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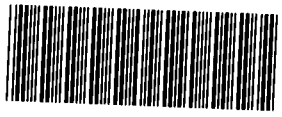
FEB. - 1989 EM-4180110-174

ROCKY FLATS PLANT



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MONTHLY ENVIRONMENTAL MONITORING REPORT

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FEBRUARY 1989 ENVIRONMENTAL MONITORING REPORT
ROCKY FLATS PLANT

This report summarizes the effluent and environmental monitoring programs at the Rocky Flats Plant for the month of February 1989

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

The Rocky Flats Plant Environmental Monitoring Program includes evaluating plant compliance with all relevant guides, limits, and standards All average results of monitoring effluent and ambient samples complied with the applicable standards as specified in Executive Order 12088 (rules, regulations, and requirements of the Department of Energy)

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 1989 Plutonium and Uranium Airborne Effluent Data

Month	Plutonium (01/19/89 - 02/20/89 - Feb) Release (uCi)	Plutonium CMax (pCi/m3)	Uranium (01/20/89 - 02/21/89 - Feb) Release (uCi)	Uranium CMax (pCi/m3)
CY 1988	15 33	0 023 ± 0 0052	11 93	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				
April				
May				
June				
July				
August				
September				
October				
November				
December				
Year to Date	0 48	0 005 ± 0 0005	0 35	0 001 ± 0 0002

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

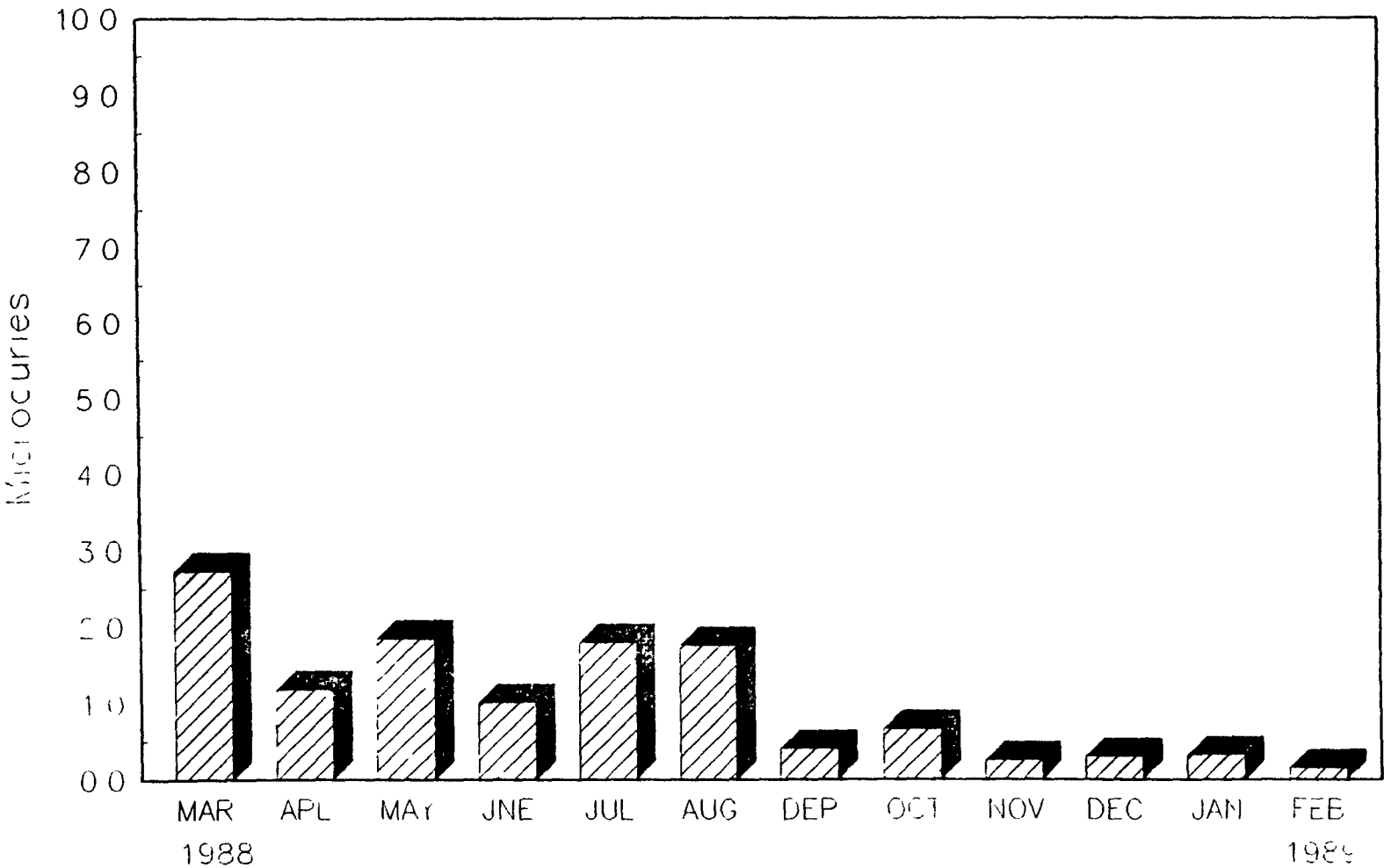
Table II 1989 Tritium and Beryllium Airborne Effluent Data

Month	Tritium (01/20/89 - 02/20/89 - Feb) Release (Ci)	Tritium CMax (pCi/m3)	Beryllium (01/19/89 - 02/21/89 - Feb) Release (grams)	Beryllium CMax (ug/m3)
CY 1988	0 015	417 ± 250	0 1383	0 00041
January	0 001	97 ± 145	0 0285*	0 00033*
February	0 002	166 ± 120	-0 0392	-0 00005
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				
Year to Date	0 003	166 ± 120	-0 0107	0 00033

