site. This program involves collection of samples for measurement of the concentrations of radiological and non-radiological constituents in various environmental media and effluents. Media and effluents monitored in accordance with this program include ambient gamma radiation, gases and vapor, soil, sediment, fauna, vegetation, surface water, soil moisture, wastewaters, aquatic eco-receptors, and ground water from multiple strata. These samples are analyzed for a variety of radionuclides and for non-radiological constituents, as described below. A comprehensive meteorological monitoring program is also maintained in support of the environmental monitoring program.

2.1 Environmental Monitoring Program Overview

Routine operations and Health Physics programs provide controls for limiting potential releases of radioactive material from the immediate facility during normal operations. Routine monitoring of work areas gives an early indication of any potential environmental concerns. The REMP serves as a primary confirmation of the adequacy of the active operational controls and the passive engineering and burial site controls for preventing releases outside the design basis for the facilities. This program also provides environmental data to demonstrate compliance with radioactive effluent release standards contained in 30 TAC §§336.304, .313 and .314. The WCS facility REMP encompasses procedures and planning documents addressing the types, frequency, and methodologies employed to acquire the requisite data.

The goals of the REMP are to:

- Verify the adequacy of facility design and operation to control radiological and non-radiological waste constituents and limit effluent releases to authorized levels;
- Assess the radiological and non-radiological impact of the facility on the surrounding environment; and
- Ensure compliance with regulatory standards established for the protection of the public and the environment.

These goals are achieved by:

- Measurement of direct radiation and radioactivity in effluents in air, soil, and sediment; and, as available, groundwater, surface water, soil moisture, vegetation, precipitation, aquatic eco-receptors and fauna;
- Measurement of chemical constituents in effluents and soil, and; as available, surface water and groundwater;
- Ensuring the quality of the measured data through planned decision-making processes, use of documented sampling and analytical procedures by trained personnel; and verification and validation of the collected data; and
- Evaluating the validated data against defined benchmarks using appropriate procedures so that true indicators of potential impacts will be recognized at the earliest practicable time, while minimizing unnecessary use of resources on erroneous indicators of such impacts.

2.2 REMP Data Quality and Management

The REMP must track data throughout the program life. The data are used to support regulatory and legal basis for the WCS facilities, therefore, it must be of known and documented quality. Data are generated

during the sampling and laboratory analytical process and are then data verified and validated to ensure data integrity.

All samples are collected in accordance with established procedures and shipped to an off-site laboratory for radiological and non-radiological analyses. The laboratory must be accredited by the National Environmental Laboratory Accreditation Program (NELAP) and the Texas Laboratory Accreditation Program (TLAP) administered by TCEQ, and analytical methods must be accredited by TCEQ, where such accreditation exists for a particular media/analyte/analytical method. Direct ambient gamma radiation is measured by either a device called a thermoluminescent dosimeter (TLD) or a device called an optically stimulated luminescence (OSL) dosimeter. Both devices convert ionizing radiation into visible light which is then measured and correlated to a corresponding radiation dose. The company supplying these dosimeters must be accredited by the National Volunteer Laboratory Accreditation Program (NVLAP).

After data validation, each measurement of environmental media is compared to applicable Investigation Levels (ILs), Action Levels (ALs), Analytical Decision Levels (ADLs), and Regulatory Limits (RLs) to determine if the current measurements exceed the existing limits computed from background data. Currently those comparison values are summarized in the individual REMP documents that have been approved for RML Nos. R04971, R05807, and R04100.

WCS is in the process of transitioning from individual REMPs and programs under the different RMLs to a consolidated, site-wide environmental monitoring program. Proposed, consolidated IL, ADL, AL, and RL values for environmental media are listed in the DQO-B report. The Part-A DQO report⁶ contains the detailed statistical methods and procedures that are used for assessing and comparing new measured data for environmental media with background data distributions. Samples with measureable levels above an IL require follow up investigations that can include re-analysis, re-sampling and/or more detailed analyses. Sample measurements verified to exceed an AL, ADL or RL require notification of TCEQ, follow-up investigations and potential corrective and/or mitigative actions.

Effluent monitoring data are directly compared to the applicable limits contained in the governing regulations and facility authorization(s). WCS conducts follow-up activities for effluent results outside of regulatory limits in accordance with the regulatory program having primacy.

WCS has established procedures to review all data to ensure sample data integrity prior to use of the data in any project. WCS's review is in addition to the data verification and validation that is performed by the analytical laboratory in accordance with the recommendations of Multi-Agency Radiological Laboratory Analytical Protocols Manual (MARLAP).

Upon receipt and before use of analytical data, the data and reports are reviewed and validated. Radiological data are reviewed according to procedure RS-1.9.1, *Approval of Offsite Radiological Data*, and non-radiological data are reviewed according to procedure AL-1.1.7, *Non-Radiological Data Validation*. Copies of these procedures and the applicable data review forms are available on-site and are provided in WCS' Quality Assurance Program Plan⁷ (QAPP).

WCS has implemented the use of a customized data management software program for electronic storage of various environmental records. The software securely stores the records and provides tools for reporting. The reports include the ability to view records related to a specific license or location through time. The software supports importing electronic data files, which prevents data entry errors associated with the manual

⁶ *Environmental Surveillance Data Quality Objectives Part A – Surveillance Objectives, Methods, and Decisions, Revision 3*, dated October 10, 2011.

⁷ *Quality Assurance Project Plan (QAPP) for WCS Radioactive Material Licenses, Revision 1*, dated October 10, 2011.

data entry process. Environmental records and analysis results may also be exported for use with other systems.

One of the goals of the electronic data management system is to minimize the manual entry process. The vast majority of the environmental monitoring data are generated by the contracted laboratory that performs the chemical and radiological analyses. In addition to the full analytical data packages provided by the laboratory, results of chemical and radiological analyses are provided to WCS as an electronic data deliverable (EDD). The EDDs are often provided in a comma-separated value (CSV) file format that has been employed for decades to move tabular data.

The environmental monitoring data system is backed up daily. All original analytical reports received will be kept in Document Control in accordance with the records disposition schedule.

2.3 Exposure Pathways and Analytes

All critical exposure pathways, as well as long-term indicator pathways, are monitored. These pathways include assessment of the internal and external mechanisms from airborne particulate releases, radon emanation, carbon-14 and tritium vapors and gases. These critical pathways were selected based on the evaluations and modeling included in the applicable licensing documents and applications. The following pathways were identified.

The airborne pathways include:

- Windblown dust from open bulk disposal areas;
- Windblown dust from processing, loading and transport of waste (where applicable);
- Airborne gases and vapors from waste cells, including evaporation (tritium, carbon-14, radon);
- Gas emanation through finished cover (tritium, carbon-14, radon);
- Air releases from a dropped or breached container; and
- Airborne gases associated with waste transport truck fire.

The groundwater pathways consider:

- Potential leaching of waste constituents from surface or near-surface accidental spills or releases into the undifferentiated Ogallala-Antlers-Gatuna (OAG) unit that overlies the red beds;
- Potential leaching of waste constituents to more transmissive saturated and unsaturated geologic strata beneath the disposal units (the 125-foot zone) and the uppermost, continuously saturated stratum beneath the disposal facilities (the 225-foot zone); and
- Surface water transport of ground-deposited waste particulate to playas or to the leachate collection systems within the disposal units.

Direct radiation monitoring addresses:

- Exposure to an off-site person from waste packages during operations;
- Exposure through the finished cover; and
- External radiation from soil contaminated by waste particulate deposition.

Soil, sediment, surface water, vegetation, and tissue sampling are not directly related to a key exposure pathway. However, these media provide measurements for evaluation of potential long-term accumulation in the environment concentrating mechanism.

The key radionuclides monitored by the REMP are shown in Table 1. WCS has selected these radionuclides based upon their radiological half-life, mobility, radio-toxicity and potential presence within radioactive wastes managed at WCS. The tracking of concentrations of these radionuclides in the environment will be used to evaluate the potential health and environmental impacts associated with the operation of the facility, as well as any possible long-term environmental impacts.

Table 1 : Key Radionuclides Monitored by the REMP

Radionuclide	Symbol	Radionuclide	Symbol	Radionuclide	Symbol
Americium-241	²⁴¹ Am	Krypton-85	⁸⁵ Kr	Radium-228	²²⁸ Ra
Carbon-14	¹⁴ C	Neptunium-237	²³⁷ Np	Strontium-90	⁹⁰ Sr
Cesium-137	¹³⁷ Cs	Nickel-63	⁶³ Ni	Technetium-99	⁹⁹ Tc
Cobalt-60	⁶⁰ Co	Plutonium-238	²³⁸ Pu	Thorium-228	²²⁸ Th
Curium-242	²⁴² Cm	Plutonium-239/240	^{239/240} Pu	Thorium-230	²³⁰ Th
Curium-243/244	^{243/244} Cm	Plutonium-241	²⁴¹ Pu	Thorium-232	²³² Th
Tritium	³ H	Plutonium-242	²⁴² Pu	Uranium-234	²³⁴ U
Iodine-129	¹²⁹ I	Radon-222	²²² Rn	Uranium-235	²³⁵ U
Lead-210	²¹⁰ Pb	Radium-226	²²⁶ Ra	Uranium-238	²³⁸ U

Other radionuclides are analyzed on a routine or as processed basis and reported when appropriate. A listing of all radionuclides analyzed during the report period is given in Table 2.

Table 2 : All Radionuclides Analyzed for the REMP

Radionuclide	Symbol	Radionuclide	Symbol	Radionuclide	Symbol	Radionuclide	Symbol
Actinium-228	²²⁸ Ac	Cobalt-56	⁵⁶ Co	Mercury-203	²⁰³ Hg	Ruthenium-106	¹⁰⁶ Ru
Americium-241	²⁴¹Am	Cobalt-57	⁵⁷ Co	Neodymium-147	¹⁴⁷ Nd	Silver-110m	^{110m} Ag
Americium-243	²⁴³ Am	Cobalt-58	⁵⁸ Co	Neptunium-237	²³⁷Np	Sodium-22	²² Na
Antimony-124	¹²⁴ Sb	Cobalt-60	⁶⁰Co	Neptunium-239	²³⁹ Np	Strontium-90	⁹⁰Sr
Antimony-125	¹²⁵ Sb	Curium-242	²⁴²Cm	Nickel-63	⁶³Ni	Technetium-99	⁹⁹Tc
Barium-133	¹³³ Ba	Curium-243/244	^{243/244}Cm	Niobium-94	⁹⁴ Nb	Thallium-208	²⁰⁸ Tl
Barium-140	¹⁴⁰ Ba	Europium-152	¹⁵² Eu	Niobium-95	⁹⁵ Nb	Thorium-228	²²⁸Th
Beryllium-7	⁷ Be	Europium-154	¹⁵⁴ Eu	Plutonium-238	²³⁸Pu	Thorium-230	²³⁰Th
Bismuth-212	²¹² Bi	Europium-155	¹⁵⁵ Eu	Plutonium-239/240	^{239/240}Pu	Thorium-232	²³²Th
Bismuth-214	²¹⁴ Bi	Tritium	³H	Plutonium-241	²⁴¹Pu	Thorium-234	²³⁴ Th
Carbon-14	¹⁴C	Iodine-129	¹²⁹I	Plutonium-242	²⁴²Pu	Tin-113	¹¹³ Sn
Cerium-139	¹³⁹ Ce	Iridium-192	¹⁹² Ir	Polonium-210	²¹⁰ Po	Uranium-233/234	^{233/234}U
Cerium-141	¹⁴¹ Ce	Iron-59	⁵⁹ Fe	Potassium-40	⁴⁰ K	Uranium-235/236	^{235/236}U
Cerium-144	¹⁴⁴ Ce	Krypton-85	⁸⁵Kr	Promethium-144	¹⁴⁴ Pr	Uranium-238	²³⁸U
Cesium-134	¹³⁴ Cs	Lead-210	²¹⁰Pb	Promethium-146	¹⁴⁶ Pr	Yttrium-88	⁸⁸ Y
Cesium-136	¹³⁶ Cs	Lead-212	²¹² Pb	Radon-222	²²²Rn	Zinc-65	⁶⁵ Zn
Cesium-137	¹³⁷Cs	Lead-214	²¹⁴ Pb	Radium-226	²²⁶Ra	Zirconium-95	⁹⁵ Zr
Chromium-51	⁵¹ Cr	Manganese-54	⁵⁴ Mn	Radium-228	²²⁸Ra		

Note: Key radionuclides are presented in **bold text**.

In addition to the radionuclides monitored as part of the REMP, gross alpha and gross beta are also monitored. There are also a number of non-radiological analytes that are monitored as required by permit/registration/license or through application document obligations. Non-radioactive analytes that are

required by RML R04100, HW-50358, and HW-50397 are listed in Table 3. These analytes are considered to be "key constituents" in a similar manner as the "key radionuclides" listed in Table 1.

Table 3 : Non-Radiological Analytes Monitored for the LLRW Facility in Accordance with RML No. R04100

Parameter	Parameter	Parameter
Acetone	1,2-Dichloroethane	<i>trans</i> -1,2-Dichloroethylene
Benzene	1,1-Dichloroethylene	1,1,1-Trichloroethane
Bromoform	1,2-Dichloropropane	1,1,2-Trichloroethane
Carbon Disulfide	<i>cis</i> -1,3-Dichloropropylene	Trichloroethylene
Carbon Tetrachloride	<i>trans</i> -1,3-Dichloropropylene	Vinyl Chloride
Chlorobenzene	Ethylbenzene	Phenol
Chlorodibromomethane	Methyl Bromide (Bromomethane)	1,4-Dioxane
Chloroethane	Methyl Chloride	Arsenic
Chloroform	1,1,2,2-Tetrachloroethane	Nickel
Dichlorobromomethane	Tetrachloroethylene	Cadmium
1,1-Dichloroethane	Toluene	Selenium

A lengthier suite of non-radiological analytes are analyzed annually at designated locations identified in the Non-Radiological Environmental Monitoring Plan (N-REMP), which was part of the license application documents for RML R04100. A wide range of non-radiological analytes are also analyzed on a semi-annual basis as required by RML R05807. These additional non-radiological analytes are listed in Table 4.

Table 4 : Non-Radiological Analytes Monitored for the LLRW Facility in Accordance with the N-REMP and RML R05807.

Type	Parameter	Parameter	Parameter
N-REMP & RML R05807 Metals	Antimony	Cobalt	Silver
	Arsenic	Copper	Thallium
	Barium	Lead	Uranium
	Beryllium	Mercury	Vanadium
	Cadmium	Molybdenum	Zinc
	Boron	Nickel	
	Chromium	Selenium	
N-REMP & RML R05807 VOCs	1,1,1,2-Tetrachloroethane	2-Chloroethylvinyl ether	Dichlorodifluoromethane
	1,1,1-Trichloroethane	2-Chlorotoluene	Ethylbenzene
	1,1,2,2-Tetrachloroethane	2-Hexanone	Hexachlorobutadiene
	1,1,2-Trichloroethane	4-Chlorotoluene	Iodomethane
	1,1-Dichloroethane	4-Isopropyltoluene	Isopropylbenzene
	1,1-Dichloroethylene	4-Methyl-2-pentanone	Methylene chloride
	1,1-Dichloropropene	Acetone	Naphthalene
	1,2,3-Trichlorobenzene	Benzene	n-Butylbenzene
	1,2,3-Trichloropropane	Bromobenzene	n-Propylbenzene
	1,2,4-Trichlorobenzene	Bromochloromethane	sec-Butylbenzene
	1,2,4-Trimethylbenzene	Bromoform	Styrene
	1,2-Dibromo-3-chloropropane	Bromomethane	tert-Butyl methyl ether
	1,2-Dibromoethane	Carbon disulfide	tert-Butylbenzene
	1,2-Dichlorobenzene	Carbon tetrachloride	Tetrachloroethylene
	1,2-Dichloroethane	Chlorobenzene	Toluene
	1,2-Dichloroethylene (total)	Chlorodibromomethane	<i>trans</i> -1,2-Dichloroethylene
	1,2-Dichloropropane	Chloroethane	<i>trans</i> -1,3-Dichloropropylene
	1,3,5-Trimethylbenzene	Chloroform	Trichloroethylene
	1,3-Dichlorobenzene	Dichlorobromomethane	Trichlorofluoromethane

Type	Parameter	Parameter	Parameter
	1,3-Dichloropropane	Chloromethane	Vinyl acetate
	1,4-Dichlorobenzene	<i>cis</i> -1,2-Dichloroethylene	Vinyl chloride
	2,2-Dichloropropane	<i>cis</i>-1,3-Dichloropropylene	Xylenes (total)
	2-Butanone	Dibromomethane	
N-REMP & RML R05807 SVOCs	1,2,4,5-Tetrachlorobenzene	4-Nitrophenol	Hexachloroethane
	1,2,4-Trichlorobenzene	4-Nitroquinoline-1-oxide	Hexachloropropene
	1,2-Dichlorobenzene	5-Nitro-o-toluidine	Indeno(1,2,3-cd)pyrene
	1,3,5-Trinitrobenzene	7,12-Dimethylbenz(a)anthracene	Isodrin
	1,3-Dichlorobenzene	Acenaphthene	Isophorone
	m-Dinitrobenzene	Acenaphthylene	Isosafrole
	1,4-Dichlorobenzene	Acetophenone	m,p-Cresols
	1,4-Dioxane	Aniline	Methapyrilene
	1,4-Naphthoquinone	Anthracene	Methyl methanesulfonate
	1-Naphthylamine	Benzo(a)anthracene	Naphthalene
	2,3,4,6-Tetrachlorophenol	Benzo(a)pyrene	Nitrobenzene
	2,4,5-Trichlorophenol	Benzo(b)fluoranthene	N-Methyl-N-nitrosomethylamine (Dimethylnitrosamine)
	2,4,6-Trichlorophenol	Benzo(ghi)perylene	N-Nitrosodiethylamine
	2,4-Dichlorophenol	Benzo(k)fluoranthene	N-Nitrosodi-n-butylamine
	2,4-Dimethylphenol	Benzoic acid	N-Nitrosodipropylamine
	2,4-Dinitrophenol	Benzyl alcohol	N-Nitrosomethylethylamine
	2,4-Dinitrotoluene	bis(2-Chloroethoxy)methane	N-Nitrosomorpholine
	2,6-Dichlorophenol	bis(2-Chloroethyl) ether	N-Nitrosopiperidine
	2,6-Dinitrotoluene	bis(2-Chloroisopropyl)ether	N-Nitrosopyrrolidine
	2-Acetylaminofluorene	bis(2-Ethylhexyl)phthalate	Triethylphosphorothioate
	2-Chloronaphthalene	Butylbenzylphthalate	o-Cresol
	2-Chlorophenol	Chlorobenzilate	o-Toluidine
	2-Methyl-4,6-dinitrophenol	Chrysene	p-(Dimethylamino)azobenzene
	2-Methylnaphthalene	Diallate	Pentachlorobenzene
	2-Naphthylamine	Dibenzo(a,h)anthracene	Pentachloronitrobenzene
	o-Nitroaniline	Dibenzofuran	Pentachlorophenol
	2-Nitrophenol	Diethylphthalate	Phenacetin
	2-Picoline	Dimethoate	Phenanthrene
	3,3'-Dichlorobenzidine	Dimethylphthalate	Phenol
	3,3-Dimethylbenzidine	Di-n-butylphthalate	p-Phenylenediamine
	3-Methylcholanthrene	Di-n-octylphthalate	Pronamide
	m-Nitroaniline	Diphenylamine	Pyrene
	4-Aminobiphenyl	Ethyl Methanesulfonate	Pyridine
	4-Bromophenylphenylether	Fluoranthene	Safrole
	4-Chloro-3-methylphenol	Fluorene	Sulfotepp
	4-Chloroaniline	Hexachlorobenzene	Thionazin
	4-Chlorophenylphenylether	Hexachlorobutadiene	Tributylphosphate
	p-Nitroaniline	Hexachlorocyclopentadiene	
RML R05807 Pesticides	4,4'-DDD	Delta-BHC	Endosulfan Sulfate
	4,4'-DDE	Dieldrin	Gamma-BHC (Lindane)
	4,4'-DDT	Endrin	Heptachlor
	Alpha-BHC	Endrin Aldehyde	Heptachlor epoxide
	Aldrin	Endrin Ketone	Methoxychlor
	Beta-BHC	Endosulfan I	Toxaphene
	Chlordane (Tech.)	Endosulfan II	
0 5 8 0 7	Aroclor-1016	Aroclor-1242	Aroclor-1254

Type	Parameter	Parameter	Parameter
	Aroclor-1221	Aroclor-1248	Aroclor-1260
	Aroclor-1232		
N-REMP & RML R05807 Other Analyses	Alkalinity, Total	Nitrogen, Ammonia	Specific Conductivity*
	Biological Oxygen Demand	Nitrate	Total Dissolved Solids
	Cyanide, Total	pH*	Total Suspended Solids
	Dissolved Oxygen*	Phenol, Total	Turbidity*
	Fluoride	Phosphorus, Total as P	

Note: Key constituents are presented in **bold text**.

* = These are measured in the field versus determined by an analytical laboratory.

There are also several non-radioactive analytes specific to the respective TPDES and TLAP permits. Because results of those analytes are reported on a monthly basis to the TCEQ and none has been detected in samples from WCS at levels of potential concern, they are not discussed in this document. Instead, as previously noted WCS' monthly effluent monitoring reports are incorporated herein by reference.

2.4 Sampling Locations and Frequencies

The types of sampling media and sampling locations in the REMP have been selected to serve as operational and early warning indicators, which provide a measure of the routine operations within and around the facilities, and off-site environmental indicators, which monitor the potential impact of the facility operations on the environment outside of the facilities.

Environmental monitoring and sampling around the WCS facility can be divided into ten different types:

- Air particulates - atmospheric evaluation of airborne particulate radioactive materials to provide a measure of material that may become airborne at the site during material processing and/or disposal activities; radioactive gases and vapors – measurements of ⁸⁵Kr, ¹⁴C, ³H, ¹²⁹I and ²²²Rn to provide a measure of radioactive gases and vapors that may be released;
- Direct radiation – Monitoring for the direct radiation exposure from radioactive materials on the site;
- Soil – providing a measure of radioactive materials in the soils around the facility to evaluate potential buildup in the environment over the duration of the facility operations;
- Soil moisture – providing a measure of radioactive materials in the soil pore moisture adjacent to FWF and CWF buildings.
- Groundwater – providing a mechanism for identification of impacts due to releases from the waste management units, primarily, the disposal units;
- Surface water – providing a measure of radioactive and non-radioactive constituents in surface waters that accumulate from time to time in playas and other surface features;
- Storm water - providing a measure of pollutants carried by non-contact storm water runoff into site conveyances/ponds;
- Sediment – providing a method to monitor the potential accumulation of contaminants transported by surface water to playas and sedimentation ponds;
- Vegetation – providing for the monitoring of vegetative uptake via deposition of airborne particulates and from root uptake of soil/sediment accumulation and surface water runoff; and
- Fauna/Tissue/Aquatic Eco-receptor – providing a method to detect bioaccumulation of radionuclides.

Effluent monitoring at the WCS site can be classified as follows:

- Tank sampling - collection of raw sanitary wastewater and treated and untreated industrial wastewaters from holding tanks of various sizes and configurations;

- Impoundment sampling - collection of impounded non-contact runoff water; treated, impounded wastewater; and any sediments associated with these waters;
- Outfall sampling - collection of non-contact storm water run-off, treated effluent, and mixtures thereof from internal release points and outfalls and from external outfalls; and
- Leachate/leak detection system sampling – collection of samples from the liquid detection and collection devices for these systems.

Environmental monitoring and effluent samples are collected in accordance with procedures developed and approved under the WCS Quality Assurance (QA) Program, WCS-QAP-100, *Quality Assurance Plan*. Table 5 identifies the current WCS sampling procedure by sample medium. Copies of the current revisions of the procedure are available on-site and are included in WCS' QAPP.

Table 5 : WCS Environmental Media and Effluent Sample Collection Procedures

Matrix	Current Matrix Code	WCS Procedure
Particulates	AP	EV-7.16 – High Volume Air Sampling
Tritium	AT	EV-7.1.2 – Low Volume Air Sampling
Cartridges	AC	
Radon	AR	
Ambient Radiation	ET	EV-7.1.6 – Thermoluminescent Dosimeters/Optically Stimulated luminescent Dosimeters
Soil (Rad and Non-Rad)	SS	EV-7.1.5 – Soil Sampling
Sediment	SE	
Vegetation (Rad and Non-Rad)	VE	EV-7.1.7 – Vegetation Sampling
Fauna	FA	EV-7.1.18 – Wildlife Sampling
Soil Moisture	LS	EV-7.1.19 – Lysimeter Sampling
Aquatic Eco-receptors*	OT	N/A
Precipitation	WS	EV-7.1.13 – Surface Water Sampling
Surface Water (Rad and Non-Rad)	SW	
Groundwater (Rad and Non-Rad)	WS	EV-7.1.8 Groundwater Sampling
Effluent Releases	WS	EV-4.5.1 Effluent Releases
RCRA Groundwater	WS	EV-7.1.10 – RCRA Environmental Groundwater Sampling

* WCS collects aquatic eco-receptor samples in accordance with a White Paper on aquatic eco-receptor sampling techniques that was prepared for them by Texas Tech University consultants.

A brief summary of the sampling methodologies for each sample medium is provided below.

Air: The air sampling procedures include sampling for air particulates, vapors and gases. Air particulate samples are collected on filters using high-volume air pumps. Radon gas is measured using passive Track-Etch® canisters. Other gases and vapors (i.e., gaseous, krypton-85, iodine-129 and carbon-14) are collected using cartridges and low-volume air flow equipment; whereas tritium is collected using silica gel and low-volume air flow equipment.

Soil/Sediment: The soil procedure includes sampling for soil and sediment samples. Samples are collected with a hand auger, shovel/trowel, coring device or similar sampling equipment.

Flora: The flora procedure includes sampling for vegetation. Vegetation samples are collected by using manual cutting tools. Samples are collected of new growth; if new growth is not available samples are not collected.

Fauna: The fauna procedure provides instruction for collecting indicator species. Fauna samples are humanely collected on the WCS property.

Aquatic Eco-receptors: Given the arid climate, sampling aquatic eco-receptors is considered an extremely unusual event by WCS. Therefore, WCS does not have formal procedure documenting how to collect aquatic eco-receptor samples. When necessary, however, WCS collects aquatic eco-receptor samples in accordance with a White Paper on aquatic eco-receptor sampling techniques that was prepared for WCS by Texas Tech University consultants.

Ambient Radiation: Gamma radiation measurements are collected using TLD and OSL dosimeters. Direct gamma radiation surveys are also conducted using real-time radiation detection instruments. Dosimeters are changed quarterly.

Water: The surface water sampling procedure includes collection of samples from surface water and precipitation. The groundwater procedure includes details on collection of samples using bailers, or low flow (minimal) purge and sampling equipment. Groundwater wells installed to monitor the groundwater at the East and West landfill in accordance with HW-50358 are sampled following the RCRA groundwater sampling procedure.

Soil Moisture: Soil moisture is sampled using subgrade, ceramic lysimeters that are installed around certain buildings/structures at the FWF and CWF, as required by RML No. R04100.

In addition to the sampling procedures identified above, other WCS procedures that support the implementation of the environmental monitoring program are listed in Table 6. Since the environmental monitoring program is conducted under the umbrella of the WCS QA program, corrective action is addressed as part of this QA program, which states:

“Conditions adverse to quality shall be identified promptly, reported to the appropriate levels of management and corrected as soon as practical. Such conditions shall be tracked and evaluated so that adverse trends can be identified and appropriate corrective action can be taken.”

Table 6 : WCS Supporting Procedures

WCS Procedure
EV-7.1.4 – Shipment of Environmental Samples and Chain of Custody
EV-7.17 – Calibration of Hi-volume Air Samplers
Quality Assurance
QA-6.1 – Document Control
QA-7.1 – Supplier Qualification
QA-12.1 – Control of Measuring and Testing Equipment
QA-16.1 – Corrective Action Management
QA-17.1 – Quality Assurance Records
Offsite Lab
AL-1.1.4 – Procurement of Off-Site Analytical Work
AL-1.1.6 – Non-Radiological Data Validation
RS-1.9.2 – Approval of Offsite Radiological Data

Implementing procedure QA-16.1, *Corrective Action Management* details how identified items are tracked, evaluated, resolved, documented and followed up by the management. Details on the WCS quality program are provided in WCS' QAPP.

Finally, when insufficient media is present for all required radiological analyses, the analyses are prioritized in the following order (1) gross alpha and beta; (2) gamma spectroscopy; (3) alpha isotopic spectrometry (including radon emanation for radium-226); and (4) liquid scintillation/gas flow proportion counting (radionuclide-specific). Non-radiological analyses are similarly prioritized in the following order; (1) volatile organic analytes, (2) semi-volatile organic analytes, (3) metals, and (4) general water quality parameters.

The specific analytical methodologies used to analyze the environmental samples are generally based on US EPA analytical methods and the Department of Energy (DOE) Environmental Measurement Laboratory Manual. These sources are industry standard analytical methods, including both sample preparation and analysis.

Samples received by the laboratory are processed in accordance with Laboratory procedure. This procedure details the process followed by the laboratory sample receipt technician regarding chain-of-custody and confirmation of sample receipt conditions.

The following presents an overview of accepted radioanalytical methodologies. These methods are capable of detecting very low levels of radioactivity in their respective samples, which allows radiological impacts to be assessed and maintained As Low As Reasonably Achievable (ALARA). Other methods are also acceptable, provided that they are subjected to review and approval with a laboratory QA/QC program for ensuring the quality of the results are consistent with recommendations in the MARLAP, and approved by the TCEQ.

Gross Alpha and Beta Analysis: For liquid samples, a sample aliquot is evaporated to dryness directly in a pre-weighed stainless steel planchet or in cases of high dissolved solids, is first ashed to reduce its mass of organic matter. The samples are counted with an appropriate low background alpha/beta counter, such as gas flow proportional counter. For vegetation, soil, and tissue, samples are ashed as necessary to reduce organic content and the resultant material is placed on a stainless steel planchet and counted with a low background alpha/beta counter. For air samples the filter paper is counted directly from the inlet side with an appropriate low background alpha/beta counter, such as a gas flow proportional counter.

Alpha Spectrometry: An aliquot of the sample is processed by radiochemical methods for removal of key isotopes, such as those for uranium, thorium and different transuranic group isotopes. The sample is then counted on an alpha spectroscopy system (e.g., silicon surface barrier detectors with associated spectral analysis).

Gamma Spectrometry: A known weight or volume of sample (including soil, water, tissue, and filter media) is placed into a standard container (e.g., a Marinelli beaker). The sample is counted on a gamma spectroscopy system (e.g., Ge Detector) with associated spectral analysis. Samples may also be counted on a low-energy gamma spectroscopy system, which uses a thin-windowed carbon fiber or beryllium detector to allow penetration by low-energy gamma radiation.

Liquid Scintillation Counting: The sample is chemically processed, typically by dissolution and/or distillation and a small aliquot is then mixed with an appropriate scintillation cocktail for counting in a liquid scintillation counter in accordance with approved procedures.

Under License Condition (LC) 164.C of RML No. R04100, non-radiological (chemical) analyses of soil, surface water, and vegetation samples are required to be performed annually for constituents listed in HW-50358, Attachment VI, Appendix 6.62, Table 1 during the construction and operational monitoring periods. Under this LC, groundwater samples are required to be analyzed for non-radiological constituents on a quarterly basis under these monitoring programs. In addition, chemical analyses are performed for other licenses and permits as described previously. Chemical analyses are performed using standard US EPA methodologies.

