SAMPLING AND ANALYSIS PLAN

Quantification and Characterization of Potential Beryllium Release to the Ambient Air During Building Demolition at The Rocky Flats Environmental Technology Site

6 November 2001 (Revision 0)

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1.0 INTRODUCTION

1.1 Overview

During the weapons production era at Rocky Flats, beryllium was one of the many hazardous materials essential to the US Department of Energy's (DOE) mission. In the current era of decommissioning and deactivation, beryllium contamination remains a concern to workers and the public. The health effects of beryllium exposure in sensitive individuals have been well documented, and appropriate exposure limits for workers and the public have been established by the regulatory community.

DOE Rocky Flats Field Office (RFFO) has committed to develop and implement an ambient air monitoring program to characterize and quantify potential beryllium release to the environment that may occur during demolition of selected buildings at Rocky Flats Environmental Technology Site (RFETS). The criteria by which a building demolition project will be judged to require beryllium monitoring during demolition are still in development, but this Sampling and Analysis Plan (SAP) establishes the sampling techniques, analytical requirements, and data quality objectives for monitoring ambient air near a demolition or remediation project for beryllium.

Though the demolition/remediation activities to be monitored are not subject sources under the National Emissions Standard for Hazardous Air Pollutants (NESHAP) for beryllium (40 CFR 61, Subpart C), this SAP is designed to reliably detect the beryllium NESHAP limit for beryllium concentration in ambient air, 0.01 $\mu g/m^3$ based on a 30-day average. This plan includes a Beryllium Monitoring Implementation Plan (BMIP) template in Appendix A; the BMIP will serve as the document connecting this Site-wide SAP with the project-specific criteria that must be developed for each building or cluster. The BMIP will identify project-specific sampler locations, sampling intervals, temporal boundaries, demolition/remediation project management contact information, and will include the consenting signature of the demolition/remediation project manager

1.2 Problem Identification Statement

This plan proposes to:

- Establish the sampling and analytical methods to characterize and quantify the average concentration of beryllium in the ambient air around selected demolition/remediation projects;
- Determine whether selected RFETS building demolition projects generate dust plumes containing beryllium at or above a level of concern; and
- Identify the criteria by which ambient air samplers shall be sited around building demolition projects to best characterize any potential fugitive dust plume resulting from the work activity.

1.3 Schedule

This SAP is intended to establish the general protocols for environmental sampling of beryllium in the ambient air and to serve as guidance to each project-specific BMIP. Application of the data quality objectives established herein to each project's specific demolition scenario shall generate a project-specific BMIP. The scheduled execution of this SAP will correspond with the scheduled demolition of buildings identified by DOE and/or their designated contractor(s) as having sufficient beryllium release potential to justify monitoring. The identification of such buildings is outside the scope of this SAP.

2.0 DATA QUALITY OBJECTIVES

Problem: Characterize and quantify beryllium concentrations in ambient air around selected building demolition projects and advise project management when ambient concentrations meet or exceed action levels. The specific actions to be taken by project managers in response to an actionable concentration of beryllium in ambient air is outside the scope of this SAP. The Environmental Media Management group shall provide guidance regarding the interpretation and analysis of any significant sample result, but will not dictate actions to be taken by demolition/remediation project personnel under any circumstance.

Assumptions:

- Though the demolition of buildings is not a subject source activity under the beryllium NESHAP, the beryllium NESHAP limit of 0.01 $\mu g/m^3$ for ambient air (30-day average) is recognized to be protective of human health and the environment. Therefore, this monitoring program shall be designed to reliably quantify 0.01 $\mu g/m^3$ of beryllium in the ambient air.
- The desired analytical detection limit to ensure certain quantification of beryllium at the level of interest is 20% of the reference concentration, or 0.002 $\mu g/m^3$.
- Sample analyses will take 72 hours from the time the laboratory receives the samples.
- Ambient air samplers with $\geq$6 cubic-feet-per-minute (cfm) constant-volume sample flow rates will be employed to collect samples; samples will be 47-millimeter (mm) diameter cellulose filter media (Whatman #41).

Decision 1: Does the average beryllium concentration in ambient air surrounding a monitored demolition project exceed 0.01 $\mu g/m^3$ on a 30-day averaged basis? Decision 1 is based on the beryllium NESHAP.

