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SEDIMENT SAMPLING SUMMARY REPORT
GREAT WESTERN RESERVOIR
BROOMFIELD COLORADO

PREPARED FOR

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April 20 1992

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TABLE 1

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1 0 INTRODUCTION

This report was prepared by Enviro Check Inc for Rocky Mountain Consultants to summarize sediment sampling conducted at the Great Western Reservoir in Broomfield Colorado during May 22 23 24 and May 25 1991 The purpose of the sampling was to evaluate the concentration of plutonium if any in near surface sediments in the zone around the reservoir between the normal high water line and the water surface as it existed on May 22 1991 The water surface on May 22 1991 was approximately 15 feet below the high water mark Photographs are in Attachment A. Sampling work was conducted by the following sampling team

Steve Hoffman	Enviro Check	Project Manager Engineer
Tracey Spence	TRC	Geologist
Ben Rustin	TRC	Field Technician

Resumes of each team member are in Attachment B

Described below are the Sample Locations (Section 2 0) Radiation Field Screening (Section 3 0) Health and Safety (Section 4 0) Sediment Sampling Procedures (Section 5 0) Decontamination Procedures (Section 6 0) Sample Documentation (Section 7 0) and Analytical Results (Section 8 0) Pertinent information is attached All work generally followed Enviro Check s workplan dated May 22 1991

2 0 SAMPLE LOCATIONS

Sediment samples were collected at nine stations around the reservoir perimeter that were staked and surveyed by Rocky Mountain Consultants Site locations are show in Plate 1 Rocky Mountain Consultant sample location coordinates are in Attachment C Each sampling site had three separate sampling locations including 5 feet, 10 feet and 15 feet below the high water mark as shown on Figure 1 The RMC survey data reflect actual sample locations regardless of whether the locations had to be moved Site 5 had six sample locations and Site 10 was eliminated The sample locations are labeled A, B and C respectively on Plate 1 except for Site 5 which additionally had locations D E and F Two inch diameter soil cores were collected at each sample location from the 0 to 6 6 to 12 and 12 to 18 inch depth interval unless excessive driving resistance was encountered A total of 89 sediment samples were collected

3 0 RADIATION FIELD SCREENING

A radiation survey was conducted on surface soils adjacent to the Great Western Reservoir during June 14 17 1989 by Merrick & Company (Attachment D) Merrick & Company was retained by Enviro Check to conduct a radiation survey for health and safety purposes during construction of the Walnut Creek by pass ditch This survey was conducted using a Model 3700 Dosimeter (Attachment F) Background radiation levels were determined to be 50 disintegrations per minute and survey results showed that most sampling points were at or below background levels No high levels were detected Merrick & Company did not evaluate Great Western Reservoir sediments

The dosimeter was rented from Cosco in Denver At time of rental the dosimeter

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was calibrated by Cosco using a known radioactive source Each sample of sediment collected by Enviro Check was screened for radiation using a Model 3700 Dosimeter (Attachment F) Radiation was measured for health and safety purposes In addition the dosimeter was used to scan the exposed end of each six inch sample interval to scan for potential laboratory analysis Radiation ranged from 20 to 70 counts per minute which are within the range of typical background levels Radiation measurements were recorded in a field book (Attachment E) and plotted on Plate 1 the field notes were typed and are presented on Table 1

4 0 HEALTH AND SAFETY

Health and safety procedures follow procedures described in Enviro Check s May 22 1991 Sediment Sampling workplan All Enviro Check personnel entered the sampling zone in level D protection which included Tyvek suits gloves half face respirators with particulate filters, hard hats safety glasses steel toed boots and disposable booties Enviro Check personnel remained in level D during all sediment sampling There was no apparent need to upgrade the level of protection because the lack of windblown sediment and radiation levels at each sampling location did not exceed background levels as measured by a Model 3700 Dosimeter

All workers equipment and vehicles were scanned with the dosimeter prior to exiting the site Measured radiation levels did not exceed background levels All Tyvek suits boots and gloves were placed in two sealed and labeled 55 gallon drums These drums are still stored on site Enviro Check recommends that these drums and their contents be disposed of as solid waste unless laboratory results indicate that sediment samples exceed background radiation levels Disposal options for the drums and their contents should be reevaluated if sediment samples exceed background radiation levels

5 0 SEDIMENT SAMPLING PROCEDURES

Discrete sediment samples from 0 to 6 6 to 12 and 12 to 18 inch depth intervals were collected at each sample location using an AMS Core Sampler using normal and customary procedures A schematic diagram of the Core Sampler is in Attachment F Rigid plastic tubes were decontaminated (see Section 6 0) and then inserted into the Core Sampler which was then driven the desired depth The sampler was then removed and snap on caps were placed over the plastic tube ends to seal the recovered soil in the tubes Each soil core was screened for radiation in the field using a Model 3700 Dosimeter Radiation readings in counts per minute (cpm) were recorded in Enviro Check s field notes (Attachment E and Table 1) Radiation readings are also shown on Plate 1

6 0 DECONTAMINATION

All sampling equipment was cleaned prior to beginning work between each sample and prior to leaving the site Decontamination of sampling equipment included

1 A wash with a mixture of Liquinox and deionized water and
2 A triple rinse with deionized water

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Rinse waters were containerized in sealed 5 gallon buckets If elevated plutonium levels are detected in any of the soil samples Enviro Check recommends the rinse waters be laboratory analyzed for plutonium to determine appropriate disposal procedures Elevated radiation levels were not detected during initial field screening and therefore the rinse waters were not laboratory analyzed Enviro Check recommends the rinse waters be discharged to the sanitary sewer if elevated plutonium levels are not detected in the sediment samples The rinse waters are still stored on site

7 0 SAMPLE DOCUMENTATION

Sample documentation included

Sample labels which prevent misidentification of samples
Sample seals to preserve the integrity of the sample from the time it is collected until it is opened in the laboratory
Field Logbook to record information about each sample collected during the field monitoring program (Attachment E)
Chain-of Custody record to establish the documentation necessary to trace sample possession from the time of collection to analysis (Attachment G)

8 0 ANALYTICAL RESULTS

At the request of Rocky Mountain Consultants Enviro Check delivered the sediment samples to AccuLabs in Golden Colorado for laboratory analysis of plutonium Chain of custody documentation in Attachment G The City of Broomfield authorized the analysis of sediment of 16 locations These locations are identified in Attachment H Enviro Check has not received the analytical results from AccuLabs but will provide them immediately upon receipt

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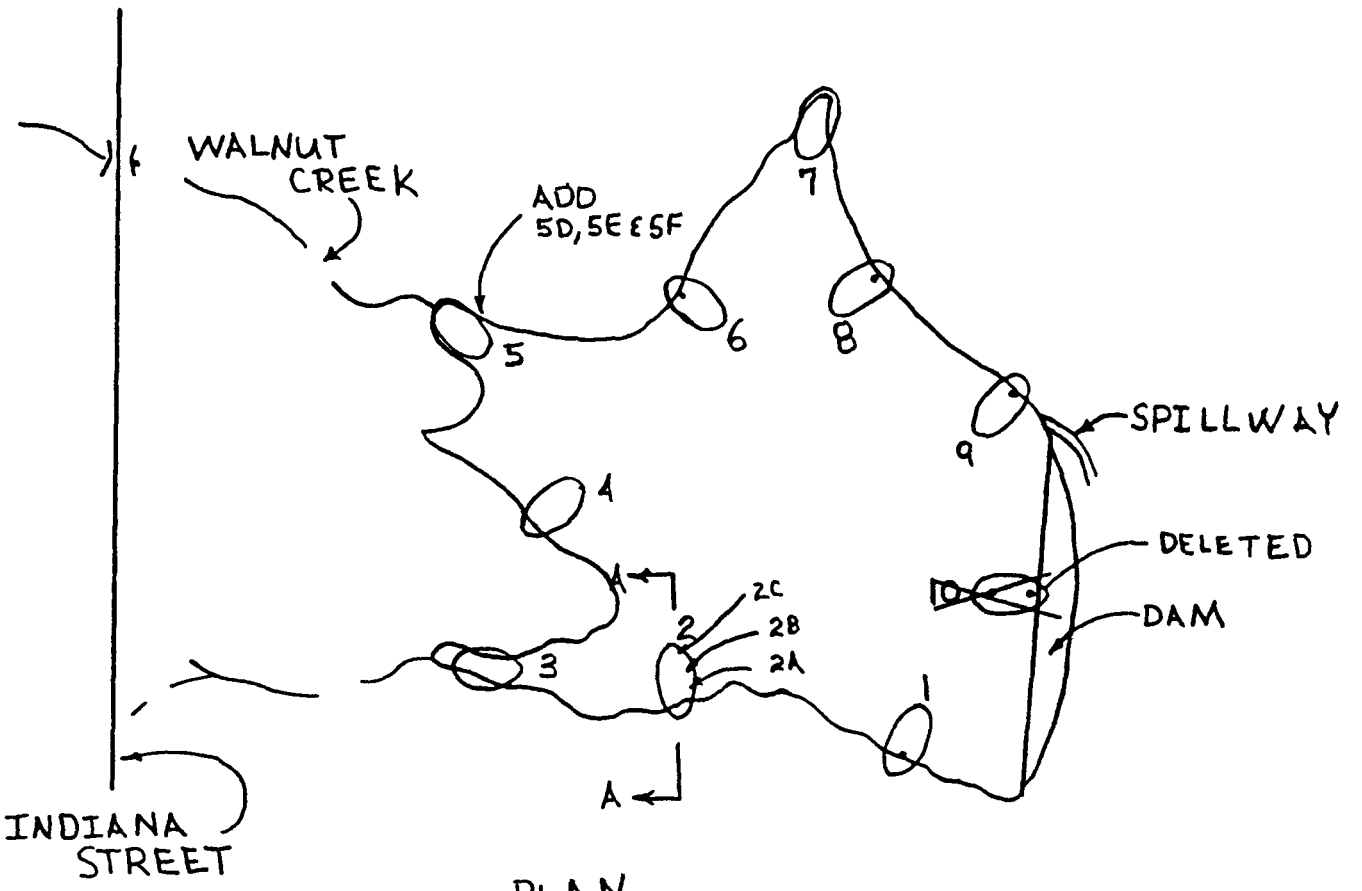
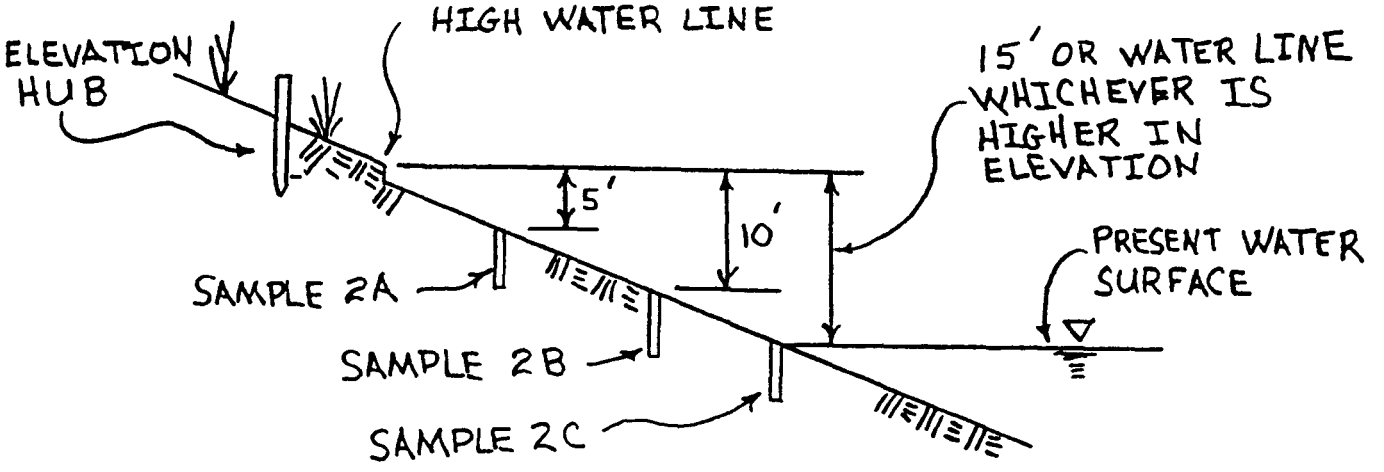


PLAN



SECTION A-A

TYPICAL SAMPLING ARRANGEMENT

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GREAT WESTERN

FIGURE 1

TABLE 1

Field Notes

Sample I D	Depth	Time	Date	Counts Per Minute	Comments
1C	(0 6)	1350	5/22/91	15	Recovery 6 /6 sample collected in 1 of water
1C	(6 12)	1400	5/22/91	30	Recovery 5 /6 sample collected in 1 of water
1C	(12 18)	1415	5/22/91	0	Sample collected in 1 of water
2C	(0 6)	1442	5/22/91	45	Recovery 6 /6 sample collected in 1 of water
2C	(6 12)	1500	5/22/91	0	Recovery 6 /6 sample collected in 1 of water
2C	(12 18)	1507	5/22/91	0	Sample collected in 1 of water
3C	(0 6)	1520	5/22/91	30	Recovery 6 /6 sample collected at waters edge
3C	(6 12)	1547	5/22/91	50	Recovery 6 /6 sample collected at waters edge
3C	(12 18)	1555	5/22/91	25	Sample collected at waters edge
4C	(0 6)	1618	5/22/91	25	Recovery 6 /6 sample collected at waters edge
4C	(6 12)	1626	5/22/91	15	Recovery 4 /6 sample collected at waters edge
4C	(12 18)	1633	5/22/91	45	Recovery 4 /6 sample collected at waters edge
5C	(0 6)	1815	5/22/91	35	Recovery 6 /6 sample collected 3 to the south side of stake
5C	(6 12)	1830	5/22/91	20	Recovery 3 5 /6 sample collected 3 to the south side of stake

