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Colorado Department of Health
Environmental Surveillance Report
on the
U.S. Department of Energy
Rocky Flats Plant

JUNE 1988

Monthly Information Exchange Meeting

This is a numerical summary of data accumulated during

JUNE 1988

pertaining to environmental surveillance activities of the Department Also included are additional data not previously reported for earlier periods

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ADMIN RECORD

SW-A-003694

Best Available Copy

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Summary Rocky Flats Report, June, 1988

This report is a summary of all current analytical data collected by the Radiation Control Division for the purpose of environmental surveillance and impact assessment of the Rocky Flats Plant. This information is collected as part of a continuing effort by the Colorado Department of Health to identify trends in radioactive hazards that may be associated with operations at Rocky Flats. The data included in this issue of the report is consistent with information collected from the same or similar sampling locations in the past.

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COLORADO DEPARTMENT OF HEALTH

U.S. DOE ROCKY FLATS PLANT SURVEILLANCE

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TABLE A

COLORADO DEPARTMENT OF HEALTH
Radiation Control Division
Gross Alpha and Beta Activity in Hi-Volume Air Filters

SURVEILLANCE SUMMARY
JUN 1988

	Sampler Type	Number of Samples	Gross Alpha Mean Concen pCi/m^3	Gross Alpha Standard Deviation pCi/M^3	Gross Alpha Max pCi/M^3	Gross Alpha Min pCi/M^3	Gross Beta Mean Concen pCi/M^3	Gross Beta Standard Deviation pCi/M^3	Gross Beta Max pCi/M^3	Gross Beta Min pCi/M^3	Total Volume M^3
ON-SITE (SECURITY)											
RF-1 ON-SITE (SECURITY)	TSP/C/2	11	<0.005	0 001	<0 007	<0 003	<0 03	< 01	0 04	0 02	37771
RF-2 ON-SITE (SECURITY)	TSP/C/2	13	<0 005	0 002	0 012	0 003	<0 03	< 01	0 05	0 02	47419
RF-3 ON-SITE (SECURITY)	TSP/C/2	13	<0 008	0 004	0 018	<0 004	<0 03	0 01	0 05	0 02	50474
RF-4 ON-SITE (SECURITY)	TSP/C/2	13	<0 006	0 002	0 009	<0 004	<0 02	< 01	0 04	0 01	47476
JUN GROUP SUMMARY		50	<0 006	0 003	0 018	<0 003	<0 03	< 01	0 05	0 01	183140
ON-SITE (PERIMETER)											
RF-5 ON-SITE (PERIMETER)	TSP/C/2	12	<0 005	0.002	0 008	<0 003	<0 02	< 01	0 04	0 02	46160
RF-6 ON-SITE (PERIMETER)	TSP/C/2	13	<0 005	0.002	0 009	<0 003	0 03	< 01	0 04	0 01	46912
RF-7 ON-SITE (PERIMETER)	TSP/C/2	12	<0 004	< 001	<0 006	<0 003	0 03	< 01	0 03	0 02	44385
RF-8 ON-SITE (PERIMETER)	TSP/C/2	13	<0 004	0 001	0 006	<0 003	<0 03	< 01	0 04	0 02	47081
