

Section 5

AIR MONITORING PROGRAM

INTRODUCTION

This section provides a description of the Air Monitoring Program in operation at the Rocky Flats Environmental Technology Site (Rocky Flats or Site). The program is diverse and used to monitor a wide variety of pollutant concentrations. Radiological, non-radiological, and meteorological parameters are monitored at selected locations to provide information that describes the air quality conditions existing at and near the Site.

Air monitoring is conducted for both gaseous and particulate pollutants. Samples are collected directly from identified emission sources (building emission stacks and vents) and from the ambient air (outside air) at or near the Site boundaries.

The Air Monitoring Program is intended to support both compliance demonstrations and emergency response requirements at Rocky Flats.

CLIMATOLOGY AND EXISTING AIR QUALITY

Rocky Flats is located in a semi-arid climate, typical of the Front Range of the Rocky Mountains, with large seasonal variations in temperature and precipitation. Summer daytime high temperatures are typically in the 80° F range, with nighttime low temperatures ranging around 60° F. Average winter daytime temperatures range around 40° F, with nighttime low temperatures in the 15° F to 25° F range. Average annual precipitation at the Site is about 15 inches, with most of the precipitation occurring in the months of March through June.

Winds at Rocky Flats are predominantly from the west or northwest. The average wind speed is approximately 8.7 miles per hour (mph). Wind speeds greater than 20 mph occur between 500 and 600 hours per year. Localized thunderstorms cause strong wind conditions during the summer months.

Strong and gusting winds are common at Rocky Flats. These winds occur primarily during November through April, peaking in January. Westerly “Chinooks” are strong winds that move from west to east over the continental divide. Chinook wind speeds typically exceed 75 miles per hour, with gusts that may exceed 100 miles per hour.

Wind, temperature, and precipitation data are collected at the Site, and summarized monthly and reported quarterly.

The air quality near Rocky Flats is considered to be near background levels and the area is in attainment for all criteria pollutants. Criteria pollutants are a category of air pollutants identified by the U.S. Environmental Protection Agency (EPA) for which standards to protect human health have been set. These include standards for carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, particulate matter, and lead. With the exception of ozone, reported concentrations for all parameters currently monitored at the Site are below Colorado and federal National Ambient Air Quality Standards (NAAQS). Ozone concentration levels are high compared to the proposed new federal ozone standard. Measurements of non-criteria pollutants, such as airborne organic compounds and beryllium, are also comparable to background levels outside of metropolitan areas or in rural settings.

There are very few industrial sources of pollutants in the area near Rocky Flats. However, this area of Colorado has a relatively high natural radionuclide background due to uranium in the soils.

HISTORIC AIR MONITORING ACTIVITIES

Each air monitoring system installed at the Site has a unique purpose and history.

Meteorological Monitoring data are needed as inputs for air quality and emergency response dispersion models. These models use emission rates and meteorological data to determine how emitted pollutants move and disperse in the atmosphere. These data are also used for risk assessment calculations.

An Ambient Air Monitoring Network, owned and operated by the Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division, is the result of the Agreement In Principle between the State of Colorado and DOE. This ambient air monitoring began with the installation of three perimeter ambient air monitoring stations in July 1992. Two additional perimeter stations began data collection in January 1995.

Radioactive Ambient Air Monitoring, conducted by DOE contractors since the 1950s, is used to confirm that administrative and mechanical controls are in place and working, to keep doses to all receptors as low as possible below regulatory standards, and to meet “as low as reasonably achievable” (ALARA) Nuclear Safety Program requirements.

On-site Radiation Monitoring by CDPHE, Radiation Control Group, has been conducted since 1969 to determine radioactive emissions originating from the facility. This sampling provides an independent assessment (independent of the Site) of the public exposure to radioactive material released from Rocky Flats.

The Community Radiation Monitoring network consists of five monitoring stations located in the communities east of the Site. The air monitoring stations were installed in 1992 and 1993 and are funded by DOE, but operated independently.

The Building Effluent sampling system monitors radioactive emissions from building process vents to support monitoring and reporting requirements for DOE Orders and radionuclide National Emission Standards for Hazardous Air Pollutants (NESHAP). For each significant source, monitoring will continue until the building for which monitoring is required is decontaminated and decommissioned. Additional monitoring will likely be required during future decontamination and decommissioning (D&D) or remediation activities.

CURRENT ONSITE AIR MONITORING PROGRAM

The air monitoring systems currently in place at Rocky Flats are summarized below. The presentation order of these different programs is not intended to reflect the relative importance of the monitoring systems to the overall Air Monitoring Program.

Monitoring System	Responsible Agency/Party
Meteorological Station (2 towers)	Site Contractor
Rocky Flats Monitoring Network (5 stations)	CDPHE—Air Pollution Control Division
Radioactive Ambient Air Monitoring (35 locations)	Site Contractor
Onsite Radiation Monitoring (16 locations)	CDPHE—Radiation Control Group
Community Radiation Monitoring (5 stations)	Communities
Building Effluent Monitoring (22 significant locations, 31 others)	Site Contractor

REGULATORY DRIVERS

Effluent and ambient air monitoring is required and governed by numerous Federal regulations, State regulations, DOE orders, and specific policies. Table I lists key regulatory drivers governing air monitoring at Rocky Flats.

**TABLE I
REGULATORY DRIVERS**

Type of Monitoring Required	Regulation
EFFLUENT MONITORING	40 CFR, Part 61, Subpart H and Appendix B (Rad NESHAPs)
	Colorado Air Quality Control Commission, Regulation No. 8, Part A, Section III A-C, State of Colorado Emission Standards for Beryllium
	DOE Order 5400.1, General Environmental Protection Program
AMBIENT AIR MONITORING	DOE Order 5400.5 (Ch 1.10), Radiation Protection of the Public and the Environment
	CERCLA—Interagency Agreement (replaced by the Rocky Flats Cleanup Agreement)
	40 CFR, Part 61, Subpart H (ambient monitoring proposed as alternative methodology to satisfy compliance demonstration and reporting requirements)
METEOROLOGICAL MONITORING	40 CFR, Part 61, Subpart H (meteorology parameters used as input parameters to compliance dispersion modeling)
	DOE Order 5400.1-IV; 2.4, General Environmental Protection Program
	DOE Order 5500.3A, Emergency Planning and Preparedness for Operational Emergencies

CERCLA - Comprehensive Environmental Restoration, Compensation, and Liability Act (42 U.S.C., sec. 9601 *et seq.*)

AIR MONITORING GOALS

The primary goal of the Air Monitoring Program is to provide a means to assess the impacts of Site operations and activities on air quality. The purpose is to ensure that Site workers, the public, and the environment are adequately protected. The monitoring program is also designed to provide critical data for wind speed, wind direction, and pollutant concentrations in the event there is an emergency involving an accidental pollutant release.

MONITORING RATIONALE AND INTENDED DATA USE

Air quality data collected through implementation of the Air Monitoring Program provides the following information or activities:

- ⊙ Data to identify and quantify air contaminants;
- ⊙ Data to evaluate air contaminant emission quantities from specific sources;
- ⊙ Data to determine how emitted contaminants will travel and disperse in the atmosphere;
- ⊙ Emission monitoring during remedial and D&D actions;
- ⊙ Evaluation of the air quality impact of Site activities on the existing air quality.

Air quality data is primarily used to support DOE's reporting and compliance demonstration requirements.

AIR MONITORING ANALYTES

The Rocky Flats Air Monitoring Program involves detection and quantification of both radiological and non-radiological pollutants.

Radiological Pollutants

The following radiological pollutants are monitored at the Site:

- ⊙ plutonium^{239, 240}
- ⊙ americium²⁴¹
- ⊙ uranium^{233, 234, 238}
- ⊙ tritium
- ⊙ gross alpha and gross beta radioactivity

Non-Radiological Pollutants

The following non-radiological compounds are monitored at Rocky Flats:

- ⊙ nitrogen oxides (NO_x)
- ⊙ ozone (O₃)
- ⊙ particulate matter (including beryllium)
- ⊙ 30 selected volatile organic compounds

The 30 monitored volatile organic compounds are presented below in Table II.

