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**Distribution of Plutonium and Americium
in Seep Waters in Operable Unit 2
at the Rocky Flats Plant**

August 9, 1991

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Prepared for:

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Rocky Flats Office**

ADMINISTRATIVE

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Executive Summary

The U.S. Environmental Protection Agency (EPA), Colorado Department of Health (CDH), U.S. Department of Energy (DOE), and the communities surrounding Rocky Flats Plant (RFP) are concerned about the potential transport of plutonium (Pu) and americium (Am) in the ground water and surface water of RFP. Knowledge of the extent to which Pu and Am are distributed between water and solids suspended in the water is useful for estimating the risk of off-site transport as well as development of remedial strategies. This report presents the results of an initial data-collection activity that was intended to determine the distribution of Pu and Am in surface-water seeps located in the 903 Pad and Lip area of Operable Unit 2 (OU2) at RFP. The analysis contained in this report supports the OU2 Woman Creek, Surface Water Interim Measure/Interim Remedial Action Plan.

The results indicate that the Pu and Am are associated with a solid, particulate phase. About eighty percent of the samples collected for this study had Pu and Am activities below the lower limit of detection. No significant difference (with 95 percent confidence) in Pu-238 and Am-241 activity was observed between the unfiltered seep water and 0.45 micrometer (μm), 0.2 μm , and 0.1 μm filtrates. However, a significant difference (with 95 percent confidence) between the unfiltered seep water and the filtrates was observed for Pu-239/240.

Activities for Pu and Am particulates on the 0.45 μm filters were significantly different (with 95 percent confidence) from the particulates on the 0.2 μm and 0.1 μm filters. The results contained in this report indicate that Pu and Am are associated with a particulate phase. However, these results do not indicate which size fractions smaller than 0.45 μm are associated with Pu and Am. Recommendations for improving the experimental design for this study are provided in this report for future radionuclide phase distribution studies.

CONTENTS

	Page
1.0 INTRODUCTION	1
1.1 BACKGROUND	1
1.2 PURPOSE AND SCOPE	1
2.0 METHODS	1
3.0 RESULTS	4
3.1 AQUEOUS FILTRATES	4
3.2 FILTERED PARTICULATES	4
4.0 CONCLUSIONS	4
5.0 RECOMMENDATIONS	8
6.0 REFERENCES	8

1.0 INTRODUCTION

1.1 BACKGROUND

The U.S. Environmental Protection Agency (EPA), Colorado Department of Health (CDH), U.S. Department of Energy (DOE), and the communities surrounding Rocky Flats Plant (RFP) are concerned about the potential transport of plutonium (Pu) and americium (Am) in the ground water and surface water of RFP. Knowledge of the extent to which Pu and Am are distributed between water and solids suspended in the water is useful in estimating the risk of off-site transport as well as development of remedial strategies. This report presents the results of an initial data-collection activity intended to determine the distribution of Pu and Am in surface-water seeps located in the 903 Pad and Lip area of Operable Unit 2 (OU2) at RFP. The analysis contained in this report supports the OU2 Woman Creek, Surface Water Interim Measure/Interim Remedial Action Plan.

1.2 PURPOSE AND SCOPE

The purpose of this report is to describe and interpret results of chemical analyses of filtered particulates and unfiltered and filtered water samples from seeps located in OU2. This report presents results of a non-parametric analysis of variance on ranked Pu and Am activity data and a qualitative interpretation of the filtration study data.