Decision 2: Does any single ambient air sample surrounding a monitored demolition project indicate that beryllium concentrations are 0.03 $\mu g/m^3$ or above? Decision 2 is designed to safeguard beryllium NESHAP compliance by alerting project management if ambient air samples are demonstrating short-term concentrations at 3 times the allowable 30-day average concentration.

Decision 3: Does any single ambient air sample surrounding a monitored demolition project indicate that beryllium concentrations are 0.1 $\mu g/m^3$ or above? Decision 3 is designed alert project management if ambient beryllium concentrations reach 50% of the air concentration exposure limitation for Site workers of 0.2 $\mu g/m^3$.

Table 2-1. Decision Rule Matrix

Decision Number	Decision Inputs	Study Boundaries	Decision Rule	Detection Limit
1	Analytical results of all ambient air samples exposed within a project period.	Six samplers, arrayed around the demolition project during the sample period as detailed in the BMIP.	The decision rule is confirmed if total beryllium divided by total sample volume is greater than 0.01 $\mu g/m^3$ for any contiguous 30-day period.	0.1 µg Be per 47 mm filter for atomic absorption spectroscopy
2	Analytical results of any single ambient air sample filter	Six samplers, arrayed around the demolition project during the sample period as detailed in the BMIP.	The decision rule is confirmed if any sample result is greater than 0.03 $\mu g/m^3$.	0.1 µg Be per 47 mm filter for atomic absorption spectroscopy
3	Analytical results of any single ambient air sample filter	Six samplers, arrayed around the demolition project during the sample period as detailed in the BMIP.	The decision rule is confirmed if any sample result is greater than 0.1 $\mu g/m^3$.	0.1 µg Be per 47 mm filter for atomic absorption spectroscopy

Notes: m^3 = cubic meters
mm = millimeters diameter
µg = micrograms
Be = beryllium

Boundary definition: Six samplers will be arrayed around each selected demolition/remediation project (assuming only one subject project is occurring at any given time). The samplers will be sited, based on historic knowledge of prevailing winds, in a manner that maximizes the probability of capturing a plume, within the limits of infrastructure interference, power availability, and other physical boundaries. Wind roses will be developed using Site-specific meteorological data from the past four years to estimate prevailing wind direction and strength for periods during which subject demolitions are scheduled. The siting of samplers and other project-specific criteria will be addressed in a BMIP for each demolition project; a template BMIP is included in Appendix A.

The sampling period will be dependent on the demolition/remediation work schedule. Samplers will operate during all periods of active demolition, but will not operate during off-shift hours for the subject projects. Below is a summary of the sampling times, flow rates, and corresponding sensitivity for the samplers.

Table 2-2. Comparison of Sample Time, Flow, and Detection Limits

Sampler	Sample flow rate[1]	Sample period	Sample quantity at 0.002 $\mu g/m^3$ [2]
Hi-Q VS23-1023CV HVOL[3]	$\geq$10.2 m^3/hr	8 hours	0.16 µg/filter
Hi-Q VS23-1023CV HVOL[3]	$\geq$10.2 m^3/hr	24 hours	0.49 µg/filter
Hi-Q VS23-1023CV HVOL[3]	$\geq$10.2 m^3/hr	40 hours	0.82 µg/filter

1 Sample flow rates reflect 47mm sample area
2 Design minimal-detectable ambient air concentration
3 Using 47 mm Whatman #41 cellulose filter

Notes: HVOL = high-volume sampler
m^3/hr = cubic meters per hour
µg = micrograms

Table 2-2 shows that an 8-hour sample is sufficient to meet the analytical detection limit (0.1 µg/filter). The sampler shelter and sample pump described above are shown in Figures 2-1 and 2-2, below. The sample head is located outside of the weather shelter at the end of the snorkel, visible in Figure 2-2. The sample head is protected from weather by a bell-shaped shell and is oriented downward to prevent precipitation from impacting the filter.

