

ENVIRONMENTAL SAMPLE DATA

3rd Quarter 1993

PETROTOMICS COMPANY  
Shirley Basin, WY

9403140107 940224  
PDR ADDCK 04006659  
B PDR

1. STACK SAMPLES

No discharge stacks present - Deleted by Amendment No. 21

2. AIR SAMPLES

LOCATIONS: Site 1 - 7800' WNW of where yellowcake dryer stack had been located.  
 Rn-222 only - Amendment No. 21.  
 Site 2 - Discontinued - Amendment No. 21.  
 Site 3 - Discontinued - Amendment No. 21.  
 Site 4 - Discontinued - Amendment No. 21.  
 Site 5 - 2000' NE of where yellowcake dryer stack had been located.  
 Site 6 - Discontinued - Amendment No. 21.

DATE COLLECTED: 3rd Quarter 1993  
 LOCATION: Site 1

<u>RADIONUCLIDE</u>	<u>CONCENTRATION</u> (uCi/ml)	<u>ERROR ESTIMATE</u> (uCi/ml)	<u>LLD</u> (uCi/ml)	<u>%MPC</u>
Rn-222	3.30 X 10 <sup>-9</sup>	± 0.20 X 10 <sup>-9</sup>	0.2 X 10 <sup>-9</sup>	110.0

DATE COLLECTED: 3rd Quarter 1993  
 LOCATION: Site 5

<u>RADIONUCLIDE</u>	<u>CONCENTRATION</u> (uCi/ml)	<u>ERROR ESTIMATE</u> (uCi/ml)	<u>LLD</u> (uCi/ml)	<u>%MPC</u>
U-nat	* X 10 <sup>-15</sup>		X 10 <sup>-16</sup>	
Th-230	* X 10 <sup>-15</sup>	± X 10 <sup>-15</sup>	X 10 <sup>-16</sup>	
Ra-226	* X 10 <sup>-15</sup>	± X 10 <sup>-15</sup>	X 10 <sup>-17</sup>	
Pb-210	* X 10 <sup>-15</sup>	± X 10 <sup>-15</sup>	X 10 <sup>-16</sup>	
Rn-222	4.1 X 10 <sup>-9</sup>	± 0.23 X 10 <sup>-9</sup>	X 10 <sup>-9</sup>	136.7

\* Report to follow.

3. LIQUID SAMPLES

DATE COLLECTED: August 10, 1993  
 LOCATION: Mine Shop Well  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat (Dissolved)	3.38 X 10 <sup>-9</sup>		
U-Nat (Suspended)	10.83 X 10 <sup>-9</sup>		
Th-230 (Dissolved)	0.14 X 10 <sup>-9</sup>	± 0.29 X 10 <sup>-9</sup>	5.0 X 10 <sup>-10</sup>
Th-230 (Suspended)	0.31 X 10 <sup>-9</sup>	± 0.50 X 10 <sup>-9</sup>	0.8 X 10 <sup>-9</sup>
Ra-226 (Dissolved)	0.45 X 10 <sup>-9</sup>	± 0.14 X 10 <sup>-9</sup>	1.0 X 10 <sup>-10</sup>
Ra-226 (Suspended)	0.46 X 10 <sup>-9</sup>	± 0.21 X 10 <sup>-9</sup>	3.0 X 10 <sup>-10</sup>
Ra-228 (Dissolved)	7.46 X 10 <sup>-9</sup>	± 3.92 X 10 <sup>-9</sup>	3.0 X 10 <sup>-9</sup>
Ra-228 (Suspended)	5.22 X 10 <sup>-9</sup>	± 6.62 X 10 <sup>-9</sup>	0.5 X 10 <sup>-9</sup>
Pb-210 (Dissolved)	0.07 X 10 <sup>-9</sup>	± 1.48 X 10 <sup>-9</sup>	2.0 X 10 <sup>-9</sup>
Pb-210 (Suspended)	1.62 X 10 <sup>-9</sup>	± 2.23 X 10 <sup>-9</sup>	3.0 X 10 <sup>-9</sup>
Po-210 (Dissolved)	0.08 X 10 <sup>-9</sup>	± 0.22 X 10 <sup>-9</sup>	2.0 X 10 <sup>-9</sup>
Po-210 (Suspended)	0.15 X 10 <sup>-9</sup>	± 0.15 X 10 <sup>-9</sup>	3.0 X 10 <sup>-9</sup>

\* Samples not run.





**WESTERN  
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6756 West Uranium Road  
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307/234-5511

76 Imperial Drive, Unit I  
Evanston, Wyoming 82930  
307/789-6420

Lab # : 93-5027-1

Client: The Petrotoomics Company  
Address: Box 8509, Shirley Basin, WY 82615  
Attention: Steve Pfaff

Mine Shop Well  
Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

	mg/L
pH, Units	9.06
Total Diss. Solids (TDS)	382
Chloride (Cl)	4.6
Sulfate (SO4)	124
Nitrate (as N)	0.29
Arsenic (As)	<0.001
Selenium (Se)	<0.001
Barium (Ba)	<0.05
Cadmium (Cd)	<0.01
Chromium (Cr)	<0.01
Lead (Pb)	<0.05
Nickel (Ni)	<0.03
Conductivity @25C, umh/cm	636

	DISSOLVED		SUSPENDED	
	pCi/L	LLD uCi/ml	pCi/L	LLD uCi/ml
Radium 226	0.45 ± 0.14	1x10E-10	0.46 ± 0.21	3x10E-10
Radium 228	7.46 ± 3.92	3x10E-9	5.22 ± 6.62	5x10E-9
Thorium 230	0.14 ± 0.29	5x10E-10	0.31 ± 0.50	8x10E-10
Lead 210	=		=	
Polonium 210	0.08 ± 0.22	2x10E-9	0.15 ± 0.15	3x10E-9
	mg/L		mg/L	
Uranium (U)	0.005		0.016	

Suspended parameters were run on an unfiltered sample

Date Submitted: 08-10-93  
Analyzed By: GLH, KAH, KB  
Date Analyzed:

*Niels L. Rasmussen*  
\_\_\_\_\_  
Laboratory Supervisor

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3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 1-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	20.31 X 10 <sup>-9</sup>		
Th-230	0.29 X 10 <sup>-9</sup>	± 0.21 X 10 <sup>-9</sup>	3 X 10 <sup>-10</sup>
Ra-226	3.27 X 10 <sup>-9</sup>	± 0.36 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	2.45 X 10 <sup>-9</sup>	± 4.37 X 10 <sup>-9</sup>	5 X 10 <sup>-9</sup>
Pb-210	0.98 X 10 <sup>-9</sup>	± 1.79 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.01 X 10 <sup>-9</sup>	± 0.26 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 3-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	588.99 X 10 <sup>-9</sup>		
Th-230	0.16 X 10 <sup>-9</sup>	± 0.23 X 10 <sup>-9</sup>	3 X 10 <sup>-10</sup>
Ra-226	1.31 X 10 <sup>-9</sup>	± 0.24 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	10.8 X 10 <sup>-9</sup>	± 5.83 X 10 <sup>-9</sup>	5 X 10 <sup>-9</sup>
Pb-210	2.02 X 10 <sup>-9</sup>	± 1.93 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.10 X 10 <sup>-9</sup>	± 0.24 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>



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307/789-6420

Lab #: 93-5023-1

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

1 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	2297
pH, units	4.15
Total Dissolved Solids, mg/l	2449
Chloride (Cl), mg/l	117
Sulfate (SO4), mg/l	1360
Nitrate (NO3 as N), mg/l	1.02
Arsenic (As), mg/l	0.001
Barium (Ba), mg/l	0.08
Cadmium (Cd), mg/l	0.01
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.11
Selenium (Se), mg/l	0.009
Uranium (U), mg/l	0.030

		LLD uCi/ml
Radium 226, pCi/l	3.27 + 0.36	2x10E-10
Radium 228, pCi/l	2.45 + 4.37	5x10E-9
Thorium 230, pCi/l	0.29 + 0.21	3x10E-10
Lead 210, pCi/l	0.98 + 1.79	2x10E-9
Polonium 210, pCi/l	0.01 + 0.26	1x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

