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SUMMARY OF HISTORICAL WATER-QUALITY DATA FOR SELECTED SEEPS IN THE 903 PAD AND LIP AREA AT THE ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE

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Surface Water

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Executive Summary

This report summarizes radiochemistry data for seep waters located in the vicinity of the 903 Pad at the Rocky Flats Environmental Technology Site (Site). The data presented herein were collected as part of the Site Wide Surface Water and Sediment Monitoring Program that operated from 1989 to 1994 at the Site. Data summarized herein are for the time period January 1, 1989 through January 1, 1995 for monitoring stations SW050, SW051, SW052, SW053, SW055, SW057, and SW059. These sites are springs (a.k.a. "seeps") that issue in Operable Unit Number 2 (OU2) where radioactive wastes containing plutonium-239,240, americium-241, and organic chemicals, were stored and inadvertently released to the environment.

The data show that plutonium-239,240 and americium-241 activities in most of these waters exceed background activities and the Site-specific surface-water discharge standard of 0.05 pCi/L by several orders of magnitude. Volatile organic analytes (VOAs) are consistently detected in the SW059 waters. No discernable change or trend in radionuclide activities is observed for these seep waters for the period of investigation for this report.

The 903 Pad has been studied extensively by Dr. M. Iggy Litaor, Ph.D., the U. S. Geological Survey National Research Program, and others. These studies focused on characterizing the form, chemical partitioning, transport, and fate of the plutonium-239,240 and americium-241 in the area. A copy of one of Dr. Litaors more recent papers is contained as an Appendix to this report.

To date, seep flow measurements are not available, largely due to the technical complexity of measuring the extremely low flows of the seeps. In the past five years, the seeps have been little more than wet areas where the water table intersects the land surface. However, this year the Site received an inordinate

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quantity of precipitation (nearly 75% of average annual precipitation in the month of May) causing the seeps to flow like never before observed. It is reasonable to expect that large changes in the hydrologic and hydrogeologic conditions at the Site could change the chemistry and yield of radionuclides observed in the 903 Pad area waters. Therefore, the data contained herein might not be representative of the current quality of these waters.

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Introduction

The 903 Pad area has been extensively investigated to determine the nature and extent of actinide contamination as well as the form, chemical partitioning and mobility of the actinides in the area's air, soils, surface water, and groundwater (EG&G, 1992a; EG&G, 1992b; EG&G, 1994; EG&G, 1995; Litaor et al, 1994; Harnish et al, In Press; McKnight et al, In Press). This report summarizes data collected for surface-water monitoring stations SW050, SW051, SW052, SW053, SW055, SW057, and SW059, located in the vicinity of the 903 Pad at the Rocky Flats Environmental Technology Site (Figure 1). All of these monitoring stations except for SW059 are springs (also known as "seeps") that issue on the southeast-facing hillside, approximately 200 feet downgradient from the 903 Pad. SW059 is a seep located about 700 feet northeast of the 903 Pad. Volatile organic contaminants are consistently detected in the SW059 water. SW059 water is treated by the OU2 Interim Measure / Interim Remedial Action facility.

Data Description

The data contained herein are total-radiochemistry and volatile organic analyte (VOA) data for the time period January 1, 1989 to July 7, 1995. These data were obtained from the Rocky Flats Environmental Data System (RFEDS) on July 7, 1995. Prior to data summarization, the RFEDS data were screened to remove extraneous data records. This screening included removal of:

- All quality-control samples such as equipment rinseate samples, duplicate samples, matrix spike samples, and blanks ;
- Duplicate RFEDS records;
- All data with data-validation codes of "R" (rejected by data validation); and

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- All dissolved radiochemistry sample data.

Therefore, all of these data are non-rejected data for real Site surface-water samples. The VOA data presented herein are only for detected non-detected compounds. Maximum detected VOA concentrations are highlighted in Table 2.

Data Analysis and Interpretation

The total radiochemistry data are summarized in Table 1. The VOA data are summarized in Table 2. Data in Table 1 indicate that mean plutonium-239,240 and americium-241 activities in SW050, SW051, SW052, SW053, and SW055 are higher than the site-specific discharge standard of 0.05 pCi/L. Mean plutonium-239,240 activities range from 11.14 pCi/L at station SW053 to 0.06 pCi/L for station SW059. Mean americium-241 activities range from 3.54 pCi/L at station SW055 to 0.07 pCi/L at station SW059.

Concentrations of 1,1-trichloroethylene, 1,1-dichloroethylene, and carbon tetrachloride are highest at station SW059, and these contaminants are also observed at stations SW051, SW053, SW055, and SW057.. These contaminants are also observed in the groundwater of this area (EG&G, 1994).

The intent of this report is to briefly summarize the data for these seeps which are contained in OU2. Detailed analysis and interpretation of environmental data collected in OU2 may be found in the OU2 Phase II Remedial Investigation (DOE, 1995) and other reports and papers referenced herein.