TABLE II
LIST OF VOLATILE ORGANIC COMPOUNDS
MONITORED

chloromethane	1,2-dichloropropane
bromomethane	<i>trans</i> -1,3-dichloropropene
vinyl chloride	trichloroethene
chloroethane	dibromochloromethane
methylene chloride	1,1,2-trichloroethane
carbon disulfide	benzene
1,1-dichloroethene	<i>cis</i> -1,3-dichloropropene
1,1-dichloroethane	2-chloroethyl vinyl ether
<i>trans</i> -1,2-dichloroethene	bromoform
chloroform	tetrachloroethene
1,2-dichloroethane	toluene
1,1,1-trichloroethane	chlorobenzene
carbon tetrachloride	ethyl benzene
bromodichloromethane	styrene
1,1,2,2-tetrachloroethane	total xylenes

AIR MONITORING ACTION LEVELS AND STANDARDS

Nitrogen dioxide (NO₂), ozone (O₃), and respirable particulate (PM10) are Clean Air Act criteria pollutants with National Ambient Air Quality Standards. These standards are shown in Table III.

Volatile organic compounds, typically organic solvents and degreasers, are important indicators of industrial type pollutant releases. The State of Colorado does not have ambient air quality standards for any of the 30 volatile organic compounds monitored at the Site.

**TABLE III
NATIONAL AMBIENT AIR QUALITY STANDARDS**

POLLUTANT	AVERAGING TIME	CONCENTRATION
Carbon Monoxide (CO) Primary Standard Primary Standard	1 Hour* 8 Hour*	35 ppm 9 ppm
Ozone (O₃) Primary Standard Secondary Standard	1 Hour** (same as the primary)	0.12 ppm
Nitrogen Dioxide (NO₂) Primary Standard Secondary Standard	Annual Arithmetic Mean (same as the primary)	0.053 ppm
Sulfur Dioxide (SO₂) Primary Standard Primary Standard Secondary Standard	Annual Arithmetic Mean 24 Hour* 3 Hour*	0.03 ppm 0.14 ppm 0.5 ppm
Particulates (PM-10) Primary Standard Primary Standard	Annual Arithmetic Mean 24 Hour**	50 µg/m ³ 150 µg/m ³
Lead (Pb) Primary Standard	Calendar Quarter***	1.5 µg/m ³
Total Suspended Particulates (TSP) Primary Standard Primary Standard Secondary Standard Secondary Standard	Annual Geometric Mean**** 24 Hour**** Annual Geometric Mean**** 24 Hour****	75 µg/m ³ 260 µg/m ³ 60 µg/m ³ 150 µg/m ³

* Not to be exceeded more than 1/year

** Statistically estimated number of days with concentrations above this level averaged over a 3 year period, is not to be more than 1/year

*** Colorado State Pb standard averaging time is monthly with same concentration

****The TSP standard was replaced by the PM-10 standard on July 1, 1987. TSP is now a State standard only and was temporarily suspended from August 30, 1993 to October 30, 1995 by the AQCC.

Note: New federal standards have been proposed for ozone and PM-10

AIR MONITORING APPROACH AND METHODS

METEOROLOGICAL STATIONS

The meteorological data are used primarily for modeling, routine assessments, and emergency response. Meteorological data are important for air quality monitoring support, atmospheric modeling, hydrological studies, and emergency planning and preparedness for operational emergencies.

The Meteorological Station consists of two towers equipped to measure and record various meteorological information. MET01 is a 61-meter (200-foot) tower with wind speed, wind direction, and temperature sensors at 10 meters, 25 meters, and 60 meters. Measurements at different elevations provide information on the stability of the atmosphere, which influences how emitted air pollutants will move and disperse.

MET02 is a 10-meter tower with a redundant set of sensors at the 10 meter level to provide backup data if needed. Sigma Theta (the standard deviation of the wind direction, used for wind stability classification), precipitation, relative humidity, and solar radiation are also measured. This station is the main meteorological data collection location for the Site. The two towers are located onsite in the western portion of the buffer zone.

In addition to the primary Meteorological Station, a 10-meter meteorological tower is located at each of the state Air Pollution Control Division's five Rocky Flats Monitoring Network ambient air monitoring stations. These meteorological stations provide data on a scale that represents the transport and dispersion of contaminants in the immediate area of the monitors. Each of the 10-meter meteorological towers is equipped to record wind speed, wind direction, temperature, and rainfall. If funding is provided, these monitoring site meteorological towers are will be integrated into the primary Meteorological Station to enable central data access and recording. This will allow "real-time" input to the Site emergency response, Terrain Responsive Atmospheric Code (TRAC) model. The rainfall equipment was installed but is not currently operational. Rainwater can be analyzed for tritium, a radioactive isotope of hydrogen gas, not normally found in water.

Figure 1 illustrates the configuration of the Site Meteorological Towers and Figure 2 shows the location of the Rocky Flats Monitoring Network stations, including 10-meter meteorological towers.

