April 1990 ER-4180110-187

ROCKY FLATS PLANT

MONTHLY ENVIRONMENTAL MONITORING REPORT

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April 1990

ENVIRONMENTAL MONITORING REPORT
ROCKY FLATS PLANT

This report summarizes the effluent and environmental monitoring programs at the Rocky Flats Plant for the month of April 1990. The data presented herein are the best information available to the Rocky Flats Plant at this time. Should subsequent analyses indicate that any data presented herein are inaccurate or misleading appropriate revisions will be issued promptly.

Included in the report are monitoring results for radioactive and nonradioactive airborne effluents continuously sampled from Plant buildings, Tables I and II. Tables III through V summarize environmental monitoring data from the Rocky Flats Plant ambient air sampling network. This network is comprised of continuously operating air samplers located on plantsite, around the Plant boundary, and in neighboring communities.

Water sampling results for radioactive constituents are given in Tables VI through VIII. Results are summarized for Plant surface water control ponds, for nearby drinking water reservoirs, and for tap water for neighboring communities. Nitrate monitoring for Great Western Reservoir and Standley Lake, the two drinking water reservoirs which can receive surface water discharges from the Plant, are summarized in Table IX.

The Environmental Protection Agency (EPA) has issued to the Plant a National Pollutant Discharge Elimination System (NPDES) permit for control of surface water discharges. Water sampling results associated with the NPDES permit, as well as applicable discharge limitations imposed by that permit, are reported in Table X. Analytical results for nonradioactive parameters in water at the Walnut Creek at Indiana Street location are summarized in Table XI. Daily flow data for surface water from the two Plant drainage systems are given in Tables XI, XII, and XIII. Meteorological data, including percent Wind Direction Frequency by Wind Speed class, are given in Table XV.

The data provided in this report are provided as a matter of comity and should not be construed as an application for a permit or license, or in support of such an application. Approval of the Department of Energy should be obtained prior to publication of any data contained within this report.

Table I

1990 Plutonium and Uranium Airborne Effluent Data

April 1990

Month	Plutonium (03/22/90 - 04/26/90) Release (µCi)	Plutonium (03/22/90 - 04/26/90) CMax (pCi/m³)	Uranium (03/17/90 - 04/24/90) Release (µCi)	Uranium (03/17/90 - 04/24/90) CMax (pCi/m³)
CY 1989	4.88	0.145 ± 0.0060	7.60	0.217 ± 0.0231
January	0.29	0.001 ± 0.0002	0.08	0.002 ± 0.0006
February	0.07	0.000 ± 0.0000	0.04	0.000 ± 0.0001
March	0.06	0.001 ± 0.0003	0.07	0.000 ± 0.0001
April	0.08*	0.001 ± 0.0002	0.02**	0.002 ± 0.0003
May				
June				
July				
August				
September				
October				
November				
December				
Year to Date	0.50	0.001 ± 0.0002	0.21	0.002 ± 0.0006

* 17 incomplete analyses
** 2 incomplete analyses

NOTE: The plutonium, uranium, americium, and beryllium measured concentrations in this report include values that are less than the corresponding calculated minimum detectable concentrations (MDC's). In some cases, the values are less than zero. This method of reporting began in January 1981. These negative values result when the measured value for the laboratory reagent blank is subtracted from an analytical result which was measured as a smaller value than the reagent blank. This may happen when measuring concentrations which are very close to zero.

Table II

1990 Tritium, Beryllium, and Americium Airborne Effluent Data

March 1990

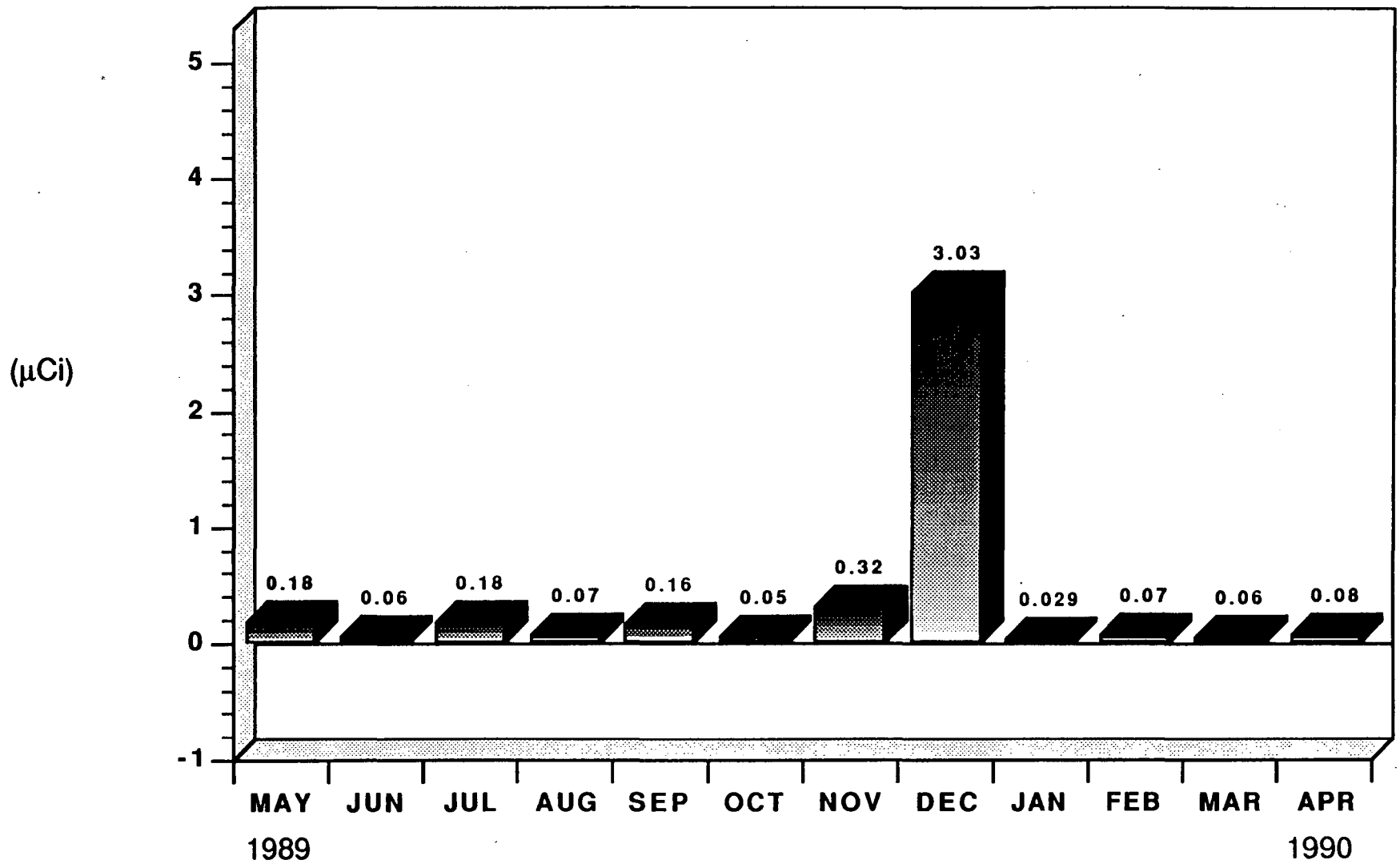
	Tritium (03/30/90 - 04/30/90)		Beryllium (03/27/90 - 04/24/90)		Americium (02/22/90 - 03/22/90)	
Month	Release (mCi)	CMax (pCi/m^3)	Release (grams)	CMax (ug/m^3)	Release (µCi)	CMax (pCi/m^3)
CY 1989	175.585	14000 ± 320	0.6442	0.00106	1.17	0.033 ± 0.0046
January	0.375	35 ± 6	0.0503*	0.00080	0.11	0.000 ± 0.0001
February	0.451	88 ± 7	0.0634*	0.00051	0.01	0.000 ± 0.0000
March	0.370	72 ± 13	0.0782*	0.00032	0.01	0.000 ± 0.0001
April	0.382	68 ± 19	0.0535*	0.00051		
May						
June						
July						
August						
September						
October						
November						
December						
Year to Date	1.578	88 ± 7	0.2454*	0.00080	0.13	0.000 ± 0.0001

NOTE: Beryllium measured at the remaining 44 locations was below the screening level of 0.1 gram per month.

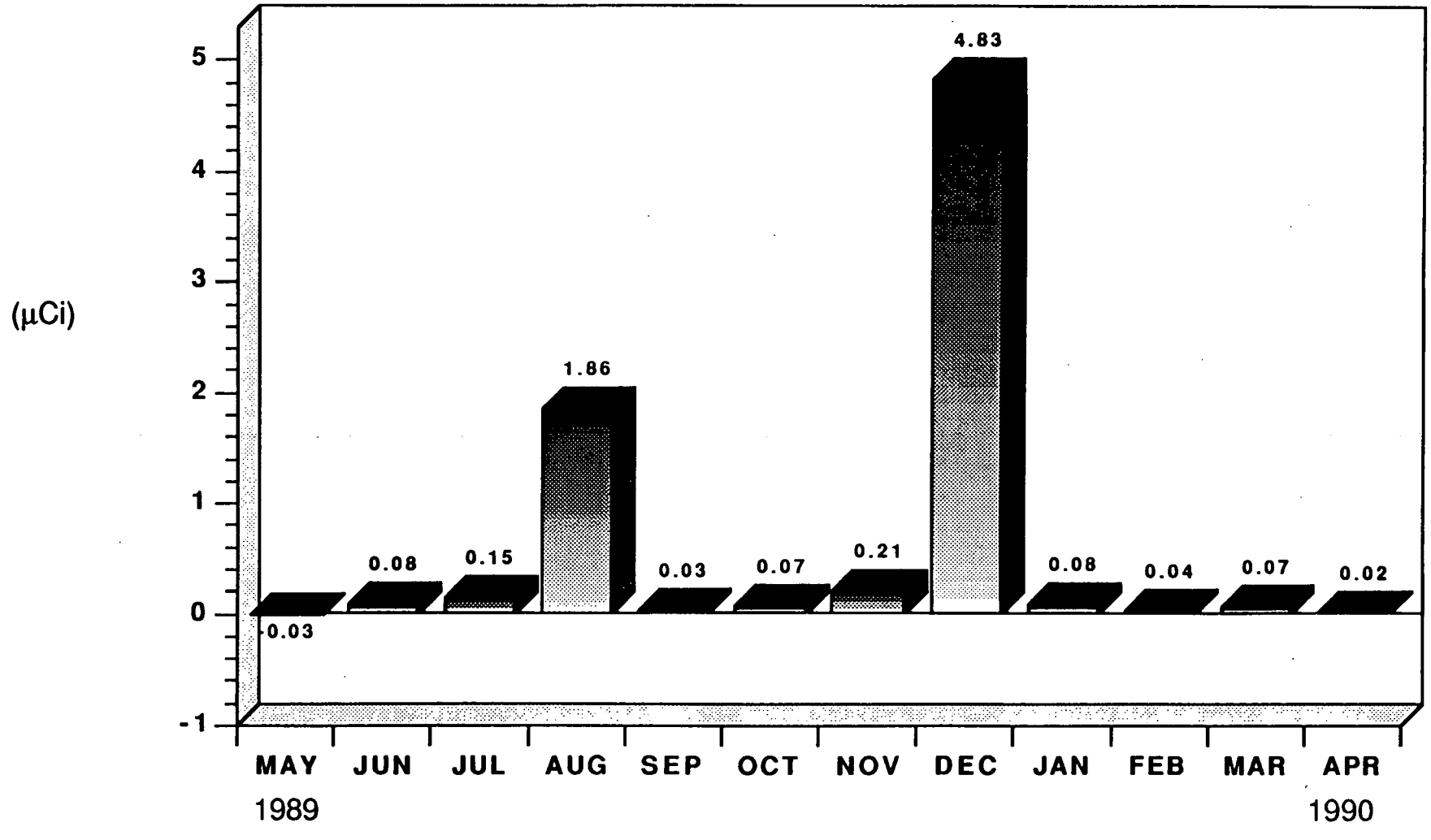
The calibration methodology for the beryllium analyses was changed beginning with the September samples to improve quality assurance. The previous procedure used the single-point, "simple method of additions," one of the methods recommended by the manufacturer of the graphite furnace atomic absorption analytical equipment. The current method is based on 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 assure absence of equipment contamination and matrix effects during the analysis.