JUN GROUP SUMMARY		50	<0 005	0.001	0.009	<0 003	<0 03	< 01	0 04	0 01	184538
OFF-SITE (METROPOLITAN DENVER)											
ADAMS CITY 4301 E 72nd Ave	TSP/6	5	<0 008	0 003	<0 013	<0 006	<0 05	< 01	0 05	<0 04	7953
BOULDER 13th & Spruce	TSP/6	5	<0 007	< 001	<0 008	<0 006	<0 05	0 01	0 07	<0 04	7529
BROOMFIELD 18 Garden Ofc Ctr	TSP/C/7	5	<0 005	0 002	0 008	<0 002	0 02	< 01	0 03	0 02	33939
DENVER 414 Fourteenth Street	TSP/6	5	<0 008	0 001	0 010	<0 007	<0 04	< 01	<0 04	<0 04	7470
DENVER CAMP 2105 Broadway	TSP/6	5	<0 008	0 003	<0 013	<0 007	<0 04	< 01	0 05	<0 04	8004
DENVER Gates 1050 S Broadway	TSP/6	5	<0 008	< 001	<0 009	<0 007	<0 05	< 01	0 05	<0 04	7488
ENGLEWOOD 4857 South Broadway	TSP/6	4	<0 008	0 003	<0 012	<0 006	<0 04	< 01	0 05	<0 04	6594
WESTMINSTER 10100 Garland St	TSP/C/7	5	<0 003	< 001	<0 004	<0 002	0 02	< 01	0 03	0 01	30780
JUN GROUP SUMMARY		39	<0 007	0 003	<0 013	<0 002	<0 04	0 01	0 07	0 01	109757
OFF-SITE (REMOTE)											
COLO SPGS 3730 N Meadowland	TSP/6	3	<0 008	0 002	<0 010	<0 007	<0 04	< 01	<0 04	<0 04	4704
DURANGO Court House	TSP/6	5	<0 009	0 002	<0 011	<0 006	<0 04	< 01	0 05	<0 04	8155
LEADVILLE 510 Harrison Avenue	TSP/6	5	<0 009	0 003	<0 013	<0 006	<0 05	< 01	<0 05	<0 04	6848
COLORADO NATIONAL MONUMENT	TSP/6	3	<0 007	< 001	<0 007	<0 006	<0 05	< 01	<0 05	<0 05	4080
PUEBLO Health Department	TSP/6	3	<0 008	< 001	<0 008	<0 007	<0 04	< 01	<0 04	<0 04	4999
STERLING 3rd & Ash Street	TSP/6	4	<0 008	< 001	0 009	<0 007	<0 04	< 01	0 05	<0 04	6508
PLATTEVILLE City Hall	TSP/6	5	<0 007	0 001	<0 009	<0 006	<0 05	< 01	0 05	<0 04	8692
JUN GROUP SUMMARY		28	<0 008	0 002	<0 013	<0 006	<0 04	< 01	0 05	<0 04	43986
PM-10 (METRO AND REMOTE)											
ADAMS CITY 4201 E 72nd Ave	PM-10/6	4	<0 011	0 003	<0 013	<0 008	<0 05	< 01	<0 05	<0 05	5326
ARVADA 8101 Ralston Road	PM-10/6	0									
COLO SPGS 3730 N Meadowland	PM-10/1	5	<0 010	0 002	<0.012	<0 008	<0 05	< 01	<0 05	<0 04	6841
DENVER 414 Fourteenth Street	PM-10/6	5	<0 008	0 002	<0 012	<0 007	<0 05	< 01	<0 05	<0 05	6820
DENVER CAMP 2105 Broadway	PM-10/6	5	<0 010	0 002	<0 012	<0 007	<0 05	< 01	<0 05	<0 05	6775
DENVER Gates 1050 S Broadway	PM-10/6	4	<0 008	< 001	<0 009	<0 007	<0 05	< 01	<0 05	<0 05	5270
ENGLEWOOD 4857 South Broadway	PM-10/6	5	<0 007	< 001	0 007	<0 006	<0 05	< 01	<0 05	<0 05	6770
PUEBLO Health Department	PM-10/6	4	<0 009	0 002	0 011	<0 007	<0.05	< 01	<0 05	<0 05	5516
JUN GROUP SUMMARY		32	<0 009	0 002	<0 013	<0 006	<0 05	< 01	<0 05	<0 04	43318

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TABLE B
AIR SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
1986 and 1987