WCS' contract laboratory participates in the TCEQ's NELAC accreditation program. Specific details regarding laboratory accreditation are provided in WCS's QAPP.

Sample locations are summarized in tables and figures provided in individual sections of this report. All operational monitoring locations associated with the RCRA TSDF (Permit No. HW-50358), the waste processing and storage facility (RML No. R04971), the byproduct disposal facility (RML No. R05807) and the low-level radioactive waste disposal facility (RML No. R04100) appear in these summary tables and figures. Each table and figure provides sample location per media (i.e., all of the sample locations for surface water figure). Figures for ground water sample locations are also separated by the strata being monitored.

2.5 Regulatory Requirements

TCEQ regulations in 30 TAC Chapter 336 establish limits for radiation exposure to members of the public and require monitoring to demonstrate compliance. These are the primary regulations addressed by the REMP. The amounts of radiation and radioactive material that may be released from the facility to the environment are strictly controlled under these regulations. Key exposure pathways are monitored and sampled to verify compliance.

30 TAC Chapter 336 limits the total effective dose equivalent (TEDE) to individual members of the public from licensed and/or registered operation in three manners:

- a) A constraint on air emissions of radioactive material to the environment, excluding Radon-222 and its daughters, restricts the TEDE to the individual member of the public to less than 0.01 rem (<10.0 millirem, 100 microSievert [μSv]) in a year.
- b) The TEDE to individual members of the public from the licensed operations shall not exceed 0.1 rem (100 millirem, one millisievert) in a year.
- c) The dose in any unrestricted area from external radiation sources does not exceed 0.002 rem (2 millirem, 0.02 millisievert) in any one hour. This dose limit does not include sources of background radiation, medical administration of radioactive material, or voluntary participation in medical research programs.

These regulations also require licensees to perform surveys of radiation levels in unrestricted areas and monitor for radioactive materials in effluents that may be released to unrestricted areas to comply with the dose limits for individual members of the public. A licensee shows compliance with the annual dose limits by:

- Measurement or calculation that the TEDE to the individual likely to receive the highest dose from the licensed or registered operation does not exceed the annual dose limit;
- The average annual concentrations of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area do not exceed the values specified in 30 TAC Chapter 336; and

- By ensuring that if an individual was continuously present in an unrestricted area, the dose rate from external sources of radiation would not exceed 0.002 rem (2 millirem) in an hour and 0.05 rem (50 millirem) in a year.

2.6 Pre-Operational Program Overview and Data

Many of the key radionuclides listed in Table 1 are naturally present in our environment. The uranium and thorium isotopes (and their progeny) are primordial, having existed since the creation of the earth. Tritium and carbon-14 are created by cosmic radiation interactions in our upper atmosphere as well as from nuclear weapons testing during the 1950s and 60s. Strontium-90 and cesium-137 are also products remaining from weapons testing. It is important to establish baseline measurements of the natural background levels of radiation and radioactivity for the site so that any impact resulting from facility operations can be distinguished. Prior to receipt of LLRW materials at WCS, a pre-operational environmental monitoring program was performed to establish this baseline. Background levels of radiation and radioactive materials in the air, air particulate, soil, sediment, groundwater, surface water, fauna, vegetation, and other media were monitored and reported in the Pre-Operational Monitoring Report⁸.

2.7 Investigation Levels and Action Levels

WCS currently has three different sets of ILs and ALs corresponding to WCS' three primary radioactive materials licenses. The bases on which the ILs and ALs were derived vary between the three licenses. WCS is currently working to consolidate these ILs and ALs to simplify and strengthen the REMP. This report includes comparisons associated with WCS' three primary radioactive materials licenses. The IL/AL pairs for the three primary radiological licenses are described below.

In accordance with EV-1.10, *Radiological Environmental Monitoring Program*, associated with RML No. R04971, the ILs for the Waste Processing and Storage Facility are typically based upon a fraction of guidance limits. For airborne particulate samples, the IL is set at two percent (2%) of the applicable pathway regulatory standard in 30 TAC §336.359 Appendix C, Table II, Column 1. Investigation levels for groundwater are set at two percent (2%) of the 30 TAC §336.359, Appendix C, Table II, Column 2 value, which yields a dose of one (1) millirem. The soil and sediment ILs are based upon four percent (4%) of the levels in Nuclear Regulatory Commission (NRC) Regulatory Guide NUREG-1757, *Consolidated Decommissioning Guidance*, Table B.2, which corresponds to a dose of one (1) millirem, except for isotopes of radium, thorium, and uranium where background levels are likely to exceed the 4% level. For these isotopes the IL is set at background plus 3 standard deviations. For vegetation, the ILs are based upon four percent (4%) of the levels in EPA Federal Guidance Report No. 11 and an assumed 190 kilogram/year (kg/yr) vegetable consumption. This corresponds to a dose of one (1) millirem, except for isotopes of radium, thorium, and uranium where background levels are likely to exceed the 4% level. For these isotopes, the IL is set at background plus 3 standard deviations. ALs under this REMP are set at 10% of the applicable regulatory or guidance limits.

In accordance with BP-EV-1.1.0, *Radiological Environmental Monitoring Program*, associated with RML No. R05807, the ILs for the Byproduct Disposal Facility are set at a point above the baseline mean that is considered statistically significant; i.e., at a value that is considered above the background variation. IL's are established specifically for each radionuclide and type of environmental media sampled. For radionuclides where there is a measurable background level, the IL is currently set at three (3) standard deviations above the background average value.

⁸ *Report of Completion of Modified Natural Radiation Monitoring Program and Pre-Operational Environmental Monitoring Program for RML No. R04100*, dated May 12, 2011.

The Action Levels for the Byproduct Disposal Facility are based on some percent of the applicable pathway regulatory standard. For most radionuclides, the AL is set at 10% of the applicable regulatory limit. There are, however, a few radionuclides where the background levels and/or variation approach or exceed the applicable limits. For these radionuclides, alternative bases have been developed for AL establishment. Two approaches have been taken. In one approach, the AL is based on the corresponding regulatory standard value plus a background contribution. This approach is suitable for most situations, but is impractical for radionuclides where the variation also exceeds the regulatory standard value. For example, the natural levels and variation of lead-210 in soil and groundwater do not allow for being able to readily distinguish the corresponding regulatory standard from background and its variation. For these situations, a precursor, or indicator radionuclide, is used for indicating potential level of concern. In the case of lead-210, the parent radionuclide radium-226 is used.

The LLRW ILs are based upon prediction limits that have been calculated from pre-operational and baseline data. ILs based on prediction limits have been proposed for each LLRW REMP analyte in each applicable media at the site. Depending on the background population of the combined baseline and pre-operational data sets, either parametric or non-parametric prediction limits have been calculated. In most cases the IL's are "site-wide" values, but in other cases ILs have been calculated from individual monitoring locations or groups of locations due to spatial variability. WCS will compare operational data to ILs. If the concentration of an analyte exceeds its IL during the operational period, one or more resampling events will be conducted to complete the statistical test. The number of resampling events is established for each IL to optimize the statistical performance of the test. If the concentrations of the initial sample and all necessary resampling events for a given statistical test exceeds the IL, there will be statistical evidence of a potential release. ALs for RML No. R04100 are not statistically derived. They are simply 10 times the IL⁹. They serve as an intermediate point between the IL and the regulatory limit.

Regulatory Limits form the third tier of the environmental monitoring system. Collectively, comparisons of operational data to the IL, AL, and RL will provide early warning of any conditions that could suggest a release and determine if a release has occurred. Sample measurements verified to exceed an AL, ADL or RL require notification of TCEQ, follow-up investigations and potential corrective and/or mitigative actions. WCS' response to a potential release will be escalated based on the tier of the potential release (i.e., there will be a greater response to an RL exceedance than to an IL exceedance).

Table A-1 in Appendix A contains the ILs and ALs for the key radionuclides identified in Section 2.4 under the three primary radioactive materials licenses. Proposed ILs, ADLs, ALs, and RLs for all of the radionuclides and most of the non-radioactive constituents are provided in Tables A-2, A-3, and A-4.

⁹ Except for some special cases. An example would be for a non-radioactive metal whose background value is greater than its regulatory limit. In that case, the IL, AL, and RL for that metal would be the sample value. This relationship is described in much greater detail in WCS' DQO-A document.

3 Environmental Data Summary

The radiological and non-radiological data for the WCS Andrews County site collected for the reporting period of January 1, 2012 through December 31, 2012 are summarized in the following subsections and all data are located in the appendix.

Typically, figures that graphically plot analytical data over time and against comparison values (if applicable) are provided for analytes that:

1. Are gross alpha, gross beta, or a key radionuclide listed in Table 1 or 2, as determined by the preferred analytical method for the media (the most sensitive method, i.e, radium-226 by gamma spectroscopy for solid media, and by Lucas Cell for other media), or are a non-radiological analyte identified in Table 3 or 4 of this document; and
2. Were detected during the reporting period; or
3. Are otherwise considered significant.

All of the data plots provided as figures in this document depict analytes that follow this convention and are referred to as 'analytes of note'. Solid icons on the data plots represent detected results¹⁰; hollow icons represent non-detect results.

In most cases the LLRW IL's, AL's and ADL's are "site-wide" values, but in other cases these comparison values have been calculated from individual monitoring locations or groups of locations due to spatial variability. In cases where multiple LLRW comparison values exist, the most conservative comparison values are provided in summary statics tables and figures that graphically plot analytical data over time unless otherwise noted.

3.1 Radon Monitoring

Radon is monitored by the use of Track-Etch® detectors. These detectors are changed out quarterly and handled in accordance with procedure EV-7.1.2, *Low Volume Air Sampling*. Table 7 lists the radon sampling requirements by license. The quarterly radon monitoring results for the calendar year of 2012 are provided in Table 8. Sample results are compared against the radon IL to determine whether or not there is a change significant enough to warrant an investigation. All radon monitoring results received for this reporting period were below the corresponding radon IL (3000 picocuries per cubic meter of air (pCi/m³) for the Byproduct IL, 1500 pCi/m³ for the LLRW IL and 2000 pCi/m³ for the waste processing and storage facility IL).

The Fernald Silo canisters represent the primary potential source of radon above background at the Andrews County, Texas site for the calendar year of 2012. The Fernald Silos were emplaced in the byproduct landfill during the months of October and November 2009. No other byproduct materials were placed in the disposal units either before or after the placement of the Fernald Silo canisters.

The radon monitoring results measured at the site for the calendar year of 2012 are representative of typical background concentrations. The historical average radon concentration¹¹ is 1200 pCi/m³ with a standard deviation (1σ) of 600 pCi/m³. Sample locations are shown in Figure 3.

¹⁰ Detected results are those reported above either the MDC (for radionuclides) or the practical quantification limit (PQL) (for non-radioactive analytes).

¹¹The average radon concentration reported in the REMP documents for the LLRW and Byproduct facilities is 1200 ± 600 pCi/m³. This value is more recent and encompasses more data than the average provided in the REMP document for the waste processing and storage facility and therefore is used in this report.

Table 7 : Air Radon Sampling Location Requirements

Sample Type	Byproduct Stations	TSDf Stations	LLRW Stations
Air Radon	1, 3, 4, 6, 7, 8, 9, 11, 26, 27, 30, 31, and 32	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 26, and 27	1, 4, 6, 7, 9, 11, 26, 27, 31, 50, 55, 59, and 65

Table 8 : 2012 Quarterly Air Radon Concentration (picocuries/cubic meter of air [pCi/m³] $\pm 2\sigma$)

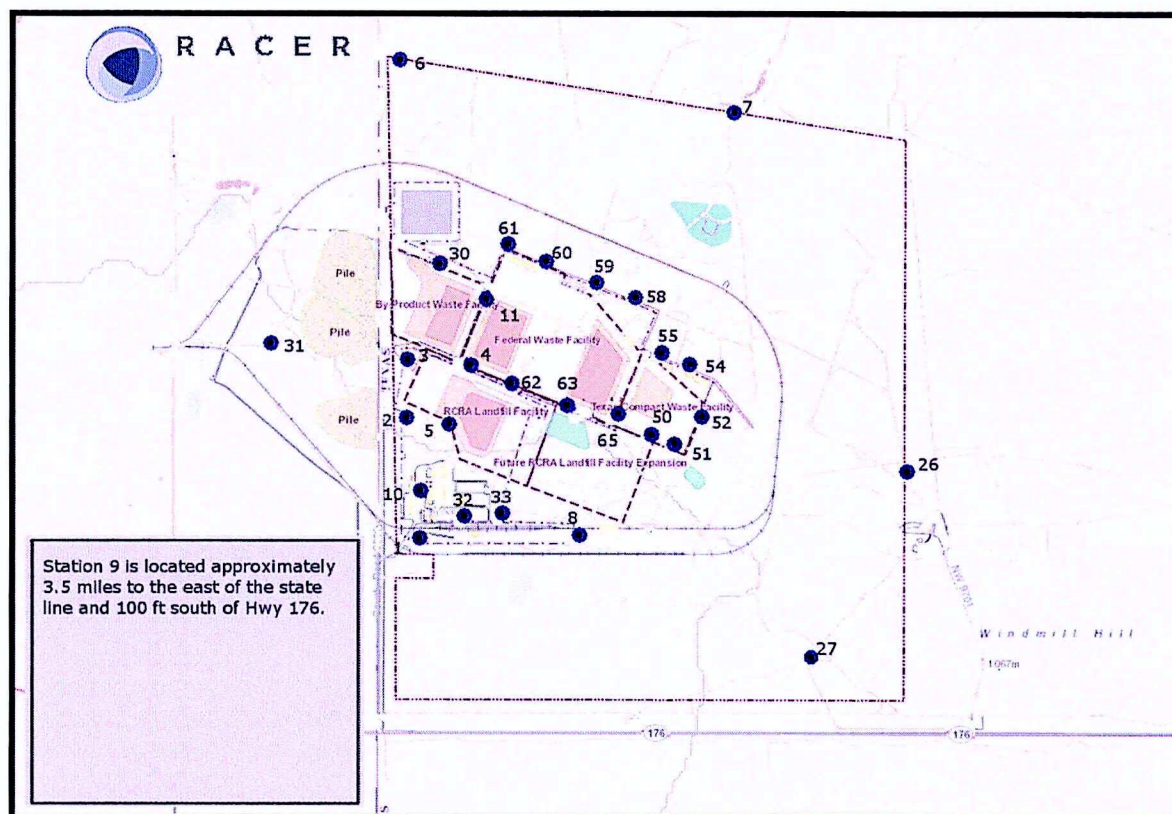
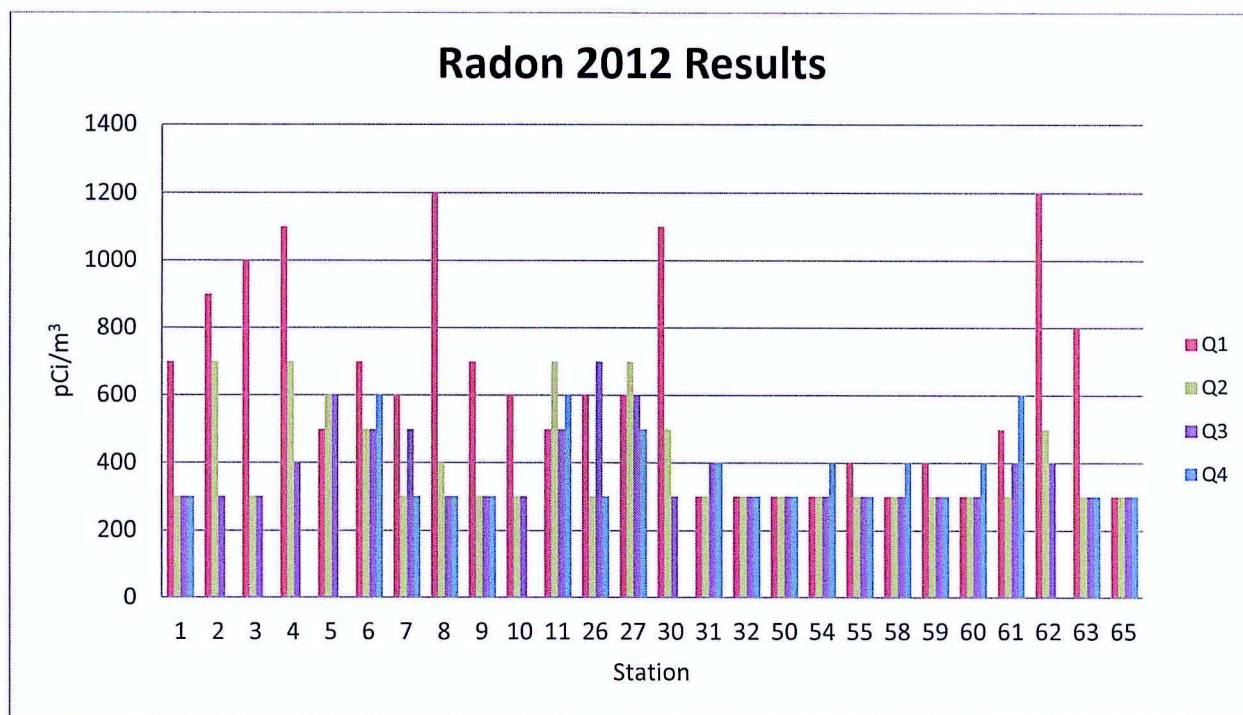
Station	Quarter 1	IL%	Quarter 2	IL%	Quarter 3	IL%	Quarter 4	IL%
1	700 $\pm$ 60	23.3%	300 $\pm$ 40*	10.0%	300 $\pm$ -40*	10.0%	300 $\pm$ -30*	10.0%
2	900 $\pm$ 70	30.0%	700 $\pm$ 60	23.3%	300 $\pm$ -30*	10.0%	Lost	Lost
3	1000 $\pm$ 70	33.3%	300 $\pm$ 40*	10.0%	300 $\pm$ -300*	10.0%	Lost	Lost
4	1100 $\pm$ 80	36.7%	700 $\pm$ 60	23.3%	400 $\pm$ -30	13.3%	Lost	Lost
5	500 $\pm$ 40	16.7%	600 $\pm$ 60	20.0%	600 $\pm$ -50	20.0%	Lost	Lost
6	700 $\pm$ 50	23.3%	500 $\pm$ 50	16.7%	500 $\pm$ -40	16.7%	600 $\pm$ -50	20.0%
7	600 $\pm$ 50	20.0%	300 $\pm$ 40*	10.0%	500 $\pm$ -50	16.7%	300 $\pm$ -30*	10.0%
8	1200 $\pm$ 80	40.0%	400 $\pm$ 40	13.3%	300 $\pm$ -30*	10.0%	300 $\pm$ -30*	10.0%
9	700 $\pm$ 50	23.3%	300 $\pm$ 40*	10.0%	300 $\pm$ -40*	10.0%	300 $\pm$ -30*	10.0%
10	600 $\pm$ 50	20.0%	300 $\pm$ 50*	10.0%	300 $\pm$ -40*	10.0%	Lost	0.0%
11	500 $\pm$ 50	16.7%	700 $\pm$ 60	23.3%	500 $\pm$ -50	16.7%	600 $\pm$ -50	20.0%
26	600 $\pm$ 50	20.0%	300 $\pm$ 40*	10.0%	700 $\pm$ -60	23.3%	300 $\pm$ -30*	10.0%
27	600 $\pm$ 50	20.0%	700 $\pm$ 60	23.3%	600 $\pm$ -50	20.0%	500 $\pm$ -40	16.7%
30	1100 $\pm$ 80	36.7%	500 $\pm$ 50	16.7%	300 $\pm$ -40	10.0%	Lost	Lost
31	300 $\pm$ 30*	10.0%	300 $\pm$ 40*	10.0%	400 $\pm$ -40	13.3%	400 $\pm$ -40	13.3%
32	300 $\pm$ 30*	10.0%	300 $\pm$ 40*	10.0%	300 $\pm$ -30	10.0%	300 $\pm$ -30*	10.0%
50	300 $\pm$ 30*	10.0%	300 $\pm$ 40	10.0%	300 $\pm$ -40	10.0%	300 $\pm$ -30*	10.0%
54**	300 $\pm$ 30*	10.0%	300 $\pm$ 50*	10.0%	300 $\pm$ -40*	10.0%	400 $\pm$ -30	13.3%
55	400 $\pm$ 40	13.3%	300 $\pm$ 40*	10.0%	300 $\pm$ -40*	10.0%	300 $\pm$ -30	10.0%
58**	300 $\pm$ 30*	10.0%	300 $\pm$ 40*	10.0%	300 $\pm$ -30*	10.0%	400 $\pm$ -30	13.3%
59	400 $\pm$ 30	13.3%	300 $\pm$ 40*	10.0%	300 $\pm$ -40*	10.0%	300 $\pm$ -30*	10.0%
60**	300 $\pm$ 30*	10.0%	300 $\pm$ 40*	10.0%	300 $\pm$ -30*	10.0%	400 $\pm$ -30	13.3%
61**	500 $\pm$ 40	16.7%	300 $\pm$ 40*	10.0%	400 $\pm$ -40	13.3%	600 $\pm$ -50	20.0%
62**	1200 $\pm$ 80	40.0%	500 $\pm$ 50	16.7%	400 $\pm$ -40	13.3%	Lost	Lost
63***	800 $\pm$ 60	26.7%	300 $\pm$ 40*	10.0%	300 $\pm$ -40*	10.0%	300 $\pm$ -30*	10.0%
65	300 $\pm$ 30*	10.0%	300 $\pm$ 40*	10.0%	300 $\pm$ -40*	10.0%	300 $\pm$ -30*	10.0%
Deployed	1-19-12		4-18-12		8-17-12		10-18-13	
Collected	4-18-12		8-17-12		10-18-12		1-25-13	

* Result is less than MDC

** Location specified in WCS LLRW REMP, not in RML No. R04100.

*** Location not required by license, permit or application document.

Byproduct Radon IL = 3,000 pCi/m³



3.2 Fauna

A fauna sample (primary herbivore) is collected annually/semi-annually in the general site area and handled in accordance with procedure EV-7.1.18, *Wildlife Sampling*. The sample is shipped to an offsite NELAP accredited laboratory and the target organ is analyzed as specified in RML No. R05807 and RML No. R04100. Table 9 lists the fauna sampling requirements by license. WCS collected two rabbit samples in the month of November.

Table 9 : Fauna Sampling Requirements

Sample Type	Byproduct License	TSD License	LLRW License	LLRW REMP
Fauna	Annual (Rabbit)	Not Applicable (N/A)	Annual (Dove)	Semiannual (Dove)

Table 10 displays the 2012 fauna results greater than the MDC. All 2012 fauna results are included in the Appendix B. Summary statistics for key radionuclides in fauna are provide in Table 11.

Table 10 : Fauna Data Greater than the MDC, 2012

Sample #	Station	Collect Date	Parameter	Result	TPU	Units	MDC
12-FA-12-259	Rabbit 1	10/3/12	Actinium-228	1.30E-1	9.83E-2	pCi/g	1.03E-1
12-FA-12-259	Rabbit 1	10/3/12	BETA	1.32E+1	3.96E+0	pCi/g	3.75E+0
12-FA-12-259	Rabbit 1	10/3/12	Beryllium-7	1.12E+0	6.75E-1	pCi/g	7.11E-1
12-FA-12-259	Rabbit 1	10/3/12	Bismuth-214	7.72E-2	5.26E-2	pCi/g	5.76E-2
12-FA-12-259	Rabbit 1	10/3/12	Lead-214	9.53E-2	5.78E-2	pCi/g	5.00E-2
12-FA-12-259	Rabbit 1	10/3/12	Potassium-40	1.25E+1	1.33E+0	pCi/g	2.80E-1
12-FA-12-259	Rabbit 1	10/3/12	Radium-226	7.72E-2	5.26E-2	pCi/g	5.76E-2
12-FA-12-259	Rabbit 1	10/3/12	Radium-228	1.30E-1	9.83E-2	pCi/g	1.03E-1
12-FA-12-259	Rabbit 1	10/3/12	Thorium-228	3.61E-2	1.50E-2	pCi/g	1.39E-2
12-FA-12-259	Rabbit 1	10/3/12	Thorium-230	1.51E-2	1.05E-2	pCi/g	1.32E-2
12-FA-12-260	Rabbit 2	10/24/12	BETA	1.17E+1	3.56E+0	pCi/g	3.81E+0
12-FA-12-260	Rabbit 2	10/24/12	Potassium-40	1.09E+1	1.20E+0	pCi/g	2.98E-1
12-FA-12-260	Rabbit 2	10/24/12	Thorium-228	6.30E-2	1.92E-2	pCi/g	9.01E-3

TPU = Total Propagated Uncertainty (2σ)

Table 11 : Fauna Summary Statistics, 2012

Analyte	No. of Stations	Obs	Above MDC	Mean	Standard Deviation	Max	Min	Units	LL IL	LL ADL
Actinium-228g	2	2	1	6.69E-2	8.93E-2	1.30E-1	3.72E-3	pCi/g	3.31E-1	2.97E+0
Beryllium-7g	2	2	1	6.80E-1	6.22E-1	1.12E+0	2.40E-1	pCi/g	1.35E+0	1.21E+1
BETA	2	2	2	1.25E+1	1.06E+0	1.32E+1	1.17E+1	pCi/g	1.43E+1	1.29E+2
Bismuth-214g	2	2	1	7.12E-2	8.56E-3	7.72E-2	6.51E-2	pCi/g	1.01E-1	9.06E-1
Lead-214g	2	2	1	4.77E-2	6.74E-2	9.53E-2	0.00E+0	pCi/g	9.23E-1	1.32E+0
Potassium-40g	2	2	2	1.17E+1	1.13E+0	1.25E+1	1.09E+1	pCi/g	1.19E+1	5.53E+1
Radium-226g	2	2	1	7.12E-2	8.56E-3	7.72E-2	6.51E-2	pCi/g	N/A	N/A
Radium-228g	2	2	1	6.69E-2	8.93E-2	1.30E-1	3.72E-3	pCi/g	3.31E-1	9.43E-1
Thorium-228	2	2	2	4.96E-2	1.90E-2	6.30E-2	3.61E-2	pCi/g	1.83E-1	1.64E+0
Thorium-230	2	2	1	1.68E-2	2.33E-3	1.84E-2	1.51E-2	pCi/g	1.58E-1	1.42E+0

Notes: Obs = Number of Observations (data points)

MDC = Minimum Detectable Concentration.

PQL = Practical Quantitation Limit

BP IL = Byproduct Investigation Level.

S&P IL = Processing and Storage License Investigation Level.

LL IL = Low Level Radioactive Waste Investigation Level.

LL ADL = Low Level Radioactive Waste Analytical Decision Level.

Bold Analytes were detected in environmental media during the report period.

Bold Comparison Values are not "site-wide" values.

g added to a radionuclide name signifies a gamma spectroscopy result.

N/A = Not Applicable

pCi/g = picocuries per gram of material.

ug/kg = micrograms per kilogram.

mg/kg = milligrams per kilogram.

Please note that because table conventions remain consistent throughout this document, table footnotes for summary statistic tables are only provided once.

3.3 Soil

Soil samples are collected from the WCS Andrews County site from two different strata as follows:

- Core samples are collected from 0-6 inches below ground surface (bgs).
- Composite samples are collected from 0-2 inches bgs in a 1 meter square area.

Soil sample results are compared against their respective ILs to determine whether or not there is a change significant enough to warrant an investigation. Table 12 lists the soil sampling location requirements by license. Figure 4 displays the all of the soil sampling locations. Because these groups represent data sets from slightly different strata, each are described separately below.

Table 12 : Soil Sampling Location Requirements

Sample Type	Byproduct Stations	TSDF Stations	LLRW Stations
Soil (0-2) bgs	3, 6, 8, 9, 22, and 26*	8, 9, 12, 13, 15, 17, 20, and 26**	1, 4, 6, 7, 9, 11, 26, 27, 31, 50, 55, and 59**
Soil (0-6) bgs	N/A	N/A	1, 4, 6, 7, 9, 11, 26, 27, 31, 50, 54, 55, 58, 59, 60, 61, 62, 63, and 65***

* Required Quarterly

**Required Annually (may not be reported in this document)

***Radiological Sampling Required Quarterly, Non-Radiological Semi-Annually

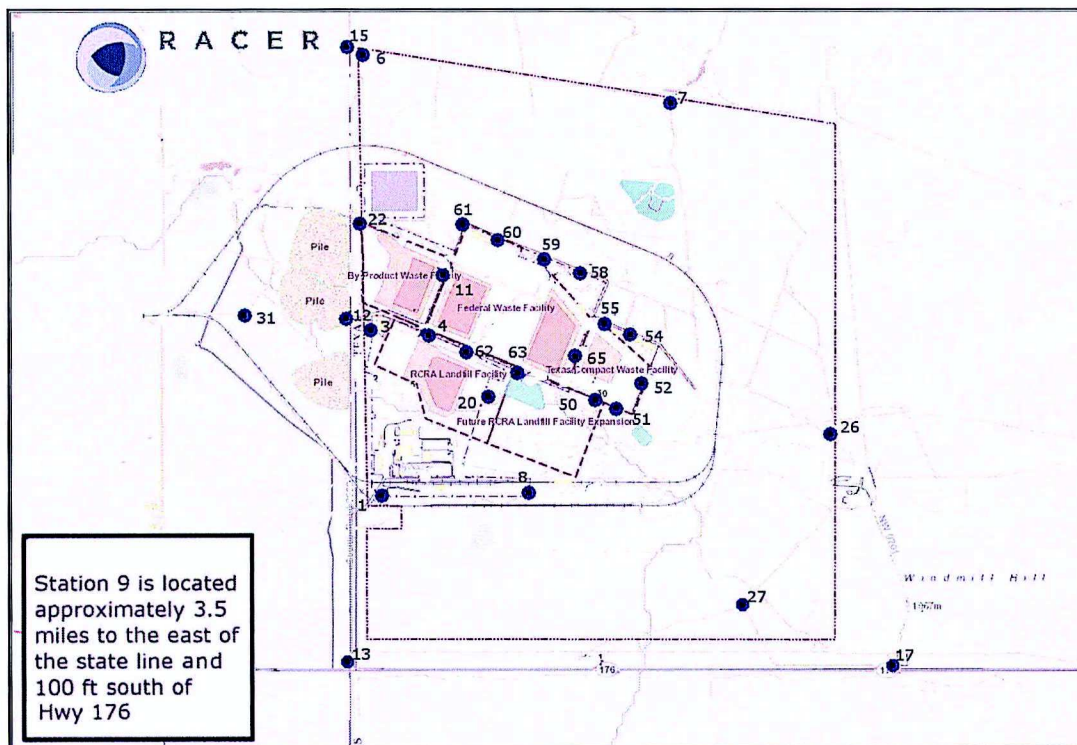


Figure 4 : Soil Sampling Locations

3.3.1 Results: Soil Samples From 0-2 Inches bgs Over a 1 Meter Square Area

Surface samples, to a depth of no more than 5 centimeters (cm), are collected from within two (2) 1 square meter (m²) areas located about 3 meters apart. Samples are collected from the center and corners of the grid and sieved through a screen to remove rocks and debris. Summary statistics for key radionuclides and for non-radioactive analytes that were detected in samples from the 0-2 inch bgs stratum are presented in Table 13. Figure 5 through Figure 24 graphically depict the 0-2 inch bgs stratum soil monitoring results for analytes of note. Complete soil sample results for the 0-2 inch bgs stratum are given in Appendix C. Soil samples collected during this reporting period are indistinguishable from background levels.

