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Revision 9

Quality Assurance Program Plan for Sampling Emissions of Radionuclides to the Ambient Air at the Waste Isolation Pilot Plant

Cognizant Section: Radiological Control and Dosimetry

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ACRONYMS AND ABBREVIATIONS

Am	americium
ANSI	American National Standards Institute
BECR	Biennial Environmental Compliance Report
CAM	continuous air monitor
CBFO	Carlsbad Field Office
CE	Cognizant Engineer
CFR	*Code of Federal Regulations*
cm^2	square centimeter
CMR	Central Monitoring Room
CMS	Central Monitoring System
CY	Calendar Year
DOE	U.S. Department of Energy
dpm	disintegrations per minute
DQO	data quality objective
E&TS	Engineering and Technical Services
EDE	effective dose equivalent
EFR	Engineering File Room
EMS	Effluent Monitoring System
EPA	U.S. Environmental Protection Agency
FAS	fixed air sampler
HEPA	high-efficiency particulate air (filter)
HWFP	Hazardous Waste Facility Permit
I&C	Instrument and Control
keV	kilo electron volts
LCS	laboratory control sample
M&O	Management and Operating
MOU	Memorandum of Understanding
NARAC	National Atmospheric Release Advisory Center
NIST	National Institute of Standards and Technology
NESHAP	National Emissions Standards for Hazardous Air Pollutants
ORC	Office of Regulatory Compliance

PCM	periodic confirmatory measurement
Pu	plutonium
QA	Quality Assurance
QAPD	Quality Assurance Program Description
QC	quality control
RadCon	Radiological Control
RCT	Radiological Control Technician
RIDS	Records Inventory and Disposition Schedule
RMS	Radiological Monitoring System
S&H	Safety and Health
SEC	Site Environmental Compliance
Sr	strontium
TRU	transuranic
U	uranium
U/G	Underground
WHB	Waste Handling Building
WIPP	Waste Isolation Pilot Plant
WTS	Washington TRU Solutions LLC

1.0 INTRODUCTION [1]

The U.S. Department of Energy (DOE), Carlsbad Field Office (CBFO) is the owner of the Waste Isolation Pilot Plant (WIPP) and is responsible for all aspects of development and operation. The CBFO Office of Regulatory Compliance (ORC) oversees the implementation of the regulatory compliance program, and manages the activities of environmental monitoring, and ensures that the Effluent Monitoring Program is effectively performed.

Washington TRU Solutions LLC (WTS) is the management and operating (M&O) contractor and, as such, is responsible for the daily facility operational and compliance duties.

The Quality Assurance (QA) Program Plan for Sampling Emissions of Radionuclides to the Ambient Air at the WIPP is provided to comply with Title 40 *Code of Federal Regulations* (CFR) Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities," which requires in §61.93(b)(5)(v) that a QA program shall be conducted that meets the performance requirements described in Appendix B, Method 114. Through the periodic confirmatory sampling program, WIPP provides documentation that the effluents meet the regulatory limits of 40 CFR Part 61, Subpart H and 40 CFR Part 191, Subpart A, "Environmental Standards for Management and Storage."

To assure a uniform and consistent interpretation of the National Emissions Standards for Hazardous Air Pollutants (NESHAP) provisions for Radionuclides at DOE facilities and U.S. Environmental Protection Agency (EPA) regional offices, a Memorandum of Understanding (MOU) was prepared and signed, between the EPA and the DOE, dated April 5, 1995, concerning the Clean Air Act Emission Standards for Radionuclides (40 CFR Part 61, including Subparts H, I, Q, and T). The MOU also specifies use of alternative monitoring methods and procedures for the WIPP facility under 40 CFR §61.93(b)(3).

The January 1997, WIPP Subpart A Guidance document, EPA 402-R-97-001, *Guidance for the Implementation of EPA's Standards for Management and Storage of Transuranic Waste* (40 CFR Part 191, Subpart A) *at the Waste Isolation Pilot Plant*, Section 3.1(2)(iii)(a) states "The Shrouded Probe collection method has been approved by the EPA as an alternative method." The EPA 402-R-97-001 document further states that "EPA expects radionuclides to be directly monitored or extracted, collected and measured..." following the guidance presented in the American National Standards Institute (ANSI) N13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*.

In 1969, ANSI established a standard for effluent sampling in stacks that recommended the use of isokinetic samplers and established the number of sampling points based on stack diameter. The ANSI N13.1-1969 Standard also established recommendations for fabrication and installation of transport lines. The standard allowed the installation of

engineered systems that were as efficient as the isokinetic collector specified. Through testing, the Aerosol Technology Laboratory of Texas A&M University established the standard recommending isokinetic sampling system have a transport efficiency of 50% compared to the concentration of particles of 10 micron AD (the particle size the standard is based on).

With that equivalency for transport efficiency established, Texas A&M University designed and tested the single point representative sampling system currently in use at the WIPP Station A, Station B, and Station D effluent air monitoring stations. Station A and Station B installed systems are qualified and installed per the ANSI N13.1-1969 Standard as justified in the June 1994 WIPP report, Effluent Monitoring Station A Shrouded Sample Probe Inspection Report.

Per ANSI N13.1-1969, engineered systems that are proven to perform as well as the recommended isokinetic sampling system are acceptable for use in stack sampling for radioactive airborne contamination. The WIPP single point representative sampling systems installed at Station A and Station B are engineered systems qualified as equal to or superior to the ANSI N13.1-1969 specified isokinetic sampling system for effluent monitoring of airborne radioactive contamination in stacks. Station C sampling system was installed and qualified to maintain isokinetic sampling conditions. Station C fixed air sampler (FAS) is located in the Waste Handling Building (WHB). Documentation proving the superiority of the WIPP-installed systems over the ANSI N13.1-1969 recommended isokinetic stack sampling system are provided in reports by Texas A&M University. These reports culminated in the 1994 WIPP report as referenced above. Copies of the referenced documentation are located in the Engineering File Room (EFR).

In the past, there has been some confusion related to the standard ANSI N13.1-1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*. The criteria, in the 1999 revision, was established based on the work that Texas A&M University did for the WIPP. The 1999 revision of ANSI N13.1 was established after the WIPP Effluent Monitoring Systems (EMS) for Station A and Station B were installed and qualified, therefore, they cannot, by definition, be installed and qualified per the 1999 standard. Neither the sampling nor collection systems have been revised in a manner that would require the systems to be requalified. Therefore, the systems remain qualified per the ANSI N13.1-1969 Standard and supported by the Texas A&M University research, design and documentation performed specifically for WIPP (all which predate 1999).

