Z-AREA GROUNDWATER MONITORING REPORT FOR 2004 (U)

WSRC-TR-04-00633

January 11, 2005

Introduction

In accordance with SRS Z-Area Saltstone Industrial Solid Waste Permit, #025500-1603, wells ZBG-1, ZBG-1A and ZBG-2 are monitored for the parameters listed below:

pH
Specific Conductance
Water level
Arsenic
Antimony
Barium
Cadmium
Chromium
Lead
Mercury
Nitrate as Nitrogen
Nitrite as Nitrogen
Selenium
Silver
Benzene and Toluene
Radium 226 and 228 (sum)
Gross alpha
Nonvolatile beta

New wells ZBG-3, ZBG-4 and ZBG-5 were also monitored although the permit has not yet been modified to include them. The wells (with the exception of ZGB-1A which was dry) were sampled twice during 2004. The first event was during first quarter and the second was spread over third and fourth quarters of due to sampling difficulties described below.

The well sampling and analyses were conducted in accordance with Procedure Manual 3Q5, Hydrogeologic Data Collection except in the case of fourth quarter sampling at ZBG-3, ZBG-4 and ZBG-5 where Hydrasleeve no-purge samplers were used. These wells are low producers with historically turbid samples that appear to yield anomalously high results for some metals. Confronted with the choice of not sampling at all or obtaining extremely turbid samples with a bailer, SRS opted to try the Hydrasleeve.

This sampler is capable of obtaining representative samples that are relatively clear without "wasting" any water in a purging procedure. The underlying principal for most no purge samplers (like passive dilution samplers) is the idea that purging is not needed if the sample can be taken directly from the screen zone with no mixing of stagnant water from above or below the screen zone. The hydrasleeve sampler is an elongated plastic bag with a check valve at the top. The collapsed bag is installed with the check valve near the bottom of the screen zone and left in place for at least 24 hours. During that time, any silts and clays stirred up during installation have time to settle. The sampler is then pulled up rapidly through the sample zone. This opens the valve causing the hydrasleeve to fill. The sleeve is full before it reaches any overlying stagnant water. The valve then closes adding extra protection against the collection of stagnant water. At this point, the sampler can be pulled to surface.

The analytical results are attached. The sampling did not reveal any evidence of a release from the Saltstone vaults. Flow directions and velocities were similar to those observed in past years.

Flow Direction and Rate

Potentiometric surface maps for the water table aquifer were constructed using first and third quarter data. Flow rate can be estimated using the following equation:

$$\text{Flow(ft/day)} = \frac{\text{Hydraulic Conductivity (ft/day)}}{\text{Porosity (unitless)}} \times \frac{\text{dh(ft)}}{\text{dl(ft)}}$$

Where the hydraulic conductivity constant is 1.7 ft/day, the effective porosity value is 30 percent, the change in head is dh, and the horizontal distance is simply the distance between potentiometric contours (figures 1 and 2).

For first quarter of 2004, the calculation is as follows:

$$\frac{1.7 \text{ ft/day}}{0.30} \times \frac{12 \text{ ft}}{1350 \text{ ft}} = 0.050 \text{ ft/day or } 18.4 \text{ ft/year}$$

For third quarter of 2004, the calculation is as follows:

$$\frac{1.7 \text{ ft/day}}{0.30} \times \frac{12 \text{ ft}}{1300 \text{ ft}} = 0.052 \text{ ft/day or } 19.1 \text{ ft/year}$$

Analytical results

The nitrate/nitrite results are by far the most important in determining whether or not an unexpected release is occurring. This is because nitrate is the most mobile constituent likely to leach from saltstone. As in past years, nitrate/nitrite was detected in the downgradient wells but higher concentrations were found in background well ZBG-1. Therefore the downgradient detections do not represent evidence of a release from the vaults.

As was the case last year, samples from wells ZBG-4 and ZBG-5 had unusually high levels of chromium. This is believed to be coming from natural clays suspended in the samples. Interestingly, chromium concentrations in both wells dropped about 68% in fourth quarter. This is related to the use of the Hydrasleeve samplers which produce less turbid samples (table 1).

Table 1. Chromium results for ZBG-4 and ZBG-5.

