

Rocky Flats Plant

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Monthly Environmental Monitoring Report

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Rocky Flats Plant Environmental Monitoring Report

August Highlights

Summarized below are highlights from the major data categories presented. Remaining data presented in this report are within the ranges historically measured for their respective parameters and locations.

Environmental Radiochemistry Laboratory - Several analytical results for radioactivity in air effluent, ambient air, and surface water samples are not reported this month because of incomplete laboratory analyses. In an effort to standardize count time with other analytical programs and reduce the analytical minimum detectable activity (MDA), the Environmental Radiochemistry Laboratory in August changed sample counting times from 12 to 24 hours. This required the generation of a new blank population which is used to correct for analytical background contributions to sample counts. Analyses required for the blank population significantly increased the laboratory's sample load and delayed completion of all analytical results. Incomplete analytical results are expected to be complete and available during the next monthly meeting.

Uranium Airborne Effluent Concentrations - During the August 31 meeting, it was reported that Rocky Flats personnel were reviewing the results of July uranium airborne effluent data after one value was reported that was higher than typical releases. The concentrations of Uranium-234 from one sampling location in Building 881 was below the plant action level, but above what is normally reported for that location. The total release of Uranium-233, -234 for July was reported as 2.1129 μCi . The maximum concentration for Uranium-234 was 0.0149 pCi/m^3 , compared to the plant action level of 0.02 pCi/m^3 . The initial alpha/beta screening of the individual filters at the sampling location, which were composited for the analysis, did not show any elevated levels of activity. The sample was re-analyzed in September and results were within normally expected ranges. Plant personnel are continuing to evaluate the source of the initial elevated results.

For August, uranium airborne effluent data are reported in Table 2. The data for two locations are missing because of failure of quality assurance criteria. The samples are being rerun and results will be reported when they become available. The remaining uranium effluent results are within the ranges typically measured for uranium airborne effluent calculations.

Tritium and Beryllium Effluent Concentrations - The August data for tritium concentrations are reported in Table 3. Results are within historically expected ranges. Beryllium results are not available because of incomplete laboratory analysis.

Onsite Water Sample Results - Gross alpha and gross beta analyses for Pond A-4 discharges, and at Walnut Creek at Indiana, were within expected ranges. June data for onsite water sampling, previously reported as incomplete, are provided in individual errata tables.

NPDES Sampling - All NPDES samples for August 1993 were submitted and analyzed by the Analytical Laboratories. There were no NPDES exceedances reported during the month and all results were within expected ranges. In Table 11, there are incomplete analyses for three metals from July and two metals from August. Results will be reported when they become available.

1. Introduction

The Rocky Flats Plant (RFP) has been part of a nationwide Department of Energy (DOE) complex for the research, development, and production of nuclear weapons. The plant was responsible for fabricating nuclear weapons components from plutonium, uranium, beryllium, and stainless steel. The primary production activities included metal fabrication and assembly, chemical recovery and purification of process-produced transuranic radionuclides, and related quality control functions.

This mission changed with the announcement in early 1992 that certain planned weapons systems had been canceled. RFP no longer produces weapons components, and is now in a transition phase into decontamination and decommissioning (D&D). Primary objectives of this new mission include achieving and maintaining compliance with environmental regulatory requirements, as well as effecting proper D&D steps that are under development.

Because radioactive and chemically hazardous materials may be used or handled at RFP during transition, the plant maintains an extensive environmental protection program. Included in that program is regular monitoring for radioactive and hazardous constituents at onsite, plant boundary, and offsite locations.

This Monthly Environmental Monitoring Report summarizes the effluent and environmental monitoring programs at the RFP for August 1993. Data presented herein reflect the best information available to the RFP at this time. If subsequent analyses indicate that any data presented herein are inaccurate or misleading, revisions will be issued promptly.

The Highlights section summarizes the major data categories presented. Remaining data presented in this report are within the ranges historically measured for their respective parameters and locations.

Radiation standards for protection of the public are discussed in Appendix A of this report. The primary standards are based on calculations of radiation dose. These calculations are performed annually using monitoring data presented in the Monthly Environmental Monitoring Report. Radiation doses to the public from RFP operations are typically well below any regulatory limit and far less than are received from naturally occurring radiation sources in the Denver metropolitan area.

Appendix B lists the Volatile Organic Compounds (VOCs) for which monitoring is required under the National Pollutant Discharge Elimination System/Federal Facilities Compliance Agreement (NPDES/FFCA). Appendix C describes Colorado Water Quality Control Commission (CWQCC) standards for the Walnut Creek and Woman Creek drainages downstream of RFP.

Error terms in the form of "a±b" are included with some of the data. For a single sample, "a" is the analytical-blank corrected value; for multiple samples it represents the arithmetic mean, the volume-weighted mean, or the annual total, as indicated in the table. The error term "b" accounts for the propagated statistical counting uncertainty of the sample(s) and the associated analytical blanks at the 95 percent confidence level. These error terms represent a minimum estimate of error for the data.

Plutonium, uranium, americium, tritium, and beryllium measured concentrations are given in this report. Most of the measured concentrations are at or very near background levels, and often there is little or no amount of these materials in the media analyzed. When this occurs, the results of the laboratory analyses can be expected to show a statistical distribution of positive and negative numbers near zero and numbers that are less than the calculated minimum detectable concentration for the analyses. The laboratory analytical blanks, used to correct for background contributions to the measurements, show a similar statistical distribution around their average values. Negative sample values result when the measured value for a laboratory analytical blank is subtracted from a sample analytical result smaller than the analytical blank value. Results that are less than calculated minimum detectable levels indicate that the results are below the level of statistical confidence in the actual numerical values. All reported results, including negative values and values that are less than minimum detectable levels, are included in any arithmetic calculations on the data set. Reporting all values allows all of the data to be evaluated using appropriate statistical treatment. This assists in identifying any bias in the analyses, allows better evaluation of distributions and trends in environmental data, and helps in estimating the true sensitivity of the measurement process.

The reader should use caution in interpreting individual values that are negative or less than minimum detectable levels. A negative value has no physical significance. Values less than minimum detectable levels lack statistical confidence as to what the actual number is, although it is known with high confidence that it is below the specified

detection level. Such values should not be interpreted as being the actual amount of material in the sample, but should be seen as reflecting a range (from zero to the minimum detectable level) in which the actual amount would likely lie. These values are significant, however, when taken together with other analytical results that indicate that the distribution is near zero.

The data in this report are provided as a matter of courtesy and should not be construed as an application for a permit or license, or in support of such an application. Approval of the DOE should be obtained before publication of any data contained in this report.

Abbreviations used within this report are as defined.

Abbreviations

BOD ₅	Biochemical Oxygen Demand, 5 day test
C Average	Average concentration
CBOD ₅	Carbonaceous Biochemical Oxygen Demand, 5 day test
C Maximum	Maximum concentration
C Minimum	Minimum concentration
EFF	Efficiency
LC ₅₀	Lethal concentration to 50 percent of the organisms
m ³	Cubic meter
m/s	Meters per second
mCi	Millicurie
mg/l	Milligrams per liter
mrem	Millirem
pCi/l	Picocuries per liter
pCi/m ³	Picocuries per cubic meter
pH	Hydrogen ion concentration
SU	Standard Unit
µg/m ³	Micrograms per cubic meter
#/100 ml	Number per 100 milliliter
µCi	Microcurie
µg/l	Micrograms per liter

2. Air

2.1 Airborne Effluent

RFP continuously monitors radionuclide air emissions at 53 locations in 17 buildings. The requirements outlined in the "General Environmental Protection Programs" (DOE Order 5400.1) and the "National Emission Standards for Emissions of Radionuclides Other Than Radon From DOE Facilities" (40 CFR 61, Subpart H), mandate the continuous monitoring of air emissions at all release points with the potential of discharging radionuclides into the air in quantities that could result in an effective dose equivalent (EDE) greater than 0.1 millirem per year.

The radiological particulate monitoring and sampling program uses a three-tier approach comprising Selective Alpha Air Monitors (SAAMs), total long-lived alpha screening of routine air duct emission sample filters, and radiochemical analysis of isotopes collected from air duct emission samples. This approach balances both sensitivity and timeliness of desired results. Figure 1 shows a typical radiological emission sampler configuration within an exhaust duct at the RFP.

For immediate detection of abnormal conditions, RFP building ventilation systems that service areas containing plutonium are equipped with SAAMs. SAAMs are sensitive to specific alpha particle energies and are set to detect plutonium-239 and -240. These detectors are subjected to daily operational checks, monthly performance testing and calibration for airflow, and an annual radioactive source calibration to maintain sensitivity and reliability. Monitors alarm automatically if out-of-tolerance conditions are experienced.

At regular intervals, particulate material samples from a continuous sampling system are removed from each exhaust system and radiometrically analyzed for long-lived alpha and beta emitters. The concentration of long-lived alpha and beta emitters is indicative of effluent quality and overall performance of the High Efficiency Particulate Air (HEPA) filtration system. If the total long-lived alpha concentration for an effluent sample exceeds the RFP action value of 0.020×10^{-12} microcuries per milliliter, a follow-up investigation is conducted to determine the cause and to evaluate the need for corrective action. The action value is equal to the most restrictive offsite Derived Concentration Guide (DCG) for plutonium activity in air.

At the end of each month, individual samples from each exhaust system are composited by location. An aliquot of each dissolved composite sample is analyzed for beryllium particulate materials. The remainder of the dissolved sample is subjected to radiochemical separation and alpha spectral analysis that quantifies specific alpha-emitting radionuclides. Analyses for uranium isotopes are conducted for each composite sample.

Forty-one of the ventilation exhaust systems are located in buildings where plutonium processing is conducted. Particulate material samples from these exhaust systems are analyzed for specific isotopes of plutonium and americium. Typically, americium contributes only a small fraction of the total alpha activity release from RFP.

Processes ventilated from several exhaust systems potentially exhibit trace quantities of tritium contamination. Impinger-type samplers are used to collect samples three times each week from the monitored locations. Tritium concentrations in the sample are measured using a liquid scintillation photospectrometer.

The calibration methodology for the beryllium analyses was changed beginning with the September 1990 samples to improve quality assurance. The previous procedure used the single-point, "simple method of additions," one of the methods recommended by the manufacturer of the graphite furnace atomic absorption analytical equipment. The current method is based on Environmental Protection Agency (EPA) Contract Laboratory Program protocol. It uses multi-point calibration curves, periodic validation of the curve with EPA validation standards, and periodic blank and sample checks to ensure absence of equipment contamination and matrix effects during the analysis.

Tables 1 through 3 show monitoring results for radioactive and nonradioactive airborne effluents continuously sampled from plant buildings.