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5C	(12 18)	1845	5/22/91	25	Recovery 4 /6 sample collected 3 to the south side of stake
5F	(0 6)	1903	5/22/91	70	Recovery 4 /6 sample collected 5 to the south side of stake
5F	(6 12)	1925	5/22/91	35	Recovery 6 /6 sample collected 5 to the south side of stake
5F	(12 18)	1935	5/22/91	15	Recovery 6 /6 sample collected 5 to the south side of stake
6C	(0 6)	0825	5/23/91	25	Recovery 5 /6 sample collected 30 west of stake-stake 1 under water
6C	(6 12)	0835	5/23/91	28	Recovery 4 /6 sample collected 30 west of stake stake 1 under water
6C	(12 18)	0842	5/23/91	25	Recovery 4 /6 sample collected 30 west of stake stake 1 under water
7C	(0 6)	0857	5/23/91	40	Recovery 6 /6 sample collected 70 northwest of stake
7C	(6 12)	0905	5/23/91	20	Recovery 5 /6 sample collected 70 northwest of stake
7C	(12 18)	0914	5/23/91	15	Recovery 5 /6 sample collected 70 northwest of stake dense dark brown clay
8C	(0 6)	1250	5/23/91	20	Recovery 4 /6 sample collected 5 north of stake
8C	(6 12)	1258	5/23/91	30	Recovery 6 /6 sample collected 5 north of stake
8C	(12 18)	1305	5/23/91	15	Recovery 5 /6 sample collected 5 north of stake
9C	(0 6)	1320	5/23/91	30	Recovery 3 /6 sample collected 6 north of stake too rocky

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9C	(6 12)	1330	5/23/91	40	Recovery 3 /6 sample collected 6 north of stake too rocky
9C	(12 18)	1340	5/23/91	15	Recovery 4 /6 sample collected 6 north of stake too rocky
7B	(0 6)	1425	5/23/91	20	Recovery 6 /6 no water encountered
7B	(6 12)	1428	5/23/91	20	Recovery 6 /6 no water encountered
7B	(12 18)	1435	5/23/91	15	Recovery 2 /6 encountered hard soil
6B	(0 6)	1503	5/23/91	15	Recovery 6 /6 no water encountered
6B	(6 12)	1506	5/23/91	50	Recovery 6 /6 no water encountered
6B	(12 18)	1510	5/23/91	15	Recovery 5 /6 hard soil encountered
5B	(0 6)	1543	5/23/91	15	Recovery 6 /6 no water encountered
5B	(6 12)	1547	5/23/91	25	Recovery 6 /6 no water encountered
5B	(12 18)	1555	5/23/91	15	Recovery 6 /6 no water encountered
3B	(0 6)	1654	5/23/91	20	Recovery 5 /6 encountered hard soil
3B	(6 12)	1705	5/23/91	15	Recovery 4 /6 encountered hard soil
3B	(12 18)	1710	5/23/91	15	Recovery 2 /6 encountered hard soil
1B	(0 6)	0825	5/24/91	25	Recovery 5 /6 encountered hard soil
1B	(6 12)	0828	5/24/91	30	Recovery 4 /6 encountered hard soil

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1B	(12 18)	0833	5/24/91	25	Recovery 2 /6 encountered hard soil
1A	(0 16)	0840	5/24/91	15	Recovery 4 /6 encountered hard soil
1A	(6 12)	0844	5/24/91	25	Recovery 3 /6 encountered hard soil
1A	(12 18)	0850	5/24/91	25	Recovery 5 /6 encountered hard soil
2A	(0 6)	0903	5/24/91	25	Recovery 4 /6 encountered hard soil
2A	(6 12)	0907	5/24/91	20	Recovery 4 /6 encountered hard soil
2A	(12 18)	0910	5/24/91	35	Recovery 4 /6 encountered hard soil
2B	(0 6)	0913	5/24/91	25	Recovery 5 /6 encountered hard soil
2B	(6 12)	0915	5/24/91	15	Recovery 5 /6 encountered hard soil
2B	(12 18)	0920	5/24/91	20	Recovery 5 /6 encountered hard soil
3A	(0 6)	1008	5/24/91	25	Recovery 5 /6 encountered hard soil
3A	(6 12)	1011	5/24/91	20	Recovery 4 /6 encountered hard soil
3A	(12 18)	1020	5/24/91	25	Recovery 3 /6 encountered hard soil
4A	(0 6)	1056	5/24/91	20	Recovery 4 /6 encountered hard soil
4A	(6 12)	1058	5/24/91	20	Recovery 3.5 /6 encountered hard soil
4A	(12 18)	1102	5/24/91	15	Recovery 4 /6 encountered hard soil
4B	(0 6)	1047	5/24/91	20	Recovery 5 /6 encountered hard soil

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4B	(6 12)	1050	5/24/91	35	Recovery 4 /6 encountered hard soil
4B	(12 18)	1055	5/24/91	20	Recovery 3.5 /6 encountered hard soil
5E	(0 6)	1120	5/24/91	20	Recovery 6 /6 inflowing water
5E	(6 12)	1123	5/24/91	15	Recovery 6 /6 inflowing water
5E	(12 18)	1130	5/24/91	40	Recovery 5 /6 inflowing water
5D	(0 6)	1135	5/24/91	20	Recovery 6 /6 inflowing water
5D	(6 12)	1139	5/24/91	15	Recovery 6 /6 inflowing water
5D	(12 18)	1145	5/24/91	25	Recovery 2 /6 inflowing water
5A	(0 6)	1150	5/24/91	15	Recovery 6 /6 in soft soil
5A	(6 12)	1154	5/24/91	25	Recovery 6 /6 in soft soil
5A	(12 18)	1205	5/24/91	30	Recovery 6 /6 in soft soil
6A	(0 6)	1307	5/24/91	25	Recovery 5 /6 hard soil
6A	(6 12)	1311	5/24/91	40	Recovery 4 /6 hard soil
6A	(12 18)	1315	5/24/91	40	Recovery 3 5 /6 hard soil
7A	(0 6)	1330	5/24/91	15	Recovery 5 /6 hard soil
7A	(6 12)	1333	5/24/91	15	Recovery 4 /6 hard soil
7A	(12 18)	1335	5/24/91	50	Recovery 4 /6 hard soil
8A	(0 6)	1350	5/24/91	25	Recovery 5 /6 hard soil
8A	(6 12)	1354	5/24/91	20	Recovery 4 /6 hard soil
8A	(12 18)	1400	5/24/91	25	Recovery 3 /6 hard soil
8B	(0 6)	1410	5/24/91	20	Recovery 4 /6 hard soil
8B	(6 12)	1413	5/24/91	20	Recovery 3 5 /6 hard soil

GREAT WESTERN RESERVOIR CORE SEDIMENT SAMPLES (see ttached map)
Pl tonium i Sediment (pCi/g)

o e epth inch)	May 1991 Core Location*																																			
	1 A		1 C		2 C		3 A		3 C		4 A		4 C		5 A		5 E		5 F		6 A		6 C		7 A		8 C		9 A		9 C	
1	0 00	0 01	0 01	0 01	0 05	0 07	0 01	0 02	0 04	0 05	0 02	0 12	0 12	0 10	0 06	0 05	0 02	0 06	0 32	0 13	0 00	0 01	0 08	0 09	0 05	0 06	0 00	0 08	0 02	0 03	0 02	0 03
2	0 00	0 01	0 01	0 01	0 03	0 04	0 00	0 01	0 05	·0 11	0 05	0 05	0 10	0 09	0 03	0 04	0 13	0 11	0 05	0 05	0 00	0 01	0 03	0 04	0 00	0 01	0 03	0 05	0 00	0 01	0 02	0 03
3	0 00	0 01	0 00	0 01	0 04	0 08	0 00	0 01	0 05	0 08	0 04	0 05	0 05	0 06	0 00	0 01	0 12	0 09	0 11	0 07	0 01	0 01	0 07	0 07	0 02	0 05	0 03	0 05	0 02	0 03	0 02	0 03
4	0 00	0 01	0 35	0 23	0 00	0 01	0 00	0 01	0 22	0 14	0 04	0 05	0 05	0 07	0 02	0 05	0 11	0 09	0 14	0 09	0 00	0 01	0 03	0 04	0 00	0 01	0 04	0 05	0 00	0 01	0 02	0 03
5	0 00	0 02	0 47	0 31	0 00	0 01	0 00	0 01	0 00	0 07	0 04	0 05	0 02	0 04	0 00	0 01	0 09	0 07	0 22	0 10	0 01	0 03	0 00	0 01	0 00	0 01	0 04	0 05	0 00	0 01	2 00	0 03
6	0 00	0 01	0 44	0 33	0 00	0 01	0 00	0 01	0 11	0 14	0 03	0 06	0 02	0 04	0 00	0 01	0 26	0 11	0 19	0 10	0 00	0 01	0 02	0 04	0 00	0 01	0 04	0 05	0 00	0 01	0 00	0 05
7			0 04	0 05	0 00	0 01	0 00	0 01	0 03	0 06			0 00	0 01	0 03	0 05	1 30	0 20	0 03	0 04	0 00	0 01	0 02	0 04	0 00	0 01	0 00	0 01			0 00	0 05
8			0 06	0 06	0 01	0 02	0 00	0 01	0 10	0 17			0 04	0 06	0 04	0 05	2 00	0 40	0 04	0 05	0 00	0 01	0 00	0 01	0 02	0 03	0 00	0 01			0 05	0 08
9			0 08	0 06	0 02	0 04	0 00	0 01	0 17	0 16			0 02	0 04	0 10	0 08	2 30	0 30	0 11	0 07	0 01	0 02	0 02	0 04	0 00	0 01	0 01	0 01			0 07	0 08
0			0 18	0 12	0 00	0 01	0 00	0 01	0 28	0 18			0 07	0 09	0 16	0 10	3 40	0 40	0 02	0 04	0 01	0 02	0 02	0 04	0 00	0 01	0 00	0 01			0 12	0 10
1			0 00	0 01	0 00	0 01	0 00	0 01	0 34	0 24			0 00	0 01	0 11	0 08	5.30	0 50	0 04	0 04	0 01	0 02	0 00	0 01	0 00	0 01	0 00	0 01			0 03	0 06
2			0 12	0 11	0 02	0 05	0 00	0 01	0 02	0 05			0 00	0 01	0 10	0 07	16 00	1 00	0 01	0 03	0 01	0 02	0 00	0 01	0 00	0 01	0 00	0 01			0 00	0 01
3			0 05	0 06	0 06	0 09	0 00	0 01	9.60	0 08			0 03	0 05	0 11	0 09	2 40	0 40	0 03	0 04	0 01	0 02	0 02	0 04	0 02	0 08	0 00	0 01			0 00	0 01
4			0 02	0 03	0 00	0 06	0 00	0 01	0 22	0 16			0 03	0 07	8 60	0 70	9 60	0 90	0 02	0 03	0 01	0 04	0 06	0 08	0 03	0 05	0 00	0 01			0 00	0 01
15			0 05	0 10	0 01	0 06	0 00	0 01	0 06	0 11			0 02	0 04	11 00	1 00	11.00	1 00	0 02	0 04	0 01	0 02	0 00	0 01	0 03	0 13	0 00	0 01			0 02	0 04
16			0 16	0 09	0 01	0 06	0 00	0 01	0 05	0 05			0 00	0 01	5 10	0 50	6 00	0 60	0 01	0 03	0 01	0 02	0 00	0 01	0 01	0 07	0 01	0 03			0 00	0 01
17			0 23	0 18	0 04	0 05	0 00	0 01	0 05	0 05			0 03	0 05	3 50	0 40	6 00	0 70	0 12	0 17	0 02	0 05	0 02	0 04	0 03	0 05	0 00	0 01			0 00	0 01
18			0 02	0 04	0 03	0 05	0 02	0 02	0 05	0 05			0 02	0 03	5 40	0 60	4 60	0 50	0 07	0 09	0 01	0 02	0 00	0 01	0 03	0 05	0 00	0 01			0 00	0 01
19																																				
0																																				

C l rado Depa tment of He lth s pl tonium i il onstruction tandard is 0 9 pCi/g (2 d/m/g)
A Labs Rese h Inc provided ur ent B oomfi ld dat
*A Labs R s a h Inc provided Bmfld dat Rockwell I t rnational provided DOE dat