Table 13 : Soil (0-2") Summary Statistics, 2012

Analyte	No. of Stations	Obs	Above MDC or PQL	Mean	Standard Deviation	Max	Min	Units	BP IL	S&P IL	LL IL	LL ADL /LL AL
2-Butanone	6	12	4	2.97E+0	7.95E-1	3.62E+0	1.97E+0	ug/kg	N/A	N/A	N/A	N/A
Acetone	22	31	4	7.22E+0	1.72E+0	9.57E+0	5.87E+0	ug/kg	N/A	N/A	4.31E+1	4.31E+2
Actinium-228g	11	35	35	5.04E-1	1.46E-1	7.68E-1	1.87E-1	pCi/g	N/A	N/A	3.55E-1	3.19E+0
ALPHA	11	35	33	7.24E+0	2.99E+0	1.41E+1	1.57E+0	pCi/g	1.60E+1	1.80E+2	9.18E+0	8.23E+1
Antimony	6	12	5	5.72E+2	1.91E+2	7.72E+2	3.47E+2	ug/kg	N/A	N/A	N/A	N/A
Arsenic	22	31	31	3.22E+3	1.12E+3	5.48E+3	1.31E+3	ug/kg	N/A	N/A	7.98E+3	7.98E+3
Barium	6	12	12	1.05E+5	6.04E+4	1.93E+5	3.10E+4	ug/kg	N/A	N/A	2.06E+5	4.44E+5
Benzo(b)fluoranthene	6	12	1	1.80E+1	N/A	1.80E+1	1.80E+1	ug/kg	N/A	N/A	3.28E+1	3.28E+2
Beryllium	6	12	9	2.96E+2	1.56E+2	5.16E+2	1.18E+2	ug/kg	N/A	N/A	N/A	N/A
Beryllium-7g	11	35	21	2.10E-1	1.60E-1	5.40E-1	-5.30E-2	pCi/g	N/A	N/A	6.30E-1	5.65E+0
BETA	11	35	34	1.06E+1	4.30E+0	1.97E+1	3.41E+0	pCi/g	2.40E+1	1.60E+2	1.98E+1	1.77E+2
Bismuth-212g	11	35	17	3.01E-1	3.30E-1	8.10E-1	0.00E+0	pCi/g	N/A	N/A	1.11E+0	3.56E+0
Bismuth-214g	11	35	35	5.22E-1	1.79E-1	1.14E+0	2.47E-1	pCi/g	N/A	N/A	4.79E-1	4.30E+0
Cadmium	22	31	21	2.72E+2	5.44E+1	3.76E+2	1.73E+2	ug/kg	N/A	N/A	7.33E+2	1.51E+3
Cesium-137g	11	35	20	6.64E-2	9.87E-2	3.80E-1	-7.25E-3	pCi/g	N/A	4.80E-1	2.98E-2	2.55E-1
Chromium	6	12	12	5.26E+3	2.01E+3	8.13E+3	2.84E+3	ug/kg	N/A	N/A	9.00E+3	9.00E+4
Chrysene	6	12	1	2.27E+1	N/A	2.27E+1	2.27E+1	ug/kg	N/A	N/A	N/A	N/A
Cobalt	6	12	12	2.30E+3	1.16E+3	3.67E+3	7.24E+2	ug/kg	N/A	N/A	N/A	N/A
Fluoranthene	6	12	2	2.37E+1	1.34E+1	3.31E+1	1.42E+1	ug/kg	N/A	N/A	N/A	N/A
Lead	6	12	12	4.99E+3	2.30E+3	8.62E+3	2.03E+3	ug/kg	N/A	N/A	1.42E+4	1.42E+4
Lead-210	11	35	18	8.04E-1	4.24E-1	1.95E+0	-5.35E-2	pCi/g	4.20E+0	4.20E+0	1.19E+0	3.66E+0
Lead-210g	11	35	21	8.48E-1	8.76E-1	3.14E+0	-9.62E-1	pCi/g	N/A	N/A	N/A	N/A
Lead-212g	11	35	35	5.42E-1	1.56E-1	8.35E-1	2.28E-1	pCi/g	N/A	N/A	4.42E-1	3.97E+0
Lead-214g	11	35	35	6.43E-1	2.04E-1	1.35E+0	3.27E-1	pCi/g	N/A	N/A	4.68E-1	4.20E+0
Mercury	6	12	6	7.57E+0	3.97E+0	1.53E+1	4.00E+0	ug/kg	N/A	N/A	9.97E+0	9.97E+0
Methylene chloride	6	12	2	2.95E+0	1.00E+0	3.66E+0	2.24E+0	ug/kg	N/A	N/A	N/A	N/A
Nickel	22	31	31	5.13E+3	1.77E+3	9.20E+3	1.59E+3	ug/kg	N/A	N/A	N/A	N/A
Phenanthrene	6	12	1	1.27E+1	N/A	1.27E+1	1.27E+1	ug/kg	N/A	N/A	N/A	N/A
Potassium-40g	11	35	35	7.17E+0	2.68E+0	1.22E+1	3.31E+0	pCi/g	N/A	N/A	9.96E+0	2.06E+1
Pyrene	6	12	1	2.81E+1	N/A	2.81E+1	2.81E+1	ug/kg	N/A	N/A	N/A	N/A
Radium-226g	11	35	35	5.22E-1	1.79E-1	1.14E+0	2.47E-1	pCi/g	9.00E-1	6.00E-1	5.27E-1	4.73E+0
Radium-228g	11	35	35	5.04E-1	1.46E-1	7.68E-1	1.87E-1	pCi/g	9.00E-1	9.00E-1	3.55E-1	3.19E+0
Selenium	22	31	4	7.66E+2	6.35E+1	8.46E+2	6.91E+2	mg/kg	N/A	N/A	1.04E+4	1.04E+4
Silver	6	12	4	2.77E+3	2.88E+3	6.86E+3	2.58E+2	ug/kg	N/A	N/A	5.23E+2	5.23E+2
Thallium-208g	11	35	35	1.50E-1	4.04E-2	2.24E-1	6.52E-2	pCi/g	N/A	N/A	1.40E-1	1.25E+0
Thorium-228	11	35	29	4.64E-1	1.77E-1	7.82E-1	1.24E-1	pCi/g	1.10E+0	1.10E+0	8.01E-1	3.16E+0
Thorium-230	11	35	31	5.29E-1	2.43E-1	1.34E+0	1.08E-1	pCi/g	7.80E-1	N/A	7.09E-1	6.37E+0
Thorium-230g	11	35	35	5.22E-1	1.79E-1	1.14E+0	2.47E-1	pCi/g	N/A	N/A	N/A	N/A
Thorium-232	11	35	32	4.47E-1	2.09E-1	9.06E-1	8.44E-2	pCi/g	1.00E+0	9.00E-1	7.05E-1	6.33E+0
Thorium-234g	11	35	18	4.98E-1	4.10E-1	1.46E+0	-9.40E-2	pCi/g	N/A	N/A	2.99E+0	2.68E+1
Toluene	22	31	1	4.31E-1	N/A	4.31E-1	4.31E-1	ug/kg	N/A	N/A	1.27E+0	1.27E+1
Tritium	11	17	1	3.53E-1	1.63E-1	6.29E-1	5.78E-2	pCi/g	N/A	4.00E+0	9.36E-1	8.40E+0
Uranium-233/234	11	35	33	3.83E-1	1.93E-1	1.11E+0	8.54E-2	pCi/g	1.00E+0	1.00E+0	5.56E-1	4.99E+0
Uranium-235/236	11	35	6	2.10E-2	2.25E-2	6.90E-2	-2.41E-2	pCi/g	2.00E-1	2.00E-1	9.36E-2	8.40E-1
Uranium-235g	11	35	8	4.99E-2	4.98E-2	1.71E-1	-6.84E-2	pCi/g	N/A	N/A	2.11E-1	1.89E+0
Uranium-238	11	35	34	4.21E-1	1.87E-1	9.26E-1	1.46E-1	pCi/g	1.70E+0	1.40E+0	5.26E-1	4.72E+0
Uranium-238g	11	35	18	4.98E-1	4.10E-1	1.46E+0	-9.40E-2	pCi/g	N/A	N/A	N/A	N/A
Zinc	6	12	12	1.68E+4	8.19E+3	3.12E+4	4.70E+3	ug/kg	N/A	N/A	N/A	N/A

Radionuclide concentrations, with the exception of americium-241 at station 22, also appear to be consistent with background. The americium-241 detection appears to be a false positive. Americium-241 was not detected in any of the following samples collected at station 22. Results for station 26 were greater than the most conservative LLRW ADL (0.2547 pCi/g) for cesium-137 with a maximum value of 0.38 pCi/g. However, the maximum value for cesium-137 was still well below the station specific LLRW ADL for Cesium-137 (5.915 pCi/g) as indicated in Figure 8.

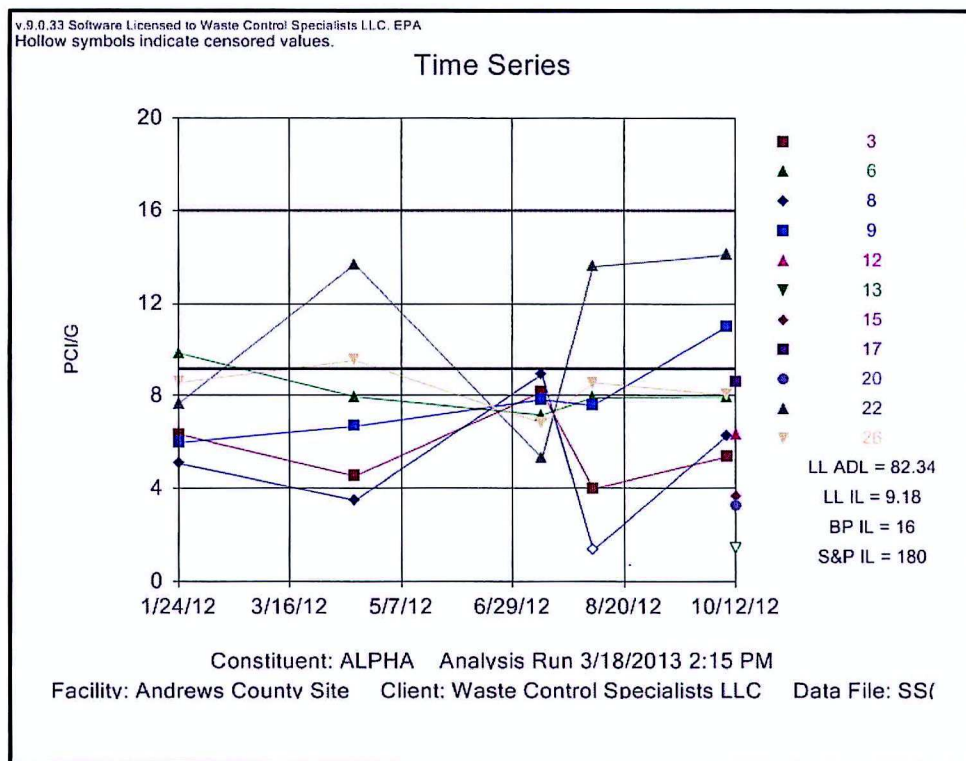


Figure 5 : Gross Alpha Activity Concentration in Soil (0-2 inches bgs [""])

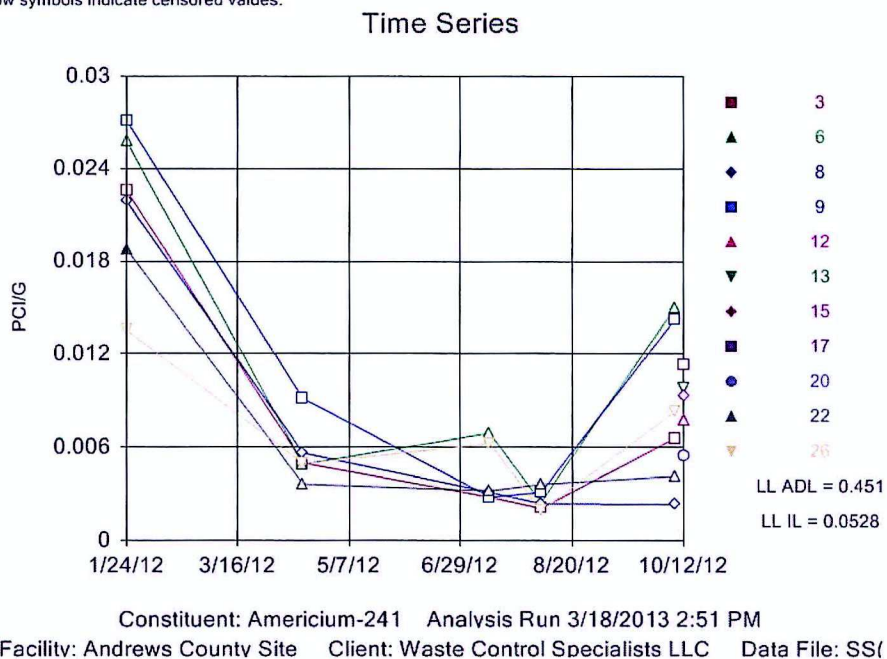


Figure 6 : Americium-241 Activity Concentration in Soil (0-2")

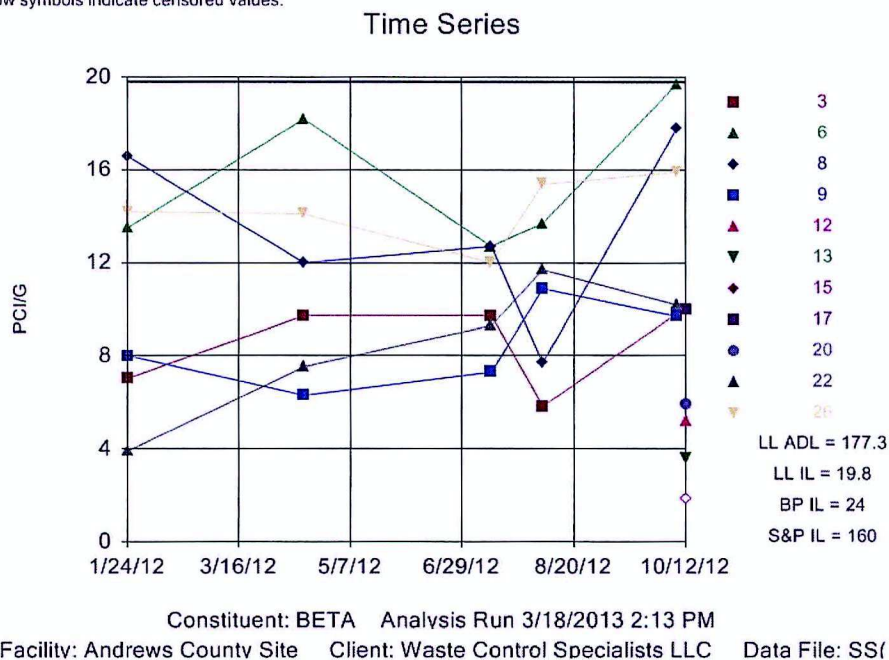


Figure 7 : Gross Beta Activity Concentration in Soil (0-2")

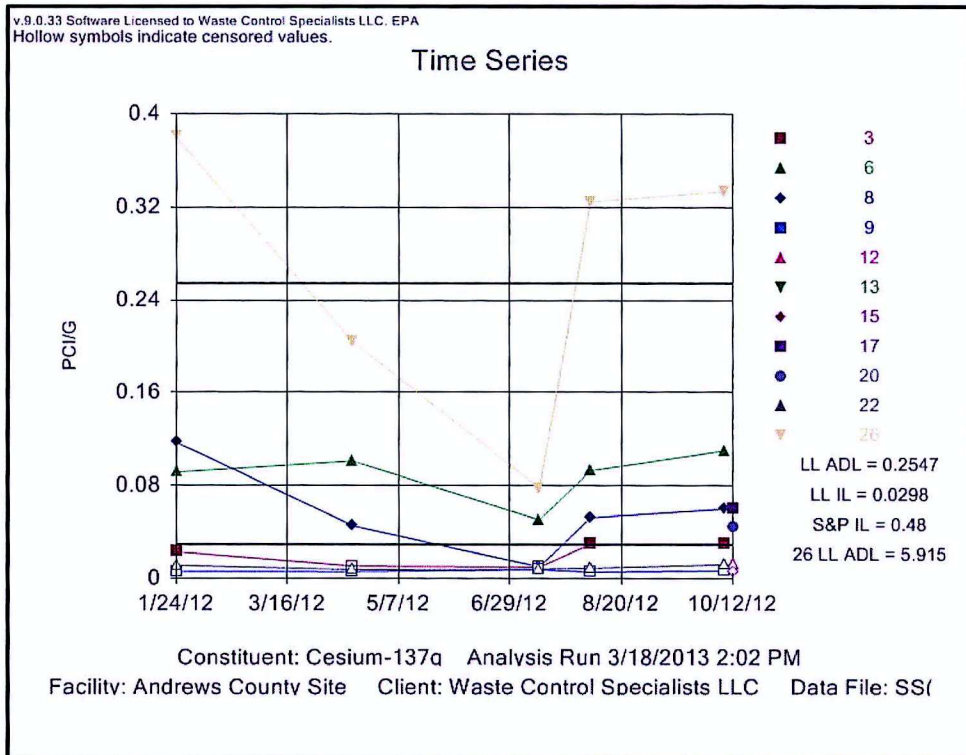


Figure 8 : Cesium-137 Activity Concentration in Soil (0-2")

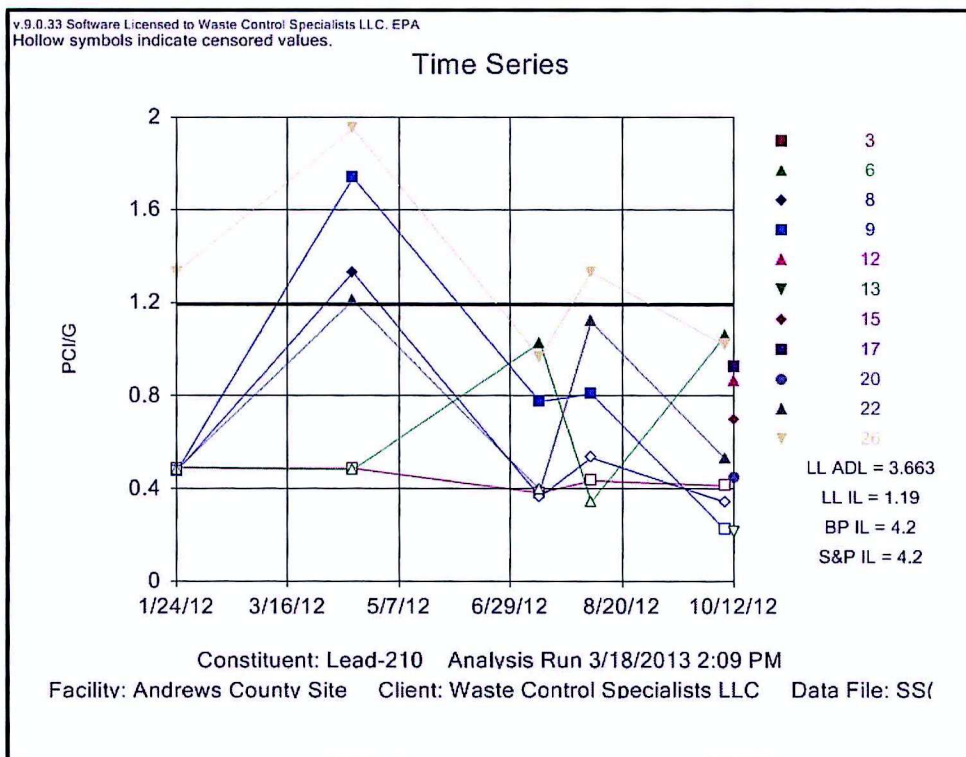


Figure 9 : Lead-210 Activity Concentration in Soil (0-2")

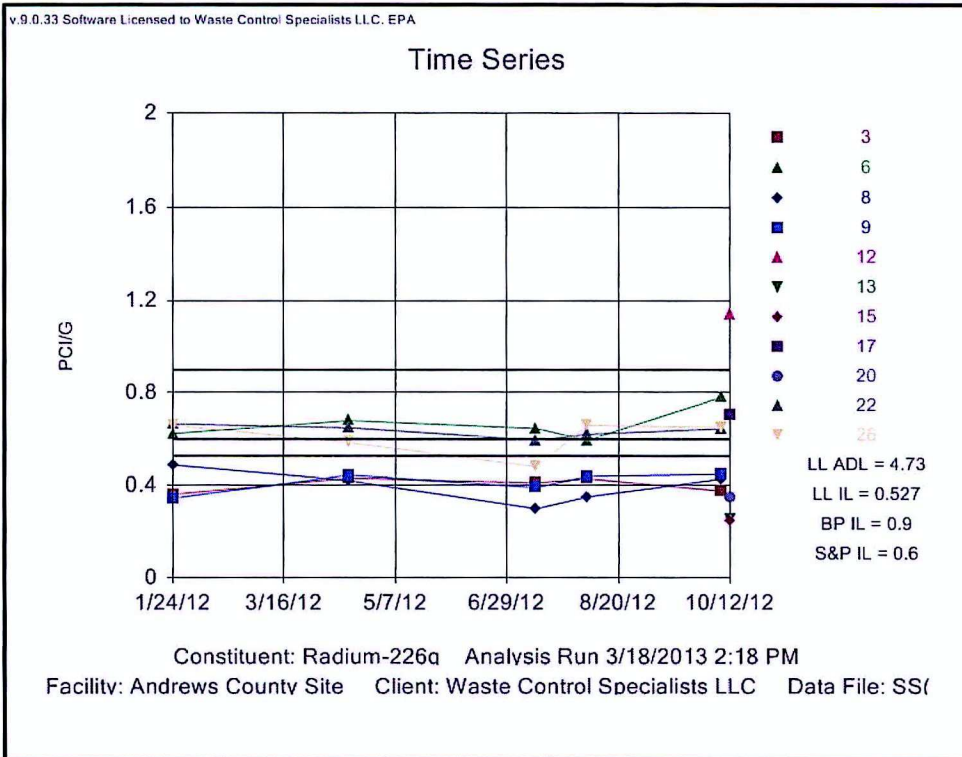


Figure 10 : Radium-226 Activity Concentration in Soil (0-2")

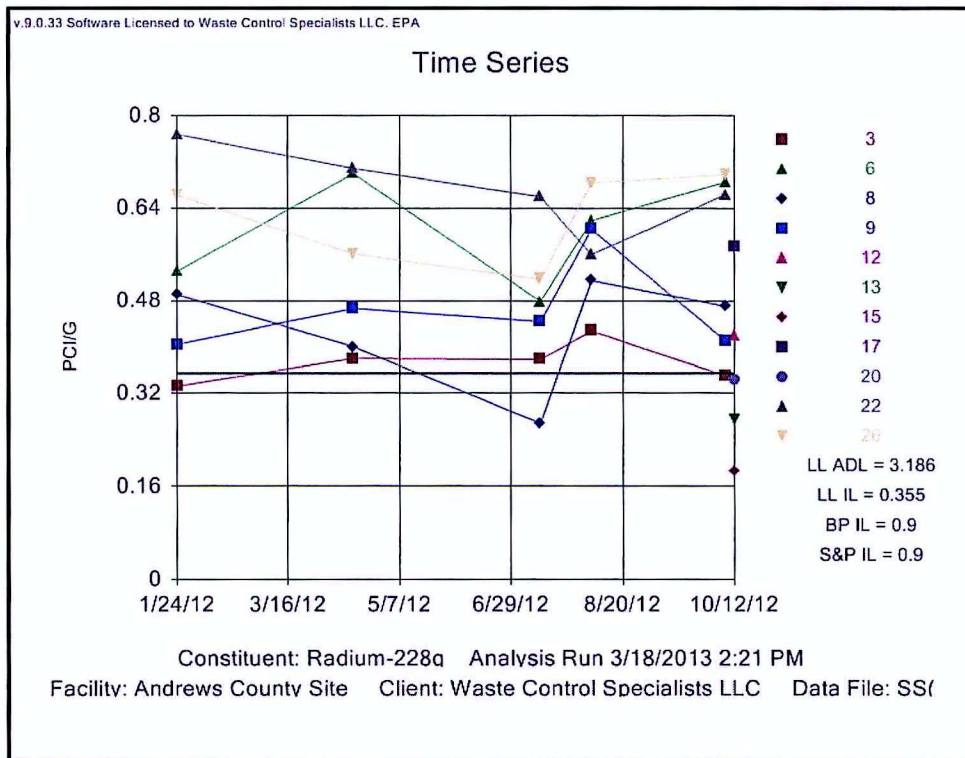


Figure 11 : Radium-228 Activity Concentration in Soil (0-2")

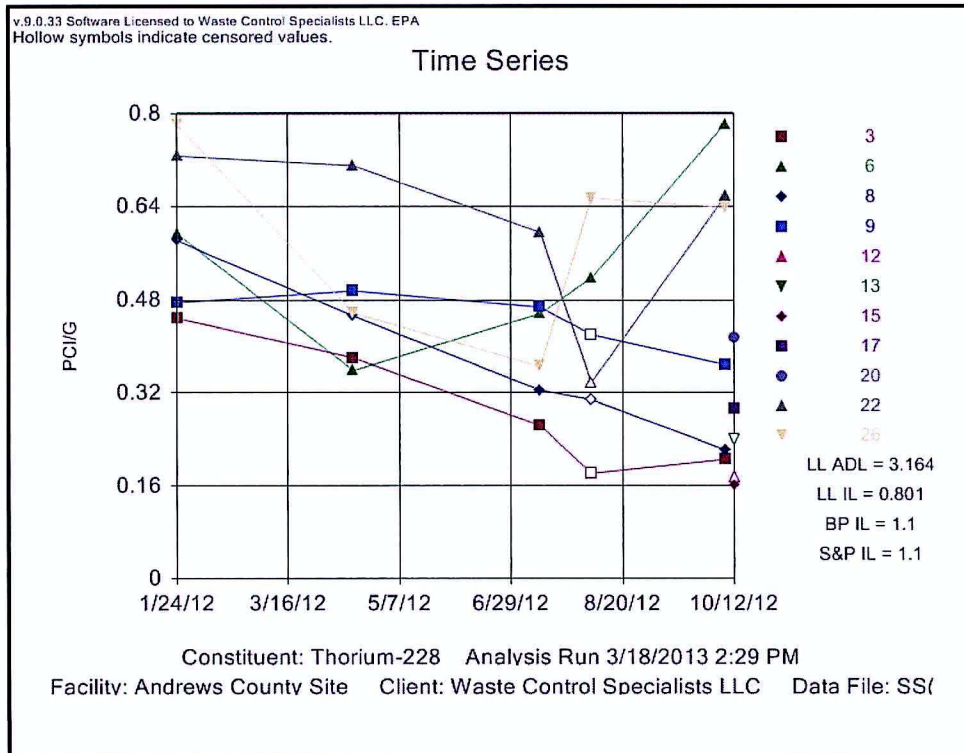


Figure 12 : Thorium-228 Activity Concentration in Soil (0-2")

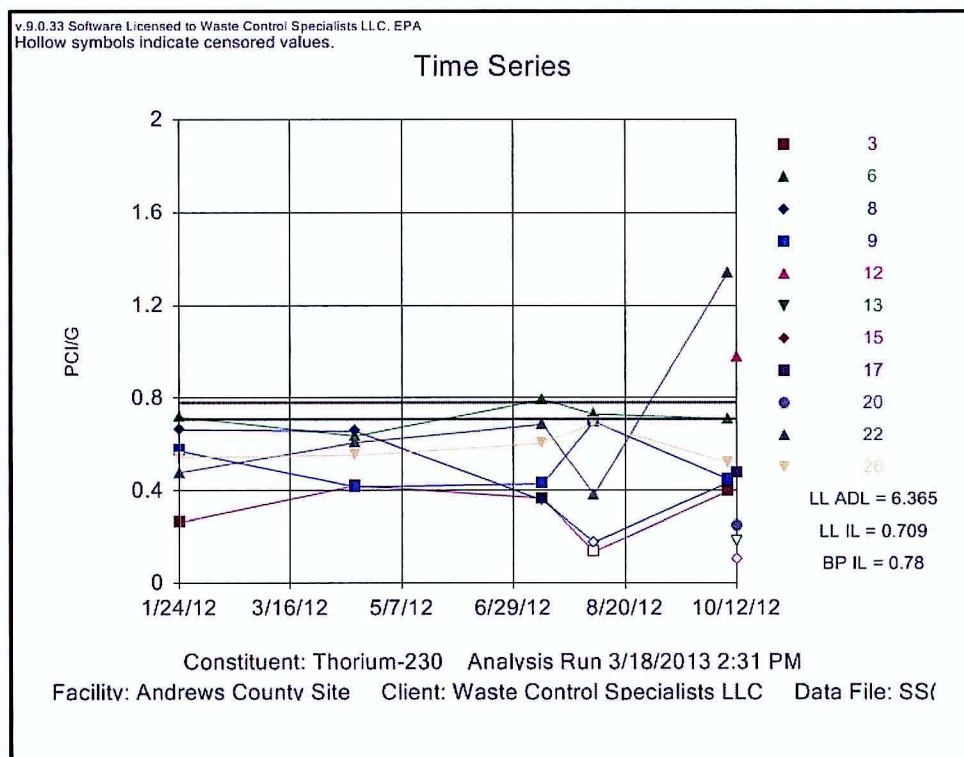


Figure 13 : Thorium-230 Activity Concentration in Soil (0-2")

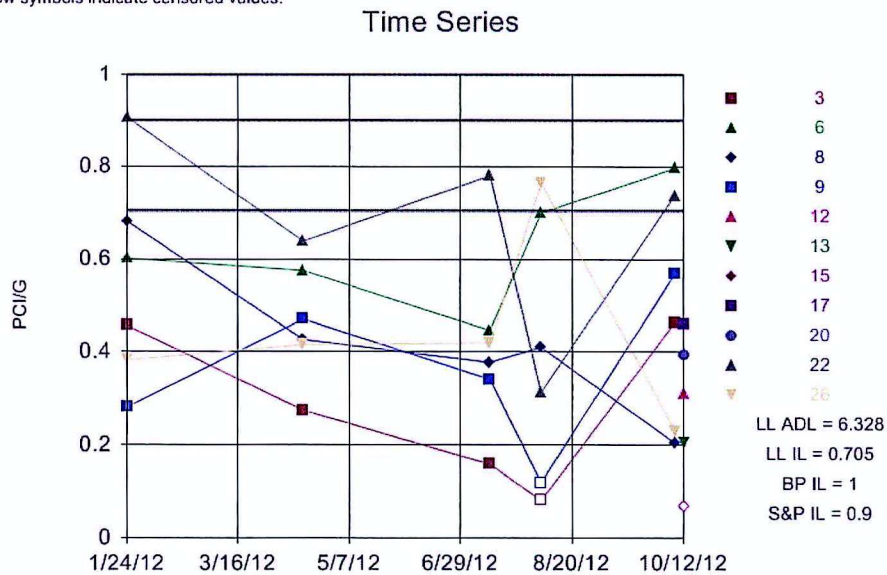


Figure 14 : Thorium-232 Activity Concentration in Soil (0-2")