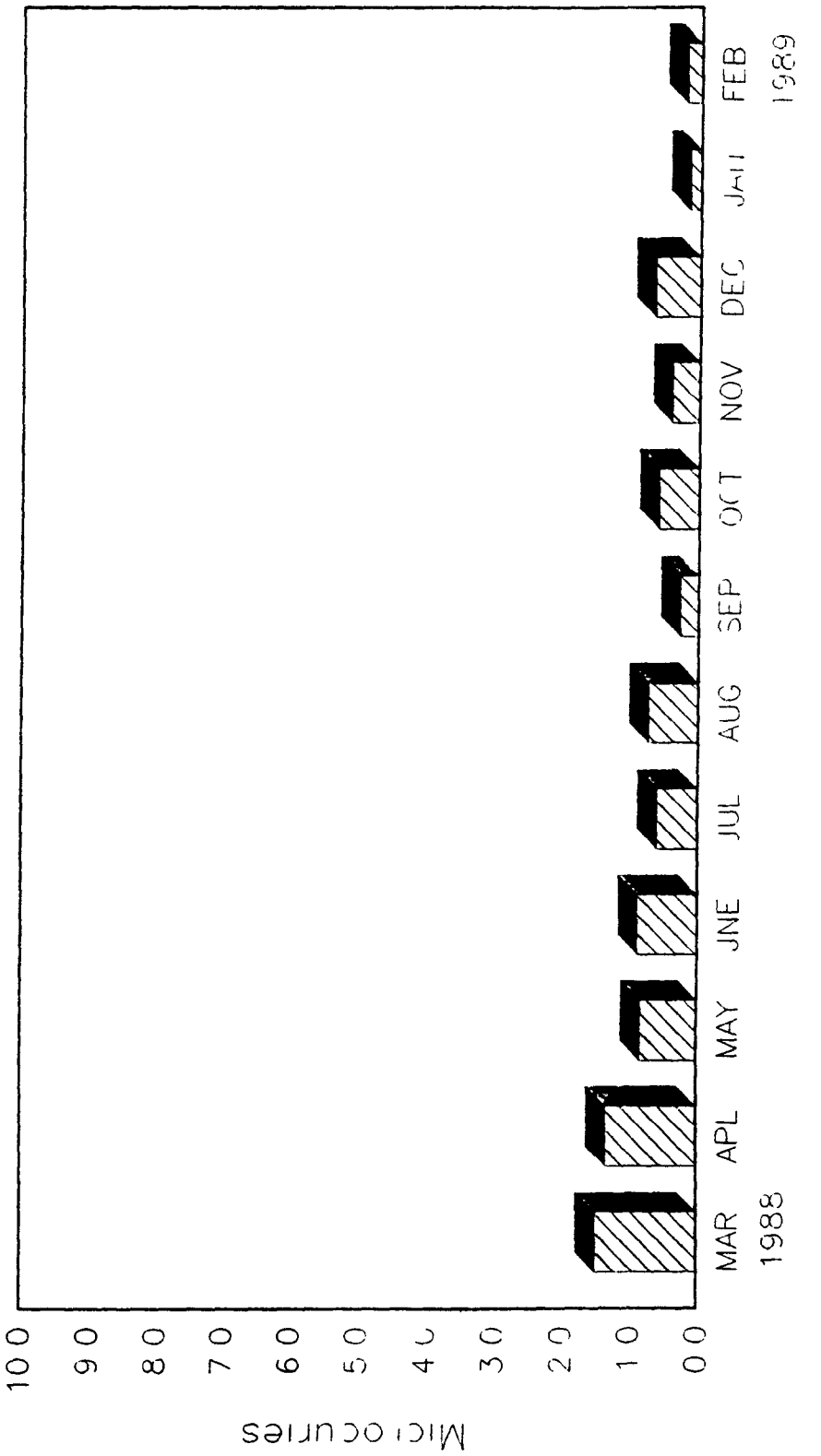
* Previously Unreported Data

NOTE Beryllium measured at 36 other screening locations was below the screening level of 0 1 gram per month

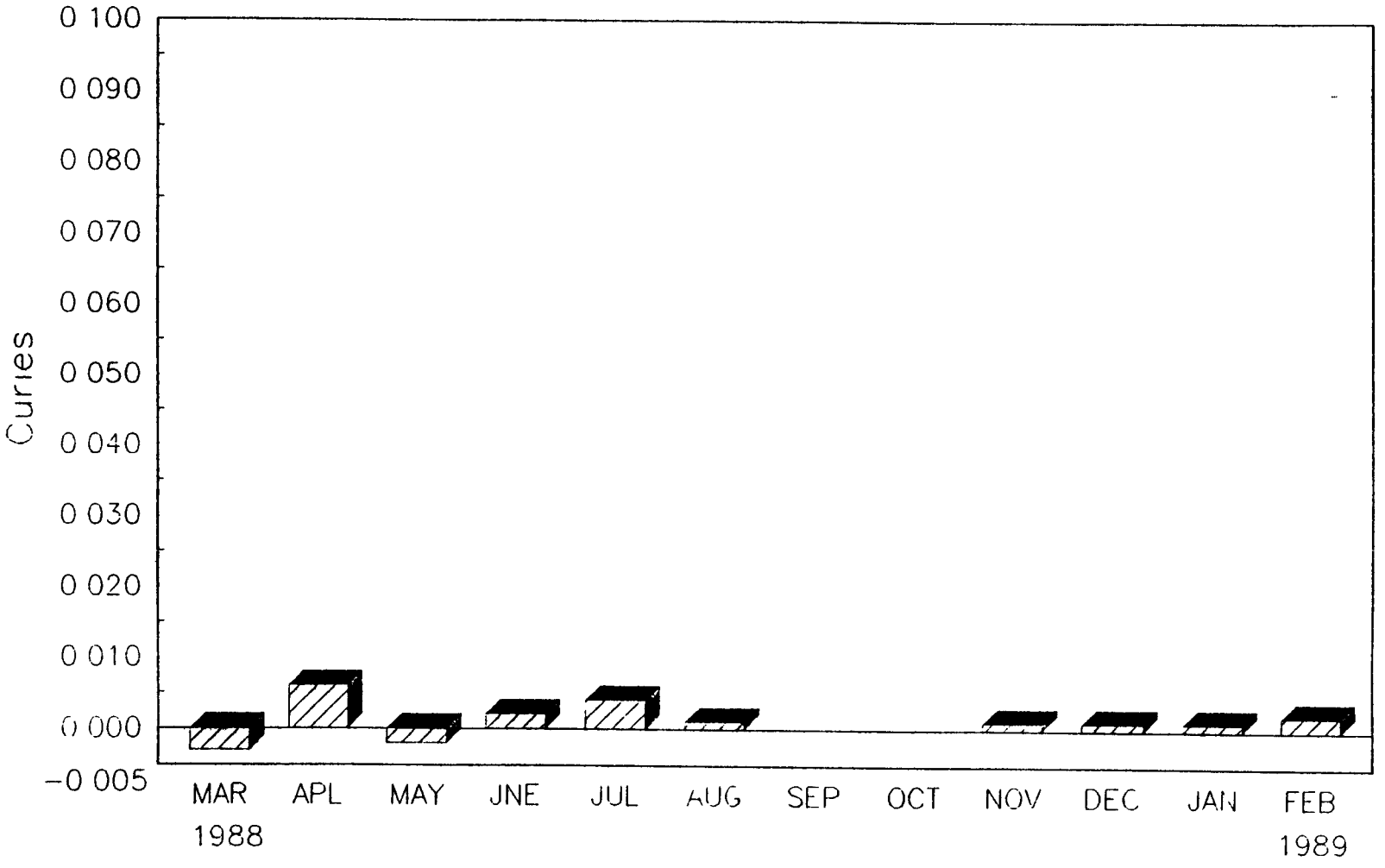
PLUTONIUM MEASURED IN EFFLUENT AIR



URANIUM MEASURED IN EFFLUENT AIR



TRITIUM MEASURED IN EFFLUENT AIR



BERYLLIUM MEASURED IN EFFLUENT AIR

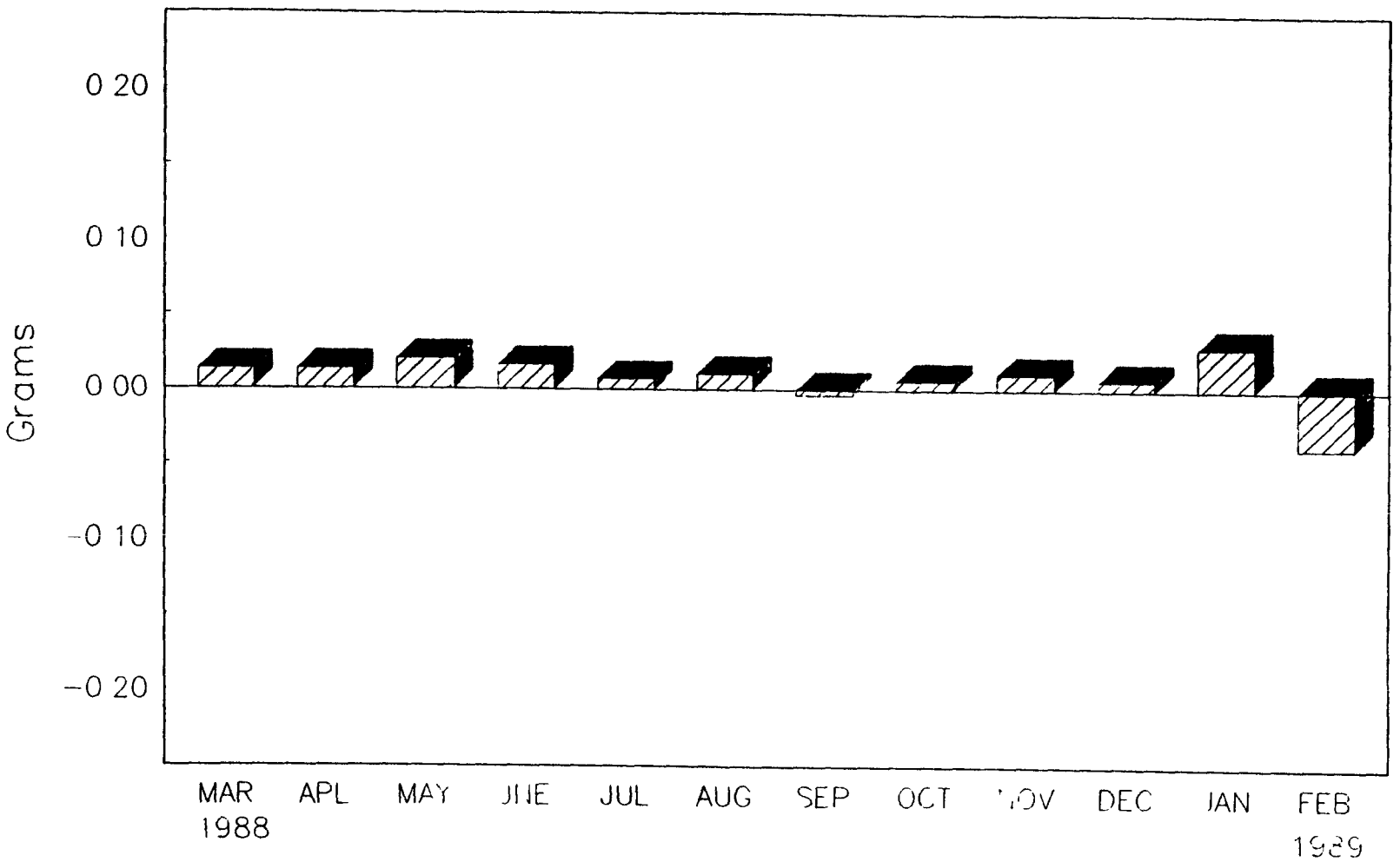


Table III. Plutonium at Selected Onsite Ambient Air Locations
(01/24/89 - 02/21/89)