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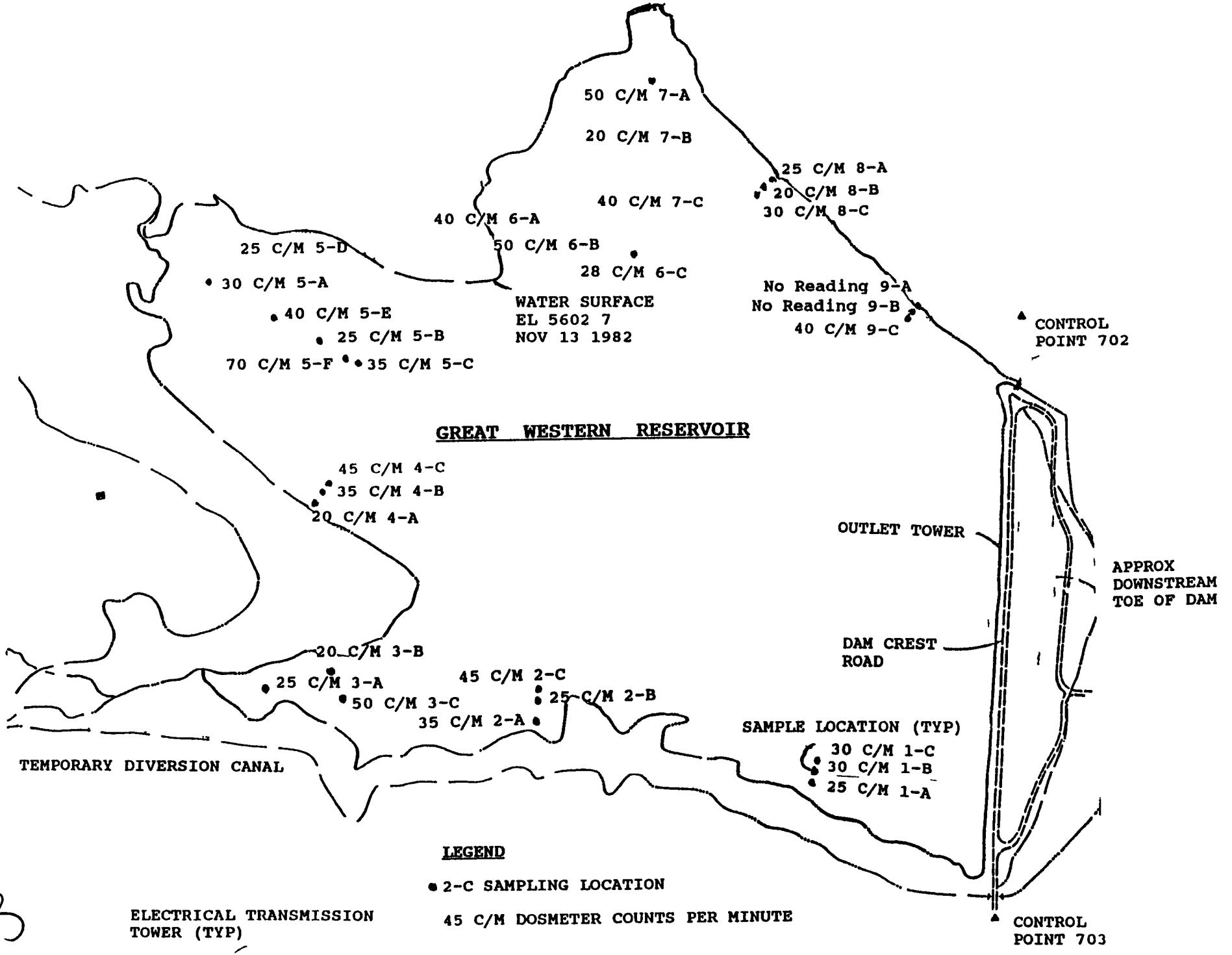
50 C/M 7-A
20 C/M 7-B
40 C/M 7-C
40 C/M 6-A
50 C/M 6-B
28 C/M 6-C
25 C/M 8-A
20 C/M 8-B
30 C/M 8-C
25 C/M 5-D
30 C/M 5-A
40 C/M 5-E
25 C/M 5-B
70 C/M 5-F
35 C/M 5-C
WATER SURFACE
EL 5602 7
NOV 13 1982
No Reading 9-A
No Reading 9-B
40 C/M 9-C
CONTROL
POINT 702
GREAT WESTERN RESERVOIR
45 C/M 4-C
35 C/M 4-B
20 C/M 4-A
OUTLET TOWER
APPROX
DOWNSTREAM
TOE OF DAM
DAM CREST
ROAD
20 C/M 3-B
25 C/M 3-A
50 C/M 3-C
45 C/M 2-C
25 C/M 2-B
35 C/M 2-A
SAMPLE LOCATION (TYP)
30 C/M 1-C
30 C/M 1-B
25 C/M 1-A
TEMPORARY DIVERSION CANAL
LEGEND
2-C SAMPLING LOCATION
45 C/M DOSMETER COUNTS PER MINUTE
ELECTRICAL TRANSMISSION
TOWER (TYP)
CONTROL
POINT 703

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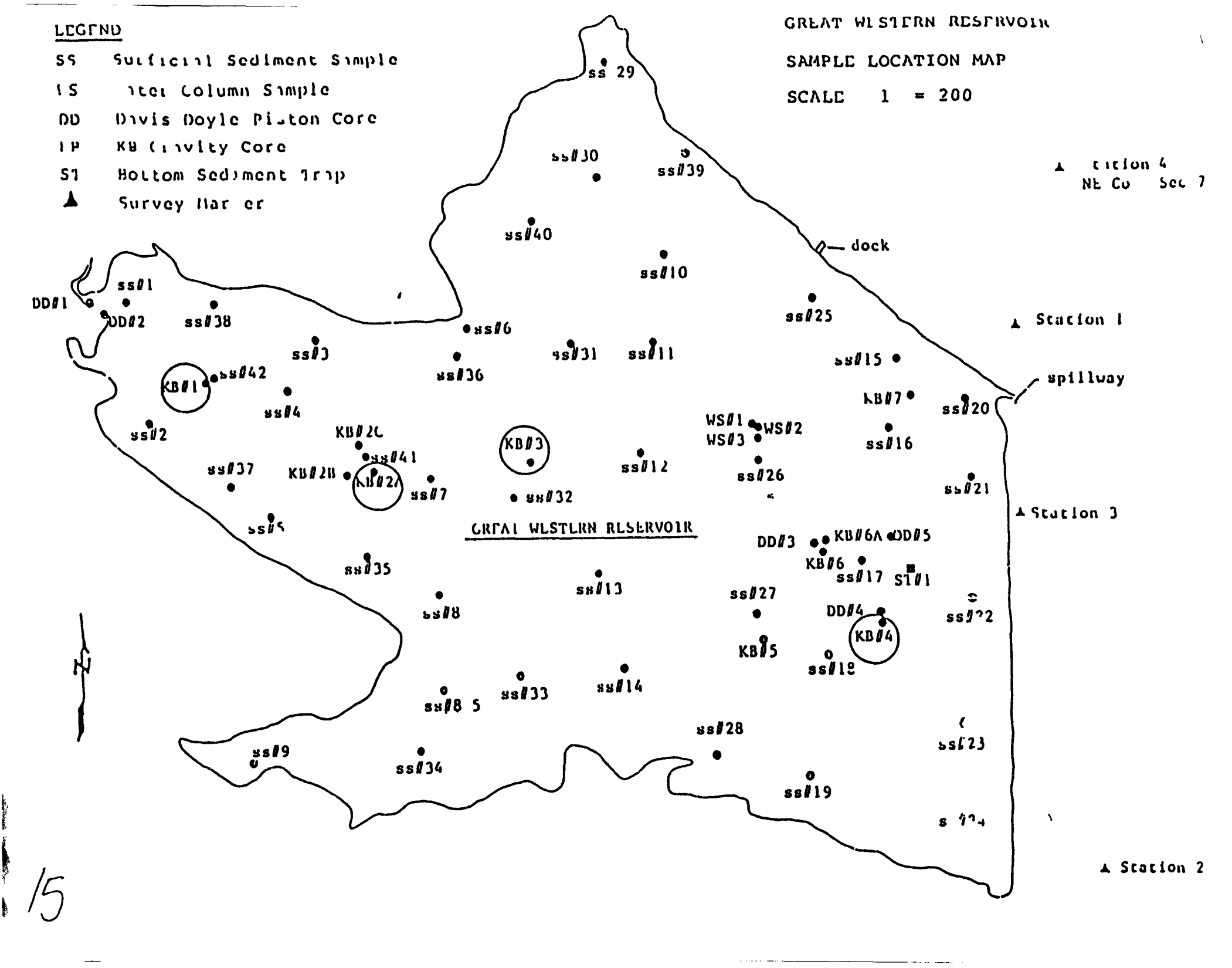
GREAT WESTERN RESERVOIR CORE SEDIMENT SAMPLES (see attached map)

Plutonium in Sediment (pCi/g)

Core Depth (inch)	May 1983 Core Locations											
	KB1			KB2			KB3			KB4		
	BMFLD	DOE		BMFLD	DOE		BMFLD	DOE		BMFLD	DOE	
1	0 03						0 65			0 36		
2	0 06	0 20	023	0 19		023	0 72	0 16	021	0 47	0 25	026
3	0 06						1 20			0 81		
4	0 03	0 23	025	0 18		021	1 50	0 18	022	0 89	0 39	036
5	0 01						1 30			1 60		
6	0 53	0 75	062	0 16		020	1 20	0 14	018	1 70	0 95	069
7										2 20		
8		1 00	078	0 14		019		0 24	024	4 90	1 40	099
9										2 80		
10		1 00	082	0 17		022		1 30	088	4 30	1 60	110
11										1 80		
12		0 11	017	0 67		052		0 75	057		2 10	130
13												
14				0 97		067		1 50	010		3 70	250
15												
16				1 30		088		1 90	130		3 80	230
17												
18											5 40	390
19												
20											3 30	190


LEGEND
SS Surficial Sediment Sample
WS Water Column Sample
DD Davis Doyle Piston Core
KB Kajak Brinkhurst Gravity Core
ST Bottom Sediment Trap
Survey Marker
GREAT WESTERN RESERVOIR
SAMPLE LOCATION MAP
SCALE 1 = 200
GREAT WESTERN RESERVOIR
dock
spillway
Station 1
Station 2
Station 3
Station 4
NE Co Sec 7
ss#29
ss#30
ss#39
ss#40
ss#10
ss#25
ss#1
DD#1
DD#2
ss#38
ss#6
ss#3
ss#31
ss#11
ss#15
KB#1
ss#42
ss#36
ss#4
KB#7
ss#20
ss#2
KB#2C
KB#3
WS#1
WS#2
WS#3
ss#16
ss#37
KB#2B
KB#2A
ss#41
ss#12
ss#26
ss#21
ss#7
ss#32
ss#5
DD#3
KB#6A
DD#5
KB#6
ss#17
ST#1
ss#35
ss#13
ss#27
ss#8
DD#4
ss#22
KB#4
KB#5
ss#18
ss#33
ss#14
ss#8 5
ss#28
ss#23
ss#9
ss#34
ss#19

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8B	(12 18)	1420	5/24/91	10	Recovery 1 5 /6 hard soil
9A	(0 6)	1450	5/24/91	25	Recovery 5 /6 hard soil
9A	(6 12)	1455	5/24/91	25	Recovery 4 /6 refusal
9B	(0 6)	1505	5/24/91	No reading	Recovery 3 /6 hard soil
9B	(6 12)	1515	5/24/91	No reading	Recovery 2 /6 hard soil
9B	(12 18)	N/A	5/24/91	No reading	Recovery refusal