WELL	QUARTER	Cr (ppb)
ZBG-4	1st	23.18
ZBG-4	4th	J 7.41 with Hydrasleeve
ZBG-5	1st	67.96
ZBG-5	4th	21.1 with Hydrasleeve

Estimated concentrations (J qualified) were reported for arsenic in well ZBG-5 and for selenium in ZBG-4 and ZBG-5. Since the results are estimates well below the practical quantitation limits, no conclusions can be drawn about their meaning. However, it should be noted that there is no plausible mechanism for these metals to leach from saltstone and travel to the wells without being preceded by a plume of nitrate.

Conclusions

The ZBG well series was sampled twice during 2004. ZBG-1A was dry. Flow rate and direction were consistent with historical patterns. The sampling did not reveal any evidence of a release from the saltstone vaults. Hydrasleeve no-purge samplers were used at low producing wells with promising results.

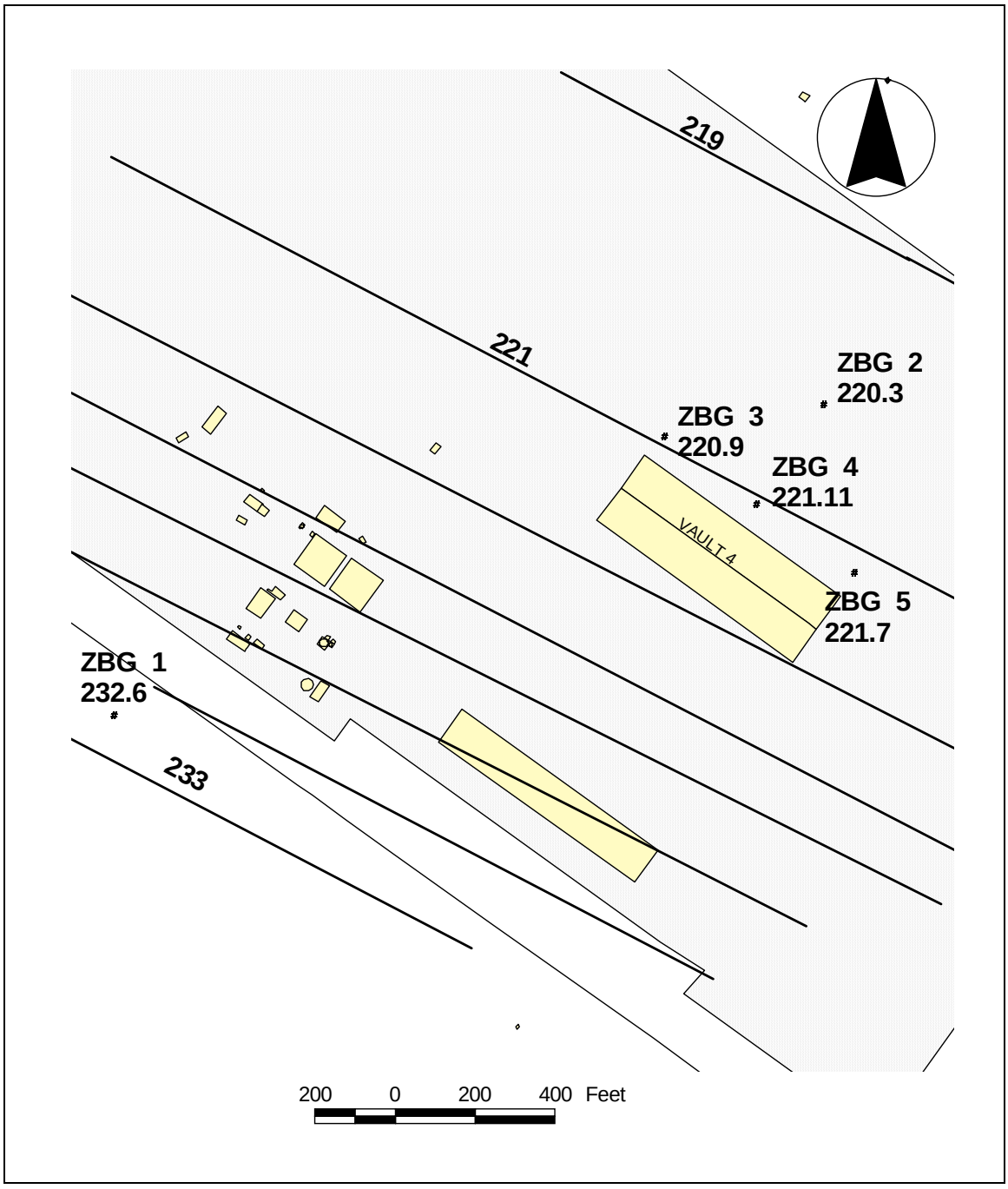

Figure 1. Water elevation data in Z-Area for first quarter of 2004.

