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The Administrative Record Staff

SEPTEMBER - 1989 EM-4180110-180

ROCKY FLATS PLANT

MONTHLY ENVIRONMENTAL MONITORING REPORT

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Table I. 1989 Plutonium and Uranium Airborne Effluent Data

Month	Plutonium (08/21/89 - 09/21/89 -SEPT) Release (uCi)	Plutonium (08/21/89 - 09/21/89 -SEPT) C_{Max} (pCi/m^3)	Uranium (08/22/89 - 09/22/89 -SEPT) Release (uCi)	Uranium (08/22/89 - 09/22/89 -SEPT) C_{Max} (pCi/m^3)
CY 1988	15.07	0.023 ± 0.0052	11.28	0.009 ± 0.0009
January	0.33	0.005 ± 0.0005	0.15	0.000 ± 0.0001
February	0.15	0.001 ± 0 0001	0.20	0.001 ± 0.0002
March	0 07	0.001 ± 0.0001	0.04	0.002 ± 0.0002
April	0.28	0.001 ± 0.0001	0.04	0.001 ± 0.0001
May	0.18	0.001 ± 0.0001	-0.03	0.001 ± 0.0001
June	0.06	0.001 ± 0.0001	0.06	0.001 ± 0.0002
July	0.18	0.001 ± 0.0002	0.15	0.001 ± 0.0002
August	0.07	0.001 ± 0.0002	1.87*	0.015 ± 0.0015*
September	0.16	0.032 ± 0.0097**	0.03	0.022 ± 0.0046**
October				
November				
December				
Year to Date	1.47	0.032 ± 0.0097	2.51	0.022 ± 0.0046

* Previously unreported data.

** These maximum concentrations are for a 4-day sampling period only.

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.

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Table II. 1989 Tritium and Beryllium Airborne Effluent Data

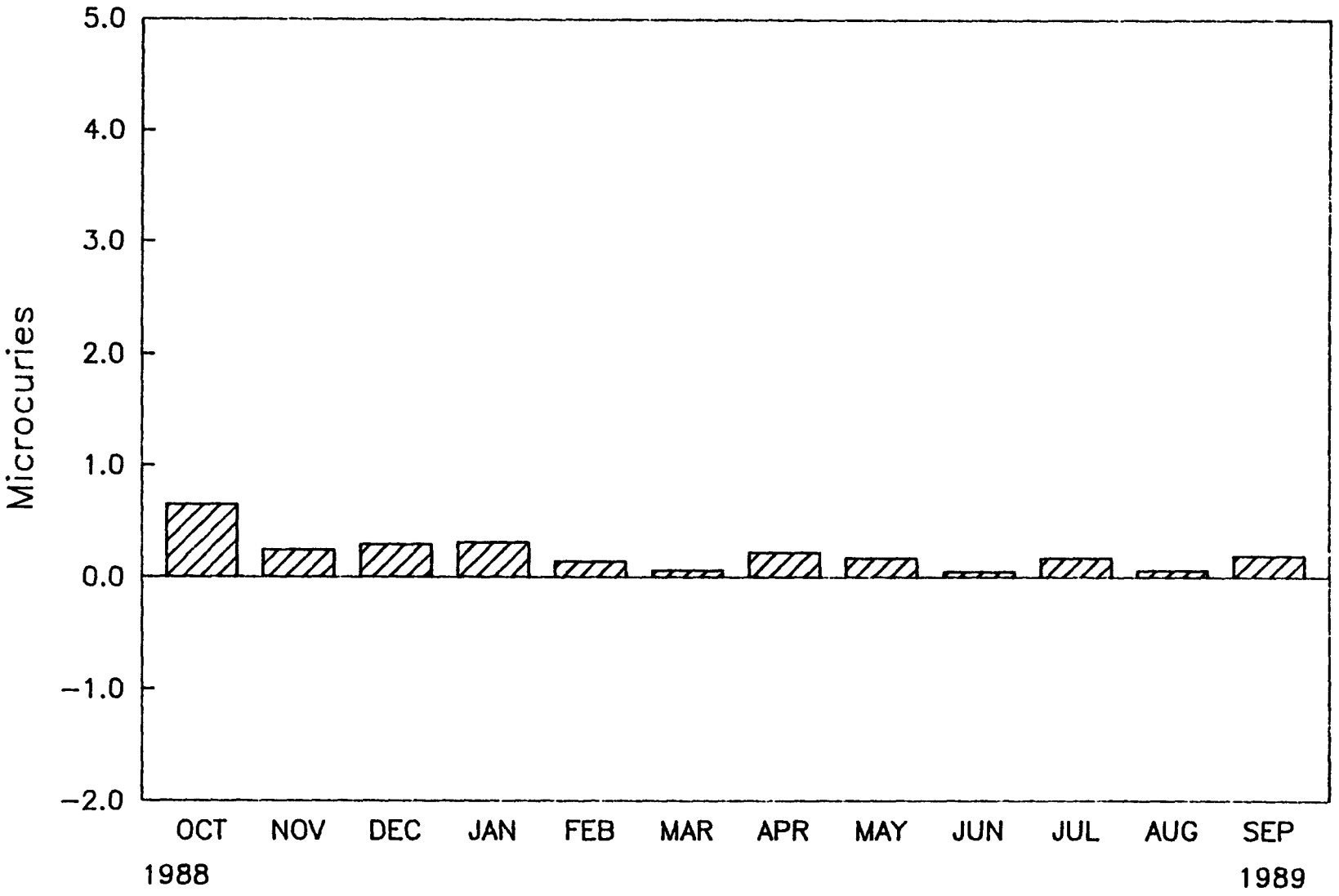
	Tritium (08/28/89 - 09/22/89 -SEPT.)		Beryllium (08/22/89 - 09/22/89 -SEPT)	
Month	Release (Ci)	CMax (pCi/m3)	Release (grams)	CMax (ug/m3)
CY 1988	0.014	417 ± 250	0.1322	0.00041
January	0.001	97 ± 145	0 0285	0.00033
February	0.002	166 ± 120	-0.0392	-0.00005
March	0.007	389 ± 220	-0.0025	0.00000
April	0.152	14000 ± 320	-0.0031	0.00017
May	0.003	65 ± 35	0.0024	0.00004
June	0.001	99 ± 10	0.0525*	0.00025
July	0.001	108 ± 13	0.1727*	0.00106
August	0.006	2735 ± 34	0.1343*	0.00100
September	0.001	85 ± 10	0.0522**	0.00028**
October				
November				
December				
Year to Date	0.173	14000 ± 320	0.3978	0.00106

* These results include no correction for analytical background.

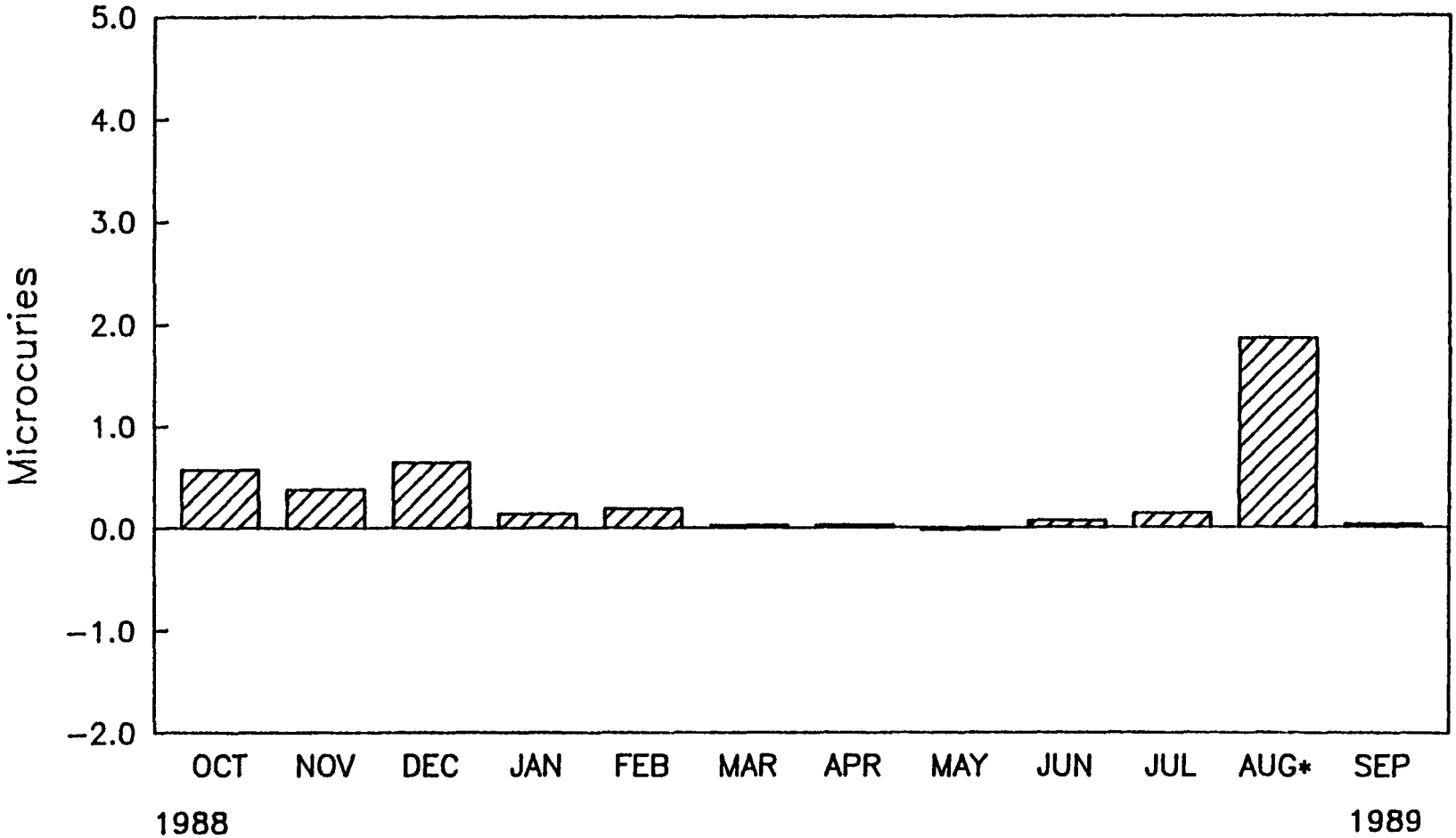
** The calibration methodology for the beryllium analyses was changed beginning with the September samples to improve quality assurance. The previous procedure used the single-point, "simple method of additions," one of the methods recommended by the manufacturer of the graphite furnace atomic absorption 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.