*Nils L. Rasmussen*

Laboratory Supervisor

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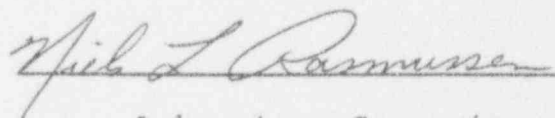
3 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	6479
pH, units	6.16
Total Dissolved Solids, mg/l	8608
Chloride (Cl), mg/l	401
Sulfate (SO4), mg/l	3440
Nitrate (NO3 as N), mg/l	6.1
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.47
Cadmium (Cd), mg/l	0.06
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.85
Selenium (Se), mg/l	0.078
Uranium (U), mg/l	0.870

		LLD uCi/ml
Radium 226, pCi/l	1.31 + 0.24	2x10E-10
Radium 228, pCi/l	10.8 + 5.83	5x10E-9
Thorium 230, pCi/l	0.16 + 0.23	3x10E-10
Lead 210, pCi/l	2.02 + 1.93	2x10E-9
Polonium 210, pCi/l	0.10 + 0.24	2x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 4-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

<u>RADIONUCLIDE</u>	<u>CONCENTRATION</u> <u>(uCi/ml)</u>	<u>ERROR ESTIMATE</u> <u>(uCi/ml)</u>	<u>LLD</u> <u>(uCi/ml)</u>
U-nat	180.76 X 10 <sup>-9</sup>		
Th-230	0.29 X 10 <sup>-9</sup>	± 0.22 X 10 <sup>-9</sup>	3 X 10 <sup>-10</sup>
Ra-226	7.14 X 10 <sup>-9</sup>	± 0.51 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	14.5 X 10 <sup>-9</sup>	± 6.6 X 10 <sup>-9</sup>	5 X 10 <sup>-9</sup>
Pb-210	2.37 X 10 <sup>-9</sup>	± 1.68 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.47 X 10 <sup>-9</sup>	± 0.35 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 5-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

<u>RADIONUCLIDE</u>	<u>CONCENTRATION</u> <u>(uCi/ml)</u>	<u>ERROR ESTIMATE</u> <u>(uCi/ml)</u>	<u>LLD</u> <u>(uCi/ml)</u>
U-nat	7243.90 X 10 <sup>-9</sup>		
Th-230	783. X 10 <sup>-9</sup>	± 29. X 10 <sup>-9</sup>	30 X 10 <sup>-10</sup>
Ra-226	1.44 X 10 <sup>-9</sup>	± 0.22 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	1.45 X 10 <sup>-9</sup>	± 6.63 X 10 <sup>-9</sup>	5 X 10 <sup>-9</sup>
Pb-210	0.61 X 10 <sup>-9</sup>	± 3.16 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	± 0.30 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>



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Lab #: 93-5023-4

Petrotoomics Company  
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Attention: Steve Pfaff

4 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	4653
pH, units	4.63
Total Dissolved Solids, mg/l	5544
Chloride (Cl), mg/l	463
Sulfate (SO4), mg/l	2920
Nitrate (NO3 as N), mg/l	19.9
Arsenic (As), mg/l	0.001
Barium (Ba), mg/l	0.40
Cadmium (Cd), mg/l	0.02
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.42
Selenium (Se), mg/l	0.009
Uranium (U), mg/l	0.267

		LLD uCi/ml
Radium 226, pCi/l	7.14 + 0.51	2x10E-10
Radium 228, pCi/l	14.5 + 6.6	5x10E-9
Thorium 230, pCi/l	0.29 + 0.22	3x10E-10
Lead 210, pCi/l	2.37 + 1.68	2x10E-9
Polonium 210, pCi/l	0.47 + 0.35	1x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

*Niel L Rasmussen*

Laboratory Supervisor



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307/789-6420

Lab #: 93-5023-5

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

5 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	9895
pH, units	3.44
Total Dissolved Solids, mg/l	20192
Chloride (Cl), mg/l	252
Sulfate (SO4), mg/l	12960
Nitrate (NO3 as N), mg/l	0.47
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.15
Cadmium (Cd), mg/l	0.08
Chromium (Cr), mg/l	1.10
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	2.77
Selenium (Se), mg/l	0.019
Uranium (U), mg/l	10.7

		LLD uCi/ml
Radium 226, pCi/l	1.44 + 0.22	1x10E-10
Radium 228, pCi/l	1.45 + 6.63	5x10E-9
Thorium 230, pCi/l	783 + 29	3x10E-9
Lead 210, pCi/l	0.61 + 3.1	3x10E-9
Polonium 210, pCi/l	0.00 + 0.30	1x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

Laboratory Supervisor



3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 39-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	15.57 X 10 <sup>-9</sup>		
Th-230	0.24 X 10 <sup>-9</sup>	+ 0.23 X 10 <sup>-9</sup>	3 X 10 <sup>-10</sup>
Ra-226	2.46 X 10 <sup>-9</sup>	+ 0.28 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	0.00 X 10 <sup>-9</sup>	+ 3.33 X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Pb-210	3.02 X 10 <sup>-9</sup>	+ 2.12 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	+ 0.40 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 40-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	1.35 X 10 <sup>-9</sup>		
Th-230	0.09 X 10 <sup>-9</sup>	+ 0.24 X 10 <sup>-9</sup>	4 X 10 <sup>-10</sup>
Ra-226	0.42 X 10 <sup>-9</sup>	+ 0.12 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	3.69 X 10 <sup>-9</sup>	+ 3.95 X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Pb-210	0.05 X 10 <sup>-9</sup>	+ 1.71 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.21 X 10 <sup>-9</sup>	+ 0.44 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>





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Lab #: 93-5023-6

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307/789-6420

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff


39 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	1849
pH, units	4.71
Total Dissolved Solids, mg/l	1871
Chloride (Cl), mg/l	41.2
Sulfate (SO4), mg/l	1180
Nitrate (NO3 as N), mg/l	1.1
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	0.01
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.17
Selenium (Se), mg/l	0.005
Uranium (U), mg/l	0.023

		LLD uCi/ml
Radium 226, pCi/l	2.46 + 0.28	1x10E-10
Radium 228, pCi/l	0.00 + 3.33	4x10E-9
Thorium 230, pCi/l	0.24 + 0.23	3x10E-10
Lead 210, pCi/l	3.02 + 2.12	2x10E-9
Polonium 210, pCi/l	0.00 + 0.40	1x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor



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Lab #: 93-5023-7

Petrotomics Company  
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Attention: Steve Pfaff

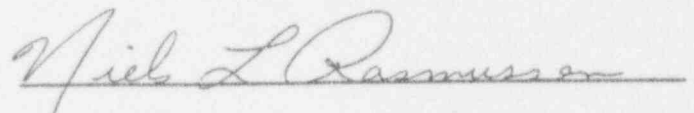
40 3C  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	2003
pH, units	6.84
Total Dissolved Solids, mg/l	1947
Chloride (Cl), mg/l	144
Sulfate (SO4), mg/l	1020
Nitrate (NO3 as N), mg/l	1.4
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.20
Cadmium (Cd), mg/l	<0.01
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.02
Selenium (Se), mg/l	0.017
Uranium (U), mg/l	0.002

		LLD uCi/ml
Radium 226, pCi/l	0.42 + 0.12	1x10E-10
Radium 228, pCi/l	3.69 + 3.95	4x10E-9
Thorium 230, pCi/l	0.09 + 0.24	4x10E-10
Lead 210, pCi/l	0.05 + 1.71	2x10E-9
Polonium 210, pCi/l	0.21 + 0.44	2x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor

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3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 41-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	18.28 X 10 <sup>-9</sup>		
Th-230	0.25 X 10 <sup>-9</sup>	+ 0.25 X 10 <sup>-9</sup>	4 X 10 <sup>-10</sup>
Ra-226	0.60 X 10 <sup>-9</sup>	+ 0.15 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	0.56 X 10 <sup>-9</sup>	+ 4.24 X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Pb-210	1.38 X 10 <sup>-9</sup>	+ 1.67 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.02 X 10 <sup>-9</sup>	+ 0.16 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 42-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	3594.87 X 10 <sup>-9</sup>		
Th-230	1128.00 X 10 <sup>-9</sup>	+ 34.00 X 10 <sup>-9</sup>	40 X 10 <sup>-10</sup>
Ra-226	4.24 X 10 <sup>-9</sup>	+ 0.38 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	7.62 X 10 <sup>-9</sup>	+ 5.09 X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Pb-210	2.51 X 10 <sup>-9</sup>	+ 2.47 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	+ 0.24 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>



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Evanston, Wyoming 82930  
307/789-6420

Lab #: 93-5023-8

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Attention: Steve Pfaff

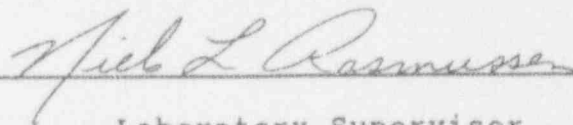
41 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	2827
pH, units	6.85
Total Dissolved Solids, mg/l	3018
Chloride (Cl), mg/l	345
Sulfate (SO4), mg/l	1200
Nitrate (NO3 as N), mg/l	3.5
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.20
Cadmium (Cd), mg/l	0.01
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.03
Selenium (Se), mg/l	0.078
Uranium (U), mg/l	0.027

		LLD uCi/ml
Radium 226, pCi/l	0.60 + 0.15	1x10E-10
Radium 228, pCi/l	0.56 + 4.24	4x10E-9
Thorium 230, pCi/l	0.25 + 0.25	4x10E-10
Lead 210, pCi/l	1.38 + 1.67	2x10E-9
Polonium 210, pCi/l	0.02 + 0.16	1x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor



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76 Imperial Drive, Unit I  
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307/789-6420

Lab #: 93-5023-9

Petrotomics Company  
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Attention: Steve Pfaff

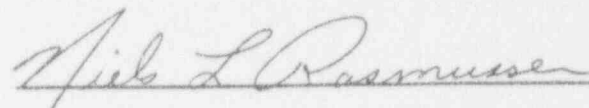
42 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	3652
pH, units	4.05
Total Dissolved Solids, mg/l	4682
Chloride (Cl), mg/l	75.2
Sulfate (SO4), mg/l	3000
Nitrate (NO3 as N), mg/l	0.79
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.16
Cadmium (Cd), mg/l	0.03
Chromium (Cr), mg/l	0.11
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.55
Selenium (Se), mg/l	0.003
Uranium (U), mg/l	5.31

		LLD uCi/ml
Radium 226, pCi/l	4.24 + 0.38	1x10E-10
Radium 228, pCi/l	7.63 + 5.09	4x10E-9
Thorium 230, pCi/l	1128 + 34	4x10E-9
Lead 210, pCi/l	2.51 + 2.47	3x10E-9
Polonium 210, pCi/l	0.00 + 0.24	2x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 43-SC  
 TYPE OF SAMPLE: Groundwater - dry well

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	QNS X 10 <sup>-9</sup>		
Th-230	QNS X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-8</sup>
Ra-226	QNS X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-228	QNS X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Pb-210	QNS X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Po-210	QNS X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 44-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	4150.01 X 10 <sup>-9</sup>		
Th-230	1758.00 X 10 <sup>-9</sup>	± 43.0 X 10 <sup>-9</sup>	40 X 10 <sup>-10</sup>
Ra-226	0.87 X 10 <sup>-9</sup>	± 0.20 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	1.68 X 10 <sup>-9</sup>	± 5.38 X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Pb-210	0.96 X 10 <sup>-9</sup>	± 3.11 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.41 X 10 <sup>-9</sup>	± 0.50 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>



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Lab #: 93-5023-10

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Attention: Steve Pfaff

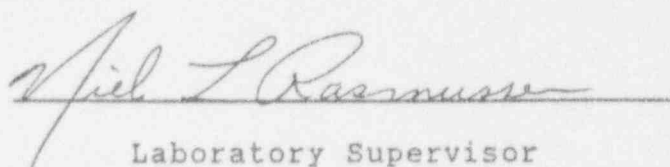
44 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	10602
pH, units	2.91
Total Dissolved Solids, mg/l	19545
Chloride (Cl), mg/l	309
Sulfate (SO4), mg/l	12960
Nitrate (NO3 as N), mg/l	0.85
Arsenic (As), mg/l	0.001
Barium (Ba), mg/l	0.09
Cadmium (Cd), mg/l	0.08
Chromium (Cr), mg/l	0.83
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	2.97
Selenium (Se), mg/l	0.041
Uranium (U), mg/l	6.13

		LLD uCi/ml
Radium 226, pCi/l	0.87 + 0.20	2x10E-10
Radium 228, pCi/l	1.68 + 5.38	4x10E-9
Thorium 230, pCi/l	1758 + 43	4x10E-9
Lead 210, pCi/l	0.96 + 3.11	3x10E-9
Polonium 210, pCi/l	0.41 + 0.50	1x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor



3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 45-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	1909.14 X 10 <sup>-9</sup>		
Th-230	676.00 X 10 <sup>-9</sup>	±22.40 X 10 <sup>-9</sup>	20 X 10 <sup>-10</sup>
Ra-226	5.08 X 10 <sup>-9</sup>	± 0.41 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	63.90 X 10 <sup>-9</sup>	± 6.80 X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Pb-210	2.22 X 10 <sup>-9</sup>	± 3.29 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.34 X 10 <sup>-9</sup>	± 0.48 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 49-SC  
 TYPE OF SAMPLE: Groundwater - Unable to obtain sample (Dry).

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	X 10 <sup>-9</sup>		
Th-230	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-226	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-228	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Pb-210	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Po-210	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>





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Lab #: 93-5023-11

Petrotomics Company  
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Attention: Steve Pfaff

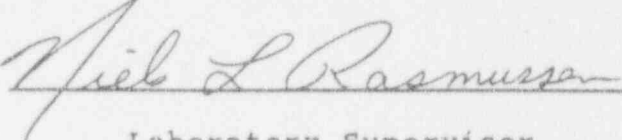
45 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	12486
pH, units	3.68
Total Dissolved Solids, mg/l	30371
Chloride (Cl), mg/l	345
Sulfate (SO4), mg/l	20200
Nitrate (NO3 as N), mg/l	0.34
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.10
Cadmium (Cd), mg/l	0.08
Chromium (Cr), mg/l	1.31
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	4.66
Selenium (Se), mg/l	0.002
Uranium (U), mg/l	2.82

		LLD uCi/ml
Radium 226, pCi/l	5.08 + 0.41	2x10E-10
Radium 228, pCi/l	63.9 + 6.8	4x10E-9
Thorium 230, pCi/l	676 + 22.4	2x10E-9
Lead 210, pCi/l	2.22 + 3.29	3x10E-9
Polonium 210, pCi/l	0.34 + 0.48	2x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 51-SC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	14.89 X 10 <sup>-9</sup>		
Th-230	13.60 X 10 <sup>-9</sup>	± 2.60 X 10 <sup>-9</sup>	20 X 10 <sup>-10</sup>
Ra-226	0.93 X 10 <sup>-9</sup>	± 0.20 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	7.51 X 10 <sup>-9</sup>	± 3.05 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	2.95 X 10 <sup>-9</sup>	± 3.06 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.05 X 10 <sup>-9</sup>	± 0.16 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 52-SC  
 TYPE OF SAMPLE: Groundwater - Dry

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	X 10 <sup>-9</sup>		
Th-230	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-226	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-228	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Pb-210	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Po-210	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>



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307/789-6420

Lab #: 93-5023-12

Petrotoomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

51 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	11780
pH, units	3.61
Total Dissolved Solids, mg/l	28645
Chloride (Cl), mg/l	338
Sulfate (SO4), mg/l	18200
Nitrate (NO3 as N), mg/l	0.25
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.05
Cadmium (Cd), mg/l	0.05
Chromium (Cr), mg/l	0.12
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	4.24
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.022

		LLD uCi/ml
Radium 226, pCi/l	0.93 + 0.20	2x10E-10
Radium 228, pCi/l	7.51 + 3.05	3x10E-9
Thorium 230, pCi/l	13.6 + 2.6	2x10E-9
Lead 210, pCi/l	2.95 + 3.06	3x10E-9
Polonium 210, pCi/l	0.05 + 0.16	2x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

*Niels L Rasmussen*

Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 53-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	67.02 X 10 <sup>-9</sup>		
Th-230	1.20 X 10 <sup>-9</sup>	± 0.31 X 10 <sup>-9</sup>	3 X 10 <sup>-10</sup>
Ra-226	3.88 X 10 <sup>-9</sup>	± 0.35 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	12.80 X 10 <sup>-9</sup>	± 3.60 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	0.99 X 10 <sup>-9</sup>	± 1.87 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.27 X 10 <sup>-9</sup>	± 0.36 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 54-SC  
 TYPE OF SAMPLE: Groundwater - Bailed.