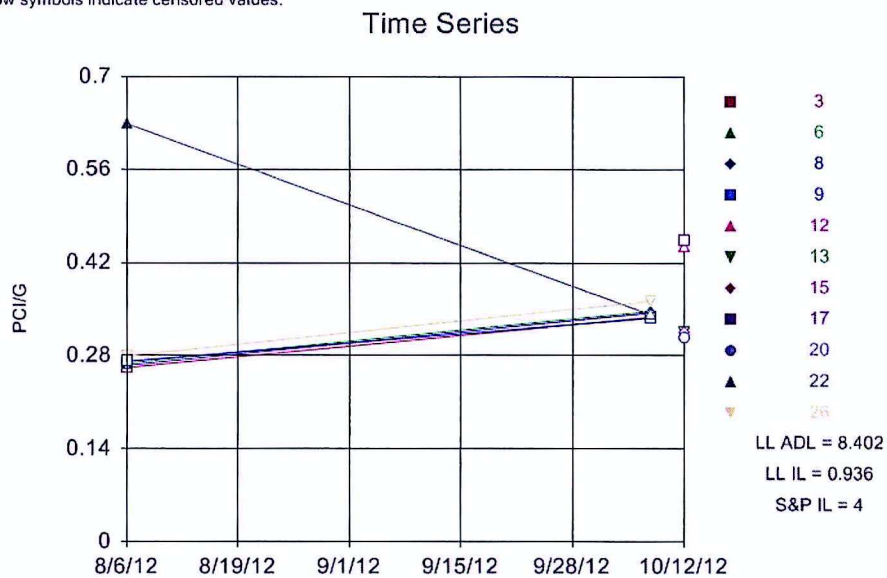


Figure 15 : Tritium Activity Concentration in Soil (0-2")

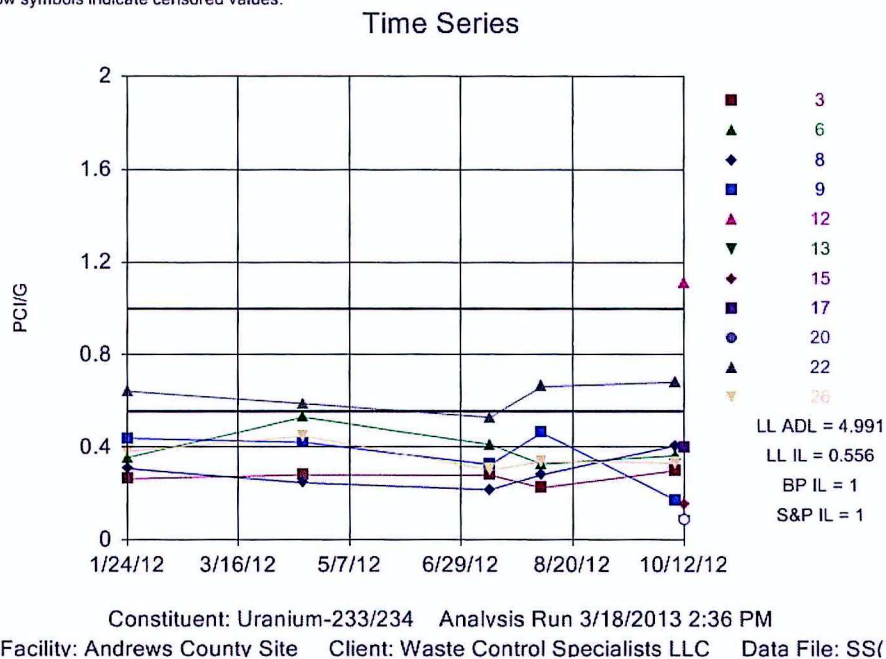


Figure 16 : Uranium-233/234 Activity Concentration in Soil (0-2")

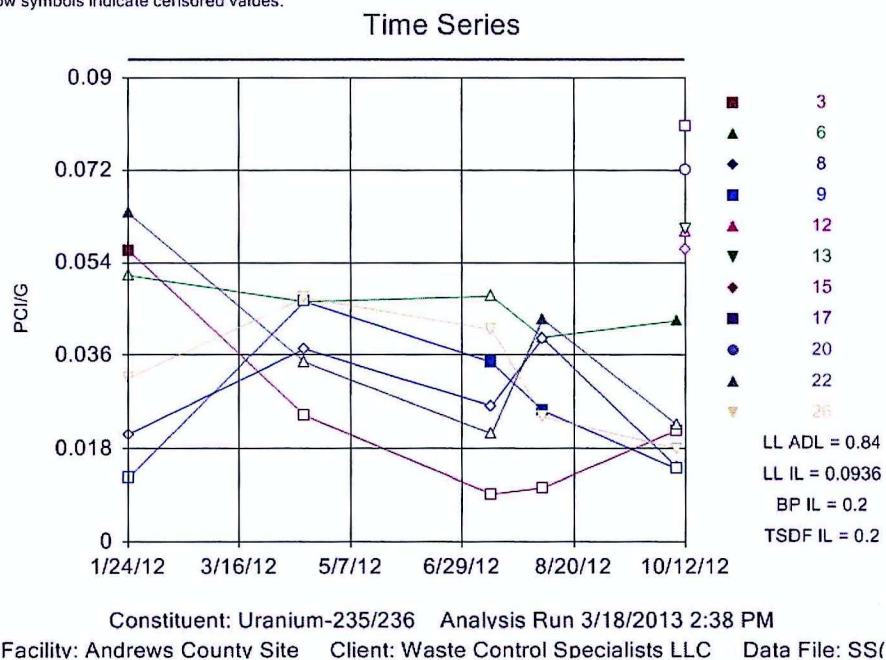


Figure 17 : Uranium-235/236 Activity Concentration in Soil (0-2")

v.9.0.33 Software Licensed to Waste Control Specialists LLC, EPA
Hollow symbols indicate censored values.

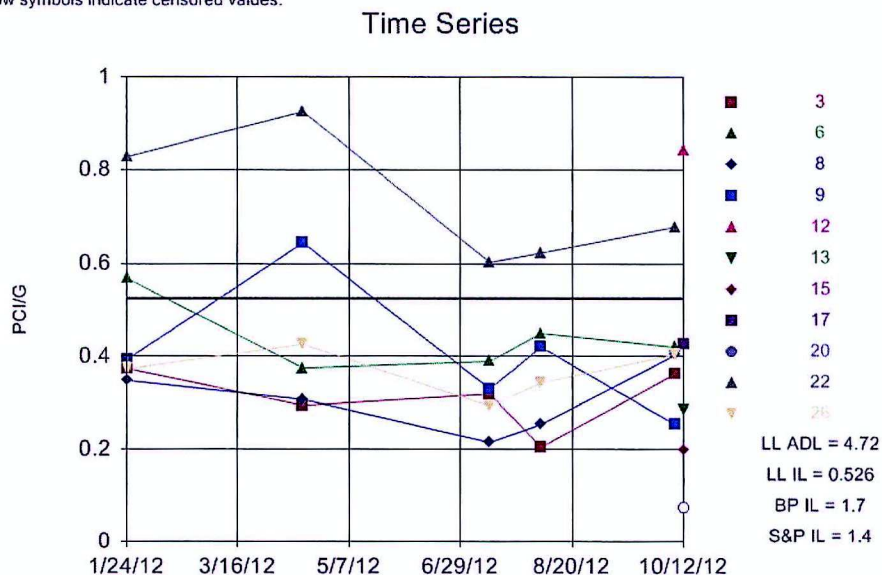


Figure 18 : Uranium-238 Activity Concentration in Soil (0-2")

v.9.2.17 Software Licensed to Waste Control Specialists LLC, EPA
Hollow symbols indicate censored values.

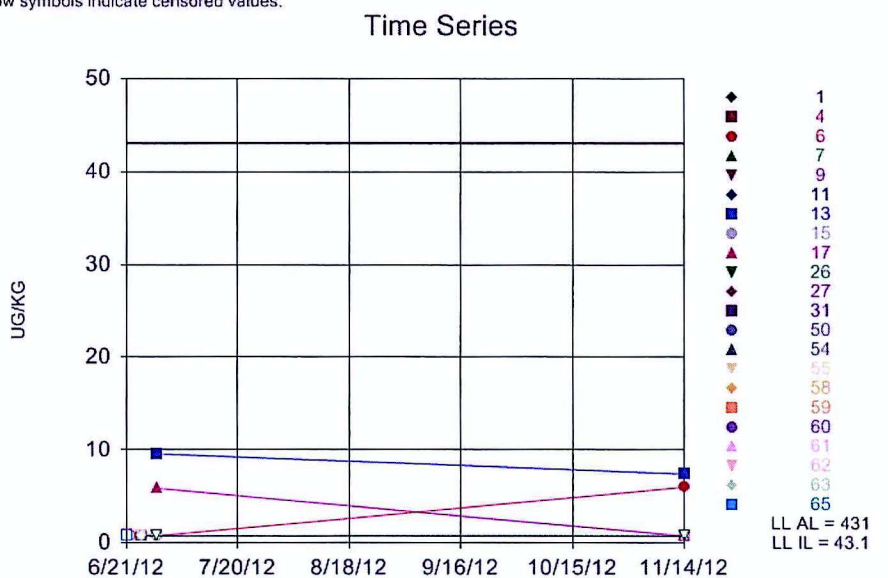


Figure 19 : Acetone Concentration in Soil (0-2")

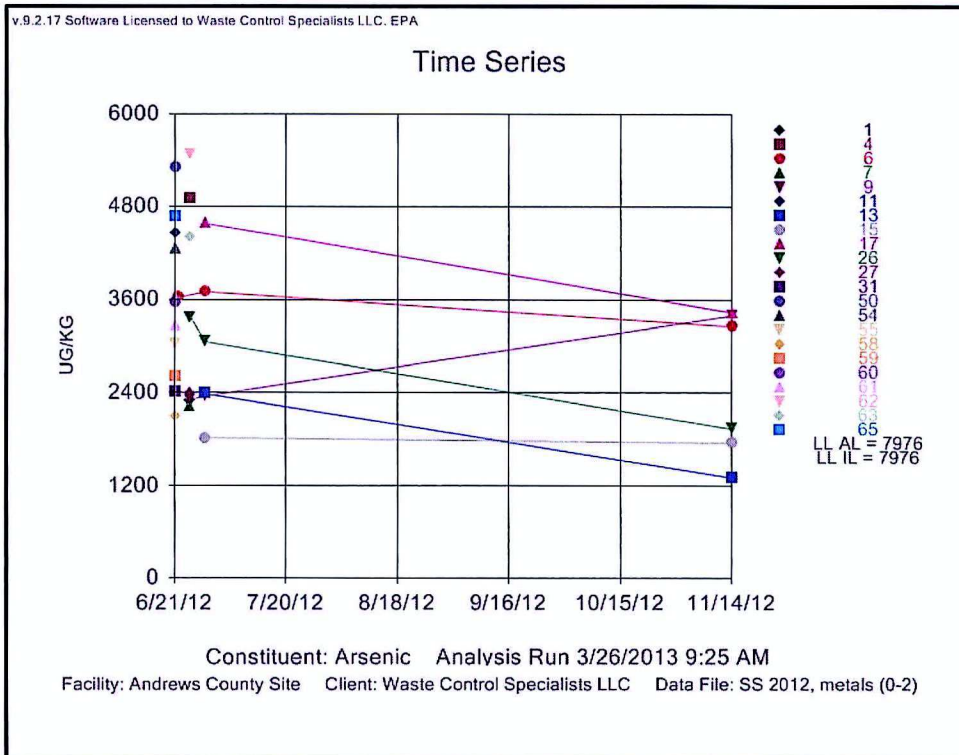


Figure 20 : Arsenic Concentration in Soil (0-2")

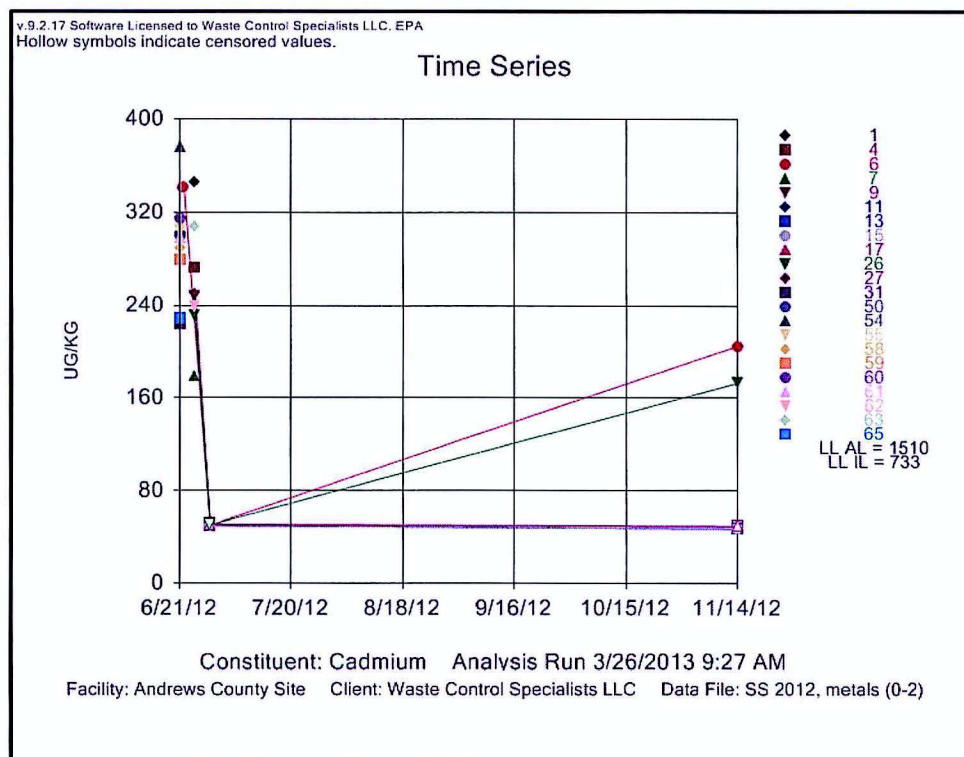


Figure 21 : Cadmium Concentration in Soil (0-2")

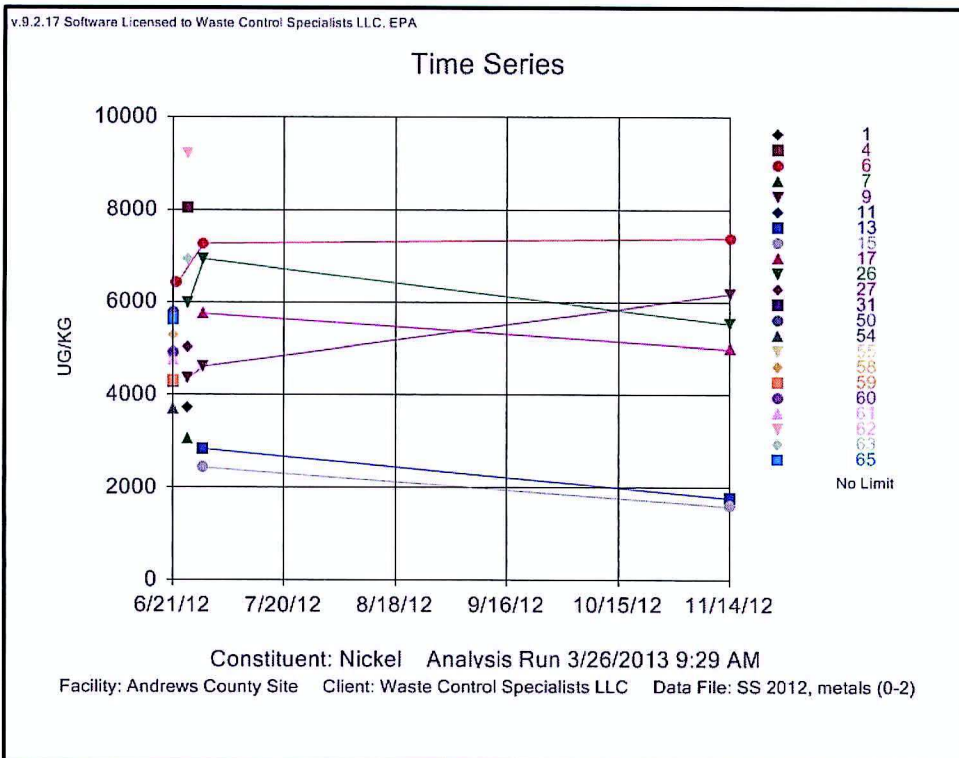


Figure 22 : Nickel Concentration in Soil (0-2")

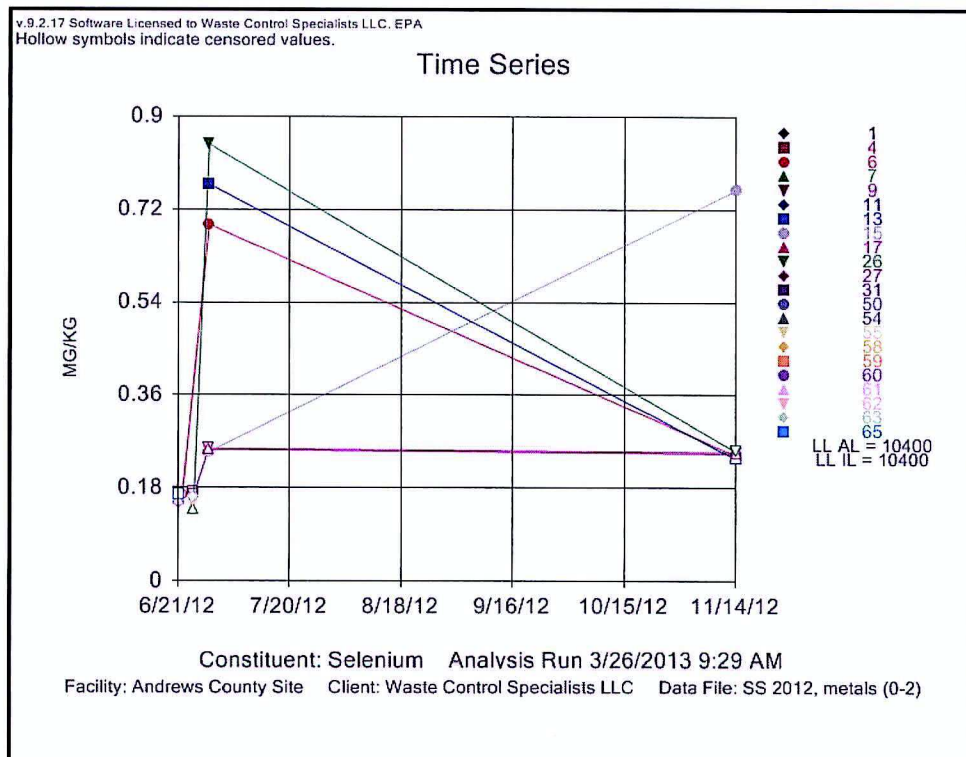


Figure 23 : Selenium Concentration in Soil (0-2")

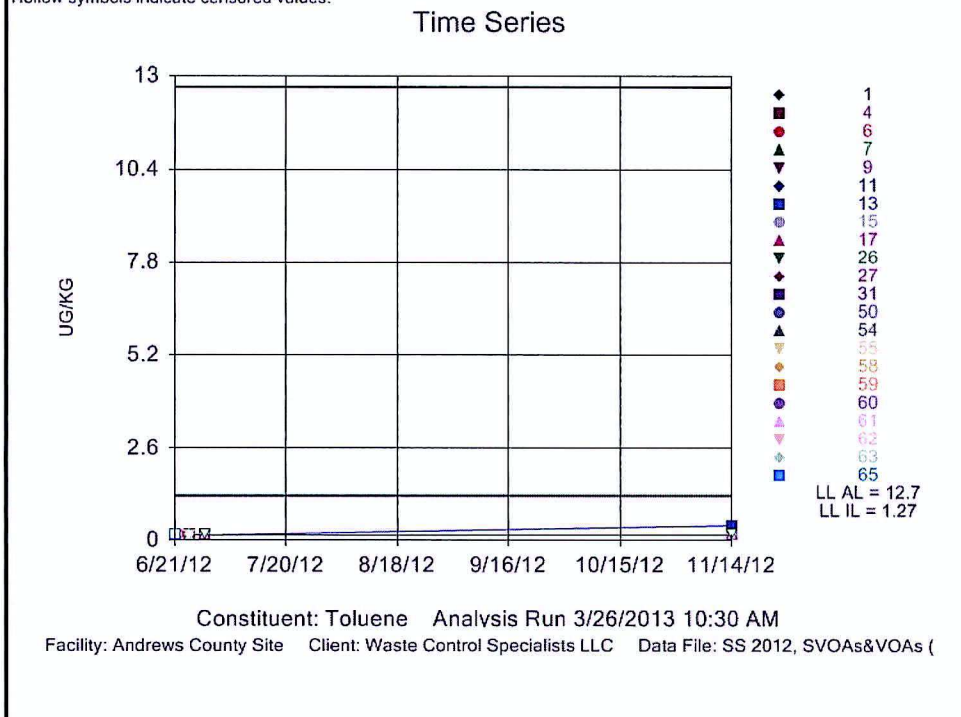


Figure 24 : Toluene Concentration in Soil (0-2")

3.3.2 Results: Soil Samples From 0-6 Inches bgs

Summary statistics for analytes of note in the 0-6 inch bgs stratum are presented in Table 14. Figure 25 through Figure 29 graphically depict the soil results for analytes of note in the 0-6 inch bgs stratum. Complete soil sample results for the 0-6 inch bgs stratum are given in Appendix C. Soil sample results that exceeded their corresponding ILs are discussed in more detail in Section 4, Investigations.

Table 14 : Soil (0-6") Summary Statistics (pCi/g), 2012

Analyte	No. of Stations	Obs	Above MDC	Mean	Standard Deviation	Max	Min	LL IL	LL ADL
Actinium-228g	19	76	76	5.36E-1	2.21E-1	1.32E+0	1.86E-1	5.92E-1	2.90E+0
ALPHA	19	76	75	8.39E+0	3.20E+0	1.58E+1	2.19E+0	8.16E+0	7.32E+1
Beryllium-7g	19	76	1	3.96E-2	6.31E-2	2.12E-1	-1.15E-1	2.35E-1	2.11E+0
BETA	19	76	76	1.17E+1	4.48E+0	2.37E+1	4.17E+0	1.46E+1	1.31E+2
Bismuth-212g	19	76	44	3.73E-1	3.75E-1	1.36E+0	0.00E+0	1.05E+0	3.49E+0
Bismuth-214g	19	76	76	6.57E-1	1.35E-1	8.85E-1	3.27E-1	7.21E-1	3.06E+0
Cesium-137g	19	76	49	4.91E-2	5.53E-2	2.17E-1	-1.07E-2	1.20E-1	1.02E+0
Lead-210g	19	76	26	6.95E-1	8.41E-1	3.19E+0	-2.37E+0	N/A	N/A
Lead-212g	19	76	76	5.74E-1	2.41E-1	1.45E+0	2.37E-1	6.24E-1	2.94E+0
Lead-214g	19	76	76	8.02E-1	1.71E-1	1.11E+0	3.22E-1	8.75E-1	3.26E+0
Potassium-40g	19	76	76	7.39E+0	3.26E+0	1.32E+1	2.07E+0	1.32E+1	2.48E+1
Radium-226g	19	76	76	6.57E-1	1.35E-1	8.85E-1	3.27E-1	7.21E-1	3.06E+0
Radium-228g	19	76	76	5.36E-1	2.21E-1	1.32E+0	1.86E-1	5.92E-1	2.90E+0
Thallium-208g	19	76	76	1.59E-1	6.69E-2	3.84E-1	6.27E-2	1.72E-1	1.54E+0
Thorium-230g	19	57	57	6.58E-1	1.34E-1	8.85E-1	3.27E-1	N/A	N/A
Thorium-234g	19	76	47	6.35E-1	4.10E-1	1.75E+0	0.00E+0	1.49E+0	1.34E+1
Uranium-235g	19	76	17	5.58E-2	5.04E-2	2.02E-1	-3.97E-2	1.68E-1	1.51E+0
Uranium-238g	19	76	47	6.35E-1	4.10E-1	1.75E+0	0.00E+0	N/A	N/A
Zinc-65g	19	76	1	1.21E-3	1.72E-2	3.45E-2	-4.31E-2	4.79E-2	4.10E-1

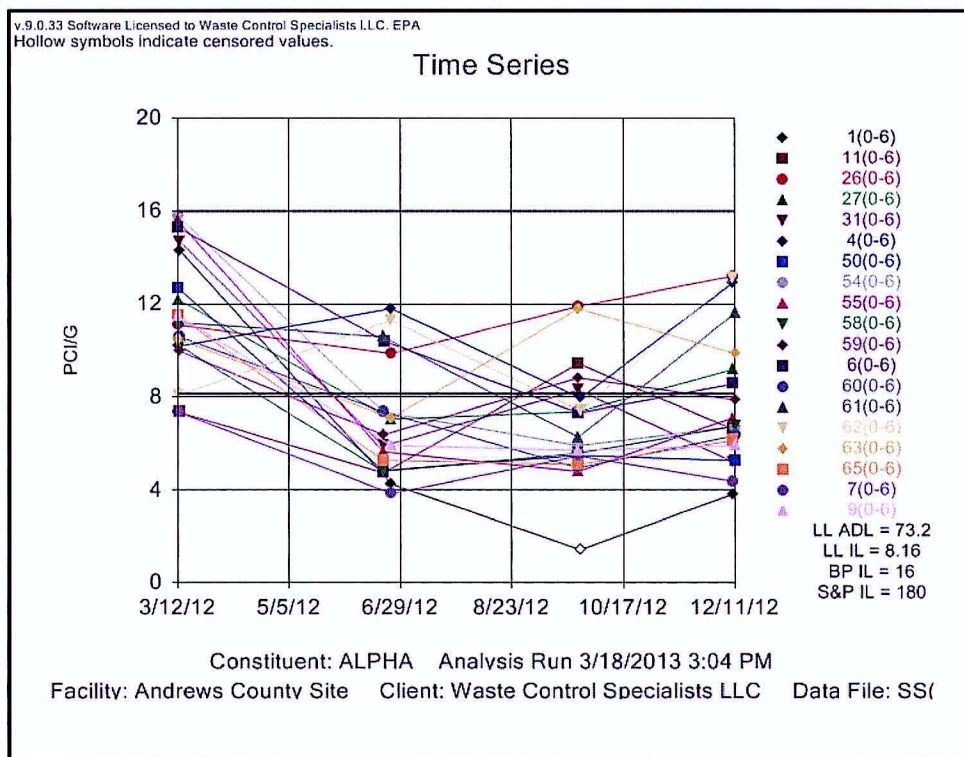


Figure 25 : Gross Alpha Activity Concentration in Soil (0-6")

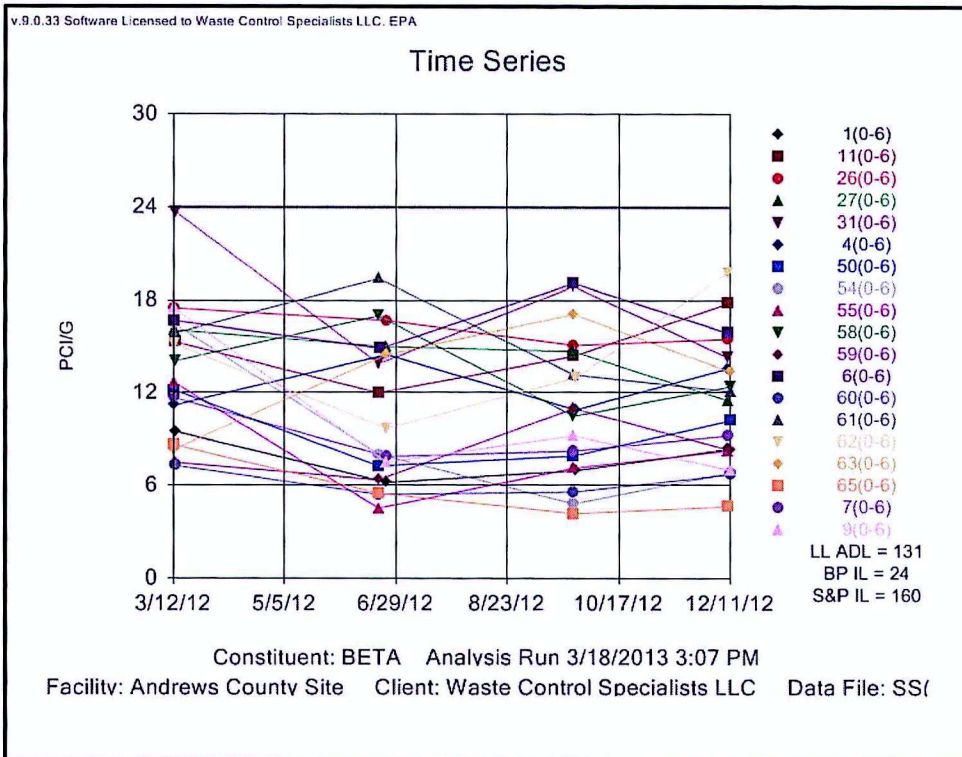


Figure 26 : Gross Beta Activity Concentration in Soil (0-6")

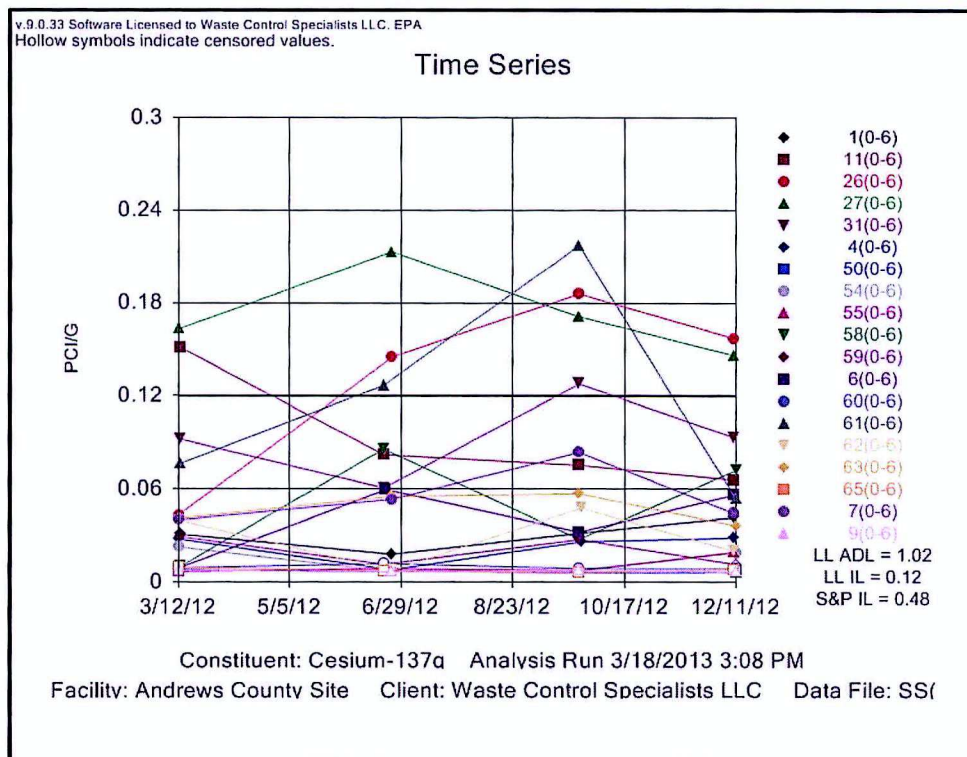


Figure 27 : Cesium-137 Activity Concentration in Soil (0-6")