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

PLUTONIUM MEASURED IN EFFLUENT AIR



URANIUM MEASURED IN EFFLUENT AIR



* PREVIOUSLY UNREPORTED DATA

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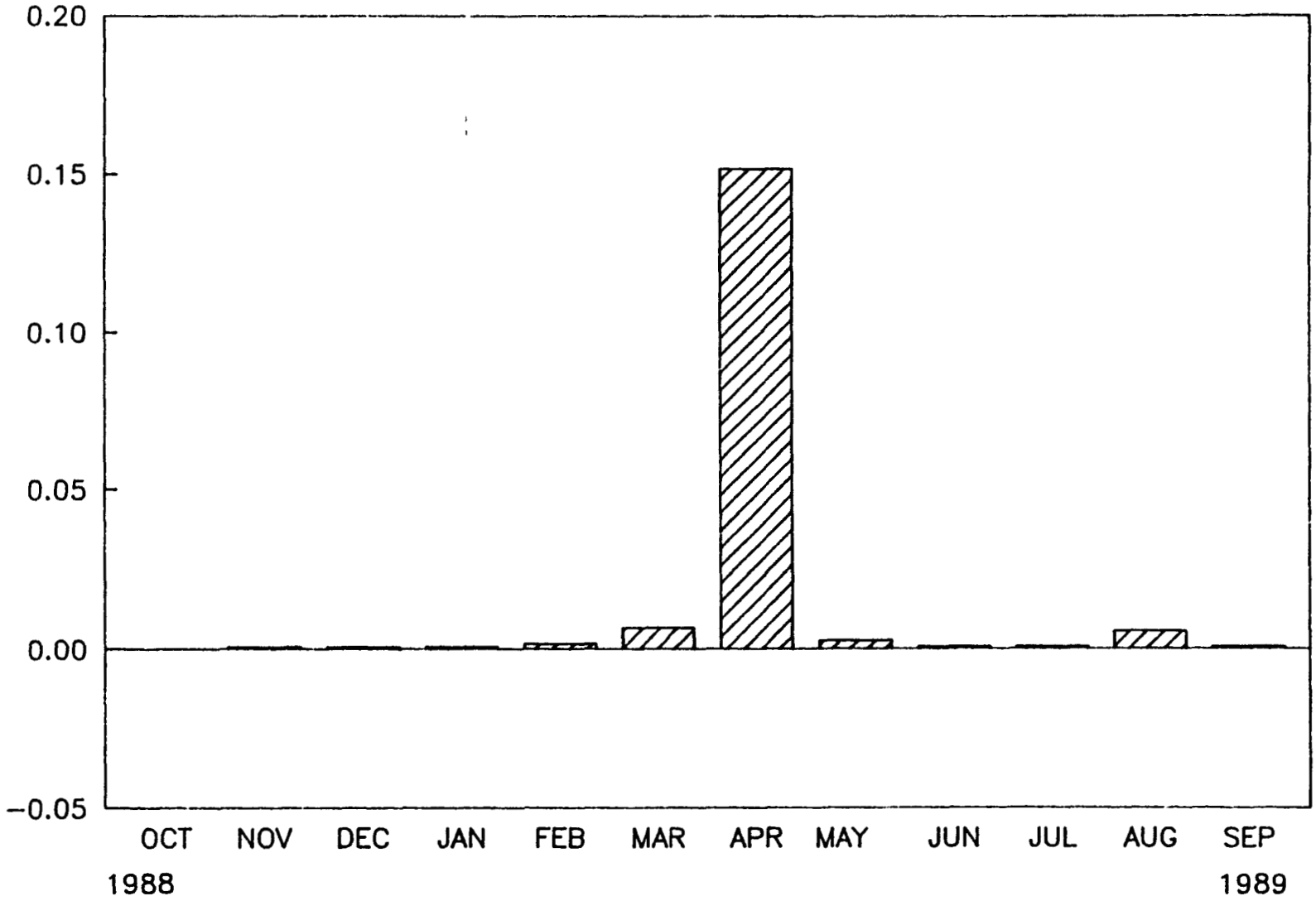
TRITIUM MEASURED IN EFFLUENT AIR



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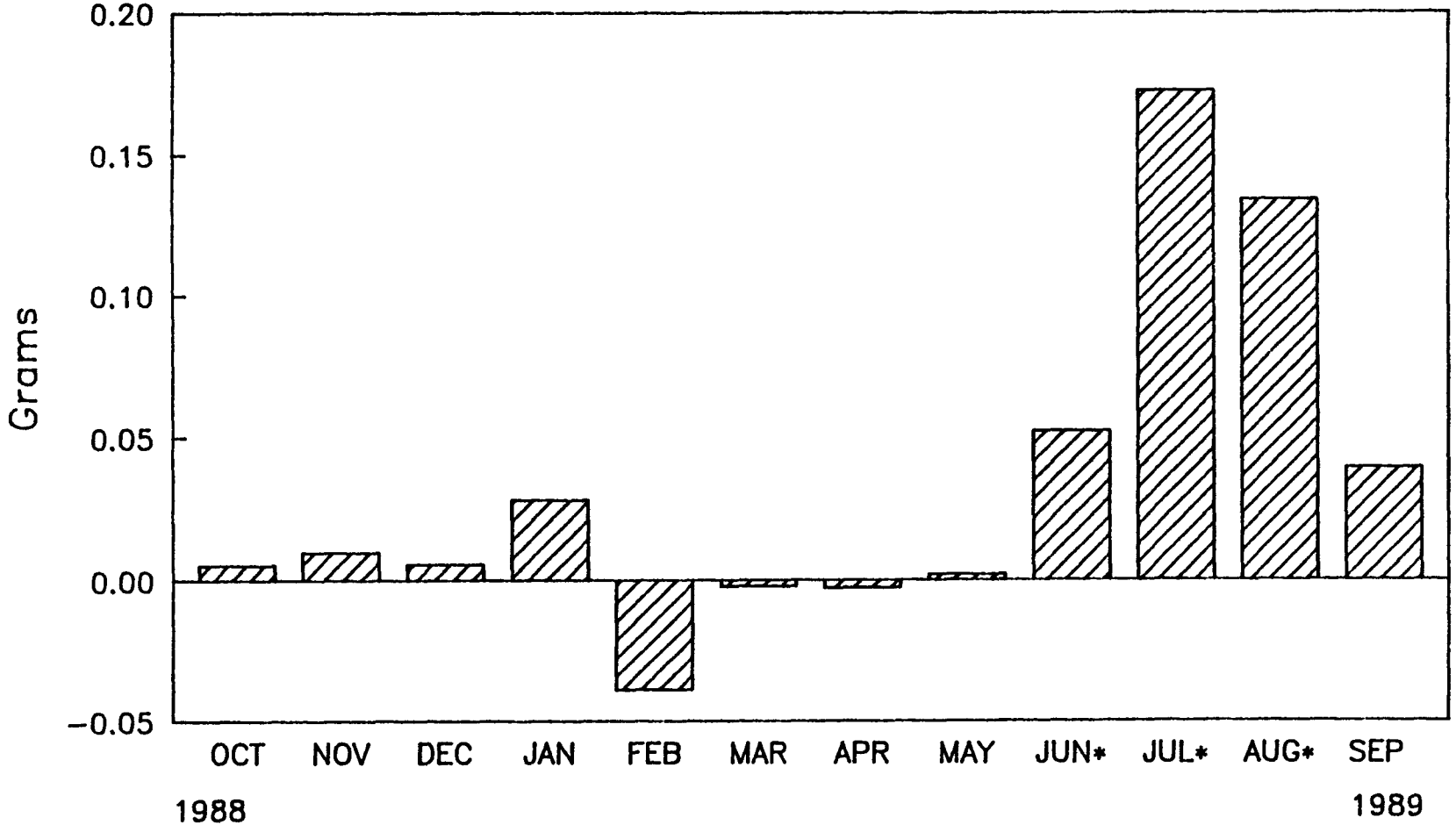
BERYLLIUM MEASURED IN EFFLUENT AIR



* NOT BLANK CORRECTED

Table III.

Plutonium Concentration in Ambient Air for Selected Onsite Samplers

SEPTEMBER 1989
(08/22/89 - 09/19/89)

Location	N	Volume (m^3)	Avg. Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-05	1*	16000	0 000026	0.000009
S-06	2	33000	0.000017	0.000008
S-07	2	28000	0.000526	0.000102
S-08	2	33000	0.000977	0.000183
S-09	2	29000	0.000869	0.000162

NOTE: The total long-lived alpha activities of the remaining onsite ambient air sampler filters were below 0 01 pCi/m3. Plutonium-specific analyses are performed and reported if any filter from these air samplers exceeds the Rocky Flats Plant screening level of 0.01 pCi/m3 total long-lived alpha activity. Plutonium concentration data is routinely reported only for the five locations (above) which have historically produced the largest total long-lived alpha activities of the 23 onsite ambient air sampler locations.

Air sampler S-02 was inoperational during this period.

* The sample period for S-05 was from 08/22/89 to 09/05/89. The air sampler was inoperational for the remainder of the period.

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CORRECTIONS TO AMBIENT AIR MONITORING DATA

The attached addenda to the ambient air monitoring data are corrections to previously-reported data from April through August 1989. The addenda values reflect corrections for analytical background contributions using a background value specific to the analytical sample batch, rather than based on cumulative population data developed over many batches. The change in methodology was prompted by an apparent negative bias in plutonium concentrations for ambient air data calculated using a cumulative population background value which was generated beginning in April 1989. The batch background values should provide more representative analytical background corrections, since they will more accurately reflect variations in background from one sample batch to another.

The range of deviations from previously-reported plutonium concentrations is ± 0.000002 pCi/m^3. The changes fall within the range of the reported uncertainties associated with both the original and the corrected values for these measurements.

No changes resulted from the batch background correction for August 1989 onsite ambient air data since the calculated batch background value was identical to the cumulative population background value.

No batch background corrections could be made to the July 1989 perimeter and community ambient air data because there was an insufficient number of background analyses run to appropriately calculate correction factors.

All September 1989 ambient air plutonium concentration data have been calculated using the batch background correction methodology. This methodology will be used for all ambient air data reported in the future or until further notice.

Cumulative population background corrections also have been used to calculate radioactivity in airborne effluents. A review of airborne effluent data for uranium and americium emissions indicated that no batch-to-batch variation occurred for these data and that the population background correction was not inappropriate. There was a slight difference in results for plutonium airborne effluent values. However, the cumulative background correction methodology yielded consistently higher airborne release values compared with the batch background correction methodology. Because the previously-reported plutonium airborne effluent values present an upper bound on plutonium releases, no corrected data will be issued for these values. Beginning with the October sampling period, the batch background correction methodology will be used for all airborne effluent radioactivity analyses.

A review of radioactivity in water data is underway to determine if the batch background correction methodology may be used for these analyses. Results of that review will be announced in a later Monthly Environmental Monitoring Report.

Table III.

Plutonium Concentration in Ambient Air for Selected Onsite Samplers

JULY 1989
(06/27/89 - 07/25/89)

Location	N	Volume (m^3)	Avg. Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-05	2	32000	0.000067	0 000017
S-06	2	32000	0.000095	0.000026
S-07	2	25000	0.001119	0.000231
S-08	2	31000	0.001211	0.000256
S-09	2	26000	0.001602	0.000318

NOTE: The total long-lived alpha activities of the remaining onsite ambient air sampler filters were below 0.01 pCi/m3. Plutonium-specific analyses are performed and reported if any filter from these air samplers exceeds the Rocky Flats Plant screening level of 0.01 pCi/m3 total long-lived alpha activity. Plutonium concentration data is routinely reported only for the five locations (above) which have historically produced the largest total long-lived alpha activities of the 23 onsite ambient air sampler locations.