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	14.89 X 10 <sup>-9</sup>		
Th-230	0.53 X 10 <sup>-9</sup>	± 1.66 X 10 <sup>-9</sup>	30 X 10 <sup>-10</sup>
Ra-226	9.62 X 10 <sup>-9</sup>	± 0.57 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	1.94 X 10 <sup>-9</sup>	± 0.97 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	1.98 X 10 <sup>-9</sup>	± 2.72 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.46 X 10 <sup>-9</sup>	± 0.69 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>



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Lab #: 93-5023-13

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307/789-6420

Petrotomics Company  
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Attention: Steve Pfaff

53 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

**WATER ANALYSIS**

Conductivity @ 25C, umho/cm	3861
pH, units	4.51
Total Dissolved Solids, mg/l	5107
Chloride (Cl), mg/l	78.2
Sulfate (SO4), mg/l	3200
Nitrate (NO3 as N), mg/l	16.5
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.08
Cadmium (Cd), mg/l	0.02
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.43
Selenium (Se), mg/l	0.012
Uranium (U), mg/l	0.099

		LLD uCi/ml
Radium 226, pCi/l	3.88 + 0.35	1x10E-10
Radium 228, pCi/l	12.8 + 3.6	3x10E-9
Thorium 230, pCi/l	1.20 + 0.31	3x10E-10
Lead 210, pCi/l	0.99 + 1.87	2x10E-9
Polonium 210, pCi/l	0.27 + 0.36	1x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

*Niel L Rasmussen*  
Laboratory Supervisor

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Lab #: 93-5026-1

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Attention: Steve Pfaff

54 SC

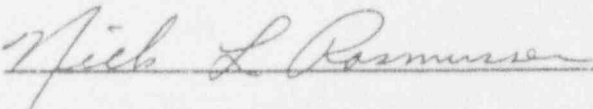
Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	6361
pH, units	4.25
Total Dissolved Solids, mg/l	10302
Chloride (Cl), mg/l	329
Sulfate (SO4), mg/l	6720
Nitrate (NO3 as N), mg/l	0.36
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.34
Cadmium (Cd), mg/l	0.02
Chromium (Cr), mg/l	0.02
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.75
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.022

		LLD uCi/ml
Radium 226, pCi/l	9.62 ± 0.57	1x10E-10
Radium 228, pCi/l	1.94 ± 0.97	1x10E-9
Thorium 230, pCi/l	0.53 ± 1.66	3x10E-9
Lead 210, pCi/l	1.98 ± 2.72	3x10E-9
Polonium 210, pCi/l	0.46 ± 0.69	2x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

  
Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 55-SC  
 TYPE OF SAMPLE: Groundwater - Dry

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	X 10 <sup>-9</sup>		
Th-230	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-226	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-228	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Pb-210	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Po-210	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>

DATE COLLECTED: August 10, 1993  
 LOCATION: 56-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	8.80 X 10 <sup>-9</sup>		
Th-230	8.32 X 10 <sup>-9</sup>	± 3.68 X 10 <sup>-9</sup>	50 X 10 <sup>-10</sup>
Ra-226	3.26 X 10 <sup>-9</sup>	± 0.35 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	5.38 X 10 <sup>-9</sup>	± 1.39 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>
Pb-210	0.97 X 10 <sup>-9</sup>	± 2.51 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	± 0.14 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>



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Lab #: 93-5026-2

Petrotomics Company  
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Attention: Steve Pfaff

56 SC

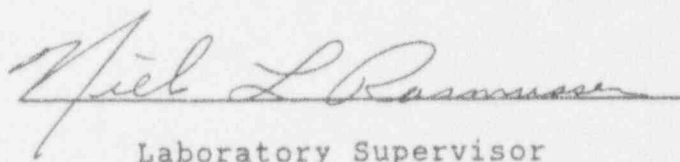
Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	7304
pH, units	3.52
Total Dissolved Solids, mg/l	13896
Chloride (Cl), mg/l	288
Sulfate (SO4), mg/l	8200
Nitrate (NO3 as N), mg/l	0.23
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.10
Cadmium (Cd), mg/l	0.02
Chromium (Cr), mg/l	0.021
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	3.0
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.013

		LLD uCi/ml
Radium 226, pCi/l	3.26 ± 0.35	2x10E-10
Radium 228, pCi/l	5.38 ± 1.39	1x10E-9
Thorium 230, pCi/l	8.32 ± 3.68	5x10E-9
Lead 210, pCi/l	0.97 ± 2.51	3x10E-9
Polonium 210, pCi/l	0.00 ± 0.14	1x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

  
Laboratory Supervisor



3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 57-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	3.38 X 10 <sup>-9</sup>		
Th-230	0.68 X 10 <sup>-9</sup>	± 3.49 X 10 <sup>-9</sup>	60 X 10 <sup>-10</sup>
Ra-226	0.90 X 10 <sup>-9</sup>	± 0.19 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	3.70 X 10 <sup>-9</sup>	± 1.43 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>
Pb-210	1.19 X 10 <sup>-9</sup>	± 1.96 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	± 0.61 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 58-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	24.37 X 10 <sup>-9</sup>		
Th-230	27.30 X 10 <sup>-9</sup>	± 4.0 X 10 <sup>-9</sup>	30 X 10 <sup>-10</sup>
Ra-226	0.66 X 10 <sup>-9</sup>	± 0.16 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	2.12 X 10 <sup>-9</sup>	± 1.48 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>
Pb-210	0.33 X 10 <sup>-9</sup>	± 0.33 X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Po-210	0.23 X 10 <sup>-9</sup>	± 0.59 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>



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307/789-6420

Lab #: 93-5026-3

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

57 SC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	6832
pH, units	3.79
Total Dissolved Solids, mg/l	12176
Chloride (Cl), mg/l	283
Sulfate (SO4), mg/l	6800
Nitrate (NO3 as N), mg/l	0.31
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.19
Cadmium (Cd), mg/l	0.02
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	1.9
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.005

		LLD uCi/ml
Radium 226, pCi/l	0.90 ± 0.19	2x10E-10
Radium 228, pCi/l	3.70 ± 1.43	1x10E-9
Thorium 230, pCi/l	0.68 ± 3.49	6x10E-9
Lead 210, pCi/l	1.19 ± 1.96	2x10E-9
Polonium 210, pCi/l	0.00 ± 0.61	3x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

Laboratory Supervisor



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Lab #: 93-5026-4

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

58 SC

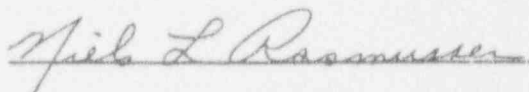
Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	10837
pH, units	2.75
Total Dissolved Solids, mg/l	26053
Chloride (Cl), mg/l	326
Sulfate (SO4), mg/l	17600
Nitrate (NO3 as N), mg/l	0.31
Arsenic (As), mg/l	0.002
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	0.04
Chromium (Cr), mg/l	0.30
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	4.0
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.036

		LLD uCi/ml
Radium 226, pCi/l	0.66 ± 0.16	1x10E-10
Radium 228, pCi/l	2.12 ± 1.48	1x10E-9
Thorium 230, pCi/l	27.3 ± 4.0	3x10E-9
Lead 210, pCi/l	0.33 ± 3.88	4x10E-9
Polonium 210, pCi/l	0.23 ± 0.59	1x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

  
Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 59-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

<u>RADIONUCLIDE</u>	<u>CONCENTRATION</u> (uCi/ml)	<u>ERROR ESTIMATE</u> (uCi/ml)	<u>LLD</u> (uCi/ml)
U-nat	7.45 X 10 <sup>-9</sup>		
Th-230	0.66 X 10 <sup>-9</sup>	± 2.54 X 10 <sup>-9</sup>	40 X 10 <sup>-10</sup>
Ra-226	7.75 X 10 <sup>-9</sup>	± 0.52 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	5.72 X 10 <sup>-9</sup>	± 0.85 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>
Pb-210	1.12 X 10 <sup>-9</sup>	± 3.16 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.04 X 10 <sup>-9</sup>	± 0.11 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 10, 1993  
 LOCATION: 60-SC  
 TYPE OF SAMPLE: Groundwater - Bailed.

