BACKGROUND GEOCHEMICAL CHARACTERIZATION REPORT

U S DEPARTMENT OF ENERGY

Rocky Flats Plant
Golden Colorado

15 DECEMBER 1989

Rockwell International
Aerospace Operations
Rocky Flats Plant

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ROCKY FLATS PLANT
GOLDEN, COLORADO

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BACKGROUND GEOCHEMICAL CHARACTERIZATION REPORT

TABLE OF CONTENTS

SECTION	TITLE	PAGE
1 0	EXECUTIVE SUMMARY AND RECOMMENDATIONS	1-1
2 0	INTRODUCTION	2-1
	2 1 Purpose	2-1
	2 2 Background	2-2
	2 3 General Approach	2-2
	2 4 Computation of Normal Tolerance Interval Statistical Methods	2-3
3 0	SAMPLE LOCATIONS AND SAMPLE COLLECTION	3-1
	3 1 Ground Water	3-1
	3 1 1 Rocky Flats Alluvium Ground Water	3-3
	3 1 2 Colluvial Ground Water	3-10
	3 1 3 Valley Fill Alluvium Ground Water	3-10
	3 1 4 Bedrock Ground Water	3-11
	3 2 Surface Water	3-11
	3 3 Stream Sediment	3-15
	3 4 Borehole Samples	3-15
4 0	BACKGROUND GEOCHEMICAL CHARACTERIZATION	4-1
	4 1 Ground Water	4-1
	4 1 1 Rocky Flats Alluvium Ground Water	4-4
	4 1 2 Colluvial Ground Water	4-4
	4 1 3 Valley Fill Ground Water	4-12
	4 1 4 Weathered Bedrock Ground Water	4-17
	4 1 5 Unweathered Sandstone Ground Water	4-17
	4 2 Surface Water	4-27
	4 2 1 Round 1 Surface Water Samples	4-28
	4 2 2 Round 2 Surface Water Samples	4-28
	4 3 Sediments	4-38
	4 4 Borehole Materials	4-41
	4 4 1 Rocky Flats Alluvium	4-41
	4 4 2 Colluvium	4-41
	4 4 3 Weathered Claystone	4-45
	4 4 4 Weathered Sandstone	4-52
5 0	REFERENCES	5-1

BACKGROUND GEOCHEMICAL CHARACTERIZATION REPORT

LIST OF APPENDICES

APPENDIX	TITLE
A	DATA SUMMARIES
B	TOLERANCE INTERVAL CALCULATIONS (Based on normal distribution)

LIST OF PLATES

PLATE	TITLE
1	1989 Background Surface Water, Sediment, Borehole, and Monitoring Well Locations
2	Stiff Diagrams for Background Ground-Water and Surface Water Samples, Round 1, 1989

LIST OF FIGURES

FIGURE	TITLE	PAGE
2-1	Statistical Methods for the Evaluation of Background Samples	2-4
3-1	Schematic Diagram of Ground Water/Surface Water Interaction	3-2
4-1	Trilinear Diagram - Ground Water - Round 1, 1989	4-2

BACKGROUND GEOCHEMICAL CHARACTERIZATION REPORT

LIST OF TABLES

TABLE	TITLE	PAGE
1-1	Background Ground Water (Round 1) Tolerance Interval Upper Limits or Maximum Detected Value	1-2
1-2	Background Surface Water (Rounds 1 and 2) Tolerance Interval Upper Limits or Maximum Detected Value	1-4
1-3	Background Sediment Tolerance Interval Upper Limits or Maximum Detected Value	1-6
1-4	Background Borehole Tolerance Interval Upper Limits or Maximum Detected Value	1-8
2-1	Tolerance Factors for Normal Tolerance Limits for 95% Population at 95% Confidence	2-7
2-2	Values of Lambda for Estimating the Mean and Variance of a Normal Distribution when ND Values are Present	2-10
3-1	Background Well Data for Rocky Flats Plant	3-4
3-2	Background Ground-Water Sample Information	3-5
3-3	Background Ground-Water and Surface Water Sampling Parameters	3-8
3-4	Background Surface Water and Sediment Station Data for Rocky Flats Plant	3-12
3-5	Background Surface Water Sample Information - Round 1	3-13
3-6	Background Surface Water Sample Information - Round 2	3-14
3-7	Background Sediment Sample Information	3-16
3-8	Background Sediment Sampling Parameters	3-17
3-9	Background Borehole Data for Rocky Flats Plant	3-19
3-10	Background Borehole Sample Information	3-21
3-11	Background Borehole Sampling Parameters	3-25
4-1	Comparison of TDS for Ground-Water Subgroups	4-3
4-2	Chemical Stratification of Rocky Flats Alluvium Ground Water	4-5

LIST OF TABLES
(Continued)

TABLE	TITLE	PAGE
4-3	Background Dissolved Metal Results Rocky Flats Alluvium Ground Water (Round 1, 1989)	4-6
4-4	Other Background Inorganic Results Rocky Flats Alluvium Ground Water (Round 1, 1989)	4-7
4-5	Background Dissolved Radiochemical Results Rocky Flats Alluvium Ground Water (Round 1, 1989)	4-8
4-6	Background Dissolved Metal Results Colluvium Ground Water (Round 1, 1989)	4-9
4-7	Other Background Inorganic Results Colluvium Ground Water (Round 1, 1989)	4-10
4-8	Background Radiochemical Results Colluvium Ground Water (Round 1, 1989)	4-11
4-9	Background Dissolved Metal Results Valley Fill Alluvium Ground Water (Round 1, 1989)	4-13
4-10	Other Background Inorganic Results Valley Fill Alluvium Ground Water (Round 1, 1989)	4-14
4-11	Background Radiochemical Results Valley Fill Alluvium Ground Water (Round 1, 1989)	4-15
4-12	Ranges of Chemical Results for Valley Fill Alluvial Ground Water by Drainage System	4-16
4-13	Background Dissolved Metals Results Weathered Claystone Ground Water (Round 1, 1989)	4-18
4-14	Other Background Inorganic Results Weathered Claystone Ground Water (Round 1, 1989)	4-19
4-15	Background Radiochemical Results Weathered Claystone Ground Water (Round 1, 1989)	4-20
4-16	Background Dissolved Metals Results Weathered Sandstone Ground Water (Round 1, 1989)	4-21
4-17	Other Background Inorganic Results Weathered Sandstone Ground Water (Round 1, 1989)	4-22
4-18	Background Dissolved Radiochemical Results Weathered Sandstone Ground Water (Round 1, 1989)	4-23
4-19	Background Dissolved Metals Results Unweathered Sandstone Ground Water (Round 1, 1989)	4-24

LIST OF TABLES
(Continued)

TABLE	TITLE	PAGE
4-20	Other Background Inorganic Results Unweathered Sandstone Ground Water (Round 1, 1989)	4-25
4-21	Background Dissolved Radiochemical Results Unweathered Sandstone Ground Water (Round 1, 1989)	4-26
4-22	Background Dissolved Metal Results Surface Water (Round 1, 1989)	4-29
4-23	Background Total Metal Results Surface Water (Round 1, 1989)	4-30
4-24	Other Background Inorganic Results Surface Water (Round 1, 1989)	4-31
4-25	Background Dissolved Radiochemical Results Surface Water (Round 1, 1989)	4-32
4-26	Background Total Radiochemical Results Surface Water (Round 1, 1989)	4-33
4-27	Background Dissolved Metal Results Surface Water (Round 2, 1989)	4-34
4-28	Background Total Metal Results Surface Water (Round 2, 1989)	4-35
4-29	Other Background Inorganic and Radiochemical Results Surface Water (Round 2, 1989)	4-36
4-30	Background Total Radiochemical Results Surface Water (Round 2, 1989)	4-37
4-31	Background Total Metal Results - Sediments	4-39
4-32	Other Background Inorganic and Total Radiochemical Results Sediments	4-40
4-33	Background Total Metal Results - Rocky Flats Alluvium	4-42
4-34	Other Background Inorganic Results - Rocky Flats Alluvium	4-43
4-35	Background Total Radiochemical Results - Rocky Flats Alluvium	4-44
4-36	Background Total Metal Results - Colluvium	4-46
4-37	Other Background Inorganic Results - Colluvium	4-47
4-38	Background Total Radiochemical Results - Colluvium	4-48

LIST OF TABLES
(Continued)

TABLE	TITLE	PAGE
4-39	Background Total Metal Results - Weathered Claystone	4-49
4-40	Other Background Inorganic Results - Weathered Claystone	4-50
4-41	Background Total Radiochemical Results - Weathered Claystone	4-51
4-42	Background Total Metal Results - Weathered Sandstone	4-53
4-43	Other Background Inorganic Results - Weathered Sandstone	4-54
4-44	Background Total Radiochemical Results - Weathered Sandstone	4-55

SECTION 1.0

EXECUTIVE SUMMARY AND RECOMMENDATIONS

The background characterization program is designed to document the spatial and temporal variability of constituents in order to facilitate the interpretation of chemical results in non-background areas This document summarizes the background data for ground water, surface water, sediments, and borehole materials, and identifies preliminary statistical boundaries of background variability Spatial variations in the chemistry of borehole materials and water have been addressed by placing sample locations throughout the background areas at the Plant, however, the goal of evaluating temporal variations in water chemistry cannot be achieved until at least two years of quarterly data have been collected This preliminary report will be finalized in the near future by incorporation of analytical data currently unavailable for samples collected to date, which includes a second round of ground-water samples for which no data is available at this time Other additions to the final report are noted in the recommendations at the end of this section

The boundary of background variability has been quantified in this report through the calculation of tolerance intervals assuming a normal distribution The upper limit of the tolerance interval or the maximum detected value for each parameter in ground-water, surface water, sediment and borehole samples are provided in Tables 1-1 through 1-4, respectively Maximum detected values are provided where there is insufficient data to calculate tolerance intervals This condition results from there being an insufficient number of samples, or where there is an insufficient number of detectable concentrations for a given analyte Alternative statistical methods are identified, such as ANOVA or test of proportionality, to determine whether non-background data significantly differs from the background population where tolerance intervals have not been calculated

As depicted in Table 1-1, high sodium, sulfate, and total dissolved solids distinguishes the unweathered (deep) sandstone ground water from the other shallow ground-water

TABLE 1-1

BACKGROUND GROUND WATER (ROUND 1)
TOLERANCE INTERVAL UPPER LIMITS
MAXIMUM DETECTED VALUE

Analyte	Units	Rocky Flats Alluvium (11 Samples)	Colluvium (2 Samples)	Valley Fill Alluvium (8 Samples)	Weathered Claystone (4 Samples)	Weathered Sandstone (2 Samples)	Unweathered Sandstone (7 Samples)
Dissolved Metals							
Aluminum	mg/l	ND	ND	ND	ND	ND	0.327*
Antimony	mg/l	ND	ND	ND	ND	ND	ND
Arsenic	mg/l	ND	ND	ND	ND	ND	0.0186*
Barium	mg/l	ND	ND	ND	ND	ND	ND
Beryllium	mg/l	ND	ND	ND	ND	ND	ND
Cadmium	mg/l	ND	ND	ND	ND	ND	ND
Calcium	mg/l	85	76 8*	138	73.4*	65 7*	64.6
Cesium	mg/l	ND	ND	ND	ND	ND	ND
Chromium	mg/l	ND	ND	ND	ND	0 0122*	ND
Cobalt	mg/l	ND	ND	ND	ND	ND	ND
Copper	mg/l	ND	ND	ND	ND	ND	ND
Iron	mg/l	0.266*	ND	0.94*	ND	ND	ND
Lead	mg/l	ND	ND	ND	ND	ND	ND
Lithium	mg/l	ND	0.172*	0.028	.031*	0.0106*	ND
Magnesium	mg/l	5.79*	15.3*	26.57	45.3*	9.41*	ND
Manganese	mg/l	0.365	0.088*	0 686*	0.126*	0 292*	0.0182*
Mercury	mg/l	ND	ND	0 003*	.008*	ND	ND
Molybdenum	mg/l	0.0136*	ND	ND	0.015*	0.015*	0.112*
Nickel	mg/l	0.0432*	ND	ND	ND	ND	ND
Potassium	mg/l	7.73*	ND	ND	ND	ND	21.89*
Selenium	mg/l	ND	ND	0.0114*	ND	ND	0.041*
Silver	mg/l	ND	ND	ND	ND	ND	ND
Sodium	mg/l	13.4	98.7*	88	36.9*	25.6*	599
Strontium	mg/l	0.159*	ND	ND	ND	ND	0.451*
Thallium	mg/l	ND	ND	ND	0.01*	ND	ND
Tin	mg/l	ND	ND	ND	ND	ND	
Vanadium	mg/l	ND	ND	ND	ND	ND	ND
Zinc	mg/l	0 141*	ND	0 0212*	0.107*	ND	0 564

TABLE 1-1 (cont.)

BACKGROUND GROUND WATER (ROUND 1)
TOLERANCE INTERVAL UPPER LIMITS
MAXIMUM DETECTED VALUE

Analyte	Units	Rocky Flats Alluvium (11 Samples)	Colluvium (2 Samples)	Valley Fill Alluvium (8 Samples)	Weathered Claystone (4 Samples)	Weathered Sandstone (2 Samples)	Unweathered Sandstone (7 Samples)
Other							
Total Dissolved Solids	mg/l	352	520*	947	320*	170*	1761
Carbonate	mg/l	ND	ND	ND	ND	ND	49
Bicarbonate	mg/l	436	470*	719	400*	140*	412
Chloride	mg/l	15.6	20*	40 29	11*	15*	607
Sulfate	mg/l	45.1	86*	150	44*	16*	950
Nitrate	mg/l	2 98	0.18*	0 69*	0.58*	1.6*	0.610
Cyanide	mg/l	.0038*	ND	ND	0 0036*	ND	ND
pH	----	8.6 (5.98)	7.4* (7.1)**	8.68 (6.12)	8 2* (7.4)**	7 5* (7.2)**	10.57 (7.43)
Dissolved Radionuclides							
Gross Alpha	pCi/l	12 543	27±12*	13.515	12±4*	7±5*	13±5*
Gross Beta	pCi/l	14.570	12±5*	18 530	7±2*	2±3*	15±4*
Uranium 233, 234	pCi/l	1.647	11±1*	6.481	5.8±0.6*	1.1±0.3*	12.936
Uranium 235	pCi/l	0 000	0.3±0 1*	0 232	0.2±0.1*	0±0.1*	0.135
Uranium 238	pCi/l	0.195	7.7±0.7*	5.084	3 2±0.5	0.6±0.2*	3.3507
Strontium 89, 90	pCi/l	0.552	0.1±0 4*	0.878	0 1±0.5	-0.1±0.6*	0.2±5*
Plutonium 239, 240	pCi/l	0.009	0±0.01*	0 012	0.03±0.02	0.01±0.01*	0.000
Americium 241	pCi/l	0.000	0±0 01*	0.012	0±0 01	0.01±0 01*	0.019
Cesium 137	pCi/l	0 603	0.2±0 6*	0 776	0 4±0 6	0 3±0.7*	0.7±0.5*
Tritium	pCi/l	309.149	100±150*	505.111	100±160	100±210*	731.876

* - Maximum Detected Value
** - Minimum Detected Value
ND - Not Detected
() - Tolerance Internal Lower Limit for Two-Sided Parameter

TABLE 1-2

BACKGROUND SURFACE WATER (ROUNDS 1 and 2)
TOLERANCE INTERVAL UPPER LIMITS
OR MAXIMUM DETECTED VALUE

Analyte	Units	Round 1 (9 samples) Total	Round 1 (9 samples) Dissolved	Round 2 (7 samples) Total	Round 2 (7 samples) Dissolved
Metals					
Aluminum	mg/l	64 10*	0 485*	8.444	0 454*
Antimony	mg/l	ND	ND	ND	ND
Arsenic	mg/l	0 116*	ND	ND	ND
Barium	mg/l	4 49*	ND	0.294*	ND
Beryllium	mg/l	0 0097*	ND	ND	ND
Cadmium	mg/l	0 0690*	ND	ND	ND
Calcium	mg/l	254 11	99 14	105 03	93 27
Cesium	mg/l	2 53*	ND	ND	ND
Chromium	mg/l	0 0598*	ND	0.0115*	ND
Cobalt	mg/l	0 0730*	ND	ND	ND
Copper	mg/l	0 180*	ND	ND	ND
Iron	mg/l	692 59	4 69*	12.070	0 453*
Lead	mg/l	0 233*	0 0055*	0.0308*	0.0131*
Lithium	mg/l	ND	ND	0.0192*	0.0166*
Magnesium	mg/l	27 71	11.98	17.578	15 74
Manganese	mg/l	1 140	0 826	1.101	0 232
Mercury	mg/l	0 001	0 002	0.004*	0 0004*
Molybdenum	mg/l	0 199*	ND	0.026	0 032
Nickel	mg/l	0 251*	ND	ND	ND
Potassium	mg/l	9 86*	ND	ND	ND
Selenium	mg/l	ND	ND	ND	ND
Silver	mg/l	0 148*	0 0125*	ND	ND
Sodium	mg/l	43 020	44.81	42.651	43 22
Strontium	mg/l	1 341	0.35	ND	ND
Thallium	mg/l	ND	ND	ND	ND
Tin	mg/l	0 969*	ND	ND	ND
Vanadium	mg/l	0 364*	ND	ND	ND
Zinc	mg/l	0 723*	032	0 0892*	0 0228*

TABLE 1-2 (cont.)

BACKGROUND SURFACE WATER (ROUNDS 1 and 2)
TOLERANCE INTERVAL UPPER LIMITS
OR MAXIMUM DETECTED VALUE

Analyte	Units	Round 1 (9 samples) Total	Round 1 (9 samples) Dissolved	Round 2 (7 samples) Total	Round 2 (7 samples) Dissolved
Other					
Total Dissolved Solids	mg/l	329.52	NA	365 15	NA
Carbonate	mg/l	ND	NA	ND	NA
Bicarbonate	mg/l	389.72	NA	344 21	NA
Chloride	mg/l	89.11	NA	82 56	NA
Sulfate	mg/l	50.20	NA	65 30	NA
Nitrate	mg/l	2.45	NA	2.1*	NA
Cyanide	mg/l	ND	NA	0.0043*	NA
pH	----	9 02 (5 89)	NA	8.3 (6 44)	NA
Radionuclides					
Gross Alpha	pCi/l	266.658	5.805	106 207	NA
Gross Beta	pCi/l	213.432	9.335	79 549	NA
Uranium 233, 234	pCi/l	1 250	3.684	1 326	NA
Uranium 235	pCi/l	0.106	0 364	0 000	NA
Uranium 238	pCi/l	0.937	2.311	0 977	NA
Strontium 89, 90	pCi/l	2.160	1.452	1.243	NA
Plutonium 239, 240	pCi/l	1.066	0.017	0 112	NA
Americium 241	pCi/l	0.111	0.014	0 014	NA
Cesium 137	pCi/l	12.788	0.591	1.059	NA
Tritium	pCi/l	266 107	NA	863 276	NA

NA - Not Analyzed
ND - Not Detected
* - Maximum Detected Value
() - Tolerance Interval Lower Limit for Two-Sided Parameter

TABLE 1-3

BACKGROUND SEDIMENT
TOLERANCE INTERVAL UPPER LIMITS
OR MAXIMUM DETECTED VALUE

Analyte	Units	Upper Limit (9 Samples)
Total Metals		
Aluminum	mg/l	24789
Antimony	mg/l	ND
Arsenic	mg/l	13.0*
Barium	mg/l	182*
Beryllium	mg/l	ND
Cadmium	mg/l	ND
Calcium	mg/l	72551
Cesium	mg/l	ND
Chromium	mg/l	43.38
Cobalt	mg/l	ND
Copper	mg/l	22.0*
Iron	mg/l	28308
Lead	mg/l	39.502
Lithium	mg/l	ND
Magnesium	mg/l	4110*
Manganese	mg/l	372.20
Mercury	mg/l	ND
Molybdenum	mg/l	ND
Nickel	mg/l	29.9*
Potassium	mg/l	ND
Selenium	mg/l	ND
Silver	mg/l	6.8*
Sodium	mg/l	ND
Strontium	mg/l	175*
Thallium	mg/l	ND
Tin	mg/l	ND
Vanadium	mg/l	50.2*
Zinc	mg/l	92.688

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TABLE 1-3 (cont.)

BACKGROUND SEDIMENT
TOLERANCE INTERVAL UPPER LIMITS
OR MAXIMUM DETECTED VALUE

Analyte	Units	Upper Limit (9 Samples)
Other		
Nitrate	mg/l	ND
pH	----	9 03 (8.77)
Total Radionuclides		
Gross Alpha	pCi/l	60.137
Gross Beta	pCi/l	50.168
Uranium 233, 234	pCi/l	1.669
Uranium 235	pCi/l	0.176
Uranium 238	pCi/l	1.755
Strontium 89, 90	pCi/l	1 390
Plutonium 239, 240	pCi/l	0.096
Americium 241	pCi/l	0.029
Cesium 137	pCi/l	1.578
Tritium	pCi/l	0.408

ND - Not Detected
* - Maximum Detected Value
() - Tolerance Interval Lower Limit for Two-Sided Parameter

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TABLE 1-4

BACKGROUND BOREHOLE
TOLERANCE INTERVAL UPPER LIMITS
MAXIMUM DETECTED VALUE

Analyte	Units	Rocky Flats Alluvium (70 Samples)	Colluvium (28 Samples)	Weathered Claystone (17 Samples)	Weathered Sandstone (4 Samples)
Total Metals					
Aluminum	mg/l	25312	21663	13495	10300*
Antimony	mg/l	ND	ND	16 2*	ND
Arsenic	mg/l	15 86	7 7	15.05	3.6*
Barium	mg/l	155 8	345 8	240.1	165*
Beryllium	mg/l	11 27	17.75	11 8	2 2*
Cadmium	mg/l	3 2*	1.8*	ND	ND
Calcium	mg/l	43079	20811	10183	5940*
Cesium	mg/l	ND	274*	ND	ND
Chromium	mg/l	37 9	26 8	16.57	10 7*
Cobalt	mg/l	18 2*	15 9*	29.7*	20.5*
Copper	mg/l	20 03	26 7	30.62	19.6*
Iron	mg/l	22916	29991	41295	12300*
Lead	mg/l	18 04	26 4	34.5	13.4*
Lithium	mg/l	44 4	32 1	33.37	7.0*
Magnesium	mg/l	4425	6151	4896	2520*
Manganese	mg/l	422 9	545.1	656	305*
Mercury	mg/l	0 58*	0 44*	0.35*	0.27*
Molybdenum	mg/l	38 65	32 78	33.68	11.2*
Nickel	mg/l	43 27	35 4	56.95	14.3*
Potassium	mg/l	3336	2789	1400*	ND
Selenium	mg/l	ND	ND	ND	ND
Silver	mg/l	40 9*	33 5*	18 7*	12.7*
Sodium	mg/l	ND	3680*	ND	ND
Strontium	mg/l	226*	111 1	144.42	69 2*
Thallium	mg/l	ND	ND	ND	ND
Tin	mg/l	338*	441*	274*	268*
Vanadium	mg/l	54 67	58 2	47 7	22 2*
Zinc	mg/l	52 64	98 1	106 7	79.9*

TABLE 1-4 (cont.)

BACKGROUND BOREHOLE
TOLERANCE INTERVAL UPPER LIMITS
MAXIMUM DETECTED VALUE

Analyte	Units	Rocky Flats Alluvium (70 Samples)	Colluvium (28 Samples)	Weathered Claystone (17 Samples)	Weathered Sandstone (4 Samples)
Other					
Sulfide	mg/l	13*	5*	5*	2*
Nitrate	mg/l	4.3*	4 274	2.0*	1 9*
pH	----	9.64 (6.06)	9.48 (6.96)	10 14 (7 04)	9.2* (8 0)**
Total Radionuclides					
Gross Alpha	pCi/l	37.108	51.710	52 302	37±17
Gross Beta	pCi/l	36.886	35.135	35.743	29±6
Uranium 233, 234	pCi/l	1 491	1 759	1.985	0 8±0.3
Uranium 235	pCi/l	0 087	0 169	0 258	0 1±0 1
Uranium 238	pCi/l	1 353	1 675	1 643	1.0±0.2
Strontium 89, 90	pCi/l	0 768	0 776	0 786	0 4±0.6
Plutonium 239, 240	pCi/l	0 017	0.023	0 020	0.01±0 01
Americium 241	pCi/l	0 018	NR	NR	NR
Cesium 137	pCi/l	0 082	0.113	ND	0.0±0.1
Tritium	pCi/l	0 410	0 299	0.322	0.39±0.15

ND - Not Detected
NR - Data Not Received
* - Maximum Detected Value
** - Minimum Detected Value
() - Tolerance Interval Lower Limit for Two-Sided Parameter

subgroups The shallow ground water subgroups are similar in chemistry, however, closer inspection suggests that the ground water of the Rocky Flats Alluvium is less saline than any of the other shallow ground-water subgroups it recharges This phenomenon is likely a result of the relatively greater evaporative losses in the colluvium and valley fill (less saturated thickness than the Rocky Flats Alluvium), and in the case of the weathered and unweathered bedrock, longer contact time with these materials (less permeable than the Rocky Flats Alluvium)

Differences in the analytical results from Round 1 and Round 2 surface water samples document the temporal variation in surface water chemistry (Table 1-2) These differences include variability in the suite of parameters with detected concentrations as well as the magnitude of the concentrations As discussed in Section 4 2, surface water becomes relatively less concentrated in sodium chloride and more concentrated in calcium bicarbonate as it flows from west to east Surface water chemistry changes from west to east across the background areas reflect the increased influence of ground water on surface water quality

Relative to the Rocky Flats Alluvium, colluvium, and weathered sandstone and claystone, the sediments have fewer detected trace metals and lower concentrations of aluminum, iron, and calcium (Tables 1-3 and 1-4) Potassium was also not detected in the sediments but was detected elsewhere The absence of detected potassium, together with the lower concentrations of aluminum and iron, suggest that there is less clay in the sediments relative to the other materials This is further supported by the physical description of this material, i e, the sediments tend to be more coarse A smaller clay fraction may also explain the fewer detections of trace metals owing to the high adsorptive capacity of the clay fraction

To detect releases from sites/units, station-specific data will be compared to the range of background concentrations (tolerance intervals), and in the case of surface water and ground water, also compared to the concentrations at the station or well over time

Borehole sampling data will be compared to the background tolerance intervals for the corresponding borehole material A constituent concentration at a site/unit that is greater than the upper limit of the one-sided 95% tolerance interval at the 95% confidence level will be considered to likely represent contamination

Determination that a constituent concentration in ground water or surface water represents contamination will be based on 1) comparison of new data to the background tolerance interval, 2) trend testing, and/or 3) use of control charts for annual means As previously stated, at least two years of water quality data will be needed to perform the temporal tests (trend testing and control charts)

In the process of reviewing the background data, questions arose concerning appropriate background populations Specifically, does a single population characterize (1) ground water sampled in valley fill associated with Rock Creek and Woman Creek, (2) ground water within valley fill and colluvium, (3) ground water within weathered claystone and weathered sandstone, and (4) weathered claystone and weathered sandstone materials?

In the review of Round 1 and Round 2 water data, it became apparent that temporal variation in surface water and ground-water sampling is a function of at least two factors (1) natural variations in water quality, and (2) changes in the number and spatial representation of background samples due to the availability of water at sampling sites

Similar issues arose in the review of borehole samples (1) analyte concentrations may be dependent upon depth from surface, and (2) higher concentrations of analytes tend to cluster within the same sample

For these reasons it is recommended that for the final background geochemical characterization report.

- the statistical distribution of the data be investigated, and the appropriate distribution be used in subsequent statistical analysis,

- multi-variate analysis of variance be used to evaluate the appropriateness of present division of ground-water populations and thus the potential for combining data from these populations into fewer water groups, and

- principal component analysis be investigated as a method to identify factors which may influence the distribution and concentration of analytes within background samples

2.0 INTRODUCTION

2.1 PURPOSE

Representative background analytical data are necessary for meaningful interpretations of RCRA facility investigations and CERCLA remedial investigation (soils, bedrock, surface water, and ground water) analytical results Background data assist in the evaluation of environmental degradation by determining spatial and temporal variability of a naturally-occurring constituent These characteristics can be compared statistically with data from a downgradient site to determine the likelihood that a particular concentration of chemicals represents a release from the SWMU

This document presents the results of the first phase of a background hydrogeochemical characterization conducted pursuant to the Background Hydrogeochemical Characterization Monitoring Plan (BHCMP) (Rockwell International, 1989a) Described herein is a characterization of these media surficial and bedrock materials, stream sediments, an initial round of ground-water samples, and, two rounds of surface water samples This document identifies the appropriate statistical approach to compare background to non-background concentrations for each analyte, and provides calculated tolerance intervals for each analyte where possible

The long-term goal of background hydrogeochemical characterization is evaluation of spatial and temporal variations in background ground-water and surface water quality Spatial variations have been addressed by placing sample locations at several different locations across the plant The goal of evaluating temporal variation cannot be achieved until multiple data sets for each media are available This report covers only the first round of background ground-water samples and two rounds of surface water samples

2.2 BACKGROUND

The Rocky Flats Plant (RFP) is a Department of Energy (DOE) facility involved in the manufacture of components for nuclear weapons The Plant fabricates the components from plutonium, uranium, beryllium, and stainless steel Both radioactive and nonradioactive wastes are generated in the process Current waste handling practices involve on-site and off-site recycling of hazardous materials and off-site disposal of solid radioactive materials at another DOE facility However, both storage and disposal of hazardous and radioactive wastes have occurred and are occurring on site Preliminary assessments under the DOE Comprehensive Environmental Assessment and Response Program (now called the Environmental Restoration (ER) Program) identified past on-site storage and disposal locations as potential sources of environmental contamination

The ER Program is a comprehensive, phased program of site characterization, environmental monitoring, remedial investigations, risk assessments, feasibility studies, remedial/corrective actions, and site closures The Program includes CERCLA, RCRA 3004u and RCRA closure projects Draft remedial investigation (RI) and feasibility study (FS) reports, and RCRA closure plans have been submitted to EPA and CDH However, owing to aggressive investigation/clean-up schedules, sufficient background characterization data have not been previously collected Background data are necessary to identify which inorganic compounds, if any, may be indicative of contamination at the Rocky Flats Plant Therefore, the final remedial investigation/feasibility study reports and closure plans will incorporate this background information

2.3 GENERAL APPROACH

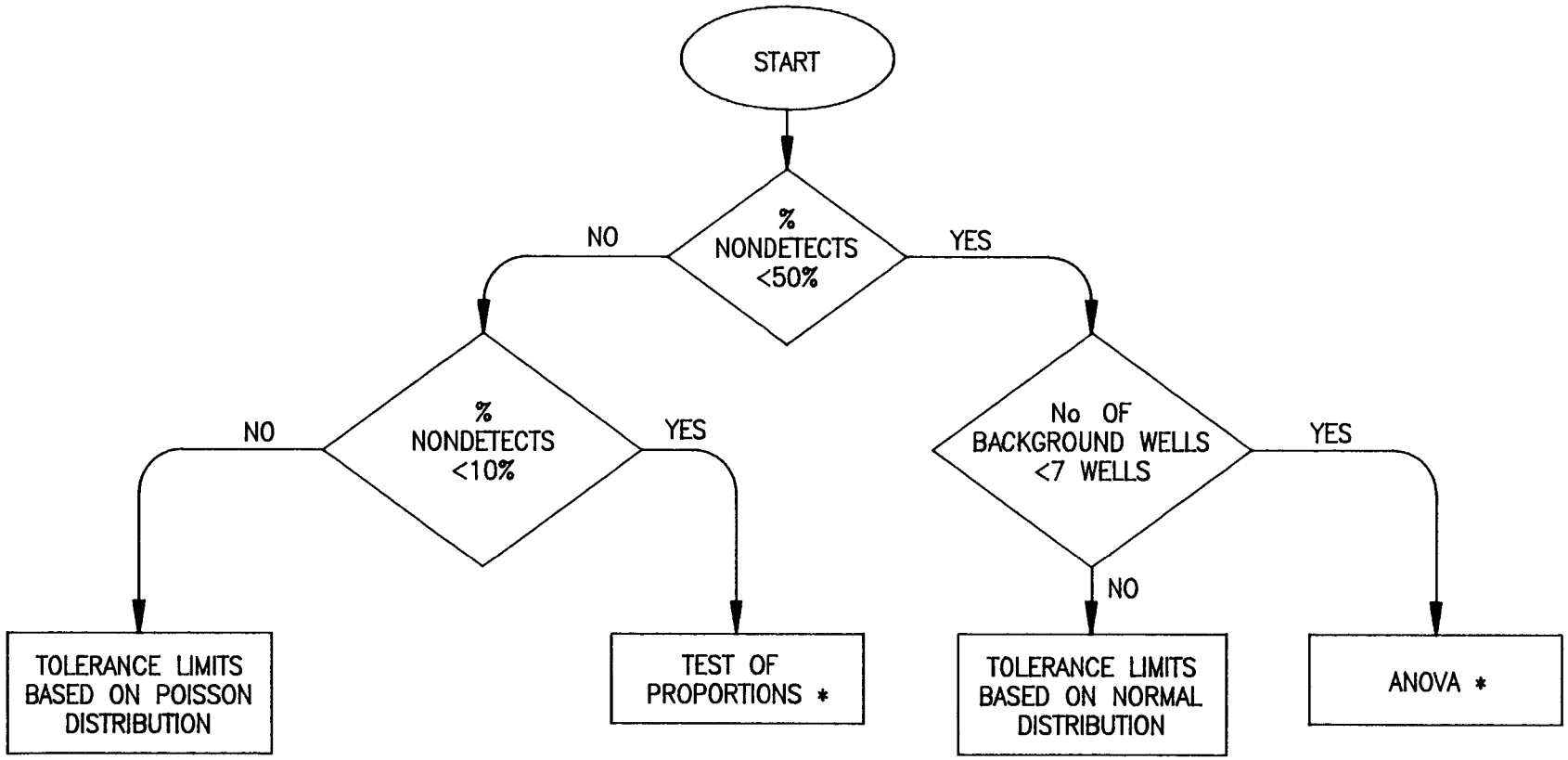
In order to develop representative background data, samples were collected spatially across the Rocky Flats Property to characterize background variation within various media surficial and bedrock materials, stream sediments, ground water, and surface water In addition, samples were collected within subsets of some media based upon geological and

hydrogeological considerations For example ground water was sampled in Rocky Flats Alluvium, colluvium, valley fill alluvium, weathered sandstone and claystone, and unweathered sandstone

The logic for selecting the appropriate method of statistical comparison between background and non-background is charted in Figure 2-1 As indicated within this flowchart, the primary determinant for use of the appropriate statistical method is the percentage of values above analytical detection limits If there are less than 10% detects for a particular parameter, tolerance intervals based on the Poisson distribution are appropriate, if greater than 10% and less than 50% detects occur, a test of proportions is appropriate, and if greater than 50% detects are encountered, tolerance intervals or analysis of variance (ANOVA) are appropriate (EPA, 1989) Tolerance intervals will be calculated if the number of samples collected is equal to or greater than seven while ANOVA will be reserved for analytes when the number of samples collected is less than seven The appropriate statistical procedure to be used for background/non-background comparative purposes, for each analyte within each subgroup, is identified in Section 4 0

2.4 COMPUTATION OF NORMAL TOLERANCE INTERVAL STATISTICAL METHODS

A tolerance interval will be computed for a constituent concentration in a background soil or water type based on the latest quarterly data. (This will occur only once for soils and bedrock units as only one round of sampling is necessary to characterize background geochemistry) Tolerance intervals define a range that contains at least p% of a population with P% probability (level of confidence), i e, upon repeated sampling, P% of the calculated intervals will contain p% of the population Tolerance intervals answer the question where do most of the observations lie?



* THIS STATISTICAL METHOD REQUIRES NONBACKGROUND SAMPLES

FIGURE 2-1

STATISTICAL METHODS FOR THE EVALUATION OF BACKGROUND SAMPLES

R33022.MB-120689

For the tolerance interval to be useful in decision making, both "p" and "P" are chosen to be large, in this case, p = 0 95 and P = 0 95 A site-related or downgradient concentration that lies outside this interval will be evaluated as a potential release from a site/unit

A tolerance interval is either one-sided or two-sided A two-sided tolerance interval is appropriate whenever a concentration either larger or smaller than background may be associated with a contaminant release, e g , pH One-sided tolerance intervals are appropriate for all other constituents for which an increase over background concentrations are indicative of releases A two-sided interval is defined by two limits (L_1 and L_2) where a proportion "p" of the population is contained between the limits L_1 and L_2 with probability "P" An upper (or lower) one-sided tolerance limit is defined so that P% of the population is less than (or greater than) the upper limit L_2 (or the lower limit L_1)

Criteria for the use of tolerance intervals based on normal distribution are (1) a 50% or greater rate of detection among samples (EPA, 1989), and (2) a sample size of seven or more Tolerance interval calculations have been restricted to seven or more samples in order to obtain a 95 percent interval (95% of the population within a one-sided interval) with a tolerance factor of 3 4 (one-sided) at the 95% confidence level (Table 2-1) (The BHCMP calls for nine samples to achieve a tolerance factor of 3 0, however, for preliminary use, if seven samples are available a tolerance interval will be calculated) When a sample set size was less than seven, the mean plus three standard deviations were calculated for comparison with other tolerance intervals When comparing these values, it must be emphasized that the mean plus three standard deviations reflects less than a 95% confidence level and/or less than 95% of the population

Parametric tolerance intervals are calculated assuming a normal probability distribution Assumption of a normal probability distribution is consistent with new EPA regulations for RCRA ground-water monitoring (EPA, 1988) If a given constituent's concentration ranges over more than three orders of magnitude, then a log normal tolerance interval will be used (Doctor, Gilbert, and Kinnison, 1986) The other criterion used to

determine if the data was normally distributed was the calculation of the coefficient of variation The coefficient of variation is the standard deviation divided by the mean (or adjusted mean as developed by Cohen, 1961) If the coefficient of variation resulted in a value greater than one or less than zero, the data is assumed to be lognormally distributed, therefore, lognormal tolerance intervals are proposed

The lower and upper limits of a normal population tolerance interval are computed as

$L_1 = \overline{x} - Ks$ and

$L_2 = \overline{x} + Ks$,

where

$\overline{x}$ = mean of the sample population of size n,

s = standard deviation of the sample population, and

K = the normal tolerance factor [dependent on p, P, n (the number of samples), and on whether the interval is one- or two-sided]

Table 2-1 presents tolerance factors K for two-sided and one-sided tolerance intervals at 95% population and 95% confidence With the exception of pH, one sided tolerance intervals (L_2) will be calculated for all analytes For a small number of samples, the K value is large leading to tolerance intervals that probably would not detect releases from sites/units As the number of samples increases, the value of K decreases, which leads to narrower tolerance intervals Narrower background tolerance intervals will be more sensitive to detecting releases to the environment from sites/units

Many Inorganic Target Analyte List constituents will be undetected in both background and downgradient wells Special procedures are thus needed to compute the mean and standard deviation of a population when a significant number of the observations are below the detection limit A data set is termed censored when not detected (ND) observations are present in a data set, and some assumption must be made about the statistical distribution

TABLE 2-1

TOLERANCE FACTORS FOR NORMAL TOLERANCE LIMITS

FOR 95% POPULATION AT 95% CONFIDENCE

n	Two-Sided	One-Sided
2	37 67	
3	9 916	7 655
4	6 370	5 145
5	5 079	4.202
6	4 414	3 707
7	4 007	3 399
8	3 732	3 188
9	3 532	3 031
10	3 379	2 911
11	3 259	2 815
12	3 162	2 736
13	3 081	2 670
14	3 012	2 614
15	2 954	2 566
16	2 903	2 523
17	2 858	2 486
18	2 819	2 453
19	2 784	2 423
20	2 752	2 396
21	2 723	2 371
22	2 697	2 350
23	2 673	2 329
24	2 651	2 309
25	2 631	2 292
26	2 612	
27	2 595	
28	2 579	
29	2 554	
30	2 549	2 220
35	2 490	2 166
40	2 445	2 126
45		2 092
50	2 379	2 065
60	2 333	
80	2 272	
100	2 233	
200	2 143	
500	2 070	
1000	2 036	
inf	1 960	

for the entire data set A technique for calculation of the mean and standard deviation of such a data set was developed by Cohen (1961) and can be used if the data are normally distributed

The Cohen procedure is as follows (Doctor, Gilbert, and Kinnison, 1986)

Let

n = the total number of observations for a constituent,

k = number of actual measurements out of n (not NDs), and

x_o = the detection limit of the constituent

Then

1) Compute $h = (n-k)/n$ (the proportion of measurements below the detection limit),

2) Compute x_u = (Sum of x_i for $i = 1$ to k)/k,

3) Compute s^2_u = (Sum of $(x_i - x_u)^2$ for $i = 1$ to k)/k,

4) Compute $t = s^2_u/(x_u-x_o)^2$,

5) Obtain an estimate of Lambda from Table 2-2 using h and t,

6) Estimate the mean and variance of the population from which the censored data set was drawn by computing

$$x = x_u - \lambda 2\ (x_u-x_o)$$

and $$s = [s^2_u + \lambda 2\ (x_u-x_o)^2]^{1/2}$$

With regard to radiochemistry data, a measurement error, equal to 2 standard deviations (2s) of the measurement is associated with the results It is necessary to consider propagation of error when interpreting the mean value computed from a series of radiochemical results, i e, the precision of each measurement must be considered in order to define the precision of the mean value This is accounted for by computing the variance (s^2) of the mean value

It is noted that the variance of the sum of n observations each with variance s^2_{xi} is simply the sum of the variances

$$y = x_i + x_{i+1} + x_n$$

$$s^2_y = s^2_{xi} + s^2_{xi+1} + s^2_n$$

When coefficients are involved, the relationship is as follows

$$y = ax_c + bx_{c+1} + .kx_n$$

$$s^2_y = a^2s^2_{xi} + b^2s^2_{xi+1} + k^2s^2_{xn}$$

Computation of mean implies the coefficients are each equal to 1/n Therefore the variance of the mean is

$$s^2_x = 1/n^2 \ (s^2_{xi} + s^2_{xi+1} + s^2_n)$$

The relationship has been used to calculate the error associated with the mean, where the error is $2s_x$.

TABLE 2-2

Values of Lambda for Estimating the Mean and Variance of a Normal Distribution when ND Values are Present

h													h
Tau	01	.02	03	04	.05	.06	07	08	09	.10	.15	.25>	Tau
0.00	0.010100	0 020400	0.030902	0.041583	0 052507	0 063627	0 074953	0 086488	0 098240	0.110200	0.173420	0.242680	0.00
0 05	0 010551	0.021294	0.032225	0 043350	0 054670	0 066189	0.077909	0 089634	0 101970	0.114310	0.179350	0.250330	0.05
0 10	0 010950	0 022082	0.033398	0 044902	0 056596	0 068483	0.080568	0 092852	0.105340	0 118040	0.184790	0.257410	0.10
0 15	0.011310	0.022798	0 034466	0.046318	0 058356	0.070586	0.083009	0 095629	0.108450	0.121480	0.189650	0.264050	0.15
0.20	0 011642	0.023459	0.035453	0.047629	0 059990	0 072539	0 085280	0 098216	0 111350	0.124690	0.194600	0.270310	0.20
0 25	0.011952	0.024076	0.036377	0 048858	0 061522	0 074372	0.087413	0 100650	0 114080	0.127720	0.199100	0.276260	0 25
0 30	0.012243	0 024658	0.037249	0.050018	0.062969	0.076106	0.089433	0 102950	0 116670	0.130590	0.203380	0.281930	0.30
0.35	0 012520	0.025211	0 038077	0.051120	0 064345	0.077756	0.091355	0 105150	0 119140	0.133330	0 207470	0.287370	0.35
0 40	0.012784	0.025738	0.038866	0 052173	0 065660	0 079332	0.093193	0 107250	0.121500	0.135950	0.211390	0.292600	0 40
0 45	0.013036	0.026243	0 039624	0 053182	0 066921	0.080845	0 094958	0 109260	0 123770	0.138470	0.215170	0.297650	0 45
0.50	0 013279	0.026728	0.040352	0.054153	0 068135	0.082301	0.096657	0 111210	0 125950	0.140900	0.218820	0.302530	0 50
0.55	0.013513	0.027196	0.041054	0 055089	0 069306	0.083708	0 098298	0 113080	0.128060	0.143250	0.222350	0.307250	0.55
0 60	0.013739	0.027649	0 021733	0 055995	0.070439	0.085068	0 099887	0 114900	0.130110	0 145520	0 225780	0.311840	0.60
0 65	0.013958	0.028087	0 042391	0.056874	0 071538	0.086388	0.101430	0.116660	0 132090	0.147730	0 229100	0.316300	0.65
0.70	0.014171	0.028513	0 043030	0.057726	0 072605	0.087670	0.102920	0 118370	0.134020	0.149870	0.232340	0.320650	0.70
0 75	0.014378	0.028927	0.043652	0 058556	0 073643	0.088917	0.104380	0 120040	0 135900	0.151960	0.235500	0.324890	0.75
0.80	0.014579	0.029330	0 044258	0 059364	0.074655	0.090133	0 105800	0 121670	0 137730	0.154000	0.238580	0.329030	0.80
0 85	0.014775	0.029723	0.044848	0 060153	0.075642	0.091319	0 107190	0 123250	0 139520	0.155990	0.241580	0.333070	0.85
0.90	0.014967	0.030107	0 045425	0 060923	0.076606	0.092477	0.108540	0 124800	0 141260	0.157930	0.244520	0.337030	0.90
0.95	0 015154	0.030483	0 045989	0 061676	0.077549	0.093611	0.109870	0 126320	0 142970	0.159830	0.247400	0.340910	0.95
1.00	0.015338	0.030850	0.046540	0 062413	0 078471	0.094720	0 111160	0 127800	0 144650	0 161700	0.250220	0 344710	1.00

TABLE 2-2
(continued)

Values of Lambda for Estimating the Mean and Variance of a
Normal Distribution when ND Values are Present

Tau \ h	25	.30	35	40	45	.50	55	.60	.65	.70	80	.90	Tau \ h
0.00	0 318620	0.402100	0.494100	0.596100	0 709600	0.836800	0 980800	1.145000	1 336000	1.561000	2.176000	3 283000	0 00
0.05	0 327930	0 413000	0.506600	0.610100	0 725200	0.854000	0 999400	1 166000	1 358000	1 585000	2.203000	3.314000	0.05
0 10	0.336620	0 423300	0.518400	0.623400	0.740000	0.870300	1 017000	1 185000	1 379000	1 608000	2.229000	3.345000	0.10
0.15	0.344800	0 433000	0.529600	0.636100	0.754200	0.886000	1 035000	1.204000	1.400000	1 630000	2 255000	3.376000	0.15
0.20	0.352550	0.442200	0 540300	0.648300	0.767800	0.901200	1 051000	1 222000	1 419000	1.651000	2 280000	3.405000	0.20
0 25	0.359930	0 451000	0.550600	0.660000	0.781000	0.915800	1.067000	1 240000	1 439000	1.672000	2.305000	3.435000	0 25
0 30	0.367000	0 459500	0.560400	0.671300	0.793700	0.930000	1.083000	1.257000	1.457000	1.693000	2.329000	3.464000	0.30
0.35	0 373790	0 467600	0.569900	0.682100	0 806000	0.943700	1 098000	1.274000	1 476000	1.713000	2.353000	3.492000	0 35
0.40	0 380330	0 475500	0 579100	0.692700	0 816900	0.957000	1.113000	1.290000	1 494000	1 732000	2.376000	3.520000	0 40
0 45	0.386630	0 483100	0 588000	0.702900	0 829500	0.970000	1 127000	1.306000	1 511000	1 751000	2.399000	3.547000	0 45
0.50	0 392760	0 490400	0.596700	0.712900	0 840800	0.982600	1.141000	1 321000	1 528000	1.770000	2.421000	3.575000	0 50
0.55	0.398700	0 497600	0.605100	0.722500	0.851700	0.995000	1.155000	1.337000	1.545000	1.788000	2.443000	3.601000	0 55
0.60	0.404470	0 504500	0.613300	0.732000	0.862500	1.007000	1.169000	1 351000	1.561000	1.806000	2.465000	3 628000	0 60
0.65	0 410080	0.511400	0 621300	0.741200	0.872900	1.019000	1.182000	1 366000	1 557000	1.824000	2.486000	3.654000	0 65
0 70	0 415550	0.518000	0 629100	0.750200	0.883200	1.030000	1.195000	1 380000	1 593000	1.841000	2.507000	3.679000	0.70
0.75	0.420900	0.524500	0 636700	0.759000	0.893200	1.042000	1.207000	1.394000	1 608000	1 858000	2.528000	3.705000	0 75
0.80	0 426120	0.530800	0 644100	0.767600	0.903100	1.053000	1 220000	1 408000	1.624000	1.875000	2.548000	3.730000	0.80
0.85	0.431220	0 537000	0 651500	0 776100	0.912700	1.064000	1.232000	1 422000	1 639000	1 892000	2 568000	3.754000	0 85
0.90	0.436220	0 543000	0 658600	0.784400	0.922200	1.074000	1 244000	1 435000	1 653000	1.908000	2 588000	3.779000	0.90
0 95	0 441120	0 549000	0.665600	0.792500	0.931400	1.085000	1.255000	1 448000	1 668000	1 924000	2 607000	3.803000	0 95
1 00	0 445920	0.554800	0 672400	0.800500	0.940600	1 095000	1.267000	1 461000	1 682000	1 940000	2 626000	3 827000	1 00

SECTION 3.0

SAMPLING LOCATIONS AND SAMPLE COLLECTION

In order to identify changes in site soil and water chemistry due to Plant operations, background conditions in soil and water are being evaluated Fifty monitoring wells were installed during this program and nine stations were selected for collection of surface water and sediment samples (Plate 1) In addition, samples were collected from eighteen boreholes for chemical analysis

All ground-water, surface water, borehole, and sediment sampling activities were conducted in accordance with the ER Program Standard Operating Procedures (SOPs) for Rocky Flats Plant (Rockwell International, 1989b) Laboratory analyses of the samples were performed following Contract Laboratory Program (CLP) protocols for the Inorganic Target Analyte List Details of laboratory analyses for these and other constituents are presented in the Quality Assurance/Quality Control (QA/QC) Plan (Rockwell International, 1989c) Also presented in the QA/QC plan are the guidelines used during the Background Field Program for collection of QA/QC samples (field/equipment blanks, and field duplicates)

3.1 GROUND WATER

Two ground-water flow systems have been identified within the Rocky Flats Plant, a surficial flow system within the Rocky Flats Alluvium, colluvium, valley fill and weathered bedrock, and a bedrock flow system within unweathered bedrock sandstones (Figure 3-1) The hydraulic connection between the two flow systems are the bedrock sandstones which subcrop beneath surficial materials Ground-water flow for both systems is generally west to east, although ground-water flow in the surficial system is locally determined by topography Ground water within the Rocky Flats Alluvium moves downslope into colluvium and then into valley fill Ground water from the Rocky Flats Alluvium recharges weathered bedrock, and also the bedrock flow system where the weathered bedrock includes subcropping sandstones

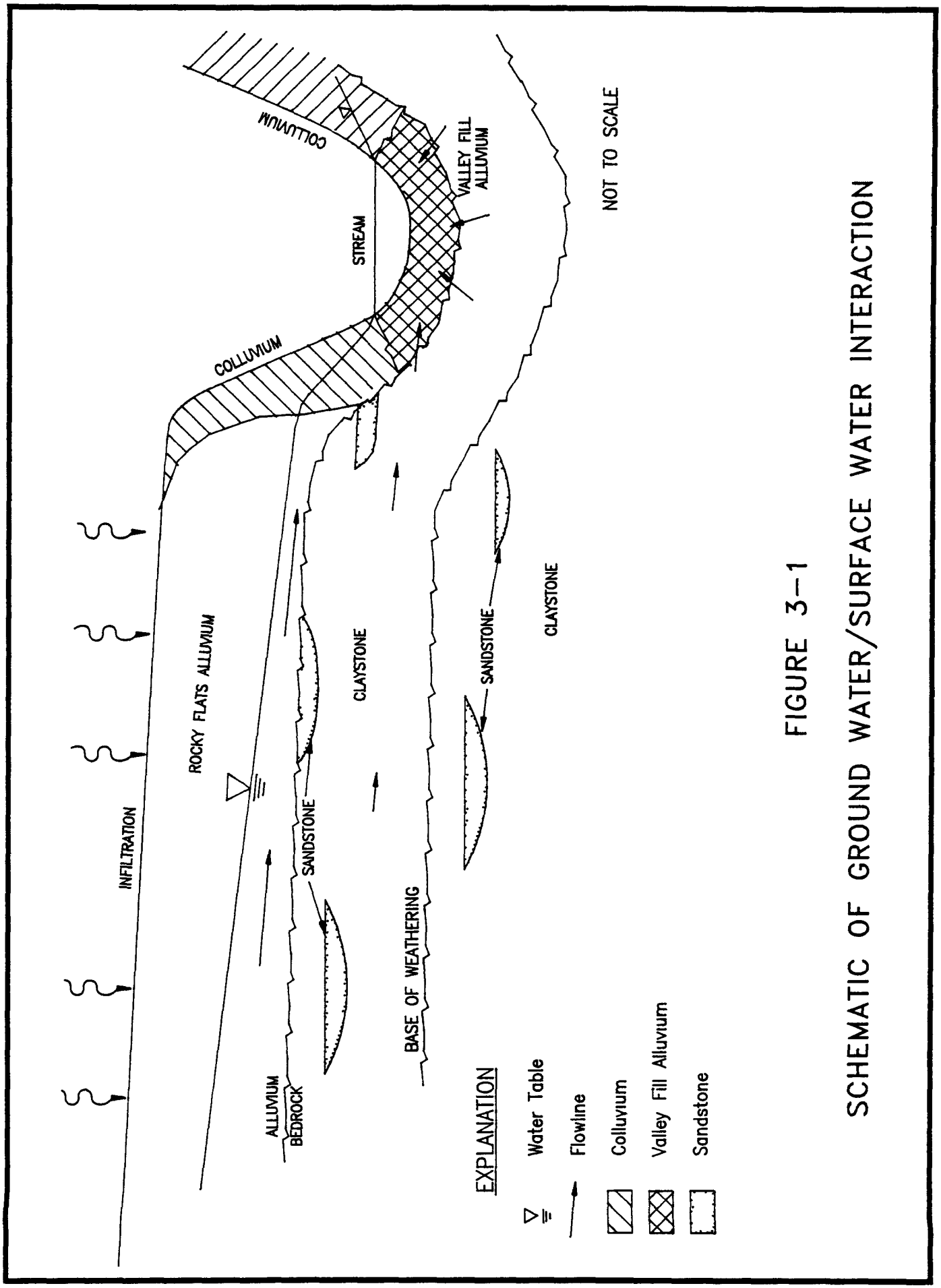


FIGURE 3-1

SCHEMATIC OF GROUND WATER/SURFACE WATER INTERACTION

Samples collected from fifty-one ground-water monitoring wells (fifty wells installed in 1989 and one well installed in 1986) at the Rocky Flats Plant were analyzed to characterize background ground-water quality (Table 3-1) Also shown in Table 3-1 are the completion units for each of the background monitoring wells Wells were completed in the alluvium, colluvium, valley fill alluvium, and weathered and unweathered bedrock

Results of the first round (Round 1) of ground-water samples are presented in this report Round 1 began on April 4, 1989 and was completed on July 17, 1989 A total of 35 samples were collected from the fifty-one wells as shown in Table 3-2. Eight colluvial wells, one valley fill alluvium well, six weathered claystone wells, and one unweathered sandstone well were dry during the Round 1 sampling effort A well was considered dry if the water level in the well was below the base of the screen prior to the pre-sample purge The samples collected were analyzed for the parameters listed in Table 3-3 Contract Laboratory Program (CLP) Target Compound List (TCL) organics do not occur naturally and should not be present in background ground water Therefore, they were not included in the analyte list

3 1 1 Rocky Flats Alluvium Ground Water

Alluvial ground water was characterized by sampling alluvial wells installed in eight borings used for characterization of the Rocky Flats Alluvium (Wells B400189, B400289, B400389, B400489, B200589, B200689, B200789 and B200889) Well B405586 serves as the ninth background alluvial well (Plate 1) The wells were installed in two different areas of the Plant Buffer Zone to account for spatial variability Wells B405586, B400189, B400289, B400389 and B400489 were installed in the southwest portion of the buffer zone in an area which exhibits lithologies similar to the West Spray Field Wells B200589, B200689, B200789, and B200889 were installed in the northern buffer zone sidegradient of the Plant due to expected similarities in lithology and saturated thicknesses to those at the Solar Evaporation Ponds, 903 Pad, Mound, and East Trenches Areas

TABLE 3-1

BACKGROUND WELL DATA FOR ROCKY FLATS PLANT

Well Number	Well Status	Depth to Top of Screen (ft)	Depth to Bottom of Screen (ft)	Total Depth (ft)	Depth to Bedrock (ft)	Geologic Strata of Complete
8400189	1	10 09	49 60	51 35	49 80	Qrf
8400289	1,5	20 52	50 00	51 25	49 60	Qrf
8400389	1,5	9 50	49 00	50 30	48 50	Qrf
8400489	1,5	9 87	54 45	55 70	54 00	Qrf
8200589	1,5	11 86	31 57	33 31	30 00	Qrf
8200689	1,5	11 58	31 05	32 80	30 60	Qrf
8200789	1,5	9 07	28 50	30 47	28 00	Qrf
8200889	1 5	8 60	23 12	24 70	22 80	Qrf
8201089	1,5	3 48	7 83	9 60	7 50	Qc
8201189	1,5	20 36	34 80	36 50	34 00	Qc
8201289	1,5	14 73	23 90	26 11	23 40	Qc
8201489	1 5	5 58	9 96	11 64	7 00	Qc
8201589	1,5	4 38	8 76	10 50	8 20	Qc
8301889	1,5	13 16	22 60	24 45	22 30	Qc
8401989	1,5	6 55	21 00	22 65	20 50	Qc
8302089	1,5	3 85	13 30	15 00	13 50	Qc
8402189	1,5	13 50	22 90	24 60	7 50	Kss
8102289	1	3 00	12 47	14 22	12 50	Qvf
8102389	1	3 74	10 90	12 61	10 40	Qvf
8202489	1	3 43	12 90	14 65	12 40	Qvf
8202589	1	4 53	11 60	13 40	11 20	Qvf
8402689	1	2 55	3 28	5 85	2 80	Qvf
8302789	1	4 00	8 55	10 17	8 00	Qvf
8302889	1	5 92	10 52	12 10	10 20	Qvf
8302989	1	3 46	7 90	9 65	7 40	Qvf
8303089	1	4 61	7 00	8 90	6 60	Qvf
8203189	1	35 26	44 70	46 47	30 30	Kcl
8203289	1	35 00	44 47	46 00	30 10	Kcl
8203489	1	31 00	40 50	41 25	28 60	Kcl
8203589	1	29 70	39 16	40 94	24 30	Kcl
8203689	4	27 05	36 55	37 30	22 60	Kcl
8203789	1	134 15	138 59	140 84	26 70	Kss
8203889	1	107 00	111 43	113 90	28 40	Kss
8203989	1	125 97	130 42	132 70	23 70	Kss
8204089	1	106 50	112 90	115 23	1 60	Kss
8204189	1	81 10	95 33	97 62	3 70	Kss
8304289	1	84 40	88 49	90 95	10 50	Kss
8204689	4	105 50	109 95	112 22	2 90	Kss
8304789	1	27 90	37 57	39 14	22 90	Kcl
8304889	1	14 66	24 14	25 90	9 70	Kcl
8304989	1	75 50	82 87	86 25	8 40	Kss
8405189	1	13 20	22 69	24 45	8 20	Kcl
8405289	1	41 24	45 67	48 00	10 30	Kss
8305389	1	15 18	25 00	26 30	10 00	Kcl
8405489	1	39 13	48 57	50 05	34 00	Kcl
8205589	1	6 87	16 30	18 00	32 30	Qc
8405689	1	3 00	22 51	23 75	0 00	Qrf
8405789	1	43 01	52 48	53 72	52 00	Qrf
8405889	1	36 04	45 50	46 75	6 50	Kss
8405989	1	2 80	6 70	8 50	6 20	Qc
8405586	1	3 55	36 39	36 39	35 50	Qrf

KEY TO STATUS 1 - Active Well, 2 - Abandoned Borehole, 3 - Abandoned Well,
4 - Inactive Well, 5 - Borehole Sampled, 6 - Observation Well

KEY TO GEOLOGIC STRATA Qrf-Rocky Flats Alluvium; Qc-Colluvium, Qvf-Valley Fill Alluvium Kcl-Weathered Claystone, Kss-Sandstone

TABLE 3-2

BACKGROUND GROUND-WATER

	SAMPLE INFORMATION		FIELD PARAMETERS		
WELL NUMBER	SAMPLE NUMBER	SAMPLE DATE	pH	FIELD COND (umhos/cm)	TEMP (deg C)
B102289	G18890489001	04/25/89	7 00	130 0	10 0
B102389	G19890489001	04/25/89	6 70	250 0	9 0
B200589	G05890689001	06/07/89	7 00	150 0	10 5
B200689	G06890689001	06/07/89	7 20	200 0	11 0
B200789	G07890689001	06/06/89	7 40	220 0	11 0
B200889	G08890689001	06/05/89	8 60	205 0	12 2
B201089	DRY	04/19/89	N/A	N/A	N/A
B201189	G10890589001	05/05/89	7 20	550 0	10 0
B201289	DRY	05/15/89	N/A	N/A	N/A
B201489	DRY	05/15/89	N/A	N/A	N/A
B201589	DRY	05/12/89	N/A	N/A	N/A
B202489	G20890489001D	04/24/89	7 00	265 0	12 0
B202489	G20890489001	04/24/89	7 00	265 0	12 0
B202589	G21890489001	04/26/89	7 30	265 0	11 0
B203189	DRY	05/24/89	N/A	N/A	N/A
B203289	G28890689001	06/20/89	8 00	400 0	15 0
B203489	DRY	05/25/89	N/A	N/A	N/A
B203589	DRY	05/22/89	N/A	N/A	N/A
B203689	G31890589001	05/25/89	7 80	230 0	11 0
B203689	G31890589001D	05/25/89	7 80	230 0	11 0
B203789	G32890689001	06/27/89	10 00	260 0	12 0
B203889	G33890789001	06/29/89	9 80	340 0	20 0
B203989	G34890689001	06/16/89	9 00	320 0	13 0
B204089	G35890789001	07/06/89	9 70	1000 0	17 0

*FB Field Blank

TABLE 3-2 (CONTINUED)

BACKGROUND GROUND-WATER SAMPLE INFORMATION

	SAMPLE INFORMATION		FIELD PARAMETERS		
WELL NUMBER	SAMPLE NUMBER	SAMPLE DATE	pH	FIELD COND (umhos/cm)	TEMP (deg C)
B204189	G36890689001	06/27/89	10 40	1800 0	12 0
B205589	DRY	05/05/89	N/A	N/A	N/A
B301889	DRY	05/11/89	N/A	N/A	N/A
B302089	DRY	05/16/89	N/A	N/A	N/A
B302789	G23890489001	04/26/89	7 50	370 0	10 0
B302889	G24890489001	04/27/89	7 50	410 0	11 0
B302989	G25890489001	04/27/89	7 50	475 0	9 0
B303089	DRY	05/10/89	N/A	N/A	N/A
B304289	G37890689001	06/23/89	9 00	760 0	21 0
B304789	DRY	05/24/89	N/A	N/A	N/A
B304889	DRY	05/22/89	N/A	N/A	N/A
B304989	G41890689001	06/23/89	8 90	890 0	21 0
B305389	G44890589001	05/31/89	7 30	570 0	12 0
B400189	G01890689001	06/14/89	6 60	140 0	11 0
B400289	G02890689001	06/14/89	6 70	160 0	11 5
B400389	G03890689001	06/14/89	7 40	380 0	11 5
B400489	G04890689001	06/15/89	7 00	210 0	13 0
B401989	G15890589001	05/04/89	7 10	340 0	9 0
B401989	G15890589001D	05/04/89	7 10	340 0	9 0
B402189	G17890689001	06/05/89	8 40	345 0	10 0
B402689	G22890489001	04/27/89	7 10	500 0	14 0
B405189	DRY	05/24/89	N/A	N/A	N/A
B405289	DRY	06/23/89	N/A	N/A	N/A
B405489	G45890689001	06/21/89	8 10	325 0	23 0

*FB Field Blank

TABLE 3-2 (CONTINUED)

BACKGROUND GROUND-WATER SAMPLE INFORMATION

	SAMPLE INFORMATION		FIELD PARAMETERS		
WELL NUMBER	SAMPLE NUMBER	SAMPLE DATE	pH	FIELD COND (umhos/cm)	TEMP (deg C)
B405586	G55860689001	06/08/89	7 10	180 0	11 0
B405689	G47890689001	06/14/89	7 50	340 0	11 0
B405789	G48890689001	06/15/89	7 00	190 0	13 0
B405889	G49890689001	06/14/89	7 00	250 0	9 0
B405889	G49890689001D	06/14/89	7 00	250 0	9 0
B405989	DRY	05/17/89	N/A	N/A	N/A
FB	G20890489001FB	04/24/89	N/A	N/A	N/A
FB	G10890589001FB	05/05/89	N/A	N/A	N/A
FB	G31890589001FB	05/25/89	N/A	N/A	N/A
FB	G49890689001FB	06/14/89	N/A	N/A	N/A

*FB Field Blank

TABLE 3-3

BACKGROUND GROUND-WATER AND SURFACE WATER SAMPLING PARAMETERS

FIELD PARAMETERS

pH
Specific Conductance
Temperature
Dissolved Oxygen*

INDICATORS

Total Dissolved Solids
Total Suspended Solids*
pH

METALS**

CLP Inorganic Target Analyte List
- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Nickel
- Potassium
- Selenium
- Silver
- Sodium
- Thallium
- Vanadium
- Zinc

Other Metals
- Cesium
- Lithium
- Molybdenum
- Strontium
- Tin

TABLE 3-3 (CONTINUED)