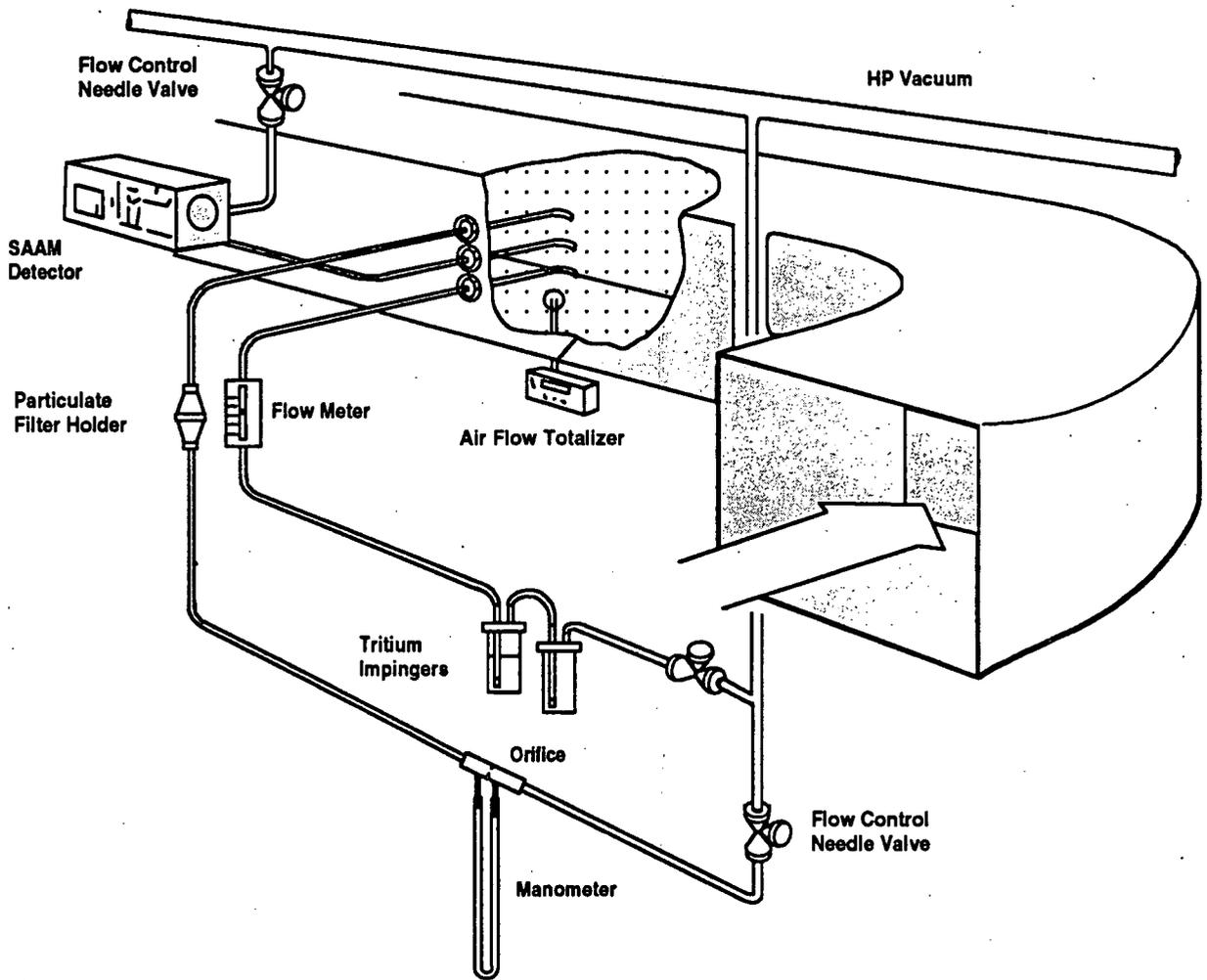


Figure 1: Radiological Effluent Air Sampling System

Table 1**Plutonium and Americium Airborne Effluent Data**

Month	Plutonium-239, -240 (7/15/93 - 8/13/93)		Americium-241 (6/16/93 - 7/15/93)	
	Release (μCi)	C Maximum (pCi/m^3)	Release (μCi)	C Maximum (pCi/m^3)
CY1992	0.3841 \pm 0.0552	0.0016 \pm 0.0003	0.2457 \pm 0.0493	0.0012 \pm 0.0002
1993				
January	0.0325 \pm 0.0043 ^a	0.0006 \pm 0.0001	0.0060 \pm 0.0028 ^a	0.0000 \pm 0.0000
February	0.0194 \pm 0.0035 ^a	0.0003 \pm 0.0001	0.0070 \pm 0.0029 ^a	0.0000 \pm 0.0000
March	0.0075 \pm 0.0024	0.0003 \pm 0.0001	0.0091 \pm 0.0033 ^a	0.0001 \pm 0.0001
April	0.0017 \pm 0.0022 ^a	0.0000 \pm 0.0000	0.0053 \pm 0.0026	0.0000 \pm 0.0000
May	0.0092 \pm 0.0023	0.0004 \pm 0.0001	0.0049 \pm 0.0031 ^a	0.0000 \pm 0.0000
June	0.0107 \pm 0.0027 ^a	0.0001 \pm 0.0000	0.0073 \pm 0.0028 ^b	0.0000 \pm 0.0000
July	0.0156 \pm 0.0028	0.0001 \pm 0.0000	0.0047 \pm 0.0023 ^c	0.0000 \pm 0.0000
August	0.0049 \pm 0.0014 ^d	0.0000 \pm 0.0000		
Year to Date	0.1014 \pm 0.0216	0.0006 \pm 0.0001	0.0442 \pm 0.0198	0.0001 \pm 0.0001

- a. The data for some locations were missing because of failure of Quality Assurance Criteria and were not available because no additional sample remained for analysis. Best estimates of release activities for these samples were included in the Monthly Environmental Monitoring Report.
- b. The data for 6 americium locations are missing because of incomplete laboratory analysis.
- c. The data for 34 americium locations are missing because of incomplete laboratory analysis.
- d. The data for 23 plutonium locations are missing because of incomplete laboratory analysis.

Table 2**Uranium Airborne Effluent Data**

Month	Uranium-233, -234 (7/15/93 - 8/13/93)				Uranium-238 (7/15/93 - 8/13/93)			
	Release (μCi)		C Maximum (pCi/m^3)		Release (μCi)		C Maximum (pCi/m^3)	
CY1992	0.3380	\pm 0.1078	0.0041	\pm 0.0006	0.5996	\pm 0.1160	0.0023	\pm 0.0005
1993								
January	0.0234	\pm 0.0076	0.0001	\pm 0.0000	0.0526	\pm 0.0089	0.0004	\pm 0.0001
February	0.0437	\pm 0.0097	0.0001	\pm 0.0000	0.0550	\pm 0.0093	0.0001	\pm 0.0001
March	0.0559	\pm 0.0109	0.0001	\pm 0.0000	0.0733	\pm 0.0110	0.0001	\pm 0.0001
April	-0.0056	\pm 0.0075 ^a	0.0000	\pm 0.0000	0.0047	\pm 0.0076 ^a	0.0000	\pm 0.0000
May	0.0551	\pm 0.0106	0.0001	\pm 0.0000	0.0741	\pm 0.0107	0.0001	\pm 0.0001
June	0.0519	\pm 0.0102 ^a	0.0001	\pm 0.0000	0.0839	\pm 0.0109 ^a	0.0001	\pm 0.0000
July	0.0464	\pm 0.0095 ^{a,b}	0.0002	\pm 0.00201	0.0589	\pm 0.0097 ^{a,b}	0.0001	\pm 0.0000
August	0.0579	\pm 0.0085 ^c	0.0001	\pm 0.0001	0.0788	\pm 0.0087 ^c	0.0001	\pm 0.0000
Year to Date	0.3289	\pm 0.0744	0.0002	\pm 0.0001	0.4821	\pm 0.0767	0.0004	\pm 0.0001

- a. The data for some locations were missing because of failure of Quality Assurance Criteria and were not available because no additional sample remained for analysis. Best estimates of release activities for these samples were included in the Monthly Environmental Monitoring Report.
- b. The data for 3 uranium locations are missing because of failure of Quality Assurance Criteria. The samples are being rerun.
- c. The data for 2 uranium locations are missing because of failure of Quality Assurance Criteria. The samples are being rerun.

Table 3**Tritium and Beryllium Airborne Effluent Data**

<u>Month</u>	<u>Tritium (H-3)</u> <u>(7/30/93 - 8/30/93)</u>		<u>Beryllium</u> <u>(7/15/93 - 8/13/93)</u>	
	<u>Release</u> <u>(mCi)</u>	<u>C Maximum</u> <u>(pCi/m³)</u>	<u>Release</u> <u>(grams)</u>	<u>C Maximum</u> <u>(ug/m³)</u>
CY1992	3.7991	117 ± 11	0.6156 ± 0.0443	0.00066
1993				
January	0.1886	51 ± 7	0.0280 ± 0.0019	0.00038
February	0.8773	91 ± 7	0.0477 ± 0.0038	0.00038
March	0.4892 ^a	32 ± 7	0.0504 ± 0.0039	0.00043
April	0.1674	22 ± 3	0.0391 ^a ± 0.0028	0.00016
May	0.1037	32 ± 4	0.0635 ± 0.0045	0.00034
June	0.3265	102 ± 8	0.0640 ± 0.0043	0.00023
July	0.2121	45 ± 7	0.0530 ± 0.0036	0.00018
August	0.4414	35 ± 86	c	
Year to Date	2.8062	102 ± 8	0.3456 ± 0.0247	0.00043

NOTE: Beryllium measured at the remaining 44 locations was below the screening level of 0.1 gram per month. Beryllium emissions from Rocky Flats Plant are regulated by the State of Colorado under Colorado Air Quality Control Regulation #8. The limit for beryllium air emissions is 10 grams per stationary source in a 24-hour period. No blank corrections are made to any beryllium data.

- a. The data for one location was missing because of failure of Quality Assurance Criteria and was not available because no additional sample remained for analysis. Best estimates of release activities for this sample was included in the Monthly Environmental Monitoring Report.
- b. Previously reported as complete laboratory analysis.
- c. Incomplete laboratory analysis. See highlights for further explanation.

2.2 Ambient

Ambient air samplers monitor plutonium concentrations in air in the surrounding environment. This monitoring is performed in accordance with DOE Order 5400.1. The data are used to determine the air-inhalation dose to the public for comparison with the DOE standard of 100 millirem per year EDE from all modes of exposure from routine plant operations.

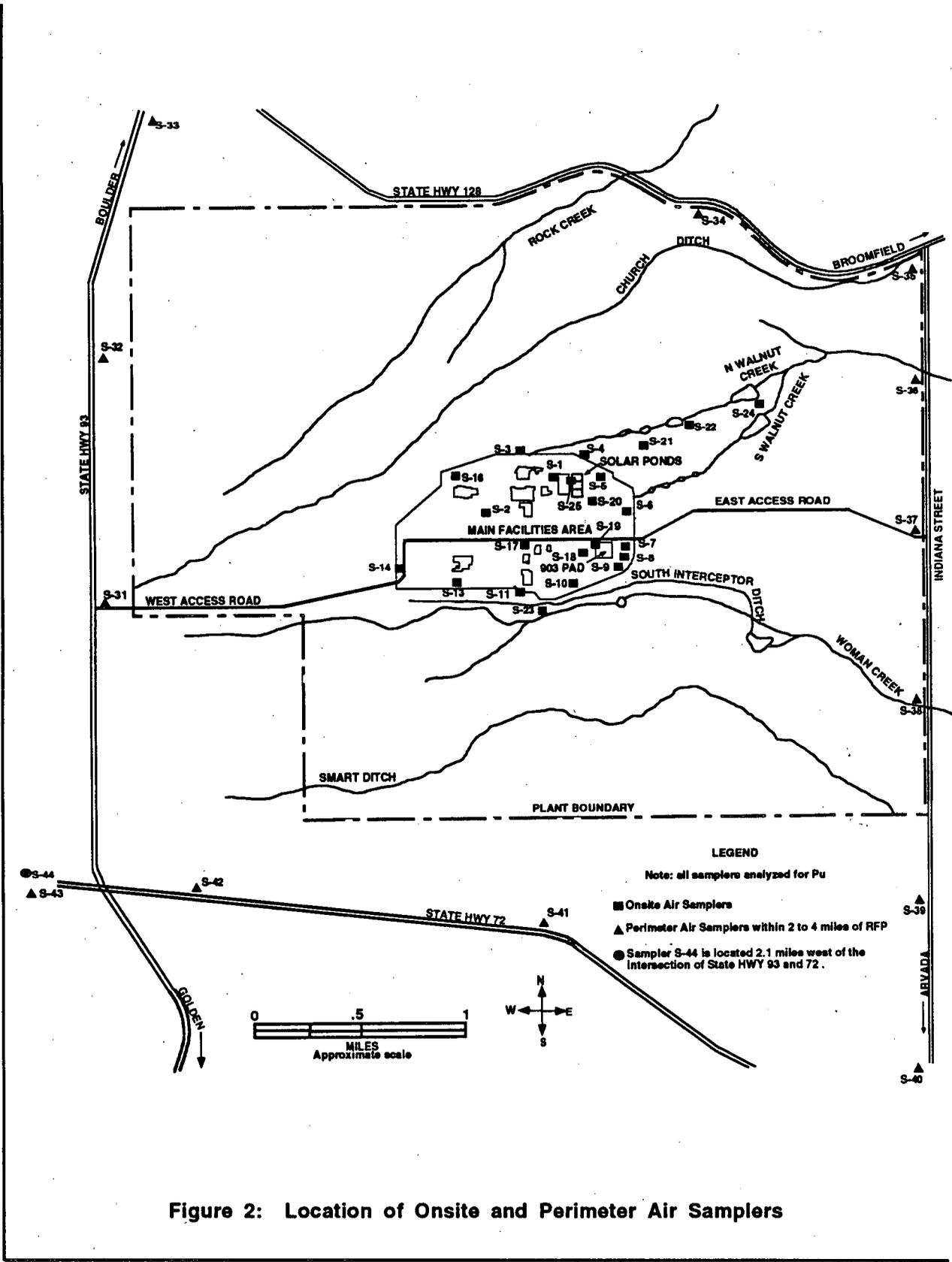
Samplers are designated in three categories by their proximity to the main facilities area.