Air samplers S-02 and S-19 were inoperational during this period.

Table III.

Plutonium Concentration in Ambient Air for Selected Onsite Samplers

JUNE 1989
(05/30/89 - 06/27/89)

Location	N	Volume (m^3)	Avg. Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-05	2	31000	0.000036	0.000011
S-06	2	33000	0.000100	0.000023
S-07	2	26000	0.000244	0.000064
S-08	2	34000	0.000276	0.000063
S-09	2	28000	0.000252	0.000054

NOTE: The total long-lived alpha activities of the remaining onsite ambient air sampler filters were below 0.01 pCi/m3. Plutonium-specific analyses are performed and reported if any filter from these air samplers exceeds the Rocky Flats Plant screening level of 0.01 pCi/m3 total long-lived alpha activity. Plutonium concentration data is routinely reported only for the five locations (above) which have historically produced the largest total long-lived alpha activities of the 23 onsite ambient air sampler locations.

Table III.

Plutonium Concentration in Ambient Air for Selected Onsite Samplers

MAY 1989
(05/02/89 - 05/30/89)

Location	N	Volume (m^3)	Avg. Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-05	2	31000	0.000037	0.000012
S-06	2	32000	0.000185	0.000041
S-07	2	28000	0.000153	0.000043
S-08	1*	17000	0.000111	0.000027
S-09	2	31000	0.000216	0.000055

* The S-08 plutonium analysis was performed on a single filter from the 05/02/89-05/16/89 sampling period. The air sampler was inoperational during the remainder of the month.

NOTE: The total long-lived alpha activities of the remaining onsite ambient air sampler filters were below 0.01 pCi/m3. Plutonium-specific analyses are performed and reported if any filter from these air samplers exceeds the Rocky Flats Plant screening level of 0.01 pCi/m3 total long-lived alpha activity. Plutonium concentration data is routinely reported only for the five locations (above) which have historically produced the largest total long-lived alpha activities of the 23 onsite ambient air sampler locations.

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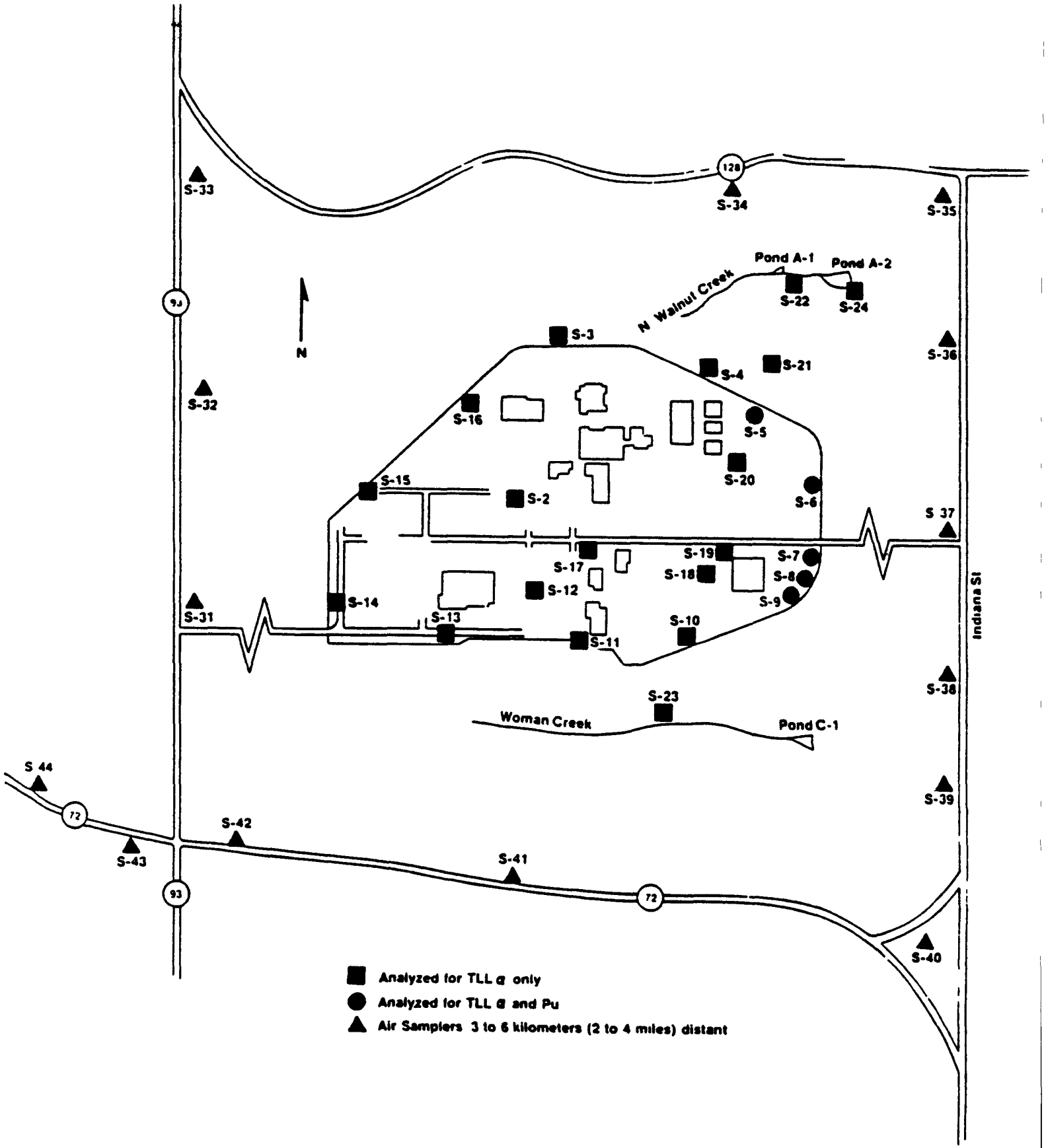
Table III.

Plutonium Concentration in Ambient Air for Selected Onsite Samplers

APRIL 1989
(03/21/89 - 05/02/89)

Location	N	Volume (m^3)	Avg. Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-05	3	46000	0.000050	0.000012
S-06	3	46000	0.000169	0.000213
S-07	3	46000	0.000205	0.000036
S-08	3	53000	0.000224	0.000039
S-09	3	48000	0.000512	0.000098

NOTE: The total long-lived alpha activities of the remaining onsite ambient air sampler filters were below 0.01 pCi/m3. Plutonium-specific analyses are performed and reported if any filter from these air samplers exceeds the Rocky Flats Plant screening level of 0.01 pCi/m3 total long-lived alpha activity. Plutonium concentration data is routinely reported only for the five locations (above) which have historically produced the largest total long-lived alpha activities of the 23 onsite ambient air sampler locations.



Location of Onsite and Plant Perimeter Ambient Air Samplers
(Portions of figure are not to scale)

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Table IV.

Plutonium Concentration in Ambient Air for Perimeter Samplers

SEPTEMBER 1989
(08/29/89 - 09/26/89)

Location	N	Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-31	1	29000	0.000000	0.000003
S-32	1	31000	0.000000	0.000003
S-33	1	31000	0.000000	0.000003
S-34	1	31000	0.000003	0.000003
S-35	1	28000	0.000000	0.000003
S-36	1	39000	0.000000	0.000002
S-37	1	30000	0.000002	0.000003
S-38	1	30000	0.000002	0.000003
S-39	1	32000	0.000000	0.000003
S-40	1	29000	0.000002	0.000003
S-41	1	33000	0.000001	0.000003
S-42	1	31000	0.000002	0.000003
S-43	1	32000	-0.000001	0.000003
S-44	1	31000	-0.000001	0.000003

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Table IV.

Plutonium Concentration in Ambient Air for Perimeter Samplers

AUGUST 1989
(08/01/89 - 08/29/89)

Location	N	Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-31	1	28000	0.000004	0 000003
S-32	1	31000	0.000004	0.000003
S-33	1	32000	0.000001	0.000003
S-34	1	30000	0.000004	0.000003
S-35	1	27000	0.000001	0.000003
S-36	*	0		
S-37	1	30000	0.000002	0.000003
S-38	1	29000	0.000001	0.000003
S-39	1	31000	0.000001	0.000003
S-40	1	28000	0.000001	0.000003
S-41	1	32000	0.000001	0.000003
S-42	1	31000	0.000000	0.000003
S-43	1	32000	0.000002	0.000003
S-44	1	30000	0.000001	0.000003

* Air sampler inoperational during this period.

Table IV.

Plutonium Concentration in Ambient Air for Perimeter Samplers

JUNE 1989
(05/23/89 - 06/20/89)

Location	N	Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-31	1	29000	0.000001	0.000003
S-32	1	31000	0.000000	0.000003
S-33	1	32000	0.000000	0.000003
S-34	1	29000	0.000001	0.000003
S-35	1	33000	0.000000	0.000003
S-36	1	30000	0.000002	0.000003
S-37	1	31000	0.000006	0.000003
S-38	1	30000	0.000001	0.000003
S-39	1	32000	0.000001	0.000003
S-40	1	29000	0.000000	0.000003
S-41	1	33000	0.000001	0.000003
S-42	1	31000	0.000000	0.000003
S-43	1	32000	0.000000	0.000003
S-44	1	31000	0.000000	0.000003

Table IV.

Plutonium Concentration in Ambient Air for Perimeter Samplers

MAY 1989
(04/25/89 - 05/23/89)

Location	N	Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-31	1	30000	0.000000	0.000003
S-32	*			
S-33	1	32000	0.000000	0.000003
S-34	1	31000	0.000001	0.000003
S-35	1	34000	0.000001	0.000003
S-36	1	31000	0.000001	0.000003
S-37	1	31000	0.000004	0.000003
S-38	1	31000	0.000000	0.000003
S-39	1	32000	0.000006	0.000003
S-40	1	30000	0.000002	0.000003
S-41	1	33000	0.000000	0.000003
S-42	1	31000	0.000001	0.000003
S-43	1	36000	0.000000	0.000003
S-44	1	31000	0.000001	0.000003

* Air sampler inoperational during this period.