BACKGROUND GROUND-WATER AND SURFACE WATER SAMPLING PARAMETERS

ANIONS

Carbonate
Bicarbonate
Chloride
Sulfate
Nitrate (as N)
Cyanide

RADIONUCLIDES

Gross Alpha
Gross Beta
Uranium 233+234, 235, and 238
Americium 241
Plutonium 239+240
Strontium 90
Cesium 137
Tritium
Radium 226, 228***

* For surface water samples only

** Analysis for total and dissolved metals for surface water Analysis for total (Rounds 1 and 2) and dissolved (Round 1 only) radionuclides (except tritium) on surface water Analysis for dissolved metals and radionuclides (except tritium) only for ground water Analysis for total tritium only in surface water and ground water

*** Decision tree If the Gross Alpha value was ≥ 5 pCi/l then the sample was analyzed for Ra 226,228

In addition to the above alluvial background wells, one well cluster was installed in the Rocky Flats Alluvium at the location where the greatest saturated thickness was encountered The purpose of this cluster is to evaluate geochemical stratification of alluvial ground-water quality west of the Plant This will aid in the interpretation of potential geochemical stratification and impacts on ground-water quality from the West Spray Field The well cluster consists of three wells constructed on the basis of the saturated thickness encountered during drilling Well B400489 was screened over the entire saturated thickness of the Rocky Flats Alluvium (9 87 to 54 45 feet below ground surface) Well B405789 located approximately 15 feet west of B400489 and was screened over the bottom ten feet of saturated alluvium (43 01 to 52 48 feet below ground surface) and Well B405689, installed approximately 15 feet east of B400489, was screened from ten feet above to ten feet below the water level (3 0 to 22 51 feet below ground surface)

3 1 2 Colluvial Ground Water

Ten wells were installed in colluvial materials to account for spatial variability Wells B201089, B201189, B201289, B201489, B201589 and B205589 were installed in the north buffer, whereas Wells B301889, B401989, B302089 and B405989 were installed in the south buffer zone (Plate 1) There are no waste sites/units in either of these areas

3 1 3 Valley Fill Alluvium Ground Water

Valley fill ground-water quality was characterized by sampling nine wells installed in valley fill materials (Plate 1) Wells B102289, B102389, B202489 and B202589 were installed at four locations along the Rock Creek drainage, and five additional wells were installed in the Woman Creek drainage and other unnamed drainages in the south buffer (B402689, B302789, B302889, B302989 and B303089) to characterize spatial variability along and between drainages None of the above areas have been impacted by waste sites/units

3 1 4 Bedrock Ground Water

Data for the characterization of background bedrock ground-water quality were collected by installing and sampling 21 monitoring wells screened in bedrock These wells were drilled in various areas of the Plant buffer zone (Plate 1)

Eleven bedrock wells were completed in the northern buffer zone Five of the eleven wells (B303189, B203289, B203489, B203589 and B203689) were installed adjacent to the sidegradient northern alluvial wells and were completed in weathered claystone The remaining six wells (B203789, B203889, B203989, B204089, B204189 and B204689) were completed in unweathered sandstones

Ten bedrock wells were installed in the southern buffer zone Three were completed in unweathered sandstones (Wells B304289, B304989, and B405289), five were completed in shallow, weathered claystone (Wells B304789, B304889, B405189, B305389, and B405489), and two (B402189 and B405889) were completed in weathered sandstones

3.2 SURFACE WATER

Nine surface water monitoring locations were selected as background stations (Plate 1 and Table 3-4) One station (SW-107) is located in the Woman Creek drainage upstream of all sites/units Three stations (SW-41, SW-80, and SW-104) are positioned within tributaries entering Woman Creek from the southwest Station SW-07 is situated in a tributary of Walnut Creek and stations SW-06, SW-05, SW-108, and SW-04 are located along the Rock Creek drainage Analytical data from the first two rounds of sampling are included in this report The first round of samples was collected between 2/24/89 and 3/2/89 with all nine stations sampled (Table 3-5) The second round of samples was collected on 5/8/89 through 6/1/89 and two stations (SW-80 and SW-04) were dry (Table 3-6) Additional rounds are being collected to evaluate seasonal variations in surface water chemistry

TABLE 3-4

BACKGROUND SURFACE WATER AND SEDIMENT STATION DATA FOR ROCKY FLATS PLANT

Surface Water Station Number	Sediment Station Number	Location
SW004	SED 22	Rock Creek Drainage
SW005	SED 20	Rock Creek Drainage
SW006	SED 23	Rock Creek Drainage
SW007	SED 04	Tributary of Walnut Creek
SW041	SED 17	Tributary of Woman Creek
SW080	SED 18	Tributary of Woman Creek (spring)
SW104	SED 19	Tributary of Woman Creek (spring)
SW107	SED 16	Woman Creek Drainage
SW108	SED 21	Rock Creek Valley Wall

TABLE 3-5

BACKGROUND SURFACE WATER SAMPLE INFORMATION
ROUND 1

	SAMPLE INFORMATION		FIELD PARAMETERS			
STATION NUMBER	SAMPLE NUMBER	SAMPLE DATE	pH	FIELD COND (umhos/cm)	TEMP (deg C)	D O (mg/l)
FB	SW06001FB	02/24/89	N/A	N/A	N/A	N/A
SW04	SW004001	03/02/89	6 50	210 00	3 0	7 0
SW05	SW05001	02/28/89	6 28	150 00	2 7	4 0
SW06	SW06001	02/24/89	6 45	60 00	4 0	3 1
SW06	SW06001D	02/24/89	6 45	60 00	4 0	3 1
SW07	SW07001	02/27/89	6 40	130 00	5 0	1 3
SW104	SW104001	03/02/89	5 90	410 00	1 0	3 0
SW107	SW107001	02/28/89	5 60	190 00	0 5	5 3
SW108	SW108001	03/02/89	5 80	285 00	1 0	7 4
SW41	SW41001	03/01/89	5 00	200 00	0 5	5 5
SW80	SW080001	03/01/89	6 00	160 00	0 6	3 8

*FB Field Blank

TABLE 3-6

BACKGROUND SURFACE WATER SAMPLE INFORMATION
ROUND 2

	SAMPLE INFORMATION		FIELD PARAMETERS			
STATION NUMBER	SAMPLE NUMBER	SAMPLE DATE	pH	FIELD COND (umhos/cm)	TEMP (deg C)	D O (mg/l)
FB	SW108002FB	05/30/89	N/A	N/A	N/A	N/A
SW04	DRY	05/30/89	N/A	N/A	N/A	N/A
SW05	SW005002	05/30/89	7 20	70 00	12 0	3 4
SW06	SW006002	05/31/89	7 00	90 00	14 0	4 5
SW07	SW007002	05/31/89	6 50	285 00	15 0	5 9
SW104	SW104002	06/01/89	7 50	140 00	14 0	5 3
SW107	SW107002	05/26/89	7 50	192 00	21 0	3 2
SW108	SW108002	05/30/89	7 40	300 00	13 0	0 0
SW108	SW108002D	05/30/89	7 40	300 00	13 0	0 0
SW41	SW041002	05/26/89	6 80	165 00	19 0	0 0
SW80	DRY	05/24/89	N/A	N/A	N/A	N/A

*FB Field Blank

Laboratory analyses on background surface water samples consisted of the parameters listed in Table 3-3 Surface water samples were analyzed in the field for pH, conductivity, temperature, and dissolved oxygen (Table 3-2)

3.3 STREAM SEDIMENT

Background stream sediment chemistry was evaluated by sampling nine sediment monitoring locations for subsequent chemical analyses (Plate 1 and Table 3-4) These stations are paired with the background surface water stations described above Stations SED-20, SED-21, SED-22, and SED-23 are located in the Rock Creek drainage, station SED-04 is located in Walnut Creek, and stations SED-16, SED-17, SED-18, and SED-19 are located in Woman Creek These sites were selected as locations representative of sediments present in the drainages on the plant site where impacts from sites/units are not anticipated

Sample collection took place between 2/21/89 and 2/24/89 and a total of nine samples were collected (Table 3-7) The background sediment samples were analyzed for the parameters listed in Table 3-8

3.4 BOREHOLE SAMPLES

Two major types of surficial materials (Rocky Flats Alluvium and Colluvium) have been identified at the Rocky Flats Plant Many of the RCRA/CERCLA sites are situated on Rocky Flats Alluvium, including the Present Landfill, Original Process Waste Lines, West Spray Field, Solar Evaporation Ponds, 903 Pad Area, Mound Area, and East Trenches Areas Colluvium is present in the previously mentioned investigation areas as well as in the 881 Hillside Area Development of background borehole data therefore required sampling of both types of materials

TABLE 3-7

BACKGROUND SEDIMENT SAMPLE INFORMATION

	SAMPLE INFORMATION	
STATION NUMBER	SAMPLE NUMBER	SAMPLE DATE
FB	SED22001FB	02/22/89
SD004	SED04001	02/21/89
SD004	SED04001D	02/21/89
SD016	SED16001	02/23/89
SD017	SED17001	02/23/89
SD018	SED18001	02/23/89
SD019	SED19001	02/23/89
SD020	SED20001	02/22/89
SD021	SED21001	02/22/89
SD022	SED22001	02/22/89
SD023	SED23001	02/21/89

*FB Field Blank

TABLE 3-8

BACKGROUND SEDIMENT SAMPLING PARAMETERS

METALS

CLP Target Analyte List
Cesium
Lithium
Molybdenum
Strontium
Tin

INORGANICS

Nitrate (as N)
pH
% solids

RADIONUCLIDES

Gross Alpha
Gross Beta
Uranium 233, 234, 235, 238
Plutonium 239, 240
Americium 241
Strontium 89, 90
Cesium 137
Tritium
Radium 226, 228

In addition to surficial materials, bedrock underlies the surficial deposits at the Rocky Flats Plant, therefore characterization of the background geochemical conditions in these geologic units was conducted for comparison with investigative samples

Borehole samples were collected from nine borings drilled in the Rocky Flats Alluvium and nine boreholes drilled in colluvial materials (Plate 1) Weathered bedrock samples were also collected from the boreholes drilled in the colluvium to characterize the weathered sandstone and claystone

Several different areas of the plant were chosen in order to account for spatial variability of soil chemistry Table 3-10 lists the survey data as well as the total depth and depth to bedrock for each borehole Boreholes B400189, B400289, B400389, and B400489 were drilled in the southwestern buffer and boreholes B200589, B200689, B200789, B200889, and B200989 were drilled in the northern buffer zone These boreholes were used to collect soil samples to characterize the geochemistry of the Rocky Flats Alluvium Background samples from colluvial materials were collected in both the northern and southern buffer zones Boreholes B201189, B201289, B201489, and B201589 were drilled along the Rock Creek valley walls and borehole B201089 was drilled along McKay Ditch Boreholes B301889, B401989, B302089 and B402189 were drilled in the southern buffer along the south wall of Woman Creek

Split-spoon, split-tube, or cuttings were collected from ground surface to total depth in each borehole Composite soil samples were prepared from each desired interval based on drilled footages and lithology (Table 3-10) Each soil boring in the Rocky Flats Alluvium extended from ground surface to approximately three feet below the alluvium/bedrock contact A three-foot (drilled footage) composite sample was collected at the surface of each borehole regardless of lithology Six-foot composite samples were collected from three feet below ground surface to the alluvium/bedrock contact unless a lithologically distinct layer two feet or greater in thickness was encountered A total of 70 samples (excluding field duplicates

TABLE 3-9

BACKGROUND BOREHOLE DATA FOR ROCKY FLATS PLANT

Borehole Number	Borehole Status	Ground Surface Elev (ft)	Total Depth (ft)	Bedrock Depth (ft)
8405189	5,6	6121 80	54 60	48 50
8400289	1,5	6105 90	52 00	49 60
8400389	1,5	6122 00	50 40	48 50
8400489	1,5	6105 90	56 00	54 00
8200589	1,5	5968 40	33 51	30 00
8200689	1 5	5960 10	35 70	30 60
8200789	1,5	5946 10	34 40	28 00
8200889	1,5	5936 10	27 80	22 80
8200989	2,5	5920 80	24 50	22 00
8201089	1,5	5883 10	19 55	7 50
8201189	1,5	5806 50	46 00	34 00
8201289	1 5	5826 10	32 10	23 40
8201489	1,5	5859 40	19 20	7 00
8201589	1,5	5846 00	20 30	8 20
8301889	1,5	5866 80	34 50	22 30
8401989	1,5	6025 60	33 00	20 50
8302089	1,5	5907 50	25 50	13 50
8402189	1 5	6024 60	49 00	7 50

KEY TO STATUS 1 - Active Well, 2 - Abandoned Borehole 3 - Abandoned Well
4 - Inactive Well 5 - Borehole Sampled 6 - Observation Well

and redrills) collected from within the Rocky Flats Alluvium were submitted to the laboratory for chemical analysis.

Sampling methodology at locations originating in colluvium was the same as the sampling scheme used for the Rocky Flats Alluvium Boreholes except that these borings extended approximately twelve feet into bedrock so that weathered bedrock soil samples could be obtained. A total of 28 soil samples from the colluvial materials were collected and submitted for chemical analysis

The weathered bedrock samples were comprised of two six-foot composite samples originating at the colluvium/bedrock contact. As in alluvial samples, discrete samples were collected if a lithologically distinct layer two feet or greater in thickness was encountered Twenty bedrock soil samples were collected for chemical analysis.

Samples were submitted to the laboratory for chemical analysis Soil samples were analyzed for the parameters listed in Table 3-10 With the exception of Target Compound List (TCL) organics, and hexavalent and trivalent chromium, this list includes all parameters for which investigative samples from the 881 Hillside, 903 Pad, Mound, East Trenches, Solar Evaporation Ponds, and West Spray Field have been analyzed TCL organics were not expected to be present in background soils; therefore, they were not selected as analytes A separate off-site investigation is being conducted to verify the background concentration range of plutonium in surficial soils

TABLE 3-10

BACKGROUND BOREHOLE SAMPLE INFORMATION

BOREHOLE NUMBER	SAMPLE INFORMATION: SAMPLE NUMBER	SAMPLE DATE	DEPTH INCREMENT(ft)	LITHOLOGICAL DESCRIPTION
B405189	BH01890003	03/09/89	0 00 - 3 00	CLAYEY GRAVEL
B405189	BH01890309	03/09/89	3 60 - 8 55	SANDY GRAVEL
B405189	BH01890915	03/09/89	9 60 - 15 40	GRAVELLY CLAYEY SAND
B405189	BH01891521	03/09/89	15 60 - 20 30	SANDY GRAVELLY CLAY
B405189	BH01892127	03/09/89	21 60 - 26 50	GRAVEL
B405189	BH01893036	03/10/89	29 50 - 35 60	CLAYEY GRAVEL
B405189	BH01893638	03/10/89	35 60 - 37 60	GRAVELLY CLAY
B405189	BH01893844	03/10/89	37 60 - 42 60	GRAVELLY CLAYEY SAND
B405189	BH01894448	03/10/89	43 60 - 47 50	GRAVELLY CLAYEY SAND
B400289	BH02890003	04/12/89	0 00 - 3 00	SILTY CLAYEY SAND&GRAVEL
B400289	BH02890309	04/12/89	4 00 - 9 00	SILTY CLAYEY SAND&GRAVEL
B400289	BH02890915	04/12/89	9 00 - 14 90	SILTY CLAYEY SAND&GRAVEL
B400289	BH02891521	04/13/89	16 00 - 21 10	SILTY CLAYEY SAND&GRAVEL
B400289	BH02891521D	04/13/89	16 00 - 21 10	SILTY CLAYEY SAND&GRAVEL
B400289	BH02892130	04/13/89	21 10 - 28 70	SILTY CLAYEY SAND&GRAVEL
B400289	BH02893036	04/14/89	30 00 - 36 00	SILTY CLAYEY SAND&GRAVEL
B400289	BH02893642	04/14/89	36 00 - 41 30	SILTY CLAYEY SAND&GRAVEL
B400289	BH02894248	04/17/89	42 00 - 47 20	SILTY CLAYEY SAND&GRAVEL
B400389	BH03890003	04/25/89	0 00 - 3 00	SILTY SAND
B400389	BH03890309	04/25/89	3 00 - 9 00	SILTY SAND TO CLAYEY SAND
B400389	BH03890309D	04/25/89	3 00 - 9 00	SILTY SAND TO CLAYEY SAND
B400389	BH03890915	04/25/89	9 00 - 15 00	SILTY SAND
B400389	BH03891521	04/25/89	15 00 - 21 00	SILTY SAND
B400389	BH03892127	04/25/89	21 00 - 27 00	SILTY SAND
B400389	BH03892733	04/05/89	27 00 - 33 00	SILTY SAND
B400389	BH03893339	04/25/89	33 00 - 39 00	SILTY SAND
B400389	BH03893945	04/26/89	39 00 - 45 00	SILTY-CLAYEY SAND
B400389	BH03894548	04/26/89	45 00 - 48 50	SILTY-CLAYEY SAND
B400489	BH04890003	04/28/89	0 00 - 3 00	SILTY SAND
B400489	BH04890309	04/28/89	3 00 - 9 00	SILTY SAND
B400489	BH04890915	04/28/89	9 00 - 15 00	SAND & GRAVEL
B400489	BH04890915D	04/28/89	9 00 - 15 00	SAND & GRAVEL
B400489	BH04891521	04/28/89	15 00 - 21 00	SAND & GRAVEL
B400489	BH04892127	04/28/89	21 00 - 27 00	SAND&GRAVEL TO SILTY SAND
B400489	BH04892733	05/01/89	27 00 - 33 00	SILTY SAND
B400489	BH04893335	05/01/89	33 00 - 35 50	SILTY SAND
B400489	BH04893538	05/01/89	35 50 - 38 00	CLAYEY SILT
B400489	BH04893840	05/01/89	38 00 - 40 00	CLAYEY SILT AND SAND
B400489	BH04894046	05/01/89	40 00 - 46 00	SANDY GRAVEL
B400489	BH04894652	05/01/89	46 00 - 52 00	SANDY GRAVEL
B400489	BH04895254	05/01/89	52 00 - 54 00	SANDY GRAVEL
B200589	BH05890003R	03/08/89	0 00 - 2 80	SILTY SANDY CLAY
B200589	BH05890003	02/22/89	0 00 - 3 10	GRAVEL

*FB. Field Blank

TABLE 3-10
(Continued)

BACKGROUND BOREHOLE SAMPLE INFORMATION

BOREHOLE NUMBER	SAMPLE INFORMATION: SAMPLE NUMBER	SAMPLE DATE	DEPTH INCREMENT(ft)	LITHOLOGICAL DESCRIPTION
B200589	BH05890308	02/22/89	3 50 - 8 40	CLAY & SAND
B200589	BH05890308D	02/22/89	3 50 - 8 40	CLAY & SAND
B200589	BH05890913	02/22/89	9 50 - 12 70	CLAYEY SAND
B200589	BH05891317	02/22/89	13 50 - 17 00	SANDY CLAY
B200589	BH05891723	02/22/89	17 00 - 23 50	GRAVEL & SAND
B200589	BH05892325	02/22/89	23 50 - 25 50	GRAVEL & SAND
B200589	BH05892530	02/23/89	25 00 - 30 00	GRAVEL & SAND
B200689	BH06890003	03/09/89	0 00 - 1 90	SILT & CLAY
B200689	BH06890104	02/28/89	1 00 - 4 50	GRAVELLY CLAY
B200689	BH06890410	02/28/89	4 50 - 9 20	GRAVEL
B200689	BH06891016	02/28/89	9 90 - 15 90	SANDY GRAVEL
B200689	BH06891618	02/28/89	15 90 - 17 90	CLAY
B200689	BH06891824	02/28/89	17 90 - 23 90	SANDY CLAYEY GRAVEL
B200689	BH06892430	02/28/89	23 90 - 29 40	SAND & GRAVEL
B200789	BH07890003	03/08/89	0 00 - 2 90	SILTY SANDY CLAY
B200789	BH07890103	03/01/89	1 00 - 2 70	GRAVELLY CLAY
B200789	BH07890306	03/01/89	3 00 - 6 30	CALICHE
B200789	BH07890612	03/01/89	6 30 - 10 30	SAND & GRAVEL
B200789	BH07891218	03/01/89	12 00 - 17 70	GRAVELLY SAND CLAY
B200789	BH07891824	03/01/89	18 00 - 23 00	GRAVEL & SAND
B200789	BH07892426	03/01/89	24 00 - 26 00	GRAVEL & SAND
B200889	BH08890003	03/08/89	0 00 - 2 10	GRAVELLY CLAY
B200889	BH08890106	03/06/89	1 00 - 6 10	SANDY SILT CLAY
B200889	BH08890106D	03/06/89	1 00 - 6 10	SANDY SILTY CLAY
B200889	BH08890608	03/06/89	6 30 - 7 10	SILTY SAND & GRAVEL
B200889	BH08890814	03/06/89	8 30 - 13 70	SILTY SAND
B200889	BH08891420	03/06/89	14 30 - 19 30	SILTY SAND & GRAVEL
B200889	BH08892022	03/06/89	20 30 - 21 20	SILTY SAND & GRAVEL
B200989	BH09890003	03/08/89	0 00 - 2 80	GRAVEL
B200989	BH09890104	03/02/89	1 00 - 4 00	GRAVELLY CLAY
B200989	BH09890410D	03/02/89	4 00 - 9 90	GRAVEL & SAND
B200989	BH09890410	03/02/89	4 00 - 9 90	GRAVEL & SAND
B200989	BH09891016	03/02/89	10 00 - 14 80	GRAVEL & SAND
B200989	BH09891620	03/02/89	16 00 - 18 40	GRAVEL & SAND
B201089	BH10890003	03/09/89	0 00 - 2 60	SILTY SANDY CLAY
B201089	BH10890106D	03/02/89	1 00 - 6 50	SILTY CLAY
B201089	BH10890106	03/02/89	1 00 - 6 50	SILTY CLAY
B201189	BH11890003	03/17/89	0 00 - 3 00	CLAY
B201189	BH11890309	03/17/89	3 00 - 9 00	CLAY
B201189	BH11890915	03/17/89	9 00 - 15 00	CLAY
B201189	BH11890915D	03/17/89	9 00 - 15 00	CLAY

*FB Field Blank

TABLE 3-10
(Continued)

BACKGROUND BOREHOLE SAMPLE INFORMATION

	SAMPLE INFORMATION			
BOREHOLE NUMBER	SAMPLE NUMBER	SAMPLE DATE	DEPTH INCREMENT(ft)	LITHOLOGICAL DESCRIPTION
B201189	BH11891521	03/17/89	15 00 - 21 00	CLAY
B201189	BH11892127	03/17/89	21 00 - 27 00	CLAY
B201189	BH11892733	03/17/89	27 00 - 33 00	CLAY
B201289	BH12890003	03/22/89	0 00 - 3 00	CLAY
B201289	BH12890307	03/22/89	3 00 - 6 80	SILTY CLAY
B201289	BH12890915	03/23/89	9 00 - 15 00	SILTY CLAY
B201289	BH12891521	03/23/89	15 00 - 20 65	SILTY CLAY
B201289	BH12891521D	03/23/89	15 00 - 20 65	SILTY CLAY
B201489	BH13890003	03/10/89	0 00 - 3 00	SILTY CLAY
B201489	BH13890307	03/10/89	3 00 - 7 00	SILTY CLAY
B201589	BH14890003	03/15/89	0 00 - 3 00	SILTY CLAY
B201589	BH14890307	03/15/89	3 00 - 7 00	SILTY CLAY
B301889	BH15890003	03/07/89	0 00 - 3 00	SILTY CLAY
B301889	BH15890309	03/07/89	3 00 - 9 00	SILTY CLAY
B301889	BH15890915	03/07/89	9 00 - 15 00	SILTY CLAY
B301889	BH15891521	03/07/89	15 00 - 21 00	SILTY CLAY
B401989	BH16890003	04/05/89	0 00 - 3 00	CLAY & GRAVEL
B401989	BH16890309	04/05/89	3 00 - 9 00	CLAY
B401989	BH16890915	04/05/89	9 20 - 13 30	CLAY
B401989	BH16891519	04/05/89	16 00 - 19 00	SANDY GRAVELLY CLAY
B302089	BH17890003	03/28/89	0 00 - 2 10	CLAY
B302089	BH17890306	03/28/89	3 60 - 6 00	CLAY
B402189	BH18890003	03/29/89	0 00 - 0 80	CLAY
B402189	BH18890307	03/29/89	3 30 - 7 30	CLAY
B201089	BH10890713	03/02/89	7 50 - 13 50	SILTY CLAYSTONE
B201089	BH10891319	03/02/89	13 50 - 19 50	SILTY CLAYSTONE
B201189	BH11893541	03/23/89	34 50 - 41 00	CLAYSTONE
B201189	BH11894146	03/23/89	41 00 - 46 00	CLAYSTONE
B201289	BH12892329	03/23/89	23 40 - 29 40	CLAYSTONE
B201289	BH12892930	03/23/89	29 00 - 29 90	CLAYSTONE
B201489	BH13891015	03/10/89	10 70 - 15 00	CLAYSTONE
B201489	BH13891015D	03/10/89	10 70 - 15 00	CLAYSTONE
B201489	BH13891519	03/10/89	15 00 - 19 20	CLAYSTONE
B201589	BH14890814	03/16/89	8 20 - 14 20	CLAYSTONE
B201589	BH14891417	03/16/89	14 20 - 17 00	SILTY CLAYSTONE

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TABLE 3-10
(Continued)

BACKGROUND BOREHOLE SAMPLE INFORMATION

	SAMPLE INFORMATION			
BOREHOLE NUMBER	SAMPLE NUMBER	SAMPLE DATE	DEPTH INCREMENT(ft)	LITHOLOGICAL DESCRIPTION
B301889	BH15892228	03/07/89	22 00 - 28 30	SANDY SILTY CLAYSTONE
B301889	BH15892834	03/07/89	28 30 - 34 30	SANDY SILTY CLAYSTONE
B401989	BH16892127	04/05/89	20 50 - 26 50	CLAYSTONE
B401989	BH16892733	04/05/89	26 50 - 32 50	CLAYSTONE
B302089	BH17891319	03/28/89	13 50 - 19 50	CLAYSTONE
B302089	BH17891319D	03/28/89	13 50 - 19 50	CLAYSTONE
B302089	BH17891925	03/28/89	19 50 - 25 50	CLAYSTONE
B402189	BH18890713	03/29/89	7 50 - 13 50	CLAYSTONE
FB	BH08890306FB	03/06/89	N/A	FIELD BLANK
FB	BH05890222FB	02/22/89	N/A	FIELD BLANK
FB	BH11890317FB	03/17/89	N/A	FIELD BLANK
FB	BH12890323FB	03/23/89	N/A	FIELD BLANK
FB	BH06890003FB	03/08/89	N/A	FIELD BLANK
FB	BH17890328FB	03/28/89	N/A	FIELD BLANK
FB	BH02890915FB	04/12/89	N/A	FIELD BLANK
FB	BH03893339FB	04/25/89	N/A	FIELD BLANK
FB	BH04892127FB	04/28/89	N/A	FIELD BLANK
FB	BH15890307FB	03/07/89	N/A	FIELD BLANK
B201289	BH12893032	03/23/89	29 90 - 32 00	SANDY SILTSTONE
B201489	BH13890709	03/10/89	7 00 - 9 30	SILTY SANDSTONE
B201589	BH14891720	03/16/89	17 00 - 20 00	CLAYEY SANDSTONE
B402189	BH18891319	03/29/89	13 50 - 19 50	SANDSTONE

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TABLE 3-11

BACKGROUND BOREHOLE SAMPLING PARAMETERS

METALS

CLP Inorganic Target Analyte List
- Aluminum
- Antimony
- Arsenic
- Barium
- Beryllium
- Cadmium
- Calcium
- Chromium
- Cobalt
- Copper
- Iron
- Lead
- Magnesium
- Manganese
- Mercury
- Nickel
- Potassium
- Selenium
- Silver
- Sodium
- Thallium
- Vanadium
- Zinc

Other Metals
- Cesium
- Lithium
- Molybdenum
- Strontium
- Tin

RADIONUCLIDES

Gross Alpha
Gross Beta
Strontium 90
Cesium 137
Radium 226, 228
Uranium 233 + 234, 235 and 238
Americium 241
Plutonium 239 + 240
Tritium

OTHER

pH
Nitrate
Sulfide
Cyanide

SECTION 4.0

BACKGROUND CHEMICAL CHARACTERIZATION

Background data for ground water, surface water, sediment, and boreholes were evaluated to establish background conditions in each media Chemical results and a discussion of general geochemical characteristics of each media sampled are summarized in the following sections This evaluation is based on data received as of December 15, 1989 and includes results obtained from one round of ground water, two rounds of surface water, and one round of borehole and sediment sampling Approximately 90% of the data has been received and are incorporated in this project Missing data are identified in Appendix A

Data validation has not yet been completed Tolerance intervals will be recalculated upon receipt on complete validation packages and the currently outstanding data

4 1 GROUND WATER

A two system model of ground-water flow (Section 3 1) is substantiated by the analytical results from background ground-water samples (Figure 4-1) Plate 2 presents Stiff diagrams for the Round 1, 1989 samples of ground water and surface water at various sampling locations Relatively high sodium, chloride, and high sulfate distinguishes the unweathered sandstone ground water from other ground-water subgroups Stiff diagrams for the surficial ground-water flow system are similar in shape and general magnitude Closer inspection of the Stiff diagrams suggests that the ground water of the Rocky Flats Alluvium is less saline than any of the subgroups it recharges With the exception of the weathered sandstone this is confirmed in a comparison of the mean recorded total dissolved solids (TDS) for each subgroup as shown in Table 4-1 This phenomenon is likely a result of increases in clay content, the relatively greater evaporative losses in the colluvium and valley fill (less saturated thickness than the Rocky Flats Alluvium), and in the case of the weathered and unweathered bedrock, longer contact time with these materials (less permeable than the Rocky

FIGURE 4-1

TRILINEAR DIAGRAM

GROUND WATER - ROUND 1, 1989

HC—GRAM

HydroChemical Graphic Representation Analysis Methods

Version. HC-GRAM 1.42

PROJECT: Ground Water - Round 1
plus - Rocky Flats Alluvial Ground Water
circle - Colluvial Ground Water
diamond - Valley Fill Alluvial Ground Water
X - Weathered Bedrock Ground Water
square - Unweathered Sandstone

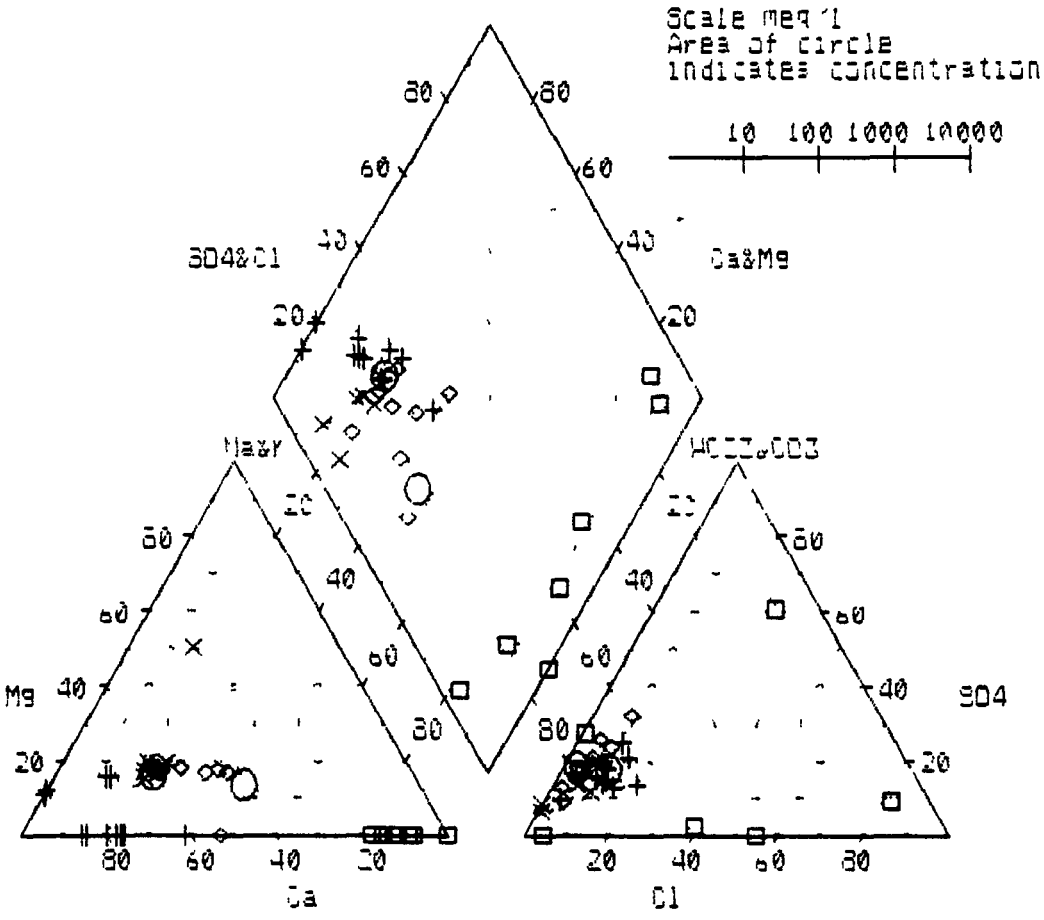

TABLE 4-1

COMPARISON OF TDS FOR GROUND-WATER SUBGROUPS

SUBGROUP	MEAN TDS (mg/l)	REFERENCED TABLE
Rocky Flats Alluvium	217	3-5
Colluvium	405	3-8
Valley Fill	416	3-11
Weathered Bedrock		
Weathered Claystone	255	3-15
Weathered Sandstone	195	3-18
Unweathered Sandstone	1761	3-21

Note See Referenced Table for details

Flats Alluvium) In addition, the claystone is less chemically inert than the constituents in the Rocky Flats Alluvium

4 1 1 Rocky Flats Alluvium Ground Water

Rocky Flats Alluvium ground water is relatively low in Total Dissolved Solids (TDS), major ions, and uranium Several trace metals (iron, molybdenum, nickel, potassium, strontium, zinc, and cyanide) were also detected Statistical summaries of chemical results are presented in Tables 4-3, 4-4, and 4-5 As discussed in Section 3 1 1, a well cluster was installed to evaluate geochemical stratification within alluvial ground water Chemical results for this well cluster are presented in Table 4-2 Total dissolved and total suspended solids are greater in the well completed at the water table, (B405689) than in the well completed at the base of the Rocky Flats Alluvium (B405789) Near the water table the ground water is relatively enriched in calcium carbonate and relatively depleted in sodium chloride Complete characterization of the chemical stratification of ground water in Rocky Flats Alluvium requires additional data both to characterize chemical stratification through time and to establish the reproducibility of these results

4 1 2 Colluvial Ground Water

Ten wells were installed to monitor ground water within colluvium, although eight of those wells were dry during Round 1, 1989 sampling Although tolerance intervals cannot be compiled with so few data, dry wells will provide valuable information about the extent of unsaturated materials

Statistical summaries of chemical results are presented in Tables 4-6, 4-7, and 4-8 In the absence of additional data, statistical comparisons of background colluvial ground water to non-background ground water is not possible

TABLE 4-2

CHEMICAL STRATIFICATION IN ROCKY FLATS ALLUVIUM GROUND WATER

	UNITS	B400489	B405689	B405789
Screened Interval (ft)		9 87-54 45	3 0-22 51	43.01-52 48
Analyte				
Calcium (Ca)	mg/l	47	64 5	30 9
Magnesium (Mg)	mg/l	5U	5.32	5U
Manganese (Mn)	mg/l	268	139	0150U
Sodium (Na)	mg/l	8 90	5U	9 02
Total Suspended Solids (TSS)	mg/l	18	120	12
Total Dissolved Solids (TDS)	mg/l	220	250	180
Chloride (Cl)	mg/l	11	4	14
Nitrate-Nitrite as N (N)	mg/l	0 92	0.66	1 2
Sulfate (SO_4)	mg/l	22	32	16
HCO_3 as ($CaCO_3$)	mg/l	150	200	100
pH		7 9	7 9	7 2
Gross Alpha	pCi/l	2±2	3±3	1±2
Gross Beta	pCi/l	-1±2	1±2	2±2
Uranium 233, 234	pCi/l	0 6±0 2	1.3±0 3	0 0±0 1
Uranium 235	pCi/l	0 0±0 1	0.0±0.1	0.0±0 1
Uranium 238	pCi/l	0.3±0 1	1.1±0 3	0 0±0 1
Strontium 89, 90	pCi/l	0.1±0.4	0.1±0.4	-0.1±0 4
Plutonium 239, 240	pCi/l	0.00±0 1	0.0±0.1	0 00±0 01
Americium 241	pCi/l	0.00±0 1	0.00±0.01	0.00±0 01
Cesium 137	pCi/l	0.0±0.5	0.3±0.5	0.3±0 6
Tritium	pCi/l	30±210	190±210	80±150

Note Analytes not listed in this table were not detected or not reported for all three wells

TABLE 4-3

BACKGROUND DISSOLVED METAL RESULTS

ROCKY FLATS ALLUVIUM GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	Calcium	Iron	Magnesium	Manganese	Molybdenum	Nickel	Potassium	Sodium	Strontium	Zinc
NUMBER OF SAMPLES	11	11	11	11	11	11	11	11	11	11
NUMBER OF DETECTS	11	2	4	10	1	1	1	9	3	4
PERCENT DETECTS	100	18	36	91	9	9	9	82	27	36
MAXIMUM DETECTED VALUE	71 4	266	5 79	268	0136	0432	7 73	11	159	141
MINIMUM DETECTED VALUE	18 6	129	5 23	0187	0136	0432	7 73	6 89	115	0289
*MEAN	38	---	---	09	---	---	---	7 55	---	---
*STANDARD DEVIATION	16 8	---	---	1	---	---	---	2 07	---	---
*COEFFICIENT OF VARIATION	442	---	---	1 111***	---	---	---	274	---	---
MINIMUM REPORTED DETECTION LIMIT	---	1	5	015	1	04	5	5	1	02
MAXIMUM REPORTED DETECTION LIMIT	---	1	5	015	1	04	5	5	1	02
APPROPRIATE STATISTICAL METHOD	TIN	TP	TP	TIN	TIP	TIP	TIP	TIN	TP	TP
*TOLERANCE INTERVAL (UPPER LIMIT)	85	---	---	365	---	---	---	13 4	---	---
MEAN + 3 STD DEVIATION	88 4	---	---	0 39	---	---	---	13 76	---	---
ARAR VALUE	NS	0 3	NS	0 05	0 1	0 2	NS	NS	NS	2 0

Notes Dissolved Metals not detected in Rocky Flats Alluvium Al Sb As Ba Be,Cd Cs,Cr Co Cu Pb Li Hg,Se Ag Tl Sn V

*Tolerance Intervals, Coefficient of Variation, Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-4

OTHER BACKGROUND INORGANIC RESULTS

ROCKY FLATS ALLUVIUM GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	CHLORIDE	CYANIDE	NITRATE AS N	PH	SULFATE	BICARBONATE	TDS
NUMBER OF SAMPLES	11	11	11	11	11	11	11
NUMBER OF DETECTS	11	2	11	11	11	11	11
PERCENT DETECTS	100	18	100	100	100	100	100
MAXIMUM DETECTED VALUE	14	0038	2 3	7 9	39	450	300
MINIMUM DETECTED VALUE	3	0035	0 66	6 6	10	72	150
*MEAN	6 3	---	1 4	7 3	22 3	144	217
*STANDARD DEVIATION	3 3	---	0 56	0 4	8 1	104	48
*COEFFICIENT OF VARIATION	524	---	4	055	363	722	221
MINIMUM REPORTED DETECTION LIMIT	---	0025	---	---	---	---	---
MAXIMUM REPORTED DETECTION LIMIT	---	0025	---	---	---	---	---
APPROPRIATE STATISTICAL METHOD	TIN	TP	TIN	TIN	TIN	TIN	TIN
*TOLERANCE INTERVAL (UPPER LIMIT)	15 6	---	2 98	8 6	45 1	436	352
**TOLERANCE INTERVAL (LOWER LIMIT)	---	---	---	5 98	---	---	---
MEAN + 3 STD DEVIATION	16 2	---	3 08	8 5	46 6	453	361
MEAN - 3 STD DEVIATION	---	---	---	6 1	---	---	---

Notes Ions not detected in Rocky Flats Alluvium Carbonate

*Tolerance Intervals, Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-5

BACKGROUND DISSOLVED RADIOCHEMICAL RESULTS

ROCKY FLATS ALLUVIUM GROUND WATER

(ROUND 1 1989) (CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233 U234	U235	U238	Sr89 Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226
NUMBER OF SAMPLES	11	11	11	11	11	11	11	11	11	11	3
MAX VALUE	12+/-8	13+/-3	1 3+/- 3	0+/- 1	1 1+/- 3	1+/- 5	01+/- 01	0+/- 01	3+/- 6	250+/-220	5+/- 5
MIN VALUE	0+/-1	-1+/-2	0+/- 1	0+/- 1	0+/- 1	- 7+/-1	0+/- 01	0+/- 01	- 3+/- 7	30+/-210	1+/- 5
*MEAN	3 182	3 545	0 418	0 000	0 282	-0 064	0 001	0 000	0 036	140 909	0 333
*STD DEVIATION	3 325	3 917	0 437	0 000	0 324	0 2186	0 0029	0 000	0 2012	59 765	0 5703
COEFF /VARIATION	1 045***	1 105***	1 044***	0 000	1 150***	-3 416***	2 9***	0 000	5 589***	0 424	1 713***
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	ANOVA
*T INTERVAL(U LIMIT)	12 543	14 570	1 647	0 000	0 195	0 552	0 009	0 000	0 603	309 149	---
MEAN + 3 STD DEV	13 158	15 295	1 728	0 000	1 255	0 592	0 010	0 000	0 640	320 205	2 044

Notes Because of results on other radionuclides, Radium 228 was not run on Background Rocky Flats Groundwater Samples

*Tolerance Intervals Coefficient of Variation, Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-6

BACKGROUND DISSOLVED METAL RESULTS

COLLUVIUM GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	Calcium	Magnesium	Manganese	Lithium	Sodium
NUMBER OF SAMPLES	2	2	2	2	2
NUMBER OF DETECTS	2	2	1	1	2
PERCENT DETECTS	100	100	50	50	100
MAXIMUM DETECTED VALUE	76 8	15 3	088	172	98 7
MINIMUM DETECTED VALUE	65 6	10 6	088	172	28 1
*MEAN	71 2	12 95	03	04	63 4
*STANDARD DEVIATION	5 6	2 35	0668	15	35 3
*COEFFICIENT OF VARIATION	0786	1815	2 227***	3 75	5568
MINIMUM REPORTED DETECTION LIMIT	---	---	015	01	---
MAXIMUM REPORTED DETECTION LIMIT	---	---	015	01	---
APPROPRIATE STATISTICAL METHOD	NONE	NONE	TP	TP	NONE
*TOLERANCE INTERVAL (UPPER LIMIT)	---	---	---	---	---
MEAN + 3 STD DEVIATION	88 0	20 0	230	49	169
ARAR VALUE	NS	NS	0 05	2 5	NS

Notes Dissolved Metals not detected in Colluvium Al,Sb,As,Ba Be Cd,Cs,Cr,Co,Cu,Fe,Pb,Hg,Mo Ni Se,Sr K,Ag,Tl,Sn,V,Zn

*Tolerance Intervals, Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-7

OTHER BACKGROUND INORGANIC RESULTS

COLLUVIUM GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	CHLORIDE	NITRATE AS N	pH	SULFATE	BICARBONATE	TDS
NUMBER OF SAMPLES	2	2	2	2	2	2
NUMBER OF DETECTS	2	1	2	2	2	2
PERCENT DETECTS	100	50	100	100	100	100
MAXIMUM DETECTED VALUE	20	18	7 4	86	470	520
MINIMUM DETECTED VALUE	11	18	7 1	45	230	290
*MEAN	15 5	0 07	7 25	65 5	350	405
*STANDARD DEVIATION	4 5	0 12	0 15	20 5	120	115
*COEFFICIENT OF VARIATION	2903	1 7***	0207	3129	3429	2839
MINIMUM REPORTED DETECTION LIMIT	---	05	---	---	---	---
MAXIMUM REPORTED DETECTION LIMIT	---	05	---	---	---	---
APPROPRIATE STATISTICAL METHOD	NONE	TP	NONE	NONE	NONE	NONE
*TOLERANCE INTERVAL (UPPER LIMIT)	---	---	---	---	---	---
**TOLERANCE INTERVAL (LOWER LIMIT)	---	---	---	---	---	---
MEAN + 3 STD DEVIATION	29 0	43	7 7	127	710	750
MEAN - 3 STD DEVIATION	---	---	6 8	---	---	---

Notes Ions not detected in Colluvium Carbonate, Cyanide

*Tolerance Intervals, Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-8

BACKGROUND RADIOCHEMICAL RESULTS

COLLUVIUM GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233 U234	U235	U238	Sr89,Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226
NUMBER OF SAMPLES	2	2	2	2	2	2	2	2	2	2	1
MAX VALUE	27+/-12	12•/-5	11+/-1	3+/- 1	7 7+/- 7	1+/- 4	0+/- 01	0+/- 01	2+/- 6	100+/-150	4+/- 2
MIN VALUE	1+/-3	2+/-2	6+/- 2	0+/- 1	4+/- 2	0+/- 5	0+/- 01	- 01+/- 01	- 6+/- 6	-100+/-140	4+/- 2
*MEAN	14 000	7 000	5 800	0 150	4 050	0 050	0 000	-0 005	-0 200	0 000	---
*STD DEVIATION	30 871	14 866	12 712	0 335	8 884	0 112	0 000	0 0112	0 566	100 0	---
COEFF /VARIATION	2 205***	2 124***	2 192***	2 233***	2 194***	2 240***	0 000	-2 240***	-2 83***	0 000	---
APP STAT METHOD	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
*T INTERVAL(U LIMIT)	----	---	---	---	---	---	---	---	---	---	---
MEAN + 3 STD DEV	106 61	51 598	43 94	1 155	30 702	0 386	---	0 029	14 98	300	---

Notes Because of results on other radionuclides, Radium 228 was not run on Background Colluvium Groundwater Samples

*Tolerance Intervals Coefficient of Variation, Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

A comparison of the summary tables for colluvial ground water to that of Rocky Flats Alluvium ground water indicates that ground water in colluvium is relatively high in all the major ions as well as uranium, and relatively low in nitrate In addition, iron, molybdenum, nickel, potassium, strontium, zinc, and cyanide were detected in alluvial ground water and were not detected in colluvial water, while lithium was only detected in colluvial ground water The absence of detected analytes with colluvial ground water may be in part an artifact of the small sample size

4 1 3 Valley Fill Ground Water

Statistical summaries of chemical results are presented in Tables 4-9, 4-10, and 4-11 Nineteen tolerance intervals based on a normal distribution are presented Of these, four analytes, all radionuclides, have a coefficient of variation in excess of one or less than zero which suggests recalculation as lognormal tolerance intervals may be appropriate

Valley fill ground water is chemically similar to the colluvium Both ground waters have similar concentrations of major ions, uranium, and nitrate which differentiate these waters from the Rocky Flats Alluvium ground water The uranium concentrations are somewhat less than the colluvial ground water but are higher than the Rocky Flats Alluvium ground water However, like the ground water of the Rocky Flats Alluvium, several trace metals were detected that were not detected in the colluvium (iron, molybdenum, nickel, strontium, and zinc) Also detected in the valley fill ground water was selenium, mercury, and lithium Lithium was the one trace metal, aside from manganese, also detected in the colluvium

As detailed in Section 3 1 3 both the Rock Creek drainage and the Woman Creek drainage have been sampled to ensure evaluation of spatial variability Table 4-12 presents concentration ranges of analytes for each drainage system Woman Creek valley fill ground water is higher in concentration for most of the analytes listed relative to the Rock Creek

TABLE 4-9

BACKGROUND DISSOLVED METAL RESULTS

VALLEY FILL ALLUVIUM GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS IN mg/l)

	CALCIUM	IRON	MERCURY	LITHIUM	MAGNESIUM	MANGANESE	SODIUM	SELENIUM	ZINC
NUMBER OF SAMPLES	8	8	8	8	8	8	8	8	8
NUMBER OF DETECTS	8	1	2	7	7	4	8	1	1
PERCENT DETECTS	100	13	25	88	88	50	100	13	13
MAXIMUM DETECTED VALUE	103	944	0003	0223	18 10	686	74 7	0114	0212
MINIMUM DETECTED VALUE	18 9	944	0003	0116	8 5	0546	19 3	0114	0212
*MEAN	56 94	---	---	0 01	10 83	--- **	37 88	---	---
*STANDARD DEVIATION	25 46	---	---	0041	4 94	---	15 72	---	---
*COEFFICIENT OF VARIATION	4471	---	---	41	4561	---	4150	---	---
MINIMUM REPORTED DETECTION LIMIT	---	1	0002	010	5	015	---	005	020
MAXIMUM REPORTED DETECTION LIMIT	---	1	0002	010	5	015	---	005	020
APPROPRIATE STATISTICAL METHOD	TIN	TP	TP	TIN	TIN	ANOVA	TIN	TP	TP
*TOLERANCE INTERVAL (UPPER LIMIT)	138	---	---	028	26 57	---	88	---	---
MEAN + 3 STD DEVIATION	133 3	---	---	022	25 65	---	85 04	---	---
ARAR VALUE	NS	0 3	0 002	2 5	NS	0 05	NS	0 01	2 0

Notes Dissolved Metals not detected in Valley Fill Alluvium Al,Sb,As,Ba Be Cd Cs,Cr,Co,Cu,Pb,Mo Ni,K,Ag,Sr,Tl Sn V

*Tolerance Intervals Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Manganese mean determined by Cohens method is less than zero Will evaluate with lognormal values for final

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-10

OTHER BACKGROUND INORGANIC RESULTS

VALLEY FILL ALLUVIUM GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	CHLORIDE	NITRATE AS N	pH	SULFATE	BICARBONATE	TDS
NUMBER OF SAMPLES	8	8	8	8	8	8
NUMBER OF DETECTS	7	3	8	8	8	8
PERCENT DETECTS	88	38	100	100	100	100
MAXIMUM DETECTED VALUE	26	69	8 0	120	610	800
MINIMUM DETECTED VALUE	6	05	6 8	13	110	200
*MEAN	12 22	---	7 4	56 5	269	416
*STANDARD DEVIATION	8 81	---	0 34	29 35	141	166
*COEFFICIENT OF VARIATION	7209	---	0459	5195	524	399
MINIMUM REPORTED DETECTION LIMIT	3	05	---	---	---	---
MAXIMUM REPORTED DETECTION LIMIT	3	05	---	---	---	---
APPROPRIATE STATISTICAL METHOD	TIN	TP	TIN	TIN	TIN	TIN
*TOLERANCE INTERVAL (UPPER LIMIT)	40 29	---	8 68	150	719	947
**TOLERANCE INTERVAL (LOWER LIMIT)	---	---	6 12	---	---	---
MEAN + 3 STD DEVIATION	38 65	---	8 42	145	692	947
MEAN - 3 STD DEVIATION	---	---	6 38	---	---	---

Notes Ions not detected in Colluvium Carbonate Cyanide

*Tolerance Intervals Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-11

BACKGROUND RADIOCHEMICAL RESULTS

VALLEY FILL ALLUVIUM GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233 U234	U235	U238	Sr89,Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226
NUMBER OF SAMPLES	8	8	8	8	8	8	8	8	8	8	2
MAX VALUE	10+/-9	14+/-4	4 1+/- 6	1+/- 1	2 8+/- 5	5+/- 5	01+/- 01	0+/- 01	3+/- 6	380+/-150	2+/- 2
MIN VALUE	2+/-2	2+/-2	4+/- 2	0+/- 1	2+/- 2	- 3+/- 5	0+/- 01	- 01+/- 01	- 5+/- 8	50+/-150	- 1+/- 2
*MEAN	4 250	5 750	1 950	0 063	1 475	0 113	0 001	-0 004	0 012	151 250	0 050
*STD DEVIATION	2 906	4 009	1 421	0 053	1 132	0 240	0 003	0 005	0 247	110 998	0 177
COEFF /VARIATION	0 684	0 697	0 729	0 844	0 768	2 126***	3 3***	-1 25***	20 6***	0 734	3 536***
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	NONE
*T INTERVAL(U LIMIT)	13 515	18 530	6 481	0 232	5 084	0 878	0 012	0 012	0 776	505 111	0 050
MEAN + 3 STD DEV	12 968	17 776	6 214	0 223	4 871	0 834	0 011	0 011	0 754	484 24	0 580

Notes Because of results on other radionuclides Radium 228 was not run on Background Valley Fill Alluvium Groundwater Samples

*Tolerance Intervals, Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-12

RANGES OF CHEMICAL RESULTS FOR VALLEY FILL ALLUVIAL GROUND WATER BY DRAINAGE SYSTEM

Parameter	Rock Creek Drainage* Range of concentrations (mg/l)	Women Creek and Associated Drainage** Range of concentrations (mg/l)
Calcium	18 9 - 41 90	68 10 - 103
Iron	0 944	ND
Lithium	0 0116 - 0.0154	0.0126 - 0 0223
Magnesium	8 50 - 8 61	11 80 - 18.10
Manganese	0.0649 - 0.208	0.0546 - 0.686
Selenium	ND	0 0114
Sodium	19 30 - 34.70	31 40 - 74 70
Zinc	ND	0 0212
Total Dissolved Solids	200 - 800	360 - 470
Chloride	6 - 84	14 - 26
Nitrate	0 69	0 05 - 0.08
Sulfate	13 - 53	52 - 120
Bicarbonate	110 - 230	280 - 610
pH (pH units)	6 8 - 7 4	7 4 - 8 0
Gross Alpha	2±2 - 4±4	3±6 - 10±9
Gross Beta	2±2 - 6±3	5±3 - 14±4
Uranium 233, 234	0.4±0 2 - 1.4±0.3	2 2±0 3 - 4 1±0 6
Uranium 235	0.0±0 1 - 0.1±0.1	0.1±0.1 - 0.1±0.1
Uranium 238	0.8±0.2 - 1.2±0.3	1.4±0.3 - 2.8±0.5
Strontium 89, 90	-0.3±0 5 - 0 5±0 5	-0.1±0 5 - -0 3±0.5
Plutonium 239, 240	0 00±0 01 - 0 01±0.01	0 00±0.01 - 0.00±0 01
Americium 241	-0.01±0.01 - 0.00±0 01	-0.01±0 01 - 0 00±0 01
Cesium 137	-0 3±0.6 - 0.3±0 6	-0.05±0.08 - 0 1±0.6
Tritium	50±150 - 190±150	50±150 - 380±150
Radium 226	NR	-0 1±0.2 - 0 2±0 2

* Range of values for wells B102289, B102389, B202489, and B202589

** Range of values for wells B402689, B302789, B302889, and B302989. Well B303089 was dry during Round 1.

ND Not detected in any sample from the subgroup

NR Not reported; not analyzed

valley fill ground water Therefore, the concentrations presented in the table indicate that two populations may be present

4 1 4 Weathered Bedrock Ground Water

Weathered bedrock ground water is a mixture derived from claystone and sandstone Statistical summaries of chemical results of weathered claystone ground water are presented in Tables 4-13, 4-14, and 4-15 Summaries of weathered sandstone ground water are found in Tables 4-16, 4-17, and 4-18 Comparison of Tables 4-13 through 4-15 to Tables 4-16 through 4-18, albeit recognizing the small sample size upon which these tables are based suggest the possibility that weathered claystone ground water and weathered sandstone ground water may be considered a single population Unlike the valley fill and colluvial ground water which appear chemically similar to each other and different from the Rocky Flats Alluvial ground water, weathered claystone and weathered sandstone ground water appear to be chemically similar to each other and show characteristics of both the Rocky Flats Alluvium and colluvium/valley fill ground waters Major cation concentrations are similar to the colluvium/valley fill ground waters, while major anion concentrations and TDS resemble the Rocky Flats Alluvial ground water Many of the trace metals detected in either the Rocky Flats Alluvium, colluvium, and valley fill ground water, were detected in the weathered bedrock ground water In addition, chromium and thallium were just above detection limits in the weathered bedrock ground water A notable difference between the weathered sandstone and weathered claystone ground water is the uranium concentrations Weathered claystone ground water has higher uranium concentrations (similar to the colluvial and valley fill ground waters) than the weathered sandstone ground water (similar to the Rocky Flats Alluvium ground water)

4 1 5 Unweathered Sandstone Ground Water

Statistical summaries of the chemical results of unweathered sandstone ground water are presented in Tables 4-19, 4-20 and 4-21 Nine tolerance intervals based upon the normal

TABLE 4-13

BACKGROUND DISSOLVED METALS RESULTS

WEATHERED CLAYSTONE GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	CALCIUM	MERCURY	LITHIUM	MAGNESIUM	MANGANESE	MOLYBDENUM	SODIUM	THALLIUM	ZINC
NUMBER OF SAMPLES	4	4	4	4	4	4	4	4	4
NUMBER OF DETECTS	4	1	2	4	3	2	4	1	2
PERCENT DETECTS	100	25	50	100	75	50	100	25	50
MAXIMUM DETECTED VALUE	73 4	0008	0381	45 3	126	015	36 9	01	107
MINIMUM DETECTED VALUE	41 4	0008	013	6 7	053	0113	15 7	01	059
*MEAN	51 9	---	09	18 97	06	09	24 7	---	0 03
*STANDARD DEVIATION	13 03	---	0699	15 58	051	0795	8 0	---	064
*COEFFICIENT OF VARIATION	2511	---	7767	8213	85	8833	3239	---	2 133***
MAXIMUM REPORTED DETECTION LIMIT	---	0002	1	---	015	1	---	05	02
MINIMUM REPORTED DETECTION LIMIT	---	0002	1	---	015	1	---	01	02
APPROPRIATE STATISTICAL METHOD	ANOVA	TP	TP	ANOVA	ANOVA	TP	ANOVA	TP	TP
*TOLERANCE INTERVAL(UPPER LIMIT)	---	---	---	---	---	---	---	---	---
MEAN + 3 STD DEVIATION	91 0	---	0 30	65 7	0 21	0 33	48 7	---	0 22
ARAR VALUE	NS	0 002	2 5	NS	0 05	0 1	NS	0 01 U	2 0

Notes Dissolved Metals not detected in Weathered Claystone Ground Water Al,Sb As Ba Be,Cd,Cs Cr Co Cu Fe Pb Ni K Se Ag Sr Sn V

*Tolerance Intervals, Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-14

OTHER BACKGROUND INORGANIC RESULTS

WEATHERED CLAYSTONE GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS IN mg/l)

	CHLORIDE	NITRATE AS N	pH	SULFATE	BICARBONATE	TDS	CYANIDE
NUMBER OF SAMPLES	4	4	4	4	4	4	4
NUMBER OF DETECTS	2	4	4	4	4	4	1
PERCENT DETECTS	50	100	100	100	100	100	25
MAXIMUM DETECTED VALUE	11	58	8 2	44	400	320	0036
MINIMUM DETECTED VALUE	6	1	7 4	11	180	210	0036
*MEAN	3 54	325	7 675	26 75	260	255	---
*STANDARD DEVIATION	5 79	19	31	11 78	86 02	43 87	---
*COEFFICIENT OF VARIATION	1 6***	5846	0404	4404	3309	1720	---
MINIMUM REPORTED DETECTION LIMIT	3	---	---	---	---	---	0025
MAXIMUM REPORTED DETECTION LIMIT	3	---	---	---	---	---	0025
APPROPRIATE STATISTICAL METHOD	TP	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	TP
*TOLERANCE INTERVAL(UPPER LIMIT)	---	---	---	---	---	---	---
**TOLERANCE INTERVAL(LOWER LIMIT)	---	---	5 69	---	---	---	---
MEAN + 3 STD DEVIATION	20 9	0 895	8 605	62 09	518	387	---
MEAN - 3 STD DEVIATION	---	---	6 745	---	---	---	---

Notes Ions not detected in Colluvium Carbonate

*Tolerance Intervals Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >=

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-15

BACKGROUND RADIOCHEMICAL RESULTS

WEATHERED CLAYSTONE GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233,U234	U235	U238	Sr89 Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226
NUMBER OF SAMPLES	4	4	4	4	4	4	4	4	4	4	3
MAX VALUE	12+/-4	7+/-2	5 8+/- 6	2+/- 1	3 2+/- 5	1+/- 5	03+/- 02	0+/- 01	4+/- 6	100+/-160	6+/- 3
MIN VALUE	0+/-3	3+/-3	7+/- 2	0+/- 1	4+/- 2	- 2+/- 4	0+/- 01	0+/- 01	- 1+/- 5	-100+/-230	4+/- 5
MEAN	6 750	5 500	3 150	0 075	2 000	0 000	0 007	0 000	0 175	2 500	0 500
*STD DEVIATION	9 4885	6 9011	4 2716	0 1237	2 6736	0 1225	0 0159	0 000	0 2789	88 4767	0 7681
COEFF /VARIATION	1 4***	1 3***	1 4***	1 6***	1 337	UNDETERM	2 3***	UNDETERM	1 6***	35 4***	1 5***
APP STAT METHOD	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA
*T INTERVAL(U LIMIT)	55 568	41 006	25 127	0 712	15 753	0 630	0 089	0 000	1 610	457 713	6 380
MEAN + 3 STD DEV	35 215	26 203	15 965	0 446	10 019	0 3675	0547	0 000	1 012	268 740	2 804

Notes Because of results on other radionuclides, Radium 228 was not run on Background Weathered Claystone Groundwater Samples

*Tolerance Intervals, Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-16

BACKGROUND DISSOLVED METALS RESULTS

WEATHERED SANDSTONE GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	CALCIUM	CHROMIUM	LITHIUM	MAGNESIUM	MANGANESE	MOLYBDENUM	SODIUM
NUMBER OF SAMPLES	2	2	2	2	2	2	2
NUMBER OF DETECTS	2	1	1	2	2	1	2
PERCENT DETECTS	100	50	50	100	100	50	100
MAXIMUM DETECTED VALUE	65 7	0122	0106	9 41	292	015	25 6
MINIMUM DETECTED VALUE	36 2	0122	0106	6 05	0178	015	13 7
*MEAN	50 95	01	09	7 73	155	09	19 7
*STANDARD DEVIATION	14 75	002	082	1 68	14	078	5 95
*COEFFICIENT OF VARIATION	2895	2	9111	2173	9032	8667	3020
MAXIMUM REPORTED DETECTION LIMIT	---	01	1	---	---	1	---
MINIMUM REPORTED DETECTION LIMIT	---	01	1	---	---	1	---
APPROPRIATE STATISTICAL METHOD	NONE	TP	TP	NONE	NONE	TP	NONE
*TOLERANCE INTERVAL(UPPER LIMIT)	---	---	---	---	---	---	---
MEAN + 3 STD DEVIATION	95 2	016	34	12 8	575	0 32	37 6
ARAR VALUE	NS	0 05	2 5	NS	0 05	0 1	NS

Notes Dissolved Metals not detected in Weathered Sandstone Ground Water Al,Sb As,Ba Be,Cd,Cs Co Cu Fe Pb Hg,Ni K Se,Ag,Sr Tl Sn,V Zn

*Tolerance Intervals Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-17

OTHER BACKGROUND INORGANIC RESULTS

WEATHERED SANDSTONE GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS IN mg/l)

	CHLORIDE	NITRATE AS N	pH	SULFATE	BICARBONATE	TDS
NUMBER OF SAMPLES	2	2	2	2	2	2
NUMBER OF DETECTS	2	2	2	2	2	2
PERCENT DETECTS	100	100	100	100	100	100
MAXIMUM DETECTED VALUE	15	1 6	7 5	48	230	220
MINIMUM DETECTED VALUE	6	18	7 2	16	140	170
*MEAN	10 5	89	7 35	32	185	195
*STANDARD DEVIATION	4 5	71	15	16	45	25
*COEFFICIENT OF VARIATION	4286	7978	0204	5	2432	1282
MINIMUM REPORTED DETECTION LIMIT	---	---	---	---	---	---
MAXIMUM REPORTED DETECTION LIMIT	---	---	---	---	---	---
APPROPRIATE STATISTICAL METHOD	NONE	NONE	NONE	NONE	NONE	NONE
*TOLERANCE INTERVAL(UPPER LIMIT)	---	---	---	---	---	---
**TOLERANCE INTERVAL(LOWER LIMIT)	---	---	---	---	---	---
MEAN + 3 STD DEVIATION	24 0	3 0	7 8	80	320	270
MEAN - 3 STD DEVIATION	---	---	6 9	---	---	---

Notes Ions not detected in Weathered Sandstone Carbonate Cyanide

Tolerance Intervals Coefficient of Variation, Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-18

BACKGROUND DISSOLVED RADIOCHEMICAL RESULTS

WEATHERED SANDSTONE GROUND WATER

(ROUND 1 1989) (CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233 U234	U235	U238	Sr89,Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226
NUMBER OF SAMPLES	2	2	2	2	2	2	2	2	2	2	1
MAX VALUE	7+/-5	2+/-3	1 1+/- 3	0+/- 1	6+/- 2	- 1+/- 6	01+/- 01	01+/- 01	3+/- 7	100+/-210	4+/-1
MIN VALUE	3+/-3	0+/-2	3+/- 1	0+/- 1	1+/- 1	- 2+/- 5	0+/- 01	0+/- 01	0+/- 6	-40+/-150	4+/-1
*MEAN	5 000	1 000	0 700	0 000	0 350	-0 150	0 005	0 005	0 150	30 000	0 400
*STD DEVIATION	2 000	1 000	0 400	0 000	0 250	0 050	0 0050	0 0050	0 150	70 000	0 400
COEFF /VARIATION	0 400	1 000	0 571	UNDETERM	0 714	-0 333***	1 000	1 000	1 000	2 333***	1 000
APP STAT METHOD	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
*T INTERVAL(U LIMIT)	5 000	1 000	0 7000	0 000	0 350	-0 150	0 005	0 005	0 150	30 000	---
MEAN + 3 STD DEV	11 000	4 000	1 900	0 000	1 100	0 000	0 020	0 020	0 600	240 000	1 600

Notes Because of results on other radionuclides Radium 228 was not run on Background Weathered Sandstone Groundwater Samples