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References

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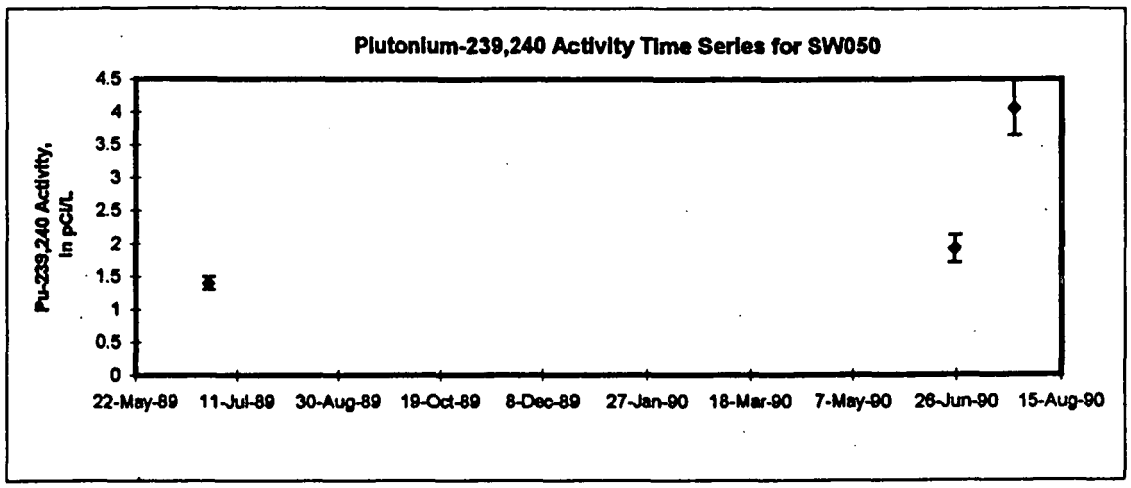
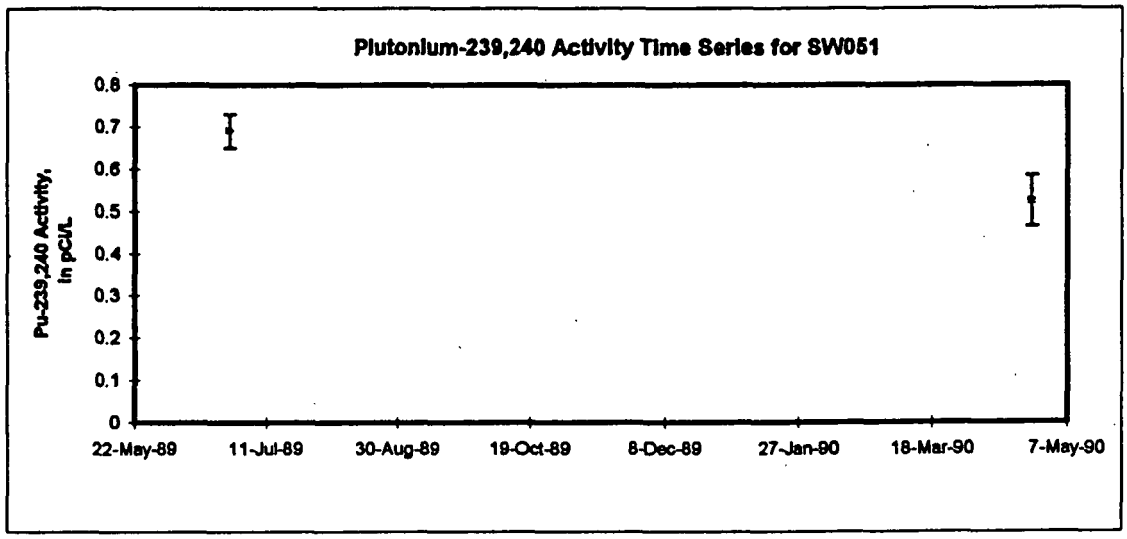
Figure 2


Plutonium-239,240 Activity Time Series for SW050
Pu-239,240 Activity, in pCi/L
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
22-May-89
11-Jul-89
30-Aug-89
19-Oct-89
8-Dec-89
27-Jan-90
18-Mar-90
7-May-90
26-Jun-90
15-Aug-90


Plutonium-239,240 Activity Time Series for SW051
Pu-239,240 Activity, in pCi/L
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
22-May-89
11-Jul-89
30-Aug-89
19-Oct-89
8-Dec-89
27-Jan-90
18-Mar-90
7-May-90

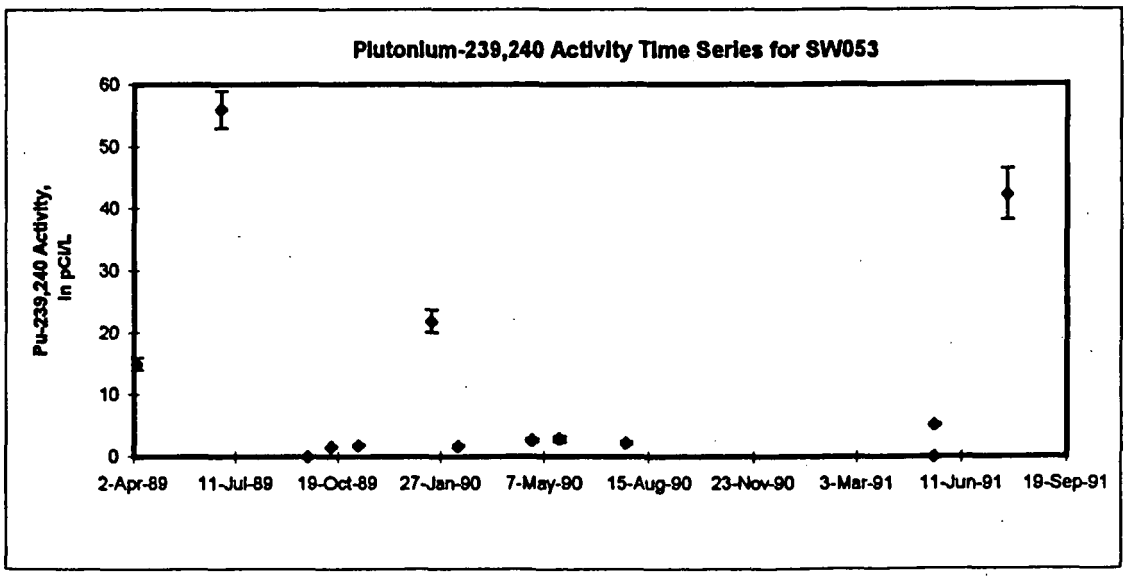

Plutonium-239,240 Activity Time Series for SW053
Pu-239,240 Activity, in pCi/L
60
50
40
30
20
10
0
2-Apr-89
11-Jul-89
19-Oct-89
27-Jan-90
7-May-90
15-Aug-90
23-Nov-90
3-Mar-91
11-Jun-91
19-Sep-91