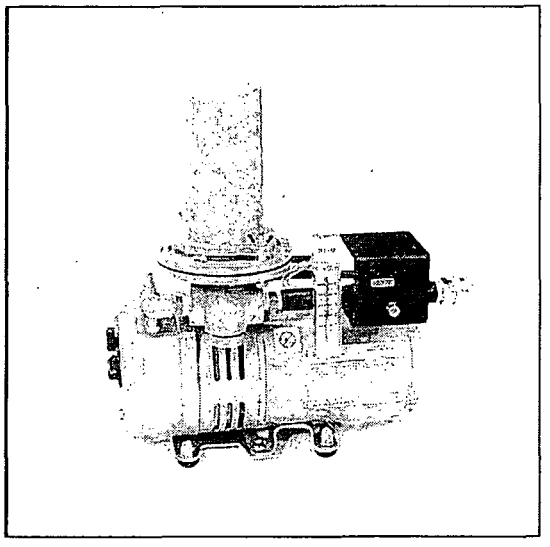

Figure 2-1. Hi-Q VS23-1023CV

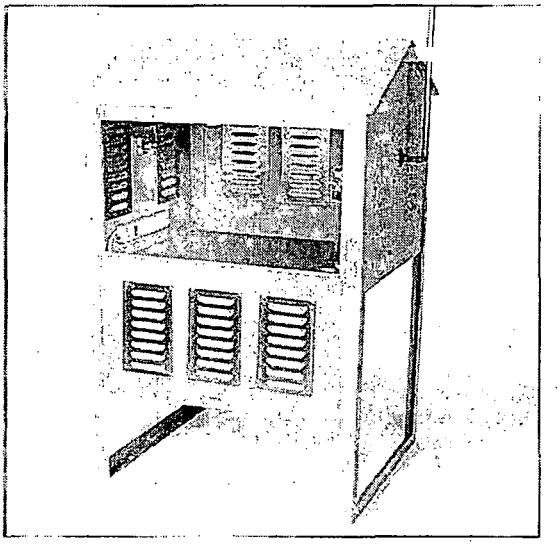

Figure 2-2. Sampler Shelter

3.0 SCOPE OF WORK

3.1 Number of Samples

Six samplers will be arrayed around each selected demolition project/cluster, assuming only one such project is in work at any given time. Sample periods will reflect the schedule of active demolition, but will be no fewer than 8 hours (one work shift) nor more than 45 hours (five work shifts) in duration. The sample period may be scaled within each project, based on early sample results, and may vary between projects due to differences in individual demolition plans. Sample periods and scaling decision factors will be documented in the project BMIP.

The number of samples for a given project will be the product of the following equation:

$$N_s = 6 * D_d$$

Where: N_s = the total number of beryllium samples
6 = the number of samplers in the sampling array
D_d = the duration of the sampling evolution, in days

The duration of any given project has been assumed to be 30 days for design purposes, but will vary significantly depending on the size of the project cluster. No more than six samples per day will be collected. Temporal boundaries, including daily sample period for each project, will be memorialized in each BMIP.

3.2 Analytical Detection Limits

The following table summarizes the limits of detection for the analytical methods employed:

Table 3-1. Analytical Detection Limits

Sample	Analysis Method	Absolute Detection Limit	Sample Detection Limit
Cellulose matrix (47 mm)	Atomic Absorption Spectroscopy (AAS)[1]	0.1 µg/sample	0.002 µg/m^3
Cellulose matrix (47 mm)	Inductively Coupled Plasma Spectroscopy (ICP)[2,3]	<0.1 µg/sample	<0.002 µg/m^3

1 NIOSH Method 7300
2 OSHA Inorganic Method 121
3 Cannot be used when radioisotopes are present in the sample

Notes: mm = millimeters diameter
µg = micrograms
µg/m^3 = micrograms per cubic meter

3.3 Air Sampler Siting

Samplers shall be arrayed in a manner that maximizes the potential for intercepting a plume resulting from demolition activity, subject to the limits of structural interference, power

availability, and project processes. The topography of the industrial area is complex, with many buildings and variable elevation; the interaction of Site structures with wind can produce wake effects, further complicating the siting issue. Power requirements for the samplers make siting a significant task, as line power or generator availability (and therefore refueling access) must factor in the decision.

