



A N D R E W S , T E X A S

March 30, 2015

VIA EMAIL AND FEDERAL EXPRESS

Charles Maguire, Director
Radioactive Material Licensing Section
Radioactive Materials Division
Texas Commission on Environmental Quality
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References: (1) Radioactive Material License No. R05807, Amendment No. 09
CN600616890, RN101702439
(2) Radioactive Material License No. R04100, Amendment 28, CN600616890,
RN101702439 (3)

**Subject: Annual/Semi-Annual Radiological Environmental Monitoring Plan Report for
January - December of 2014**

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 No. R05807, License Condition 77 (Reference 1):

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.

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Radioactive Material License No. R04100, License Condition 158.H.9 (Reference 2):

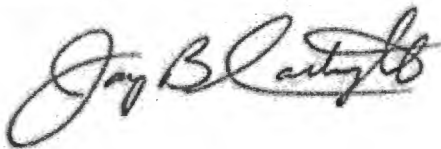
158.H.9 The Licensee shall provide a semi-annual environmental monitoring report to the executive director to be submitted before March 31 and September 30 of the preceding six (6) months. The semi-annual report shall include the results of all environmental media samples for all facilities at the Waste Control Specialist LLC, Andrews County site. The Annual Meteorological Report should be submitted prior to or included in the March 31 semi-annual environmental monitoring report. The Licensee shall follow the requirements of 30 TAC Chapter 25 (Environmental Testing Laboratory Accreditation and Certification,) and provide the executive director with acceptable analytical data provided by and accredited environmental testing laboratory unless extenuating conditions exist as specified under 30 TAC §25.6 (Conditions Under Which the Commission May Accept Analytical Data).

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 Fauna Data
- Appendix C. Summary of Soil Data
- Appendix D. Summary of Sediment Data
- Appendix E. Summary of Vegetation
- Appendix F. Summary of Air Data
- Appendix G. Summary of Groundwater Data
- Appendix H. Summary of Surface Water Data
- Appendix I. Summary of Leachate and Leak Detection Data
- Appendix J. Summary of Septic Data
- Appendix K. Summary of CWF and FWF Contact Water Tank Data
- Appendix L. Summary of Pre-Discharge Sump Data

WCS requests that a copy of all correspondence regarding this matter be directly emailed (jcartwright@wcstexas.com) to my attention as soon as possible after issuance. If you have any questions or need additional information, please call me at 432-525-8698.

Sincerely,



Jay B. Cartwright
Radiation Safety Officer and Director of Radiation Safety

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A N D R E W S , T E X A S

**All Facilities
Annual / Semi-Annual Radiological Environmental
Monitoring Report**

January 1 – December 31, 2014

Andrews County, Texas Site

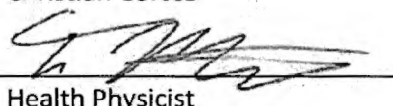
Prepared By:


Health Physicist
Christian Cortez

3/30/15

Date

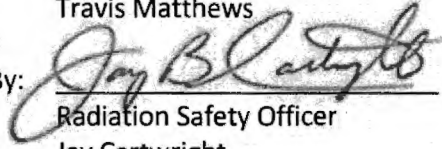
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Radiation Safety Officer
Jay Cartwright

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- Appendix L. Summary of Pre-Discharge Sump Data

**Waste Control Specialists LLC
Semi-Annual Radiological Environmental Monitoring Program Report
For January 1 – December 31, 2014**

Executive Summary

Purpose

This report summarizes the 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, 2014. 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:

- RML No. R05807, Amendment 9, for the Byproduct Material Disposal Facility;
- RML No. R04100, Amendment 28, for the Low-Level Radioactive Waste Disposal Facility, including the Federal Facility Waste Disposal Facility (FWF) and the Compact Waste Disposal Facility (CWF) and for the radioactive waste processing and storage facility;
- 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 review and evaluation of potential migration of 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 28), LC 77 of RML No. R05807 (Amendment 9), LC 92.B of RML No. R05807 (Amendment 9). 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 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.B of RML No. R05807 states "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, groundwater, surface water, wastewater, soil, sediment, 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, 2014 in and around the WCS site. The analyses of these samples yielded approximately 34,000 radiological results.

A fauna sample was collected during this reporting period. All values were below the established ILs and ALs.

Soil samples were collected during this reporting period. Although these results do not show any significant differences from historical soil data, one of the data points for a naturally occurring radionuclide exceeded the current applicable comparison value. This exceedance is common and is not the result of a release; rather, it is due to ILs and ALs that are inappropriately low when compared against natural conditions. The soil sample at station 22 was reported with a concentration of thorium-230 greater than the respective Byproduct IL. This exceedance was reported to the TCEQ within four hours of confirmation as required by LC 92.K of R05807.

