RCRA FACILITY INVESTIGATION – REMEDIAL INVESTIGATION/ CORRECTIVE MEASURES STUDY – FEASIBILITY STUDY REPORT

NATURE AND EXTENT OF AIR CONTAMINATION

SECTION 6.0 : ATTACHMENT 1

CD ROM, Air Data Adequacy and Quality Assessment

June 2006

1.0 SCOPE OF RFETS AIR MONITORING ACTIVITIES

A large-scale, continuous environmental air monitoring program was underway at the Rocky Flats Environmental Technology Site (RFETS or site) as early as 1971. In general, the program was designed to quantify potential public exposure to radionuclides that might result from site activities, and to determine compliance with applicable regulatory limits. The program comprised effluent, ambient, and meteorological monitoring. Effluent sampling ceased when buildings entered into active decommissioning and the program was terminated in 2005. Over the years, additional analytes, such as beryllium or volatile organic compounds (VOCs), were monitored in a limited fashion for specific purposes.

Through the years, the air monitoring program at RFETS evolved in response to new regulatory requirements and accelerated site closure activities. Air monitoring activities at RFETS characterized materials of potential concern that may have been introduced into the atmosphere (primarily radionuclides, through both ambient and effluent monitoring) and identified the associated meteorological conditions that influence the transport and dispersion of airborne materials.

Ambient radionuclide monitoring was initially developed to detect and quantify any accidental or unplanned release of radioactive particles that occurred from sources that were not subject to effluent monitoring. The design of ambient radionuclide samplers was upgraded over the years, and sampling locations were shifted to ensure the representativeness of samples relative to potential public receptors. At its peak, the radioactive ambient air monitoring task included 39 samplers operating continuously both on and off RFETS. Under an agreement reached in 1998 with the U.S. Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE) pursuant to Title 40 of the Code of Federal Regulations (CFR), Part 61.93(b)(5), 14 ambient air samplers arrayed around the site perimeter were used to demonstrate compliance with the emission limits of 40 CFR 61.92. In addition to collecting samples for regulatory compliance, ambient samplers have been used to monitor fugitive radionuclide emissions from decommissioning, remediation, and demolition operations.

On-site meteorological monitoring historically supported both 40 CFR 61, Subpart H, reporting requirements and the emergency response requirements of U.S. Department of Energy (DOE) Orders. Data were collected at four levels at a 61-meter (m) tower located in the northwest Buffer Zone, and at an adjacent, redundant, 10-m tower. Following decommissioning of the site's 61-m tower in April 2004, representative data were obtained from the National Renewable Energy Laboratory (NREL) M2 tower, located approximately 1 mile north of the former site tower location.

A limited program to characterize potential beryllium emissions during building decommissioning was implemented between 2001 and 2005. The program employed six ambient air samplers arrayed in a circular fashion around affected buildings, as close as possible to the demolition considering neighboring buildings and roads. Samplers ran 8 to 10 hours per day during project activity, with the filters exchanged and analyzed daily.

Unlike certain radioactive materials at RFETS, beryllium contamination was largely confined to building and equipment surfaces in areas where beryllium was processed, stored, or used, and where beryllium-contaminated waste was managed. The beryllium monitoring conducted during demolition activities confirmed that soils and other environmental media at RFETS would not have been subject to beryllium contamination due to decommissioning activities. Therefore, with the completion of accelerated actions, no significant source of airborne beryllium emissions exists.

Following completion of accelerated actions under the *Rocky Flats Cleanup Agreement* (RFCA), sources of ongoing emissions to air include only: 1) resuspension of residual radioactive contaminants attached to surface soil particles; and 2) volatilization/release of VOCs from residual subsurface contamination and the closed landfills. As described in Section 6.0 of this report, VOC emissions are rapidly decreasing and offer no health or environmental concerns at present and future levels in ambient air. Past monitoring has also shown that airborne radionuclides are below levels of concern; however, resuspended plutonium/americium/uranium (Pu/Am/U) from surface soils have been quantified further in Section 7.7 of this report, primarily because of their long-radioactive half-lives and persistence in the environment.

This section addresses the adequacy and quality of the airborne radionuclide and beryllium data that contributed to the above-listed determinations, as well as the meteorological data used to characterize the fate and transport of resuspended particle-bound radionuclides in Section 7.7 of this report.