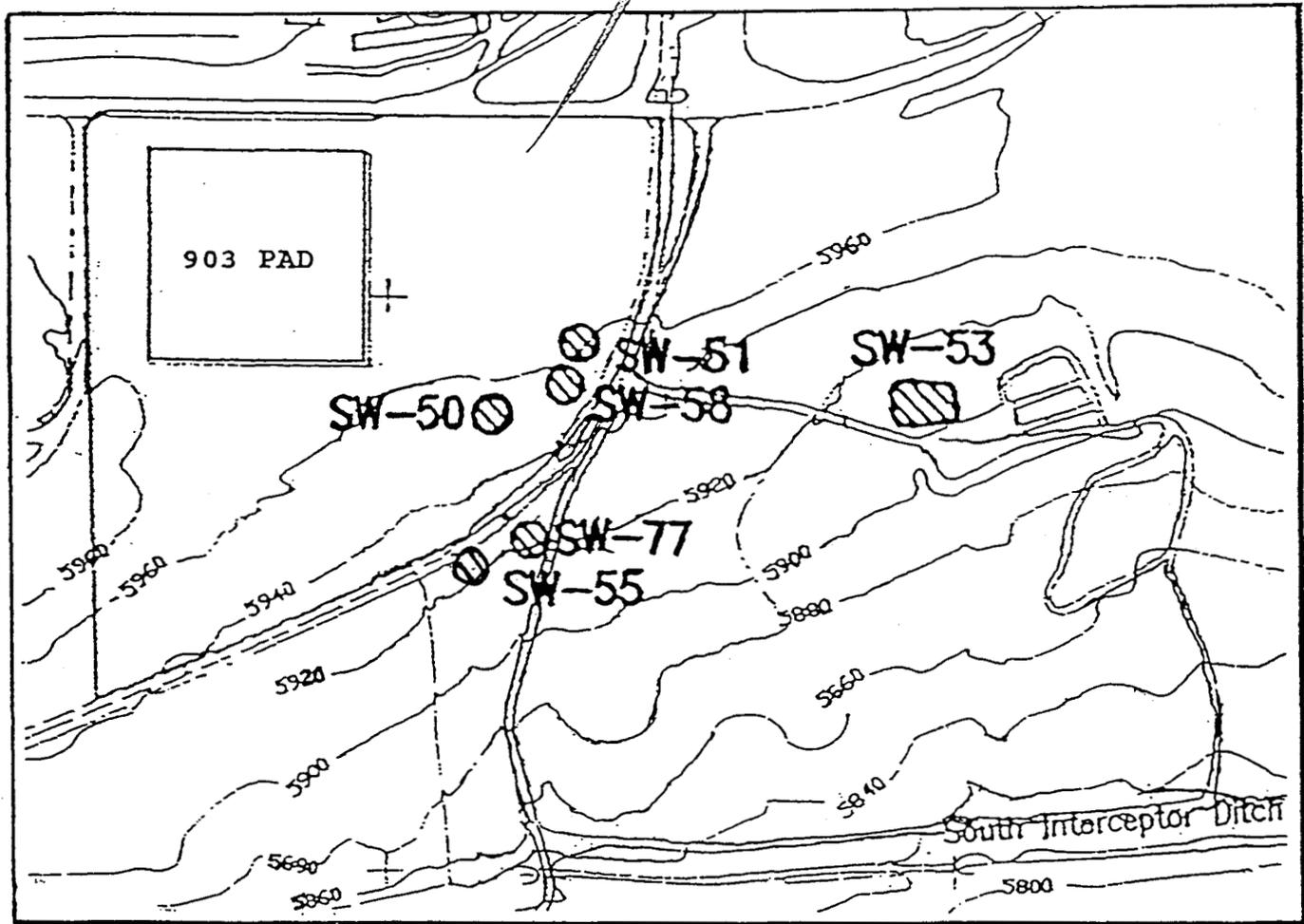
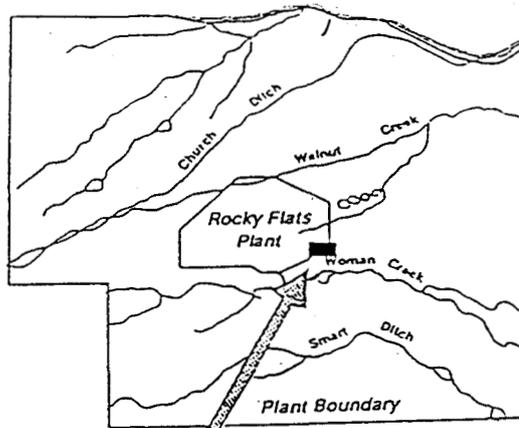
The six sampling locations: SW-50, SW-51, SW-53, SW-55, SW-58, and SW077 are shown in Figure 1.2-1. The samples were taken during June and July of 1990. Field-indicator parameter data that includes water temperature, dissolved oxygen, specific conductance, pH, and alkalinity were collected and are listed in Appendix 1. All Pu and Am activity data for both aqueous samples and filtered particulates are listed in Appendices 1 and 1a.

2.0 METHODS

Water samples were collected from seeps in the 903 Pad area according to RFP Environmental Monitoring and Assessment Division Standard Operating Procedure 4.3: Surface Water Sampling (EG&G, February, 1991). One site was selected for sampling during each day of data collection. The amount of water collected at the sampling location depended on the amount of water available at each seep.

The samples were filtered through a 142 millimeter (mm) diameter, 12 micron (μm) polycarbonate disk prefilter to prevent clogging of subsequent filters. The water samples passed sequentially through 0.45, 0.2, and 0.1 μm polycarbonate filters. After the filters were flushed with 50 milliliters (ml) of sample, aliquots of filtrates were collected from each filter. A schematic representation of the filtration system is shown in Figure 2-1.


 Maps not to scale



EXPLANATION

-  SW-077 Surface-Water Seep and Identification Label
-  5900 Altitude of land surface in feet

Figure 1.2-1 Locations of seep-sampling stations for the Pu and Am distribution study.