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PLATE 1

Sediment Sample Stations and Locations

ATTACHMENT A

Photographs

PHOTO LOG

(1) Great Western Reservoir from dam looking northwest

(2) Typical sample station as surveyed by Rocky Mountain Consultants

(3) Decon station showing decon procedure on AMS hand core sampling tool

(4) Inserting new core sample sleeve into AMS hand core sampling tool

(5) Driving clean core sampler at typical sample location

(6) Reinserting core sampler to sample lower strata at typical sample location

(7) Typical sample documentation note label seal and chain of custody

(8) Decon water was drummed and labeled for storage on city property

(9) Drums were staged on the lower face of the dam

(10) View of Great Western Reservoir Note water levels

(11) View of Great Western Reservoir Note water levels

20

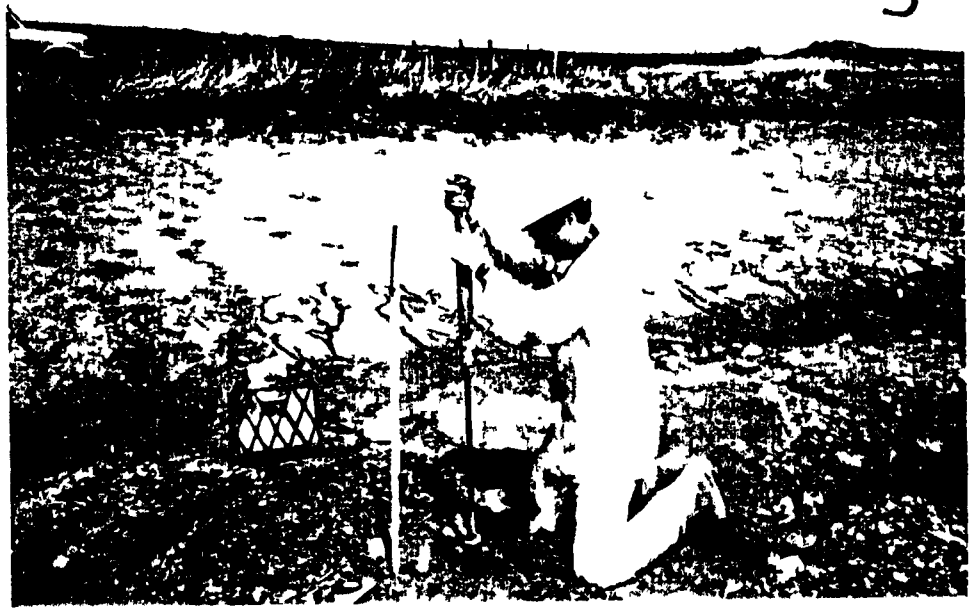
2

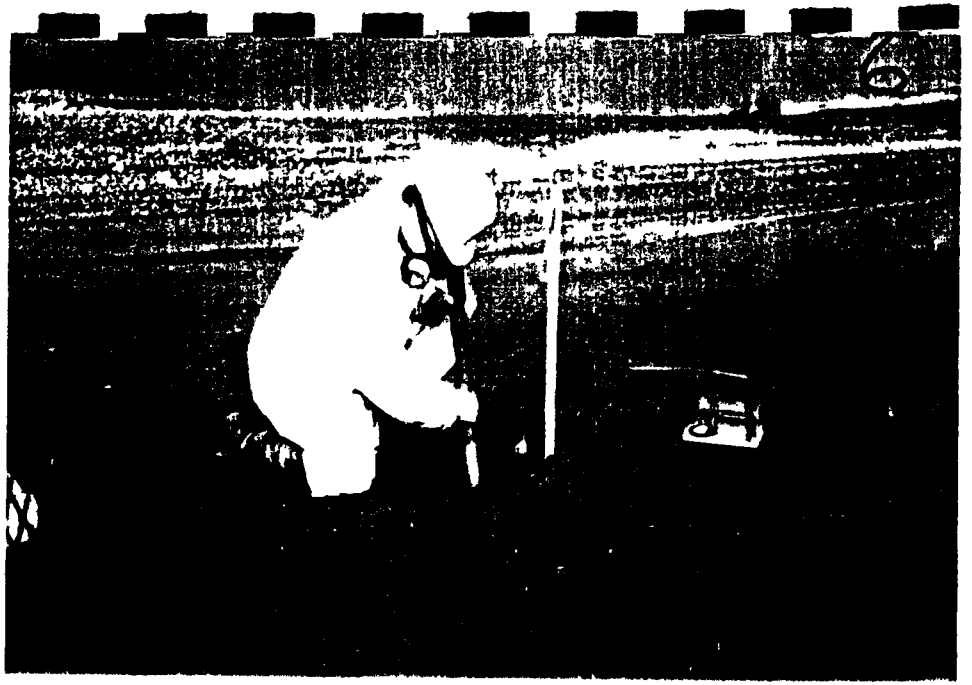
1

3

2

5





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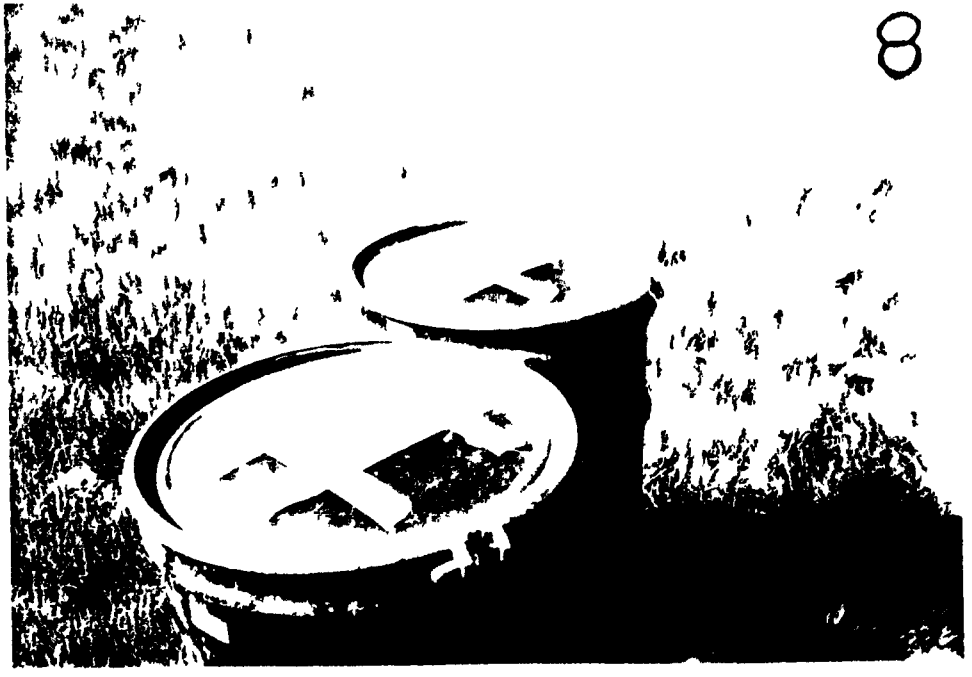

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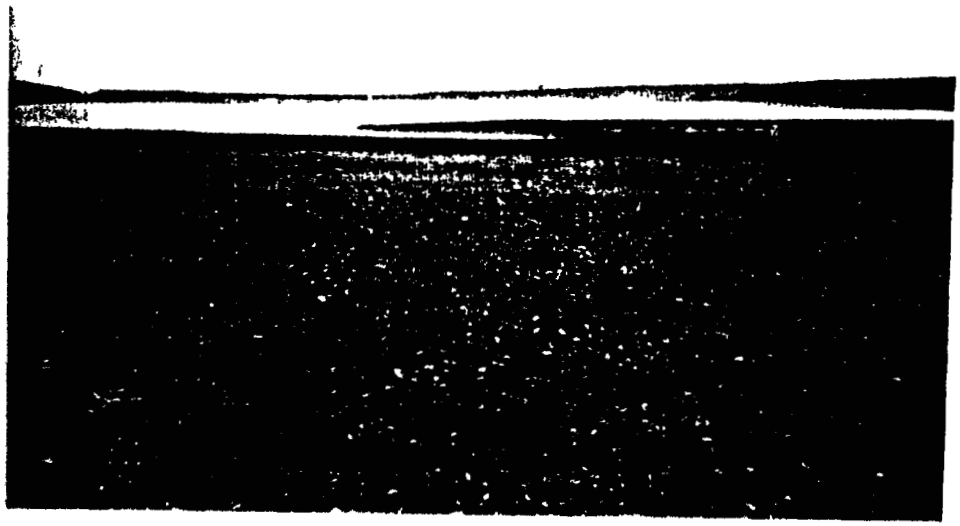

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ATTACHMENT B

Resumes of Sampling Team Members

STEVEN L HOFFMAN

Project Manager
Principal Remediation Specialist

EXPERTISE

Remedial Contracting and Construction Management
Hazardous Materials Handling

SUMMARY OF EXPERIENCE

Mr Hoffman is a Project Manager for Enviro Check in Denver and works primarily on remediation projects at industrial sites and commercial facilities He is responsible for project management, negotiations with local State and Federal regulatory agencies client communication, report preparation, permitting, and supervision of construction activities related to recommended remedial actions

Typical projects Mr Hoffman has managed include

General Maintenance Within Oil Refineries and Chemical Plants--Tank cleaning, bio-pond cleaning and construction, construction and maintenance of truck and train loading facilities

Environmental Projects at Major Smelting/Refining Company--Projects associated with ongoing operations include eighteen acre cap on mill tailings, installation of groundwater interceptors, construction of stabilization facilities UST removals, installation of air filtration systems

ERCS (Emergency Response Cleanup Services) for EPA Region VII--Includes containment of mine and mill tailings to protect major waterway from contamination, closure and cleanup of abandoned plating operations

Maintenance and New Construction at E I duPont Facility--Projects include asbestos abatement UST removals, site remediation, new construction and maintenance of plant facilities

Management of Remedial Activities at Oil Reclamation Refinery EPA Superfund Site--Responsibilities include development of interim health and safety plan monitoring of site and development and review of corrective action

25

plan

Prior to his work at Enviro Check, Mr Hoffman spent fifteen years as a Project Manager in heavy construction specializing in utilities construction, mechanical systems installations and maintenance, and hazardous waste handling projects

EDUCATION

1982, B S Colorado State University, Fort Collins
Industrial Construction Management

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BENJAMIN R. RUSTIN
ENVIRONMENTAL TECHNICIAN

EXPERTISE

Soil and Groundwater Investigations
Resource Conservation
RCRA Regulations

SUMMARY OF EXPERIENCE.

Mr Rustin is an environmental technician with TRC s Western Regional Office in Denver Colorado Mr Rustin collaborated in the evaluation acquisition and implementation of test equipment and sample material He is knowledgeable in legal and regulatory practices within the hazardous waste industry and has site inspection experience with Superfund sites His duties currently include on site sampling acquiring site background information from state and federal agencies and establishing inventory and procurement procedures for field supplies and equipment

EDUCATION

1992 (pending)	B S Land Management with emphasis on Hydrogeology and Environmental Engineering
40 Hr OSHA Training in	Health & Safety First Aid and CPR Field Monitoring and Sampling Equipment Hazardous Ranking System Data Evaluation

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TRC

TRACEY H SPENCE
GEOLOGIST

EXPERTISE.

Underground Storage Tank Removal
Property Conveyance Site Investigations
Soil Gas Survey Programs
GC/MS Data Interpretation
Contaminant Assessment/Plume Definition

SUMMARY OF EXPERIENCE.

Mr Spence is a staff geologist specializing in remediation services and projects related to investigation and evaluation of volatile organic compound contamination at industrial sites He has developed and implemented on site soil gas vapor studies for the identification of contaminant sources and determination of contaminant migration pathways His ability to interpret survey results has been utilized in the generation of contaminant concentration contour maps and to optimize placement of monitoring well networks in successive stages of site investigation

Mr Spence has managed removal of underground storage tanks and coordinated all related aspects including obtaining of necessary permits and preparation of all reporting documentation As part of the contaminant assessment in these efforts he has been responsible for monitoring well placement and installation and the performance of the monitoring program

Mr Spence has performed property conveyance assessments at commercial and industrial properties

Prior to his environmental consulting career Mr Spence was a Research/Laboratory Technician at the Petroleum Research Center Socorro N M performing enhanced oil recovery research

EDUCATION

1990 Environmental Health and Safety Training (29 CFR 1910 120)
1990 Mechanical Engineering Studies University of Colorado
1985 B S Geology New Mexico Institute of Mining and Technology

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TRC

ATTACHMENT C

RMC Sample Location Coordinates

ROCKY MOUNTAIN CONSULTANTS INC

RMC

8301 E Prentice Ave
Suite 101
Englewood CO 80111
(303) 741 6000
FAX (303) 741 6106

MEMORANDUM

TO Matthew Glasser Special Counsel to
CITY OF BROOMFIELD

Mike Bartleson Business Manager - DOE Grant
Administration
CITY OF BROOMFIELD

FROM Stephen Schmidt Project Manager
ROCKY MOUNTAIN CONSULTANTS INC

SUBJECT Implementation of DOE Commitment FY91
Great Western Reservoir Replacement Project
Reservoir Management Plan RMC No 0331 071 06
Sediment Sampling Program

DATE June 24 1991 (Draft)
September 3 1991 (Revised)

In February 1991 RMC prepared for the City of Broomfield a Draft Preliminary Reservoir Management Plan addressing the long term management of Great Western Reservoir (GWR) when the reservoir is not longer used for a public water supply Subsequently RMC suggested that additional sampling and testing of the near shore sediments of GWR would be beneficial to verify the assumptions made in preparing the Plan concerning the distribution and amount of plutonium contamination of the sediments Those assumptions were reached based on available sampling and testing data

On May 15 1991 the reservoir water surface was at approximately G H 47 3 (El 5 90 3) which is historically the minimum water surface elevation to be reasonably expected to occur This appeared to be a unique opportunity to obtain high quality reservoir sediment samples in the dry from the near shore area rather than taking underwater dredge samples or cores On May 16 the City directed Rocky Mountain Consultants (RMC) to formulate and implement a sampling program

RMC was responsible or overall project direction and surveying of sampling locations Enviro Check was responsible for obtaining the samples and delivering them to Accu-Labs for storage The testing program will be conducted by Accu-Labs at a later date to be specified by the City Time was of the essence because filling of the reservoir was to begin on May 17 at a slow rate but the rate was to increase later in the week of May 19

30

The objective of the sampling program was to obtain push samples of the upper 18 inches of sediments at three different surface elevations at each site These elevations were to be approximately 5 10 and 15 feet vertically below the normal high water line elevation of 5605 In addition at site 5 samples were to be taken both in the alluvial fan and the Walnut Creek channel for a total of 6 sample locations at site 5

Because of the time constraints the high water line apparent from limits of vegetation and erosion marks was used as reference in locating the sampling locations at each site This enabled the sampling to be conducted simultaneously with surveying necessary to determine the horizontal and vertical location of each sampling location with relation to the public land survey and USGS elevation datum