* No blank correction

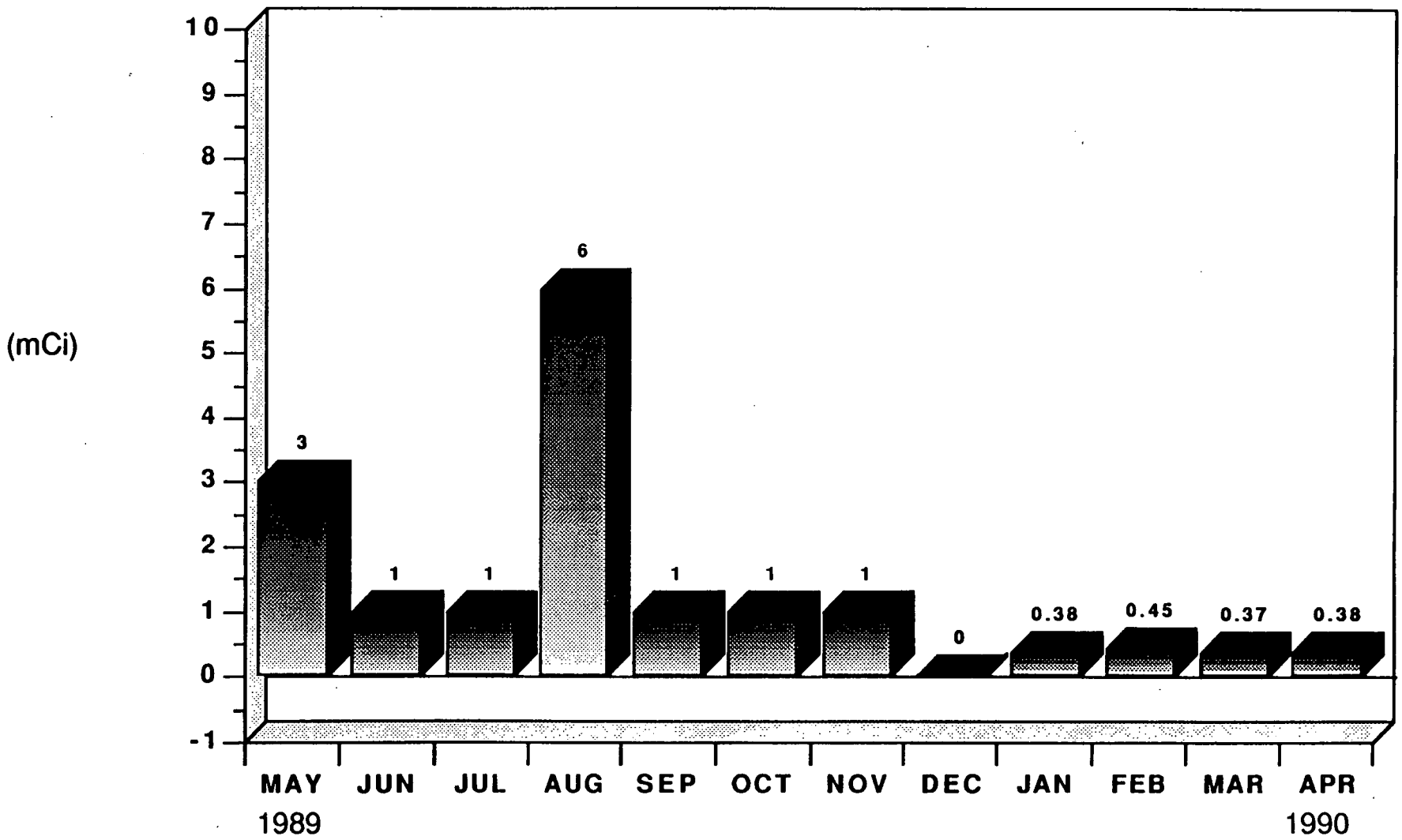
PLUTONIUM MEASURED IN EFFLUENT AIR



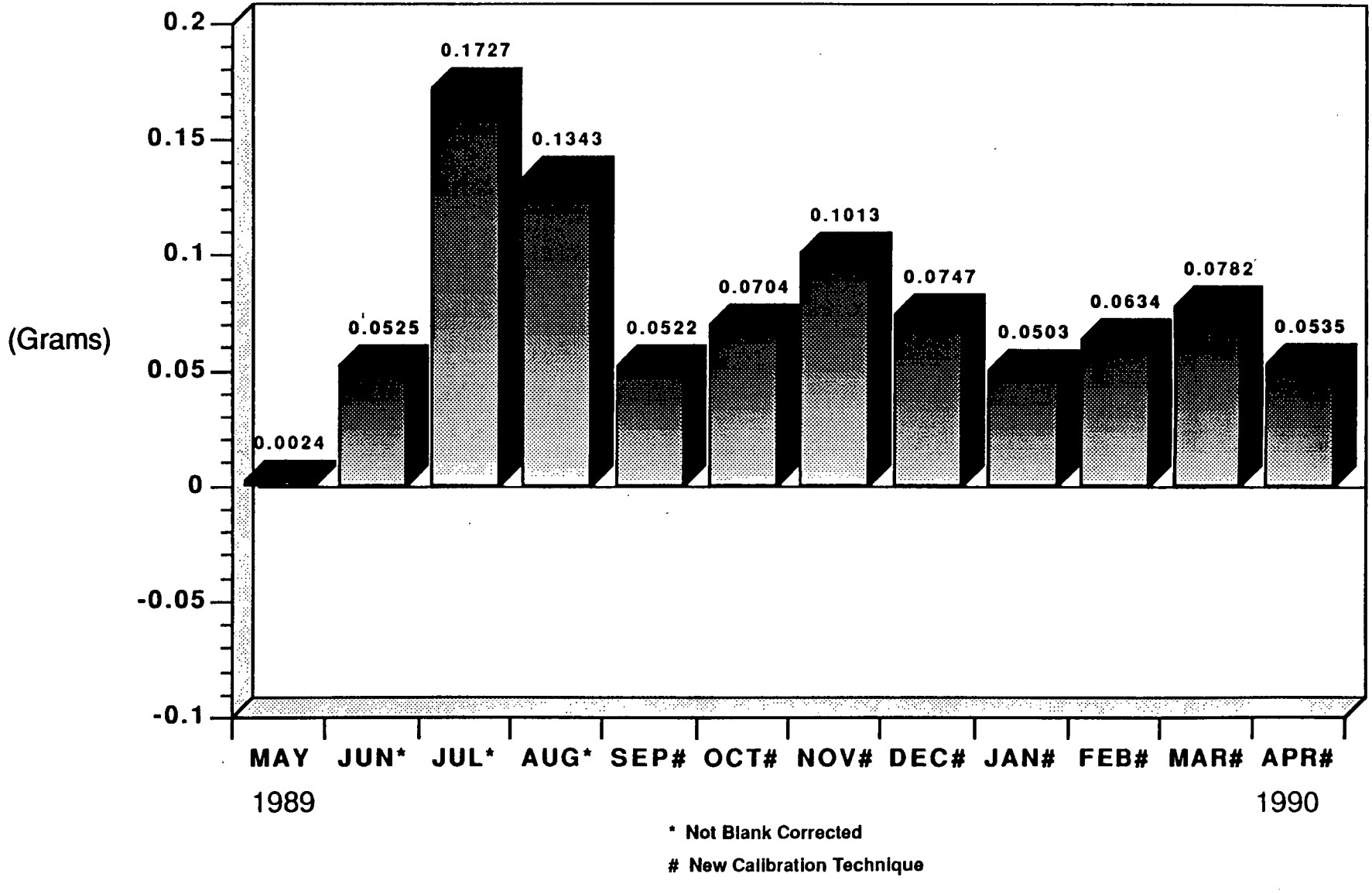
URANIUM MEASURED IN EFFLUENT AIR



TRITIUM MEASURED IN EFFLUENT AIR



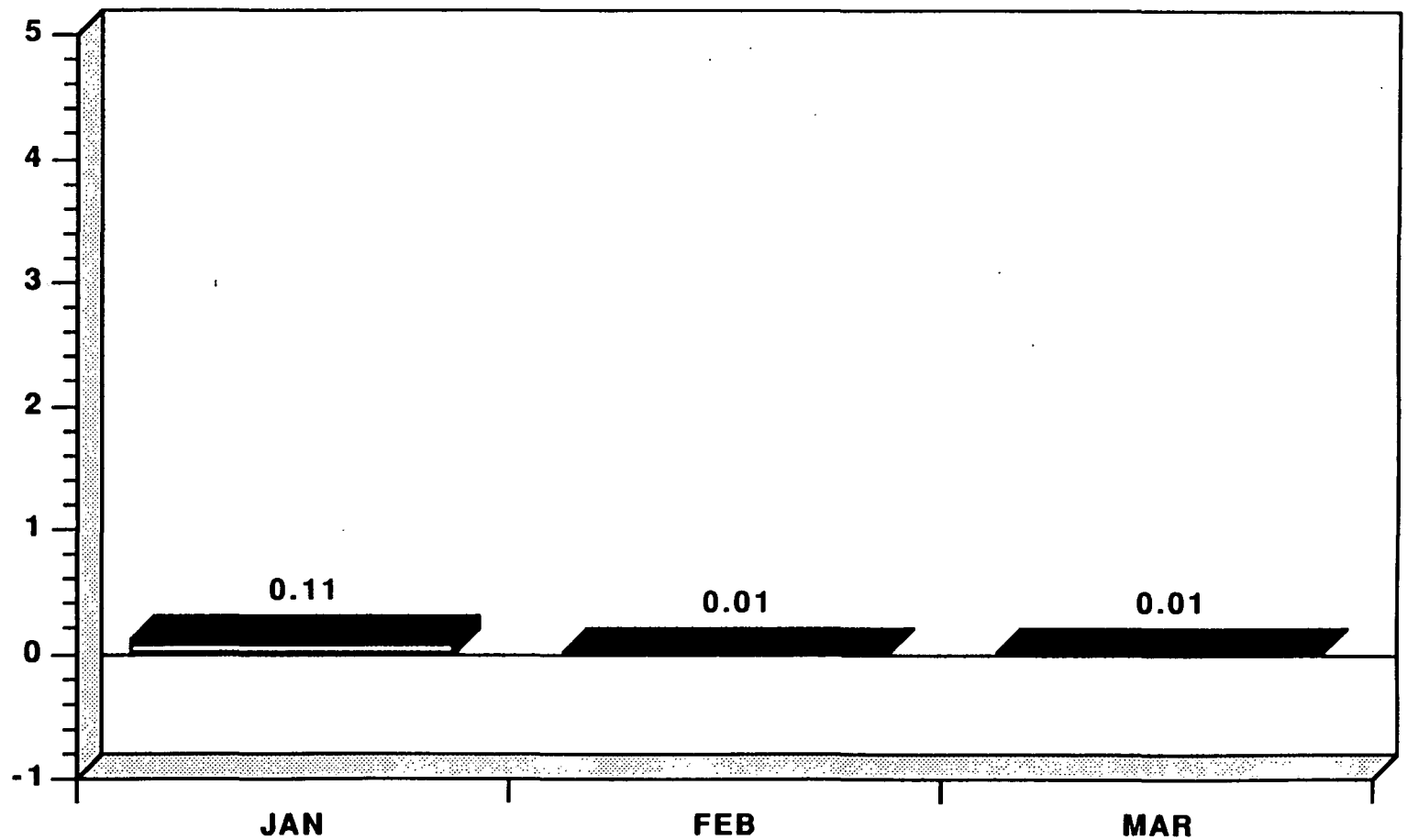
BERYLLIUM MEASURED IN EFFLUENT AIR



* Not Blank Corrected

\# New Calibration Technique

AMERICIUM MEASURED IN EFFLUENT AIR



1990

Table III

Plutonium Concentration in Ambient Air for Selected Onsite Samplers

April 1990

(3/20/90 - 04/17/90)

Location	Number of Composited Monthly Samples	Volume (m^3)	Avg. Pu Conc. (pCi/m^3)	± 95% Confidence Interval (pCi/m^3)
S-01	2	35000	0.000872	0.000204
S-02	*			
S-03	1	32000	0.000003	0.000002
S-04	1	27000	0.000018	0.000006
S-05	2	31000	0.000012	0.000014
S-06	2	26000	0.000017	0.000017
S-07	2	30000	0.000068	0.000025
S-08	2	36000	0.000016	0.000007
S-09	2	35000	0.000219	0.000014
S-10	1	32000	0.000010	0.000004
S-11	1	32000	0.000003	0.000003
S-12	1	33000	0.000015	0.000005
S-13	1	32000	0.000014	0.000005
S-14	1	29000	0.000002	0.000003
S-15	1	33000	0.000006	0.000013
S-16	1	34000	0.000005	0.000003
S-17	1	33000	0.000023	0.000006
S-18	**			
S-19	1	32000	0.000074	0.000014
S-20	1	33000	0.000018	0.000007
S-21	1	24000	0.000009	0.000003
S-22	1	29000	0.000005	0.000003
S-23	1	33000	0.000004	0.000003
S-24	1	41000	0.000003	0.000002
S-81	1***	85742	0.000006	0.000006

* Air sampler was inoperational during this period because of equipment failure.

** Incomplete analysis.

*** S-81 is a temporary air sampler to provide monitoring information for the 881 hillside remediation area. This air sampler intermittently operated during sampling interval 3/20/90 to 5/1/90.

FIGURE 1