<u>RADIONUCLIDE</u>	<u>CONCENTRATION</u> (uCi/ml)	<u>ERROR ESTIMATE</u> (uCi/ml)	<u>LLD</u> (uCi/ml)
U-nat	677.00 X 10 <sup>-9</sup>		
Th-230	0.00 X 10 <sup>-9</sup>	± 16.3 X 10 <sup>-9</sup>	30 X 10 <sup>-9</sup>
Ra-226	2.76 X 10 <sup>-9</sup>	± 0.32 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	10.2 X 10 <sup>-9</sup>	± 2.76 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	1.87 X 10 <sup>-9</sup>	± 2.94 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.26 X 10 <sup>-9</sup>	± 0.47 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>



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307/789-6420

Lab #: 93-5026-5

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

59 SC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	10013
pH, units	3.57
Total Dissolved Solids, mg/l	24743
Chloride (Cl), mg/l	301
Sulfate (SO4), mg/l	17066
Nitrate (NO3 as N), mg/l	0.74
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	0.04
Chromium (Cr), mg/l	5.65
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	6.4
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.011

		LLD uCi/ml
Radium 226, pCi/l	7.75 ± 0.52	1x10E-10
Radium 228, pCi/l	5.72 ± 0.85	1x10E-9
Thorium 230, pCi/l	0.66 ± 2.54	4x10E-9
Lead 210, pCi/l	1.12 ± 3.16	3x10E-9
Polonium 210, pCi/l	0.04 ± 0.11	1x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

*Neil L. Rasmussen*

Laboratory Supervisor



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Lab #: 93-5026-6

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P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

60 SC  
Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	5772
pH, units	3.43
Total Dissolved Solids, mg/l	9715
Chloride (Cl), mg/l	242
Sulfate (SO4), mg/l	6400
Nitrate (NO3 as N), mg/l	0.16
Arsenic (As), mg/l	0.001
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	0.03
Chromium (Cr), mg/l	0.081
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	1.8
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	1.00

		LLD uCi/ml
Radium 226, pCi/l	2.76 ± 0.32	2x10E-10
Radium 228, pCi/l	10.2 ± 2.76	3x10E-9
Thorium 230, pCi/l	0.00 ± 16.3	3x10E-8
Lead 210, pCi/l	1.87 ± 2.94	3x10E-9
Polonium 210, pCi/l	0.26 ± 0.47	1x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

*Yick L. Rasmussen*

Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 61-SC  
 TYPE OF SAMPLE: Groundwater - Not sampled

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	X 10 <sup>-9</sup>		
Th-230	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-226	X 10 <sup>-9</sup>	±	X 10 <sup>-10</sup>
Ra-228	X 10 <sup>-9</sup>	±	X 10 <sup>-9</sup>
Pb-210	X 10 <sup>-9</sup>	±	X 10 <sup>-9</sup>
Po-210	X 10 <sup>-9</sup>	±	X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 62-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	423.12 X 10 <sup>-9</sup>		
Th-230	210. X 10 <sup>-9</sup>	± 7. X 10 <sup>-9</sup>	20 X 10 <sup>-10</sup>
Ra-226	4.15 X 10 <sup>-9</sup>	± 0.35 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	32.3 X 10 <sup>-9</sup>	± 4.8 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	1.14 X 10 <sup>-9</sup>	± 2.94 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	± 0.24 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>





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Lab #: 93-5023-14

Petrotomics Company  
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Attention: Steve Pfaff

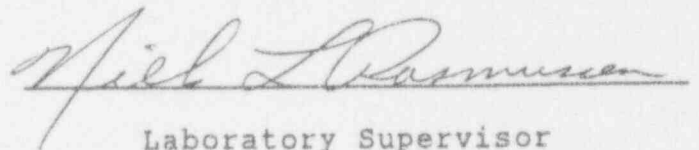
62 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	11309
pH, units	3.72
Total Dissolved Solids, mg/l	27469
Chloride (Cl), mg/l	327
Sulfate (SO4), mg/l	16000
Nitrate (NO3 as N), mg/l	0.56
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	0.05
Chromium (Cr), mg/l	0.91
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	3.93
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.625

		LLD uCi/ml
Radium 226, pCi/l	4.15 + 0.35	1x10E-10
Radium 228, pCi/l	32.3 + 4.8	3x10E-9
Thorium 230, pCi/l	210 + 7	2x10E-9
Lead 210, pCi/l	1.14 + 2.94	3x10E-9
Polonium 210, pCi/l	0.00 + 0.24	2x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor



3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 9, 1993  
 LOCATION: 63-SC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	1882.06 X 10 <sup>-9</sup>		
Th-230	3732. X 10 <sup>-9</sup>	+ 97. X 10 <sup>-9</sup>	60 X 10 <sup>-10</sup>
Ra-226	0.31 X 10 <sup>-9</sup>	+ 0.11 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	4.86 X 10 <sup>-9</sup>	+ 4.02 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	0.09 X 10 <sup>-9</sup>	+ 3.95 X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Po-210	0.64 X 10 <sup>-9</sup>	+ 0.50 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>

DATE COLLECTED: August 9, 1993  
 LOCATION: 64-SC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	5043.65 X 10 <sup>-9</sup>		
Th-230	6101. X 10 <sup>-9</sup>	+102. X 10 <sup>-9</sup>	40 X 10 <sup>-10</sup>
Ra-226	0.23 X 10 <sup>-9</sup>	+ 0.11 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	5.58 X 10 <sup>-9</sup>	+ 2.53 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	1.49 X 10 <sup>-9</sup>	+ 3.17 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	+ 0.25 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>



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Lab #: 93-5023-15

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

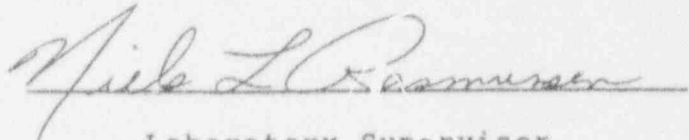
63 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	8010
pH, units	2.94
Total Dissolved Solids, mg/l	13388
Chloride (Cl), mg/l	234
Sulfate (SO4), mg/l	9900
Nitrate (NO3 as N), mg/l	0.43
Arsenic (As), mg/l	0.003
Barium (Ba), mg/l	0.19
Cadmium (Cd), mg/l	0.05
Chromium (Cr), mg/l	0.95
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.20
Selenium (Se), mg/l	0.063
Uranium (U), mg/l	2.78

		LLD uCi/ml
Radium 226, pCi/l	0.31 + 0.11	1x10E-10
Radium 228, pCi/l	4.86 + 4.02	3x10E-9
Thorium 230, pCi/l	3732 + 97	6x10E-9
Lead 210, pCi/l	0.09 + 3.95	4x10E-9
Polonium 210, pCi/l	0.64 + 0.50	2x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor



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307/789-6420

Lab #: 93-5023-16

Petrotoomics Company  
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Attention: Steve Pfaff