Location	n	Volume (m3)	Concentration (pCi/m3) Point Estimate	± Error
S-05	2	31000	0.000022	0 000004
S-06	2	28000	0.000132	0 000017
S-07	2	26000	0 000030	0.000003
S-08	2	33000	0 000063	0 000008
S-09	2	36000	0.000058	0 000008

NOTE. Total long-lived alpha at the remaining 18 onsite ambient air samplers was below the screening level of 0 01 pCi/m^3

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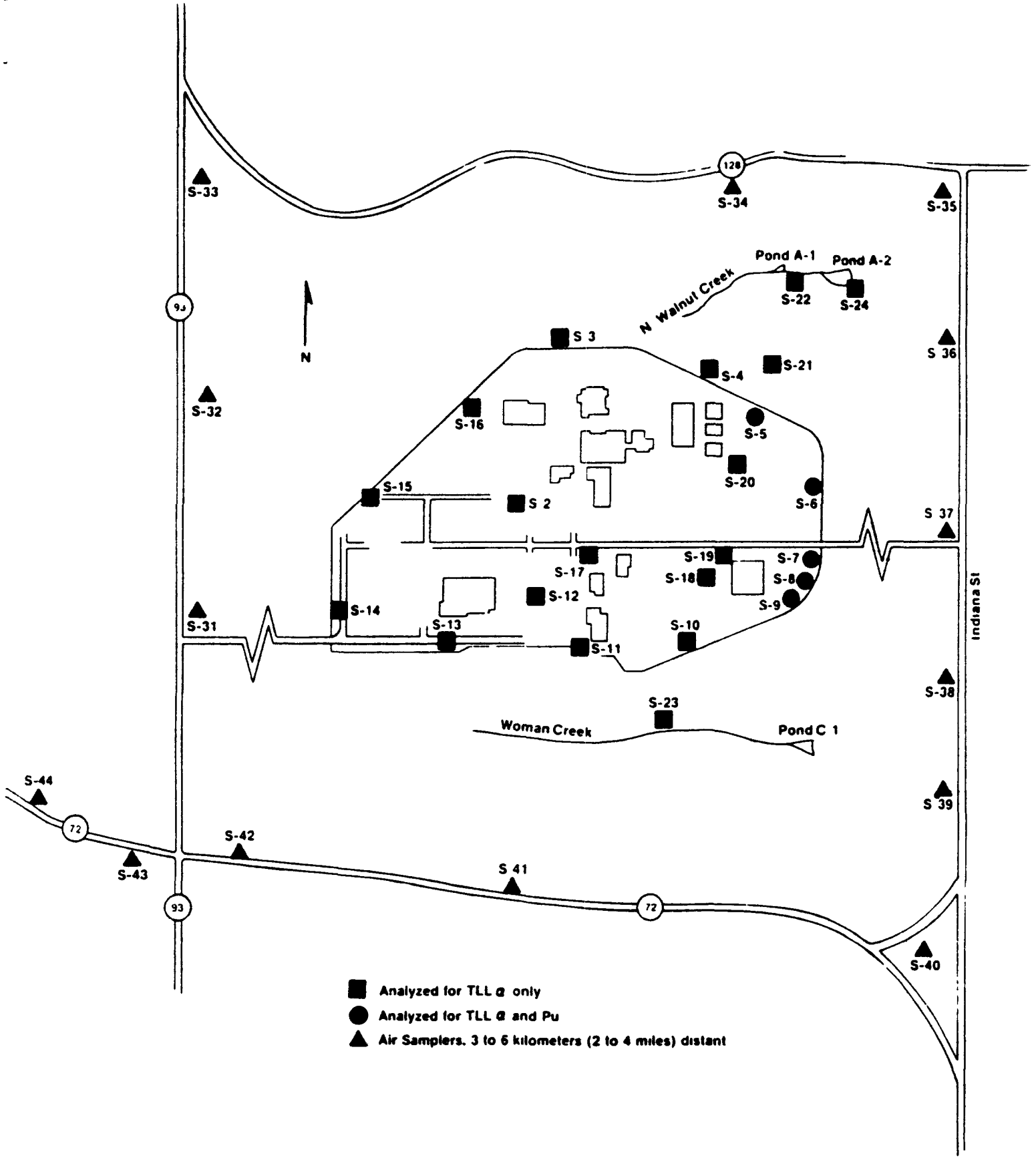
Table IV Plutonium in Perimeter Ambient Air
(01/31/89 - 02/28/89)

Location	n	Volume (m3)	Concentration (pCi/m3) Point Estimate	± Error
S-31	1	20000	0.000001	0 000002
S-32	1	35000	0 000001	0 000001
S-33	1	31000	0 000000	0 000001
S-34	1	31000	0 000000	0 000001
S-35	1	33000	0.000000	0 000001
S-36	1	30000	0 000003	0 000001
S-37	1	34000	0 000002	0.000001
S-38	1	29000	0 000002	0 000001
S-39	1	31000	0 000002	0 000001
S-40	1	32000	0.000002	0 000001
S-42	1	26000	0 000003	0 000001
S-43	1	31000	0.000000	0 000001
S-44	1	25000	0.000001	0 000001

Note: Ambient air sampler S-41 not operational this period.