Location of Onsite and Plant Perimeter Ambient Air Samplers

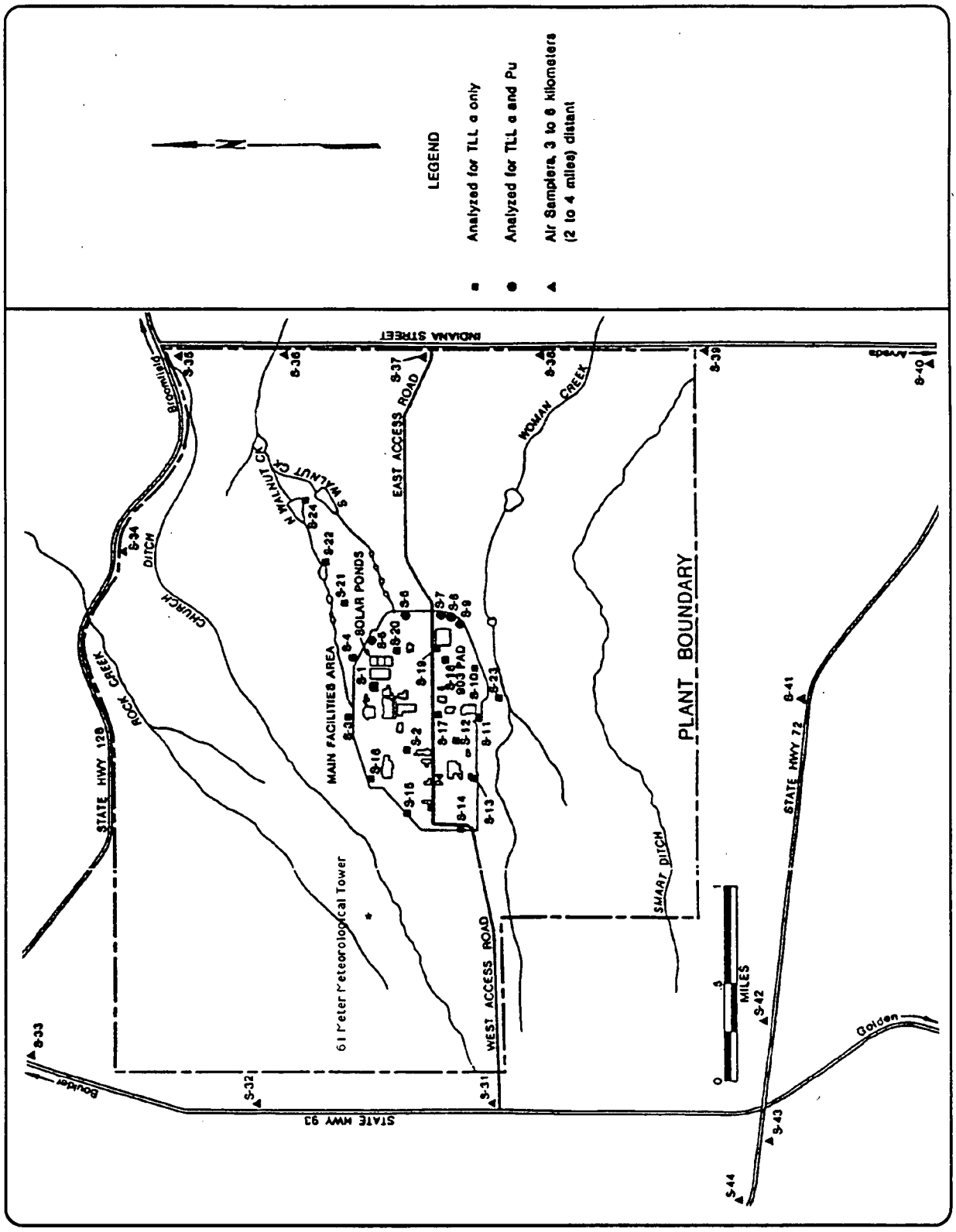


Table IV

Plutonium Concentration in Ambient Air for Perimeter Samplers

April 1990

(03/27/90 - 04/24/90)

Location	Number of Composited Monthly Samples	Volume (m^3)	Pu Conc. (pCi/m^3)	± 95% Confidence Interval (pCi/m^3)
S-31	1	33000	-0.000001	0.000001
S-32	1	34000	0.000002	0.000003
S-33	1	33000	0.000004	0.000002
S-34	1	32000	0.000001	0.000002
S-35	1	34000	0.000002	0.000004
S-36	1	33000	0.000002	0.000003
S-37	1	32000	0.000002	0.000002
S-38	1	33000	0.000001	0.000002
S-39	1	34000	0.000000	0.000002
S-40	1	33000	0.000000	0.000001
S-41	1	34000	0.000000	0.000001
S-42	1	33000	0.000004	0.000003
S-43	1	23000	0.000000	0.000001
S-44	1	32000	0.000001	0.000002

Table V

Plutonium Concentration in Ambient Air for Community Samplers

April 1990

(03/27/90 - 04/24/90)

Location	Community Name	Number of Composited Monthly Samples	Volume (m^3)	Pu Conc. (pCi/m^3)	± 95% Confidence Interval (pCi/m^3)
S-51	Marshall	1	31000	0.000003	0.000003
S-52	Jeffco Airport	1	35000	0.000002	0.000002
S-53	Superior	1	32000	0.000000	0.000002
S-54	Boulder	1	33000	0.000000	0.000001
S-55	Lafayette	1	34000	0.000000	0.000001
S-56	Broomfield	1	32000	0.000003	0.000003
S-57	Walnut Creek	1	31000	0.000001	0.000002
S-58	Wagner	1	25000	0.000002	0.000003
S-59	Leyden	1	36000	0.000003	0.000003
S-60	Westminster	1	35000	0.000002	0.000002
S-61	Denver	*			
S-62	Golden	1	34000	-0.000001	0.000001
S-68	Lakeview Pointe	1	35000	0.000001	0.000002
S-73	Cotton Creek	1	32000	0.000001	0.000002

* Sampler S-61 was inoperational during this period. This sampler has been temporarily removed because of construction activities on the building where it is installed.