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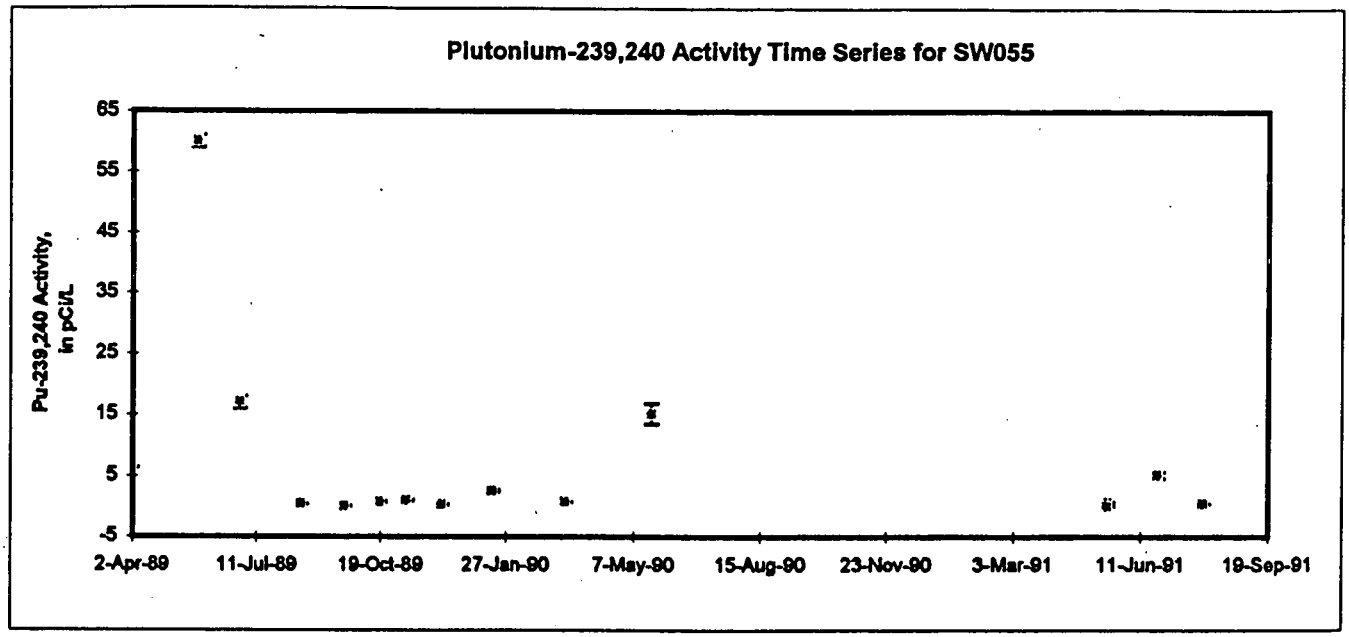
Figure 3


Plutonium-239,240 Activity Time Series for SW055
Pu-239,240 Activity, in pCi/L
65
55
45
35
25
15
5
-5
2-Apr-89
11-Jul-89
19-Oct-89
27-Jan-90
7-May-90
15-Aug-90
23-Nov-90
3-Mar-91
11-Jun-91
19-Sep-91

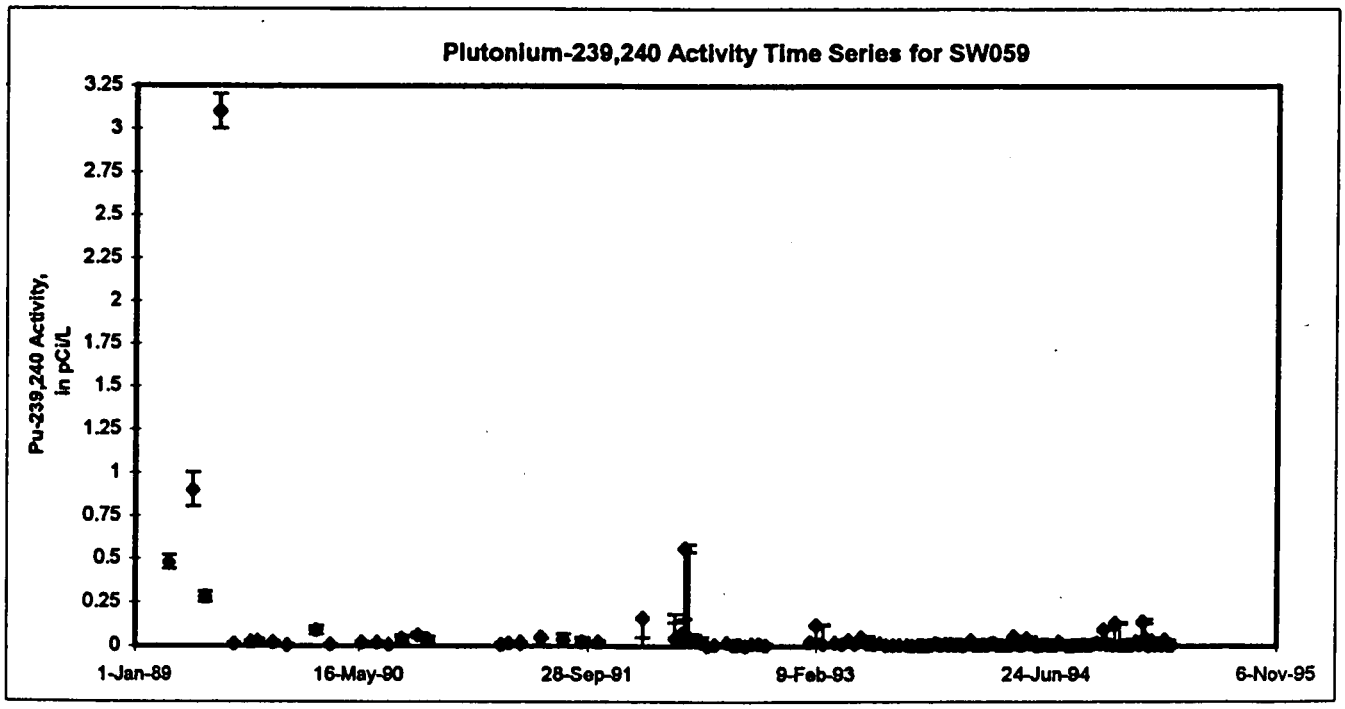
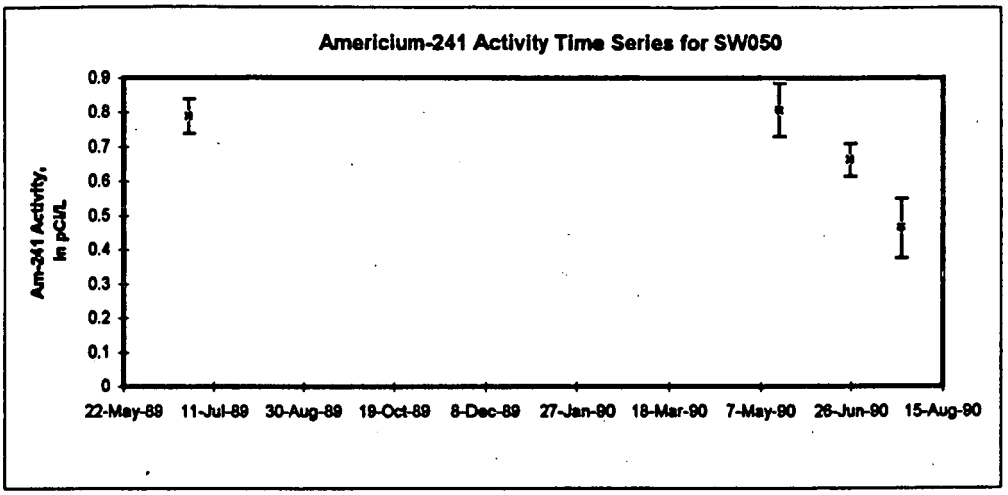
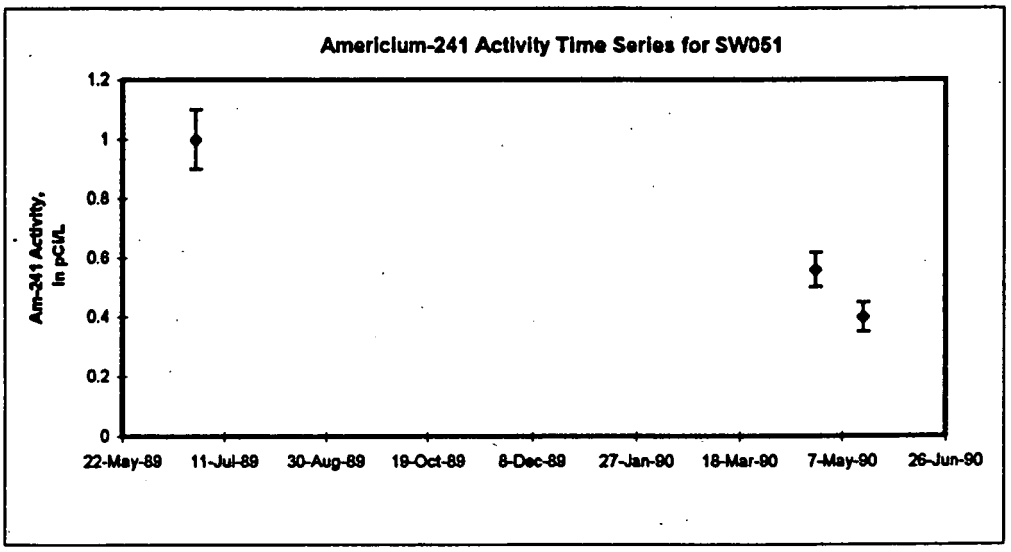