Station D is located at the base of the exhaust shaft and is considered a "supplementary station" to Station A. Station D radiochemistry results are used for verification and/or comparison of Station A results, as applicable. The Station D sampling system was designed and installed per the ANSI N13.1-1999 Standard. Station D was also supported by the Texas A&M University research design and documentation.

The effluent air sampling program is further defined, detailed, and conducted using the following documents:

- DOE/WIPP-97-2238, *Periodic Confirmatory Measurement Protocol for the Waste Isolation Pilot Plant*
- WP 12-HP1305, Fixed Air Monitoring Equipment
- WP 12-HP3500, Airborne Radioactivity
- WP 12-HP4000, Emergency Radiological Control Responses
- WP 12-RE3004, Periodic Confirmatory Analysis, Reporting, and Compliance Activities
- Radiological Control WIPP Statement of Work and Data Quality Objectives for Analysis of RadCon Samples by WIPP Laboratories
- IC041072, Calibration of Effluent Monitoring Skids A-1, A-2, A-3, B1 and B2 Flow Instrumentation
- IC041097, Calibration of Station C Flow Instrumentation
- IC041098, U/G Exhaust Mass Flow Measurement System for Fans 700A, B, and C
- IC413000, Station B Mass Flow Measurement System Loop 41A001W2001

NOTE

Attachment 1, 40 CFR Part 61, Subpart H, Appendix B, Method 114 Requirements and WIPP Document Location, provides a table that identifies where each element of Appendix B, Method 114 requirements are met in WIPP documents. Attachment 1 is based on the ANSI N13.1-1969 Standard.

2.0 PROJECT ORGANIZATION AND RESPONSIBILITIES [2]

The DOE is the owner of the WIPP Facility and is responsible for all aspects of its development and operation. As the management and operating contractor, WTS is responsible for all day-to-day facility operations, including those related to the effluent monitoring regulatory compliance requirements.

The WIPP Effluent Monitoring Program is supported by the following organizations:

- General Manager

- Safety and Health Department (S&H)
- Operations and Disposal Department
- Engineering Department
- Quality Assurance Department
- Business Management
- Regulatory Compliance
- WIPP Laboratories - Washington Safety Management Solutions, LLC (WSMS)

The WIPP Effluent Monitoring Program interfaces with the following stakeholders:

- WIPP New Mexico Environment Department Oversight Bureau
- Carlsbad Environmental Monitoring and Research Center

The department managers and the line managers are responsible for activities performed in their respective areas. Within each organization are groups that perform specific tasks related to the WIPP Effluent Monitoring Program. Figure 2-1 represents the organizational relationships between these departments, and groups; with the exception of the stakeholders.

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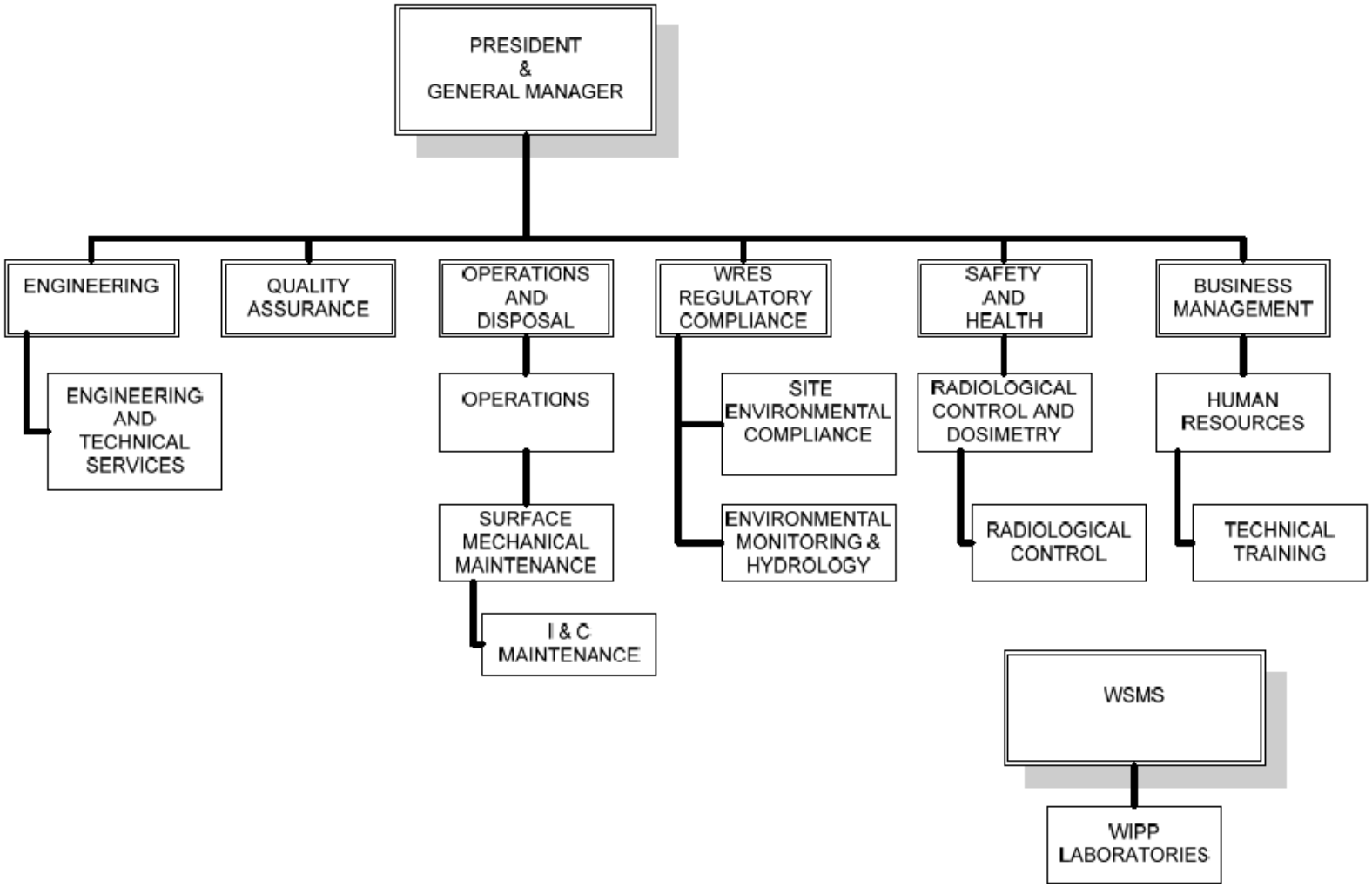
Figure 2-1 - Organizations for the WIPP Effluent Air Monitoring Program



2.1 General Manager

The General Manager has overall responsibility and authority for the development, implementation, and compliance of the WIPP Effluent Monitoring Program. The General Manager is responsible for ensuring that adequate funding is provided and requires that consistent communications and interface is maintained between the multiple organizations to enable implementation and management of the effluent monitoring regulatory compliance requirements.

