

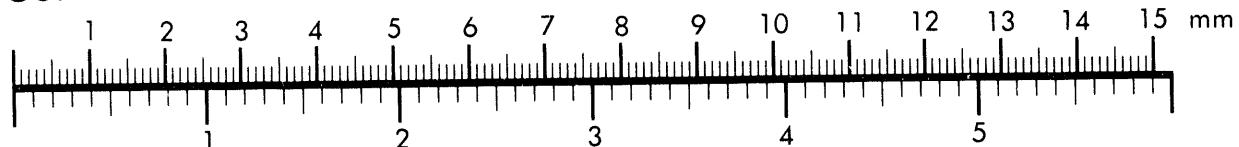


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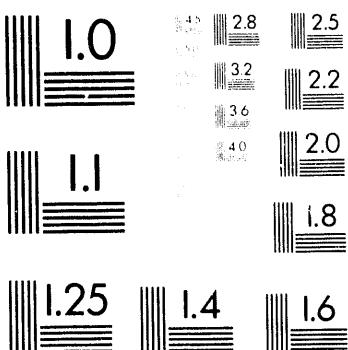
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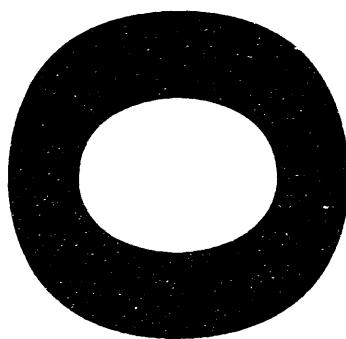
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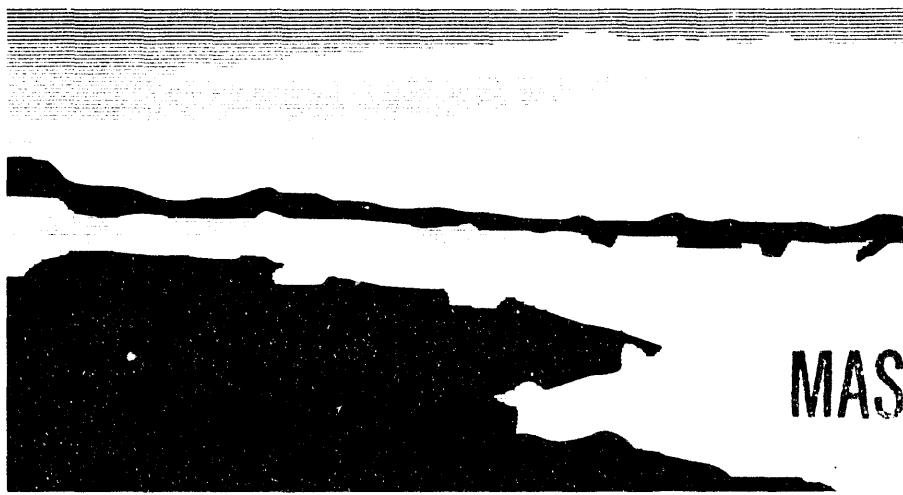
CHARACTERIZATION OF URANIUM IN SURFACE-WATERS  
COLLECTED AT THE ROCK FLATS FACILITY

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Characterization of Uranium in Surface-Waters  
Collected at the Rocky Flats Facility

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## INTRODUCTION

The Rocky Flats Plant (RFP) is a Department of Energy (DOE) facility where plutonium and uranium components were manufactured for nuclear weapons. During plant operations radioactivity was inadvertently released into the environment. This study was initiated to characterize the uranium present in surface-waters at RFP. Three drainage basins and natural ephemeral streams transverse RFP. The Woman Creek drainage basin traverses and drains the southern portion of the site. The Rock Creek drainage basin drains the northwestern portion of the plant complex. The Walnut Creek drainage basin traverses the western, northern, and northeastern portions of the RFP site. Dams, detention ponds, diversion structures, and ditches have been constructed at RFP to control the release of plant discharges and surface (storm water) runoff. The ponds located downstream of the plant complex on North Walnut Creek are designated A-1 through A-4. Ponds on South Walnut Creek are designated B-1 through B-5. The ponds in the Woman Creek drainage basin are designated C-1 and C-2. Water samples were collected from each pond and the uranium was characterized by TIMS measurement techniques.<sup>1</sup>

## RESULTS

Table I reports the highest uranium concentration measured in the RFP ponds during this study. For comparison, the uranium concentrations in three reservoirs near RFP and two wells in Colorado are also reported.<sup>2,3,4</sup>

Table I. Uranium Concentrations in Waters

Location	Description	Uranium content pCi/L
Pond A-1	RFP Holding Pond	15.8
Pond A-2	RFP Holding Pond	7.3
Pond A-3	RFP Holding Pond	5.1
Pond A-4	RFP Holding Pond	3.5
Pond B-1	RFP Holding Pond	3.8
Pond B-2	RFP Holding Pond	11.0
Pond B-3	RFP Holding Pond	0.5
Pond B-4	RFP Holding Pond	1.5
Pond B-5	RFP Holding Pond	1.8
Pond C-1	RFP Holding Pond	2.0
Pond C-2	RFP Holding Pond	3.2
Dillon	Reservoir	0.5
Great Western	Reservoir	2.1
Ralston	Reservoir	0.9
Standley	Reservoir	1.8
*La Junta	Well	497.0
*Pueblo	Well	168.0

\* The wells listed in Table I do not serve as public water supplies.