*Tolerance Intervals Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-19

BACKGROUND DISSOLVED METALS RESULTS

UNWEATHERED SANDSTONE GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	ALUMINUM	ARSENIC	CALCIUM	POTASSIUM	MANGANESE	MOLYBDENUM	SODIUM	SELENIUM	STRONTIUM	ZINC
NUMBER OF SAMPLES	7	7	7	7	7	7	7	7	7	7
NUMBER OF DETECTS	1	2	6	3	1	1	7	3	2	5
PERCENT DETECTS	14	29	86	43	14	14	100	43	29	71
MAXIMUM DETECTED VALUE	327	0186	39 6	21 89	0182	112	454	041	451	374
MINIMUM DETECTED VALUE	327	0106	8 05	5 2	0182	112	64 8	0076	446	0299
*MEAN	---	---	17 29	---	---	---	166	---	---	06
*STANDARD DEVIATION	---	---	13 9	---	---	---	127	---	---	15
*COEFFICIENT OF VARIATION	---	---	8039	---	---	---	7651	---	---	2 5***
MAXIMUM REPORTED DETECTION LIMIT	200	0100	5	5	015	10	---	005	1	02
MINIMUM REPORTED DETECTION LIMIT	200	0100	5	5	015	10	---	005	1	02
APPROPRIATE STATISTICAL METHOD	TP	TP	TIN	TP	TP	TP	TIN	TP	TP	TIN
*TOLERANCE INTERVAL(UPPER LIMIT)	---	---	64 6	---	---	---	599	---	---	564
MEAN + 3 STD DEVIATION	---	---	58 99	---	---	---	547	---	---	51
ARAR VALUE	5 0	0 05	NS	NS	0 05	0 1	NS	0 01	NS	2 0

Notes Dissolved Metals not detected in Unweathered Sandstone Sb Ba,Be Cd Cs Cr Co Cu Fe Pb Li,Mg Hg Ni Ag Tl Sn V

*Tolerance Intervals, Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-20

OTHER BACKGROUND INORGANIC RESULTS

UNWEATHERED SANDSTONE GROUND WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	CHLORIDE	NITRATE AS N	pH	SULFATE	BICARBONATE	CARBONATE	TDS
NUMBER OF SAMPLES	7	7	7	7	7	7	7
NUMBER OF DETECTS	6	4	7	5	7	6	7
PERCENT DETECTS	86	57	100	71	100	86	100
MAXIMUM DETECTED VALUE	360	35	9 5	620	270	31	1300
MINIMUM DETECTED VALUE	4 7	06	8 5	8	67	6	230
*MEAN	115	06	9 0	71 2	164	14 7	539
*STANDARD DEVIATION	145	16	39	259	73	10 03	360
*COEFFICIENT OF VARIATION	1 3***	2 7***	0433	3 6***	4451	6823	6679
MINIMUM REPORTED DETECTION LIMIT	3	05	---	5	---	5	---
MAXIMUM REPORTED DETECTION LIMIT	3	05	---	5	---	5	---
APPROPRIATE STATISTICAL METHOD	TIN	TIN	TIN	TIN	TIN	ANOVA	TIN
*TOLERANCE INTERVAL(UPPER LIMIT)	607	610	10 57	950	412	49	1761
**TOLERANCE INTERVAL(LOWER LIMIT)	---	---	7 43	---	---	---	---
MEAN + 3 STD DEVIATION	550	0 54	10 2	848	383	44 8	1619
MEAN - 3 STD DEVIATION	---	---	7 8	---	---	---	---

Notes Ions not detected in Unweathered Sandstone Cyanide

*Tolerance Intervals Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-21

BACKGROUND DISSOLVED RADIOCHEMICAL RESULTS

UNWEATHERED SANDSTONE GROUND WATER

(ROUND 1 1989) (CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233 U234	U235	U238	Sr89 Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM
NUMBER OF SAMPLES	5	5	7	7	7	6	7	7	6	5
MAX VALUE	13+/-5	15+/-4	7 5+/- 7	1+/- 1	1 9+/- 3	2+/- 5	0+/- 01	01+/- 01	7+/- 5	330+/-160
MIN VALUE	-2+/-4	3+/-2	1+/- 1	0+/- 1	0+/- 1	- 3+/- 3	0+/- 01	0+/- 01	- 1+/- 5	-110+/-220
*MEAN	4 800	7 600	2 486	0 014	0 629	-0 017	0 000	0 003	0 250	42 000
*STD DEVIATION	7 098	7 162	3 075	0 035	0 803	0 195	0 000	0 0046	0 277	164 178
COEFF /VARIATION	0 208	0 942	1 237***	2 500***	1 277***	-11 471***	UNDETERM	1 533***	1 108***	3 909***
APP STAT METHOD	ANOVA	ANOVA	TIN	TIN	TIN	ANOVA	TIN	TIN	ANOVA	ANOVA
*T INTERVAL(U LIMIT)	34 627	37 695	12 936	0 135	3 3507	0 707	0 000	0 019	1 276	731 876
MEAN + 3 STD DEV	26 094	29 086	11 711	0 119	3 038	0 568	0 000	0 017	1 0811	534 534

Notes Because of results on other radionuclides, Radium 226 and Radium 228 were not run on Background Unweathered Sandstone Groundwater Samples

*Tolerance Intervals Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

distribution are calculated in these tables Of these, two analytes had a coefficient of variation greater than one or less than zero suggesting recalculation of lognormal tolerance interval may be appropriate

The ground water sampled within unweathered sandstones is distinct from the ground waters associated with the surficial flow system Unweathered sandstone ground water is much higher in sodium, sulfate, chloride, and TDS than any of the previously discussed water It is also lower in nitrate than the bedrock waters Arsenic and aluminum are trace metals detected in the unweathered sandstone ground water that were not detected elsewhere The uranium concentrations are most similar to the weathered claystone, colluvial, and valley fill ground water

4 2 SURFACE WATER

As presented in Section 3 2, surface water sampling sites were selected within the Rock Creek, Walnut Creek and Woman Creek drainages Stiff diagrams for Round 1, 1989 surface water samples at various locations are presented in Plate 2

Surface water gradually changes from the west (upgradient) to the east (downgradient) (Plate 2) The Stiff diagrams indicate that surface water becomes relatively less concentrated in sodium chloride and more concentrated in calcium bicarbonate as it flows from west to east Downgradient Stiff diagrams of surface water resemble those Stiff diagrams of adjacent ground water The change in the shape of the surface water Stiff diagrams across the Rocky Flats Plant reflects changing surface water/ground water interactions Surface water stations at the western edge of the Plant are not in an incised drainage thus the surface water sampled is likely recharging the ground-water flow system Surface water stations further east are located within an incised drainage and the geochemistry of the surface waters reflects the ground-water recharge of the surface water flow system

4 2 1 Round 1 Surface Water Samples

Statistical summaries of chemical results are presented in Tables 4-22 through 4-26 Thirty eight tolerance intervals based on a normal distribution are presented For eleven of these analytes a lognormal tolerance interval may be appropriate because the coefficient of variation was greater than one or less than zero

Comparisons of the dissolved and total metals results (Table 4-22 and 4-23), and the dissolved and total radiochemical results (Table 4-25 and 4-26) indicate that most of the chemical load is transported in suspension

A review of the data (Appendix A) upon which these summaries are based indicates that water chemistry at location SW080 appears distinct from other surface water sampling locations Surface water from SW080 contributed the only detection of the following total metals barium, beryllium, cadmium, cesium, chromium, cobalt, copper, magnesium, molybdenum, nickel, potassium, tin, and vanadium and the highest values of the following total metals aluminum, arsenic, calcium, iron, lead, silver, strontium, and zinc Surface water from SW080 contributed the highest values for gross alpha and beta The reason for these anomalies could be attributed to the elevated concentration of total suspended solids Analytical results from this station for the dissolved analytes appear to be consistent with result from other surface water stations

4 2 2 Round 2 Surface Water Samples

Statistical summaries of chemical results are presented in Tables 4-27 through 4-30 Surface water from Round 2 sampling was not analyzed for dissolved radiochemical results The suite of surface water stations sampled in Round 2 was reduced to seven because two stations, SW004 and SW080, previously sampled in Round 1 were dry

TABLE 4-22

BACKGROUND DISSOLVED METAL RESULTS

SURFACE WATER (ROUND 1, 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	SILVER	ALUMINUM	CALCIUM	IRON	MERCURY	MAGNESIUM	MANGANESE	SODIUM	LEAD	STRONTIUM	ZINC
NUMBER OF SAMPLES	9	9	9	9	9	9	9	9	9	9	9
NUMBER OF DETECTS	1	1	9	3	7	7	5	9	1	8	2
PERCENT DETECTS	11	11	100	33	78	78	56	100	11	89	22
MAXIMUM DETECTED VALUE	0125	485	78 4	4 69	0013	10	48	32 3	0055	296	032
MINIMUM DETECTED VALUE	0125	485	15 3	1 78	00029	5 82	0396	8 38	0055	124	0242
*MEAN	---	---	35 5	---	0004	6 57	04	20 03	---	17	---
*STANDARD DEVIATION	---	---	20 98	---	0004	1 79	26	8 17	---	06	---
*COEFFICIENT OF VARIATION	---	---	5909	---	1 0	2725	6 5***	4079	---	3529	---
MAXIMUM REPORTED DETECTION LIMIT	01	2	---	1	0002	5	015	---	005	1	02
MINIMUM REPORTED DETECTION LIMIT	01	2	---	1	0002	5	015	---	01	1	02
APPROPRIATE STATISTICAL METHOD	TP	TP	TIN	TP	TIN	TIN	TIN	TIN	TP	TIN	TP
*TOLERANCE INTERVAL(UPPER LIMIT)	---	---	99 14	---	002	11 98	826	41 81	---	35	---
MEAN + 3 STD DEVIATION	---	---	98 44	---	0016	11 94	82	41 54	---	35	---
ARAR VALUE	0 05	5 0	NS	0 3	0 002	NS	0 05	NS	0 05	NS	2 0

Notes Dissolved Metals not detected in Round One Background Surface Water Sb,As,Ba,Be Cd Cr Cs,Co Cu Li Mo Ni K,Se,Tl,Sn V

*Tolerance Intervals, Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-23

BACKGROUND TOTAL METAL RESULTS

SURFACE WATER (ROUND 1 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	Ag	Al	As	Ba	Be	Ca	Cd	Cs	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Ni	Na	Pb	Sr	Sn	V	Zn
NUMBER OF SAMPLES	9	9	9	9	9	9	9	9	9	9	9	9	8	9	9	9	9	9	9	9	9	9	9	9
NUMBER DETECTS	3	3	2	1	1	9	1	1	1	1	1	9	7	1	8	6	1	1	9	2	8	1	1	4
PERCENT DETECTS	33	33	22	11	11	100	11	11	11	11	11	100	88	11	89	67	11	11	100	22	89	11	11	44
MAX DET VALUE	148	64 10	116	4 49	0097	226	0690	2 53	0730	0598	180	651	0011	9 86	24 90	716	199	250	30 80	233	1 20	969	364	7
MIN DET VALUE	0106	916	0105	4 49	0097	14 80	0690	2 53	0730	0598	180	118	00022	9 86	5 76	0175	199	250	12 50	0185	123	969	364	0
*MEAN	---	---	---	---	---	59 23	---	---	---	---	---	75 24	00039	---	8 86	0 10	---	---	20 444	---	0 28	---	---	--
*STD DEVIATION	---	---	---	---	---	64 30	---	---	---	---	---	203 68	0003	---	6 22	0 34	---	---	7 45	---	0 35	---	---	--
COEFF OF VARIATION	---	---	---	---	---	1 1***	---	---	---	---	---	2 7***	7692	---	7020	3 4***	---	---	3644	---	1 3***	---	---	--
MAX DET LIMIT	0100	200	010	200	0050	---	0050	1	0500	0100	0250	---	0002	5	5	0150	100	0400	---	005	100	100	0500	0
MIN DET LIMIT	0100	200	010	200	0050	---	0050	1	0500	0100	0250	---	0002	5	5	0150	100	0400	---	0050	100	100	0500	0
APP STAT METHOD	TP	TP	TP	TP	TP	TIN	TP	TP	TP	TP	TP	TIN	TIN	TP	TIN	TIN	TP	TP	TIN	TP	TIN	TP	TP	TP
*T INTERVAL(U LIMIT)	---	---	---	---	---	254 11	---	---	---	---	---	692 59	0 001	---	27 71	1 140	---	---	43 020	---	1 341	---	---	--
MEAN + 3 STD DEV	---	---	---	---	---	252 1	---	---	---	---	---	686 3	0 0013	---	27 5	1 12	---	---	42 794	---	1 33	---	---	--
ARAR VALUE	0 05	5 0	0 05	1 0	0 1	NS	0 01	NS	0 022U	0 05	0 2	0 3	0 002	NS	NS	0 05	0 1	0 2	NS	0 05	NS	NS	0 1	2

Notes Total Metals not detected in Round One Background Surface Water Sb Li Se Tl

*Tolerance Intervals Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-24

OTHER BACKGROUND INORGANIC RESULTS

SURFACE WATER (ROUND 1 1989)

(CONCENTRATIONS IN mg/l)

	CHLORIDE	NITRATE AS N	pH	SULFATE	BICARBONATE	TDS
NUMBER OF SAMPLES	9	9	9	9	9	9
NUMBER OF DETECTS	9	7	9	8	9	9
PERCENT DETECTS	100	78	100	89	100	100
MAXIMUM DETECTED VALUE	62	2 0	8 1	34	320	290
MINIMUM DETECTED VALUE	5	0 12	6 5	16	30	120
*MEAN	23 11	0 58	7 456	20 92	130 67	177 78
*STANDARD DEVIATION	21 77	0 62	0 44	9 66	85 47	50 06
*COEFFICIENT OF VARIATION	0 9420	1 1***	0 0590	0 4618	0 6541	0 2816
MINIMUM REPORTED DETECTION LIMIT	---	0 05	---	5	---	---
MAXIMUM REPORTED DETECTION LIMIT	---	0 05	---	5	---	---
APPROPRIATE STATISTICAL METHOD	TIN	TIN	TIN	TIN	TIN	TIN
*TOLERANCE INTERVAL (UPPER LIMIT)	89 11	2 45	9 02	50 20	389 72	329 52
**TOLERANCE INTERVAL(LOWER LIMIT)	---	---	5 89	---	---	327 96
MEAN + 3 STD DEVIATION	88 42	2 44	8 78	49 9	387 08	327 96
MEAN - 3 STD DEVIATION	---	---	6 14	---	---	---

Notes Ions not detected in Round One Background Surface Water Carbonate, Cyanide

*Tolerance Intervals Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-25

BACKGROUND DISSOLVED RADIOCHEMICAL RESULTS

SURFACE WATER (ROUND 1, 1989)

(CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233 U234	U235	U238	Sr89 Sr90	Pu239 Pu240	Am241	Cs137
NUMBER OF SAMPLES	9	9	9	9	9	9	9	9	9
MAX VALUE	4+/-5	6+/-3	2 6+/- 5	3+/- 1	1 7+/- 4	9+/- 5	01+/- 02	0+/- 02	2+/- 6
MIN VALUE	-1+/-1	-2+/-2	0+/- 1	0+/- 1	- 1+/- 1	- 5+/- 8	0+/- 02	- 01+/- 03	- 5+/- 6
*MEAN	0 556	1 444	0 667	0 044	0 378	0 078	0 002	-0 003	-0 144
*STD DEVIATION	1 732	2 603	0 995	0 105	0 638	0 452	0 005	0 006	0 243
COEFF /VARIATION	3 115***	1 803***	1 492***	2 386***	1 688***	5 795***	2 50***	-2 0***	-1 723***
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN
*T INTERVAL(U LIMIT)	5 805	9 335	3 684	0 364	2 311	1 452	0 017	0 014	0 591
MEAN + 3 STD DEV	5 752	9 253	3 652	0 359	2 292	1 434	0 017	0 015	0 588

Notes Because of results on other radionuclides Radium 226 and Radium 228 were not run on Background Round One Surfece Water Samples

*Tolerance Intervals Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-26

BACKGROUND TOTAL RADIOCHEMICAL RESULTS

SURFACE WATER AT ROCKY FLATS

(ROUND 1 1989) (CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233,U234	U235	U238	Sr89 Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226	Ra228
NUMBER OF SAMPLES	9	9	9	9	9	9	9	9	9	9	3	1
MAX VALUE	250+/-140	200+/-110	0 9+/-0 3	0 1+/-0 2	0 7+/-0 2	1 5+/-0 5	1 0+/-0 1	0 1+/-0 07	12+/-2	200+/-150	5 5+/-0 9	11+/-4
MIN VALUE	1+/-2	0+/-3	0 1+/-0 1	0 0+/-0 1	0 0+/-0 1	-0 1+/-0 4	0 0+/- 02	- 01+/- 02	- 4+/- 5	50+/-150	2+/- 2	11+/-4
*MEAN	32 111	26 556	0 411	0 011	0 267	0 500	0 122	0 013	1 211	115 556	2 133	---
*STD DEVIATION	77 383	61 655	0 277	0 031	0 221	0 548	0 311	0 032	3 8196	49 690	3 849	---
COEFF /VARIATION	2 410***	2 322***	0 674	2 818***	0 828	1 096***	2 549***	2 462***	3 154***	0 430	1 805***	---
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	ANOVA	NONE
*U INTERVAL(U LIMIT)	266 658	213 432	1 250	0 106	0 937	2 160	1 066	0 111	12 788	266 107	---	---
MEAN + 3 STD DEV	264 260	211 521	1 242	0 104	0 930	2 144	1 055	0 109	12 668	264 626	13 680	---

Notes Because of results on other radionuclides Radium 226 and Radium 228 were not run on all Background Round One Surface Water Samples

*Tolerance Intervals, Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval will be calculated for final

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-27

BACKGROUND DISSOLVED METAL RESULTS

SURFACE WATER (ROUND 2 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	ALUMINUM	CALCIUM	IRON	MERCURY	LITHIUM	MAGNESIUM	MANGANESE	MOLYBDENUM	SODIUM	LEAD	ZINC
NUMBER OF SAMPLES	7	7	7	7	7	7	7	7	7	7	7
NUMBER OF DETECTS	1	7	3	2	1	6	6	6	7	1	1
PERCENT DETECTS	14	100	43	29	14	86	86	86	100	14	14
MAXIMUM DETECTED VALUE	454	63 90	453	0004	0166	11 80	163	0234	33 80	0131	0228
MINIMUM DETECTED VALUE	454	14 50	116	0004	0166	5	0290	0119	14 10	0131	0228
*MEAN	---	33 49	---	---	---	6 7	0 05	0 01	20 89	---	---
*STANDARD DEVIATION	---	17 59	---	---	---	2 66	0522	0051	6 57	---	---
*COEFFICIENT OF VARIATION	---	0 5252	---	---	---	0 3970	1 0	0 5100	0 3145	---	---
MAXIMUM REPORTED DETECTION LIMIT	2	---	100	0002	0100	5	0150	0100	---	0050	0200
MINIMUM REPORTED DETECTION LIMIT	2	---	100	0002	0100	5	0150	0100	---	0050	0200
APPROPRIATE STATISTICAL METHOD	TP	TIN	TP	TP	TP	TIN	TIN	TIN	TIN	TP	TP
*TOLERANCE INTERVAL (UPPER LIMIT)	---	93 27	---	---	---	15 74	0 232	0 032	43 22	---	---
MEAN + 3 STD DEVIATIONS	---	86 26	---	---	---	14 68	0 2066	0 0253	40 6	---	---
ARAR VALUE	5 0	NS	0 3	0 002	2 5	NS	0 05	0 1	NS	0 05	2 0

Notes Dissolved Metals not detected in Round Two Background Surface Water Sb As Ba Be Cd Cs Cr Co Cu Ni K Se Ag Sr Tl Sn V

*Tolerance Intervals Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval will be calculated for final

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-28

BACKGROUND TOTAL METAL RESULTS

SURFACE WATER (ROUND 2 1989)

(CONCENTRATIONS IN mg/l)

	ALUMINUM	BARIUM	CALCIUM	CHROMIUM	IRON	MERCURY	LITHIUM	MAGNESIUM	MANGANESE	MOLYBDENUM	SODIUM	LEAD	ZINC
NUMBER OF SAMPLES	7	7	7	7	7	7	7	7	7	7	7	7	7
NUMBER OF DETECTS	6	1	7	2	7	3	1	5	7	7	7	1	3
PERCENT DETECTS	86	14	100	29	100	43	14	71	100	100	100	14	43
MAXIMUM DETECTED VALUE	4 98	294	69 40	0115	7 94	0004	0192	12 30	837	0203	33 30	0308	0892
MINIMUM DETECTED VALUE	236	294	16 30	0106	360	0003	0192	5 91	0162	0105	15 20	0308	0562
*MEAN	1 89	---	35 543	---	3 127	---	---	6 49	0 233	0 014	21 343	---	---
*STANDARD DEVIATION	1 93	---	20 44	---	2 63	---	---	3 26	0 26	0 0034	6 27	---	---
*COEFFICIENT OF VARIATION	1 0	---	0 5751	---	0 8411	---	---	0 5023	1 1***	0 2429	0 2938	---	---
MAXIMUM REPORTED DETECTION LIMIT	200	200	---	0100	---	0002	0100	5	---	---	---	0050	0200
MINIMUM REPORTED DETECTION LIMIT	200	200	---	0100	---	0002	0100	5	---	---	---	0050	0200
APPROPRIATE STATISTICAL METHOD	TIN	TP	TIN	TP	TIN	TP	TP	TIN	TIN	TIN	TIN	TP	TP
*TOLERANCE INTERVAL (UPPER LIMIT)	8 444	---	105 03	---	12 070	---	---	17 578	1 101	0 026	42 651	---	---
MEAN + 3 STD DEVIATION	7 68	---	96 863	---	11 017	---	---	16 27	1 013	0 0242	40 153	---	---
ARAR VALUE	5 0	1 0	NS	0 05	0 3	0 002	2 5	NS	0 05	0 1	NS	0 05	2 0

Notes Total Metals not detected in Round Two Background Surface Water Sb As Be,Cd,Cs Co Cu,Ni K Se Ag Sr Tl Sn V

*Tolerance Intervals Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval will be calculated for final

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

NS - No Standard

TABLE 4-29

OTHER BACKGROUND INORGANIC RESULTS

SURFACE WATER (ROUND 2 1989)

(CONCENTRATIONS REPORTED IN mg/l)

	CHLORIDE	NITRATE AS N	pH	SULFATE	BICARBONATE	TDS	CYANIDE
NUMBER OF SAMPLES	7	7	7	7	7	7	7
NUMBER OF DETECTS	7	3	7	7	7	7	1
PERCENT DETECTS	100	43	100	100	100	100	14
MAXIMUM DETECTED VALUE	62	2 1	7 7	46	230	280	0043
MINIMUM DETECTED VALUE	4	0 16	7 0	13	56	140	0043
*MEAN	17 143	---	7 371	31 143	126 86	191 43	---
*STANDARD DEVIATION	19 25	---	0 23	10 05	63 95	51 11	---
*COEFFICIENT OF VARIATION	1 1***	---	0312	0 3227	0 5041	0 2670	---
MINIMUM REPORTED DETECTION LIMIT	---	0 05	---	---	---	---	0025
MAXIMUM REPORTED DETECTION LIMIT	---	0 05	---	---	---	---	0025
APPROPRIATE STATISTICAL METHOD	TIN	TP	TIN	TIN	TIN	TIN	TP
*TOLERANCE INTERVAL (UPPER LIMIT)	82 56	---	8 30	65 30	344 21	365 15	---
**TOLERANCE INTERVAL (LOWER LIMIT)	---	---	6 44	---	---	---	---
MEAN + 3 STD DEVIATION	74 89	---	8 06	61 293	318 71	344 76	---
MEAN - 3 STD DEVIATION	---	---	6 68	---	---	---	---

Notes Ions not detected in Round Two Background Surface Water Carbonate

*Tolerance Intervals Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval will be calculated for final

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-30

BACKGROUND TOTAL RADIOCHEMICAL RESULTS

SURFACE WATER (ROUND 2 1989)

(CONCENTRATIONS IN pCi/l)

	ALPHA	BETA	U233,U234	U235	U238	Sr89,Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226
NUMBER OF SAMPLES	7	7	7	7	7	7	7	7	7	7	1
MAX VALUE	78+/-29	58+/-11	7+/- 2	0+/- 1	4+/- 2	8+/- 5	08+/- 03	01+/- 01	4+/- 7	550+/-220	1 4+/-1 0
MIN VALUE	-2+/-4	0+/-2	1+/- 1	0+/- 1	0+/- 1	0+/- 4	0+/- 01	0+/- 02	- 6+/- 8	-60+/-160	1 4+/-1 0
*MEAN	11 000	11 143	0 400	0 000	0 271	0 257	0 014	0 001	0 000	187 143	---
*STD DEVIATION	28 010	20 125	0 273	0 000	0 0277	0 2902	0 028	0 004	0 312	198 92	---
COEFF /VARIATION	2 546***	1 806***	0 683	UNDETERM	0 103	1 128***	2 000***	4 0***	UNDETERM	1 063***	---
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	NONE
*T INTERVAL (U LIMIT)	106 207	79 549	1 326	0 000	0 977	1 243	0 112	0 014	1 059	863 276	---
MEAN + 3 STD DEV	95 03	71 518	1 219	0 000	0 355	1 127	0 098	0 013	0 936	783 903	---

Notes Because of results on other radionuclides Radium 226 and Radium 228 were not run on all Background Round Two Surface Water Samples

*Tolerance Intervals, Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

Differences in the analytical results from Round 1 and Round 2 sampling document the temporal variation in surface water chemistry These differences include variability in the suite of detects as well as the magnitude of concentrations Much of the differences in total metals concentrations and total radiochemical concentrations are attributable in part, to the absence of data for surface water station SW080 in Round 2, however, other differences reflect natural changes in environmental conditions (e g dissolved strontium detected in 8 samples in Round 1 was not detected in Round 2, dissolved molybdenum undetected in Round 1 was detected in 6 samples in Round 2)

4 3 STREAM SEDIMENTS

Background sediment sampling locations were paired with the surface water stations discussed above Sediment sampling locations are within the drainage of Rock Creek, Walnut Creek, and Woman Creek

Statistical summaries of chemical results are presented in Tables 4-31 and 4-32 Twenty tolerance intervals based on a normal distribution are presented For three of these analytes a lognormal tolerance interval may be appropriate because the coefficient of variation is greater than one or less than zero

Relative to the Rocky Flats Alluvium, colluvium, and weathered sandstone and claystone, the sediments have less detected trace metals and lower concentrations of aluminum, iron, and calcium Trace metals not detected in the sediments but detected in the other materials include beryllium, lithium, cobalt, molybdenum, cesium, mercury, antimony, and cadmium Potassium was also not detected in the sediments but was detected elsewhere The absence of detected potassium, together with the lower concentrations of aluminum and iron, suggest the clay fraction is less in the sediments relative to the other materials This is further supported by the physical description of this material, i e, the sediments tend to be more coarse A smaller clay fraction may also explain the fewer detections of trace metals owing to the high adsorptive capacity of the clay fraction

TABLE 4-31

BACKGROUND TOTAL METAL RESULTS

SEDIMENTS

(CONCENTRATIONS IN mg/kg)

	SILVER	ALUMINUM	ARSENIC	BARIUM	CALCIUM	CHROMIUM	COPPER	IRON	MAGNESIUM	MANGANESE	NICKEL	LEAD	STRONTIUM	VANADIUM	ZINC
NUMBER OF SAMPLES	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9
NUMBER OF DETECTS	1	9	1	4	5	8	4	9	4	9	3	9	3	3	9
PERCENT DETECTS	11	100	11	44	56	89	44	100	44	100	33	100	33	33	100
MAXIMUM DETECTED VALUE	6 8	21600	13 0	182	52500	30 4	22 0	22500	4110	303	29 9	25 1	175	50 2	70 3
MINIMUM DETECTED VALUE	6 8	549	13 0	56 2	1810	3 5	8 6	1040	1380	9 0	9 9	2 3	25 2	13 4	6 5
*MEAN	---	6513 9	---	---	2590	13 48	---	8692 2	---	129 39	---	11 33	---	---	31 33
*STANDARD DEVIATION	---	6029 4	---	---	23082	9 87	---	6471 8	---	80 11	---	9 29	---	---	20 24
*COEFFICIENT OF VARIATION	---	0 9256	---	---	8 9***	0 7322	---	0 7446	---	0 6191	---	0 8200	---	---	0 6460
MAXIMUM REPORTED DETECTION LIMIT	7 0	42 1	5 0	140	3340	2 4	16 2	---	3340	---	26 8	---	70 2	33 4	---
MINIMUM REPORTED DETECTION LIMIT	2 3	13 7	2 0	47 0	1180	2 4	5 9	---	1180	---	9 4	---	23 5	11 8	---
APPROPRIATE STATISTICAL METHOD	TP	TIN	TP	TP	TIN	TIN	TP	TIN	TP	TIN	TP	TIN	TP	TP	TIN
*TOLERANCE INTERVAL (UPPER LIMIT)	---	24789	---	---	72551	43 38	---	28308	---	372 20	---	39 502	---	---	92 688
MEAN + 3 STD DEVIATION	---	24602	---	---	71836	43 09	---	28107	---	369 72	---	39 2	---	---	92 05

Notes Total Metals not detected in Background Sediments Sb Be,Cd Cs Co,Li,Hg,Mo,K,Se Na,Tl Sn

*Tolerance Intervals, Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-32

OTHER BACKGROUND INORGANIC & TOTAL RADIOCHEMICAL RESULTS

SEDIMENTS

	ALPHA pCi/g	BETA pCi/g	U233 U234 pCi/g	U235 pCi/g	U238 pCi/g	Sr89,Sr90 pCi/g	Pu239,Pu240 pCi/g	Am241 pCi/g	Cs137 pCi/g	TRITIUM pCi/ml	Ra226 pCi/g	Ra228 pCi/g	pH
NUMBER OF SAMPLES	9	9	9	9	9	9	9	9	9	9	9	9	9
NUMBER DETECTS	9	9	9	9	9	9	9	9	9	9	9	9	9
PERCENT DETECTS	100	100	100	100	100	100	100	100	100	100	100	100	100
MAX VALUE	40+/-15	40+/-7	1 2+/-0 2	1+/- 1	1 3+/- 2	8+/- 7	08+/- 02	02+/- 04	1 4+/- 1	32+/- 15	1 0+/- 1	2 1+/- 4	7 9
MIN VALUE	4+/-12	20+/-6	5+/- 2	0+/- 1	4+/- 1	- 6+/- 7	0+/- 02	- 01+/- 02	0+/- 1	12+/- 14	6+/- 1	1+/- 1	6 1
*MEAN	25 667	29 556	0 800	0 033	0 778	0 122	0 020	-0 001	0 244	0 203	0 756	1 300	7 211
*STD DEVIATION	11 373	6 801	0 287	0 047	0 322	0 418	0 025	0 010	0 440	0 068	0 107	0 346	0 52
COEFF /VARIATION	0 443	0 230	0 351	1 424***	0 414	3 426***	0 1750***	-10 00***	1 803***	0 335	0 142	0 266	0 072
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN
*T INTERVAL (U LIMIT)	60 137	50 168	1 669	0 176	1 755	1 390	0 096	0 029	1 578	0 408	1 079	2 350	9 03
MEAN + 3 STD DEV	59 780	49 959	1 661	0 174	1 744	1 376	0 095	0 029	1 564	0 611	1 077	2 338	8 77
MEAN - 3 STD DEV	---	---	---	---	---	---	---	---	---	---	---	---	5 65

Notes Ions not detected in Background Sediment Samples Nitrate

*Tolerance Intervals, Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

4 4 BOREHOLE MATERIALS

Borehole materials were collected within the Rocky Flats Alluvium, colluvium, weathered claystone and weathered sandstone

4 4 1 Rocky Flats Alluvium

Rocky Flats Alluvium is a poorly sorted, unconsolidated deposit of gravels (granule to cobbles and boulders) with clay, silt and sand matrices. Gravel is primarily quartzite and granite fragments and may be weathered, sand is primarily composed of quartz grains Caliche is locally present The surficial sample from Rocky Flats Alluvium may contain 0 to 3 feet of topsoil which varies from sandy gravel to silty clay

Statistical summaries of chemical results are presented in Tables 4-33, 4-34 and 4-35 Eighteen tolerance intervals based on a normal distribution are presented For four of these analytes a lognormal tolerance interval may be appropriate because the coefficient of variation is in excess of one Sixteen of these analytes have at least one detection in excess of the calculated tolerance interval At least in part this is a reflection of the large number of samples (70 samples) which increases the probability of sampling outside of the 95% tolerance interval

A review of the data did not reveal any specific sampling location associated with analyte concentrations in excess of the tolerance limit The review did suggest that certain analytes such as aluminum and lead tended to be in higher concentrations near surface, and that elevated concentrations of multiple analytes tended to cluster within the same sample

4 4 2 Colluvium

Colluvium is located on the sides and bases of hills and slopes A product of mass wasting and downslope creep, colluvium is a poorly sorted mixture of topsoil, weathered

TABLE 4-33

BACKGROUND TOTAL METAL RESULTS

ROCKY FLATS ALLUVIUM

(CONCENTRATIONS REPORTED IN mg/kg)

	Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Li	Mg	Mn	Mo	Ni	Pb	Sr	Sn	V	Zn
NUMBER OF SAMPLES	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70
NUMBER DETECTS	20	70	44	55	60	68	6	14	70	61	70	19	36	39	65	70	41	56	69	10	21	67	65
PERCENT DETECTS	29	100	63	79	86	97	9	20	100	87	100	27	51	56	93	100	59	80	99	14	30	96	93
MAX VALUE	40 9	40800	41 7	209	19 0	157000	3 2	18 2	69 6	31 6	33700	0 58	4020	31 3	5570	656	41 0	54 2	21 9	226	338	70 0	77 6
MIN VALUE	2 8	2240	1 2	43 8	1 0	1130	1 3	11 1	4 0	5 5	4670	0 12	1100	3 7	1180	26 6	2 5	8 8	2 6	23 3	27 3	11 7	4 3
*MEAN	---	11831	3 23	68 9	3 63	5702	---	---	17 2	9 58	12584	---	1061	18 4	2261 2	181 3	17 04	17 81	7 72	---	---	27 75	22 67
*STD DEVIATION	---	6788	6 36	43 7	3 84	18821	---	---	10 5	5 26	5202	---	1146	13 1	1089 6	121 7	10 88	12 82	5 19	---	---	13 55	15 09
COEFF /VARIATION	---	5737	2 0***	6343	1 1***	3 3***	---	---	6105	5491	4134	---	1 1***	7120	4819	6713	6385	7198	6723	---	---	4883	6656
MAX DET LIMIT	4 8	---	4 9	50 1	1 3	1170	2 4	24 2	---	6 3	---	0 24	1250	25 5	1170	---	25 5	10 2	4 2	484	48 4	11 7	4 3
MIN DET LIMIT	2 0	---	1 7	40 4	1 1	1160	1 0	10 1	---	5 1	---	0 083	1010	2 0	1010	---	2 0	8 7	4 2	20 3	20 2	10 7	4 0
APP STAT METHOD	TP	TIN	TIN	TIN	TIN	TIN	TIP	TP	TIN	TIN	TIN	TP	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TP	TP	TIN	TIN
*T INTERVAL(U LIMIT)	---	25312	15 86	155 8	11 27	43079	---	---	37 9	20 03	22916	---	3336	44 4	4425	422 9	38 65	43 27	18 04	---	---	54 67	52 64
MEAN + 3 STD DEV	---	32195	22 3	200 0	15 2	62165	---	---	48 7	25 4	28190	---	4499	57 7	5530	546 4	49 7	56 3	23 3	---	---	68 4	67 94

Notes Total Metals not detected in Background Borehole Alluvium Sb Cs,Se,Na Tl

*Tolerance Intervals Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-34

OTHER BACKGROUND INORGANIC RESULTS

ROCKY FLATS ALLUVIUM

(CONCENTRATIONS REPORTED IN mg/kg)

	SULFIDE	NITRATE	pH
NUMBER OF SAMPLES	70	70	70
NUMBER DETECTS	16	23	70
PERCENT DETECTS	23	33	100
MAX VALUE	13	4 3	9 1
MIN VALUE	2	1 1	6 1
*MEAN	---	---	7 846
*STD DEVIATION	---	---	0 78
COEFF /VARIATION	---	---	0 0994
MAX DET LIMIT	4	2 2	---
MIN DET LIMIT	2	1 0	---
APP STAT METHOD	TP	TP	TIN
**T INTERVAL(L LIMIT)	---	---	6 06
*T INTERVAL(U LIMIT)	---	---	9 64
MEAN + 3 STD DEV	---	---	10 186
MEAN - 3 STD DEVIATI	---	---	5 506

Notes

*Tolerance Intervals not calculated when the number of samples is less than seven

*Tolerance Intervals Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-35

BACKGROUND TOTAL RADIOCHEMICAL RESULTS

ROCKY FLATS ALLUVIUM

(CONCENTRATIONS IN pCi/gm) (pCi/ml FOR TRITIUM)

	ALPHA	BETA	U233 U234	U235	U238	Sr89,Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226	Ra228
NUMBER OF SAMPLES	70	70	70	70	70	69	70	21	70	70	55	55
NUMBER DETECTS	70	70	70	70	70	69	70	21	70	70	55	55
PERCENT DETECTS	100	100	100	100	100	100	100	100	100	100	100	100
MAX VALUE	40+/-16	44+/-7	3 4+/-0 2	0 2+/-0 1	3 2+/-0 2	1 2+/-1 0	0 03+/-0 03	0 01+/-0 03	0 2+/-0 1	0 44+/-0 16	0 9+/-0 1	2 2+/-0 3
MIN VALUE	3+/-7	6+/-5	0 2+/-0 2	0 0+/-0 1	0 2+/ 0 1	-0 6+/-0 7	-0 01+/-0 02	-0 02+/-0 02	0 0+/-0 1	-0 15+/-0 15	0 4+/-0 1	0 5+/-0 2
MEAN	21 387	23 600	0 633	0 013	0 639	0 055	0 002	-0 002	0 009	0 177	0 629	1 325
*STD DEVIATION	7 9157	6 6899	0 4322	0 0375	0 3595	0 3586	0 0073	0 0085	0 0368	0 1175	0 3461	0 7575
COEFF /VARIATION	0 3701	0 2835	0 6829	2 9165*	0 5629	6 5117*	2 9984*	-4 4394*	4 2947*	0 6639	0 5502	0 5715
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN	TIN
MAX DET LIMIT	---	---	---	---	---	---	---	---	---	---	---	---
MIN DET LIMIT	---	---	---	---	---	---	---	---	---	---	---	---
*T INTERVAL(U LIMIT)	37 108	36 886	1 491	0 087	1 353	0 768	0 017	0 018	0 082	0 410	1 334	2 868
MEAN + 3 STD DEV	45 1343	43 6696	1 9294	0 1254	1 7170	1 1309	0 0242	0 0235	0 1190	0 5295	1 6675	3 5979

Notes Because of results on other radionuclides, Radium 226 and Radium 228 were not run on all background borehole samples

*Tolerance Intervals Coefficient of Variation, Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

bedrock and reworked Rocky Flats Alluvium Colluvium is comprised of silty clay and clayey silt with some quartzite gravel It is weathered and sometimes sandy Caliche is present at some locations As much as two feet of topsoil may overlie the colluvium It consists of silty clay often organic rich and with trace to some quartzite gravels

Statistical summaries of chemical results are presented in Tables 4-36, 4-37, and 4-38 Twenty tolerance intervals based on a normal distribution are presented A lognormal tolerance interval for beryllium may be appropriate because the coefficient of variance is in excess of one Fourteen of these analytes have at least one detection in excess of the tolerance interval

The suite of detected analytes within colluvium are the same suite of analytes detected in Rocky Flats Alluvium plus two additional analytes cesium and sodium The calculated mean concentration for most analytes is slightly greater within colluvium than within Rocky Flats Alluvium

4 4 3 Weathered Claystone

Weathered claystone is the most common lithology comprising weathered bedrock Weathered claystone is medium hard, consolidated, and locally fractured It is silty or sandy and often contains carbonaceous debris

Statistical summaries of chemical results are presented in Tables 4-39, 4-40 and 4-41 Eighteen tolerance intervals based on a normal distribution are presented A lognormal tolerance interval for arsenic and manganese may be appropriate because the coefficient of variation is in excess of one Six of the analytes have one detection in excess of the upper tolerance limit

TABLE 4-36

BACKGROUND TOTAL METAL RESULTS

COLLUVIUM

(CONCENTRATIONS REPORTED IN mg/kg)

	Ag	Al	As	Ba	Be	Ca	Cd	Co	Cr	Cs	Cu	Fe	Hg	K	Li	Mg	Mn	Mo	Na	Ni	Pb	Sr	Sn	V	Zn
NUMBER OF SAMPLES	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28	28
NUMBER DETECTS	8	28	20	27	27	28	1	3	28	2	27	28	8	15	22	28	28	21	2	25	28	28	5	27	28
PERCENT DETECTS	29	100	71	96	96	100	4	11	100	7	96	100	29	54	79	100	100	75	7	89	100	100	18	96	100
MAX VALUE	33 5	22900	6 6	491	22 4	25900	1 8	15 9	26 9	274	28	35900	44	3090	18 0	5580	747	26 8	3680	36 2	29 9	121	441	58 8	111
MIN VALUE	2 5	4630	2 4	45 2	2 0	3020	1 8	13 0	6 1	234	6 4	6860	10	1250	3 8	1540	37 0	3 5	301	9 6	6 6	25 1	285	15 3	23 9
*MEAN	---	10849	3 31	128 8	5 35	8328	---	---	13 8	---	14 5	14798	---	1235	12 4	3177	193 4	15 95	---	16 9	16 2	56 9	---	29 9	53 0
*STD DEVIATION	---	4808	1 97	96 49	5 51	5550	---	---	5 8	---	5 4	6756	---	691	8 8	1322	156 4	7 48	---	8 2	4 5	24 1	---	12 6	20 1
COEFF /VARIATION	---	4432	5952	7491	1 0	6664	---	---	4203	---	3724	4565	---	5595	7097	4161	8087	4690	---	4852	2778	4236	---	4214	3792
MAX DET LIMIT	2 6	---	2 5	45 4	1 1	---	1 3	12 9	---	258	6 1	---	13	1220	24 8	---	---	24 8	1290	9 8	---	---	25 8	11 9	---
MIN DET LIMIT	2 2	---	1 0	45 4	1 1	---	1 1	10 8	---	216 2	6 1	---	097	1100	22 1	---	---	2 2	1080	9 5	---	---	22 5	11 9	---
APP STAT METHOD	TP	TIN	TIN	TIN	TIN	TIN	TIN	TP	TIN	TIP	TIN	TIN	TP	TIN	TIN	TIN	TIN	TIN	TIP	TIN	TIN	TIN	TP	TIN	TIN
*T INTERVAL(U LIMIT)	---	21663	7 7	345 8	17 75	20811	---	---	26 8	---	26 7	29991	---	2789	32 1	6151	545 1	32 78	---	35 4	26 4	111 1	---	58 2	98 1
MEAN+3 STD DEV	---	25273	9 2	418 3	21 9	24978	---	---	31 2	---	30 7	35066	---	3308	38 8	7143	662 6	38 4	---	41 5	29 7	129 2	---	67 7	113 3

Notes Total Metals not detected in Background Borehole Colluvium Sb,Se Tl

*Tolerance Intervals, Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-37

OTHER BACKGROUND INORGANIC RESULTS

COLLUVIUM

(CONCENTRATIONS REPORTED IN mg/kg)

	SULFIDE	NITRATE	pH
NUMBER OF SAMPLES	28	28	28
NUMBER DETECTS	6	15	28
PERCENT DETECTS	21	54	100
MAX VALUE	5	3 7	9 1
MIN VALUE	2	1 1	7 2
*MEAN	---	1 35	8 221
*STD DEVIATION	---	1 30	0 49
COEFF /VARIATION	---	0 9629	0 0596
MAX DET LIMIT	4	1 3	---
MIN DET LIMIT	2	1 1	---
APP STAT METHOD	TP	TIN	TIN
**T INTERVAL(L LIMIT)	---	---	6 96
*T INTERVAL (U LIMIT)	---	4 274	9 48
MEAN + 3 STD DEV	---	5 25	9 691
MEAN - 3 STD DEVIATI			6 751

Notes

*Tolerance Intervals, Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-38

BACKGROUND TOTAL RADIOCHEMICAL RESULTS

COLLUVIUM

(CONCENTRATIONS IN pCi/gm) (pCi/ml FOR TRITIUM)

	ALPHA	BETA	U233 U234	U235	U238	Sr89 Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226	Ra228
NUMBER OF SAMPLES	28	28	28	28	28	28	28	0	28	28	21	21
NUMBER DETECTS	28	28	28	28	28	28	28	0	28	28	21	21
PERCENT DETECTS	100	100	100	100	100	100	100	0	100	100	100	100
MAX VALUE	48+/-17	34+/-6	2 6+/-0 5	0 2+/-0 1	2 3+/-0 4	0 8+/-0 7	0 02+/-0 02	---	0 2+/-0 1	0 24+/-0 16	1 3+/-0 1	2 1+/-0 3
MIN VALUE	19+/-10	20+/-6	0 4+/-0 1	0 0+/-0 1	0 4+/-0 2	-0 6+/-0 8	0 00+/-0 02	---	0 0+/-0 1	-0 14+/-0 15	0 7+/-0 1	1 1+/-0 2
*MEAN	31 536	26 750	0 839	0 043	0 925	-0 011	0 006	---	0 014	0 060	1 067	1 567
*STD DEVIATION	8 9701	3 7285	0 4091	0 0562	0 3334	0 3498	0 0077	---	0 0440	0 1064	0 6433	0 9494
COEFF /VARIATION	0 2844	0 1394	0 4875	1 3123*	0 3604	-32 6514*	1 2712*	---	3 0822*	1 7831*	0 6031	0 6060
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	---	TIN	TIN	TIN	TIN
MAX DET LIMIT	---	---	---	---	---	---	---	---	---	---	---	---
MIN DET LIMIT	---	---	---	---	---	---	---	---	---	---	---	---
*T INTERVAL(U LIMIT)	51 710	35 135	1 759	0 169	1 675	0 776	0 023	---	0 113	0 299	2 592	3 818
MEAN + 3 STD DEV	58 4461	37 9355	2 0667	0 2116	1 9252	1 0388	0 0292	---	0 1464	0 3787	2 9966	4 4148

Notes Because of results on other radionuclides Radium 226 and Radium 228 were not run on all background borehole samples

*Tolerance Intervals, Coefficient of Variation, Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-39

BACKGROUND TOTAL METAL RESULTS

WEATHERED CLAYSTONE

(CONCENTRATIONS REPORTED IN mg/kg)

	Ag	Al	As	Ba	Be	Ca	Co	Cr	Cu	Fe	Hg	K	Li	Mg	Mn	Mo	Ni	Pb	Sb	Sr	Sn	V	Zn
NUMBER OF SAMPLES	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17	17
NUMBER DETECTS	3	17	9	16	17	17	2	17	17	17	6	4	12	16	17	12	13	17	2	17	2	16	17
PERCENT DETECTS	18	100	53	94	100	100	12	100	100	100	35	24	71	94	100	71	76	100	12	100	12	94	100
MAX VALUE	18 7	13900	10 8	243	16 1	9970	29 7	13 7	26 7	38100	35	1400	10 4	5600	737	12 1	62 4	29 5	16 2	141	274	46 4	99 5
MIN VALUE	2 4	3160	2 5	47 9	1 2	3120	15 3	3 0	6 5	2940	18	1290	2 7	1510	11 6	2 8	10 2	10 8	13 6	29 7	190	11 0	24 1
*MEAN	---	7430	2 9	100 6	3 5	5762	---	8 98	16 8	14794	---	---	11 97	2320	178	12 36	17 19	20 1	---	75 04	---	22 7	63 2
*STD DEVIATION	---	2440	4 88	56 1	3 4	1778	---	3 05	5 5	10660	---	---	8 61	1036	192	8 58	15 99	5 8	---	27 91	---	9 3	17 5
COEFF /VARIATION	---	3284	1 7***	5577	9714	3086	---	3396	3274	7206	---	---	7193	4466	1 1***	6942	9302	2886	---	3719	---	4097	2769
MAX DET LIMIT	2 6	---	2 5	46 9	---	---	12 9	---	---	---	13	1290	24 8	1060	---	24 8	9 4	---	2 5	---	25 8	10 6	---
MIN DET LIMIT	2 1	---	2 1	46 9	---	---	10 6	---	---	---	11	1060	2 1	1060	---	2 1	8 5	---	2 1	---	21 2	10 6	---
APP STAT METHOD	TP	TIN	TIN	TIN	TIN	TIN	TP	TIN	TIN	TIN	TP	TP	TIN	TIN	TIN	TIN	TIN	TIN	TP	TIN	TP	TIN	TIN
*T INTERVAL(U LIMIT)	---	13495	15 05	240 1	11 8	10183	---	16 57	30 62	41295	---	---	33 37	4896	656	33 68	56 95	34 5	---	144 42	---	47 7	106 7
MEAN + 3 STD DEV	---	14750	17 5	268 9	13 7	11096	---	18 13	33 3	46774	---	---	37 8	5428	754	38 1	65 2	37 5	---	158 8	---	50 6	115 7

Notes Total Metals not detected in Background Borehole Claystone Cd,Cs Se Na Tl

*Tolerance Intervals, Coefficient of Variation, Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-40

OTHER BACKGROUND INORGANIC RESULTS

WEATHERED CLAYSTONE

(CONCENTRATIONS REPORTED IN mg/kg)

	SULFIDE	NITRATE	pH
NUMBER OF SAMPLES	17	17	17
NUMBER DETECTS	4	7	17
PERCENT DETECTS	24	41	100
MAX VALUE	5	2 0	9 7
MIN VALUE	2	1 1	7 6
*MEAN	---	---	8 588
*STD DEVIATION	---	---	0 54
COEFF /VARIATION	---	---	0 0629
MAX DET LIMIT	4	1 2	---
MIN DET LIMIT	2	1 1	---
APP STAT METHOD	TP	TP	TIN
**T INTERVAL(L LIMIT)	---	---	7 04
*T INTERVAL (U LIMIT)	---	---	10 14
MEAN + 3 STD DEV	---	---	10 208
MEAN - 3 STD DEVIATI			6 968

Notes

*Tolerance Intervals Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-41

BACKGROUND TOTAL RADIOCHEMICAL RESULTS

WEATHERED CLAYSTONE

(CONCENTRATIONS IN pCi/gm) (pCi/ml FOR TRITIUM)

	ALPHA	BETA	U233 U234	U235	U238	Sr89 Sr90	Pu239,Pu240	Am241	Cs137	TRITIUM	Ra226	Ra228
NUMBER OF SAMPLES	17	17	17	17	17	17	17	0	17	17	12	12
NUMBER DETECTS	17	17	17	17	17	17	17	0	17	17	12	12
PERCENT DETECTS	100	100	100	100	100	100	100	0	100	100	100	100
MAX VALUE	46+/-17	32+/-6	1 7+/-0 4	0 3/-0 1	1 4+/-0 3	0 7+/-0 6	0 01+/-0 02	---	0 0+/-0 1	0 28+/-0 14	1 3+/-0 1	1 6+/-0 2
MIN VALUE	17+/-14	18+/-5	0 4+/-0 1	0 0+/-0 1	0 5+/-0 2	-0 7+/-0 7	-0 01+/-0 02	---	0 0+/-0 1	-0 11+/-0 15	0 9+/-0 1	1 1+/-0 2
*MEAN	30 059	25 471	1 035	0 047	1 012	-0 118	0 004	---	0 000	0 052	1 100	1 333
*STD DEVIATION	8 9474	4 1319	0 3819	0 0848	0 2541	0 3634	0 0068	---	0 0000	0 1086	0 7194	0 8773
COEFF /VARIATION	0 2977	0 1622	0 3688	1 8028*	0 2511	-3 0887*	1 9293*	---	---	2 0987*	0 6540	0 6580
APP STAT METHOD	TIN	TIN	TIN	TIN	TIN	TIN	TIN	---	TIN	TIN	TIN	TIN
MAX DET LIMIT	---	---	---	---	---	---	---	---	---	---	---	---
MIN DET LIMIT	---	---	---	---	---	---	---	---	---	---	---	---
*T INTERVAL(U LIMIT)	52 302	35 743	1 985	0 258	1 643	0 786	0 020	---	0 000	0 322	3 068	3 734
MEAN + 3 STD DEV	56 9009	37 8663	2 1809	0 3016	1 7741	0 9725	0 0240	---	0 0000	0 3777	3 2581	3 9652

Notes Because of results on other radionuclides Radium 226 and Radium 228 were not run on all background borehole samples

*Tolerance Intervals, Coefficient of Variation Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

The suite of detected analytes is comparable to that detected in the Rocky Flats Alluvium except that cadmium is detected only in Rocky Flats Alluvium and antimony is only detected in weathered claystone

4 4 4 Weathered Sandstone

Weathered sandstone is very fine to medium grained, and oxidized It is carbonaceous and silty or interbedded with clayey lenses It ranges from unconsolidated to consolidated

Statistical summaries of chemical results are presented in Tables 4-42, 4-43 and 4-44 Only four samples are available for weathered sandstone and consequently no tolerance intervals can be generated

The suite of analytes detected in weathered sandstone is the same as that suite detected in weathered claystone with the exception of potassium and antimony which were not detected within weathered sandstone Within weathered claystone, potassium is detected 4 out of 17 samples for a 24% detection rate and antimony is detected in 2 out of 17 samples for a 12% detection rate This probably results from a common chemical composition of the clay sized materials present in both lithologies

The maximum value of each analyte detected within weathered sandstone falls both below the upper range and, where applicable, the upper tolerance interval of the respective analyte in weathered claystone This implies that the chemical results of weathered sandstone fall within the expected distribution of chemical results of weathered claystone

TABLE 4-42

BACKGROUND TOTAL METAL RESULTS

WEATHERED SANDSTONE

(CONCENTRATIONS REPORTED IN mg/kg)

	Ag	Al	As	Ba	Be	Ca	Co	Cr	Cu	Fe	Hg	Li	Mg	Mn	Mo	Ni	Pb	Sr	Sn	V	Zn
NUMBER OF SAMPLES	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
NUMBER DETECTS	1	4	3	3	3	4	1	4	3	4	2	4	3	4	4	2	4	3	1	3	4
PERCENT DETECTS	25	100	75	75	75	100	25	100	75	100	50	100	75	100	100	50	100	75	25	75	100
MAX VALUE	12 7	10300	3 6	165	2 2	5940	20 5	10 7	19 6	12300	0 27	7 0	2520	305	11 2	14 3	13 4	69 2	268	22 2	79 9
MIN VALUE	12 7	2470	2 3	47 2	1 7	2310	20 5	3 9	8 1	3040	0 12	2 6	1290	14 9	4 3	10 6	9 4	47 2	268	11 5	38 1
*MEAN	---	5335	2 74	78 89	1 74	3673	---	6 63	9 53	7643	0 11	4 70	1511 1	119 83	7 075	9 57	11 400	47 89	---	14 46	52 75
*STD DEVIATION	---	3071	0 77	59 92	0 51	1383	---	2 73	6 62	3277	0 11	1 77	657 91	111 81	2 56	3 49	1 42	22 39	---	5 31	16 48
COEFF /VARIATION	---	5756	2810	7595	2931	3765	---	4118	6946	4288	1 0	0 3766	0 4354	0 9331	0 3618	0 3647	0 1246	0 4675	---	0 3672	0 3124
MAX DET LIMIT	2 4	---	2 2	47 9	1 2	---	12 0	---	6 0	---	0 12	---	1200	---	---	9 6	---	23 9	23 9	12 0	---
MIN DET LIMIT	2 1	---	2 2	47 9	1 2	---	10 7	---	6 0	---	0 11	---	1200	---	---	9 2	---	23 9	21 3	12 0	---
APP STAT METHOD	TP	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	TP	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	TP	ANOVA	ANOVA
*T INTERVAL(U LIMIT)	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
MEAN+3 STD DEV	---	14548	5 05	259 7	3 27	7822	---	9 36	29 4	17474	44	10 0	3485	455 26	14 75	20 04	15 66	115 1	---	30 39	102 2

Notes Total Metals not detected in Background Borehole Sandstone Sb,Cd Cs K,Se,Na,Tl

*Tolerance Intervals, Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-43

OTHER BACKGROUND INORGANIC RESULTS

WEATHERED SANDSTONE

(CONCENTRATIONS REPORTED IN mg/kg)

	SULFIDE	NITRATE	pH
NUMBER OF SAMPLES	4	4	4
NUMBER DETECTS	1	3	4
PERCENT DETECTS	25	75	100
MAX VALUE	2	1 9	9 2
MIN VALUE	2	1 2	8 0
*MEAN	---	1 31	8 675
*STD DEVIATION	---	0 39	0 44
COEFF /VARIATION	---	0 2977	0 0507
MAX DET LIMIT	3	1 1	---
MIN DET LIMIT	2	1 1	---
APP STAT METHOD	TP	ANOVA	ANOVA
**T INTERVAL(L LIMIT)	---	---	---
*T INTERVAL (U LIMIT)	---	---	---
MEAN + 3 STD DEV	---	2 48	9 995
MEAN - 3 STD DEVIATI			7 355

Notes

*Tolerance Intervals, Coefficient of Variation, Mean and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

**Lower Tolerance Intervals reported for two-sided parameters

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

TABLE 4-44

BACKGROUND TOTAL RADIOCHEMICAL RESULTS

WEATHERED SANDSTONE

(CONCENTRATIONS IN pCi/gm) (pCi/ml FOR TRITIUM)

	ALPHA	BETA	U233,U230	U235	U238	Sr89 Sr90	Pu239 Pu240	Am241	Cs137	TRITIUM	Ra226	Ra228
NUMBER OF SAMPLES	4	4	4	4	4	4	4	4	4	4	2	2
NUMBER DETECTS	4	4	4	4	4	4	4	0	4	4	2	2
PERCENT DETECTS	100	100	100	100	100	100	100	---	100	100	100	100
MAX VALUE	37+/-17	29+/-6	0 8+/-0 3	0 1+/-0 1	1 0+/-0 2	0 4+/-0 6	0 01+/-0 01	---	0 0+/-0 1	0 39+/-0 15	1 0+/-0 1	1 1+/-0 2
MIN VALUE	19+/-13	20+/-5	0 5+/-0 1	0 0+/-0 1	0 6+/-0 2	-0 7+/-1 0	-0 01+/-0 01	---	0 0+/-0 1	0 00+/-0 15	0 9+/-0 1	1 0+/-0 2
*MEAN	27 000	25 750	0 600	0 025	0 775	-0 175	0 000	---	0 000	0 105	0 950	1 050
*STD DEVIATION	7 0356	3 6997	0 1225	0 0433	0 1479	0 3961	0 0071	---	0 000	0 1647	0 9513	1 0512
COEFF /VARIATION	0 2606	0 1437	0 2041	1 7321*	0 1908	-2 2633*	---	---	---	1 5685*	1 0014*	1 0011*
APP STAT METHOD	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	ANOVA	---	ANOVA	ANOVA	ANOVA	ANOVA
MAX DET LIMIT	---	---	---	---	---	---	---	---	---	---	---	---
MIN DET LIMIT	---	---	---	---	---	---	---	---	---	---	---	---
*T INTERVAL(U LIMIT)	---	---	---	---	---	---	---	---	---	---	---	---
MEAN + 3 STD DEV	48 1069	36 8490	0 9674	0 1549	1 2187	1 0132	0 0212	---	0 0000	0 5991	3 8039	4 2036

Note: Because of results on other radionuclides Radium 226 and Radium 228 were not run on all background borehole samples

*Tolerance Intervals Coefficient of Variation Mean, and Standard Deviation not calculated when % detects < 50

*Tolerance Intervals not calculated when number of samples is less than 7

***Lognormal Tolerance Interval may be appropriate

Key to Statistical Methods TIN - Tolerance Interval based on Normal Distribution

TP - Test of Proportions Note that this test requires the total (background & nonbackground) detects >= 5

TIP - Tolerance Interval based on Poisson Distribution

ANOVA - Analysis of Variance

SECTION 5.0

REFERENCES

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NOTICE

This document (or documents) is oversized for 16mm microfilming, but is available in its entirety on the 35mm fiche card referenced below:

Document # 000376

Titled: Plate 2 ' STIFF DIAGRAMS For BACKGROUND, GROUND-WATER AND SURFACE WATER SAMPLES, ROUND 1, 1989

Fiche location: A-SW-M30

APPENDIX A

DATA SUMMARIES

APPENDIX A

This Appendix contains summary tables for the samples collected during the Background Geochemical Characterization Field Program and the analytical results for each sample The sample dates listed on the summary tables reflect the initial collection date, however, in many cases, several days were required to collect the entire sample suite The inital date was used to correspond to the date that the field water quality measurements were obtained

The organizational scheme for this Appendix is presented below

Section	Description
A-1	Sediment Analytical Data Background Sediment Sampling Information Total Metals Inorganics Total Radiochemistry
A-2	Surface Water Analytical Data - Round 1 Background Surface Water Sample Information - Round 1 Total Metals Dissolved Metals Inorganics Total Radiochemistry Dissolved Radiochemistry
A-3	Surface Water Analytical Data - Round 2 Background Surface Water Sample Information - Round 2 Total Metals Dissolved Metals Inorganics Total Radiochemistry
A-4	Ground Water Analytical Data Background Ground Water Sample Information QA/QC Samples Dissolved Metals Dissolved Radiochemistry Rocky Flats Alluvial Ground Water Dissolved Metals Inorganics Dissolved Radiochemistry

Colluvial Ground Water
- Dissolved Metals
- Inorganics
- Dissolved Radiochemistry

Valley Fill Alluvial Ground Water
- Dissolved Metals
- Inorganics
- Dissolved Radiochemistry

Weathered Claystone Ground Water
- Dissolved Metals
- Inorganics
- Dissolved Radiochemistry

Weathered Sandstone Ground Water
- Dissolved Metals
- Inorganics
- Dissolved Radiochemistry

Unweathered Sandstone Ground Water
- Dissolved Metals
- Inorganics
- Dissolved Radiochemistry

A-5 Borehole Sample Analytical Data
- Background Borehole Sample Information

QA/QC Samples
- Total Metals
- Total Radiochemistry

Rocky Flats Alluvium
- Total Metals
- Inorganics
- Total Radiochemistry

Colluvium
- Total Metals
- Inorganics
- Total Radiochemistry

Bedrock
- Total Metals
- Inorganics
- Total Radiochemistry

Parameters with an "NR" in place of a value represent data that had not been received as of December 15, 1989

APPENDIX A-1

SEDIMENT ANALYTICAL DATA

BACKGROUND ROUND 1

SEDIMENT SAMPLE INFORMATION

	SAMPLE INFORMATION					LABORATORY ANALYTES						
STATION NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	VOA	SEMI-VOA	PEST PCB	HERB	TOTAL METALS	INORGAN	TOT RADS
FB	SED22001FB	02/22/89	02/22/89	04/09/89	RRC022289002	N	N	N	N	R	N	R
SD004	SED04001	02/21/89	02/22/89	04/09/89	KMM022189001	N	N	N	N	R	R	R
SD004	SED04001D	02/21/89	02/22/89	04/09/89	KMM022189001	N	N	N	N	R	R	R
SD016	SED16001	02/23/89	02/23/89	04/10/89	MJS022389001	N	N	N	N	R	R	R
SD017	SED17001	02/23/89	02/23/89	04/10/89	KMM022389001	N	N	N	N	R	R	R
SD018	SED18001	02/23/89	02/23/89	04/10/89	MJS022389001	N	N	N	N	R	R	R
SD019	SED19001	02/23/89	02/23/89	04/10/89	MJS022389001	N	N	N	N	R	R	R
SD020	SED20001	02/22/89	02/22/89	04/09/89	RCC022289001	N	N	N	N	R	R	R
SD021	SED21001	02/22/89	02/22/89	04/09/89	RCC022289001	N	N	N	N	R	R	R
SD022	SED22001	02/22/89	02/22/89	04/09/89	RRC022289001	N	N	N	N	R	R	R
SD023	SED23001	02/21/89	02/22/89	04/09/89	KMM022189001	N	N	N	N	R	R	R

FB - Field Blank N - Not sampled for this group. Y - Sampled for this group, results not yet received. R - Results for this group received

TOTAL METALS

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be) total mg/kg	Cadmium (Cd) total mg/kg	Calcium (Ca), total mg/kg
SD004	02/21/89	6850	40 1 U	3 0 U	134 U	3 3 U	3 3 U	3340 U
SD004	02/21/89	3070	14 8 U	2 2 U	49 3 U	1 2 U	1 2 U	1230 U
SD016	02/23/89	816	15 4 U	2 2 U	51 3 U	1 3 U	1 3 U	1280 U
SD017	02/23/89	549	15 0 U	2 0 U	50 0 U	1 2 U	1 2 U	1250 U
SD018	02/23/89	8080	38 8 U	5 0 U	182	3 2 U	3 2 U	11100
SD019	02/23/89	21600	42 1 U	13 0	140 U	3 5 U	3 5 U	9220
SD020	02/22/89	1620	14 1 U	2 0 U	47 0 U	1 2 U	1 2 U	1180 U
SD021	02/22/89	7110	21 4 U	2 2 U	171	1 8 U	1 8 U	52500
SD022	02/22/89	4560	13 7 U	2 2 U	56 2	1 1 U	1 1 U	3870