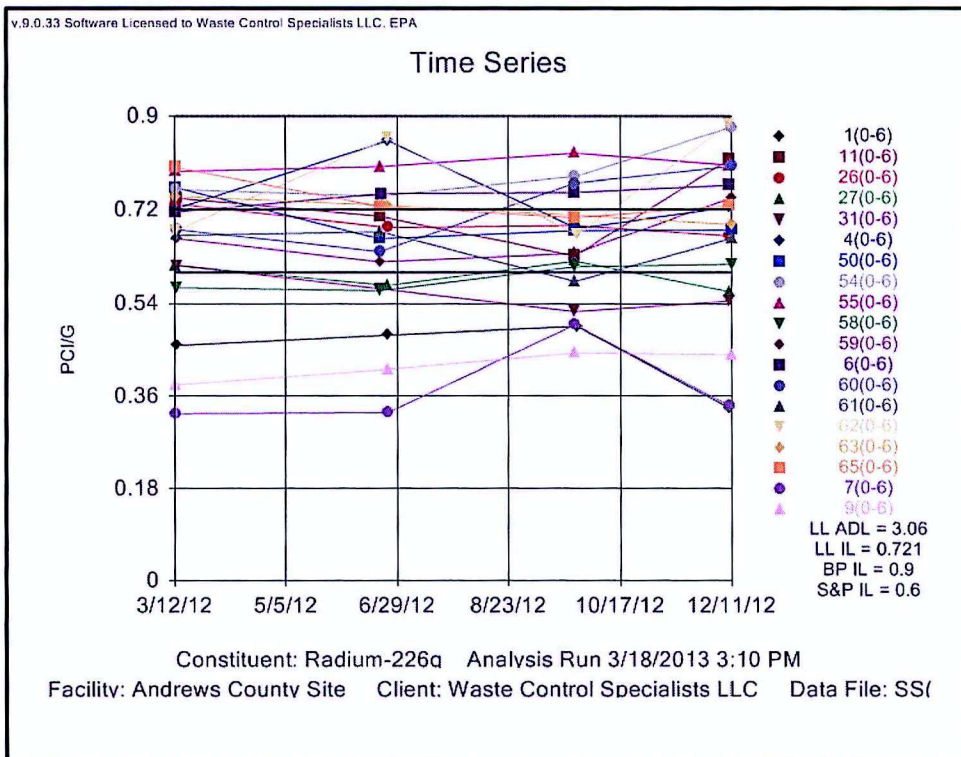


Figure 28 : Radium-226 Activity Concentration in Soil (0-6")

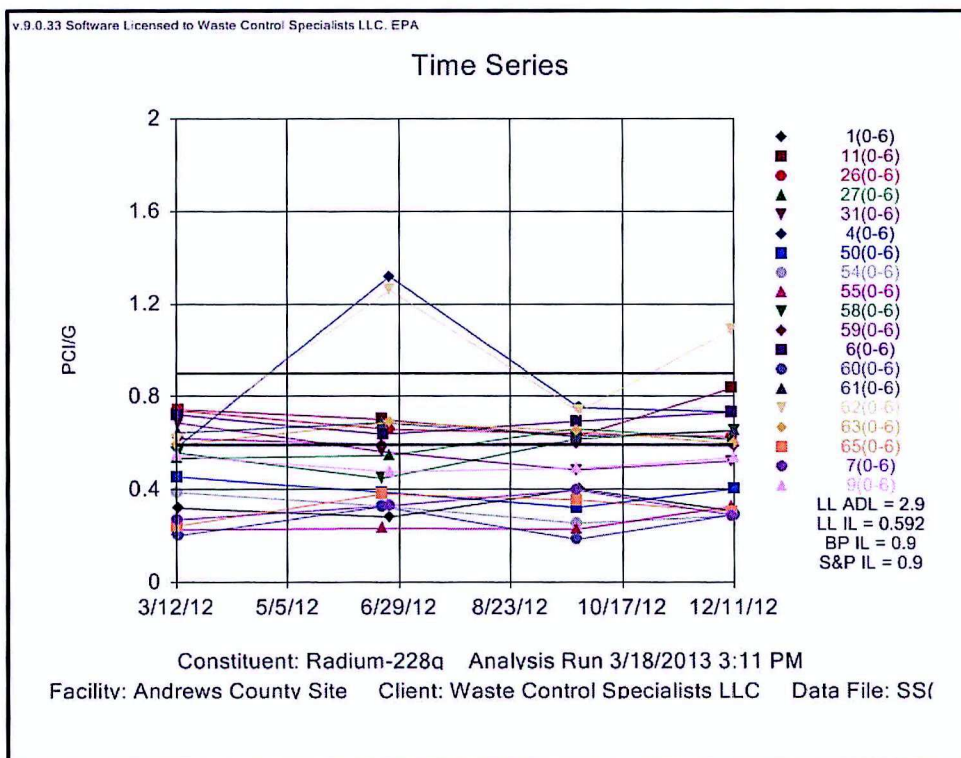


Figure 29 : Radium-228 Activity Concentration in Soil (0-6")

3.4 Sediment

Annual/quarterly sediment samples were collected from six stations in accordance with procedure EV-7.1.5, *Soil Sampling*. The samples are collected in an area prone to precipitation runoff and where runoff slows and begins to deposit sediment. Each sediment sample is taken from approximately the upper inch of newly deposited soil. Figure 30 displays the sediment sample locations and Table 15 lists the required sampling locations by license. Sample results are compared against their respective ILs to determine whether or not there is a change significant enough to warrant an investigation. Sediment sample results are summarized in Table 16. Complete sediment sample results are given in Appendix D. Sediment sample results that exceeded their corresponding ILs are discussed in more detail in Section 4, Investigations. Figure 31 through Figure 46 graphically depict results of sediment sampling for analytes of note.

Table 15 : Sediment Sampling Locations by Requirements

Sample Type	Byproduct Stations	TSDf Stations	LLRW Stations
Sediment	GW-2*	N/A	GW-1, GW-2, GW-3, GW-4, GW-5, GW-6**

* Annual Sampling Event (may not be reported in this document)

**Quarterly Sampling Event

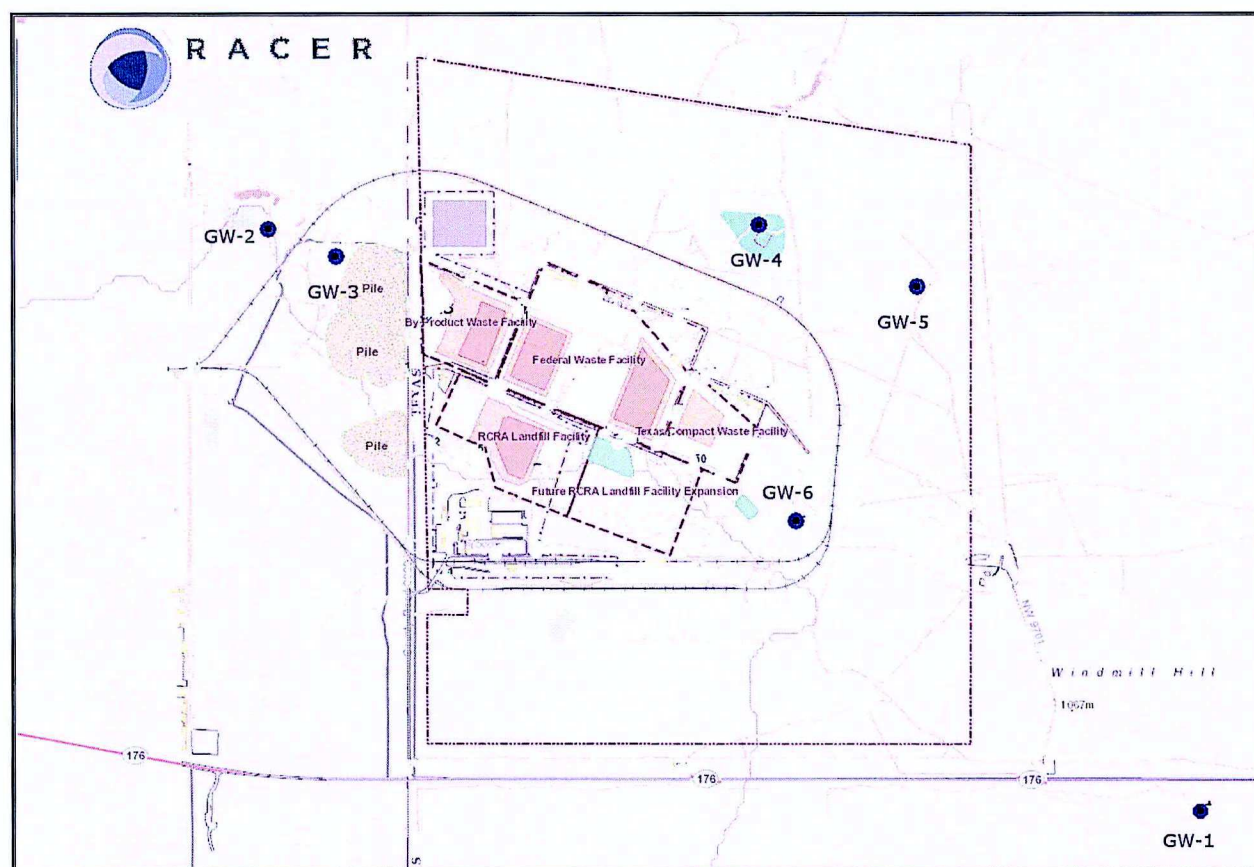


Figure 30 : Sediment Sampling Location

Table 16 : Sediment Summary Statistics (pCi/g), 2012

Analyte	No. of Station s	Obs	Greater Than MDC	Mean	Standard Deviation	Max	Min	BP IL	S&P IL	LL IL	LL ADL
Actinium-228g	6	24	24	1.19E+0	2.53E-1	1.71E+0	6.15E-1	N/A	N/A	1.53E+0	4.10E+0
ALPHA	6	24	24	2.02E+1	7.99E+0	4.51E+1	9.31E+0	1.60E+1	1.80E+2	3.23E+1	2.90E+2
Americium-241	6	17	0	4.43E-3	6.26E-3	1.63E-2	-1.17E-2	N/A	N/A	7.20E-2	6.15E-1
Beryllium-7g	6	24	23	4.54E-1	1.70E-1	6.77E-1	2.67E-2	N/A	N/A	8.26E-1	7.41E+0
BETA	6	24	24	3.03E+1	1.23E+1	7.20E+1	1.23E+1	2.40E+1	1.60E+2	4.15E+1	3.72E+2
Bismuth-212g	6	24	19	1.03E+0	5.72E-1	1.62E+0	0.00E+0	N/A	N/A	2.37E+0	5.17E+0
Bismuth-214g	6	24	24	1.11E+0	2.09E-1	1.46E+0	6.23E-1	N/A	N/A	1.61E+0	4.20E+0
Cesium-137g	6	24	23	3.52E-1	2.30E-1	8.10E-1	1.03E-2	N/A	4.80E-1	9.01E-1	7.70E+0
Lead-210	6	17	17	3.47E+0	1.83E+0	6.81E+0	1.25E+0	4.20E+0	4.20E+0	7.94E+0	1.23E+1
Lead-210g	6	24	15	2.61E+0	2.36E+0	8.12E+0	-1.60E+0	N/A	N/A	1.94E+1	2.21E+1
Lead-212g	6	24	24	1.30E+0	2.53E-1	1.85E+0	7.29E-1	N/A	N/A	1.81E+0	4.46E+0
Lead-214g	6	24	24	1.33E+0	2.22E-1	1.78E+0	8.55E-1	N/A	N/A	1.87E+0	4.53E+0
Plutonium-238	6	17	2	1.12E-2	2.76E-2	9.54E-2	-3.56E-2	N/A	N/A	1.88E-2	1.61E-1
Plutonium-239/240	6	17	3	2.04E-2	1.40E-2	5.33E-2	2.40E-3	N/A	N/A	1.81E-1	1.55E+0
Potassium-40g	6	24	24	1.70E+1	3.73E+0	2.33E+1	6.31E+0	N/A	N/A	2.60E+1	4.12E+1
Radium-226g	6	24	24	1.11E+0	2.09E-1	1.46E+0	6.23E-1	9.00E-1	6.00E-1	1.61E+0	4.20E+0
Radium-228g	6	24	24	1.19E+0	2.53E-1	1.71E+0	6.15E-1	9.00E-1	9.00E-1	1.53E+0	4.10E+0
Thallium-208g	6	24	24	3.69E-1	7.63E-2	5.57E-1	2.06E-1	N/A	N/A	5.40E-1	1.46E+0
Thorium-228	6	17	17	1.28E+0	3.35E-1	2.32E+0	9.04E-1	1.10E+0	1.10E+0	2.77E+0	5.69E+0
Thorium-230	6	17	17	1.36E+0	2.27E-1	1.78E+0	9.33E-1	7.80E-1	N/A	1.61E+0	1.45E+1
Thorium-230g	6	24	24	1.11E+0	2.09E-1	1.46E+0	6.23E-1	N/A	N/A	N/A	N/A
Thorium-232	6	17	17	1.23E+0	2.73E-1	1.79E+0	7.68E-1	1.00E+0	9.00E-1	2.20E+0	7.95E+0
Thorium-234g	6	24	15	8.31E-1	6.26E-1	2.90E+0	0.00E+0	N/A	N/A	2.14E+0	1.92E+1
Tritium	6	16	6	6.62E-1	8.99E-1	2.56E+0	-2.30E-1	N/A	4.00E+0	3.54E+0	3.18E+1
Uranium-233/234	6	17	17	6.72E-1	9.75E-2	8.67E-1	5.10E-1	1.00E+0	1.00E+0	1.12E+0	1.01E+1
Uranium-235/236	6	17	7	2.99E-2	1.64E-2	6.74E-2	0.00E+0	2.00E-1	2.00E-1	1.13E-1	1.01E+0
Uranium-235g	6	24	1	4.18E-2	4.70E-2	1.44E-1	-3.95E-2	N/A	N/A	1.67E-1	1.50E+0
Uranium-238	6	17	17	7.28E-1	8.61E-2	9.41E-1	6.22E-1	1.70E+0	1.40E+0	1.15E+0	1.03E+1
Uranium-238g	6	24	15	8.31E-1	6.26E-1	2.90E+0	0.00E+0	N/A	N/A	N/A	N/A

Radionuclide concentrations, with a few exceptions, also appear to be natural. The exceptions are the detection of americium-241, plutonium-238, and plutonium-239/240 which appear to be false positives. Results for station GW-2 exceeded the byproduct IL for radium-226, radium-228, thorium-228, thorium-230 and thorium-232 are discussed in more detail in the Section 4, Investigations of this report.