Authority for execution of this QA Program Plan is delegated to the managers of S&H, RC&D, and SEC. These managers are also responsible for establishing and maintaining, the effective implementation of, the WIPP Effluent Monitoring Program.

2.2 Safety and Health Department

Under the direction of the S&H Department Manager, RC&D Section has primary responsibility for operating the WIPP Effluent Monitoring System. In the RC&D group , the Radiological Control (RadCon) group responsibilities include the following:

- Initiating and collecting filter samples from the sampling equipment in the repository and the on-site surface sampling stations.
- Initiating sample chain of custody.
- Completing the on-site field data forms.
- Managing handling, storing, and shipping samples to the laboratory.
- Performing equipment operability checks in accordance with approved procedures. (A Statement of Work [SOW] between the WTS RadCon groups, SEC, and the WIPP Laboratories details the associated radiochemical analyses, QA, and reporting requirements.)

2.3 Operations and Disposal Department

The site Operations and Disposal Department is responsible for the following:

- Implementing the Station A preventive maintenance procedure (inspection and cleaning of the transport lines, shrouded probes, and Station A guide tubes).
- Conducting leak testing of the transport assembly, maintaining up-to-date applicable maintenance procedures, and the scheduling of all effluent FAS units maintenance and calibration activities.

- Providing electrical power to the effluent FAS units; operating the Central Monitoring Room (CMR), which monitors low-flow alarms for the effluent FAS units.

- Performing calibration of all effluent samplers and associated components. The I&C Maintenance group calibrates differential pressure units and checks them through the Central Monitoring System (CMS) on an annual basis, checks calibrations on flow controllers, performs semiannual preventive maintenance on pumps, performs semiannual preventive maintenance as required, and any modifications as required by the system Cognizant Engineer (CE).

2.4 Engineering Department

2.4.1 Engineering and Technical Services

E&TS group is responsible for performing consequence assessments using the HOTSPOT and National Atmospheric Release Advisory Center (NARAC) Programs. If power, communication, computer, or network problems prevent the use of either HOTSPOT or NARAC, hand calculations based on dispersion curves for chi/Q may be used instead. Engineering group responsibilities include cognizant engineering responsibilities for the air monitoring systems. The Engineering department ensures the proper design, testing, and placement of air monitoring equipment within the facility exclusive use area. Descriptions of monitoring equipment placement and location are provided in Section 4.1.

System CEs provide technical assistance to maintenance for work to be performed on plant structures, systems, and components, and review and approve post-maintenance test results.

2.5 Quality Assurance Department

The QA Department is responsible for conducting independent oversight of the WIPP Effluent Monitoring Program. The sampling and analysis activities are designated Quality Level 1 in accordance with the graded approach specified in WP 09-CN3005, Graded Approach to Application of QA Controls. This designation is based on the potential for members of the public to be exposed to radiological contaminates due to WIPP operations.

2.6 Business Management

In conjunction with the General Manager's Office, the Business Management Department is responsible for ensuring that adequate funding is provided to the responsible departments to enable them to comply with 40 CFR Part 191, Subpart A, "Environmental Standards for Management and Storage" and 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities."

2.7 Regulatory Compliance

2.7.1 Site Environmental Compliance

SEC is responsible for demonstrating compliance by showing that the annual radiation dose to any member of the public is below the regulatory limits with two regulations; 40 CFR Part 61, Subpart H and the requirements of 40 CFR Part 191, Subpart A.

SEC is responsible for preparing and submitting an annual report to the DOE. The DOE must then submit the report to the EPA headquarters, and the appropriate regional EPA office by June 30. The annual report must include the results of the effluent monitoring and the dose calculations required by 40 CFR §61.93(a) for the previous calendar year.

As required by the WIPP Land Withdrawal Act, compliance with 40 CFR Part 191, Subpart A standard is determined by submitting documentation every two years on continued compliance with the Subpart A standard. The report must include the results of the monitoring and the dose calculations for the reporting period (i.e., the two calendar years previous to report submittal). Although each report covers a two-year time period, annual radiation doses must be calculated separately for each calendar year.

The Template for Annual Periodic Confirmatory Measurement Compliance Report, Attachment 2 of WP 12-RE3004, contains an example to be used in generating the Annual Periodic Confirmatory Measurement (PCM) Compliance Report. It is to be copied from this procedure and modified as necessary.

SEC is responsible for receiving analytical data (filter sample analyses) from the WIPP Laboratories; summarizing the radionuclide emissions data, and ensuring that the annual off-site EDE is correctly calculated and reported. The analytical data from sample filter analyses are used to calculate the total quantity of radionuclides released in air emissions and recorded on Attachment 1, Composite Samples Worksheet of WP 12-RE3004.

The radionuclide emission data, the average temperature, five-year meteorological data, population data and precipitation are entered into the EPA-approved computer model to calculate the annual off-site EDE in accordance with the User's Guide for CAP88-PC.

Upon completion of a final NESHAP report by SEC group, the report is sent to (1) the DOE for signature and transmittal to the appropriate EPA office; (2) the SEC group for inclusion in the WIPP Biennial Environmental Compliance Report (BECR).

2.7.2 Environmental Monitoring and Hydrology

EM&H group is responsible for the off-site monitoring and providing reports of the ambient air, groundwater, surface water, soils, sediments and biota to characterize the

radiological environment around the WIPP facility in accordance with the WIPP Environmental Monitoring Program. This program is carried out in accordance with the DOE/WIPP-99-2194, Waste Isolation Pilot Plant Environmental Monitoring Plan. EM&H is also responsible for providing certified WIPP meteorology data for use in reports to the DOE and the regulators.

2.8 WIPP Laboratories - WSMS

WIPP Laboratories provide radiochemistry analysis in support of RC&D, EM&H, and SEC groups at the WIPP site.

The WIPP Laboratories are responsible for the following:

- Analysis of the filter samples submitted by RadCon, EM&H, and SEC groups
- QA and quality control (QC) within the sample analysis
- Data verification and validation

The WIPP Laboratories has the capability to analyze for all isotopes of interest within the transuranic (TRU) waste profile. These isotopes include: ^{238}Pu (plutonium), $^{239/240}$Pu, ^{241}Am, ^{234}U, ^{238}U, ^{235}U, ^{90}Sr (strontium), ^{60}Co, and ^{137}Cs. The lab also has the capability to analyze for other isotopes.

Other EM&H and SEC matrices analyzed by WIPP Laboratories include air filters, surface and ground water, soil, sediment, sewage lagoon, vegetation, and biota. Biota samples usually include quail, rabbits, road-killed deer, and fish, as well as any sample of opportunity.