FIGURE 1 - METEOROLOGICAL TOWER CONFIGURATION

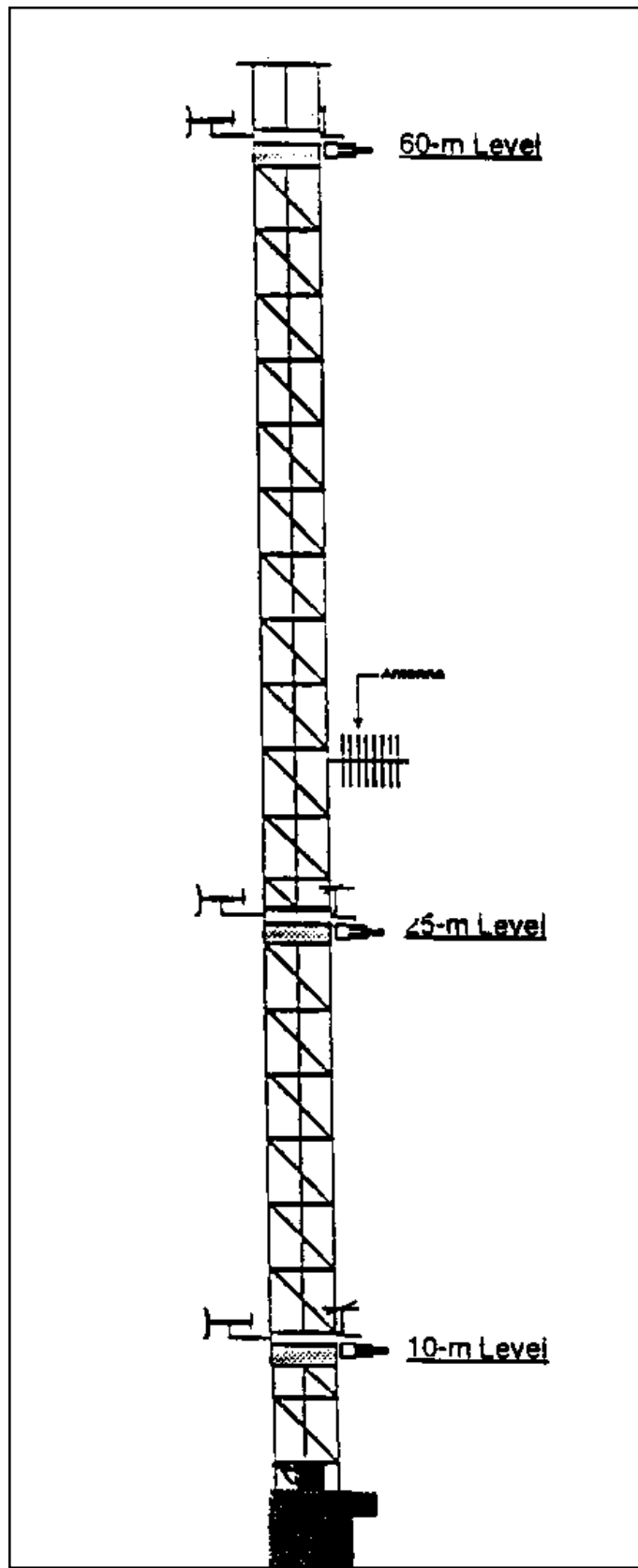
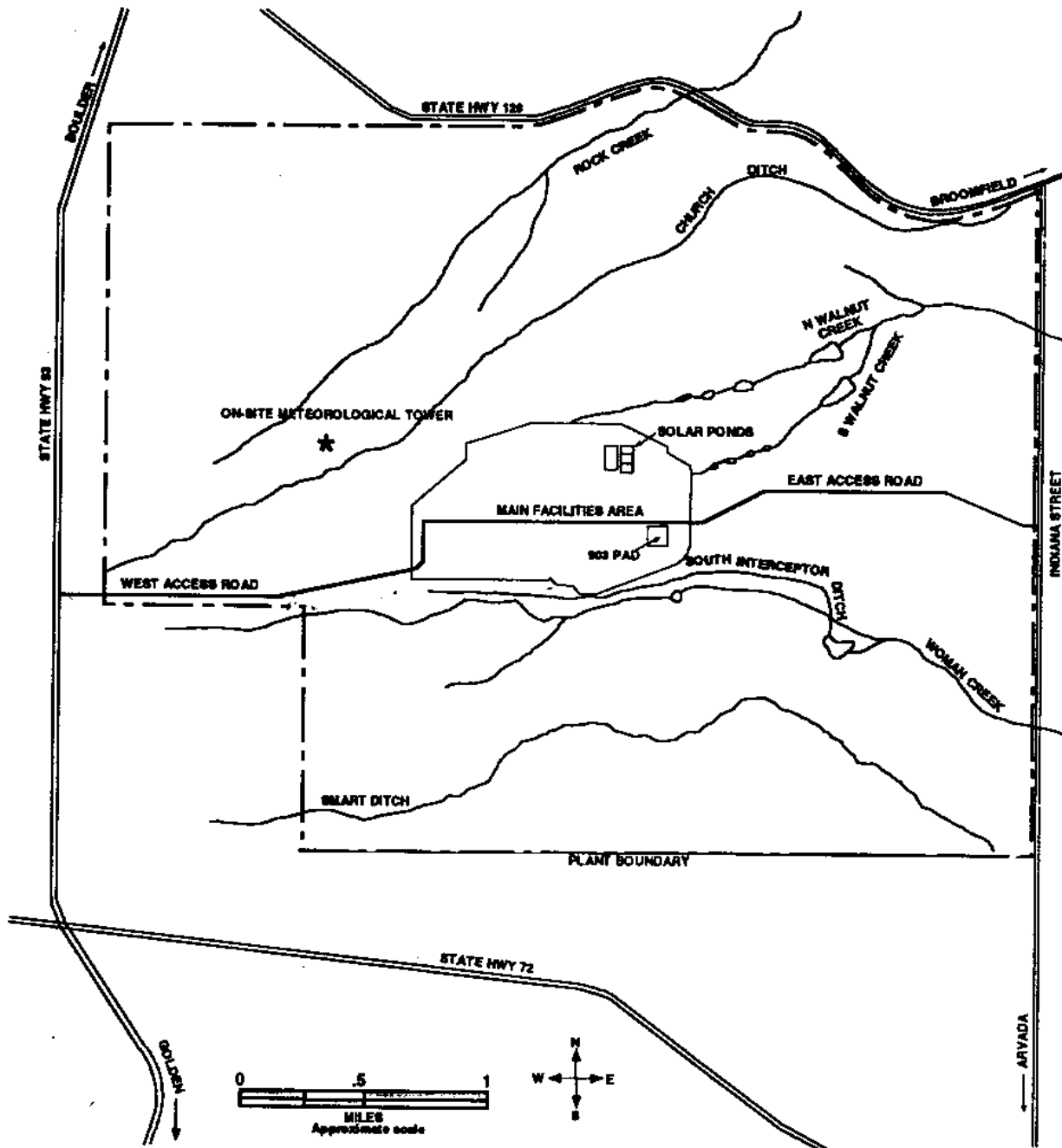


FIGURE 2 - METEOROLOGICAL TOWER LOCATION



ROCKY FLATS MONITORING NETWORK (CDPHE)

The Rocky Flats Monitoring Network consists of five ambient air monitoring stations operated by the CDPHE Air Quality Division. All samples collected within this network are analyzed by the CDPHE at the state laboratory. This network provides data to determine compliance with environmental standards and to evaluate the impacts on ambient air quality and the risks to the general public.

Oxides of nitrogen (NO_x), primarily nitrogen oxide (NO) and nitrogen dioxide (NO₂), are monitored continuously at all but the X-2 site. Ozone (O₃) is monitored only at the X-1 site and is monitored as a regional pollutant as part of a Greater Denver Metro Area study. Ozone monitoring is not directly connected to that performed for Site emissions.

Volatile organic compounds are monitored once every sixth day by collecting a sample, then analyzing the sample for the 30 specific compounds listed in Table II (p. 5-6). At the monitoring site, ambient air is drawn through a sorbent trap to remove the volatile organic compounds from the air stream. This trap is then transported to the state laboratory for analysis. The volatile organic compounds collected are desorbed and analyzed to determine the total mass of each compound collected in the trap. An air concentration is then determined from the mass of the compound and the total volume of air pulled through the sorbent trap during sampling.

Total suspended particulates (TSP) and respirable particulates (PM₁₀) are sampled every sixth day at the Site. These pollutants are measured by drawing ambient air through a fiber filter, then weighing the filter to determine the total mass of particulate collected. Concentrations are determined from the total particulate mass and the total air volume drawn through the filter.

The filter samples are collected using size-selective inlet or high volume (Hi Vol) samplers. Design of the sampler's air inlet determines whether all particulate in the sample (TSP) or only the respirable fraction of particulate (PM₁₀, the particulates with an aerodynamic particle diameter of less than 10 microns) are collected. Filter samples are also analyzed by CDPHE to determine the concentration of beryllium. Beryllium is a non-radioactive metal that is regulated under a Colorado emission standard and a National Emission Standard for Hazardous Air Pollutants. In addition, filters are routinely composited and analyzed for radioactive uranium.

RADIOACTIVE AMBIENT AIR MONITORING PROGRAM

The Radioactive Ambient Air Monitoring Program consists of 35 air samplers. There are 19 samplers located onsite, including collocated samplers that provide sample duplicates (using the old style samplers) for quality control purposes. Twelve samplers are located along the Site boundary, and four samplers are located offsite in neighboring communities near Boulder, Broomfield, and Westminster. These samplers routinely collect continuous samples of airborne radioactive materials during one month intervals but can be set to sample more frequently if necessary.

Both coarse and fine particulate samples are collected. The total concentration of fine and coarse particles provides an indication of the amount of radioactive particulate present in the atmosphere. Fine particulate samples indicate the portion of radioactive particulates that are respirable and not easily cleared from the lungs by normal biological mechanisms (mucus transport, coughing, etc.). Knowing the relative size distribution of radioactive particles allows a better assessment of the health risk posed by those particles.