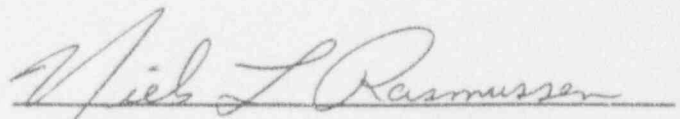
64 SC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	8364
pH, units	3.06
Total Dissolved Solids, mg/l	15270
Chloride (Cl), mg/l	242
Sulfate (SO <sub>4</sub> ), mg/l	10560
Nitrate (NO <sub>3</sub> as N), mg/l	0.21
Arsenic (As), mg/l	0.002
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	0.06
Chromium (Cr), mg/l	1.61
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	2.70
Selenium (Se), mg/l	0.051
Uranium (U), mg/l	7.45

		LLD uCi/ml
Radium 226, pCi/l	0.23 + 0.11	2x10E-10
Radium 228, pCi/l	5.58 + 2.53	3x10E-9
Thorium 230, pCi/l	6101 + 102	4x10E-9
Lead 210, pCi/l	1.49 + 3.17	3x10E-9
Polonium 210, pCi/l	0.00 + 0.25	1x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 65-SC  
 TYPE OF SAMPLE: Groundwater - Dry

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	X 10 <sup>-9</sup>		
Th-230	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-226	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-228	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Pb-210	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Po-210	X 10 <sup>-9</sup>	± X 10 <sup>-9</sup>	X 10 <sup>-9</sup>

DATE COLLECTED: August 10, 1993  
 LOCATION: 66-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	6.77 X 10 <sup>-9</sup>		
Th-230	0.00 X 10 <sup>-9</sup>	± 2.93 X 10 <sup>-9</sup>	50 X 10 <sup>-10</sup>
Ra-226	4.95 X 10 <sup>-9</sup>	± 0.43 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	8.89 X 10 <sup>-9</sup>	± 2.96 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	1.43 X 10 <sup>-9</sup>	± 3.06 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.31 X 10 <sup>-9</sup>	± 0.54 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>



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307/789-6420

Lab #: 93-5026-7

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

66 SC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	7539
pH, units	4.18
Total Dissolved Solids, mg/l	15084
Chloride (Cl), mg/l	353
Sulfate (SO4), mg/l	8640
Nitrate (NO3 as N), mg/l	0.30
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.44
Cadmium (Cd), mg/l	0.03
Chromium (Cr), mg/l	0.014
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	1.8
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.010

		LLD uCi/ml
Radium 226, pCi/l	4.95 + 0.43	2x10E-10
Radium 228, pCi/l	8.89 + 2.96	3x10E-9
Thorium 230, pCi/l	0.00 + 2.93	5x10E-9
Lead 210, pCi/l	1.43 + 3.06	3x10E-9
Polonium 210, pCi/l	0.31 + 0.54	3x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

*Neil L. Rossmore*

Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 67-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	18.28 X 10 <sup>-9</sup>		
Th-230	0.00 X 10 <sup>-9</sup>	± 0.38 X 10 <sup>-9</sup>	10 X 10 <sup>-10</sup>
Ra-226	27.6 X 10 <sup>-9</sup>	± 1.0 X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	3.48 X 10 <sup>-9</sup>	± 2.96 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	0.71 X 10 <sup>-9</sup>	± 1.49 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.34 X 10 <sup>-9</sup>	± 0.87 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 10, 1993  
 LOCATION: 68-SC  
 TYPE OF SAMPLE: Groundwater - Bailed

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	8.80 X 10 <sup>-9</sup>		
Th-230	0.00 X 10 <sup>-9</sup>	± 2.71 X 10 <sup>-9</sup>	50 X 10 <sup>-10</sup>
Ra-226	8.95 X 10 <sup>-9</sup>	± 0.54 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	16.5 X 10 <sup>-9</sup>	± 4.03 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	0.77 X 10 <sup>-9</sup>	± 1.93 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.01 X 10 <sup>-9</sup>	± 0.18 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>



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307/789-6420

Lab #: 93-5026-8

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

67 SC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	2957
pH, units	6.51
Total Dissolved Solids, mg/l	3055
Chloride (Cl), mg/l	134
Sulfate (SO4), mg/l	1400
Nitrate (NO3 as N), mg/l	<0.01
Arsenic (As), mg/l	0.001
Barium (Ba), mg/l	0.20
Cadmium (Cd), mg/l	0.011
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.06
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.027

		LLD uCi/ml
Radium 226, pCi/l	27.6 ± 1.0	2x10E-10
Radium 228, pCi/l	3.48 ± 2.96	3x10E-9
Thorium 230, pCi/l	0.00 ± 0.38	1x10E-9
Lead 210, pCi/l	0.71 ± 1.49	2x10E-9
Polonium 210, pCi/l	0.34 ± 0.87	1x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

*Neil L. Rasmussen*

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Lab #: 93-5026-9

Petrotomics Company  
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Attention: Steve Pfaff

68 SC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	6243
pH, units	5.88
Total Dissolved Solids, mg/l	11194
Chloride (Cl), mg/l	363
Sulfate (SO4), mg/l	6133
Nitrate (NO3 as N), mg/l	0.69
Arsenic (As), mg/l	0.001
Barium (Ba), mg/l	0.18
Cadmium (Cd), mg/l	0.02
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.59
Selenium (Se), mg/l	0.005
Uranium (U), mg/l	0.013

		LLD uCi/ml
Radium 226, pCi/l	8.95 ± 0.54	1x10E-10
Radium 228, pCi/l	16.5 ± 4.03	3x10E-9
Thorium 230, pCi/l	0.00 ± 2.71	5x10E-9
Lead 210, pCi/l	0.77 ± 1.93	2x10E-9
Polonium 210, pCi/l	0.01 ± 0.18	2x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

*Neil L. Rasmussen*

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3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 5-DC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION ( $\mu\text{Ci}/\text{ml}$ )	ERROR ESTIMATE ( $\mu\text{Ci}/\text{ml}$ )	LLD ( $\mu\text{Ci}/\text{ml}$ )
U-nat	$23.02 \times 10^{-9}$		
Th-230	$27.1 \times 10^{-9}$	$\pm 5.3 \times 10^{-9}$	$50 \times 10^{-10}$
Ra-226	$5.62 \times 10^{-9}$	$\pm 0.44 \times 10^{-5}$	$2 \times 10^{-10}$
Ra-228	$3.37 \times 10^{-9}$	$\pm 3.7 \times 10^{-9}$	$3 \times 10^{-9}$
Pb-210	$2.98 \times 10^{-9}$	$\pm 3.75 \times 10^{-9}$	$4 \times 10^{-9}$
Po-210	$0.22 \times 10^{-9}$	$\pm 0.50 \times 10^{-9}$	$2 \times 10^{-9}$

DATE COLLECTED: August 10, 1993  
 LOCATION: 6-DC  
 TYPE OF SAMPLE: Groundwater - Dry

RADIONUCLIDE	CONCENTRATION ( $\mu\text{Ci}/\text{ml}$ )	ERROR ESTIMATE ( $\mu\text{Ci}/\text{ml}$ )	LLD ( $\mu\text{Ci}/\text{ml}$ )
U-nat	$\times 10^{-9}$		
Th-230	$\times 10^{-9}$	$\pm \times 10^{-9}$	$\times 10^{-10}$
Ra-226	$\times 10^{-9}$	$\pm \times 10^{-9}$	$\times 10^{-10}$
Ra-228	$\times 10^{-9}$	$\pm \times 10^{-9}$	$\times 10^{-9}$
Pb-210	$\times 10^{-9}$	$\pm \times 10^{-9}$	$\times 10^{-9}$
Po-210	$\times 10^{-9}$	$\pm \times 10^{-9}$	$\times 10^{-9}$



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Lab #: 93-5026-10

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5 DC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	5360
pH, units	3.44
Total Dissolved Solids, mg/l	10496
Chloride (Cl), mg/l	119
Sulfate (SO4), mg/l	6400
Nitrate (NO3 as N), mg/l	5.3
Arsenic (As), mg/l	0.002
Barium (Ba), mg/l	0.07
Cadmium (Cd), mg/l	0.08
Chromium (Cr), mg/l	0.10
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	1.5
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.034