Wind speed and direction data from 1997 to the present shall be compiled and wind roses generated for each interval during which monitored demolition projects are scheduled. These plots of wind direction frequency and strength will provide a basis for predicting the most likely downwind directions during each demolition project. Daytime wind roses will be used to predict wind directions, rather than 24-hour wind roses, when demolition work is scheduled for daylight hours only (there are significant differences between daytime and nighttime winds during most months). Figure 3-1 illustrates the September 2000 wind rose for daylight hours, which is characterized by prevailing light winds from the east but shorter-duration, stronger winds from the west.

Samplers will be sited as close to the project as is reasonable, within the limits of structural interference, power availability, and project processes. As Figure 3-2 illustrates, plume dispersion begins immediately and plume concentration decreases logarithmically with distance. Based on the plume concentration plot in Figure 3-2, samplers deployed at a distance of 200 meters would be well within the region of maximum concentration. Whenever possible, however, samplers will be placed within 100 meters to minimize potential sample dispersion.

A majority of samplers will be placed within the region of highest predicted concentration, within the constraints of physical and infrastructure barriers, in order to maximize the probability of capturing potential peak plume strength. A minority of samplers will be positioned to capture upwind samples. This approach will place an unbalanced ring of samplers around each project.

Sampler locations will be documented using global positioning system (GPS) resources to allow for mapping and integration into the Site Geographic Information System database.

