

ENVIRONMENTAL SAMPLE DATA

3rd Quarter 1998

PETROTOMICS COMPANY
Shirley Basin, WY

9903100098 990226
PDR ADDCK 04006659
C 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 1998
LOCATION: Site 1

<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>%EC</u>
Rn-222	2.1 X 10 ⁻⁹	± 0.20 X 10 ⁻⁹	<0.2 X 10 ⁻⁹	21.9

DATE COLLECTED: 3rd Quarter 1998
LOCATION: Site 5

<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>%EC</u>
U-nat	* X 10 ⁻¹⁵		X 10 ⁻¹⁶	0.
Th-230	* X 10 ⁻¹⁵	± X 10 ⁻¹⁵	X 10 ⁻¹⁶	0.
Ra-226	* X 10 ⁻¹⁵	± X 10 ⁻¹⁵	X 10 ⁻¹⁷	0.
Rn-222	2.7 X 10 ⁻⁹	± 0.23 X 10 ⁻⁹	<0.2 X 10 ⁻⁹	27.9

* Sample data will be submimtted when received.

3. LIQUID SAMPLES

DATE COLLECTED: Aug. 20, 1998
 LOCATION: Mine Shop Well
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: Unable to measure - sealed well.

<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 (Dissolved)	3.11×10^{-9}		
U-Nat (Suspended)	1.42×10^{-9}		
Th-230 (Dissolved)	$<0.2 \times 10^{-9}$	$\pm \quad \times 10^{-9}$	2×10^{-10}
Th-230 (Suspended)	$<0.2 \times 10^{-9}$	$\pm \quad \times 10^{-9}$	$.2 \times 10^{-9}$
Ra-226 (Dissolved)	$<0.2 \times 10^{-9}$	$\pm \quad \times 10^{-9}$	2×10^{-10}
Ra-226 (Suspended)	$<0.2 \times 10^{-9}$	$\pm \quad \times 10^{-9}$	2×10^{-10}
Ra-228 (Dissolved)	3.2×10^{-9}	$\pm 0.2 \times 10^{-9}$	1.0×10^{-9}
Ra-228 (Suspended)	2.8×10^{-9}	$\pm 0.3 \times 10^{-9}$	1.0×10^{-9}

ND (not detected)

* Samples not run.

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Sep. 09, 1998
 LOCATION: 1-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 7049.74

<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	23.69 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	4.3 X 10 ⁻⁹	± 1.0 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	4.3 X 10 ⁻⁹	± 0.4 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	<1.0 X 10 ⁻⁹	± X 10 ⁻⁹	1.0 X 10 ⁻⁹

DATE COLLECTED: Aug. 18, 1998
 LOCATION: 3-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 7067.76

<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	10,628.9 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	1.2 X 10 ⁻⁹	± 0.5 X 10 ⁻⁹	12 X 10 ⁻¹⁰
Ra-226	8.4 X 10 ⁻⁹	± 0.8 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	41.6 X 10 ⁻⁹	± 2.5 X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 18, 1998
 LOCATION: 4-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 7036.16

<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	138.11 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	<0.2 X 10 ⁻⁹	± X 10 ⁻⁹	30 X 10 ⁻¹⁰
Ra-226	30.1 X 10 ⁻⁹	± 1.5 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	66.7 X 10 ⁻⁹	± 3.0 X 10 ⁻⁹	1.0 X 10 ⁻⁹

DATE COLLECTED: Aug. 26, 1998
 LOCATION: 5-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 7001.59

<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	6,377.34 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	568.00 X 10 ⁻⁹	± 12.6 X 10 ⁻⁹	0.2 X 10 ⁻⁹
Ra-226	16.4 X 10 ⁻⁹	± 1.2 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	<1.0 X 10 ⁻⁹	± X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 18, 1998
 LOCATION: 39-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 7051.17

<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	10.83 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	<0.2 X 10 ⁻⁹	± X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	2.4 X 10 ⁻⁹	± 0.3 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	<1.0 X 10 ⁻⁹	± X 10 ⁻⁹	1.0 X 10 ⁻⁹