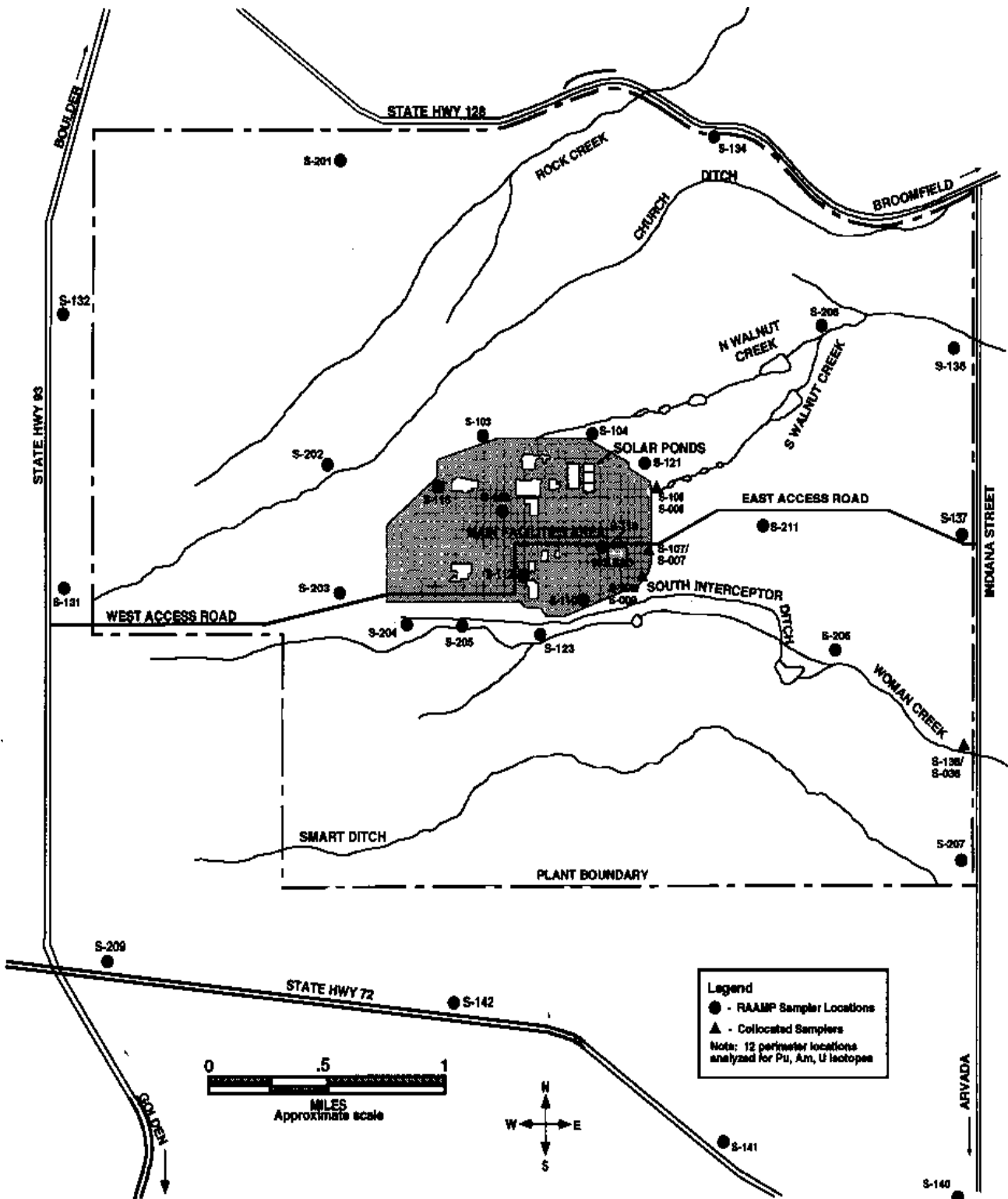
These samplers are different from those operated by the CDPHE (the Rocky Flats Monitoring Network described above). The Radioactive Ambient Air Monitoring Program air samplers achieve particle size separation using a two-stage sample cartridge that includes an oil-soaked impactor pad and a conventional fiber filter. In the cartridge, air must flow around the impactor before passing to the filter. Heavier particles, those above approximately 10 micron size, are unable to avoid hitting the pad and sticking in the oil. Fine particles flow past the impactor and are collected in the fiber filter.

The present Radioactive Ambient Air Monitoring Program is made up of a network of air samplers needed to monitor potential impacts to the public from current Site activities and the sampling needed to monitor emissions that may result from planned environmental restoration and D&D activities in the future.

Currently, thirteen of the collected samples (12 on the Site perimeter and one at a major fugitive dust source area) are analyzed for plutonium, americium, and uranium on a monthly basis. (Fewer were analyzed during fiscal 1995 due to budget restraints.) The other 26 samplers routinely collect samples, but these samples are not analyzed unless emissions from local cleanup projects have significant potential impact or an accidental release from the Site occurs. These samples are analyzed by a contract laboratory.

Figure 3 shows the Radioactive Air Monitoring Program monitoring locations.

FIGURE 3 - RADIOACTIVE AMBIENT AIR MONITORING LOCATIONS



ONSITE RADIATION CONTROL MONITORING (CDPHE)

The Radiation Control Division of CDPHE operates a system of 15 particulate samplers and two rainfall collectors at onsite, buffer zone, and perimeter locations around the Site. Eleven of these samplers are high volume (Hi Vol) samplers; eight of those are at ground level and three are elevated. Ground level samplers are preferentially sited for collecting larger soil-derived particulates that have been suspended or resuspended from ground level sources by high winds or other mechanical means, such as excavation or vehicle traffic. Three other samplers are PM10 samplers, all of which are elevated. Elevated samplers better represent the kinds of materials that can be transported longer distances in the atmosphere.

Samples are collected over approximate one week periods and analyzed for gross alpha and beta radioactivity. Quarterly composite samples are analyzed for plutonium, americium, and the ratio of uranium isotopes (^{234}U to ^{238}U). Any rainfall collected is composited and analyzed for tritium, gross alpha and beta radioactivity, plutonium, americium, $^{234}\text{U}/^{238}\text{U}$ ratio, and total uranium. These samples are collected close to emission sources at the Site and are routinely analyzed by the CDPHE Radiation Control Division for a wider variety of different radioactive components than other ambient samples.

This system also employs a cascade impactor for providing up to seven discrete particulate size ranges on another Hi-Vol sampler inlet, as a particulate sizing study. A cascade impactor is a device that causes the air to flow through a series of impactor plates. Each impactor plate is arranged so that the air will be required to make a sharper turn on its way to the vacuum motor. Heavier particles are deposited on the first impactor stage and each stage collects successively lighter particles until the air finally passes through a filter. Each stage is weighed separately to determine the fraction of particulate collected. Particle size collected (by each stage) is determined by the physical design of the cascade impactor and the sampling flow rate for each sample. This project has been active over the several previous years and continues to be conducted to determine if a definitive size range can be identified for radioactive airborne materials. Other than isolated sampling results, no important conclusions concerning particulate sizing have been published to date.

COMMUNITY RADIATION MONITORING PROGRAM (COMRAD)

The Community Radiation Monitoring Program consists of five discrete monitoring stations equipped to measure meteorological parameters and environmental radiation exposure. A single monitoring station is installed in four communities located east of the Site (Arvada, Broomfield, Northglenn/Thornton, Westminster). The sampler design is the same as that described for the Radioactive Ambient Air Monitoring Program samplers.

The meteorological data collected at each station includes wind speed, wind direction, temperature, solar radiation, barometric pressure, humidity, dew point, wind chill, and precipitation. Particulate samples are collected at each location to determine the plutonium content. Samples are analyzed by the EPA Laboratory in Las Vegas, Nevada, which is completely independent of the Site. Gamma radiation and Thermoluminescent Dosimeter (TLD) exposure are also measured at each station. TLD exposure is a measurement of penetrating ionizing radiation, typically originating from gamma radiation sources in soil, building materials, and cosmic radiation.

Figure 4 shows the map locations of the community air samplers.

Because the stations are operated by members of the local community and the plutonium analysis is independent from the sampling and analysis performed by the DOE and its contractors, these monitoring sites provide additional assurance that measured ambient plutonium levels are being accurately reported.

BUILDING EFFLUENT MONITORING

Building effluent, or exhaust air, is routinely monitored at locations throughout the central portion (Industrial Area) of the Site. Monitoring and reporting of emissions from specific sources (buildings and/or processes) are required by both Colorado and federal regulations.

There are currently 22 significant point sources at Rocky Flats. Significant sources are those with an estimated uncontrolled emission rate that could potentially result in an effective dose equivalent of 0.1 millirem per year (mrem/yr). Although these sources are controlled (air from process buildings is filtered through multiple stages of High Efficiency Particulate Air [HEPA] filters before being discharged), monitoring is required on the basis of uncontrolled emissions. An additional 31 ducts or vents are not considered to be significant and require only periodic confirmation sampling of low emissions.