All sample preparation and destructive analyses are performed by qualified WIPP Laboratories personnel utilizing approved procedures. A counting room containing alpha spectrometers, gamma spectrometers and a gas proportional counter with detectors are kept calibrated to count samples as soon as the chemistry is completed.

All data validation and verification is performed by qualified WIPP Laboratories personnel and can be reported as Level I, II, III, or IV based on the client SOW.

In addition, WIPP Laboratories still maintains a counting room at the WIPP site (Bldg. 451) to perform all gross alpha/beta measurements of air filters, and monitoring of emergency samples in an expedited manner. One gamma spectrometer and a bank of alpha spectrometers are kept calibrated in the event a quick analysis is needed for emergency samples.

Samples are tracked from time of collection to time of disposal through the use of a chain of custody form, and an internal chain of custody form that is maintained within

the laboratory. The tracking continues until the sample is either disposed of or returned to the client.

Samples are stored and maintained in predetermined environmental conditions to preserve sample integrity, as needed.

3.0 ADMINISTRATIVE AND ENGINEERED CONTROLS

Administrative and engineered controls have been implemented to minimize the release of airborne radionuclides from the WIPP site. In the event of a radionuclide release, facility controls ensure that off-site consequences are minimized.

3.1 Administrative Controls [3]

The WIPP facility operational philosophy is to start radiologically "clean" and stay radiologically "clean." WIPP uses 10 CFR Part 835, "Occupational Radiation Protection," and DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*, as its standards for conduct of radiological control activities by trained and qualified personnel. Administrative controls for minimizing airborne radioactive emissions include training, approved procedures, establishment of waste acceptance criteria, verification of waste container integrity, and limiting the conditions under which facility operations will proceed.

Personnel in the RadCon group and EM&H group are trained in the application of the specific procedures required to complete radiological air sampling tasks. Specific training associated with radiological air sampling and analysis is provided in the qualification processes for radiological control technicians (RCTs). RCT candidates must successfully complete the WIPP Qualification Standard (RCT-01, Part B) to become a qualified air sampling RCT. Radiochemistry laboratory staff must successfully complete the qualification cards required by their job description. These include Counting Room Technician Alpha Spectroscopy (CRT-AS), Counting Room Technician - Gamma Spectroscopy (CRT-GS), Counting Room Technician - Liquid Scintillation Counter (CRT-LSC), Counting Room Technician - Proportional Counting Qualification (CRT-PC), Radiochemistry Technician Qualification Card (TRC-01), and/or Staff Radiochemist Qualification Card (SRC-01). These qualification processes were developed using DOE standardized training materials and supplemented with site-specific materials, including approved procedures. Copies of all approved procedures are maintained and controlled by the Document Services group.

The following WIPP procedures define response actions in the event of a contamination event or when effluent filter samples indicate an unexpected release of radioactive materials. WP 12-ER4903, Radiological Event Response, and WP 12-HP4000, provide guidance to the RadCon group and the E&TS group for response to unexpected releases. These procedures help ensure that any release of radioactive material is identified, responded to, and stopped in a timely manner. Additional administrative

controls are identified in DOE/WIPP-07-3372, Waste Isolation Pilot Plant Documented Safety Analysis.

Waste accepted for emplacement in the WIPP facility must conform with DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*, and WP 12-5, Waste Isolation Pilot Plant Radiation Safety Manual, which establishes a limit for removable contamination on the surface of waste containers to <20 dpm/100 cm^2 (disintegrations per minute/100 square centimeters) for alpha (transuranic) and <200 dpm/100 cm^2 for beta-gamma (strontium-90 [Sr-90]) (10 CFR Part 835 and DOE/WIPP-02-3122). The potential for routine, detectable radioactive air emissions are minimized by limiting the levels of removable surface contamination on waste containers to these levels and by keeping the waste containers sealed. The transport and handling of waste containers is administratively controlled to ensure containers maintain their integrity and function as the primary containment barrier.

3.2 Engineered Controls

The WIPP facility uses both primary and secondary methods to prevent or reduce the release of airborne radioactive material from two potential emission sources; the WHB and the underground (U/G) repository. All waste packages remain sealed at all times in both locations. The metal packages are the primary physical containment barrier for preventing the release of airborne radioactive material. Secondary physical confinement is provided during shipping by U.S. Nuclear Regulatory Commission approved waste shipping containers. Secondary physical confinement, when the waste is not in shipping, is provided by the WHB, the U/G walls and ceilings, and the ventilation systems described below.

The WHB effluent is subjected to continuous high-efficiency particulate air (HEPA) filtration before being discharged to the environment through a vent located on the west side of the WHB. Under normal conditions, the effluent from the U/G repository is exhausted directly to the environment through the exhaust shaft east of the WHB. However, if an above-normal potential exists for, or there is an indication of airborne contamination, the effluent volume from the U/G repository is reduced and diverted through HEPA filtration units in the Exhaust Filter Building. During filtration, ventilation flow rates through the U/G are greatly reduced because of the airflow restrictions of the HEPA filters.

Air monitors are maintained at strategic locations in the WHB and in the U/G repository to monitor the real-time levels of airborne radioactivity. Monitors in the WHB are located at each end of the waste handling docks. In the U/G, monitors are placed so as to monitor the exit airflow from the active waste emplacement panels. If airborne contamination were detected in the U/G repository, the Radiological Monitoring System (RMS) would automatically divert the U/G effluent through the HEPA filtration units before it is exhausted to the environment. If this automatic function were to fail and a potential for contamination existed, CMR personnel could manually switch to filtration mode, which diverts effluent air through the HEPA filters.

The ventilation system in the WHB maintains a negative pressure differential between the environment and the HEPA filtration system. This pressure differential ensures that airflows from the environment to the WHB and then is exhausted through the HEPA filters at all times.

U/G air is supplied to four ventilation subsystems: the radioactive waste disposal area; U/G mining area; the north end of the mine; and the area between the waste shaft and the exhaust shaft. All flows are combined near the exhaust shaft. A pressure differential is maintained between the subsystems to ensure that air leakage between the subsystems flows from non-waste areas of the U/G (the mining area and the north end have the least contamination potential) into the waste area (waste disposal and waste hoist areas have the highest contamination potential). Bulkheads and airflow regulators separate airflows and maintain pressure differentials.