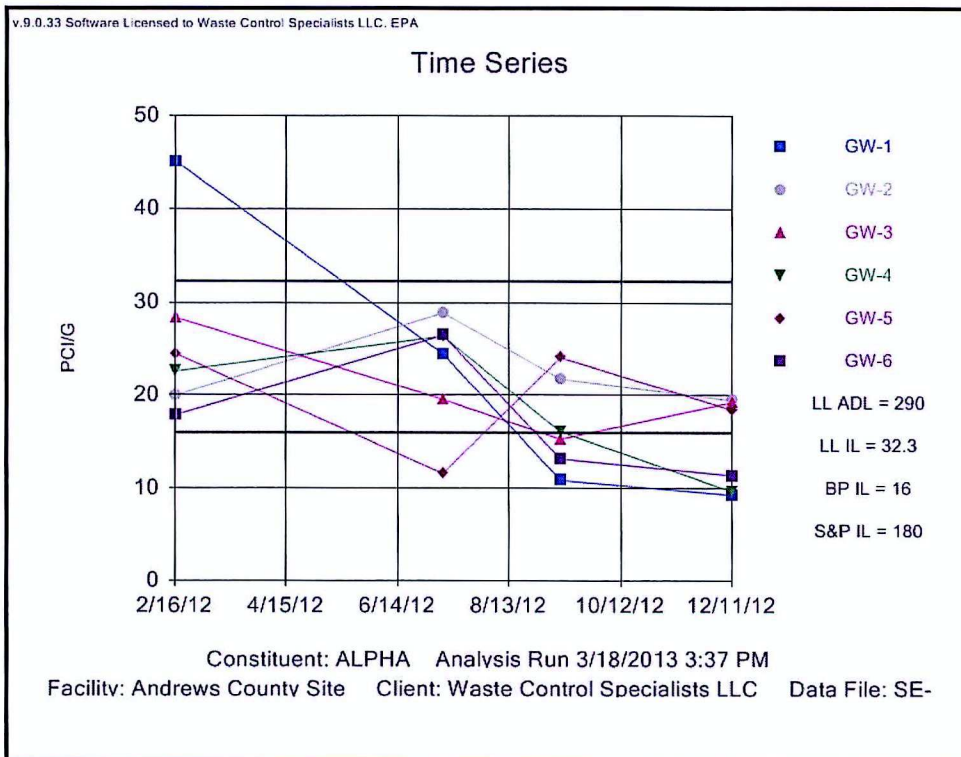


Figure 31 : Gross Alpha Activity Concentration in Sediment

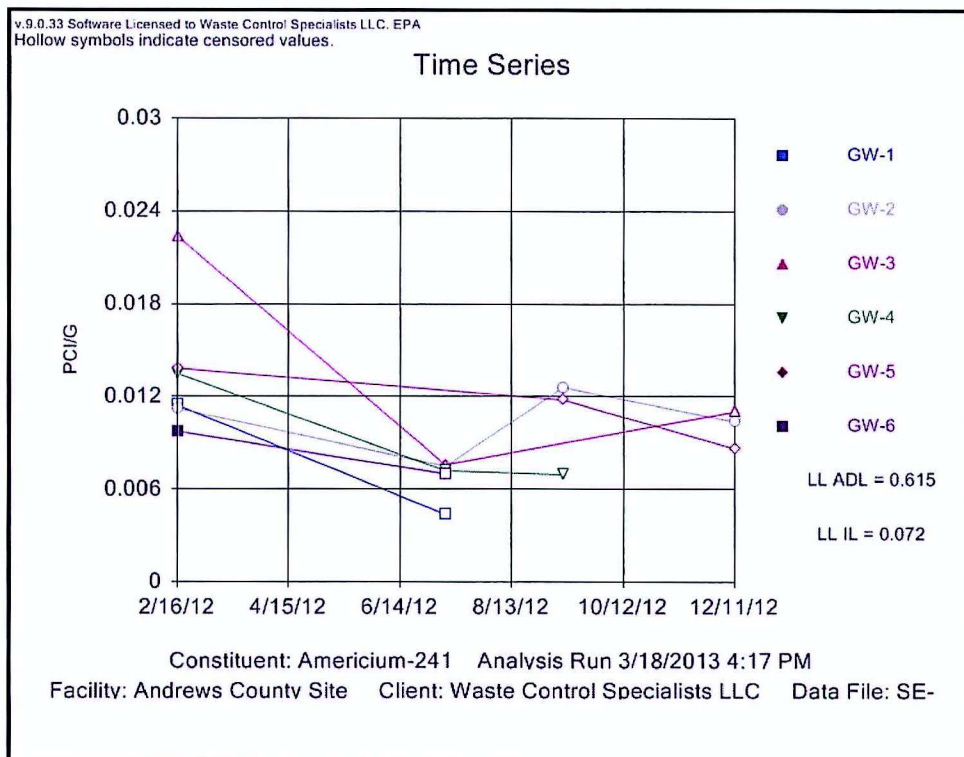


Figure 32 : Americium-241 Activity Concentration in Sediment

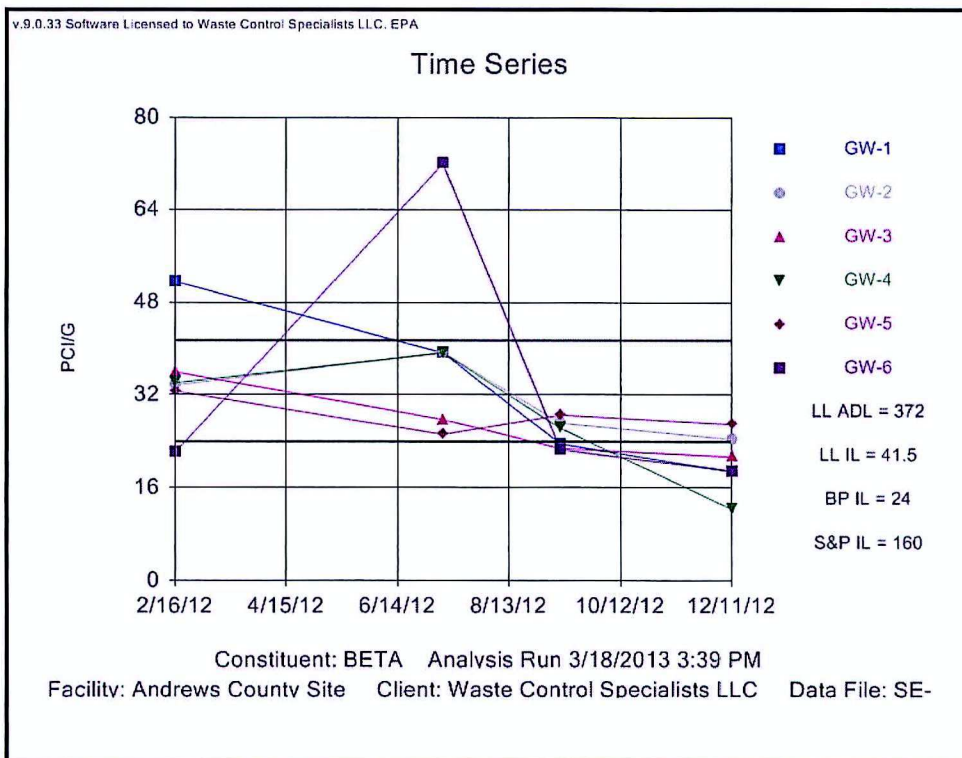


Figure 33 : Gross Beta Activity Concentration in Sediment

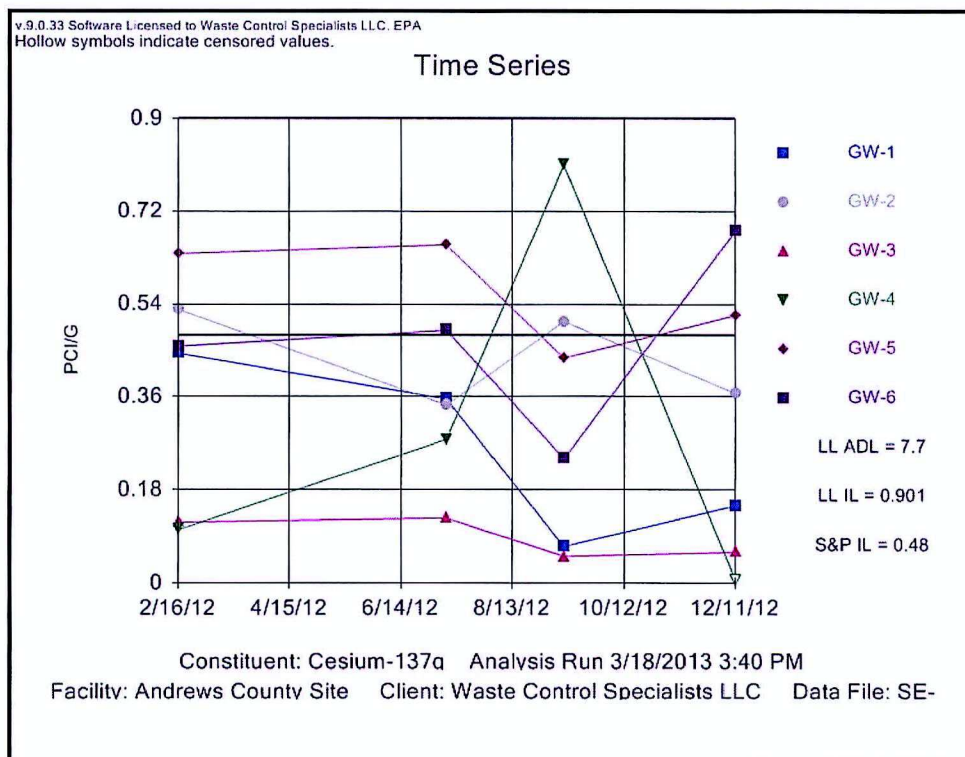


Figure 34 : Cesium-137 Activity Concentration in Sediment

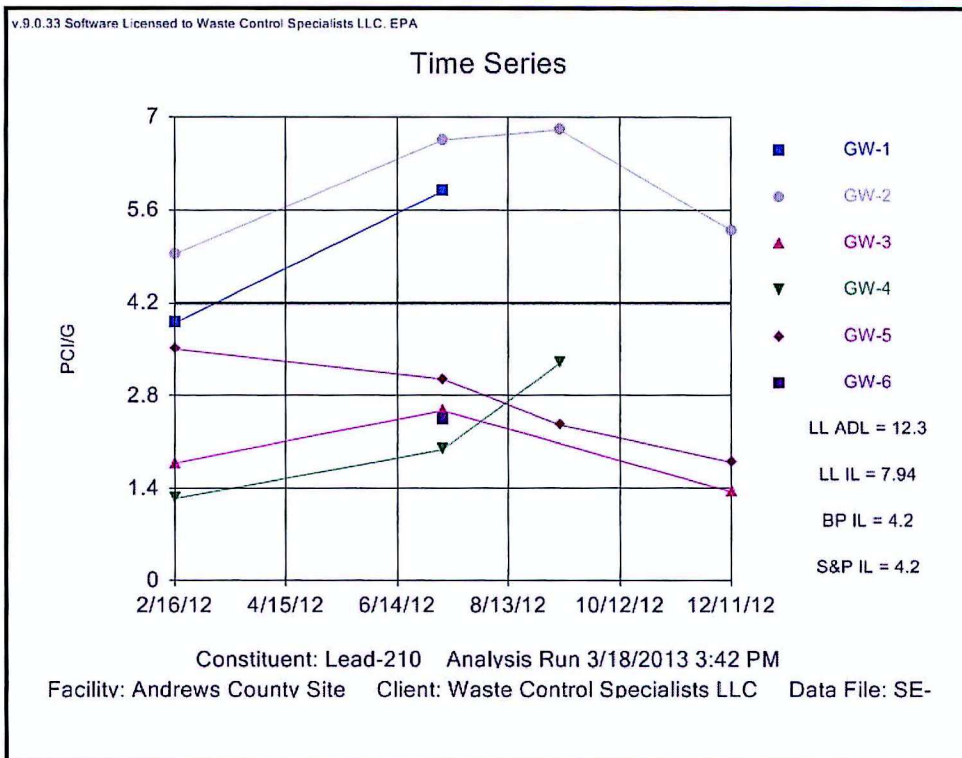


Figure 35 : Lead-210 Activity Concentration in Sediment

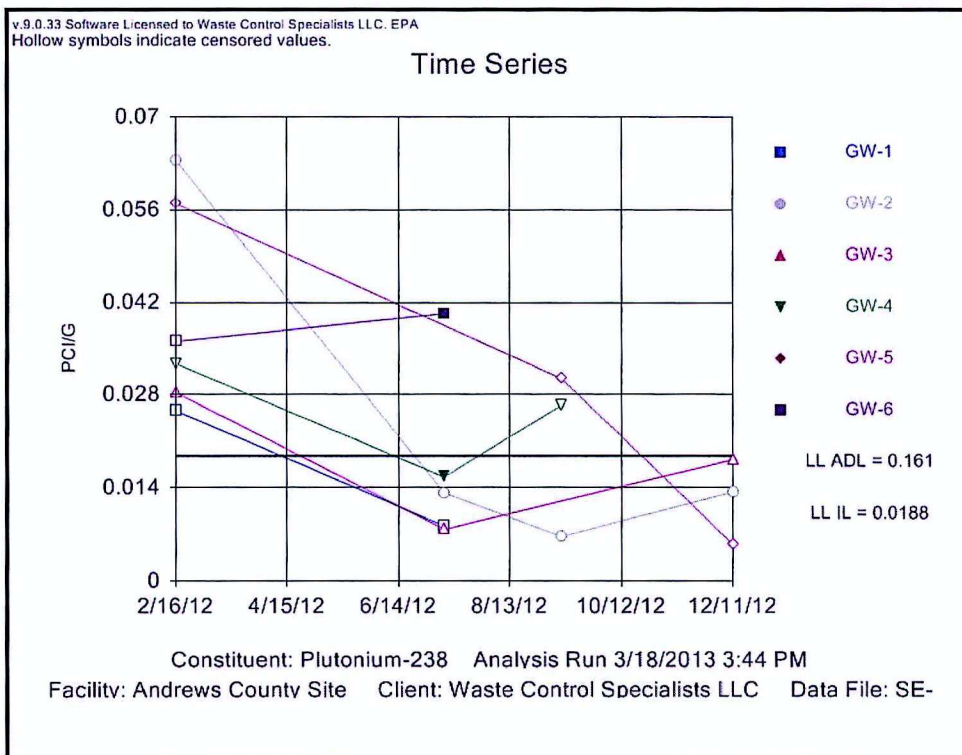


Figure 36 : Plutonium-238 Activity Concentration in Sediment

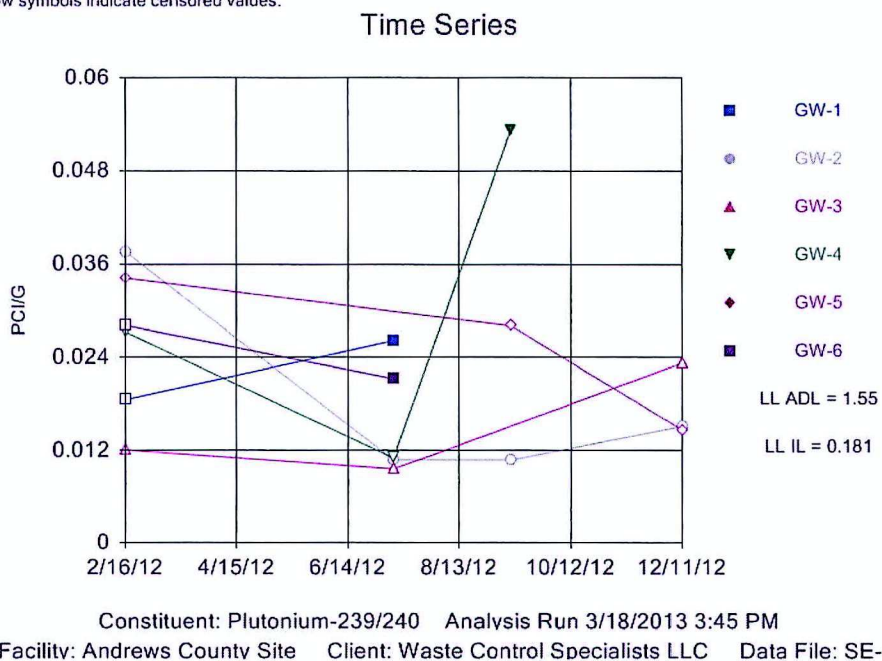


Figure 37 : Plutonium-239/240 Activity Concentration in Sediment

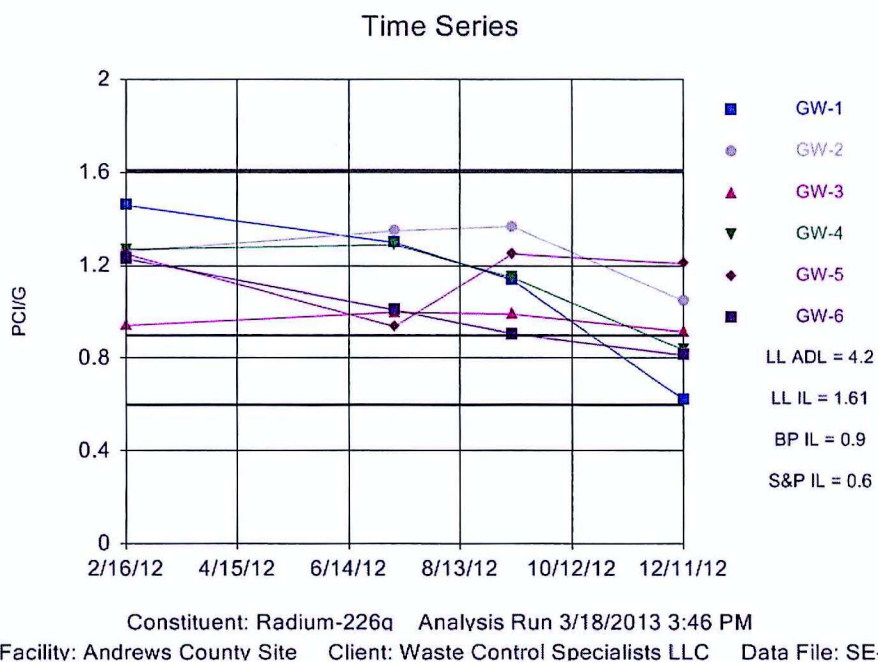


Figure 38 : Radium-226 Activity Concentration in Sediment

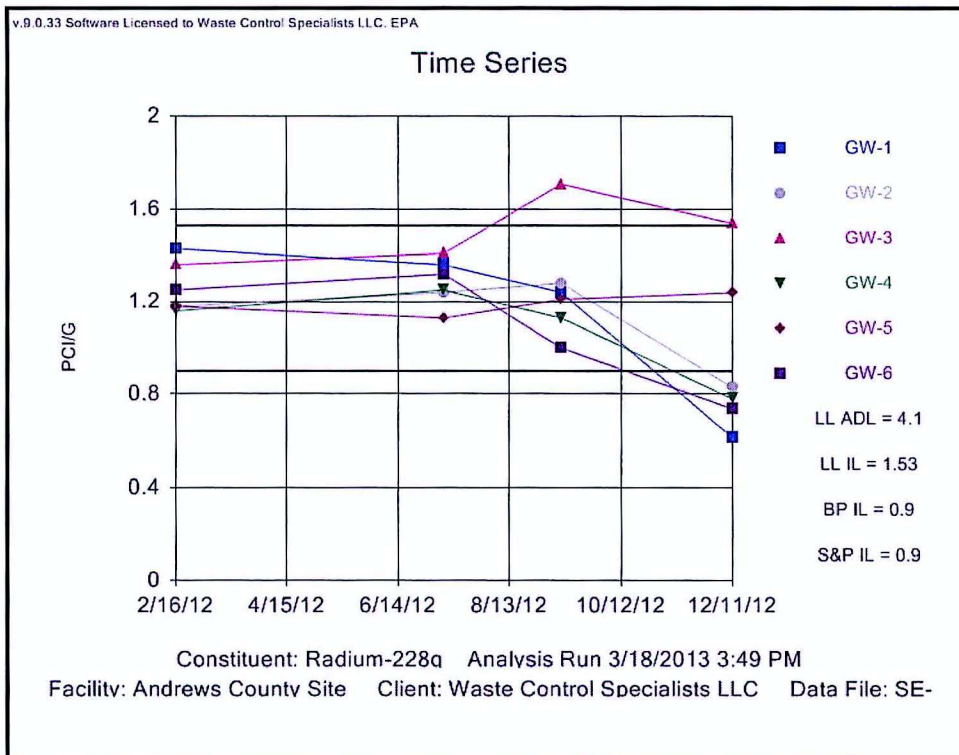


Figure 39 : Radium-228 Activity Concentration in Sediment

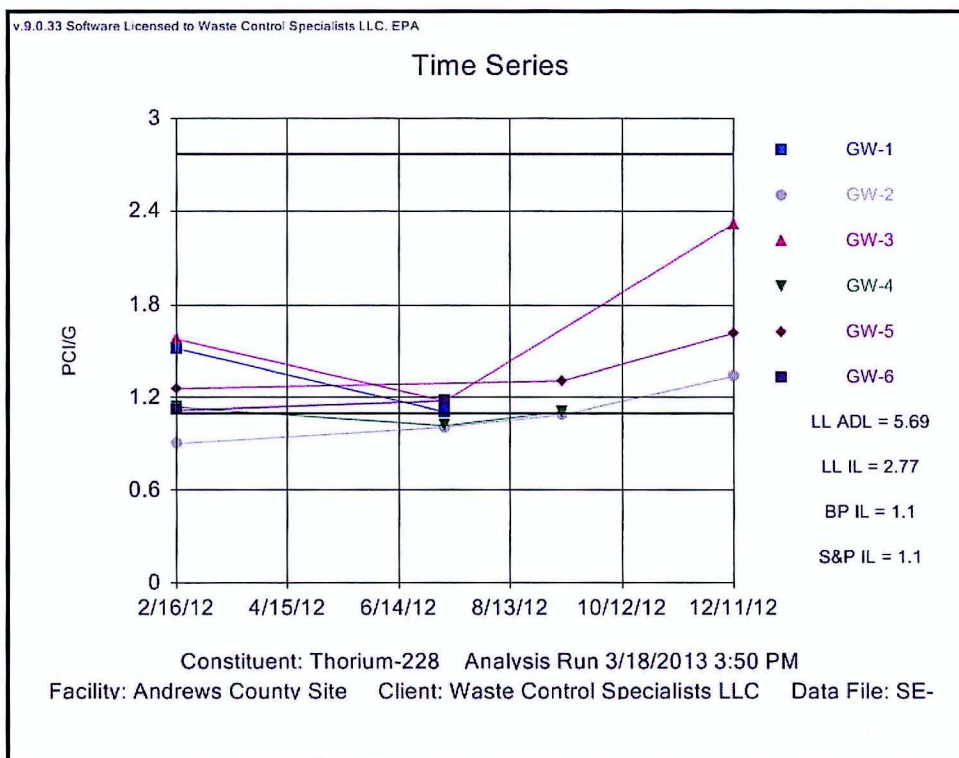


Figure 40 : Thorium-228 Activity Concentration in Sediment

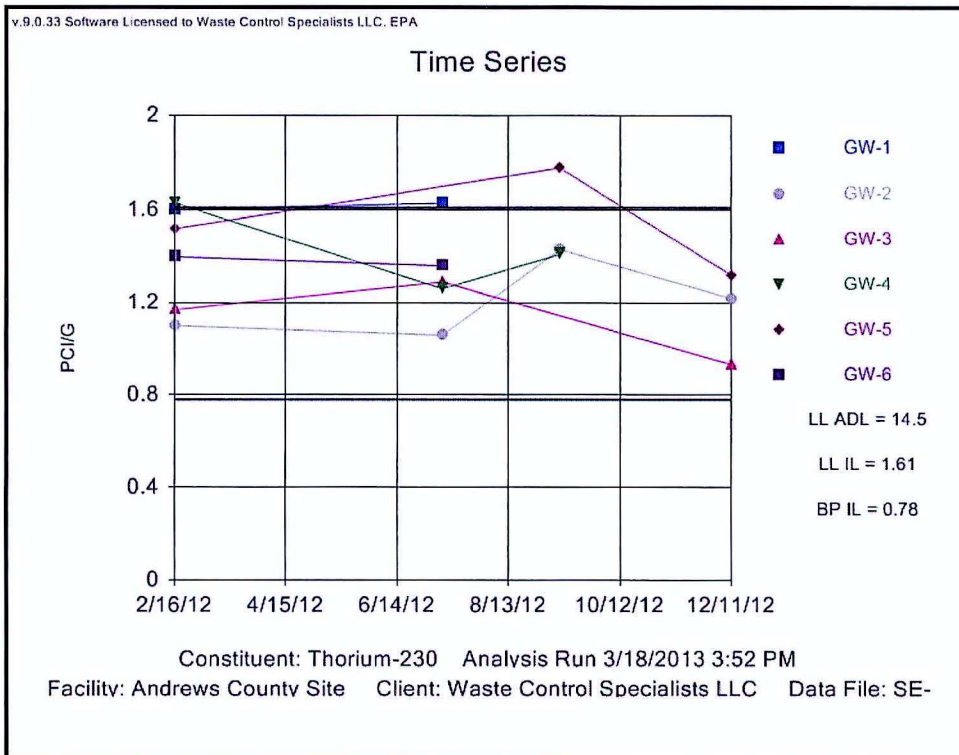


Figure 41 : Thorium-230 Activity Concentration in Sediment

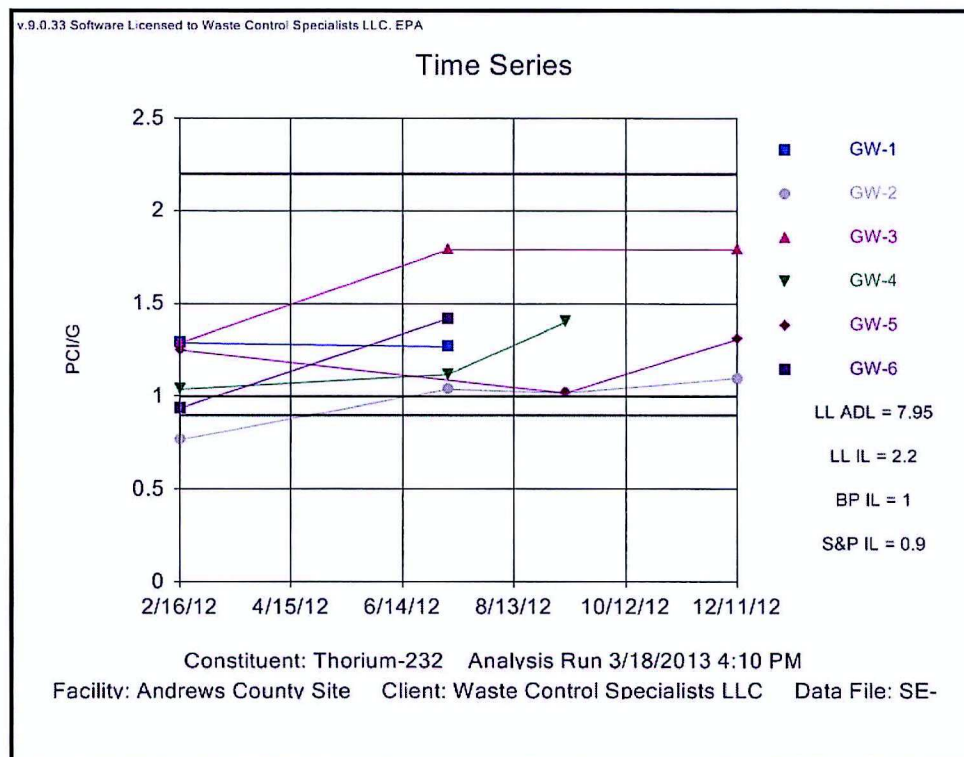


Figure 42 : Thorium-232 Activity Concentration in Sediment

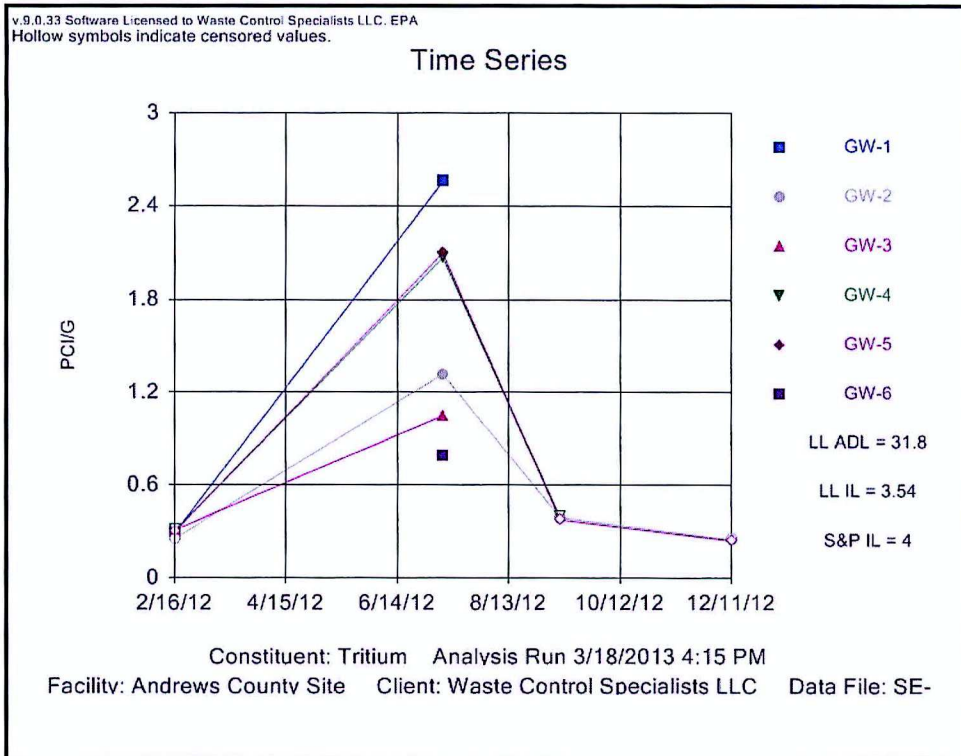


Figure 43 : Tritium Activity Concentration in Sediment

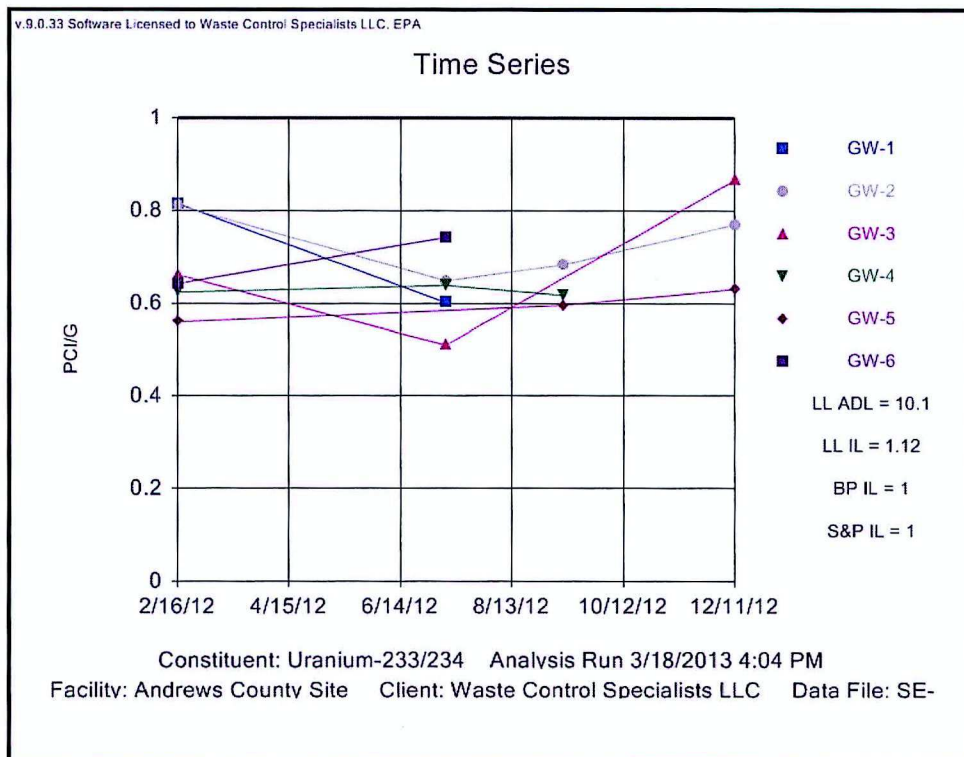


Figure 44 : Uranium-233/234 Activity Concentration in Sediment

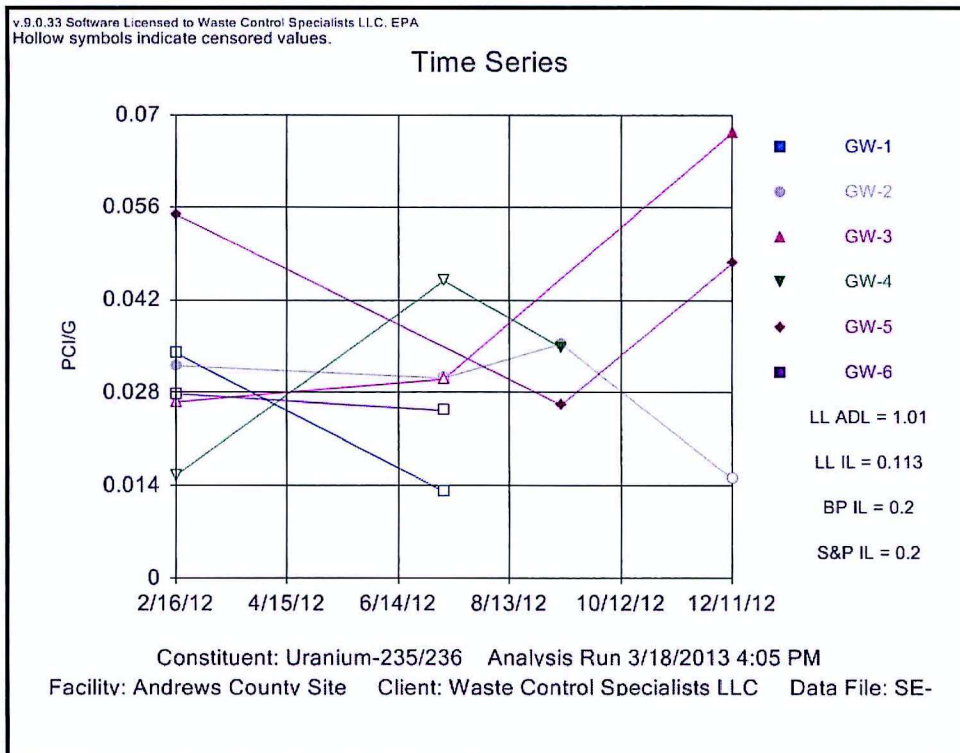


Figure 45 : Uranium-235/236 Activity Concentration in Sediment

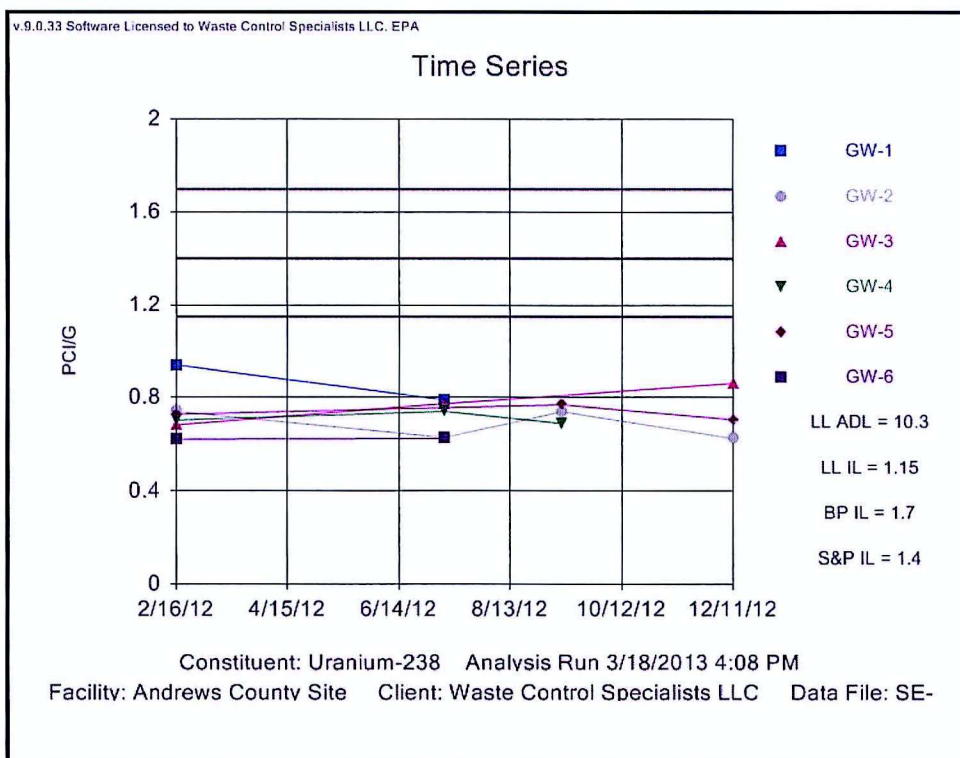


Figure 46 : Uranium-238 Activity Concentration in Sediment

3.5 Vegetation

Vegetation samples are collected in the spring and summer months in accordance with procedure EV-7.17, *Vegetation Sampling*. Two pounds of live leafy vegetation are collected, if available, from each of 32 sampling locations around the site. Vegetation samples are obtained within 100 feet of the station location, or if insufficient vegetation exists within a 100-foot radius to obtain the minimum sample size at a sampling location, vegetation can be collected within 200 feet of the station. Table 17 displays the vegetation sampling requirements by license. Figure 47 displays the vegetation sample locations. Figure 48 through Figure 64 graphically depict results of vegetation sampling for analytes of note. Vegetation sample results are summarized in Table 18. All vegetation sample results are provided in Appendix E. All results of vegetation samples collected during this reporting period are indistinguishable from background levels.

Table 17 : Vegetation Sampling Requirements

Sample Type	Byproduct Stations	TSDF Stations	LLRW Stations
Vegetation	3, 6, 8, and 9**	8, 9, 12, 13, 15, 17, 20, and 26*	1, 4, 6, 7, 9, 11, 26, 27, 31, 50, 54, 55, 58, 59, 60, 61, 62, 63, 65, GW-1, GW-2, GW-3, GW-4, GW-5, and GW-6**

* Sampling required Annually (may not be reported in this document)

**Sampling required Semi-Annually

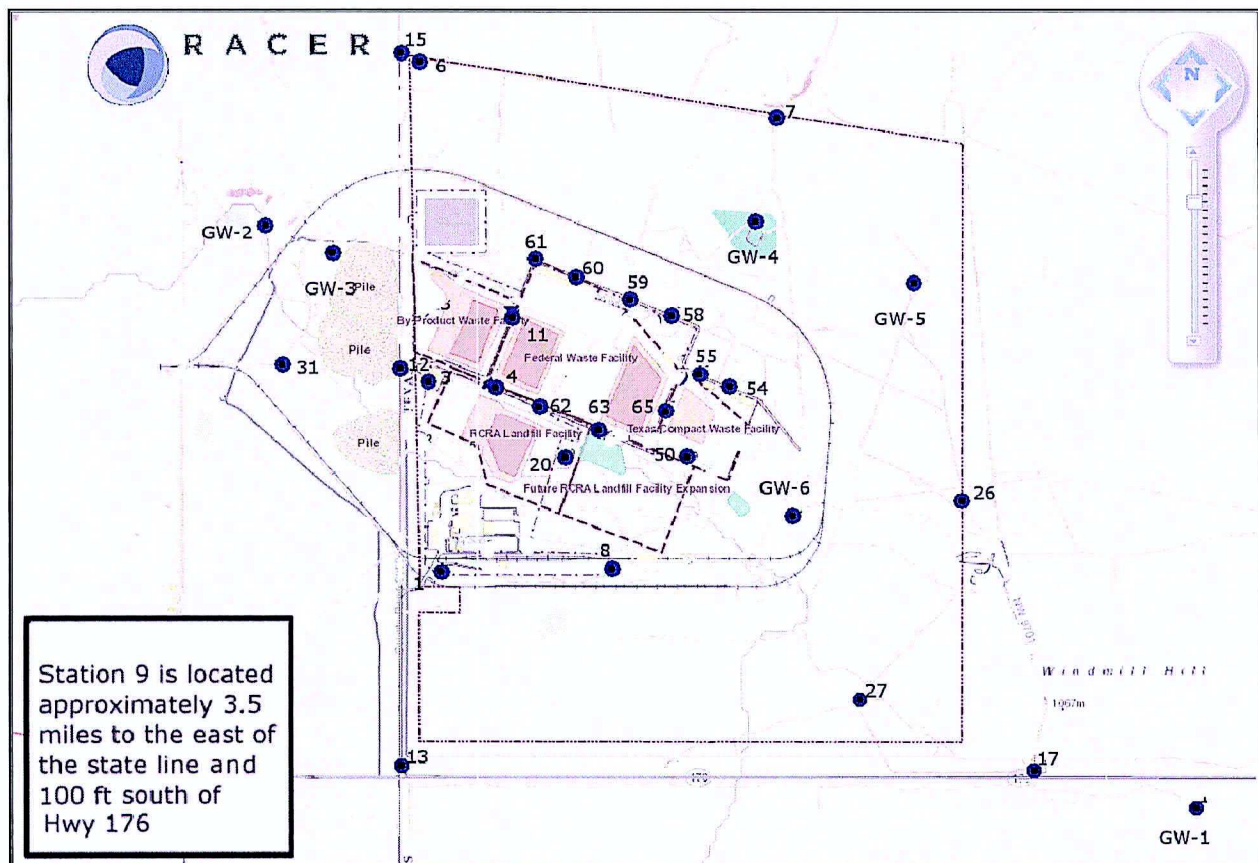


Figure 47 : Vegetation Sample Locations

Table 18 : Summary of Vegetation Sample Results, 2012

Analyte	No. of Station s	Obs	Below MDC	Mean	Standard d Deviation	Max	Min	Units	BP IL	S&PIL	LLIL	LL ADL
Actinium-228g	32	54	5	7.78E-2	8.00E-2	2.29E-1	-2.26E-2	pCi/g	N/A	N/A	4.20E-1	3.77E+0
ALPHA	32	54	12	5.84E-1	8.38E-1	2.81E+0	-9.85E-1	pCi/g	2.60E+0	2.60E+0	3.54E+0	3.18E+1
Arsenic	18	18	13	1.03E+3	5.44E+2	2.40E+3	4.74E+2	ug/kg	N/A	N/A	2.12E+3	N/A
Beryllium-7g	32	54	54	4.61E+0	1.23E+0	7.89E+0	1.98E+0	pCi/g	N/A	N/A	8.86E+0	7.95E+1
BETA	32	54	54	3.07E+1	1.87E+1	9.78E+1	3.00E+0	pCi/g	2.30E+1	2.30E+1	8.87E+1	7.96E+2
Bismuth-214g	32	54	19	7.33E-2	6.47E-2	2.77E-1	-5.01E-2	pCi/g	N/A	N/A	3.82E-1	3.43E+0
Cadmium	18	18	11	1.72E+2	4.55E+1	2.71E+2	1.00E+2	ug/kg	N/A	N/A	3.54E+2	N/A
Carbon disulfide	18	18	5	3.47E+2	2.32E+2	6.84E+2	1.75E+2	ug/kg	N/A	N/A	1.29E+2	N/A
Cesium-137g	32	54	2	8.37E-3	1.48E-2	4.96E-2	-2.65E-2	pCi/g	N/A	N/A	8.93E-2	7.63E-1
Cobalt-60g	32	54	1	5.08E-3	2.18E-2	1.03E-1	-4.41E-2	pCi/g	N/A	1.30E-1	5.36E-1	4.58E+0
Lead-210	13	15	15	6.71E-1	3.37E-1	1.41E+0	2.54E-1	pCi/g	1.10E+0	1.10E+0	1.27E+0	1.77E+0
Lead-210g	32	54	14	1.61E+0	2.53E+0	9.15E+0	-5.49E+0	pCi/g	N/A	N/A	N/A	N/A
Lead-212g	32	54	13	4.24E-2	3.37E-2	1.12E-1	-3.59E-2	pCi/g	N/A	N/A	1.86E-1	1.67E+0
Lead-214g	32	54	25	7.88E-2	8.45E-2	2.78E-1	-1.11E-1	pCi/g	N/A	N/A	4.73E-1	4.24E+0
Nickel	18	18	12	3.80E+2	2.16E+2	9.52E+2	1.37E+2	ug/kg	N/A	N/A	1.25E+3	N/A
Potassium-40g	32	54	54	3.20E+1	1.72E+1	8.44E+1	1.32E+1	pCi/g	N/A	N/A	1.16E+2	1.90E+2
Radium-226g	32	54	19	7.33E-2	6.47E-2	2.77E-1	-5.01E-2	pCi/g	1.00E-1	2.00E-1	4.26E-1	3.82E+0
Radium-228g	32	54	5	7.78E-2	8.00E-2	2.29E-1	-2.26E-2	pCi/g	3.90E-1	2.00E-1	4.20E-1	3.77E+0
Thallium-208g	32	54	6	1.58E-2	2.26E-2	8.02E-2	-4.09E-2	pCi/g	N/A	N/A	1.18E-1	1.06E+0
Thorium-230	4	6	1	5.18E-2	4.03E-2	1.26E-1	8.68E-3	pCi/g	1.50E-1	N/A	4.48E-1	1.97E+0
Thorium-232	4	6	1	2.13E-2	2.24E-2	5.33E-2	-3.96E-3	pCi/g	2.00E-1	8.00E-2	1.91E-1	5.25E-1
Toluene	18	18	1	3.60E+1	N/A	3.60E+1	3.60E+1	ug/kg	N/A	N/A	1.66E+2	N/A
Tritium	21	28	1	1.33E-1	1.87E-1	7.27E-1	-1.19E-1	pCi/g	N/A	1.00E+0	5.31E-1	4.77E+0
Uranium-233/234	4	6	1	2.18E-2	2.64E-2	7.05E-2	-2.75E-3	pCi/g	2.20E-1	1.80E-1	4.75E-1	4.26E+0
Uranium-238	4	6	1	2.89E-2	2.17E-2	5.88E-2	2.27E-3	pCi/g	1.70E-1	1.70E-1	1.40E-1	1.26E+0

Cobalt-60 was detected above the MDC at station GW-6 and is a suspected false positive. Cobalt-60 was not detected at station GW-6 for the following sampling event. Also, a result for vegetation station 17 exceeded the radium-226 IL for the TSDF license. This result is discussed in more detail in Section 4, Investigations, of this report.