Plutonium-239,240 Activity Time Series for SW059
Pu-239,240 Activity, in pCi/L
3.25
3
2.75
2.5
2.25
2
1.75
1.5
1.25
1
0.75
0.5
0.25
0
1-Jan-89
16-May-90
28-Sep-91
9-Feb-93
24-Jun-94
6-Nov-95

Figure 4


Americium-241 Activity Time Series for SW050
Am-241 Activity, in pCi/L
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
22-May-89
11-Jul-89
30-Aug-89
19-Oct-89
8-Dec-89
27-Jan-90
18-Mar-90
7-May-90
26-Jun-90
15-Aug-90


Americium-241 Activity Time Series for SW051
Am-241 Activity, in pCi/L
1.2
1
0.8
0.6
0.4
0.2
0
22-May-89
11-Jul-89
30-Aug-89
19-Oct-89
8-Dec-89
27-Jan-90
18-Mar-90
7-May-90
26-Jun-90

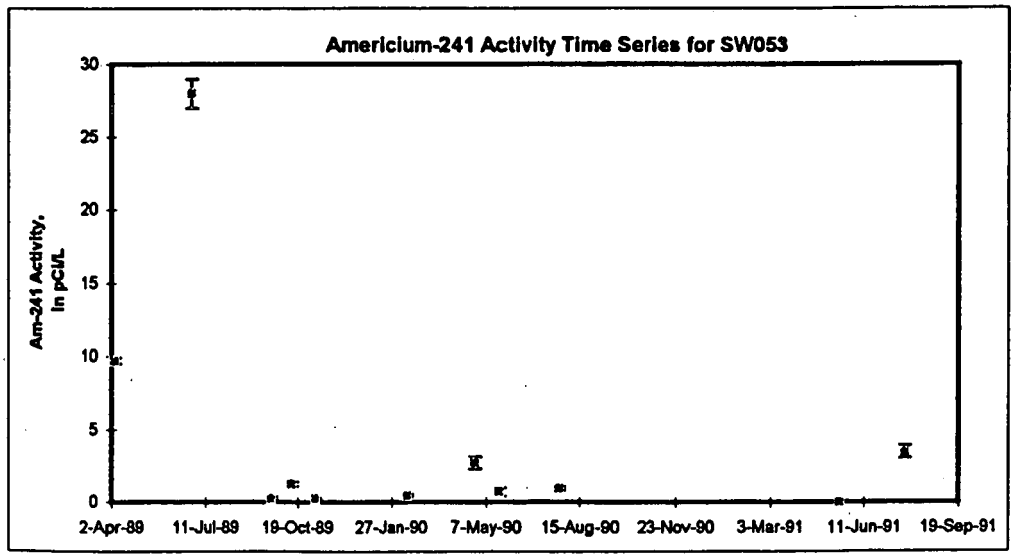

Americium-241 Activity Time Series for SW053
Am-241 Activity, in pCi/L
30
25
20
15
10
5
0
2-Apr-89
11-Jul-89
19-Oct-89
27-Jan-90
7-May-90
15-Aug-90
23-Nov-90
3-Mar-91
11-Jun-91
19-Sep-91