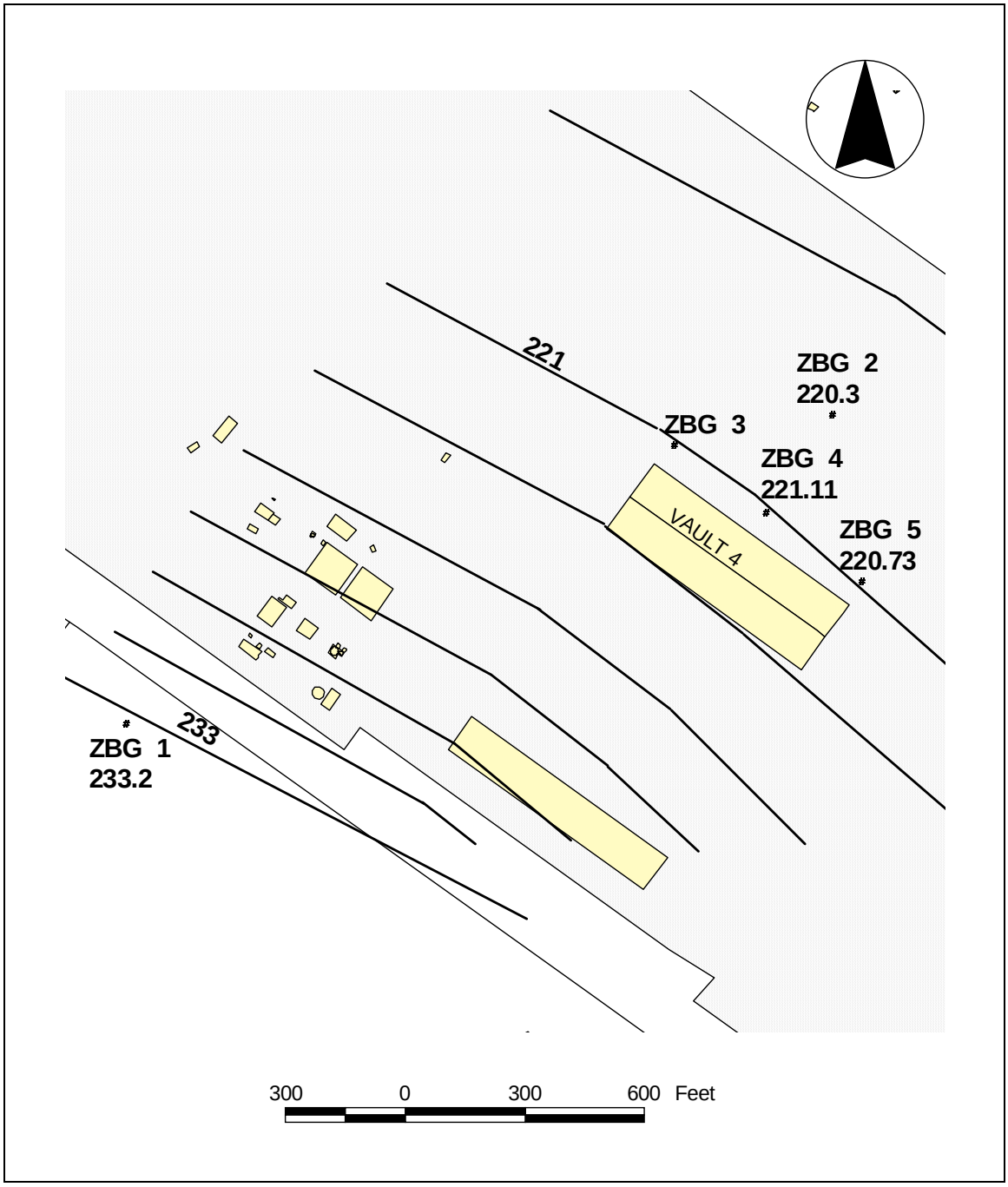

Figure 2. Water elevation data in Z-Area for third quarter of 2004.