Station	N	Total Long-lived ALPHA (pCi/m^3) $\bar{x}$	S.D.	max.	min.	Total Long-lived BETA (pCi/m^3) $\bar{x}$	S.D.	max.	min.	Volume (m^3)
ON-SITE (Security)										
1987										
June	40	<0.004	0.002	0.012	<0.002	<0.03	<0.01	0.05	0.02	146031
July	54	<0.009	0.006	0.036	<0.003	<0.05	0.01	0.08	0.02	190553
August	51	<0.006	0.004	0.019	<0.003	<0.06	0.02	0.16	0.03	189725
September	48	<0.006	0.003	0.019	<0.002	<0.06	0.02	0.12	<0.03	173550
October	51	<0.010	0.007	0.036	<0.004	<0.07	0.02	0.12	<0.04	186313
November	49	<0.006	0.003	0.014	<0.003	<0.06	0.02	0.10	<0.03	184507
December	39	<0.006	0.001	<0.008	<0.003	<0.04	0.02	0.09	<0.02	139485
1988										
January	43	<0.005	0.002	<0.019	<0.002	<0.03	0.02	<0.09	<0.01	152299
February	46	<0.005	0.001	0.009	<0.002	<0.03	0.01	0.06	0.01	182877
March	49	<0.005	0.001	0.011	<0.003	<0.03	0.01	0.07	0.02	172034
April	48	<0.006	0.002	0.011	<0.004	<0.03	<0.01	0.05	0.01	172940
May	51	<0.007	0.002	<0.013	<0.004	<0.03	<0.01	0.04	0.01	189161
June	50	<0.006	0.003	0.018	<0.003	<0.03	<0.01	0.05	0.01	183140
ON-SITE (Perimeter)										
1987										
June	50	<0.004	0.001	0.008	<0.002	<0.03	<0.01	0.06	<0.02	188610
July	55	<0.006	0.002	0.012	0.003	<0.05	0.01	0.09	0.02	197874
August	49	<0.004	0.001	0.009	<0.003	<0.05	0.02	0.09	<0.02	184755
September	49	<0.004	0.001	0.007	<0.002	<0.06	0.02	0.11	0.03	176842
October	52	<0.006	0.001	0.010	<0.004	<0.08	0.02	0.12	0.03	189440
November	50	<0.005	0.001	0.008	<0.003	<0.07	0.02	0.11	<0.03	186989
December	44	<0.005	0.001	<0.008	<0.002	<0.04	0.01	0.08	<0.02	170443
1988										
January	45	<0.005	0.001	<0.007	<0.002	<0.03	0.02	0.08	<0.01	165033
February	46	<0.005	0.002	<0.009	<0.002	<0.03	0.01	0.06	<0.01	184246
March	51	<0.005	0.001	<0.008	<0.003	<0.03	0.01	0.06	0.02	189060
April	48	<0.005	0.001	0.008	<0.003	<0.03	<0.01	0.05	<0.01	178597
May	48	<0.005	0.001	<0.009	<0.003	<0.03	<0.01	0.04	0.01	185815
June	50	<0.005	0.001	0.009	<0.003	<0.03	<0.01	0.04	0.01	184538

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TABLE B, CONT.

Station	N	Total Long-lived ALPHA (pCi/m³) x̄	S.D.	max.	min.	Total Long-lived BETA (pCi/m³) x̄	S.D.	max.	min.	Volume (m³)
OFF-SITE (Metro)										
1987										
June	29	<0.005	0.001	<0.006	<0.002	<0.06	0.02	0.10	0.02	63557
July	33	<0.007	0.002	<0.011	0.004	<0.08	0.02	0.11	0.03	78973
August	38	<0.008	0.002	<0.012	<0.002	<0.07	0.02	0.09	<0.02	111435
September	34	<0.008	0.003	<0.012	<0.003	<0.08	0.03	0.14	0.03	104038
October	36	<0.009	0.003	<0.014	<0.004	<0.10	0.03	0.16	0.04	102959
November	33	<0.010	0.004	<0.016	0.003	0.09	0.03	0.16	0.02	102130
December	12	<0.010	0.003	<0.017	<0.007	<0.10	0.03	0.16	<0.07	20887
1988										
January	37	<0.009	0.004	0.015	<0.002	<0.04	0.01	0.06	0.01	106821
February	38	<0.009	0.004	<0.018	<0.003	<0.04	0.01	0.09	0.01	101079
March	37	<0.009	0.004	<0.017	<0.002	<0.04	0.01	0.07	0.01	109612
April	33	<0.010	0.004	<0.016	<0.003	<0.04	0.01	0.07	0.01	85283
May	37	<0.010	0.004	<0.015	<0.003	<0.04	0.01	0.07	0.02	97673
June	39	<0.007	0.003	<0.013	<0.002	<0.04	0.01	0.07	0.01	109757
OFF-SITE (Remote)										
1987										
June	11	<0.005	<0.001	<0.005	<0.004	<0.07	<0.02	0.11	<0.05	17436
July	13	<0.007	0.002	<0.009	<0.005	<0.10	0.02	0.14	<0.07	20525
August	17	<0.009	<0.001	<0.010	<0.008	<0.08	<0.01	0.10	<0.07	26988
September	10	<0.010	0.001	0.011	<0.008	0.11	0.02	0.14	0.08	16366
October	15	<0.011	<0.001	<0.013	<0.009	<0.10	0.03	0.17	0.07	25016
November	17	<0.011	0.001	<0.012	<0.008	<0.09	0.02	0.13	<0.06	30084
December	19	<0.009	0.001	<0.011	<0.007	<0.08	0.03	0.19	<0.06	34111
1988										
January	28	<0.011	0.005	<0.023	<0.005	<0.05	0.02	0.12	<0.03	45465
February	28	<0.008	0.002	<0.013	<0.005	<0.04	0.01	0.10	<0.03	49329
March	34	<0.009	0.002	<0.012	<0.006	<0.05	0.01	0.07	<0.03	59147
April	27	<0.010	0.002	<0.015	<0.007	<0.04	<0.01	<0.06	<0.03	43733
May	32	<0.011	0.002	<0.017	<0.008	<0.04	<0.01	0.08	<0.03	51461
June	28	<0.008	0.002	<0.013	<0.006	<0.04	<0.01	0.05	<0.04	43986