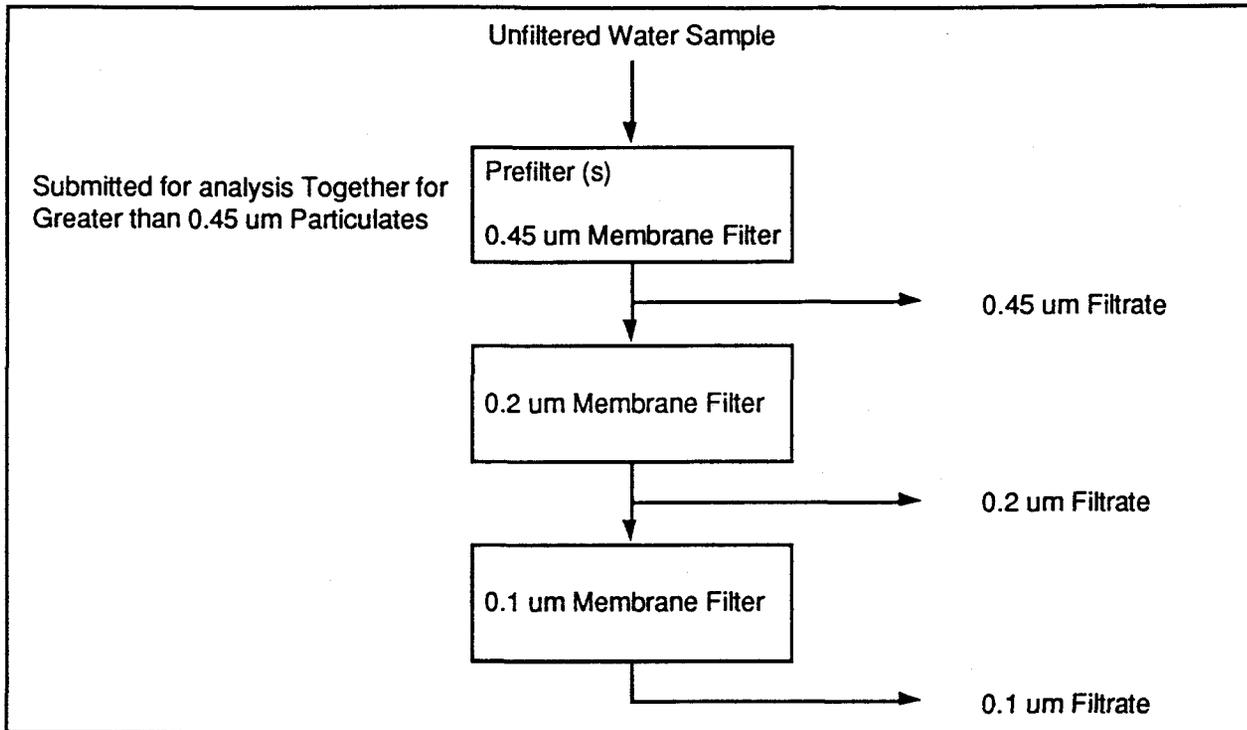


Figure 2-1 Schematic representation of the filtration process used for water and particulate sample fractionation.

After filtration, the filters were removed and placed in petri dishes for radiochemical analysis. The unfiltered and filtered water were analyzed by Alpha Spectrometry by International Technologies in Oak Ridge, Tennessee. The filtered particulates were analyzed by International Technologies in Richland, Washington. The filters were digested in acid, and the residue was analyzed by Alpha Spectrometry.

The water samples were analyzed for Pu and Am activity, and the results were reported in units of pCi/L (picocuries per liter). The filter samples were analyzed for Pu and Am activity, and the results were reported in units of pCi/sample. The volume of water that passed through each filter was not recorded; nor was it the same for each sample. Therefore, conversion of pCi/sample to pCi/L can not be done.

The instrumental analytical results for the water samples were adjusted by subtracting activities obtained from blanks to account for background and instrumental noise. The lower limit of detection (LLD) was reported for a sample if the blank-corrected results were lower than the LLD. The analytical results for the filtered particulates were reported as blank-corrected numbers. Several of the blank-corrected results are negative numbers.

3.0 RESULTS

3.1 AQUEOUS FILTRATES

The data shown in Figure 3.1-1 suggests that Am-241 and Pu-239/240 activities generally are higher in unfiltered samples than in the filtered samples, but Pu-238 activities in the unfiltered and filtered samples are similar. A Kruskal-Wallis analysis of variance, on ranked Pu and Am activity data (Table 3.1-1), indicates that there is a significant difference (with 95 percent confidence) between the filtered samples and the unfiltered samples for Pu-239/240 but not for Pu-238 and Am-241.

Samples for each individual filter size and the unfiltered samples were compared to investigate differences between the individual filter sizes. No significant difference (with 95% confidence) between filtered samples from each filter size and the unfiltered samples was observed for Pu and Am (Table 3.1-1).

The Pu and Am water-sample activities were plotted against the field-indicator parameter data to investigate geochemical relationships between radionuclide activity, pH, and conductivity. No such relationships were observed.

3.2 FILTERED PARTICULATES

Pu and Am activities for the 0.45 um filters generally are higher than the Pu and Am activities for the 0.2 and 0.1 um filters (Fig. 3.2-1). A Kruskal-Wallis analysis of variance on the ranked Pu and Am activity data indicates a significant difference (with 95 percent confidence) between the 0.45 um, 0.2 um, and 0.1 um filtered particulate activities for Am-241, Pu-238, and Pu-239/240 (Table 3.1-1).

4.0 CONCLUSIONS

These results indicate that Am and Pu are associated with a solid, particulate phase. The 0.45 um filters had higher Pu and Am activities than the 0.2 um and 0.1 um filters. This does not indicate that the radionuclides are specifically associated with a particle size larger than 0.45 um. Reduction of the effective pore size of the 0.45 um filters by clogging with particulates might have caused higher radionuclide activity on the 0.45 um filters. Low Pu and Am activities also were observed in the aqueous filtrates. Therefore, water that passed sequentially through the 0.45 um filter, 0.2 um filter, and the 0.1 um filters might have contained small amounts of particulate matter and consequently non-detectable amounts of Am and Pu.