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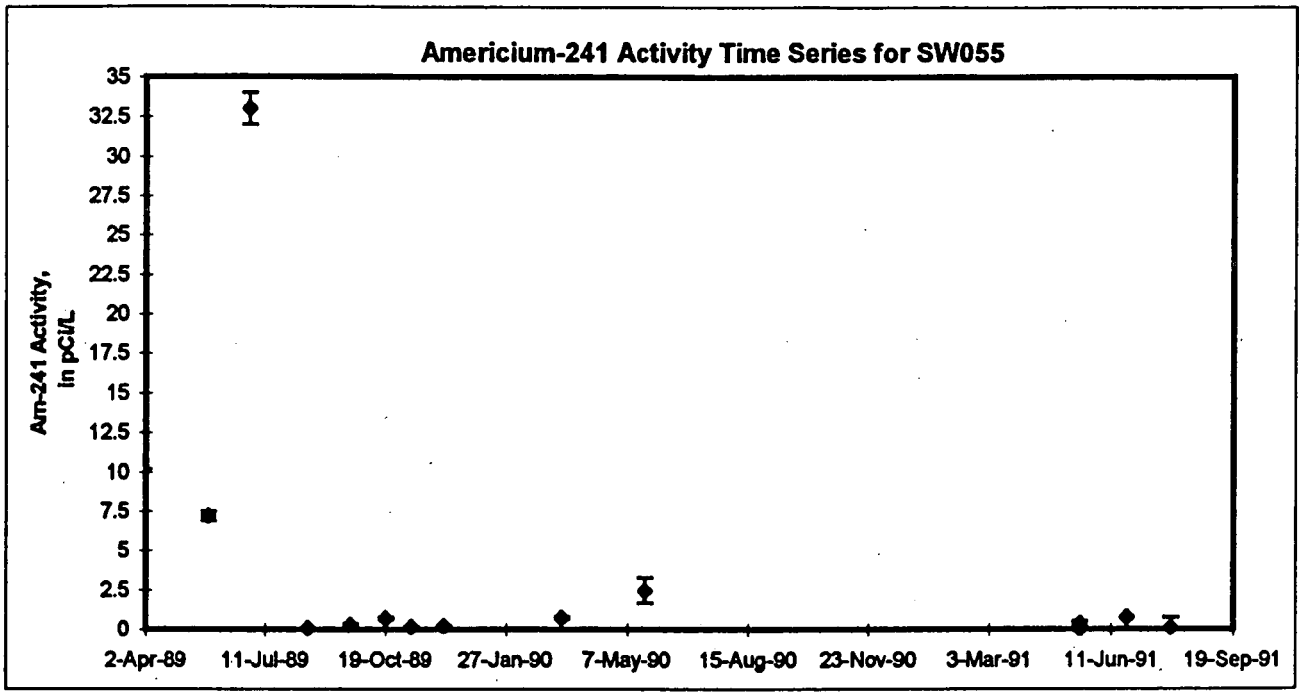
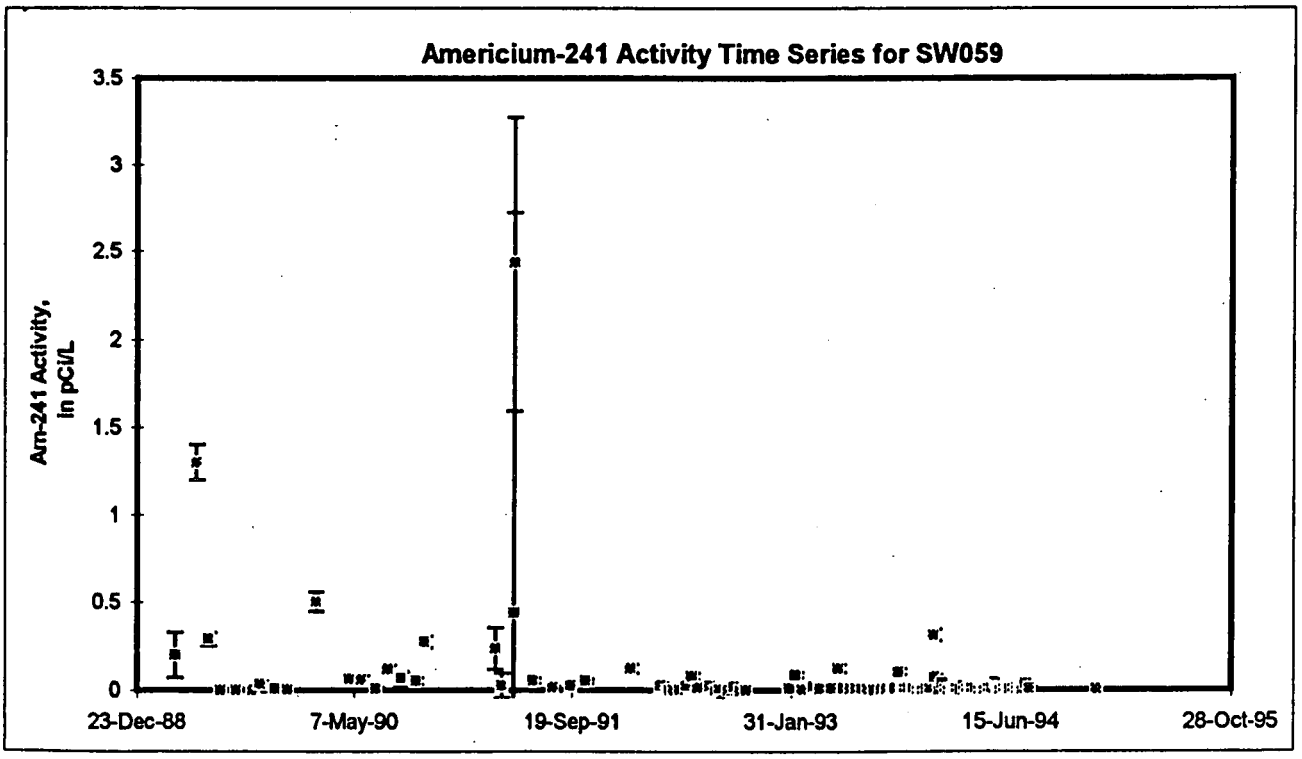
Figure 5


Americium-241 Activity Time Series for SW055
Am-241 Activity, in pCi/L
35
32.5
30
27.5
25
22.5
20
17.5
15
12.5
10
7.5
5
2.5
0
2-Apr-89
11-Jul-89
19-Oct-89
27-Jan-90
7-May-90
15-Aug-90
23-Nov-90
3-Mar-91
11-Jun-91
19-Sep-91


Americium-241 Activity Time Series for SW059
Am-241 Activity, in pCi/L
3.5
3
2.5
2
1.5
1
0.5
0
23-Dec-88
7-May-90
19-Sep-91
31-Jan-93
15-Jun-94
28-Oct-95

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Tat...