1. Twenty-three onsite samplers are located within RFP, generally downwind of RFP production facilities areas and near areas of known plutonium contamination (Figure 2).
2. Fourteen perimeter samplers border RFP along major highways on the north (Highway 128), east (Indiana Street), south (Highway 72), and west (Highway 93) (Figure 2).
3. Eleven community samplers are located in metropolitan areas adjacent to RFP (Figure 3).

Samplers operate continuously at a volumetric flow rate of approximately 0.84 cubic meters per minute, collecting air particulates on 20- by 25-centimeter fiberglass filters. Manufacturer's test specifications rate this filter media to be 99.97 percent efficient for relevant particle sizes under conditions typically encountered in routine ambient air sampling.

Ambient air filters are collected biweekly and composited monthly by location before isotopic analysis. All routine ambient air filters are analyzed for plutonium-239 and -240.

Tables 4 through 6 summarize environmental monitoring data from the RFP ambient air sampling network.



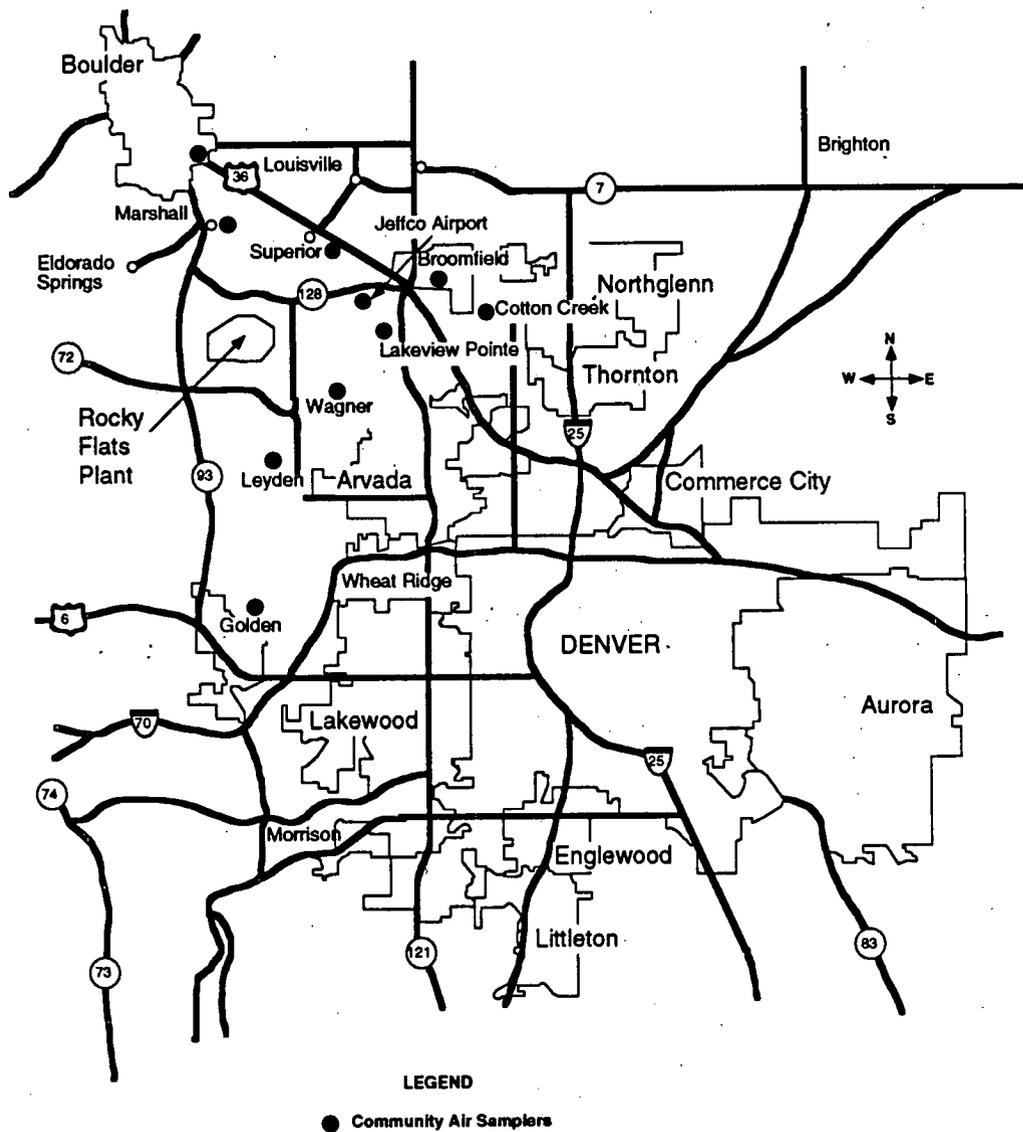


Figure 3: Location of Community Air Samplers

Table 4**Plutonium Concentrations in Ambient Air for Onsite Samplers****(7/19/93 - 8/16/93)**

Location	Volume (m³)	Plutonium Concentration (pCi/m³)	± 95 percent Confidence Interval (pCi/m³)
S-01a			
S-02a			
S-03b			
S-04b			
S-05	30675	.000016	.000003
S-06	29129	.000202	.000018
S-07	24087	.000280	.000024
S-08b			
S-09b			
S-10			
S-12	29199	.000008	.000002
S-13	30491	.000001	.000001
S-14	26738	.000000	.000001
S-16	30942	.000000	.000001
S-17c			
S-18	27500	.000023	.000004
S-19	32089	.000011	.000003
S-20b			
S-21b			
S-22b			
S-23b			
S-24b			
S-25	14435	.000064	.000010
S-81d			

- a. These samplers were out of service.
- b. Incomplete laboratory analysis.
- c. Incomplete data analysis.
- d. Unable to incorporate new calibration data.

Table 5

Plutonium Concentrations in Ambient Air for Perimeter Samplers

(7/20/93 - 8/17/93)

Location	Volume (m³)	Plutonium Concentration (pCi/m³)	± 95 percent Confidence Interval (pCi/m³)
S-31a			
S-32a			
S-33a			
S-34a			
S-35a			
S-36a			
S-37a			
S-38a			
S-39a			
S-40a			
S-41a			
S-42a			
S-43a			
S-44a			

a. Incomplete laboratory analysis. See highlights for further explanation.

Table 6**Plutonium Concentrations in Ambient Air for Community Samplers****(7/21/93 - 8/18/93)**

Location	Community Name	Volume (m³)	Plutonium Concentration (pCi/m³)	± 95 percent Confidence Interval (pCi/m³)
S-51a	Marshall			
S-52a	Jeffco Airport			
S-53a	Superior			
S-54a	Boulder			
S-55b	Lafayette			
S-56a	Broomfield			
S-57b	Walnut Creek			
S-58a	Wagner			
S-59a	Leyden			
S-61c	Denver			
S-62a	Golden			
S-68a	Lakeview Pointe			
S-73a	Cotton Creek			

- a. Incomplete laboratory analysis. See highlights for further explanation.
- b. This sampler was damaged beyond repair and must be replaced.
- c. Sampler S-61 located in Denver was inoperative during this period. This sampler has been temporarily removed because of construction activities on the building where it is installed.

Errata

Table 4 - Errata July 1993

Plutonium Concentrations in Ambient Air for Onsite Samplers

(6/21/93 - 7/19/93)

<u>Location</u>	<u>Volume (m³)</u>	<u>Plutonium Concentration (pCi/m³)</u>	<u>± 95 percent Confidence Interval (pCi/m³)</u>
S-01 ^a			
S-02 ^a			
S-03	25673	.000022	.000006
S-04	20808	.000035	.000008
S-05	30381	.000069	.000015
S-06	27873	.000067	.000012
S-07	22955	.000464	.000098
S-08	29372	.000849	.000128
S-09	25433	.000330	.000052
S-10	30468	.000016	.000004
S-12	28595	.000022	.000050
S-13	25897	.000020	.000006
S-14	23132	.000020	.000006
S-16	25979	.000021	.000006
S-17	7893	.000071	.000020
S-18	27463	.000000	.000002
S-19	30731	.000032	.000007
S-20	29199	.000028	.000006
S-21	29342	.000034	.000008
S-22	21435	.000037	.000009
S-23	31081	.000021	.000005
S-24	31512	.000019	.000005
S-25	17260	.000460	.000070
S-81 ^b			

a. These samplers were out of service.

b. Unable to incorporate new calibration data.



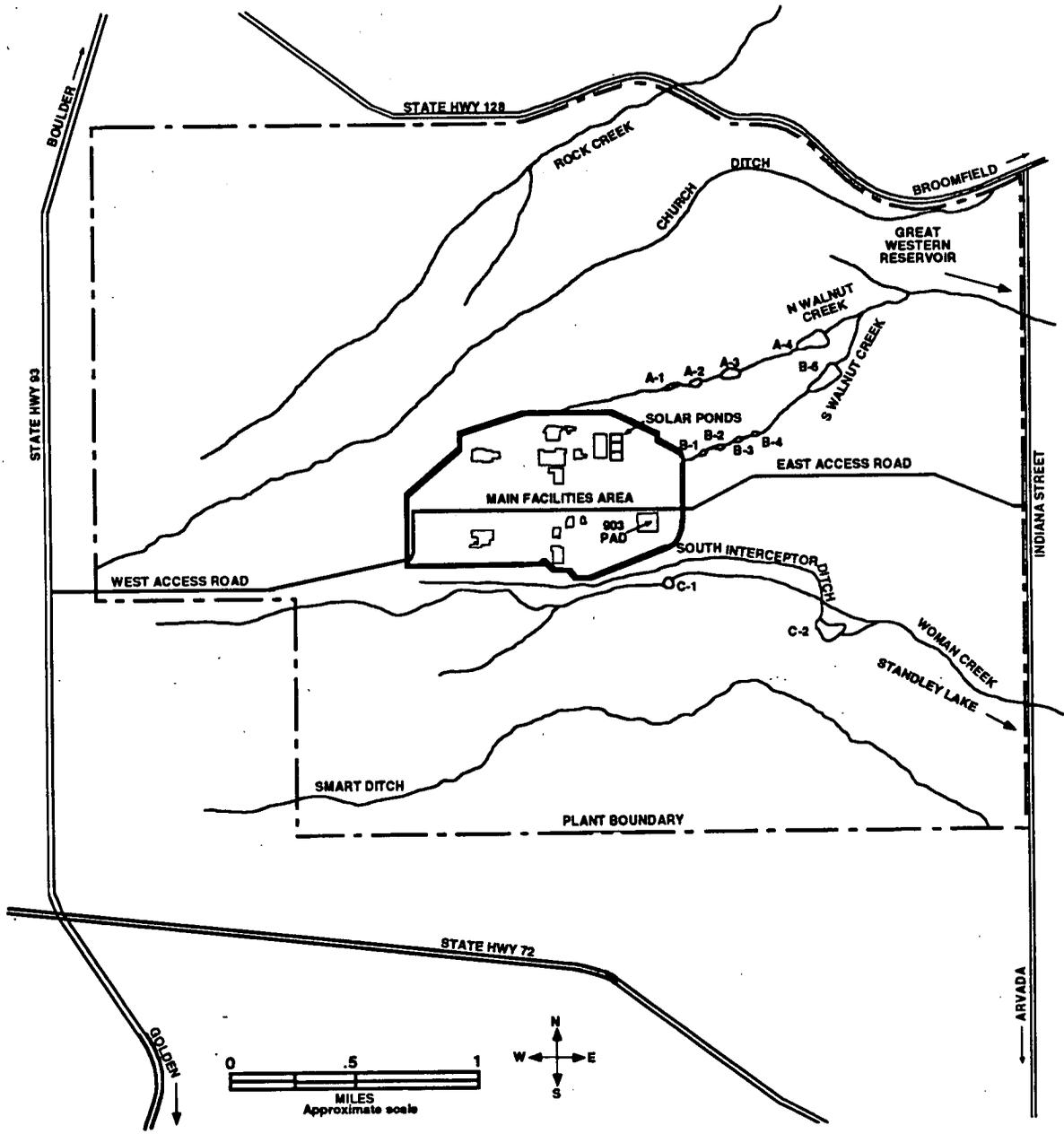
3. Water

3.1 Radionuclide

RFP samples for and analyzes radionuclides that may be present in the plant surface water control ponds and drinking water reservoirs. Radionuclide standards for discharge of surface-water effluents are given in DOE Order 5400.5, "Radiation Protection of the Public and the Environment." In addition, the CWQCC has issued stream segment standards for drainages downstream of RFP. These standards address both radioactive and nonradioactive parameters.