4.0 SAMPLE SYSTEM COLLECTION AND ANALYSIS

This section describes the systems, procedures, and equipment used at the WIPP facility to perform the emission sampling of radionuclides to the ambient air, necessary to demonstrate compliance with 40 CFR Part 61, Subpart H, and 40 CFR Part 191, Subpart A. Representative filtration samples of the airborne effluent from the WIPP facility are routinely collected and analyzed for the presence of specific radionuclides. The analytical results are then used to assess compliance with the standards identified in Section 1.0. The collection and analysis of filters are controlled by the following WIPP procedures:

- WP 12-HP1305, Air Sampling Equipment
- WP 12-HP3500, Airborne Radioactivity
- WP 12-RE3004, Periodic Confirmatory Analysis, Reporting, and Compliance Activities
- WP 12-RL.01, Radiochemistry Quality Assurance Plan
- WP 12-RL1001, Sample Tracking and Custody
- WP 12-RL1012, Elemental Separation-Transuranic Products
- WP 12-RL1016, Operation of the Oxford Series 5 Gas Proportional Counter
- WP 12-RL1017, Vacuum-Assisted Rapid Sequential Separation of Actinides and Strontium in Various Matrices
- WP 12-RL3002, Radiochemistry Laboratory Data Validation and Verification
- WP 12-RL3003, Data Reduction and Reporting

4.1 Effluent Sampling Site Locations and Equipment [4, 5, 7]

FAS units at Station A sample the unfiltered exhaust ventilation effluent from the U/G repository. FASs at Station B sample the HEPA-filtered exhaust ventilation effluent from the U/G repository. Additionally, Station B samples the air after Station A (redundant) when the HEPA filters are bypassed during maintenance bypass, minimum, or reduced modes of U/G ventilation operation. FASs at Station C sample the HEPA-filtered exhaust ventilation effluent from the WHB.

The WHB and U/G repository ventilation systems were analyzed to determine the location of the sampling probes for each sampling station to ensure representative samples are obtained. In 1988, the Energy Systems Laboratory of Texas A&M University conducted tests using scale models of the WIPP exhaust airflow systems to recommend the locations for the shrouded sampling probes for Stations A and B, and to determine the expected velocity and particle concentration profiles at these locations. The DOE subsequently published the results of these tests. The study recommended the Station A sampling probe be located 1.5 stack diameters (21 feet) upstream of, or below, the exhaust duct elbow, and the Station B sampling probe be located 11.5 stack diameters (69 feet) downstream of the final fan discharge to the exhaust duct. Additional tests were conducted on the effluent sampling systems at both Stations A and B after the probes were installed. The tests confirmed the appropriateness of single-point sampling.

The sampling point for Station C was designed according to the methodology specified by the ANSI N13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*.

Shrouded probe aerosol samplers are used to collect samples at Station A and B. A standard isokinetic sampling traverse is used to obtain representative samples at Station C. The air sampling testing and evaluation for Stations A, B, and C are documented in the following documents:

- DOE/WIPP-88-024, *Tests of Model Waste Isolation Pilot Plant (WIPP) Exhaust Airflow Systems*
- DOE/WIPP-89-026, *Evaluation of the Station A Effluent Monitoring System in the Underground Exhaust Ventilation System at the Waste Isolation Pilot Plant*
- DOE/WIPP-89-027, *Evaluation of the Station B Effluent Monitoring System in the Underground Exhaust Ventilation System at the Waste Isolation Pilot Plant*
- DOE/WIPP-89-028, *Evaluation of the Station C Effluent Monitoring System in the WHB Exhaust Ventilation System at the Waste Isolation Pilot Plant*

All samples collected from Stations A, B, and C will be counted for gross alpha/beta activity. Representative samples will be utilized for the radiochemical analysis used to determine the source term for the CAP88-PC dose modeling program. Representative filters are further defined in WP 12-RE3004.

The WIPP facility uses skid-mounted FAS units at each sampling station to collect representative samples of airborne particulates. An FAS is a device designed to pass a volume of air through an appropriate filter medium. The basic components of an FAS are a vacuum supply, filter holder, flow-controlling unit, and differential pressure indicator. The FASs at Stations A, B, and C have the same basic components and configuration. The vacuum supply for each FAS includes two independent vacuum pumps. Only one pump actually supplies the vacuum; the other pump functions as a backup. The vacuum draws effluent air from the sampling probe through stainless steel tubing. A vacuum relief valve is provided to protect the vacuum pumps in the event of a flow blockage or clogged filter. A backup power system provides sufficient backup power for all systems at each sampling station for approximately 30 minutes should primary power be disrupted. Diesel generators are used to furnish power if an electrical outage lasts longer than 30 minutes.

The FAS flow-controlling system is designed to regulate the total flow from the sampling probe to each individual FAS after the total flow has passed through the three-way splitter. It is designed to maintain accurate aerosol flow rates within ±10% of the set point. Flow rates for Stations A and B are set at 2 cubic feet per minute for each FAS. Flow rates for the Station C FAS vary according to WHB exhaust airflow in order to maintain isokinetic sampling conditions.

Currently, the FAS filters used are 3 micron, 47-mm-diameter, Versapor® membrane filters manufactured with a copolymer deposited on a nylon mesh for support. The filter pore size maintains a low-pressure drop and provides high-particle collection efficiency of sub-micron and larger-sized particles.

A FAS unit located in the U/G is Station D, which was designed according to the methodology specified by the ANSI N13.1-1999 Standard. Station D samples the ventilation from the waste storage area. The filter samples collected from this location are counted for gross alpha/beta activity and submitted for isotopic composite analysis as required.

4.1.1 Flow Measurements [8]

Different types of sample flow measurements are used at WIPP, depending upon the monitoring stations. Stations A and B air samplers use electronic flow controllers to regulate, monitor, and record the flow rates for each individual FAS. An electronic flow controller regulates and records Station C flow rates. Flow rates are monitored by the CMR to help ensure that representative samples are collected during normal working hours.

Approved and controlled operating procedures WP 12-HP1305 and WP 12-HP3500 are used to obtain and record flow rate data. Controlled Preventive Maintenance Instructions are used to calibrate flow rate measuring equipment. The flow controllers are calibrated on an annual basis at a minimum. The calibration procedures are IC041072 and IC041097.

The effluent flow rates in the filtered and unfiltered exhaust from the U/G are continuously monitored using airflow sensors. The monitoring data is continuously transmitted to the CMR for reading and recording.

The effluent flow rate from the WHB is monitored continuously as part of the isokinetic sampling system for the exhaust stream. The effluent flow rate is continuously measured and recorded using a combination of a flow meter and flow control system. To ensure the accuracy of flow rate measurements, the flow measurement and control system is calibrated annually against a series of pitot tube measurements at the Station C sampling traverse. The effluent flows are calibrated using the following procedures:

- IC041096, Calibration of Station C Mass Flow
- IC041098, U/G Exhaust Mass Flow Measurement System for Fans 700A, B, and C
- IC413000, Station B Mass Flow Measurement System Loop 41A001W2001

4.2 Sample Collection and Laboratory Analysis [7, 10]

Filters are exchanged, handled, and analyzed using WP 12-HP1305 and WP 12-HP3500. The gross alpha and beta counting is conducted after a minimum of three days. Action levels have been established to give an indication of a possible release. At this indication, further investigation is conducted including radioanalysis of the filters. The filter chain of custody is also outlined in WP 12-HP3500.