Total Site point source emissions for plutonium, uranium, and americium are determined using measured values and published emission factors. Tritium samples are also collected and analyzed at five of the significant and one of the insignificant point source locations. Collected samples are analyzed by a contract laboratory.

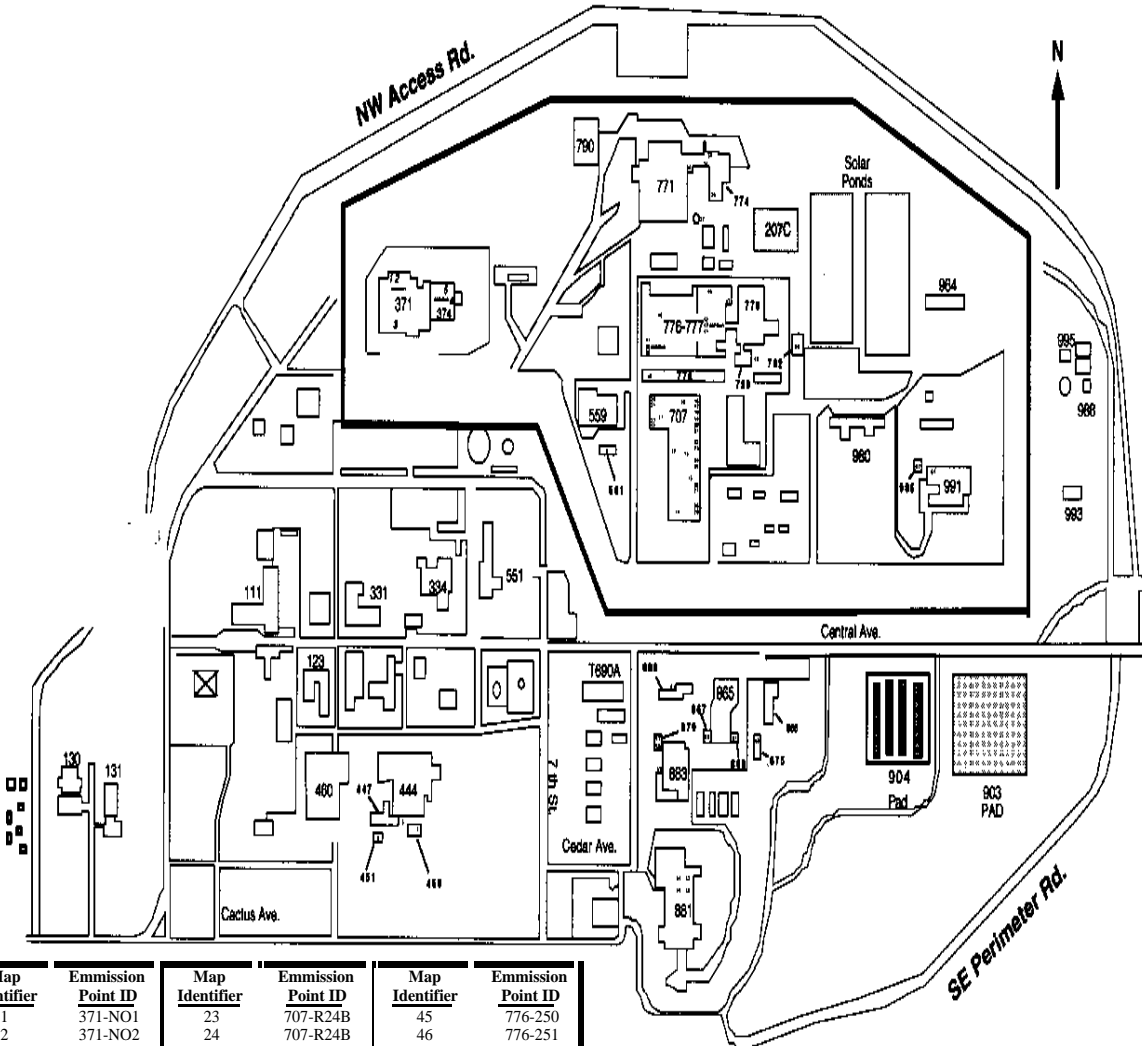
Reported emissions from the Site also include emissions from non-point sources. Non-point source emissions primarily result from mechanical disturbances (including remediation activities and traffic) and natural disturbances of soils contaminated as a result of past radioactive spills and other releases. As a result of the cessation of production activities at the facility, building (point source) emissions currently account for less than 10 percent of facility emissions. Area or non-point sources account for approximately 90 to 95 percent of the an effective dose equivalent from the Site. Any additional soil handling activities associated with remediation work may contribute significantly to emission totals. Emissions from non-point sources are modeled using previously collected soil contamination data and calculated surface distributions of that contamination.

Figure 5 shows the radionuclide air effluent emission measurement locations at the Site.

REPORTING AND DATA MANAGEMENT

Air monitoring data are reported quarterly at public environmental data exchange meetings and are published in a Site Quarterly Environmental Monitoring Report. Data from all Rocky Flats environmental monitoring programs are presented at the data exchange meetings and in the quarterly reports. Data from effluent samplers and ambient air samplers, as well as modeled analyses of dose impacts from Site emissions, are reported in the “Annual Radionuclide Air Emissions Report,” submitted by DOE to EPA and CDPHE in June of each year. In the near future, these data will also be posted on DOE’s Rocky Flats Internet web site.

FIGURE 5 - BUILDING EFFLUENT MONITORING LOCATIONS



Map Identifier	Emission Point ID	Map Identifier	Emission Point ID	Map Identifier	Emission Point ID
1	371-NO1	23	707-R24B	45	776-250
2	371-NO2	24	707-R24B	46	776-251
3	371-SSS	25	707-R25A	47	776-252
4	374-MAI	26	707-R26A	48	778-LDY
5	374-SPD	27	707-R26B	49	779-729
6	444-DO5	28	707-R27A	50	779-782
7	444-MAI	29	707-R27B	51	865-EEE
8	447-MAI	30	707-R45A	52	865-WWW
9	559-561	31	707-R45B	53	881-MA7
10	707-101	32	707-R46A	54	881-MA2
11	707-102	33	707-R46B	55	881-MA3
12	707-105	34	771-CMA	56	881-MA4
13	707-106	35	771-CRM8	57	883-AAA
14	707-107	36	771-CRM10	58	883-BBB
15	707-108	37	771-MAI	59	883-CCC
16	707-R21A	38	774-202	60	886-875
17	707-R21B	39	776-201	61	889-MA1
18	707-R22A	40	776-202	62	991-985
19	707-R22B	41	776-204	63	991-MA1
20	707-R23A	42	776-205	64	C-549-1
21	707-R23B	43	776-206		
22	707-R24A	44	776-207		

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CRITICAL ANALYSIS

INTRODUCTION

This section of the Air Monitoring Program report presents a preliminary critical analysis of the air monitoring systems currently in place at or adjacent to the Rocky Flats Environmental Technology Site. The primary purpose of this section is to determine if the current Air Monitoring Program sufficiently satisfies public concerns about air quality as expressed in the Rocky Flats Community Needs Assessment (CNA).

The Rocky Flats Health Advisory Panel has identified inhalation as the most critical pathway for exposure to contaminants from Rocky Flats. Respondents in the Citizens Needs Assessment (CNA) collectively expressed a need for continuous environmental monitoring of air, soil, and surface and groundwater for contamination from Rocky Flats. Another issue involves a perception of increased risk of potential offsite contaminant migration resulting from cleanup and decommissioning activities. These and other environmental concerns are not satisfactorily addressed by DOE. Although the Air Monitoring Program at Rocky Flats meets the minimum legal requirements for monitoring, it does not meet the hopes and expectations expressed by participants of the Community Needs Assessment.

The critical analysis is based on information provided by Site staff and other knowledgeable parties, including staff from Kaiser-Hill and its subcontractors, municipalities, Colorado state offices, EPA, DOE, and public stakeholders. Information sources include various reports, documents, studies, articles, personal interviews, and follow-up telephone conversations.