Water sampling is performed at several locations at RFP. These include ponds A-4, B-5, C-1, and C-2, as well as Walnut Creek at Indiana Street. Daily samples are collected during discharges or periods of flow for these locations and composited into weekly samples. Analyses are then performed for plutonium, americium, and uranium isotopic concentrations.

Water sampling results for radioactive constituents are given in Tables 7 through 10.



Note: Stream flow in the Rocky Flats area is to the east.

Figure 4: Holding Pond and Liquid Effluent Water Courses

Table 7

Onsite Water Sample Results - Plutonium and Americium

<u>Location</u>	<u>Holding Pond Outfall (pCi/l)</u>		<u>Americium-241</u>			
	<u>Plutonium-239, -240</u>					
<u>Pond A-4</u>						
07/31/93 - 08/06/93	0.001	±	0.005	0.004	±	0.002
08/07/93 - 08/11/93		a			a	
Volume weighted average concentration		a			a	
<u>Pond B-5 - No Discharge</u>						
<u>Pond C-1 - No Flow</u>						
Average concentration						
<u>Pond C-2 - No Discharge</u>						
Volume weighted average concentration						
<u>Walnut Creek at Indiana</u>						
07/31/93 - 08/06/93	0.004	±	0.006	0.002	±	0.002
08/07/93 - 08/12/93		a			a	
Volume weighted average concentration		a			a	

a. Incomplete laboratory analysis. See highlights for further explanation.

Table 8

Onsite Water Sample Results - Uranium

<u>Location</u>	<u>Holding Pond Outfall (pCi/l)</u>		
	<u>Uranium-233, -234</u>		<u>Uranium-238</u>
<u>Pond A-4</u>			
07/31/93 - 08/06/93	0.42	± 0.09	0.44 ± 0.09
08/07/93 - 08/11/93		a	a
Volume weighted average concentration		a	a
<u>Pond B-5</u> - No Discharge			
<u>Pond C-1</u> - No Flow			
Average concentration			
<u>Pond C-2</u> - No Discharge			
Volume weighted average concentration			
<u>Walnut Creek at Indiana</u>			
07/31/93 - 08/06/93	0.33	± 0.08	0.30 ± 0.07
08/07/93 - 08/12/93		a	a
Volume weighted average concentration			

a. Incomplete laboratory analysis. See highlights for further explanation.

Table 9

Onsite Water Sample Results - Tritium

<u>Location</u>	<u>Number of Samples</u>	<u>Tritium (pCi/l)</u>		
		<u>C Minimum</u>	<u>C Maximum</u>	<u>C Average</u>
Pond A-4 ^b	11	a	a	a
Walnut at Indiana ^b	12	a	a	a

- a. Incomplete laboratory analysis. See highlights for further explanation.
- b. Volume weighted average concentration.

3.2 Nonradionuclide

RFP conducts sitewide surface-water sampling programs to monitor discharges from detention ponds, evaluate potential contaminant releases, and characterize baseline water quality. Nonradioactive parameters requirements for this monitoring are derived from the NPDES permit as modified in March 1991 by an FFCA. The NPDES/FFCA permit sets limits for nonradioactive pollutants in effluent water from federal facilities.

The EPA has issued to the RFP an NPDES permit for control of surface-water discharges. The RFP NPDES permit establishes effluent limitations for seven surface-water discharge points that may discharge into drainages leading off of the RFP.

Water sampling results associated with the NPDES/FFCA permit are reported in Table 10. Applicable NPDES/FFCA limits are included in Table 10 for comparison. Monitoring results for which no limits have been established under the NPDES/FFCA are reported in Table 11. Analytical results for nonradioactive parameters in water at Walnut Creek at the Indiana Street location are summarized in Table 12.

Table 10

NPDES/FFCA Permit Water Sample Results

Discharge 001-A (Pond B-3) - Pond discharged continuously 08/01/93 - 08/31/93

<u>Parameters</u>		<u>Measured 30-Day Average</u>	<u>Limit 30-Day Average</u>	<u>Measured Max. 7-Day Average</u>	<u>Limit Max. 7-Day Average</u>
Nitrate	mg/l	3.5	10	4.4	20
Total Residual Chlorine	mg/l		<u>Measured Maximum</u> 0.14	<u>Limit Maximum</u> 0.5	

Discharge 001-B (Sewage Treatment Plant) - Discharged continuously 08/01/93 - 08/31/93

<u>Parameters</u>		<u>Measured 30-Day Average</u>	<u>Limit 30-Day Average</u>	<u>Measured Maximum</u>	<u>Limit Maximum</u>
CBOD ₅	mg/l	1	10	3.8	25
Total Phosphorus	mg/l	1.6	8	2.8	12
Total Chromium	mg/l	<0.008	0.05	<0.008	0.10
Fecal Coliforms	#/100 ml	<u>Measured 30-Day Average</u> <1 (Geometric)	<u>Limit 30-Day Average</u> 200 (Geometric)	<u>Measured Max. 7-Day Average</u> <1 (Geometric)	<u>Limit Max. 7-Day Average</u> 400 (Geometric)
Total Suspended Solids	mg/l	4	30	4.5	45
pH	SU	<u>Measured Minimum</u> 6.8	<u>Limit Minimum</u> 6.0	<u>Measured Maximum</u> 7.1	<u>Limit Maximum</u> 9.0
Oil and Grease		<u>Observed Sheen</u> No visual	<u>Limit Sheen</u> No visual		

Discharge 002 (Pond A-3) - No Discharge

<u>Parameters</u>		<u>Measured 30-Day Average</u>	<u>Limit 30-Day Average</u>	<u>Measured Maximum</u>	<u>Limit Maximum</u>
Nitrates as N	mg/l		10		20
pH	SU	<u>Measured Minimum</u>	<u>Limit Minimum</u> 6.0	<u>Measured Maximum</u>	<u>Limit Maximum</u> 9.0

Table 10

NPDES/FFCA Permit Water Sample Results (Continued)

Discharge 003 (RO Pilot Plant) and Discharge 004 (RO Plant) are inactive outfalls and will be eliminated from the new NPDES permit.

Discharge 005 (Pond A-4) - Pond discharged continuously 08/01/93 - 08/11/93

<u>Parameters</u>		<u>Measured Maximum</u>	<u>Limit Maximum</u>
Total Chromium	mg/l	<0.008	0.05

Discharge 006 (Pond B-5) - No Discharge

<u>Parameters</u>		<u>Measured 30-Day Average</u>	<u>Limit 30-Day Average</u>	<u>Measured Max. 7-Day Maximum</u>	<u>Limit Max. 7-Day Maximum</u>
Nitrate as Na	mg/l		10		20

		<u>Measured Maximum</u>	<u>Limit Maximum</u>
Total Residual Chlorine ^a			0.5
Total Chromium	mg/l		0.05

Discharge 007 (Pond C-2) - No Discharge

<u>Parameters</u>		<u>Measured Maximum</u>	<u>Limit Maximum</u>
Total Chromium	mg/l		0.05

a. These parameters are measured only in the event that Waste Water Treatment Plant effluent bypasses Pond B-3 and flows directly into Pond B-5.

Table 11

NPDES/FFCA Effluent Monitoring

Discharge 001-A (Pond B-3) - Pond discharged continuously 08/01/93 - 08/31/93

<u>Parameters</u>		<u>Measured Maximum</u>	<u>Measured 30-Day Average</u>
BOD ₅	mg/l	14.8	6.6
CBOD ₅	mg/l	1.9	1.4
Total Suspended Solids	mg/l	18	7.2

Discharge 001-B (Sewage Treatment Plant [STP]) - Discharged continuously 08/01/93 -08/31/93

<u>Parameters</u>		<u>Measured Maximum</u>	<u>Measured 30-Day Average</u>
Total Residual Chlorine	mg/l	0.04	0.03
Whole Effluent Toxicity ^a	Sampled quarterly; data reported June 1993		
Ceriodaphnia	% EFF to LC ₅₀ :		
Fathead Minnows	% EFF to LC ₅₀ :		

		<u>Measured 30-Day Average</u>
Metals	µg/l	
Metals were sampled on 08/04/93 and 08/11/93		
Antimony		<23.0
Arsenic		Analysis not complete
Beryllium		<1.0
Cadmium		Analysis not complete
Copper		<3.6
Iron		61.9
Lead		<1.3
Manganese		24.1
Mercury		<0.20
Nickel		<15.0
Silver		Analysis not complete
Zinc		31.7

		<u>PQL^b</u>	<u>Concentrations that were above PQL</u>
Volatile Organic Compounds (VOCs)	µg/l		
Chloroform		5	6 sampled 08/04/93

Table 11

NPDES/FFCA Effluent Monitoring (Continued)

Discharge 003 (Reverse Osmosis Pilot Plant) and Discharge 004 (Reverse Osmosis Plant) are inactive outfalls and will be eliminated from the new NPDES permit.

Discharge 005 (Pond A-4) - Pond discharged continuously 08/01/93 - 09/11/93

Whole Effluent Toxicity Sampled quarterly; data reported June 1993

Ceriodaphnia	% EFF to LC ₅₀ :
Fathead Minnows	% EFF to LC ₅₀ :

Discharge 006 (Pond B-5) - No Discharge

Whole Effluent Toxicity^a

Ceriodaphnia	% EFF to LC ₅₀ :
Fathead Minnows	% EFF to LC ₅₀ :

Discharge 007 (Pond C-2) - No Discharge

Whole Effluent Toxicity^a

Ceriodaphnia	% EFF to LC ₅₀ :
Fathead Minnows	% EFF to LC ₅₀ :

- a. Results for whole effluent toxicity are given in percentage of effluent sample that will cause mortality to half the test result organisms within the time frame of the test. For example, >100 percent indicates that 100 percent pure effluent did not cause acute toxicity to at least half of the organisms. A lower percentage LC₅₀ (lethal concentration to 50 percent of test organisms) indicates a greater toxic effect since less of the sample is required to observe a sufficiently extensive adverse effect.
- b. PQL (Practical Quantitation Limit) is equal to ten times the Method Detection Limit and represents the quantity at which 70 percent of laboratories can report in the 95 percent confidence interval.