2.0 DATA ADEQUACY ASSESSMENT

2.1 Radionuclide Ambient Air Monitoring Data

40 CFR 61, Subpart H, "National Emission Standards for the Emission of Radionuclides Other Than Radon From Department of Energy Facilities," sets an annual dose standard of 10 millirem (mrem) effective dose equivalent (EDE) to any member of the public. According to Section 61.93(b)(5), environmental measurements of radionuclide air concentrations at critical receptor locations may be used to demonstrate compliance with the standard if certain criteria are met.

In 1997, the site submitted an application for approval to use environmental sampling to demonstrate compliance with the 10 mrem standard (DOE 1997; DOE 1998). The application discussed how the requirements of Section 61.93(b)(5) would be met using the 14 samplers in the site's perimeter Radioactive Ambient Air Monitoring Program (RAAMP) network. In 1998, EPA and CDPHE determined that the site's RAAMP sampling and analytical methodology met all of the necessary 40 CFR 61.93(b)(5) criteria.

One of the criteria outlined in 40 CFR 61.93(b)(5) states that a quality assurance program shall be conducted that meet the requirements described in 40 CFR 61, Appendix B, Method 114. The adequacy of the site's sampling and analytical methodology, with reference to Method 114 requirements, is outlined in *Environmental Air Monitoring*

Quality Assurance Plan: EPA Method 114 Requirements (EAM QA Plan; Kaiser-Hill Company [K-H] 2003a).

Data adequacy can be determined by assuring that a sufficient number of samples are taken, and that sampling is both spatially and temporally representative. 40 CFR 61.93(b)(5)(i) requires that ambient air at the point of measurement be continuously sampled for radionuclides if environmental sampling is used in lieu of stack sampling to demonstrate compliance. RAAMP samplers continuously collect respirable and nonrespirable particles on separate substrates and multiple years of record assure that samples have been temporally representative of site emissions. The RAAMP samplers have been very reliable and have annually met or exceeded the 20 percent data loss standard set in Section 2.2 of Appendix A to the EPA's *Guidance on Implementing the Radionuclide NESHAPs* (EPA 1991).

Section 4.2 of the EAM QA Plan discusses the adequacy of the RAAMP sampler siting. Based on siting studies performed in 1991 and 1993, and subsequent dispersion modeling analyses, a 14-sampler RAAMP network was implemented that adequately met the criteria for measurements at the location of the critical receptor listed in Section 2.1 of Appendix A to the EPA's *Guidance on Implementing the Radionuclide NESHAPs* (EPA 1991).

Pursuant to RFCA and in consultation with the regulatory agencies, DOE established the Integrated Monitoring Plan (IMP) in 1997. Under the IMP, data quality objectives (DQOs) were outlined for project monitoring for radionuclides (PM-Rad) in air during decommissioning or remediation projects that had the potential to release radionuclides in sufficient concentrations to contribute a 0.1-mrem annual dose to the most impacted public receptor. During execution of those portions of projects that had a significant potential to release fugitive air emissions, the routine RAAMP air compliance sampling program was supplemented by more frequent sampling using selected RAAMP network samplers located in the immediate vicinity of the projects. This project-specific sampling provided additional assurance that public receptors would be protected, and that the 10-mrem fenceline standard would not be exceeded due to unexpected emissions from site accelerated actions.

Ambient radionuclide data collected at RFETS from 1997 to 2005 are included in Attachment 2 to Section 6.0 of this report.

2.2 Meteorological Data

Meteorological observations have been made at RFETS since 1952, although the specific location of measurement was moved several times. Periodically, supplemental monitoring stations have been set up and operated in conjunction with various activities at the site. In 1995, AeroVironment produced an historical data summary of RFETS's meteorological data; the document provides as much as a 35-year record for certain meteorological parameters (AeroVironment 1995).

Data have been used as inputs for air quality and emergency response dispersion modeling, as well as risk assessment calculations and hydrologic assessments. Collected data have included wind speed, wind direction, temperature, relative humidity, precipitation, solar radiation, and a calculated sigma theta (used to determine stability classes). Beginning in 1992, data were routinely validated in accordance with an established quality assurance (QA) program that specified how the data are archived, screened, corrected, and reviewed.