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

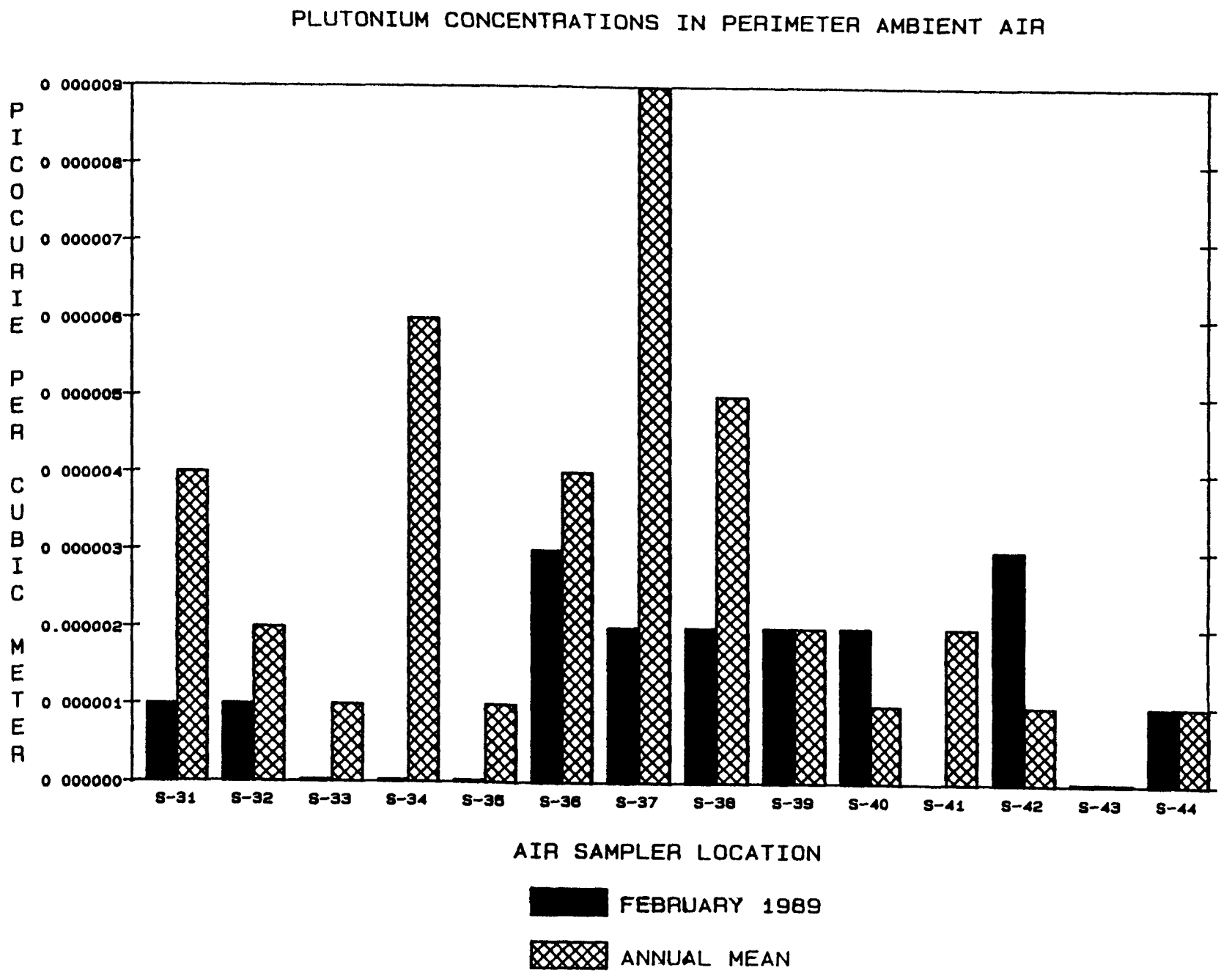

PLUTONIUM CONCENTRATIONS IN PERIMETER AMBIENT AIR
PICOCURIE PER CUBIC METER
0.000009
0.000008
0.000007
0.000006
0.000005
0.000004
0.000003
0.000002
0.000001
0.000000
S-31
S-32
S-33
S-34
S-35
S-36
S-37
S-38
S-39
S-40
S-41
S-42
S-43
S-44
AIR SAMPLER LOCATION
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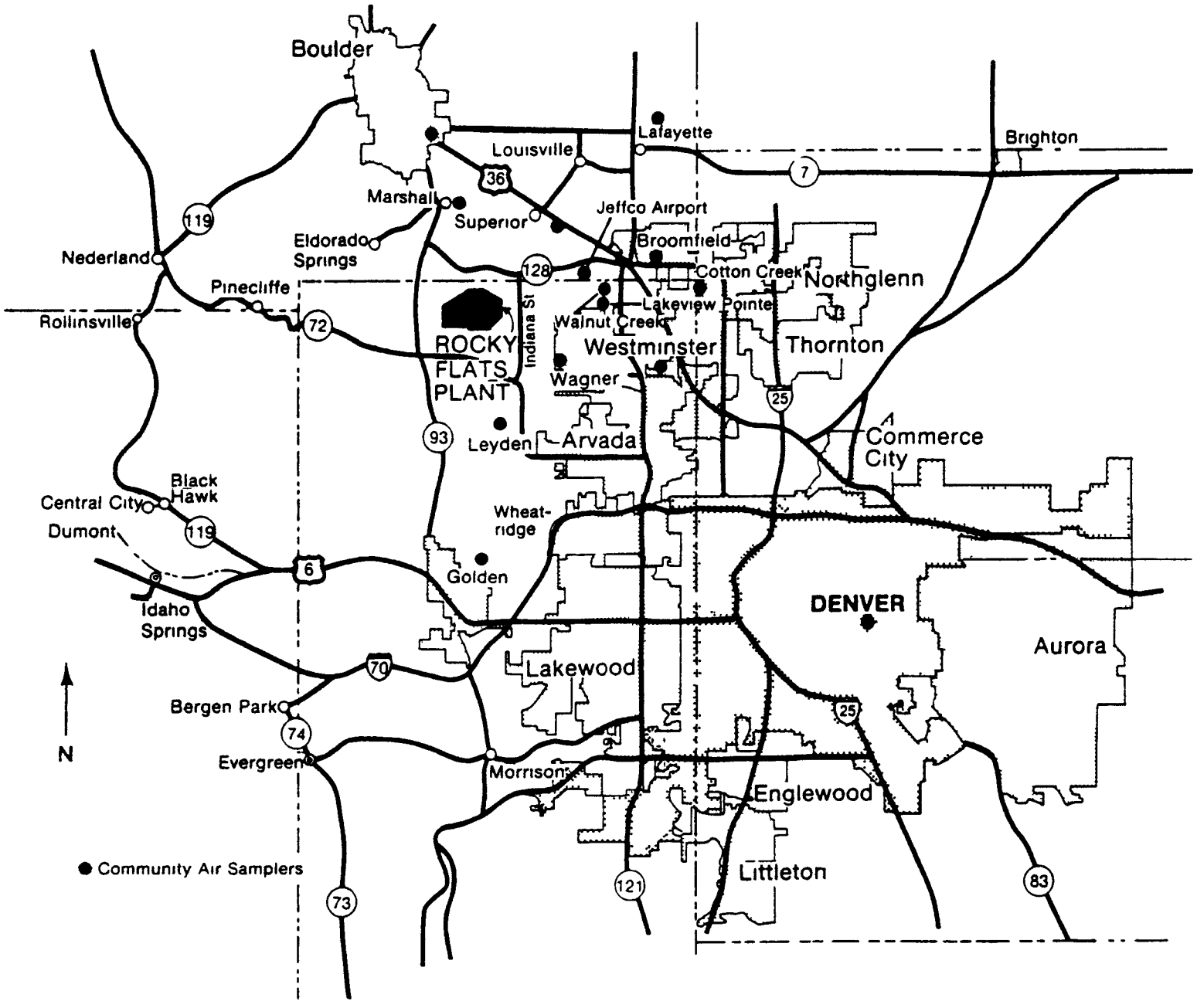
Table V. Plutonium in Community Ambient Air
(02/01/89 - 03/01/89)

Location	Community Name	n	Concentration (pCi/m3) Volume (m3)	Point Estimate	± Error
S-51	Marshall	1	27000	0 000001	0 000001
S-52	Jeffco Airport	1	35000	0 000000	0 000001
S-53	Superior	1	27000	0 000007	0 000002
S-54	Boulder	1	30000	0.000001	0 000001
S-55	Lafayette	1	30000	0 000000	0.000001
S-56	Broomfield	1	27000	0 000003	0.000001
S-57	Walnut Creek	1	31000	0 000001	0.000001
S-58	Wagner	1	29000	0 000003	0.000001
S-59	Leyden	1	34000	0.000002	0.000001
S-60	Westminster	1	23000	0.000000	0.000001
S-61	Denver	1	9000	0 000004	0 000004
S-62	Golden	1	27000	0.000002	0.000001
S-68	Lakeview Pointe	1	39000	0.000004	0 000001
S-73	Cotton Creek	1	30000	0.000001	0.000001
S-53*	Superior	1	26000	0.000033	0 000005

* Note. The Superior S-53 ambient air sampler for December 1988 was reanalyzed, the result is reported here

The original analysis on this sampling location resulted in a measured point estimate of 0 000050 pCi/m^3