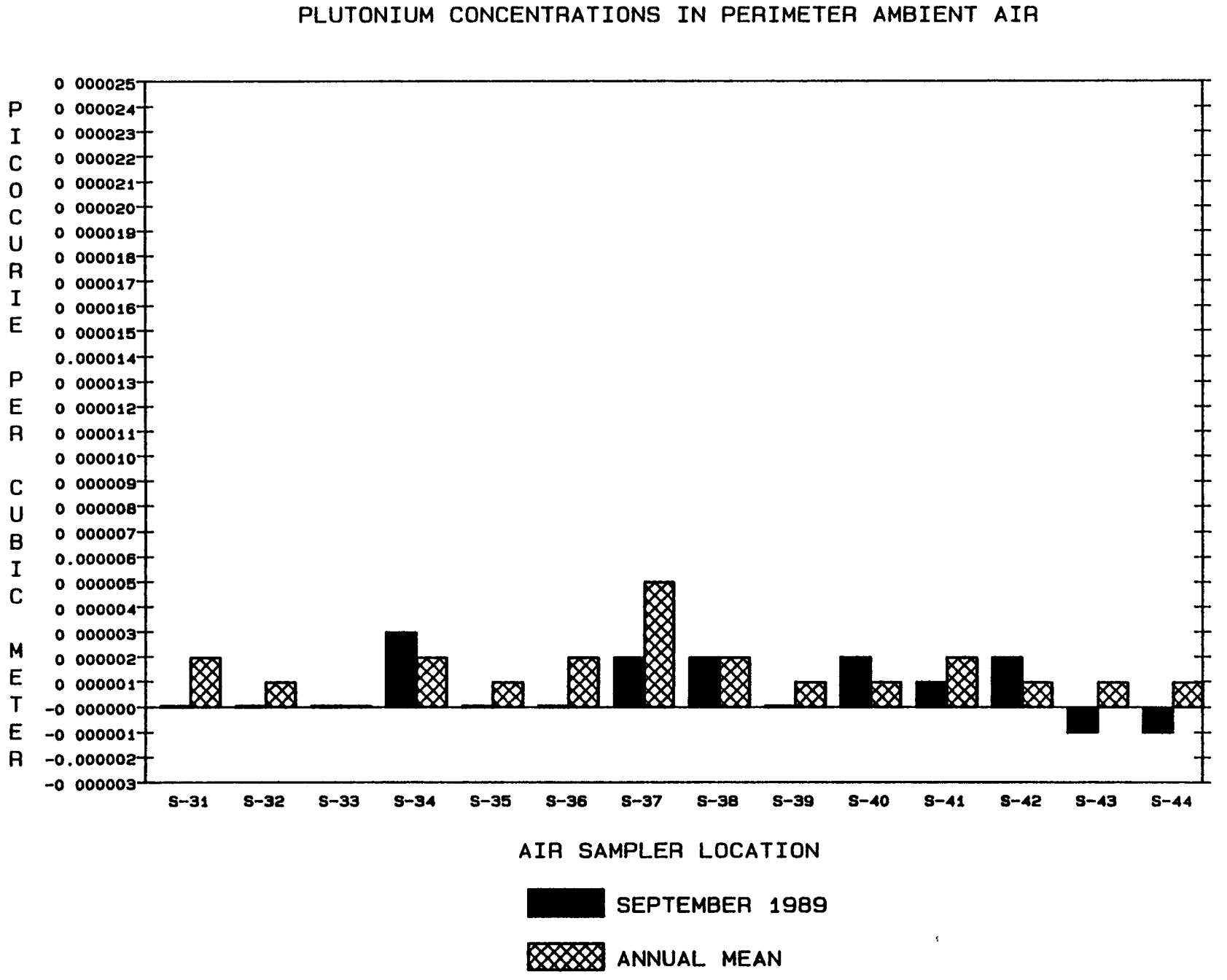
Table IV.

Plutonium Concentration in Ambient Air for Perimeter Samplers

APRIL 1989
(03/28/89 - 04/25/89)

Location	N	Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-31	1	30000	-0.000001	0.000003
S-32	*	0		
S-33	1	33000	0.000001	0.000003
S-34	1	31000	0.000002	0.000003
S-35	1	28000	0.000002	0.000003
S-36	1	32000	0.000001	0.000003
S-37	1	32000	0.000005	0.000003
S-38	1	31000	0.000002	0.000004
S-39	1	33000	0.000002	0.000003
S-40	1	32000	0.000001	0.000003
S-41	1	30000	0.000001	0.000004
S-42	1	32000	0.000000	0.000003
S-43	1	33000	0.000001	0.000003
S-44	1	32000	0.000001	0.000004

* Air sampler inoperational during this period.


PLUTONIUM CONCENTRATIONS IN PERIMETER AMBIENT AIR
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AIR SAMPLER LOCATION
SEPTEMBER 1989
ANNUAL MEAN

Table V.

Plutonium Concentration in Ambient Air for Community Samplers

SEPTEMBER 1989
(08/30/89 - 09/27/89)

Location	Community Name	N		Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-51	MARSHALL	1		29000	0.000001	0.000003
S-52	JEFFCO AIRPORT	1		31000	0 000001	0.000003
S-53	SUPERIOR	1	*	21000	0.000001	0.000004
S-54	BOULDER	1		32000	0.000003	0.000003
S-55	LAFAYETTE	1		33000	0.000001	0.000003
S-56	BROOMFIELD	1		28000	0.000000	0.000003
S-57	WALNUT CREEK	1		30000	0.000001	0 000003
S-58	WAGNER	1		32000	0.000003	0.000003
S-59	LEYDEN	1		32000	0.000001	0.000003
S-60	WESTMINSTER	1		29000	0.000000	0.000003
S-61	DENVER	1		27000	0.000000	0.000003
S-62	GOLDEN	1		30000	0.000001	0.000003
S-68	LAKEVIEW POINTE	1		30000	0.000000	0.000003
S-73	COTTON CREEK	1		30000	0.000000	0.000003

* The sample period for S-53 was from 09/08/89 to 09/27/89. The air sampler was inoperational for the beginning of the period.

Table V.

Plutonium Concentration in Ambient Air for Community Samplers

JUNE 1989
(05/24/89 - 06/21/89)

Location	Community Name	N	Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-51	MARSHALL	1	29000	0.000000	0.000003
S-52	JEFFCO AIRPORT	1	32000	0 000004	0.000003
S-53	SUPERIOR	**	0		
S-54	BOULDER	*	31000		
S-55	LAFAYETTE	1	33000	0.000004	0.000003
S-56	BROOMFIELD	1	29000	0.000000	0.000003
S-57	WALNUT CREEK	1	30000	0.000000	0.000003
S-58	WAGNER	1	32000	0.000000	0.000003
S-59	LEYDEN	1	33000	0.000001	0.000003
S-60	WESTMINSTER	1	22000	0.000001	0.000004
S-61	DENVER	1	28000	0.000000	0.000003
S-62	GOLDEN	1	31000	0.000003	0.000003
S-68	LAKEVIEW POINTE	1	30000	0.000001	0.000003
S-73	COTTON CREEK	1	22000	0.000001	0.000004

* No plutonium analysis of S-54 sample reported due to insufficient chemical recovery of both sample aliquots.

** Air sampler inoperational during this period.

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Table V.

Plutonium Concentration in Ambient Air for Community Samplers

MAY 1989
(04/26/89 - 05/24/89)

Location	Community Name	N	Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-51	MARSHALL	1	30000	0.000001	0.000003
S-52	JEFFCO AIRPORT	1	32000	0.000000	0.000003
S-53	SUPERIOR	1	29000	0.000000	0.000003
S-54	BOULDER	1	32000	0.000000	0.000003
S-55	LAFAYETTE	1	33000	0.000000	0.000003
S-56	BROOMFIELD	1	29000	0.000001	0.000003
S-57	WALNUT CREEK	1	30000	0.000000	0.000003
S-58	WAGNER	*	0		
S-59	LEYDEN	1	33000	0.000000	0.000003
S-60	WESTMINSTER	1	21000	0.000004	0.000005
S-61	DENVER	1	27000	0.000000	0.000004
S-62	GOLDEN	1	30000	0.000002	0.000003
S-68	LAKEVIEW POINTE	1	30000	0.000000	0.000003
S-73	COTTON CREEK	1	20000	-0.000001	0.000005

* Air sampler inoperational during this period.

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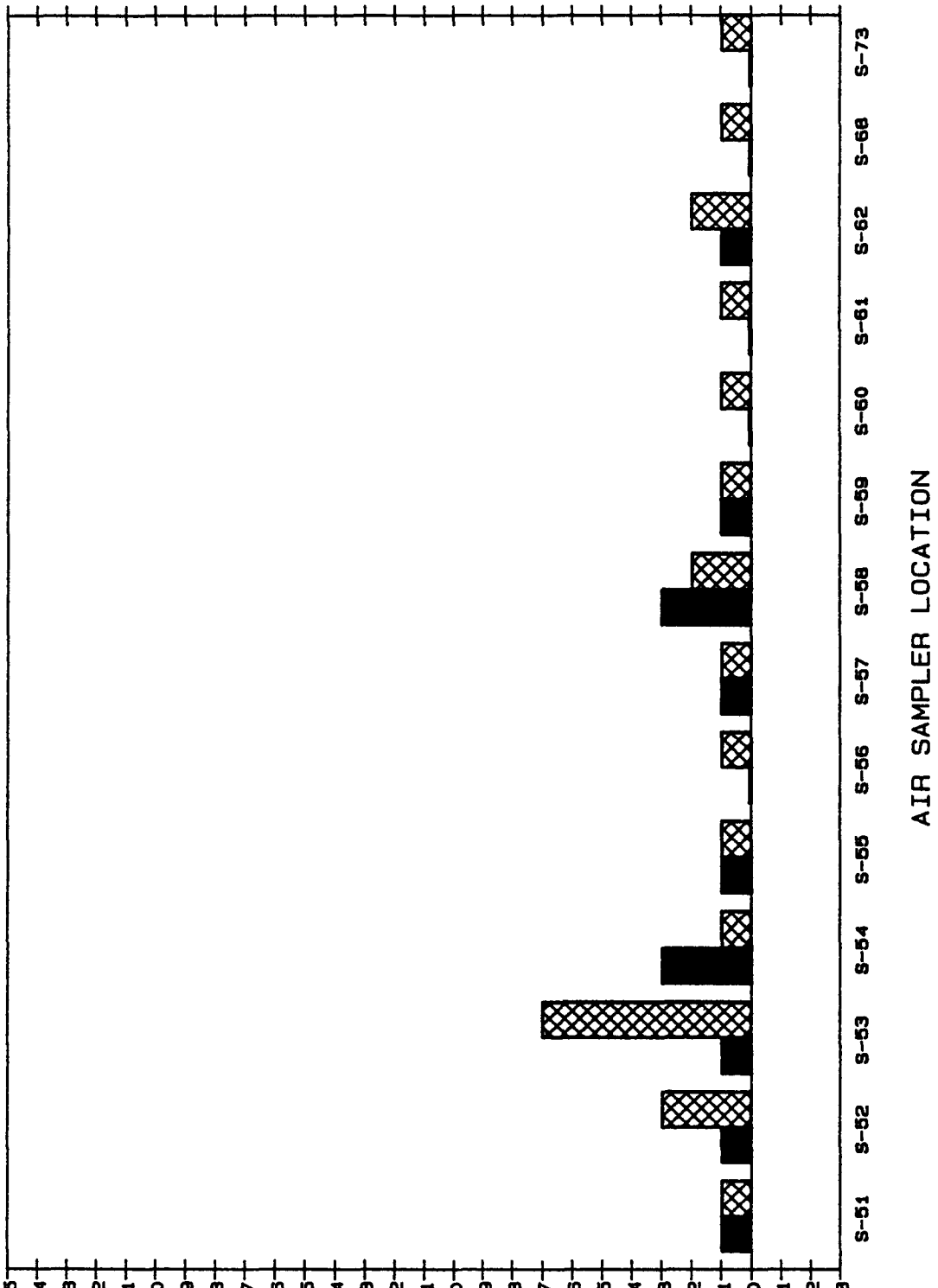
Table V.