RMC with assistance of City staff field located the 9 sampling sites on May 20 1991 RMC staff then staked the sampling locations at each site on May 21 and determined the ground elevation at each sampling location with respect to an arbitrarily set reference hub On May 22 23 and 24 RMC staff conducted a horizontal survey of each sample location and on June 3 conducted a vertical survey of the reference hub for each site thus completing the horizontal and vertical survey for each sample location

Enviro Check mobili ed on May 22 1991 and began obtaining cores at the lowest sampling location at each site However the reservoir water surface elevation rose somewhat faster than had been anticipated and some of the original sampling locations had to be moved upslope above the water in order to obtain quality samples Three 6-inch long cores were obtained at each sample location There are three sample locations at each of the nine sampling sites plus an additional 3 sampling locations at site 5 for a total of 90 six-inch cores Enviro Check completed the sampling program on May 24 and delivered the samples to Accu-Labs for storage on June 3 Accu-Labs is storing the samples in a locked free er unit pending receipt of authorization and specifications for the testing program

The results of the survey of the sampling locations are presented in tabular form on Table 1 below and are illustrated on the attached Figure 1 Because of the time constraints and methods used to initially locate the sampling locations and the need to keep the sampling in the dry the upper two locations at each site were slightly lower in elevation than intended and the lower locations somewhat higher than intended Nevertheless the distribution of samples was adequate with one sample at each site

from the future shore line above the future high water line and two samples at each site from the zone which in the future will be expected to see reservoir water surface elevation fluctuation and be subjected to wave action

Also attached to this memorandum are copies of Enviro Check s sampling field notes chain of custody forms and sediment sampling work plan Dosimeter readings for each sample were recorded by Enviro Check and have been included on the attached Figure 1

Except for photographs of the sampling sites/locations sent under separate cover to Kathy Schnoor I believe this memorandum and attachments provide the available documentation for the sampling program When deemed appropriate by the City Enviro Check will produce a formal report documenting their sampling effort and testing at Accu Labs will proceed

cc Kathy Schnoor Chemist/Environmental Specialist
City of Broomfield

RMC

TABLE 1

GREAT WESTERN RESERVOIR
MAY 1991 SAMPLING LOCATIONS

SAMPLING SITE	SAMPLING LOCATION	RMC PT NO	NORTH CO-ORD	EAST CO-ORD	ELEVATION
1	A	521	12474 8	13910 4	5598 7
1	B	520	12519 3	13921 6	5593 7
1	C	501	12556 0	13931 0	5591 1
2	A	526	12761 4	12897 1	5598 7
2	B	527	12826 3	12903 1	5593 7
2	C	502	12867 6	12906 4	5591 1
3	A	529	12874 9	11901 1	5598 0
3	B	528	12926 7	12138 6	5593 0
3	C	503	12837 4	12182 3	5591 1
4	A	522	13578 0	12078 9	5598 9
4	B	523	13621 5	12106 3	5593 9
4	C	504	13646 6	12122 4	5591 3
5	A	533	14416 2	11677 5	5597 8
5	B	530	14204 3	12093 5	5592 8
5	C	525	14121 6	12238 5	5591 4
5	D	532	14521 9	11757 7	5596 2
5	E	531	14288 0	11918 4	5593 1
5	F	524	14178 3	12192 5	5591 7
6	A	519	14681 8	12884 4	5597 6
6	B	518	14606 6	13057 1	5592 6
6	C	517	14518 4	13262 9	5591 6*
7	A	514	15156 5	13350 7	5598 1
7	B	515	15012 6	13349 7	5593 1
7	C	516	14751 3	13343 2	5592 0*
8	A	510	14789 5	13787 6	5598 3
8	B	511	14751 5	13751 1	5593 3
8	C	513	14740 3	13740 6	5591 7
9	A	509	14331 4	14316 0	5599 0
9	B	508	14316 1	14301 1	5594 0
9	C	507	14301 5	14286 3	5591 1

Basis of Survey NE corner Sec 7 T2S R69W is N14851 859 E14897 318 North line of the northeast one-quarter of Sec 7 bears S88 38 17 W Elevations are USGS datum

* Revised March 25 1992

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ATTACHMENT D

Merrick & Company Radiation Survey

MERRICK

June 27 1989

Ref 354-6932

Steve Hoffman
Enviro-Check
P O Box 3090
Englewood, CO 80161

Dear Mr Hoffman

Merrick is pleased to submit the radiation survey results for the Broomfield diversion ditch around Great Western Reservoir The survey was begun on June 14, 1989 and completed June 17, 1989 No dangerous levels of radioactivity were found during the performance of the survey No contamination was found on the excavation equipment during spot checks conducted by Merrick personnel

If you have any questions concerning the survey or the results please don't hesitate to contact me

Sincerely

Micheal Gard
Environmental Scientist

MG/sih

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INTRODUCTION

Merrick & Company was retained by Enviro-Check to conduct a cursory radiation survey in the area along the temporary channel which reroutes the waters received from Rocky Flats in Walnut Creek around the Great Western Reservoir from June 14-17, 1989 Because of the short time constraints direct soil sampling was determined to the ineffective and a Geiger-Muler radiation detector, the Dosimeter Model 3700 was selected for the survey This method was used to obtain qualitative information regarding the potential exposure level of radiation to the excavation workers

Background radiation levels were determined to be 50 disintegrations per minute (DPM) Sampling was performed using the existing construction stationing along the proposed channel Sampling activities included removing the vegetation in the sample location and agitating the upper 1/4 inch of soil The Dosimeter probe was placed on the disturbed soil and readings were observed for approximately one minute and the highest reading above 50 DPM was recorded Additional readings were collected from the excavation machinery to ensure radiation levels did not exceed safe working levels

SAMPLING RESULTS AND RECOMMENDATIONS

The results of the sampling effort are summarized in Table 1 and radiation readings of 50 or greater are posted on the attached drawing The sampling results did not indicate dangerous levels of radioactivity along the channel route Radiation levels at a few locations were above the background level of 50 DPM In general higher radioactivity readings were found on the north facing slopes along the channel route This is consistant with the sampling performed by the Colorado Department of Health (See Figure 1)

During the initial phase of the sampling effort, it was recommended that the excavation area should be saturated with water to suppress the dust and reduce the radiation exposure potential attributable to resuspension of alpha radiation emitting substances Excavation workers were informed of the potential dangers of ingestion of radioactive substances while eating smoking gum chewing and other routes of potential exposure In relation to these warnings, workers were directed to wash their hands prior to lunch and at the end of each work shift DCS Construction supplied portable wash basins and coveralls were supplied to the workers to reduce the possibility of contaminating personal clothing

COLORADO DEPARTMENT OF HEALTH

PLUTONIU IN OIL E ST OF ROCKY L TS

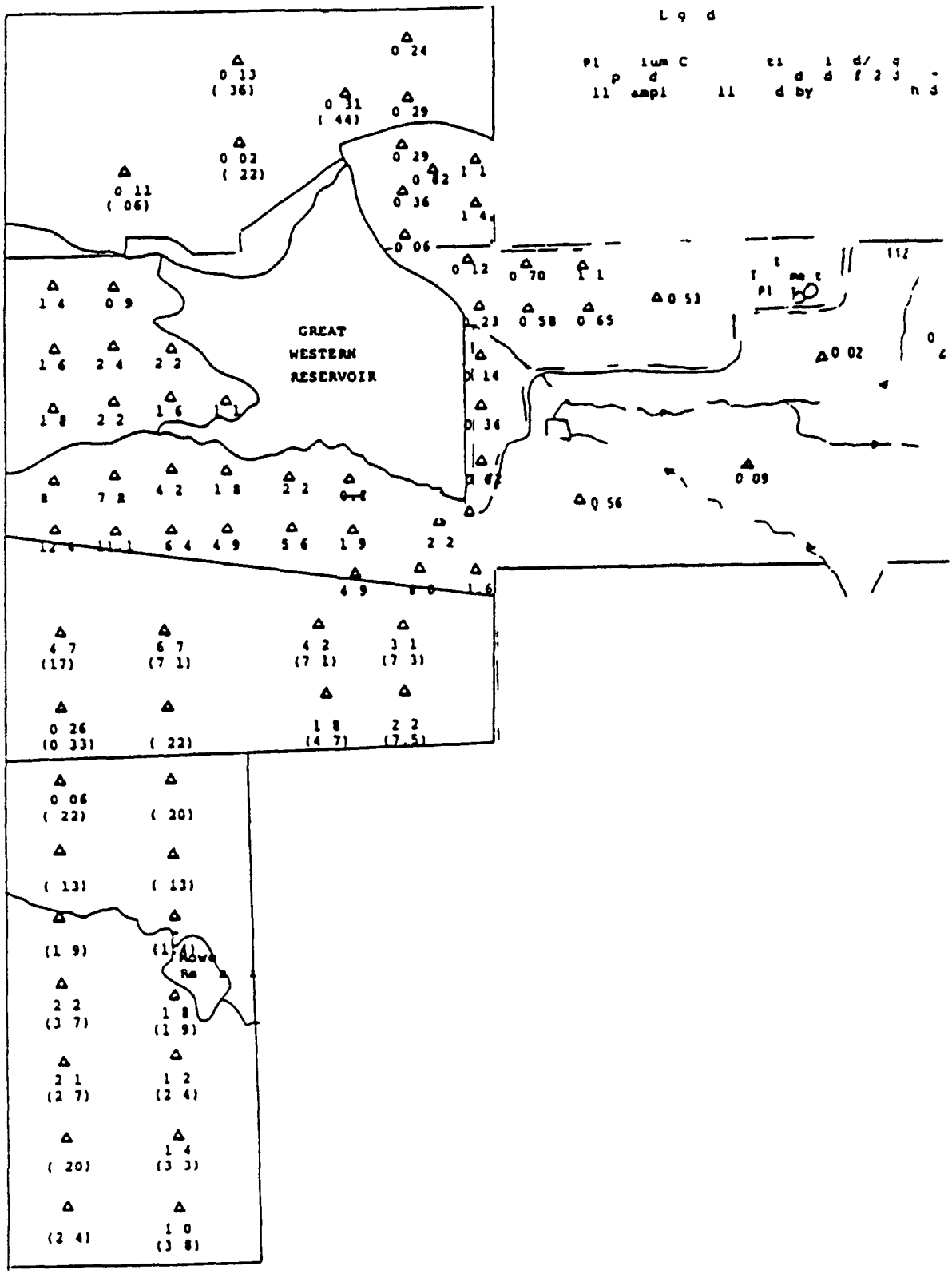

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TABLE 1
GIEIGER COUNTER READINGS IN COUNTS PER MINUTE

STATION	COUNTS/MIN
0050	50
0100	ND
0250	ND
0300	60
0350	ND
0400	ND
0450	ND
0500	ND
0550	50
0600	ND
0650	ND
0700	ND
0750	ND
0800	ND
0850	ND
0900	ND
0950	50
1000	ND
1050	ND
1100	ND
1150	ND
1200	ND
1250	ND
1300	ND
1350	ND
1400	50
1450	50
1500	ND
1550	60
1600	50
1650	ND
1700	ND
1750	ND
1800	ND
1850	ND
1900	50
1950	50
2000	ND
2050	ND
2100	ND
2150	ND
2200	--
2250	--
2300	--
2350	--
2400	--
2450	--
2500	ND
2550	ND

STATION	COUNTS/MIN
2600	ND
2650	ND
2700	ND
2750	ND
2800	ND
2850	ND
2900	ND
2950	ND
3000	ND
3050	ND
3100	ND
3150	ND
3200	ND
3250	ND
3300	ND
3350	ND
3400	50
3450	ND
3500	ND
3550	ND
3600	ND
3650	ND
3700	ND
3750	ND
3800	ND
3850	ND
3900	ND
3925	ND
3950	ND
4000	ND
4050	50
4100	50
4150	ND
4200	ND
4250	--
4300	ND
4400	60
4500	ND
4600	ND
4700	ND
4800	ND
4900	ND
5000	50
5100	50
5200	ND
5300	50
5400	50
5500	60
5550	50
5600	ND
5700	ND
5800	50
5900	ND

STATION	COUNTS/MIN
6000	ND
6100	70
6200	ND
6300	ND
6400	ND
6500	ND
6600	ND
6700	ND
6800	ND
6900	ND
7000	ND
7100	ND
7200	ND
7300	ND
7400	ND
7500	ND
7600	ND
7700	ND
7800	ND
7900	ND
8000	ND
8100	ND
8200	ND
8300	ND
8400	ND
8500	ND
8600	ND
8700	ND
8800	ND
8900	ND
9000	ND
9100	ND
9200	ND
9200	ND
9220	--
9300	ND
9400	ND
9500	ND
9600	ND
9700	ND
9800	ND
9900	ND
10000	ND
10100	ND
10275	ND
10350	ND
10400	ND
10518	ND
10593	ND
10200	ND

ATTACHMENT E

Enviro Check Field Notes

2/ JA 5/22/91

Dosimeter Readings

Location

1A 15 c/m (Counts/Min)

25

25

Marker Stake 50 c/m

3/ JA 5/22/91

SAMPLING

Sample ID	TIME	DATE
1C (0-6)	1350	5/22/91
15 c/m - Full Recovery ~6		
NOTE Sample was collected under ~ 1 water		
1C (6-12)	1400	5/22/91
30 c/m - 5/6" Recovery		
Collected under ~ 1 water		
1C (12-18)	1415	5/22/91
0 c/m		
Collected under ~ 1" water		