		Chemical										
Location	Data	AMERICIUM-241	CESIUM-137	GROSS ALPHA	GROSS BETA	PLUTONIUM-239/240	RADIUM-226	STRONTIUM-89,90	TRITIUM	URANIUM-233,-234	URANIUM-235	URANIUM-238
SW050	Count of Result	4.00	3.00	3.00	3.00	3.00	3.00	4.00	6.00	3.00	3.00	3.00
	Max of Result	0.81	1.28	32.00	24.00	4.06	1.50	0.70	418.00	2.60	0.20	1.80
	Average of Result	0.68	0.86	15.67	9.53	2.46	0.62	0.39	177.80	2.20	0.13	1.52
	Min of Result	0.46	0.50	6.20	1.90	1.40	0.15	0.24	20.00	1.76	0.10	1.36
	Average of Error	0.07	0.52	4.07	2.83	0.25	0.14	0.26	166.42	0.58	0.15	0.49
SW051	Count of Result	3.00	3.00	3.00	3.00	2.00	2.00	3.00	4.00	3.00	3.00	3.00
	Max of Result	1.00	0.97	11.00	13.00	0.69	0.13	0.38	210.00	2.86	0.10	1.60
	Average of Result	0.65	0.60	9.33	7.47	0.61	0.12	0.18	67.50	1.88	0.03	1.32
	Min of Result	0.40	0.40	8.00	3.60	0.53	0.10	0.00	-120.00	1.38	0.00	1.16
	Average of Error	0.07	0.50	2.67	2.07	0.05	0.18	0.26	135.00	0.57	0.12	0.47
SW052	Count of Result	1.00	2.00	2.00	2.00	1.00	1.00	2.00	3.00	1.00	1.00	1.00
	Max of Result	0.17	2.23	5.00	3.80	0.31	0.05	0.66	355.00	2.25	0.00	1.57
	Average of Result	0.17	1.33	4.45	3.20	0.31	0.05	0.33	158.33	2.25	0.00	1.57
	Min of Result	0.17	0.42	3.90	2.60	0.31	0.05	0.00	0.00	2.25	0.00	1.57
	Average of Error	0.05	0.57	1.70	1.85	0.05	0.05	0.18	103.67	0.70	0.03	0.58
SW053	Count of Result	14.00	11.00	12.00	12.00	16.00	5.00	6.00	18.00	9.00	9.00	9.00
	Max of Result	28.00	0.47	230.00	34.40	56.00	0.90	0.74	950.00	19.98	0.56	15.00
	Average of Result	3.47	0.07	39.54	11.14	11.14	0.58	0.35	187.99	4.34	0.22	3.23
	Min of Result	0.01	-0.60	0.60	2.20	0.01	0.32	-0.20	-30.00	0.50	0.00	0.40
	Average of Error	0.21	0.58	7.07	4.03	0.85	0.28	0.30	170.60	0.91	0.23	0.76
SW055	Count of Result	13.00	10.00	8.00	8.00	15.00	5.00	6.00	14.00	10.00	10.00	10.00
	Max of Result	33.00	0.80	350.00	65.00	60.00	3.80	1.20	290.00	5.00	0.48	4.40
	Average of Result	3.54	0.10	69.16	18.04	7.07	1.30	0.63	100.41	3.20	0.22	2.70
	Min of Result	0.04	-0.20	0.60	3.00	0.01	0.20	0.10	-180.00	0.50	-0.01	0.40
	Average of Error	0.23	0.52	11.48	4.84	0.34	0.30	0.32	173.97	1.02	0.25	0.90
SW059	Count of Result	104.00	34.00	133.00	133.00	137.00	15.00	91.00	111.00	75.00	76.00	76.00
	Max of Result	2.43	2.65	310.00	340.00	3.10	7.20	9.25	580.00	7.70	1.00	7.90
	Average of Result	0.07	0.61	9.40	10.53	0.06	1.42	0.54	67.60	3.28	0.18	2.87
	Min of Result	-0.06	-0.60	-0.71	0.00	0.00	0.00	-0.35	-250.00	0.03	-0.02	0.01
	Average of Error	0.04	0.35	3.50	2.45	0.01	0.33	0.22	159.36	0.70	0.15	0.64

Table 2

Max Value in UG/L	Location						
Analyte	SW050	SW051	SW052	SW053	SW055	SW057	SW059
1,1,1,2-TETRACHLOROETHANE	0	0	0	0	0	0	1
1,1,1-TRICHLOROETHANE	5	5	5	5	5	5	42
1,1,2,2-TETRACHLOROETHANE	5	5	5	5	5	5	25
1,1,2-TRICHLOROETHANE	5	5	5	5	5	5	25
1,1-DICHLOROETHANE	5	5	5	5	5	5	25
1,1-DICHLOROETHENE	5	5	5	5	5	5	160
1,1-DICHLOROPROPENE	0	0	0	0	0	0	0.5
1,2 DICHLOROETHANE -D4	0	0	0	0	0	0	111
1,2,3-TRICHLOROBENZENE	0	0	0	0	0	0	1
1,2,3-TRICHLOROPROPANE	0	0	0	0	0	0	2
1,2,4-TRICHLOROBENZENE	0	0	0	10	10	0	10
1,2-DIBROMOETHANE	0	0	0	0	0	0	2
1,2-DICHLOROBENZENE	0	0	0	10	10	0	10
1,2-DICHLOROBENZENE-D4	0	0	0	0	0	0	120
1,2-DICHLOROETHANE	5	5	5	5	5	5	25
1,2-DICHLOROETHENE	5	5	5	44	11	5	170
1,2-DICHLOROPROPANE	5	5	5	5	5	5	25
1,3-DICHLOROBENZENE	0	0	0	10	10	0	10
1,3-DICHLOROPROPANE	0	0	0	0	0	0	1
1,4-DICHLOROBENZENE	0	0	0	10	10	0	10
2,2-DICHLOROPROPANE	0	0	0	0	0	0	2
2,4,5-TRICHLOROPHENOL	0	0	0	52	50	0	52
2,4,6-TRICHLOROPHENOL	0	0	0	10	10	0	10
2,4-DICHLOROPHENOL	0	0	0	10	10	0	10
2,4-DIMETHYLPHENOL	0	0	0	10	10	0	10
2,4-DINITROPHENOL	0	0	0	52	50	0	52
2,4-DINITROTOLUENE	0	0	0	10	10	0	10
2,6-DINITROTOLUENE	0	0	0	10	10	0	10
2-BUTANONE	10	10	10	10	10	10	50
2-CHLOROETHYL VINYL ETHER	10	10	10	0	10	0	0
2-CHLORONAPHTHALENE	0	0	0	10	10	0	10
2-CHLOROPHENOL	0	0	0	10	10	0	10
2-FURANOL, TETRAHYDRO-2-METH	0	0	0	0	0	0	8
2-HEXANONE	10	10	10	10	10	10	50
2-METHYLNAPHTHALENE	0	0	0	10	10	0	10
2-METHYLPHENOL	0	0	0	10	10	0	10
2-NITROANILINE	0	0	0	52	50	0	52
2-NITROPHENOL	0	0	0	10	10	0	10
3,3'-DICHLOROBENZIDINE	0	0	0	21	20	0	21
3-NITROANILINE	0	0	0	52	50	0	52
4,6-DINITRO-2-METHYLPHENOL	0	0	0	52	50	0	52
4-CHLORO-3-METHYLPHENOL	0	0	0	10	10	0	10
4-CHLOROANILINE	0	0	0	10	10	0	10
4-CHLOROPHENYL PHENYL ETHER	0	0	0	10	10	0	10
4-ISOPROPYLTOLUENE	0	0	0	0	0	0	1
4-METHYL-2-PENTANONE	10	10	10	10	10	10	50
4-METHYLPHENOL	0	0	0	10	10	0	10
4-NITROANILINE	0	0	0	52	50	0	52
4-NITROPHENOL	0	0	0	52	50	0	52
ACENAPHTHENE	0	0	0	10	10	0	10