Sediment samples were collected during this reporting period. Station GW-2 exceeded the thorium-230, radium-226 and radium-228 Byproduct ILs. These exceedances are not the result of a release. This exceedance was reported to the TCEQ within four hours of confirmation as required by LC 92.K of R05807.

Vegetation samples were collected during this reporting period when sufficient leafy vegetation was present. The vegetation results are consistent with the established background. The vegetation result for station 6 was greater than the byproduct IL for radium-226. This exceedance was reported to the TCEQ within four hours of confirmation as required by LC 92.K of R05807. This result was not indicative of a release, but is instead attributable to natural variability of naturally-occurring radionuclides.

Direct radiation monitors at the facility boundary (stations 13, 6, 7, 16, 26, 17, 34) were consistent with historical data. This background dose is attributed to naturally occurring terrestrial and cosmic radiation and averaged 2.1 mrem for TLDs and 1.9 mrem for OSLs over the reporting period.

The air radiological monitoring results for the reporting period of January 1 through June 30 were consistent with those of previous years. One air particulate result, the April result for station 9, exceeded its associated Byproduct Investigation Limit (IL) for uranium-238; however, it was well below the Action Limit (AL). This result was reported to the TCEQ within four hours of confirmation in accordance with LC 92.K of RML No. R05807. This result was not indicative of a release, but is instead

attributable to dust overloading of a naturally-occurring radionuclide. All other 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. R05807 and R04100.

Groundwater monitoring results for the reporting period of January 1 through June 30 were consistent with those of previous years. Groundwater was sampled from 69 wells and radiological analyses were performed when water sufficient for all analyses was present. These results show no significant differences from background.

Surface water was collected during this reporting period. All values were below the established ILs and 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 semi-annually. 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.

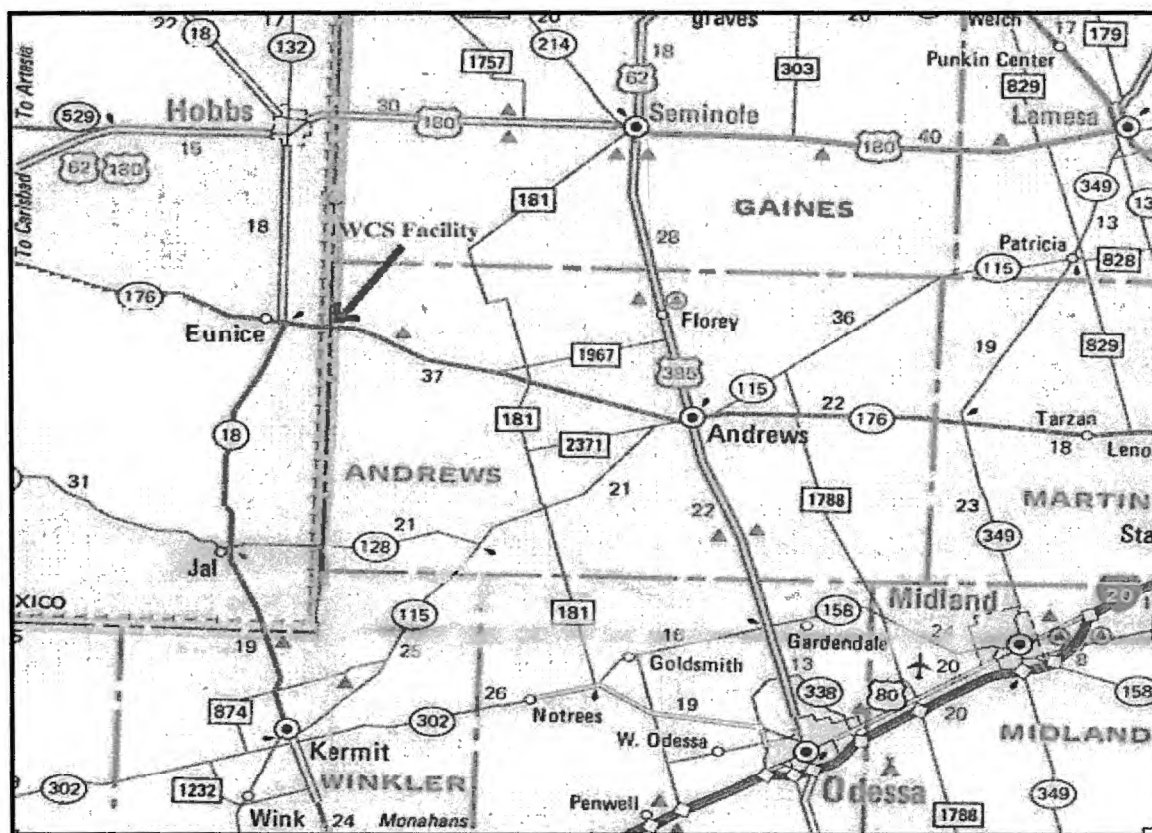
Sanitary wastewater generated at the WCS site is collected in above ground tanks and transported to a Publicly Owned Treatment Works (POTW) in Andrews, Texas. All septic results for the reporting period for carbon-14 and tritium were below the Minimum Detectable Concentration (MDC). All calculated results 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. 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.