DATE COLLECTED: Aug. 26, 1998
 LOCATION: 40-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 7050.86

<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	4.06 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	<0.2 X 10 ⁻⁹	± X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	0.6 X 10 ⁻⁹	± 0.1 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	<1.0 X 10 ⁻⁹	± X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 26, 1998
 LOCATION: 41-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 7038.09

<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	17.74 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	1.7 X 10 ⁻⁹	± 0.8 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	0.6 X 10 ⁻⁹	± 0.1 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	<1.0 X 10 ⁻⁹	± X 10 ⁻⁹	1.0 X 10 ⁻⁹

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 42-SC
 TYPE OF SAMPLE: Groundwater - Bailed
 WATER ELEVATION: 6999.63

<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	2,031. X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	765.0 X 10 ⁻⁹	± 14.7 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	8.3 X 10 ⁻⁹	± 0.8 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	14.9 X 10 ⁻⁹	± 0.8 X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 26, 1998
 LOCATION: 43-SC
 TYPE OF SAMPLE: Groundwater - dry well
 WATER ELEVATION: < 6995.8

<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	QNS X 10 ⁻⁹		0.7 X 10 ⁻⁹
Th-230	QNS X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁸
Ra-226	QNS X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	QNS X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

DATE COLLECTED: Aug. 26, 1998
 LOCATION: 44-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 7003.6

<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	2,044.54 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	1,200.0 X 10 ⁻⁹	±18.4 X 10 ⁻⁹	0.2 X 10 ⁻⁹
Ra-226	11.2 X 10 ⁻⁹	± 1.0 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	<1.0 X 10 ⁻⁹	± X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 45-SC
 TYPE OF SAMPLE: Groundwater - Dry Well
 WATER ELEVATION: < 7000.37

<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	X 10 ⁻⁹		X 10 ⁻⁹
Th-230	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹
Ra-226	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 49-SC
 TYPE OF SAMPLE: Groundwater - Bailed
 WATER ELEVATION: 6955.83

<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	3.93 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	<0.2 X 10 ⁻⁹	± X 10 ⁻⁹	2.0 X 10 ⁻¹⁰
Ra-226	4.7 X 10 ⁻⁹	± 0.6 X 10 ⁻⁹	2.0 X 10 ⁻¹⁰
Ra-228	<1.0 X 10 ⁻⁹	± X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 50-SC
 TYPE OF SAMPLE: Groundwater - Dry
 WATER ELEVATION: < 6985.5

<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	X 10 ⁻⁹		X 10 ⁻⁹
Th-230	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-226	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 51-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 6994.35

<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	12.19 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	1.7 X 10 ⁻⁹	± 1.0 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	11.46X 10 ⁻⁹	± 1.0 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	<1.0 X 10 ⁻⁹	± X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 52-SC
 TYPE OF SAMPLE: Groundwater - Dry
 WATER ELEVATION: < 6964.2

<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	X 10 ⁻⁹		X 10 ⁻⁹
Th-230	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-226	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 53-SC
 TYPE OF SAMPLE: Groundwater - Bailed
 WATER ELEVATION: 7025.93

<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	104.26 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	1.0 X 10 ⁻⁹	± 0.6 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	4.2 X 10 ⁻⁹	± 0.3 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	6.5 X 10 ⁻⁹	± 0.2 X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 18, 1998
 LOCATION: 54-SC
 TYPE OF SAMPLE: Groundwater - Pumped.
 WATER ELEVATION: 6949

<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	28.91 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	2.1 X 10 ⁻⁹	± 0.8 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	17.4 X 10 ⁻⁹	± 1.1 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	30.7 X 10 ⁻⁹	± 2.3 X 10 ⁻⁹	1.0 X 10 ⁻⁹

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 55-SC
 TYPE OF SAMPLE: Groundwater - Dry
 WATER ELEVATION: < 6936.3

<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	X 10 ⁻⁹		0.7 X 10 ⁻⁹
Th-230	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-226	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 56-SC
 TYPE OF SAMPLE: Groundwater - Dry Well
 WATER ELEVATION: <6944.99

<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	X 10 ⁻⁹		X 10 ⁻⁹
Th-230	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-226	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 57-SC
 TYPE OF SAMPLE: Groundwater - Dry Well
 WATER ELEVATION: <6946.14

<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	X 10 ⁻⁹		X 10 ⁻⁹
Th-230	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-226	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 18, 1998
 LOCATION: 58-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: Sealed - pumping.