Table 2. Monitoring data.

STATION_	DATE	ANALYTE_NAME	MDL	PQL	LAB_QUALIER	RESULT	UNITS
ZBG 1	2/9/2004 0:00	ANTIMONY	8	80	U	20.75	ug/L
ZBG 1	2/9/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 2	2/9/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 3	2/9/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 4	2/9/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 5	2/9/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 1	8/4/2004 0:00	ANTIMONY	10	100	U	100	ug/L
ZBG 1	8/4/2004 0:00	ANTIMONY	10	100	U	100	ug/L
ZBG 2	8/4/2004 0:00	ANTIMONY	10	100	U	100	ug/L
ZBG 3	11/16/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 4	11/16/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 4	11/16/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 5	11/16/2004 0:00	ANTIMONY	8	80	U	80	ug/L
ZBG 1	2/9/2004 0:00	ARSENIC	4	40	U	40	ug/L
ZBG 1	2/9/2004 0:00	ARSENIC	4	40	U	40	ug/L
ZBG 2	2/9/2004 0:00	ARSENIC	4	40	U	40	ug/L
ZBG 3	2/9/2004 0:00	ARSENIC	4	40	U	40	ug/L
ZBG 4	2/9/2004 0:00	ARSENIC	4	40	U	40	ug/L
ZBG 5	2/9/2004 0:00	ARSENIC	4	40	J	10.95	ug/L
ZBG 1	8/4/2004 0:00	ARSENIC	6	60	U	60	ug/L
ZBG 1	8/4/2004 0:00	ARSENIC	6	60	U	60	ug/L
ZBG 2	8/4/2004 0:00	ARSENIC	6	60	U	60	ug/L
ZBG 3	11/16/2004 0:00	ARSENIC	4	40	U	40	ug/L
ZBG 4	11/16/2004 0:00	ARSENIC	4	40	U	40	ug/L
ZBG 4	11/16/2004 0:00	ARSENIC	4	40	U	40	ug/L
ZBG 5	11/16/2004 0:00	ARSENIC	4	40	J	11.75	ug/L
ZBG 1	2/9/2004 0:00	BARIUM	1	10		11.31	ug/L
ZBG 1	2/9/2004 0:00	BARIUM	1	10		11.5	ug/L
ZBG 2	2/9/2004 0:00	BARIUM	1	10	J	7.038	ug/L
ZBG 3	2/9/2004 0:00	BARIUM	1	10	J	4.125	ug/L
ZBG 4	2/9/2004 0:00	BARIUM	1	10		186	ug/L
ZBG 5	2/9/2004 0:00	BARIUM	1	10		404	ug/L
ZBG 1	8/4/2004 0:00	BARIUM	2	20	J	15.36	ug/L
ZBG 1	8/4/2004 0:00	BARIUM	2	20	J	15.75	ug/L
ZBG 2	8/4/2004 0:00	BARIUM	2	20	J	12.05	ug/L
ZBG 3	11/16/2004 0:00	BARIUM	1	10		11.52	ug/L
ZBG 4	11/16/2004 0:00	BARIUM	1	10		136.7	ug/L
ZBG 4	11/16/2004 0:00	BARIUM	1	10		133.4	ug/L
ZBG 5	11/16/2004 0:00	BARIUM	1	10		134.6	ug/L
ZBG 1	2/9/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 2	2/9/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 3	2/9/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 4	2/9/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 5	2/9/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 1	8/4/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 2	8/4/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 3	11/16/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 4	11/16/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 5	11/16/2004 0:00	BENZENE	0.33	1	U	1	ug/L
ZBG 1	8/4/2004 0:00	BERYLLIUM	0.2	2	U	2	ug/L
ZBG 1	8/4/2004 0:00	BERYLLIUM	0.2	2	U	2	ug/L
ZBG 2	8/4/2004 0:00	BERYLLIUM	0.2	2	U	2	ug/L
ZBG 1	2/9/2004 0:00	CADMIUM	0.1	1	J	0.183	ug/L
ZBG 1	2/9/2004 0:00	CADMIUM	0.1	1	J	0.3397	ug/L
ZBG 2	2/9/2004 0:00	CADMIUM	0.1	1	J	0.1294	ug/L
ZBG 3	2/9/2004 0:00	CADMIUM	0.1	1	J	0.3437	ug/L
ZBG 4	2/9/2004 0:00	CADMIUM	0.1	1	J	0.3249	ug/L
ZBG 5	2/9/2004 0:00	CADMIUM	0.1	1		2.18	ug/L
ZBG 1	8/4/2004 0:00	CADMIUM	1	10	U	10	ug/L
ZBG 1	8/4/2004 0:00	CADMIUM	1	10	U	10	ug/L
ZBG 2	8/4/2004 0:00	CADMIUM	1	10	U	10	ug/L
ZBG 3	11/16/2004 0:00	CADMIUM	1	10	U	10	ug/L
ZBG 4	11/16/2004 0:00	CADMIUM	1	10	U	10	ug/L
ZBG 4	11/16/2004 0:00	CADMIUM	1	10	U	10	ug/L
ZBG 5	11/16/2004 0:00	CADMIUM	1	10	U	10	ug/L
ZBG 1	2/9/2004 0:00	CHROMIUM	0.9	9	J	1.023	ug/L
ZBG 1	2/9/2004 0:00	CHROMIUM	0.9	9	U	9	ug/L
ZBG 2	2/9/2004 0:00	CHROMIUM	0.9	9	J	2.067	ug/L
ZBG 3	2/9/2004 0:00	CHROMIUM	0.9	9	J	1.226	ug/L
ZBG 4	2/9/2004 0:00	CHROMIUM	0.9	9		23.18	ug/L
ZBG 5	2/9/2004 0:00	CHROMIUM	0.9	9		67.96	ug/L
ZBG 1	8/4/2004 0:00	CHROMIUM	1	10	J	1.075	ug/L
ZBG 1	8/4/2004 0:00	CHROMIUM	1	10	J	1.107	ug/L
ZBG 2	8/4/2004 0:00	CHROMIUM	1	10	J	1.907	ug/L
ZBG 3	11/16/2004 0:00	CHROMIUM	1	10	J	2.682	ug/L
ZBG 4	11/16/2004 0:00	CHROMIUM	1	10	J	7.414	ug/L
ZBG 4	11/16/2004 0:00	CHROMIUM	1	10	J	6.865	ug/L
ZBG 5	11/16/2004 0:00	CHROMIUM	1	10		21.1	ug/L
ZBG 2	2/9/2004	DEPTH TO WATER				57.8	FEET