Location of Community Ambient Air Samplers



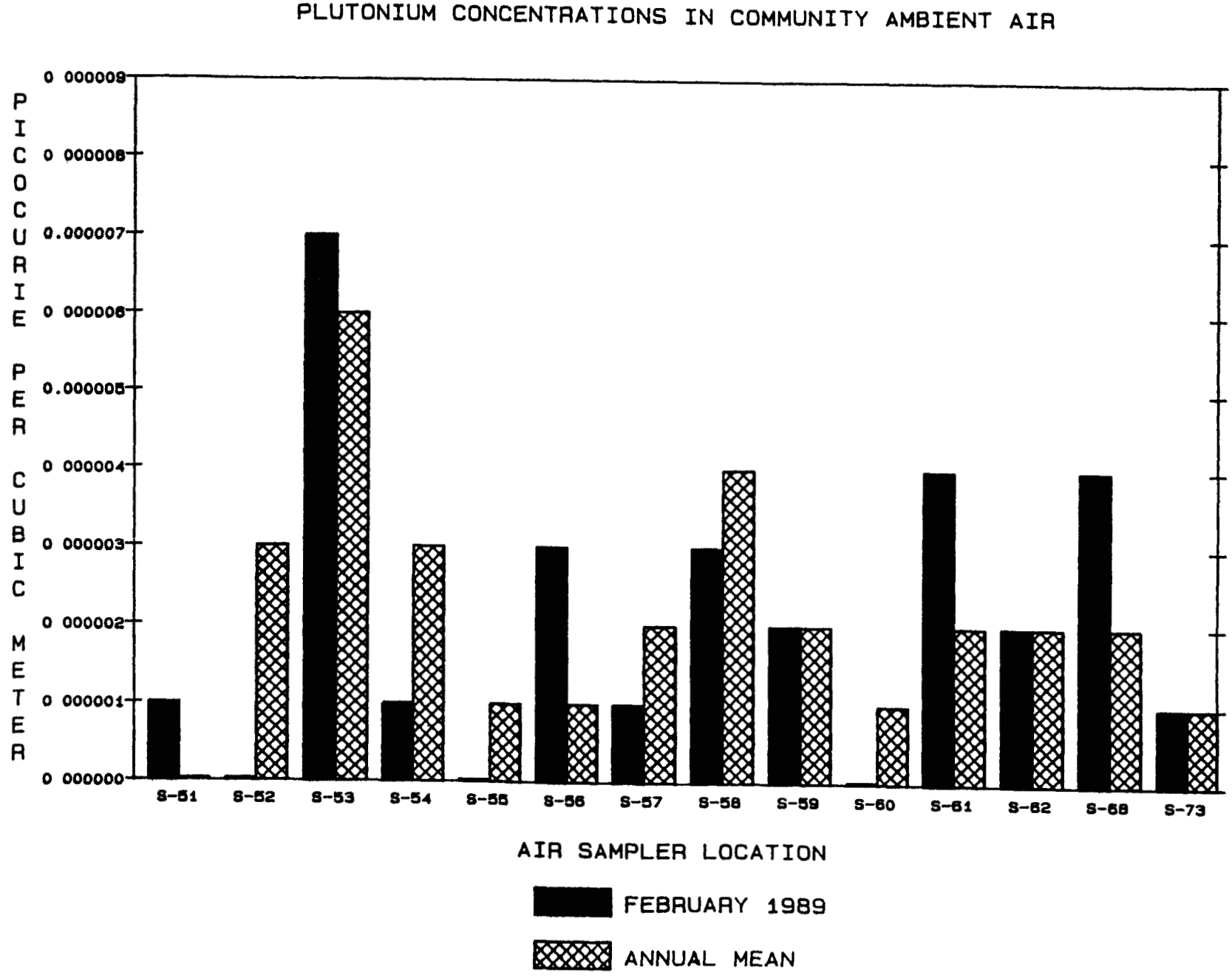

PLUTONIUM CONCENTRATIONS IN COMMUNITY AMBIENT AIR
PICOCURIE PER CUBIC METER
0 000009
0 000008
0.000007
0 000006
0.000005
0 000004
0 000003
0 000002
0 000001
0 000000
S-51
S-52
S-53
S-54
S-55
S-56
S-57
S-58
S-59
S-60
S-61
S-62
S-68
S-73
AIR SAMPLER LOCATION
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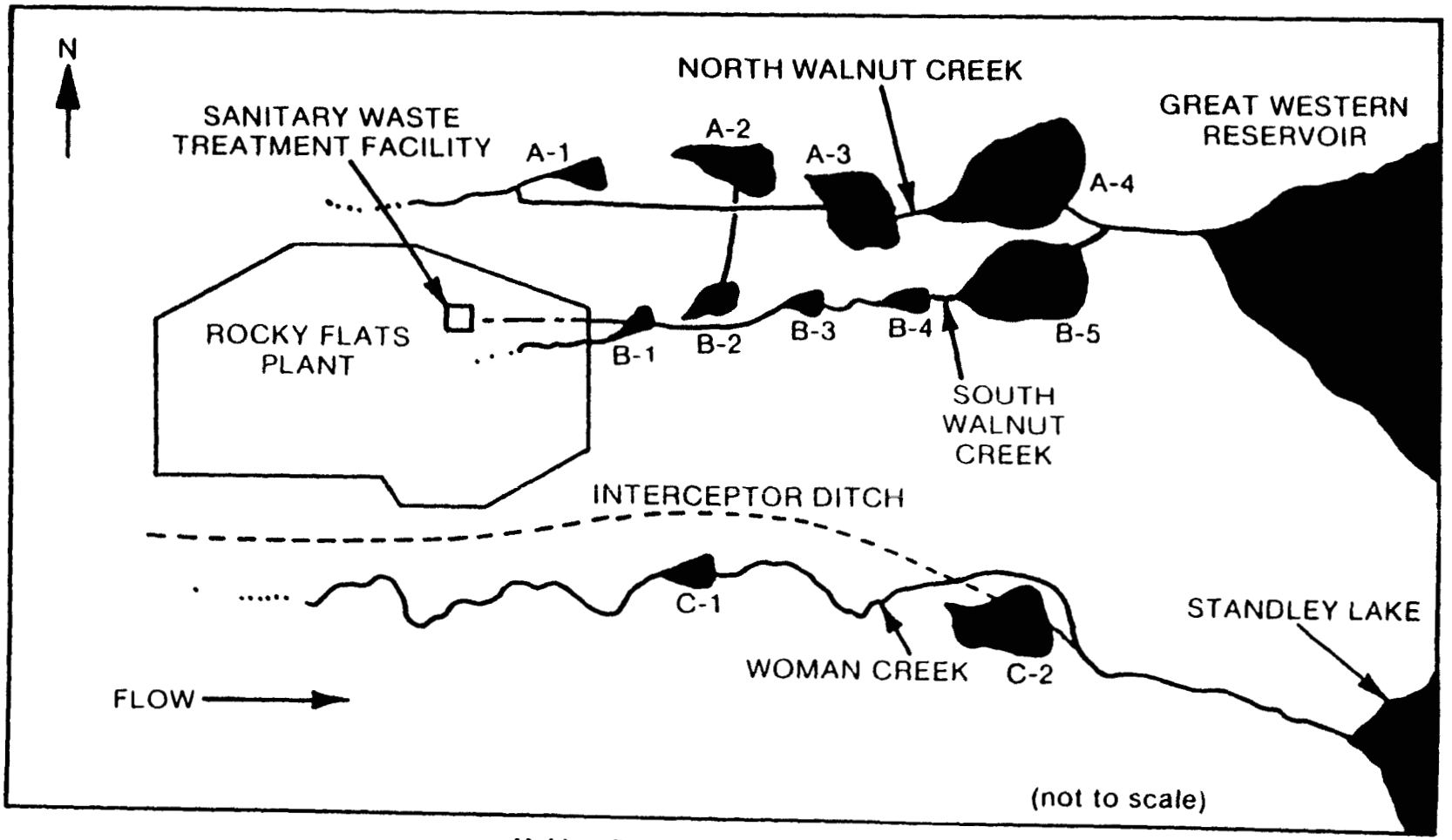
Table VI. Onsite Water Sample Results - Plutonium, Uranium, and Americium