Table 12

Water Sample Results, Nonradioactive Parameters

Flow measured and sampled 08/01/93 - 08/11/93

Walnut Creek at Indiana Street

<u>Parameters</u>		<u>Number of Samples</u>	<u>C Minimum</u>	<u>C Maximum</u>	<u>C Average</u>
pH	SU	11	8.37	9.94	N/A
Nitrates as N	mg/l	11	1.69	4.93	3.32

3.3 Flow

Daily flow data for surface water from the two plant drainage systems (Walnut Creek and Woman Creek) are given in Tables 13 and 14. The current NPDES/FFCA permit requires flow measurement for terminal ponds when discharged offsite (A-4, B-5, and C-2). Other flow data are reported for informational purposes.

Daily flow data for water transferred from Pond B-5 to Pond A-4, for subsequent discharge offsite, are given in Table 15. Discharges from Pond A-4, which include transfers from Pond B-5, enter Walnut Creek and are diverted around Great Western Reservoir through the Broomfield Diversion Ditch. Discharges from Pond C-2 are pumped through a pipeline into the Broomfield Diversion Ditch, and also diverted around Great Western Reservoir.

Table 13

Daily Flow Data Recorded at the Walnut Creek at Indiana Gaging Station, Ponds A-4 and B-5

<u>Date</u>	<u>Walnut Creek at Indiana (Gallons)</u>	<u>Pond A-4 (Gallons)</u>	<u>Pond B-5 (Gallons)</u>
08/01/93	1,131,000	1,229,000	No Discharge
08/02/93	1,360,000	1,270,000	
08/03/93	1,430,000	1,141,000	
08/04/93	1,154,000	1,361,000	
08/05/93	1,595,000	1,402,000	
08/06/93	1,053,000	1,359,000	
08/07/93	1,296,000	1,386,000	
08/08/93	1,120,000	1,364,000	
08/09/93	1,248,000	1,395,000	
08/10/93	1,432,000	1,399,000	
08/11/93	1,101,000	1,201,000	
08/12/93	No Flow	No Discharge	
08/13/93			
08/14/93			
08/15/93			
08/16/93			
08/17/93			
08/18/93			
08/19/93			
08/20/93			
08/21/93			
08/22/93			
08/23/93			
08/24/93			
08/25/93			
08/26/93			
08/27/93			
08/28/93			
08/29/93			
08/30/93			
08/31/93	No Flow	No Discharge	No Discharge
Total	14,108,000	14,507,000	No Discharge

Table 14

Daily Flow Data Recorded at Ponds C-1 and C-2 (Woman Creek)

<u>Date</u>	<u>Pond C-1 (Gallons)</u>	<u>Pond C-2 (Gallons)</u>
08/01/93	No Flow	No Discharge
08/02/93		
08/03/93		
08/04/93		
08/05/93		
08/06/93		
08/07/93		
08/08/93		
08/09/93		
08/10/93		
08/11/93		
08/12/93		
08/13/93		
08/14/93		
08/15/93		
08/16/93		
08/17/93		
08/18/93		
08/19/93		
08/20/93		
08/21/93		
08/22/93		
08/23/93		
08/24/93		
08/25/93		
08/26/93		
08/27/93		
08/28/93		
08/29/93		
08/30/93		
08/31/93	No Flow	No Discharge

Table 15

Daily Transfer Flow Data Recorded for Pond B-5 to Pond A-4

<u>Date</u>	<u>Pond B-5 to Pond A-4 (Gallons)</u>
08/01/93	1,046,000
08/02/93	1,021,000
08/03/93	987,000
08/04/93	955,000
08/05/93	916,000
08/06/93	1,077,000
08/07/93	964,000
08/08/93	976,000
08/09/93	1,063,000
08/10/93	653,000
08/11/93	No Transfer
08/12/93	
08/13/93	
08/14/93	
08/15/93	
08/16/93	
08/17/93	
08/18/93	
08/19/93	
08/20/93	
08/21/93	
08/22/93	
08/23/93	
08/24/93	
08/25/93	
08/26/93	
08/27/93	
08/28/93	
08/29/93	No Transfer
08/30/93	704,000
08/31/93	1,081,000
Total	11,443,000

Errata

Table 7 - Errata June 1993

Onsite Water Sample Results - Plutonium and Americium

<u>Location</u>	<u>Holding Pond Outfall (pCi/l)</u>		<u>Americium-241</u>
	<u>Plutonium-239, -240</u>		
<u>Pond A-4</u>			
06/15/93 - 06/18/93	0.003	± 0.003 ^a	0.004 ± 0.003 ^a
06/19/93 - 06/22/93	0.003	± 0.003 ^a	0.001 ± 0.002 ^a
Volume weighted average concentration	0.003	± 0.002 ^a	0.002 ± 0.002 ^a
<u>Pond B-5 - No Discharge</u>			
<u>Pond C-1</u>			
05/29/93 - 06/04/93	0.034	± 0.009	0.009 ± 0.003
06/05/93 - 06/11/93	0.016	± 0.003	0.004 ± 0.002
06/12/93 - 06/18/93	0.008	± 0.011 ^a	0.003 ± 0.002 ^a
06/19/93 - 06/25/93	0.015	± 0.006 ^a	0.007 ± 0.002 ^a
06/26/93 - 06/28/93	0.009	± 0.004	0.004 ± 0.003
Average concentration	0.016	± 0.010 ^a	0.005 ± 0.003 ^a
<u>Pond C-2 - No Discharge</u>			
<u>Walnut Creek at Indiana</u>			
06/16/93 - 06/18/93	-0.001	± 0.002 ^a	0.006 ± 0.003 ^a
06/19/93 - 06/22/93	-0.001	± 0.002 ^a	0.001 ± 0.002 ^a
Volume weighted average concentration	-0.001	± 0.001 ^a	0.003 ± 0.002 ^a

a. Previously reported incomplete.

Table 9

Onsite Water Sample Results - Tritium

<u>Location</u>	<u>Number of Samples</u>	<u>Tritium (pCi/l)</u>		
		<u>C Minimum</u>	<u>C Maximum</u>	<u>C Average</u>
Pond A-4 ^a	9	-150 ± 80	170 ± 80	30 ± 30
Walnut at Indiana ^a	8	0 ± 80	230 ± 80	-50 ± 30

a. Volume weighted average concentration.

4. Meteorology and Climatology

Meteorological data are routinely collected on the plantsite from instrumentation installed on a 61-meter (200-foot) tower located in the west buffer zone at an elevation of 1,870 meters (6,140 feet) above sea level. Meteorological data recovery was nearly 100 percent for August. The frequency of wind direction and speed are shown in Table 16. The compass points indicate the direction from which the wind blows. Day and night wind roses display these frequencies graphically in Figures 5 and 6 to illustrate the large diurnal wind changes. The wind rose sectors also represent the direction from which the wind blows (i.e., wind along each sector blows toward the center).

Winds at RFP generally occur from the west through northwest, especially when speeds are greater than 4 m/s (9 mph). At lighter wind speeds less than 4 m/s (9 mph), the distribution of wind direction is more even. Wind speeds greater than 5 m/s (11 mph) from the east sector rarely occur. The distribution of winds during August indicates a relatively low frequency of strong, large-scale winds from the west southwest to northwest, primarily during the day. The strong sunshine, long days, and light, large-scale winds promoted the generation of thermally driven winds up the slope southeast of RFP and up-valley (S. Platte) from the north. Nighttime winds were most frequently northwesterly, probably because low-level drainage winds down the Rocky Flats slope blended with leftover, thermally-driven winds up the S. Platte. Southwesterly winds were also common at night, reflecting the combination of local drainage winds and regional, down-valley drainage winds.

August was cool, dry, and tranquil. Several Canadian air masses were responsible for the below-normal temperatures. Much of the month's rainfall, albeit light, fell during August 4-6, as a Canadian high pressure system produced upslope winds. An unusually cold Arctic air mass (for so early in the season) caused the high temperature to reach on 53 °F (12 °C) on August 30. There were no strong winds reported during the month.

The mean wind speed during August was 7.5 mph (3.3 m/s). The peak gust during the month occurred on August 8, reaching 47 mph (21 m/s). The mean temperature was 75.4 °F (24.1 °C), or about 3 °F (1.7 °C) below normal. Precipitation was about one-quarter of normal during the month, with water-equivalent totalling 0.42 inches (1.1 cm). It was the driest August in 8 years. The summer's (June-August) rainfall of 2.69 in. (6.8 cm) was the least since

1980. This year remains very dry, as annual precipitation through August was 35 percent below normal, totalling 7.46 inches (18.9 cm).

Table 16**Rocky Flats Plant Wind Direction Frequency (Percent) by Four Wind-Speed Classes****(Fifteen-Minute Averages - August 1993)**

	<u>Calm</u>	<u>1-2.5</u> <u>(m/s)</u>	<u>2.5-4</u> <u>(m/s)</u>	<u>4-8</u> <u>(m/s)</u>	<u>>8</u> <u>(m/s)</u>	<u>Total</u> <u>(m/s)</u>
N	-	1.80	2.62	3.98	0.17	8.78
NNE	-	1.67	2.45	2.25	0.00	6.40
NE	-	1.57	1.97	0.61	0.00	4.22
ENE	-	1.63	1.70	0.41	0.00	3.78
E	-	2.01	1.53	0.17	0.00	3.78
ESE	-	2.62	2.21	1.26	0.00	6.16
SE	-	2.32	2.42	1.63	0.00	6.37
SSE	-	2.01	2.49	1.80	0.00	6.37
S	-	2.01	2.45	0.82	0.00	5.41
SSW	-	1.60	2.35	1.09	0.07	5.31
SW	-	1.09	2.52	2.01	0.07	5.72
WSW	-	1.94	2.32	2.18	0.31	6.81
W	-	2.18	2.04	1.43	0.34	6.09
WNW	-	2.59	3.27	1.40	0.65	8.14
NW	-	2.93	3.27	1.53	0.14	8.00
NNW	-	2.35	3.34	2.83	0.03	8.65
TOTAL	1.57	32.31	38.95	25.40	1.77	100.00

Table 17

Climatic Summary

Date	TEMPERATURE (deg. F)			DEW- POINT (deg. F)	WIND SPEED (mph)		PRESS. (mb)	SOLAR (kW-h/m2)	WATER- EQUIV.- PRECIP. (inches)	SNOW (inches)	
	High	Low	Mean	Mean	Mean	Peak gust (1 sec)	Mean	Total	Total	Peak (15 min)	Total
08/01/93	73.8	58.8	66.3	47.5	7.8	23.9	822	5.68	0.00	0.00	0.00
08/02/93	69.6	51.6	60.6	43.9	9.2	28.4	818	4.85	0.00	0.00	0.00
08/03/93	60.1	45.1	52.6	41.9	6.9	19.5	821	2.67	0.00	0.00	0.00
08/04/93	70.0	48.6	59.3	43.3	7.2	23.0	819	5.33	0.05	0.04	0.00
08/05/93	68.9	50.7	59.8	45.1	6.7	35.1	819	5.68	0.14	0.04	0.00
08/06/93	76.1	47.8	62.0	42.6	6.9	26.4	816	6.72	0.10	0.04	0.00
08/07/93	79.7	55.2	67.5	39.0	6.5	23.5	814	5.77	0.00	0.00	0.00
08/08/93	83.7	56.1	69.9	40.3	9.8	46.5	817	6.31	0.00	0.00	0.00
08/09/93	84.4	60.8	72.6	36.9	6.0	20.4	821	6.19	0.00	0.00	0.00
08/10/93	76.3	57.6	67.0	46.6	9.4	28.4	820	4.53	0.00	0.00	0.00
08/11/93	81.1	54.1	67.6	44.4	7.6	21.9	818	6.07	0.00	0.00	0.00
08/12/93	69.6	54.3	62.0	46.4	6.0	23.5	819	4.43	0.02	0.01	0.00
08/13/93	83.1	54.9	69.0	42.8	8.9	43.6	816	4.56	0.00	0.00	0.00
08/14/93	76.5	58.6	67.6	37.8	8.5	39.1	815	3.69	0.00	0.00	0.00
08/15/93	78.3	55.6	67.0	38.8	6.9	30.0	816	6.62	0.00	0.00	0.00
08/16/93	86.4	55.0	70.7	34.0	8.5	25.5	815	7.34	0.00	0.00	0.00
08/17/93	83.5	57.6	70.6	37.4	6.7	21.3	816	5.84	0.03	0.02	0.00
08/18/93	74.8	59.5	67.2	43.7	8.1	22.6	818	4.46	0.00	0.00	0.00
08/19/93	77.2	53.4	65.3	45.1	6.0	18.8	818	4.52	0.00	0.00	0.00
08/20/93	74.7	52.5	63.6	47.8	7.4	30.0	819	5.06	0.04	0.01	0.00
08/21/93	74.3	52.5	63.4	45.9	7.6	29.8	815	3.85	0.02	0.01	0.00
08/22/93	75.2	55.6	65.4	35.1	12.1	35.8	813	4.88	0.00	0.00	0.00
08/23/93	81.1	53.1	67.1	36.9	6.5	17.2	815	7.12	0.00	0.00	0.00
08/24/93	87.3	63.3	75.3	34.5	8.1	22.8	815	7.20	0.00	0.00	0.00
08/25/93	81.7	55.2	68.5	41.5	8.5	26.2	814	6.47	0.01	0.01	0.00
08/26/93	67.1	53.2	60.2	44.1	7.6	22.4	819	2.13	0.01	0.01	0.00
08/27/93	61.9	48.4	55.2	43.5	5.1	17.9	820	2.91	0.00	0.00	0.00
08/28/93	77.7	52.7	65.2	37.8	7.2	20.1	815	5.49	0.00	0.00	0.00
08/29/93	79.3	51.1	65.2	35.1	7.4	24.8	812	3.60	0.00	0.00	0.00
08/30/93	53.2	43.0	48.1	33.4	5.1	13.2	820	2.02	0.00	0.00	0.00
08/31/93	70.7	44.8	57.8	36.1	5.6	23.5	817	4.69	0.00	0.00	0.00