NOTE: N = number of observations (samples)
x = arithmetic mean
S.D. = standard deviation of the population of results observed (1 sigma)
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III
SI Unit Equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.48 Bq/l

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TABLE C
PLUTONIUM AND TOTAL LONG-LIVED ALPHA
CONCENTRATIONS IN AIR
June 1988

Station	DATE Month/Quarter	$Pu^{239+240}$ (pCi/m^3)	Total Long-lived ALPHA (pCi/m^3)

No data to report.

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TABLE D
WATER SURVEILLANCE SUMMARY
(INDIVIDUAL SAMPLES)
June 1988

Station	Date	Activity (pCi/l) ALPHA	BETA	TRITIUM
R. F. Pond B-3	06/01/88	<5	6 ± 4	<350
	06/08/88	<5	6 ± 3	<350
	06/15/88	<5	<5	<350
	06/22/88	<5	8 ± 4	<350
	06/29/88	<5	7 ± 4	<350
Monthly Average		<5	6	<350
Walnut Creek at Indiana	06/01/88	4 ± 3	<5	<350
	06/03/88	<4	<5	<350
	06/06/88	<3	<5	<350
	06/08/88	<4	<5	<350
	06/10/88	<4	<5	<350
	06/13/88	<4	<5	
	*06/15/88			
	06/17/88	<4	<5	<350
	06/20/88	6 ± 4	<5	<350
	06/22/88	8 ± 4	15 ± 4	<350
	*06/24/88			
	*06/27/88			
	*06/29/88			
Monthly Average		<4	<6	<350
Broomfield	06/01/88	<4	<5	<350
	06/08/88	5 ± 3	<5	<350
	06/15/88	<4	<5	<350
	06/22/88	<4	<5	<350
	06/29/88	<4	<5	<350
Monthly Average		<4	<5	<350

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TABLE D
WATER SURVEILLANCE SUMMARY
(INDIVIDUAL SAMPLES)
June 1988

Station	Date	Activity (pCi/l) ALPHA	BETA	TRITIUM
R. F. Pond A-4	06/01/88	4 ± 3	<5	<350
R. F. Pond B-5	06/01/88	<5	<5	<350
	06/08/88	<5	<5	<350
	06/15/88	<5	<5	<350
	06/22/88	<5	6 ± 3	<350
	06/29/88	<5	5 ± 3	<350
Monthly Average		<5	<5	<350
RF Walnut Creek/Broomfield Split Samples				
Split	06/07/88	<4	<5	<350
Split	06/21/88	2 ± 1	<5	<350
Split	06/28/88	<5	5 ± 3	<350

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TABLE D
WATER SURVEILLANCE SUMMARY
(INDIVIDUAL SAMPLES)
June 1988

Station	Date	Activity (pCi/l) ALPHA	BETA	TRITIUM
Woman Creek at Indiana	06/06/88	<5	<5	<350
Westminster	06/10/88	<4	<5	<350
	06/22/88	<4	<5	<350
	06/29/88	<4	<5	<350
Monthly Average		<4	<5	<350
Arvada	06/10/88	<5	<5	<350
North Table Mountain	06/10/88	<3	<5	<350
CDH (ppt)	06/27/88			<350
	06/14/88			485 ± 172
D-4 (ppt)	06/10/88			<350
	06/22/88			<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis. Nominal values for the minimum detectable activity are listed in Appendix III.
* = dry not running
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l
**** No Tritium results this month