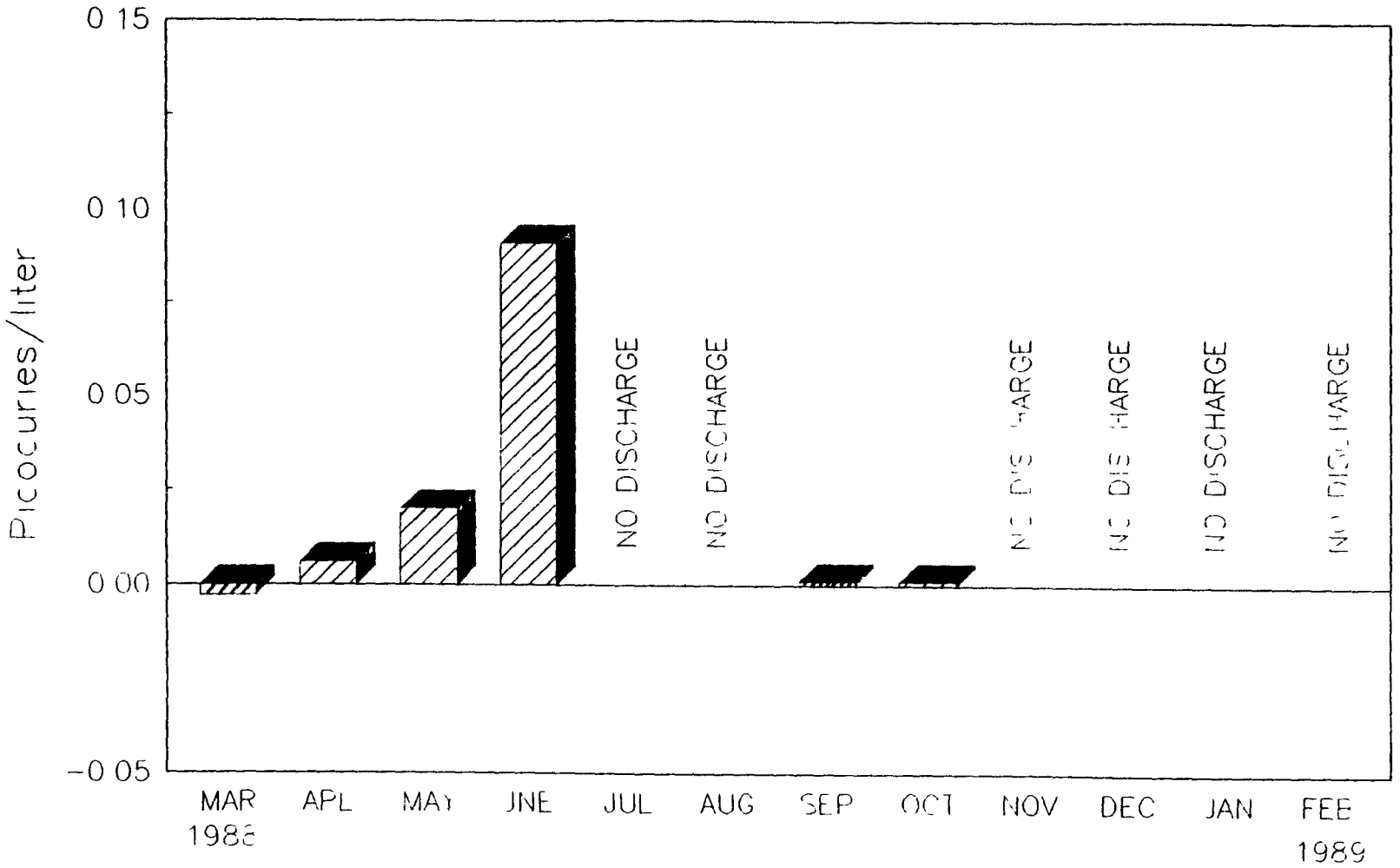
Holding Pond Outfall (pCi/l)

Location	Plutonium	Uranium	Americium
Pond A-4			
No Discharge			
Average Concentration			
Pond B-5			
01/31/89 - 02/02/89	0 001 ± 0 031	5 18 ± 0 36	0 012 ± 0.034
Average Concentration	0 001 ± 0 031	5 18 ± 0 36	0 012 ± 0 034
Pond C-1			
01/30/89 - 02/03/89	-0 004 ± 0 005	0 71 ± 0 18	-0 001 ± 0 005
02/13/89 - 02/17/89	0 010 ± 0 005	1.92 ± 0 23	-0 003 ± 0 006
02/20/89 - 02/24/89	0 010 ± 0 013	0.55 ± 0 17	-0 003 ± 0 005
Average Concentration	0 005 ± 0.009	1 06 ± 0 20	-0 002 ± 0.005
Pond C-2			
No Discharge			
Average Concentration			
Walnut Creek at Indiana			
01/30/89 - 02/03/89	0 017 ± 0 026	6 98 ± 0 45	0.019 ± 0 032
Average Concentration	0.017 ± 0.026	6.98 ± 0 45	0.019 ± 0 032