Recent data have been collected in accordance with DQOs laid out in the RFETS's IMP. The IMP has been evaluated annually by DOE and the regulatory agencies to assess the adequacy of the monitoring based on previous monitoring results, changed conditions, planned remedial activities, and public input. The RFETS's meteorological data collection program was also designed to comply with EPA guidelines for data collected for regulatory purposes, including the provisions for periodic audits and calibrations (EPA 1987; EPA 2000).

The IMP specifies collection of meteorological data to show representative air flow patterns impacting RFETS, measured a minimum of 10 m above ground level. Recent data were collected at the RFETS's towers, which were located on the site, just west of the Industrial Area (IA), in an area free of obstructions that could produce flow perturbations. Data were measured at ground level, 10 m, 25 m, and 60 m. Following decommissioning of the site's 61-m tower in April 2004, 10-m data were obtained from the NREL M2 tower located approximately 1 mile north of the RFETS's tower location.

Dispersion modeling showing the fate and transport of airborne contamination following completion of accelerated actions is described in Section 7.7 of this report and uses meteorological data collected at the site meteorological towers in 1996. The model used to evaluate fate and transport of airborne contaminants at RFETS requires one year of preprocessed sequential hourly meteorological data. The 1996 data set was processed for use with this model during the Fiscal Year 1999 Actinide Migration Evaluation (AME) project; 1996 was chosen for processing because it presented the most complete data set for certain needed parameters compared with other recent years.

2.3 Beryllium Ambient Air Monitoring Data

When a decommissioning project at the site involved a facility with a history of significant beryllium operations, project monitoring for beryllium (PM-Be) was implemented. A sampling and analysis plan was prepared for each project that outlined procedures to reliably detect ambient beryllium concentrations at or above the 0.01 micrograms per cubic meter National Emission Standard for Hazardous Air Pollutants (NESHAP) limit for beryllium in ambient air contained in 40 CFR 61, Subpart C. (Although 40 CFR 61, Subpart C, did not apply to any operations at RFETS that were monitored, this limit provided an appropriate environmental benchmark for comparison.) Six portable, high volume ambient air samplers constituted the core infrastructure for the PM-Be program.

Project beryllium air monitoring data were taken during those portions of the projects deemed most likely to result in measurable beryllium emissions. Beryllium samplers ran continuously during hours of active demolition. Sample periods reflected the schedule of active demolition, but were no fewer than 8 hours, which was sufficient to meet the analytical detection limit of 0.1 micrograms per filter.

Samplers were arrayed in a manner that maximized the potential for intercepting a plume resulting from demolition activity, subject to limits of structural interference. Wind speed and direction data from 1997 on were compiled and wind roses were generated for each interval during which the monitored demolition projects were scheduled. These provided the basis for predicting the most likely downwind directions during each demolition project.

Plume concentration plots were created to find the optimal distance for samplers. It was determined that samplers deployed within 200 meters of each project were well within the region of maximum concentration. Most samplers were placed in downwind locations within 200 meters of the projects to minimize potential plume dispersion. Fewer samplers were placed in upwind locations to capture upwind samples.

PM-Be data are included on CD-ROM in Attachment 2 to Section 6.0 of this report.

3.0 DATA QUALITY ASSESSMENT

The quality assurance program for ambient radionuclide data necessary to comply with EPA Method 114 is outlined in the EAM QA Plan (K-H 2003a). QA procedures applicable to data collected by the RFETS Air Quality Management (AQM) program since 1997 are summarized below.

3.1 Data Storage and Processing

Prior to 1997, air quality data resided exclusively in paper records. In 1997, the Fox Pro-based AMSD database was developed to store and process meteorological, field, and analytical data collected by AQM. AMSD was updated to AMSD2. In 2001, AMSD2 was replaced by an Oracle-based database called AIR. The data from AMSD2 were migrated to the new system and reviewed to ensure duplicate and inaccurate data were not included in the new database.

Data residing in AIR include field data (sampler flow, sampler on/off readings, sampling dates), isotopic analytical data (Pu-238, Pu-239/240, Am-241, U-233/234, U-235, and U-238), gross alpha analytical data, beryllium analytical data, and tritium analytical data. Meteorological data used to support modeling and emergency response efforts are also stored in AIR.