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TABLE E-1
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
POND A-3
1986 - 1988

Date		N	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986					
	Annual Data		<7	<7	<358
1987					
	June		18 ± 6	7 ± 4	<350
	July		<8	<8	<350
	August*				
	September		7 ± 4	<5	<350
	October		6 ± 4	9	<350
	November		<4	<5	<350
	December	1	<4	8 ± 4	<350
1988					
	January *	0			
	February*	0			
	March	1	6 ± 4	7 ± 4	388 ± 170
	April	1	<5	7 ± 4	<350
	May	1	<4	<5	<350
	June	*			

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-2
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
POND B-3
1986 - 1988

Date	N	ALPHA (pCi/l) x̄	max.	min.	BETA (pCi/l) x̄	max.	min.	TRITIUM (pCi/l) x̄	max.	min.
1986										
Annual Data	52	<4	10	2	<11	19	<5	<379	2046	<350
1987										
June	4	<6	8	<4	< 8	12	5	<350	<350	<350
July	5	<4	6	<4	<10	12	7	<350	364	<350
August	4	<4	<4	<4	< 9	12	7	<409	469	<350
September	5	<6	7	<4	10	11	9	<350	<350	<350
October	4	<9	23	<7	9	10	7	<350	<350	<350
November	4	<5	6	<4	9	13	5	<350	<350	<350
December	4	<5	9	<3	< 8	12	<5	<350	<350	<350
1988										
January	4	<5	7	<4	< 8	13	<5	<350	<350	<350
February	3	<5	5	<5	7	8	6	<350	<350	<350
March	5	<5	5	<5	< 7	9	5	<350	<350	<350
April	4	<4	<5	<3	< 7	9	<5	<362	398	<350
May	4	5	7	4	6	8	<4	<350	<350	<350
June	5	<5	<5	<5	6	8	<5	<350	<350	<350

NOTE: N = number of observations (samples)
x̄ = arithmetic mean
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III
SI Unit Equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.48 Bq/l

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TABLE E-3
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
WALNUT CREEK AT INDIANA
1986 - 1988

Date	N	ALPHA (pCi/l) $\bar{x}$	max.	min.	BETA (pCi/l) $\bar{x}$	max.	min.	TRITIUM (pCi/l) $\bar{x}$	max.	min.
1986										
Annual Data	62	<7	15	<2	<7	18	<5	<356	655	<350
1987										
June	8	<8	22	<5	<8	12	<5	<350	<350	<350
July	4	10	13	9	12	20	7	<350	<350	<350
August	1	<4	<4	<4	12	12	12	<350	<350	<350
September	1	5	5	5	8	8	8	<350	<350	<350
October*	0									
November	2	<6	<6	<6	<6	6	<5	<350	<350	<350
December*										
1988										
January *	0									
February	8	<9	16	<5	7	10	<5	<350	670	<350
March	11	<7	15	<5	9	14	5	<350	<350	<350
April	13	<6	10	<3	<6	8	<5	<350	<350	<350
May	11	5	6	<4	<5	7	<5	<350	<350	<350
June	9	<4	8	<3	<6	15	<5	<350	<350	<350

NOTE: N = number of observations (samples)
$\bar{x}$ = arithmetic mean
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III
* = No sample collected
SI Unit Equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.48 Bq/l

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TABLE E-4
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
BROOMFIELD*
1986 - 1988

Date	N	ALPHA (pCi/l) $\bar{x}$	max.	min.	BETA (pCi/l) $\bar{x}$	max.	min.	TRITIUM (pCi/l) $\bar{x}$	max.	min.
1986										
Annual Data	50	<4	11	<3	<5	8	<5	<354	488	350
1987										
June	4	<5	7	<4	<6	10	<5	<350	<350	<350
July	5	<5	10	<4	<6	8	<5	<350	<350	<350
August	3	<4	<4	<4	<5	<5	<5	<350	<350	<350
September	5	<4	7	<3	<6	7	<5	<350	<350	<350
October	4	<5	7	<4	<5	7	<5	<350	<386	<350
November	4	<5	6	<4	<5	<6	<5	<350	<350	<350
December	5	<5	6	<4	<5	6	<5	<350	<350	<350
1988										
January	4	<5	6	<4	<5	5	<5	<350	<350	<350
February	4	<4	6	<4	<5	6	<5	<350	<350	<350
March	5	<4	<4	<5	<5	5	<5	<350	<350	<350
April	4	<4	<6	<4	<5	<5	<5	<350	<350	<350
May	4	<4	<4	<4	<5	5	<5	<350	<350	<350
June	5	<4	5	<4	<5	<5	<5	<350	<350	<350