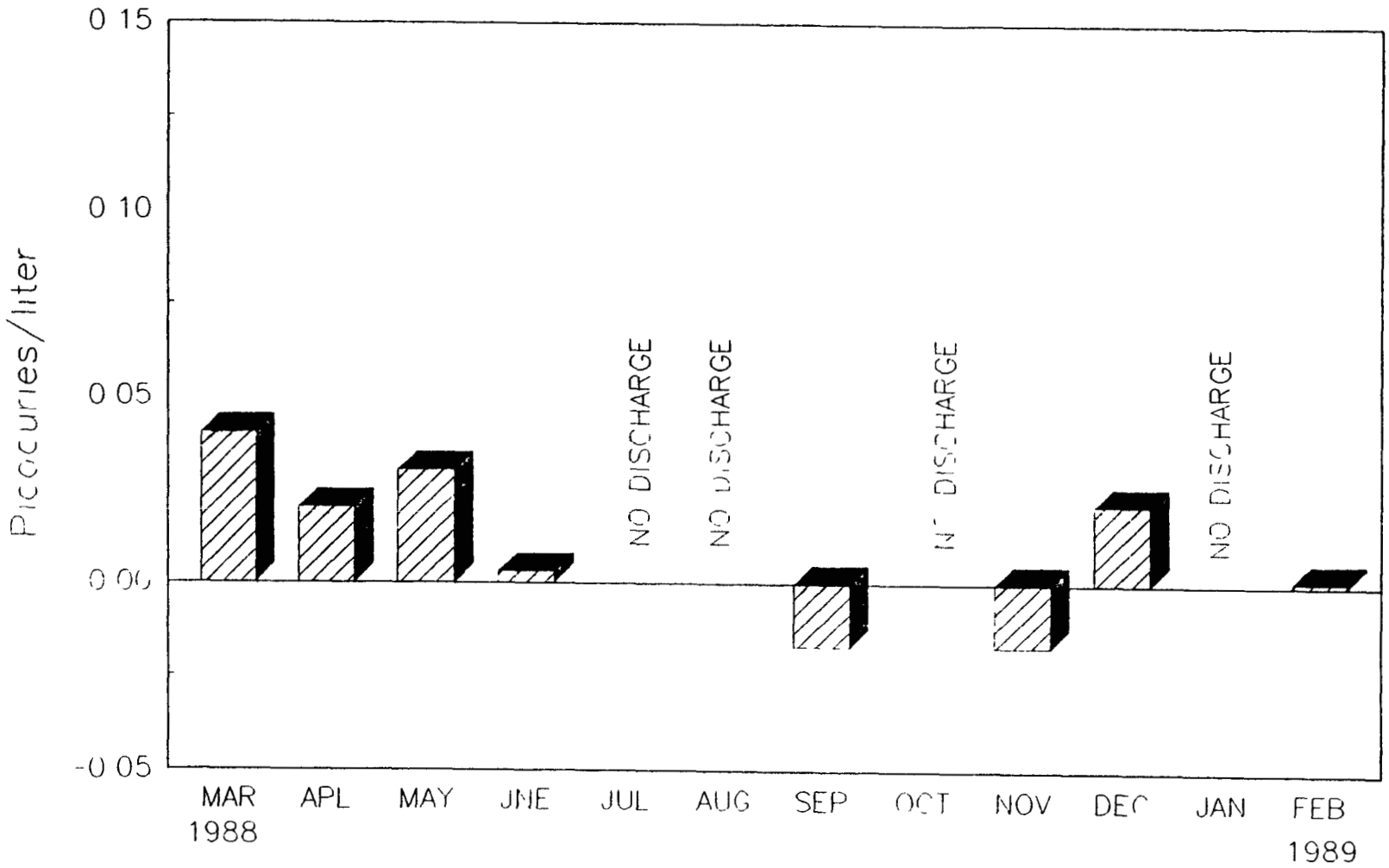


Holding Ponds and Liquid Effluent Watercourses

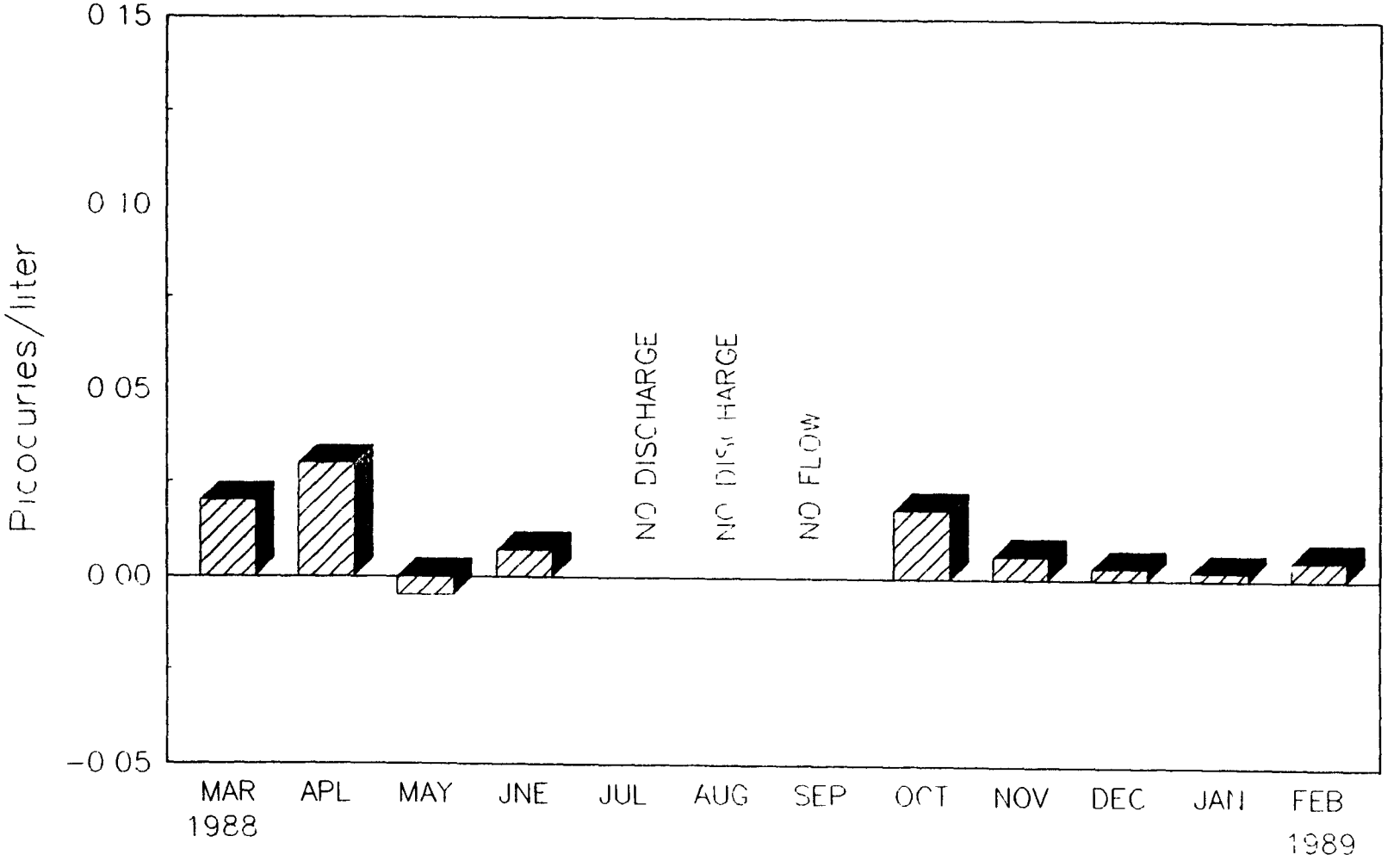
PLUTONIUM IN POND A-4 EFFLUENT WATER

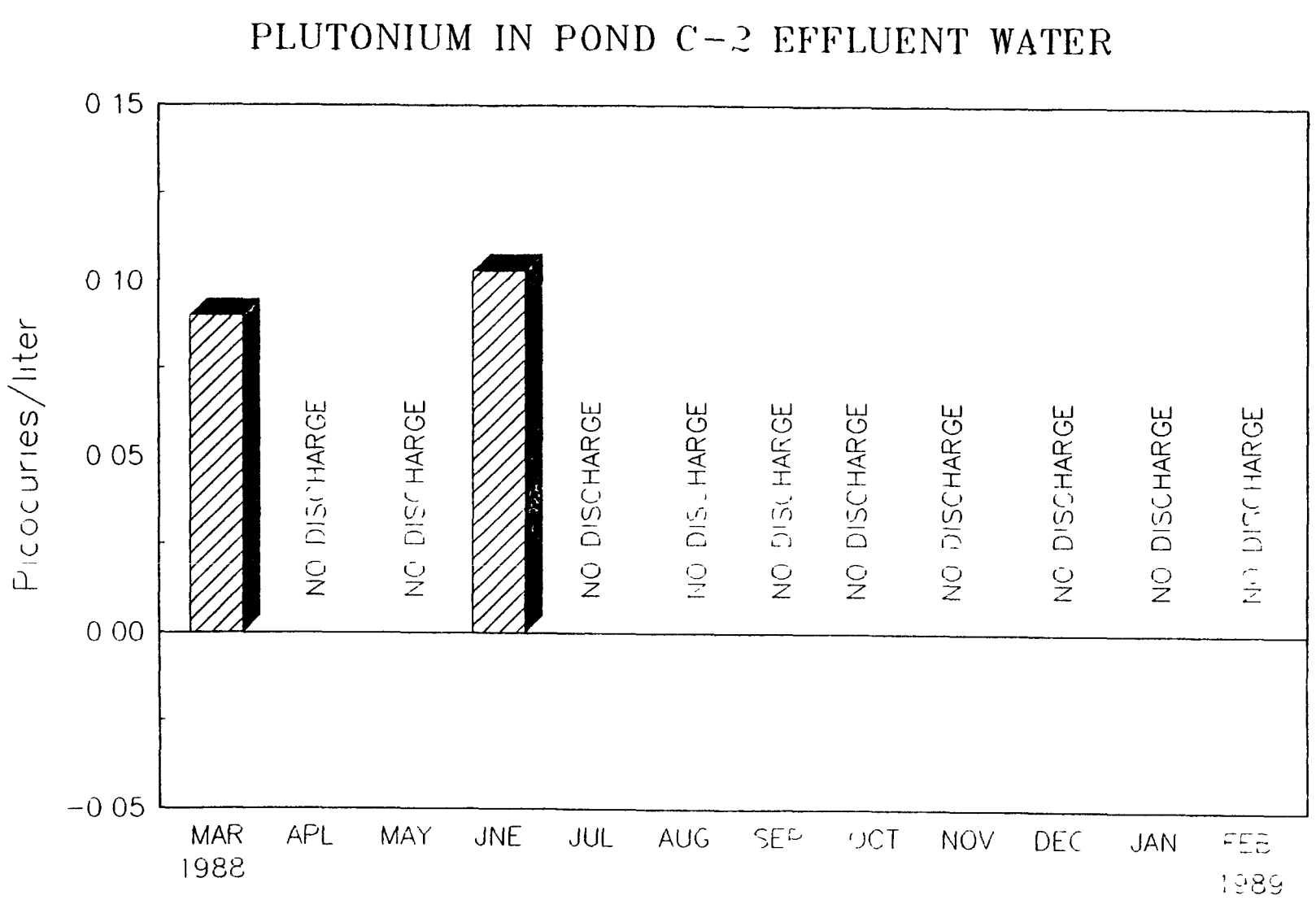


PLUTONIUM IN POND B-5 EFFLUENT WATER

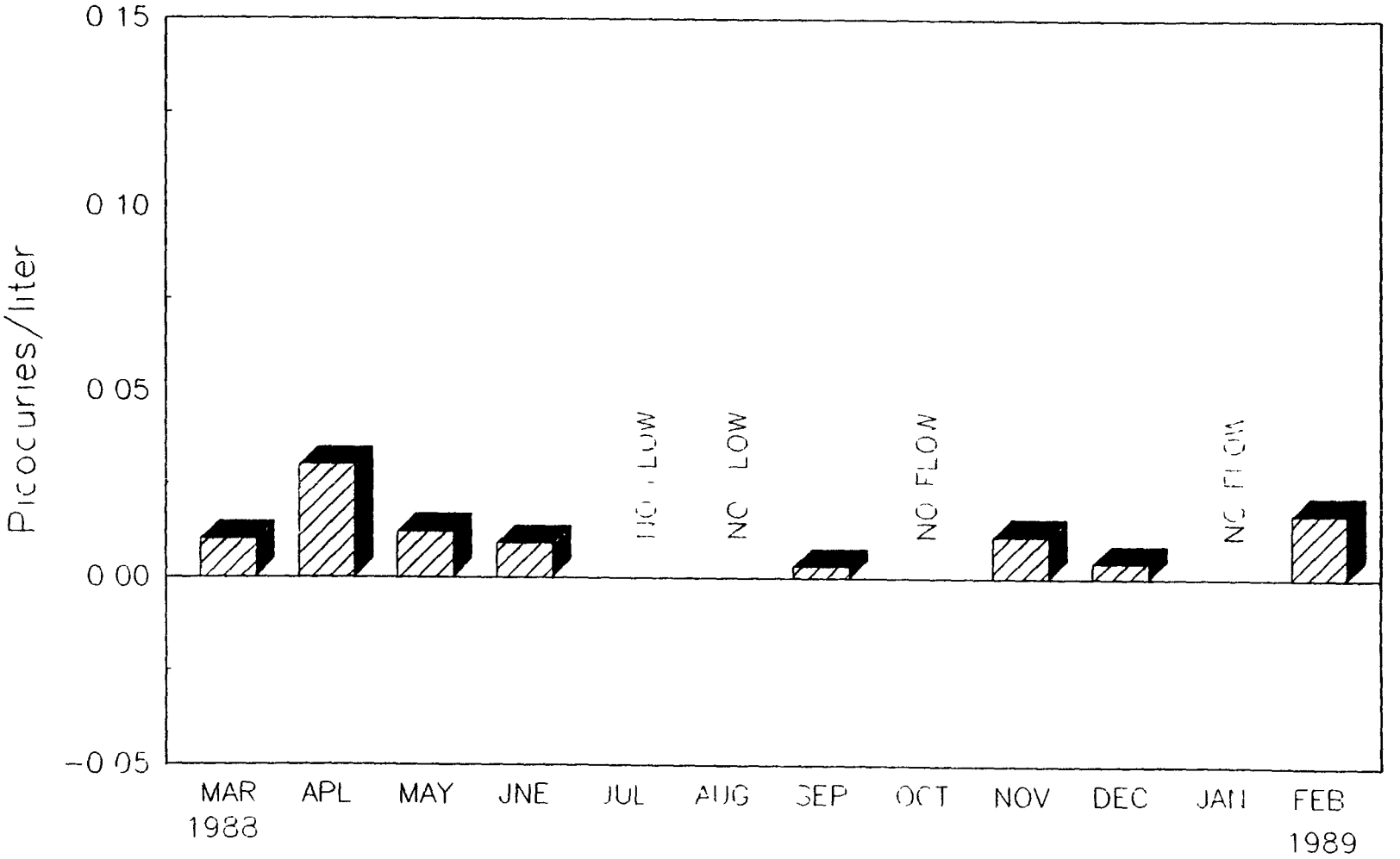


PLUTONIUM IN POND C-1 EFFLUENT WATER




PLUTONIUM IN POND C-2 EFFLUENT WATER
0 15
0 10
0 05
0 00
-0 05
Picocuries/liter
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
NO DISCHARGE
MAR
1988
APL
MAY
JNE
JUL
AUG
SEP
OCT
NOV
DEC
JAN
FEB
1989

PLUTONIUM IN WALNUT CREEK AT INDIANA WATER



FEBRUARY 1989

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

Reservoirs (pCi/l)

Location	n	Plutonium	Uranium	Americium
Great Western	1*	0 001 ± 0 007	1.64 ± 0 21	0.000 ± 0 007
Standley Lake	1*	-0 001 ± 0 006	1 60 ± 0 20	0 003 ± 0 007

Community Tap Water (pCi/l)

Location	n	Plutonium	Uranium	Americium
Boulder	1*	0 000 ± 0 006	0 62 ± 0 18	0 003 ± 0 007
Broomfield	1*	0 006 ± 0 008	1.58 ± 0.20	0 002 ± 0 007
Westminster	1*	0 000 ± 0.007	0 80 ± 0 18	0 005 ± 0 007

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

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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		No Discharge		
Pond B-5	2	85 ± 505	192 ± 519	139 ± 512
Pond C-1	4	-261 ± 388	224 ± 426	-179 ± 440
Pond C-2		No Discharge		
Walnut Creek at Indiana	3	-281 ± 517	496 ± 514	131 ± 455
Boulder	4	-472 ± 507	284 ± 515	-58 ± 440
Broomfield	3	-34 ± 290	283 ± 421	100 ± 415
Great Western	4	61 ± 516	228 ± 295	122 ± 443
Standley	4	-232 ± 508	210 ± 424	60 ± 442
Westminster	4	-560 ± 502	-108 ± 414	-304 ± 434

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Table IX. Offsite Water Sample Results - Nitrate as Nitrogen

Nitrate (as N) at Great Western Reservoir

Sample Date	Nitrate (as N) (mg/l)
02/02/89	<0 02
02/09/89	<0 02
02/16/89	0.02
02/23/89	0 02

Nitrate (as N) at Standley Lake

Sample Date	Nitrate (as N) (mg/l)
02/02/89	0 11
02/09/89	0 13
02/16/89	0 20
02/23/89	0.20

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)
No Discharge

Parameters		Measured 30-Day Average	Limits 30-Day* Average	Measured Daily Maximum	Limits Daily Maximum