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe) total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
SD004	02/21/89	669 U	30 4	33 4 U	22 0	15000	5 9	66 9 U
SD004	02/21/89	247 U	11 0	12 3 U	7 7	6900	14 4	24 7 U
SD016	02/23/89	257 U	3 5	12 8 U	6 4 U	2290	3 4	25 7 U
SD017	02/23/89	250 U	3 6	12 5 U	6 2 U	2280	2 3	25 0 U
SD018	02/23/89	647 U	15 3	32 4 U	16 2 U	7490	24 6	64 7 U
SD019	02/23/89	702 U	22 5	35 1 U	20 2	22500	23 0	70 2 U
SD020	02/22/89	235 U	2 4 U	11 8 U	5 9 U	1040	3 1	23 5 U
SD021	02/22/89	357 U	19 5	17 9 U	14 3	10600	8 1	35 7 U
SD022	02/22/89	228 U	16 5	11 4 U	8 6	7920	25 1	22 8 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se) total mg/kg
SD004	02/21/89	3340 U	303	0 34 U	66 9 U	26 8 U	3340 U	1 5 U
SD004	02/21/89	1230 U	139	0 12 U	24 7 U	9 9 U	1230 U	1 1 U
SD016	02/23/89	1280 U	139	0 13 U	25 7 U	10 3 U	1280 U	1 1 U
SD017	02/23/89	1250 U	179	0 12 U	25 0 U	10 0 U	1250 U	1 0 U
SD018	02/23/89	3240 U	57 3	0 32 U	64 7 U	25 9 U	3240 U	2 5 U
SD019	02/23/89	4110	180	0 35 U	70 2 U	29 9	3510 U	2 4 U
SD020	02/22/89	1180 U	9 0	0 12 U	23 5 U	9 4 U	1180 U	0 98 U
SD021	02/22/89	2490	105	0 19 U	35 7 U	14 3 U	1790 U	1 1 U
SD022	02/22/89	1380	95 2	0 12 U	22 8 U	9 9	1140 U	1 1 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn) Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn) total mg/kg
SD004	02/21/89	6 7 U	3340 U	66 9 U	3 0 U	66 9 U	33 4 U	70 3
SD004	02/21/89	2 5 U	1230 U	24 7 U	2 2 U	24 7 U	12 9	26 0
SD016	02/23/89	2 6 U	1280 U	25 7 U	2 2 U	25 7 U	12 8 U	8 7
SD017	02/23/89	2 5 U	1250 U	25 0 U	2 0 U	25 0 U	12 5 U	9 3
SD018	02/23/89	6 5 U	3240 U	74 2	5 0 U	64 7 U	32 4 U	37 2
SD019	02/23/89	7 0 U	3510 U	70 2 U	48 0 U	70 2 U	50 2	48 3
SD020	02/22/89	2 4 U	1180 U	23 5 U	2 0 U	23 5 U	11 8 U	6 5
SD021	02/22/89	6 8	1790 U	175	2 2 U	35 7 U	17 9 U	43 2
SD022	02/22/89	2 3 U	1140 U	25 2	2 2 U	22 8 U	13 4	35 7

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Aluminum (Al), total mg/kg	Antimony (Sb) total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be) total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca) total mg/kg
SD023	02/21/89	7440	17 0 U	2 0 U	82 1	1 4 U	1 4 U	1810

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Cesium (Cs) total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co) total mg/kg	Copper (Cu), total mg/kg	Iron (Fe) total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
SD023	02/21/89	283 U	10 8	14 1 U	7 1 U	9110	6 5	28 3 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni) total mg/kg	Potassium (K), total mg/kg	Selenium (Se) total mg/kg
SD023	02/21/89	1530	97 0	0 14 U	28 3 U	14 2	1410 U	1 0 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr) total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn) Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn) total mg/kg
SD023	02/21/89	2 8 U	1410 U	28 3 U	2 0 U	28 3 U	20 6	22 8

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENT SAMPLE FIELD BLANKS

Station Number	Date Sampled	Aluminum (Al), total mg/l	Antimony (Sb), total mg/l	Arsenic (As), total mg/l	Barium (Ba) total mg/l	Beryllium (Be), total mg/l	Cadmium (Cd), total mg/l	Calcium (Ca), total mg/l
FB	02/22/89	200 U	0600 U	010 U	200 U	0050 U	0050 U	5U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENT SAMPLE FIELD BLANKS

Station Number	Date Sampled	Cesium (Cs), total mg/l	Chromium (Cr), total mg/l	Cobalt (Co), total mg/l	Copper (Cu), total mg/l	Iron (Fe) total mg/l	Lead (Pb), total mg/l	Lithium (Li), total mg/l
FB	02/22/89	1U	0100 U	0500 U	0250 U	100 U	005 U	100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENT SAMPLE FIELD BLANKS

Station Number	Date Sampled	Magnesium (Mg), total mg/l	Manganese (Mn), total mg/l	Mercury (Hg) total mg/l	Molybdenum (Mo) total mg/l	Nickel (Ni) total mg/l	Potassium (K) total mg/l	Selenium (Se) total mg/l
FB	02/22/89	5U	0150 U	0002 U	100 U	0400 U	5U	005 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Sediment Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENT SAMPLE FIELD BLANKS

Station Number	Date Sampled	Silver (Ag) total mg/l	Sodium (Na), total mg/l	Strontium (Sr), total mg/l	Thallium (Tl), total mg/l	Tin (Sn) Total mg/l	Vanadium (V) total mg/l	Zinc (Zn) total mg/l
FB	02/22/89	0100 U	5U	100 U	01 U	100 U	0500 U	0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

INORGANICS

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit
SD004	02/21/89	1 3 U	7 0
SD004	02/21/89	1 3 U	7 2
SD016	02/23/89	1 4 U	7 3
SD017	02/23/89	1 4 U	7 3
SD018	02/23/89	2 9 U	6 9
SD019	02/23/89	1 8 U	7 0
SD020	02/22/89	1 4 U	7 7
SD021	02/22/89	2 7 U	7 9
SD022	02/22/89	2 1 U	7 7

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Sediment Inorganic Results

For Stations at Rockwell (Rocky Flats)

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit
SD023	02/21/89	1 4 U	6 1

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

TOTAL RADIOCHEMISTRY

Sediment Total Radiochemistry Results

for Stations at Rocky Flats Plant

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
SD004	02/21/89	25 ± 13	35 ± 6	1 1 ± 0 3	0 0 ± 0 1
SD004	02/21/89	48 ± 16	33 ± 6	1 0 ± 0 2	0 1 ± 0 1
SD016	02/23/89	20 ± 13	39 ± 6	0 5 ± 0 2	0 0 ± 0 1
SD017	02/23/89	31 ± 15	40 ± 7	0 5 ± 0 1	0 1 ± 0 1
SD018	02/23/89	35 ± 14	23 ± 6	0 7 ± 0 2	0 0 ± 0 1
SD019	02/23/89	39 ± 15	29 ± 6	0 9 ± 0 2	0 1 ± 0 1
SD020	02/22/89	4 ± 12	20 ± 6	0 5 ± 0 1	0 0 ± 0 1
SD021	02/22/89	24 ± 15	24 ± 6	1 2 ± 0 1	0 0 ± 0 1
SD022	02/22/89	13 ± 13	25 ± 6	0 6 ± 0 1	0 0 ± 0 1
SD023	02/21/89	40 ± 15	31 ± 6	1 2 ± 0 2	0 1 ± 0 1
FB	02/22/89	0 ± 1	-1 ± 2	0 1 ± 0 1	0 0 ± 0 1

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Sediment Total Radiochemistry Results

for Stations at Rocky Flats Plant

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
SD004	02/21/89	1 0 ± 0 2	0 6 ± 0 9	0 00 ± 0 02	0 01 ± 0 03
SD004	02/21/89	1 0 ± 0 2	0 0 ± 0 8	0 00 ± 0 02	0 01 ± 0 02
SD016	02/23/89	0 6 ± 0 2	-0 2 ± 0 6	0 00 ± 0 02	-0 01 ± 0 02
SD017	02/23/89	0 5 ± 0 1	-0 6 ± 0 7	0 01 ± 0 02	-0 01 ± 0 02
SD018	02/23/89	0 5 ± 0 2	-0 2 ± 0 6	0 03 ± 0 02	0 02 ± 0 04
SD019	02/23/89	1 1 ± 0 2	0 4 ± 0 7	0 04 ± 0 03	0 00 ± 0 02
SD020	02/22/89	0 4 ± 0 1	-0 1 ± 0 4	0 00 ± 0 02	-0 01 ± 0 02
SD021	02/22/89	1 1 ± 0 1	0 8 ± 0 7	0 08 ± 0 02	0 00 ± 0 02
SD022	02/22/89	0 5 ± 0 1	0 1 ± 0 5	0 01 ± 0 02	0 00 ± 0 02
SD023	02/21/89	1 3 ± 0 2	0 3 ± 0 7	0 01 ± 0 02	0 01 ± 0 02
FB	02/22/89	0 0 ± 0 1	0 3 ± 0 4	0 02 ± 0 03	-0 01 ± 0 03

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Sediment Total Radiochemistry Results

for Stations at Rocky Flats Plant

1989 BACKGROUND SEDIMENTS

Station Number	Date Sampled	Cesium 137 pCi/g	Tritium pCi/g	Radium 226 pCi/g	Radium 228 pCi/g
SD004	02/21/89	0 0 ± 0 1	0 20 ± 0 15	0 8 ± 0 1	1 6 ± 0 3
SD004	02/21/89	0 0 ± 0 1	0 09 ± 0 14	0 8 ± 0 1	1 4 ± 0 2
SD016	02/23/89	0 0 ± 0 1	0 13 ± 0 14	0 7 ± 0 1	1 5 ± 0 3
SD017	02/23/89	0 0 ± 0 1	0 20 ± 0 14	0 7 ± 0 1	1 1 ± 0 1
SD018	02/23/89	0 4 ± 0 1	0 12 ± 0 14	0 8 ± 0 1	1 2 ± 0 2
SD019	02/23/89	1 4 ± 0 1	0 18 ± 0 14	0 8 ± 0 1	1 0 ± 0 1
SD020	02/22/89	0 0 ± 0 1	0 31 ± 0 15	0 6 ± 0 1	1 1 ± 0 2
SD021	02/22/89	0 4 ± 0 1	0 32 ± 0 15	0 7 ± 0 1	1 1 ± 0 2
SD022	02/22/89	0 0 ± 0 1	0 15 ± 0 14	0 7 ± 0 1	1 0 ± 0 2
SD023	02/21/89	0 0 ± 0 1	0 22 ± 0 15	1 0 ± 0 1	2 1 ± 0 4
FB	02/22/89	-0 1 ± 0 6	240 ± 150	NR	NR

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

APPENDIX A-2

SURFACE WATER ANALYTICAL DATA
ROUND 1

BACKGROUND ROUND 1

SURFACE WATER SAMPLE INFORMATION

	SAMPLE INFORMATION					FIELD PARAMETERS				LABORATORY ANALYTES								
STATION NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	pH	FIELD COND (umhos/cm)	TEMP (deg C)	D O (mg/l)	VOA	SEMI-VOA	PEST PCB	HERB	TOT METS	DIS MET	INORG	TOT RADS	DISS RADS
FB	SW06001FB	02/24/89	02/24/89	04/11/89	KMM022489001	N/A	N/A	N/A	N/A	N	N	N	N	R	R	N	R	R
SW004	SW004001	03/02/89	03/02/89	04/17/89	MJS030289003	6 50	210 00	3 0	7 0	N	N	N	N	R	R	R	R	R
SW005	SW05001	02/28/89	02/28/89	04/15/89	KMM022889003	6 28	150 00	2 7	4 0	N	N	N	N	R	R	R	R	R
SW006	SW06001	02/24/89	02/24/89	04/11/89	KMM022489001	6 45	60 00	4 0	3 1	N	N	N	N	R	R	R	R	R
SW006	SW06001D	02/24/89	02/24/89	04/11/89	KMM022489001	6 45	60 00	4 0	3 1	N	N	N	N	R	R	R	R	R
SW007	SW07001	02/27/89	02/28/89	04/15/89	KMM022789003	6 40	130 00	5 0	1 3	N	N	N	N	R	R	R	R	R
SW041	SW41001	03/01/89	03/01/89	04/16/89	MJS030189002	5 00	200 00	0 5	5 5	N	N	N	N	R	R	R	R	R
SW080	SW080001	03/01/89	03/01/89	04/16/89	MJS030189002	6 00	160 00	0 6	3 8	N	N	N	N	R	R	R	R	R
SW104	SW104001	03/02/89	03/02/89	04/17/89	MJS030289003	5 90	410 00	1 0	3 0	N	N	N	N	R	R	R	R	R
SW107	SW107001	02/28/89	02/28/89	04/15/89	KMM0222789003	5 60	190 00	0 5	5 3	N	N	N	N	R	R	R	R	R
SW108	SW108001	03/02/89	03/02/89	04/17/89	MJS030289003	5 80	285 00	1 0	7 4	N	N	N	N	R	R	R	R	R

N - Not sampled for this group, Y - Sampled for this group, results not yet received, R - Results for this group received

TOTAL METALS

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Aluminum (Al), total mg/l	Antimony (Sb), total mg/l	Arsenic (As) total mg/l	Barium (Ba), total mg/l	Beryllium (Be) total mg/l	Cadmium (Cd), total mg/l	Calcium (Ca), total mg/l
SW-04	03/02/89		200 U	0600 U	010 U	200 U	0050 U	0050 U	35 10
SW 05	02/28/89		200 U	0600 U	010 U	200 U	0050 U	0050 U	24 20
SW-06	02/24/89		916	0600 U	01 U	200 U	0050 U	0050 U	26 20
SW-06	02/24/89		1 06	0600 U	0 01 U	200 U	0050 U	0050 U	24 10
SW-07	02/27/89		200 U	0600 U	01 U	200 U	0050 U	0050 U	14 80
SW-104	03/02/89		8 36	0600 U	0105	200 U	0050 U	0050 U	98 10
SW-107	02/28/89		200 U	0600 U	01 U	200 U	0050 U	0050 U	20
SW-108	03/02/89		200 U	0600 U	010 U	200 U	0050 U	0050 U	67
SW-41	03/01/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	21 70

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Cesium (Cs) total mg/l	Chromium (Cr) total mg/l	Cobalt (Co) total mg/l	Copper (Cu) total mg/l	Iron (Fe) total mg/l	Lead (Pb), total mg/l	Lithium (Li) total mg/l
SW-04	03/02/89		1U	0100 U	0500 U	0250 U	118	0050 U	100 U
SW-05	02/28/89		1U	0100 U	0500 U	0250 U	124	005 U	100 U
SW-06	02/24/89		1U	0100 U	0500 U	0250 U	2 41	005 U	100 U
SW-06	02/24/89		1U	0100 U	0500 U	0250 U	2 21	005 U	100 U
SW-07	02/27/89		1U	0100 U	0500 U	0250 U	185	005 U	100 U
SW-104	03/02/89		1U	0100 U	0500 U	0250 U	22 60	0185	100 U
SW-107	02/28/89		1U	0100 U	0500 U	0250 U	149	005 U	100 U
SW-108	03/02/89		1U	0100 U	0500 U	0250 U	396	0050 U	100 U
SW-41	03/01/89		1U	0100 U	0500 U	0250 U	132	0050 U	100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Magnesium (Mg) total mg/l	Manganese (Mn), total mg/l	Mercury (Hg), total mg/l	Molybdenum (Mo), total mg/l	Nickel (Ni), total mg/l	Potassium (K), total mg/l	Selenium (Se) total mg/l
SW-04	03/02/89		7 82	0150 U	00022	100 U	0400 U	5U	0050 U
SW-05	02/28/89		5 76	0150 U	0004	100 U	0400 U	5U	005 U
SW-06	02/24/89		8	378	0002 U	100 U	0400 U	5U	005 U
SW-06	02/24/89		7 63	371	0002 U	100 U	0400 U	5U	005 U
SW-07	02/27/89		5U	0150 U	0004	100 U	0400 U	5U	005 U
SW-104	03/02/89		9 04	716	00029	100 U	0400 U	5U	0050 U
SW-107	02/28/89		5 78	0175	0005	100 U	0400 U	5U	005 U
SW-108	03/02/89		9 47	0534	00029	100 U	0400 U	5U	0050 U
SW-41	03/01/89		6 10	0212	0011	100 U	0400 U	5U	0050 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Silver (Ag), total mg/l	Sodium (Na) total mg/l	Strontium (Sr) total mg/l	Thallium (Tl), total mg/l	Tin (Sn), Total mg/l	Vanadium (V), total mg/l	Zinc (Zn), total mg/l
SW-04	03/02/89		0100 U	21 90	194	0500 U	100 U	0500 U	0200 U
SW-05	02/28/89		0100 U	15 30	140	010 U	100 U	0500 U	0200 U
SW-06	02/24/89		0100 U	30 20	177	01 U	100 U	0500 U	0268
SW-06	02/24/89		0100 U	27 80	171	01 U	100 U	0500 U	0536
SW-07	02/27/89		0100 U	16 10	100 U	010 U	100 U	0500 U	0276
SW-104	03/02/89		0174	14 40	255	0500 U	100 U	0500 U	0281
SW-107	02/28/89		0100 U	30 80	123	010 U	100 U	0500 U	0200 U
SW-108	03/02/89		0106	12 50	285	005 U	100 U	0500 U	0200 U
SW-41	03/01/89		0100 U	30	127	0400 U	100 U	0500 U	0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Aluminum (Al), total mg/l	Antimony (Sb) total mg/l	Arsenic (As) total mg/l	Barium (Ba), total mg/l	Beryllium (Be) total mg/l	Cadmium (Cd) total mg/l	Calcium (Ca) total mg/l
SW-80	03/01/89		64 10	0600 U	116	4 49	0097	0690	226
FB	02/24/89		200 U	0600 U	01 U	200 U	0050 U	0050 U	5U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Cesium (Cs) total mg/l	Chromium (Cr) total mg/l	Cobalt (Co) total mg/l	Copper (Cu), total mg/l	Iron (Fe) total mg/l	Lead (Pb), total mg/l	Lithium (Li) total mg/l
SW-80	03/01/89		2 53	0598	0730	180	651	233	100 U
FB	02/24/89		1U	0100 U	0500 U	0250 U	100 U	05 U	100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Magnesium (Mg) total mg/l	Manganese (Mn), total mg/l	Mercury (Hg), total mg/l	Molybdenum (Mo), total mg/l	Nickel (Ni) total mg/l	Potassium (K), total mg/l	Selenium (Se) total mg/l
SW-80	03/01/89		24 90	480	NR	199	250	9 86	0050 U
FB	02/24/89		5U	0150 U	0002 U	100 U	0400 U	5U	005 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Silver (Ag), total mg/l	Sodium (Na), total mg/l	Strontium (Sr), total mg/l	Thallium (Tl), total mg/l	Tin (Sn), Total mg/l	Vanadium (V), total mg/l	Zinc (Zn) total mg/l
SW-80	03/01/89		148	12 80	1 20	0400 U	969	364	723
FB	02/24/89		0100 U	5U	100 U	01 U	100 U	0500 U	0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

DISSOLVED METALS

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Aluminum (Al) diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As) diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca) diss mg/l
SW-04	03/02/89		200 U	0600 U	010 U	200 U	0050 U	0050 U	34
SW-05	02/28/89		200 U	0600 U	01 U	200 U	0050 U	0050 U	26 50
SW-06	02/24/89		485	0600 U	01 U	200 U	0050 U	0050 U	25 50
SW-06	02/24/89		252	0600 U	01 U	200 U	0050 U	0050 U	23 90
SW-07	02/27/89		200 U	0600 U	01 U	200 U	0050 U	0050 U	15 30
SW-104	03/02/89		200 U	0600 U	010 U	200 U	0050 U	0050 U	78 40
SW-107	02/28/89		200 U	0600 U	01 U	200 U	0050 U	0050 U	20 30
SW-108	03/02/89		200 U	0600 U	010 U	200 U	0050 U	0050 U	68
SW-41	03/01/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	20 40

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu) diss mg/l	Iron (Fe) diss mg/l	Lead (Pb), diss mg/l	Lithium (Li) diss mg/l
SW-04	03/02/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
SW-05	02/28/89		1U	0100 U	0500 U	0250 U	100 U	01 U	100 U
SW-06	02/24/89		1U	0100 U	0500 U	0250 U	1 78	005 U	100 U
SW-06	02/24/89		1U	0100 U	0500 U	0250 U	901	005 U	100 U
SW-07	02/27/89		1U	0100 U	0500 U	0250 U	100 U	005 U	100 U
SW-104	03/02/89		1U	0100 U	0500 U	0250 U	4 69	0050 U	100 U
SW-107	02/28/89		1U	0100 U	0500 U	0250 U	100 U	0055	100 U
SW-108	03/02/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
SW-41	03/01/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
SW-04	03/02/89		7 65	0150 U	00049	100 U	0400 U	5U	0050 U
SW-05	02/28/89		6 43	0150 U	0003	100 U	0400 U	5U	005 U
SW-06	02/24/89		7 73	368	0002 U	100 U	0400 U	5U	005 U
SW-06	02/24/89		7 49	338	0002 U	100 U	0400 U	5U	005 U
SW-07	02/27/89		5U	0150 U	0003	100 U	0400 U	5U	005 U
SW-104	03/02/89		6 83	480	00029	100 U	0400 U	5U	0050 U
SW-107	02/28/89		5 92	0150 U	0003	100 U	0400 U	5U	005 U
SW-108	03/02/89		10	0506	00056	100 U	0400 U	5U	0050 U
SW-41	03/01/89		5 82	0396	0002 U	100 U	0400 U	5U	0050 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
SW-04	03/02/89		0100 U	21 70	197	0500 U	100 U	0500 U	0200 U
SW-05	02/28/89		0100 U	17 10	161	01 U	100 U	0500 U	0200 U
SW-06	02/24/89		0100 U	29 30	173	01 U	100 U	0500 U	0242
SW-06	02/24/89		0100 U	27	163	01 U	100 U	0500 U	0200 U
SW-07	02/27/89		0100 U	17 70	100 U	01 U	100 U	0500 U	0320
SW-104	03/02/89		0125	11 20	206	0500 U	100 U	0500 U	0200 U
SW-107	02/28/89		0100 U	32 30	129	01 U	100 U	0500 U	0200 U
SW-108	03/02/89		0100 U	13 20	296	0500 U	100 U	0500 U	0200 U
SW-41	03/01/89		0100 U	29 40	124	0400 U	100 U	0500 U	0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Aluminum (Al) diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba) diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
SW-80	03/01/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	31 50
FB	02/24/89		200 U	0600 U	010 U	200 U	0050 U	0050 U	5U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co) diss mg/l	Copper (Cu), diss mg/l	Iron (Fe) diss mg/l	Lead (Pb) diss mg/l	Lithium (Li) diss mg/l
SW-80	03/01/89		1U	0100 U	0500 U	0250 U	2 03	0050 U	100 U
FB	02/24/89		1U	0100 U	0500 U	0250 U	100 U	005 U	100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
SW-80	03/01/89		5U	150	0013	100 U	0400 U	5U	0050 U
F8	02/24/89		5U	0150 U	0002 U	100 U	0400 U	5U	005 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
SW-80	03/01/89		0100 U	8 38	138	0400 U	100 U	0500 U	0200 U
FB	02/24/89		0100 U	5U	100 U	01 U	100 U	0500 U	0294

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

INORGANICS

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
SW04	03/02/89	180	7	0 12	34	150
SW05	02/28/89	130	6	0 91	29	110
SW06	02/24/89	200	14	0 25	23	120
SW06	02/24/89	200	15	0 64	5	120
SW07	02/27/89	140	28	2 0	17	30
SW104	03/02/89	290	14	0 05 U	5 U	320
SW107	02/28/89	160	62	0 39	16	48
SW108	03/02/89	220	5	0 30	33	200
SW41	03/01/89	160	62	0 29	17	48

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	CO3= MG/L	pH pH Unit	Cyanide Total MG/L	Suspended Solids MG/L
SW04	03/02/89	5 U	8 1	01 U	5 U
SW05	02/28/89	5 U	7 8	0 0025 U	8
SW06	02/24/89	5 U	7 3	0 0025 U	18
SW06	02/24/89	5 U	7 2	0 0025 U	18
SW07	02/27/89	5 U	7 3	0 0025 U	15
SW104	03/02/89	5 U	7 1	0 0025 U	340
SW107	02/28/89	5 U	7 7	0 0025 U	11
SW108	03/02/89	5 U	7 7	0 0025 U	5 U
SW41	03/01/89	5 U	7 6	0 0025 U	5 U

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled		Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
SW80	03/01/89		120	10	1* U	16	150

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Surface Water Inorganic Results

For Stations at Rockwell (Rocky Flats) - ROUND ONE

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled		CO3= MG/L	pH pH Unit	Cyanide, Total MG/L	Suspended Solids MG/L
SW80	03/01/89		5 U	6 5	0 0025 U	4200

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

TOTAL RADIOCHEMISTRY

Surface Water Total Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 1

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
SW004	03/02/89	1 ± 3	0 ± 3	0 9 ± 0 3	0 0 ± 0 1
SW005	02/28/89	2 ± 2	4 ± 2	0 2 ± 0 2	0 0 ± 0 1*
SW006	02/24/89	1 ± 2	7 ± 3	0 4 ± 0 2	0 0 ± 0 1
SW006	02/24/89	1 ± 2	8 ± 3	0 4 ± 0 1	0 0 ± 0 1
SW007	02/27/89	2 ± 2	2 ± 2	0 5 ± 1 3	0 1 ± 0 2
SW104	03/02/89	25 ± 12	22 ± 5	0 5 ± 0 2	0 0 ± 0 1
SW107	02/28/89	1 ± 2	1 ± 2	0 1 ± 0 1	0 0 ± 0 1
SW108	03/02/89	6 ± 5	1 ± 3	0 8 ± 0 3	0 0 ± 0 1
SW041	03/01/89	1 ± 2	2 ± 2	0 1 ± 0 1	0 0 ± 0 1
SW080	03/01/89	250 ± 140	200 ± 110	0 2 ± 0 2	0 0 ± 0 1
FB	02/24/89	1 ± 1	-1 ± 2	0 1 ± 0 1	0 0 ± 0 1

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 1

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
SW004	03/02/89	0 5 ± 0 2	0 2 ± 0 4	0 00 ± 0 02	0 00 ± 0 02
SW005	02/28/89	0 0 ± 0 1*	0 3 ± 0 5*	0 01 ± 0 02	0 00 ± 0 02
SW006	02/24/89	0 2 ± 0 2	1 5 ± 0 5	0 00 ± 0 02	0 02 ± 0 01
SW006	02/24/89	0 3 ± 0 2	1 1 ± 0 5	0 00 ± 0 02	0 01 ± 0 03
SW007	02/27/89	0 2 ± 1 2	0 3 ± 0 4	0 00 ± 0 02	-0 01 ± 0 02
SW104	03/02/89	0 7 ± 0 2	1 1 ± 0 5	0 08 ± 0 03	0 00 ± 0 02
SW107	02/28/89	0 0 ± 0 1	-0 1 ± 0 4	0 00 ± 0 02	-0 01 ± 0 02
SW108	03/02/89	0 4 ± 0 2	0 1 ± 0 5	0 01 ± 0 02	0 00 ± 0 03
SW041	03/01/89	0 1 ± 0 1	0 2 ± 0 5	0 00 ± 0 02	0 02 ± 0 03
SW080	03/01/89	0 3 ± 0 2	1 1 ± 0 6	1 0 ± 0 1	0 10 ± 0 07
FB	02/24/89	0 0 ± 0 1	-0 1 ± 0 4	0 00 ± 0 02	0 00 ± 0 02

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 1

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
SW004	03/02/89	-0 3 ± 0 6	70 ± 150	NR	NR
SW005	02/28/89	-0 4 ± 0 5	140 ± 140	NR	NR
SW006	02/24/89	-0 1 ± 0 5	100 ± 150	NR	NR
SW006	02/24/89	0 1 ± 0 5	100 ± 150	NR	NR
SW007	02/27/89	0 3 ± 0 6	200 ± 150	NR	NR
SW104	03/02/89	0 3 ± 0 6	50 ± 150	0 7 ± 0 4	NR
SW107	02/28/89	0 0 ± 0 6	70 ± 140	NR	NR
SW108	03/02/89	-0 2 ± 0 5	120 ± 150	0 2 ± 0 2	NR
SW041	03/01/89	0 1 ± 0 5	100 ± 140	NR	NR
SW080	03/01/89	12 ± 2	190 ± 140	5 5 ± 0 9	11 ± 4
FB	02/24/89	0 2 ± 0 5	80 ± 150 *	NR	NR

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

DISSOLVED RADIOCHEMISTRY

Surface Water Dissolved Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 1

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Gross Alpha PCI/L	(MDA)	Gross Beta PCI/L	(MDA)	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)
SW004	03/02/89	0 ± 2		1 ± 3		0 8 ± 0 2		0 0 ± 0 1	
SW005	02/28/89	0 ± 2		1 ± 2		0 8 ± 0 3		0 0 ± 0 1	
SW006	02/24/89	0 ± 2		6 ± 3		0 3 ± 0 1		0 0 ± 0 1	
SW006	02/24/89	0 ± 2		5 ± 3		0 7 ± 0 2		0 0 ± 0 1	
SW007	02/27/89	-1 ± 1		3 ± 2		0 5 ± 1 3		0 1 ± 0 2	
SW104	03/02/89	4 ± 5		1 ± 3		2 6 ± 0 5		0 3 ± 0 1	
SW107	02/28/89	0 ± 2		0 ± 2		0 2 ± 0 1		0 0 ± 0 1	
SW108	03/02/89	3 ± 4		0 ± 3		0 7 ± 0 2		0 0 ± 0 1	
SW041	03/01/89	-1 ± 2		3 ± 2		0 1 ± 0 2		0 0 ± 0 1	
SW080	03/01/89	0 ± 2		-2 ± 2		0 0 ± 0 1		0 0 ± 0 1	
FB	02/24/89	0 ± 1		0 ± 2		0 0 ± 0 1		0 0 ± 0 1	

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Dissolved Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 1

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Uranium 238 PCI/L	(MDA)	Strontium 89, 90 PCI/L	(MDA)	Plutonium 239, 240 PCI/L	(MDA)	Americium 241 PCI/L	(MDA)
SW004	03/02/89	0 6 ± 0 2		-0 5 ± 0 8		0 00 ± 0 02		0 00 ± 0 02	
SW005	02/28/89	0 3 ± 0 2		-0 2 ± 0 4		0 00 ± 0 02		-0 01 ± 0 03	
SW006	02/24/89	0 2 ± 0 2		0 9 ± 0 5		0 00 ± 0 02		0 00 ± 0 02	
SW006	02/24/89	0 3 ± 0 2		1 0 ± 0 5	*	0 01 ± 0 02		0 00 ± 0 02	
SW007	02/27/89	0 1 ± 1 2		0 1 ± 0 4		0 00 ± 0 02		-0 01 ± 0 02	
SW104	03/02/89	1 7 ± 0 4		0 8 ± 0 4		0 01 ± 0 02		0 00 ± 0 03	
SW107	02/28/89	0 1 ± 0 1		-0 1 ± 0 5*		0 00 ± 0 02		0 00 ± 0 02	
SW108	03/02/89	0 5 ± 0 2		-0 3 ± 0 4		0 00 ± 0 02		0 00 ± 0 02	
SW041	03/01/89	0 0 ± 0 1		0 0 ± 0 7		0 00 ± 0 02		-0 01 ± 0 02	
SW080	03/01/89	-0 1 ± 0 1		0 0 ± 0 4		0 01 ± 0 02		0 00 ± 0 02	
FB	02/24/89	0 0 ± 0 1		0 2 ± 0 4		-0 01 ± 0 02		0 00 ± 0 02	

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Dissolved Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 1

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Cesium 137 PCI/L	(MDA)	Tritium PCI/L	(MDA)	Radium 226 PCI/L	Radium 228 PCI/L
SW004	03/02/89	0 2 ± 0 6		NR		NR	NR
SW005	02/28/89	-0 2 ± 0 5		NR		NR	NR
SW006	02/24/89	-0 3 ± 0 7		NR		NR	NR
SW006	02/24/89	0 1 ± 0 5		NR		NR	NR
SW007	02/27/89	0 1 ± 0 6		NR		NR	NR
SW104	03/02/89	-0 5 ± 0 6		NR		NR	NR
SW107	02/28/89	-0 2 ± 0 6		NR		NR	NR
SW108	03/02/89	-0 1 ± 0 6		NR		NR	NR
SW041	03/01/89	-0 1 ± 0 5		NR		NR	NR
SW080	03/01/89	0 2 ± 0 6		NR		NR	NR
FB	02/24/89	-0 4 ± 0 5		NR		NR	NR

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

APPENDIX A-3

SURFACE WATER ANALYTICAL DATA
ROUND 2

BACKGROUND ROUND 2

SURFACE WATER SAMPLE INFORMATION

	SAMPLE INFORMATION					FIELD PARAMETERS				LABORATORY ANALYTES								
STATION NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	pH	FIELD COND (umhos/cm)	TEMP (deg C)	D O (mg/l)	VOA	SEMI-VOA	PEST PCB	HERB	TOT METS	DIS MET	INORG	TOT RADS	DISS RADS
FB	SW108002FB	05/30/89	05/30/89	07/15/89	WWB053089001	N/A	N/A	N/A	N/A	N	N	N	N	R	R	N	R	N
SW004	DRY	05/30/89	/ /	/ /		N/A	N/A	N/A	N/A	N	N	N	N	N	N	N	N	N
SW005	SW005002	05/30/89	05/30/89	07/15/89	WWB053089001	7 20	70 00	12 0	3 4	N	N	N	N	R	R	R	R	N
SW006	SW006002	05/31/89	05/31/89	07/16/89	SAS053189001	7 00	90 00	14 0	4 5	N	N	N	N	R	R	R	R	N
SW007	SW007002	05/31/89	05/31/89	07/16/89	SAS053189001	6 50	285 00	15 0	5 9	N	N	N	N	R	R	R	R	N
SW041	SW041002	05/26/89	05/26/89	07/11/89	WWB052689001	6 80	165 00	19 0	0 0	N	N	N	N	R	R	R	R	N
SW080	DRY	05/24/89	/ /	/ /		N/A	N/A	N/A	N/A	N	N	N	N	N	N	N	N	N
SW100	SW104002	06/01/89	06/02/89	07/18/89	WWB060189001	7 50	140 00	14 0	5 3	N	N	N	N	R	R	R	R	N
SW107	SW107002	05/26/89	05/26/89	07/11/89	WWB052689001	7 50	192 00	21 0	3 2	N	N	N	N	R	R	R	R	N
SW108	SW108002	05/30/89	05/30/89	07/15/89	WWB053089001	7 40	300 00	13 0	0 0	N	N	N	N	R	R	R	R	N
SW108	SW108002D	05/30/89	05/30/89	07/15/89	WWB053089001	7 40	300 00	13 0	0 0	N	N	N	N	R	R	R	R	N

N - Not sampled for this group, Y - Sampled for this group, results not yet received, R - Results for this group received

TOTAL METALS

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Aluminum (Al), total mg/l	Antimony (Sb), total mg/l	Arsenic (As), total mg/l	Barium (Ba), total mg/l	Beryllium (Be), total mg/l	Cadmium (Cd), total mg/l	Calcium (Ca), total mg/l
SW-04	05/30/89		DRY						
SW-05	05/30/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	19 90
SW-06	05/31/89		1 67	0600 U	0100 U	200 U	0050 U	0050 U	16 30
SW-07	05/31/89		1 21	0600 U	0100 U	200 U	0050 U	0050 U	26 20
SW-104	06/01/89		4 02	0600 U	0100 U	294	0050 U	0050 U	69 40
SW-107	05/26/89		236	0600 U	0100 U	200 U	0050 U	0050 U	19 10
SW-108	05/30/89		4 98	0600 U	0100 U	200 U	0050 U	0050 U	63 90
SW-108	05/30/89		4 93	0600 U	0100 U	200 U	0050 U	0050 U	63
SW-41	05/26/89		2 14	0600 U	0100 U	200 U	0050 U	0050 U	34

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Cesium (Cs), total mg/l	Chromium (Cr), total mg/l	Cobalt (Co), total mg/l	Copper (Cu), total mg/l	Iron (Fe) total mg/l	Lead (Pb), total mg/l	Lithium (Li), total mg/l
SW-04	05/30/89		DRY						
SW-05	05/30/89		1U	0100 U	0500 U	0250 U	360	0050 U	0100 U
SW-06	05/31/89		1U	0106	0500 U	0250 U	1 64	0050 U	0100 U
SW-07	05/31/89		1U	0100 U	0500 U	0250 U	946	0050 U	0100 U
SW-104	06/01/89		1U	0115	0500 U	0250 U	7 94	0308	0100 U
SW-107	05/26/89		1U	0100 U	0500 U	0250 U	1 20	0050 U	0100 U
SW-108	05/30/89		1U	0100 U	0500 U	0250 U	4 32	0050 U	0192
SW-108	05/30/89		1U	0100 U	0500 U	0250 U	4 19	0062	0183
SW-41	05/26/89		1U	0100 U	0500 U	0250 U	5 48	0050 U	0100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Magnesium (Mg), total mg/l	Manganese (Mn), total mg/l	Mercury (Hg), total mg/l	Molybdenum (Mo), total mg/l	Nickel (Ni), total mg/l	Potassium (K), total mg/l	Selenium (Se), total mg/l
SW-04	05/30/89		DRY						
SW-05	05/30/89		5 19	0162	0002 U	0138	0400 U	5U	0050 U
SW-06	05/31/89		5U	0848	0003	0106	0400 U	5U	0050 U
SW-07	05/31/89		6 58	105	0003	0144	0400 U	5U	0050 U
SW-104	06/01/89		7 36	837	0002 U	0203	0400 U	5U	0050 U
SW-107	05/26/89		5U	158	0002 U	0105	0400 U	5U	0050 U
SW-108	05/30/89		12 30	218	0004	0176	0400 U	5U	0050 U
SW-108	05/30/89		12 20	214	0012	0188	0400 U	5U	0050 U
SW-41	05/26/89		8 81	209	0002 U	0115	0400 U	5U	0050 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Silver (Ag), total mg/l	Sodium (Na), total mg/l	Strontium (Sr), total mg/l	Thallium (Tl), total mg/l	Tin (Sn), Total mg/l	Vanadium (V), total mg/l	Zinc (Zn), total mg/l
SW-04	05/30/89		DRY						
SW-05	05/30/89		0100 U	15 20	1U	0100 U	100 U	0500 U	0200 U
SW-06	05/31/89		0100 U	22	1U	0100 U	100 U	0500 U	0676
SW-07	05/31/89		0100 U	33 30	1U	0100 U	100 U	0500 U	0200 U
SW-104	06/01/89		0100 U	15 30	1U	0100 U	100 U	0500 U	0562
SW-107	05/26/89		0100 U	15 70	1U	0100 U	100 U	0500 U	0200 U
SW-108	05/30/89		0100 U	21 50	1U	0100 U	100 U	0500 U	0200 U
SW-108	05/30/89		0100 U	21 90	1U	0100 U	100 U	0500 U	0200 U
SW-41	05/26/89		0100 U	26 40	1U	0100 U	100 U	0500 U	0892

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Aluminum (Al), total mg/l	Antimony (Sb), total mg/l	Arsenic (As) total mg/l	Barium (Ba), total mg/l	Beryllium (Be), total mg/l	Cadmium (Cd), total mg/l	Calcium (Ca), total mg/l
SW-80	05/24/89		DRY						
FB	05/30/89		1 05	0600 U	0100 U	200 U	0050 U	0050 U	58

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Cesium (Cs), total mg/l	Chromium (Cr), total mg/l	Cobalt (Co), total mg/l	Copper (Cu), total mg/l	Iron (Fe), total mg/l	Lead (Pb) total mg/l	Lithium (Li) total mg/l
SW-80	05/24/89		DRY						
FB	05/30/89		1U	0100 U	0500 U	0250 U	1 35	0050 U	0162

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Magnesium (Mg), total mg/l	Manganese (Mn), total mg/l	Mercury (Hg) total mg/l	Molybdenum (Mo), total mg/l	Nickel (Ni) total mg/l	Potassium (K) total mg/l	Selenium (Se), total mg/l
SW-80	05/24/89		DRY						
FB	05/30/89		11 50	182	0013	0133	0400 U	5U	0050 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Total Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Silver (Ag), total mg/l	Sodium (Na), total mg/l	Strontium (Sr), total mg/l	Thallium (Tl), total mg/l	Tin (Sn), Total mg/l	Vanadium (V), total mg/l	Zinc (Zn), total mg/l
SW-80	05/24/89		DRY						
FB-	05/30/89		0100 U	21 80	1U	0100 U	100 U	0500 U	0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

DISSOLVED METALS

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
SW-04	05/30/89		DRY						
SW-05	05/30/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	20 90
SW-06	05/31/89		454	0600 U	0100 U	200 U	0050 U	0050 U	14 50
SW-07	05/31/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	23 60
SW-104	06/01/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	55 30
SW-107	05/26/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	21 40
SW-108	05/30/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	63 90
SW-108	05/30/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	64
SW-41	05/26/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	34 80

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe) diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
SW-04	05/30/89		DRY						
SW-05	05/30/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U
SW-06	05/31/89		1U	0100 U	0500 U	0250 U	371	0131	0100 U
SW-07	05/31/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U
SW-104	06/01/89		1U	0100 U	0500 U	0250 U	116	0050 U	0100 U
SW-107	05/26/89		1U	0100 U	0500 U	0250 U	453	0050 U	0100 U
SW-108	05/30/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0166
SW-108	05/30/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0165
SW-41	05/26/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
SW-04	05/30/89		DRY						
SW-05	05/30/89		5	0150 U	0002 U	0234	0400 U	5U	0050 U
SW-06	05/31/89		5U	0290	0002 U	0176	0400 U	5U	0050 U
SW-07	05/31/89		6 09	0768	0002 U	0119	0400 U	5U	0050 U
SW-104	06/01/89		6 30	0404	0002 U	0154	0400 U	5U	0050 U
SW-107	05/26/89		5 40	0364	0004	0178	0400 U	5U	0050 U
SW-108	05/30/89		11 80	163	0002 U	0100 U	0400 U	5U	0050 U
SW-108	05/30/89		11 80	162	0005	0100 U	0400 U	5U	0050 U
SW-41	05/26/89		9 04	0566	0004	0105	0400 U	5U	0050 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
SW-04	05/30/89		DRY						
SW-05	05/30/89		0100 U	15 10	1U	0100 U	100 U	0500 U	0200 U
SW-06	05/31/89		0100 U	21 40	1U	0100 U	100 U	0500 U	0228
SW-07	05/31/89		0100 U	33 80	1U	0500 U	100 U	0500 U	0200 U
SW-104	06/01/89		0100 U	14 10	1U	0500 U	100 U	0500 U	0200 U
SW-107	05/26/89		0100 U	15 60	1U	0500 U	100 U	0500 U	0200 U
SW-108	05/30/89		0100 U	20 10	1U	0500 U	100 U	0500 U	0200 U
SW-108	05/30/89		0100 U	20	1U	0100 U	100 U	0500 U	0200 U
SW-41	05/26/89		0100 U	26 10	1U	0500 U	100 U	0500 U	0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
SW-80	05/24/89		DRY						
FB	05/30/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	5U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
SW-80	05/24/89		DRY						
FB	05/30/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
SW-80	05/24/89		DRY						
FB	05/30/89		5U	0150 U	0002 U	0124	0400 U	5U	0050 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Surface Water Dissolved Metals Results

For Stations at Rockwell (Rocky Flats) - ROUND TWO

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
SW-80	05/24/89		DRY						
FB	05/30/89		0100 U	5U	1U	0100 U	100 U	0500 U	0200 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

TOTAL RADIOCHEMISTRY

Surface Water Total Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 2

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
SW004	05/30/89	DRY			
SW005	05/30/89	-2 ± 2	0 ± 2	0 4 ± 0 2	0 0 ± 0 1
SW006	05/31/89	0 ± 2	4 ± 2	0 3 ± 0 2	0 0 ± 0 1
SW007	05/31/89	2 ± 3	3 ± 3	0 1 ± 0 1	0 0 ± 0 1
SW104	06/01/89	78 ± 29	58 ± 11	0 5 ± 0 2	0 0 ± 0 1
SW107	05/26/89	0 ± 2	3 ± 2	0 4 ± 0 2	0 0 ± 0 1
SW108	05/30/89	-2 ± 4	3 ± 3	0 4 ± 0 2	0 0 ± 0 1
SW108	05/30/89	1 ± 4	2 ± 3	0 4 ± 0 2	0 0 ± 0 1
SW041	05/26/89	1 ± 4	7 ± 3	0 7 ± 0 2	0 0 ± 0 1
SW080	05/24/89	DRY			
FB	05/30/89	0 ± 1	-1 ± 2	0 0 ± 0 1	0 0 ± 0 1

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 2

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
SW004	05/30/89	DRY			
SW005	05/30/89	0 0 ± 0 1	0 0 ± 0 3	0 00 ± 0 01	0 00 ± 0 01
SW006	05/31/89	0 4 ± 0 2	0 8 ± 0 5	0 00 ± 0 01	0 00 ± 0 01
SW007	05/31/89	0 1 ± 0 1	0 2 ± 0 4	0 02 ± 0 01	0 00 ± 0 01
SW104	06/01/89	0 3 ± 0 2	0 4 ± 0 4	0 08 ± 0 03	0 01 ± 0 01
SW107	05/26/89	0 4 ± 0 2	0 0 ± 0 4	0 00 ± 0 01	0 00 ± 0 02
SW108	05/30/89	0 3 ± 0 2	0 2 ± 0 4	0 00 ± 0 01	0 00 ± 0 01
SW108	05/30/89	0 2 ± 0 2	-0 3 ± 0 4	0 00 ± 0 01	0 00 ± 0 01
SW041	05/26/89	0 4 ± 0 2	0 2 ± 0 4	0 00 ± 0 01	0 00 ± 0 02
SW080	05/24/89	DRY			
FB	05/30/89	0 0 ± 0 1	-0 1 ± 0 4	0 00 ± 0 01	0 01 ± 0 01

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Surface Water Total Radiochemistry Results

for Stations at Rocky Flats Plant - ROUND 2

BACKGROUND SURFACE WATER STATIONS - 1989

Station Number	Date Sampled	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
SW004	05/30/89	DRY			
SW005	05/30/89	-0 2 ± 0 6	-60 ± 160	NR	NR
SW006	05/31/89	0 1 ± 0 7	110 ± 210	NR	NR
SW007	05/31/89	0 3 ± 0 5	550 ± 220	NR	NR
SW104	06/01/89	0 4 ± 0 7	110 ± 210	1 4 ± 1 0	NR
SW107	05/26/89	0 1 ± 0 6	200 ± 230	NR	NR
SW108	05/30/89	-0 6 ± 0 8	230 ± 160	NR	NR
SW108	05/30/89	0 2 ± 0 6	550 ± 210	NR	NR
SW041	05/26/89	-0 1 ± 0 8	170 ± 230	NR	NR
SW080	05/24/89	DRY			
FB	05/30/89	-0 4 ± 0 6	40 ± 160	NR	NR

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

APPENDIX A-4

GROUND-WATER ANALYTICAL DATA

BACKGROUND ROUND 1

GROUND WATER SAMPLE INFORMATION

		SAMPLE INFORMATION					FIELD PARAMETERS			LABORATORY ANALYTES							
WELL NUMBER	PREVIOUS WELL NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	pH	FIELD COND (umhos/cm)	TEMP (deg C)	VOA	SEMI-VOA	PEST PCB	TOTAL METALS	DISS METALS	INORG	TOT RADS	DISS RADS
B102289	1889	G18890489001	04/25/89	04/27/89	06/12/89	MJS042589001	7 00	130 0	10 0	N	N	N	N	R	R	N	R
B102389	1989	G19890489001	04/25/89	04/27/89	06/12/89	MJS042589001	6 70	250 0	9 0	N	N	N	N	R	R	N	R
B200589	0589	G05890689001	06/07/89	06/08/89	07/24/89	MJS060789001	7 00	150 0	10 5	N	N	N	N	R	R	N	R
B200689	0689	G06890689001	06/07/89	06/08/89	07/24/89	MJS060789001	7 20	200 0	11 0	N	N	N	N	R	R	N	R
B200789	0789	G07890689001	06/06/89	06/07/89	07/23/89	MJS060689001	7 40	220 0	11 0	N	N	N	N	R	R	N	R
B200889	0889	G08890689001	06/05/89	06/05/89	07/21/89	MJS060589001	8 60	205 0	12 2	N	N	N	N	R	R	N	R
B201089	0989	DRY	04/19/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B201189	1089	G10890589001	05/05/89	05/05/89	06/20/89	MJS050489001	7 20	550 0	10 0	N	N	N	N	R	R	N	R
B201289	1189	DRY	05/15/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B201489	1289	DRY	05/15/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B201589	1389	DRY	05/12/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B202489	2089	G20890489001D	04/24/89	04/27/89	06/12/89	MJS042489001	7 00	265 0	12 0	N	N	N	N	R	R	N	R
B202489	2089	G20890489001	04/24/89	04/27/89	06/12/89	MJS042489001	7 00	265 0	12 0	N	N	N	N	R	R	N	R
B202589	2189	G21890489001	04/26/89	04/27/89	06/12/89	MJS042689004	7 30	265 0	11 0	N	N	N	N	R	R	N	R

FB - Field Blank N - Not sampled for this group, Y - Sampled for this group, results not yet received, R - Results for this group received

BACKGROUND ROUND 1

GROUND WATER SAMPLE INFORMATION

		SAMPLE INFORMATION					FIELD PARAMETERS			LABORATORY ANALYTES							
WELL NUMBER	PREVIOUS WELL NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	pH	FIELD COND (umhos/cm)	TEMP (deg C)	VOA	SEMI-VOA	PEST PCB	TOTAL METALS	DISS METALS	INORG	TOT RADS	DISS RADS
B203189	2789BR	DRY	05/24/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B203289	2889BR	G28890689001	06/20/89	06/20/89	08/05/89	MJS062089001	8 00	400 0	15 0	N	N	N	N	R	R	N	R
B203489	2989BR	DRY	05/25/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B203589	3089BR	DRY	05/22/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B203689	3189BR	G31890589001	05/25/89	05/25/89	07/10/89	MJS052589001	7 80	230 0	11 0	N	N	N	N	R	R	N	R
B203689	3189BR	G31890589001D	05/25/89	05/25/89	07/10/89	MJS052589001	7 80	230 0	11 0	N	N	N	N	R	R	N	R
B203789	3289BR	G32890689001	06/27/89	06/28/89	08/13/89	MJS062789001	10 00	260 0	12 0	N	N	N	N	R	R	N	R
B203889	3389BR	G33890789001	06/29/89	07/15/89	08/30/89	CSW071489001	9 80	340 0	20 0	N	N	N	N	R	R	N	R
B203989	3489BR	G34890689001	06/16/89	06/16/89	08/01/89	MJS061689001	9 00	320 0	13 0	N	N	N	N	R	R	N	R
B204089	3589BR	G35890789001	07/06/89	08/10/89	09/25/89	CSW080989001	9 70	1000 0	17 0	N	N	N	N	R	R	N	R
B204189	3689BR	G36890689001	06/27/89	06/28/89	08/13/89	MJS062789001	10 40	1800 0	12 0	N	N	N	N	R	R	N	R
B205589	4689	DRY	05/05/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	Y
B301889	1489	DRY	05/11/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B302089	1689	DRY	05/16/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N

FB - Field Blank N - Not sampled for this group, Y - Sampled for this group, results not yet received, R - Results for this group received

BACKGROUND ROUND 1

GROUND WATER SAMPLE INFORMATION

		SAMPLE INFORMATION					FIELD PARAMETERS			LABORATORY ANALYTES							
WELL NUMBER	PREVIOUS WELL NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	pH	FIELD COND (umhos/cm)	TEMP (deg C)	VOA	SEMI-VOA	PEST PCB	TOTAL METALS	DISS METALS	INORG	TOT RADS	DISS RADS
B302789	2389	G23890489001	04/26/89	04/27/89	06/12/89	MJS042689001	7 50	370 0	10 0	N	N	N	N	R	R	N	R
B302889	2489	G24890489001	04/27/89	04/28/89	06/13/89	MJS042789001	7 50	410 0	11 0	N	N	N	N	R	R	N	R
B302989	2589	G25890489001	04/27/89	04/28/89	06/13/89	MJS042789001	7 50	475 0	9 0	N	N	N	N	R	R	N	R
B303089	2689	DRY	05/10/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B304289	3789BR	G37890689001	06/23/89	06/23/89	08/08/89	DEJ062389001	9 00	760 0	21 0	N	N	N	N	R	R	N	R
B304789	3989BR	DRY	05/24/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B304889	4089BR	DRY	05/22/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B304989	4189BR	G41890689001	06/23/89	06/23/89	08/08/89	DEJ062389001	8 90	890 0	21 0	N	N	N	N	R	R	N	R
B305389	4489BR	G44890589001	05/31/89	05/31/89	07/16/89	DEJ053189001	7 30	570 0	12 0	N	N	N	N	R	R	N	R
B400189	0189A	G01890689001	06/14/89	06/15/89	07/31/89	MJS061589001	6 60	140 0	11 0	N	N	N	N	R	R	N	R
B400289	0289	G02890689001	06/14/89	06/15/89	07/31/89	MJS061589001	6 70	160 0	11 5	N	N	N	N	R	R	N	R
B400389	0389	G03890689001	06/14/89	06/16/89	08/01/89	MJS061689001	7 40	380 0	11 5	N	N	N	N	R	R	N	R
B400489	0489	G04890689001	06/15/89	06/15/89	07/31/89	MJS061589001	7 00	210 0	13 0	N	N	N	N	R	R	N	R
B401989	1589	G15890589001	05/04/89	05/05/89	06/20/89	MJS050489001	7 10	340 0	9 0	N	N	N	N	R	R	N	R

FB - Field Blank N - Not sampled for this group, Y - Sampled for this group, results not yet received, R - Results for this group received

BACKGROUND ROUND 1

GROUND WATER SAMPLE INFORMATION

		SAMPLE INFORMATION					FIELD PARAMETERS			LABORATORY ANALYTES							
WELL NUMBER	PREVIOUS WELL NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	pH	FIELD COND (umhos/cm)	TEMP (deg C)	VOA	SEMI-VOA	PEST PCB	TOTAL METALS	DISS METALS	INORG	TOT RADS	DISS RADS
B401989	1589	G15890589001D	05/04/89	05/05/89	06/20/89	MJS050489001	7 10	340 0	9 0	N	N	N	N	R	R	N	R
B402189	1789BR	G17890689001	06/05/89	06/05/89	07/21/89	MJS060589001	8 40	345 0	10 0	N	N	N	N	R	R	N	R
B402689	2289	G22890489001	04/27/89	04/28/89	06/13/89	MJS042789001	7 10	500 0	14 0	N	N	N	N	R	R	N	R
B405189	4289BR	DRY	05/24/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B405289	4389BR	DRY	06/23/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
B405489	4589BR	G45890689001	06/21/89	06/23/89	08/08/89	DEJ062189001	8 10	325 0	23 0	N	N	N	N	R	R	N	R
B405586	5586	G55860689001	06/08/89	06/09/89	07/25/89	MJS060889001	7 10	180 0	11 0	N	N	N	N	R	R	N	R
B405689	4789	G47890689001	06/14/89	06/15/89	07/31/89	MJS061589001	7 50	340 0	11 0	N	N	N	N	R	R	N	R
B405789	4889	G48890689001	06/15/89	06/16/89	08/01/89	MJS061689001	7 00	190 0	13 0	N	N	N	N	R	R	N	R
B405889	4989BR	G49890689001	06/14/89	06/14/89	07/30/89	WWB061489001	7 00	250 0	9 0	N	N	N	N	R	R	N	R
B405889	4989BR	G49890689001D	06/14/89	06/14/89	07/30/89	WWB061489001	7 00	250 0	9 0	N	N	N	N	R	R	N	R
B405989	5089	DRY	05/17/89	/ /	/ /		N/A	N/A	N/A	N	N	N	N	N	N	N	N
FB	FB	G20890489001FB	04/24/89	04/27/89	06/12/89	MJS042489001	N/A	N/A	N/A	N	N	N	N	R	N	N	R
FB	FB	G10890589001FB	05/05/89	05/05/89	06/20/89	MJS050589001	N/A	N/A	N/A	N	N	N	N	R	N	N	R
FB	FB	G31890589001FB	05/25/89	05/25/89	07/10/89	MJS052589001	N/A	N/A	N/A	N	N	N	N	R	N	N	R
FB	FB	G49890689001FB	06/14/89	06/14/89	07/30/89	WWB061489001	N/A	N/A	N/A	N	N	N	N	R	N	N	R

FB - Field Blank N - Not sampled for this group, Y - Sampled for this group, results not yet received, R - Results for this group received

QA/QC SAMPLES

DISSOLVED METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND GROUNDWATER FIELD BLANKS - ROUND ONE

Well Number	Date* Sampled	Qtr	Aluminum (Al) diss mg/l	Antimony (Sb) diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
FB	04/24/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	5U
FB	05/05/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	5U
FB	05/25/89		200 U	060 U	010 U	200 U	005 U	005 U	5 0 U
FB	06/14/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	5U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND GROUNDWATER FIELD BLANKS - ROUND ONE

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr) diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
FB	04/24/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U
FB	05/05/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U
FB	05/25/89		1 000 U	010 U	050 U	025 U	100 U	0050 U	010 U
FB	06/14/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND GROUNDWATER FIELD BLANKS - ROUND ONE

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
FB	04/24/89		5U	0150 U	0002 U	0100 U	0400 U	5U	0050 U
FB	05/05/89		5U	0150 U	0002 U	0136	0400 U	5U	0050 U
FB	05/25/89		5U	015 U	0023	0145	040 U	5U	005 U
FB	06/14/89		5U	0150 U	0002 U	100 U	0400 U	5U	0050 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND GROUNDWATER FIELD BLANKS - ROUND ONE

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
FB	04/24/89		0100 U	5U	1U	0100 U	100 U	0500 U	0200 U
FB	05/05/89		0100 U	5U	1U	0100 U	100 U	0500 U	0200 U
FB	05/25/89		010 U	5U	1U	010 U	100 U	050 U	020 U
FB	06/14/89		0100 U	5U	1U	0100 U	100 U	0500 U	0200 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

DISSOLVED RADIOCHEMISTRY

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND GROUNDWATER FIELD BLANKS - ROUND ONE

Well Number	Date Sampled	Qtr	Gross Alpha PCI/L	(MDA)	Gross Beta PCI/L	(MDA)	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)
FB	04/24/89		-1 ± 1		1 ± 2		0 0 ± 0 1		0 0 ± 0 1	
FB	05/05/89		0 ± 1		-1 ± 2		0 0 ± 0 1		0 0 ± 0 1	
FB	05/25/89		0 ± 1		1 ± 2		0 0 ± 0 1		0 0 ± 0 1	
FB	06/14/89		1 ± 1		2 ± 2		0 0 ± 0 1		0 0 ± 0 1	

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND GROUNDWATER FIELD BLANKS - ROUND ONE

Well Number	Date Sampled	Qtr	Uranium 238 PCI/L	(MDA)	Strontium 89, 90 PCI/L	(MDA)	Plutonium 239, 240 PCI/L	(MDA)	Americium 241 PCI/L	(MDA)
FB	04/24/89		0 0 ± 0 1		0 1 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
FB	05/05/89		0 0 ± 0 1		0 3 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
FB	05/25/89		0 0 ± 0 1		-0 1 ± 0 3		0 00 ± 0 01		0 00 ± 0 01	
FB	06/14/89		0 0 ± 0 1		-0 2 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND GROUNDWATER FIELD BLANKS - ROUND ONE

Well Number	Date Sampled	Qtr	Cesium 137 PCI/L	(MDA)	Tritium PCI/L	(MDA)	Radium 226 PCI/L	Radium 228 PCI/L
FB	04/24/89		0 1 ± 0 6		130 ± 150		NR	NR
FB	05/05/89		0 0 ± 0.6		10 ± 140		NR	NR
FB	05/25/89		-0 1 ± 0 6		-70 ± 150		NR	NR
FB	06/14/89		-0 1 ± 0 5		-70 ± 150		NR	NR

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

ROCKY FLATS ALLUVIAL GROUND WATER

DISSOLVED METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B400189	06/14/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B400289	06/14/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B400389	06/14/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B400489	06/15/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B200589	06/07/89		100 U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B200689	06/07/89		100 U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B200789	06/06/89		100 U	0100 U	0500 U	0250 U	266	0050 U	100 U
B200889	06/05/89		1U	0100 U	0500 U	0250 U	129	0050 U	0100 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B400189	06/14/89		5U	151	0002 U	100 U	0400 U	5U	0050 U
B400289	06/14/89		5U	257	0002 U	100 U	0400 U	5U	0050 U
B400389	06/14/89		5 23	0847	0002 U	100 U	0400 U	5U	0050 U
B400489	06/15/89		5U	268	0002 U	100 U	0400 U	5U	0050 U
B200589	06/07/89		5U	0615	0002 U	100 U	0400 U	5U	0050 U
B200689	06/07/89		5U	0187	0002 U	100 U	0400 U	5U	0050 U
B200789	06/06/89		5 29	0201	0002 U	100 U	0432	5U	0500 U
B200889	06/05/89		5 79	0283	0002 U	0136	0400 U	5U	0050 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B400189	06/14/89		0100 U	6 89	1U	0100 U	100 U	0500 U	0200 U
B400289	06/14/89		0100 U	7 77	1U	0100 U	100 U	0500 U	0200 U
B400389	06/14/89		0100 U	5U	1U	0400 U	100 U	0500 U	0200 U
B400489	06/15/89		0100 U	8 90	1U	0400 U	100 U	0500 U	0200 U
B200589	06/07/89		0100 U	8 03	100 U	0100 U	100 U	0500 U	0289
B200689	06/07/89		0100 U	7 35	130	0100 U	100 U	0500 U	0405
B200789	06/06/89		0100 U	8 36	159	0100 U	500 U	0500 U	141
B200889	06/05/89		0100 U	8 55	1U	0100 U	100 U	0500 U	0200 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B405689	06/14/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	64 50
B405789	06/15/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	30 90
B405586	06/08/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	21 50

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B405689	06/14/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B405789	06/15/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B405586	06/08/89		100 U	0100 U	0500 U	0250 U	100 U	0050 U	100 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B405689	06/14/89		5 32	139	0002 U	100 U	0400 U	5U	0050 U
B405789	06/15/89		5U	0150 U	0002 U	100 U	0400 U	5U	0050 U
B405586	06/08/89		5U	0231	0002 U	100 U	0400 U	7 73	0050 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B405689	06/14/89		0100 U	5U	1U	0100 U	100 U	0500 U	0200 U
B405789	06/15/89		0100 U	9 02	1U	0400 U	100 U	0500 U	0200 U
B405586	06/08/89		0100 U	11	115	0100 U	100 U	0500 U	0383

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

INORGANICS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B400189	06/14/89		170	7	0 88	18	72
B400289	06/14/89		150	5	0 87	16	83
B400389	06/14/89		300	8	1 2	39	450
B400489	06/15/89		220	11	0 92	22	150
B200589	06/07/89		210	3	2 1	10	72
B200689	06/07/89		160	4	2 0	16	100
B200789	06/06/89		210	4	2 0	21	130
B200889	06/05/89		280	4	2 3	29	140

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L
B400189	06/14/89		5 U	7 0	0 0025 U
B400289	06/14/89		5 U	7 2	0 0025 U
B400389	06/14/89		5 U	7 5	0 0025 U
B400489	06/15/89		5 U	7 9	0 0025 U
B200589	06/07/89		5 U	6 6	0038
B200689	06/07/89		5 U	7 0	0025 U
B200789	06/06/89		5 U	7 7	0025 U
B200889	06/05/89		5 U	7 3	0 0025 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B405689	06/14/89		250	4	0 66	32	200
B405789	06/15/89		180	14	1 2	16	100
B405586	06/08/89		260	5	1 3	26	86

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L
B405689	06/14/89		5 U	7 9	0 0025 U
B405789	06/15/89		5 U	7 2	0 0025 U
B405586	06/08/89		5 U	6 9	0035

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E=

DISSOLVED RADIOCHEMISTRY

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr	Gross Alpha PCI/L	(MDA)	Gross Beta PCI/L	(MDA)	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)
B400189	06/14/89		2 ± 2		13 ± 3		0 1 ± 0 1		0 0 ± 0 1	
B400289	06/14/89		0 ± 1		1 ± 2		1 2 ± 0 3		0 0 ± 0 3	
B400389	06/14/89		6 ± 3		2 ± 2		0 6 ± 0 2		0 0 ± 0 1	
B400489	06/15/89		2 ± 2		-1 ± 2		0 6 ± 0 2		0 0 ± 0 1	
B200589	06/07/89		1 ± 2		2 ± 2		0 3 ± 0 1		0 0 ± 0 1	
B200689	06/07/89		5 ± 3		1 ± 2		0 1 ± 0 1		0 0 ± 0 1	
B200789	06/06/89		3 ± 3		3 ± 2		0 1 ± 0 1		0 0 ± 0 1	
B200889	06/05/89		12 ± 8		7 ± 5		0 2 ± 0 1		0 0 ± 0 1	
B405689	06/14/89		3 ± 3		1 ± 2		1 3 ± 0 3		0 0 ± 0 1	
B405789	06/15/89		1 ± 2		2 ± 2		0 0 ± 0 1		0 0 ± 0 1	
B405586	06/08/89		0 ± 2		8 ± 3		0 1 ± 0 1		0 0 ± 0 1	

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr	Uranium 238 PCI/L	(MDA)	Strontium 89, 90 PCI/L	(MDA)	Plutonium 239, 240 PCI/L	(MDA)	Americium 241 PCI/L	(MDA)
B400189	06/14/89		0 0 ± 0.1		0 1 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B400289	06/14/89		0 7 ± 0 2		0 0 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B400389	06/14/89		0 4 ± 0 2		0 0 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B400489	06/15/89		0 3 ± 0 1		0 1 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B200589	06/07/89		0 2 ± 0 1		-0 7 ± 1 0		0 00 ± 0 01		0 00 ± 0 01	
B200689	06/07/89		0 1 ± 0 1		-0 1 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
B200789	06/06/89		0 1 ± 0 1		-0 1 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
B200889	06/05/89		0 1 ± 0 1		-0 1 ± 0 6		0 01 ± 0 01		0 00 ± 0 02	
B405689	06/14/89		1 1 ± 0 3		0 1 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B405789	06/15/89		0 0 ± 0 1		0 1 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B405586	06/08/89		0 1 ± 0 1		0 1 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	

Notes. NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND ROCKY FLATS ALLUVIUM

Well Number	Date Sampled	Qtr	Cesium 137 PCI/L	(MDA)	Tritium PCI/L	(MDA)	Radium 226 PCI/L	Radium 228 PCI/L
B400189	06/14/89		0 0 ± 0 5		200 ± 210		NR	NR
B400289	06/14/89		0 0 ± 0 4		160 ± 210		NR	NR
B400389	06/14/89		0 2 ± 0 6		150 ± 150		0 4 ± 0 5	NR
B400489	06/15/89		0 0 ± 0 5		30 ± 210		NR	NR
B200589	06/07/89		-0 2 ± 0 6		110 ± 150		NR	NR
B200689	06/07/89		-0 1 ± 0 7		140 ± 150		0 1 ± 0 5	NR
B200789	06/06/89		-0 1 ± 0 5		250 ± 220		NR	NR
B200889	06/05/89		-0 3 ± 0 7		160 ± 210		0 5 ± 0 5	NR
B405689	06/14/89		0 3 ± 0 5		190 ± 210		NR	NR
B405789	06/15/89		0 3 ± 0 6		80 ± 150		NR	NR
B405586	06/08/89		0 3 ± 0 6		80 ± 140		NR	NR