NOTE: N = number of observations (samples)
$\bar{x}$ = arithmetic mean
* = Weekly composite
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III
SI Unit Equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.48 Bq/l

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TABLE E-5
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
WOMAN CREEK AT INDIANA
1986 - 1988

Date	N	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986				
Annual Data		<5	<5	<350
1987				
June		5 ± 4	5 ± 4	<350
July		6 ± 4	5 ± 4	<350
August*				
September*				
October		8 ± 5	<6	<350
November		8 ± 4	<5	<350
December*				
1988				
January	1	6 ± 4	7 ± 4	<350
February	1	<4	<5	<350
March	1	5 ± 3	<5	<350
April	1	<3	<5	<350
May	2	<3	<5	<350
June	1	<5	<5	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-6
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
WESTMINSTER
1986 - 1988

Date	N	ALPHA (pCi/l) $\bar{x}$	max.	min.	BETA (pCi/l) $\bar{x}$	max.	min.	TRITIUM (pCi/l) $\bar{x}$	max.	min.
1986										
Annual Data	24	<3	7	<3	<5	5	4	<350	<350	<350
1987										
June	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
July	2	<3	<3	<3	5	<5	<5	<350	<350	<350
August	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
September	3	<4	5	<3	<6	9	<5	<350	<350	<350
October	2	<5	6	<3	<5	5	<5	<350	<350	<350
November	2	<3	<3	<3	<5	5	<5	<350	<350	<350
December	1	<3	<3	<3	<5	<5	<5	<350	<350	<350
1988										
January	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
February	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
March	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
April	2	<3	<3	<3	<5	<5	<5	<350	<350	<350
May	4	<4	<4	<3	<5	<5	<5	<350	<350	<350
June	3	<4	<4	<4	<5	<5	<5	<350	<350	<350

NOTE: N = number of observations (samples)
$\bar{x}$ = arithmetic mean
max. = maximum individual sample concentration observed
min. = minimum individual sample concentration observed
Nominal values for the minimum detectable activity are listed in Appendix III.
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-7
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
ARVADA
1986 - 1988

Date	N	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986				
Annual Data		<2	<5	<350
1987				
June		<2	<5	<350
July		<2	<5	<350
August		2 ± 2	<5	<350
September		<2	<5	<350
October		<2	<5	<350
November		<2	<5	<350
December	1	<2	<5	<350
1988				
January	1	<3	<5	<350
February	1	<3	<5	<350
March	1	5 ± 3	<5	<350
April	1	<3	<5	<350
May	1	<3	<5	<350
June	1	<5	<5	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-8
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
NORTH TABLE MOUNTAIN
1986 - 1988

Date	N	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986				
Annual Data		<2	<5	<350
1987				
June		<3	<5	<350
July		<3	<5	<350
August		<2	<5	<350
September		<2	<5	<350
October		7 ± 3	5 ± 3	<350
November		8 ± 3	6 ± 3	<350
December	1	<2	<5	<350
1988				
January	1	<3	<5	<350
February	1	3 ± 2	<5	<350
March	1	<3	<5	<350
April	1	<3	<5	<350
May	1	3 ± 2	<5	<350
June	1	<3	<5	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE E-8
WATER SURVEILLANCE SUMMARY
MONTHLY COMPARISON DATA
NORTH TABLE MOUNTAIN
1986 - 1988

Date	N	ALPHA (pCi/l)	BETA (pCi/l)	TRITIUM (pCi/l)
1986				
Annual Data		<2	<5	<350
1987				
June		<3	<5	<350
July		<3	<5	<350
August		<2	<5	<350
September		<2	<5	<350
October		7 ± 3	5 ± 3	<350
November		8 ± 3	6 ± 3	<350
December	1	<2	<5	<350
1988				
January	1	<3	<5	<350
February	1	3 ± 2	<5	<350
March	1	<3	<5	<350
April	1	<3	<5	<350
May	1	3 ± 2	<5	<350
June	1	<3	<5	<350