Nitrates as N	mg/l	No Discharge	10	No Discharge	20

		Measured Daily Minimum	Limits Daily Minimum	Measured Daily Maximum	Limits Daily Maximum
pH	S.U	No Discharge	6 0	No Discharge	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)

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)
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				

Discharge 006 (Pond B-5)
Discharged once

Parameters		n	C Minimum	C Maximum	C Average
pH	S U	2	7 0	7 0	7.0
Nitrates as N	mg/l	2	2 25	2 57	2 41
Nonvolatile Suspended Solids	mg/l	2	8	15	12

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

Parameters		n	$C_{Minimum}$	$C_{Maximum}$	$C_{Average}$
pH	S U	3	7 3	7 4	7 3
Nitrates as N	mg/l	3	1 21	2 71	2 14

Total Volume (gallons) = 3,833,000

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

(Walnut Creek Drainage)

DATE	WALNUT CREEK AT INDIANA (gallons)	POND A-4 (gallons)	POND B-5 (gallons)
01/31/89	1,729,000	No Discharge	1,640,000
02/01/89	1,752,000	" "	1,442,000
02/02/89	352,000	" "	400,000
02/03/89	No Discharge	" "	No Discharge
02/06/89	" "	" "	" "
02/07/89	" "	" "	" "
02/08/89	" "	" "	" "
02/09/89	" "	" "	" "
02/10/89	" "	" "	" "
02/13/89	" "	" "	" "
02/14/89	" "	" "	" "
02/15/89	" "	" "	" "
02/16/89	" "	" "	" "
02/17/89	" "	" "	" "
02/20/89	" "	" "	" "
02/21/89	" "	" "	" "
02/22/89	" "	" "	" "
02/23/89	" "	" "	" "
02/24/89	" "	" "	" "
02/27/89	" "	" "	" "
02/28/89	" "	" "	" "
TOTAL VOLUME	3,833,000	No Discharge	3,482,000

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

(Woman Creek Drainage)

DATE	POND C-1 (gallons)	POND C-2 (gallons)
02/01/89	654,000	No Discharge
02/02/89	606,000	" "
02/03/89	678,000	" "
02/06/89	frozen	" "
02/07/89	frozen	" "
02/08/89	3,386,000	" "
02/09/89	614,000	" "
02/10/89	732,000	" "
02/13/89	2,014,000	" "
02/14/89	654,000	" "
02/15/89	666,000	" "
02/16/89	602,000	" "
02/17/89	670,000	" "
02/20/89	2,042,000	" "
02/21/89	658,000	" "
02/22/89	668,000	" "
02/23/89	614,000	" "
02/24/89	660,000	" "
02/27/89	2,074,000	" "
02/28/89	654,000	" "
TOTAL VOLUME	18,646,000	No Discharge

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

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