Automated data entry has been used where possible to populate AIR after data have been verified by qualified personnel. Analytical data have been loaded into AIR using Analytical Services Electronic Data Deliverables (EDDs) after review by AQM. Field

data have been entered via text uploads and manual entry and have been subject to subsequent quality control checks.

The AIR database contains thousands of records that have been loaded on a routine basis; load frequency has depended on data availability and data type. The RAAMP compliance network generated samples monthly. Other air sampling programs, such as project monitoring for beryllium or radionuclides, generated samples that were entered more frequently as data became available.

Analytical data provided to the AIR database for isotopic and gross alpha data types has been entered electronically and accurate transfer has been verified after upload. Data are subsequently processed through AIR to provide various concentration and release reports used in compliance determinations. Isotopic data submitted for inclusion in AIR have been reviewed by Analytical Services (or one of their contractors) prior to upload, and appropriate data flags have been assigned where appropriate (see discussion below)

A copy of pertinent portions of the AIR database, in Microsoft Access format, is included in Attachment 2 to Section 6.0 of this report.

3.2 Analytical Data

Over 22,000 specific analytical records exist in the AIR database. To ensure data quality, all phases of the laboratory analytical process have been performed under a stringent set of QA requirements as identified within the DOE National Basic Ordering Agreement (BOA) for Analytical Services and the RFETS *Basic Ordering Agreement Implementation Requirements*, Module GR03-A.5 (K-H 2003b). BOA modules pertaining to the air monitoring program (GR01-B.2, GR02-D, GR03-A.4, GR04-A.3, RC01-B.3, and RC02-B.1) describe the QA/quality control (QC) criteria that apply to off-site laboratories. The analytical procedures used by the laboratories are based on procedures adopted from DOE- and/or EPA-approved sources, or from other recognized authoritative publications (e.g., ASTM International methods) where EPA-approved procedures were not available.

The analytical methods used for ambient air data analysis also conform to EPA Method 114 requirements. These requirements are summarized in the EAM QA Plan (K-H 2003a).

All RAAMP data generated after September 2000 have been verified or validated (V&V) as described in the EAM QA Plan (K-H 2003a). Effluent samples collected after December 2000 were also subject to V&V.

Data have been reviewed by validators for compliance with contract-stipulated quality and completeness parameters. After review, data may be qualified based on quality or contractual deficiencies. Reviewed data are uploaded to AIR as final data. Data can also receive qualifiers based on V&V findings; qualifiers may or may not affect data utility depending on the basis of assignment. Reasons for qualifier assignment are listed as "reason codes" within the database.

Qualifiers for RAAMP data fall into two categories: "J," estimated value, or "R," rejected value. Analytical values have received J qualification for several reasons; examples include failure to meet peak resolution/integration requirements or slightly elevated tracer recovery.

The two reasons for R qualification are low tracer recovery for a given analyte or failure to meet the contractual minimum detectable amount (MDA) criteria. Data receiving R qualification for tracer recovery failure have been removed from air compliance calculations. Data receiving R qualification for failure to meet the contractual MDA requirements have not generally been removed from calculations if all the associated QC data are valid and the sample MDA is within 10-15% of the contractual MDA. This situation primarily affects U-238 and U-233/234 isotopic data for fiberglass filters due to the relatively high background levels of these isotopes found in the fiberglass filter sampling media.

Approximately 56% of the RAAMP network samples collected from 1997 through mid-2005 that were used for compliance determinations have been validated or verified, including 100% of those collected in 2001 and following. Less than 1 percent of the data were qualified as unusable according to site requirements. All PM-Be samples that were taken after 2001 were validated or verified, with no rejected data. PM-Rad gross alpha data were not subject to validation and verification since the data were used as a screening tool only.

3.3 Meteorological Data

Meteorological data used for dispersion modeling were collected through the RFETS AQM program. AQM program personnel or their contractors have recovered, validated, and reported the meteorological data used for modeling. Meteorological data handling has been performed according to *Quality Assurance & Quality Check Manual, Meteorological Monitoring & RAAMP Program at RFETS* (MERCO 1998). Calibrations of the meteorological instruments/sensors have also been performed in accordance with this manual. The instruments used for meteorological monitoring system calibrations and audits at RFETS were National Institute of Standards and Technology (NIST)-traceable.

4.0 REFERENCES

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