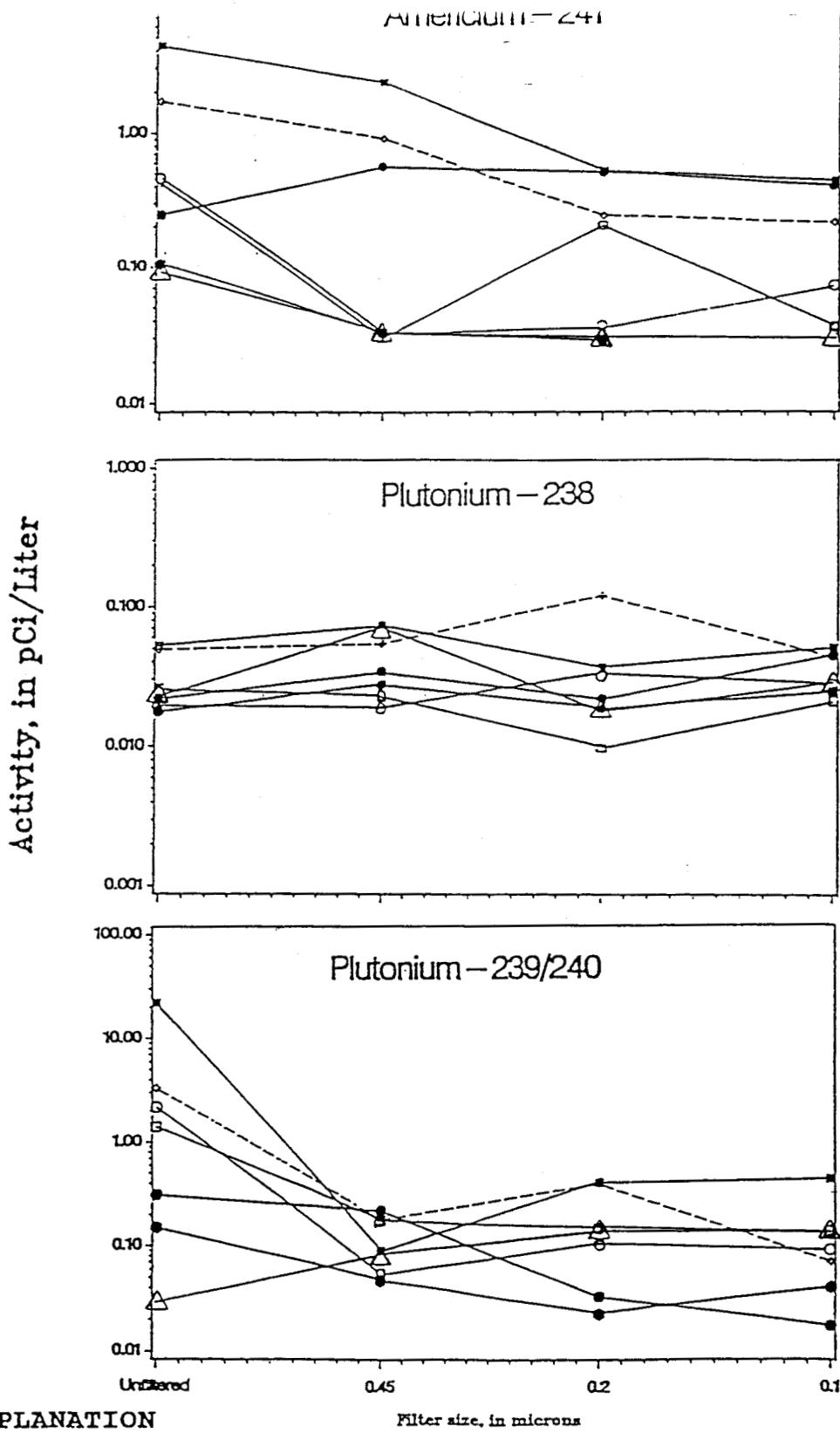
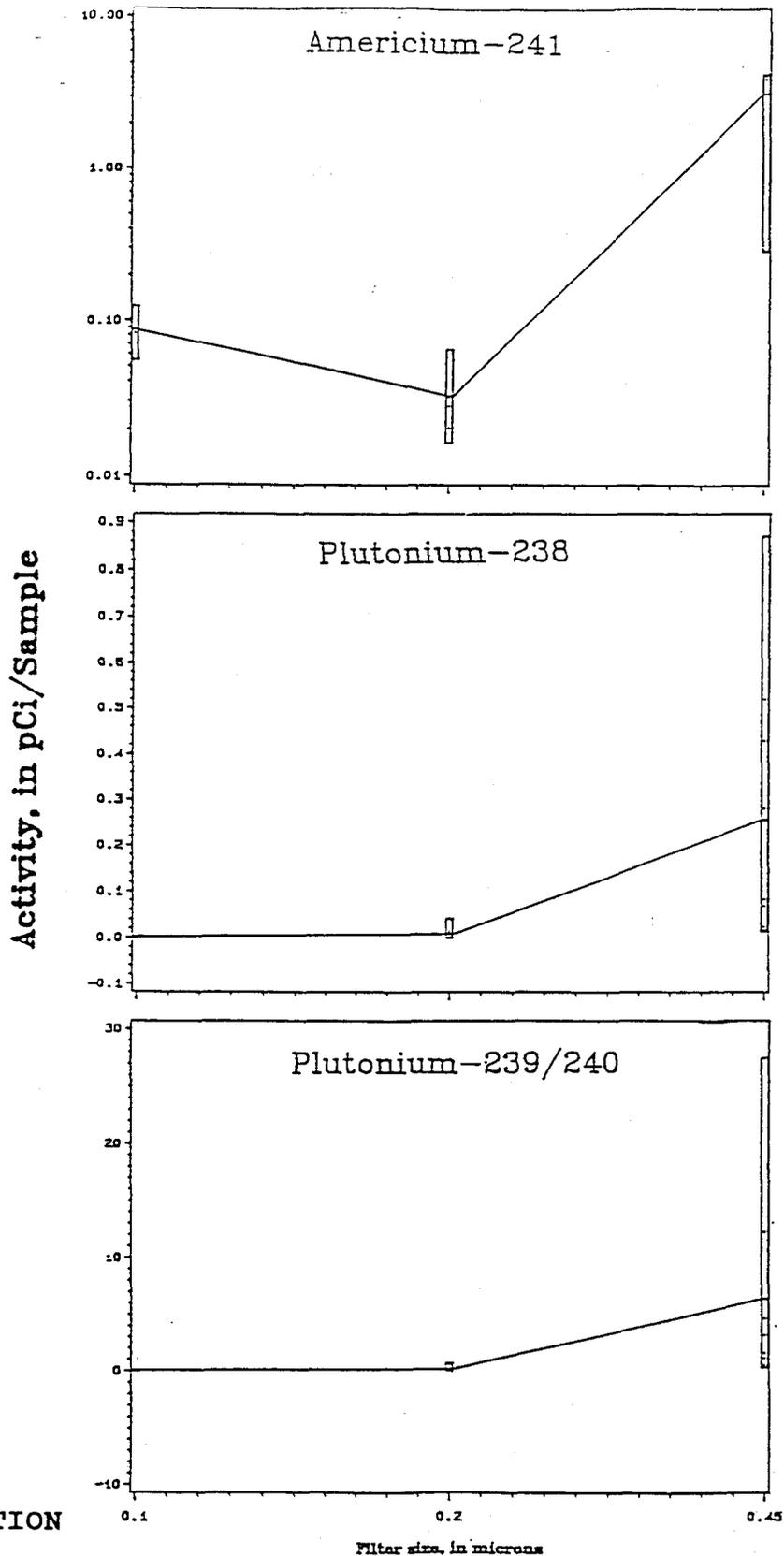