FIGURE 2

Location of Community Ambient Air Samplers

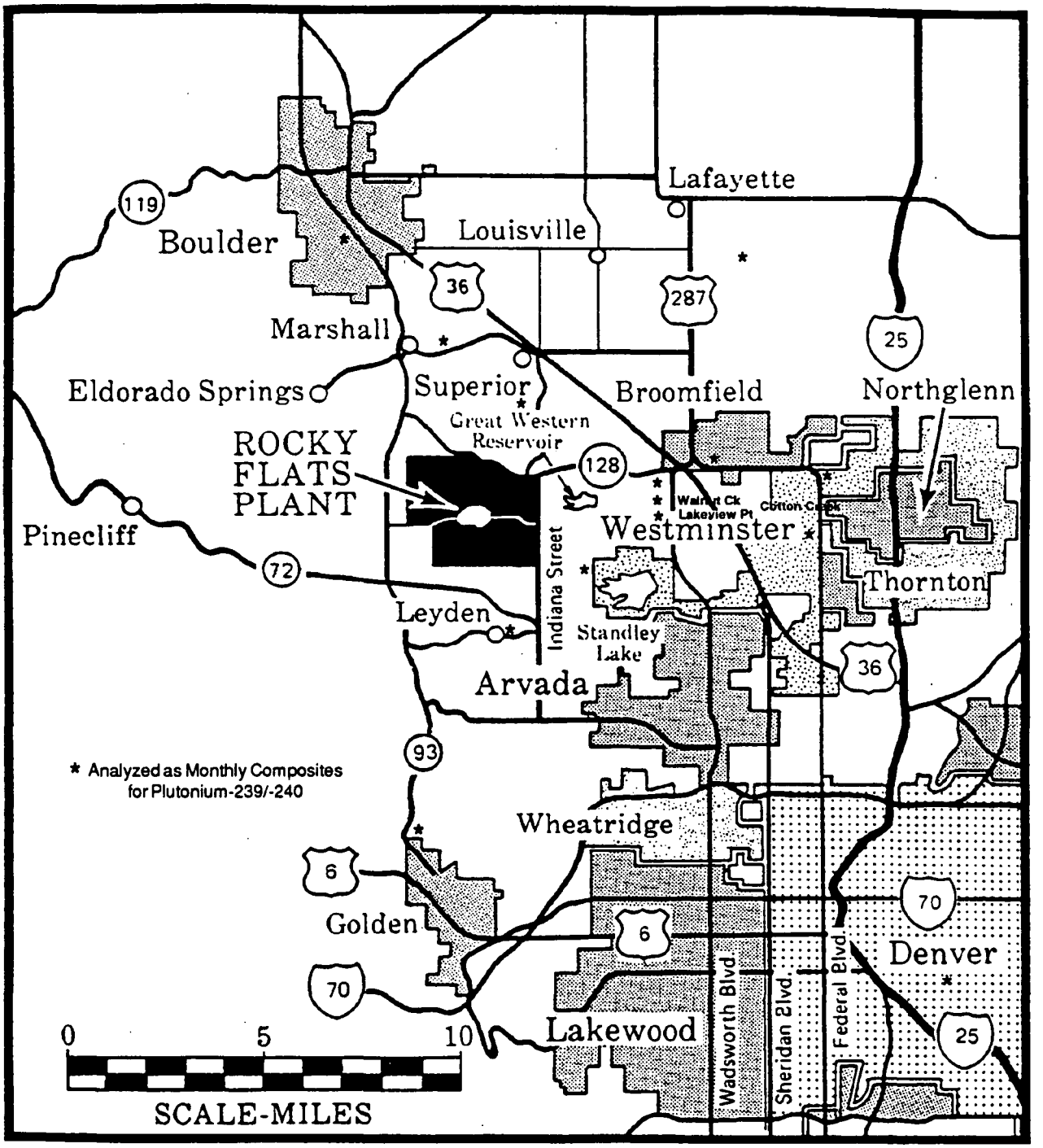


Table VIa

Onsite Water Sample Results - Plutonium, Uranium, and Americium

March 1990

Holding Pond Outfall (pCi/l)

Location	Plutonium	Uranium	Americium
*Pond A-4***			
03/29/90 - 03/31/90	-0.019 ± 0.030	5.74 ± 0.35	0.002 ± 0.046
03/31/90 - 04/01/90	-0.013 ± 0.028	6.86 ± 0.40	0.000 ± 0.050
Average Concentration	-0.016 ± 0.021	6.30 ± 0.27	0.001 ± 0.034
*Pond B-5***			
03/23/90 - 03/25/90	-0.014 ± 0.032	4.48 ± 0.42	0.000 ± 0.040
03/26/90 - 03/30/90	-0.036 ± 0.034	4.28 ± 0.27	-0.012 ± 0.042
03/31/90 - 04/01/90	0.016 ± 0.041	4.25 ± 0.29	0.019 ± 0.050*
Average Concentration	-0.011 ± 0.021	4.34 ± 0.19	0.002 ± 0.026*
Pond C-1			
03/05/90 - 03/09/90	0.005 ± 0.016	1.74 ± 0.16	0.033 ± 0.026
03/14/90 - 03/16/90	-0.004 ± 0.018	1.31 ± 0.17	0.040 ± 0.021
03/19/90 - 03/23/90	0.018 ± 0.017	0.69 ± 0.16	0.010 ± 0.011
03/26/90 - 03/30/90	0.004 ± 0.014	0.63 ±0.13	0.004 ± 0.010
Average Concentration	0.006 ± 0.009	1.09 ± 0.08	0.022 ± 0.017

* Previously reported as incomplete data

** Discharges from Ponds A-4 and B-5 have been conditioned using sediment filtration and activated carbon absorption prior to release.

(Continued on next page)

Table VIa

Onsite Water Sample Results - Plutonium, Uranium, and Americium

(March 1990 - continued)

Holding Pond Outfall (pCi/l)

Location	Plutonium	Uranium	Americium
Pond C-2			
No Discharge			
Average Concentration			
Walnut Creek at Indiana			
03/12/90 - 03/16/90	-0.013 ± 0.016	3.96 ± 0.35	0.009 ± 0.010
03/19/90 - 03/23/90	0.006 ± 0.010	1.79 ± 0.22	-0.001 ± 0.038*
03/24/90 - 03/25/90	-0.018 ± 0.028	4.28 ± 0.31	-0.010 ± 0.040
03/26/90 - 03/30/90	0.001 ± 0.011	3.81 ±0.34	0.008 ± 0.011
03/31/90 - 04/01/90	-0.009 ± 0.029	3.78 ± 0.23	-0.010 ± 0.040
Average Concentration	-0.007 ± 0.009	3.52 ± 0.87	-0.001 ± 0.008*

* Previously reported as incomplete data

Table VIb

Onsite Water Sample Results - Plutonium, Uranium, and Americium

April 1990

Holding Pond Outfall (pCi/l)*

Location	Plutonium	Uranium	Americium
Pond A-4			
04/02/90 - 04/06/90	-0.006 ± 0.035	5.49 ± 0.31	-0.024 ± 0.034
04/07/90 - 04/08/90	0.007 ± 0.035	5.79 ± 0.41	-0.007 ± 0.039
04/09/90 - 04/12/90	0.013 ± 0.042	5.22 ± 0.27	0.040 ± 0.042
04/13/90 - 04/15/90	0.026 ± 0.042	5.05 ± 0.27	0.015 ± 0.039
04/16/90 - 04/20/90	0.006 ± 0.029	7.60 ± 0.40	0.019 ± 0.041
04/21/90 - 04/22/90	-0.011 ± 0.026	4.67 ± 0.25	0.012 ± 0.052
04/23/90 - 04/27/90	0.006 ± 0.032	3.60 ± 0.40	-0.008 ± 0.035
04/28/90 - 04/29/90	0.009 ± 0.048	3.58 ± 0.25	-0.011 ± 0.036
Average Concentration	0.006 ± 0.008	5.13 ± 0.89	0.005 ± 0.015
Pond B-5			
04/02/90 - 04/06/90	-0.002 ± 0.036	4.03 ± 0.28	0.002 ± 0.044
04/07/90 - 04/08/90	0.026 ± 0.045	4.66 ± 0.27	0.000 ± 0.047
04/09/90 - 04/12/90	0.019 ± 0.027	4.48 ± 0.24	0.025 ± 0.048
04/13/90 - 04/15/90	0.013 ± 0.046	3.37 ± 0.20	0.061 ± 0.047**
04/16/90 - 04/20/90	-0.002 ± 0.027	4.83 ± 0.29	0.000 ± 0.040
04/21/90 - 04/22/90	0.003 ± 0.033	4.15 ± 0.28	-0.010 ± 0.036
04/23/90 - 04/27/90	-0.015 ± 0.028	4.86 ± 0.28	-0.014 ± 0.034
04/28/90 - 04/29/90	-0.011 ± 0.039	4.34 ± 0.40	-0.005 ± 0.036
Average Concentration	0.004 ± 0.010	4.34 ± 0.34	0.007 ± 0.017
Pond C-1			
04/02/90 - 04/06/90	0.005 ± 0.020	0.60 ± 0.13	-0.001 ± 0.009
04/09/90 - 04/13/90	0.002 ± 0.013	0.50 ± 0.11	-0.006 ± 0.009
04/16/90 - 04/20/90	0.001 ± 0.010	0.83 ± 0.12	-0.002 ± 0.008
04/23/90 - 04/27/90	0.008 ± 0.012	1.01 ± 0.15	-0.001 ± 0.007
Average Concentration	0.004 ± 0.003	0.74 ± 0.22	-0.003 ± 0.002

* Discharges from Ponds A-4, B-5, and C-2 have been conditioned using sediment filtration and activated carbon absorption prior to release.

** This sample is being re-analyzed to verify result.

(Continued on next page)

Table VIb

Onsite Water Sample Results - Plutonium, Uranium, and Americium

(April 1990 - continued)

Holding Pond Outfall (pCi/l)*

Location	Plutonium	Uranium	Americium
*Pond C-2****			
04/14/90 - 04/15/90	0.003 ± 0.034	****	-0.010 ± 0.035
04/16/90 - 04/20/90	-0.003 ± 0.028	4.68 ± 0.30	-0.003 ± 0.036
04/21/90 - 04/22/90	-0.008 ± 0.028	4.82 ± 0.34	0.015 ± 0.045
04/23/90 - 04/27/90	0.020 ± 0.060	5.25 ± 0.30	-0.008 ± 0.036
04/28/90 - 04/29/90	0.002 ± 0.047	4.16 ± 0.29	-0.014 ± 0.036
Average Concentration	0.003 ± 0.009	****	-0.004 ± 0.010
*Pond C-2 Basin****			
04/14/90 - 04/15/90	0.020 ± 0.040	4.25 ± 0.27	0.000 ± 0.040
04/16/90 - 04/20/90	0.008 ± 0.029	4.55 ± 0.40	-0.023 ± 0.034
04/21/90 - 04/22/90	0.021 ± 0.043	5.03 ± 0.25	0.008 ± 0.041
04/23/90 - 04/27/90	-0.015 ± 0.028	4.70 ± 0.42	-0.009 ± 0.041
04/28/90 - 04/29/90	0.011 ± 0.044	****	0.009 ± 0.043
Average Concentration	0.009 ± 0.013	****	-0.001 ± 0.012
Walnut Creek at Indiana			
04/02/90 - 04/06/90	0.007 ± 0.013	4.70 ± 0.42	0.006 ± 0.013
04/07/90 - 04/08/90	0.004 ± 0.031	2.82 ± 0.29	0.004 ± 0.064
04/09/90 - 04/12/90	0.013 ± 0.017	4.66 ± 0.29	-0.003 ± 0.009
04/13/90 - 04/15/90	0.032 ± 0.053	5.20 ± 0.28	0.002 ± 0.038
04/16/90 - 04/20/90	0.024 ± 0.021	4.74 ± 0.29	0.006 ± 0.010
04/21/90 - 04/22/90	0.012 ± 0.038	4.95 ± 0.31	0.037 ± 0.049
04/23/90 - 04/27/90	0.001 ± 0.009	4.04 ± 0.30	0.003 ± 0.008
04/28/90 - 04/29/90	0.004 ± 0.050	3.27 ± 0.26	-0.008 ± 0.036
Average Concentration	0.012 ± 0.007	4.30 ± 0.59	0.006 ± 0.009