STATION_	DATE	ANALYTE_NAME	MDL	PQL	LAB_QUALIER	RESULT	UNITS
ZBG 5	2/9/2004 0:00	PH	0.01	0.1		7.19	pH
ZBG 2	2/9/2004	PH				5.5	PH
ZBG 3	2/9/2004	PH				5.8	PH
ZBG 4	2/9/2004	PH				6.1	PH
ZBG 1	2/9/2004	PH				5.8	PH
ZBG 5	2/9/2004	PH				6.8	PH
ZBG 1	8/4/2004	PH				5.8	PH
ZBG 2	8/4/2004	PH				5.5	PH
ZBG 5	11/18/2004	PH				6.5	PH
ZBG 4	11/18/2004	PH				5.4	PH
ZBG 3	11/18/2004	PH				5.8	PH
ZBG 1	2/9/2004 0:00	RADIUM-226	0.298	1.384		2.6	pCi/L
ZBG 1	2/9/2004 0:00	RADIUM-226	0.269	1.159		2.13	pCi/L
ZBG 2	2/9/2004 0:00	RADIUM-226	0.353	1.791		5.08	pCi/L
ZBG 3	2/9/2004 0:00	RADIUM-226	0.32	1.45		2.91	pCi/L
ZBG 4	2/9/2004 0:00	RADIUM-226	0.372	1.536		2.83	pCi/L
ZBG 5	2/9/2004 0:00	RADIUM-226	0.462	1.794		3.06	pCi/L
ZBG 1	8/4/2004 0:00	RADIUM-226	0.397	0.969	J	0.45	pCi/L
ZBG 1	8/4/2004 0:00	RADIUM-226	0.339	1.01	J	0.878	pCi/L
ZBG 2	8/4/2004 0:00	RADIUM-226	0.352	1.02	J	0.806	pCi/L
ZBG 3	11/16/2004 0:00	RADIUM-226	0.854	3.13		5.38	pCi/L
ZBG 4	11/16/2004 0:00	RADIUM-226	0.725	1.83	J	1	pCi/L
ZBG 5	11/16/2004 0:00	RADIUM-226	0.72	1.73	J	0.726	pCi/L
ZBG 5	11/16/2004 0:00	RADIUM-226	0.681	1.78	J	1.09	pCi/L
ZBG 1	2/9/2004 0:00	RADIUM-228	1.02	2.036	U	0.768	pCi/L
ZBG 2	2/9/2004 0:00	RADIUM-228	0.854	1.898	U	2.11	pCi/L
ZBG 3	2/9/2004 0:00	RADIUM-228	0.76	1.59	UJ	0.89	pCi/L
ZBG 4	2/9/2004 0:00	RADIUM-228	0.557	1.157	U	0.472	pCi/L
ZBG 5	2/9/2004 0:00	RADIUM-228	0.919	1.887	U	0.6	pCi/L
ZBG 5	2/9/2004 0:00	RADIUM-228	0.895	1.895	J	1.19	pCi/L
ZBG 1	8/4/2004 0:00	RADIUM-228	0.703	1.55	U	0.482	pCi/L
ZBG 1	8/4/2004 0:00	RADIUM-228	0.682	1.5	U	0.354	pCi/L
ZBG 2	8/4/2004 0:00	RADIUM-228	0.701	1.53	U	0.252	pCi/L
ZBG 3	11/16/2004 0:00	RADIUM-228	1.04	2.21	U	-0.676	pCi/L
ZBG 3	11/16/2004 0:00	RADIUM-228	0.621	1.39	J	0.779	pCi/L
ZBG 4	11/16/2004 0:00	RADIUM-228	0.982	2.15	U	0.49	pCi/L
ZBG 5	11/16/2004 0:00	RADIUM-228	1.01	2.22	U	0.629	pCi/L