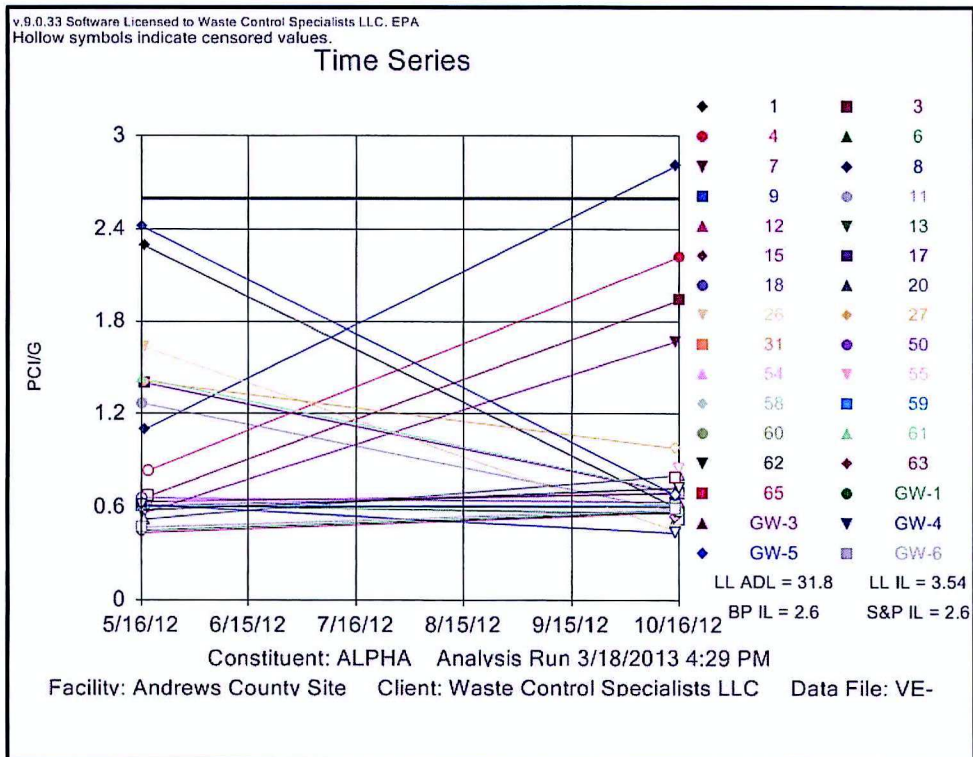


Figure 48 : Alpha Activity Concentration in Vegetation

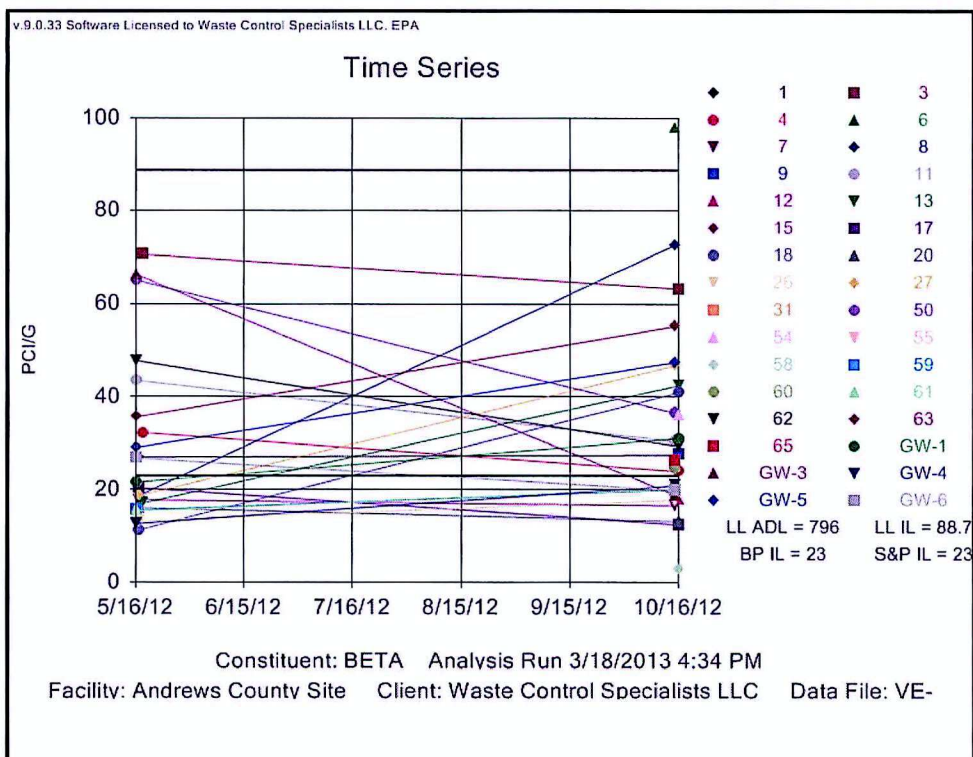


Figure 49 : Beta Activity Concentration in Vegetation

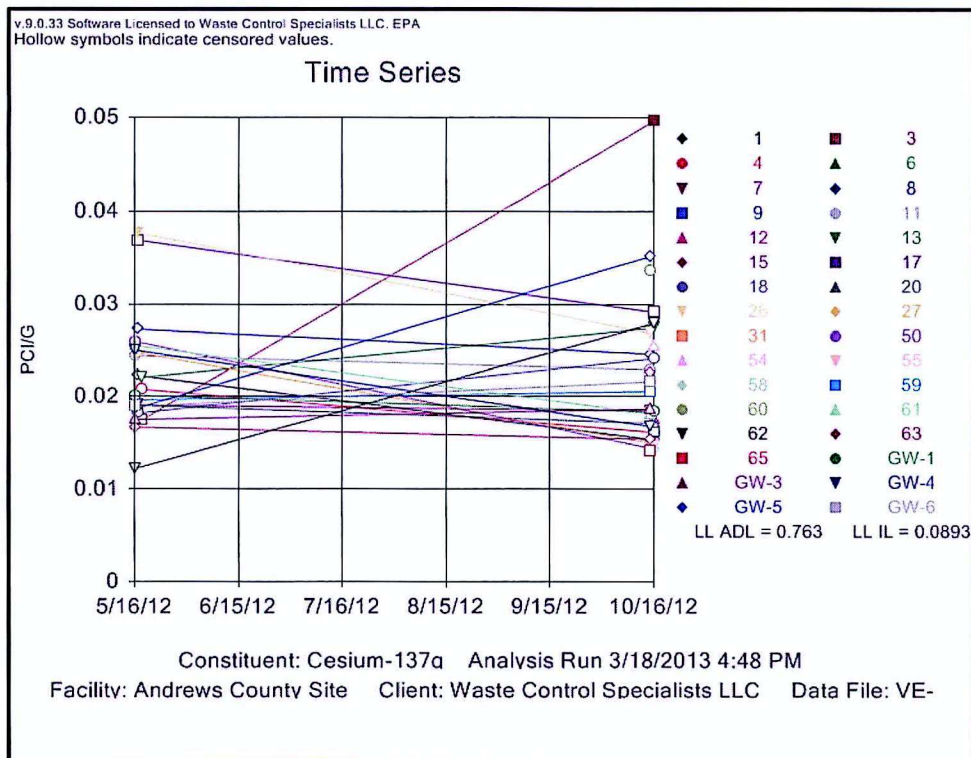


Figure 50 : Cesium-137 Activity Concentration in Vegetation

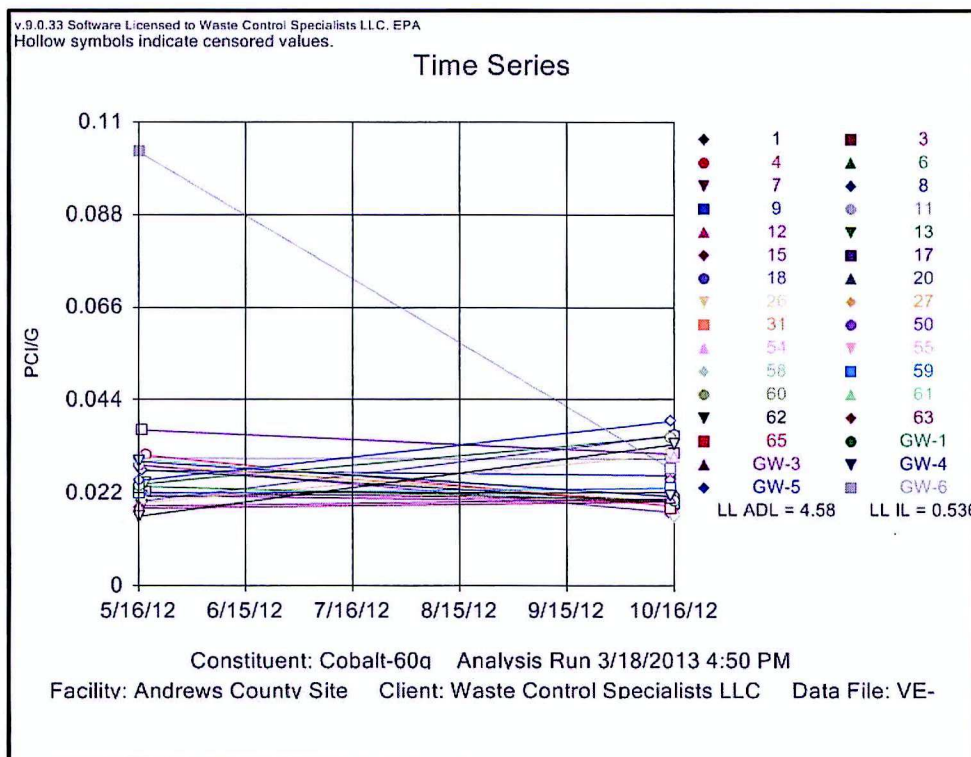


Figure 51 : Cobalt-60 Activity Concentration in Vegetation

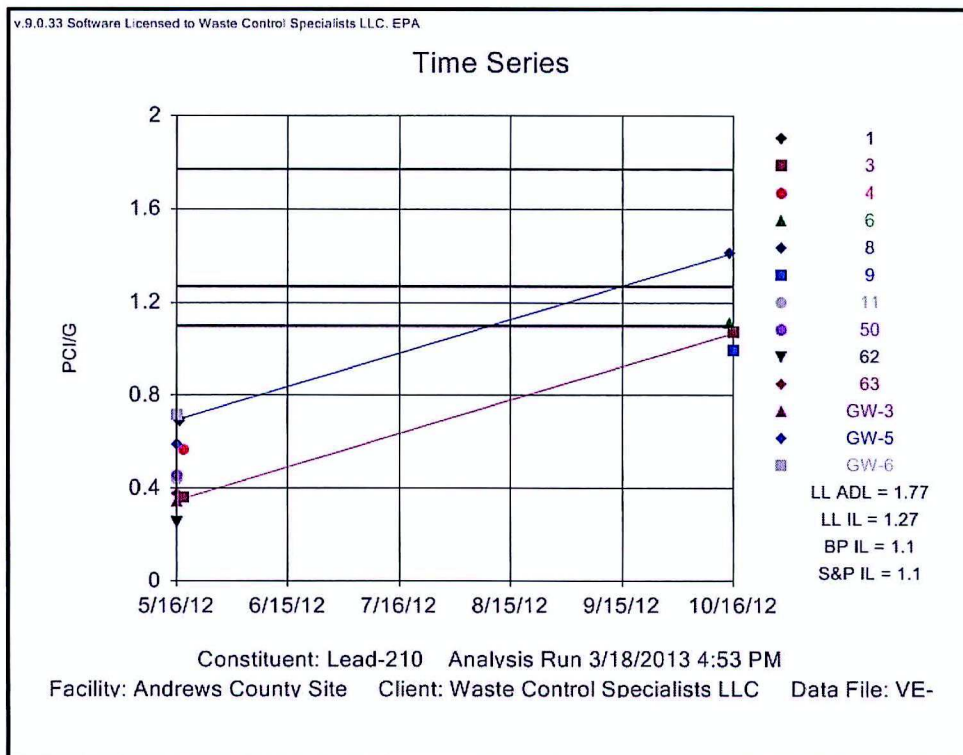


Figure 52 : Lead-210 Activity Concentration in Vegetation

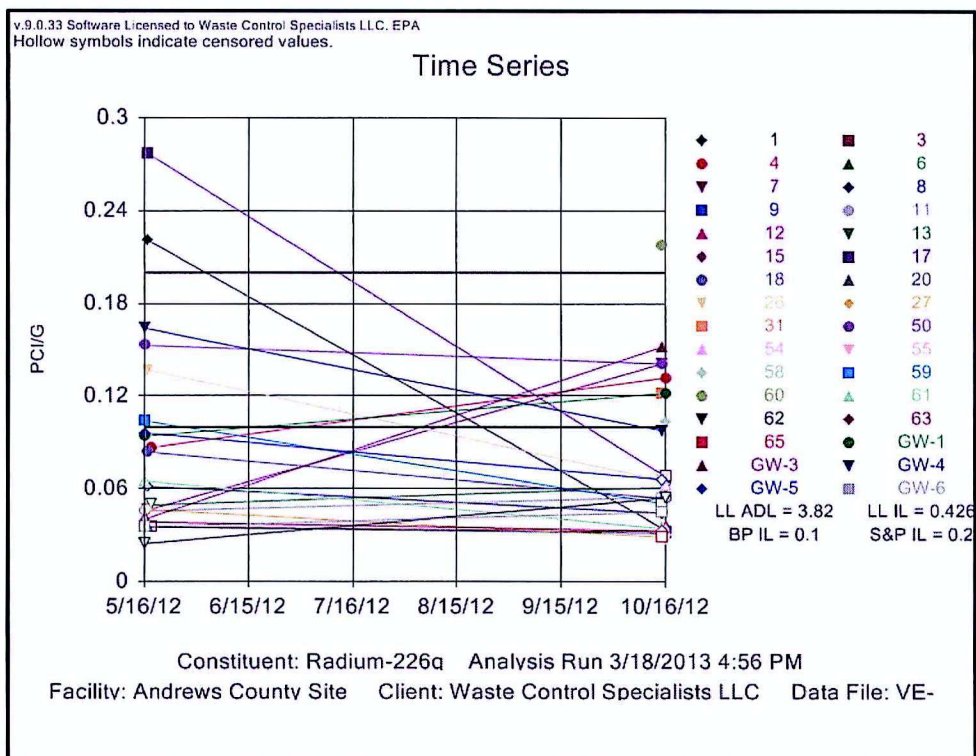


Figure 53 : Radium-226 Activity Concentration in Vegetation

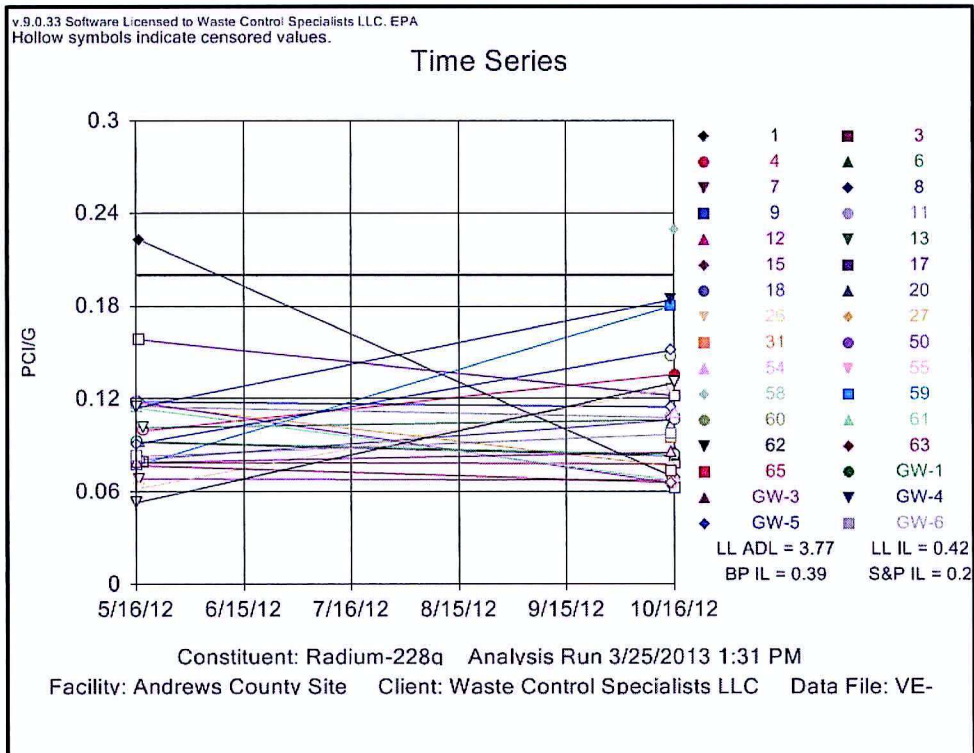


Figure 54 : Radium-228 Activity Concentration in Vegetation

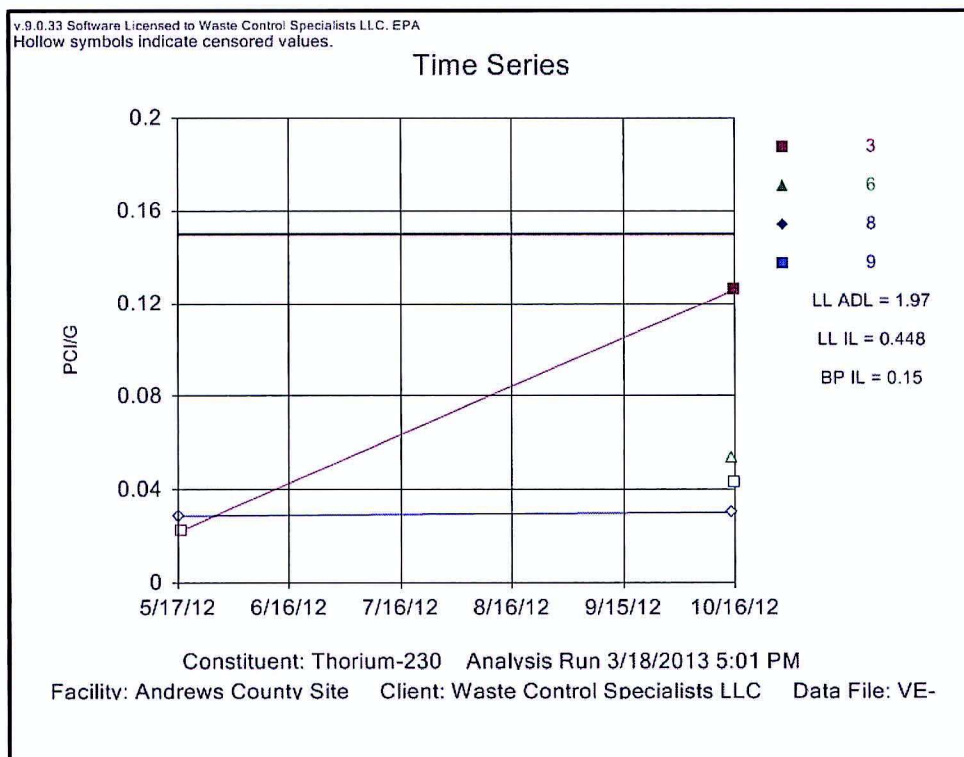


Figure 55 : Thorium-230 Activity Concentration in Vegetation

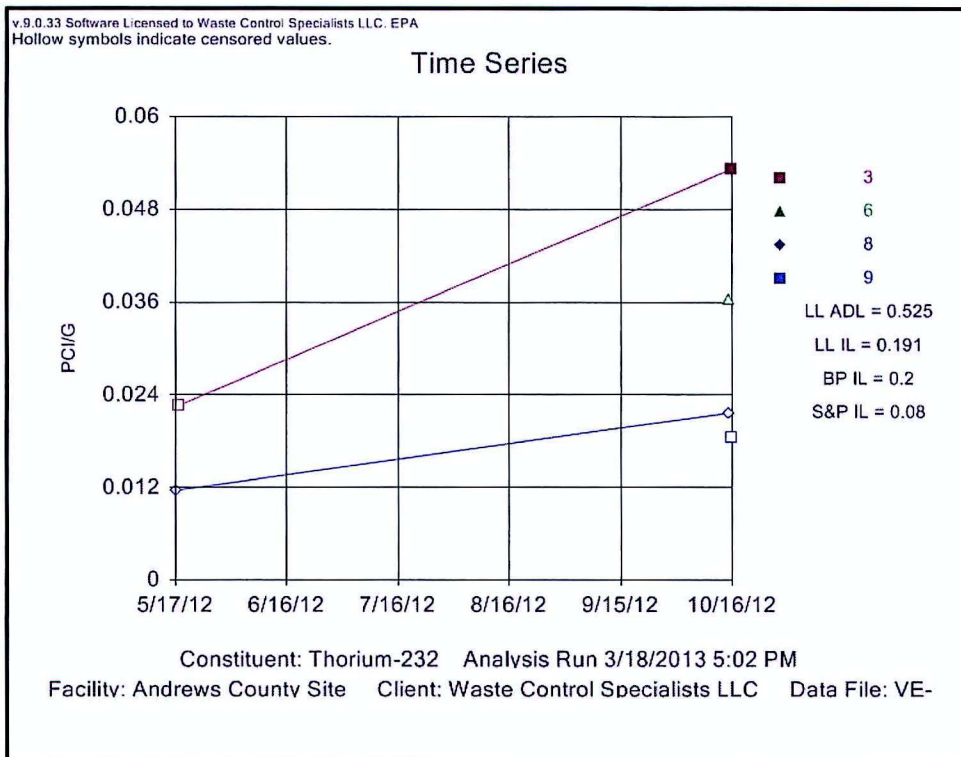


Figure 56 : Thorium-232 Activity Concentration in Vegetation

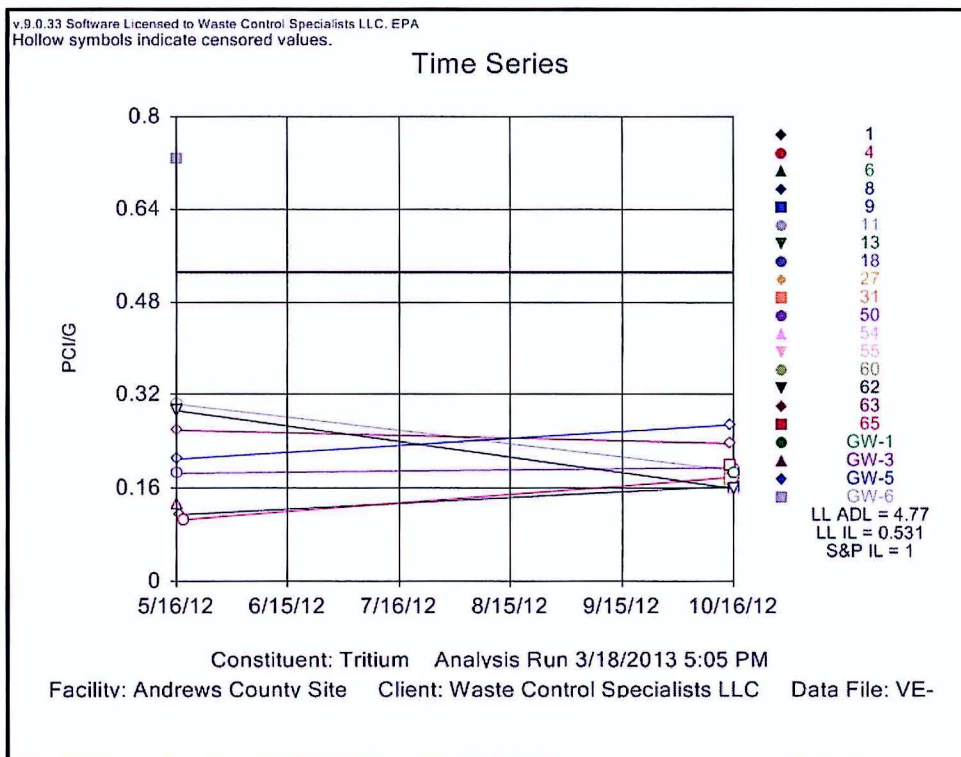


Figure 57 : Tritium Activity Concentration in Vegetation

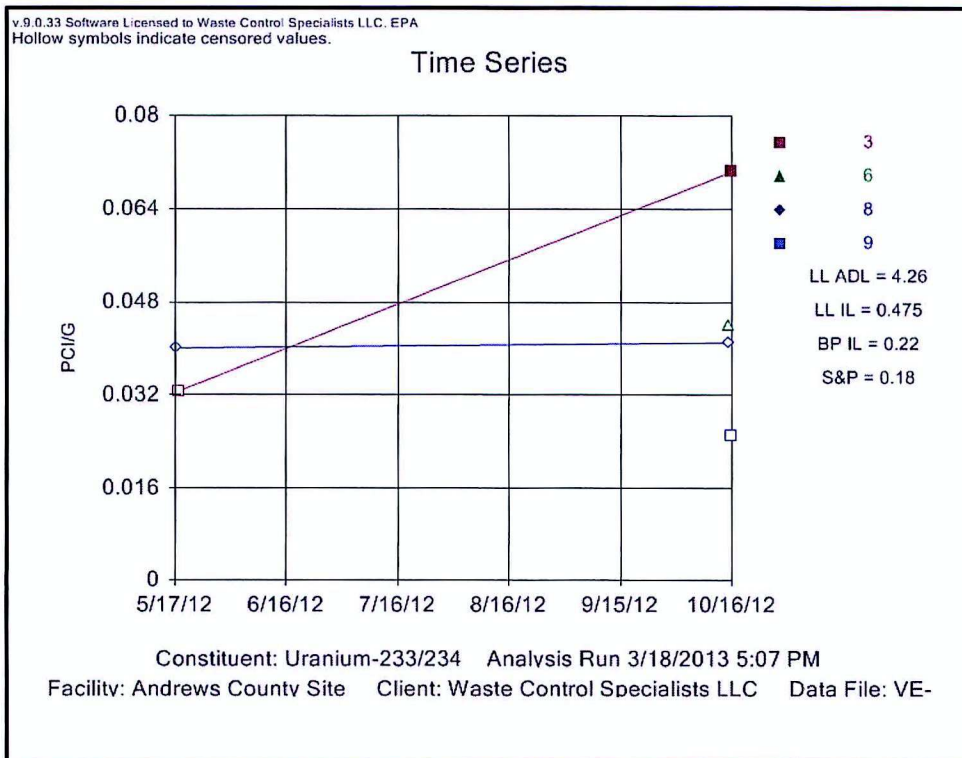


Figure 58 : Uranium-234 Activity Concentration in Vegetation

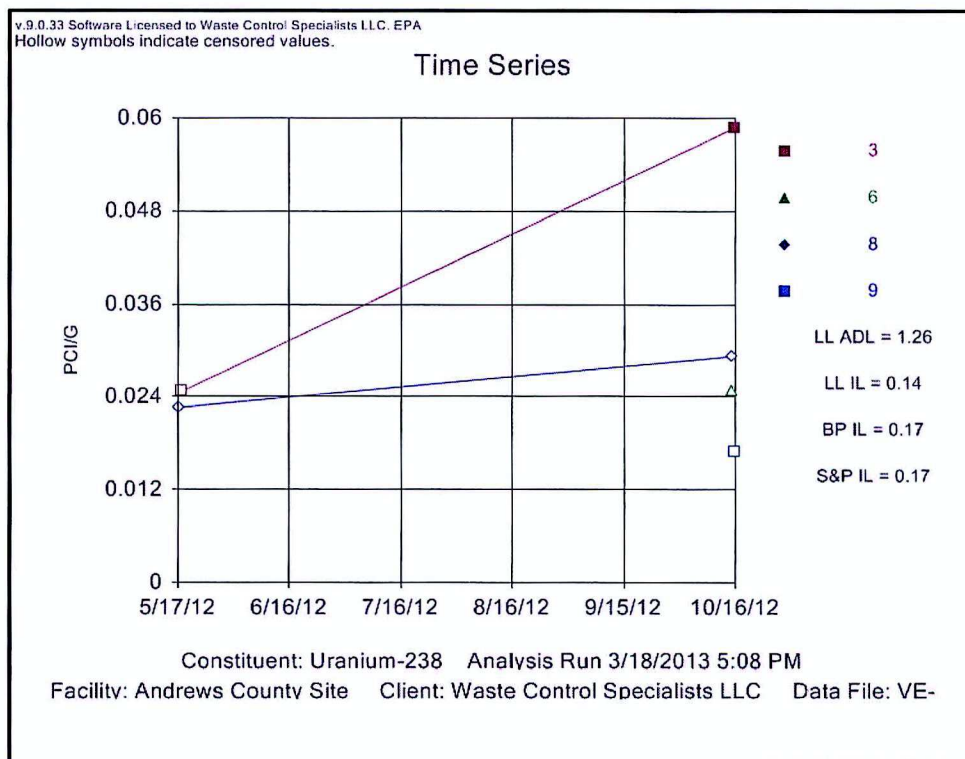


Figure 59 : Uranium-238 Activity Concentration in Vegetation

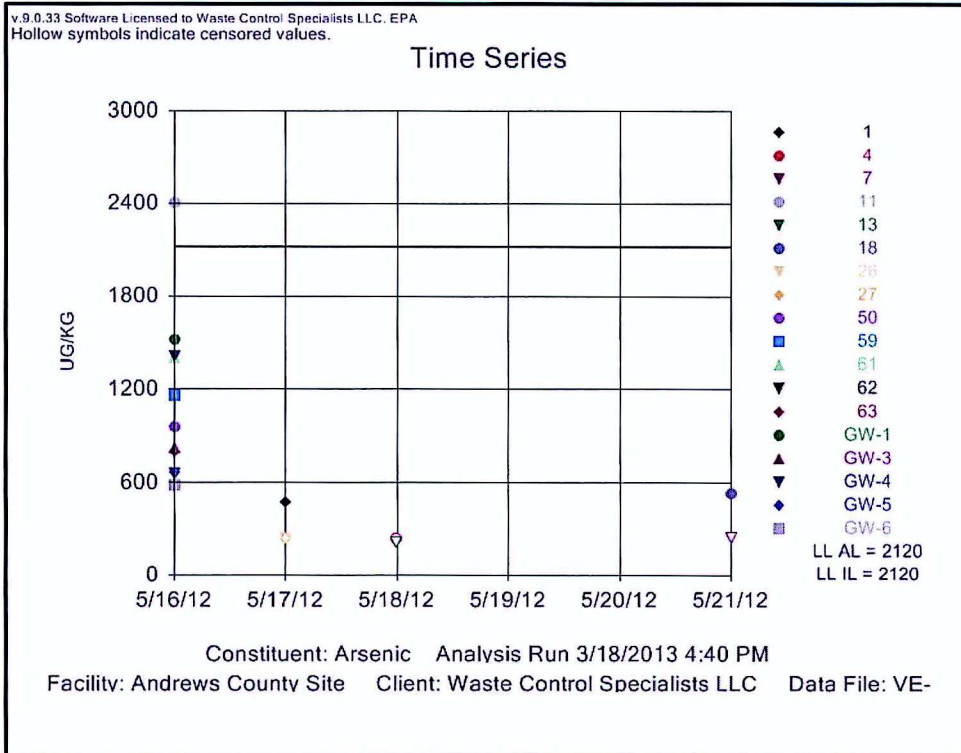


Figure 60 : Arsenic Concentration in Vegetation

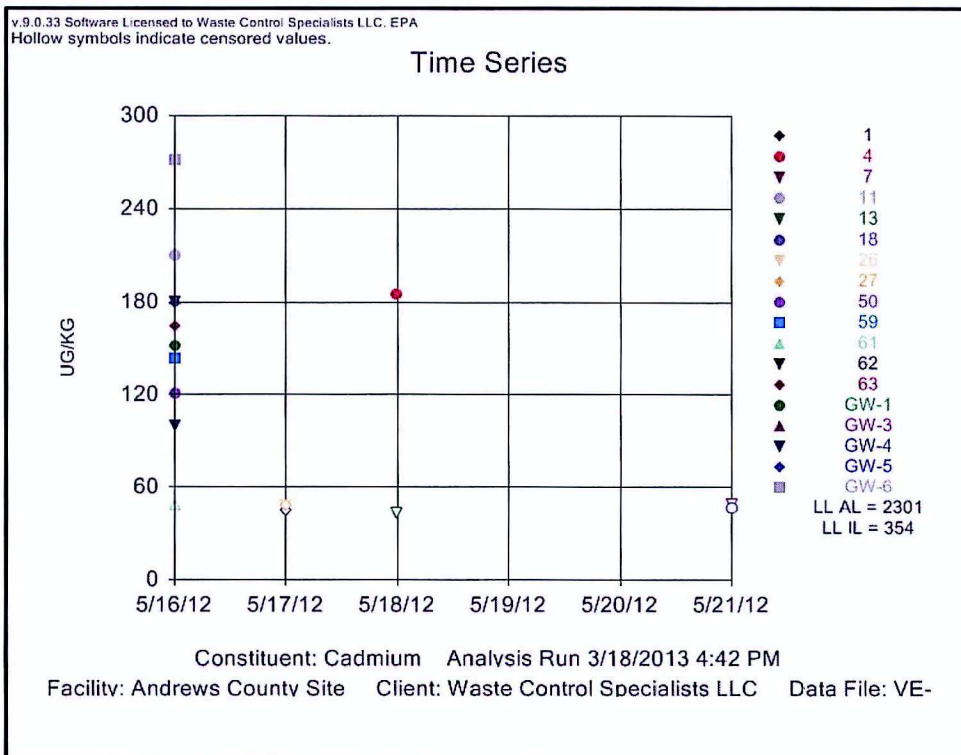


Figure 61 : Cadmium Concentration in Vegetation

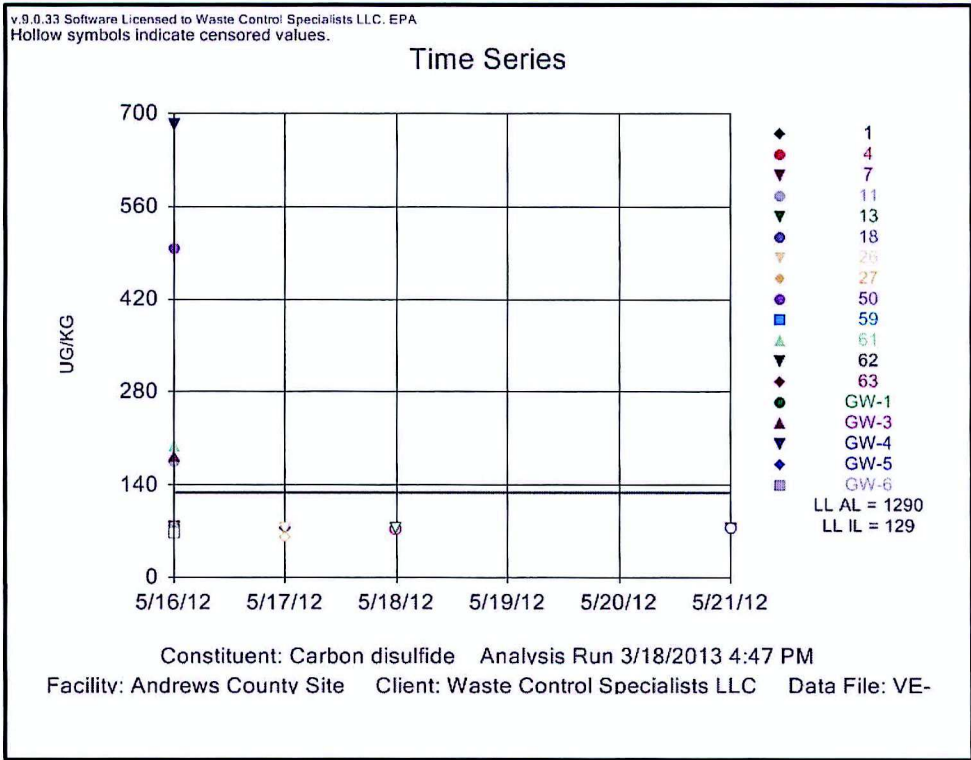


Figure 62 : Carbon Disulfide Concentration in Vegetation

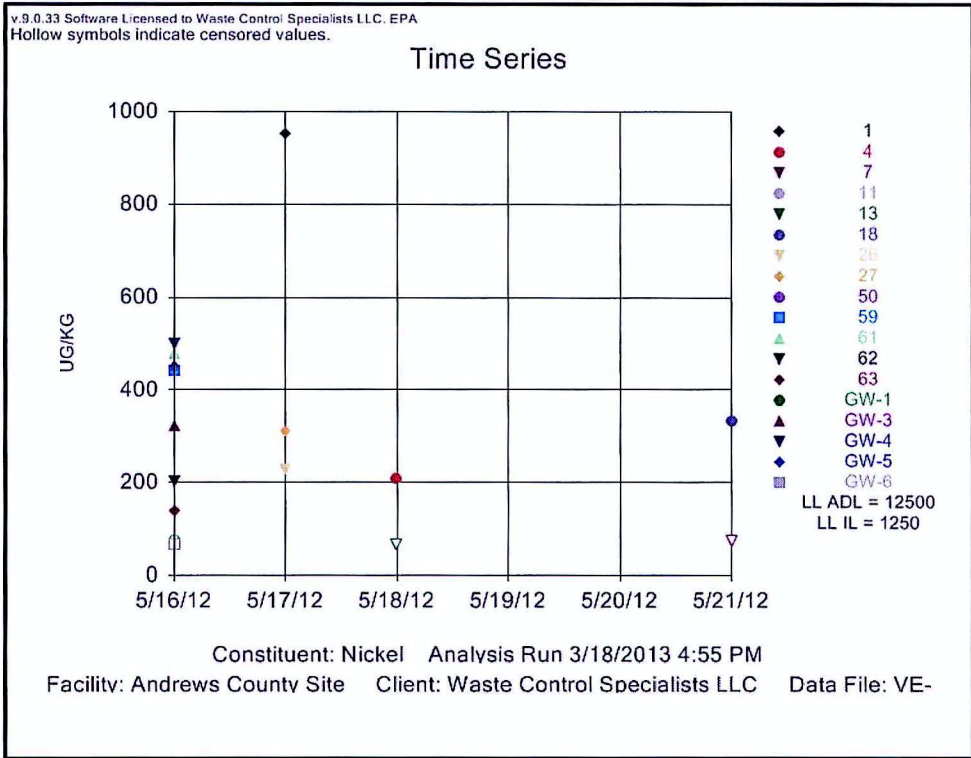


Figure 63 : Nickel Concentration in Vegetation

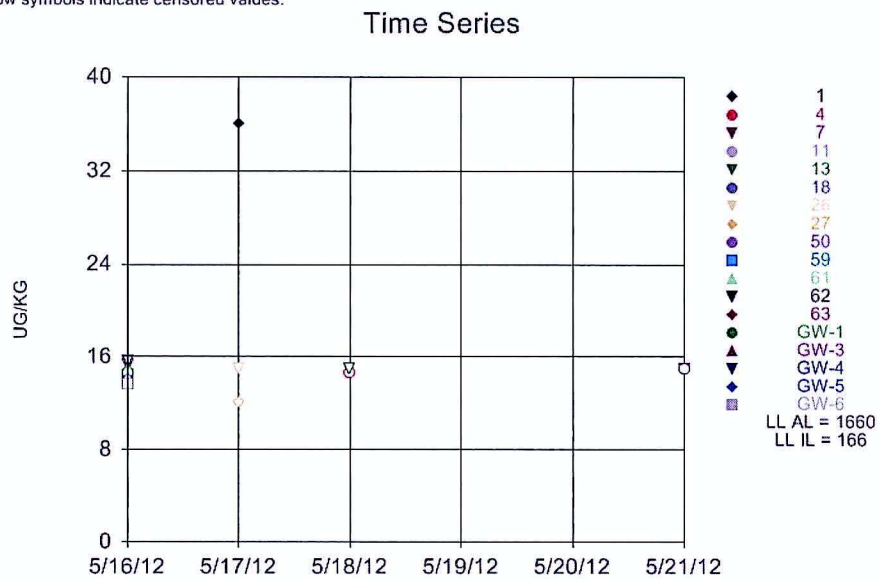


Figure 64 : Toluene Concentration in Vegetation

3.6 Ambient Radiation

Ambient radiation is monitored using Optically Stimulated Luminescent (OSL) dosimeters and thermoluminescent dosimeters (TLD). These dosimeters are placed one meter above the ground. TLDs and OSLs are exchanged on a quarterly basis and are handled in accordance with procedure EV-7.1.6, *Thermoluminescent Dosimeters – Optically Stimulated Dosimeters*. Transit and deployment control dosimeters are maintained in a shielded storage box. Table 19 displays the ambient radiation monitoring requirements. Figure 65 contains a map showing the locations of the OSL and TLD stations.

Table 19 : Ambient Radiation Monitoring Requirements

Sample Type	Byproduct Stations	TSDf Stations	LLRW Stations
Ambient Radiation OSL	1, 3, 4, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 21, 22, 23, 24, 25, 26, 27, 28, 30, 31, and 32	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 24, 25, 26, 27, 28, Andrews Office (29), 30, and 31	1, 4, 6, 7, 9, 11, 26, 27, 31, 50, 51, 52, 54, 55, 58, 59, 60, 61, 62, 64, and 65
Ambient Radiation TLD		13, 15, 17, 25, and Andrews Office (29)	

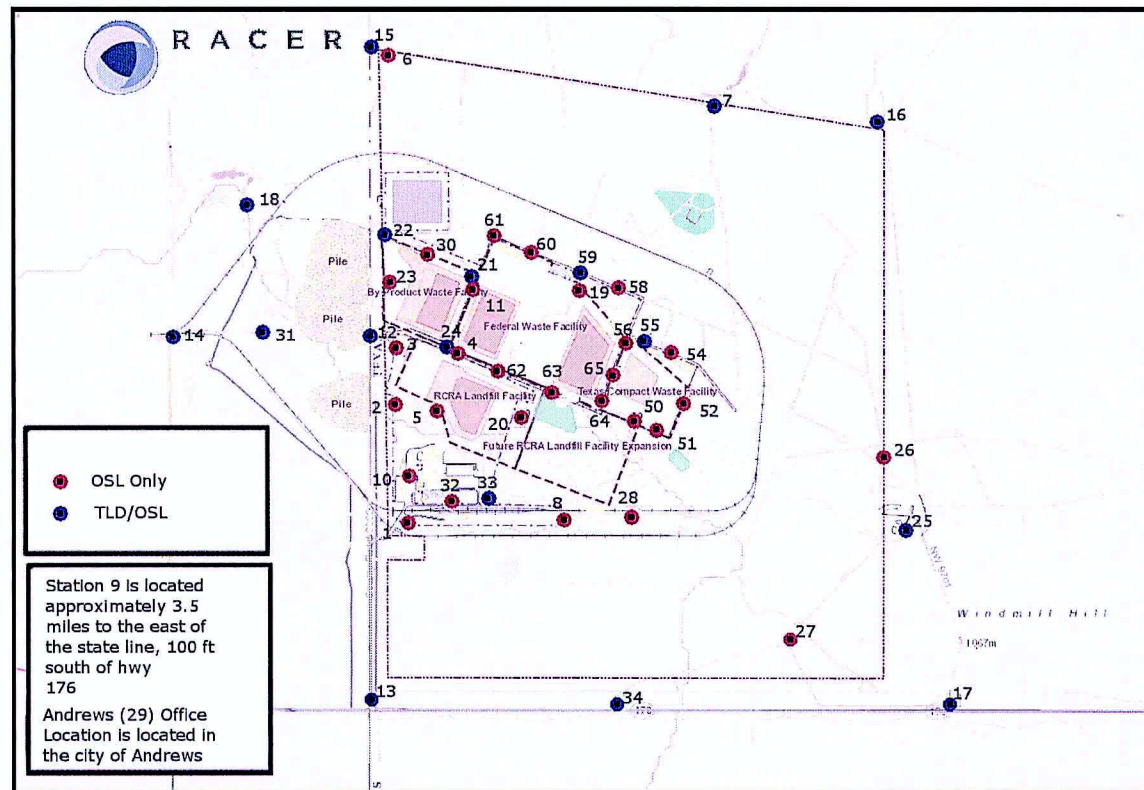


Figure 65 : OSL and TLD Locations

Although they are not required by license, permit, authorization, or WCS application documents, WCS also maintains TLDs at stations 7, 12, 14, 16, 18, 21, 22, 24, 31, 33, 34, 55, and 59. In addition, WCS historically had OSLs at stations 33 and 34. WCS is including data from these stations in this report to ensure that the TCEQ is provided with all relevant environmental monitoring data. However, WCS does not consider its inclusion in this report an obligation to continue monitoring in those locations in the future.

The ambient radiation results for 2012 are provided in Table 20 and Table 21 for measurements using OSL dosimeters and TLDs, respectively. The ambient gamma radiation readings from Stations 22 (near the LSA pad) and Stations 52, 54, 55, 56, and 65 (located near CWF operations) were elevated. Station 22 is located near the Low Specific Activity (LSA) Pad and is likely affected by the transfer of shipments. Stations 52, 54, 55, 56, and 65 surround the CWF cell and are affected by the transfer and movement of waste shipment. The elevated readings at these locations are near radiological operations and are in controlled areas. These are temporary and expected conditions that do not suggest that a release occurred or a risk to unprotected members of the public. For comparison, the dose from ambient background radiation for 2012 as measured with an OSL at the WCS office in Andrews was provided. Figure 66 and Figure 67 graphically display the TLD and OSL results respectively.

Table 20 : 2012 Quarterly OSL Direct Gamma Results

Station	1st Quarter (mrem)	2nd Quarter (mrem)	3rd Quarter (mrem)	4th Quarter (mrem)	LL AL (mrem/Q)	LL ADL (mrem/Q)
Andrews (29)	4	2	7	1	8	19.7
1	2	M	M	M	6	17.9
2	9	7	9	3	14.2	25
3	M	M	M	M	7	18.8
4	4	2	3	M	14.2	25
5	5	3	5	1	14.2	25
6	3	1	4	Lost	14.2	25
7	M	M	M	M	5	17.1
8	2	M	M	M	6	17.9
9	1	M	M	M	5	17.1
10	5	12	9	1	14.2	25
11	3	M	5	M	N/A	N/A
12	6	3	5	M	14.2	25
13	1	M	M	M	5	17.1
14	M	M	M	M	6	17.9