ANALYSIS OF CURRENT AIR MONITORING SYSTEMS

The stated purpose of the Air Monitoring Program is to support both compliance demonstration and emergency response needs at the Site.

The Site Air Monitoring Program includes multiple systems to monitor for criteria and non-criteria pollutants. Climatological and meteorological data and gaseous and particulate pollutant levels are measured. Analyses are performed for radiological and non-radiological parameters, and both ambient (outside) air and source (building exhaust) samples are collected. Air sampling stations are located onsite, at the fenceline (perimeter), and offsite in the nearby communities.

The following air monitoring systems are currently in operation at the Site. The order of presentation is not intended to imply greater importance to any system in the overall Air Monitoring Program:

- ⊙ Rocky Flats Meteorological Station operated by the Site contractor (2 towers);
- ⊙ Rocky Flats Monitoring Network operated by Colorado Department of Public Health and Environment, Air Pollution Control Division (5 stations);
- ⊙ Radioactive Ambient Air Monitoring operated by the Site contractor (35 locations);
- ⊙ Onsite Radiation Monitoring operated by Colorado Department of Public Health and Environment, Radiation Control Group (15 locations);
- ⊙ Community Radiation Monitoring operated by the communities (5 stations);
- ⊙ Site Building Effluent Monitoring operated by the Site contractor (22 significant, 31 other).

ANALYSIS OF MONITORING SYSTEMS

Meteorological Station

The Meteorological Station is the main meteorological data collection location for the Site. These data are used primarily for modeling, routine assessments, and emergency response. Meteorological data are important for air quality monitoring support, atmospheric modeling, hydrological studies, and emergency planning and preparedness for operational emergencies. Two towers (MET01 and MET02) are located onsite in the western buffer zone to provide site- specific data.

The 61-meter (200-foot) MET01 tower is equipped to measure wind speed, wind direction, and temperature at the various levels (10 meter, 25 meter, and 60 meter levels). Sigma Theta (which classifies wind stability), precipitation, relative humidity, and solar radiation are also measured. These parameters are needed to satisfy regulatory requirements and support Site operations and activities.

Although upper level wind data are important for larger scale modeling, wind data at the 10 meter level are critical for routine dispersion modeling and assessments. MET02 is a 10-meter tower with a redundant set of sensors at the 10 meter level to provide this critical backup data if needed.

Meteorological data collection is a necessary component of the Rocky Flats Air Monitoring Program. The appropriate meteorological parameters are monitored at the Site and support the objectives of this program.

Overall air quality data reporting is addressed later in this report. However, unexplained data gaps were observed in several reports. In two randomly selected Quarterly Environmental Monitoring Reports (April-June 1996 and July-September 1996), several periods of missing meteorological data were observed that were either not clarified or explained as “unknown.” This is not acceptable.

Justification for the missing data should be provided at the time of reporting and data management procedures explained. If blank data is averaged with valid data, reported values are skewed and the data is suspect. Unexplained data gaps in air monitoring reporting may indicate deficiencies in the quality assurance/quality control procedures.

Rocky Flats Monitoring Network

The Rocky Flats Monitoring Network consists of five ambient air monitoring stations operated by the Colorado Department of Public Health and Environment (CDPHE), Air Pollution Control Division. The ambient monitoring network around the outer perimeter of the Site was established to assure that emissions from the Site which impact the public do not exceed regulatory and known health limits.

Monitoring site X-1 is located on the northern boundary, X-5 is on the western boundary, and X-4 is on the southern boundary. Sites X-2 and X-3 are located in two natural drainage areas on the eastern boundary of the buffer zone. The two drainage areas are excellent locations to monitor the impact of pollutants leaving the Site because the wind will have a tendency to flow down the drainage slopes and directly toward and across the sampling stations.

The gaseous pollutants, oxides of nitrogen (NO_x) and ozone (O₃), are monitored at these sites. Both nitrogen dioxide and O₃ are criteria pollutants with established National Ambient Air Quality Standards (NAAQS).

The NO_x, composed mostly of nitrous oxide (NO) and nitrogen dioxide (NO₂), is a byproduct of combustion. Typical man-made sources are automobile exhausts and combustion heating or boiler stack emissions. NO_x emissions also occur naturally. NO_x is monitored continuously at all but the X-2 site.

Although the Air Monitoring Program plan for fiscal year 1997 (Integrated Monitoring Plan, June 1997) stated that NO_x was monitored to determine the attainment status of the area, it is, reportedly, being used to determine compliance with the Prevention of Significant Deterioration (PSD)

emission requirements for sources at the facility. (R. Fox Interview, 1997). The final IMP states that if an exceedance occurs, the Site's operating permit may be reopened and potentially revised to mitigate the exceedance. The Colorado Air Pollution Control Division would very likely investigate the cause of elevated measurements well before there was an exceedance of an annual standard.

The determination of emissions from a source is customarily the responsibility of the source owner or operator; however, in this case it is performed by the enforcing agency as part of the Agreement In Principle between CDPHE, EPA and DOE.

Ozone is monitored at the X-1 site only. It is officially part of a special Denver Metro Area study, not a planned monitored pollutant of the Rocky Flats Monitoring Network. Ozone is a secondary pollutant, formed by the atmospheric reaction of oxygen with airborne nitrogen oxides and hydrocarbons in the presence of sunlight. It is typically detected downwind from populated metropolitan areas during warm summer months. The ozone levels recorded at the Site are fairly high compared to the new proposed National Ambient Air Quality Standards for ozone.

Sampling is also performed for 30 specific volatile organic compounds at each of these sites on a once-every-sixth-day schedule. The volatile organic compounds, typically organic solvents, are collected in traps containing a sorbent material for laboratory extraction and analysis. The methodology for sampling and analysis was recently changed from using Tenax to using Carbotrap as the trapping sorbent. As a result, the list of compounds sampled and reported was modified slightly. This is probably not an important change because the ambient concentrations of hydrocarbons are typically low, and very few organic compounds are expected to be released from the Site except possibly during remediation activities.

Volatile organic compound sampling at the Site fenceline is probably not needed, with the possible exception of periods during performance of remediation activities. Even then, this monitoring would be of questionable value because the downwind concentrations at this distance are usually very low because of natural dispersion by the wind. During remediation activities, monitoring should be performed at the project site close to the potential source. The fenceline is too distant from a potential volatile organic compound source for the measurements to be useful.

The Rocky Flats Air Monitoring Program Plan (IMP) states that "IF... The highest annual baseline-mean volatile organic compound concentration at any station exceeds residential screening levels, THEN... Evaluate risk to determine need for source control" (emphasis added). However, no

volatile organic compound samples are currently being taken to determine the volatile organic compound concentrations. This apparent conflict in air monitoring decisions should be clarified.

Particulate samples, both total suspended particulate and particulate matter less than 10 microns in size (PM10), are collected on a standard once-every-sixth-day schedule at each of the monitoring stations. PM10 is considered to be the respirable fraction of total suspended particulates (TSP). Both are important measurements of the particulate loading in ambient air around the Site. Measured levels of particulates are typically low except when impacted by activities at the Site.

In addition to measuring the amount of particulate collected, all sample filters are also used to determine the concentration of beryllium contained in the particulate sample. Beryllium, a non-radioactive metal regulated by a Colorado emission standard and federal NESHAP, is routinely analyzed for by CDPHE. Although there is not an ambient air quality standard for beryllium, CDPHE would likely investigate any significant increase in measured levels in order to determine the emission source. There are currently no known emission sources of beryllium at the Site. However, fugitive emissions of beryllium might be encountered during remediation activities.

In addition to beryllium, both total suspended particulates (TSP) and PM10 filters are routinely composited and analyzed for radioactive plutonium, americium, and uranium. Although uranium is a naturally occurring element and both plutonium and americium are man-made elements, elevated levels detected for any of the radionuclides would indicate a possible impact from the Site.