Notes: NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

COLLUVIAL GROUND WATER

DISSOLVED METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B201089	04/19/89		DRY						
B201189	05/05/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	76 80
B201289	05/15/89		DRY						
B201489	05/15/89		DRY						
B201589	05/12/89		DRY						
B301889	05/11/89		DRY						
B401989	05/04/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	63
B401989	05/04/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	65 60
B302089	05/16/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B201089	04/19/89		DRY						
B201189	05/05/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	172
B201289	05/15/89		DRY						
B201489	05/15/89		DRY						
B201589	05/12/89		DRY						
B301889	05/11/89		DRY						
B401989	05/04/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U
B401989	05/04/89		1U	0100 U	0500 U	0250 U	100 U	0250 U	0100 U
B302089	05/16/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B201089	04/19/89		DRY						
B201189	05/05/89		15 30	0880	0002 U	0100 U	0400 U	5U	0050 U
B201289	05/15/89		DRY						
B201489	05/15/89		DRY						
B201589	05/12/89		DRY						
B301889	05/11/89		DRY						
B401989	05/04/89		10 10	0150 U	0002 U	0100 U	0400 U	5U	0050 U
B401989	05/04/89		10 60	0150 U	0002 U	0100 U	0400 U	5U	0050 U
B302089	05/16/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B201089	04/19/89		DRY						
B201189	05/05/89		0100 U	98 70	1U	0400 U	100 U	0500 U	0200 U
B201289	05/15/89		DRY						
B201489	05/15/89		DRY						
B201589	05/12/89		DRY						
B301889	05/11/89		DRY						
B401989	05/04/89		0100 U	27 40	1U	0100 U	100 U	0500 U	0200 U
B401989	05/04/89		0100 U	28 10	1U	0400 U	100 U	0500 U	0200 U
B302089	05/16/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B205589	05/05/89		DRY						
B405989	05/17/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B205589	05/05/89		DRY						
B405989	05/17/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B205589	05/05/89		DRY						
B405989	05/17/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B205589	05/05/89		DRY						
B405989	05/17/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

INORGANICS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B201089	04/19/89		DRY				
B201189	05/05/89		520	11	0 05 U	86	470
B201289	05/15/89		DRY				
B201489	05/15/89		DRY				
B201589	05/12/89		DRY				
B301889	05/11/89		DRY				
B401989	05/04/89		2900	18	0 20	41	230
B401989	05/04/89		290	20	0 18	45	230
B302089	05/16/89		DRY				

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L	Suspended Solids MG/L
B201089	04/19/89		DRY			
B201189	05/05/89		5 U	7 4	0 0025 U	5 U
B201289	05/15/89		DRY			
B201489	05/15/89		DRY			
B201589	05/12/89		DRY			
B301889	05/11/89		DRY			
B401989	05/04/89		5 U	7 1	0 0025 U	900
B401989	05/04/89		5 U	7 1	0 0025 U	40
B302089	05/16/89		DRY			

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
8205589	05/05/89		DRY				
8405989	05/17/89		DRY				

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND COLLUVIUM

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide Total MG/L	Suspended Solids MG/L
B205589	05/05/89		DRY			
B405989	05/17/89		DRY			

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

DISSOLVED RADIOCHEMISTRY

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr	Gross Alpha PCI/L	(MDA)	Gross Beta PCI/L	(MDA)	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)
B201089	04/19/89		DRY							
B201189	05/05/89		27 ± 12		12 ± 5		11 ± 1		0 3 ± 0 1	
B201289	05/15/89		DRY							
B201489	05/15/89		DRY							
B201589	05/12/89		DRY							
B301889	05/11/89		DRY							
B401989	05/04/89		0 ± 3		2 ± 2		0 9 ± 0 3		0 0 ± 0 1	
B401989	05/04/89		1 ± 3		2 ± 2		0 6 ± 0 2		0 0 ± 0 1	
B302089	05/16/89		DRY							
B205589	05/05/89		DRY							
B405989	05/17/89		DRY							

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr	Uranium 238 PCI/L	(MDA)	Strontium 89, 90 PCI/L	(MDA)	Plutonium 239, 240 PCI/L	(MDA)	Americium 241 PCI/L	(MDA)
B201089	04/19/89		DRY							
B201189	05/05/89		7 7 ± 0 7		0 1 ± 0 4		0 00 ± 0 01		-0 01 ± 0 01	
B201289	05/15/89		DRY							
B201489	05/15/89		DRY							
B201589	05/12/89		DRY							
B301889	05/11/89		DRY							
B401989	05/04/89		0 3 ± 0 2		0 1 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
B401989	05/04/89		0 4 ± 0 2		0 0 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
B302089	05/16/89		DRY							
B205589	05/05/89		DRY							
B405989	05/17/89		DRY							

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND COLLUVIUM

Well Number	Date Sampled	Qtr	Cesium 137 PCI/L	(MDA)	Tritium PCI/L	(MDA)	Radium 226 PCI/L	Radium 228 PCI/L
B201089	04/19/89		DRY					
B201189	05/05/89		0 2 ± 0.6		-100 ± 140		0 4 ± 0 2	NR
B201289	05/15/89		DRY					
B201489	05/15/89		DRY					
B201589	05/12/89		DRY					
B301889	05/11/89		DRY					
B401989	05/04/89		-0 1 ± 0.6		140 ± 150		NR	NR
B401989	05/04/89		-0 6 ± 0 6		100 ± 150		NR	NR
B302089	05/16/89		DRY					
B205589	05/05/89		DRY					
B405989	05/17/89		DRY					

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

VALLEY FILL ALLUVIAL GROUND WATER

DISSOLVED METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As) diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B102289	04/25/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	18 90
B102389	04/25/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	36 40
B202489	04/24/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	40 30
B202489	04/24/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	41 90
B202589	04/26/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	40 30
B402689	04/27/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	103
B302789	04/26/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	68 10
B302889	04/27/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	76 70
B302989	04/27/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	70 20

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B102289	04/25/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U
B102389	04/25/89		1U	0100 U	0500 U	0250 U	944	0050 U	0116
B202489	04/24/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0133
B202489	04/24/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0134
B202589	04/26/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0154
B402689	04/27/89		1U	0100 U	0500 U	0250 U	100 U	0250 U	0167
B302789	04/26/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0126
B302889	04/27/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0164
B302989	04/27/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0223

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B102289	04/25/89		5U	0649	0003	0100 U	0400 U	5U	0050 U
B102389	04/25/89		8 61	208	0002 U	0100 U	0400 U	5U	0050 U
B202489	04/24/89		8 19	0150 U	0002 U	0100 U	0400 U	5U	0050 U
B202489	04/24/89		8 50	0150 U	0003	0100 U	0400 U	5U	0050 U
B202589	04/26/89		8 51	0150 U	0002 U	0100 U	0400 U	5U	0050 U
B402689	04/27/89		18 10	686	0002 U	0100 U	0400 U	5U	0050 U
B302789	04/26/89		11 80	0150 U	0002 U	0100 U	0400 U	5U	0050 U
B302889	04/27/89		13 80	0150 U	0002 U	0100 U	0400 U	5U	0050 U
B302989	04/27/89		16 60	0546	0002 U	0100 U	0400 U	5U	0114

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B102289	04/25/89		0100 U	19 30	1U	0400 U	100 U	0500 U	0200 U
B102389	04/25/89		0100 U	34 70	1U	0400 U	100 U	0500 U	0200 U
B202489	04/24/89		0100 U	27 30	1U	0400 U	100 U	0500 U	0200 U
B202489	04/24/89		0100 U	25 90	1U	0400 U	100 U	0500 U	0200 U
B202589	04/26/89		0100 U	33 80	1U	0400 U	100 U	0500 U	0200 U
B402689	04/27/89		0100 U	45 90	1U	0400 U	100 U	0500 U	0212
B302789	04/26/89		0100 U	31 40	1U	0400 U	100 U	0500 U	0200 U
B302889	04/27/89		0100 U	37 30	1U	0400 U	100 U	0500 U	0200 U
B302989	04/27/89		0100 U	74 70	1U	0400 U	100 U	0500 U	0200 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B303089	05/10/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B303089	05/10/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results
For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B303089	05/10/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B303089	05/10/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

INORGANICS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B102289	04/25/89		800	3 U	0 69	13	110
B102389	04/25/89		370	6	0 05 U	41	230
B202489	04/24/89		220	8 4	0 05 U	32	180
B202489	04/24/89		200	8 4	0 05 U	40	180
B202589	04/26/89		290	8	0 05 U	53	180
B402689	04/27/89		380	19	0 05 U	52	610
B302789	04/26/89		360	14	0 05	56	280
B302889	04/27/89		460	21	0 05 U	77	280
B302989	04/27/89		470	26	0 08	120	280

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L	Suspended Solids MG/L
B102289	04/25/89		5 U	7 0	0 0025 U	2700
B102389	04/25/89		5 U	6 8	0 0025 U	18,000
B202489	04/24/89		5 U	7 5	0 0025 U	NR
B202489	04/24/89		5 U	7 4	0 0025 U	NR
B202589	04/26/89		5 U	7 5	0 0025 U	2000
B402689	04/27/89		5 U	7 6	0 0025 U	99
B302789	04/26/89		5 U	7 4	0 0025 U	5800
B302889	04/27/89		5 U	7 5	0 0025 U	47
B302989	04/27/89		5 U	8 0	0 0025 U	92

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B303089	05/10/89		DRY				

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L	Suspended Solids MG/L
B303089	05/10/89		DRY			

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

DISSOLVED RADIOCHEMISTRY

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr	Gross Alpha PCI/L	(MDA)	Gross Beta PCI/L	(MDA)	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)
B102289	04/25/89		2 ± 2		3 ± 2		0 4 ± 0 2		0 0 ± 0 1	
B102389	04/25/89		4 ± 4		2 ± 2		0 4 ± 0 2		0 0 ± 0 1	
B202489	04/24/89		3 ± 4		5 ± 3		1 0 ± 0 3		0 1 ± 0 1	
B202489	04/24/89		2 ± 4		4 ± 3		1 2 ± 0 3		0 0 ± 0 1	
B202589	04/26/89		4 ± 4		6 ± 3		1 4 ± 0 3		0 1 ± 0 1	
B402689	04/27/89		3 ± 8		7 ± 4		4 1 ± 0 6		0 1 ± 0 1	
B302789	04/26/89		3 ± 6		5 ± 3		2 2 ± 0 3		0 1 ± 0 1	
B302889	04/27/89		6 ± 7		14 ± 4		2 9 ± 0 5		0 1 ± 0 1	
B302989	04/27/89		10 ± 9		5 ± 4		3 0 ± 0 4		0 1 ± 0 1	
B303089	05/10/89		DRY							

Notes. NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr	Uranium 238 PCI/L	(MDA)	Strontium 89, 90 PCI/L	(MDA)	Plutonium 239, 240 PCI/L	(MDA)	Americium 241 PCI/L	(MDA)
B102289	04/25/89		0 2 ± 0 2		0 1 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B102389	04/25/89		0 2 ± 0 2		-0 3 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
B202489	04/24/89		0 6 ± 0 2		0 6 ± 0 5		0 00 ± 0 01		-0 01 ± 0 01	
B202489	04/24/89		0 8 ± 0 2		0 3 ± 0 5		0 01 ± 0 01		0.00 ± 0 01	
B202589	04/26/89		1 2 ± 0 3		0 5 ± 0 5		0 00 ± 0 01		-0 01 ± 0 01	
B402689	04/27/89		2 8 ± 0 5		-0 1 ± 0 5		0 00 ± 0 01		-0 01 ± 0 01	
B302789	04/26/89		1 4 ± 0 3		0 3 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
B302889	04/27/89		2 6 ± 0 5		0 1 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
B302989	04/27/89		2 6 ± 0 4		0 0 ± 0 4		0 00 ± 0 01		-0 01 ± 0 01	
B303089	05/10/89		DRY							

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND VALLEY FILL ALLUVIUM

Well Number	Date Sampled	Qtr	Cesium 137 PCI/L	(MDA)	Tritium PCI/L	(MDA)	Radium 226 PCI/L	Radium 228 PCI/L
B102289	04/25/89		-0 3 ± 0 6		50 ± 150		NR	NR
B102389	04/25/89		0 3 ± 0 6		150 ± 150		NR	NR
B202489	04/24/89		-0 1 ± 0 5		170 ± 150		NR	NR
B202489	04/24/89		0 2 ± 0 6		190 ± 150		NR	NR
B202589	04/26/89		0 1 ± 0 6		130 ± 140		NR	NR
B402689	04/27/89		0 0 ± 0 6		380 ± 150		NR	NR
B302789	04/26/89		-0 5 ± 0 8		130 ± 140		NR	NR
B302889	04/27/89		0 1 ± 0 6		130 ± 150		-0 1 ± 0 2	NR
B302989	04/27/89		0 0 ± 0 6		50 ± 150		0 2 ± 0 2	NR
B303089	05/10/89		DRY					

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

WEATHERED CLAYSTONE GROUND WATER

DISSOLVED METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B203189	05/24/89		DRY						
B203289	06/20/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	51 10
B203489	05/25/89		DRY						
B203589	05/22/89		DRY						
B203689	05/25/89		2 U	06 U	01 U	2 U	005 U	005 U	41 4
B203689	05/25/89		2 U	06 U	01 U	2 U	005 U	005 U	41 4
B304789	05/24/89		DRY						
B304889	05/22/89		DRY						
B405189	05/24/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B203189	05/24/89		DRY						
B203289	06/20/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B203489	05/25/89		DRY						
B203589	05/22/89		DRY						
B203689	05/25/89		1 0 U	01 U	05 U	025 U	1 U	005 U	013
B203689	05/25/89		1 0 U	01 U	05 U	025 U	1 U	005 U	013
B304789	05/24/89		DRY						
B304889	05/22/89		DRY						
B405189	05/24/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B203189	05/24/89		DRY						
B203289	06/20/89		45 30	126	0002 U	100 U	0400 U	5U	0050 U
B203489	05/25/89		DRY						
B203589	05/22/89		DRY						
B203689	05/25/89		6 72	07	0008	015	04 U	5 0 U	005 U
B203689	05/25/89		6 72	07	0008	015	04 U	5 0 U	005 U
B304789	05/24/89		DRY						
B304889	05/22/89		DRY						
B405189	05/24/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B203189	05/24/89		DRY						
B203289	06/20/89		0100 U	26 20	1U	0100 U	100 U	0500 U	0594
B203489	05/25/89		DRY						
B203589	05/22/89		DRY						
B203689	05/25/89		01 U	19 8	1 0 U	0 01	1 U	05 U	02 U
B203689	05/25/89		01 U	19 8	1 0 U	0 01	1 U	05 U	02 U
B304789	05/24/89		DRY						
B304889	05/22/89		DRY						
B405189	05/24/89		DRY						

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B305389	05/31/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	73 40
B405489	06/21/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	41 60

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B305389	05/31/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0381
B405489	06/21/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B305389	05/31/89		15 70	0526	0002 U	0113	0400 U	5U	0050 U
B405489	06/21/89		8 17	0150 U	0002 U	100 U	0400 U	5U	0050 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na) diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl) diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B305389	05/31/89		0100 U	36 90	1U	0500 U	100 U	0500 U	0200 U
B405489	06/21/89		0100 U	15 70	1U	0100 U	100 U	0500 U	107

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

INORGANICS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B203189	05/24/89		DRY				
B203289	06/20/89		270	3 U	0 10	28	400
B203489	05/25/89		DRY				
B203589	05/22/89		DRY				
B203689	05/25/89		210	3 U	0 66	13	200
B203689	05/25/89		210	3 U	0 44	11	200
B304789	05/24/89		DRY				
B304889	05/22/89		DRY				
B405189	05/24/89		DRY				

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L	Suspended Solids MG/L
B203189	05/24/89		DRY			
B203289	06/20/89		5 U	8 2	0 0025 U	29,000
B203489	05/25/89		DRY			
B203589	05/22/89		DRY			
B203689	05/25/89		5 U	7 6	0025 U	2,900
B203689	05/25/89		5 U	7 6	0025 U	2,000
B304789	05/24/89		DRY			
B304889	05/22/89		DRY			
B405189	05/24/89		DRY			

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B305389	05/31/89		320	11	0 18	44	260
B405489	06/21/89		220	6	0 58	24	180

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L	Suspended Solids MG/L
B305389	05/31/89		5 U	7 4	0 0025 U	5 U
B405489	06/21/89		5 U	7 5	0 0036	40

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

DISSOLVED RADIOCHEMISTRY

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr	Gross Alpha PCI/L	(MDA)	Gross Beta PCI/L	(MDA)	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)
B203189	05/24/89		DRY							
B203289	06/20/89		12 ± 4		6 ± 2		5 8 ± 0 6		0 1 ± 0 1	
B203489	05/25/89		DRY							
B203589	05/22/89		DRY							
B203689	05/25/89		0 ± 3		3 ± 3		1 1 ± 0 3		0 0 ± 0 1	
B203689	05/25/89		0 ± 3		3 ± 3		0 7 ± 0 2		0 0 ± 0 1	
B304789	05/24/89		DRY							
B304889	05/22/89		DRY							
B405189	05/24/89		DRY							
B305389	05/31/89		10 ± 7		6 ± 3		3 5 ± 0 5		0 2 ± 0 1	
B405489	06/21/89		5 ± 3		7 ± 2		2 6 ± 0 4		0 0 ± 0 1	

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr	Uranium 238 PCI/L	(MDA)	Strontium 89, 90 PCI/L	(MDA)	Plutonium 239, 240 PCI/L	(MDA)	Americium 241 PCI/L	(MDA)
B203189	05/24/89		DRY							
B203289	06/20/89		2 7 ± 0 4		0 1 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B203489	05/25/89		DRY							
B203589	05/22/89		DRY							
B203689	05/25/89		0 4 ± 0 2		-0 1 ± 0 3		0 00 ± 0 01		0 00 ± 0 01	
B203689	05/25/89		0 4 ± 0 2		-0 2 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B304789	05/24/89		DRY							
B304889	05/22/89		DRY							
B405189	05/24/89		DRY							
B305389	05/31/89		3 2 ± 0 5		0 1 ± 0 5		0 03 ± 0 02		0 00 ± 0 01	
B405489	06/21/89		1 7 ± 0 3		0 0 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND WEATHERED CLAYSTONE

Well Number	Date Sampled	Qtr	Cesium 137 PCI/L	(MDA)	Tritium PCI/L	(MDA)	Radium 226 PCI/L	Radium 228 PCI/L
B203189	05/24/89		DRY					
B203289	06/20/89		0 2 ± 0 6		-100 ± 230		0 5 ± 0 7	NR
B203489	05/25/89		DRY					
B203589	05/22/89		DRY					
B203689	05/25/89		0 1 ± 0 5		30 ± 150		NR	NR
B203689	05/25/89		0 2 ± 0 6		80 ± 150		NR	NR
B304789	05/24/89		DRY					
B304889	05/22/89		DRY					
B405189	05/24/89		DRY					
B305389	05/31/89		0 4 ± 0 6		100 ± 160		0 6 ± 0 3	NR
B405489	06/21/89		-0 1 ± 0 5		-70 ± 210		0 4 ± 0 5	NR

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

WEATHERED SANDSTONE GROUND WATER

DISSOLVED METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B402189	06/05/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	65 70
B405889	06/14/89		200 U	176	0100 U	200 U	0050 U	0050 U	34 40
B405889	06/14/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	36 20

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B402189	06/05/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	0106
B405889	06/14/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	1 79
B405889	06/14/89		1U	0122	0500 U	0250 U	100 U	0050 U	100 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B402189	06/05/89		9 41	292	0002 U	0150	0400 U	5U	0050 U
B405889	06/14/89		5 89	0190	0002 U	100 U	0400 U	10 20	0050 U
B405889	06/14/89		6 05	0178	0002 U	100 U	0400 U	5U	0050 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B402189	06/05/89		0100 U	25 60	1U	0500 U	100 U	0500 U	0200 U
B405889	06/14/89		0100 U	21 20	2 03	0100 U	100 U	0500 U	0200 U
B405889	06/14/89		0100 U	13 70	1U	0100 U	100 U	0500 U	0200 U

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date

J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

INORGANICS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B402189	06/05/89		220	15	0 18	48	230
B405889	06/14/89		170	6	1 4	16	140
B405889	06/14/89		170	6	1 6	16	140

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L	Suspended Solids MG/L
B402189	06/05/89		5 U	7 2	0 0025 U	210
B405889	06/14/89		5 U	7 7	0 0025 U	260
B405889	06/14/89		5 U	7 5	0 0025 U	92

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

DISSOLVED RADIOCHEMISTRY

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr	Gross Alpha PCI/L	(MDA)	Gross Beta PCI/L	(MDA)	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)
B203789	06/27/89		13 ± 5		5 ± 3		6 6 ± 1 3		0 0 ± 0 1	
B203889	06/29/89		11 ± 6		8 ± 3		7 5 ± 0 7		0 0 ± 0 1	
B203989	06/16/89		2 ± 2		3 ± 2		0 7 ± 0 3		0 1 ± 0 1	
B204089	07/06/89		NR		NR		0 8 ± 0 2		0 0 ± 0 1	
B204189	06/27/89		NR		NR		1 5 ± 0 3		0 0 ± 0 1	
B304289	06/23/89		0 ± 4		7 ± 3		0 1 ± 0 1		0 0 ± 0 1	
B304989	06/23/89		-2 ± 4		15 ± 4		0 2 ± 0 1		0 0 ± 0 1	
B405289	06/23/89		DRY							

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr	Uranium 238 PCI/L	(MDA)	Strontium 89, 90 PCI/L	(MDA)	Plutonium 239, 240 PCI/L	(MDA)	Americium 241 PCI/L	(MDA)
B203789	06/27/89		1 7 ± 0 7		0 1 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B203889	06/29/89		1 9 ± 0 3		NR		0 00 ± 0 01		0 01 ± 0 01	
B203989	06/16/89		0 1 ± 0 1		-0 2 ± 0 2		0 00 ± 0 01		0 00 ± 0 01	
B204089	07/06/89		0 0 ± 0 1		-0 1 ± 0 3		0 00 ± 0 01		0 00 ± 0 01	
B204189	06/27/89		0 6 ± 0 2		-0 3 ± 0 3		0 00 ± 0 01		0 01 ± 0 01	
B304289	06/23/89		0 1 ± 0 1		0 2 ± 0 4		0 00 ± 0 01		0 00 ± 0 01	
B304989	06/23/89		0 0 ± 0 1		0 2 ± 0 5		0 00 ± 0 01		0 00 ± 0 01	
B405289	06/23/89		DRY							

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date Sampled	Qtr	Cesium 137 PCI/L	(MDA)	Tritium PCI/L	(MDA)	Radium 226 PCI/L	Radium 228 PCI/L
B203789	06/27/89		0 3 ± 0 4		-110 ± 220		NR	NR
B203889	06/29/89		NR		NR		NR	NR
B203989	06/16/89		0 2 ± 0 4		330 ± 160		NR	NR
B204089	07/06/89		0 7 ± 0 5		NR		NR	NR
B204189	06/27/89		-0 1 ± 0 5		100 ± 230		NR	NR
B304289	06/23/89		0 2 ± 0 5		-80 ± 220		NR	NR
B304989	06/23/89		0 2 ± 0 6		-30 ± 220		NR	NR
B405289	06/23/89		DRY					

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

UNWEATHERED SANDSTONE GROUND WATER

DISSOLVED METALS

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Aluminum (Al), diss mg/l	Antimony (Sb), diss mg/l	Arsenic (As), diss mg/l	Barium (Ba), diss mg/l	Beryllium (Be), diss mg/l	Cadmium (Cd), diss mg/l	Calcium (Ca), diss mg/l
B203789	06/27/89		200 U	0600 U	0186	200 U	0050 U	0050 U	8 05
B203889	06/29/89		200 U	0600 U	0106	200 U	0050 U	0050 U	5U
B203989	06/16/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	12 80
B204089	07/06/89		327	060 U	01 U	20 U	005 U	005 U	32 9
B204189	06/27/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	39 60
B304289	06/23/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	10 80
B304989	06/23/89		200 U	0600 U	0100 U	200 U	0050 U	0050 U	20 70

INSUFFICIENT SAMPLE FOR METALS ANALYSIS

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Cesium (Cs), diss mg/l	Chromium (Cr), diss mg/l	Cobalt (Co), diss mg/l	Copper (Cu), diss mg/l	Iron (Fe), diss mg/l	Lead (Pb), diss mg/l	Lithium (Li), diss mg/l
B203789	06/27/89		1U	0100 U	0500 U	0250 U	100 U	0250 U	100 U
B203889	06/29/89		1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B203989	06/16/89		1U	0100 U	0500 U	0250 U	100 U	0250 U	100 U
B204089	07/06/89		1 0 U	01 U	50 U	025 U	10 U	003 U	10 U
B204189	06/27/89		1U	0100 U	0500 U	0250 U	100 U	0250 U	100 U
B304289	06/23/89		100 U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
B304989	06/23/89		100 U	0100 U	0500 U	0250 U	100 U	0050 U	100 U

INSUFFICIENT SAMPLE FOR METALS ANALYSIS

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Magnesium (Mg), diss mg/l	Manganese (Mn), diss mg/l	Mercury (Hg), diss mg/l	Molybdenum (Mo), diss mg/l	Nickel (Ni), diss mg/l	Potassium (K), diss mg/l	Selenium (Se), diss mg/l
B203789	06/27/89		5U	0150 U	0002 U	100 U	0400 U	5U	0076
B203889	06/29/89		5U	0150 U	0002 U	112	0400 U	5U	0410
B203989	06/16/89		5U	0150 U	0002 U	100 U	0400 U	5U	0050 U
B204089	07/06/89		5 0 U	015 U	0002 U	10 U	04 U	21 89	017
B204189	06/27/89		5U	0150 U	0002 U	100 U	0400 U	5 20	0050 U
B304289	06/23/89		5U	0150 U	0002 U	100 U	0400 U	5U	0050 U
B304989	06/23/89		5U	0182	0002 U	100 U	0400 U	12 30	0050 U

INSUFFICIENT SAMPLE FOR METALS ANALYSIS

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation, this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Dissolved Metals Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Silver (Ag), diss mg/l	Sodium (Na), diss mg/l	Strontium (Sr), diss mg/l	Thallium (Tl), diss mg/l	Tin (Sn), diss mg/l	Vanadium (V), diss mg/l	Zinc (Zn), diss mg/l
B203789	06/27/89		0100 U	64 80	1U	0100 U	100 U	0500 U	0200 U
B203889	06/29/89		0100 U	71 30	1U	0100 U	100 U	0500 U	0389
B203989	06/16/89		0100 U	67 80	1U	0400 U	100 U	0500 U	374
B204089	07/06/89		01 U	198 92	1 0 U	01 U	10 U	05 U	047
B204189	06/27/89		0100 U	454	1U	0100 U	100 U	0500 U	0200 U
B304289	06/23/89		0100 U	138	451	0100 U	100 U	0500 U	0329
B304989	06/23/89		0100 U	168	446	0100 U	100 U	0500 U	0299

INSUFFICIENT SAMPLE FOR METALS ANALYSIS

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

INORGANICS

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	Total Dissolved Solids MG/L	Chloride MG/L	Nitrate+ Nitrite-Nitrogen MG/L	Sulfate MG/L	HCO3- MG/L
B203789	06/27/89		240	4 7	0 14	31	130
B203889	06/29/89		260	3 U	0 35	54	120
B203989	06/16/89		230	6	0 06	5 U	210
B204089	07/06/89		760	360	0 05 U	55	67
B204189	06/27/89		1300	220	0 16	620	100
B304289	06/23/89		420	110	0 05 U	8	250
B304989	06/23/89		560	200	0 05 U	5 U	270
B405289	06/23/89		DRY				

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

Groundwater Inorganic Results

For Wells at Rockwell (Rocky Flats)

1989 BACKGROUND UNWEATHERED SANDSTONE

Well Number	Date* Sampled	Qtr	CO3= MG/L	pH pH Unit	Cyanide, Total MG/L	Suspended Solids MG/L
B203789	06/27/89		22	9 4	01 U	440
B203889	06/29/89		31	9 5	01 U	1600
B203989	06/16/89		9	8 7	0 0025 U	140
B204089	07/06/89		5 U	8 6	002 U	62
B204189	06/27/89		18	9 4	0 0025 U	810
B304289	06/23/89		18	8 9	0025 U	10
B304989	06/23/89		6	8 5	0027 U	30
B405289	06/23/89		DRY			

NR = Analyte not reported U = Analyzed but not detected * = Well recovery did not always allow collection of entire sample on one day In that situation this is start date
J = Present below detection limit B = Present in laboratory blank N = Batch spike not in 80-120% range R = Data rejected during validation E= Estimated value

DISSOLVED RADIOCHEMISTRY

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr	Gross Alpha PCI/L	(MDA)	Gross Beta PCI/L	(MDA)	Uranium 233, 234 PCI/L	(MDA)	Uranium 235 PCI/L	(MDA)
B402189	06/05/89		7 ± 5		2 ± 3		1 1 ± 0 3		0 0 ± 0 1	
B405889	06/14/89		1 ± 2		2 ± 2		0 3 ± 0 2		0 0 ± 0 1	
B405889	06/14/89		3 ± 3		0 ± 2		0 3 ± 0 1		0 0 ± 0 1	

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr	Uranium 238 PCI/L	(MDA)	Strontium 89, 90 PCI/L	(MDA)	Plutonium 239, 240 PCI/L	(MDA)	Americium 241 PCI/L	(MDA)
B402189	06/05/89		0 6 ± 0 2		-0 1 ± 0 6		0 00 ± 0 01		0 01 ± 0 01	
B405889	06/14/89		0 1 ± 0 1		0 0 ± 0 3		0 00 ± 0 01		0 00 ± 0 01	
B405889	06/14/89		0 1 ± 0 1		-0 2 ± 0 5		0 01 ± 0 01		0 00 ± 0 01	

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Groundwater Dissolved Radiochemistry Results

for Wells at Rocky Flats Plant

1989 BACKGROUND WEATHERED SANDSTONE

Well Number	Date Sampled	Qtr	Cesium 137 PCI/L	(MDA)	Tritium PCI/L	(MDA)	Radium 226 PCI/L	Radium 228 PCI/L
B402189	06/05/89		0 3 ± 0 7		100 ± 210		0 4 ± 1 0	NR
B405889	06/14/89		0 3 ± 0 6		0 ± 150		NR	NR
B405889	06/14/89		0 0 ± 0 6		-40 ± 150		NR	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

APPENDIX A-5

BOREHOLE SAMPLE ANALYTICAL DATA

BACKGROUND

BOREHOLE SAMPLE INFORMATION

		SAMPLE INFORMATION							LABORATORY ANALYTES					
BOREHOLE NUMBER	PREVIOUS BH NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	DEPTH INCREMENT(ft)	SAMPLE TYPE	VOA	SEMI-VOA	PEST PCB	METALS	INORG	RADS
B405189	BH0189	BH01890003	03/09/89	03/09/89	04/24/89	KEM030989002	0 00 - 3 00	CLAYEY GRAVEL	N	N	N	R	R	R
B405189	BH0189	BH01890309	03/09/89	03/09/89	04/24/89	KEM030989003	3 60 - 8 55	SANDY GRAVEL	N	N	N	R	R	R
B405189	BH0189	BH01890915	03/09/89	03/09/89	04/24/89	KEM030689002	9 60 - 15 40	GRAVELLY CLAYEY SAND	N	N	N	R	R	R
B405189	BH0189	BH01891521	03/09/89	03/09/89	04/24/89	KEM030989002	15 60 - 20 30	SANDY GRAVELLY CLAY	N	N	N	R	R	R
B405189	BH0189	BH01892127	03/09/89	03/09/89	04/24/89	KEM030989002	21 60 - 26 50	GRAVEL	N	N	N	R	R	R
B405189	BH0189	BH01893036	03/10/89	03/10/89	04/25/89	RC031089003	29 50 - 35 60	CLAYEY GRAVEL	N	N	N	R	R	R
B405189	BH0189	BH01893638	03/10/89	03/10/89	04/25/89	RC031089003	35 60 - 37 60	GRAVELLY CLAY	N	N	N	R	R	R
B405189	BH0189	BH01893844	03/10/89	03/10/89	04/25/89	RC031089003	37 60 - 42 60	GRAVELLY CLAYEY SAND	N	N	N	R	R	R
B405189	BH0189	BH01894448	03/10/89	03/10/89	04/25/89	RC031089003	43 60 - 47 50	GRAVELLY CLAYEY SAND	N	N	N	R	R	R
B400289	BH0289	BH02890003	04/12/89	04/13/89	05/29/89	KVA041289001	0 00 - 3 00	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400289	BH0289	BH02890309	04/12/89	04/13/89	05/29/89	KVA041289001	4 00 - 9 00	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400289	BH0289	BH02890915	04/12/89	04/13/89	05/29/89	KVA041289001	9 00 - 14 90	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400289	BH0289	BH02891521	04/13/89	04/14/89	05/30/89	KVA041389001	16 00 - 21 10	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400289	BH0289	BH02891521D	04/13/89	04/14/89	05/30/89	KVA041389001	16 00 - 21 10	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400289	BH0289	BH02892130	04/13/89	04/14/89	05/30/89	KVA041389001	21 10 - 28 70	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400289	BH0289	BH02893036	04/14/89	04/14/89	05/30/89	KVA041489001	30 00 - 36 00	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400289	BH0289	BH02893642	04/14/89	04/14/89	05/30/89	KVA041489001	36 00 - 41 30	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400289	BH0289	BH02894248	04/17/89	04/18/89	06/03/89	KVA041789001	42 00 - 47 20	SILTY CLAYEY SAND&GRAVEL	N	N	N	R	R	R
B400389	BH0389	BH03890003	04/25/89	04/27/89	06/12/89	KVA042589001	0 00 - 3 00	SILTY SAND	N	N	N	R	R	R
B400389	BH0389	BH03890309	04/25/89	04/27/89	06/12/89	KVA042589001	3 00 - 9 00	SILTY SAND TO CLAYEY SAND	N	N	N	R	R	R
B400389	BH0389	BH03890309D	04/25/89	04/27/89	06/12/89	KVA042589001	3 00 - 9 00	SILTY SAND TO CLAYEY SAND	N	N	N	R	R	R
B400389	BH0389	BH03890915	04/25/89	04/27/89	06/12/89	KVA042589001	9 00 - 15 00	SILTY SAND	N	N	N	R	R	R
B400389	BH0389	BH03891521	04/25/89	04/27/89	06/12/89	KVA042589001	15 00 - 21 00	SILTY SAND	N	N	N	R	R	R
B400389	BH0389	BH03892127	04/25/89	04/27/89	06/12/89	KVA042589001	21 00 - 27 00	SILTY SAND	N	N	N	R	R	R
B400389	BH0389	BH03892733	04/05/89	04/27/89	06/12/89	KVA042589001	27 00 - 33 00	SILTY SAND	N	N	N	R	R	R

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BACKGROUND

BOREHOLE SAMPLE INFORMATION

		SAMPLE INFORMATION							LABORATORY ANALYTES					
BOREHOLE NUMBER	PREVIOUS BH NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	DEPTH INCREMENT(ft)	SAMPLE TYPE	VOA	SEMI-VOA	PEST PCB	METALS	INORG	RADS
B400389	BH0389	BH03893339	04/25/89	04/27/89	06/12/89	KVA042589001	33 00 - 39 00	SILTY SAND	N	N	N	R	R	R
B400389	BH0389	BH03893945	04/26/89	04/27/89	06/12/89	KVA042689001	39 00 - 45 00	SILTY-CLAYEY SAND	N	N	N	R	R	R
B400389	BH0389	BH03894548	04/26/89	04/27/89	06/12/89	KVA042689001	45 00 - 48 50	SILTY-CLAYEY SAND	N	N	N	R	R	R
B400489	BH0489	BH04890003	04/28/89	04/28/89	06/13/89	KVA042889001	0 00 - 3 00	SILTY SAND	N	N	N	R	R	R
B400489	BH0489	BH04890309	04/28/89	04/28/89	06/13/89	KVA042889001	3 00 - 9 00	SILTY SAND	N	N	N	R	R	R
B400489	BH0489	BH04890915	04/28/89	04/28/89	06/13/89	KVA042889001	9 00 - 15 00	SAND & GRAVEL	N	N	N	R	R	R
B400489	BH0489	BH04890915D	04/28/89	04/28/89	06/13/89	KVA042889001	9 00 - 15 00	SAND & GRAVEL	N	N	N	R	R	R
B400489	BH0489	BH04891521	04/28/89	04/28/89	06/13/89	KVA042889001	15 00 - 21 00	SAND & GRAVEL	N	N	N	R	R	R
B400489	BH0489	BH04892127	04/28/89	04/28/89	06/13/89	KVA042889001	21 00 - 27 00	SAND&GRAVEL TO SILTY SAND	N	N	N	R	R	R
B400489	BH0489	BH04892733	05/01/89	05/02/89	06/17/89	RIT050189001	27 00 - 33 00	SILTY SAND	N	N	N	R	R	R
B400489	BH0489	BH04893335	05/01/89	05/02/89	06/17/89	RIT050189001	33 00 - 35 50	SILTY SAND	N	N	N	R	R	R
B400489	BH0489	BH04893538	05/01/89	05/02/89	06/17/89	RIT050189001	35 50 - 38 00	CLAYEY SILT	N	N	N	R	R	R
B400489	BH0489	BH04893840	05/01/89	05/02/89	06/17/89	RIT050189001	38 00 - 40 00	CLAYEY SILT AND SAND	N	N	N	R	R	R
B400489	BH0489	BH04894046	05/01/89	05/02/89	06/17/89	RIT050189001	40 00 - 46 00	SANDY GRAVEL	N	N	N	R	R	R
B400489	BH0489	BH04894652	05/01/89	05/02/89	06/17/89	RIT050189001	46 00 - 52 00	SANDY GRAVEL	N	N	N	R	R	R
B400489	BH0489	BH04895254	05/01/89	05/02/89	06/17/89	RIT050189001	52 00 - 54 00	SANDY GRAVEL	N	N	N	R	R	R
B200589	BH0589	BH05890003R	03/08/89	03/08/89	04/23/89	JEM030889001	0 00 - 2 80	SILTY SANDY CLAY	N	N	N	R	R	R
B200589	BH0589	BH05890003	02/22/89	02/22/89	04/09/89	KEM022289001	0 00 - 3 10	GRAVEL	N	N	N	R	R	R
B200589	BH0589	BH05890308	02/22/89	02/22/89	04/09/89	KEM022289001	3 50 - 8 40	CLAY & SAND	N	N	N	R	R	R
B200589	BH0589	BH05890308D	02/22/89	02/22/89	04/09/89	KEM022289001	3 50 - 8 40	CLAY & SAND	N	N	N	R	R	R
B200589	BH0589	BH05890913	02/22/89	02/22/89	04/09/89	KEM022289001	9 50 - 12 70	CLAYEY SAND	N	N	N	R	R	R
B200589	BH0589	BH05891317	02/22/89	02/22/89	04/09/89	KEM022289001	13 50 - 17 00	SANDY CLAY	N	N	N	R	R	R
B200589	BH0589	BH05891723	02/22/89	02/22/89	04/09/89	KEM022289001	17 00 - 23 50	GRAVEL & SAND	N	N	N	R	R	R
B200589	BH0589	BH05892325	02/22/89	02/22/89	04/09/89	KEM022289001	23 50 - 25 50	GRAVEL & SAND	N	N	N	R	R	R
B200589	BH0589	BH05892530	02/23/89	02/23/89	04/10/89	KEM022389002	25 00 - 30 00	GRAVEL & SAND	N	N	N	R	R	R

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BACKGROUND

BOREHOLE SAMPLE INFORMATION

BOREHOLE NUMBER	PREVIOUS BH NUMBER	SAMPLE INFORMATION: SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	DEPTH INCREMENT(ft)	SAMPLE TYPE	LABORATORY ANALYTES: VOA	SEMI-VOA	PEST PCB	METALS	INORG	RADS
B200689	BH0689	BH06890003	03/09/89	03/09/89	04/24/89	KEM030989002	0 00 - 1 90	SILT & CLAY	N	N	N	R	R	R
B200689	BH0689	BH06890104	02/28/89	02/28/89	04/15/89	KEM022889002	1 00 - 4 50	GRAVELLY CLAY	N	N	N	R	R	R
B200689	BH0689	BH06890410	02/28/89	02/28/89	04/15/89	KEM022889002	4 50 - 9 20	GRAVEL	N	N	N	R	R	R
B200689	BH0689	BH06891016	02/28/89	02/28/89	04/15/89	KEM022889002	9 90 - 15 90	SANDY GRAVEL	N	N	N	R	R	R
B200689	BH0689	BH06891618	02/28/89	02/28/89	04/15/89	KEM022889002	15 90 - 17 90	CLAY	N	N	N	R	R	R
B200689	BH0689	BH06891824	02/28/89	02/28/89	04/15/89	KEM022889002	17 90 - 23 90	SANDY CLAYEY GRAVEL	N	N	N	R	R	R
B200689	BH0689	BH06892430	02/28/89	02/28/89	04/15/89	KEM022889002	23 90 - 29 40	SAND & GRAVEL	N	N	N	R	R	R
B200789	BH0789	BH07890003	03/08/89	03/08/89	04/23/89	JEM030889001	0 00 - 2 90	SILTY SANDY CLAY	N	N	N	R	R	R
B200789	BH0789	BH07890103	03/01/89	03/01/89	04/16/89	KEM030189003	1 00 - 2 70	GRAVELLY CLAY	N	N	N	R	R	R
B200789	BH0789	BH07890306	03/01/89	03/01/89	04/16/89	KEM030189	3 00 - 6 30	CALICHE	N	N	N	R	R	R
B200789	BH0789	BH07890612	03/01/89	03/01/89	04/16/89	030189003	6 30 - 10 30	SAND & GRAVEL	N	N	N	R	R	R
B200789	BH0789	BH07891218	03/01/89	03/01/89	04/16/89	KEM030189003	12 00 - 17 70	GRAVELLY SAND CLAY	N	N	N	R	R	R
B200789	BH0789	BH07891824	03/01/89	03/01/89	04/16/89	KEM030189003	18 00 - 23 00	GRAVEL & SAND	N	N	N	R	R	R
B200789	BH0789	BH07892426	03/01/89	03/01/89	04/16/89	KEM030189003	24 00 - 26 00	GRAVEL & SAND	N	N	N	R	R	R
B200889	BH0889	BH08890003	03/08/89	03/08/89	04/23/89	JEM030889001	0 00 - 2 10	GRAVELLY CLAY	N	N	N	R	R	R
B200889	BH0889	BH08890106	03/06/89	03/07/89	04/22/89	PMS030689003	1 00 - 6 10	SANDY SILT CLAY	N	N	N	R	R	R
B200889	BH0889	BH08890106D	03/06/89	03/07/89	04/22/89	PMS030689003	1 00 - 6 10	SANDY SILTY CLAY	N	N	N	R	R	R
B200889	BH0889	BH08890608	03/06/89	03/07/89	04/22/89	PMS030689003	6 30 - 7 10	SILTY SAND & GRAVEL	N	N	N	R	R	R
B200889	BH0889	BH08890814	03/06/89	03/07/89	04/22/89	PMS030689003	8 30 - 13 70	SILTY SAND	N	N	N	R	R	R
B200889	BH0889	BH08891420	03/06/89	03/07/89	04/22/89	PMS030689003	14 30 - 19 30	SILTY SAND & GRAVEL	N	N	N	R	R	R
B200889	BH0889	BH08892022	03/06/89	03/07/89	04/22/89	PMS030689003	20 30 - 21 20	SILTY SAND & GRAVEL	N	N	N	R	R	R
B200989	BH0989	BH09890003	03/08/89	03/08/89	04/23/89	JEM030889001	0 00 - 2 80	GRAVEL	N	N	N	R	R	R
B200989	BH0989	BH09890104	03/02/89	03/02/89	04/17/89	KEM030289003	1 00 - 4 00	GRAVELLY CLAY	N	N	N	R	R	R
B200989	BH0989	BH09890410D	03/02/89	03/02/89	04/17/89	KEM030289003	4 00 - 9 90	GRAVEL & SAND	N	N	N	R	R	R

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BACKGROUND

BOREHOLE SAMPLE INFORMATION

		SAMPLE INFORMATION							LABORATORY ANALYTES					
BOREHOLE NUMBER	PREVIOUS BH NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	DEPTH INCREMENT(ft)	SAMPLE TYPE	VOA	SEMI-VOA	PEST PCB	METALS	INORG	RADS
B200989	BH0989	BH09890410	03/02/89	03/02/89	04/17/89	KEM030289003	4 00 - 9 90	GRAVEL & SAND	N	N	N	R	R	R
B200989	BH0989	BH09891016	03/02/89	03/02/89	04/17/89	KEM030289003	10 00 - 14 80	GRAVEL & SAND	N	N	N	R	R	R
B200989	BH0989	BH09891620	03/02/89	03/02/89	04/17/89	KEM030289003	16 00 - 18 40	GRAVEL & SAND	N	N	N	R	R	R
B201089	BH1089	BH10890003	03/09/89	03/09/89	04/24/89	JEM030689001	0 00 - 2 60	SILTY SANDY CLAY	N	N	N	R	R	R
B201089	BH1089	BH108901060	03/02/89	03/02/89	04/17/89	KEM030289002	1 00 - 6 50	SILTY CLAY	N	N	N	R	R	R
B201089	BH1089	BH10890106	03/02/89	03/02/89	04/17/89	KEM030289002	1 00 - 6 50	SILTY CLAY	N	N	N	R	R	R
B201189	BH1189	BH11890003	03/17/89	03/17/89	05/02/89	JEM031789001	0 00 - 3 00	CLAY	N	N	N	R	R	R
B201189	BH1189	BH11890309	03/17/89	03/17/89	05/02/89	JEM031789001	3 00 - 9 00	CLAY	N	N	N	R	R	R
B201189	BH1189	BH11890915	03/17/89	03/17/89	05/02/89	JEM031789001	9 00 - 15 00	CLAY	N	N	N	R	R	R
B201189	BH1189	BH11890915D	03/17/89	03/17/89	05/02/89	JEM031789001	9 00 - 15 00	CLAY	N	N	N	R	R	R
B201189	BH1189	BH11891521	03/17/89	03/17/89	05/02/89	JEM031789001	15 00 - 21 00	CLAY	N	N	N	R	R	R
B201189	BH1189	BH11892127	03/17/89	03/17/89	05/02/89	JEM031789001	21 00 - 27 00	CLAY	N	N	N	R	R	R
B201189	BH1189	BH11892733	03/17/89	03/17/89	05/02/89	JEM031789001	27 00 - 33 00	CLAY	N	N	N	R	R	R
B201289	BH1289	BH12890003	03/22/89	03/24/89	05/09/89	JEM032289001	0 00 - 3 00	CLAY	N	N	N	R	R	R
B201289	BH1289	BH12890307	03/22/89	03/24/89	05/09/89	JEM032289001	3 00 - 6 80	SILTY CLAY	N	N	N	R	R	R
B201289	BH1289	BH12890915	03/23/89	03/24/89	05/09/89	JEM032289001	9 00 - 15 00	SILTY CLAY	N	N	N	R	R	R
B201289	BH1289	BH12891521	03/23/89	03/24/89	05/09/89	JEM032289001	15 00 - 20 65	SILTY CLAY	N	N	N	R	R	R
B201289	BH1289	BH12891521D	03/23/89	03/24/89	05/09/89	JEM032289001	15 00 - 20 65	SILTY CLAY	N	N	N	R	R	R
B201489	BH1389	BH13890003	03/10/89	03/10/89	04/25/89	JEM031089001	0 00 - 3 00	SILTY CLAY	N	N	N	R	R	R
B201489	BH1389	BH13890307	03/10/89	03/10/89	04/25/89	JEM031089001	3 00 - 7 00	SILTY CLAY	N	N	N	R	R	R
B201589	BH1489	BH14890003	03/15/89	03/15/89	04/30/89	JEM031589001	0 00 - 3 00	SILTY CLAY	N	N	N	R	R	R
B201589	BH1489	BH14890307	03/15/89	03/15/89	04/30/89	JEM031589001	3 00 - 7 00	SILTY CLAY	N	N	N	R	R	R

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BACKGROUND

BOREHOLE SAMPLE INFORMATION

		SAMPLE INFORMATION							LABORATORY ANALYTES					
BOREHOLE NUMBER	PREVIOUS BH NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	DEPTH INCREMENT(ft)	SAMPLE TYPE	VOA	SEMI-VOA	PEST PCB	METALS	INORG	RADS
B301889	BH1589	BH15890003	03/07/89	03/07/89	04/22/89	KEM030789003	0 00 - 3 00	SILTY CLAY	N	N	N	R	R	R
B301889	BH1589	BH15890309	03/07/89	03/07/89	04/22/89	KEM030789002	3 00 - 9 00	SILTY CLAY	N	N	N	R	R	R
B301889	BH1589	BH15890915	03/07/89	03/07/89	04/22/89	KEM030789002	9 00 - 15 00	SILTY CLAY	N	N	N	R	R	R
B301889	BH1589	BH15891521	03/07/89	03/07/89	04/22/89	KEM030789002	15 00 - 21 00	SILTY CLAY	N	N	N	R	R	R
B401989	BH1689	BH16890003	04/05/89	04/05/89	05/21/89	RTT040589001	0 00 - 3 00	CLAY & GRAVEL	N	N	N	R	R	R
B401989	BH1689	BH16890309	04/05/89	04/05/89	05/21/89	RTT040589001	3 00 - 9 00	CLAY	N	N	N	R	R	R
B401989	BH1689	BH16890915	04/05/89	04/05/89	05/21/89	RTT040589001	9 20 - 13 30	CLAY	N	N	N	R	R	R
B401989	BH1689	BH16891519	04/05/89	04/05/89	05/21/89	RTT040589001	16 00 - 19 00	SANDY GRAVELLY CLAY	N	N	N	R	R	R
B302089	BH1789	BH17890003	03/28/89	03/29/89	05/14/89	RTT032889001	0 00 - 2 10	CLAY	N	N	N	R	R	R
B302089	BH1789	BH17890306	03/28/89	03/29/89	05/14/89	RTT032889001	3 60 - 6 00	CLAY	N	N	N	R	R	R
B402189	BH1889	BH18890003	03/29/89	03/30/89	05/15/89	RTT032989001	0 00 - 0 80	CLAY	N	N	N	R	R	R
B402189	BH1889	BH18890307	03/29/89	03/30/89	05/15/89	RTT032989001	3 30 - 7 30	CLAY	N	N	N	R	R	R
B201089	CBH1089	BH10890713	03/02/89	03/02/89	04/17/89	KEM030289002	7 50 - 13 50	SILTY CLAYSTONE	N	N	N	R	R	R
B201089	CBH1089	BH10891319	03/02/89	03/02/89	04/17/89	KEM030289002	13 50 - 19 50	SILTY CLAYSTONE	N	N	N	R	R	R
B201189	CBH1189	BH11893541	03/23/89	03/24/89	05/09/89	RTT032389001	34 50 - 41 00	CLAYSTONE	N	N	N	R	R	R
B201189	CBH1189	BH11894146	03/23/89	03/24/89	05/09/89	RTT032389001	41 00 - 46 00	CLAYSTONE	N	N	N	R	R	R
B201289	CBH1289	BH12892329	03/23/89	03/24/89	05/09/89	JEM032289001	23 40 - 29 40	CLAYSTONE	N	N	N	R	R	R
B201289	CBH1289	BH12892930	03/23/89	03/24/89	05/09/89	JEM032289001	29 00 - 29 90	CLAYSTONE	N	N	N	R	R	R
B201489	CBH1389	BH13891015	03/10/89	03/10/89	04/25/89	JEM031089001	10 70 - 15 00	CLAYSTONE	N	N	N	R	R	R
B201489	CBH1389	BH13891015D	03/10/89	03/10/89	04/25/89	JEM031089001	10 70 - 15 00	CLAYSTONE	N	N	N	R	R	R

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BACKGROUND

BOREHOLE SAMPLE INFORMATION

BOREHOLE NUMBER	PREVIOUS BH NUMBER	SAMPLE INFORMATION: SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	DEPTH INCREMENT(ft)	SAMPLE TYPE	LABORATORY ANALYTES: VOA	SEMI-VOA	PEST PCB	METALS	INORG	RADS
B201489	CBH1389	BH13891519	03/10/89	03/10/89	04/25/89	JEM031089001	15 00 - 19 20	CLAYSTONE	N	N	N	R	R	R
B201589	CBH1489	BH14890814	03/16/89	03/16/89	05/01/89	JEM031689001	8 20 - 14 20	CLAYSTONE	N	N	N	R	R	R
B201589	CBH1489	BH14891417	03/16/89	03/16/89	05/01/89	JEM031689001	14 20 - 17 00	SILTY CLAYSTONE	N	N	N	R	R	R
B301889	CBH1589	BH15892228	03/07/89	03/07/89	04/22/89	KEM030789002	22 00 - 28 30	SANDY SILTY CLAYSTONE	N	N	N	R	R	R
B301889	CBH1589	BH15892834	03/07/89	03/07/89	04/22/89	KEM030789002	28 30 - 34 30	SANDY SILTY CLAYSTONE	N	N	N	R	R	R
B401989	CBH1689	BH16892127	04/05/89	04/05/89	05/21/89	RTT040589001	20 50 - 26 50	CLAYSTONE	N	N	N	R	R	R
B401989	CBH1689	BH16892733	04/05/89	04/05/89	05/21/89	RTT040589001	26 50 - 32 50	CLAYSTONE	N	N	N	R	R	R
B302089	CBH1789	BH17891319	03/28/89	03/29/89	05/14/89	RTT032889001	13 50 - 19 50	CLAYSTONE	N	N	N	R	R	R
B302089	CBH1789	BH17891319D	03/28/89	03/29/89	05/14/89	RTT032889001	13 50 - 19 50	CLAYSTONE	N	N	N	R	R	R
B302089	CBH1789	BH17891925	03/28/89	03/28/89	05/13/89	RTT032889001	19 50 - 25 50	CLAYSTONE	N	N	N	R	R	R
B402189	CBH1889	BH18890713	03/29/89	03/30/89	05/15/89	RTT032989001	7 50 - 13 50	CLAYSTONE	N	N	N	R	R	R
FB	FB	BH08890306FB	03/06/89	03/07/89	04/22/89	PMS030689003	N/A	FIELD BLANK	N	N	N	R	N	R
FB	FB	BH05890222FB	02/22/89	02/22/89	04/09/89	KEM022289001	N/A	FIELD BLANK	N	N	N	R	N	R
FB	FB	BH11890317FB	03/17/89	03/17/89	05/02/89	JEM031789001	N/A	FIELD BLANK	N	N	N	R	N	R
FB	FB	BH12890323FB	03/23/89	03/24/89	05/09/89	JEM032289001	N/A	FIELD BLANK	N	N	N	R	N	R
FB	FB	BH06890003FB	03/08/89	03/08/89	04/23/89	JEM030889	N/A	FIELD BLANK	N	N	N	R	N	R
FB	FB	BH17890328FB	03/28/89	03/29/89	05/14/89	RTT032889001	N/A	FIELD BLANK	N	N	N	R	N	R
FB	FB	BH02890915FB	04/12/89	04/13/89	05/29/89	KVA041289001	N/A	FIELD BLANK	N	N	N	R	Y	R
FB	FB	BH03893339FB	04/25/89	04/27/89	06/12/89	KVA042589001	N/A	FIELD BLANK	N	N	N	R	N	R
FB	FB	BH04892127FB	04/28/89	04/28/89	06/13/89	KVA042889001	N/A	FIELD BLANK	N	N	N	R	N	R
FB	FB	BH15890307FB	03/07/89	/ /	/ /		N/A	FIELD BLANK	N	N	N	R	N	R

FB - Field Blank N - Not sampled for this group Y - Sampled for this group, results not yet received, R - Results for this group received

BACKGROUND

BOREHOLE SAMPLE INFORMATION

		SAMPLE INFORMATION							LABORATORY ANALYTES					
BOREHOLE NUMBER	PREVIOUS BH NUMBER	SAMPLE NUMBER	SAMPLE DATE	SHIPPING DATE	TURNAROUND DATE	CUSTODY SHEET NO	DEPTH INCREMENT(ft)	SAMPLE TYPE	VOA	SEMI-VOA	PEST PCB	METALS	INORG	RADS
B201289	SBH1289	BH12893032	03/23/89	03/24/89	05/09/89	JEM032289001	29 90 - 32 00	SANDY SILTSTONE	N	N	N	R	R	R
B201489	SBH1389	BH13890709	03/10/89	03/10/89	04/25/89	JEM031089001	7 00 - 9 30	SILTY SANDSTONE	N	N	N	R	R	R
B201589	SBH1489	BH14891720	03/16/89	03/16/89	05/01/89	JEM031689001	17 00 - 20 00	CLAYEY SANDSTONE	N	N	N	R	R	R
B402189	SBH1889	BH18891319	03/29/89	03/30/89	05/15/89	RTT032989001	13 50 - 19 50	SANDSTONE	N	N	N	R	R	R

N - Not sampled for this group Y - Sampled for this group, results not yet received R - Results for this group received

QA/QC SAMPLES

TOTAL METALS

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE FIELD BLANKS

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/l	Antimony (Sb), total mg/l	Arsenic (As), total mg/l	Barium (Ba), total mg/l	Beryllium (Be), total mg/l	Cadmium (Cd), total mg/l	Calcium (Ca), total mg/l
FB	03/06/89	0 00 - 0 00	0002 U	00006 U	00001 U	0002 U	0050 U	0050 U	0050 U
FB	02/22/89	0 00 - 0 00	200 U	0600 U	01 U	200 U	0050 U	0050 U	5U
FB	03/17/89	0 00 - 0 00	200 U	0600 U	0100 U	200 U	0050 U	0050 U	5U
FB	03/23/89	0 00 - 0 00	200 U	0600 U	0100 U	200 U	0050 U	0050 U	5U
FB	03/08/89	0 00 - 0 00	0002 U	00006 U	0100 U	0002 U	0050 U	0050 U	0050 U
FB	03/28/89	0 00 - 0 00	300	0600 U	0100 U	200 U	0050 U	0050 U	5U
FB	04/12/89	0 00 - 0 00	252	0600 U	0100 U	200 U	0050 U	0050 U	5U
FB	04/25/89	0 00 - 0 00	200 U	0600 U	0100 U	200 U	0050 U	0050 U	5U
FB	04/28/89	0 00 - 0 00	200 U	0600 U	0100 U	200 U	0050 U	0050 U	5U
FB	03/07/89	0 00 - 0 00	0002 U	00006 U	00001 U	0002 U	0050 U	0050 U	0050 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE FIELD BLANKS

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/l	Chromium (Cr), total mg/l	Cobalt (Co), total mg/l	Copper (Cu), total mg/l	Iron (Fe), total mg/l	Lead (Pb), total mg/l	Lithium (Li), total mg/l
FB	03/06/89	0 00 - 0 00	0010 U	00001 U	00005 U	00004	0001 U	00003 U	0001 U
FB	02/22/89	0 00 - 0 00	1U	0100	0500 U	0250 U	100 U	005 U	100 U
FB	03/17/89	0 00 - 0 00	1U	0100 U	0500 U	0250 U	100 U	0050 U	100 U
FB	03/23/89	0 00 - 0 00	1U	0100 U	0500 U	0250 U	171	0050 U	0100 U
FB	03/08/89	0 00 - 0 00	0010 U	00001 U	00005 U	00003 U	0001 U	0050 U	0001 U
FB	03/28/89	0 00 - 0 00	1U	0100 U	0500 U	0250 U	221	0050 U	0100 U
FB	04/12/89	0 00 - 0 00	1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U
FB	04/25/89	0 00 - 0 00	1U	0100 U	0500 U	0250 U	100 U	0050 U	0100 U
FB	04/28/89	0 00 - 0 00	1U	0100 U	0500 U	0250 U	116	0050 U	0100 U
FB	03/07/89	0 00 - 0 00	0010 U	00001 U	00005 U	00003 U	0001 U	0050 U	0001 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80 120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE FIELD BLANKS

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/l	Manganese (Mn), total mg/l	Mercury (Hg), total mg/l	Molybdenum (Mo), total mg/l	Nickel (Ni), total mg/l	Potassium (K), total mg/l	Selenium (Se), total mg/l
FB	03/06/89	0 00 - 0 00	0050 U	00002 U	0002 U	0001 U	00004 U	0050 U	0050 U
FB	02/22/89	0 00 - 0 00	5U	0150 U	0002 U	100 U	0400 U	5U	005 U
FB	03/17/89	0 00 - 0 00	5U	0150 U	0002 U	100 U	0400 U	5U	0050 U
FB	03/23/89	0 00 - 0 00	5U	0150 U	0005	0100 U	0400 U	5U	0050 U
FB	03/08/89	0 00 - 0 00	0050 U	00002 U	0002 U	0001 U	00004 U	0050 U	0050 U
FB	03/28/89	0 00 - 0 00	5U	0150 U	0002 U	0100 U	0400 U	5U	0050 U
FB	04/12/89	0 00 - 0 00	5U	0150 U	0002	0293	0400 U	5U	0050 U
FB	04/25/89	0 00 - 0 00	5U	0150 U	0002 U	0108	0400 U	5U	0050 U
FB	04/28/89	0 00 - 0 00	5U	0150 U	0002 U	0100 U	0400 U	5U	0050 U
FB	03/07/89	0 00 - 0 00	0050 U	00002 U	0004	0001 U	00004 U	0050 U	0050 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE FIELD BLANKS

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/l	Sodium (Na), total mg/l	Strontium (Sr), total mg/l	Thallium (Tl), total mg/l	Tin (Sn), Total mg/l	Vanadium (V), total mg/l	Zinc (Zn), total mg/l
FB	03/06/89	0 00 - 0 00	00001 U	0050 U	0001 U	00002 U	0001 U	00005 U	00006
FB	02/22/89	0 00 - 0 00	0100 U	5U	100 U	01 U	100 U	0500 U	0200 U
FB	03/17/89	0 00 - 0 00	0100 U	5U	100 U	0100 U	100 U	0500 U	33 2
FB	03/23/89	0 00 - 0 00	0100 U	5U	100 U	0100 U	100 U	0500 U	947
FB	03/08/89	0 00 - 0 00	00001 U	0050 U	0001 U	00001 U	0001 U	00005 U	00004
FB	03/28/89	0 00 - 0 00	0100 U	5U	100 U	0100 U	100 U	0500 U	0200 U
FB	04/12/89	0 00 - 0 00	0100 U	5U	1U	0100 U	100 U	0500 U	0284
FB	04/25/89	0 00 - 0 00	0100 U	5U	1U	0100 U	100 U	0500 U	0200 U
FB	04/28/89	0 00 0 00	0100 U	5U	1U	0100 U	100 U	0500 U	0200 U
FB	03/07/89	0 00 - 0 00	00001 U	0050 U	0001 U	00001 U	0001 U	00005 U	00002

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

TOTAL RADIOCHEMISTRY

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE FIELD BLANKS

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/l	Gross Beta pCi/l	pCi/l	Uranium 233, 234 pCi/l	Uranium 235
FB	03/06/89	0 00 - 0 00	-1 ± 1	-2 ± 2		0 0 ± 0 1	0 0 ± 0 1
FB	02/22/89	0 00 - 0 00	0 ± 1	1 ± 2		0 0 ± 0 1	0 0 ± 0 1
FB	03/17/89	0 00 0 00	0 ± 1	1 ± 2		0 1 ± 0 2	0 0 ± 0 1
FB	03/23/89	0 00 0 00	1 ± 1	1 ± 2		0 0 ± 0 1	0 0 ± 0 1
FB	03/08/89	0 00 - 0 00	0 ± 1	0 ± 2		0 1 ± 0 2	0 0 ± 0 1
FB	03/28/89	0 00 0 00	0 ± 1	2 ± 2		0 0 ± 0 1	0 0 ± 0 1
FB	04/12/89	0 00 - 0 00	1 ± 1	1 ± 2		0 0 ± 0 1	0 0 ± 0 1
FB	04/25/89	0 00 0 00	-1 ± 1	1 ± 2		0 3 ± 0 2	0 0 ± 0 1
FB	04/28/89	0 00 - 0 00	0 ± 1	1 ± 2		0 1 ± 0 1	0 0 ± 0 1
FB	03/07/89	0 00 0 00	1 ± 2	-1 ± 2		-0 2 ± 0 2	0 0 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE FIELD BLANKS

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/l	Strontium 89,90 pCi/l	Plutonium 239 pCi/l	Americium 241
FB	03/06/89	0 00 - 0 00	0 0 ± 0 1	-0 3 ± 0 4	0 01 ± 0 01	0 00 ± 0 01
FB	02/22/89	0 00 - 0 00	-0 1 ± 0 1	1 0 ± 0 7	0 02 ± 0 03	-0 01 ± 0 03
FB	03/17/89	0 00 - 0 00	0 0 ± 0 1	-0 2 ± 0 4	0 00 ± 0 01	0 00 ± 0 01
FB	03/23/89	0 00 - 0 00	0 0 ± 0 1	-0 2 ± 0 4	0 00 ± 0 02	0 01 ± 0 01
FB	03/08/89	0 00 - 0 00	0 0 ± 0 1	0 0 ± 0 5	0 00 ± 0 01	0 00 ± 0 01
FB	03/28/89	0 00 - 0 00	0 0 ± 0 1	-0 2 ± 0 5	0 00 ± 0 01	-0 01 ± 0 01
FB	04/12/89	0 00 - 0 00	0 0 ± 0 1	-0 1 ± 0 5	0 00 ± 0 02	-0 01 ± 0 03
FB	04/25/89	0 00 - 0 00	0 1 ± 0 2	0 1 ± 0 5	0 00 ± 0 01	0 00 ± 0 01
FB	04/28/89	0 00 - 0 00	0 0 ± 0 1	-0 2 ± 0 5	0 01 ± 0 01	0 00 ± 0 01
FB	03/07/89	0 00 - 0 00	-0 1 ± 0 3	-0 2 ± 0 4	0 01 ± 0 01	0 00 ± 0 01