<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	9.75 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	5.0 X 10 ⁻⁹	± 1.1 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-226	28.0 X 10 ⁻⁹	± 1.4 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	81.7 X 10 ⁻⁹	± 3.2 X 10 ⁻⁹	1.0 X 10 ⁻⁹

DATE COLLECTED: Aug. 26, 1998
 LOCATION: 66-SC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 6987.70

<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	3.18 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	<0.2 X 10 ⁻⁹	± X 10 ⁻⁹	0.2 X 10 ⁻⁹
Ra-226	56.4 X 10 ⁻⁹	± 2.0 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	107.0 X 10 ⁻⁹	± 4.2 X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 7-DC
 TYPE OF SAMPLE: Groundwater - Dry
 WATER ELEVATION: < 6966.6

<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	X 10 ⁻⁹		X 10 ⁻⁹
Th-230	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-226	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

DATE COLLECTED: Aug. 26, 1998
 LOCATION: 5-DC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 6927.18

<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	6.84 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	0.9 X 10 ⁻⁹	± 0.6 X 10 ⁻⁹	0.2 X 10 ⁻⁹
Ra-226	7.9 X 10 ⁻⁹	± 0.4 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	14.2 X 10 ⁻⁹	± 1.0 X 10 ⁻⁹	1.0 X 10 ⁻⁹

3. LIQUID SAMPLES (CONTINUED)

DATE COLLECTED: Aug. 20, 1998
 LOCATION: 10-DC
 TYPE OF SAMPLE: Groundwater - Not sampled
 WATER ELEVATION: 6936.88

<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	X 10 ⁻⁹		X 10 ⁻⁹
Th-230	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-226	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻¹⁰
Ra-228	X 10 ⁻⁹	± X 10 ⁻⁹	X 10 ⁻⁹

DATE COLLECTED: Aug. 26, 1998
 LOCATION: 19-DC
 TYPE OF SAMPLE: Groundwater - Pumped
 WATER ELEVATION: 6931.30

<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	0.95 X 10 ⁻⁹		0.2 X 10 ⁻⁹
Th-230	<0.2 X 10 ⁻⁹	± X 10 ⁻⁹	0.2 X 10 ⁻⁹
Ra-226	9.8 X 10 ⁻⁹	± 0.5 X 10 ⁻⁹	2 X 10 ⁻¹⁰
Ra-228	5.0 X 10 ⁻⁹	± 0.2 X 10 ⁻⁹	1.0 X 10 ⁻⁹



ENERGY LABORATORIES, INC.

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

1 SC
98-54481
Water
09/09/98
October 03, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	1950
Chloride	Cl	mg/L	0.10	177
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	1.15
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	3490
Conductivity		µmho/cm	1.0	3300
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.12

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	< 0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	0.12
Selenium	Se	mg/L	0.001	0.013
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	²³⁸ U	mg/L	0.0003	0.0350
Radium 226	²²⁶ Ra	pCi/L	0.2	4.3
Radium Error Estimate ±				0.4
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	4.3
Thorium Error Estimate ±				1.0

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

1 SC
98-54481
Water
09/09/98
October 03, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	1950
Chloride	Cl	mg/L	0.10	177
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	1.15
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	3490
Conductivity		µmho/cm	1.0	3300
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.12

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	< 0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	0.12
Selenium	Se	mg/L	0.001	0.013
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	Nat U	mg/L	0.0003	0.0350
Radium 226	²²⁶ Ra	pCi/L	0.2	4.3
Radium Error Estimate ±				0.4
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	4.3
Thorium Error Estimate ±				1.0