MONTHLY TEMPERATURES				WIND SPEED		PRESS.	SOLAR	PRECIPITATION		SNOW
Mean High	Mean Low	Mean	Dew- point	Mean (mph)	Monthly Max.	Monthly Avg.	Monthly Total	Total	Monthly Max.	Total
75.4	53.6	64.5	40.9	7.5	46.5	817.2	156.68	0.42	0.04	0.00

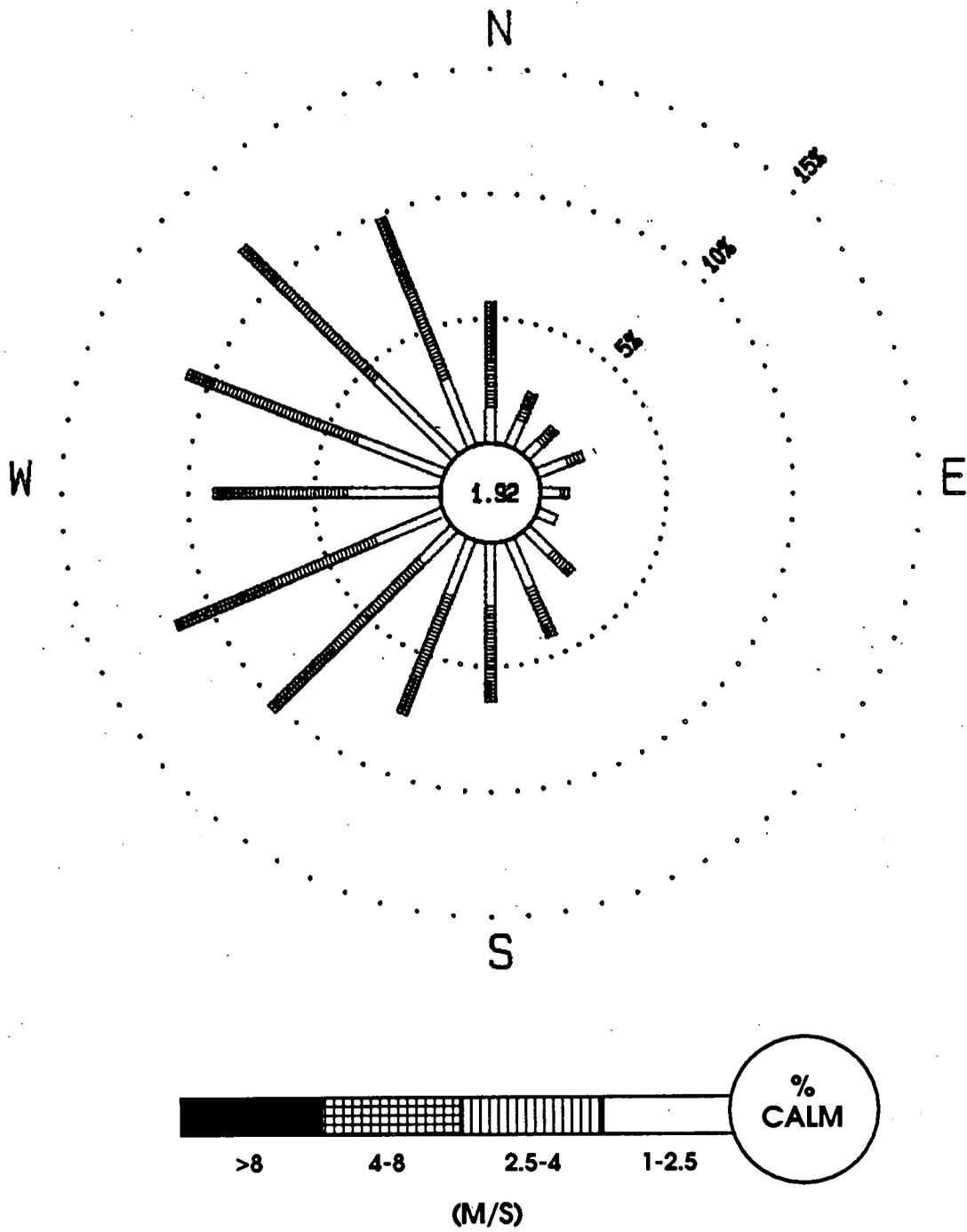


Figure 6: Nighttime Wind Rose for the Rocky Flats Plant - August 1993

Appendix A

Radiation Standards for Protection of the Public

Calculation of Potential Plant Contribution to Public Radiation Dose

The primary standards for protection of the public from radiation are based on radiation dose. Radiation dose is a means of quantifying the biological damage or risk of ionizing radiation. The unit of radiation dose is the rem or the millirem (1 rem = 1,000 mrem). Radiation protection standards for the public are annual standards, based on the projected radiation dose from a year's exposure to or intake of radioactive materials.

Radiation dose is a calculated value. It is calculated by multiplying radioactivity concentrations in air and water or on contaminated surfaces by assumed intake rates (for internal exposures) or by exposure times (for external exposure to penetrating radiation), then by the appropriate radiation dose conversion factors. That is:

$$\text{Radiation Dose} = \text{Radioactivity Concentration} \times \text{Intake Rate/Exposure Time} \times \text{Dose Conversion Factor}$$

Radioactivity concentrations can be determined either by measurements in the environment or by calculations using computer models. These computer models perform airborne dispersion/dose modeling of measured building radioactivity effluents and estimated diffuse source term emissions (e.g., from resuspension from contaminated soil areas).

Assumed intake rates and dose conversion factors used are based on recommendations of national and international radiation protection advisory organizations, such as the National Council on Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP).

Radioactive materials of importance in calculating radiation dose to the public from RFP activities include plutonium, uranium, americium, and tritium. Alpha radiation emissions from plutonium, uranium, and americium are primary contributors to the projected radiation dose.

DOE Radiation Protection Standards for the Public

ICRP-Recommended Standards for all Pathways:

Temporary Increase - 500 mrem/year
Effective Dose Equivalent
(with prior approval of DOE EH-2)

Normal Operations - 100 mrem/year
Effective Dose Equivalent

EPA Clean Air Act Standards for the Air Pathway Only:

10 mrem/year Effective Dose Equivalent

DOE Derived Concentration Guides for Radionuclides of Interest at the Rocky Flats Plant

Air Inhalation:

Radionuclide	DCG (pCi/m ³)
Plutonium-239, -240	0.02

Water Ingestion:

Radionuclide	DCG (pCi/l)
Plutonium-239, -240	30
Americium-241	30
Uranium-233, -234	500
Uranium-238	600
Hydrogen-3 (Tritium)	2,000,000

DOE Derived Concentration Guides

Potential public radiation dose commitments, which could have resulted from plant operations and from background (i.e., non-Plant) contributions, are calculated from average radionuclide concentrations measured at the DOE property boundary and in surrounding communities. Inhalation and water ingestion are the principal potential pathways of human exposure.

On February 8, 1990, DOE adopted DOE Order 5400.5, "Radiation Protection of the Public and the Environment," a radiation protection standard for DOE environmental activities (US 90). This standard incorporates guidance from the ICRP, as well as from the EPA Clean Air Act (CAA) air emission standards (as implemented in 40 CFR 61, Subpart H). Included in DOE Order 5400.5 is a revision of the dose limits for members of the public. Tables of radiation dose conversion factors currently used for calculating dose from intakes of radioactive materials were issued in July 1988 (US88a, US88b). The dose factors are based on the ICRP Publications 30 and 48 methodology and biological models for radiation dosimetry. The DOE Order 5400.5 and the dose conversion factor tables are used for assessment of any potential RFP contribution to public radiation dose. On December 15, 1989, EPA published revised CAA air emission standards for DOE facilities (US89). DOE radiation standards for protection of the public are given in this Appendix and include the December 15, 1989, EPA CAA air pathway standards.

Secondary radioactivity concentration guides can be calculated from the primary radiation dose standards and used as comparison values for measured radioactivity concentrations. DOE provides tables of these DCGs in DOE Order 5400.5. DCGs are the concentrations that would result in an EDE of 100 mrem from 1 year's chronic exposure or intake. In calculating air inhalation DCGs, DOE assumes that the exposed individual inhales 8,400 cubic meters of air at the calculated DCG during the year. Ingestion DCGs assume a water intake of 730 liters at the calculated DCG for the year. The table on this page lists the most restrictive air and water DCGs for the principal radionuclides of interest at the RFP.

**Compliance with EPA Clean
Air Act Standards**

To determine compliance with the EPA air emissions standards, measured airborne effluent radioactivity emissions are entered into the EPA-approved atmospheric dispersion/dose calculation computer code, CAP88-PC, for calculation of the maximum radiation dose that an individual in the public could receive from the air pathway only.

For comparison with the annual radiation dose standards for protection of the public, the maximum annual EDE that a member of the public could receive as a result of RFP activities is typically less than 1 mrem, or less than 1 percent of the recommended annual standard for all pathways.

Dose Equivalent and Effective Dose Equivalent

Dose equivalent is a calculated value used to quantify radiation dose; it reflects the degree of biological effect from ionizing radiation. Differences in the biological effect of different types of ionizing radiation (e.g., alpha, beta, gamma, or x-rays) are accounted for in the calculation of dose equivalent.

EDE is a calculated value used to allow comparisons of total health risk (based primarily on the risk of cancer mortality) from exposures of different types of ionizing radiation to different body organs. It is calculated by first calculating the dose equivalent to those organs receiving significant exposures, multiplying each organ dose equivalent by a health risk weighing factor, and then summing those products. One millirem EDE from natural background radiation would have the same health risk as one millirem EDE from an artificially produced source of radiation.

References

US88a DOE/EH-0070, "External Dose-Rate Conversion Factors for Calculation of Dose to the Public," United States Department of Energy, Asst. Secretary for Environment, Safety and Health, July 1988.

US88b DOE/EH-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public," United States Department of Energy, Asst. Secretary of Environment, Safety and Health, July 1988.

US89 United States Environmental Protection Agency, Code of Federal Regulations 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides other than Radon from Department of Energy Facilities," Washington, D.C., December 15, 1989.

US90 United States Department of Energy, DOE Order 5400.5, "Radiation Protection of the Public and the Environment," Washington, D.C., February 8, 1990.