Plutonium Concentration in Ambient Air for Community Samplers

APRIL 1989
(03/29/89 - 04/26/89)

Location	Community Name	N	Volume (m^3)	Pu Conc. (pCi/m^3)	+/- Error (pCi/m^3)
S-51	MARSHALL	1	31000	0.000001	0.000003
S-52	JEFFCO AIRPORT	1	33000	0.000000	0.000003
S-53	SUPERIOR	1	28000	0.000000	0.000004
S-54	BOULDER	1	31000	0.000000	0.000004
S-55	LAFAYETTE	1	34000	0.000000	0.000003
S-56	BROOMFIELD	1	30000	0.000001	0.000004
S-57	WALNUT CREEK	1	31000	0.000000	0.000003
S-58	WAGNER	*	0		
S-59	LEYDEN	1	33000	0.000000	0.000003
S-60	WESTMINSTER	1	22000	-0.000001	0.000004
S-61	DENVER	1	27000	0.000000	0.000004
S-62	GOLDEN	1	29000	0.000000	0.000004
S-68	LAKEVIEW POINTE	1	33000	0.000002	0.000003
S-73	COTTON CREEK	1	25000	0.000000	0.000004

* Air sampler inoperational during this period.


PLUTONIUM CONCENTRATIONS IN COMMUNITY AMBIENT AIR
PICOCURIE PER CUBIC METER
0.000025
0.000024
0.000023
0.000022
0.000021
0.000020
0.000019
0.000018
0.000017
0.000016
0.000015
0.000014
0.000013
0.000012
0.000011
0.000010
0.000009
0.000008
0.000007
0.000006
0.000005
0.000004
0.000003
0.000002
0.000001
-0.000000
-0.000001
-0.000002
-0.000003
S-51
S-52
S-53
S-54
S-55
S-56
S-57
S-58
S-59
S-60
S-61
S-62
S-68
S-73
AIR SAMPLER LOCATION
SEPTEMBER 1989
ANNUAL MEAN

Location of Community Ambient Air Samplers

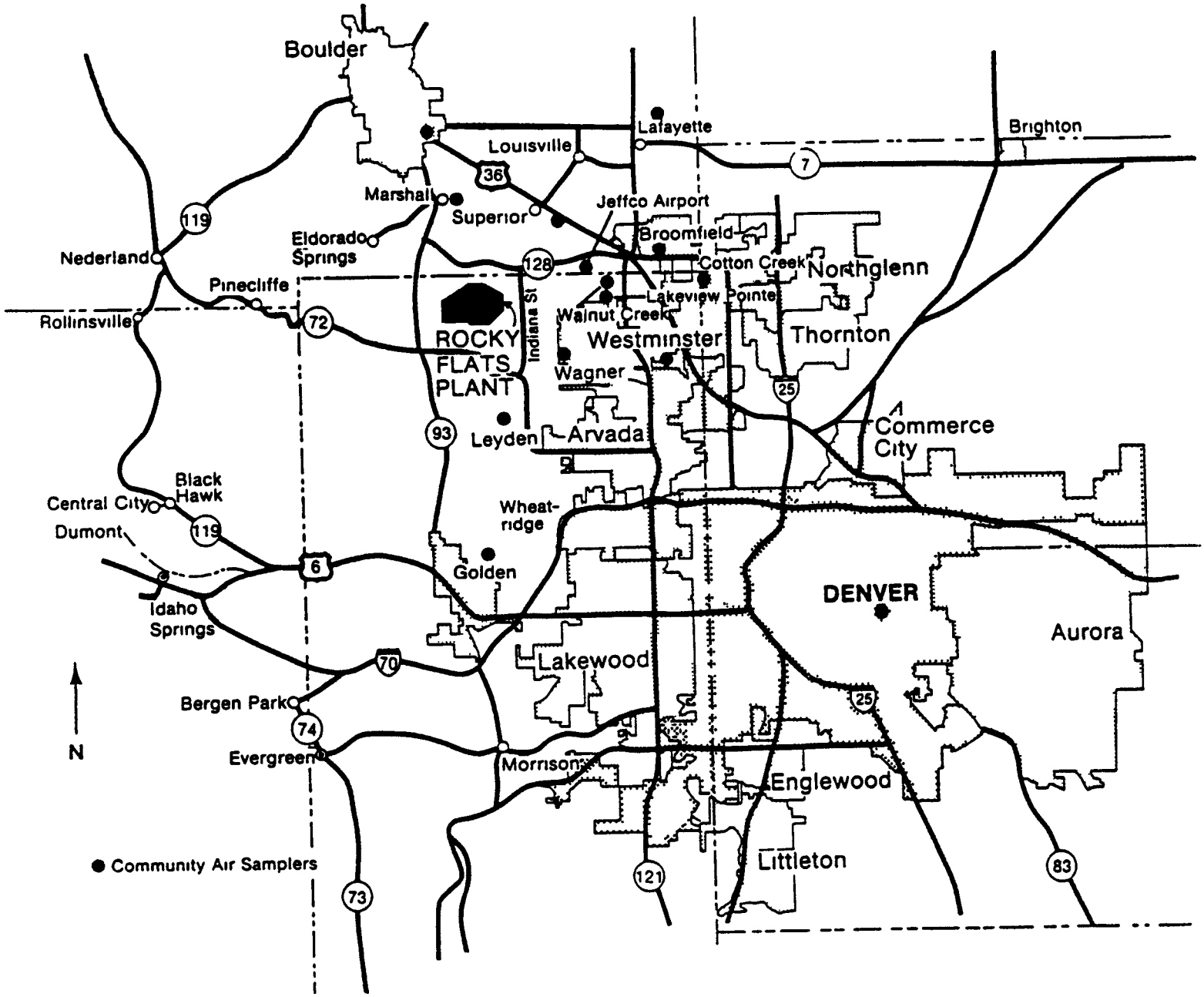


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Table VI. Onsite Water Sample Results - Plutonium, Uranium, and Americium

Holding Pond Outfall (pCi/l)

Location	Plutonium	Uranium	Americium
Pond A-4			
09/02/89-09/03/89	-0.016 ± 0.028	5.66 ± 0.40	0.109 ± 0.037
09/04/89-09/08/89	0.023 ± 0 032	5.14 ± 0.37	-0.007 ± 0 028
09/09/89-09/10/89	0.001 ± 0 030	5.93 ± 0 38	-0.007 ± 0.030
09/11/89-09/15/89	0.008 ± 0.029	5.49 ± 0.38	-0.013 ± 0.029
09/16/89-09/17/89	-0.002 ± 0.029	4.84 ± 0.33	0.023 ± 0.036
09/18/89-09/20/89	0.006 ± 0.029	4.48 ± 0.31	-0.007 ± 0.030
09/23/89-09/24/89	-0.001 ± 0.029	4.48 ± 0 31	-0.012 ± 0.029
09/27/89-09/29/89	-0.002 ± 0.030	4.79 ± 0.32	-0.026 ± 0.030
09/30/89-10/01/89	-0.017 ± 0.027	5.07 ± 0.37	-0.008 ± 0.031
Average Concentration	0.000 ± 0.028	5.10 ± 0.35	0.006 ± 0.031
Pond B-5			
09/02/89-09/03/89	-0.002 ± 0.030	2.53 ± 0.21	0.009 ± 0.029
09/04/89-09/08/89	0.012 ± 0.031	2.59 ± 0.21	0.019 ± 0.034
09/09/89-09/10/89	0.007 ± 0.032	1.24 ± 0.16	-0.020 ± 0.027
09/11/89-09/15/89	0.016 ± 0.031	0.76 ± 0.13	-0.003 ± 0.030
09/16/89-09/17/89	0.003 ± 0.029	1.79 ± 0 18	-0.002 ± 0.031
09/18/89-09/20/89	0.009 ± 0.030	3.34 ± 0.23	0.021 ± 0.031
09/23/89-09/24/89	-0.011 ± 0.027	1.48 ± 0.16	0 020 ± 0.032
09/27/89-09/29/89	-0.018 ± 0.027	2.06 ± 0.18	0.064 ± 0.035
09/30/89-10/01/89	0.009 ± 0.031	2.75 ± 0.20	-0.007 ± 0.032
Average Concentration	0.003 ± 0.030	2.06 ± 0.19	0.011 ± 0.031
Pond C-1			
09/11/89-09/15/89	0.070 ± 0.040	1.64 ± 0.17	0.005 ± 0.007
09/18/89-09/22/89	0.057 ± 0.036	2.54 ± 0.21	0.003 ± 0.006
09/25/89-09/29/89	0.010 ± 0.007	2.78 ± 0.22	0.020 ± 0.007
Average Concentration	0.046 ± 0.031	2.32 ± 0.020	0 009 ± 0.007
Pond C-2			
No Discharge			
Average Concentration			

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Table VI. Onsite Water Sample Results - Plutonium, Uranium, and Americium

Holding Pond Outfall (pCi/l)

Location	Plutonium	Uranium	Americium
Walnut Creek at Indiana			
09/02/89-09/03/89	0.047 ± 0.038	3.63 ± 0.27	0.121 ± 0.038
09/04/89-09/08/89	-0.002 ± 0.006	3.94 ± 0.27	-0.003 ± 0.006
09/09/89-09/10/89	0.019 ± 0.034	4.07 ± 0.32	-0.021 ± 0.027
09/11/89-09/15/89	0.009 ± 0.007	3.54 ± 0.25	0.000 ± 0.006
09/16/89-09/17/89	0.018 ± 0.033	**	-0.018 ± 0.029
09/18/89-09/20/89	0.009 ± 0.007	3.18 ± 0.24	0.000 ± 0.006
09/23/89-09/24/89	0 018 ± 0.031	3.31 ± 0.22	-0.004 ± 0.029
09/27/89-09/29/89	0.002 ± 0.006	3.79 ± 0.27	-0.003 ± 0.006
09/30/89-10/01/89	-0.015 ± 0.028	4.24 ± 0.28	-0.014 ± 0.031
Average Concentration	0.012 ± 0.023	**	0.006 ± 0.021