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

Mine Shop Well
98-49765
Water
08-20-98
October 23, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	207
Chloride	Cl	mg/L	0.10	4.0
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	438
Conductivity		µmho/cm	1.0	717
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	8.03

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	< 0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	< 0.001
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	0.0046
Uranium, suspended		mg/L	0.0003	0.0021
Radium 226	²²⁶ Ra	pCi/L	0.2	< 0.2
Radium Error Estimate ±				
Radium 226, suspended		pCi/L	0.2	< 0.2
Radium Error Estimate ±				
Radium 228	²²⁸ Ra	pCi/L	1.0	3.2
Radium Error Estimate ±				0.2
Radium 228, suspended		pCi/L	1.0	2.8
Radium Error Estimate ±				0.3
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				
Thorium 230, suspended		pCi/L	0.2	< 0.2
Thorium Error Estimate ±				

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COMPLETE ANALYTICAL SERVICES

LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

03 SC
98-49433
Water
06-18-98
September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	4200
Chloride	Cl	mg/L	0.10	961
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	6.20
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals		Units	Reporting Limit	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	8790
Conductivity		µmho/cm	1.0	8160
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	3.78

Trace Metals		Units	Reporting Limit	Results
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	0.06
Chromium	Cr	mg/L	0.01	0.04
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	0.007
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.01	1.14
Selenium	Se	mg/L	0.001	0.126
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics		Units	Reporting Limit	Results
Uranium	²³⁸ U	mg/L	0.0003	15.7
Radium 226	²²⁶ Ra	pCi/L	0.2	8.4
Radium Error Estimate ±				0.8
Radium 228	²²⁸ Ra	pCi/L	1.0	41.6
Radium Error Estimate ±				2.5
Thorium 230	²³⁰ Th	pCi/L	0.2	1.2
Thorium Error Estimate ±				0.5



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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

04 SC
98-49436
Water
08-18-98
September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	2000
Chloride	Cl	mg/L	1.0	803
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	32.3
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals		Units	Reporting Limit	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	5440
Conductivity		µmho/cm	1.0	5530
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.30

Trace Metals		Units	Reporting Limit	Results
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	0.01
Chromium	Cr	mg/L	0.01	0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	0.43
Selenium	Se	mg/L	0.001	0.016
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics		Units	Reporting Limit	Results
Uranium	²³⁸ U	mg/L	0.0003	0.204
Radium 226	²²⁶ Ra	pCi/L	0.2	30.1
Radium Error Estimate ±				1.5
Radium 228	²²⁸ Ra	pCi/L	1.0	66.7
Radium Error Estimate ±				3.0
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

05 SC
98-53412
Water
08-26-98
September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	14000
Chloride	Cl	mg/L	0.10	262
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	21000
Conductivity		μmho/cm	1.0	13700
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	3.09

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	0.06
Chromium	Cr	mg/L	0.01	0.54
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	4.08
Selenium	Se	mg/L	0.001	0.095
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	²³⁸ U	mg/L	0.0003	9.42
Radium 226	²²⁶ Ra	pCi/L	0.2	16.4
Radium Error Estimate ±				1.2
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	568
Thorium Error Estimate ±				12.6

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COMPLETE ANALYTICAL SERVICES

LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

39 SC
98-49440
Water
08-18-98
September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	801
Chloride	Cl	mg/L	0.10	8.0
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	0.96
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals		Units	Reporting Limit	Results
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1420
Conductivity		µmho/cm	1.0	1470
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.74

Trace Metals		Units	Reporting Limit	Results
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	< 0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	0.13
Selenium	Se	mg/L	0.001	0.005
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics		Units	Reporting Limit	Results
Uranium	²³⁵ U	mg/L	0.0003	0.0160
Radium 226	²²⁶ Ra	pCi/L	0.2	2.4
Radium Error Estimate ±				0.3
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				



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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:

Laboratory ID:

Sample Matrix:

Sample Date:

Report Date:

40 SC

98-53415

Water

08-26-98

September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	1260
Chloride	Cl	mg/L	0.10	113
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	0.74
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	2230
Conductivity		µmho/cm	1.0	2510
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	6.72