4/3

4/

JA 5/22/91

Sample ID	TIME	DATE
2C (0-6)	1442	5/22/91
- 45 c/m — 6"/6" Rec		
Collected under ~ 1" water		
2C (6-12)	1500	5/22/91
0 c/m — 6/6' Rec		
under ~ 1" water (t~4")		
2C (12-18)	1507	5/22/91
0 c/m —		
under ~ 1" water (t~14")		

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5/

lf lt 5/22/91

Sample ID	Time	date
3C (0-6)		
3C (0-6)	15:20	5/22/91
30 c/m - 6"/6" Rec.		
collected @ waters Edge		
3C (6-12)	1535	5/22/91
35 c/m — 6'/6' Rec		
collected @ waters Edge		
Redid the core @		
6'/6' Rec		
3C (6-12)	15,47	5/22/91
collected @ water Edge.		
50 c/m		
3C (12-18)		5/22/91
25 c/m	1555	
collected waters Edge		

16 | SH | 5/22/91 | 7 | SH | 5/22/91

5C (0"-6") | 1815 | 5/22/91
35 c/m | 6"/6" Recovered
- Collected ~ 3' to the side of
stake

4C (0"-6") | 16 18 Recogered
25 c/m | 6"/6" collected 5/22/91
collected @ waters' edge

5C (6"-12") | 18 30 | 5/22/91
20 c/m | 3 5 6"/6" Recovered
collected ~ 3' to the south
side of stake

4C (6"-12") | 16.26 | 5/22/91
15 c/m | 4/6 6/6 Recovered
collected @ waters Edge

5C (12"-18') | 1845 | 5/22/91
25 c/m - 4"/6" Recovered
Collected ~ 3' to south side
of stake

4C (12"-18") | 5/22/91
45 c/m | 16.33
4"/6" Recovered
collected @ Waters Edge

45

8/8 — 5/22/91

5F (0-6") — 1903 — 5/22/91
70 c/m — 4'/6' Recovered
Collected ~ 5' to the South of Stake

5F (6"-12") — 1925 — 5/22/91
35 c/m — 6"/6" Recovered
collected ~ 5' to the South of Stake

5F (12"-18") — 19:35 — 5/22/91
15 c/m — 6"/6" Recovered
collected ~ 5' to the South of Stake

Left Site @ ~ 2000

4/6 Before leaving Site, both trucks were screened with dosimeter - Both readings were within background range (15 c/m - 30 c/m)

1/6 — 5/23/91

Great Western Reservoir
T Spence, Ben Rustin arrived on-site @ 0700

NOTE Left the site from 1015 to 1230 to deliver manifest, pick up DI water

2/6 JA 5/23/91

6C (0-6') 0825 5/23/91
25 c/m (counts/min) - 5/6 Recovery
Collected ~30' West of stake since the stake is ~1' under water
Marked location w/ flag

6C (6"-12") 0835 5/23/91
28 c/m - 4"/6" Recovery
Collected as above 6C (0-6")

6C (12-18') 0842 5/23/91
25 c/m - 4"(6" Recovery

3/6 JA 5/23/91

7C (0-6') 0857 5/23/91
90 c/m - 6'/6" Recovery
Collected ~10' NW of stake
Marked collection location w/ flag

7C (6"-12") 0905 5/23/91
20 c/m - 5'/6" Recovery

7C (12"-18") 0914 5/23/91
15 c/m - 5/6" Recovery

, Dense Dark Brown Clay

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4/6 — JJ — 5/23/91

Sample ID	TIME	DATE (1991)	RECOVERY (in/in)
8C (0-6")	1250	5/23	4/6
Collected ~ 5' North of Stake Marked sample location w/ Flag			
20 c/m (counts/min)			
8C (6"-12" / 12"-16")	1258	5/23	6/6
30 c/m			
8C (12-18")	1305	5/23	5/6
15 c/m			
9C (0-6")	1320	5/23	3/6
Collected ~ 6' North of state due to rocky surface/subsurface			
30 c/m			
9C (6-12")	1330	5/23	3/6
40 c/m			
9C (12"-18")	1340	5/23	4/6
15 c/m			

5/6 — JJ — 5/23/91

Sample ID	TIME	DATE 1991	Counts/min	Recovery in/in
6B (0-6")	1425	5/23	20 c/m	6/6
6B (6-12")	1428	5/23	20 c/m	6/6
6B (12-18")	1435	5/23	15 c/m	2/6
6B (0-6")	1503	5/23	15 c/m	6/6
6B (6-12")	1506	5/23	50 c/m	6/6
6B (12-18")	1510	5/23	15 c/m	5/6
5B (0-6")	1543	5/23	15 c/m	6/6
5B (6-12")	1547	5/23	25 c/m	6/6
5B (12-18")	1555	5/23	15 c/m	6/6
3B (0-6")	1654	5/23	20 c/m	5/6
3B (6-12")	1705	5/23	15 c/m	4/6
3B (12-18")	1710	5/23	15 c/m	2/6

Decon Water 55 gal drum was placed on East side of dam for storage. Lid was fastened and labeled "DECON WATER"

6/6 JJ 5/23/91

— Gate was locked behind T Spence

— Left the site at 1800

Dropped gate/lock key off at the WWTP

1/6 5/24/91

Great Western Reservoir —
Soil Sampling

T Spence arrived on-site at 0700

— TS picked up gate/lock key from Rick ? w/ City of Broomfield WWTP for entry to the reservoir area

— Fill out labels/seals until ~ 0735

50

2/6 JA 5/24/91

Sample ID	TIME	DATE	Counts/Minute	Recovery IA/in	
1B (0-6)	0825	5/24	25 c/m	5/6	DENSE CLAY
1B (6-12)"	0828	5/24	30 c/m	4 1/6	
1B (12-18)"	0833	5/24	25 c/m	2/6	
1A (0-6)	0840	5/24	15 c/m	4 1/6	
1A (6-12)"	0844	5/24	25 c/m	3/6	
1A (12-18)"	0850	5/24	25 c/m	5/6	
2A (0-6)	0903	5/24	25 c/m	4/6	DENSE CLAY
2A (6-12)'	0907	5/24	20 c/m	4/6	
2A (12-18)"	0910	5/24	35 c/m	4/6	
2B (0-6)"	0913	5/24	25 c/m	5/6	
2B (6-12)'	0915	5/24	15 c/m	5/6	
2B (12-18)"	0920	5/24	20 c/m	5/6	
3A (0-6)'	1008	5/24	25 c/m	5/6	
3A (6-12)"	1011	5/24	20 c/m	4/6	
3A (12-18)"	1010	5/24	25 c/m	3/6	

3/6 — JA — 5/24/91

Sample ID	TIME	DATE	Counts per Minute	Recovery in/in
4A(0-6)"	1056	5/24	20 c/m	4/6
4A(6-12)"	1058	5/24	20 c/m	3.5/6
4A(12-18)	1102	5/24	15 c/m	4/6
4B(0-6)"	1047	5/24	20 c/m	5/6
4B(6-12)'	1050	5/24	35 c/m	4/6
4B(12-18)'	1055	5/24	20 c/m	3.5/6
5E(0-6)'	1120	5/24	20 c/m	6/6
5E(6-12)'	1123	5/24	15 c/m	6/6
5E(12-18)'	1130	5/24	40 c/m	5/6
5D(0-6)	1135	5/24	20 c/m	6/6
5D(6-12)	1139	5/24	15 c/m	6/6
5D(12-18)	1145	5/24	25 c/m	2/6
5A(0-6)	1150	5/24	15 c/m	6/6
5A(6-12)	1154	5/24	25 c/m	6/6
5A(12-18)	1205	5/24	30 c/m	6/6

Samples Collected in a Moving stream bed (SE of 5D)

4/6 — JA — 5/24/91

Sample ID	TIME	DATE	Counts/ Minute	Recovery in/in	
6A(0-6)"	1307	5/24	25 c/m	5/6	HARD DAMP CLAY
6A(6-12)"	1311	5/24	40 c/m	4/6	
6A(12-18)	1315	5/24	40 c/m	3.5/6	
7A(0-6)	1330	5/24	15 c/m	5/6	HARD DAMP CLAY
7A(6-12)	1333	5/24	15 c/m	4/6	
7A(12-18)	1335 1340	5/24	50 c/m	4/6	
8A(0-6)	1350	5/24	25 c/m	5/6	HARD DAMP CLAY
8A(6-12)	1354	5/24	20 c/m	4/6	
8A(12-18)	1400	5/24	25 c/m	3/6	
8B(0-6)	1410	5/24	20 c/m	4/6	Hard Moist Clay
8B(6-12)	1413	5/24	20 c/m	3.5/6	
8B(12-18)	1420	5/24	10 c/m	1.5/6	

5/6				JJ	5/24/91	6/6	JJ 5/24/91
							NOTES
9A (0-6)"	1450	5/24	Inst not working properly Estimate ~25 s/m	5/6			
9A (6-12)"	1455	5/24		4/6	Refusal @ 10 - 11" gray clay stone Bdrk		All PPE and trash was placed in plastic garbage bags and put into a 55 gallon drum.
9B (0-6)"	1505	5/24	NO READING	3/6	Refusal		The drum lid was labelled TPPE/Trash and fastened to the drum.
9B (6-12)"	1515	5/24	NO READING	2/6	Refusal		
9B (12-18)"		REFUSAL			Gray Claystone Bedrock		This drum was positioned next to the "DECON WATER" drum located on East side of the GW reservoir dam.
							The entry gate was closed & locked behind T Spence; the key to gate lock was returned to C at B WWTP office.
							Left site at 1646

52

1/ JH 5/24/91

Great Western Reservoir
Broomfield, CO

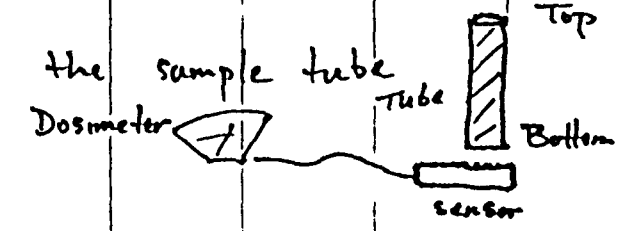
Sampling Procedures:

— Prior to collecting each sample (at a location), the sampler core barrel was washed with a Liquinox solution and rinsed with DI water.

— A sample tube was rinsed and inserted into the core barrel for sampling — after marking a "Top & Bottom" on the tube

— Immediately following the removal of the collected sample from the core barrel, a Dosimeter reading was recorded by placing the instrument sensor at the soil surface on the bottom end of the sample tube

2/ JH 5/24/91



— Following the Dosimeter reading, the sample tube was capped at both ends, labeled and sealed, and placed into a cooler

— All Decontamination rinse waters were containerized in sealed 5-gallon buckets that were emptied into a 55-gallon drum at the end of each day

— All used PPE was placed into plastic garbage bags — these bags were put into a 55-gallon drum at the end of each day

93

5/22/91

City of Broomfield
Great Western Reservoir

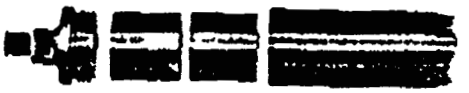
T Spence, S Hoffman, Ben Ruston arrived on-site @ 1330

34

ATTACHMENT F

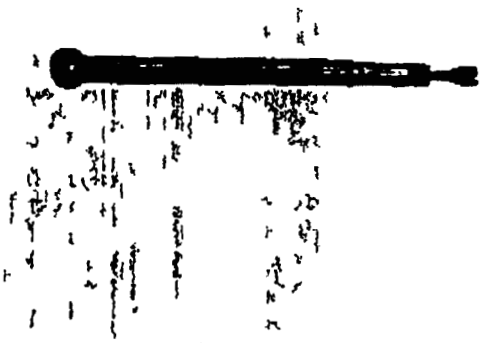
Schematic Diagram of Core Sampler and Radiation Detector Specifications

CORE SOIL SAMPLER



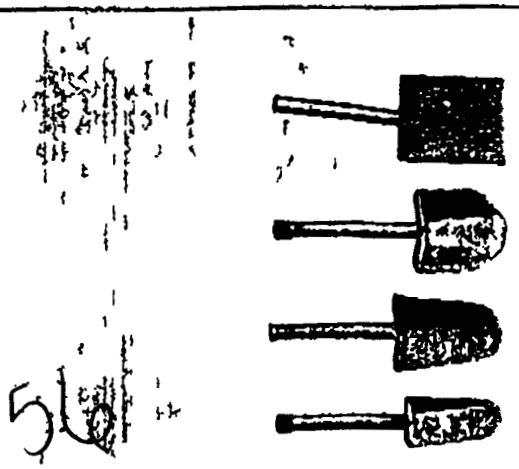
The AMS core soil sampler is designed to take undisturbed soil samples in all types of soils AMS core samplers are constructed out of the highest quality alloy tubing available The cutting end is heat treated and case hardened for longer life Core samplers are machined to strict inside tolerances to accommodate liners of various materials These liners are available in stainless plastic aluminum bronze or teflon (teflon inserts are special order only) Airtight plastic covers are also available for the inserts By capping the inserts soil samples can be sent to a lab intact for later analysis Stainless steel cap inserts can be used in the covers to eliminate the loss of volatiles in your samples AMS core samplers are 2 1/4 outside diameter to accommodate 2 ' diameter liners The standard length of samples are 2 3 4 6 and 12 Please specify length when ordering Three other sizes are also stock: 1) 1 1/2 X 6' for a 1 1/2 diameter by 6 long retaining cylinder 2) 2 1/2 X 6 for a 2 1/2 ' diameter by 6 long cylinder or 3) 3 ' X 6 for 3 diameter X 6 long retaining cylinder Core soil samplers are also available in all stainless steel construction Special order lengths and diameters are available on request The AMS quick connect system for core samplers is also available Please check price list for ordering information Complete unit includes core sampler cup and cap, one plastic liner and hammer attachment