NOTE: Error terms are based on the 2 sigma counting error for the single analysis.
Nominal values for the minimum detectable activity are listed in Appendix III.
* = No sample collected
SI unit equivalent: 1 pCi/l = 0.037 Bq/l
20 pCi/l = 0.74 Bq/l

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TABLE F
PLUTONIUM AND TOTAL ALPHA
CONCENTRATIONS IN WATER
June 1988

Station	DATE Month/Day/QTR	$Pu^{239+240}$ (pCi/l)	Total Alpha (pCi/l)
Walnut Creek Split	April 88	<0.003	<6
Westminster	April 88 (Comp)	<0.002	<3

NOTE: The 95°/° confidence interval for total alpha analysis is propagated from the sample count and background counts.
The 95°/° confidence interval for plutonium analysis is propagated from the sample count, the background count, the tracer count, the tracer background count, and the contribution of tracer progeny to the sample count.
Nominal values for the minimum detectable activity are listed in Appendix III.
The standard for general population exposure for soluble Pu is 1600 pCi/l.

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TABLE G
NATURAL URANIUM AND TOTAL ALPHA
CONCENTRATIONS IN WATER
June 1988

Station	Date	URANIUM (ug/l)	URANIUM (pCi/l)	ALPHA (pCi/l)

No Data to Report

NOTE: Total Alpha error terms are based on the 2 sigma counting error for the single analysis. Nominal values for the minimum detectable activity are listed in Appendix III.

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APPENDIX I
ROCKY FLATS PLANT AIR SURVEILLANCE
STATION IDENTIFICATION

On-Site (Security)	Location
D - 1	Rocky Flats Plant, Eastern perimeter at the security fence, North to south
D - 2	
D - 3	
D - 4	

On-Site (Perimeter	
D - 5	SE
D - 6	NE Rocky Flats Plant,
D - 7	N Plant Boundary
D - 8	NW

Off-Site (Metro)	
BROOMFIELD	Garden Office Center
ADAMS CITY	4301 East 72nd Avenue
ARVADA	8101 Ralston Road
AURORA	1633 Florence Street
BOULDER	13th & Spruce
DENVER	414 - 14th Street
ENGLEWOOD	4857 South Broadway
GOLDEN	911 - 10th Street
LAKEWOOD	260 South Kipling

Off-Site (Remote)	
DURANGO	Fire Station
LAMAR	Power Plant
LEADVILLE	510 Harrison Avenue
STERLING	3rd & Ash Street

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APPENDIX II

MAXIMUM PERMISSIBLE CONCENTRATIONS OF RADIONUCLIDES IN EFFLUENT AIR AND WATER RELEASED TO UNCONTROLLED AREAS

The maximum permissible concentrations (MPCs) below are based on recommendations of the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection (NCRP) and the Federal Radiation Council (FRC). These recommendations are incorporated in the regulations of the Colorado Department of Health and those of the Nuclear Regulatory Commission. The levels stated are those relating to general population exposures to radionuclides in effluent air and water.[1]

	Chemical Form	
Air	Insoluble (pCi/m^3)	Soluble (pCi/m^3)
Unidentified radionuclides[2]	0.007	0.007
Unidentified radionuclides[3]	33	33
Americium-241	1.3	0.066
Carbon-14	330,000	100,000
Cerium-141	1,600	6,600
Cerium-144	66	100
Cesium-137	33,000	130,000
Cobalt-60	100	3,300
Hydrogen-3 (Tritium)	66,000	66,000
Iodine-129	660	6.6
Iodine-131	3,300	33
Krypton-85	100,000	100,000
Lead-210	2.6	1.3
Niobium-95	1,000	6,600
Plutonium-238	0.33	0.033
Plutonium-239	0.33	0.033
Polonium-210	2.3	6.6
Radium-226	0.66	1.0
Radon-220	-	3,300
Ruthenium-103	1,000	6,600
Ruthenium-106	66	1,000
Strontium-90	66	3
Uranium-Natural	1.6	[illegible]
Xenon-133	100,000	100,000
Yttrium-91	330	330
Zinc-65	660	1,000
Zirconium-95	330	1,300