Figure 3.1-1 Variation of Pu and Am activity with filter size for OU2 seep water.

Table 3.1-1 Results of Kruskal-Wallis analysis of variance on ranked plutonium and americium activity data for seep-water samples and filtered particulates from OU-2.

Analyte	Filter Size	Number of Samples	DF	Chi-Square	p
Water Samples					
Am-241	All Filtrates Unfiltered	21 7	1	3.3550	.0670
Pu-238	All Filtrates Unfiltered	21 7	1	0.6344	.4257
Pu-239/240*	All Filtrates Unfiltered	21 7	1	5.8276	.0158
Am-241	0.1 um 0.2 um 0.45 um Unfiltered	7 7 7 7	3	3.4956	.3213
Pu-238	0.1 um 0.2 um 0.45 um Unfiltered	7 7 7 7	3	2.8136	.4213
Pu-239/240	0.1 um 0.2 um 0.45 um Unfiltered	7 7 7 7	3	6.1203	.1059
Filtered Particulates					
Am-241*	0.1 um 0.2 um 0.45 um	3 3 4	2	7.4364	.0243
Pu-238*	0.1 um 0.2 um 0.45 um	7 8 9	2	15.267	.0005
Pu-239/240*	0.1 um 0.2 um 0.45 um	7 7 8	2	14.441	.0007
Legend:	um – Microns		Test Performed at the Alpha = 0.05 Confidence Level		
Am – Americium	DF – Degrees of Freedom		* – Significant Difference Exists between the 0.45 um, 0.2 um, & 0.1 um Filters or between Unfiltered & Filtered Samples		
Pu – Plutonium	p – Probability That Rejection of Ho (There is no Difference between the Means of the Groups of Data) is Erroneous				
Unfiltered – raw Unfiltered Water					



EXPLANATION

1. The length of each box represents the spread between the minimum and maximum activities for each filter size.
2. The line connects the boxes at the mean activity for each filter size.

Figure 3.2-1 Variation of Pu and Am activity with filter-size for filtered particulates from OU2 seep-water samples.

5.0 RECOMMENDATIONS

The following recommendations will improve the experimental design of this study to determine the radionuclide particle-size distribution.

- 1) Unfiltered water samples should be filtered through different pore-size filters separately, not sequentially, to determine the relative amounts of Pu and Am associated with different particle-size fractions.
- 2) Filtered sample volumes should be recorded to facilitate conversion of pCi/sample units to pCi/L. This will allow direct comparison of filtered particulate samples with their respective aqueous filtrates.
- 3) Tangential-flow ultrafiltration techniques should be used to obtain water samples and particulate concentrates from large volumes of water. These filtration systems are less susceptible to clogging and reduction of the effective pore-size of the filter membranes than positive-pressure filtration systems.