Permit-required sampling of wastewater and storm water was conducted for 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.

In summary, none of the results in any of the media or effluent tested is indicative of an unauthorized waste or effluent release. All are consistent with natural conditions at WCS.

Waste Control Specialist 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 waste¹. 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).

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.



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

¹ Mixed waste is a mixture of LLRW and hazardous waste.

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 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 waters, 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 collection and leak detection systems. The bottoms of these cells extend 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:

- RML No. R05807, Amendment 9, for the Byproduct Material Disposal Facility;
- RML No. R04100, Amendment 28, for the LLRW disposal facility, which includes the Federal Facility Waste Disposal Facility (FWF) and the Compact Waste Disposal Facility (CWF), and for the radioactive waste processing and storage facility;
- 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.

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. R04100 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.

All non-radiological sampling requirements are governed by HW-50358, HW-50397, TLAP No. WQ0004948000, Byproduct TPDES WQ0004857000 and TSDF TPDES WQ0004038000, and are reported separately from this document.

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. R04100, 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 of wastes requiring intrusive sampling as part of the incoming waste verification process.

RML No. R04100 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 in authorized areas. 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 wastes identified and listed in 40 Code of Federal Regulations (CFR) Part 261 and non-hazardous industrial wastes. 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. R04100; this unit is not authorized for storage of industrial wastes or wastes containing PCBs.

Processing capabilities authorized by RML No. R04100, 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 exempt² 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. Waste exempted through the RS-5.0.0 process is also disposed in this facility.

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.

² 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.

WCS has 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 were conducted at the FWF until June 6, 2013.

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. R04100. 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 water. Contact water, leachate, and fluids from the leak detection system for the East + West landfill are either routed to the Leachate Treatment Unit (LTU) for treatment and discharge through internal outfall 101 in accordance with TPDES Permit No. WQ0004038000 or are sampled and approved for dust suppression for the landfill. 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 and 002.

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. R04100.

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 for 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 internal outfall 005 to external outfall 002.

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 landfill³ 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.

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 may 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 constituents. 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 Consolidated Radiological Environmental Monitoring Program (REMP).

³ Leak detection systems for the CWF consist of below-liner, remote sensing systems that do not produce liquids.

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 annual review and evaluation of potential migration of 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 28), LC 77 of RML No. R05807 (Amendment 9), LC 92.B of RML No. R05807 (Amendment 9). 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 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.B of RML No. R05807 states "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 constituents in various environmental media and effluents. Media and effluents monitored in accordance with this program include ambient gamma radiation, gases and vapor, air particulate, soil, sediment, fauna, vegetation, surface water, wastewaters, and ground water from multiple strata. These samples are analyzed for a variety of radionuclides, 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 waste constituents and limit effluent releases to authorized levels;
- Assess the 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, air, soil, sediment, and, as available, groundwater, surface water, vegetation, precipitation, and fauna;
- 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 suggesting 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 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 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.

WCS has transitioned 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 report⁴ 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 a Byproduct IL, or any AL, ADL or RL require notification to the 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-1.9.2, *Approval of Offsite Radiological Data*. A copy of this procedure and the applicable data review form is available on-site and is provided in WCS' Quality Assurance Program Plan⁵ (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

⁴ *Environmental Surveillance Data Quality Objectives Part A – Surveillance Objectives, Methods, and Decisions, Revision 3*, dated October 10, 2011.

⁵ *Quality Assurance Project Plan (QAPP) for WCS Radioactive Material Licenses, Revision 1*, dated October 10, 2011.

through time. The software supports importing electronic data files, which prevents data entry errors associated with the manual data entry process. Environmental records and analytical 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-Gatuña (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
Carbon 14	¹⁴ C	Radium 228	²²⁸ Ra	Tritium	³ H
Cesium 137	¹³⁷ Cs	Strontium 90	⁹⁰ Sr	Uranium 234	²³⁴ U
Cobalt 60	⁶⁰ Co	Technetium 99	⁹⁹ Tc	Uranium 235	²³⁵ U
Iodine 129	¹²⁹ I	Thorium 228	²²⁸ Th	Uranium 238	²³⁸ U
Lead 210	²¹⁰ Pb	Thorium 230	²³⁰ Th	Radon-222	²²² Rn
Radium 226	²²⁶ Ra	Thorium 232	²³² Th		

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

In addition to the radionuclides monitored as part of the REMP, gross alpha and gross beta are also monitored.

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 krypton-85, carbon-14, tritium, iodine-129 and radon-222 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;
- 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 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– 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 3 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.