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE FIELD BLANKS

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/l	Tritium pCi/l	Radium 226 pCi/l	Radium 228 pCi/l
FB	03/06/89	0 00 - 0 00	-0 2 ± 0 7	10 ± 150	NR	NR
FB	02/22/89	0 00 0 00	0 4 ± 1 0	190 ± 170	NR	NR
FB	03/17/89	0 00 - 0 00	-0 4 ± 0 6	40 ± 150	NR	NR
FB	03/23/89	0 00 - 0 00	-0 4 ± 0 5	-10 ± 160	NR	NR
FB	03/08/89	0 00 - 0 00	-0 01 ± 0 06	140 ± 160	NR	NR
FB	03/28/89	0 00 0 00	-0 3 ± 0 5	-0 06 ± 0 15	NR	NR
FB	04/12/89	0 00 - 0 00	0 0 ± 0 5	0 ± 150	NR	NR
FB	04/25/89	0 00 - 0 00	-0 3 ± 0 6	200 ± 150	NR	NR
FB	04/28/89	0 00 - 0 00	-0 3 ± 0 6	210 ± 150	NR	NR
FB	03/07/89	0 00 0 00	-0 2 ± 0 7	40 ± 150	NR	NR

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

ROCKY FLATS ALLUVIUM

TOTAL METALS

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B405189	03/09/89	0 00 - 3 00	20000	12 8 U	3 9	61 2	4 5	1 1 U	2330
B405189	03/09/89	3 60 - 8 55	12100	12 8 U	3 5	42 7 U	2 3	1 1 U	1300
B405189	03/09/89	9 60 15 40	23900	13 2 U	4 3	116	5 4	1 1 U	3350
B405189	03/09/89	15 60 - 20 30	11900	12 9 U	1 2	68 8	2 6	1 1 U	1400
B405189	03/09/89	21 60 26 50	13400	13 4 U	2 2	61 7	2 9	1 1 U	1600
B405189	03/10/89	29 50 35 60	11900	13 0 U	3 0	83 2	3 0	1 1 U	3100
B405189	03/10/89	35 60 37 60	20000	12 6 U	2 1 U	68 6	4 9	1 0 U	4620
B405189	03/10/89	37 60 - 42 60	9950	12 2 U	2 7	44 9	3 2	1 0 U	2030
B405189	03/10/89	43 60 - 47 50	10300	13 1 U	5 3	59 8	3 3	1 1 U	2330
B400289	04/12/89	0 00 - 3 00	10200	13 8 U	7 3	45 9 U	2 5	1 1 U	1700
B400289	04/12/89	4 00 - 9 00	16600	12 9 U	9 4	68 9	4 1	1 1 U	3240
B400289	04/12/89	9 00 14 90	20400	13 1 U	4 8	81 7	4 6	1 1 U	2440
B400289	04/13/89	16 00 21 10	13000	13 5 U	2 2 U	54 6	2 8	1 1 U	2330
B400289	04/13/89	16 00 - 21 10	12300	2 1 U	1 7 B	46 4	2 8	0 18 U	1800
B400289	04/13/89	21 10 28 70	11000	13 4 U	2 7	53 3	2 6	1 1 U	1900
B400289	04/14/89	30 00 36 00	12600	13 6 U	2 2 U	74 5	2 9	1 1 U	2840
B400289	04/14/89	36 00 41 30	8430	13 4 U	2 4	60 6	2 1	1 1 U	3300
B400289	04/17/89	42 00 47 20	8604	14 3 U	2 3 U	65 3	2	1 2 U	2196
B400389	04/25/89	0 00 3 00	6970	12 1 U	5 0	40 4 U	1 5	1 0 U	1210
B400389	04/25/89	3 00 9 00	8970	12 4 U	3 1	41 2 U	2 3	1 0 U	8040

NR = Analyte not reported
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N = Batch spike not in 80 120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B405189	03/09/89	0 00 - 3 00	214 U	23 1	10 7 U	6 9	15900	12 7	7 6
B405189	03/09/89	3 60 - 8 55	213 U	15 5	10 7 U	5 6	8860	5 0	5 5
B405189	03/09/89	9 60 - 15 40	221 U	31 7	11 3	25 1	20700	4 9	15 5
B405189	03/09/89	15 60 - 20 30	215 U	26 1	10 7 U	11 9	10200	3 9	7 9
B405189	03/09/89	21 60 - 26 50	223 U	17 2	11 1 U	15 1	11800	4 0	7 8
B405189	03/10/89	29 50 - 35 60	217 U	11 7	10 9 U	7 1	12800	7 9	6 4
B405189	03/10/89	35 60 - 37 60	210 U	18 8	10 5 U	11 7	20100	10 3	8 8
B405189	03/10/89	37 60 - 42 60	203 U	21 2	10 1 U	11 3	13800	4 2 U	6 9
B405189	03/10/89	43 60 - 47 50	218 U	21 1	10 9 U	14 6	14200	7 4	9 0
B400289	04/12/89	0 00 - 3 00	230 U	12 3	11 5 U	5 7 U	11000	13 0	3 7
B400289	04/12/89	4 00 - 9 00	216 U	16 8	10 8 U	5 4 U	11800	9 7	6 1
B400289	04/12/89	9 00 - 14 90	219 U	14 9	10 9 U	9 3	10900	8 9	9 9
B400289	04/13/89	16 00 - 21 10	224 U	14 9	11 2 U	6 7	9360	4 9	5 1
B400289	04/13/89	16 00 - 21 10	226 U	11 7	3 5 B	5 7	8330	6 6	22 4 U
B400289	04/13/89	21 10 28 70	223 U	9 3	11 1 U	8 1	9350	10 5	5 5
B400289	04/14/89	30 00 - 36 00	226 U	14 6	11 3 U	13 7	13300	5 2	7 3
B400289	04/14/89	36 00 - 41 30	223 U	17 4	11 1 U	11 9	10400	14 4	6 7
B400289	04/17/89	42 00 47 20	238 U	14 8	11 9 U	10 3	11100	3 3	7
B400389	04/25/89	0 00 3 00	202 U	13 8	14 3	31 6	7750	5 9	2 0 U
B400389	04/25/89	3 00 9 00	206 U	10 5	10 3 U	8 7	8700	4 2	4 1

NR = Analyte not reported
U = Analyzed but not detected
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J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B405189	03/09/89	0 00 - 3 00	1680	39 9	0 11 U	13 2	20 2	1070 U	1 1 U
B405189	03/09/89	3 60 - 8 55	1380	104	0 11 U	7 7	8 8	1070 U	5 3 U
B405189	03/09/89	9 60 - 15 40	4170	377	0 11 U	13 5	29 5	1100 U	5 5 U
B405189	03/09/89	15 60 - 20 30	1950	199	0 11 U	8 5	10 0	1550	5 3 U
B405189	03/09/89	21 60 - 26 50	2000	163	0 11 U	9 1	10 0	1110 U	5 5 U
B405189	03/10/89	29 50 - 35 60	2320	259	0 11 U	2 2 U	10 5	1100	5 1 U
B405189	03/10/89	35 60 - 37 60	3500	121	0 11 U	2 1 U	18 8	2100	1 1 U
B405189	03/10/89	37 60 - 42 60	2210	112	0 11 U	2 0 U	12 0	1390	1 0 U
B405189	03/10/89	43 60 - 47 50	2610	172	0 11 U	8 8	17 9	1550	5 5 U
B400289	04/12/89	0 00 - 3 00	1150 U	38 0	0 20	5 9	14 6	1150 U	5 8 U
B400289	04/12/89	4 00 - 9 00	1850	37 0	0 36	12 6	17 8	1080 U	1 1 U
B400289	04/12/89	9 00 - 14 90	2350	168	0 13	15 7	16 4	1950	5 6 U
B400289	04/13/89	16 00 - 21 10	1650	107	0 10 U	10 2	9 0 U	1120 U	5 4 U
B400289	04/13/89	16 00 - 21 10	1470	2 6	0 47	22 4 U	5 1	981	0 22 U
B400289	04/13/89	21 10 - 28 70	1660	136	0 11 U	7 8	8 9 U	1540	1 1 U
B400289	04/14/89	30 00 - 36 00	2800	140	0 14	8 6	14 7	1830	1 1 U
B400289	04/14/89	36 00 - 41 30	2700	189	0 12	4 8	12 8	1170	1 1 U
B400289	04/17/89	42 00 - 47 20	2724	280	0 11 U	5 7	16 2	1572	5 7 U
B400389	04/25/89	0 00 - 3 00	1010 U	26 6	0 28	4 4	24 8	1010 U	1 0 U
B400389	04/25/89	3 00 - 9 00	1290	103	0 18	4 2	22 5	1030 U	1 1 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80 120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B405189	03/09/89	0 00 - 3 00	27 2	1070 U	21 4 U	2 1 U	296	43 0	17 8
B405189	03/09/89	3 60 - 8 55	15 2	1070 U	21 3 U	2 1 U	317	22 8	11 2
B405189	03/09/89	9 60 - 15 40	35 2	1100 U	22 1 U	2 2 U	332	50 7	39 0
B405189	03/09/89	15 60 - 20 30	17 2	1070 U	21 5 U	2 1 U	333	19 9	21 1
B405189	03/09/89	21 60 - 26 50	20 0	1110 U	22 3 U	2 2 U	338	27 7	22 8
B405189	03/10/89	29 50 - 35 60	21 6	1090 U	21 7 U	2 1 U	188	24 2	19 6
B405189	03/10/89	35 60 - 37 60	34 2	1050 U	26 4	2 1 U	188	42 7	28 2
B405189	03/10/89	37 60 - 42 60	23 4	1010 U	20 3 U	2 1 U	204	27 0	20 7
B405189	03/10/89	43 60 - 47 50	24 6	1090 U	21 8 U	2 2 U	306	24 7	32 2
B400289	04/12/89	0 00 - 3 00	2 3 U	1150 U	23 0 U	2 3 U	23 0 U	36 3	16 2
B400289	04/12/89	4 00 - 9 00	2 2 U	1080 U	21 6 U	2 1 U	21 6 U	32 4	24 2
B400289	04/12/89	9 00 - 14 90	2 2 U	1090 U	21 9 U	2 2 U	21 9 U	25 9	25 0
B400289	04/13/89	16 00 - 21 10	2 2 U	1120 U	22 4 U	2 2 U	22 4 U	19 4	25 0
B400289	04/13/89	16 00 - 21 10	0 54 U	206 B	224 U	0 33 U	22 5 U	17 1	21 1
B400289	04/13/89	21 10 - 28 70	2 2 U	1110 U	22 3 U	2 2 U	22 3 U	23 4	25 1
B400289	04/14/89	30 00 - 36 00	2 3 U	1130 U	22 6 U	2 2 U	22 6 U	28 8	41 8
B400289	04/14/89	36 00 - 41 30	2 2 U	1110 U	22 3 U	2 3 U	22 3 U	25 6	35 4
B400289	04/17/89	42 00 47 20	2 4 U	1188 U	23 8 U	2 3 U	23 8 U	24	40 8
B400389	04/25/89	0 00 - 3 00	2 0 U	1010 U	202 U	2 1 U	20 2 U	21 5	4 0 U
B400389	04/25/89	3 00 - 9 00	2 1 U	1030 U	206 U	2 1 U	20 6 U	23 0	4 1 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B400389	04/25/89	3 00 - 9 00	9040	12 7 U	3 6	42 3 U	2 4	1 1 U	9520
B400389	04/25/89	9 00 - 15 00	11800	12 6 U	2 7	60 9	2 4	1 1 U	2550
B400389	04/25/89	15 00 - 21 00	9920	12 1 U	2 3	56 8	2 2	1 0 U	3160
B400389	04/25/89	21 00 - 27 00	9190	12 3 U	2 1 U	50 8	1 9	1 0 U	1910
B400389	04/05/89	27 00 - 33 00	7200	12 4 U	2 0 U	56 2	1 5	1 0 U	1270
B400389	04/25/89	33 00 - 39 00	9230	12 6 U	2 1 U	73 1	2 0	1 1 U	3060
B400389	04/26/89	39 00 - 45 00	18500	14 5 U	4 3	159	4 2	1 2 U	4870
B400389	04/26/89	45 00 - 48 50	8880	12 7 U	2 9	73 2	1 8	1 1 U	2350
B400489	04/28/89	0 00 - 3 00	8310	12 2 U	5 5	40 7 U	1 9	1 0 U	1130
B400489	04/28/89	3 00 - 9 00	12300	12 9 U	4 2	50 4	3 2	1 1 U	4850
B400489	04/28/89	9 00 - 15 00	10700	12 4 U	3 1	51 1	2 4	1 0 U	5490
B400489	04/28/89	9 00 - 15 00	9710	12 4 U	2 8	53 1	2 2	1 0 U	6000
B400489	04/28/89	15 00 - 21 00	10200	12 5 U	2 1 U	73 2	2 4	1 0 U	2530
B400489	04/28/89	21 00 - 27 00	10500	12 7 U	2 4	71 8	2 6	1 1 U	3000
B400489	05/01/89	27 00 - 33 00	8790	12 7 U	2 5	85 5	2 0	1 1 U	2590
B400489	05/01/89	33 00 - 35 50	10900	16 6 U	2 8 U	90 9	2 9	1 4 U	3120
B400489	05/01/89	35 50 - 38 00	19000	29 1 U	4 9 U	148	5 3	2 4 U	5380
B400489	05/01/89	38 00 - 40 00	10000	18 1 U	2 9 U	76 6	2 8	1 5 U	2730
B400489	05/01/89	40 00 - 46 00	3540	15 0 U	2 4 U	50 1 U	1 3 U	1 3 U	1350
B400489	05/01/89	46 00 52 00	2240	13 9 U	2 4 U	46 2 U	1 2 U	1 2 U	1160 U
B400489	05/01/89	52 00 - 54 00	4130	13 8 U	2 4 U	64 3	1 4	1 1 U	1770

NR = Analyte not reported
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* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B400389	04/25/89	3 00 - 9 00	212 U	16 5	10 6 U	9 3	9710	5 1	4 1
B400389	04/25/89	9 00 - 15 00	210 U	18 2	12 1	10 7	10900	4 9	6 7
B400389	04/25/89	15 00 - 21 00	202 U	16 1	10 1 U	7 8	10700	4 5	5 2
B400389	04/25/89	21 00 - 27 00	204 U	21 6	10 2 U	6 2	8800	3 7	5 1
B400389	04/05/89	27 00 - 33 00	207 U	17 8	11 3	5 5	8360	3 1	4 0
B400389	04/25/89	33 00 - 39 00	210 U	17 7	10 5 U	6 5	10900	4 7	6 0
B400389	04/26/89	39 00 - 45 00	241 U	21 6	13 4	13 9	20300	14 6	10 4
B400389	04/26/89	45 00 - 48 50	212 U	11 2	10 6 U	6 6	10800	6 9	5 8
B400489	04/28/89	0 00 - 3 00	203 U	25 4	10 2 U	5 1 U	9730	4 7	3 9
B400489	04/28/89	3 00 - 9 00	216 U	28 3	12 0	5 4 U	12700	5 8	5 8
B400489	04/28/89	9 00 - 15 00	208 U	30 6	10 4 U	5 2 U	11200	4 5	6 1
B400489	04/28/89	9 00 - 15 00	207 U	30 6	10 4 U	5 2 U	10800	5 4	5 6
B400489	04/28/89	15 00 - 21 00	208 U	19 9	10 4 U	6 7	11100	8 2	6 1
B400489	04/28/89	21 00 - 27 00	212 U	18 8	10 6 U	9 4	13200	6 7	7 3
B400489	05/01/89	27 00 - 33 00	211 U	14 2	10 6 U	7 1	11400	5 6	6 7
B400489	05/01/89	33 00 - 35 50	277 U	14 1	13 8 U	11 8	13100	6 0	9 0
B400489	05/01/89	35 50 - 38 00	484 U	25 7	24 2 U	22 5	22000	10 3	15 1
B400489	05/01/89	38 00 - 40 00	302 U	19 2	15 1 U	12 3	12300	6 2	8 7
B400489	05/01/89	40 00 - 46 00	250 U	9 2	12 5 U	6 3 U	5870	2 6	5 1
B400489	05/01/89	46 00 - 52 00	231 U	5 6	11 6 U	5 8 U	4670	3 2	3 9
B400489	05/01/89	52 00 - 54 00	230 U	8 1	11 5 U	7 6	8200	9 0	5 9

NR = Analyte not reported
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* = Holding time not met
E = Estimated value
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B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B400389	04/25/89	3 00 - 9 00	1340	113	0 14	5 0	34 5	1060 U	5 2 U
B400389	04/25/89	9 00 - 15 00	1860	231	0 12	6 1	33 6	1050 U	1 0 U
B400389	04/25/89	15 00 - 21 00	1700	233	0 12	4 5	30 2	1010 U	5 2 U
B400389	04/25/89	21 00 - 27 00	1570	140	0 096 U	5 6	38 3	1020 U	5 2 U
B400389	04/05/89	27 00 - 33 00	1230	91 0	0 11 U	4 6	34 2	1040 U	5 1 U
B400389	04/25/89	33 00 - 39 00	2200	216	0 10 U	4 3	32 7	1170	1 1 U
B400389	04/26/89	39 00 - 45 00	4390	409	0 19	8 1	36 7	2570	1 2 U
B400389	04/26/89	45 00 - 48 50	2350	243	0 083 U	2 5	19 2	1060 U	5 2 U
B400489	04/28/89	0 00 - 3 00	1020 U	47 8	0 11 U	6 1	37 7	1020 U	5 1 U
B400489	04/28/89	3 00 - 9 00	1690	195	0 10 U	7 9	40 3	1080 U	5 3 U
B400489	04/28/89	9 00 - 15 00	1670	197	0 10 U	6 7	30 3	1040 U	1 1 U
B400489	04/28/89	9 00 - 15 00	1640	185	0 097 U	5 5	29 2	1040 U	1 1 U
B400489	04/28/89	15 00 - 21 00	2180	427	0 10 U	6 0	30 2	1330	1 1 U
B400489	04/28/89	21 00 - 27 00	2840	294	0 10 U	5 6	32 5	1570	1 0 U
B400489	05/01/89	27 00 - 33 00	2760	488	0 10 U	3 9	23 9	1870	5 2 U
B400489	05/01/89	33 00 - 35 50	2840	254	0 15	6 4	18 3	2420	1 4 U
B400489	05/01/89	35 50 - 38 00	4910	460	0 24 U	12 3	33 0	4020	12 2 U
B400489	05/01/89	38 00 - 40 00	2700	219	0 12 U	6 9	26 1	2060	1 5 U
B400489	05/01/89	40 00 - 46 00	1480	105	0 10 U	2 5 U	10 0 U	1250 U	1 2 U
B400489	05/01/89	46 00 52 00	1180	89 3	0 58	2 3 U	9 2 U	1160 U	1 2 U
B400489	05/01/89	52 00 - 54 00	1680	293	0 095 U	2 3 U	10 5	1150 U	6 1 U

NR = Analyte not reported
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N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B400389	04/25/89	3 00 - 9 00	2 1 U	1060 U	212 U	2 1 U	21 2 U	25 9	4 2 U
B400389	04/25/89	9 00 - 15 00	2 1 U	1050 U	210 U	2 0 U	21 0 U	25 1	5 4
B400389	04/25/89	15 00 - 21 00	2 0 U	1010 U	202 U	2 1 U	20 2 U	23 0	5 1
B400389	04/25/89	21 00 - 27 00	2 0 U	1020 U	204 U	2 1 U	20 4 U	17 9	5 7
B400389	04/05/89	27 00 - 33 00	2 1 U	1040 U	207 U	2 0 U	20 7 U	16 0	4 3
B400389	04/25/89	33 00 39 00	2 1 U	1050 U	210 U	2 1 U	21 0 U	22 8	12 8
B400389	04/26/89	39 00 45 00	2 9	1200 U	241 U	2 5 U	24 1 U	43 4	34 6
B400389	04/26/89	45 00 - 48 50	2 1 U	1060 U	212 U	2 1 U	21 2 U	23 6	13 3
B400489	04/28/89	0 00 - 3 00	2 0 U	1020 U	203 U	2 1 U	20 3 U	28 9	4 1 U
B400489	04/28/89	3 00 - 9 00	2 2 U	1080 U	216 U	2 1 U	21 6 U	33 2	4 3 U
B400489	04/28/89	9 00 - 15 00	2 1 U	1040 U	208 U	2 1 U	20 8 U	26 3	4 2 U
B400489	04/28/89	9 00 - 15 00	2 1 U	1040 U	207 U	2 1 U	20 7 U	25 9	4 1 U
B400489	04/28/89	15 00 - 21 00	2 1 U	1040 U	208 U	2 1 U	20 8 U	24 2	9 9
B400489	04/28/89	21 00 - 27 00	2 1 U	1060 U	212 U	2 1 U	21 2 U	28 3	18 1
B400489	05/01/89	27 00 - 33 00	2 1 U	1060 U	211 U	2 1 U	21 1 U	22 7	16 1
B400489	05/01/89	33 00 - 35 50	2 8 U	1380 U	277 U	2 8 U	27 7 U	25 7	34 8
B400489	05/01/89	35 50 38 00	4 8 U	2420 U	484 U	4 9 U	48 4 U	45 6	64 6
B400489	05/01/89	38 00 - 40 00	3 0 U	1510 U	302 U	2 9 U	30 2 U	25 5	29 6
B400489	05/01/89	40 00 - 46 00	2 8	1250 U	250 U	2 4 U	25 0 U	12 6	18 1
B400489	05/01/89	46 00 52 00	6 6	1160 U	231 U	2 4 U	23 1 U	11 6 U	15 7
B400489	05/01/89	52 00 54 00	5 8	1150 U	230 U	2 4 U	23 0 U	19 1	26 2

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N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B200589	03/08/89	0 00 - 2 80	25800	15 7 U	6 0	137	11 8	1 3 U	2520
B200589	02/22/89	0 00 - 3 10	21400	14 0 U	4 2	88 8	1 5	3 2	3100
B200589	02/22/89	3 50 - 8 40	9900	12 5 U	4 0	48 4	1 0	1 4	2690
B200589	02/22/89	3 50 - 8 40	10100	12 4 U	4 0	48 2	1 0 U	1 8	2340
B200589	02/22/89	9 50 - 12 70	7690	12 8 U	7 3	42 5 U	1 1 U	1 3	1630
B200589	02/22/89	13 50 - 17 00	12300	14 3 U	1 8 U	54 2	1 2 U	1 5	3600
B200589	02/22/89	17 00 - 23 50	5510	13 8 U	1 7 U	45 8 U	1 1 U	1 1 U	1150
B200589	02/22/89	23 50 - 25 50	4160	14 1 U	1 9 U	46 8 U	1 2 U	1 2 U	1170 U
B200589	02/23/89	25 00 - 30 00	5640	13 0 U	1 8 U	43 4 U	1 1 U	1 1 U	1340
B200689	03/09/89	0 00 - 1 90	30300	14 5 U	4 4	107	6 7	1 2 U	3890
B200689	02/28/89	1 00 - 4 50	19900	13 6 U	41 7	75 7	1 9	1 1 U	2920
B200689	02/28/89	4 50 - 9 20	8610	14 4 U	2 2 U	54 6	1 2 U	1 2 U	1830
B200689	02/28/89	9 90 - 15 90	8640	13 0 U	2 2 U	47 0	1 1 U	1 1 U	2150
B200689	02/28/89	15 90 - 17 90	14100	15 0 U	2 2 U	104	1 3 U	1 3 U	5500
B200689	02/28/89	17 90 - 23 90	8910	13 0 U	2 2 U	120	6 1	1 1 U	3250
B200689	02/28/89	23 90 - 29 40	5770	13 4 U	2 6	58 5	6 7	1 1 U	2580
B200789	03/08/89	0 00 - 2 90	19300	13 8 U	6 5	120	9 7	1 1 U	3940
B200789	03/01/89	1 00 - 2 70	31800	15 1 U	10 0	195	19 0	1 3 U	11000
B200789	03/01/89	3 00 - 6 30	13500	12 9 U	4 1	133	6 5	1 1 U	157000
B200789	03/01/89	6 30 - 10 30	7400	13 0 U	2 6	46 5	6 1	1 5	8320

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N = Batch spike not in 80 120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B200589	03/08/89	0 00 - 2 80	261 U	16 4	13 1 U	6 8	19100	21 8	26 1 U
B200589	02/22/89	0 00 - 3 10	234 U	15 3	18 2	11 3	21700	13 0	23 4 U
B200589	02/22/89	3 50 8 40	209 U	8 4	16 6	15 3	19800	6 8	20 9 U
B200589	02/22/89	3 50 - 8 40	208 U	8 6	17 5	12 4	17200	6 7	20 8 U
B200589	02/22/89	9 50 - 12 70	212 U	7 0	12 3	16 6	15700	10 3	21 2 U
B200589	02/22/89	13 50 17 00	239 U	12 3	14 9	10 3	13900	9 7	23 9 U
B200589	02/22/89	17 00 23 50	229 U	4 1	11 5 U	7 8	7590	2 8	22 9 U
B200589	02/22/89	23 50 25 50	234 U	4 0	11 7 U	6 3	6610	2 9	23 4 U
B200589	02/23/89	25 00 - 30 00	217 U	5 6	12 2	11 0	8700	4 1	21 7 U
B200689	03/09/89	0 00 1 90	242 U	27 1	12 1 U	11 8	23900	21 8	16 1
B200689	02/28/89	1 00 - 4 50	228 U	48 5	11 4 U	7 6	18400	21 9	22 8 U
B200689	02/28/89	4 50 9 20	239 U	69 6	12 0 U	7 3	11100	5 6	23 9 U
B200689	02/28/89	9 90 15 90	216 U	12 0	10 8 U	8 9	9340	4 6	21 6 U
B200689	02/28/89	15 90 - 17 90	251 U	14 3	12 5 U	13 2	17600	6 5	25 1 U
B200689	02/28/89	17 90 - 23 90	216 U	15 0	11 1	9 2	11000	3 9	21 6 U
B200689	02/28/89	23 90 29 40	224 U	9 7	11 2 U	15 0	11600	4 2	22 4 U
B200789	03/08/89	0 00 2 90	230 U	19 4	11 5 U	10 2	17600	21 6	23 0 U
B200789	03/01/89	1 00 2 70	252 U	42 6	13 4	14 9	26600	17 4	25 2 U
B200789	03/01/89	3 00 6 30	216 U	9 8	10 8 U	7 1	9590	5 3	21 6 U
B200789	03/01/89	6 30 10 30	217 U	15 5	10 8 U	8 8	9440	4 4	21 7 U

NR = Analyte not reported
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* = Holding time not met
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N = Batch spike not in 80 120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B200589	03/08/89	0 00 - 2 80	3040	103	0 19	26 1 U	27 9	1310	1 3 U
B200589	02/22/89	0 00 - 3 10	2310	150	0 23	34 5	19 8	2370	1 0 U
B200589	02/22/89	3 50 - 8 40	2250	346	0 11 U	21 4	16 0	1210	0 89 U
B200589	02/22/89	3 50 - 8 40	2430	294	0 11 U	22 5	16 1	1130	0 92 U
B200589	02/22/89	9 50 - 12 70	1480	124	0 11 U	21 2 U	13 2	1060 U	0 77 U
B200589	02/22/89	13 50 - 17 00	3660	179	0 12 U	24 9	14 0	1800	0 89 U
B200589	02/22/89	17 00 - 23 50	1410	69 8	0 12 U	22 9 U	9 2 U	1150 U	0 83 U
B200589	02/22/89	23 50 - 25 50	1170 U	62 3	0 12 U	23 4 U	9 4 U	1170 U	0 96 U
B200589	02/23/89	25 00 - 30 00	1400	110	0 11 U	21 7 U	10 2	1080 U	0 92 U
B200689	03/09/89	0 00 - 1 90	3380	102	0 12 U	18 5	35 1	2720	1 2 U
B200689	02/28/89	1 00 - 4 50	2400	85 4	0 32	28 0	15 6	1960	0 80 U
B200689	02/28/89	4 50 - 9 20	2430	79 8	0 31	23 9 U	9 6 U	1200 U	1 1 U
B200689	02/28/89	9 90 15 90	2110	89 7	0 25	21 6 U	8 7 U	1410	1 1 U
B200689	02/28/89	15 90 17 90	3440	226	0 19	25 1 U	10 0 U	2180	1 1 U
B200689	02/28/89	17 90 23 90	1870	656	0 13	21 6 U	22 2	1080 U	1 1 U
B200689	02/28/89	23 90 29 40	1540	222	0 17	22 4 U	20 5	1120 U	0 99 U
B200789	03/08/89	0 00 2 90	3150	210	0 12 U	23 6	9 9	2880	1 2 U
B200789	03/01/89	1 00 2 70	4380	221	0 13 U	41 0	54 2	3800	1 2 U
B200789	03/01/89	3 00 6 30	5260	66 4	0 11 U	21 6 U	17 4	1990	5 5 U
B200789	03/01/89	6 30 10 30	2040	73 5	0 11 U	21 7 U	15 0	1490	5 3 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B200589	03/08/89	0 00 - 2 80	6 1	1310 U	26 1 U	2 6 U	26 1 U	43 9	6 0
B200589	02/22/89	0 00 - 3 10	4 4	1170 U	23 4 U	2 1 U	23 4 U	55 5	30 2
B200589	02/22/89	3 50 - 8 40	4 0	1040 U	20 9 U	1 8 U	20 9 U	54 5	19 1
B200589	02/22/89	3 50 8 40	3 3	1040 U	20 8 U	1 8 U	20 8 U	42 6	18 9
B200589	02/22/89	9 50 12 70	3 3	1060 U	21 2 U	1 5 U	21 2 U	48 3	15 8
B200589	02/22/89	13 50 - 17 00	3 1	1190 U	23 9 U	1 8 U	23 9 U	17 1	25 9
B200589	02/22/89	17 00 - 23 50	2 3 U	1150 U	22 9 U	1 7 U	22 9 U	17 4	10 6
B200589	02/22/89	23 50 - 25 50	2 3 U	1170 U	23 4 U	1 9 U	23 4 U	11 7 U	9 7
B200589	02/23/89	25 00 30 00	2 2 U	1080 U	21 7 U	1 8 U	21 7 U	19 8	12 6
B200689	03/09/89	0 00 - 1 90	40 9	1210 U	26 2	2 5 U	312	60 5	36 8
B200689	02/28/89	1 00 - 4 50	2 3 U	1140 U	22 8 U	1 6 U	44 0	46 1	30 6
B200689	02/28/89	4 50 - 9 20	2 4 U	1200 U	23 9 U	2 2 U	37 4	26 0	19 4
B200689	02/28/89	9 90 15 90	2 2 U	1080 U	21 6 U	2 2 U	29 6	20 7	18 0
B200689	02/28/89	15 90 17 90	2 5 U	1250 U	27 1	2 2 U	27 3	28 3	25 5
B200689	02/28/89	17 90 - 23 90	2 2 U	1080 U	21 6 U	2 2 U	21 6 U	13 8	24 3
B200689	02/28/89	23 90 29 40	2 2 U	1120 U	22 4 U	2 0 U	22 4 U	29 8	43 2
B200789	03/08/89	0 00 2 90	2 3 U	1150 U	23 3	2 4 U	34 2	36 4	40 7
B200789	03/01/89	1 00 2 70	3 3	1260 U	33 2	2 4 U	43 9	70 0	77 6
B200789	03/01/89	3 00 6 30	2 2 U	1080 U	226	2 2 U	21 6 U	21 3	30 5
B200789	03/01/89	6 30 - 10 30	2 2 U	1080 U	21 7 U	2 1 U	28 2	22 1	35 7

NR = Analyte not reported
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* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B200789	03/01/89	12 00 - 17 70	6470	13 0 U	3 1	43 3 U	7 1	1 3	2770
B200789	03/01/89	18 00 - 23 00	3030	13 5 U	2 9	45 1 U	2 1	1 1 U	1470
B200789	03/01/89	24 00 - 26 00	6680	14 2 U	2 4 U	47 4 U	3 9	1 2 U	2410
B200889	03/08/89	0 00 - 2 10	14900	15 3 U	5 9	121	8 7	1 3 U	3610
B200889	03/06/89	1 00 - 6 10	16800	13 5 U	5 9	148	9 9	1 1 U	9310
B200889	03/06/89	1 00 - 6 10	18800	13 4 U	7 5	192	13 3	1 1 U	7750
B200889	03/06/89	6 30 - 7 10	5780	13 4 U	3 2	44 5 U	4 0	1 1 U	14000
B200889	03/06/89	8 30 - 13 70	8330	13 2 U	3 5	49 0	7 1	1 1 U	2680
B200889	03/06/89	14 30 - 19 30	7170	13 1 U	2 1 U	43 8	5 3	1 1 U	1980
B200889	03/06/89	20 30 - 21 20	5260	13 4 U	3 2	128	5 5	1 1 U	2060
B200989	03/08/89	0 00 - 2 80	16100	14 0 U	8 1	124	10 8	1 2 U	3930
B200989	03/02/89	1 00 - 4 00	40800	16 4 U	8 0	209	18 3	1 4 U	7270
B200989	03/02/89	4 00 - 9 90	5640	12 4 U	2 2 U	41 4 U	1 3	1 0 U	9550
B200989	03/02/89	4 00 - 9 90	12200	12 9 U	2 2 U	57 9	4 6	1 1 U	25500
B200989	03/02/89	10 00 14 80	6410	13 1 U	4 0	47 2	6 8	1 1 U	2200
B200989	03/02/89	16 00 - 18 40	7850	14 4 U	2 4 U	53 1	5 2	1 2 U	3330

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B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B200789	03/01/89	12 00 - 17 70	217 U	16 1	10 8 U	9 9	11400	4 0	21 7 U
B200789	03/01/89	18 00 - 23 00	225 U	7 4	11 3 U	6 3	5550	3 9	22 5 U
B200789	03/01/89	24 00 - 26 00	237 U	7 9	11 9 U	9 7	8180	2 7	23 7 U
B200889	03/08/89	0 00 2 10	255 U	18 2	12 8 U	12 2	15400	19 9	25 5 U
B200889	03/06/89	1 00 - 6 10	225 U	17 4	11 2 U	8 8	15800	8 0	22 5 U
B200889	03/06/89	1 00 - 6 10	224 U	22 7	28 1	8 6	20900	25 7	22 4 U
B200889	03/06/89	6 30 - 7 10	223 U	17 7	11 1 U	5 6 U	5750	4 9	22 3 U
B200889	03/06/89	8 30 - 13 70	220 U	12 7	11 0 U	8 8	11900	7 1	22 0 U
B200889	03/06/89	14 30 - 19 30	219 U	9 5	11 0 U	8 3	8400	3 1	21 9 U
B200889	03/06/89	20 30 - 21 20	223 U	6 9	11 1 U	10 4	8650	6 7	22 3 U
B200989	03/08/89	0 00 2 80	234 U	19 4	11 7 U	11 9	17900	19 2	23 4 U
B200989	03/02/89	1 00 - 4 00	273 U	34 5	13 6 U	15 6	33700	21 8	31 3
B200989	03/02/89	4 00 - 9 90	207 U	6 0	10 3 U	5 2 U	5660	2 1	20 7 U
B200989	03/02/89	4 00 - 9 90	214 U	5 8	10 7 U	5 4 U	9630	4 2	21 4 U
B200989	03/02/89	10 00 - 14 80	219 U	7 9	16 4	10 1	9810	4 1	21 9 U
B200989	03/02/89	16 00 - 18 40	240 U	9 9	12 0 U	11 1	10400	8 9	24 0 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
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J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B200789	03/01/89	12 00 - 17 70	1590	96 6	0 11 U	21 7 U	10 9	1080 U	5 3 U
B200789	03/01/89	18 00 23 00	1130 U	120	0 12 U	22 5 U	9 0 U	1130 U	5 9 U
B200789	03/01/89	24 00 26 00	1330	75 8	0 12 U	23 7 U	9 6	1190 U	6 0 U
B200889	03/08/89	0 00 2 10	2110	216	0 13 U	25 5 U	10 2 U	2300	1 3 U
B200889	03/06/89	1 00 6 10	3110	136	0 11 U	22 5 U	23 3	1440	1 1 U
B200889	03/06/89	1 00 6 10	3000	380	0 14	22 4 U	27 7	1420	1 1 U
B200889	03/06/89	6 30 7 10	1380	30 6	0 11 U	22 3 U	8 9 U	1110 U	1 1 U
B200889	03/06/89	8 30 13 70	1900	120	0 11 U	22 0 U	10 1	1140	1 1 U
B200889	03/06/89	14 30 19 30	1450	112	0 11 U	21 9 U	8 8 U	1100 U	1 1 U
B200889	03/06/89	20 30 21 20	1440	446	0 11 U	22 3 U	8 9 U	1110 U	1 1 U
B200989	03/08/89	0 00 - 2 80	2650	197	0 12 U	23 6	15 4	1990	1 2 U
B200989	03/02/89	1 00 - 4 00	5570	255	0 14 U	28 9	52 1	3830	1 4 U
B200989	03/02/89	4 00 - 9 90	1980	79 7	0 11 U	20 7 U	15 2	1030 U	1 1 U
B200989	03/02/89	4 00 - 9 90	4090	90 6	0 11 U	21 4 U	21 6	1850	1 1 U
B200989	03/02/89	10 00 - 14 80	1770	195	0 11 U	21 9 U	15 6	1090 U	1 1 U
B200989	03/02/89	16 00 - 18 40	2410	125	0 12 U	24 0 U	16 2	1280	1 2 U

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U = Analyzed but not detected
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B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B200789	03/01/89	12 00 - 17 70	2 2 U	1080 U	21 7 U	2 1 U	27 3	19 8	30 6
B200789	03/01/89	18 00 - 23 00	2 3 U	1130 U	22 5 U	2 3 U	22 5 U	12 0	12 8
B200789	03/01/89	24 00 - 26 00	2 4 U	1190 U	23 7 U	2 4 U	23 7 U	18 8	21 5
B200889	03/08/89	0 00 - 2 10	2 6 U	1280 U	25 5 U	2 5 U	58 5	36 3	36 1
B200889	03/06/89	1 00 - 6 10	2 2 U	1120 U	33 8	2 2 U	22 5 U	35 3	27 8
B200889	03/06/89	1 00 - 6 10	2 2 U	1120 U	33 7	2 2 U	22 4 U	59 7	29 3
B200889	03/06/89	6 30 - 7 10	2 2 U	1110 U	22 3 U	2 2 U	22 3 U	11 7	8 9
B200889	03/06/89	8 30 - 13 70	2 2 U	1100 U	22 0 U	2 2 U	37 7	19 7	17 3
B200889	03/06/89	14 30 - 19 30	2 2 U	1100 U	21 9 U	2 1 U	21 9 U	12 7	15 8
B200889	03/06/89	20 30 - 21 20	2 2 U	1110 U	22 3 U	2 2 U	22 3 U	20 3	13 3
B200989	03/08/89	0 00 - 2 80	2 3 U	1170 U	29 4	2 3 U	32 4	42 3	40 4
B200989	03/02/89	1 00 - 4 00	3 9	1360 U	52 4	2 7 U	27 3 U	64 2	56 8
B200989	03/02/89	4 00 - 9 90	2 1 U	1030 U	25 2	2 2 U	20 7 U	10 3 U	4 9
B200989	03/02/89	4 00 - 9 90	2 1 U	1070 U	71 8	2 2 U	21 4 U	10 7 U	13 6
B200989	03/02/89	10 00 - 14 80	2 2 U	1090 U	21 9 U	2 2 U	21 9 U	18 1	16 8
B200989	03/02/89	16 00 - 18 40	2 4 U	1200 U	24 0 U	2 4 U	24 0 U	17 9	21 8

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N = Batch spike not in 80 120% range

INORGANICS

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B405189	03/09/89	0 00 - 3 00	1 4	7 6	3 U
B405189	03/09/89	3 60 - 8 55	1 2	7 4	3 U
B405189	03/09/89	9 60 - 15 40	1 1 U	7 6	6
B405189	03/09/89	15 60 20 30	1 1 U	7 4	4
B405189	03/09/89	21 60 - 26 50	1 1 U	7 5	3 U
B405189	03/10/89	29 50 - 35 60	1 2	7 0	3 U
B405189	03/10/89	35 60 - 37 60	2 1	7 4	3 U
B405189	03/10/89	37 60 - 42 60	1 7	7 4	3 U
B405189	03/10/89	43 60 - 47 50	3 5	7 4	3 U
B400289	04/12/89	0 00 3 00	1 2	6 4	2 3 U
B400289	04/12/89	4 00 9 00	1 1 U	6 1	2 2 U
B400289	04/12/89	9 00 14 90	1 4	6 7	2 2 U
B400289	04/13/89	16 00 - 21 10	1 2 U	7 7	2 3 U
B400289	04/13/89	16 00 - 21 10	1 1 U	7 6	2 2 U
B400289	04/13/89	21 10 - 28 70	1 1 U	7 5	2 1 U
B400289	04/14/89	30 00 - 36 00	1 1 U	7 1	2 2 U
B400289	04/14/89	36 00 41 30	1 1 U	8 8	2 2 U
B400289	04/17/89	42 00 47 20	1 1 U	7 7	2 3 U
B400389	04/25/89	0 00 3 00	1 1 U	6 3	2 U
B400389	04/25/89	3 00 9 00	1 3	7 9	2 U
B400389	04/25/89	3 00 9 00	1 1 U	8 4	2 U

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B400389	04/25/89	9 00 - 15 00	1 4	8 6	2 U
B400389	04/25/89	15 00 - 21 00	1 1 U	8 8	2 U
B400389	04/25/89	21 00 - 27 00	1 1 U	8 8	2 U
B400389	04/05/89	27 00 - 33 00	1 0 U	8 6	2 U
B400389	04/25/89	33 00 - 39 00	1 1 U	8 8	2 U
B400389	04/26/89	39 00 - 45 00	1 9	8 4	2 U
B400389	04/26/89	45 00 - 48 50	3 1	8 5	2 U
B400489	04/28/89	0 00 - 3 00	1 0 U	7 0	2 U
B400489	04/28/89	3 00 9 00	1 3	7 6	2 U
B400489	04/28/89	9 00 - 15 00	1 3	8 7	2 U
B400489	04/28/89	9 00 - 15 00	1 1 U	9 0	2 U
B400489	04/28/89	15 00 - 21 00	1 1 U	8 4	2 U
B400489	04/28/89	21 00 - 27 00	1 1 U	8 8	2 U
B400489	05/01/89	27 00 - 33 00	1 1 U	8 9	2 U
B400489	05/01/89	33 00 - 35 50	1 4 U	8 9	3 U
B400489	05/01/89	35 50 - 38 00	2 2 U	8 8	4 U
B400489	05/01/89	38 00 - 40 00	1 4 U	8 8	3 U
B400489	05/01/89	40 00 - 46 00	3 3	9 1	3 U
B400489	05/01/89	46 00 - 52 00	1 4	8 4	3 U
B400489	05/01/89	52 00 - 54 00	1 5	8 1	3 U
B200589	03/08/89	0 00 - 2 80	1 6	7 6	2 U

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B200589	02/22/89	0 00 - 3 10	1 1	6 1	4
B200589	02/22/89	3 50 - 8 40	1 1 U	6 7	9
B200589	02/22/89	3 50 - 8 40	1 1 U	7 4	9
B200589	02/22/89	9 50 - 12 70	1 1 U	7 1	4 U
B200589	02/22/89	13 50 - 17 00	1 2 U	6 2	5
B200589	02/22/89	17 00 - 23 50	1 1 U	7 2	13
B200589	02/22/89	23 50 - 25 50	1 1 U	7 2	5
B200589	02/23/89	25 00 - 30 00	1 1 U	7 8	7
B200689	03/09/89	0 00 - 1 90	3 1	7 8	4 8
B200689	02/28/89	1 00 - 4 50	1 2 U	7 3	7 2
B200689	02/28/89	4 50 - 9 20	1 1 U	7 2	4 3
B200689	02/28/89	9 90 - 15 90	1 1 U	7 6	4 5
B200689	02/28/89	15 90 - 17 90	1 2 U	7 6	4 9
B200689	02/28/89	17 90 - 23 90	1 1 U	7 5	4 5
B200689	02/28/89	23 90 - 29 40	1 1 U	7 4	6 5
B200789	03/08/89	0 00 2 90	1 2 U	7 7	2 U
B200789	03/01/89	1 00 2 70	1 2 U	7 4	4 U
B200789	03/01/89	3 00 - 6 30	1 1 U	8 9	4 U
B200789	03/01/89	6 30 - 10 30	1 1 U	8 7	4 U
B200789	03/01/89	12 00 - 17 70	1 1 U	8 5	4 U
B200789	03/01/89	18 00 - 23 00	1 2 U	8 3	4 U

Notes NR = Analyte not reported
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B = Present in laboratory blank

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B200789	03/01/89	24 00 - 26 00	1 1 U	8 1	4 U
B200889	03/08/89	0 00 - 2 10	4 3	7 6	2 U
B200889	03/06/89	1 00 - 6 10	1 2	7 9	2 U
B200889	03/06/89	1 00 6 10	1 1 U	8 0	2 U
B200889	03/06/89	6 30 7 10	1 1 U	8 7	2 U
B200889	03/06/89	8 30 13 70	1 1 U	8 5	2 U
B200889	03/06/89	14 30 - 19 30	1 1 U	8 3	2 U
B200889	03/06/89	20 30 21 20	2 5	8 2	2 U
B200989	03/08/89	0 00 2 80	2 4	7 1	2
B200989	03/02/89	1 00 - 4 00	1 2 U	7 8	4 U
B200989	03/02/89	4 00 9 90	1 1 U	8 6	4 U
B200989	03/02/89	4 00 9 90	1 1 U	8 9	4 U
B200989	03/02/89	10 00 14 80	1 1 U	8 7	4 U
B200989	03/02/89	16 00 18 40	1 2 U	8 3	4 U

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

TOTAL RADIOCHEMISTRY

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B405189	03/09/89	0 00 - 3 00	22 ± 10	12 ± 5	0 8 ± 0 2	0 0 ± 0 1
B405189	03/09/89	3 60 - 8 55	20 ± 10	17 ± 5	0 5 ± 0 1	0 0 ± 0 1
B405189	03/09/89	9 60 - 15 40	14 ± 9	28 ± 6	0 7 ± 0 2	0 0 ± 0 1
B405189	03/09/89	15 60 - 20 30	13 ± 9	22 ± 6	0 4 ± 0 1	0 0 ± 0 1
B405189	03/09/89	21 60 - 26 50	15 ± 9	19 ± 6	0 6 ± 0 2	0 0 ± 0 1
B405189	03/10/89	29 50 - 35 60	23 ± 10	23 ± 6	0 6 ± 0 2	0 2 ± 0 1
B405189	03/10/89	35 60 - 37 60	30 ± 13	21 ± 8	0 5 ± 0 2	0 0 ± 0 1
B405189	03/10/89	37 60 - 42 60	26 ± 11	25 ± 6	0 6 ± 0 1	0 0 ± 0 1
B405189	03/10/89	43 60 - 47 50	25 ± 10	30 ± 6	0 7 ± 0 2	0 0 ± 0 1
B400289	04/12/89	0 00 - 3 00	15 ± 12	6 ± 5	0 4 ± 0 2	0 0 ± 0 1
B400289	04/12/89	4 00 - 9 00	25 ± 14	21 ± 6	0 6 ± 0 2	0 0 ± 0 1
B400289	04/12/89	9 00 - 14 90	20 ± 3	23 ± 6	0 5 ± 0 2	0 0 ± 0 1
B400289	04/13/89	16 00 - 21 10	17 ± 13	28 ± 6	0 8 ± 0 2	0 0 ± 0 1
B400289	04/13/89	16 00 - 21 10	36 ± 16	32 ± 6	0 7 ± 0 2	0 0 ± 0 1
B400289	04/13/89	21 10 - 28 70	18 ± 13	24 ± 6	0 7 ± 0 2	0 1 ± 0 1
B400289	04/14/89	30 00 - 36 00	33 ± 15	28 ± 6	0 2 ± 0 2	0 0 ± 0 1
B400289	04/14/89	36 00 - 41 30	30 ± 15	30 ± 6	0 7 ± 0 2	0 0 ± 0 1
B400289	04/17/89	42 00 - 47 20	27 ± 14	25 ± 6	0 7 ± 0 2	0 0 ± 0 1
B400389	04/25/89	0 00 3 00	13 ± 9	15 ± 5	0 5 ± 0 2	0 0 ± 0 1
B400389	04/25/89	3 00 - 9 00	18 ± 10	22 ± 6	1 1 ± 0 3	0 1 ± 0 1
B400389	04/25/89	3 00 9 00	15 ± 9	20 ± 6	0 6 ± 0 2	0 0 ± 0 1
B400389	04/25/89	9 00 15 00	18 ± 10	20 ± 5	0 6 ± 0 2	0 0 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B405189	03/09/89	0 00 - 3 00	0 6 ± 0 2	0 2 ± 0 8	0 03 ± 0 03	NR
B405189	03/09/89	3 60 - 8 55	0 6 ± 0 1	0 1 ± 0 5	0 00 ± 0 02	NR
B405189	03/09/89	9 60 15 40	0 9 ± 0 2	0 0 ± 0 6	-0 01 ± 0 02	NR
B405189	03/09/89	15 60 - 20 30	0 6 ± 0 1	0 2 ± 0 5	0 00 ± 0 02	NR
B405189	03/09/89	21 60 - 26 50	0 8 ± 0 2	0 1 ± 0 4	0 00 ± 0 02	NR
B405189	03/10/89	29 50 - 35 60	0 8 ± 0 2	0 0 ± 0 4	0 01 ± 0 02	NR
B405189	03/10/89	35 60 - 37 60	0 7 ± 0 2	1 2 ± 0 6	0 00 ± 0 01	NR
B405189	03/10/89	37 60 42 60	0 9 ± 0 2	0 2 ± 0 6	0 01 ± 0 01	NR
B405189	03/10/89	43 60 - 47 50	0 7 ± 0 2	0 5 ± 0 5	0 01 ± 0 01	NR
B400289	04/12/89	0 00 3 00	0 5 ± 0 2	0 1 ± 0 5	0 01 ± 0 01	NR
B400289	04/12/89	4 00 9 00	0 7 ± 0 2	0 1 ± 0 6	0 00 ± 0 01	NR
B400289	04/12/89	9 00 - 14 90	0 5 ± 0 2	-0 3 ± 0 7	0 00 ± 0 01	NR
B400289	04/13/89	16 00 - 21 10	0 8 ± 0 2	0 2 ± 0 6	0 01 ± 0 01	NR
B400289	04/13/89	16 00 - 21 10	1 0 ± 0 2	0 0 ± 0 5	0 00 ± 0 01	NR
B400289	04/13/89	21 10 28 70	0 7 ± 0 2	0 0 ± 0 5	0 00 ± 0 01	NR
B400289	04/14/89	30 00 - 36 00	0 3 ± 0 1	0 2 ± 0 6	0 00 ± 0 01	NR
B400289	04/14/89	36 00 - 41 30	0 4 ± 0 1	0 3 ± 0 5	0 00 ± 0 01	NR
B400289	04/17/89	42 00 - 47 20	0 7 ± 0 2	0 4 ± 0 8	0 00 ± 0 01	NR
B400389	04/25/89	0 00 - 3 00	0 5 ± 0 2	0 1 ± 0 6	0 00 ± 0 01	NR
B400389	04/25/89	3 00 - 9 00	0 7 ± 0 2	0 7 ± 0 7	0 00 ± 0 01	NR
B400389	04/25/89	3 00 9 00	0 8 ± 0 2	0 4 ± 0 5	0 00 ± 0 01	NR
B400389	04/25/89	9 00 15 00	0 7 ± 0 2	0 3 ± 0 6	0 00 ± 0 01	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B405189	03/09/89	0 00 - 3 00	0 1 ± 0 1	0 18 ± 0 16	NR	NR
B405189	03/09/89	3 60 - 8 55	0 0 ± 0 1	0 32 ± 0 16	NR	NR
B405189	03/09/89	9 60 - 15 40	0 0 ± 0 1	0 32 ± 0 16	NR	NR
B405189	03/09/89	15 60 - 20 30	0 0 ± 0 1	0 22 ± 0 16	NR	NR
B405189	03/09/89	21 60 - 26 50	0 0 ± 0 1	0 25 ± 0 16	NR	NR
B405189	03/10/89	29 50 - 35 60	0 0 ± 0 1	0 06 ± 0 16	0 5 ± 0 1	1 4 ± 0 2
B405189	03/10/89	35 60 37 60	0 0 ± 0 1	0 01 ± 0 16	0 6 ± 0 1	1 8 ± 0 2
B405189	03/10/89	37 60 - 42 60	0 0 ± 0 1	0 10 ± 0 16	0 8 ± 0 1	1 1 ± 0 2
B405189	03/10/89	43 60 - 47 50	0 0 ± 0 1	0 13 ± 0 16	0 8 ± 0 1	1 4 ± 0 2
B400289	04/12/89	0 00 - 3 00	0 2 ± 0 1	0 12 ± 0 15	0 5 ± 0 1	1 3 ± 0 2
B400289	04/12/89	4 00 - 9 00	0 0 ± 0 1	0 14 ± 0 15	0 6 ± 0 1	1 8 ± 0 2
B400289	04/12/89	9 00 - 14 90	0 0 ± 0 1	0 15 ± 0 15	0 7 ± 0 1	1 1 ± 0 1
B400289	04/13/89	16 00 - 21 10	0 0 ± 0 1	0 26 ± 0 15	0 6 ± 0 1	1 4 ± 0 2
B400289	04/13/89	16 00 - 21 10	0 0 ± 0 1	0 21 ± 0 15	0 8 ± 0 1	1 4 ± 0 2
B400289	04/13/89	21 10 - 28 70	0 0 ± 0 1	0 29 ± 0 15	0 5 ± 0 1	1 2 ± 0 2
B400289	04/14/89	30 00 - 36 00	0 0 ± 0 1	0 33 ± 0 16	0 8 ± 0 1	1 8 ± 0 3
B400289	04/14/89	36 00 - 41 30	0 0 ± 0 1	0 14 ± 0 16	0 6 ± 0 1	1 5 ± 0 2
B400289	04/17/89	42 00 - 47 20	0 0 ± 0 1	0 15 ± 0 15	0 9 ± 0 1	1 6 ± 0 2
B400389	04/25/89	0 00 - 3 00	0 0 ± 0 1	0 02 ± 0 15	0 5 ± 0 1	1 2 ± 0 1
B400389	04/25/89	3 00 - 9 00	0 0 ± 0 1	0 11 ± 0 15	0 4 ± 0 1	1 5 ± 0 2
B400389	04/25/89	3 00 - 9 00	0 0 ± 0 1	0 16 ± 0 15	0 7 ± 0 1	1 2 ± 0 2
B400389	04/25/89	9 00 - 15 00	0 0 ± 0 1	0 31 ± 0 15	0 5 ± 0 1	1 4 ± 0 2

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B400389	04/25/89	15 00 - 21 00	33 ± 11	31 ± 6	0 4 ± 0 1	0 0 ± 0 1
B400389	04/25/89	21 00 - 27 00	16 ± 9	19 ± 5	0 4 ± 0 2	0 0 ± 0 1
B400389	04/05/89	27 00 - 33 00	21 ± 10	22 ± 6	0 6 ± 0 2	0 0 ± 0 1
B400389	04/25/89	33 00 - 39 00	18 ± 10	25 ± 6	0 7 ± 0 2	0 0 ± 0 1
B400389	04/26/89	39 00 - 45 00	27 ± 14	31 ± 6	0 6 ± 0 2	0 0 ± 0 1
B400389	04/26/89	45 00 - 48 50	23 ± 14	25 ± 6	1 0 ± 0 3	0 1 ± 0 1
B400489	04/28/89	0 00 - 3 00	3 ± 7	14 ± 5	0 5 ± 0 2	0 0 ± 0 1
B400489	04/28/89	3 00 - 9 00	14 ± 9	20 ± 6	0 2 ± 0 1	0 0 ± 0 1
B400489	04/28/89	9 00 - 15 00	9 ± 8	21 ± 6	0 5 ± 0 2	0 0 ± 0 1
B400489	04/28/89	9 00 - 15 00	11 ± 9	20 ± 6	0 4 ± 0 2	0 0 ± 0 1
B400489	04/28/89	15 00 - 21 00	12 ± 9	24 ± 5	0 6 ± 0 2	0 0 ± 0 1
B400489	04/28/89	21 00 - 27 00	5 ± 8	27 ± 6	0 4 ± 0 2	0 0 ± 0 1
B400489	05/01/89	27 00 - 33 00	21 ± 10	25 ± 6	0 4 ± 0 2	0 0 ± 0 1
B400489	05/01/89	33 00 - 35 50	28 ± 10	25 ± 6	0 6 ± 0 2	0 0 ± 0 1
B400489	05/01/89	35 50 38 00	23 ± 10	27 ± 6	0 7 ± 0 2	0 0 ± 0 1
B400489	05/01/89	38 00 - 40 00	12 ± 8	18 ± 5	0 5 ± 0 2	0 0 ± 0 1
B400489	05/01/89	40 00 - 46 00	18 ± 9	15 ± 5	0 4 ± 0 2	0 0 ± 0 1
B400489	05/01/89	46 00 - 52 00	9 ± 8	29 ± 6	0 4 ± 0 1	0 0 ± 0 1
B400489	05/01/89	52 00 54 00	22 ± 10	22 ± 5	0 7 ± 0 2	0 0 ± 0 1
B200589	03/08/89	0 00 - 2 80	38 ± 14	28 ± 6	0 7 ± 0 2	0 0 ± 0 1
B200589	02/22/89	0 00 - 3 10	37 ± 15	41 ± 6	0 5 ± 0 1	0 0 ± 0 1
B200589	02/22/89	3 50 - 8 40	30 ± 14	33 ± 6	0 7 ± 0 1	0 0 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B400389	04/25/89	15 00 - 21 00	0 5 ± 0 1	0 4 ± 0 7	0 00 ± 0 01	NR
B400389	04/25/89	21 00 - 27 00	0 5 ± 0 2	0 3 ± 0 6	0 00 ± 0 01	NR
B400389	04/05/89	27 00 - 33 00	0 5 ± 0 2	0 3 ± 0 5	0 00 ± 0 01	NR
B400389	04/25/89	33 00 - 39 00	0 6 ± 0 2	1 2 ± 1 0	0 00 ± 0 01	NR
B400389	04/26/89	39 00 - 45 00	0 7 ± 0 2	0 0 ± 0 5	0 00 ± 0 01	NR
B400389	04/26/89	45 00 - 48 50	1 1 ± 0 3	0 5 ± 0 7	0 00 ± 0 01	NR
B400489	04/28/89	0 00 - 3 00	0 5 ± 0 1	-0 4 ± 0 6	0 00 ± 0 01	NR
B400489	04/28/89	3 00 - 9 00	0 2 ± 0 1	0 8 ± 0 7	0 00 ± 0 01	NR
B400489	04/28/89	9 00 - 15 00	0 6 ± 0 2	-0 2 ± 0 8	0 00 ± 0 01	NR
B400489	04/28/89	9 00 - 15 00	0 6 ± 0 2	0 0 ± 0 5	0 00 ± 0 01	NR
B400489	04/28/89	15 00 - 21 00	0 4 ± 0 1	0 1 ± 0 7	0 00 ± 0 01	NR
B400489	04/28/89	21 00 - 27 00	0 6 ± 0 2	-0 1 ± 0 7	0 00 ± 0 01	NR
B400489	05/01/89	27 00 - 33 00	0 6 ± 0 2	-0 2 ± 0 9	0 00 ± 0 01	NR
B400489	05/01/89	33 00 - 35 50	1 0 ± 0 2	-0 2 ± 0 5	0 00 ± 0 01	NR
B400489	05/01/89	35 50 - 38 00	0 7 ± 0 2	-0 3 ± 0 7	0 00 ± 0 01	NR
B400489	05/01/89	38 00 40 00	0 5 ± 0 2	NR	0 00 ± 0 01	NR
B400489	05/01/89	40 00 - 46 00	0 2 ± 0 1	0 0 ± 0 7	0 00 ± 0 01	NR
B400489	05/01/89	46 00 52 00	0 6 ± 0 2	-0 3 ± 0 7	0 00 ± 0 01	NR
B400489	05/01/89	52 00 54 00	0 9 ± 0 2	-0 2 ± 0 7	0 00 ± 0 01	NR
B200589	03/08/89	0 00 2 80	0 9 ± 0 2	-0 4 ± 0 5	0 01 ± 0 02	0 01 ± 0 02
B200589	02/22/89	0 00 - 3 10	0 6 ± 0 1	0 2 ± 0 5	0 00 ± 0 02	-0 02 ± 0 02
B200589	02/22/89	3 50 - 8 40	0 8 ± 0 1	0 0 ± 0 4	0 01 ± 0 03	0 01 ± 0 03

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B400389	04/25/89	15 00 - 21 00	0 0 ± 0 1	0 31 ± 0 15	0 7 ± 0 1	1 6 ± 0 2
B400389	04/25/89	21 00 - 27 00	0 0 ± 0 1	0 22 ± 0 15	0 6 ± 0 1	1 1 ± 0 1
B400389	04/05/89	27 00 33 00	0 0 ± 0 1	0 23 ± 0 15	0 6 ± 0 1	1 1 ± 0 2
B400389	04/25/89	33 00 39 00	0 0 ± 0 1	0 27 ± 0 15	0 6 ± 0 1	1 4 ± 0 2
B400389	04/26/89	39 00 - 45 00	0 0 ± 0 1	-0 04 ± 0 14	0 7 ± 0 1	1 7 ± 0 2
B400389	04/26/89	45 00 - 48 50	0 0 ± 0 1	-0 08 ± 0 15	0 9 ± 0 1	1 6 ± 0 2
B400489	04/28/89	0 00 3 00	0 0 ± 0 1	0 10 ± 0 15	0 6 ± 0 1	1 1 ± 0 2
B400489	04/28/89	3 00 - 9 00	0 0 ± 0 1	0 15 ± 0 15	0 7 ± 0 1	1 3 ± 0 2
B400489	04/28/89	9 00 15 00	0 0 ± 0 1	0 32 ± 0 15	0 6 ± 0 1	1 4 ± 0 2
B400489	04/28/89	9 00 15 00	0 0 ± 0 1	0 23 ± 0 15	0 5 ± 0 1	1 0 ± 0 2
B400489	04/28/89	15 00 21 00	0 0 ± 0 1	0 05 ± 0 15	0 5 ± 0 1	1 4 ± 0 2
B400489	04/28/89	21 00 27 00	0 0 ± 0 1	0 17 ± 0 15	0 7 ± 0 1	1 2 ± 0 2
B400489	05/01/89	27 00 33 00	0 0 ± 0 1	0 14 ± 0 14	0 6 ± 0 1	1 0 ± 0 1
B400489	05/01/89	33 00 - 35 50	0 0 ± 0 1	0 18 ± 0 14	0 6 ± 0 1	1 3 ± 0 2
B400489	05/01/89	35 50 38 00	0 0 ± 0 1	0 06 ± 0 14	0 8 ± 0 1	1 6 ± 0 2
B400489	05/01/89	38 00 40 00	0 0 ± 0 1	0 10 ± 0 14	0 5 ± 0 1	1 2 ± 0 1
B400489	05/01/89	40 00 46 00	0 0 ± 0 1	0 05 ± 0 14	0 6 ± 0 1	0 5 ± 0 2
B400489	05/01/89	46 00 - 52 00	0 0 ± 0 1	0 13 ± 0 14	0 5 ± 0 1	1 2 ± 0 1
B400489	05/01/89	52 00 54 00	0 0 ± 0 1	0 10 ± 0 14	0 7 ± 0 1	1 0 ± 0 2
B200589	03/08/89	0 00 2 80	0 1 ± 0 1	-0 09 ± 0 15	0 9 ± 0 1	2 0 ± 0 3
B200589	02/22/89	0 00 3 10	0 0 ± 0 1	0 13 ± 0 16	0 6 ± 0 1	1 4 ± 0 3
B200589	02/22/89	3 50 8 40	0 0 ± 0 1	0 20 ± 0 17	0 8 ± 0 1	1 8 ± 0 2