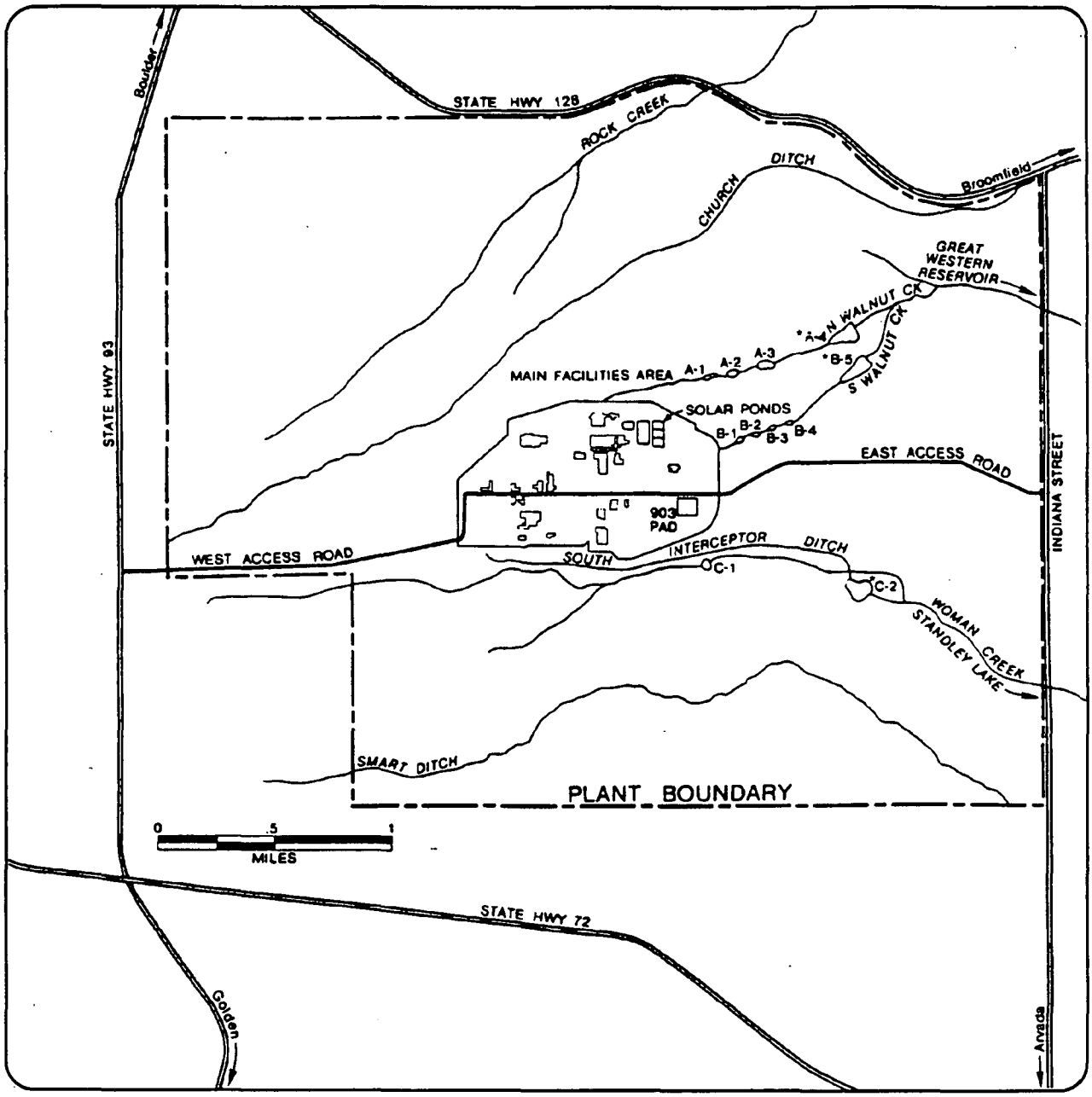
*** Pond C-2 refers to samples taken at point of discharge of pipeline from C-2 pond to Broomfield Diversion Ditch

Pond C-2 Basin refers to samples taken directly after granulated activated carbon treatment

**** Incomplete Data

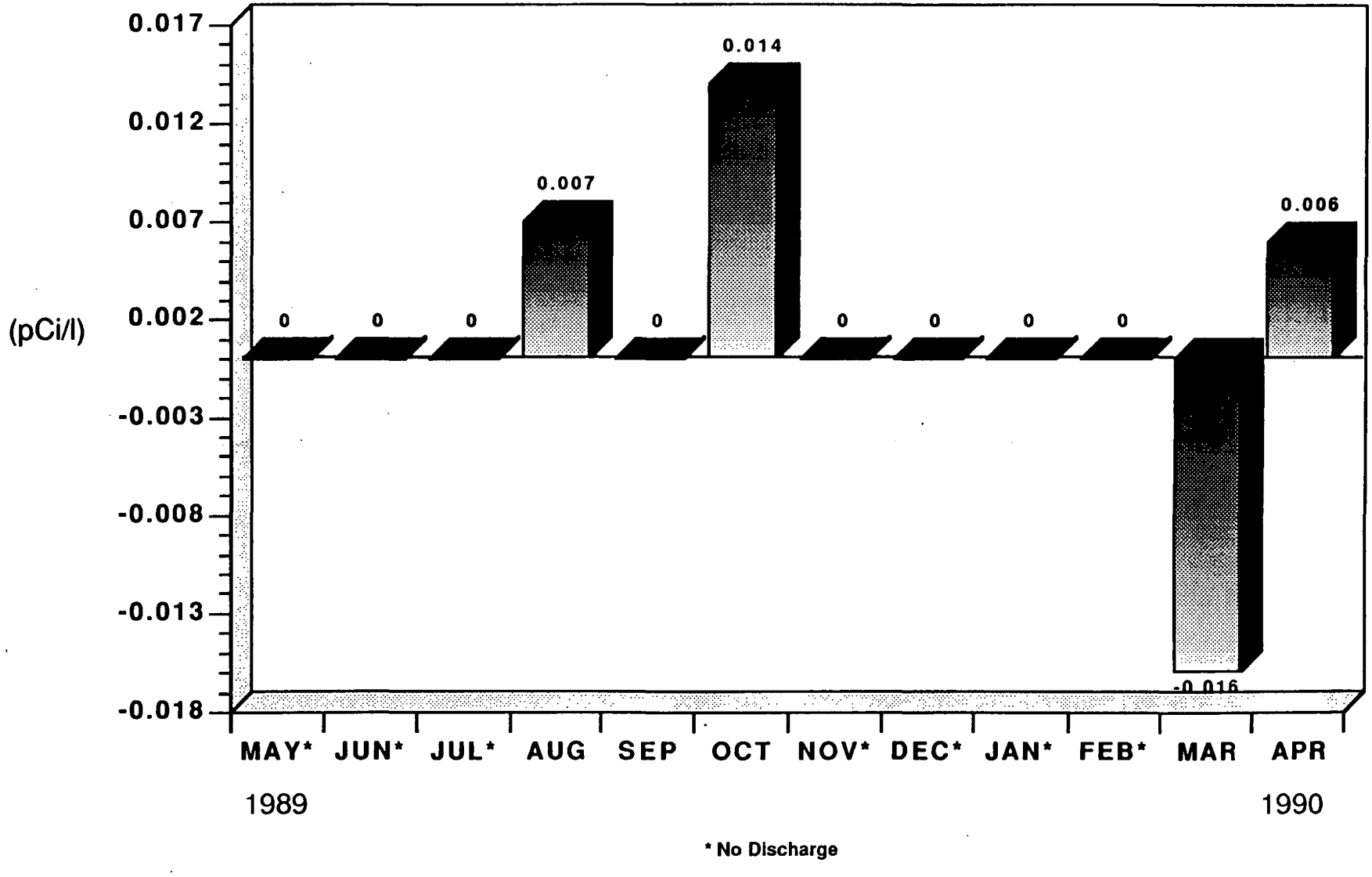
FIGURE 3

Holding Ponds and Liquid Effluent Watercourses



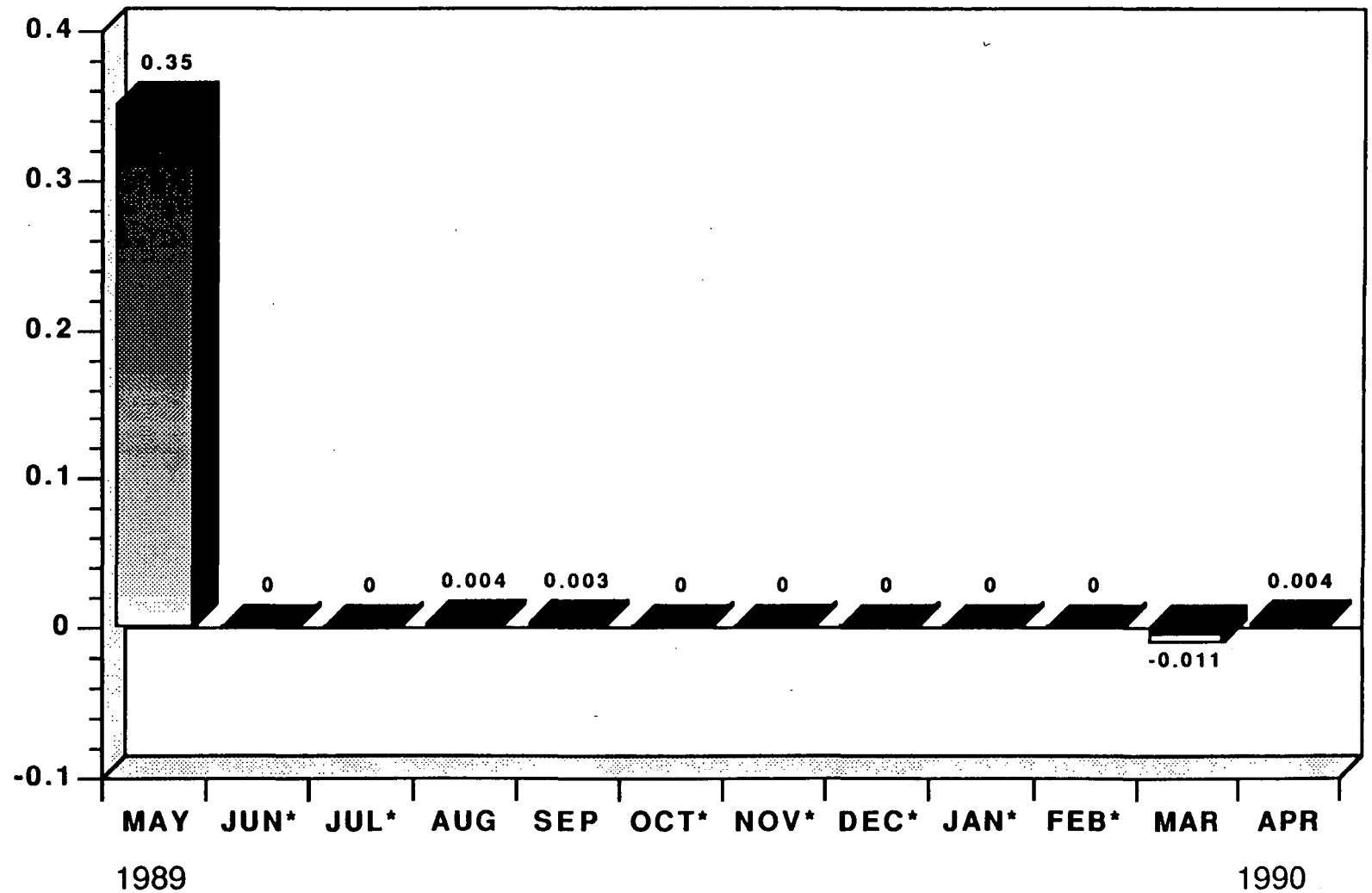
* Diversion capabilities exist for indicated locations.