Appendix B

National Pollutant Discharge Elimination System/Federal Facilities Compliance Agreement Volatile Organic Compounds

The following is a list of volatile organic compounds (VOCs) for which monitoring is required by the Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System/Federal Facilities Compliance Agreement (NPDES/FFCA).

<u>Compound</u>	<u>PQL (µg/l)</u>	<u>Compound</u>	<u>PQL (µg/l)</u>
Benzene	5	1,3-dichloropropylene	5
Bromoform	5	Ethylbenzene	5
Methyl bromide	10	Methyl chloride	10
Carbon Tetrachloride	5	Methylene chloride	5
Chlorobenzene	5	1,1,2,2-tetrachloroethane	5
Chlorodibromomethane	5	Tetrachloroethylene	5
Chloroethane	10	Toluene	5
Chloroform	5	1,2-trans-dichloroethylene	5
Dichlorobromomethane	5	1,1,1-trichloroethane	5
1,1-dichloroethane	5	1,1,2-trichloroethane	5
1,2-dichloroethane	5	Trichloroethylene	5
1,1-dichloroethylene	5	Vinyl chloride	10
1,2-dichloropropane	5		

Appendix C

Colorado Water Quality Control Commission Standards

The Colorado Water Quality Control Commission has finalized new standards for the Walnut Creek and Woman Creek drainages. The EPA has not yet written a new NPDES permit that reflects these standards; however, in the spirit of the Agreement in Principle (AIP) completed between the DOE and the State of Colorado, the RFP is attempting to meet the standards at this time (Figure 7).

Standards for CWQCC are summarized in Table 18.

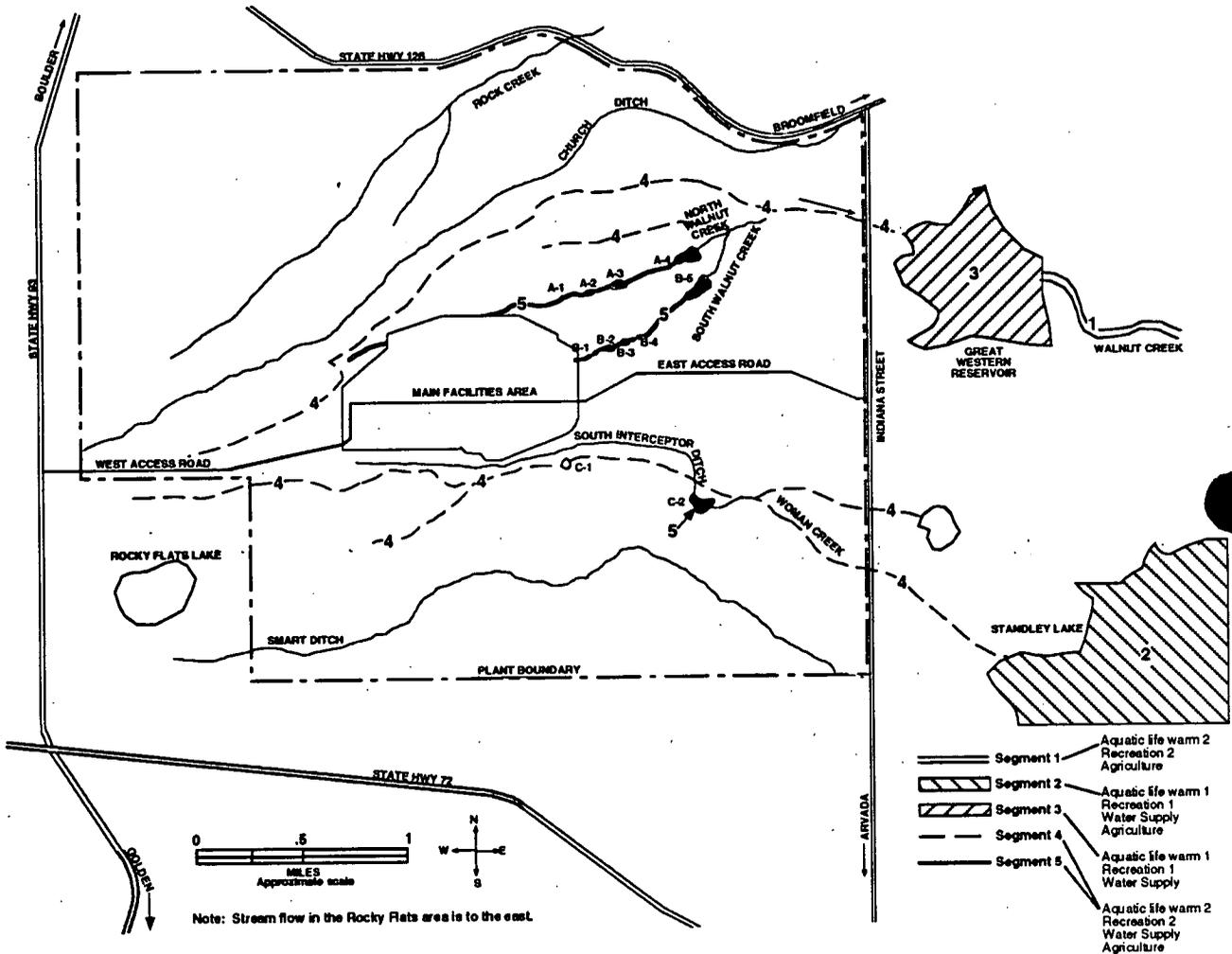


Figure 7: Stream Segmentation and Classification

Table 18**Water Quality Standards Comparison**

<i>Parameter</i>	<u>CURRENT</u>	<u>CURRENT</u>	<i>footnotes</i>
	<i>Segment 5 Standard µg/l</i>	<i>Segment 4 Standard µg/l</i>	
<u>Organics</u>			
4-CHLORO-3-METHYLPHENOL	30	30	6
ACENAPHTHENE	520	520	6
ACENAPHTHYLENE	0.0028	0.0028	3
ACROLEIN	21	21	6
ACRYLONITRILE	0.058	0.058	3
ALDICARB	10	10	2
ALDRIN	0.00013	0.00013	3,4
ANTHRACENE	0.0028	0.0028	3
ATRAZINE	3	3	3
BENZENE	1	1	2
BENZIDINE	0.00012	0.00012	2
BENZO(a)ANTHRACENE	0.0028	0.0028	3
BENZO(a)PYRENE	0.0028	0.0028	3
BENZO(b)FLUORANTHENE	0.0028	0.0028	3
BENZO(ghi)PERYLENE	0.0028	0.0028	3
BENZO(k)FLUORANTHENE	0.0028	0.0028	3
BROMODICHLOROMETHANE	0.3	0.3	3
BROMOFORM	4	4	3
BUTYL BENZYL PHTHALATE	3000	3000	6
CARBOFURAN	36	36	2
CARBON TETRACHLORIDE	18	0.25	2,5
CHLORDANE	0.00058	0.00058	3,4
CHLOROBENZENE	100	100	2
CHLOROETHYL ETHER (BIS-2)	0.03	0.03	2,3
CHLOROFORM	6.0	6.0	3
CHLOROMETHYL ETHER (BIS)	0.0000037	0.0000037	3
CHLOROPHENOL	2000	2000	6
CHLOROPYRIFOS	0.041	0.041	6
CHRYSENE	0.0028	0.0028	3
DDD 4'4	0.00083	0.00083	6
DDE 4'4	0.001	0.001	2
DDT 4'4	0.00059	0.00059	3,4
DEMETON	0.1	0.1	3
DI-N-BUTYL PHTHALATE	2700	2700	6
DIBENZO(a,h)ANTHRACENE	0.0028	0.0028	3
DIBROMOCHLOROMETHANE	6	6	3
DICHLOROBENZENE 1,2	620	620	2
DICHLOROBENZENE 1,3	400	400	2
DICHLOROBENZENE 1,4	75	75	2
DICHLOROBENZIDINE	0.039	0.039	3
DICHLOROETHANE 1,2	0.4	0.4	2
DICHLOROETHYLENE 1,1	0.057	0.057	2
DICHLOROETHYLENE 1,2-CIS	70	70	2

DICHLOROETHYLENE 1,2-TRANS	100	100	2
DICHLOROPHENOL 2,4	21	21	6
DICHLOROPHENOXYACETIC ACID (2,4-D)	70	70	3,4
DICHLOROPROPANE 1,2	0.56	0.56	2
DIELDRIN	0.00014	0.00014	3,4
DIETHYL PHTHALATE	23000	23000	6
DIMETHYL PHTHALATE	313000	313000	6
DIMETHYLPHENOL 2,4	2120	2120	6
DINITRO-O-CRESOLE	13	13	6
DINITROPHENOL 2,4	14	14	2
DINITROTOLUENE 2,4	0.11	0.11	6
DINITROTOLUENE 2,6	230	230	6
DIOXIN (2,3,7,8-TCDD)	0.000000013	1.3E-08	3,4
DIPHENYLHYDRAZINE 1,2	0.04	0.04	2
ENDOSULFAN	0.056	0.056	3
ENDRIN	0.0023	0.0023	3,4
ENDRIN ALDEHYDE	0.2	0.2	6
ETHYLBENZENE	680	680	2
ETHYLHEXYL PHTHALATE (BIS-2)	1.8	1.8	6
FLUORANTHENE	42	42	3
FLUORENE	0.0028	0.0028	3
GUTHION	0.01	0.01	3
HEPTACHLOR	0.00021	0.00021	3,4
HEPTACHLOR EPOXIDE	0.0001	0.0001	2
HEXACHLOROBENZENE	0.00072	0.00072	3,4
HEXACHLOROBUTADIENE	0.45	0.45	3,4
HEXACHLOROCYCLOHEXANE, ALPHA (BHC)	0.0039	0.0039	3
HEXACHLOROCYCLOHEXANE, BETA (BHC)	0.014	0.014	3
HEXACHLOROCYCLOHEXANE, GAMMA (BHC)	0.019	0.019	3,4
HEXACHLOROCYCLOHEXANE, TECHNICAL (BHC)	0.012	0.012	3
HEXACHLOROETHANE	1.9	1.9	3
HEXACHLOROCYCLOPENTADIENE	5	5	2
INDENO(1,2,3-cd)PYRENE	0.0028	0.0028	3
ISOPHORONE	8.4	8.4	2
MALATHION	0.1	0.1	3
METHOXYCHLOR	0.03	0.03	3,4
METHYL BROMIDE	48	48	3
METHYL CHLORIDE	5.7	5.7	3
METHYLENE CHLORIDE	4.7	4.7	3
MIREX	0.001	0.001	3
NAPHTHALENE	0.0028	0.0028	3
NITROBENZENE	3.5	3.5	2
NITROSO-DI-n-PROPYLAMINE-N	0.005	0.005	6
NITROSODI-N-BUTYLAMINE-N	0.0064	0.0064	3
NITROSODIETHYLAMINE-N	0.0008	0.0008	3
NITROSODIMETHYLAMINE-N	0.00069	0.00069	3
NITROSODIPHENYLAMINE-N	4.9	4.9	3
NITROSOPYRROLIDINE-N	0.016	0.016	3
PARATHION	0.4	0.4	3
PCBs	0.000044	0.000044	3,4
PENTACHLOROBENZENE	6	6	2
PENTACHLOROPHENOL	5.7	5.7	2
PHENANTHRENE	0.0028	0.0028	3
PYRENE	0.0028	0.0028	3
SIMAZINE	4	4	3
TETRACHLOROBENZENE 1,2,4,5	2	2	2

TETRACHLOROETHANE 1,1,2,2	0.17	0.17	6
TETRACHLOROETHYLENE	76	0.8	3,4,5
TOLUENE	1000	1000	2
TOXAPHENE	0.0002	0.0002	2
TRICHLOROETHANE 1,1,1	200	200	2
TRICHLOROETHANE 1,1,2	0.6	0.6	2
TRICHLOROETHYLENE	66	2.7	2,5
TRICHLOROPHENOL 2,4,5	700	700	2
TRICHLOROPHENOL 2,4,6	2.0	2.0	2
TRICHLOROPHENOXYPROPIONIC (2,4,5-TP)	50.0	50.0	3
VINYL CHLORIDE	2	2	2

<i>Parameter</i>	<i>CURRENT</i>	<i>CURRENT</i>	<i>footnotes</i>
	<i>Segment 5 Standard µg/l</i>	<i>Segment 4 Standard µg/l</i>	
<i>Metals</i>			
ALUMINUM	150	150	6
ARSENIC	50	50	2
BARIUM	1000	1000	2
BERYLLIUM	4	4	1
CADMIUM	TVS = 1.50	TVS=1.50	1,2
CHROMIUM III	50	50	2
CHROMIUM VI	11	11	2
COPPER	23	TVS=16	1,4
IRON (d)	300	300	2
IRON	13200	1000	5,6
LEAD	28	TVS=6.5	2
MANGANESE (d)	560	50	2
MANGANESE	1000	1000	1
MERCURY	0.01	0.01	2
NICKEL	TVS= 125	TVS=125	1
SELENIUM	10	10	2
SILVER	TVS= 0.59	TVS=0.59	2
THALLIUM	0.012	0.012	2
ZINC	350	TVS=45	1,4

TVS=TABLE VALUE STANDARD - TVSs, promulgated by the Colorado Water Quality Control Commission, are variable standards subject to the measured values for other parameters, such as total hardness.
d=DISSOLVED METAL

- 1 Statewide agricultural standard.
- 2 Statewide water supply standard.
- 3 Site-specific standard.
- 4 This standard is more restrictive than the statewide water supply standard.
- 5 Segment 5 standard is a temporary modification.
- 6 Statewide aquatic standard.