All effluent sample filters collected from an effluent sampler that qualify as representative samples are radiochemically analyzed to determine the total amount of material released to the environment. Filters are counted by the WIPP Laboratories group, using the protocol between RadCon and WIPP Laboratories, and WIPP Laboratories procedures. If the WIPP Laboratories group is not available to count the samples, an RCT may count the samples for gross alpha/beta activity. All analyses are performed according to the requirements of 40 CFR Part 61, Subpart H, Appendix B, Method 114, Test Methods for Measuring Radionuclide Emissions from Stationary Sources. Internal QC samples are included with each batch of samples. Unless specifically addressed in the SOW for WIPP Laboratories presented by the client, the

level of processing of internal QC samples constitutes, on the average, a minimum of 10% of the total processing load. QC samples include the following:

For Destructive Analysis:

- Reagent blanks constitute all the reagents added at each step of the radiochemical technique used in a particular analysis.
- Laboratory control samples (LCSs) consist of an aliquot of deionized water spiked with a known concentration of a National Institute of Standards and Technology (NIST)-traceable standard solution.
- Replicates (when there is enough sample available) are a duplicate sample analyzed in the same manner and at the same time as the original aliquot.

Gross Alpha/Beta Measurements:

- Plated NIST-traceable sources are used for LCSs
- A clean filter sample is counted as a matrix blank

Split samples and spiked samples are analyzed at the client request, although each Pu, americium (Am) and uranium (U) sample is spiked with internal tracers to measure recovery.

Control charts are kept for blanks and LCSs for each isotope analyzed.

A sequential separation method for isolating transuranic and fission products from each other has been developed and implemented at the WIPP Laboratories. In sequential separation, a known amount of tracer for Pu, U, Am, and a carrier for Sr is added to the sample. By using a series of chemical separations, the isotope of interest is isolated. The purified fractions are then prepared for counting by microprecipitation. Pu, Am, and U are counted on the alpha spectrometer. Sr is counted on a gas proportional counter. Filter samples needing gamma counting are acid digested, then aliquoted directly into marinelli flasks and counted. Filters requiring gross alpha/beta counting are also placed directly into the counting chamber.

Alpha spectrometry calibrations for energy and efficiency calibration are performed using NIST-traceable sources of known activity. Monthly calibration checks for energy and efficiency are also performed. Pulser calibration checks are performed prior to sample counting. This check is a verification that the electronics are working properly. A long background count is performed monthly and used for background subtraction for sample analysis.

Gamma spectrometry calibrations are performed annually using NIST-traceable standard sources containing various radionuclides in the energy range of 59.9 kilo electron volts (keV) to 1836 keV. The calibration must be performed for the geometry to be used for counting samples. Background counts for each detector and geometry are performed monthly. A five-minute background count is performed daily, or prior to use, or as a contamination check. A calibration check is performed daily, or prior to use, on three peaks for peak area, peak centroid, and peak full-width at half maximum.

Proportional counter calibrations are performed annually for efficiency using NIST-traceable source containing alpha and beta emitting radionuclides. An annual voltage plateau is also established. Blank sample holders are counted in the detector to establish backgrounds monthly. Daily or prior to use, efficiency checks and background checks are performed.

4.3 Continuous Monitoring [6]

A RADOS Ram 31, an alpha/beta continuous air monitor (CAM) is placed at the exit of an active waste disposal panel (for U/G shift to filtration) per the WIPP Hazardous Waste Facility Permit (HWFP).

The CAM alarm, the calibrations, and checks use the following procedures:

WP 12-HP1318, RADOS Continuous Air Monitor, provides instructions for the operation of the RADOS CAM and the equipment operability checks.

WP 12-HP1319, RADOS RAM 31 Functional Check, provides the user with instructions to perform a functional check of the RADOS RAM 31 CAMs.

IC534000, RAM 31 Continuous Air Monitor for Alpha and Beta, covers filter handling mechanism operational check, alpha and beta efficiency calibration check, GM tube calibration check, flow indication calibration check, and CMS point check.

5.0 QUALITY ASSURANCE FOR MEASUREMENT DATA [9]

WIPP established a program to ensure that all measurements meet the data requirements for precision, accuracy, and completeness. Data quality objectives (DQOs) were developed to qualify the emissions monitoring data. DQOs are qualitative and quantitative statements describing the overall level of uncertainty that a decision-maker is willing to accept in analysis results derived from environmental data. DQOs are based on the end uses of the data to be collected. They are specific characteristics of data associated with their ability to satisfy a given purpose or objective. The objective of the program is to make certain that the DQOs for precision, accuracy, and completeness have been satisfied.

The data obtained from radionuclide emission sampling will be used to provide reasonable assurance that the WIPP facility does not emit radionuclides in quantities

exceeding applicable federal emissions standards. The overall objective for the WIPP radionuclide emission monitoring program is to provide data that will allow a quantitative assessment of compliance within the limits established by 40 CFR Part 61, Subpart H and 40 CFR Part 191, Subpart A.

5.1 Precision

Per Method 114, Section 4.4, "Precision is a measure of the agreement among individual measurements of the same parameters under similar condition." The following identifies precision requirements for each of the following measurements made of the PCM:

- The Laboratory QA Officer will identify and verify that laboratory precision is being evaluated through the analysis of laboratory sample duplicates and matrix spike/matrix spike duplicates, when sample volume allows. A matrix spike and matrix spike duplicate are aliquots of a sample that are spiked with a known activity of the analyte of interest. The acceptance criteria is ± 40% of the known added activity.

5.2 Accuracy

Per Method 114, Section 4.4, "Accuracy is the degree of agreement of a measurement with a true or known value." The following identifies accuracy requirements for each of the following measurements made for PCMs:

- The Laboratory QA Officer will identify and verify that Laboratory accuracy is being measured as percent recovery for LCSs or matrix spikes, when sample volume allows. The acceptance criteria for all LCSs or matrix spikes is 80% to 120% of the known value.

5.3 Completeness

Per Method 114, Section 4.4, "Completeness is a measure of the amount of valid data obtained compared to the amount expected under normal conditions." The following identifies completeness requirements for each of the following measurements made for PCMs:

- Sample collection - The requirement for completeness of representative sample collection will be 90% for Stations A and B, and 65% for Station C. These percentages include all filter samples lost due to equipment malfunction, personnel error, and sample damage up to the point of delivery to the analytical laboratory.

- Sample analysis - The requirement for completeness for sample analysis will be 98% valid results for samples and data after delivery to the analytical laboratory.