** Indicates incomplete analysis.

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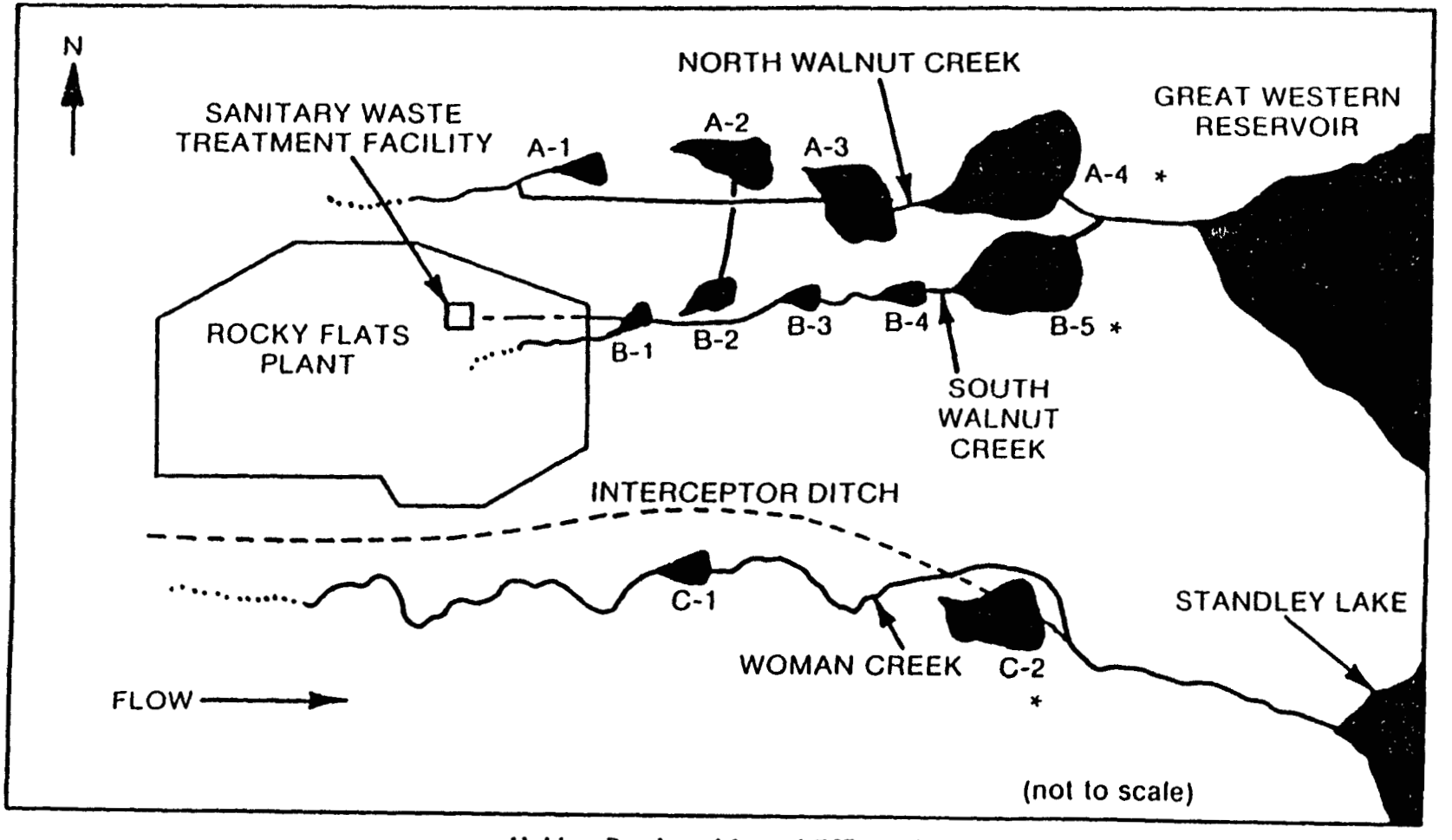
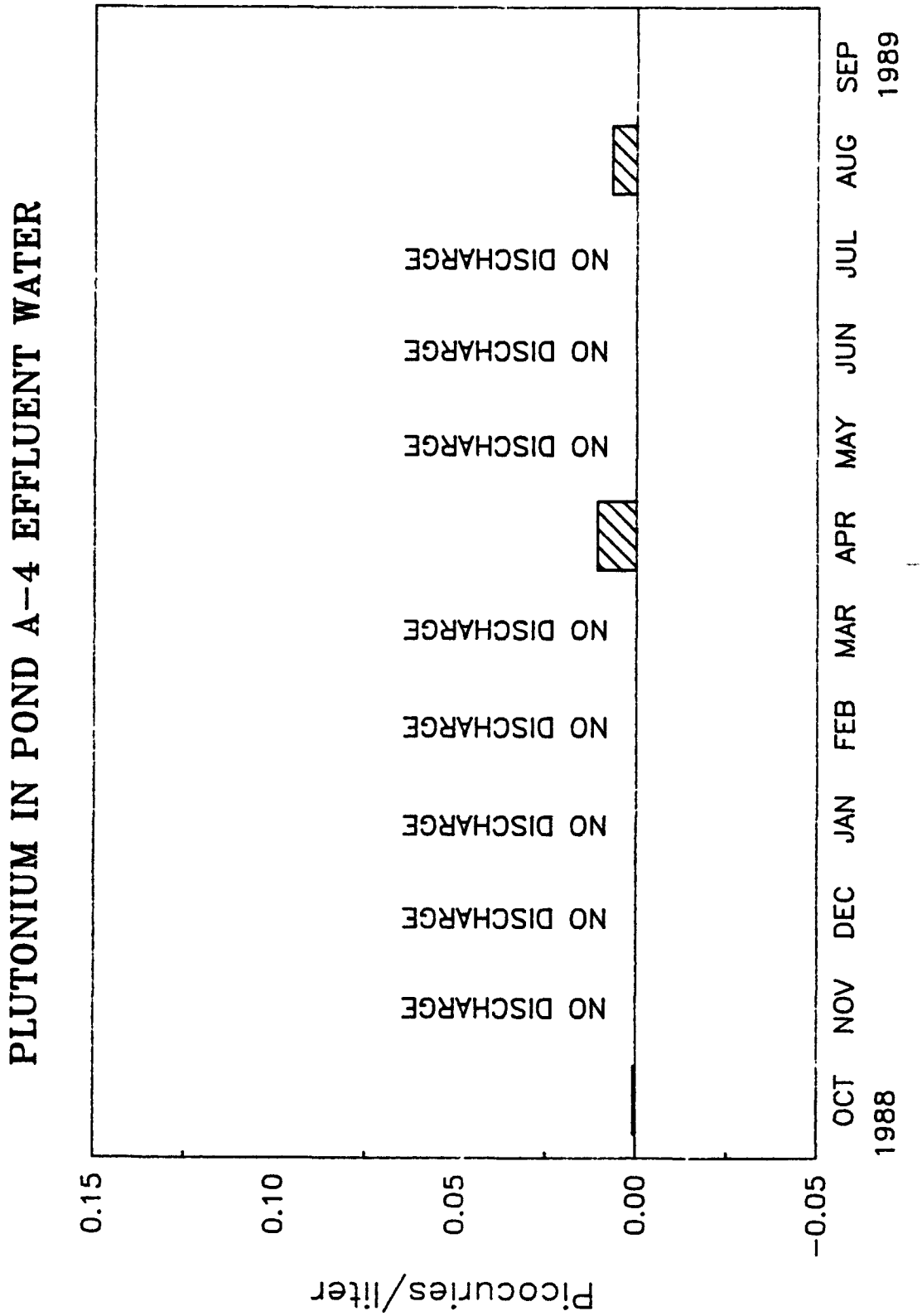


Holding Ponds and Liquid Effluent Watercourses

* Diversion capabilities exist for indicated locations. For the month of September 1989, A-4 and B-5 were diverted.


PLUTONIUM IN POND A-4 EFFLUENT WATER
Picocuries/liter
0.15
0.10
0.05
0.00
-0.05
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
1988
1989
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE

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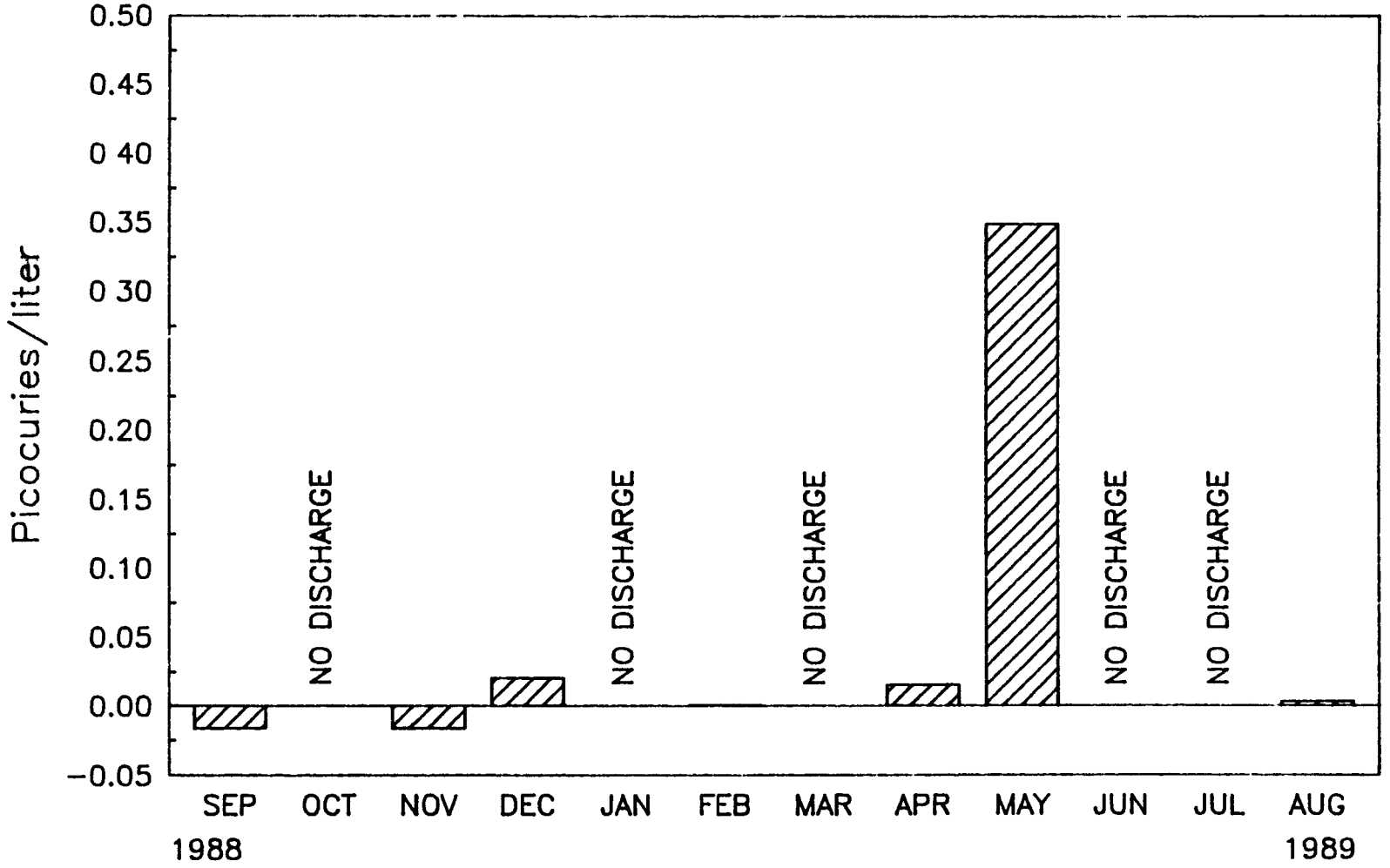
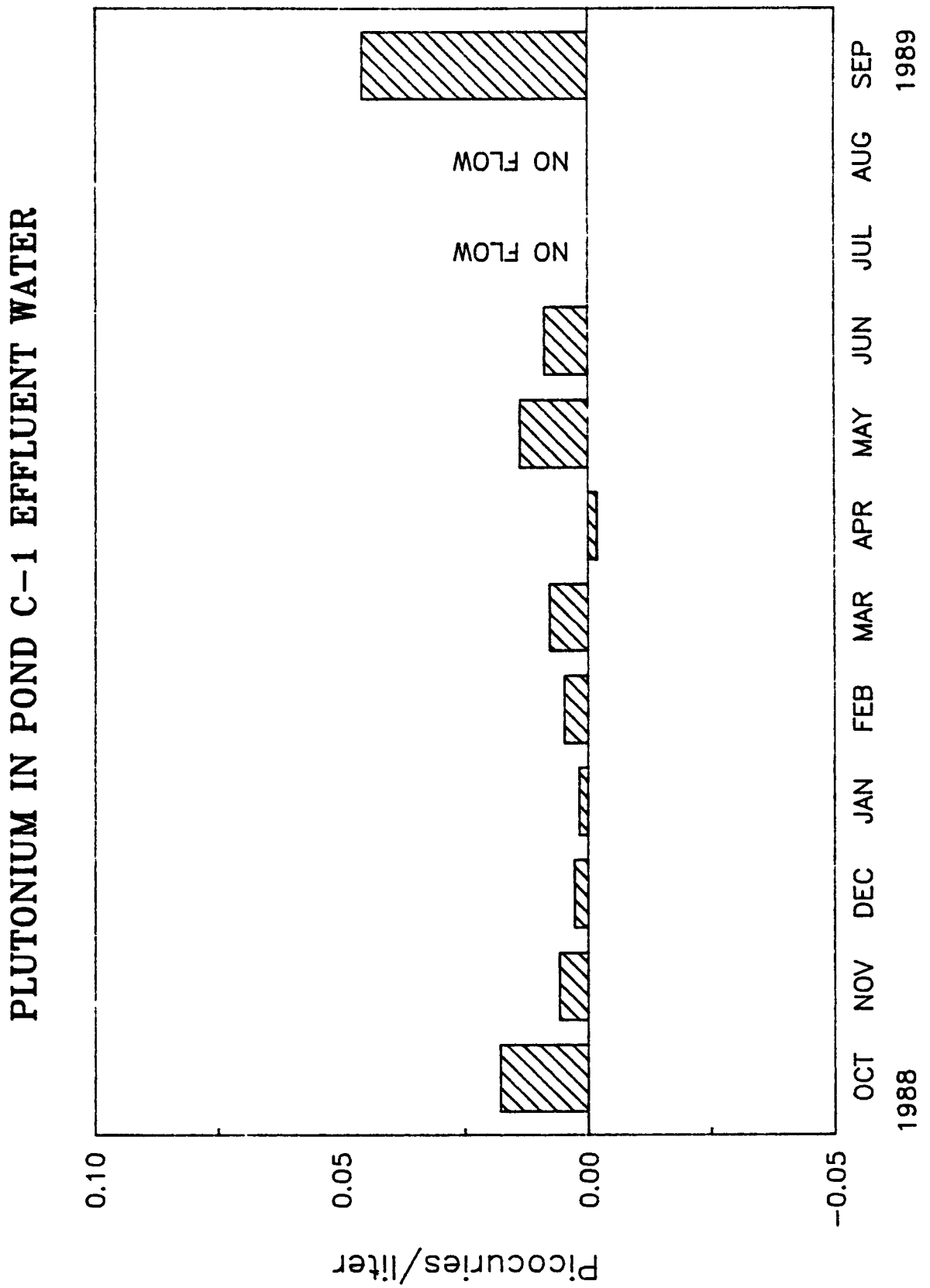
PLUTONIUM IN POND B-5 EFFLUENT WATER




PLUTONIUM IN POND C-1 EFFLUENT WATER
Picocuries/liter
0.10
0.05
0.00
-0.05
NO FLOW
NO FLOW
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
1988
1989

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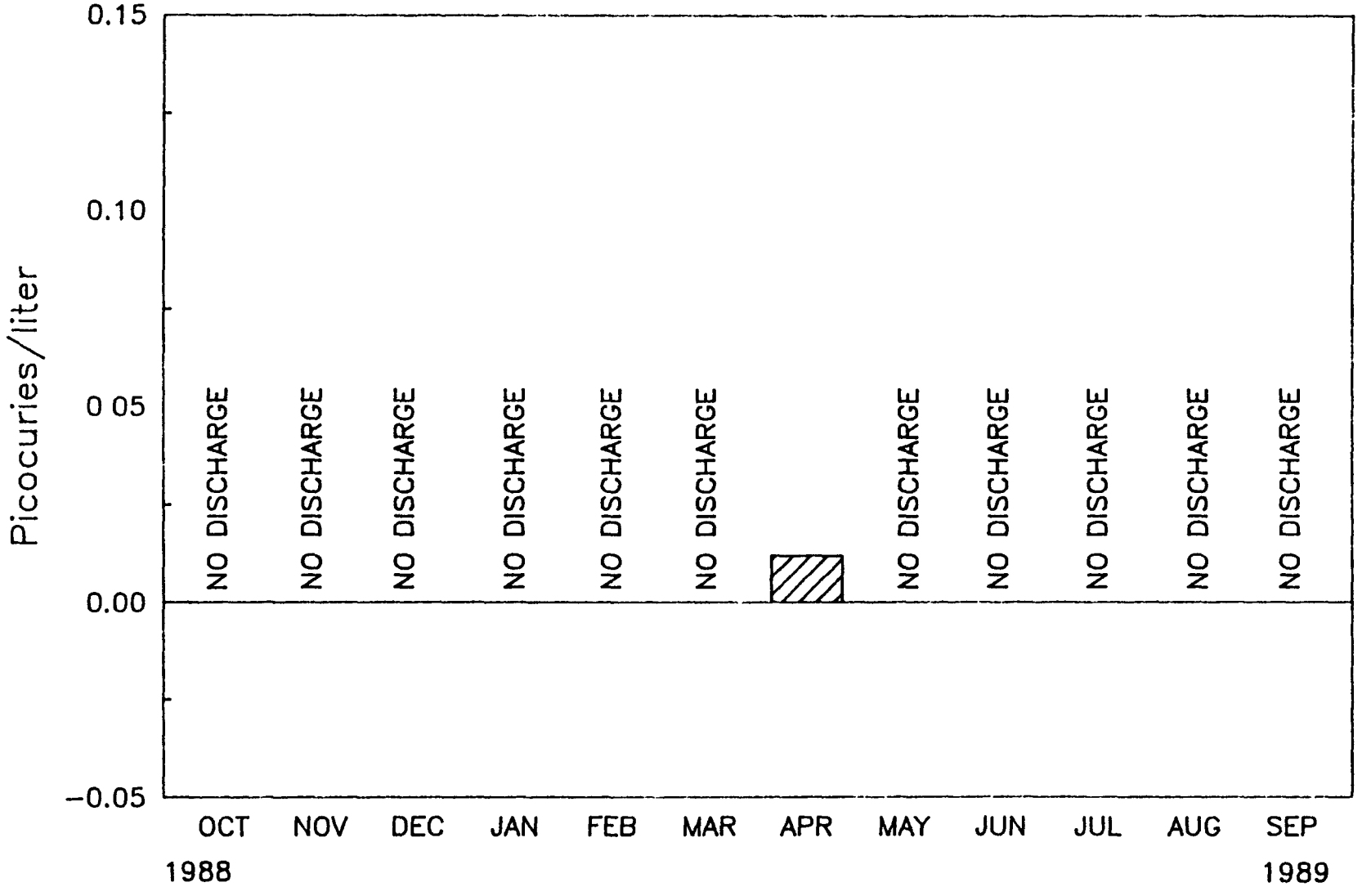
PLUTONIUM IN POND C-2 EFFLUENT WATER



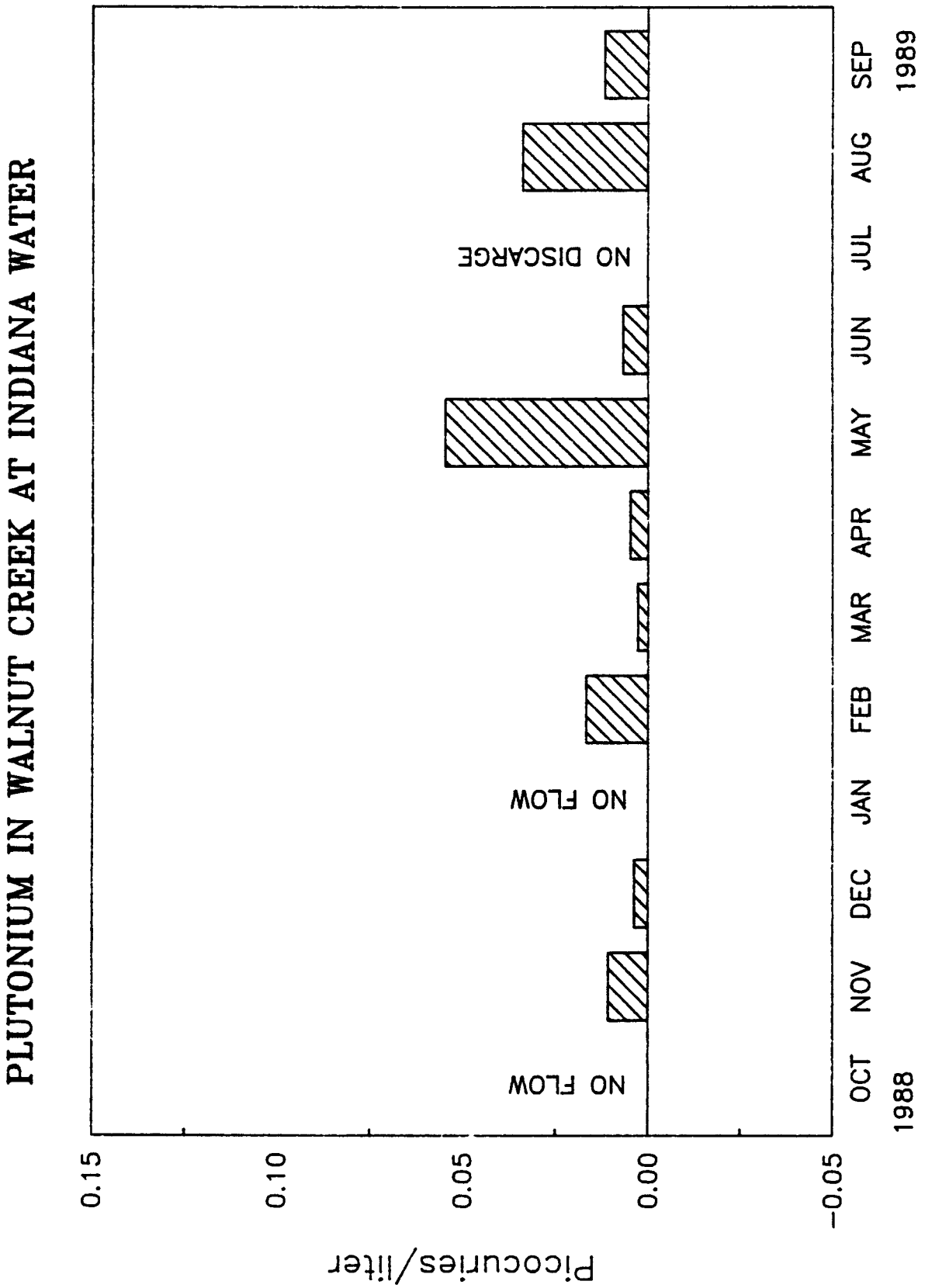

PLUTONIUM IN WALNUT CREEK AT INDIANA WATER
Picocuries/liter
0.15
0.10
0.05
0.00
-0.05
NO FLOW
NO FLOW
NO DISCHARGE
OCT
NOV
DEC
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
1988
1989