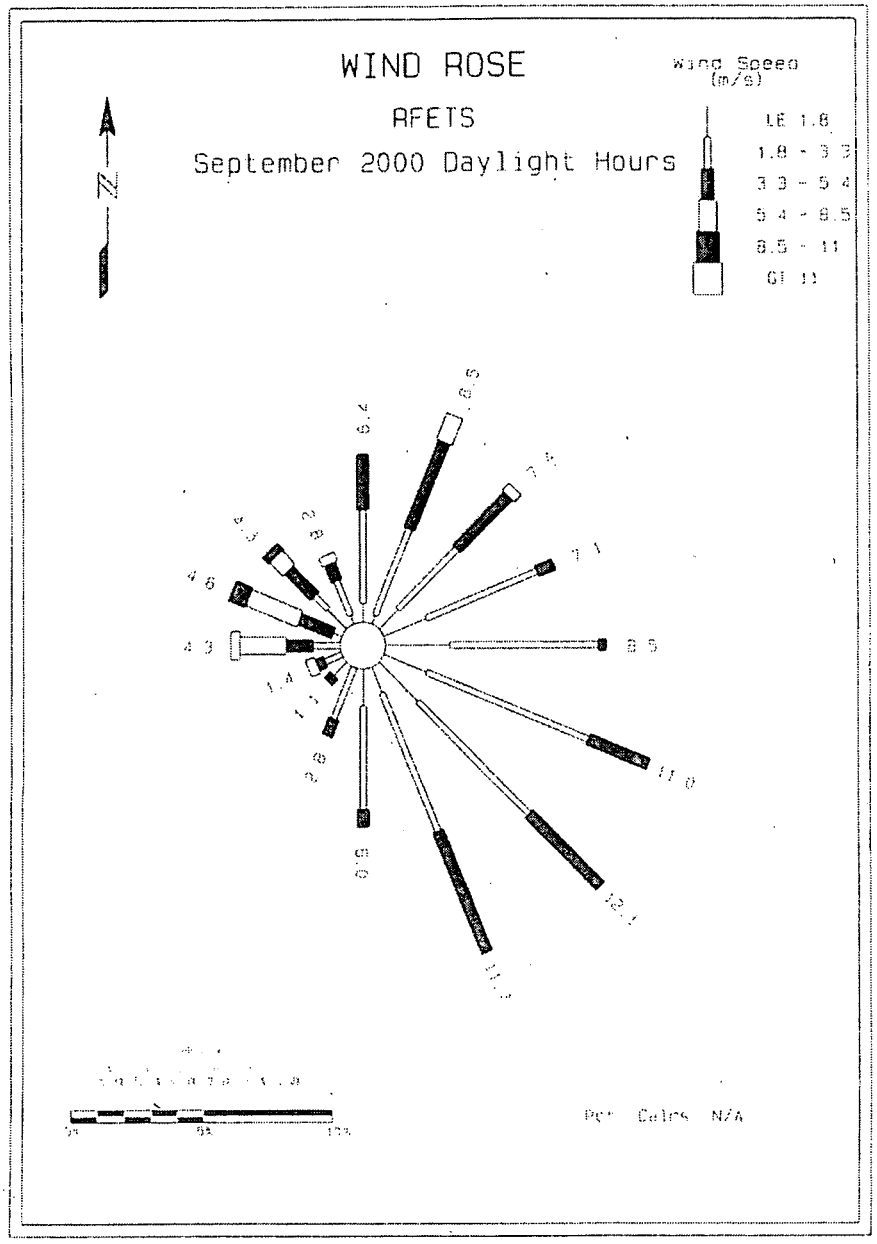

Figure 3-1. RFETS Daytime Wind Rose, September 2000

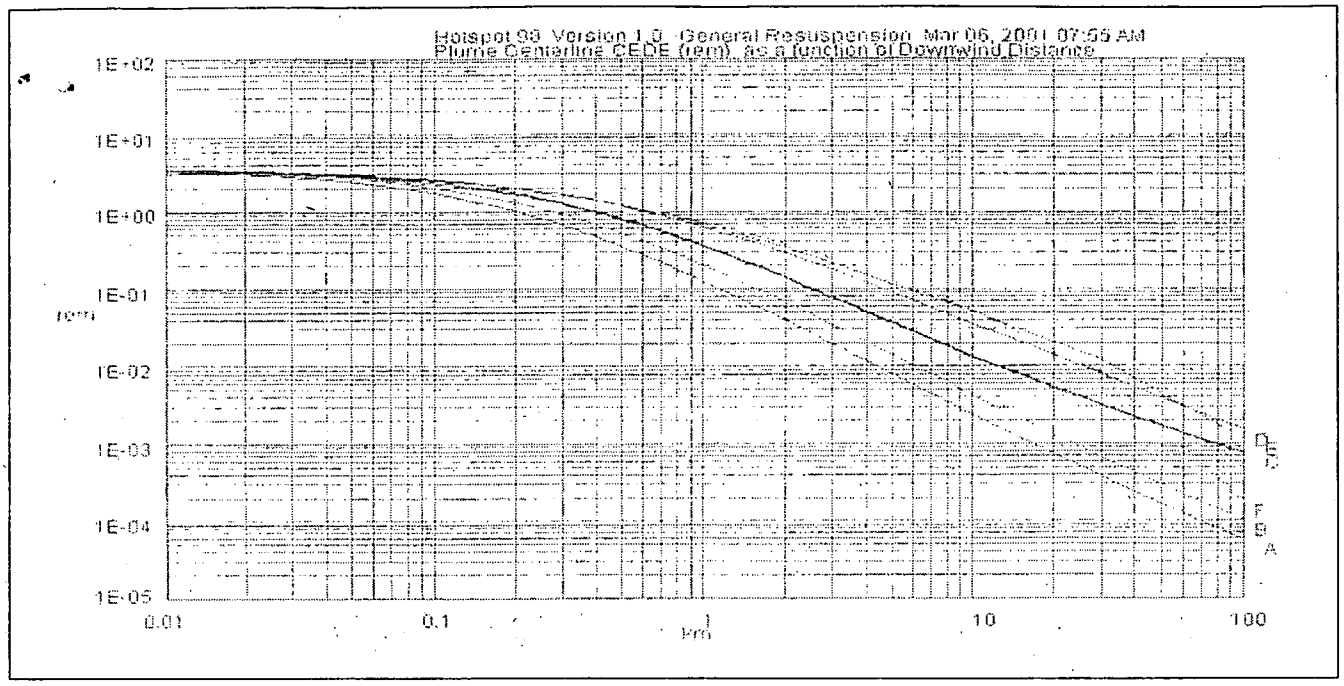

Figure 3-2. Plume Concentration Plot Versus Distance for Various Stability Classes

4.0 QUALITY ASSURANCE / QUALITY CONTROL

4.1 Documentation

A field QA/QC program will be followed to ensure that data quality objectives are met. Sample collection errors will be controlled using standard collection methods, field documentation, and chain-of-custody logs. Field documentation will utilize field log sheets, where sample identification, sample times, sample flow rates, sample anomalies and sample condition will be recorded. Samples will be labeled with a Site-standard Report Identification Number (RIN), which will be unique for each filter.