6.0 QUALITY CONTROL PROGRAM [11]

WTS has implemented a QC program to evaluate and track the quality of emissions measurement data against preset criteria. The WIPP Laboratories SOW, and DQOs for Radiochemical Analysis, are used to evaluate and track the quality of the emissions measurement data.

6.1 Quality Control Checks

Method 114, Section 4.5, states that a quality control program shall be established to evaluate and track the quality of the emissions measurement data against preset criteria. The program should include, where applicable, a system of replicates, spiked samples, split samples, blanks, and control charts. The number and frequency of quality control checks shall be identified and verified by the WIPP Laboratory QA Officer.

- The WIPP Laboratory will perform replicate sample analysis at a minimum on one per 10 samples. Radiochemical replicate determinations shall agree when the 95% confidence levels uncertainties are considered. The relative error ratio is equal to or less than two.

- Both the field sampling and laboratory analysis activities will process blank samples on a 10% basis (i.e., 1 to 10 filter samples, one blank filter and for a batch of 11 to 20 filter samples, two blanks). The laboratory analysis will also analyze one LCS, and one replicate.

6.2 Sample Tracking System

Method 114, Section 4.6, states that a sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis and reporting system.

- Sample tracking system - A unique sample number is assigned to each filter sample to provide for positive identification of samples and data through all phases of the sample collection. Sample numbers are verified automatically upon sample receipt.

- Sample analysis tracking system - A chain of custody number is assigned to each batch of filter samples submitted to the WIPP Laboratories for analysis, and reporting system. A chain of custody ensures traceability and sample integrity. Filter samples are tracked through the use of internal chain of custody upon receipt at the laboratory.

7.0 QUALITY ASSURANCE AUDITS [11]

Independent assessments are performed by WTS QA Organization or by an independent WIPP organization. Each aspect of operations is assessed as often as necessary, but no less frequently than every three years.

The QA Department administers technical compliance oversight and programmatic oversight. These additional internal oversight functions are detailed in WP 13-QA.03, Quality Assurance Independent Assessment Program; and WP 13-1, Washington TRU Solutions LLC Quality Assurance Program Description. External audits are assessments that are performed randomly by a variety of organizations outside WTS. The performance of the WIPP Laboratories group is documented by the participation in a national laboratory-comparison performance demonstration program.

8.0 CORRECTIVE ACTION PROGRAM [12]

WTS has approved procedures to identify, document noncompliances, and to initiate and report corrective actions. These procedures are described in the WTS Quality Assurance Program Description (QAPD).

Deficiencies are defined as a characteristic, documentation, or procedure that causes the quality of an item, process, or activity to conflict with specified requirements or applicable standards, and, in particular, any condition that could lead to unsafe or inefficient performance. Once a deficiency is identified, specific corrective actions are decided upon and their completion is documented.

The predetermined limits for data acceptability beyond which corrective actions are required are identified in the specific procedures used for NESHAP air sampling. When data quality is found to be indeterminate or outside the tolerances specified in Section 5.0, corrective actions are initiated. If warranted, a root cause analysis will be performed to identify the deficiency.

Employees are responsible for identifying items or conditions that do not conform to specified requirements, and for reporting such items or conditions in accordance with WP 04-IM1000, Issues Management Processing of WIPP Forms; and WP 13-QA3004, Nonconformance Report. If a specific nonconforming item is reported, the responsible individual will initiate a nonconformance report (NCR), then the WTS QA representative will place the hold tag.

9.0 REPORTS AND RECORDS MANAGEMENT [13]

The results of the NESHAP Effluent Monitoring Program are reported to the EPA annually by the DOE. The results are provided in the Annual PCM Compliance Report for the U.S. Department of Energy Waste Isolation Pilot Plant pursuant to 40 CFR Part 61, Subpart H. The NESHAP compliance report for a calendar year (CY) is submitted by June 30 of the subsequent year.

As required for 40 CFR Part 191, Subpart A compliance, the DOE submits the DOE/WIPP-06-2171, Waste Isolation Pilot Plant Biennial Environmental Compliance Report to the EPA every two calendar years. The WIPP's compliance report includes the results of the WIPP Effluent Monitoring and the dose calculations for the reporting period. Appendix A of the most recent BECR contains the CY 2006 and CY 2007 WIPP Confirmatory Measurement Compliance Reports.

9.1 Reports

At the completion of each calendar year, SEC group uses analytical data from air sample filter analyses to estimate total quantity (e.g., activity) of radionuclides released into the air during that year, as a result of normal operations and any off-normal or accidental releases. The radionuclide emission data and the concurrent meteorological data obtained from the on-site meteorological station are entered into the EPA-approved computer model to calculate the annual EDE that could be received by the maximally exposed off-site individual. The results of the air emission monitoring and dose modeling are compiled in a compliance report for submission to the DOE for signature and transmittal to the EPA Headquarters and the EPA Region VI. The report is also transmitted to SEC Section to be included in the BECR for compliance with 40 CFR Part 191, Subpart A.

9.2 Records

WTS has instituted a system for the classification and disposition of records generated by facility operations. The system makes a distinction between general facility records and QA records. In general, the system uses a Records Inventory and Disposition Schedule (RIDS) to describe the classification and disposition for all general facility records generated by a specific WIPP organizational unit. All QA records are managed in accordance with WP 15-RM, WIPP Records Management Program. All groups identified in Section 2.0 that perform specific tasks related to the WIPP Effluent Monitoring Program are responsible for project records maintenance and all records are reflected on the appropriate departmental RIDS. Records generated by the radionuclide emissions sampling program are permanent QA records.

10.0 REFERENCES

Title 10 CFR Part 835, "Occupational Radiation Protection"

Title 40 CFR Part 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities"

Title 40 CFR Part 191, Subpart A, "Environmental Standards for Management and Storage"

ANSI N13.1-1969, *Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities*

ANSI N13.1-1999, *Sampling and Monitoring Releases of Airborne Radioactive Substances from the Stacks and Ducts of Nuclear Facilities*

DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities*

DOE/WIPP-02-3122, *Transuranic Waste Acceptance Criteria for the Waste Isolation Pilot Plant*

DOE/WIPP-06-2171, *Waste Isolation Pilot Plant Biennial Environmental Compliance Report*

DOE/WIPP-07-3372, Waste Isolation Pilot Plant Documented Safety Analysis

DOE/WIPP-88-024, *Tests of Model Waste Isolation Pilot Plant (WIPP) Exhaust Airflow Systems*

DOE/WIPP-89-026, *Evaluation of the Station A Effluent Monitoring System in the Underground Exhaust Ventilation System at the Waste Isolation Pilot Plant*

DOE/WIPP-89-027, *Evaluation of the Station B Effluent Monitoring System in the Underground Exhaust Ventilation System at the Waste Isolation Pilot Plant*

DOE/WIPP-89-028, *Evaluation of the Station C Effluent Monitoring System in the WHB Exhaust Ventilation System at the Waste Isolation Pilot Plant*

DOE/WIPP-97-2238, *Periodic Confirmatory Measurement Protocol for the Waste Isolation Pilot Plant*

DOE/WIPP-99-2194, *Waste Isolation Pilot Plant Environmental Monitoring Plan*

Hazardous Waste Facility Permit, Waste Isolation Pilot Plant, Permit # NM4890139088-TSDF, issued by the New Mexico Environment Department

The MOU between the EPA and the DOE concerning the Clean Air Act Emission Standards for Radionuclides: 40 CFR Part 61 including Subparts H, I, Q and T, Signed by Mary D. Nichols, EPA Assistant Administrator for Air and Radiation: September 29, 1994, Signed by Tara O'Toole, DOE Assistant Secretary for Environment, Safety, and Health: April 5, 1995.