6.0 REFERENCES

EG&G, Rocky Flats, Inc., February, 1991, *Standard Operating Procedures, Volume IV: Surface Water.*

Appendix 1 Plutonium and Americium Data for OU2 Seep-Water Filtrates

Sample ID	Sample Date	Unfiltered Sample	Counting Error	0.45 um Filtrate	Counting Error	0.2 um Filtrate	Counting Error	0.1 um Filtrate	Counting Error
Americium-241 in pCi/L									
SW053	06/07/90	0.250	*(+-.0149)	0.570	*(+-.0274)	0.510	*(+-.0303)	0.400	*(+-.0178)
SW077	06/11/90	0.431	(+-.199)	0.030	*(+-.0385)	0.204	(+-.104)	0.037	*(+-.0329)
SW055	06/12/90	0.470	*(+-.0978)	0.033	*(+-.0384)	0.036	*(+-.0333)	0.072	*(+-.0490)
SW051	06/14/90	0.093	(+-.0495)	0.033	*(+-.0339)	0.031	(+-.0168)	0.030	*(+-.0307)
SW058	06/15/90	4.420	(+-.6700)	2.370	(+-.4400)	0.526	(+-.172)	0.436	(+-.138)
SW050	06/18/90	0.107	(+-.054)	0.033	*(+-.0329)	0.029	*(+-.0333)	0.076	(+-.0400)
SW077	07/02/90	1.700	(+-.3300)	0.911	*(+-.1900)	0.240	*(+-.149)	0.210	*(+-.1130)
Plutonium-239/240 in pCi/L									
SW053	06/07/90	0.313	(+-.0700)	0.225	(+-.054)	0.0332	(+-.0088)	0.018	*(+-.0351)
SW077	06/11/90	1.42	(+-.1.31)	0.179	(+-.170)	0.152	(+-.146)	0.142	(+-.135)
SW055	06/12/90	2.21	(+-.4700)	0.0549	(+-.142)	0.108	(+-.027)	0.0935	(+-.0232)
SW051	06/14/90	0.029	*(+-.0265)	0.084	*(+-.0531)	0.14	(+-.132)	0.138	(+-.133)
SW058	06/15/90	22.3	(+-.3.900)	0.093	*(+-.0703)	0.405	(+-.093)	0.445	(+-.100)
SW050	06/18/90	0.154	(+-.146)	0.0488	(+-.0487)	0.023	*(+-.0235)	0.0409	(+-.0406)
SW077	07/02/90	3.32	(+-.71)	0.18	*(+-.0736)	0.389	(+-.102)	0.0714	(+-.00186)
Plutonium-238 in pCi/L									
SW053	06/07/90	0.022	*(+-.0231)	0.034	*(+-.0348)	0.022	*(+-.0245)	0.046	(+-.00263)
SW077	06/11/90	0.026	*(+-.0302)	0.023	*(+-.0287)	0.010	*(+-.0266)	0.021	*(+-.0176)
SW055	06/12/90	0.02	*(+-.0261)	0.019	*(+-.0281)	0.034	*(+-.0302)	0.029	*(+-.0291)
SW051	06/14/90	0.023	*(+-.0219)	0.071	*(+-.0306)	0.018	*(+-.0199)	0.029	*(+-.0260)
SW058	06/15/90	0.053	(+-.0187)	0.074	*(+-.0617)	0.037	*(+-.0930)	0.0519	*(+-.0166)
SW050	06/18/90	0.018	*(+-.0150)	0.028	*(+-.0242)	0.019	*(+-.0218)	0.025	*(+-.0287)
SW077	07/02/90	3.32	(+-.7100)	0.180	*(+-.0736)	0.389	*(+-.1020)	0.0714	*(+-.0186)
Field Parameters									
Station ID	Date	Water Temp	Dissolved Oxygen (YSI)		Conductivity (mS/cm)		pH	Alkalinity	
SW053	06/07/90	24	8.8		1.028		7.75	351	
SW077	06/11/90	19	4.6		0.875		7.32	368	
SW055	06/12/90	19	8.1		1.040		7.24	368	
SW051	06/14/90	13	8.7		0.587		7.94	230	
SW058	06/15/90	17	2.4		0.615		8.06	307	
SW050	06/18/90	15	3.1		0.643		7.34	276	
SW077	07/02/90	18	4.5		0.916		7.63	342	
<p>Legend: *Analytical Result is the Lower Limit of Detection for the Sample – No Data Available mS/cm – Millisiemens Per Centimeter YSI – YSI Dissolved Oxygen Meter</p> <p>SW053 – Seep with Stagnant Water, Area Chocked with Vegetation, Sample Collected 30-ft South of Sample Marker SW077 – Small Seep with Stagnant Water, Vegetation Around Site, 2 ft x 2 ft & 7-9 in. deep, Sample Taken in Front of Sample Marker SW055 – Small Seep with Considerable Vegetation, 2 ft x 2 ft, Murky with algae Blloms, 6 in. deep SW051 – Stram with No Flow, Stagnant Puddle in front of Sample Sign, Considerable Algae, 5 in. Deep SW058 – Small Seep Next to Roadside SW050 – Swampy Seep, 6 in. X5 ft, Area Around Seep Full of Vegetation</p>									

Appendix 1a Filter Analyses for Plutonium-238, Plutonium-239/240, and Americium-241 for OU2 Seep-Water Particulates