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Table VII. Offsite Water Sample Results - Plutonium, Uranium, and Americium

Reservoirs (pCi/l)

Location	n	Plutonium	Uranium	Americium
Great Western	1*	-0.002 ± 0.007	0.88 ± 0 14	0.005 ± 0.008
Standley Lake	1*	0.004 ± 0.007	1.18 ± 0.15	0 003 ± 0 007

Community Tap Water (pCi/l)

Location	n	Plutonium	Uranium	Americium
Arvada	1	0.003 ± 0.032	0.67 ± 0.12	-0.002 ± 0.032
Boulder	1*	0.000 ± 0.008	0.09 ± 0.11	0.007 ± 0.008
Broomfield	1*	0.002 ± 0.008	0.77 ± 0.13	**
Denver	1	-0.008 ± 0.028	0.13 ± 0.11	0.053 ± 0.037
Golden	1	0.007 ± 0.031	0.78 ± 0.14	0.014 ± 0.028
Lafayette	1	-0.012 ± 0.028	0.14 ± 0.12	-0.017 ± 0.029
Louisville	1	0.002 ± 0.033	0.19 ± 0.11	-0.006 ± 0.029
Thornton	1	-0.001 ± 0.030	2.45 ± 0.28	-0.015 ± 0.028
Westminster	1*	0.002 ± 0.008	0.26 ± 0.11	-0.002 ± 0.008

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

** Indicates incomplete analysis.

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Table VIII. Onsite and Offsite Water Sample Results - Tritium

Tritium (pCi/l)

Location	n	[c]Minimum	[c]Maximum	[c]Average
Pond A-4	25	-170 ± 140	140 ± 150	10 ± 150
Pond B-5	31	- 70 ± 140	200 ± 160	30 ± 140
Pond C-1	3	0 ± 150	70 ± 150	30 ± 150
Walnut Creek at Indiana	31	- 80 ± 160	220 ± 160	60 ± 150
Arvada	1	150 ± 150	150 ± 150	150 ± 150
Boulder	4	- 70 ± 140	80 ± 150	20 ± 140
Broomfield	3*	30 ± 150	80 ± 150	60 ± 130
Denver	1	- 10 ± 100	- 10 ± 100	- 10 ± 100
Golden	1	80 ± 100	80 ± 100	80 ± 100
Great Western	4	70 ± 100	160 ± 150	100 ± 140
Lafayette	1	- 20 ± 150	- 20 ± 150	- 20 ± 150
Louisville	1	40 ± 150	40 ± 150	40 ± 150
Standley	4	- 50 ± 100	150 ± 150	60 ± 140
Thornton	1	90 ± 100	90 ± 100	90 ± 100
Westminster	4	- 50 ± 140	80 ± 100	20 ± 140

* Four samples originally taken, however analytical failure occurred on sample dated 9/21/89

Table IX. Offsite Water Sample Results - Nitrate as Nitrogen

Nitrate (as N) at Great Western Reservoir

Sample Date	Nitrate (as N) (mg/l)
09/07/89	0.03
09/14/89	0.04
09/22/89	<0.02
09/29/89	<0.02

Nitrate (as N) at Standley Lake

Sample Date	Nitrate (as N) (mg/l)
09/07/89	0.04
09/14/89	0.10
09/22/89	0.11
09/29/89	0.14

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.

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Table X. NPDES Permit Water Sample Results

Discharge 001 (Pond B-3)
No Discharge

Parameters		Measured 30-Day Average	Limits 30-Day* Average	Measured Daily Maximum	Limits Daily Maximum
Biochem. Oxygen Demand, 5 Day	mg/l	No Discharge	10	No Discharge	25
Total Suspended Solids	mg/l		30		NA
Nitrates as N	mg/l		10		NA
Total Chromium	mg/l		0 05		0.1
Total Phosphorus	mg/l		8		NA
Oil and Grease, Visual			NA		NA
Total Residual Chlorine	mg/l		NA		0.5
Fecal Coliforms	#/100 ml		200		NA

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

Discharge 002 (Pond A-3)
Seven days of discharge **

Parameters		Measured 30-Day Average	Limits 30-Day* Average	Measured Daily Maximum	Limits Daily Maximum
Nitrates as N	mg/l	3.16	10	3.52	20

		Measured Daily Minimum	Limits Daily Minimum	Measured Daily Maximum	Limits Daily Maximum
pH	S.U.	7.4	6.0	7.9	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.

** Pond A-3 was discharged September 22 - 29, 1989 Under the Plant NPDES permit, daily composite samples normally would be taken throughout the discharge. For the period September 22-24, a composite samples was collected on September 25 Daily samples were collected for the remainder of the discharge.

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Table X NPDES Permit Water Sample Results (Continued)

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)
25 days of discharge

Parameters		n	[c]Minimum	[c]Maximum	[c]Average
pH	S.U	25	7.3	8.2	N/A
Nitrates as N	mg/l	25	0.18	2.45	0.65
Nonvolatile Suspended Solids	mg/l	25	0	1	0.08

Discharge 006 (Pond B-5)
31 days of discharge

Parameters		n	[c]Minimum	[c]Maximum	[c]Average
pH	S.U.	31	6.0	7.8	N/A
Nitrates as N	mg/l	31	0.05	1.58	0.61
Nonvolatile Suspended Solids	mg/l	31	0	1	0.10

Discharge 007 (Pond C-2)
No Discharge

Parameters		n	[c]Minimum	[c]Maximum	[c]Average
pH	S.U	No Discharge			
Nitrates as N	mg/l				
Nonvolatile Suspended Solids	mg/l				

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Table XI. Water Sample Results, Nonradioactive Parameters

Walnut Creek at Indiana Street

31 days of discharge

Parameters		n	[c]Minimum	[c]Maximum	[c]Average
pH	S.U.	31	6.8	8.2	N/A
Nitrates as N	mg/l	31	<0.02	1.04	<0.37

Total Volume (gallons) = 18,312,000

Table XII.
Daily Flow Data Recorded at the
Walnut Creek at Indiana Gaging Station
Ponds A-4 and B-5,
September, 1989

DATE	POND A-4 (gallons)	POND B-5 (gallons)	WALNUT CREEK AT INDIANA (gallons)
09/01/89	510,000	435,000	766,000
09/02/89	559,000	517,000	921,000
09/03/89	580,000	499,000	820,000
09/04/89	418,000	445,000	732,000
09/05/89	498,000	439,000	690,000
09/06/89	548,000	508,000	805,000
09/07/89	455,000	403,000	732,000
09/08/89	577,000	505,000	874,000
09/09/89	403,000	510,000	811,000
09/10/89	430,000	332,000	714,000
09/11/89	356,000	382,000	634,000
09/12/89	300,000	301,000	669,000
09/13/89	427,000	327,000	728,000
09/14/89	412,000	309,000	693,000
09/15/89	463,000	346,000	716,000
09/16/89	384,000	480,000	768,000
09/17/89	296,000	647,000	816,000
09/18/89	226,000	425,000	607,000
09/19/89	223,000	382,000	547,000
09/20/89	75,000	384,000	465,000
09/21/89	13,000	378,000	417,000
09/22/89	No Flow	292,000	370,000
09/23/89	" "	227,000	298,000
09/24/89	" "	223,000	289,000
09/25/89	" "	188,000	178,000
09/26/89	" "	175,000	166,000
09/27/89	428,000	148,000	415,000
09/28/89	383,000	167,000	491,000
09/29/89	478,000	304,000	703,000
09/30/89	425,000	14,000	477,000
TOTAL VOLUME	9,867,000	10,592,000	18,312,000

Table XIII.
Daily Flow Data Recorded at
Ponds C-1 and C-2 During
September, 1989

(WOMAN CREEK)

DATE	POND C-1 (gallons)	POND C-2 (gallons)
09/01/89	No Flow *	No Discharge
09/02/89	" "	" "
09/03/89	" "	" "
09/04/89	" "	" "
09/05/89	" "	" "
09/06/89	" "	" "
09/07/89	" "	" "
09/08/89	" "	" "
09/09/89	" "	" "
09/10/89	" "	" "
09/11/89	" "	" "
09/12/89	" "	" "
09/13/89	" "	" "
09/14/89	" "	" "
09/15/89	" "	" "
09/16/89	" "	" "
09/17/89	" "	" "
09/18/89	" "	" "
09/19/89	" "	" "
09/20/89	" "	" "
09/21/89	" "	" "
09/22/89	" "	" "
09/23/89	" "	" "
09/24/89	" "	" "
09/25/89	" "	" "
09/26/89	" "	" "
09/27/89	" "	" "
09/28/89	" "	" "
09/29/89	" "	" "
09/30/89	" "	" "
TOTAL VOLUME	No Flow	No Discharge

* Low flow observed, flow meter was inoperational.

Appendix

RADIATION STANDARDS FOR PROTECTION OF THE PUBLIC

Introduction

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.

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

Calculation of Potential Plant Contribution to Public Radiation Dose

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. The DOE radiation standards for protection of the public are given below:

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:

WHOLE BODY -	25 mrem/year DOSE EQUIVALENT
ANY ORGAN -	75 mrem/year DOSE EQUIVALENT

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

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-EPA, 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 1percent of the recommended annual standard for all pathways.

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

AIR INHALATION:

Radionuclide	DCG (pCi/m^3)
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

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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, Office of Environmental Guidance and Compliance, July 1988.

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

Va85 Vaughan, 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, "Preparation of Annual Site Environmental Reports for Calendar Year 1985," DOE memorandum, Office of Environmental Guidance, February 28, 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 sources of radiation.

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