PLUTONIUM IN POND A-4 EFFLUENT WATER



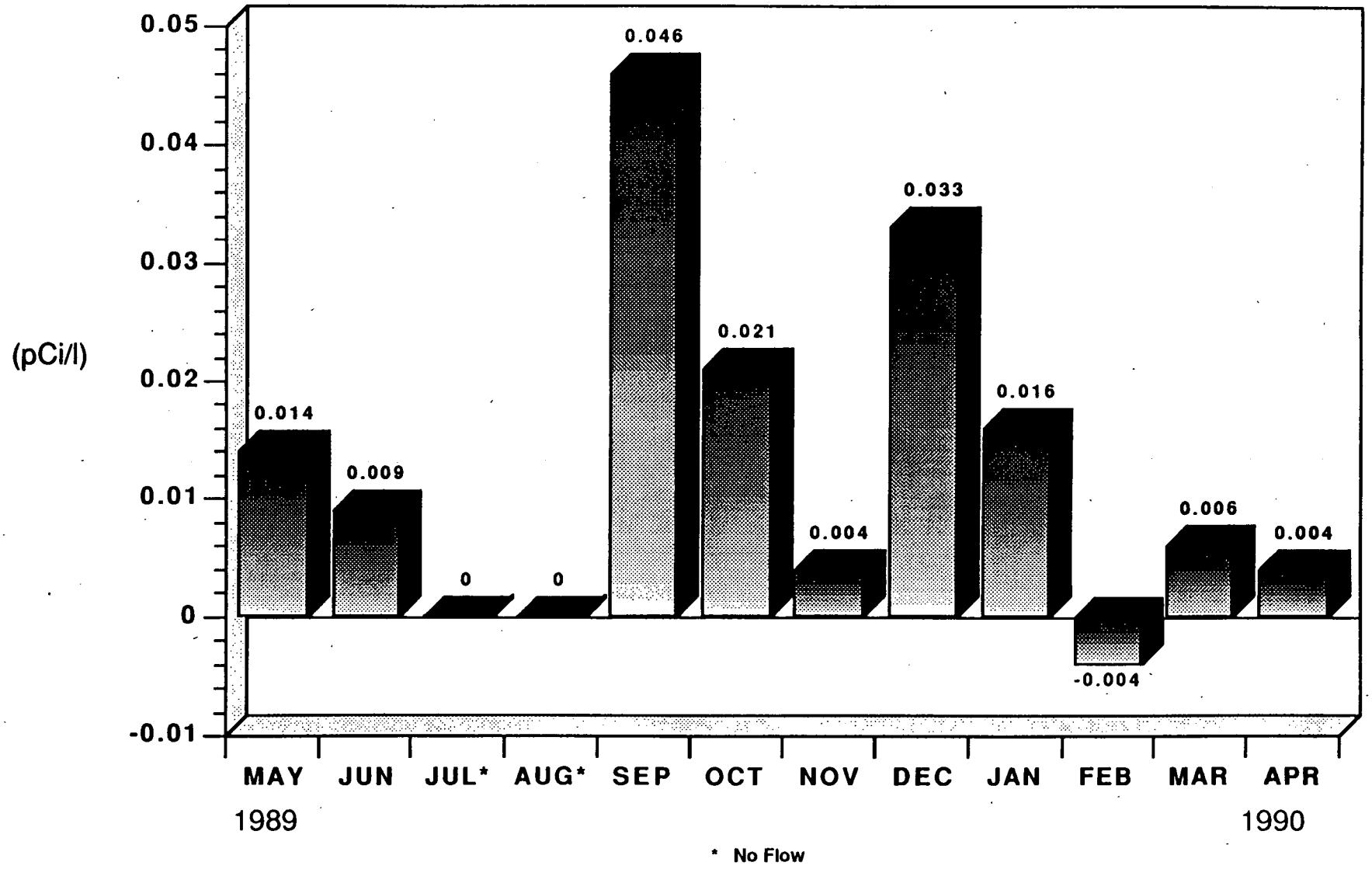
* No Discharge

PLUTONIUM IN POND B-5 EFFLUENT WATER



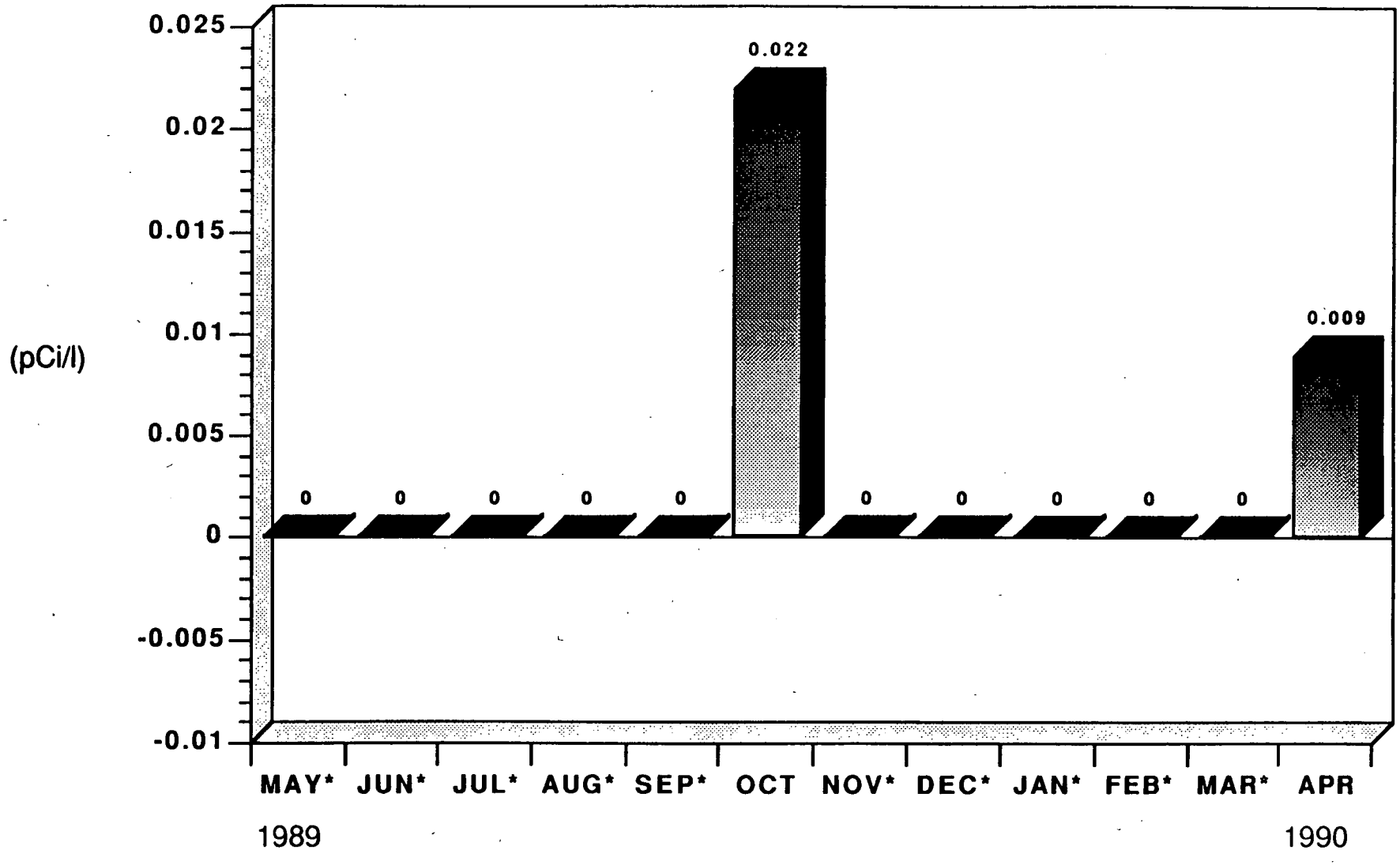
* No Discharge

PLUTONIUM IN POND C-1 EFFLUENT WATER



* No Flow

PLUTONIUM IN POND C-2 EFFLUENT WATER



* No Discharge

Table XI

Water Sample Results, Nonradioactive Parameters

Walnut Creek at Indiana Street
Flow occured from 4/1/90 through 4/30/90

Parameters		*n*	*CMinimum*	*CMaximum*	*CAverage*
pH	S.U.	30	7.5	8.8	N/A
Nitrates as N	mg/l	30	1.68	4.45	2.74

Total Volume (gallons) = 35,225,000

Table XII

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

April 1990

Date	Walnut Creek At Indiana (gallons)	Pond A-4 (Gallons)	Pond B-5 (Gallons)
04/01/90	1,308,000	495,000	501,000
04/02/90	1,396,000	667,000	670,000
04/03/90	942,000	492,000	524,000
04/04/90	1,269,000	497,000	750,000
04/05/90	1,097,000	555,000	637,000
04/06/90	1,199,000	425,000	577,000
04/07/90	2,065,000	650,000	650,000
04/08/90	1,441,000	616,000	600,000
04/09/90	1,181,000	745,000	1,011,000
04/10/90	1,369,000	575,000	661,000
04/11/90	1,239,000	562,000	626,000
04/12/90	1,024,000	552,000	549,000
04/13/90	1,171,000	573,000	541,000
04/14/90	1,117,000	729,000	530,000
04/15/90	1,109,000	707,000	510,000
04/16/90	1,259,000	748,000	736,000
04/17/90	931,000	542,000	570,000
04/18/90	1,187,000	621,000	605,000
04/19/90	1,038,000	619,000	578,000
04/20/90	929,000	618,000	635,000
04/21/90	903,000	824,000	850,000
04/22/90	843,000	648,000	699,000
04/23/90	1,028,000	816,000	932,000
04/24/90	1,494,000	753,000	673,000
04/25/90	1,100,000	1,426,000	772,000
04/26/90	1,285,000	1,331,000	636,000
04/27/90	1,352,000	1,689,000	719,000
04/28/90	781,000	1,181,000	126,000
04/29/90	1,070,000	1,277,000	686,000
04/30/90	1,098,000	1,437,000	532,000
TOTAL	35,225,000	23,370,000	19,086,000

Table XIII

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

April 1990

Date	Pond C-1 (Gallons)	Pond C-2 (Gallons)
04/01/90		No Discharge
04/02/90	10,420,000	" "
04/03/90	3,130,000	" "
04/04/90	4,180,000	" "
04/05/90	3,060,000	" "
04/06/90	3,730,000	" "
04/07/90		" "
04/08/90		" "
04/09/90	9,860,000	" "
04/10/90	3,820,000	" "
04/11/90	3,180,000	" "
04/12/90	3,110,000	" "
04/13/90	Holiday	" "
04/14/90		" "
04/15/90		" "
04/16/90	14,070,000	772,199
04/17/90	3,210,000	696,700
04/18/90	3,170,000	836,700
04/19/90	3,980,000	696,450
04/20/90	2,610,000	643,350
04/21/90		569,700
04/22/90		721,300
04/23/90	9,790,000	708,200
04/24/90	2,940,000	547,400
04/25/90	3,380,000	646,500
04/26/90	3,450,000	764,850
04/27/90	3,470,000	642,850
04/28/90		791,400
04/29/90		720,300
04/30/90	9,510,000	673,600
Total	104,070,000	10,431,400

SITE METEOROLOGY AND CLIMATOLOGY

Meteorological data were collected on the plantsite from instrumentation installed on a 61-meter (200 foot) tower located in the west buffer zone during April 1990. Meteorological information in this report represents 99% data recovery from this instrumentation (data loss resulted from maintenance on tower). Table XV is the April 1990 summary of the percent frequency of wind directions (16 compass points) divided into four wind speed categories. The compass point designations indicate the true bearing when facing against the wind. These frequency values are represented graphically in the accompaning wind rose. The wind rose vectors also represent the bearing against the wind (i.e., wind along each vector blows toward the center).