ZBG 1	2/9/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 1	2/9/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 2	2/9/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 3	2/9/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 4	2/9/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 5	2/9/2004 0:00	SELENIUM	5	50	J	19.75	ug/L
ZBG 1	8/4/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 1	8/4/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 2	8/4/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 3	11/16/2004 0:00	SELENIUM	5	50	U	50	ug/L
ZBG 4	11/16/2004 0:00	SELENIUM	5	50	J	9.533	ug/L
ZBG 4	11/16/2004 0:00	SELENIUM	5	50	J	6.329	ug/L
ZBG 5	11/16/2004 0:00	SELENIUM	5	50	J	26.3	ug/L
ZBG 1	2/9/2004 0:00	SILVER	1	10	U	10	ug/L
ZBG 1	2/9/2004 0:00	SILVER	1	10	U	10	ug/L
ZBG 2	2/9/2004 0:00	SILVER	1	10	U	10	ug/L
ZBG 3	2/9/2004 0:00	SILVER	1	10	U	10	ug/L
ZBG 4	2/9/2004 0:00	SILVER	1	10	U	10	ug/L
ZBG 5	2/9/2004 0:00	SILVER	1	10	J	2.571	ug/L
ZBG 1	8/4/2004 0:00	SILVER	1	10	U	10	ug/L
ZBG 1	8/4/2004 0:00	SILVER	1	10	U	10	ug/L
ZBG 2	8/4/2004 0:00	SILVER	1	10	U	10	ug/L
ZBG 3	11/16/2004 0:00	SILVER	2	20	U	20	ug/L
ZBG 4	11/16/2004 0:00	SILVER	2	20	U	20	ug/L
ZBG 4	11/16/2004 0:00	SILVER	2	20	U	20	ug/L
ZBG 5	11/16/2004 0:00	SILVER	2	20	U	20	ug/L
ZBG 2	2/9/2004	SP. COND				16	us/cm
ZBG 3	2/9/2004	SP. COND				18	us/cm
ZBG 4	2/9/2004	SP. COND				21	us/cm
ZBG 1	2/9/2004	SP. COND				25	us/cm
ZBG 5	2/9/2004	SP. COND				109	us/cm
ZBG 1	8/4/2004	SP. COND				27	us/cm
ZBG 2	8/4/2004	SP. COND				42	us/cm
ZBG 5	11/18/2004	SP. COND				127	us/cm
ZBG 4	11/18/2004	SP. COND				25	us/cm
ZBG 3	11/18/2004	SP. COND				21	us/cm
ZBG 2	2/9/2004	TEMP				19.7	C
ZBG 3	2/9/2004	TEMP				16.9	C
ZBG 4	2/9/2004	TEMP				15.8	C
ZBG 1	2/9/2004	TEMP				18.5	C
ZBG 5	2/9/2004	TEMP				17.9	C
ZBG 1	8/4/2004	TEMP				21.2	C