		LLD uCi/ml
Radium 226, pCi/l	5.62 ± 0.44	2x10E-10
Radium 228, pCi/l	3.37 ± 3.7	3x10E-9
Thorium 230, pCi/l	27.1 ± 5.3	5x10E-9
Lead 210, pCi/l	2.98 ± 3.75	4x10E-9
Polonium 210, pCi/l	0.22 ± 0.50	2x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

*Niels L Rasmussen*

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3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 7-DC  
 TYPE OF SAMPLE: Groundwater - Dry

<u>RADIONUCLIDE</u>	<u>CONCENTRATION</u> (uCi/ml)		<u>ERROR ESTIMATE</u> (uCi/ml)	<u>LLD</u> (uCi/ml)
U-nat	X 10 <sup>-9</sup>			
Th-230	X 10 <sup>-9</sup>	±	X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-226	X 10 <sup>-9</sup>	±	X 10 <sup>-9</sup>	X 10 <sup>-10</sup>
Ra-228	X 10 <sup>-9</sup>	±	X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Pb-210	X 10 <sup>-9</sup>	±	X 10 <sup>-9</sup>	X 10 <sup>-9</sup>
Po-210	X 10 <sup>-9</sup>	±	X 10 <sup>-9</sup>	X 10 <sup>-9</sup>

DATE COLLECTED: August 10, 1993  
 LOCATION: 8-DC  
 TYPE OF SAMPLE: Groundwater - Bailed

<u>RADIONUCLIDE</u>	<u>CONCENTRATION</u> (uCi/ml)		<u>ERROR ESTIMATE</u> (uCi/ml)	<u>LLD</u> (uCi/ml)
U-nat	23.02 X 10 <sup>-9</sup>			
Th-230	230.0 X 10 <sup>-9</sup>	± 8.	X 10 <sup>-9</sup>	20 X 10 <sup>-10</sup>
Ra-226	0.72 X 10 <sup>-9</sup>	± 0.19	X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	9.15 X 10 <sup>-9</sup>	± 3.28	X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Pb-210	1.97 X 10 <sup>-9</sup>	± 3.52	X 10 <sup>-9</sup>	4 X 10 <sup>-9</sup>
Po-210	0.10 X 10 <sup>-9</sup>	± 0.46	X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>



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Lab #: 93-5023-18

Petrotomics Company  
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Attention: Steve Pfaff

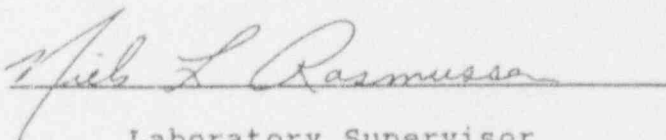
8 DC  
Sample collected August 9, 1993  
Field filtered & preserved by S. Pfaff

WATER ANALYSIS

Conductivity @ 25C, umho/cm	9660
pH, units	3.39
Total Dissolved Solids, mg/l	21350
Chloride (Cl), mg/l	280
Sulfate (SO4), mg/l	15200
Nitrate (NO3 as N), mg/l	0.25
Arsenic (As), mg/l	<0.001
Barium (Ba), mg/l	0.05
Cadmium (Cd), mg/l	0.04
Chromium (Cr), mg/l	0.35
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	3.13
Selenium (Se), mg/l	0.001
Uranium (U), mg/l	0.034

		LLD uCi/ml
Radium 226, pCi/l	0.72 + 0.19	2x10E-10
Radium 228, pCi/l	9.15 + 3.28	3x10E-9
Thorium 230, pCi/l	230 + 8	2x10E-9
Lead 210, pCi/l	1.97 + 3.52	4x10E-9
Polonium 210, pCi/l	0.10 + 0.46	2x10E-9

Date Submitted: 8-9-93  
Analyzed By: KB, KAH, GLH, JPM  
Date Reported: 11-03-93

  
Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 9-DC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	8.12 X 10 <sup>-9</sup>		
Th-230	0.00 X 10 <sup>-9</sup>	± 2.93 X 10 <sup>-9</sup>	60 X 10 <sup>-10</sup>
Ra-226	5.19 X 10 <sup>-9</sup>	± 0.42 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	18.9 X 10 <sup>-9</sup>	± 2.94 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Pb-210	0.89 X 10 <sup>-9</sup>	± 3.01 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	± 0.28 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 10, 1993  
 LOCATION: 10-DC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	3.38 X 10 <sup>-9</sup>		
Th-230	0.00 X 10 <sup>-9</sup>	± 0.35 X 10 <sup>-9</sup>	10 X 10 <sup>-10</sup>
Ra-226	16.2 X 10 <sup>-9</sup>	± 0.7 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	3.15 X 10 <sup>-9</sup>	± 2.45 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Pb-210	1.17 X 10 <sup>-9</sup>	± 1.92 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	± 0.13 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>



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Lab #: 93-5026-11

Petrotomics Company  
P.O.Box 8509, Shirley Basin, WY 82615-8509  
Attention: Steve Pfaff

9 DC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	6361
pH, units	5.20
Total Dissolved Solids, mg/l	10628
Chloride (Cl), mg/l	371
Sulfate (SO4), mg/l	6200
Nitrate (NO3 as N), mg/l	7.6
Arsenic (As), mg/l	0.002
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	0.02
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.23
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.012

		LLD uCi/ml
Radium 226, pCi/l	5.19 ± 0.42	1x10E-10
Radium 228, pCi/l	18.9 ± 2.94	2x10E-9
Thorium 230, pCi/l	0.00 ± 2.93	6x10E-9
Lead 210, pCi/l	0.89 ± 3.01	3x10E-9
Polonium 210, pCi/l	0.00 ± 0.28	1x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

Laboratory Supervisor



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Lab #: 93-5026-12

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Attention: Steve Pfaff

10 DC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	1791
pH, units	6.26
Total Dissolved Solids, mg/l	1869
Chloride (Cl), mg/l	73.1
Sulfate (SO4), mg/l	1200
Nitrate (NO3 as N), mg/l	0.05
Arsenic (As), mg/l	0.002
Barium (Ba), mg/l	0.28
Cadmium (Cd), mg/l	<0.01
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.04
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.005

		LLD uCi/ml
Radium 226, pCi/l	16.2 ± 0.7	1x10E-10
Radium 228, pCi/l	3.15 ± 2.45	2x10E-9
Thorium 230, pCi/l	0.00 ± 0.35	1x10E-9
Lead 210, pCi/l	1.17 ± 1.92	2x10E-9
Polonium 210, pCi/l	0.00 ± 0.13	2x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

*Nicholas L. Rasmussen*

Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 11-DC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	8.12 X 10 <sup>-9</sup>		
Th-230	0.09 X 10 <sup>-9</sup>	+ 0.34 X 10 <sup>-9</sup>	10 X 10 <sup>-10</sup>
Ra-226	4.34 X 10 <sup>-9</sup>	+ 0.39 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	2.59 X 10 <sup>-9</sup>	+ 2.70 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Pb-210	0.67 X 10 <sup>-9</sup>	+ 1.65 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	+ 0.21 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>

DATE COLLECTED: August 10, 1993  
 LOCATION: 12-DC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	LLD (uCi/ml)
U-nat	3940.14 X 10 <sup>-9</sup>		
Th-230	86.4 X 10 <sup>-9</sup>	+ 5.4 X 10 <sup>-9</sup>	20 X 10 <sup>-10</sup>
Ra-226	234. X 10 <sup>-9</sup>	+ 3. X 10 <sup>-9</sup>	2 X 10 <sup>-10</sup>
Ra-228	0.97 X 10 <sup>-9</sup>	+ 2.92 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Pb-210	4.57 X 10 <sup>-9</sup>	+ 3.02 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>
Po-210	0.20 X 10 <sup>-9</sup>	+ 0.35 X 10 <sup>-9</sup>	1 X 10 <sup>-9</sup>





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Lab #: 93-5026-13

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Attention: Steve Pfaff

11 DC

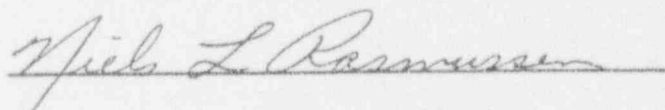
Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	2120
pH, units	6.50
Total Dissolved Solids, mg/l	2239
Chloride (Cl), mg/l	86.5
Sulfate (SO4), mg/l	1100
Nitrate (NO3 as N), mg/l	<0.01
Arsenic (As), mg/l	0.002
Barium (Ba), mg/l	0.07
Cadmium (Cd), mg/l	<0.01
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	<0.03
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.012