Each Rocky Flats Monitoring Network site also includes a 10-meter meteorological tower equipped with wind speed, wind direction, and temperature sensors and a rainfall monitor. The meteorological parameters are currently being integrated into the Rocky Flats Meteorological Station for possible use to provide “real-time” input to the Site emergency response, Terrain Responsive Atmospheric Code (TRAC) model.

Although CDPHE staff might disagree, meteorological monitoring at these sites may not be needed. While the capability of correlating measured pollutants with wind direction is important, one meteorological tower for the entire Site is generally adequate to provide the required data. After these sites are connected to the Rocky Flats Meteorological Station, the 10-meter data from either tower could supply wind speed and direction information. It will also be beneficial to determine how well the Terrain Responsive Atmospheric Code TRAC model is able to “use” data from the Rocky Flats Monitoring Network sites.

Once operational, the rainfall equipment should provide useful rainfall data. If measurable amounts of tritium, gross alpha/beta radioactivity, plutonium, americium, or uranium are found in the rainfall it would indicate emission impacts from the Site.

The CDPHE Air Pollution Control Division does a good job of confirming that emissions from the Site that impact the public do not exceed the established air quality standards. However, non-regulated pollutants (except volatile organic compounds) are not monitored. Protection of the public is based on whether there is an existing regulation or standard to compare with the measured emissions.

Radioactive Ambient Air Monitoring

The Radioactive Ambient Air Monitoring Program samplers are used to collect continuous samples of airborne radioactive materials. Thirty-five samplers are located onsite, along the Site perimeter, and in the communities east of the Site. These samplers collect both coarse and fine particulates over one month periods to determine ambient plutonium levels.

The 12 samplers used to satisfy the regulatory requirements, plus one additional sample, are analyzed for plutonium content on a monthly basis. The other 26 samplers are routinely used to collect samples but are not analyzed unless needed to determine local impact from cleanup projects, or if an accidental release from the Site occurs. Additional sample analysis is not normally required.

This is a dynamic monitoring program with new sites being added as needed and old sites discontinued when they are no longer useful. Changes will likely continue to occur as activities at the Site intensify, such as decontaminating and demolishing buildings and remediation of contaminated soils.

Data collected through the Radioactive Ambient Air Monitoring Program are both required and useful. It provides a means to assess the impacts of Site operations and activities on the surrounding environment, using measured plutonium levels as an indicator. However, assessing potential impacts is not possible unless the samples that are collected are analyzed. Reporting might be improved if measured levels, either with or without wind speed and direction information, were plotted on a Site map.

Data quality objectives and decision rules for this sampling should be clearly identified in the Air Monitoring Program plan (IMP). They are not. The methodology for determining the required number of samples and the periods and frequency of sampler operation should also be provided. It is not. Changes are likely to occur within this monitoring program. It is important to have a clear understanding of how, when, and why changes are made. The rationale for making changes should be documented and available for review prior to implementation.

Onsite Radiation Control Monitoring

Onsite Radiation Control Monitoring is performed by the CDPHE Radiation Control Group, and is intended to provide an independent assessment of public exposure to radiological contaminant releases from the Site. The data collected are compared to Derived Concentration Guides for non-occupationally-exposed persons. This proactive monitoring program has validated Site sampling procedures, confirmed measured plutonium concentrations in the air, and helped identify some errors made by site monitoring personnel.

This monitoring program is important because it is the only Site system that incorporates comprehensive sampling and analysis procedures to evaluate the full range of radioactive elements, plutonium, americium, and uranium and their isomers.

Eight of the samplers in this system are sampling at ground level. Although this does not meet the regulatory stipulation requiring inlet height to be two meters above the surface for compliance sampling, these results are not intended for use in compliance determination. The samplers are appropriately installed and designed for the intended purpose of collecting particulate samples close to the emission source.

The results of the particulate sizing study conducted over the last few years should be reported to determine if a definitive size range could be identified for radioactive airborne materials.

In addition to particulate samplers, this system includes two rainfall collectors. Collected rainfall is analyzed for radioactive components. If significant amounts of radioactivity are detected in the rain, it would indicate emission impacts from the Site.

Community Radiation Monitoring Program

The five Community Radiation Monitoring Program (COMRAD) monitoring stations are equipped to measure meteorological parameters and environmental radiation exposure. A variety of meteorological data, including wind speed, wind direction, temperature, solar radiation, barometric pressure, humidity, dew point, wind chill and precipitation, is collected at each location. In addition, particulate samples are collected to determine the plutonium content by an independent laboratory. Gamma radiation and Thermoluminescent Dosimeter (TLD) exposures are also determined.

These are important sites because they are located within the communities closest to the Site and its potential impacts. However, measured plutonium levels will most likely remain low unless emissions from remediation activities or an accidental release are significant. This information would, of course, only be available well after the fact because of the expected delay between any event and the issuing of the data monitoring report.

More immediate results might be available using a Coefficient of Haze, or tape sampler. This is an out-of-date sampler that was used to measure haze. It was not accurate and could not be related to any standard but, in this case, might provide useful information if there is a release from the Site. The availability of this device should be determined and the desirability of operating it at the Community Radiation Monitoring Program stations discussed.

Building Effluent Monitoring

Building effluent, or exhaust air, is required by both State of Colorado and federal regulations. Building exhaust air is routinely monitored for radionuclides at 22 significant point source locations throughout the central portion of the Site. An additional 31 ducts or vents, not considered to be significant and requiring only periodic confirmation of low emissions, are also routinely sampled. Tritium samples are also collected and analyzed at five of the significant and one of the insignificant point source locations. Site point source emission totals for plutonium, uranium, and americium are determined using these measured values and other emission factors.

The Building Effluent Monitoring will be discontinued as individual sources (buildings) containing radioactive materials are decontaminated and decommissioned, and monitoring is no longer required. This is an additional reason for documenting the rationale for making changes in the Radioactive Ambient Air Monitoring Program.

This monitoring appears to meet or exceed all federal and Colorado state requirements. However, it is not clear that Project-Specific Monitoring will be conducted to protect the environment during D&D and other cleanup activities. Emissions from the Site, including emissions from non-point sources, are required to be reported annually.

ANALYSIS OF AIR MONITORING REPORTING

Data from all monitoring systems at the Site are reported quarterly (reportedly reduced from monthly because of the excessive time required and lack of general need for this frequency) at public data exchange meetings. Data from building effluent monitoring and ambient samplers, as well as modeled analyses of dose impacts from Site emissions, are reported in an Annual Radionuclide Air Emissions Report, submitted by DOE to EPA and CDPHE in June of each year.

The following comments are based on a limited examination of randomly selected reporting documents.

Quarterly Environmental Monitoring Reports

- ⊙ At least one error in reporting a sample number was identified;
- ⊙ Reasons were not provided for missing data;
- ⊙ Monitoring results and other significant information were not explained;
- ⊙ “Errata” sheets were used rather than final reports;
- ⊙ Wind roses, which are easily generated but not very important, take up too much room, especially day and night roses;
- ⊙ Pollutant roses would be valuable but were not provided;
- ⊙ Negative analytical results are reported.

Environmental Surveillance Report

- ⊙ Summary and Overview are very poor;
- ⊙ Reports contain mostly data tables with little or no explanation;
- ⊙ Reports contain mostly boiler plate, not specific to current report;
- ⊙ Map inserts were unreadable and unusable.

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RECOMMENDATIONS FOR IMPROVEMENTS

INTRODUCTION

This section provides recommendations for improvements to the Air Monitoring Program and reporting systems that are currently in place at or adjacent to the Rocky Flats Environmental Technology Site (Rocky Flats or Site). These recommendations provide the basis for discussion between concerned citizens, DOE and its contractors. They should be interpreted as suggestions only, not as requirements to meet federal, state, or local environmental standards or requirements.

The following air monitoring systems are currently in operation at the Site. The order of presentation does not imply any order of importance.