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B200589	02/22/89	3 50 - 8 40	42 ± 16	22 ± 6	0 6 ± 0 2	0 0 ± 0 1
B200589	02/22/89	9 50 - 12 70	29 ± 14	39 ± 6	0 7 ± 0 1	0 0 ± 0 1
B200589	02/22/89	13 50 - 17 00	40 ± 16	44 ± 7	0 8 ± 0 1	0 0 ± 0 1
B200589	02/22/89	17 00 - 23 50	20 ± 13	28 ± 6	0 5 ± 0 1	0 0 ± 0 1
B200589	02/22/89	23 50 - 25 50	25 ± 14	21 ± 6	0 8 ± 0 2	0 0 ± 0 1
B200589	02/23/89	25 00 - 30 00	26 ± 14	18 ± 5	0 7 ± 0 2	0 0 ± 0 1
B200689	03/09/89	0 00 - 1 90	17 ± 9	18 ± 5	0 3 ± 0 1	0 0 ± 0 1
B200689	02/28/89	1 00 - 4 50	19 ± 12	21 ± 6	0 7 ± 0 2	0 0 ± 0 1
B200689	02/28/89	4 50 - 9 20	27 ± 13	16 ± 6	0 5 ± 0 1	0 0 ± 0 1
B200689	02/28/89	9 90 - 15 90	24 ± 13	32 ± 6	0 5 ± 0 1	0 0 ± 0 1
B200689	02/28/89	15 90 - 17 90	34 ± 14	27 ± 6	0 7 ± 0 2	0 0 ± 0 1
B200689	02/28/89	17 90 - 23 90	17 ± 12	20 ± 6	0 8 ± 0 2	0 0 ± 0 1
B200689	02/28/89	23 90 - 29 40	14 ± 11	20 ± 6	0 6 ± 0 2	0 0 ± 0 1
B200789	03/08/89	0 00 - 2 90	17 ± 11	29 ± 6	0 8 ± 0 2	0 0 ± 0 1
B200789	03/01/89	1 00 2 70	34 ± 14	27 ± 6	0 6 ± 0 1	0 0 ± 0 1
B200789	03/01/89	3 00 - 6 30	19 ± 13	25 ± 6	0 5 ± 0 1	0 0 ± 0 1
B200789	03/01/89	6 30 10 30	30 ± 13	37 ± 6	0 4 ± 0 1	0 0 ± 0 1
B200789	03/01/89	12 00 17 70	30 ± 13	21 ± 6	0 5 ± 0 1	0 0 ± 0 1
B200789	03/01/89	18 00 - 23 00	18 ± 11	22 ± 6	0 5 ± 0 1	0 0 ± 0 1
B200789	03/01/89	24 00 - 26 00	12 ± 10	26 ± 6	0 4 ± 0 1	0 1 ± 0 1
B200889	03/08/89	0 00 - 2 10	27 ± 12	14 ± 5	0 7 ± 0 2	0 0 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B200589	02/22/89	3 50 - 8 40	0 5 ± 0 2	0 0 ± 0 4	0 02 ± 0 02	-0 01 ± 0 02
B200589	02/22/89	9 50 12 70	0 8 ± 0 1	-0 1 ± 0 8	0 00 ± 0 02	0 01 ± 0 02
B200589	02/22/89	13 50 17 00	0 9 ± 0 1	0 6 ± 0 6	0 00 ± 0 02	0 00 ± 0 02
B200589	02/22/89	17 00 - 23 50	0 5 ± 0 1	0 6 ± 0 6	-0 01 ± 0 02	0 01 ± 0 02
B200589	02/22/89	23 50 - 25 50	0 6 ± 0 2	0 3 ± 0 4	0 01 ± 0 03	0 01 ± 0 03
B200589	02/23/89	25 00 30 00	0 6 ± 0 2	-0 1 ± 0 6	0 01 ± 0 02	0 00 ± 0 02
B200689	03/09/89	0 00 - 1 90	0 5 ± 0 2	-0 2 ± 0 5	0 00 ± 0 02	NR
B200689	02/28/89	1 00 - 4 50	0 8 ± 0 2	0 2 ± 0 4	-0 01 ± 0 02	-0 01 ± 0 02
B200689	02/28/89	4 50 9 20	0 3 ± 0 1	-0 1 ± 0 4	-0 01 ± 0 02	0 00 ± 0 02
B200689	02/28/89	9 90 - 15 90	0 6 ± 0 1	0 0 ± 0 7	0 01 ± 0 02	0 00 ± 0 02
B200689	02/28/89	15 90 - 17 90	0 9 ± 0 2	0 0 ± 0 7	0 00 ± 0 02	0 00 ± 0 02
B200689	02/28/89	17 90 - 23 90	0 7 ± 0 2	-0 6 ± 0 7	0 01 ± 0 02	0 01 ± 0 02
B200689	02/28/89	23 90 29 40	0 7 ± 0 2	-0 1 ± 0 6	0 00 ± 0 02	-0 01 ± 0 02
B200789	03/08/89	0 00 - 2 90	0 6 ± 0 2	0 1 ± 0 6	0 01 ± 0 02	0 01 ± 0 01
B200789	03/01/89	1 00 - 2 70	0 6 ± 0 1	-0 4 ± 0 8	0 01 ± 0 02	NR
B200789	03/01/89	3 00 6 30	0 6 ± 0 1	0 0 ± 0 6	0 00 ± 0 02	NR
B200789	03/01/89	6 30 10 30	0 4 ± 0 1	-0 6 ± 0 8	0 01 ± 0 02	NR
B200789	03/01/89	12 00 17 70	0 3 ± 0 1	-0 3 ± 0 5	0 02 ± 0 02	NR
B200789	03/01/89	18 00 23 00	0 7 ± 0 1	-0 4 ± 0 4	-0 01 ± 0 02	NR
B200789	03/01/89	24 00 26 00	0 4 ± 0 1	-0 4 ± 0 7	0 00 ± 0 02	NR
B200889	03/08/89	0 00 - 2 10	0 6 ± 0 2	0 0 ± 0 5	0 00 ± 0 02	-0 01 ± 0 01

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B200589	02/22/89	3 50 - 8 40	0 0 ± 0 1	0 08 ± 0 16	0 6 ± 0 1	1 9 ± 0 2
B200589	02/22/89	9 50 - 12 70	0 0 ± 0 1	0 30 ± 0 17	0 7 ± 0 1	2 0 ± 0 3
B200589	02/22/89	13 50 - 17 00	0 0 ± 0 1	0 34 ± 0 17	0 8 ± 0 1	2 2 ± 0 3
B200589	02/22/89	17 00 - 23 50	0 0 ± 0 1	0 11 ± 0 16	0 6 ± 0 1	1 2 ± 0 2
B200589	02/22/89	23 50 - 25 50	0 0 ± 0 1	0 13 ± 0 16	0 6 ± 0 1	1 0 ± 0 1
B200589	02/23/89	25 00 - 30 00	0 0 ± 0 1	0 28 ± 0 15	0 6 ± 0 1	0 9 ± 0 1
B200689	03/09/89	0 00 - 1 90	0 1 ± 0 1	0 04 ± 0 16	0 6 ± 0 1	1 3 ± 0 2
B200689	02/28/89	1 00 - 4 50	0 0 ± 0 1	0 11 ± 0 15	0 6 ± 0 1	1 2 ± 0 2
B200689	02/28/89	4 50 - 9 20	0 0 ± 0 1	0 17 ± 0 15	0 5 ± 0 1	1 0 ± 0 1
B200689	02/28/89	9 90 - 15 90	0 0 ± 0 1	0 29 ± 0 16	0 6 ± 0 1	1 3 ± 0 3
B200689	02/28/89	15 90 - 17 90	0 0 ± 0 1	0 28 ± 0 16	0 6 ± 0 1	1 6 ± 0 2
B200689	02/28/89	17 90 - 23 90	0 0 ± 0 1	0 20 ± 0 16	0 6 ± 0 1	1 4 ± 0 3
B200689	02/28/89	23 90 - 29 40	0 0 ± 0 1	0 21 ± 0 16	0 7 ± 0 1	0 9 ± 0 1
B200789	03/08/89	0 00 - 2 90	0 1 ± 0 1	0 10 ± 0 15	0 7 ± 0 1	1 7 ± 0 3
B200789	03/01/89	1 00 - 2 70	0 0 ± 0 1	0 02 ± 0 15	NR	NR
B200789	03/01/89	3 00 - 6 30	0 0 ± 0 1	0 14 ± 0 15	NR	NR
B200789	03/01/89	6 30 - 10 30	0 0 ± 0 1	0 34 ± 0 16	NR	NR
B200789	03/01/89	12 00 17 70	0 0 ± 0 1	0 35 ± 0 16	NR	NR
B200789	03/01/89	18 00 - 23 00	0 0 ± 0 1	0 32 ± 0 16	NR	NR
B200789	03/01/89	24 00 - 26 00	0 0 ± 0 1	0 44 ± 0 16	NR	NR
B200889	03/08/89	0 00 2 10	0 0 ± 0 1	0 08 ± 0 15	0 5 ± 0 1	1 0 ± 0 2

Notes. NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B200889	03/06/89	1 00 - 6 10	28 ± 13	18 ± 5	0 4 ± 0 1	0 0 ± 0 1
B200889	03/06/89	1 00 - 6 10	19 ± 11	12 ± 5	0 4 ± 0 1	0 0 ± 0 1
B200889	03/06/89	6 30 - 7 10	15 ± 11	16 ± 5	0 3 ± 0 1	0 0 ± 0 1
B200889	03/06/89	8 30 - 13 70	25 ± 12	27 ± 6	0 5 ± 0 1	0 0 ± 0 1
B200889	03/06/89	14 30 - 19 30	9 1 ± 9 4	31 ± 6	0 3 ± 0 1	0 0 ± 0 1
B200889	03/06/89	20 30 - 21 20	19 ± 11	22 ± 5	0 3 ± 0 1	0 0 ± 0 1
B200989	03/08/89	0 00 - 2 80	29 ± 13	19 ± 6	2 4 ± 0 3	0 0 ± 0 1
B200989	03/02/89	1 00 - 4 00	34 ± 16	28 ± 7	0 4 ± 0 1	0 0 ± 0 1
B200989	03/02/89	4 00 - 9 90	15 ± 13	24 ± 6	0 4 ± 0 1	0 0 ± 0 1
B200989	03/02/89	4 00 - 9 90	14 ± 13	18 ± 6	3 4 ± 0 2	0 1 ± 0 1
B200989	03/02/89	10 00 - 14 80	16 ± 13	19 ± 6	0 5 ± 0 1	0 1 ± 0 1
B200989	03/02/89	16 00 - 18 40	32 ± 15	14 ± 6	0 7 ± 0 1	0 1 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B200889	03/06/89	1 00 - 6 10	0 4 ± 0 1	0 3 ± 0 5	0 01 ± 0 02	-0 01 ± 0 01
B200889	03/06/89	1 00 - 6 10	0 4 ± 0 1	0 2 ± 0 5	0 00 ± 0 02	-0 01 ± 0 01
B200889	03/06/89	6 30 - 7 10	0 4 ± 0 1	0 4 ± 0 5	0 00 ± 0 02	0 00 ± 0 02
B200889	03/06/89	8 30 - 13 70	0 5 ± 0 1	0 1 ± 0 4	0 00 ± 0 02	0 00 ± 0 01
B200889	03/06/89	14 30 - 19 30	0 3 ± 0 1	0 2 ± 0 4	-0 01 ± 0 02	0 00 ± 0 02
B200889	03/06/89	20 30 - 21 20	0 4 ± 0 1	0 4 ± 0 8	0 01 ± 0 02	0 00 ± 0 02
B200989	03/08/89	0 00 - 2 80	0 7 ± 0 2	-0 3 ± 0 7	0 02 ± 0 02	0 00 ± 0 02
B200989	03/02/89	1 00 - 4 00	0 3 ± 0 1	0 2 ± 0 5	0 01 ± 0 02	NR
B200989	03/02/89	4 00 - 9 90	0 5 ± 0 1	0 3 ± 0 5	0 01 ± 0 02	NR
B200989	03/02/89	4 00 - 9 90	3 2 ± 0 2	0 2 ± 0 4	0 01 ± 0 02	NR
B200989	03/02/89	10 00 - 14 80	0 5 ± 0 1	0 1 ± 0 5	0 00 ± 0 02	NR
B200989	03/02/89	16 00 - 18 40	0 6 ± 0 1	0 4 ± 0 5	-0 01 ± 0 02	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B200889	03/06/89	1 00 - 6 10	0 0 ± 0 1	0 14 ± 0 15	0 5 ± 0 1	1 2 ± 0 2
B200889	03/06/89	1 00 6 10	0 0 ± 0 1	0 12 ± 0 15	0 5 ± 0 1	1 2 ± 0 2
B200889	03/06/89	6 30 - 7 10	0 0 ± 0 1	0 18 ± 0 15	0 6 ± 0 1	1 1 ± 0 1
B200889	03/06/89	8 30 - 13 70	0 0 ± 0 1	0 19 ± 0 15	0 7 ± 0 1	1 4 ± 0 3
B200889	03/06/89	14 30 - 19 30	0 0 ± 0 1	0 17 ± 0 15	0 7 ± 0 1	0 9 ± 0 1
B200889	03/06/89	20 30 - 21 20	0 0 ± 0 1	0 14 ± 0 15	0 6 ± 0 1	1 3 ± 0 2
B200989	03/08/89	0 00 - 2 80	0 2 ± 0 1	0 02 ± 0 15	0 7 ± 0 1	1 2 ± 0 2
B200989	03/02/89	1 00 - 4 00	0 0 ± 0 1	0 16 ± 0 15	NR	NR
B200989	03/02/89	4 00 - 9 90	0 0 ± 0 1	0 30 ± 0 15	NR	NR
B200989	03/02/89	4 00 - 9 90	0 0 ± 0 1	0 33 ± 0 15	NR	NR
B200989	03/02/89	10 00 14 80	0 0 ± 0 1	0 37 ± 0 15	NR	NR
B200989	03/02/89	16 00 - 18 40	0 0 ± 0 1	0 29 ± 0 15	NR	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

COLLUVIUM

TOTAL METALS

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B201089	03/09/89	0 00 - 2 60	22900	14 0 U	5 2	101	5 0	1 2 U	4250
B201089	03/02/89	1 00 - 6 50	13200	13 4 U	5 2	86 9	7 3	1 1 U	44300
B201089	03/02/89	1 00 6 50	17300	14 1 U	1 0 U	95 3	10 3	1 2 U	5330
B201189	03/17/89	0 00 - 3 00	5860	14 1 U	3 1	73 2	2 2	1 2 U	6050
B201189	03/17/89	3 00 - 9 00	4630	13 9 U	6 5	86 4	2 0	1 2 U	6100
B201189	03/17/89	9 00 - 15 00	6960	14 4 U	2 4 U	114	2 4	1 2 U	7040
B201189	03/17/89	9 00 15 00	7520	14 3 U	2 5 U	56 1	2 8	1 2 U	5590
B201189	03/17/89	15 00 - 21 00	5520	13 6 U	5 2	45 4 U	2 1	1 1 U	5000
B201189	03/17/89	21 00 27 00	5540	14 3 U	2 4 U	124	2 2	1 2 U	5580
B201189	03/17/89	27 00 - 33 00	4850	14 7 U	2 8	96 3	2 1	1 2 U	4560
B201289	03/22/89	0 00 - 3 00	11000	14 4 U	3 2	189	3 6	1 2 U	9250
B201289	03/22/89	3 00 - 6 80	7110	13 6 U	2 3 U	69 3	2 5	1 1 U	7650
B201289	03/23/89	9 00 - 15 00	6600	14 1 U	2 4	102	2 4	1 2 U	6680
B201289	03/23/89	15 00 20 65	7300	14 4 U	2 6	73 0	2 6	1 2 U	6610
B201289	03/23/89	15 00 20 65	7570	14 5 U	3 0	48 2 U	2 9	1 2 U	6240
B201489	03/10/89	0 00 - 3 00	13800	13 0 U	4 1	99 7	3 5	1 1 U	3020
B201489	03/10/89	3 00 - 7 00	8390	13 1 U	2 4	45 2	2 4	1 1 U	5270

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B201089	03/09/89	0 00 - 2 60	232 U	21 3	13 0	15 6	19800	12 2	16 5
B201089	03/02/89	1 00 6 50	223 U	8 3	11 1 U	13 0	12100	12 8	22 3 U
B201089	03/02/89	1 00 - 6 50	235 U	14 0	11 8 U	18 0	18100	13 8	23 5 U
B201189	03/17/89	0 00 - 3 00	235 U	6 1	11 8 U	11 3	6860	16 0	3 8
B201189	03/17/89	3 00 - 9 00	232 U	7 2	15 9	14 2	10700	14 7	6 2
B201189	03/17/89	9 00 - 15 00	239 U	7 9	12 0 U	12 4	11200	16 8	5 2
B201189	03/17/89	9 00 - 15 00	239 U	8 0	11 9 U	11 4	9980	15 2	5 8
B201189	03/17/89	15 00 - 21 00	227 U	7 1	11 3 U	10 9	8810	16 6	5 6
B201189	03/17/89	21 00 - 27 00	239 U	7 2	12 0 U	15 3	7420	18 5	5 8
B201189	03/17/89	27 00 - 33 00	244 U	6 3	12 2 U	13 0	9700	13 4	4 7
B201289	03/22/89	0 00 - 3 00	241 U	12 5	12 0 U	13 6	11800	18 9	7 3
B201289	03/22/89	3 00 - 6 80	228 U	17 4	11 4 U	13 9	10500	19 4	5 8
B201289	03/23/89	9 00 - 15 00	236 U	11 4	11 8 U	12 5	8660	16 8	6 5
B201289	03/23/89	15 00 - 20 65	240 U	9 8	12 0 U	17 8	10900	25 7	7 1
B201289	03/23/89	15 00 20 65	241 U	9 4	12 1 U	21 8	18800	25 2	7 0
B201489	03/10/89	0 00 3 00	216 2 U	12 9	10 8 U	20 7	14200	12 0	8 1
B201489	03/10/89	3 00 7 00	219 U	8 5	11 0 U	13 1	9840	12 5	6 6

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B201089	03/09/89	0 00 - 2 60	4510	303	0 12 U	13 3	28 6	3090	1 2 U
B201089	03/02/89	1 00 - 6 50	4550	82 1	0 12 U	22 3 U	24 9	1540	5 6 U
B201089	03/02/89	1 00 - 6 50	5480	145	0 12 U	23 5 U	36 2	2180	5 9 U
B201189	03/17/89	0 00 - 3 00	1770	237	0 12 U	9 1	10 9	1180 U	6 1 U
B201189	03/17/89	3 00 - 9 00	1910	281	0 12 U	7 0	25 1	1160 U	5 9 U
B201189	03/17/89	9 00 - 15 00	1820	141	0 10 U	8 7	10 6	1200 U	6 0 U
B201189	03/17/89	9 00 - 15 00	1920	94 7	0 12 U	11 7	9 9	1190 U	6 2 U
B201189	03/17/89	15 00 - 21 00	1850	149	0 11 U	9 6	14 8	1130 U	5 6 U
B201189	03/17/89	21 00 - 27 00	1840	85 5	0 12 U	9 7	13 5	1200 U	6 0 U
B201189	03/17/89	27 00 - 33 00	1540	98 4	0 12 U	7 8	10 9	1220 U	1 2 U
B201289	03/22/89	0 00 - 3 00	2710	195	0 23	14 8	13 3	1380	1 2 U
B201289	03/22/89	3 00 - 6 80	2350	128	0 21	11 7	14 1	1140 U	5 7 U
B201289	03/23/89	9 00 - 15 00	2430	115	0 27	10 2	11 8	1180 U	5 7 U
B201289	03/23/89	15 00 - 20 65	2270	161	0 44	11 3	9 6 U	1200 U	6 1 U
B201289	03/23/89	15 00 - 20 65	2250	237	0 22	10 4	18 3	1210 U	5 9 U
B201489	03/10/89	0 00 - 3 00	2650	110	0 11 U	6 4	15 5	1290	1 1 U
B201489	03/10/89	3 00 - 7 00	2470	62 2	0 11 U	2 2 U	9 6	1100 U	1 1 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80 120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B201089	03/09/89	0 00 - 2 60	33 5	1160 U	30 8	2 3 U	379	40 9	43 8
B201089	03/02/89	1 00 - 6 50	2 2 U	1110 U	64 7	2 2 U	22 3 U	20 3	29 5
B201089	03/02/89	1 00 - 6 50	2 5	1180 U	47 1	2 4 U	23 5 U	31 3	39 1
B201189	03/17/89	0 00 - 3 00	2 4 U	1180 U	41 6	2 4 U	23 5 U	15 8	34 1
B201189	03/17/89	3 00 - 9 00	2 3 U	1160 U	45 0	2 3 U	23 2 U	26 0	65 0
B201189	03/17/89	9 00 - 15 00	2 4 U	1200 U	54 4	2 4 U	23 9 U	20 3	44 3
B201189	03/17/89	9 00 - 15 00	2 4 U	1190 U	50 3	2 5 U	23 9 U	21 8	39 6
B201189	03/17/89	15 00 - 21 00	2 3 U	1130 U	44 0	2 2 U	22 7 U	16 0	58 9
B201189	03/17/89	21 00 - 27 00	2 4 U	1200 U	58 5	2 4 U	23 9 U	23 0	67 1
B201189	03/17/89	27 00 - 33 00	2 4 U	1220 U	49 4	2 5 U	24 4 U	19 6	56 6
B201289	03/22/89	0 00 - 3 00	2 4 U	1200 U	56 4	2 4 U	24 1 U	34 8	44 4
B201289	03/22/89	3 00 - 6 80	2 3 U	1140 U	51 8	2 3 U	22 8 U	25 7	41 2
B201289	03/23/89	9 00 - 15 00	2 4 U	1180 U	50 0	2 3 U	23 6 U	23 6	35 8
B201289	03/23/89	15 00 - 20 65	2 4 U	1200 U	71 5	2 4 U	24 0 U	21 8	74 9
B201289	03/23/89	15 00 - 20 65	2 4 U	1210 U	71 5	2 4 U	24 1 U	27 1	129
B201489	03/10/89	0 00 - 3 00	24 4	1080 U	34 4	2 1 U	293	28 8	38 6
B201489	03/10/89	3 00 - 7 00	16 4	1100 U	40 8	2 1 U	285	15 3	37 2

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80 120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B201589	03/15/89	0 00 3 00	9840	13 3 U	2 3 U	86 3	1 1 U	1 1 U	3830
B201589	03/15/89	3 00 7 00	8230	14 3 U	2 3 U	60 9	2 1	1 2 U	5630
B301889	03/07/89	0 00 3 00	14300	14 9 U	5 0	171	22 4	1 2 U	8200
B301889	03/07/89	3 00 - 9 00	12300	14 3 U	5 5	250	12 5	1 2 U	14100
B301889	03/07/89	9 00 15 00	13100	13 8 U	5 8	115	17 3	1 1 U	11000
B301889	03/07/89	15 00 21 00	10900	14 6 U	6 6	122	17 6	1 8	10300
B401989	04/05/89	0 00 - 3 00	20800	14 5 U	4 8	491	6 2	1 2 U	25600
B401989	04/05/89	3 00 9 00	16100	15 5 U	3 2	257	5 1	1 3 U	9430
B401989	04/05/89	9 20 - 13 30	14900	14 3 U	2 5 U	129	4 5	1 2 U	4770
B401989	04/05/89	16 00 19 00	8910	14 3 U	3 4	58 1	3 0	1 2 U	4160
B302089	03/28/89	0 00 2 10	17800	14 5 U	5 1	313	5 5	1 2 U	25900
B302089	03/28/89	3 60 6 00	9770	13 5 U	2 3 U	94 7	3 5	1 1 U	11700
B402189	03/29/89	0 00 0 80	8270	14 7 U	4 7	102	3 2	1 2 U	4470
B402189	03/29/89	3 30 - 7 30	10800	13 9 U	4 8	109	3 9	1 2 U	11700

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B201589	03/15/89	0 00 - 3 00	221 U	9 4	11 0 U	16 1	17300	11 6	22 1 U
B201589	03/15/89	3 00 - 7 00	238 U	7 4	11 9 U	10	9060	14 8	4 8
B301889	03/07/89	0 00 - 3 00	274	17 2	12 4 U	21 6	35900	16 5	24 8 U
B301889	03/07/89	3 00 - 9 00	239 U	16 4	11 9 U	19 5	18500	21 0	23 9 U
B301889	03/07/89	9 00 - 15 00	234	17 7	11 5 U	27 8	27200	14 7	22 9 U
B301889	03/07/89	15 00 - 21 00	244 U	15 0	12 2 U	28 0	28500	29 9	24 4 U
B401989	04/05/89	0 00 - 3 00	242 U	26 9	13 9	10 1	18100	16 8	18 0
B401989	04/05/89	3 00 - 9 00	258 U	25 4	12 9 U	10 3	17500	16 8	14 3
B401989	04/05/89	9 20 - 13 30	238 U	22 2	11 9 U	15 2	14000	14 3	13 1
B401989	04/05/89	16 00 - 19 00	238 U	13 9	11 9 U	6 4	9990	6 6	5 6
B302089	03/28/89	0 00 - 2 10	241 U	21 6	12 0 U	14 2	20800	15 7	16 8
B302089	03/28/89	3 60 - 6 00	225 U	14 2	11 3 U	9 2	13200	17 6	12 2
B402189	03/29/89	0 00 - 0 80	246 U	12 9	12 3 U	6 1 U	12600	20 8	6 3
B402189	03/29/89	3 30 - 7 30	232 U	15 4	11 6 U	12 1	13200	9 6	8 3

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B201589	03/15/89	0 00 - 3 00	3210	231	0 11 U	22 1 U	19 2	1790	1 1 U
B201589	03/15/89	3 00 - 7 00	2200	103	0 11 U	3 5	11 9	1190 U	1 2 U
B301889	03/07/89	0 00 - 3 00	3600	747	0 13 U	24 8 U	32 4	1940	1 3 U
B301889	03/07/89	3 00 - 9 00	4730	462	0 12 U	23 9 U	20 8	1700	1 2 U
B301889	03/07/89	9 00 - 15 00	5520	318	0 12 U	22 9 U	24 8	1610	1 1 U
B301889	03/07/89	15 00 - 21 00	5350	511	0 13 U	24 4 U	32 1	1450	1 2 U
B401989	04/05/89	0 00 - 3 00	4640	97 4	0 12 U	26 8	20 8	1710	1 2 U
B401989	04/05/89	3 00 - 9 00	4320	76 9	0 20	21 7	16 2	1390	6 4 U
B401989	04/05/89	9 20 - 13 30	3940	77 4	0 13	20 8	15 4	2030	1 2 U
B401989	04/05/89	16 00 - 19 00	2010	37 0	0 16	14 2	9 5 U	1190 U	5 8 U
B302089	03/28/89	0 00 - 2 10	5580	260	0 098 U	22 0	20 4	1730	1 2 U
B302089	03/28/89	3 60 - 6 00	3680	115	0 097 U	13 9	15 3	1130 U	5 7 U
B402189	03/29/89	0 00 - 0 80	1840	75 7	0 13 U	12 6	9 8 U	1250	1 2 U
B402189	03/29/89	3 30 - 7 30	2740	91 9	0 10	15 8	11 9	1270	1 1 U

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80 120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B201589	03/15/89	0 00 - 3 00	2 2 U	301	25 1	2 3 U	441	22 3	50 0
B201589	03/15/89	3 00 7 00	15 2	1190 U	38 4	2 3 U	382	11 9 U	28 3
B301889	03/07/89	0 00 - 3 00	3 8	1240 U	63 6	2 5 U	24 8 U	56 7	74 8
B301889	03/07/89	3 00 - 9 00	2 4 U	1190 U	79 7	2 3 U	23 9 U	28 8	66 8
B301889	03/07/89	9 00 - 15 00	2 6	1150 U	91 3	2 2 U	22 9 U	33 3	111
B301889	03/07/89	15 00 - 21 00	2 7	1220 U	82 3	2 4 U	24 4 U	30 3	101
B401989	04/05/89	0 00 3 00	2 4 U	1210 U	79 6	2 4 U	24 2 U	52 9	51 8
B401989	04/05/89	3 00 9 00	2 6 U	1290 U	83 3	2 6 U	25 8 U	46 2	48 3
B401989	04/05/89	9 20 13 30	2 4 U	1190 U	40 8	2 5 U	23 8 U	37 5	64 4
B401989	04/05/89	16 00 - 19 00	2 4 U	1190 U	28 5	2 3 U	23 8 U	23 0	30 4
B302089	03/28/89	0 00 2 10	2 4 U	3680	121	2 4 U	24 1 U	58 8	63 3
B302089	03/28/89	3 60 6 00	2 3 U	1130 U	110	2 3 U	22 5 U	27 2	46 9
B402189	03/29/89	0 00 0 80	2 5 U	1230 U	31 7	2 4 U	24 6 U	38 6	23 9
B402189	03/29/89	3 30 7 30	2 3 U	1160 U	41 1	2 3 U	23 2 U	35 7	42 6

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120% range
E = Estimated value

INORGANICS

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B201089	03/09/89	0 00 - 2 60	1 9	7 6	3 U
B201089	03/02/89	1 00 6 50	1 2 U	8 4	4 U
B201089	03/02/89	1 00 - 6 50	1 1 U	7 8	4 U
B201189	03/17/89	0 00 3 00	1 2 U	7 5	2 U
B201189	03/17/89	3 00 9 00	1 2 U	7 2	2 U
B201189	03/17/89	9 00 15 00	1 2 U	7 9	2 U
B201189	03/17/89	9 00 15 00	1 2 U	8 0	2 U
B201189	03/17/89	15 00 - 21 00	1 2 U	8 3	2 U
B201189	03/17/89	21 00 27 00	1 3 U	8 5	3 U
B201189	03/17/89	27 00 33 00	1 3 U	8 4	3 U
B201289	03/22/89	0 00 - 3 00	2 4	8 7	2 U
B201289	03/22/89	3 00 - 6 80	1 5	8 4	2 U
B201289	03/23/89	9 00 - 15 00	1 9	8 7	2 U
B201289	03/23/89	15 00 20 65	2 5	8 7	2 U
B201289	03/23/89	15 00 20 65	1 9	8 7	2 U
B201489	03/10/89	0 00 3 00	1 2 U	7 6	3 U
B201489	03/10/89	3 00 7 00	1 1 U	8 4	5

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B201589	03/15/89	0 00 - 3 00	1 2 U	7 9	5
B201589	03/15/89	3 00 - 7 00	1 1 U	8 5	2 U
B301889	03/07/89	0 00 - 3 00	3 5	8 0	3 U
B301889	03/07/89	3 00 - 9 00	2 0	8 5	2 U
B301889	03/07/89	9 00 15 00	1 2 U	8 8	2 U
B301889	03/07/89	15 00 - 21 00	1 2 U	8 9	2 U
B401989	04/05/89	0 00 - 3 00	1 3	7 9	2 U
B401989	04/05/89	3 00 - 9 00	3 7	8 0	2
B401989	04/05/89	9 20 13 30	3 4	8 0	5
B401989	04/05/89	16 00 - 19 00	2 8	7 7	2 U
B302089	03/28/89	0 00 - 2 10	2 0	9 1	2 U
B302089	03/28/89	3 60 - 6 00	1 1	9 0	2 U
B402189	03/29/89	0 00 0 80	3 0	7 8	3
B402189	03/29/89	3 30 7 30	1 3	8 4	5

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

TOTAL RADIOCHEMISTRY

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B201089	03/09/89	0 00 2 60	28 ± 11	32 ± 6	0 5 ± 0 2	0 0 ± 0 1
B201089	03/02/89	1 00 - 6 50	27 ± 14	22 ± 6	0 6 ± 0 1	0 1 ± 0 1
B201089	03/02/89	1 00 - 6 50	20 ± 13	27 ± 6	0 5 ± 0 1	0 0 ± 0 1
B201189	03/17/89	0 00 - 3 00	26 ± 14	26 ± 6	0 8 ± 0 2	0 1 ± 0 1
B201189	03/17/89	3 00 - 9 00	39 ± 16	25 ± 6	0 6 ± 0 1	0 0 ± 0 1
B201189	03/17/89	9 00 - 15 00	47 ± 17	23 ± 6	0 5 ± 0 1	0 1 ± 0 1
B201189	03/17/89	9 00 15 00	36 ± 16	27 ± 6	0 5 ± 0 1	0 0 ± 0 1
B201189	03/17/89	15 00 21 00	44 ± 17	28 ± 6	0 6 ± 0 1	0 0 ± 0 1
B201189	03/17/89	21 00 27 00	38 ± 16	24 ± 6	1 0 ± 0 2	0 1 ± 0 1
B201189	03/17/89	27 00 - 33 00	46 ± 17	31 ± 6	1 2 ± 0 2	0 0 ± 0 1
B201289	03/22/89	0 00 - 3 00	31 ± 12	29 ± 6	0 7 ± 0 2	0 0 ± 0 1
B201289	03/22/89	3 00 6 80	27 ± 11	25 ± 6	0 5 ± 0 2	0 0 ± 0 1
B201289	03/23/89	9 00 - 15 00	24 ± 11	24 ± 5	0 6 ± 0 2	0 0 ± 0 1
B201289	03/23/89	15 00 20 65	19 ± 10	28 ± 6	1 2 ± 0 2	0 0 ± 0 1
B201289	03/23/89	15 00 20 65	25 ± 11	28 ± 6	0 9 ± 0 3	0 0 ± 0 1
B201489	03/10/89	0 00 3 00	40 ± 16	29 ± 6	0 5 ± 0 1	0 0 ± 0 1
B201489	03/10/89	3 00 7 00	22 ± 14	20 ± 6	0 9 ± 0 2	0 1 ± 0 1
B201589	03/15/89	0 00 3 00	26 ± 15	27 ± 6	0 4 ± 0 1	0 1 ± 0 1
B201589	03/15/89	3 00 7 00	27 ± 16	20 ± 6	0 7 ± 0 2	0 0 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B201089	03/09/89	0 00 - 2 60	0 4 ± 0 2	-0 1 ± 0 8	0 00 ± 0 02	NR
B201089	03/02/89	1 00 6 50	0 5 ± 0 1	0 0 ± 0 6	0 02 ± 0 02	NR
B201089	03/02/89	1 00 - 6 50	0 7 ± 0 1	0 0 ± 0 4	0 00 ± 0 02	NR
B201189	03/17/89	0 00 - 3 00	0 8 ± 0 2	0 0 ± 0 8	0 01 ± 0 02	NR
B201189	03/17/89	3 00 - 9 00	0 7 ± 0 2	0 5 ± 0 8	0 00 ± 0 01	NR
B201189	03/17/89	9 00 15 00	0 7 ± 0 2	0 5 ± 0 6	0 01 ± 0 02	NR
B201189	03/17/89	9 00 - 15 00	1 1 ± 0 2	-0 2 ± 0 8	-0 01 ± 0 01	NR
B201189	03/17/89	15 00 21 00	0 9 ± 0 2	0 5 ± 0 7	0 00 ± 0 01	NR
B201189	03/17/89	21 00 - 27 00	1 2 ± 0 3	0 1 ± 0 5	0 02 ± 0 02	NR
B201189	03/17/89	27 00 33 00	1 3 ± 0 2	-0 6 ± 0 8	0 01 ± 0 01	NR
B201289	03/22/89	0 00 3 00	0 9 ± 0 2	0 2 ± 0 6	0 00 ± 0 02	NR
B201289	03/22/89	3 00 - 6 80	1 0 ± 0 3	0 2 ± 0 8	0 02 ± 0 02	NR
B201289	03/23/89	9 00 - 15 00	0 9 ± 0 2	0 8 ± 0 7	0 00 ± 0 01	NR
B201289	03/23/89	15 00 - 20 65	1 2 ± 0 2	0 6 ± 0 9	0 00 ± 0 02	NR
B201289	03/23/89	15 00 - 20 65	1 3 ± 0 3	-0 2 ± 0 8	0 01 ± 0 02	NR
B201489	03/10/89	0 00 - 3 00	0 7 ± 0 2	0 0 ± 0 5	0 01 ± 0 02	NR
B201489	03/10/89	3 00 7 00	0 8 ± 0 2	-0 4 ± 0 5	0 00 ± 0 01	NR
B201589	03/15/89	0 00 3 00	0 7 ± 0 2	-0 5 ± 0 7	0 01 ± 0 02	NR
B201589	03/15/89	3 00 - 7 00	0 9 ± 0 2	-0 5 ± 0 6	0 00 ± 0 01	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B201089	03/09/89	0 00 - 2 60	0 0 ± 0 1	0 18 ± 0 16	0 7 ± 0 1	1 7 ± 0 2
B201089	03/02/89	1 00 - 6 50	0 0 ± 0 1	0 11 ± 0 14	NR	NR
B201089	03/02/89	1 00 - 6 50	0 0 ± 0 1	0 19 ± 0 14	NR	NR
B201189	03/17/89	0 00 - 3 00	0 0 ± 0 1	0 11 ± 0 15	1 0 ± 0 1	1 1 ± 0 2
B201189	03/17/89	3 00 - 9 00	0 0 ± 0 1	0 10 ± 0 15	1 2 ± 0 1	1 3 ± 0 2
B201189	03/17/89	9 00 - 15 00	0 0 ± 0 1	0 08 ± 0 15	1 1 ± 0 1	1 4 ± 0 2
B201189	03/17/89	9 00 - 15 00	0 0 ± 0 1	0 08 ± 0 15	1 1 ± 0 1	1 4 ± 0 2
B201189	03/17/89	15 00 21 00	0 0 ± 0 1	-0 02 ± 0 15	1 1 ± 0 1	1 5 ± 0 2
B201189	03/17/89	21 00 - 27 00	0 0 ± 0 1	0 00 ± 0 15	1 2 ± 0 1	1 1 ± 0 2
B201189	03/17/89	27 00 - 33 00	0 0 ± 0 1	0 03 ± 0 15	1 3 ± 0 2	1 7 ± 0 3
B201289	03/22/89	0 00 - 3 00	0 0 ± 0 1	-0 14 ± 0 15	0 9 ± 0 1	1 3 ± 0 2
B201289	03/22/89	3 00 - 6 80	0 0 ± 0 1	-0 07 ± 0 16	0 9 ± 0 1	1 4 ± 0 2
B201289	03/23/89	9 00 - 15 00	0 0 ± 0 1	0 04 ± 0 14	0 8 ± 0 1	1 6 ± 0 2
B201289	03/23/89	15 00 20 65	0 0 ± 0 1	-0 12 ± 0 15	0 9 ± 0 1	1 4 ± 0 2
B201289	03/23/89	15 00 20 65	0 0 ± 0 1	-0 08 ± 0 15	1 0 ± 0 1	1 1 ± 0 2
B201489	03/10/89	0 00 - 3 00	0 0 ± 0 1	-0 03 ± 0 15	NR	NR
B201489	03/10/89	3 00 7 00	0 0 ± 0 1	0 09 ± 0 16	NR	NR
B201589	03/15/89	0 00 3 00	0 0 ± 0 1	0 23 ± 0 16	NR	NR
B201589	03/15/89	3 00 7 00	0 0 ± 0 1	0 24 ± 0 16	NR	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B301889	03/07/89	0 00 - 3 00	30 ± 15	25 ± 6	1 1 ± 0 2	0 1 ± 0 1
B301889	03/07/89	3 00 - 9 00	24 ± 14	29 ± 6	0 9 ± 0 2	0 2 ± 0 1
B301889	03/07/89	9 00 - 15 00	19 ± 13	21 ± 6	0 9 ± 0 3	0 0 ± 0 1
B301889	03/07/89	15 00 - 21 00	24 ± 14	26 ± 6	1 0 ± 0 2	0 1 ± 0 1
B401989	04/05/89	0 00 - 3 00	40 ± 16	24 ± 6	0 9 ± 0 3	0 0 ± 0 1
B401989	04/05/89	3 00 - 9 00	36 ± 16	34 ± 6	1 1 ± 0 3	0 0 ± 0 1
B401989	04/05/89	9 20 - 13 30	48 ± 17	32 ± 6	0 8 ± 0 2	0 0 ± 0 1
B401989	04/05/89	16 00 - 19 00	32 ± 15	33 ± 6	0 9 ± 0 3	0 0 ± 0 1
B302089	03/28/89	0 00 - 2 10	46 ± 18	31 ± 6	2 6 ± 0 5	0 1 ± 0 1
B302089	03/28/89	3 60 - 6 00	28 ± 15	28 ± 6	0 9 ± 0 3	0 0 ± 0 1
B402189	03/29/89	0 00 - 0 80	28 ± 14	24 ± 6	0 5 ± 0 2	0 1 ± 0 1
B402189	03/29/89	3 30 - 7 30	24 ± 14	24 ± 6	0 7 ± 0 3	0 1 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B301889	03/07/89	0 00 - 3 00	1 1 ± 0 2	-0 1 ± 0 4	0 02 ± 0 02	NR
B301889	03/07/89	3 00 - 9 00	1 0 ± 0 2	-0 1 ± 0 5	0 00 ± 0 02	NR
B301889	03/07/89	9 00 - 15 00	0 8 ± 0 3	-0 5 ± 0 5	0 01 ± 0 02	NR
B301889	03/07/89	15 00 - 21 00	0 5 ± 0 1	-0 3 ± 0 4	0 00 ± 0 02	NR
B401989	04/05/89	0 00 - 3 00	1 1 ± 0 3	-0 2 ± 0 5	0 00 ± 0 02	NR
B401989	04/05/89	3 00 - 9 00	0 8 ± 0 2	-0 1 ± 0 5	0 00 ± 0 02	NR
B401989	04/05/89	9 20 - 13 30	0 9 ± 0 2	-0 1 ± 0 8	0 00 ± 0 02	NR
B401989	04/05/89	16 00 - 19 00	0 9 ± 0 3	0 2 ± 0 6	0 01 ± 0 02	NR
B302089	03/28/89	0 00 - 2 10	2 3 ± 0 4	0 0 ± 0 6	0 00 ± 0 02	NR
B302089	03/28/89	3 60 - 6 00	0 9 ± 0 3	-0 3 ± 0 7	0 00 ± 0 02	NR
B402189	03/29/89	0 00 - 0 80	0 7 ± 0 2	0 0 ± 0 5	0 02 ± 0 02	NR
B402189	03/29/89	3 30 - 7 30	1 1 ± 0 3	-0 1 ± 0 7	0 02 ± 0 02	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND BOREHOLE COLLUVIUM

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B301889	03/07/89	0 00 - 3 00	0 1 ± 0 1	0 16 ± 0 15	1 2 ± 0 1	1 7 ± 0 2
B301889	03/07/89	3 00 - 9 00	0 0 ± 0 1	0 20 ± 0 15	1 2 ± 0 1	2 0 ± 0 3
B301889	03/07/89	9 00 - 15 00	0 0 ± 0 1	0 19 ± 0 15	1 0 ± 0 1	1 5 ± 0 2
B301889	03/07/89	15 00 - 21 00	0 0 ± 0 1	0 05 ± 0 15	1 0 ± 0 1	1 3 ± 0 2
B401989	04/05/89	0 00 - 3 00	0 1 ± 0 1	-0 10 ± 0 15	1 3 ± 0 1	2 1 ± 0 2
B401989	04/05/89	3 00 - 9 00	0 0 ± 0 1	-0 10 ± 0 15	1 2 ± 0 1	2 0 ± 0 2
B401989	04/05/89	9 20 - 13 30	0 0 ± 0 1	0 13 ± 0 15	1 2 ± 0 1	2 1 ± 0 3
B401989	04/05/89	16 00 - 19 00	0 0 ± 0 1	0 02 ± 0 15	0 7 ± 0 1	1 6 ± 0 2
B302089	03/28/89	0 00 - 2 10	0 0 ± 0 1	0 10 ± 0 15	1 3 ± 0 1	1 5 ± 0 2
B302089	03/28/89	3 60 - 6 00	0 0 ± 0 1	0 00 ± 0 15	1 2 ± 0 1	1 6 ± 0 2
B402189	03/29/89	0 00 - 0 80	0 2 ± 0 1	0 04 ± 0 15	NR	NR
B402189	03/29/89	3 30 - 7 30	0 0 ± 0 1	0 07 ± 0 15	NR	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

BEDROCK

TOTAL METALS

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B201089	03/02/89	7 50 - 13 50	7400	14 5 U	10 8	75 8	4 0	1 2 U	5650
B201089	03/02/89	13 50 - 19 50	5530	14 1 U	2 4 U	46 9 U	1 9	1 2 U	5380
B201189	03/23/89	34 50 - 41 00	7040	15 5 U	2 5 U	212	2 8	1 3 U	8890
B201189	03/23/89	41 00 - 46 00	5550	13 5 U	2 2 U	69 0	2 2	1 1 U	5190
B201289	03/23/89	23 40 - 29 40	6310	13 4 U	2 3 U	92 0	2 3	1 1 U	6420
B201289	03/23/89	29 00 - 29 90	6920	13 6	2 7	98 0	3 1	1 1 U	8100
B201489	03/10/89	10 70 - 15 00	13900	13 0 U	2 1 U	54 8	2 6	1 1 U	4980
B201489	03/10/89	10 70 - 15 00	11300	12 8 U	2 1 U	156	2 4	1 1 U	5340
B201489	03/10/89	15 00 - 19 20	6960	12 7 U	2 2 U	96 2	2 0	1 1 U	4550
B201589	03/16/89	8 20 - 14 20	4550	14 1 U	2 4 U	66 6	1 9	1 2 U	4140
B201589	03/16/89	14 20 - 17 00	3160	12 7 U	2 2 U	47 9	1 2	1 1 U	3470
B301889	03/07/89	22 00 - 28 30	9000	14 1 U	8 9	97 9	16 1	1 2 U	9970
B301889	03/07/89	28 30 - 34 30	10700	14 9 U	4 7	243	6 7	1 2 U	6150

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B201089	03/02/89	7 50 - 13 50	242 U	6 1	12 1 U	20 6	7120	25 8	24 2 U
B201089	03/02/89	13 50 - 19 50	234 U	4 5	11 7 U	14 0	2940	14 6	23 4 U
B201189	03/23/89	34 50 - 41 00	258 U	10 1	12 9 U	26 7	20700	27 4	7 1
B201189	03/23/89	41 00 - 46 00	225 U	6 9	11 3 U	21 6	6850	28 2	6 1
B201289	03/23/89	23 40 - 29 40	223 U	8 8	11 2 U	15 5	12600	18 0	6 3
B201289	03/23/89	29 00 - 29 90	226 U	11 3	29 7	20 9	37800	23 7	8 1
B201489	03/10/89	10 70 - 15 00	217 U	13 7	10 8 U	12 4	10900	13 8	10 4
B201489	03/10/89	10 70 - 15 00	213 U	10 6	10 6 U	13 0	9790	13 9	8 3
B201489	03/10/89	15 00 - 19 20	212 U	6 9	10 6 U	10 2	8790	13 6	9 2
B201589	03/16/89	8 20 - 14 20	234 U	5 2	11 7 U	9 4	7030	10 8	2 7
B201589	03/16/89	14 20 - 17 00	212 U	3 0	10 6 U	6 5	3430	18 2	2 1 U
B301889	03/07/89	22 00 28 30	235 U	12 1	11 8 U	16 4	25800	13 3	23 5 U
B301889	03/07/89	28 30 - 34 30	248 U	13 1	12 4 U	24 3	10900	29 5	24 8 U

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* = Holding time not met
N = Batch spike not in 80 120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B201089	03/02/89	7 50 - 13 50	1950	16 0	0 13 U	24 2 U	21 5	1210 U	1 2 U
B201089	03/02/89	13 50 - 19 50	1600	11 6	0 12 U	23 4 U	17 3	1170 U	1 2 U
B201189	03/23/89	34 50 - 41 00	2320	205	0 28	9 7	17 4	1290 U	1 2 U
B201189	03/23/89	41 00 - 46 00	1760	45 8	0 35	10 0	16 1	1130 U	1 1 U
B201289	03/23/89	23 40 - 29 40	2020	127	0 31	9 8	13 8	1120 U	5 8 U
B201289	03/23/89	29 00 - 29 90	2750	524	0 30	3 0	62 4	1130 U	1 1 U
B201489	03/10/89	10 70 - 15 00	2700	54 8	0 11 U	5 1	10 2	1400	1 1 U
B201489	03/10/89	10 70 - 15 00	2350	53 1	0 11 U	2 1 U	8 5 U	1060	1 1 U
B201489	03/10/89	15 00 - 19 20	2060	74 1	0 11 U	2 1 U	8 5 U	1060 U	1 1 U
B201589	03/16/89	8 20 - 14 20	1510	84 9	0 11 U	8 7	9 4 U	1170 U	5 9 U
B201589	03/16/89	14 20 - 17 00	1060 U	34 7	0 11 U	6 6	8 5 U	1060 U	5 5 U
B301889	03/07/89	22 00 - 28 30	5600	255	0 12 U	23 5 U	19 2	1180 U	1 2 U
B301889	03/07/89	28 30 - 34 30	3380	56 4	0 12 U	24 8 U	21 4	1330	1 2 U

NR = Analyte not reported
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U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B201089	03/02/89	7 50 - 13 50	2 4 U	1210 U	68 5	2 4 U	24 2 U	17 4	50 9
B201089	03/02/89	13 50 - 19 50	2 3 U	1170 U	51 8	2 4 U	23 4 U	19 4	45 9
B201189	03/23/89	34 50 - 41 00	2 6 U	1290 U	113	2 5 U	25 8 U	32 1	99 5
B201189	03/23/89	41 00 - 46 00	2 3 U	1130 U	89 2	2 2 U	22 5 U	20 5	74 9
B201289	03/23/89	23 40 - 29 40	2 2 U	1120 U	81 0	2 3 U	22 3 U	21 2	59 5
B201289	03/23/89	29 00 - 29 90	2 3 U	1130 U	96 3	2 3 U	22 6 U	46 4	76 6
B201489	03/10/89	10 70 - 15 00	18 7	1080 U	53 8	2 1 U	274	22 3	64 3
B201489	03/10/89	10 70 15 00	16 8	1060 U	63 1	2 1 U	201	16 5	36 1
B201489	03/10/89	15 00 19 20	14 9	1060 U	41 1	2 2 U	190	11 0	47 7
B201589	03/16/89	8 20 14 20	2 3 U	1170 U	31 6	2 4 U	23 4 U	12 0	41 1
B201589	03/16/89	14 20 17 00	2 1 U	1060 U	29 7	2 2 U	21 2 U	10 6 U	24 1
B301889	03/07/89	22 00 28 30	2 4	1180 U	86 6	2 4 U	23 5 U	18 3	63 3
B301889	03/07/89	28 30 34 30	2 5 U	1240 U	141	2 4 U	24 8 U	21 0	74 9

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B401989	04/05/89	20 50 26 50	9720	14 6 U	2 5	110	2 1	1 2 U	6020
B401989	04/05/89	26 50 32 50	9150	15 0 U	10	102	2 2	1 3 U	5740
B302089	03/28/89	13 50 - 19 50	6420	16 2	3 4	62 0	2 7	1 1 U	4140
B302089	03/28/89	13 50 19 50	8810	14 0 U	5 2	77 7	3 2	1 2 U	4490
B302089	03/28/89	19 50 - 25 50	6290	13 6 U	8 0	105	2 3	1 1 U	3120
B402189	03/29/89	7 50 13 50	7710	14 6 U	7 0	162	3 1	1 2 U	6050

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B401989	04/05/89	20 50 26 50	243 U	10 6	12 2 U	23 0	14300	25 0	7 0
B401989	04/05/89	26 50 32 50	251 U	10 9	12 5 U	20 8	12000	23 6	7 3
B302089	03/28/89	13 50 - 19 50	230 U	8 9	15 3	14 6	38100	22 0	6 5
B302089	03/28/89	13 50 19 50	234 U	11 7	11 7 U	19 8	23800	21 5	6 0
B302089	03/28/89	19 50 25 50	226 U	8 5	11 3 U	12 2	6930	15 6	5 3
B402189	03/29/89	7 50 13 50	244 U	12 0	12 2 U	17 1	25300	18 3	3 3

NR = Analyte not reported
U = Analyzed but not detected
* = Holding time not met
E = Estimated value
J = Present below detection limit
B = Present in laboratory blank
N = Batch spike not in 80-120% range

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B401989	04/05/89	20 50 - 26 50	2570	190	0 18	2 8	15 1	1290	6 1 U
B401989	04/05/89	26 50 - 32 50	2880	84 0	0 19	3 7	32 3	1350	1 2 U
B302089	03/28/89	13 50 - 19 50	2090	367	0 12 U	4 2	31 1	1150 U	1 2 U
B302089	03/28/89	13 50 - 19 50	2270	199	0 12	11 2	18 2	1170 U	1 2 U
B302089	03/28/89	19 50 - 25 50	1680	164	0 11 U	12 1	9 0 U	1130 U	1 1 U
B402189	03/29/89	7 50 - 13 50	2050	737	0 11 U	11 5	26 2	1220 U	6 2 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B401989	04/05/89	20 50 - 26 50	2 4 U	1220 U	67 2	2 5 U	24 3 U	27 6	71 9
B401989	04/05/89	26 50 - 32 50	2 5 U	1250 U	72 9	2 4 U	25 1 U	25 1	82 4
B302089	03/28/89	13 50 - 19 50	2 3 U	1150 U	94 2	2 3 U	23 0 U	37 7	78 2
B302089	03/28/89	13 50 - 19 50	2 3 U	1170 U	90 2	2 3 U	23 4 U	38 1	133
B302089	03/28/89	19 50 - 25 50	2 3 U	1130 U	74 4	2 2 U	22 6 U	15 1	56 7
B402189	03/29/89	7 50 - 13 50	2 4 U	1220 U	83 3	2 5 U	24 4 U	33 8	62 3

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND SANDSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Aluminum (Al), total mg/kg	Antimony (Sb), total mg/kg	Arsenic (As), total mg/kg	Barium (Ba), total mg/kg	Beryllium (Be), total mg/kg	Cadmium (Cd), total mg/kg	Calcium (Ca), total mg/kg
B201489	03/10/89	7 00 - 9 30	10300	13 3 U	2 3	165	2 1	1 1 U	5940
B201589	03/16/89	17 00 - 20 00	2470	14 4 U	3 6	47 9 U	1 2 U	1 2 U	2310
B201289	03/23/89	29 90 - 32 00	3130	12 8 U	2 2 U	47 2	1 7	1 1 U	2870
B402189	03/29/89	13 50 - 19 50	5440	13 8 U	3 3	93 5	2 2	1 2 U	3570

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80-120% range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND SANDSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium (Cs), total mg/kg	Chromium (Cr), total mg/kg	Cobalt (Co), total mg/kg	Copper (Cu), total mg/kg	Iron (Fe), total mg/kg	Lead (Pb), total mg/kg	Lithium (Li), total mg/kg
B201489	03/10/89	7 00 - 9 30	222 U	10 7	20 5	19 6	7420	11 2	7 0
B201589	03/16/89	17 00 - 20 00	239 U	3 9	12 0 U	6 0 U	3040	9 4	2 6
B201289	03/23/89	29 90 - 32 00	213 U	4 4	10 7 U	8 1	12300	13 4	5 8
B402189	03/29/89	13 50 - 19 50	231 U	7 5	11 5 U	8 6	7810	11 6	3 4

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120/ range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND SANDSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Magnesium (Mg), total mg/kg	Manganese (Mn), total mg/kg	Mercury (Hg), total mg/kg	Molybdenum (Mo), total mg/kg	Nickel (Ni), total mg/kg	Potassium (K), total mg/kg	Selenium (Se), total mg/kg
B201489	03/10/89	7 00 - 9 30	2520	305	0 11 U	4 3	14 3	1110 U	1 1 U
B201589	03/16/89	17 00 - 20 00	1200 U	14 9	0 12 U	6 9	9 6 U	1200 U	6 1 U
B201289	03/23/89	29 90 - 32 00	1290	107	0 27	5 9	10 6	1070 U	5 4 U
B402189	03/29/89	13 50 - 19 50	1460	52 4	0 12	11 2	9 2 U	1150 U	1 2 U

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120/ range
E = Estimated value

Total Metals Results for

Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND SANDSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Silver (Ag), total mg/kg	Sodium (Na), total mg/kg	Strontium (Sr), total mg/kg	Thallium (Tl), total mg/kg	Tin (Sn), Total mg/kg	Vanadium (V), total mg/kg	Zinc (Zn), total mg/kg
B201489	03/10/89	7 00 - 9 30	12 7	1110 U	69 2	2 2 U	268	22 2	79 9
B201589	03/16/89	17 00 - 20 00	2 4 U	1200 U	23 9 U	2 4 U	23 9 U	12 0 U	51 8
B201289	03/23/89	29 90 - 32 00	2 1 U	1070 U	62 3	2 2 U	21 3 U	11 5	38 1
B402189	03/29/89	13 50 - 19 50	2 3 U	1150 U	47 3	2 3 U	23 1 U	15 6	41 2

NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank
* = Holding time not met
N = Batch spike not in 80 120% range
E = Estimated value

INORGANICS

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B201089	03/02/89	7 50 13 50	1 2 U	8 4	4 U
B201089	03/02/89	13 50 19 50	1 2 U	8 4	4 U
B201189	03/23/89	34 50 41 00	1 4	9 4	2 U
B201189	03/23/89	41 00 - 46 00	1 1 U	9 7	2 U
B201289	03/23/89	23 40 29 40	1 1	8 7	2 U
B201289	03/23/89	29 00 29 90	1 1	8 5	2 U
B201489	03/10/89	10 70 15 00	1 1 U	8 9	3 U
B201489	03/10/89	10 70 - 15 00	1 1 U	8 9	3 U
B201489	03/10/89	15 00 - 19 20	1 1 U	8 8	3 U
B201589	03/16/89	8 20 - 14 20	1 2 U	7 6	2 U
B201589	03/16/89	14 20 17 00	1 1 U	7 6	2 U
B301889	03/07/89	22 00 28 30	2 0	8 2	2
B301889	03/07/89	28 30 34 30	1 4	8 3	2

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B401989	04/05/89	20 50 - 26 50	1 2 U	8 5	2 U
B401989	04/05/89	26 50 - 32 50	1 2 U	8 9	5
B302089	03/28/89	13 50 - 19 50	1 6	9 1	2 U
B302089	03/28/89	13 50 - 19 50	1 2 U	9 2	2 U
B302089	03/28/89	19 50 - 25 50	1 1 U	8 9	2 U
B402189	03/29/89	7 50 - 13 50	1 5	8 1	5

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

Borehole Inorganic Results

For Boreholes at Rockwell (Rocky Flats)

1989 BACKGROUND SANDSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Nitrate+ Nitrite-Nitrogen MG/KG	pH pH Unit	Sulfide MG/KG
B201489	03/10/89	7 00 - 9 30	1 3	8 9	3 U
B201589	03/16/89	17 00 - 20 00	1 1 U	9 2	2 U
B201289	03/23/89	29 90 - 32 00	1 2	8 6	2 U
B402189	03/29/89	13 50 - 19 50	1 9	8 0	2

Notes NR = Analyte not reported
J = Present below detection limit
U = Analyzed but not detected
B = Present in laboratory blank

TOTAL RADIOCHEMISTRY

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B201089	03/02/89	7 50 - 13 50	28 ± 14	24 ± 6	1 0 ± 0 2	0 3 ± 0 1
B201089	03/02/89	13 50 19 50	39 ± 16	24 ± 6	1 3 ± 0 2	0 0 ± 0 1
B201189	03/23/89	34 50 - 41 00	24 ± 14	32 ± 6	1 5 ± 0 3	0 2 ± 0 1
B201189	03/23/89	41 00 - 46 00	46 ± 17	25 ± 6	1 7 ± 0 4	0 0 ± 0 1
B201289	03/23/89	23 40 29 40	18 ± 10	18 ± 5	1 3 ± 0 3	0 0 ± 0 1
B201289	03/23/89	29 00 - 29 90	27 ± 11	23 ± 6	0 9 ± 0 3	0 0 ± 0 1
B201489	03/10/89	10 70 15 00	22 ± 14	30 ± 6	0 8 ± 0 2	0 1 ± 0 1
B201489	03/10/89	10 70 15 00	33 ± 15	30 ± 6	0 8 ± 0 2	0 0 ± 0 1
B201489	03/10/89	15 00 - 19 20	19 ± 13	31 ± 6	0 4 ± 0 1	0 1 ± 0 1
B201589	03/16/89	8 20 14 20	23 ± 15	25 ± 6	0 8 ± 0 2	0 0 ± 0 1
B201589	03/16/89	14 20 17 00	17 ± 14	20 ± 6	0 4 ± 0 2	0 0 ± 0 1
B301889	03/07/89	22 00 28 30	30 ± 15	23 ± 6	0 9 ± 0 2	0 0 ± 0 1
B301889	03/07/89	28 30 34 30	38 ± 16	26 ± 6	0 5 ± 0 1	0 0 ± 0 1
B401989	04/05/89	20 50 26 50	37 ± 16	22 ± 6	1 0 ± 0 3	0 0 ± 0 1
B401989	04/05/89	26 50 32 50	42 ± 16	23 ± 6	1 5 ± 0 3	0 0 ± 0 1
B302089	03/28/89	13 50 19 50	29 ± 15	24 ± 6	1 5 ± 0 4	0 0 ± 0 1
B302089	03/28/89	13 50 19 50	34 ± 16	26 ± 6	1 3 ± 0 3	0 0 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B201089	03/02/89	7 50 - 13 50	1 1 ± 0 2	-0 5 ± 0 8	0 01 ± 0 02	NR
B201089	03/02/89	13 50 - 19 50	1 4 ± 0 2	-0 2 ± 0 6	0 00 ± 0 01	NR
B201189	03/23/89	34 50 41 00	1 3 ± 0 3	0 2 ± 0 9	-0 01 ± 0 02	NR
B201189	03/23/89	41 00 46 00	1 4 ± 0 3	-0 7 ± 0 7	0 00 ± 0 02	NR
B201289	03/23/89	23 40 29 40	1 2 ± 0 3	0 2 ± 0 7	0 00 ± 0 01	NR
B201289	03/23/89	29 00 - 29 90	0 9 ± 0 2	0 5 ± 1 0	0 00 ± 0 02	NR
B201489	03/10/89	10 70 15 00	1 0 ± 0 2	-0 4 ± 0 6	0 01 ± 0 01	NR
B201489	03/10/89	10 70 15 00	1 2 ± 0 3	-0 8 ± 0 9	0 00 ± 0 01	NR
B201489	03/10/89	15 00 - 19 20	0 7 ± 0 1	0 7 ± 0 6	0 01 ± 0 01	NR
B201589	03/16/89	8 20 - 14 20	0 5 ± 0 2	-0 2 ± 0 6	0 00 ± 0 02	NR
B201589	03/16/89	14 20 - 17 00	0 7 ± 0 3	0 0 ± 0 6	-0 01 ± 0 01	NR
B301889	03/07/89	22 00 28 30	0 9 ± 0 2	-0 2 ± 0 4	0 01 ± 0 02	NR
B301889	03/07/89	28 30 34 30	0 7 ± 0 2	-0 3 ± 0 4	0 01 ± 0 02	NR
B401989	04/05/89	20 50 26 50	1 2 ± 0 3	-0 6 ± 0 8	0 00 ± 0 01	NR
B401989	04/05/89	26 50 - 32 50	1 2 ± 0 3	-0 1 ± 0 5	0 01 ± 0 02	NR
B302089	03/28/89	13 50 19 50	1 1 ± 0 3	0 1 ± 0 6	0 01 ± 0 02	NR
B302089	03/28/89	13 50 19 50	1 4 ± 0 3	0 1 ± 0 7	0 00 ± 0 02	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B201089	03/02/89	7 50 13 50	0 0 ± 0 1	0 28 ± 0 14	NR	NR
B201089	03/02/89	13 50 - 19 50	0 0 ± 0 1	0 05 ± 0 14	NR	NR
B201189	03/23/89	34 50 - 41 00	0 0 ± 0 1	0 04 ± 0 15	1 3 ± 0 1	1 4 ± 0 2
B201189	03/23/89	41 00 - 46 00	0 0 ± 0 1	-0 03 ± 0 15	1 2 ± 0 1	1 6 ± 0 2
B201289	03/23/89	23 40 - 29 40	0 0 ± 0 1	0 09 ± 0 21	1 2 ± 0 1	1 5 ± 0 2
B201289	03/23/89	29 00 - 29 90	0 0 ± 0 1	0 05 ± 0 14	1 0 ± 0 1	1 4 ± 0 2
B201489	03/10/89	10 70 15 00	0 0 ± 0 1	-0 11 ± 0 15	NR	NR
B201489	03/10/89	10 70 - 15 00	0 0 ± 0 1	-0 03 ± 0 15	NR	NR
B201489	03/10/89	15 00 - 19 20	0 0 ± 0 1	-0 08 ± 0 15	NR	NR
B201589	03/16/89	8 20 - 14 20	0 0 ± 0 1	0 17 ± 0 16	1 0 ± 0 1	1 1 ± 0 2
B201589	03/16/89	14 20 17 00	0 0 ± 0 1	0 18 ± 0 16	0 9 ± 0 1	1 2 ± 0 1
B301889	03/07/89	22 00 - 28 30	0 0 ± 0 1	0 20 ± 0 15	1 1 ± 0 1	1 2 ± 0 2
B301889	03/07/89	28 30 34 30	0 0 ± 0 1	0 13 ± 0 15	1 0 ± 0 1	1 1 ± 0 2
B401989	04/05/89	20 50 26 50	0 0 ± 0 1	-0 02 ± 0 15	1 2 ± 0 1	1 6 ± 0 2
B401989	04/05/89	26 50 32 50	0 0 ± 0 1	0 01 ± 0 15	1 1 ± 0 1	1 2 ± 0 1
B302089	03/28/89	13 50 19 50	0 0 ± 0 1	-0 11 ± 0 15	1 2 ± 0 1	1 4 ± 0 2
B302089	03/28/89	13 50 19 50	0 0 ± 0 1	-0 08 ± 0 15	1 3 ± 0 1	1 4 ± 0 2

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B302089	03/28/89	19 50 - 25 50	29 ± 15	31 ± 6	1 1 ± 0 3	0 1 ± 0 1
B402189	03/29/89	7 50 - 13 50	43 ± 17	32 ± 6	1 0 ± 0 3	0 0 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)		Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B302089	03/28/89	19 50	25 50	0 9 ± 0 2	-0 4 ± 0 4	0 01 ± 0 02	NR
B402189	03/29/89	7 50	13 50	1 0 ± 0 2	0 1 ± 0 6	0 00 ± 0 02	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND CLAYSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B302089	03/28/89	19 50 25 50	0 0 ± 0 1	-0 02 ± 0 15	1 0 ± 0 1	1 3 ± 0 2
B402189	03/29/89	7 50 - 13 50	0 0 ± 0 1	0 05 ± 0 15	NR	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND SANDSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Gross Alpha pCi/g	Gross Beta pCi/g	Uranium 233, 234 pCi/g	Uranium 235 pCi/g
B201489	03/10/89	7 00 - 9 30	22 ± 14	29 ± 6	0 5 ± 0 1	0 1 ± 0 1
B201589	03/16/89	17 00 - 20 00	37 ± 17	25 ± 6	0 5 ± 0 1	0 0 ± 0 1
B201289	03/23/89	29 90 - 32 00	30 ± 11	20 ± 5	0 8 ± 0 3	0 0 ± 0 1
B402189	03/29/89	13 50 - 19 50	19 ± 13	29 ± 6	0 6 ± 0 3	0 0 ± 0 1

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND SANDSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Uranium 238 pCi/g	Strontium 89,90 pCi/g	Plutonium 239 pCi/g	Americium 241 pCi/g
B201489	03/10/89	7 00 - 9 30	0 6 ± 0 2	0 3 ± 0 5	0 01 ± 0 01	NR
B201589	03/16/89	17 00 - 20 00	0 8 ± 0 2	0 1 ± 0 9	-0 01 ± 0 01	NR
B201289	03/23/89	29 90 - 32 00	1 0 ± 0 2	0 4 ± 0 6	0 00 ± 0 01	NR
B402189	03/29/89	13 50 - 19 50	0 7 ± 0 2	0 7 ± 1 0	0 00 ± 0 01	NR