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Table 2

ACENAPHTHYLENE	0	0	0	10	10	0	10
ACETONE	10	10	10	43	96	10	50
ANTHRACENE	0	0	0	10	10	0	10
BENZENE	5	5	5	5	5	5	150
BENZENE, 1,2,4-TRIMETHYL	0	0	0	0	0	0	1
BENZENE, 1,3,5-TRIMETHYL-	0	0	0	0	0	0	1
BENZENE, 1-CHLORO-4-(1-PROPY	0	0	0	0	0	0	0.84
BENZO(a)ANTHRACENE	0	0	0	10	10	0	10
BENZO(a)PYRENE	0	0	0	10	10	0	10
BENZO(b)FLUORANTHENE	0	0	0	10	10	0	10
BENZO(ghi)PERYLENE	0	0	0	10	10	0	10
BENZO(k)FLUORANTHENE	0	0	0	10	10	0	10
BENZOIC ACID	0	0	0	52	50	0	52
BENZYL ALCOHOL	0	0	0	10	10	0	10
BIS(2-CHLOROETHOXY)METHANE	0	0	0	10	10	0	10
BIS(2-CHLOROETHYL)ETHER	0	0	0	10	10	0	10
BIS(2-CHLOROISOPROPYL)ETHER	0	0	0	10	10	0	10
BIS(2-ETHYLHEXYL)PHTHALATE	0	0	0	10	10	0	10
BROMOBENZENE	0	0	0	0	0	0	1
BROMOCHLOROMETHANE	0	0	0	0	0	0	2
BROMODICHLOROMETHANE	5	5	5	5	5	5	25
BROMOFLUOROBENZENE	0	0	0	0	0	0	116
BROMOFORM	5	5	5	5	5	5	25
BROMOMETHANE	10	10	10	10	10	10	50
BUTYL BENZYL PHTHALATE	0	0	0	10	10	0	10
CARBON DISULFIDE	5	11	5	5	5	5	25
CARBON TETRACHLORIDE	110	250	16	20	10	1	430
CHLOROBENZENE	5	5	5	5	5	5	180
CHLOROETHANE	10	10	10	10	10	10	50
CHLOROFORM	27	6	3	20	5	4	82
CHLOROMETHANE	10	10	10	10	10	10	50
CHRYSENE	0	0	0	10	10	0	10
cis-1,2-DICHLOROETHENE	0	0	0	0	0	0	76
cis-1,3-DICHLOROPROPENE	5	5	5	5	5	5	25
CUMENE	0	0	0	0	0	0	1
DI-n-BUTYL PHTHALATE	0	0	0	10	10	0	10
DI-n-OCTYL PHTHALATE	0	0	0	10	10	0	10
DIBENZO(a,h)ANTHRACENE	0	0	0	10	10	0	10
DIBENZOFURAN	0	0	0	10	10	0	10
DIBROMOCHLOROMETHANE	5	5	5	5	5	5	25
DIBROMOMETHANE	0	0	0	0	0	0	2
DICHLORODIFLUOROMETHANE	0	0	0	0	0	0	1
DIETHYL PHTHALATE	0	0	0	10	10	0	10
DIMETHYL PHTHALATE	0	0	0	10	10	0	10
ETHYLBENZENE	5	5	5	5	5	5	25
FLUORANTHENE	0	0	0	10	10	0	10
FLUORENE	0	0	0	10	10	0	10
HEXACHLOROBENZENE	0	0	0	10	10	0	10
HEXACHLOROBUTADIENE	0	0	0	10	10	0	10
HEXACHLOROCYCLOPENTADIENE	0	0	0	10	10	0	10
HEXACHLOROETHANE	0	0	0	10	10	0	10
INDENO(1,2,3-cd)PYRENE	0	0	0	10	10	0	10