The presence of  $^{236}\text{U}$  in the surface-water samples collected at RFP and the variable  $^{238}\text{U}/^{235}\text{U}$  atom ratios detected in water samples collected from the holding ponds prove that anthropogenic uranium is present. Table II illustrates the maximum amount of depleted uranium that is present in each water sample collected at RFP. The values derived assume a simple two component system that assumes the depleted uranium released by RFP contains 0.5%  $^{235}\text{U}$ . This conservative estimate determines the maximum amount of  $^{235}\text{U}$  in the water that is attributable to the depleted uranium present in the surface-waters.

Table II. Maximum Percentage of  $^{235}\text{U}$  in Water Attributable to Release of Depleted Uranium at RFP

Date Sampled	Pond	Maximum Percentage of $^{235}\text{U}$ in Water Attributable to Depleted Uranium	Date Sampled	Pond	Maximum Percentage of $^{235}\text{U}$ in Water Attributable to Depleted Uranium
02/29/93	A1	2	05/13/93	B3	35
05/12/93	A1	50	08/24/93	B3	36
08/24/93	A1	100	11/25/92	B4	19
11/25/92	A2	81	05/13/93	B4	26
05/12/93	A2	46	02/29/93	B4	25
02/29/93	A2	50	08/24/93	B4	19
08/24/93	A2	66	10/23/92	B5	13
11/25/92	A3	100	11/24/92	B5	10
02/29/93	A3	57	12/14/92	B5	12
05/12/93	A3	80	01/14/93	B5	21
08/24/93	A3	100	02/23/93	B5	18
10/23/92	A4	81	03/17/93	B5	18
11/24/92	A4	17	04/21/93	B5	17
12/14/92	A4	41	05/13/93	B5	16
01/14/93	A4	40	06/15/93	B5	46
02/23/93	A4	53	07/15/93	B5	16
03/17/93	A4	58	08/23/93	B5	12
04/21/93	A4	49	12/03/92	C1	1
05/12/93	A4	45	05/13/93	C1	0
06/15/93	A4	54	02/23/93	C1	1
07/15/93	A4	56	08/23/93	C1	0
08/23/93	A4	31	10/23/92	C2	63
11/25/92	B1	14	11/25/92	C2	60
05/13/93	B1	23	12/14/92	C2	51
02/24/93	B1	17	01/14/93	C2	58
08/24/93	B1	23	02/23/93	C2	51
11/25/92	B2	0	03/17/93	C2	52
05/13/93	B2	57	04/15/93	C2	53
02/24/93	B2	50	05/13/93	C2	53
08/24/93	B2	56	06/15/93	C2	46
11/25/92	B3	12	07/15/93	C2	51
02/24/93	B3	23	08/24/93	C2	54

## **CONCLUSIONS**

The upper Ponds A-1, A-2, A-3, B-1, B-2, B-3, and B-4 contain measurable quantities of depleted uranium. The uranium concentrations in water samples collected from these ponds ranged from 0.2 to 15.8 pCi/L. Essentially 100% of the uranium in Pond A-1 and Pond A-2 originated as depleted uranium. All other ponds, except Pond C-1, contain mixtures of naturally occurring and depleted uranium. Approximately half of the uranium present in Ponds A-4 and C-2 originated as depleted uranium. Approximately 20% of the uranium in the waters collected from Pond B-5 originated as depleted uranium. Approximately 50% of the uranium detected in the waters collected from Pond C-2 were anthropogenic.

## **ACKNOWLEDGMENTS**

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## **REFERENCES**

1. Efurd, D. W., D. J. Rokop and R. E. Perrin, "Characterization of the Radioactivity in Surface-Waters and Sediments Collected at the Rocky Flats Plant," Los Alamos National Laboratory report LA-UR-93-4373, December, 1993.
2. Parson, J. D. and R. G. Warren, "Uranium Hydrogeochemical and Stream Sediment Reconnaissance of the La Junta NTMS Quadrangle, Colorado, Including Concentrations of Forty-three Additional Elements," Los Alamos National Laboratory report LA-7343-MS, 1979.
3. S. S. Shannon, "Uranium Hydrogeochemical and Stream Sediment Reconnaissance of the Pueblo NTMS Quadrangle, Colorado, Including Concentrations of Forty-two Additional Elements," Los Alamos National Laboratory report LA-7541-MS and suppl., 1978.
4. N. M. Daughtry Ed., "Rocky Flats Site Environmental Report For 1988," Rocky Flats report RFP-ENV-88, May, 1989.

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