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	< 0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.019
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometric				
Uranium	²³⁵ U	mg/L	0.0003	0.0060
Radium 226	²²⁶ Ra	pCi/L	0.2	0.6
Radium Error Estimate ±				0.1
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:

Laboratory ID:

Sample Matrix:

Sample Date:

Report Date:

41 SC

98-53416

Water

08-26-98

September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	572
Chloride	Cl	mg/L	0.10	198
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	3.80
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	1490
Conductivity		µmho/cm	1.0	1830
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	7.10

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	< 0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.066
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	0.0262
Radium 226	²²⁶ Ra	pCi/L	0.2	0.6
Radium Error Estimate ±				0.1
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	1.7
Thorium Error Estimate ±				0.8

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

42 SC
98-49763
Water
08/20/98
October 03, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	2400
Chloride	Cl	mg/L	0.10	63.8
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	5.29
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	3750
Conductivity		µmho/cm	1.0	3680
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.01

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	0.03
Chromium	Cr	mg/L	0.01	0.05
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	0.010
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	0.49
Selenium	Se	mg/L	0.001	0.026
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	NatU	mg/L	0.0003	3.000
Radium 226	²²⁶ Ra	pCi/L	0.2	8.3
Radium Error Estimate ±				0.8
Radium 228	²²⁸ Ra	pCi/L	1.0	14.9
Radium Error Estimate ±				0.8
Thorium 230	²³⁰ Th	pCi/L	0.2	765
Thorium Error Estimate ±				14.7

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:

Laboratory ID:

Sample Matrix:

Sample Date:

Report Date:

44 SC

98-53413

Water

08-26-98

September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	11100
Chloride	Cl	mg/L	0.10	245
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	16100
Conductivity		µmho/cm	1.0	11900
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	2.61

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	0.05
Chromium	Cr	mg/L	0.01	0.53
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	3.00
Selenium	Se	mg/L	0.001	0.090
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	²³⁸ U	mg/L	0.0003	3.02
Radium 226	²²⁶ Ra	pCi/L	0.2	11.2
Radium Error Estimate ±				1.0
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	1200
Thorium Error Estimate ±				18.4

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

49 SC
98-49759
Water
08/20/98
October 03, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	1800
Chloride	Cl	mg/L	0.10	62.1
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	0.31
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	3290
Conductivity		µmho/cm	1.0	3270
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	7.54

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	< 0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	< 0.05
Selenium	Se	mg/L	0.001	0.003
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	²³⁸ U	mg/L	0.0003	0.0058
Radium 226	²²⁶ Ra	pCi/L	0.2	4.7
Radium Error Estimate ±				0.6
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				

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COMPLETE ANALYTICAL SERVICES

LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

51 SC
98-49758
Water
08/20/98
October 03, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	13000
Chloride	Cl	mg/L	0.10	299
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	20900
Conductivity		µmho/cm	1.0	13200
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	3.31

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	1.14
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	0.009
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	3.08
Selenium	Se	mg/L	0.001	0.040
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	²³⁸ U	mg/L	0.0003	0.0180
Radium 226	²²⁶ Ra	pCi/L	0.2	11.4
Radium Error Estimate ±				1.0
Radium 228	²²⁸ Ra	pCi/L	1.0	< 1.0
Radium Error Estimate ±				
Thorium 230	²³⁰ Th	pCi/L	0.2	1.7
Thorium Error Estimate ±				1.0

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

53 SC
98-49757
Water
08/20/98
October 03, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	2900
Chloride	Cl	mg/L	0.10	80.3
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	20.3
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	4870
Conductivity		µmho/cm	1.0	4430
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.14

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	0.03
Chromium	Cr	mg/L	0.01	< 0.01
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	0.025
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	0.45
Selenium	Se	mg/L	0.001	0.036
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	Nat U	mg/L	0.0003	0.154
Radium 226	²²⁶ Ra	pCi/L	0.2	4.2
Radium Error Estimate ±				0.3
Radium 228	²²⁸ Ra	pCi/L	1.0	6.5
Radium Error Estimate ±				0.2
Thorium 230	²³⁰ Th	pCi/L	0.2	1.0
Thorium Error Estimate ±				0.6