The project name, sample RIN, analytical method, name of sampling technician(s), analyte of interest, and date and time of collection will all be recorded on sample chain of custody forms. Chain of custody logs will reflect the same sample RINs as the sample labels, to ensure sample integrity. Site Analytical Services Division (ASD) will follow established Site procedures in tracking samples to and data from the analytical laboratories and providing data quality assurance through result validation/verification procedures.

4.2 Blanks and Duplicates

A blank population equal to ten percent of the sample population for each sample matrix will be submitted for analysis. Blank corrections will be performed in accordance with approved Site data analysis procedures. Duplicate analyses will be conducted as required during analyses in

accordance with the established analytical quality programs currently in use by the laboratories contracted to perform this work.

5.0 HEALTH AND SAFETY

Health and safety issues are addressed under separate cover, in the project-specific Health and Safety Plan (HSP). Job Hazard Analysis and Job Hazard Identification Tool forms are attached to the HSP. The HSP shall conform to Site standards, as documented in the *Occupational Safety and Industrial Hygiene Program Manual.*

6.0 RECORDS MANAGEMENT

Completed field logs, chain-of-custody documentation, calibration records, and analytical results will be treated as non-WIPP/LL/LLM Quality Assurance documents. All quality assurance documents generated as a result of this SAP will be maintained in accordance with the Site standards, as documented in the Site *Documents Requirements Manual and Records Management Guidance for Records Sources.*

7.0 REFERENCES

National Institute for Occupational Safety and Health (1994). *Method 7300, Determination of Elements by Inductively Coupled Argon Plasma Atomic Emissions Spectroscopy.* Cincinnati, Ohio.

Occupational Safety and Health Administration (1991). *Inorganic Method # 121, Metal and Metalloid Particulates in Workplace Atmospheres (Atomic Absorption).* Salt Lake City, Utah.

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Rocky Flats Environmental Technology Site (1996). *Statement of Work for Analytical Measurements, General Laboratory Requirements*, Module GR01-A.

U.S. Environmental Protection Agency (1994). *Guidance for the Data Quality Objective Process, QA/G-4.* Research Triangle Park, North Carolina.

U.S. Environmental Protection Agency (1987). *On-Site Meteorological Program Guidance for Regulatory Modeling Applications.* Office of Air Quality Planning and Standards, Research Triangle Park, NC.

U.S. Environmental Protection Agency (1994). *Quality Assurance Handbook for Air Pollution Measurement Systems.* Office of Research and Development, Research triangle park, NC.

APPENDIX A

Beryllium Monitoring Implementation Plan Template

Building or Cluster ID: Building 111

Project Manager (print/sign): Cameron Freiboth Phone/Pager: 2823 / 1761

Project Start Date: 11/07/01 (11/14/01)* Project End Date: 12/0501 (11/21/01)*

Hours of Demolition Operations: 07:00 – 16:30

Hours of Sampler Operation (should bracket hours of demolition by 30 min.): 06:30-17:30

Sample Interval (by shift, daily, weekly, etc.): Daily

Sampler Locations: (attach map with locations by sample pump number)

Action Level 1 (requires call to project manager within 12 hours of results): 0.01 $\mu g/m^3$

Action Level 2 (requires call to project manager within 6 hours of results): 0.03 $\mu g/m^3$

Action Level 3 (requires call to project manager within 2 hours of results): 0.1 $\mu g/m^3$

Sampler Power Supply (by pump number):

1. generator 2. generator 3. generator

4. generator 5. generator 6. generator

Refueling required? [YES] NO Refueling Contact: Bill Brokaw, 2628

Refueling Schedule: Daily at 06:00 with mid-day top-off (no shutdown during topoff)

Analytical Method (AAS required if radionuclides present): AAS [ICP]

Laboratory: AccuLabs ASD CTR for Lab: Pat Preese

Sample Shipper: CASI Sample Shipper Phone/Pager: Chuck Brown, x2225

Sample Shipment Requirements (release evaluation): Free release

* active demolition will occur between 11/14 and 11/22; remaining sampling time is baseline