STATION_	DATE	ANALYTE_NAME	MDL	PQL	LAB_QUALIER	RESULT	UNITS
ZBG 2	8/4/2004	TEMP				21.3	C
ZBG 5	11/18/2004	TEMP				19.6	C
ZBG 4	11/18/2004	TEMP				19	C
ZBG 3	11/18/2004	TEMP				18.5	C
ZBG 1	2/9/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 2	2/9/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 3	2/9/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 4	2/9/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 5	2/9/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 1	8/4/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 2	8/4/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 3	11/16/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 4	11/16/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 5	11/16/2004 0:00	TOLUENE	0.39	1	U	1	ug/L
ZBG 1	2/9/2004 0:00	TRITIUM	0.297	0.785		5.057	pCi/mL
ZBG 1	2/9/2004 0:00	TRITIUM	0.297	0.796		5.473	pCi/mL
ZBG 2	2/9/2004 0:00	TRITIUM	0.297	0.739		3.104	pCi/mL
ZBG 3	2/9/2004 0:00	TRITIUM	0.296	0.74		3.242	pCi/mL
ZBG 4	2/9/2004 0:00	TRITIUM	0.293	0.695		1.754	pCi/mL
ZBG 5	2/9/2004 0:00	TRITIUM	0.293	0.703		2.022	pCi/mL
ZBG 1	8/4/2004 0:00	TRITIUM	0.874	2.27		5.15	pCi/mL
ZBG 1	8/4/2004 0:00	TRITIUM	0.869	2.25		5	pCi/mL
ZBG 2	8/4/2004 0:00	TRITIUM	0.873	2.14		3.27	pCi/mL
ZBG 3	11/16/2004 0:00	TRITIUM	0.995	2.38		2.81	pCi/mL
ZBG 3	11/16/2004 0:00	TRITIUM	1	2.38		2.61	pCi/mL
ZBG 4	11/16/2004 0:00	TRITIUM	0.954	2.27		2.45	pCi/mL
ZBG 5	11/16/2004 0:00	TRITIUM	0.957	2.13	U	0.53	pCi/mL
ZBG 2	2/9/2004	TURBIDITY				0.4	NTU
ZBG 3	2/9/2004	TURBIDITY				1.1	NTU
ZBG 4	2/9/2004	TURBIDITY				450	NTU
ZBG 1	2/9/2004	TURBIDITY				0.4	NTU
ZBG 5	2/9/2004	TURBIDITY				350	NTU
ZBG 1	8/4/2004	TURBIDITY				3.9	NTU
ZBG 2	8/4/2004	TURBIDITY				4.5	NTU
ZBG 3	11/18/2004	TURBIDITY				9.1	NTU
ZBG 1	2/9/2004 0:00	XYLENES	0.25	1	U	1	ug/L
ZBG 2	2/9/2004 0:00	XYLENES	0.25	1	U	1	ug/L
ZBG 3	2/9/2004 0:00	XYLENES	0.25	1	U	1	ug/L
ZBG 4	2/9/2004 0:00	XYLENES	0.25	1	U	1	ug/L
ZBG 5	2/9/2004 0:00	XYLENES	0.25	1	U	1	ug/L