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

54 SC
98-49438
Water
08-18-98
September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	6900
Chloride	Cl	mg/L	0.10	312
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	12200
Conductivity		µmho/cm	1.0	8910
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.24

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	0.15
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	1.15
Selenium	Se	mg/L	0.001	0.036
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	²³⁸ U	mg/L	0.0003	0.0427
Radium 226	²²⁶ Ra	pCi/L	0.2	17.4
Radium Error Estimate ±				1.1
Radium 228	²²⁸ Ra	pCi/L	1.0	30.7
Radium Error Estimate ±				2.3
Thorium 230	²³⁰ Th	pCi/L	0.2	2.1
Thorium Error Estimate ±				0.8

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:

Laboratory ID:

Sample Matrix:

Sample Date:

Report Date:

58 SC

98-49439

Water

08-18-98

September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	15000
Chloride	Cl	mg/L	0.10	331
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	24700
Conductivity		µmho/cm	1.0	15300
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	3.67

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	0.43
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	4.29
Selenium	Se	mg/L	0.001	0.074
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	²³⁸ U	mg/L	0.0003	0.0144
Radium 226	²²⁶ Ra	pCi/L	0.2	28.0
Radium Error Estimate ±				1.4
Radium 228	²²⁸ Ra	pCi/L	1.0	81.7
Radium Error Estimate ±				3.2
Thorium 230	²³⁰ Th	pCi/L	0.2	5.0
Thorium Error Estimate ±				1.1

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COMPLETE ANALYTICAL SERVICES

LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

66 SC
98-53417
Water
08-26-98
September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	13000
Chloride	Cl	mg/L	0.10	296
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	21700
Conductivity		µmho/cm	1.0	13200
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.01

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	0.04
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	0.012
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	3.33
Selenium	Se	mg/L	0.001	0.048
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometric				
Uranium	Nat U	mg/L	0.0003	0.0047
Radium 226	²²⁶ Ra	pCi/L	0.2	56.4
Radium Error Estimate ±				2.0
Radium 228	²²⁸ Ra	pCi/L	1.0	107
Radium Error Estimate ±				4.2
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				



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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:
Laboratory ID:
Sample Matrix:
Sample Date:
Report Date:

05 DC
98-49434
Water
08-18-98
September 21, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	
Magnesium	Mg	mg/L	0.10	
Sodium	Na	mg/L	0.10	
Potassium	K	mg/L	0.10	
Carbonate	CO ₃	mg/L	1.0	
Bicarbonate	HCO ₃	mg/L	1.0	
Hydroxide	OH	mg/L	1.0	
Sulfate	SO ₄	mg/L	1.0	4300
Chloride	Cl	mg/L	0.10	109
Ammonium as N	NH ₄	mg/L	0.05	
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	
Silica	SiO ₂	mg/L	1.0	

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	7510
Conductivity		µmho/cm	1.0	6100
Alkalinity	CaCO ₃	mg/L	1.0	
pH		std. units	0.10	4.52

Trace Metals				
Aluminum	Al	mg/L	0.10	
Arsenic	As	mg/L	0.001	
Boron	B	mg/L	0.10	
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	0.02
Copper	Cu	mg/L	0.01	
Iron	Fe	mg/L	0.01	
Lead	Pb	mg/L	0.005	0.007
Manganese	Mn	mg/L	0.01	
Molybdenum	Mo	mg/L	0.10	
Nickel	Ni	mg/L	0.05	0.86
Selenium	Se	mg/L	0.001	0.003
Vanadium	V	mg/L	0.10	
Zinc	Zn	mg/L	0.01	

Radiometrics				
Uranium	²³⁵ U	mg/L	0.0003	0.0101
Radium 226	²²⁶ Ra	pCi/L	0.2	7.9
Radium Error Estimate ±				0.4
Radium 228	²²⁸ Ra	pCi/L	1.0	14.2
Radium Error Estimate ±				1.0
Thorium 230	²³⁰ Th	pCi/L	0.2	0.9
Thorium Error Estimate ±				0.6

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LABORATORY ANALYSIS REPORT - PETROTOMICS, INC.