HAMMER ATTACHMENTS

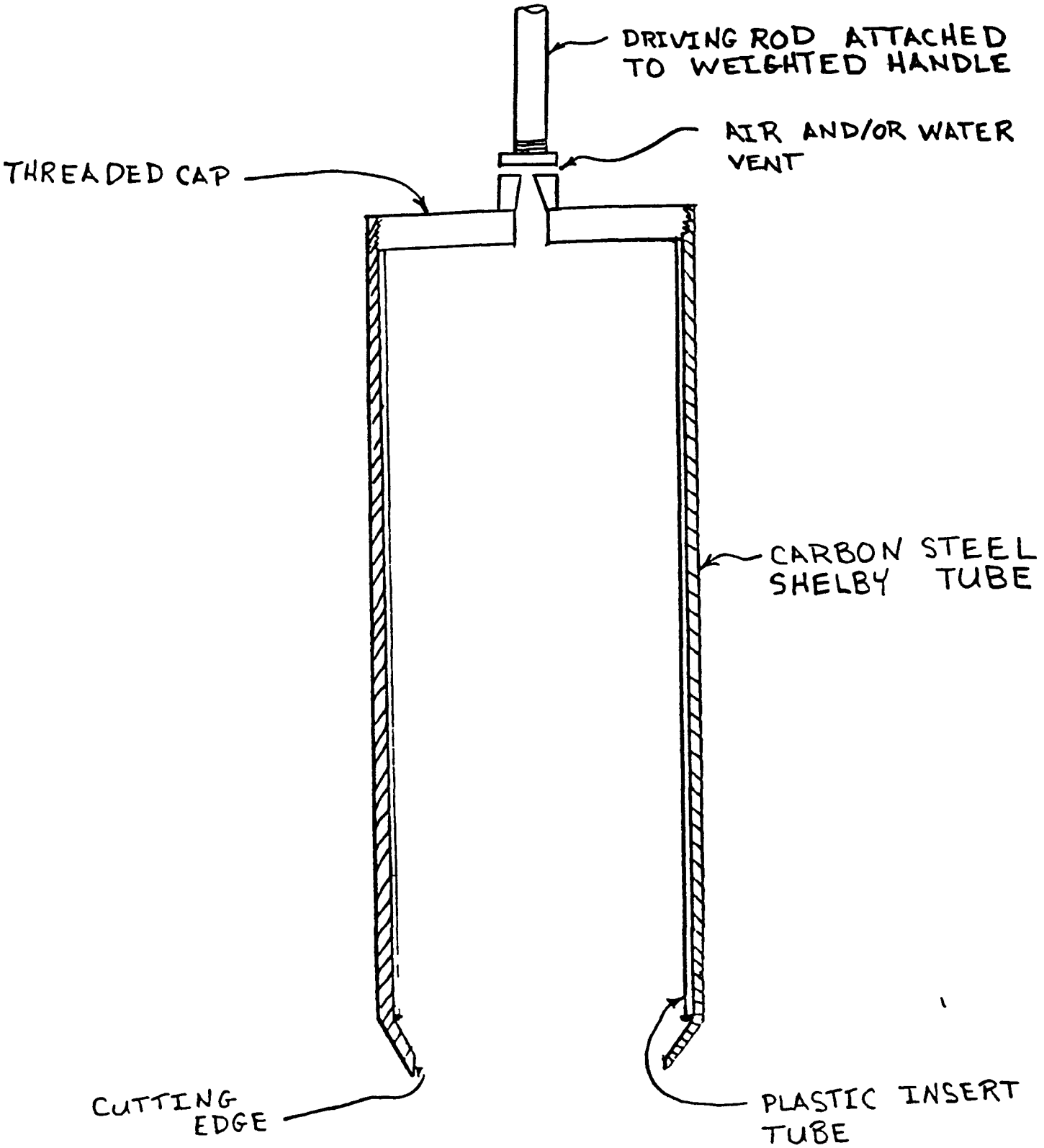


We suggest the use of our soil probe hammer attachment when working with lightly frozen and dry crusted soils The AMS up and down hammer attachment is recommended to be used with the soil probe The hammer attachment helps to eliminate twisting turning and bending Probes can be easily inserted into hard dry or lightly frozen soils with the hammer attachment The hammer attachment weighs approximately 11 pounds and is approximately 20 in length It has a soft baked on rubber coating which eliminates shock to the operator's hands and increases comfort

STAINLESS STEEL SCOOPS



AMS stainless scoops were developed to be used for taking samples of top soil in all areas Scoop are constructed out of all stainless steel There are five sizes available No 2 No 3 No 6 No 8 and No 12 (Numbers indicate approximate ounces of material that each will hold) Scoops may be ordered individually or as a set Special order sizes are available upon request Please call for prices and availability



AMS CORE SAMPLER SECTION

MODEL 3700 and 3007

INSTRUCTION MANUAL

PORTABLE RADIOLOGICAL SURVEY METER

TABLE OF CONTENTS

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LIST OF ILLUSTRATIONS

1 GENERAL DESCRIPTION

1 1 INTRODUCTION

The Models 3700 and 3007 are portable battery powered transistorized survey meters that can be used for radiation monitoring purposes and/or contamination measurements

The Model 3700 has a permanently attached beta gamma probe It measures from 0 to 50 mR/h (milliroentgens per hour) and can be used for radiation surveys The Model 3007 has a BNC connector on the panel to attach any one of a series of interchangeable probes Both have a mR/h scale and CPM (counts per minute) scale

These instruments are supplied with an adjustable carrying strap A headphone for aural monitoring and a check source to verify operation are available as options

1 2 THE PROBE

The Model 3700 uses a Model 3073 Probe It consists of a nickel plated brass housing with a beta window and detents which can lock the windows open or closed

The Model 3007 can use the different probes listed in Section 2 1

1 3 THE PANEL ASSEMBLY

The panel assembly consists of 2 each 1 1/2 volt type D cell batteries a transistorized pulse shaping network a detecting (metering) circuit a regulated transistorized high voltage power supply and an audio output circuit The system is shockproof and splashproof and is secured in its case with rapid takedown clamps in order to make access very simple

1 4 THE CARRYING STRAP

The carrying strap is made of plastic and is adjustable from 30 to 60 inches in length

1 5 THE HEADSET (Optional)

The Model 3020 Headset consists of a single piece magnetic headphone attached through a cable to a connector that mates to the jack mounted on the panel A plastic dust cover is provided to cover the jack when the headphone is not in use

1 6 CHECK SOURCE (Optional)

The Model 3001 Check Source is a generally licensed source of less than 5 μcuries of Cs 137 No specific NRC or state license is required by the user

2 SPECIFICATIONS

2 1 RADIATION DETECTED

Model 3700 with permanently attached Model 3073 Side Window Probe–beta gamma

Model 3007 Optional Probes

3011	End Window Probe–alpha beta gamma
3012	Side Window Probe–beta gamma
3053	Long Handle Shielded Pancake Contamination Probe–alpha beta
3054	Long Handle Shielded Pancake Contamination Probe–alpha beta
3055	Pancake Contamination Probe–alpha beta
3056	Shielded Pancake Contamination Probe–alpha beta

requires 3018 or 3018 12 Connector Cable

2 2 OPERATING CHARACTERISTICS

Accuracy	±20 /
Reproducibility	±10 /
Energy Dependence	
Linearity	±20%
Exposure Rate Limit	1 R/h
Warm up time	none
Response time	2 sec time constant
Environmental Effects	
Temperature Range	10 C o 50 (14 F to 122 F)
Temperature Dependence	±10 / throughout operating range
Relative Humidity Range	20 to 95 / (non condensing)

2 3 PHYSICAL CHARACTERISTICS

Readout	
Visual	2 62 round meter
Audio (optional)	clicking type headset
Controls	4 position selector switch
(i e OFF X1 X10 X100)	battery check switch
Power	2 D cells (1 5 volt)
Connectors	microphone connection for Model 3020 headset
Mechanical	
Case	ruggedized aluminum body & cover
Finish	polyurethane enamel

Dimensions	Millimeters	Inches
Width	111	4 38
Length	222	8 75
Height	108	4 25
Weight	Grams	Pounds
	1589	3 5
Accessories Included		carrying strap
Accessories Optional		Model 3001 Source (5 µCi Cs 137) Model 3020 Headset

3 THE THEORY OF OPERATION

3 1 INTRODUCTION

These instruments each have a halogen quenched Geiger tube a regulated power supply a transistorized pulse shaping and metering network an indicating meter an audio pulse amplifier and an optional headphone for audible monitoring of radioactivity

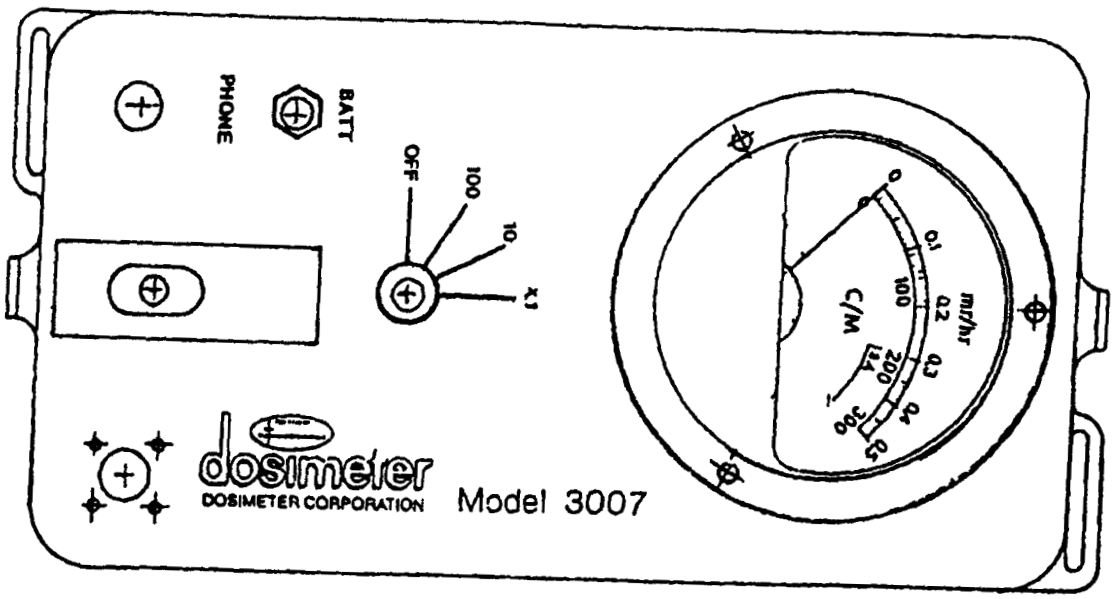
3 2 THE GEIGER TUBE

1 The Model 1 5114 900 Geiger Mueller tube consists of a thin cylindrical shell which is the cathode a fine wire anode suspended along the longitudinal axis of the shell and an inert gas into which a small amount of halogen gas is inserted to act as a quenching agent A voltage slightly less than that required to produce a discharge is applied between the anode and cathode When a beta particle of sufficient energy impinges upon the tube some of the particle s kinetic energy is used to ionize a gas molecule The electrons resulting from this ionization are accelerated toward the anode by the electric field and in movement toward the anode cause additional ions to be formed Similarly gamma rays impinging upon the cathode wall cause secondary electrons to be ejected which in turn become the ionizing event The creation of additional ions is very rapid thus producing discharge in the gas The small amount of halogen gas in the tube serves to help in quenching the discharge without self consumption and restores the tube to its original condition This discharge results in a pulse in the external circuit The frequency of such pulses is proportional to the intensity of the radiation field

2 Model 3007— A selection of interchangeable probes is available (See 2 1 for complete list and description) With the Model 3012 Probe the Model 3007 is equivalent to the Model 3700 With the Model 3053 to 3056 Probes the Model 3007 can be used for low level contamination measurement

3 3 SCALE RANGES

Th ee operating ranges (x1 x10 x100) are provided These correspond respectively to 0 5 5 and 50 mR/h equivalent radiation for the 3700 The 3007 has both mR/h and CPM scales