EPA 402-R-97-001, *Guidance for the Implementation of EPA's Standards for Management and Storage of Transuranic Waste* (40 CFR Part 191, Subpart A) *at the Waste Isolation Pilot Plant*

WIPP, 2007, Radiological Controls Statement of Work and Data Quality Objectives for Radiochemical Analysis, Carlsbad, New Mexico, Waste Isolation Pilot Plant

WP 04-IM1000, Issues Management Processing of WIPP Forms

WP 09-CN3005, Graded Approach to Application of QA Controls

WP 12-5, Waste Isolation Pilot Plant Radiation Safety Manual

WP 12-ER4903, Radiological Event Response

WP 12-HP1305, Air Sampling Equipment

WP 12-HP1318, RADOS Continuous Air Monitor

WP 12-HP1319, RADOS RAM 31 Functional Check

WP 12-HP3500, Airborne Radioactivity

WP 12-HP4000, Emergency Radiological Control Responses

WP 12-RE3004, Periodic Confirmatory Sampling, Reporting, and Compliance Activities

WP 12-RL.01, Radiochemistry Quality Assurance Plan

WP 12-RL1001, Sample Tracking and Custody

WP 12-RL1012, Elemental Separation-Transuranic Products

WP 12-RL1016, Operation of the Oxford Series 5 Gas Proportional Counter

WP 12-RL1017, Vacuum-Assisted Rapid Sequential Separation of Actinides and Strontium in Various Matrices

WP 12-RL3002, Radiochemistry Laboratory Data Validation and Verification

WP 12-RL3003, Data Reduction and Reporting

WP 13-1, Washington TRU Solutions LLC Quality Assurance Program Description

WP 13-QA.03, Quality Assurance Independent Assessment Program

WP 13-QA3004, Nonconformance Report

WP 15-RM, WIPP Records Management Program

IC534000, RAM 31 Continuous Air Monitor for Alpha and Beta

IC041072, Calibration of Effluent Monitoring Skids A-1, A-2, A-3, B1 and B2 Flow Instrumentation

IC041096, Calibration of Station C Mass Flow

IC041097, Calibration of Station C Flow Instrumentation

IC041098, U/G Exhaust Mass Flow Measurement System for Fans 700A, B, and C

IC413000, Station B Mass Flow Measurement System, Loop 41A001W2001

Attachment 1 - 40 CFR Part 61, Subpart H, Appendix B, Method 114 Requirements and WIPP Document Location

APPENDIX B, METHOD 114		WIPP DOCUMENT LOCATION
4.1	The organizational structure, functional responsibilities, levels of authority and lines of communication for all activities related to the emissions measurement program shall be identified and documented.	WP 12-RC.01, Section 2.0
4.2	Administrative controls shall be prescribed to ensure prompt response in the event that emission levels increase due to unplanned operations.	WP 12-RC.01, Section 3.1
4.3	The sample collection and analysis procedures used in measuring the emissions shall be described including where applicable:	WP 12-RC.01, Section 4.1
4.3.1	Identification of sampling sites and number of sampling points, including the rationale for site selections.	
4.3.2	A description of sampling probes and representativeness of the samples.	WP 12-RC.01, Section 4.1
4.3.3	A description of any continuous monitoring system used to measure emissions, including the sensitivity of the system, calibration procedures and frequency of calibration.	WP 12-RC.01, Section 4.3
4.3.4	A description of the sample collection systems for each radionuclide measured, including frequency of collection, calibration procedures and frequency of calibration.	WP 12-RC.01, Section 4.1
4.3.5	A description of the laboratory analysis procedures used for each radionuclide measured, including frequency of analysis, calibration procedures and frequency of calibration.	WP 12-RC.01, Section 4.2
4.3.6	A description of the sample flow rate measurement system or procedures, including calibration procedures and frequency of calibration.	WP 12-RC.01, Section 4.1.1
4.3.7	A description of the effluent flow rate measurement procedures, including frequency of measurements, calibration procedures and frequency of calibration.	WP 12-RC.01, Section 4.1.1
4.4	The objectives of the QA program shall be documented and shall state the required precision, accuracy and completeness of the emission measurements data including a description of the procedures used to assess these parameters.	WP 12-RC.01, Section 4.2, 5.1, 5.2, and 5.3
4.5	A QC program shall be established to evaluate and track the quality of the emissions measurement data against the preset criteria. The program should include where applicable a system of replicates, spiked samples, split samples, blanks and control charts. The number and frequency of such QC checks shall be identified.	WP 12-RC.01, Section 6.1

Attachment 1 - 40 CFR Part 61, Subpart H, Appendix B, Method 114 Requirements and WIPP Document Location

APPENDIX B, METHOD 114		WIPP DOCUMENT LOCATION
4.6	A sample tracking system shall be established to provide for positive identification of samples and data through all phases of the sample collection, analysis and reporting system. Sample handling and preservation procedures shall be established to maintain the integrity of samples during collection, storage and analysis.	WP 12-RC.01, Sections 2.2, 4.2, and 6.2.
4.7	Periodic internal and external audits shall be performed to monitor compliance with the QA program. These audits shall be performed in accordance with written procedures and conducted by personnel who do not have responsibility for performing any of the operations being audited.	WP 12-RC.01, Sections 6.0 and 7.0
4.8	A corrective action program shall be established including criteria for when corrective action is needed, what corrective actions will be taken and who is responsible for taking the corrective action.	WP 12-RC.01, Section 8.0
4.9	Periodic reports to responsible management shall be prepared on the performance of the emissions measurements program. These reports should include assessment of the quality of the data, results of audits and description of corrective actions.	WP 12-RC.01, Sections 9.0 and 9.1
4.10	The QA program should be documented in a quality assurance project plan which should address each of the above requirements.	WP 12-RC.01