Filter Size (um)	Sample Number	Result	Units	Counting Error
Filter Analyses for Plutonium-238 in OU2 Seeps				
0.1	SW055	* 0.00E+00	PCI/SA	0.00E+00
0.1	SW070B	*-1.94E-03	PCI/SA	3.88E-03
0.1	SW053A	* 2.22E-03	PCI/SA	7.68E-03
0.1	SW045B	*-9.29E-04	PCI/SA	1.31E-03
0.1	SW058B	* 0.00E+00	PCI/SA	0.00E+00
0.1	SW069B	* 2.71E-03	PCI/SA	5.42E-03
0.1	SW051A	* 2.95E-03	PCI/SA	5.90E-03
0.1	SW031A	*-1.83E-03	PCI/SA	2.11E-03
0.1	SW029	* 0.00E_00	PCI/SA	0.00E+00
0.1	SW050B	*-8.62E-04	PCI/SA	1.72E-03
0.1	SW077A	* 0.00E+00	PCI/SA	0.00E+00
0.1	SW067B	*-2.01E-03	PCI/SA	4.03E-03
0.1	SW035A	* 1.83E-03	PCI/SA	5.04E-03
0.1	SW068B	* 2.45E-03	PCI/SA	4.90E-03
0.1	SW077	* 0.00E+00	PCI/SA	0.00E+00
0.1	SW066B	* 0.00E+00	PCI/SA	0.00E+00
0.2	SW035A	*-7.56E-04	PCI/SA	1.51E-03
0.2	SW066B	* 0.00E+00	PCI/SA	0.00E+00
0.2	SW031A	* 1.98E-02	PCI/SA	2.80E-02
0.2	SW050B	*-7.17E-04	PCI/SA	1.43E-03
0.2	SW053A	* 4.25E-02	PCI/SA	8.50E-02
0.2	SW068B	* 0.00E+00	PCI/SA	0.00E+00
0.2	SW055	* 0.00E_00	PCI/SA	0.00E+00
0.2	SW058B	* 2.57E-03	PCI/SA	5.13E-03
0.2	SW045B	*-5.74E-04	PCI/SA	1.15E-03
0.2	SW069B	*-1.12E-03	PCI/SA	2.24E-03
0.2	SW051A	* 0.00E+00	PCI/SA	0.00E+00
0.2	SW077	*-6.17E-04	PCI/SA	1.23E-03
0.2	SW067FB	* 1.92E-03	PCI/SA	3.85E-03
0.2	SW077A	* 0.00E+00	PCI/SA	0.00E+00
0.2	SW029	* 0.00E+00	PCI/SA	0.00E+00
0.2	SW070B	*-4.36E-04	PCI/SA	5.30E-03
0.45	SW067FB	* 0.00E+00	PCI/SA	0.00E+00
0.45	SW077FB	* 5.19E-01	PCI/SA	1.39E-01
0.45	SW029FB	* 3.84E-03	PCI/SA	1.06E-02
0.45	SW031FB	*-8.15E-04	PCI/SA	1.63E-03
0.45	SW029FB	* 0.00E+00	PCI/SA	0.00E+00
0.45	SW045FB	* 0.00E+00	PCI/SA	0.00E+00
0.45	SW058FB	* 8.70E-01	PCI/SA	1.35E-01
0.45	SW051FB	* 1.53E-02	PCI/SA	1.15E-02
0.45	SW053FB	* 7.06E-02	PCI/SA	2.69E-02
0.45	SW035FB	* 1.31E-02	PCI/SA	1.51E-02
0.45	SW069FB	* 3.66E-02	PCI/SA	3.27E-02
0.45	SW053FAB	* 2.56E-02	PCI/SA	1.72E-02
0.45	SW068FB	* 0.00E+00	PCI/SA	0.00E+00
0.45	SW055FB	* 8.48E-02	PCI/SA	4.17E-02
0.45	SW050FB	* 1.79E-02	PCI/SA	1.36E-02
0.45	SW077FB	* 2.81E-01	PCI/SA	8.37E-02

Appendix 1a (cont)