Air Monitoring System	Primary Responsibility
⊙ Meteorological Station	DOE contractor
⊙ Rocky Flats Monitoring Network	Colorado Department of Public Health and Environment, Air Pollution Control Division
⊙ Radioactive Ambient Air Monitoring	DOE contractor
⊙ Onsite Radiation Monitoring	Colorado Department of Public Health and Environment, Radiation Control Division
⊙ Community Radiation Monitoring	Communities
⊙ Building Effluent Monitoring	DOE contractor

In general, these sampling systems were developed and installed separately and have never been truly integrated. Each serves to provide its own distinct contribution to the Air Monitoring Program at Rocky Flats. Reporting recommendations are addressed as a separate section of this report.

RECOMMENDATIONS FOR AIR MONITORING SYSTEMS

METEOROLOGICAL STATION

The Rocky Flats Meteorological Station, the main meteorological data collection location at the facility, is critical for the support of air quality and other programs at the Site. Meteorological data are important for air quality monitoring support, atmospheric modeling, hydrological studies, and

planning and preparedness for operational emergencies. This section offers no recommendations for changes or improvements for the meteorological parameters being monitored.

Recommendations to improve reporting data are suggested for this system. Recommendations to improve reporting procedures are discussed separately below.

ROCKY FLATS MONITORING NETWORK

The Colorado Department of Public Health and Environment (CDPHE), Air Quality Division, operates the five ambient air monitoring stations that make up the Rocky Flats Monitoring Network. Technically, the work being performed by CDPHE is superior. However, the value of the data collected and its importance to both the overall Site monitoring program and to the citizens should be reviewed. The air monitoring critical analysis section indicates that each monitored parameter on the Rocky Flats Monitoring Network sampling parameter list and its importance should be re-evaluated.

RADIOACTIVE AMBIENT AIR MONITORING

The Radioactive Ambient Air Monitoring Program consists of 35 samplers: 19 located onsite, 12 along the Site boundary, and four in neighboring communities. This monitoring, conducted by DOE contractors, is both required and useful. Sample data are used to confirm that administrative and mechanical controls are in place and working. One report change is suggested below. In addition, it is recommended that the methodology for making changes to this system be fully documented.

To improve the air monitoring reporting for this system, it is recommended that measured levels, either with or without wind speed and direction information, be plotted and presented on a Site map. A map showing concentration isopleths (lines of equal concentration) would provide an easily understood picture that will help identify and assess the impacts from Site operations and activities on the surrounding environment.

As stated in the air monitoring critical analysis section of this report, the data quality objectives and decision rules for air sampling should be clearly identified in the air monitoring program plan. A clear statement concerning how collected data and other critical inputs are used to demonstrate regulatory compliance and to calculate annual dose estimates is essential.

ONSITE RADIATION MONITORING BY CDPHE

The Onsite Radiation Monitoring Program is performed by the CDPHE Radiation Control Division. This sampling provides an independent assessment of public exposure to radioactive material released from the Site. This air monitoring is more analogous to a scientific investigation or research project than to monitoring for regulatory compliance. Although this sampling is valuable, it must be better documented. Results from the particle sizing study ongoing over the past several years should be assembled, interpreted, and published.

One recommendation to improve data reporting is suggested for this system. Reporting recommendations are discussed separately below.

COMMUNITY RADIATION MONITORING

The Community Radiation Monitoring Program monitoring sites are important to the community. The five stations are located within nearby communities, and are equipped to measure meteorological parameters and environmental radiation exposure. The program provides a mechanism for individuals living within the surrounding area to actively participate in the Site's environmental surveillance. The program also increases public awareness of radiation and improves communication between local communities and the staff at Rocky Flats. The continuation of this team effort should be encouraged and supported.

Meteorological and gamma radiation data measured at these stations is available in real time because it is measured immediately. However, plutonium concentrations are reported only after analysis has been completed, long after the actual sampling took place.

The air monitoring critical analysis section of this report suggested the installation of a tape sampler (also known as a Coefficient of Haze sampler) be considered. This is an out-of-date sampler that was used in the past to measure atmospheric haze. It was quantitatively inaccurate and could not be related to any standard. However, it might provide useful, near real-time information in the event of a significant release from the Site. A newer device, the BETA Attenuation Particulate Monitor (Beta Gauge), is an EPA-approved equivalent method for automatic and continuous measurements of particles in the atmosphere. If there was a significant release from the Site, and the wind carried emissions into the monitored communities, either the tape sampler or the Beta Gauge would be useful in defining impact periods and duration of episodes. The Beta Gauges sampler sells for approximately \$20,000, and the tape sampler would be slightly less expensive.

However, Beta Gauge samplers, installed at one or both of CDPH's monitoring stations, X-2 and X-3 located at the Site boundary, would provide more suitable locations for this sampling.

The Community Radiation Monitoring Program reports would be more like conventional data reporting documents if hourly or daily averages for meteorological parameters were reported, rather than the instantaneous readings now provided. These instantaneous observations can not usually be correlated to 24-hour meteorological conditions. Also, data are more conventionally reported on a calendar basis instead of matching a sampler change-out schedule.

BUILDING EFFLUENT MONITORING

Building Effluent Monitoring is different from other air sampling conducted at the Site. While ambient air samples provide a measurement of the mass of a given pollutant in a specified volume of air, this monitoring measures the amount of a given pollutant being emitted into the environment.

Point sources (stacks or process vents) that have an estimated uncontrolled potential to result in an estimated dose equivalent of greater than 0.1 millirem per year (mrem/yr) to any member of the public require continuous effluent monitoring for radionuclides

The required Building Effluent Monitoring meets or exceeds all federal and state requirements. Measured emissions, as well as emissions from non-point sources, are reported annually. No changes are suggested for this air monitoring system. Reporting improvements are discussed below.

AIR MONITORING REPORTING

In general, all of the air monitoring reports reviewed were too technical and, from a non-technical citizen's point of view, cumbersome and somewhat difficult to comprehend. From a community relations standpoint, discussions of exactly what the collected data means and how it compares to standards or normal background would be valuable. The notable exception to this is CDPHE's Air Monitoring Data Reports. These reports provided data in tabular, graphical, and diagram formats. A significant attempt was made to provide explanations for the purpose of the monitoring and interpreted monitoring results. These efforts should be extended to all data reporting.

Data from all monitoring systems at Rocky Flats are reported quarterly at public data exchange meetings. The Quarterly Environmental Monitoring Reports could be considerably improved. These reports contain little narrative explaining the significance or interpretation of the data, they had unexplained missing data, and included “errata” sheets for previous sampling reports rather than issuing a final report. This makes it difficult to appreciate the amount of work that goes into preparing these reports, and even harder to understand the significance of the data.

Wind roses, which are easily generated but not very important, take up too much space. This is especially true of the day and night roses. Pollutant roses, which would be much more valuable, are not provided. Graphed or plotted data are often easier to understand than tables filled with numbers. More effort needs to be extended in these areas and consideration given to the target audience for these reports.

The Summary and Overview sections of Environmental Surveillance Reports, prepared for the information exchange meetings, provide limited insight. The reports consist primarily of data tables with almost no explanation. Further, these appear to be boiler plate reports rather than specific to the current report, and the maps provided are difficult to read. For individuals not intimately familiar with the monitoring at the Site, these reports are opaque.

Data from Building Effluent Monitoring and modeled analyses of dose impacts from Site emissions are reported in an Annual Radionuclide Air Emissions Report, submitted by DOE to EPA and CDPHE in June of each year. Reported emissions are primarily from non-point sources, such as mechanical disturbances, including remediation activities and traffic, and natural disturbances of soils contaminated by past radioactive spills and other releases. These emissions appear to be based on established Site-specific data. It is not clear that this database is either current or that it has been recently verified by additional soil sampling. It would be helpful to have a description of how the soils resuspension coefficient is used.

As stated previously, the particulate sizing study results should be published. An explanation for the reason particulate sampling was conducted both at elevated and ground levels and any significant differences resulting from the two positions should be considered for publication.

All environmental data reporting would be improved if easily understood graphs and figures were included that would compare measured values to standards or normal background levels. Additional discussion relating the interpreted results to its significance to public health and the environment would also be helpful.