15	2	M	1	M	8	19.7
16	M	M	M	M	5	17.1
17	1	M	1	M	8	19.7
18	3	2	2	M	8	19.7
19	3	M	M	M	8	19.7
20	2	M	M	M	5	17.1
21	3	1	3	M	N/A	N/A
22	12	M	14	1	N/A	N/A
23	6	4	3	1	N/A	N/A
24	1	1	1	M	8	19.7
25	3	M	1	M	7	18.8
26	2	M	M	M	7	18.8
27	3	1	1	M	7	18.8
28	4	3	2	1	8	19.7
30	3	2	1	M	N/A	N/A
31	4	1	1	M	7	18.8
32	3	4	5	2	7	18.8
33	2	2	M	M	5	17.1
34	M	M	M	M	5	17.1
50	1	M	13	6	7	18.8
51	M	M	7	M	6	17.9
52	1	Lost	12	11	7	18.8
54	3	M	14	3	7	18.8
55	1	M	11	4	8	19.7
56	1	M	12	Lost	6	17.9
58	1	1	2	M	7	18.8
59	1	M	M	M	7	18.8
60	1	M	M	M	7	18.8
61	3	M	2	M	N/A	N/A
62	5	M	4	M	6	17.9
63	2	M	M	M	6	17.9
64	2	M	7	1	7	18.8
65	M	M	22	8	5	17.1
Deployed	1-10-12	4-10-12	7-12-12	10-18-12	N/A	N/A
Collected	4-10-12	7-12-12	10-18-12	1-25-13	N/A	N/A

Notes: Landauer processes OSLs and only reports results greater than Minimal Detectable Level, therefore, M indicates the value was less than Minimal Detectable Level (1 mrem).

The OSL result for station 65 was greater than the OSL LL ADL of 17.1 mrem for this location with a value of 22 in the third quarter of 2012. However, this was an expected condition inside a controlled area.

Table 21 : 2012 Quarterly TLD Direct Gamma Results

Station	1st Quarter (mrem)	2nd Quarter (mrem)	3rd Quarter (mrem)	4th Quarter (mrem)
Andrews	7.8	3.4	7.9	4.6
7	1.1	1.8	4.2	0.8
12	6.7	3.9	7.9	2
13	2.6	0.5	2.1	-0.1
14	2.2	-0.3	3.8	-1
15	3.5	2.9	3.2	-1.9
16	2.3	-1.6	1.7	-1.6
17	4.2	3.3	4.2	3
18	4.1	4.7	5	5
21	3	5	5.7	3.8
22	15.1	12.3	15.6	6.5
24	3.6	1.5	4.3	0.3
25	4.9	3.9	4.3	2.4
31	5.1	1.4	3.8	4.8
33	5.5	5.8	4.6	1.8
34	2.8	-0.2	1.9	-0.7
55	3	1.9	14.6	6.3
59	3	0.6	3.6	1.6
Deployed	1-10-12	4-10-12	7-12-12	10-18-12
Collected	4-10-12	7-12-12	10-18-12	1-25-13

Note: LLRW AL =13.8 mrem
LLRW ADL= 28.4 mrem

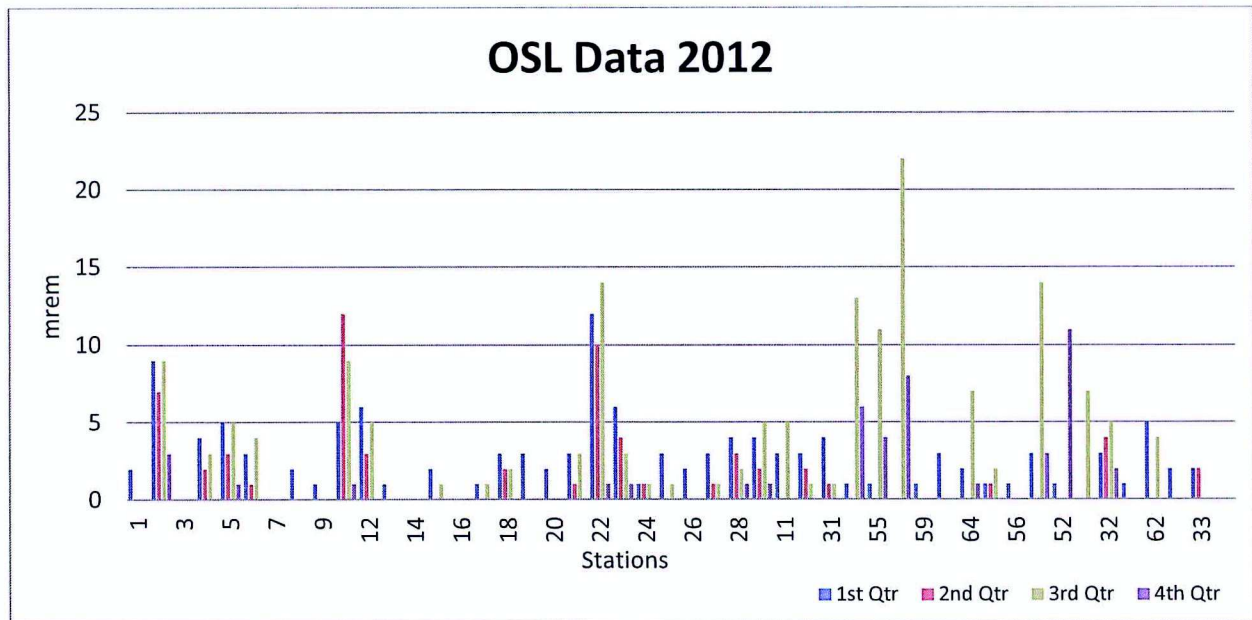


Figure 66 : OSL Results for 2012.

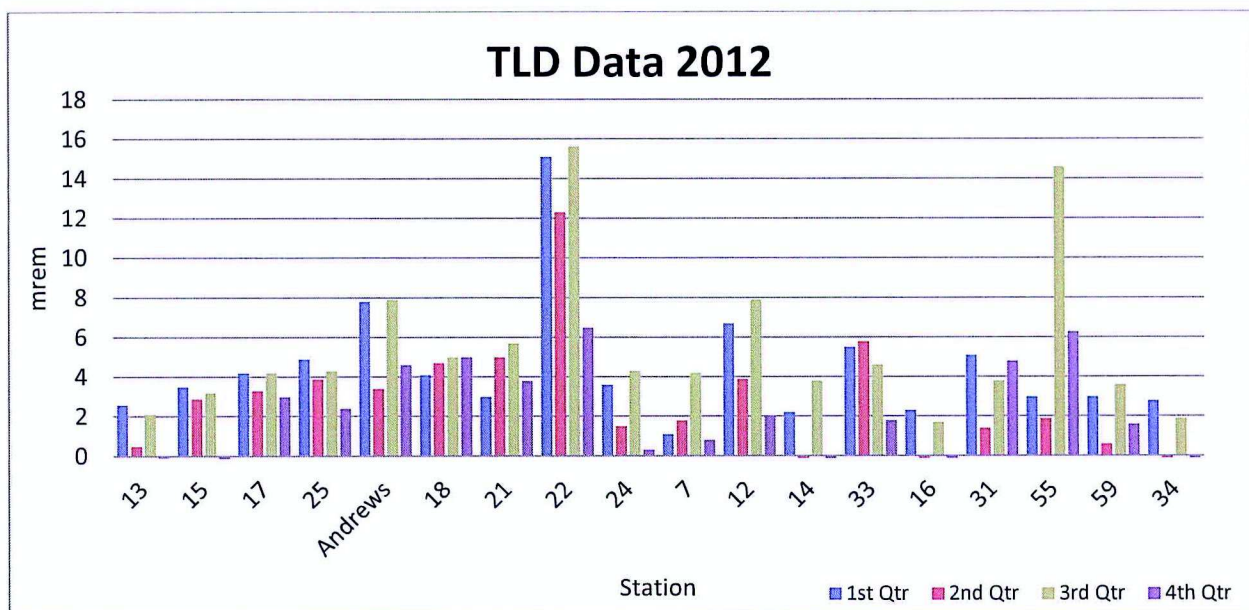


Figure 67 : TLD Results for 2012

3.7 Air Monitoring

As part of the REMP, air is sampled monthly from twenty-six locations for air particulates and tritium vapor. Nineteen stations are sampled for air vapors (air cartridge). Figure 68 displays all of the air monitoring locations.

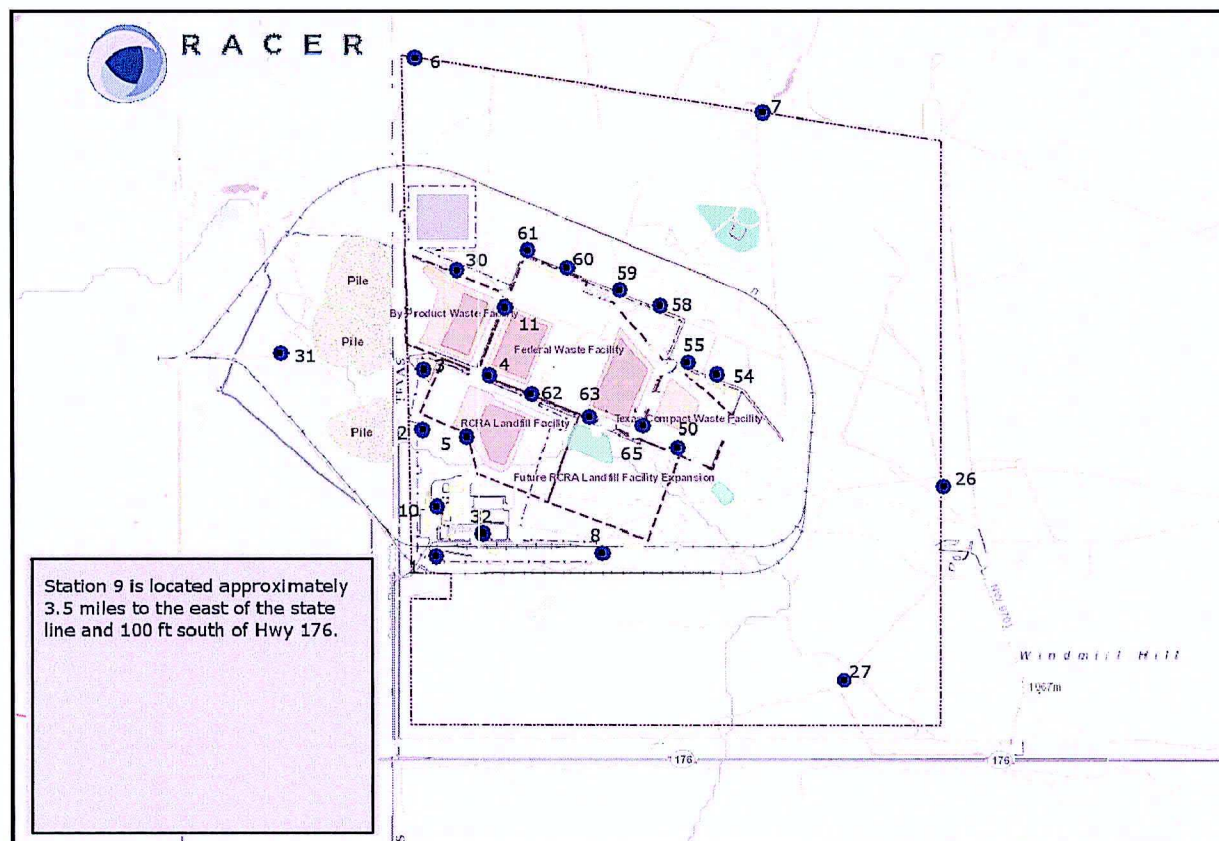


Figure 68 : Air Particulate Sample Locations

3.7.1 Air Particulate

High-volume air particulate samples were collected weekly, composited monthly, and sent to an offsite accredited laboratory for analysis in accordance procedure EV-7.1.16, *High Volume Air Sampling*. Sample results are compared against their respective ILs to determine whether or not a change significant enough to warrant an investigation occurred. Table 22 displays all of the air particulate sampling requirements.

Table 22 : Air Particulate Sampling Requirements

Sample Type	Byproduct Stations	TSDF Stations	LLRW Stations
Air Particulate	1, 3, 4, 6, 7, 8, 9, 11, 26, 27, 30, 31, and 32	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 26, and 27	1, 4, 6, 7, 9, 11, 26, 27, 31, 50, 54, 55, 58, 59, 60, 61, 62, 63, and 65

A statistical summary for the 2012 air particulate data collected during the report period is provided in Table 23. The air particulate samples results for high volume air samples are given in Appendix F. Figure 69 through Figure 79 plot the air particulate results for analytes of note for this reporting period with respect to time.

Table 23 : Summary of Air Particulate Results for January 2012 through December 2012 (pCi/m³)

Parameters	No. of Stations	Obs	Below MDC	Mean	Standard Deviation	Max	Min	BP IL	S&P IL	LL IL	LL ADL
ALPHA	27	324	281	2.06E-3	1.53E-3	1.20E-2	5.83E-5	9.80E-3	1.20E-2	3.30E-3	2.96E-2
Beryllium-7g	27	324	312	8.54E-2	2.54E-2	1.41E-1	-1.80E-3	N/A	N/A	1.42E-1	1.27E+0
BETA	27	324	323	9.31E-3	3.92E-3	3.46E-2	-1.45E-4	1.10E-1	7.70E-2	1.67E-2	1.50E-1
Lead-210	26	312	303	6.01E-3	2.69E-3	1.75E-2	1.32E-4	9.80E-2	1.20E-2	1.17E-2	1.05E-1
Lead-210g	27	324	58	6.86E-3	1.34E-2	9.05E-2	-5.10E-2	N/A	N/A	N/A	N/A
Potassium-40g	27	324	23	1.24E-3	1.34E-3	5.41E-3	-2.14E-3	N/A	N/A	1.03E-2	9.24E-2
Radium-226	26	312	214	1.05E-4	8.13E-5	8.36E-4	-1.52E-5	7.60E-3	1.80E-2	5.89E-4	5.29E-3
Radium-228	26	312	153	1.49E-4	1.92E-4	1.83E-3	-1.63E-4	7.00E-3	4.00E-2	8.19E-4	7.35E-3
Thallium-208g	27	324	5	1.54E-5	9.85E-5	3.57E-4	-2.58E-4	N/A	N/A	3.66E-4	3.28E-3
Thorium-228	26	312	124	4.20E-5	3.35E-5	3.26E-4	-4.72E-5	6.20E-4	4.00E-4	1.91E-4	1.71E-3
Thorium-230	26	312	160	4.95E-5	3.69E-5	3.50E-4	-3.70E-5	1.00E-2	N/A	2.00E-4	1.79E-3
Thorium-232	26	312	193	3.57E-5	2.62E-5	1.89E-4	-3.57E-5	3.40E-4	4.00E-5	1.60E-4	1.44E-3
Uranium-233/234	26	312	311	1.15E-4	2.77E-5	2.52E-4	4.52E-5	9.00E-4	1.00E-3	3.57E-4	3.20E-3
Uranium-235/236	26	312	23	6.50E-6	6.27E-6	3.20E-5	-6.18E-6	2.90E-4	6.00E-4	3.88E-5	3.48E-4
Uranium-238	26	312	312	1.21E-4	2.71E-5	2.47E-4	5.73E-5	3.20E-4	6.00E-4	3.44E-4	3.09E-3

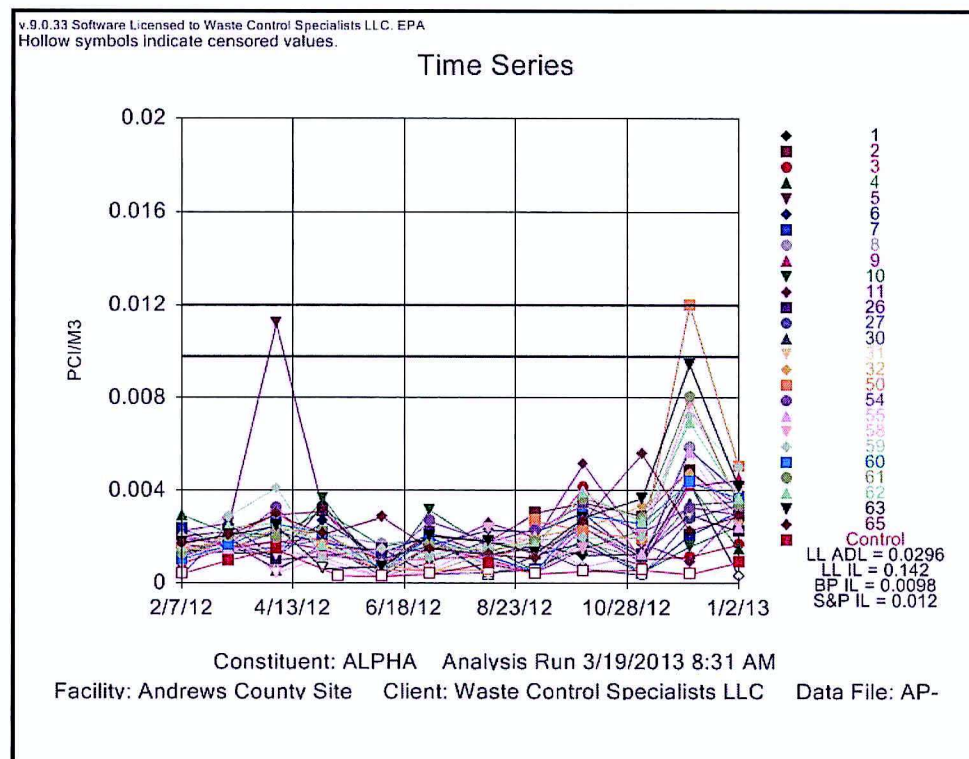


Figure 69 : Air Particulate Results for Gross Alpha