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Table 2

ISOPHORONE	0	0	0	10	10	0	10
ISOPROPYLBENZENE	0	0	0	0	0	0	1
m+p XYLENE	0	0	0	0	0	0	2
METHANE, ISOCYANO	0	0	0	0	0	0	8.1
METHYLENE CHLORIDE	8	5	5	17	7	5	71
n-BUTYLBENZENE	0	0	0	0	0	0	1
N-NITROSO-DI-n-PROPYLAMINE	0	0	0	10	10	0	10
N-NITROSODIPHENYLAMINE	0	0	0	10	10	0	10
n-PROPYLBENZENE	0	0	0	0	0	0	1
NAPHTHALENE	0	0	0	10	10	0	10
NITROBENZENE	0	0	0	10	10	0	10
o-CHLOROTOLUENE	0	0	0	0	0	0	2
o-XYLENE	5	5	5	0	5	0	1
p-BROMODIPHENYL ETHER	0	0	0	10	10	0	10
p-CHLOROTOLUENE	0	0	0	0	0	0	1
P-CRESOL	0	0	0	10	10	0	10
p-CYMENE	0	0	0	0	0	0	1
PENTACHLOROPHENOL	0	0	0	52	50	0	52
PHENANTHRENE	0	0	0	10	10	0	10
PHENOL	0	0	0	10	10	0	10
PROPANE, 1,2-DIBROMO-3-CHLORO-	0	0	0	0	0	0	2
PYRENE	0	0	0	10	10	0	10
sec-BUTYLBENZENE	0	0	0	0	0	0	1
STYRENE	5	5	5	5	5	5	25
tert-BUTYLBENZENE	0	0	0	0	0	0	1
TETRACHLOROETHENE	22	32	18	11	5	1	270
TIC	6	0	0	0	10	0	10
TOLUENE	5	5	5	5	5	5	170
TOLUENE - D8	0	0	0	0	0	0	109
TOTAL XYLENES	5	5	5	5	5	5	25
trans-1,2-DICHLOROETHENE	0	0	0	0	0	0	1
trans-1,3-DICHLOROPROPENE	5	5	5	5	5	5	25
TRICHLOROETHENE	9	14	4	14	90	5	380
TRICHLOROFLUOROMETHANE	0	0	0	0	0	0	2
VINYL ACETATE	10	10	10	10	10	10	50
VINYL CHLORIDE	10	10	10	10	10	10	50

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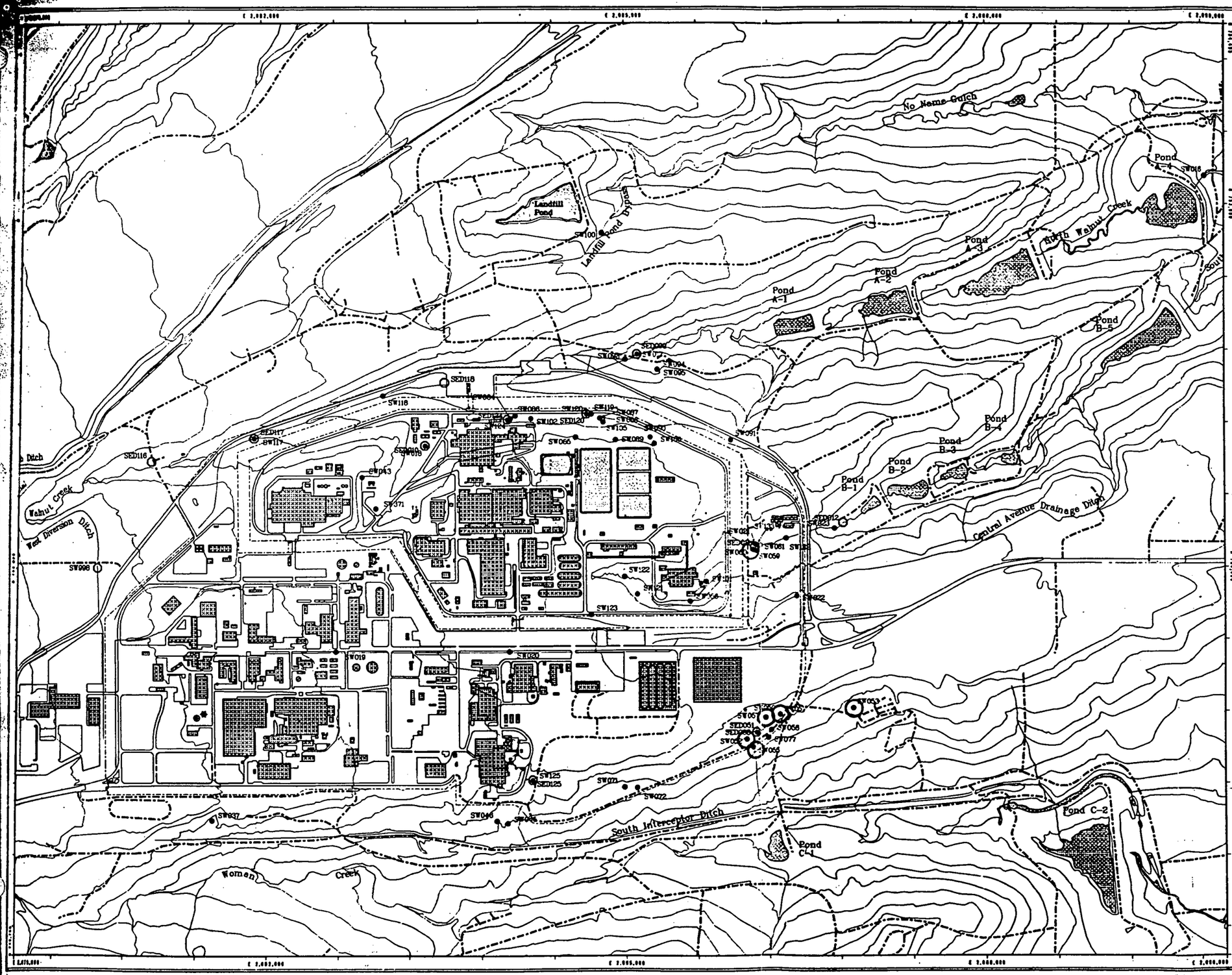

Rocky Flats Environmental Technology Site Industrial Area Historical Surface Water and Sediment Sampling Locations

- Surface water sampling locations
- Sediment sampling locations
- NPDES storm water permit sampling sites

Standard Map Features

- Buildings or other structures
- Lakes and ponds
- Streams, ditches, or other drainage features
- Fences
- Contours (20' intervals)
- Paved roads
- Dirt roads

DATA SOURCE:
E. Mings, roads, and fences provided by Facilities Engr., EG&G Rocky Flats, Inc. - 1991.
Hydrology provided by USGS - (date unknown)

Figure 1

Scale = 1 : 6760
1 inch represents 615 feet

State Plane Coordinate Projection
Colorado Central Zone
Datum: NAD27

U.S. Department of Energy
Rocky Flats Environmental Technology Site

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