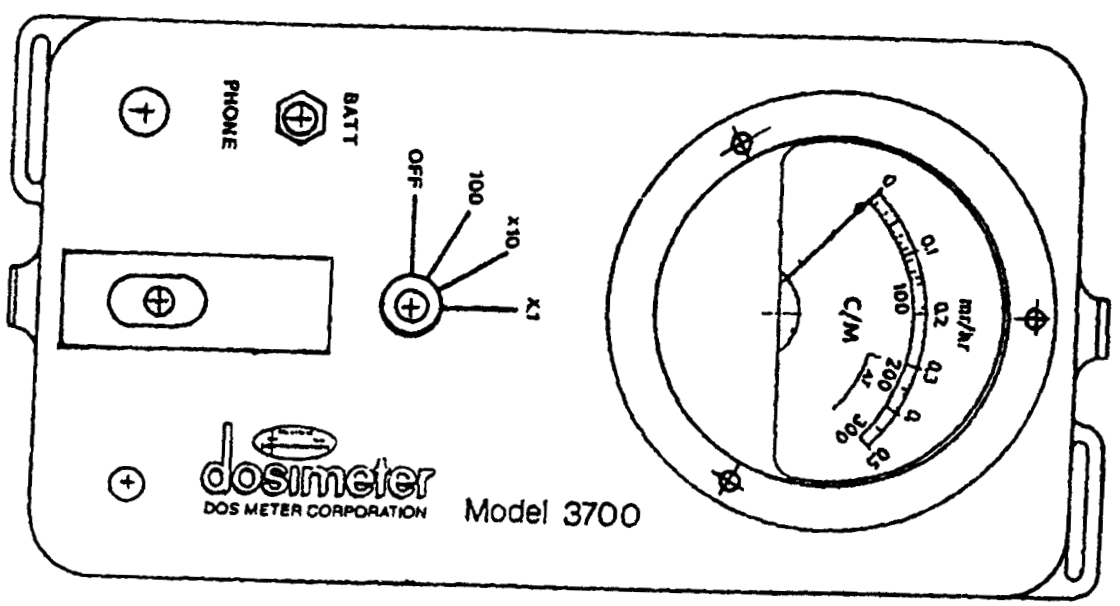


Fig 2 Front Panels

ATTACHMENT G

Chain of Custody Documentation

[redacted] ENVI [redacted] MEN [redacted] PRO [redacted] ION [redacted] NC [redacted]
Environmental Services Division

CHAIN OF CUSTODY RECORD

[redacted] TH'S [redacted] r
DENVER CO 80202 2413

PROJ NO. 10218-082
PROJECT NAME ENVIRO CHECK
~~(-7-3N-2)~~ VA [redacted] VA

SAMPLERS (Signature)
Tracy Sy[redacted]

STAT NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	Soil Core						REMARKS
0	5/1/91	1110	✓	✓	1 6	1	✓						20 c/m
|	|	1415	✓	✓	2	1	✓						10 c/m
|	|	1420	✓	✓	2 1	1	✓						15 c/m
1 C	5/1/91	1250	✓	✓	1 6	1	✓						20 c/m
|	|	1438	✓	✓	1 2	1	✓						20 c/m
|	|	1505	✓	✓	12 13	1	✓						15 c/m
14	5/29/91	1150		✓	2 6	1	✓						< 25 c/m
|	|	1455		✓	6 2	1	✓						< 25 c/m
—	—	—		✓	2 18	+							—
13	5/29/91	1505		✓	1 6	1	✓						< 25 c/m
|	|	1515		✓	1 12	1	✓						< 25/cm
—		—		✓	—	—							—
9 C	5/23/91	1320		✓	1 6	1	✓						30 c/m
|	|	1430		✓	1 12	1	✓						40 c/m
|	|	1440		✓	2 18	1	✓						15 c/m

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
[redacted]	5/28/91 1312				
Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	
		[redacted]	6/3/91 12		

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Special Samples
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62

R-111291

U S ENVIRONMENTAL PROTECTION AGENCY
Environmental Services Division

CHAIN OF CUSTODY RECORD

[redacted] IN [redacted]
999 18TH STREET
DENVER CO 80202 2413

PROJ NO 10218-082
PROJECT NAME ENVIRO CHECK
SAMPLERS (Signature) [redacted]

STAT NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	Soil Core	REMARKS
6C	5/24/11	0825		✓	06	1	✓	25 ch1
1		0825		✓	12	1	✓	28 ch1
1	1	0842		✓	23	1	✓	25 c 1
7H	5/24/11	1020		✓	06	1	✓	15 c/H
1	1	1050		✓	12	1	✓	15 c/H
1	1	1105		✓	23	1	✓	50 c/H
3	12/11	1125		✓	06	1	✓	20 c/H
1	1	1145		✓	12	1	✓	20 c/H
1	1	1155		✓	23	1	✓	15 c/H
7C	1	857		✓	06	1	✓	10 c/H
1		905		✓	12	1	✓	20 c/H
1	1	1314		✓	20	1	✓	15/CH
8H	5/24/11	310		✓	06	1	✓	25 c/H
1	1	314		✓	12	1	✓	20 c/H
1	1	1400		✓	18	1	✓	25 c/H

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
[redacted]	6/28/11 1312				
Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	
		[redacted]	6/1/11 1113		

Distribution Original Accompanies Shipment Copy Coordinator Field Files Second Copy Representative Inspected Facility

Special Samples
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63

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R-10090

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Environmental Services Division

CHAIN OF CUSTODY RECORD

[redacted] REGION VI [redacted] DE[redacted] LA[redacted]
999 18TH STREET
DENVER CO 80202 2413

PROJ NO 10218-Q82 | PROJECT NAME ENVIRO CHECK

SAMPLERS (Signature)

STAT NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	Soil Core	REMARKS
2	12/6/91	1125		✓	2-6	1	✓	2
		1129		✓	6 2	1	✓	15 ml
		1145		✓	2 12	1	✓	25 c'ml
E	12/91	1200		✓	6 6	1	✓	2 c'ml
		1123		✓	6 2	1	✓	11 c'ml
		1110		✓	2 2	1	✓	100 c l
5	12/91	1903		✓	0 6	1	✓	70 c ml
		1925		✓	6 2	1	✓	5c l
		1935		✓	2 8	1	✓	15 c ml
1	12/91	1207		✓	0 6	1	✓	25 c l
		1211		✓	6 12	1	✓	1c c l
		1315		✓	12 18	1	✓	1c c l
1 2	12/6/91	1500		✓	0-6	1	✓	5 ml
		506		✓	6 12	1	✓	100 l
		510		✓	12 18	1	✓	15 c ml

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
	12/6/91 1512				
Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	

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8-10299

U S ENVIRONMENTAL PROTECTION AGENCY
Environmental Services Division

CHAIN OF CUSTODY RECORD

999 18TH STREET
DENVER CO 80202 2413

PROJ NO 10218-082 VA | PROJECT NAME ENVIRO CHECK VA

SAMPLERS (Signature)

STAT NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	Soil Core						REMARKS
11	5/24/91	1047		✓	0 6	1	✓						20 c/m
		1050		✓	1 2	1	✓						25 c/m
		1055		✓	2 15	1	✓						30 c/m
4C	5/24/91	1618		✓	0 6	1	✓						25 c/m
		1626		✓	1 12	1	✓						15 c/m
		1633		✓	2 18	1	✓						45 c/m
5H	5/24/91	1150		✓	0 6	1	✓						15 c/m
		1154		✓	1 2	1	✓						25 c/m
		1205		✓	2 8	1	✓						50 c/m
6	5/24/91	1215		✓	0 6	1	✓						15 c/m
		1217		✓	2	1	✓						25 c/m
		1555		✓	2 18	1	✓						15 c/m
SC	5/22/91	1815		✓✓	0 6	1	✓						35 c/m
		1900		✓✓	6 12	1	✓						70 c/m
		1915		✓	12 18	1	✓						25 c/m

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
[signature]	06/02/91 1317				
Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	
		[signature]	6/3/91 16		

65

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R-10228

U S ENVIRONMENTAL PROTECTION AGENCY
Environmental Services Division

CHAIN OF CUSTODY RECORD

999 18TH ST T
DENVER CO 80202 2413

PROJ NO 10218-Q82
PROJECT NAME ENVIRO CHECK
SAMPLERS (Signature) Tracey Fix

STAT NO	DATE	TIME	COMP	GRAB	STATION LOCATION	NO OF CONTAINERS	Soil Code	REMARKS
2C	5/22/91	1102		✓	2 6	1	✓	45 c/m
1	1	1500		✓	2	1	✓	0 c/m
1	1	1507		✓	2 1C	1	✓	0 c/m
1	5/23/91	1008		✓	1 6	1	✓	25 c/m
1	1	1011		✓	6 2	1	✓	10 c/m
1	1	020		✓	2 5	1	✓	25 c/m
2	5/23/91	1654		✓	C C	1	✓	10 c/m
1	1	1705		✓	6 2	1	✓	5 c/m
1	1	1710		✓	2 18	1	✓	15 c/m
2C	5/22/91	1520		✓	2 6	1	✓	30 c/m
1	1	1525		✓	1 2	1	✓	35 c/m
1	1	553		✓	12 15	1	✓	25 c/m
1	5/25/91	556		✓	C 6	1	✓	10 c/m
		1558		✓	12 12	1	✓	20 c/m
1	1	1102		✓	2 18	1	✓	5 c/m

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
	06 05/24/91 1012				
Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	
			6-3-91 1 13		

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Split Samples
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RB EPA-014B

R-10287

U S ENVIRONMENTAL PROTECTION AGENCY
Environmental Services Division

CHAIN OF CUSTODY RECORD

[redacted] ON [redacted] NE [redacted] H [redacted]
999 18TH STREET
DENVER CO 80202 2413

PROJ NO 10218-082
PROJECT NAME ENVIRO CHECK
SAMPLERS (Signature)

STAT NO	DATE	TIME	COMP	GRAB	STATION LOCATION (Depth)	NO OF CONTAINERS	SOIL						REMARKS
1,1	1 11	1500		✓	0-6	1	✓						15 c/11
		1501		✓	6 12	1	✓						25 c/1
1	1	1505		✓	12 15	1	✓						25 c/1
2	1 11 1	1525		✓	0 6	1	✓						25 c/11
1	1	1525		✓	6 12	1	✓						20 c/11
1	1	1530		✓	12 15	1	✓						25 c/11
C	1 1	1550		✓	0 6	1	✓						15 c/11
		1600		✓	6 12	1	✓						20 c/11
1	1	1615		✓	12 18	1	✓						0 c/11
2 1	1 11 91	0903		✓	0 6	1	✓						25 c/11
1	1	0907		✓	6 12	1	✓						20 c/11
1	1	0910		✓	12 18	1	✓						25 c/11
2 3	1 11	0915		✓	0 6	1	✓						25 c/11
1	1	0915		✓	6 12	1	✓						5 c/11
1	1	0920		✓	12 15	1	✓						20 c/11

Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
[signature]	06/03/91 1512				
Relinquished by (Signature)	Date/Time	Received by (Signature)	Relinquished by (Signature)	Date/Time	Received by (Signature)
Relinquished by (Signature)	Date/Time	Received for Laboratory by (Signature)	Date/Time	Remarks	
		[signature]	1517		

Distribution: Original Accompanies Shipment; Copy Coordinator Field Files; Second Copy Representative Inspected Facility

Special Samples
☐ Accepted ☐ Declined
Sign

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R8 EPA 014B

B-10296

ATTACHMENT H

AccuLabs Sample Analysis List

City of Broomfield

NUMBER SIX GARDEN OFFICE CENTER P O BOX 1415 BROOMFIELD CO 80038 1415 (303) 469 3301

REC'D DEC 5 1991

December 3 1991

Bud Summers
Radiochemistry Division
Accu-Labs Research Inc
4663 Table Mesa Drive
Golden, Colorado 80403-1650

RE Great Western Reservoir Core Samples

Dear Bud

The attached City of Broomfield P O #18080 authorizes the analysis of Great Western Reservoir sediment samples Please begin the first phase of the sediment analysis according to these instructions The following six inch cores should be sectioned in to one inch samples (6 samples per core)

Location	Core Depth (inches)	Number of 1" Samples
1-A	0-6	6
1-C	0-6 6-12 12-18	18
2-C	0-6 6-12, 12-18	18
3-A	0-6 6-12 12-18	18
3-C	0-6 6-12 12-18	18
4-A	0-6	6
4-C	0-6 6-12 12-18	18
5-A	0-6, 6-12 12-18	18
5-E	0-6 6-12 12-18	18
5-F	0-6, 6-12, 12-18	18
6-A	0-6 6-12, 12-18	18
6-C	0-6 6-12 12-18	18
7-A	0-6, 6-12, 12-18	18
8-C	0-6 6-12, 12-18	18
9-A	0-6	6
9-C	0-6, 6-12, 12-18	18
Total 6 cores	42	Total samples 252

Please retain the remaining 48 cores until further notice The City will review the phase one data before making a decision on the need for additional analysis

Thank you for your patience If you have any questions please call me at 466-2302

Sincerely

Kathy Schnoor

Kathy Schnoor
Chemist/Environmental Specialist

69/69

NDIANA STREET

WAI NUT CREEK

GREAT WESTERN RESERVOIR

112TH AVENUE

LEGEND

CITY OF BROOMFIELD
GREAT WESTERN RESERVOIR REPLACEMENT PROJECT
SEDIMENT SAMPLING PROGRAM

NO.	DESCRIPTION	DATE	BY
	LEGEND DOSIMETE COUNTS	/SN	LSS

ROCKY MOUNTAIN CONSULTANTS
8301 EAST PRENTICE AVENUE SUITE 101
ENGLEWOOD COLORADO 80111
(303) 741 6000

JOB NO 0534.071.06

FIGURE 1