Notes NR = Analyte not reported

*** = Insufficient Sample for Radiochemistry Analyses

Borehole Total Radiochemistry Results

for Boreholes at Rocky Flats Plant

1989 BACKGROUND SANDSTONE

Borehole Number	Date Sampled	Depth Increment (ft)	Cesium 137 pCi/g	Tritium pCi/ml	Radium 226 Radium 226	Radium 228 Radium 228
B201489	03/10/89	7 00 9 30	0 0 ± 0 1	0 02 ± 0 15	NR	NR
B201589	03/16/89	17 00 20 00	0 0 ± 0 1	0 01 ± 0 15	1 0 ± 0 1	1 0 ± 0 2
B201289	03/23/89	29 90 - 32 00	0 0 ± 0 1	0 39 ± 0 15	0 9 ± 0 1	1 1 ± 0 2
B402189	03/29/89	13 50 19 50	0 0 ± 0 1	0 00 ± 0 15	NR	NR

Notes NR = Analyte not reported
*** = Insufficient Sample for Radiochemistry Analyses

APPENDIX B

TOLERANCE INTERVAL CALCULATIONS

DISSOLVED METALS

ROUND ONE
DISSOLVED METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al)				3 031		5164	0 0000	88 89	3 2830	- 4507	9	1	11
Antimony (Sb)				3 031				100 00		******	9	0	0
Arsenic (As)				3 031				100 00		******	9	0	0
Barium (Ba)				3 031				100 00		******	9	0	0
Beryllium (Be)				3 031				100 00		******	9	0	0
Cadmium (Cd)				3 031				100 00		******	9	0	0
Calcium (Ca)		99 147	35 544	3 031	20 98						9	9	100
Cesium (Cs)				3 031				100 00		******	9	0	0
Chromium (Cr)				3 031				100 00		******	9	0	0
Cobalt (Co)				3 031				100 00		******	9	0	0
Copper (Cu)				3 031				100 00		******	9	0	0
Iron (Fe)			2 833	3 031	1 32	3 533	0 2500	66 67	1 4390	-1 100	9	3	33
Lead (Pb)				3 031		0002	0 0000	88 89	3 2830	00591	9	1	11
Lithium (Li)				3 031				100 00		******	9	0	0
Magnesium (Mg)		11 976	7 197	3 031	1 34	1 785	0 3500	22 22	0 2874	6 57	9	7	78
Manganese (Mn)		0 826	0 218	3 031	0 18	2604	0 7500	44 44	0 8932	0 04	9	5	56
Mercury (Hg)		0 002	0 001	3 031	0 0003	0004	1 0000	22 22	0 3447	00040	9	7	78
Molybdenum(Mo)				3 031				100 00		******	9	0	0
Nickel (Ni)				3 031				100 00		******	9	0	0
Potassium (K)				3 031				100 00		******	9	0	0
Selenium (Se)				3 031				100 00		******	9	0	0
Silver (Ag)				3 031		0045	0 0000	88 89	3 2830	00429	9	1	11
Sodium (Na)		44 809	20 031	3 031	8 17						9	9	100
Strontium (Sr)		0 350	0 178	3 031	0 05	0602			0 1385	0 17	9	8	89
Thallium (Tl)				3 031				100 00		******	9	0	0
Tin (Sn)				3 031				100 00		******	9	0	0
Vanadium (V)				3 031				100 00		******	9	0	0
Zinc (Zn)			0 028	3 031	0 0039	0129	0 2500	77 78	2 3050	00943	9	2	22

ROUND TWO
DISSOLVED METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al)				3 399		4602	0 0000	85 71	3 2830	- 3799	7	1	14
Antimony (Sb)				3 399				100 00		******	7	0	0
Arsenic (As)				3 399				100 00		******	7	0	0
Barium (Ba)				3 399				100 00		******	7	0	0
Beryllium (Be)				3 399				100 00		******	7	0	0
Cadmium (Cd)				3 399				100 00		******	7	0	0
Calcium (Ca)		93 266	33 486	3 399	17 59						7	7	100
Cesium (Cs)				3 399				100 00		******	7	0	0
Chromium (Cr)				3 399				100 00		******	7	0	0
Cobalt (Co)				3 399				100 00		******	7	0	0
Copper (Cu)				3 399				100 00		******	7	0	0
Iron (Fe)			0 313	3 399	0 14	2681	0 4524	57 14	1 1270	0 07	7	3	43
Lead (Pb)				3 399		0147	0 0000	85 71	3 2830	- 0135	7	1	14
Lithium (Li)				3 399		0120	0 0000	85 71	3 2830	- 0051	7	1	14
Magnesium (Mg)		15 737	7 272	3 399	2 40	2 658		14 29	0 2502	6 70	7	6	86
Manganese (Mn)		0 232	0 067	3 399	0 05	0522		14 29	0 2355	0 05	7	6	86
Mercury (Hg)			0 000	3 399		0002	0 0000	71 43	1 5610	00009	7	2	29
Molybdenum(Mo)		0 032	0 016	3 399	0 0042	0051		14 29	0 2188	0 01	7	6	86
Nickel (Ni)				3 399				100 00		******	7	0	0
Potassium (K)				3 399				100 00		******	7	0	0
Selenium (Se)				3 399				100 00		******	7	0	0
Silver (Ag)				3 399				100 00		******	7	0	0
Sodium (Na)		43 223	20 886	3 399	6 57						7	7	100
Strontium (Sr)				3 399				100 00		******	7	0	0
Thallium (Tl)				3 399				100 00		******	7	0	0
Tin (Sn)				3 399				100 00		******	7	0	0
Vanadium (V)				3 399				100 00		******	7	0	0
Zinc (Zn)				3 399		0051	0 0000	85 71	3 2830	0 01	7	1	14

DISSOLVED METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND ROCKY FLATS ALLUVIUM GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al)				2 815				100 00		******	11	0	0
Antimony (Sb)				2 815				100 00		******	11	0	0
Arsenic (As)				2 815				100 00		******	11	0	0
Barium (Ba)				2 815				100 00		******	11	0	0
Beryllium (Be)				2 815				100 00		******	11	0	0
Cadmium (Cd)				2 815				100 00		******	11	0	0
Calcium (Ca)		85 358	38 073	2 815	16 80						11	11	100
Cesium (Cs)				2 815				100 00		******	11	0	0
Chromium (Cr)				2 815				100 00		******	11	0	0
Cobalt (Co)				2 815				100 00		******	11	0	0
Copper (Cu)				2 815				100 00		******	11	0	0
Iron (Fe)			0 198	2 815	0 07	1665	0 5000	81 82	2 4210	- 0385	11	2	18
Lead (Pb)				2 815				100 00		******	11	0	0
Lithium (Li)				2 815				100 00		******	11	0	0
Magnesium (Mg)			5 407	2 815	0 22	5402	0 3000	63 64	1 4570	4 81	11	4	36
Manganese (Mn)		0 365	0 105	2 815	0 09	0971		9 09	0 1447	0 09	11	10	91
Mercury (Hg)				2 815				100 00		******	11	0	0
Molybdenum(Mo)				2 815		1565	0 0000	90 91	3 2830	0 30	11	1	9
Nickel (Ni)				2 815		0058	0 0000	90 91	3 2830	0 03	11	1	9
Potassium (K)				2 815		4 947	0 0000	90 91	3 2830	-1 233	11	1	9
Selenium (Se)				2 815				100 00		******	11	0	0
Silver (Ag)				2 815				100 00		******	11	0	0
Sodium (Na)		13 376	8 430	2 815	1 12	2 070	0 1000	18 18	0 2574	7 55	11	9	82
Strontium (Sr)			0 135	2 815	0 02	1 111	0 0006	72 73	2 1760	1 77	11	3	27
Thallium (Tl)				2 815				100 00		******	11	0	0
Tin (Sn)				2 815				100 00		******	11	0	0
Vanadium (V)				2 815				100 00		******	11	0	0
Zinc (Zn)			0 062	2 815	0 05	0713	1 0000	63 64	1 6820	- 0088	11	4	36

DISSOLVED METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND COLLUVIUM GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al)				0 000				100 00		******	2	0	0
Antimony (Sb)				0 000				100 00		******	2	0	0
Arsenic (As)				0 000				100 00		******	2	0	0
Barium (Ba)				0 000				100 00		******	2	0	0
Beryllium (Be)				0 000				100 00		******	2	0	0
Cadmium (Cd)				0 000				100 00		******	2	0	0
Calcium (Ca)		71 200	71 200	0 000	5 60						2	2	100
Cesium (Cs)				0 000				100 00		******	2	0	0
Chromium (Cr)				0 000				100 00		******	2	0	0
Cobalt (Co)				0 000				100 00		******	2	0	0
Copper (Cu)				0 000				100 00		******	2	0	0
Iron (Fe)				0 000				100 00		******	2	0	0
Lead (Pb)				0 000				100 00		******	2	0	0
Lithium (Li)		0 036	0 172	0 000		1482		50 00	0 8368	0 04	2	1	50
Magnesium (Mg)		12 950	12 950	0 000	2 35						2	2	100
Manganese (Mn)		0 027	0 088	0 000		0668		50 00	0 8368	0 03	2	1	50
Mercury (Hg)				0 000				100 00		******	2	0	0
Molybdenum(Mo)				0 000				100 00		******	2	0	0
Nickel (Ni)				0 000				100 00		******	2	0	0
Potassium (K)				0 000				100 00		******	2	0	0
Selenium (Se)				0 000				100 00		******	2	0	0
Silver (Ag)				0 000				100 00		******	2	0	0
Sodium (Na)		63 400	63 400	0 000	35 30						2	2	100
Strontium (Sr)				0 000				100 00		******	2	0	0
Thallium (Tl)				0 000				100 00		******	2	0	0
Tin (Sn)				0 000				100 00		******	2	0	0
Vanadium (V)				0 000				100 00		******	2	0	0
Zinc (Zn)				0 000				100 00		******	2	0	0

DISSOLVED METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND VALLEY FILL ALLUVIUM GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al)				3 188				100 00		******	8	0	0
Antimony (Sb)				3 188				100 00		******	8	0	0
Arsenic (As)				3 188				100 00		******	8	0	0
Barium (Ba)				3 188				100 00		******	8	0	0
Beryllium (Be)				3 188				100 00		******	8	0	0
Cadmium (Cd)				3 188				100 00		******	8	0	0
Calcium (Ca)		138 094	56 938	3 188	25 46						8	8	100
Cesium (Cs)				3 188				100 00		******	8	0	0
Chromium (Cr)				3 188				100 00		******	8	0	0
Cobalt (Co)				3 188				100 00		******	8	0	0
Copper (Cu)				3 188				100 00		******	8	0	0
Iron (Fe)				3 188		1 529	0 0000	87 50	3 2830	-1 827	8	1	13
Lead (Pb)				3 188				100 00		******	8	0	0
Lithium (Li)		0 028	0 015	3 188	0 0033	0041		12 50	0 2075	0 01	8	7	88
Magnesium (Mg)		26 573	12 274	3 188	3 72	4 940		12 50	0 1991	10 83	8	7	88
Manganese (Mn)		1 134	0 253	3 188	0 26	3582	1 0000	50 00	1 0950	- 0076	8	4	50
Mercury (Hg)			0 000	3 188		0001	0 0000	75 00	2 1760	00008	8	2	25
Molybdenum(Mo)				3 188				100 00		******	8	0	0
Nickel (Ni)				3 188				100 00		******	8	0	0
Potassium (K)				3 188				100 00		******	8	0	0
Selenium (Se)				3 188		0116	0 0000	87 50	3 2830	- 0096	8	1	13
Silver (Ag)				3 188				100 00		******	8	0	0
Sodium (Na)		88 002	37 875	3 188	15 72						8	8	100
Strontium (Sr)				3 188				100 00		******	8	0	0
Thallium (Tl)				3 188				100 00		******	8	0	0
Tin (Sn)				3 188				100 00		******	8	0	0
Vanadium (V)				3 188				100 00		******	8	0	0
Zinc (Zn)				3 188		0022	0 0000	87 50	3 2830	0 02	8	1	13

DISSOLVED METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND WEATHERED CLAYSTONE GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al)				5 145				100 00		******	4	0	0
Antimony (Sb)				5 145				100 00		******	4	0	0
Arsenic (As)				5 145				100 00		******	4	0	0
Barium (Ba)				5 145				100 00		******	4	0	0
Beryllium (Be)				5 145				100 00		******	4	0	0
Cadmium (Cd)				5 145				100 00		******	4	0	0
Calcium (Ca)		118 919	51 875	5 145	13 03						4	4	100
Cesium (Cs)				5 145				100 00		******	4	0	0
Chromium (Cr)				5 145				100 00		******	4	0	0
Cobalt (Co)				5 145				100 00		******	4	0	0
Copper (Cu)				5 145				100 00		******	4	0	0
Iron (Fe)				5 145				100 00		******	4	0	0
Lead (Pb)				5 145				100 00		******	4	0	0
Lithium (Li)		0 449	0 026	5 145	0 01	0699	0 0500	50 00	0 8540	0 09	4	2	50
Magnesium (Mg)		99 120	18 973	5 145	15 58						4	4	100
Manganese (Mn)		0 322	0 083	5 145	0 03	0510		25 00	0 3525	0 06	4	3	75
Mercury (Hg)				5 145		0009	0 0000	75 00	2 1760	- 0005	4	1	25
Molybdenum(Mo)		0 495	0 013	5 145	0 0018	0795	0 0005	50 00	0 8368	0 09	4	2	50
Nickel (Ni)				5 145				100 00		******	4	0	0
Potassium (K)				5 145				100 00		******	4	0	0
Selenium (Se)				5 145				100 00		******	4	0	0
Silver (Ag)				5 145				100 00		******	4	0	0
Sodium (Na)		65 817	24 650	5 145	8 00						4	4	100
Strontium (Sr)				5 145				100 00		******	4	0	0
Thallium (Tl)				5 145		0197	0 0000	75 00	2 1760	0 04	4	1	25
Tin (Sn)				5 145				100 00		******	4	0	0
Vanadium (V)				5 145				100 00		******	4	0	0
Zinc (Zn)		0 357	0 083	5 145	0 02	0641	0 1500	50 00	0 8860	0 03	4	2	50

DISSOLVED METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND WEATHERED SANDSTONE GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al)				0 000				100 00		******	2	0	0
Antimony (Sb)				0 000				100 00		******	2	0	0
Arsenic (As)				0 000				100 00		******	2	0	0
Barium (Ba)				0 000				100 00		******	2	0	0
Beryllium (Be)				0 000				100 00		******	2	0	0
Cadmium (Cd)				0 000				100 00		******	2	0	0
Calcium (Ca)		50 950	50 950	0 000	14 75						2	2	100
Cesium (Cs)				0 000				100 00		******	2	0	0
Chromium (Cr)		0 010	0 012	0 000		0020		50 00	0 8368	0 01	2	1	50
Cobalt (Co)				0 000				100 00		******	2	0	0
Copper (Cu)				0 000				100 00		******	2	0	0
Iron (Fe)				0 000				100 00		******	2	0	0
Lead (Pb)				0 000				100 00		******	2	0	0
Lithium (Li)		0 085	0 011	0 000		0818		50 00	0 8368	0 09	2	1	50
Magnesium (Mg)		7 730	7 730	0 000	1 68						2	2	100
Manganese (Mn)		0 155	0 155	0 000	0 14						2	2	100
Mercury (Hg)				0 000				100 00		******	2	0	0
Molybdenum(Mo)		0 086	0 015	0 000		0778		50 00	0 8368	0 09	2	1	50
Nickel (Ni)				0 000				100 00		******	2	0	0
Potassium (K)				0 000				100 00		******	2	0	0
Selenium (Se)				0 000				100 00		******	2	0	0
Silver (Ag)				0 000				100 00		******	2	0	0
Sodium (Na)		19 650	19 650	0 000	5 95						2	2	100
Strontium (Sr)				0 000				100 00		******	2	0	0
Thallium (Tl)				0 000				100 00		******	2	0	0
Tin (Sn)				0 000				100 00		******	2	0	0
Vanadium (V)				0 000				100 00		******	2	0	0
Zinc (Zn)				0 000				100 00		******	2	0	0

DISSOLVED METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND UNWEATHERED SANDSTONE GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al)				3 399		2301	0 0000	85 71	3 2830	- 0899	7	1	14
Antimony (Sb)				3 399				100 00		******	7	0	0
Arsenic (As)			0 015	3 399	0 0040	0074	0 7500	71 43	1 8580	00605	7	2	29
Barium (Ba)				3 399				100 00		******	7	0	0
Beryllium (Be)				3 399				100 00		******	7	0	0
Cadmium (Cd)				3 399				100 00		******	7	0	0
Calcium (Ca)		64 551	20 808	3 399	11 74	13 90		14 29	0 2223	17 29	7	6	86
Cesium (Cs)				3 399				100 00		******	7	0	0
Chromium (Cr)				3 399				100 00		******	7	0	0
Cobalt (Co)				3 399				100 00		******	7	0	0
Copper (Cu)				3 399				100 00		******	7	0	0
Iron (Fe)				3 399				100 00		******	7	0	0
Lead (Pb)				3 399				100 00		******	7	0	0
Lithium (Li)				3 399				100 00		******	7	0	0
Magnesium (Mg)				3 399				100 00		******	7	0	0
Manganese (Mn)				3 399		0058	0 0000	85 71	3 2830	00769	7	1	14
Mercury (Hg)				3 399				100 00		******	7	0	0
Molybdenum (Mo)				3 399		0217	0 0000	85 71	3 2830	0 07	7	1	14
Nickel (Ni)				3 399				100 00		******	7	0	0
Potassium (K)			13 130	3 399	6 84	11 21	0 7000	57 14	1 1950	3 41	7	3	43
Selenium (Se)			0 022	3 399	0 01	0232	0 6952	57 14	1 1950	00171	7	3	43
Silver (Ag)				3 399				100 00		******	7	0	0
Sodium (Na)		599 251	166 117	3 399	127 43						7	7	100
Strontium (Sr)			0 449	3 399	0 0025	6890	0 0000	71 43	1 5610	1 31	7	2	29
Thallium (Tl)				3 399				100 00		******	7	0	0
Tin (Sn)				3 399				100 00		******	7	0	0
Vanadium (V)				3 399				100 00		******	7	0	0
Zinc (Zn)		0 564	0 105	3 399	0 13	1488	1 0000	28 57	0 5548	0 06	7	5	71

TOTAL METALS

TOTAL METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SEDIMENTS
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al) total		24789 00	6513 89	3 031	6029 40						9	9	100
Antimony (Sb), total				3 031				100 00		******	9	0	0
Arsenic (As), total				3 031		18 89	0 0000	88 89	3 2830	-21 23	9	1	11
Barium (Ba) total			122 825	3 031	54 59	69 60	1 0000	55 56	1 2670	74 22	9	4	44
Beryllium (Be) total				3 031				100 00		******	9	0	0
Cadmium (Cd) total				3 031				100 00		******	9	0	0
Calcium (Ca) total		72551 32	15700 0	3 031	18709 7	23082	1 0000	44 44	0 9406	2590 4	9	5	56
Cesium (Cs) total				3 031				100 00		******	9	0	0
Chromium (Cr) total		43 383	15 262	3 031	8 63	9 865			0 1385	13 48	9	8	89
Cobalt (Co) total				3 031				100 00		******	9	0	0
Copper (Cu) total			16 275	3 031	5 27	9 917	0 4500	55 56	1 1270	7 35	9	4	44
Iron (Fe) total		28308 31	8692 22	3 031	6471 82						9	9	100
Lead (Pb) total		39 502	11 333	3 031	9 29						9	9	100
Lithium (Li) total				3 031				100 00		******	9	0	0
Magnesium (Mg) total			2377 50	3 031	1087 14	1145	1 0000	55 56	1 2670	1972 7	9	4	44
Manganese (Mn) total		372 203	129 389	3 031	80 11						9	9	100
Mercury (Hg) total				3 031				100 00		******	9	0	0
Molybdenum(Mo), total				3 031				100 00		******	9	0	0
Nickel (Ni) total			18 000	3 031	8 60	8 936	1 0000	66 67	1 6820	14 83	9	3	33
Potassium (K), total				3 031				100 00		******	9	0	0
Selenium (Se), total				3 031				100 00		******	9	0	0
Silver (Ag) total				3 031		4 892	0 0000	88 89	3 2830	-2 064	9	1	11
Sodium (Na) total				3 031				100 00		******	9	0	0
Strontium (Sr) total			91 467	3 031	62 36	91 41	1 0000	66 67	1 6820	4 79	9	3	33
Thallium (Tl) total				3 031				100 00		******	9	0	0
Tin (Sn) total				3 031				100 00		******	9	0	0
Vanadium (V) total			28 067	3 031	15 92	18 96	1 0000	66 67	1 6820	14 72	9	3	33
Zinc (Zn), total		92 688	31 333	3 031	20 24						9	9	100

ROUND 1
TOTAL METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al) total			24 459	3 031	28 19	42 25	1 0000	66 67	1 6820	-16 34	9	3	33
Antimony (Sb), total				3 031				100 00		******	9	0	0
Arsenic (As) total			0 063	3 031	0 05	1011	1 0000	77 78	2 6260	- 0766	9	2	22
Barium (Ba), total				3 031		7 773	0 0000	88 89	3 2830	-9 594	9	1	11
Beryllium (Be), total				3 031		0085	0 0000	88 89	3 2830	- 0057	9	1	11
Cadmium (Cd), total				3 031		1160	0 0000	88 89	3 2830	- 1411	9	1	11
Calcium (Ca) total		254 113	59 233	3 031	64 30						9	9	100
Cesium (Cs) total				3 031		2 772	0 0000	88 89	3 2830	-2 493	9	1	11
Chromium (Cr) total				3 031		0902	0 0000	88 89	3 2830	- 1037	9	1	11
Cobalt (Co) total				3 031		0417	0 0000	88 89	3 2830	- 0025	9	1	11
Copper (Cu) total				3 031		2808	0 0000	88 89	3 2830	- 3289	9	1	11
Iron (Fe) total		692 593	75 235	3 031	203 68						9	9	100
Lead (Pb) total			0 126	3 031	0 11	2206	0 8000	77 78	2 5480	- 1819	9	2	22
Lithium (Li), total				3 031				100 00		******	9	0	0
Magnesium (Mg) total		27 707	9 609	3 031	5 93	6 217			0 1617	8 86	9	8	89
Manganese (Mn), total		1 140	0 278	3 031	0 27	3429	1 0000	33 33	0 6724	0 10	9	6	67
Mercury (Hg), total		0 001	0 000	3 188	0 0003	0003		12 50	0 2502	00039	8	7	88
Molybdenum(Mo), total				3 031		1794	0 0000	88 89	3 2830	- 1260	9	1	11
Nickel (Ni), total				3 031		3805	0 0000	88 89	3 2830	- 4394	9	1	11
Potassium (K) total				3 031		8 806	0 0000	88 89	3 2830	-6 095	9	1	11
Selenium (Se) total				3 031				100 00		******	9	0	0
Silver (Ag), total			0 059	3 031	0 06	0893	1 0000	66 67	1 6820	- 0232	9	3	33
Sodium (Na) total		43 020	20 444	3 031	7 45						9	9	100
Strontium (Sr) total		1 341	0 313	3 031	0 34	3505			0 1617	0 28	9	8	89
Thallium (Tl) total				3 031				100 00		******	9	0	0
Tin (Sn) total				3 031		1 575	0 0000	88 89	3 2830	-1 884	9	1	11
Vanadium (V) total				3 031		5689	0 0000	88 89	3 2830	- 6669	9	1	11
Zinc (Zn), total			0 201	3 031	0 30	3638	1 0000	55 56	1 2670	- 0284	9	4	44

ROUND 2
TOTAL METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al) total		8 444	2 376	3 399	1 63	1 928		14 29	0 2223	1 89	7	6	86
Antimony (Sb) total				3 399				100 00		******	7	0	0
Arsenic (As) total				3 399				100 00		******	7	0	0
Barium (Ba), total				3 399		1703	0 0000	85 71	3 2830	- 0146	7	1	14
Beryllium (Be) total				3 399				100 00		******	7	0	0
Cadmium (Cd) total				3 399				100 00		******	7	0	0
Calcium (Ca) total		105 029	35 543	3 399	20 44						7	7	100
Cesium (Cs) total				3 399				100 00		******	7	0	0
Chromium (Cr) total			0 011	3 399	0 0004	0014	0 2000	71 43	1 6510	00932	7	2	29
Cobalt (Co), total				3 399				100 00		******	7	0	0
Copper (Cu), total				3 399				100 00		******	7	0	0
Iron (Fe) total		12 070	3 127	3 399	2 63						7	7	100
Lead (Pb) total				3 399		0467	0 0000	85 71	3 2830	- 0539	7	1	14
Lithium (Li) total				3 399		0167	0 0000	85 71	3 2830	- 0110	7	1	14
Magnesium (Mg) total		17 578	8 048	3 399	2 43	3 262	0 6500	28 57	0 5114	6 49	7	5	71
Manganese (Mn) total		1 101	0 233	3 399	0 26						7	7	100
Mercury (Hg) total			0 000	3 399	0 0000	0001	0 1000	57 14	1 0170	00020	7	3	43
Molybdenum(Mo) total		0 026	0 014	3 399	0 0034						7	7	100
Nickel (Ni) total				3 399				100 00		******	7	0	0
Potassium (K), total				3 399				100 00		******	7	0	0
Selenium (Se) total				3 399				100 00		******	7	0	0
Silver (Ag) total				3 399				100 00		******	7	0	0
Sodium (Na) total		42 651	21 343	3 399	6 27						7	7	100
Strontium (Sr), total				3 399				100 00		******	7	0	0
Thallium (Tl) total				3 399				100 00		******	7	0	0
Tin (Sn) total				3 399				100 00		******	7	0	0
Vanadium (V) total				3 399				100 00		******	7	0	0
Zinc (Zn), total			0 071	3 399	0 01	0528	0 0500	57 14	0 9994	0 02	7	3	43

TOTAL METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM BOREHOLES
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al) total		25311 97	11830 9	1 986	6788 05						70	70	100
Antimony (Sb) total				1 986				100 00		******	70	0	0
Arsenic (As) total		15 859	5 134	1 986	5 92	6 357	1 0000	37 14	0 6724	3 23	70	44	63
Barium (Ba) total		155 762	81 793	1 986	37 83	43 74	1 0000	21 43	0 3447	68 90	70	55	79
Beryllium (Be), total		11 266	4 448	1 986	3 48	3 845	1 0000	14 29	0 2502	3 63	70	60	86
Cadmium (Cd), total			1 700	1 986	0 68	1 276	1 0000	91 43	3 8270	- 4168	70	6	9
Calcium (Ca), total		43079 47	5923 18	1 986	18792 6	18821	1 0000	2 86	0 0465	5701 7	70	68	97
Cesium (Cs), total				1 986				100 00		******	70	0	0
Chromium (Cr) total		37 915	17 150	1 986	10 46						70	70	100
Cobalt (Co) total			13 536	1 986	2 16	3 933	1 0000	80 00	2 6260	8 21	70	14	20
Copper (Cu) total		20 030	10 818	1 986	4 60	5 264	0 7500	12 86	0 2355	9 58	70	61	87
Iron (Fe) total		22916 16	12584 1	1 986	5202 43						70	70	100
Lead (Pb) total		18 035	7 777	1 986	5 17	5 193		1 43	0 0153	7 72	70	69	99
Lithium (Li) total		44 445	7 821	1 986	4 79	13 14	0 1000	44 29	0 7400	18 35	70	39	56
Magnesium (Mg) total		4425 129	2390 52	1 986	1009 85	1090	0 6000	7 14	0 0999	2261 2	70	65	93
Manganese (Mn) total		422 915	181 316	1 986	121 65						70	70	100
Mercury (Hg), total			0 219	1 986	0 11	2051	1 0000	72 86	2 6260	- 0596	70	19	27
Molybdenum(Mo), total		38 645	11 771	1 986	9 15	10 88	1 0000	41 43	0 8005	17 04	70	41	59
Nickel (Ni), total		43 272	21 841	1 986	10 66	12 82	0 7000	20 00	0 3206	17 81	70	56	80
Potassium (K), total		3335 818	1955 61	1 986	737 40	1146	0 7500	48 57	1 0420	1060 7	70	36	51
Selenium (Se) total				1 986				100 00		******	70	0	0
Silver (Ag) total			14 980	1 986	12 36	21 51	0 9485	71 43	1 9240	-9 436	70	20	29
Sodium (Na) total				1 986				100 00		******	70	0	0
Strontium (Sr) total			54 960	1 986	58 77	100 5	1 0000	85 71	3 8270	214 41	70	10	14
Thallium (Tl) total				1 986				100 00		******	70	0	0
Tin (Sn) total			153 071	1 986	129 13	222 5	1 0000	70 00	1 9400	-99 33	70	21	30
Vanadium (V) total		54 673	28 710	1 986	12 93	13 55	0 5534	4 29	0 0551	27 75	70	67	96
Zinc (Zn) total		52 642	24 617	1 986	13 71	15 09	0 4481	7 14	0 0950	22 67	70	65	93

TOTAL METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND BOREHOLE COLLUVIUM BOREHOLES
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al) total		21663 32	10849 3	2 249	4808 38						28	28	100
Antimony (Sb) total				2 249				100 00		******	28	0	0
Arsenic (As) total		7 734	4 320	2 249	1 31	1 969	0 4000	28 57	0 4755	3 31	28	20	71
Barium (Ba) total		345 797	134 348	2 249	93 89	96 49		3 57	0 0624	128 80	28	27	96
Beryllium (Be), total		17 745	5 633	2 249	5 39	5 511		3 57	0 0624	5 35	28	27	96
Cadmium (Cd) total				2 249			0 0000	96 43		1 80	28	1	4
Calcium (Ca) total		20810 74	8327 86	2 249	5550 41						28	28	100
Cesium (Cs) total			254 000	2 249	20 00	20 00	1 0000	92 86		254 00	28	2	7
Chromium (Cr) total		26 790	13 757	2 249	5 80						28	28	100
Cobalt (Co) total			14 267	2 249	1 21	4 737	0 2500	89 29	3 4350	5 78	28	3	11
Copper (Cu), total		26 691	14 919	2 249	5 06	5 435		3 57	0 0511	14 47	28	27	96
Iron (Fe) total		29991 29	14797 9	2 249	6755 64						28	28	100
Lead (Pb) total		26 422	16 214	2 249	4 54						28	28	100
Lithium (Li) total		32 119	8 573	2 249	4 29	8 749	0 1000	21 43	0 2574	12 44	28	22	79
Magnesium (Mg) total		6150 783	3177 14	2 249	1322 21						28	28	100
Manganese (Mn) total		545 139	193 371	2 249	156 41						28	28	100
Mercury (Hg), total			0 217	2 249	0 10	1721	0 9500	71 43	1 9240	0 02	28	8	29
Molybdenum(Mo), total		32 776	12 900	2 249	5 72	7 483	0 5500	25 00	0 3987	15 95	28	21	75
Nickel (Ni) total		35 371	18 244	2 249	7 48	8 197	0 7543		0 1520	16 94	28	25	89
Potassium (K) total		2789 068	1720 67	2 249	458 72	691 0	0 6959	46 43	0 8832	1235 0	28	15	54
Selenium (Se) total				2 249				100 00		******	28	0	0
Silver (Ag) total			12 637	2 249	11 04	18 05	1 0000	71 43	1 9400	-7 262	28	8	29
Sodium (Na) total			1990 50	2 249	1689 50	1690	1 0000	92 86		1990 5	28	2	7
Strontium (Sr) total		111 082	56 861	2 249	24 11						28	28	100
Thallium (Tl) total				2 249				100 00		******	28	0	0
Tin (Sn) total			356 000	2 249	59 06	496 6	0 0500	82 14	2 2030	-375 8	28	5	18
Vanadium (V) total		58 154	30 896	2 249	11 79	12 56		3 57	0 0522	29 91	28	27	96
Zinc (Zn) total		98 123	53 018	2 249	20 06						28	28	100

TOTAL METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND CLAYSTONE BOREHOLES
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al), total		13494 89	7430 00	2 486	2439 62						17	17	100
Antimony (Sb) total			14 900	2 486	1 30	2 157	1 0000	88 24	3 8270	11 53	17	2	12
Arsenic (As) total		15 047	6 444	2 486	3 02	4 884	0 5500	47 06	0 8517	2 90	17	9	53
Barium (Ba) total		240 069	105 887	2 486	53 25	56 11		5 88	0 0901	100 57	17	16	94
Beryllium (Be), total		11 845	3 482	2 486	3 36						17	17	100
Cadmium (Cd) total				2 486				100 00		******	17	0	0
Calcium (Ca) total		10182 91	5762 35	2 486	1778 18						17	17	100
Cesium (Cs) total				2 486				100 00		******	17	0	0
Chromium (Cr) total		16 565	8 976	2 486	3 05						17	17	100
Cobalt (Co) total			22 500	2 486	7 20	21 60	0 4500	88 24	3 5470	-15 85	17	2	12
Copper (Cu) total		30 618	16 835	2 486	5 54						17	17	100
Iron (Fe) total		41294 60	14793 5	2 486	10660 1						17	17	100
Lead (Pb) total		34 465	20 082	2 486	5 79						17	17	100
Lithium (Li) total		33 371	6 608	2 486	2 09	8 607	0 0500	29 41	0 4130	11 97	17	12	71
Magnesium (Mg) total		4895 842	2432 50	2 486	958 61	1036		5 88	0 0823	2319 5	17	16	94
Manganese (Mn) total		656 018	178 312	2 486	192 16						17	17	100
Mercury (Hg) total			0 268	2 486	0 06	1914	0 1500	64 71	1 4000	0 05	17	6	35
Molybdenum(Mo) total		33 679	7 267	2 486	3 27	8 575	0 0500	29 41	0 4130	12 36	17	12	71
Nickel (Ni) total		56 947	23 385	2 486	12 87	15 99	0 8000	23 53	0 4261	17 19	17	13	76
Potassium (K) total			1342 50	2 486	39 61	280 5	0 0500	76 47	2 2030	930 28	17	4	24
Selenium (Se) total				2 486				100 00		******	17	0	0
Silver (Ag) total			12 000	2 486	6 96	16 55	0 5000	82 35	2 4210	-11 36	17	3	18
Sodium (Na) total				2 486				100 00		******	17	0	0
Strontium (Sr) total		144 423	75 035	2 486	27 91						17	17	100
Thallium (Tl) total				2 486				100 00		******	17	0	0
Tin (Sn) total			232 000	2 486	42 00	381 8	0 0500	88 24	3 3140	-458 8	17	2	12
Vanadium (V) total		47 701	23 806	2 486	9 31	10 05		5 88	0 0823	22 72	17	16	94
Zinc (Zn) total		106 694	63 188	2 486	17 50						17	17	100

TOTAL METAL TOLERANCE INTERVALS
FOR 1989 BACKGROUND SANDSTONE BOREHOLES
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Aluminum (Al) total		21137 04	5335 00	5 145	3071 34						4	4	100
Antimony (Sb), total				5 145				100 00		******	4	0	0
Arsenic (As) total		6 704	3 067	5 145	0 56	7711		25 00	0 3803	2 74	4	3	75
Barium (Ba) total		387 188	101 900	5 145	48 46	59 92		25 00	0 4261	78 89	4	3	75
Beryllium (Be) total		4 344	2 000	5 145	0 22	5065		25 00	0 3279	1 74	4	3	75
Cadmium (Cd) total				5 145				100 00		******	4	0	0
Calcium (Ca), total		10788 83	3672 50	5 145	1383 16						4	4	100
Cesium (Cs), total				5 145				100 00		******	4	0	0
Chromium (Cr) total		20 656	6 625	5 145	2 73						4	4	100
Cobalt (Co), total				5 145		13 42	0 0000	75 00	2 1760	0 70	4	1	25
Copper (Cu) total		43 594	12 100	5 145	5 31	6 620		25 00	0 4209	9 53	4	3	75
Iron (Fe) total		24502 26	7642 50	5 145	3276 92						4	4	100
Lead (Pb) total		18 712	11 400	5 145	1 42						4	4	100
Lithium (Li) total		13 831	4 700	5 145	1 77						4	4	100
Magnesium (Mg) total		4896 070	1756 67	5 145	544 20	657 9		25 00	0 4411	1511 1	4	3	75
Manganese (Mn) total		695 109	119 825	5 145	111 81						4	4	100
Mercury (Hg) total		0 684	0 195	5 145	0 07	1118	0 9000	50 00	1 0740	0 11	4	2	50
Molybdenum(Mo) total		20 224	7 075	5 145	2 56						4	4	100
Nickel (Ni) total		27 543	12 450	5 145	1 85	3 493	0 3500	50 00	0 9437	9 57	4	2	50
Potassium (K) total				5 145				100 00		******	4	0	0
Selenium (Se), total				5 145				100 00		******	4	0	0
Silver (Ag) total				5 145		15 39	0 0000	75 00	2 1760	-10 00	4	1	25
Sodium (Na) total				5 145				100 00		******	4	0	0
Strontium (Sr) total		163 114	59 600	5 145	9 14	22 39		25 00	0 3279	47 89	4	3	75
Thallium (Tl) total				5 145				100 00		******	4	0	0
Tin (Sn) total				5 145		361 8	0 0000	75 00	2 1760	-265 6	4	1	25
Vanadium (V) total		41 775	16 433	5 145	4 41	5 310		25 00	0 4459	14 46	4	3	75
Zinc (Zn) total		137 527	52 750	5 145	16 48						4	4	100

INORGANICS

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SEDIMENTS
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Nitrate-Nitrite as N				3 031				100 00		******	9	0	0
pH	5 39	9 03	7 211	3 532	0 52						9	9	100
Sulfide				0 000							0	0	***

ROUND 1
INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Total Dissolved Solids		329 515	177 778	3 031	50 06						9	9	100
Chloride		89 108	23 111	3 031	21 77						9	9	100
Nitrate-Nitrite as N		2 447	0 609	3 031	0 61	6159	1 0000	22 22	0 3447	0 58	9	7	78
Sulfate		50 195	23 125	3 031	7 30	9 658			0 1215	20 92	9	8	89
HCO3- as CaCO3		389 722	130 667	3 031	85 47						9	9	100
CO3= as CaCO3				3 031				100 00		******	9	0	0
pH	5 89	9 02	7 456	3 532	0 44						9	9	100
Cyanide, Total				3 031				100 00		******	9	0	0

ROUND 2
INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Total Dissolved Solids		365 152	191 429	3 399	51 11						7	7	100
Chloride		82 560	17 143	3 399	19 25						7	7	100
Nitrate-Nitrite as N			0 887	3 399	0 86	1 278	1 0000	57 14	1 2670	- 1734	7	3	43
Sulfate		65 299	31 143	3 399	10 05						7	7	100
HCO3- as CaCO3		344 214	126 857	3 399	63 95						7	7	100
CO3= as CaCO3				3 399				100 00		******	7	0	0
pH	6 44	8 30	7 371	4 007	0 23						7	7	100
Cyanide Total				3 399		0033	0 0000	85 71	3 2830	- 0016	7	1	14

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND ROCKY FLATS ALLUVIUM GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Total Dissolved Solids		352 057	217 273	2 815	47 88						11	11	100
Chloride		15 577	6 273	2 815	3 31						11	11	100
Nitrate-Nitrite as N		2 977	1 403	2 815	0 56						11	11	100
Sulfate		45 082	22 273	2 815	8 10						11	11	100
HCO3- as CaCO3		435 892	143 909	2 815	103 72						11	11	100
CO3= as CaCO3				2 815				100 00		******	11	0	0
pH	5 98	8 60	7 291	3 259	0 40						11	11	100
Cyanide Total			0 004	2 815	0 0001	0017	0 0000	81 82	2 1760	00115	11	2	18

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND COLLUVIUM GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Total Dissolved Solids		405 000	405 000	0 000	115 00						2	2	100
Chloride		15 500	15 500	0 000	4 50						2	2	100
Nitrate-Nitrite as N		0 071	0 180	0 000		1189		50 00	0 8368	0 07	2	1	50
Sulfate		65 500	65 500	0 000	20 50						2	2	100
HCO3- as CaCO3		350 000	350 000	0 000	120 00						2	2	100
CO3= as CaCO3				0 000				100 00		******	2	0	0
pH	1 60	12 90	7 250	37 670	0 15						2	2	100
Cyanide, Total				0 000				100 00		******	2	0	0

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND VALLEY FILL ALLUVIUM GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Total Dissolved Solids		946 584	416 250	3 188	166 35						8	8	100
Chloride		40 294	14 629	3 188	7 04	8 807		12 50	0 2075	12 22	8	7	88
Nitrate-Nitrite as N			0 273	3 188	0 29	4133	1 0000	62 50	1 6820	- 1023	8	3	38
Sulfate		150 058	56 500	3 188	29 35						8	8	100
HCO3- as CaCO3		718 596	268 750	3 188	141 11						8	8	100
CO3= as CaCO3				3 188				100 00		******	8	0	0
pH	6 12	8 68	7 400	3 732	0 34						8	8	100
Cyanide Total				3 188				100 00		******	8	0	0

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND WEATHERED CLAYSTONE GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Total Dissolved Solids		480 736	255 000	5 145	43 87						4	4	100
Chloride		33 327	8 500	5 145	2 50	5 789	0 2000	50 00	0 9012	3 54	4	2	50
Nitrate-Nitrite as N		1 321	0 325	5 145	0 19						4	4	100
Sulfate		87 340	26 750	5 145	11 78						4	4	100
HCO3- as CaCO3		702 590	260 000	5 145	86 02						4	4	100
CO3= as CaCO3				5 145				100 00		******	4	0	0
pH	5 69	9 66	7 675	6 370	0 31						4	4	100
Cyanide, Total				5 145		0016	0 0000	75 00	2 1760	00121	4	1	25

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND WEATHERED SANDSTONE GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Total Dissolved Solids		195 000	195 000	0 000	25 00						2	2	100
Chloride		10 500	10 500	0 000	4 50						2	2	100
Nitrate-Nitrite as N		0 890	0 890	0 000	0 71						2	2	100
Sulfate		32 000	32 000	0 000	16 00						2	2	100
HCO3- as CaCO3		185 000	185 000	0 000	45 00						2	2	100
CO3= as CaCO3				0 000				100 00		******	2	0	0
pH	1 70	13 00	7 350	37 670	0 15						2	2	100
Cyanide Total				0 000				100 00		******	2	0	0

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND UNWEATHERED SANDSTONE GROUND WATER
ALL CONCENTRATIONS IN mg/l

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Total Dissolved Solids		1760 920	538 571	3 399	359 62						7	7	100
Chloride		607 113	150 117	3 399	125 80	144 6		14 29	0 2355	115 47	7	6	86
Nitrate-Nitrite as N		0 610	0 178	3 399	0 11	1602	0 6963	42 86	0 8832	0 06	7	4	57
Sulfate		950 515	153 600	3 399	233 84	258 7	1 0000	28 57	0 5548	71 16	7	5	71
HCO3- as CaCO3		412 123	163 857	3 399	73 04						7	7	100
CO3= as CaCO3		48 775	17 333	3 399	8 24	10 03		14 29	0 2152	14 68	7	6	86
pH	7 43	10 57	9 000	4 007	0 39						7	7	100
Cyanide Total				3 399				100 00		******	7	0	0

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM BOREHOLES
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Nitrate-Nitrite as N			1 948	1 986	0 90	1 370	1 0000	67 14	1 6820	0 61	70	23	33
pH	6 06	9 64	7 846	2 304	0 78						70	70	100
Sulfide			5 731	1 986	2 44	5 368	0 6501	77 14	2 4860	-1 804	70	16	23

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND BOREHOLE COLLUVIUM BOREHOLES
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Nitrate-Nitrite as N		4 274	2 287	2 249	0 82	1 298	0 5500	46 43	0 8517	1 35	28	15	54
pH	6 96	9 48	8 221	2 579	0 49						28	28	100
Sulfide			4 167	2 249	1 21	3 110	0 4500	78 57	2 3990	- 2678	28	6	21

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND CLAYSTONE BOREHOLES
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Nitrate-Nitrite as N			1 443	2 486	0 29	4546	0 9500	58 82	1 4480	1 02	17	7	41
pH	7 04	10 14	8 588	2 858	0 54						17	17	100
Sulfide			3 500	2 486	1 50	2 254	1 0000	76 47	2 6260	0 77	17	4	24

INORGANIC COMPOUND TOLERANCE INTERVALS
FOR 1989 BACKGROUND SANDSTONE BOREHOLES
ALL CONCENTRATIONS IN mg/kg

Analyte	Lower Interval	Upper Interval	Mean	Tolerance Factor	Standard Deviation	Revised Standard Deviation	TAU	Percent Nondetects	LAMBDA	Revised Mean	No of Samples	No of Detects	Percent Detects
Nitrate-Nitrite as N		3 316	1 467	5 145	0 31	3891		25 00	0 4155	1 31	4	3	75
pH	5 85	11 50	8 675	6 370	0 44						4	4	100
Sulfide				5 145		4917	0 0000	75 00	2 1760	2 73	4	1	25

DISSOLVED RADIOCHEMISTRY

ROUND 1
DISSOLVED RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	5 528	0 556	3 0310	1 6405	9	0 90	2 9530	5 4772
Gross Beta	8 009	1 444	3 0310	2 1660	9	0 83	1 4995	7 9423
Uranium 233, 234	2 908	0 667	3 0310	0 7394	9	0 16	1 1091	2 8848
Uranium 235	0 334	0 044	3 0310	0 0956	9	0 04	2 1506	0 3312
Uranium 238	1 935	0 378	3 0310	0 5138	9	0 15	1 3600	1 9191
Strontium 89, 90	1 432	0 078	3 0310	0 4467	9	0 17	5 7428	1 4178
Plutonium 239, 240	0 015	0 002	3 0310	0 0042	9	0 01	1 8708	0 0147
Americium 241	0 011	-0 003	3 0310	0 0047	9	0 01	-1 4142	0 0108
Cesium 137	0 447	-0 144	3 0310	0 1950	9	0 20	-1 3500	0 4406
Tritium	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000
Radium 226	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000
Radium 228	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000

DISSOLVED RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND ROCKY FLATS ALLUVIUM GROUND WATER
ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	12 543	3 182	2 8150	3 3253	11	1 00	1 0451	13 1578
Gross Beta	14 570	3 545	2 8150	3 9165	11	0 79	1 1046	15 2949
Uranium 233, 234	1 647	0 418	2 8150	0 4366	11	0 05	1 0439	1 7278
Uranium 235	0 000	0 000	2 8150	0 0000	11	0 04	*********	0 0000
Uranium 238	1 195	0 282	2 8150	0 3242	11	0 05	1 1505	1 2545
Strontium 89 90	0 552	-0 064	2 8150	0 2186	11	0 16	-3 4345	0 5920
Plutonium 239 240	0 009	0 001	2 8150	0 0029	11	0 00	3 1623	0 0095
Americium 241	0 000	0 000	2 8150	0 0000	11	0 00	*********	0 0000
Cesium 137	0 603	0 036	2 8150	0 2012	11	0 17	5 5340	0 6401
Tritium	309 149	140 909	2 8150	59 7654	11	55 93	0 4241	320 2052
Radium 226	4 699	0 333	7 6550	0 5703	3	0 29	1 7108	2 0441
Radium 228	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000

DISSOLVED RADIOCHEMISTRY TOLERANCE INTERVALS FOR 1989 BACKGROUND COLLUVIUM GROUND WATER ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	14 000	14 000	0 0000	30 8707	2	6 18	2 2050	106 6121
Gross Beta	7 000	7 000	0 0000	14 8661	2	2 69	2 1237	51 5982
Uranium 233, 234	5 800	5 800	0 0000	12 7122	2	0 51	2 1918	43 9366
Uranium 235	0 150	0 150	0 0000	0 3354	2	0 07	2 2361	1 1562
Uranium 238	4 050	4 050	0 0000	8 8844	2	0 36	2 1937	30 7032
Strontium 89, 90	0 050	0 050	0 0000	0 1118	2	0 32	2 2361	0 3854
Plutonium 239 240	0 000	0 000	0 0000	0 0000	2	0 01	*********	0 0000
Americium 241	-0 005	-0 005	0 0000	0 0112	2	0 01	-2 2361	0 0285
Cesium 137	-0 200	-0 200	0 0000	0 5657	2	0 42	-2 8284	1 4971
Tritium	0 000	0 000	0 0000	100 0000	2	102 59	*********	300 0000
Radium 226	0 400	0 400	0 0000	1 2000	1	0 20	3 0000	4 0000
Radium 228	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000

DISSOLVED RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND VALLEY FILL ALLUVIUM GROUND WATER
ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	13 515	4 250	3 1880	2 9061	8	2 10	0 6838	12 9682
Gross Beta	18 530	5 750	3 1880	4 0088	8	1 14	0 6972	17 7763
Uranium 233 234	6 481	1 950	3 1880	1 4214	8	0 13	0 7289	6 2141
Uranium 235	0 232	0 063	3 1880	0 0532	8	0 04	0 8515	0 2222
Uranium 238	5 084	1 475	3 1880	1 1320	8	0 12	0 7674	4 8709
Strontium 89 90	0 878	0 113	3 1880	0 2402	8	0 17	2 1347	0 8330
Plutonium 239 240	0 012	0 001	3 1880	0 0033	8	0 00	2 6693	0 0113
Americium 241	0 012	-0 004	3 1880	0 0050	8	0 00	-1 3385	0 0113
Cesium 137	0 776	-0 012	3 1880	0 2472	8	0 22	-19 7769	0 7291
Tritium	505 111	151 250	3 1880	110 9978	8	52 17	0 7339	484 2433
Radium 226	0 050	0 050	0 0000	0 1768	2	0 14	3 5355	0 5803
Radium 228	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000

DISSOLVED RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND WEATHERED CLAYSTONE GROUND WATER
ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	55 568	6 750	5 1450	9 4885	4	2 28	1 4057	35 2154
Gross Beta	41 006	5 500	5 1450	6 9011	4	1 27	1 2547	26 2033
Uranium 233, 234	25 127	3 150	5 1450	4 2716	4	0 23	1 3561	15 9647
Uranium 235	0 712	0 075	5 1450	0 1237	4	0 05	1 6499	0 4462
Uranium 238	15 753	2 000	5 1450	2 6730	4	0 18	1 3365	10 0190
Strontium 89, 90	0 630	0 000	5 1450	0 1225	4	0 21	*********	0 3674
Plutonium 239, 240	0 089	0 007	5 1450	0 0159	4	0 01	2 1213	0 0552
Americium 241	0 000	0 000	5 1450	0 0000	4	0 01	*********	0 0000
Cesium 137	1 610	0 175	5 1450	0 2789	4	0 29	1 5940	1 0118
Tritium	457 713	2 500	5 1450	88 4767	4	95 23	35 3907	267 9301
Radium 226	6 380	0 500	7 6550	0 7681	3	0 30	1 5362	2 8043
Radium 228	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000

DISSOLVED RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND WEATHERED SANDSTONE GROUND WATER
ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	5 000	5 000	0 0000	2 0000	2	2 92	0 4000	11 0000
Gross Beta	1 000	1 000	0 0000	1 0000	2	1 80	1 0000	4 0000
Uranium 233, 234	0 700	0 700	0 0000	0 4000	2	0 16	0 5714	1 9000
Uranium 235	0 000	0 000	0 0000	0 0000	2	0 07	********	0 0000
Uranium 238	0 350	0 350	0 0000	0 2500	2	0 11	0 7143	1 1000
Strontium 89 90	-0 150	-0 150	0 0000	0 0500	2	0 39	-0 3333	0 0000
Plutonium 239 240	0 005	0 005	0 0000	0 0050	2	0 01	1 0000	0 0200
Americium 241	0 005	0 005	0 0000	0 0050	2	0 01	1 0000	0 0200
Cesium 137	0 150	0 150	0 0000	0 1500	2	0 46	1 0000	0 6000
Tritium	30 000	30 000	0 0000	70 0000	2	129 03	2 3333	240 0000
Radium 226	0 400	0 400	0 0000	0 4000	1	1 00	1 0000	1 6000
Radium 228	0 000	0 000	0 0000	0 0000	0	0	********	0 0000

DISSOLVED RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND UNWEATHERED SANDSTONE GROUND WATER
ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	34 627	4 800	4 2020	7 0982	5	1 97	1 4788	26 0945
Gross Beta	37 695	7 600	4 2020	7 1621	5	1 37	0 9424	29 0864
Uranium 233 234	12 936	2 486	3 3990	3 0745	7	0 22	1 2369	11 7092
Uranium 235	0 135	0 014	3 3990	0 0354	7	0 04	2 4785	0 1205
Uranium 238	3 357	0 629	3 3990	0 8026	7	0 12	1 2769	3 0364
Strontium 89 90	0 707	-0 017	3 7070	0 1953	6	0 15	-11 7189	0 5693
Plutonium 239 240	0 000	0 000	3 3990	0 0000	7	0 00	*********	0 0000
Americium 241	0 019	0 003	3 3990	0 0046	7	0 00	1 6257	0 0168
Cesium 137	1 276	0 250	3 7070	0 2769	6	0 20	1 1075	1 0807
Tritium	731 876	42 000	4 2020	164 1780	5	94 59	3 9090	534 5339
Radium 226	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000
Radium 228	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000

TOTAL RADIOCHEMISTRY

TOTAL RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SEDIMENTS
ALL CONCENTRATIONS IN pci/gm (pci/ml for tritium)

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	36 500	36 500	0 0000	11 5000	2	10 31	0 3151	71 0000
Gross Beta	34 000	34 000	0 0000	1 0000	2	4 24	0 0294	37 0000
Uranium 233 234	1 050	1 050	0 0000	0 0500	2	0 18	0 0476	1 2000
Uranium 235	0 050	0 050	0 0000	0 0500	2	0 07	1 0000	0 2000
Uranium 238	1 000	1 000	0 0000	0 0000	2	0 14	0 0000	1 0000
Strontium 89 90	0 300	0 300	0 0000	0 3000	2	0 60	1 0000	1 2000
Plutonium 239 240	0 000	0 000	0 0000	0 0000	2	0 01	*********	0 0000
Americium 241	0 000	0 000	0 0000	0 0100	2	0 02	*********	0 0300
Cesium 137	0 000	0 000	0 0000	0 0000	2	0 07	*********	0 0000
Tritium	0 145	0 145	0 0000	0 0550	2	0 10	0 3793	0 3100
Radium 226	0 800	0 800	0 0000	0 0000	2	0 07	0 0000	0 8000
Radium 228	1 500	1 500	0 0000	0 1000	2	0 18	0 0667	1 8000

ROUND ONE
TOTAL RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	266 658	32 111	3 0310	77 3828	9	15 63	2 4098	264 2595
Gross Beta	213 432	26 556	3 0310	61 6552	9	12 26	2 3217	211 5210
Uranium 233, 234	1 250	0 411	3 0310	0 2767	9	0 16	0 6730	1 2411
Uranium 235	0 106	0 011	3 0310	0 0314	9	0 04	2 8284	0 1054
Uranium 238	0 937	0 267	3 0310	0 2211	9	0 14	0 8292	0 9300
Strontium 89, 90	2 160	0 500	3 0310	0 5477	9	0 16	1 0954	2 1432
Plutonium 239 240	1 066	0 122	3 0310	0 3113	9	0 01	2 5470	1 0561
Americium 241	0 111	0 013	3 0310	0 0323	9	0 01	2 4238	0 1103
Cesium 137	12 788	1 211	3 0310	3 8194	9	0 28	3 1536	12 6692
Tritium	266 167	115 556	3 0310	49 6904	9	48 55	0 4300	264 6268
Radium 226	31 594	2 133	7 6550	3 8485	3	0 33	1 8040	13 6789
Radium 228	11 000	11 000	0 0000	31 1127	1	4 00	2 8284	104 3381

ROUND TWO
TOTAL RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND STATIONS - SURFACE WATER
ALL CONCENTRATIONS IN pci/l

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	106 207	11 000	3 3990	28 0102	7	4 27	2 5464	95 0306
Gross Beta	79 549	11 143	3 3990	20 1253	7	1 81	1 8061	71 5186
Uranium 233, 234	1 326	0 400	3 3990	0 2726	7	0 07	0 6814	1 2177
Uranium 235	0 000	0 000	3 3990	0 0000	7	0 04	*********	0 0000
Uranium 238	0 977	0 271	3 3990	0 2076	7	0 07	0 7648	0 8942
Strontium 89 90	1 243	0 257	3 3990	0 2902	7	0 15	1 1284	1 1277
Plutonium 239, 240	0 112	0 014	3 3990	0 0287	7	0 01	2 0114	0 1005
Americium 241	0 014	0 001	3 3990	0 0036	7	0 01	2 5071	0 0122
Cesium 137	1 059	0 000	3 3990	0 3117	7	0 26	*********	0 9350
Tritium	863 276	187 143	3 3990	198 9213	7	77 41	1 0629	783 9067
Radium 226	1 400	1 400	0 0000	3 9598	1	1 00	2 8284	13 2794
Radium 228	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000

TOTAL RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND BOREHOLE ROCKY FLATS ALLUVIUM BOREHOLES
ALL CONCENTRATIONS IN pci/gm (pci/ml for tritium)

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	37 108	21 387	1 9860	7 9157	70	1 40	0 3701	45 1343
Gross Beta	36 886	23 600	1 9860	6 6899	70	0 70	0 2835	43 6696
Uranium 233 234	1 491	0 633	1 9860	0 4322	70	0 02	0 6829	1 9294
Uranium 235	0 087	0 013	1 9860	0 0375	70	0 01	2 9165	0 1254
Uranium 238	1 353	0 639	1 9860	0 3595	70	0 02	0 5629	1 7170
Strontium 89, 90	0 768	0 055	1 9890	0 3586	69	0 07	6 5117	1 1309
Plutonium 239 240	0 017	0 002	1 9860	0 0073	70	0 00	2 9884	0 0242
Americium 241	0 018	-0 002	2 3710	0 0085	21	0 00	-4 4394	0 0235
Cesium 137	0 082	0 009	1 9860	0 0368	70	0 01	4 2947	0 1190
Tritium	0 410	0 177	1 9860	0 1175	70	0 02	0 6639	0 5295
Radium 226	1 334	0 629	2 0360	0 3461	55	0 01	0 5502	1 6675
Radium 228	2 868	1 325	2 0360	0 7575	55	0 03	0 5715	3 5979

TOTAL RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND BOREHOLE COLLUVIUM BOREHOLES
ALL CONCENTRATIONS IN pci/gm (pci/ml for tritium)

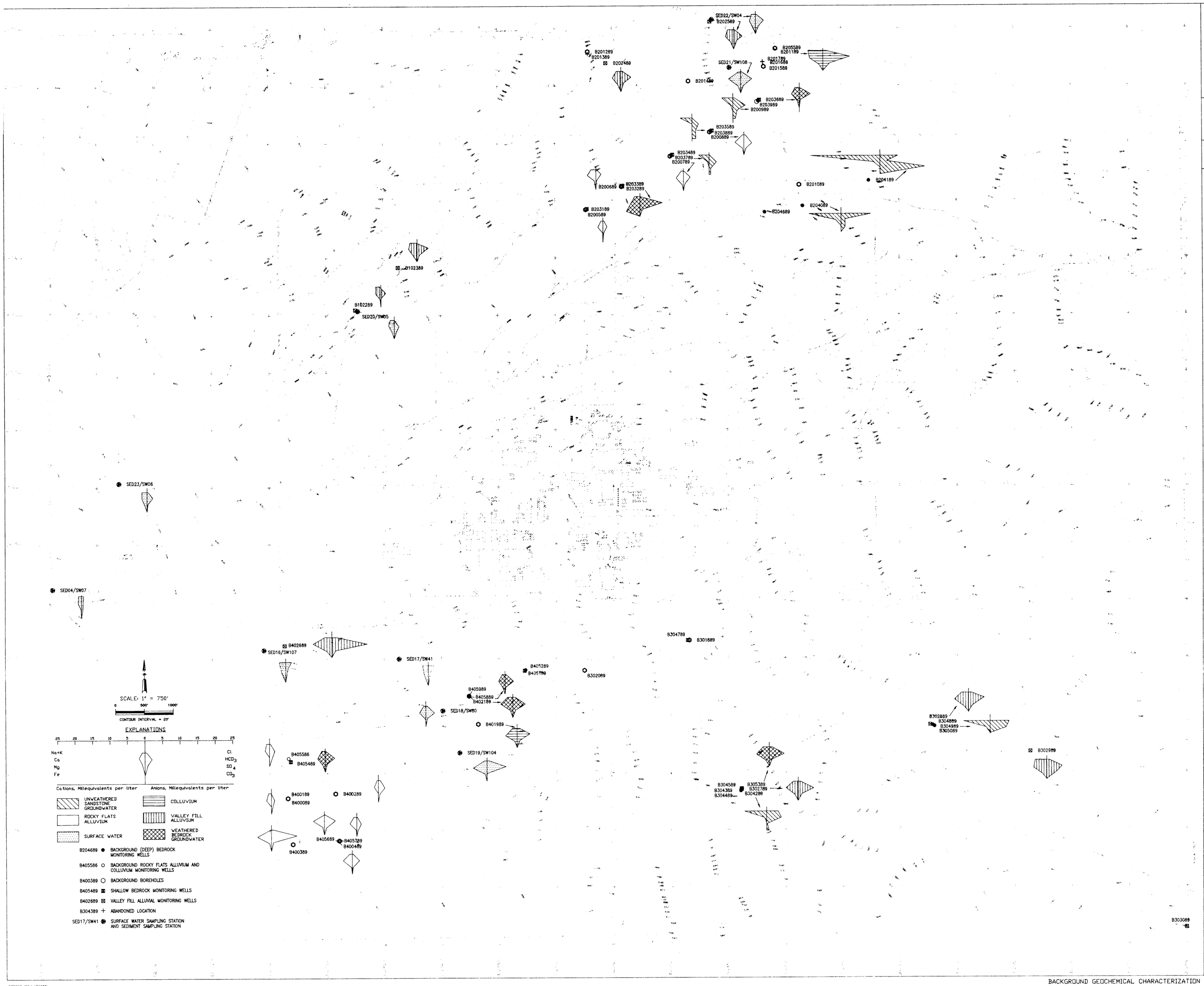
Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	51 710	31 536	2 2490	8 9701	28	2 77	0 2844	58 4461
Gross Beta	35 135	26 750	2 2490	3 7285	28	1 13	0 1394	37 9355
Uranium 233 234	1 759	0 839	2 2490	0 4091	28	0 04	0 4875	2 0667
Uranium 235	0 169	0 043	2 2490	0 0562	28	0 02	1 3123	0 2116
Uranium 238	1 675	0 925	2 2490	0 3334	28	0 04	0 3604	1 9252
Strontium 89 90	0 776	-0 011	2 2490	0 3498	28	0 12	-32 6514	1 0388
Plutonium 239 240	0 023	0 006	2 2490	0 0077	28	0 00	1 2712	0 0292
Americium 241	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000
Cesium 137	0 113	0 014	2 2490	0 0440	28	0 02	3 0822	0 1464
Tritium	0 299	0 060	2 2490	0 1064	28	0 03	1 7831	0 3787
Radium 226	2 592	1 067	2 3710	0 6433	21	0 02	0 6031	2 9966
Radium 228	3 818	1 567	2 3710	0 9494	21	0 05	0 6060	4 4148

TOTAL RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND CLAYSTONE BOREHOLES
ALL CONCENTRATIONS IN pci/gm (pci/ml for tritium)

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	52 302	30 059	2 4860	8 9474	17	3 57	0 2977	56 9009
Gross Beta	35 743	25 471	2 4860	4 1319	17	1 44	0 1622	37 8663
Uranium 233 234	1 985	1 035	2 4860	0 3819	17	0 06	0 3688	2 1809
Uranium 235	0 258	0 047	2 4860	0 0848	17	0 02	1 8028	0 3016
Uranium 238	1 643	1 012	2 4860	0 2541	17	0 06	0 2511	1 7741
Strontium 89, 90	0 786	-0 118	2 4860	0 3634	17	0 16	-3 0887	0 9725
Plutonium 239 240	0 020	0 004	2 4860	0 0068	17	0 00	1 9293	0 0240
Americium 241	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000
Cesium 137	0 000	0 000	2 4860	0 0000	17	0 02	*********	0 0000
Tritium	0 322	0 052	2 4860	0 1086	17	0 04	2 0987	0 3777
Radium 226	3 068	1 100	2 7360	0 7194	12	0 03	0 6540	3 2581
Radium 228	3 734	1 333	2 7360	0 8773	12	0 05	0 6580	3 9652

TOTAL RADIOCHEMISTRY TOLERANCE INTERVALS
FOR 1989 BACKGROUND SANDSTONE BOREHOLES
ALL CONCENTRATIONS IN pci/gm (pci/ml for tritium)

Analyte	Upper Interval	Mean	Tolerance factor	Standard Deviation	Number of Samples	Error for Mean	Coeff of Variation	3 Std Dev + Mean
Gross Alpha	63 198	27 000	5 1450	7 0356	4	6 96	0 2606	48 1069
Gross Beta	44 785	25 750	5 1450	3 6997	4	2 88	0 1437	36 8490
Uranium 233, 234	1 230	0 600	5 1450	0 1225	4	0 11	0 2041	0 9674
Uranium 235	0 248	0 025	5 1450	0 0433	4	0 05	1 7321	0 1549
Uranium 238	1 536	0 775	5 1450	0 1479	4	0 10	0 1908	1 2187
Strontium 89, 90	1 863	-0 175	5 1450	0 3961	4	0 39	-2 2633	1 0132
Plutonium 239 240	0 036	0 000	5 1450	0 0071	4	0 01	*********	0 0212
Americium 241	0 000	0 000	0 0000	0 0000	0	0	*********	0 0000
Cesium 137	0 000	0 000	5 1450	0 0000	4	0 05	*********	0 0000
Tritium	0 952	0 105	5 1450	0 1647	4	0 07	1 5685	0 5991
Radium 226	0 950	0 950	0 0000	0 9513	2	0 07	1 0014	3 8039
Radium 228	1 050	1 050	0 0000	1 0512	2	0 14	1 0011	4 2036



NO.	DATE	REVISION

U.S. DEPARTMENT OF ENERGY

ROCKWELL INTERNATIONAL
Rocky Flats Plant
Golden, Colorado
Plate 2

STIFF DIAGRAMS FOR BACKGROUND, GROUND-WATER AND SURFACE WATER SAMPLES, ROUND 1, 1989

RF750E.JBPJ-120689