<i>Parameter</i>	<u>CURRENT</u> Segment 5 Standard $\mu\text{g/l}$	<u>CURRENT</u> Segment 4 Standard $\mu\text{g/l}$	<i>footnotes</i>
<u>Physical & Biological</u>			
MINIMUM DISSOLVED OXYGEN (mg/l)	5.0	5.0	1,2
pH (s.u.)	6.5-9.0	6.5-9.0	2
FECAL COLIFORMS PER 100 ML	2000	2000	2

Inorganics

UNIONIZED AMMONIA - March through June	1800	calculated	2
UNIONIZED AMMONIA - July through February	700	calculated	2
Note: Statewide water supply unionized ammonia standard of 0.5 $\mu\text{g/l}$ applied at water supply intake.			
AMMONIA	100	100	
BORON	750	750	1
CHLORIDE	250000	250000	2
CHLORINE (ACUTE)	19	19	6
CHLORINE (CHRONIC)	11	11	6
CYANIDE (FREE)	5	5	1,2
FLUORIDE	2000		2
NITRATE	10000	10000	2
NITRITE	500	500	2
SULFATE	250000	250000	2
SULFIDE (AS H ₂ S)	2	2	2

<i>Parameter</i>	<u>CURRENT</u> Segment 5 Standard Woman Creek pCi/l	<u>CURRENT</u> Segment 4 Standard Walnut Creek pCi/l
<u>Radionuclides</u>		
Gross Alpha	7	11
Gross Beta	5	19
Americium	0.05	0.05
Curium 244	60	60
Neptunium 237	30	30
Plutonium	0.05	0.05
Uranium	5	10
Uranium 233 & 234		
Uranium 238		
Cesium 134	80	80
Radium 226 & 228	5	5
Strontium 90	8	8
Thorium 230 & 232	60	60
Tritium	500	500

Appendix D

Distribution

Federal Agencies

US DOE, RFO
Attn: A.H. Paoule
Bldg. 115

US EPA
Attn: Dr. M. Lammering,
R. Rutherford
One Denver Place - Suite 1300
999 18th Street
Denver, CO 80202-2413

US EPA
Attn: B. Lavelle
999 18th Street, Suite 500
8 HWM-FF
Denver, CO 80202-2405

State Government Agencies

Colorado Council
on Rocky Flats
Attn: G. Swartz
1536 Cole Blvd., Suite 325
Denver West Office Park #4
Golden, CO 80401

Colorado Water Conservation Board
Attn: N.C. Ioannides
823 State Centennial Building
1313 Sherman Street
Denver, CO 80203

Denver Regional Council of
Governments
Attn: L. Mugler
2480 W. 27th Avenue, #200B
Denver, CO 80211

Department of Natural Resources
Attn: B. Hamlett III
1313 Sherman Street
Denver, CO 80203

City Governments

City of Arvada
Utilities Division
Attn: M. Mauro
8101 Ralston Road
Arvada, CO 80002

City of Boulder
Office of the City Manager
Attn: J. Piper, A. Struthers
P.O. Box 791
Boulder, CO 80302

City of Broomfield
Attn: H. Mahan, K. Schnoor
#6 Garden Office Center
P.O. Box 1415
Broomfield, CO 80038-1415

City of Fort Collins
Office of the City Manager
Attn: S. Burkett
300 La Porte
Fort Collins, CO 80525

City of Northglenn
Attn: N. Renfro
11701 Community Center Drive
Northglenn, CO 80233-1099

City of Thornton
Attn: J. Ethredge, City Manager
9500 Civic Center Drive
Thornton, CO 80229-1120

City of Westminster
Attn: D. Cross, S. Nechtrieb
4800 W. 92nd Avenue
Westminster, CO 80030

Denver Water Department
Quality Control
Attn: J. Dice
1600 W. 12th Avenue
Denver, CO 80254

Health Departments

Boulder City/County Health
Department - Division of
Environmental Health
Attn: T. Douville, V. Harris
3450 Broadway
Boulder, CO 80020

Colorado Department of Health
4300 Cherry Creek Drive South
Denver, CO 80222-1530
Attn: J. Bruch, R. Fox, D. Holm,
E. Kray, A. Lockhart, P. Nolan, R.
Quillin, J. Sowinski

Colorado Department of Health
Office of Environmental Multimedia
Focal Group
4300 Cherry Creek Drive South
Denver, CO 80222-1530
Attn: S. Tarlton

Jefferson County Health Department
Attn: Dr. M. Johnson, C. Sanders
260 South Kipling
Lakewood, CO 80226

Tri County District Health
Attn: S. Salyards
4301 E. 72nd Avenue
Commerce City, CO 80022

Environmental

Advance Sciences, Inc.
Attn: D. Kaskie, M.G. Waltermire
405 Urban Street, Suite 401
Lakewood, CO 80228

American Friends Service Co.
Attn: T. Rauch
1535 High Street, 3rd Floor
Denver, CO 80218

W. Gale Biggs Associates
Attn: Dr. W. Gale Biggs
P.O. Box 3344
Boulder, CO 80307

F.H. Blaha
2303 Table Heights Drive
Golden, CO 80401

Environmental Information Network
Attn: P. Elofson-Gardine
8470 W. 52nd Place, Suite 9
Arvada, CO 80002-3447

L.C. Holdings
Attn: M. Jones
18300 Hwy 72
Golden, CO 80403-8222

IT Corporation
Attn: C. Rayburn
5600 S. Quebec, Suite 280D
Englewood, CO 80111

National Renewable Energy
Laboratory
Attn: R. Noun
1617 Cole Blvd.
Golden, CO 80402

PRC Environmental Management,
Inc.
Attn: R.J. Fox
1099 18th Street, Suite 1960
Denver, CO 80202

Peak Rock Spring Water
Attn: S. Dolson
4615 Broadway Street
Boulder, CO 80304-0509

Rocky Flats Cleanup Commission
Attn: K. Korkia
1738 Wynkoop, Suite 302
Denver, CO 80202

Sierra Club - Rocky Mountain
Chapter
Attn: Dr. E. DeMayo
11684 Ranch Elsie Road
Golden, CO 80203

Woodward Clyde/ERCE
Attn: W. Glasgow
Stanford Place 3, Suite 415
4582 S. Ulster Street Pkwy.
Denver, CO 80237

Wright Water Engineers
Attn: J. Jones, S. Kribs
2490 W. 26th Avenue, Suite 100A
Denver, CO 80211

Other

R.M. Borinsky
13004 Lowell Court
Broomfield, CO 80020

W.J. Jones
10986 W. 77th Avenue
Arvada, CO 80005

T.T. Matsuo
11746 W. 74th Way
Arvada, CO 80005

R.D. Morgenstern
3213 W. 133rd Avenue
Broomfield, CO 80020

J.K. Natale
11767 W. 74th Way
Arvada, CO 80005

National Center for Atmospheric
Research
Attn: S. Sadler
P.O. Box 3000
Boulder, CO 80307-3000

L.S. Newton
5993 W. 75th Avenue
Arvada, CO 80003

M. Peceny
Fluor Daniels
1726 Cole Blvd., Suite 150
Golden, CO 80401

Physicians for Social
Responsibility
Attn: T. Perry
1000 16th NW, Suite 810
Washington, D.C. 20036

F.H. Shoemaker
13631 W. 54th Avenue
Arvada, CO 80002

D.S. Smith
11122 Seton Place
Westminster, CO 80030

D.L. Weiland
7648 Owens Court
Arvada, CO 80005

S.M. Yasutake
6381 West 74th Place
Arvada, CO 80003

EG&G Rocky Flats

S.J. Bender
MA, Bldg. 850

B.M. Bowen, EPM/Air Quality
Division

E.A. Brovsky, General Chemistry

M.S. Brugh, Gen. Spect. Laboratory

D.A. Cirrincione, EPM/
Environmental Protection and Waste
Reporting

J.A. Cuicci, Regulated Waste
Bldg. T130B

S.L. Cunningham, Info. Security

N.M. Daugherty, EPM/Air Quality
Division

N.S. Demos, ERM/Facility
Operations

R.A. Deola, EPM/Air Quality
Division

J.R. Dick, Analytical Labs

L.A. Doerr, Op. Health Physics

L.A. Dunstan, EPM/Surface Water
Division

G.D. Elliott, FPM Program
Management

E.W. Ellis, Technical Development

Environmental Master File
c/o M. Paliani, EPM/Records and
Reporting

N.L. Erdmann, EPM/Environmental
Protection and Waste Reporting

P.J. Etchart, EPM/Environmental Protection and Waste Reporting

G.R. Euler, EPM/Air Quality Division

V.T. Guettlein, EPM/Surface Water

T.G. Hedahl, Associate General Manager Environmental & Waste Management

D.I. Hunter, General Laboratory

J.E. Janke, ERM/Remediation Reporting Management

H. Jordan, Nuclear Safety Engineering

T.G. Kalivas, EPM/Air Quality Division

R.D. Lindberg, ERM/Env. Science and Technology

H.P. Mann, General Manager

F.G. McKenna, Chief Counsel

J.I. McLaughlin, EPM/Environmental Protection and Waste Reporting

W.E. Osborne, EPM/Air Quality Division

J.G. Paukert, Media Relations

B.J. Pauley, EPM/Air Quality Division

L.C. Pauley, EPM/Air Quality Division

V.L. Peterson, Safety Analysis Engineering

D.R. Pierson, Pondrete Ops.

F. Primozić, Waste Quality Engineering

A.J. Read, Analytical Labs

Rocky Flats Plant
Public Reading Room
c/o Front Range Community College
3645 W. 112th Avenue
Westminster, CO 80037

R.S. Roberts, Remediation Programs Division

C.M. Sanda, Community Relations

J.K. Schwartz, Media Communications

C.A. Sedlmayr, Administration

G.H. Setlock, Director
Environmental Protection
Management

T.A. Smith, Community Relations

N.R. Stallcup, EPM/Environmental Protection and Waste Reporting

D.R. Stanton, EPM/Environmental Protection and Waste Reporting

D. Stein, Mechanical Utilities

M.T. Sullivan, Radiation Protection

P. V. Thomas, EPM/Environmental Protection and Waste Reporting

C. Trice, Analytical Labs

J.M. Wilson, Director,
Communications

J. Zarret, Analytical Labs

K. Zbryk, Analytical Labs