The predominance of northwesterly winds is typical of Rocky Flats. The low frequency of winds greater than 7 meters per second (15.6 mph) with easterly components is normal.

The mean temperature recorded for April 1990 was 7.05°C (44.69°F). The maximum temperature recorded was 21.06°C (69.91°F) on 22 April 1990 at 11:45 a.m. The minimum temperature recorded was -7.53°C (18.45°F) on 6 April 1990 at 3:30 a.m.

In April 1990, the Rocky Flats Plant recorded 3.38 centimeters (1.33 inches) of precipitation. The maximum precipitation for a 15 minute period was 0.20 centimeters (0.08 inches) on 24 April 1990 at 1:15 p.m.

The mean wind speed for April 1990 was 3.82 m/s (8.55 mph). The highest wind speed for April 1990 was 25.82 m/s (57.76 mph) on 28 April at 11:00 a.m.

TABLE XIV

Wind Direction Frequency (Percent), by Four Wind-Speed Clases, at the Rocky Flats Plant

(Fifteen-Minute Averages-January 1990)

	Calm	1-3 (m/s)	3-7 (m/s)	7-15 (m/s)	>15 (m/s)	TOTAL
-	5.32	-	-	-	-	5.32
N	-	2.38	4.20	1.15	0.10	7.83
NNE	-	3.43	4.51	0.49	0.00	8.43
NE	-	3.32	3.01	0.03	0.00	6.36
ENE	-	2.06	1.85	0.00	0.00	3.91
E	-	2.62	0.28	0.00	0.00	2.90
ESE	-	2.03	0.42	0.00	0.03	2.48
SE	-	2.06	1.61	0.00	0.00	3.67
SSE	-	2.76	2.52	0.10	0.00	5.38
S	-	2.94	2.27	0.07	0.00	5.28
SSW	-	1.99	3.11	0.21	0.00	5.31
SW	-	1.50	1.43	0.07	0.00	3.00
WSW	-	1.71	3.04	0.70	0.03	5.48
W	-	2.27	2.59	1.40	0.21	6.47
WNW	-	2.69	3.04	2.94	0.03	8.70
NW	-	3.57	5.77	2.27	0.00	11.61
NNW	-	3.01	4.48	0.38	0.00	7.87
TOTALS	5.32	40.34	44.13	9.81	0.40	100. 00

Table X

NPDES Permit Water Sample Results

April 1990

Discharge 001 (Pond B-3)
Discharged 13 times

Parameters		Measured 30-Day Average	Limits 30-Day* Average	Measured Daily Maximum	Limits Daily Maximum
Biochem. Oxygen Demand, 5 Day	mg/l	8.91	10	12.1	25
Total Suspended Solids	mg/l	10	30	28	NA
Nitrates as N	mg/l	2.36	10	4.29	NA
Total Chromium	mg/l	<0.009	0.05	0.011	0.1
Total Phosphorus	mg/l	<0.08	8	0.79	NA
Oil and Grease, Visual		No visual	NA	No visual	NA
Total Residual Chlorine	mg/l	0.05	NA	0.10	0.5
Fecal Coliforms (geometric mean)	#/100 ml	11.3	200	45	NA

Parameter		Measured Daily Minimum	Limits Daily Minimum	Measured Daily Maximum	Limits Daily Maximum
pH	S.U.	6.8	6.0	7.6	9.0

Discharge 002 (Pond A-3)
Discharged 4/1/90 through 4/30/90

Parameters		Measured 30-Day Average	Limits 30-Day* Daily Average	Measured Daily Maximum	Limits Maximum
Nitrates as N	mg/l	5.23	10	6.61	20

		Measured Daily Minimum	Limits Daily Minimum	Measured Daily Maximum	Limits Daily Maximum
pH	S.U.	7.2	6.0	8.2	9.0

Discharge 003 (RO Pilot Plant)
No Discharge

Parameter		Measured Daily Minimum	Limits Daily Minimum	Measured Daily Maximum	Limits Daily Maximum
pH	S.U.	No Discharge	6.0	No Discharge	9.0

* This limitation applies when a minimum of 3 consecutive samples are taken during separate weeks.

Table X

NPDES Permit Water Sample Results (Continued)

April 1990

Discharge 004 (RO Plant)
No Discharge

Parameters		Measured 30-Day Average	Limits 30-Day* Average	Measured Daily Maximum	Limits Daily Maximum
Total Suspended Solids	mg/l	No Discharge	15	No Discharge	25
Total Organic Compounds	mg/l		22		30
Total Phosphorus	mg/l		8		12
Nitrates as N	mg/l		10		20
Total Chromium	mg/l		0.05		0.1
Total Residual Chlorine	mg/l		NA		0.5
		7-Day Average	7-Day Average	30-Day Average	30-Day Average
Fecal Coliform	#/100 ml	No Discharge	400	No Discharge	200
		Daily Minimum	Daily Minimum	Daily Maximum	Daily Maximum
pH	S.U.	No Discharge	6.0	No Discharge	9.0

Discharge 005 (Pond A-4)
Discharged 4/1/90 through 4/30/90

Parameters		n	CMinimum	CMaximum	CAverage
pH	S.U.	30	7.5	8.6	N/A
Nitrates as N	mg/l	30	1.15	3.65	3.01
Nonvolatile Suspended Solids	mg/l	30	0	22	9

Discharge 006 (Pond B-5)
Discharged 4/1/90 through 4/30/90

Parameters		n	CMinimum	CMaximum	CAverage
pH	S.U.	30	7.2	8.3	N/A
Nitrates as N	mg/l	30	2.18	4.44	2.81
Nonvolatile Suspended Solids	mg/l	30	0	22	7

Discharge 007 (Pond C-2)/(Pond C-2 Basin)
Discharged 4/14/90 through 4/30/90

Parameters		n	CMinimum	CMaximum	CAverage
pH	S.U.	16/17	7.5/7.6	8.4/8.5	N/A
Nitrates as N	mg/l	16/17	1.07/1.07	2.13/2.16	1.46/1.51
Nonvolatile Suspended Solids	mg/l	16/17	0/0	15/16	3/5

Table VIII

Onsite and Offsite Water Sample Results - Tritium

April 1990

Tritium (pCi/l)

Location	n*	CMinimum	CMaximum	CMean
Pond A-4	30	-100 ± 130	180 ± 130	-10 ± 20
Pond B-5	30	-110 ± 120	190 ± 150	30 ± 30
Pond C-1	5	-10 ± 140	30 ± 120	1 ± 20
Pond C-2 Basin	17	-100 ± 120	160 ± 130	10 ± 30
Pond C-2	17	-100 ± 120	130 ± 130	20 ± 40
Walnut Creek	30	-130 ± 120	100 ± 120	0 ± 20
Arvada	1	-100 ± 120	-100 ± 120	-100 ± 120
Boulder	4	-50 ± 120	10 ± 120	-10 ± 20
Broomfield	3	-30 ± 120	50 ± 120	0 ± 70
Denver	1	10 ± 130	10 ± 130	10 ± 130
Golden	1	-10 ± 130	-10 ± 130	-10 ± 130
Great Western	3	-120 ± 110	120 ± 120	-20 ± 70
Lafayette	1	50 ± 130	50 ± 130	50 ± 130
Louisville	1	30 ± 130	30 ± 130	30 ± 130
Standley	4	-50 ± 120	30 ± 120	-10 ± 40
Thornton	1	-70 ± 120	-70 ± 120	-70 ± 120
Westminster	4	-80 ± 130	0 ± 120	-40 ± 40

* n- Number of Samples

Table IX

Offsite Water Sample Results - Nitrate as Nitrogen

April 1990

Nitrate (as N) at Great Western Reservoir

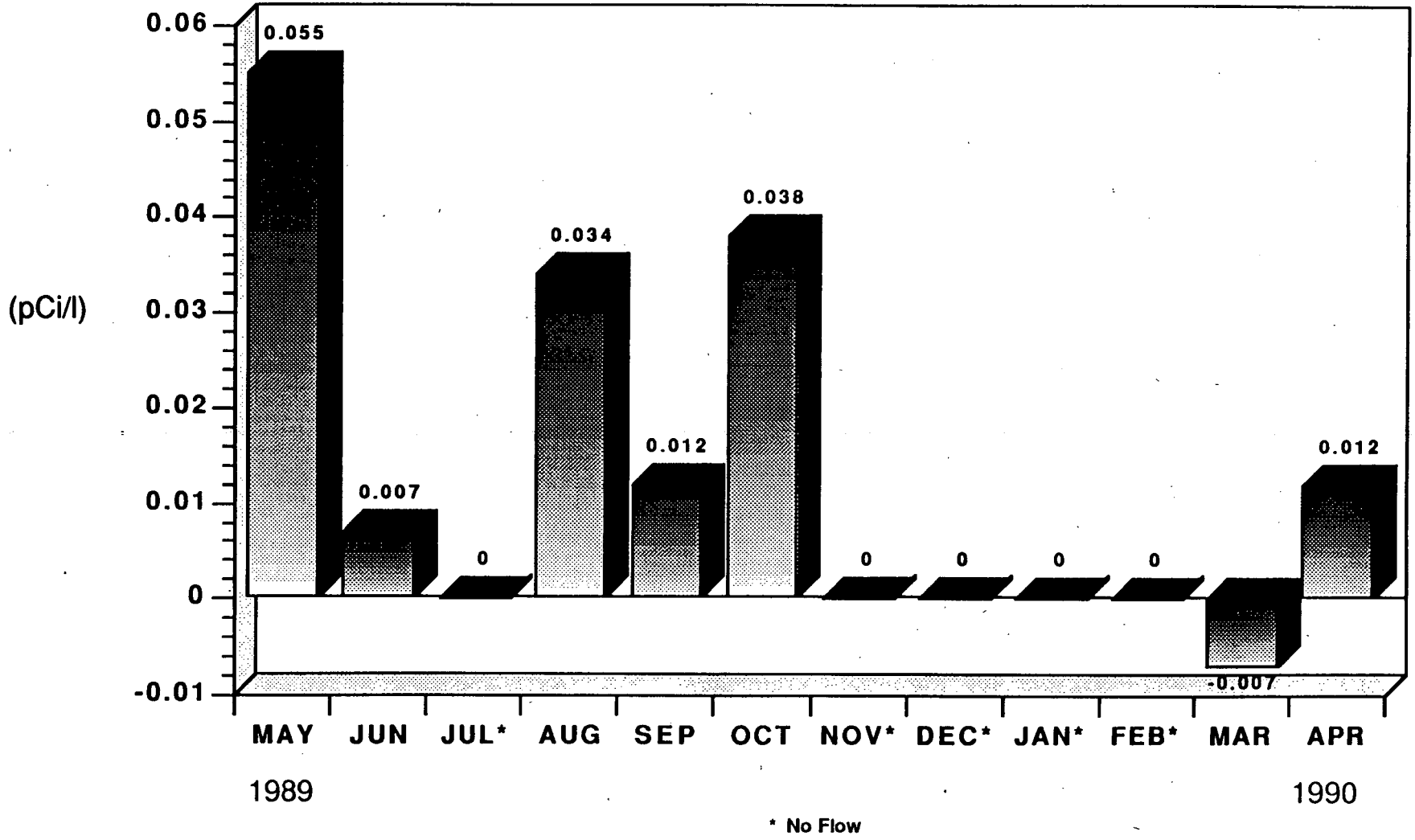
Sample Date	Nitrate (as N) (mg/l)
04/07/90	No Sample
04/13/90	<0.02
04/20/90	<0.02
04/27/90	<0.02

Nitrate (as N) at Standley Lake

Sample Date	Nitrate (as N) (mg/l)
04/07/90	0.04
04/13/90	0.03
04/20/90	0.02
04/27/90	0.04

NOTE: For some nonradioactive parameters, the concentrations that are measured at or below the minimum detectable concentration (MDC) are assigned to MDC. The less than symbol (<) indicates MDC values and calculated values that include one or more MDC's.