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Water	Insoluble (pCi/l)	Soluble (pCi/l)
Unidentified radionuclides[1]	10	10
Unidentified radionuclides[2]	1,000	1,000
Americium-241	10,000	1,300
Carbon-14	-	260,000
Cerium-141	30,000	30,000
Cerium-144	3,300	3,300
Cesium-137	13,000	6,600
Cobalt-60	10,000	16,000
Hydrogen-3 (Tritium)	1,000,000	1,000,000
Iodine-129	66,000	20
Iodine-131	20,000	100
Lead-210	66,000	33
Niobium-95	33,000	33,000
Plutonium-238	10,000	1,600
Plutonium-239	10,000	1,600
Polonium-210	10,000	230
Radium-226	10,000	10
Ruthenium-103	26,000	26,000
Ruthenium-106	3,300	3,300
Strontium-90	13,000	100
Uranium-natural	10,000	10,000
Yttrium-91	10,000	10,000
Zinc-65	66,000	33,000
Zirconium-95	20,000	20,000

1. Concentrations may be averaged over a period not greater than a year
2. Any single radionuclide which decays by alpha emission or spontaneous fission
3. Any single radionuclide with a decay mode other than alpha emission or spontaneous fission and with a radioactive half-life greater than 2 hours

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MAXIMUM CONTAMINANT LEVELS FOR RADIUM-226, RADIUM-228, AND GROSS ALPHA PARTICLE ACTIVITY IN COMMUNITY WATER SYSTEMS

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle activity in community water systems

a. combined radium-226 and radium-228 -- 5 pCi/l

b. gross alpha particle activity (including radium-226 but excluding radon and uranium) -- 15 pCi/l

MAXIMUM CONTAMINANT LEVELS FOR BETA PARTICLE AND PHOTON RADIOACTIVITY FROM MAN-MADE RADIONUCLIDES IN COMMUNITY WATER SYSTEMS

The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water provided by community water systems shall not produce an annual dose equivalent to the total body of any internal organ greater than 4 mrem/year

Except for the radionuclides listed below, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168 hour data listed in "Maximum Permissible Body Burden and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure", NBS Handbook 69 as amended August 1963, U S Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 mrem/year

AVERAGE ANNUAL CONCENTRATIONS OF RADIONUCLIDES ASSUMED TO PRODUCE A TOTAL BODY OR ORGAN DOSE OF 4 mrem/YEAR.

Radionuclide	Critical Organ	pCi per liter
tritium	total body	20,000
strontium-90	bone marrow	8

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APPENDIX III
LIMITS OF SENSITIVITY

Lower limits of detection (LLD's) are based on the U.S.A.E.C. Health and Safety Laboratory Procedures Manual (HASL-300, 1972).

The calculated LLD will be reported based upon actual measurement when they are available. Otherwise the following LLD will be reported, which are based upon nominal (average) measurements.

A. WATER ANALYSIS

1.	Gross alpha	7.0	pCi/L
2.	Gross beta	6.0	pCi/L
3.	Plutonium-239	0.02	pCi/L
4.	Tritium	350.0	pCi/L

B. AIR ANALYSIS

1. Gross alpha (uncorrected to density thickness)		
Individual samples		
APC stations (1500 m^3)	.007	pCi/m^3
O-x stations (3000 m^3)	.004	pCi/m^3
2. Gross beta (uncorrected to density thickness)		
Individual samples		
APC stations (1500 m^3)	.05	pCi/m^3
O-x stations (3000 m^3)	.03	pCi/m^3
3. Plutonium-239		
Individual samples (using 1/4 sample)		
APC stations (1500 m^3)	.00019	pCi/m^3
O-x stations (3000 m^3)	.00009	pCi/m^3
Monthly composites (using 1 inch^2 per sample)		
APC stations (1500 m^3/sample x 8 samples)	.00037	pCi/m^3
O-x stations (3000 m^3/sample x 13 samples)	.00011	pCi/m^3
Quarterly composites (using 1 inch^2 per sample)		
APC stations (1500 m^3/sample x 23 samples)	.00010	pCi/m^3

C. SOIL ANALYSIS

1. Plutonium - 239	0.08 pCi/gm	18 dpm/gm

A "lower detection limit" for fluorometric uranium analysis is reported by the Water Quality Laboratory as 3 µg/L, or 2 pCi/L at isotopic equilibrium, and is defined as "three times background"

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