		LLD uCi/ml
Radium 226, pCi/l	4.34 ± 0.39	1x10E-10
Radium 228, pCi/l	2.59 ± 2.70	2x10E-9
Thorium 230, pCi/l	0.09 ± 0.34	1x10E-9
Lead 210, pCi/l	0.67 ± 1.65	2x10E-9
Polonium 210, pCi/l	0.00 ± 0.21	1x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

  
Laboratory Supervisor



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Lab #: 93-5026-14

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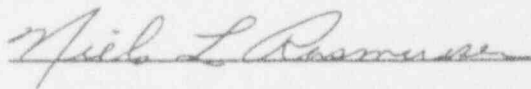
12 DC  
Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	10366
pH, units	3.65
Total Dissolved Solids, mg/l	31186
Chloride (Cl), mg/l	340
Sulfate (SO4), mg/l	19470
Nitrate (NO3 as N), mg/l	0.34
Arsenic (As), mg/l	0.002
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	0.05
Chromium (Cr), mg/l	0.39
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	3.5
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	5.82

		LLD uCi/ml
Radium 226, pCi/l	234 ± 3	2x10E-10
Radium 228, pCi/l	0.97 ± 2.92	2x10E-9
Thorium 230, pCi/l	86.4 ± 5.4	2x10E-9
Lead 210, pCi/l	4.57 ± 3.02	3x10E-9
Polonium 210, pCi/l	0.20 ± 0.35	1x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported: 11-02-93

  
Laboratory Supervisor

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: August 10, 1993  
 LOCATION: 13-DC  
 TYPE OF SAMPLE: Groundwater - Pumped

RADIONUCLIDE	CONCENTRATION (uCi/ml)	ERROR ESTIMATE (uCi/ml)	L.L.D (uCi/ml)
U-nat	6.09 X 10 <sup>-9</sup>		
Th-230	2.29 X 10 <sup>-9</sup>	± 0.61 X 10 <sup>-9</sup>	10 X 10 <sup>-10</sup>
Ra-226	7.48 X 10 <sup>-9</sup>	± 0.51 X 10 <sup>-9</sup>	1 X 10 <sup>-10</sup>
Ra-228	1.59 X 10 <sup>-9</sup>	± 3.31 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Pb-210	0.21 X 10 <sup>-9</sup>	± 1.94 X 10 <sup>-9</sup>	2 X 10 <sup>-9</sup>
Po-210	0.00 X 10 <sup>-9</sup>	± 0.10 X 10 <sup>-9</sup>	3 X 10 <sup>-9</sup>



Lab #: 93-5026-15

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13 DC

Sample field filtered & preserved by S. Pfaff on August 10, 1993

WATER ANALYSIS

Conductivity @ 25C, umho/cm	1414
pH, units	6.87
Total Dissolved Solids, mg/l	1158
Chloride (Cl), mg/l	8.2
Sulfate (SO4), mg/l	620
Nitrate (NO3 as N), mg/l	<0.01
Arsenic (As), mg/l	0.002
Barium (Ba), mg/l	<0.05
Cadmium (Cd), mg/l	<0.01
Chromium (Cr), mg/l	<0.01
Lead (Pb), mg/l	<0.05
Nickel (Ni), mg/l	0.03
Selenium (Se), mg/l	<0.001
Uranium (U), mg/l	0.009

		LLD uCi/ml
Radium 226, pCi/l	7.48 ± 0.51	1x10E-10
Radium 228, pCi/l	1.59 ± 3.31	2x10E-9
Thorium 230, pCi/l	2.29 ± 0.61	1x10E-9
Lead 210, pCi/l	0.21 ± 1.94	2x10E-9
Polonium 210, pCi/l	0.00 ± 0.10	3x10E-9

Date Submitted: 8-10-93  
Analyzed By: KB, KAH, GLH  
Date Reported:

*Neil L. Rasmussen*  
Laboratory Supervisor

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4. VEGETATION, FOOD, AND FISH SAMPLES

Deleted by Amendment No. 21

5. SOIL AND SEDIMENT SAMPLES

Deleted by Amendment No. 21

6. DIRECT RADIATION MEASUREMENTS

DATE: 3rd Quarter 1993

<u>LOCATION</u>	<u>EXPOSURE RATE</u> <u>(mr/qr)</u>	<u>ERROR ESTIMATE</u> <u>(mr/qr)</u>
Site 1	48.2	+11.5
Site 5	65.6	+13.1

LOCATIONS: Site 1 - 7800' WNW of where yellowcake dryer stack had been located.

Site 2 - Discontinued.

Site 3 - Discontinued.

Site 4 - Discontinued.

Site 5 - 1800' NE of where yellowcake dryer stack had been located.

Site 6 - Discontinued.

## LLD CALCULATIONS

$$\text{LLD} = \frac{4.66 \sqrt{C_B * T}}{(2.22)(E)(R)(V)(T)} \quad \text{in pCi/units used (V)}$$

WHERE:

$C_B$  = BACKGROUND COUNT RATE

$T$  = COUNT TIME (SAME FOR SAMPLE AND BACKGROUND)

$E$  = DETECTOR EFFICIENCY (CPM/DPM)

$R$  = FRACTIONAL RECOVERY

$V$  = SAMPLE SIZE    LITERS OF AIR OR WATER  
                           GRAMS OF SOIL  
                           KILOGRAMS OF VEGETATION

2.22 = DPM/pCi

Since the LLD is a function of sample volume, counting efficiency, radiochemical yield, etc., it may vary for different sampling and analysis procedures. The following are some of the normal values used.

$Ra^{226}$

$C_B$  = 0.05 to 0.30 counts per minute

$T$  = 50 minutes

$E$  = about 0.9

$R$  = about 0.9 frequently less in soil and vegetation

$V$  = 1 liter of water  
      = 20 grams of soil  
      = air volume taken is usually 1/4 of volume sampled  
      = vegetation weight is usually 1/2 of sample provided

Th<sup>230</sup>

C<sub>a</sub> = 0.04 to 0.20 cpm

T = 200 minutes, may be less for "hot" samples like tailings pond

E+R = combined recovery and efficiency from Th<sup>228</sup> tracer varies greatly from 0.02 to 0.20

V = 1 liter of water, or less if high in iron. Iron interferes and volumes as low as 25 or 50 ml. may be used.  
= 1.0 grams soil  
= air volume taken is usually 1/4 of volume sampled (about 7 x 10<sup>6</sup> L)

Pb<sup>210</sup>

C<sub>a</sub> = 1 to 2 cpm

T = 100 to 200 minutes

E = 0.25 to 0.33

R = usually 0.75 to 0.90 but may be less for vegetation and waters high in TDS

V = 1 liter of water, again samples high in iron will be less to lessen its interference.  
= air volume taken is usually 1/4 of sample (about 7 x 10<sup>6</sup> L)  
= vegetation weight is usually 1/2 of sample provided.

Po<sup>210</sup>

C<sub>a</sub> = about 0.2 cpm

T = 100 to 200 minutes

E = 0.15 to 0.20

R = 0.5 to 0.8

V = 1 liter of water, iron causes interference so smaller volumes of samples high in iron are used, down to about 200 ml.



## %MPC CALCULATION

The %MPC is calculated using the values obtained from 10 CFR 20 appendix B for unrestricted limits in air.

The calculation is as follows:

$$\%MPC = \frac{\text{sample concentration}}{\text{unrestricted limit}}$$

unrestricted limits for air from 10 CFR 20 Appendix B

U nat	$5000 \times 10^{-15}$
Th <sup>230</sup>	$80 \times 10^{-15}$
Ra <sup>226</sup>	$3000 \times 10^{-15}$
Pb <sup>210</sup>	$4000 \times 10^{-15}$
Rn <sup>222</sup>	$3 \times 10^{-9}$