PLUTONIUM IN WALNUT CREEK AT INDIANA WATER



* No Flow

Table VII

Offsite Water Sample Results - Plutonium, Uranium, and Americium

April 1990

Reservoirs (pCi/l)

Location	n	Plutonium	Uranium	Americium
Great Western	1*	-0.001 ± 0.008	1.48 ± 0.15	0.000 ± 0.009
Standley Lake	1*	-0.002 ± 0.007	1.78 ± 0.18	0.006 ± 0.010

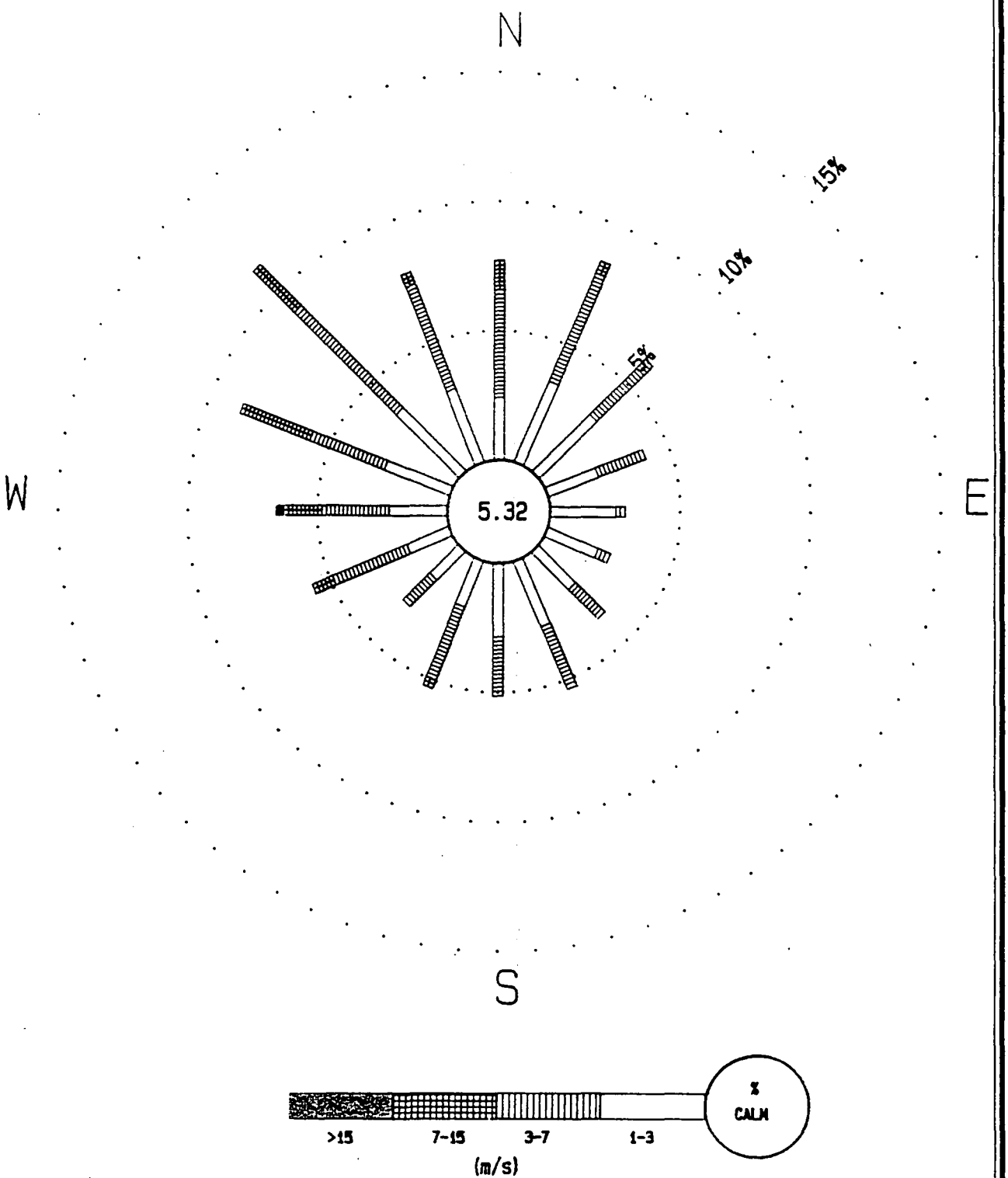
Community Tap Water (pCi/l)

Location	n	Plutonium	Uranium	Americium
Arvada	1	-0.018 ± 0.039	0.74 ± 0.11	0.015 ± 0.042
Boulder	1*	0.000 ± 0.008	0.35 ± 0.11	0.002 ± 0.010
Broomfield	1*	0.003 ± 0.011	0.51 ± 0.15	-0.002 ± 0.009
Denver	1	-0.009 ± 0.030	2.54 ± 0.22	-0.014 ± 0.036
Golden	1	0.001 ± 0.030	1.93 ± 0.20	-0.013 ± 0.038
Lafayette	1	-0.007 ± 0.031	0.03 ± 0.11	-0.013 ± 0.038
Louisville	1	-0.004 ± 0.031	0.19 ± 0.10	0.025 ± 0.046
Thornton	1	0.005 ± 0.043	1.56 ± 0.20	0.010 ± 0.043
Westminster	1*	-0.010 ± 0.010	0.54 ± 0.14	0.011 ± 0.011

* Plutonium, uranium and americium analyses were performed on one sample composited from four weekly grab samples.

Wind Rose for the Rocky Flats Plant

April 1990



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 exposure times (for external exposure to penetrating radiation), then by the appropriate radiation dose conversion factors. That is:

RADIATION DOSE=
(RADIOACTIVITY CONCENTRATION) X
(INTAKE RATE/EXPOSURE TIME) X
(DOSE CONVERSION FACTOR)

The 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).

The 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 of Radiation Protection and Measurements (NCRP) and the International Commission on Radiological Protection (ICRP).

The radioactive materials of importance in calculating radiation dose to the public from Rocky Flats Plant activities include plutonium, uranium, americium, and tritium. The alpha radiation emissions from the plutonium, uranium, and americium are the primary contributors to the projected radiation dose.

DOE Radiation Protection Standards for the Public

ICRP-, NCRP- RECOMMENDED STANDARDS FOR ALL PATHWAYS:

Occasional Exposures -	500 mrem/year Effective Dose Equivalent*
Prolonged Exposures - (>5 Years)	100 mrem/year Effective Dose Equivalent
Individual Organ -	5,000 mrem/year Dose Equivalent

EPA CLEAN AIR ACT STANDARDS FOR THE AIR PATHWAY ONLY:

Effective Dose Equivalent	10 mrem/year

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 Department of Energy (DOE) property boundary and in surrounding communities. Inhalation and water ingestion are the principal potential pathways of human exposure.

Pending final revision of its DOE Order for radiation protection standards for the public, DOE adopted an interim radiation protection standard for DOE environmental activities to be implemented in CY1985 (Va85). This interim standard incorporates guidance from the National Council on Radiation Protection and Measurements (NCRP), as well as, the Environmental Protection Agency Clean Air Act air emission standards (as implemented in 40 CFR 61, Subpart H). Included in the interim standard 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 International Commission on Radiological Protection (ICRP) Publications 30 and 48 methodology and biological models for radiation dosimetry. The DOE interim standard and the dose conversion factor tables are used for assessment of any potential Rocky Flats Plant contribution to public radiation dose. On December 15, 1989, EPA published revised Clean Air Act air emission standards for the DOE facilities (US89). The DOE radiation standards for protection of the public are given above; modified to include the December 15, 1989 EPA Clean Air Act standards for the air pathway.

DOE Derived Concentration Guides

Secondary radioactivity concentration guides can be calculated from the primary radiation dose standards and used as comparison values for measured radioactivity concentrations. DOE provided guidance for calculating these concentration guides - called "Derived Concentration Guides" - in a 1985 memorandum to its facilities (St85). Derived Concentration Guides (DCGs) are the concentrations which would result in an effective dose equivalent of 100 mrem from one 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 following table lists the air and water DCGs for the principal radionuclides of interest at the Rocky Flats Plant.

DOE DERIVED CONCENTRATION GUIDES FOR RADIONUCLIDES OF INTEREST AT THE ROCKY FLATS PLANT

AIR INHALATION:

Radionuclide	DCG (pCi/m3)
Pu-239, -240	0.02

WATER INGESTION:

Radionuclide	DCG (pCi/l)
Pu-239, -240	30
Am-241	30
U-233, -234, -238	500
H-3	2,000,000

Compliance with EPA Clean Air Act Standards

To determine compliance with the EPA air emissions standards, measured airborne effluent radioactivity emissions and estimated radioactivity resuspension from soil are entered into the EPA-approved atmospheric dispersion/dose calculation computer model, AIRDOS-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 effective dose equivalent that a member of the public could receive as a result of Rocky Flats Plant activities is typically less than 1 mrem, or less than 1 percent of the recommended annual standard for all pathways.

References

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

US88b DOE/HE-0071, "Internal Dose Conversion Factors for Calculation of Dose to the Public," U.S. Dept. of Energy, Asst. Secretary of Environment, Safety and Health , July 1988.

US89 U.S. Environmental Protection Agency, Code of Federal Regulations 30 CFR 61, Subpart H, "National Emission Standards of Emissions of Radionuclides other than Radon from Department of Energy Facilities," Washington D.C., December 15, 1989.

Va85 Vaughn, W.A., Asst. Secretary, "Radiation Standards for Protection of the Public in the Vicinity of DOE Facilities," DOE memorandum from Environment, Safety and Health, August 5, 1985.

St86 Stern, R.J., Director tor, "Preparation of Annual Site Environmental Reports for Calendar Year 1985," DOE memorandum, Office of Environmental Guidance, February 18, 1986.

***NOTE:** "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.*

"Effective dose equivalent" 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 weighting factor, and then summing those products. One millirem effective dose equivalent from natural background radiation would have the same health risk as one millirem effective dose equivalent from artificially-produced source of radiation.

Appendix B

COLORADO WATER QUALITY CONTROL COMMISSION STANDARDS

The Colorado Water Quality Control commission has promulgated new standards for the Walnut and Woman Creek drainages downstream from the Rocky Flats Plant. Although EPA has not yet written a new NPDES permit which reflects these standards, in the spirit of the Agreement in Principle completed between DOE and the State of Colorado, the plant is attempting to meet the standards at this time.