Filter Size (um)	Sample Number	Result	Units	Counting Error
0.45	SW066FB	* 3.20E-03	PCI/SA	6.40E-03
0.45	SW077FB	4.29E-01	PCI/SA	1.21E-01
0.45	SW070FB	* 2.14E-02	PCI/SA	2.47E-02
0.45	SW070FB	* 1.93E-03	PCI/SA	2.21E-02
Filter Analyses for Plutonium-239/240 in OU2 Seeps				
0.1	SW035A	* 1.22E-03	PCI/SA	5.16E-03
0.1	SW045B	*-4.63E-04	PCI/SA	9.26E-04
0.1	SW069B	* 5.40E-03	PCI/SA	7.63E-03
0.1	SW077	1.64E-02	PCI/SA	1.16E-02
0.1	SW068B	* 0.00E+00	PCI/SA	9.76E-03
0.1	SW029	* 2.12E-03	PCI/SA	5.84E-03
0.1	SW067B	*-2.01E-03	PCI/SA	4.01E-03
0.1	SW077A	* 1.12E-02	PCI/SA	1.12E-02
0.1	SW066B	*-1.83E-03	PCI/SA	6.34E-03
0.1	SW051A	* 1.18E-02	PCI/SA	1.18E-02
0.1	SW058B	1.71E-02	PCI/SA	1.29E-02
0.1	SW055	* 1.92E-03	PCI/SA	8.58E-03
0.1	SW050B	*-1.72E-02	PCI/SA	2.43E-03
0.1	SW070B	* 1.93E-03	PCI/SA	6.70E-03
0.1	SW053A	1.10E-01	PCI/SA	3.19E-02
0.1	SW031A	* 3.65E-03	PCI/SA	.09E-03
0.2	SW070B	* 1.30E-03	PCI/SA	4.67E-03
0.2	SW077	8.61E-02	PCI/SA	2.91E-02
0.2	SW068B	*-2.15E-03	PCI/SA	7.45E-03
0.2	SW029	1.83E-02	PCI/SA	1.64E-02
0.2	SW069B	*-1.11E-03	PCI/SA	2.23E-03
0.2	SW053A	5.58E-01	PCI/SA	9.72E-02
0.2	SW050B	1.64E-02	PCI/SA	1.41E-02
0.2	SW035A	* 0.00E+00	PCI/SA	6.74E-03
0.2	SW077A	1.08E-01	PCI/SA	3.00E-02
0.2	SW031A	*-1.98E-03	PCI/SA	3.95E-03
0.2	SW055	* 0.00E+00	PCI/SA	8.78E-03
0.2	SW067FB	* 1.92E-03	PCI/SA	3.83E-03
0.2	SW051A	1.84E-02	PCI/SA	1.39E-02
0.2	SW053A	7.26E-01	PCI/SA	1.15E-01
0.2	SW066B	* 0.00E+00	PCI/SA	8.36E-03
0.2	SW058B	1.07E-01	PCI/SA	3.31E-02
0.45	SW067FB	* 0.00E+00	PCI/SA	0.00E+00
0.45	SW070FB	* 2.88E-02	PCI/SA	3.33E-02
0.45	SW077FB	1.22E+01	PCI/SA	5.50E-01
0.45	SW070FB	* 2.13E-02	PCI/SA	2.46E-02
0.45	SW077FB	2.75E+01	PCI/SA	1.01E+00
0.45	SW031FB	* 4.87E-03	PCI/SA	9.47E-03
0.45	SW035FB	5.64E-02	PCI/SA	3.13E-02
0.45	SW055FB	4.63E+00	PCI/SA	3.48E-01
0.45	SW066FB	* 3.19E-03	PCI/SA	1.11E-02
0.45	SW029FB	4.06E-02	PCI/SA	3.08E-02
0.45	SW050FB	1.12E+00	PCI/SA	1.07E-01
0.45	SW053FB	3.13E+00	PCI/SA	1.78E-01

Appendix 1a (concl)

Filter Size (um)	Sample Number	Result	Units	Counting Error
0.45	SW069FB	* 2.73E-02	PCI/SA	2.94E-02
0.45	SW053FAB	1.56E+00	PCI/SA	1.30E-01
0.45	SW045FB	*-8.05E-04	PCI/SA	1.61E-03
0.45	SW029FB	* 1.53E-02	PCI/SA	1.77E-02
0.45	SW051FB	5.04E-01	PCI/SA	6.61E-02
0.45	SW068FB	*-1.40E-02	PCI/SA	2.81E-02
0.45	SW077FB	2.61E-01	PCI/SA	9.44E-01
Filter Analyses for Americium-241 in OU2 Seeps				
0.1	SW066B	1.98E-02	PCI/SA	1.40E-02
0.1	SW050B	8.22E-02	PCI/SA	2.39E-02
0.1	SW070B	1.51E-02	PCI/SA	1.42E-02
0.1	SW069B	2.13E-02	PCI/SA	1.57E-02
0.1	SW058B	1.24E-01	PCI/SA	3.61E-02
0.1	SW068B	* 4.57E-03	PCI/SA	9.15E-03
0.1	SW031A	1.78E-02	PCI/SA	1.34E-02
0.1	SW067B	1.79E-02	PCI/SA	1.35E-02
0.1	SW051A	5.48E-02	PCI/SA	1.97E-02
0.2	SW067FB	1.10E-02	PCI/SA	9.87E-03
0.2	SW045B	* 0.00E+00	PCI/SA	4.57E-02
0.2	SW029	* 7.66E-02	PCI/SA	1.14E-01
0.2	SW069B	3.90E-02	PCI/SA	2.62E-02
0.2	SW058B	2.83E-02	PCI/SA	1.42E-02
0.2	SW066B	* 6.61E-03	PCI/SA	9.85E-03
0.2	SW051A	2.05E-02	PCI/SA	1.18E-02
0.2	SW050B	6.49E-02	PCI/SA	2.11E-02
0.2	SW068B	1.11E-02	PCI/SA	9.89E-03
0.2	SW035A	* 1.33E-02	PCI/SA	1.54E-02
0.2	SW070B	* 9.64E-03	PCI/SA	1.18E-02
0.45	SW070FB	* 7.61E-02	PCI/SA	8.79E-02
0.45	SW077FB	3.91E+00	PCI/SA	2.79E-01
0.45	SW069FB	3.85E-02	PCI/SA	3.04E-02
0.45	SW070FB	* 1.51E-02	PCI/SA	1.74E-02
0.45	SW035FB	4.82E-02	PCI/SA	2.01E-02
0.45	SW050FB	2.92E-01	PCI/SA	6.37E-02
0.45	SW068FB	* 2.93E-03	PCI/SA	5.86E-03
0.45	SW067FB	2.07E-02	PCI/SA	1.63E-02
0.45	SW066FB	* 1.33E-02	PCI/SA	2.66E-02
0.45	SW031FB	* 0.00E+00	PCI/SA	2.63E-02
0.45	SW077FB	4.22E+00	PCI/SA	2.95E-01
0.45	SW045FB	* 6.55E-03	PCI/SA	7.56E-03
Note: *Less Than the Minimum Detectable Activity (MDA)				