Sample ID:

Laboratory ID:

Sample Matrix:

Sample Date:

Report Date:

19 DC

98-54088

Water

09-02-98

September 25, 1998

Major Ions		Units	Reporting Limit	Results
Calcium	Ca	mg/L	0.05	374
Magnesium	Mg	mg/L	0.10	155
Sodium	Na	mg/L	0.10	83.1
Potassium	K	mg/L	0.10	11.0
Carbonate	CO ₃	mg/L	1.0	< 1.0
Bicarbonate	HCO ₃	mg/L	1.0	83.2
Hydroxide	OH	mg/L	1.0	< 1.0
Sulfate	SO ₄	mg/L	1.0	1700
Chloride	Cl	mg/L	0.10	74.8
Ammonium as N	NH ₄	mg/L	0.05	1.80
Nitrate + Nitrite as N	NO ₃ + NO ₂	mg/L	0.10	< 0.10
Fluoride	F	mg/L	0.10	3.39
Silica	SiO ₂	mg/L	1.0	17.7

Non-Metals				
Total Dissolved Solids @ 180°C	TDS	mg/L	2.0	2820
Conductivity		µmho/cm	1.0	3020
Alkalinity	CaCO ₃	mg/L	1.0	68.2
pH		std. units	0.10	6.99

Trace Metals				
Aluminum	Al	mg/L	0.10	< 0.10
Arsenic	As	mg/L	0.001	0.001
Boron	B	mg/L	0.10	< 0.10
Cadmium	Cd	mg/L	0.01	< 0.01
Chromium	Cr	mg/L	0.01	< 0.010
Copper	Cu	mg/L	0.01	< 0.01
Iron	Fe	mg/L	0.01	132
Lead	Pb	mg/L	0.005	< 0.005
Manganese	Mn	mg/L	0.01	8.89
Molybdenum	Mo	mg/L	0.10	< 0.10
Nickel	Ni	mg/L	0.05	0.25
Selenium	Se	mg/L	0.001	0.004
Vanadium	V	mg/L	0.10	< 0.10
Zinc	Zn	mg/L	0.01	0.08

Radiometric				
Uranium	²³⁸ U	mg/L	0.0003	0.0014
Radium 226	²²⁶ Ra	pCi/L	0.2	9.8
Radium Error Estimate ±				0.5
Radium 228	²²⁸ Ra	pCi/L	1.0	5.0
Radium Error Estimate ±				0.2
Thorium 230	²³⁰ Th	pCi/L	0.2	< 0.2
Thorium Error Estimate ±				-

Quality Assurance Data		Target Range	
Anion	meq		39.07
Cation	meq		43.24
WYDEQ A/C Balance	%	-5 - +5	5.06
Calc TDS	mg/L		2602
TDS A/C Balance	dec. %	0.80 - 1.20	1.08

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COMPLETE ANALYTICAL SERVICES

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 1998

<u>LOCATION</u>	<u>EXPOSURE RATE</u> <u>(mr/gr)</u>	<u>ERROR ESTIMATE</u> <u>(mr/gr)</u>
Site 1	42.8	± 5.2
Site 5	42.2	± 7.5

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.

7. Radon Flux Rates

Not required in license environmental sampling program.

LLD CALCULATIONS

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

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.

Ra²²⁶

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 = 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

Th²³²

C_B = 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 Th²³² 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 10⁶ L)

Pb²¹⁰

C_B = 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 10⁶ L)
= vegetation weight is usually 1/2 of sample provided.

Po²¹⁰

C_B = 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.

% ELC CALCULATION

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

The calculation is as follows:

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

Unrestricted limits for air from 10 CFR 20 Appendix B:

U nat	3000×10^{-15}
Th ²³⁰	20×10^{-15}
Ra ²²⁶	900×10^{-15}
Rn ²²²	10×10^{-9}