REPORT

Frontier Chemical - Pendleton Site Semi-Annual Ground Water Monitoring Report

Pendleton Site PRP Group

September 2000

O'BRIEN & GERE
ENGINEERS, INC.

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REPORT

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Pendleton Site PRP Group

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September 2000

O'BRIEN & GERE ENGINEERS, INC.

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Contents

List of Tables

List of Figures

List of Appendices

1. Introduction

This document is the first 2000/2001 Semi-Annual Ground Water Monitoring Report for the Frontier Chemical - Pendleton Site (Site), located on Town Line Road in the Town of Pendleton, Niagara County, New York. This report is prepared based on the New York State Department of Environmental Conservation (NYSDEC)-approved Operation & Maintenance (O&M) Manual (O'Brien & Gere Engineers, 1997) for the Site, which addresses, among other items, long-term ground water monitoring at the Site. This Semi-Annual Ground Water Monitoring Report presents a discussion of the following:

- Piezometer/monitoring well inspection
- Hydraulic evaluation of the capped area and collection trench
- Evaluation of ground water chemistry in the intermediate and deep ground water zones.

These items are described in the following sections.

1.1. Piezometer/monitoring well inspection

The piezometer/monitoring well inspection was conducted on August 9, 2000, and included the piezometers (P-1 through P-8), standpipe (SP-1), and ground water monitoring wells (85-5R, URS-5D, 85-7R, URS-7D, URS-9I, URS-9D, 88-12C, 88-12D, URS-14I, and URS-14D) identified as the Site monitoring network in the O&M Manual for the Site.

Results of the inspection indicated that each piezometer and monitoring well was in an acceptable condition for collecting water elevation measurements and sampling. Similar maintenance issues to those identified in previous inspection reports were noted at the Site:

- Piezometer P-6 is currently angled 20 to 30 degrees from vertical.
- Monitoring wells URS-14I and URS-14D should have fill material installed around the concrete pads.

In addition, it was noted during the inspection that SP-1 is slightly angled from vertical.

It should be noted that, at this time, these issues are not affecting the integrity of the piezometers or monitoring wells. August 2000 inspection forms are included in Appendix A.

1.2. Hydraulic evaluation of capped area and collection trench

In accordance with the O&M Manual, a complete round of static ground water elevations was collected from the piezometers (P-1 through P-8), standpipe (SP-1), and ground water monitoring wells (85-5R, URS-5D, 85-7R, URS-7D, URS-9I, URS-9D, 88-12C, 88-12D, URS-14I, and URS-14D). The ground water elevation measurements were collected on August 9, 2000. The surface water elevation of Quarry Lake was measured on August 10, 2000, by Glynn Geotechnical Engineering, Inc. The ground water elevations measured in the piezometers and standpipe, and in the monitoring wells, are summarized on Tables 1 and 2, respectively. Quarry Lake elevations are summarized on Table 3. As shown on Table 3, the August 10, 2000 surface water elevation of Quarry Lake is slightly above the outlet weir elevation of 577.2 ft.

The water level measurements collected on August 9 and 10, 2000 are illustrated on Figure 1. These measurements are the ninth round collected since remedial construction was substantially completed in August 1996. The water elevation data was used to evaluate the following:

- Whether an inward hydraulic gradient exists at the site by comparing water level measurements within the capped area (P-2, P-3, P-4, P-6, and P-7) to those measured outside the capped area (P-1, P-5, P-8, SP-1, and Quarry Lake)
- The ground water flow potential inside the capped area

- Whether the ground water collection trench is effectively controlling ground water migration away from the capped area.

The data indicates that an inward hydraulic gradient exists at the Site, except in the eastern portion of the capped area in the vicinity of piezometers P-1 and P-2, where the data indicates a slight outward hydraulic gradient. The ground water elevation in piezometer P-2, located inside the capped area, is higher than the ground water elevation in piezometer P-1, installed outside the capped area. An inward hydraulic gradient exists in the northern and southern portions of the capped area, as the ground water elevations inside the capped area (P-6 and P-7) are less than the ground water elevations outside the capped area (P-5 and P-8, respectively). Along the western portion of the site, the ground water elevation at P-4 is higher than the elevation in the ground water collection trench (SP-1). The ground water elevation in piezometer P-3, installed within the center of the capped area, is greater than ground water elevations measured in piezometers P-1 and P-8, installed outside the capped area.

Although the data indicates an outward hydraulic gradient within the eastern portion of the capped area, the ground water elevations collected in the piezometers installed within the capped area (P-2, P-3, P-4, P-6, and P-7) are lower than originally measured in June 1997. This suggests that dewatering of the capped area is occurring. The fluctuations in water elevations in the piezometers located within the capped area (P-2, P-3, P-4, P-6, and P-7) may be attributed to differences in: barometric pressure during sampling events; the movement of water within the capped area; and/or the low permeability of the materials. The fluctuations in water elevations in the piezometers located outside the capped area (P-1, P-5, and P-8) may be attributed to seasonal variations.

The contrasting fluctuations of ground water levels within and outside the capped area demonstrate that ground water within the capped area has been isolated. In addition, the ground water elevation in the standpipe (SP-1) in the ground water collection trench is less than the surface water elevation of Quarry Lake, indicating that Quarry Lake is isolated from the capped area.

Ground water elevations of piezometers installed within the capped area along the northern (P-7), western (P-4), eastern (P-2), and southern (P-6) portions of the Site are higher than the invert elevations (bottom) of the ground water collection trench. The invert elevations of the ground water collection trench vary from 568.80 ft to 563.37 ft. This information indicates that the overall hydraulic gradient is to the west towards the ground water collection trench. In summary, the data

indicates that the ground water collection trench is effectively removing shallow ground water from within the capped area.

As discussed in the March 1998 monitoring report (O'Brien & Gere Engineers, 1998), based on an average daily flow rate to the ground water collection trench of 170 gallons/day and a hydraulic conductivity adjacent to the ground water collection trench of 3.3×10^{-6} cm/sec, it is estimated that approximately 110 years will be required to dewater the containment area. However, the amount of water present within the capped area and the time to dewater beneath the capped area has minimal impact on the effectiveness of the containment, since hydraulic isolation within the capped area has been established and ground water beneath the capped area is migrating towards the ground water collection trench.

1.3. Ground water sampling and chemistry

Between August 10 and 11, 2000, the seventh round of post-closure ground water samples was collected in accordance with the protocols presented in the O&M Manual. Ground water samples were obtained from the ten ground water monitoring wells identified for sampling in the O&M Manual (85-5R, URS-5D, 85-7R, URS-7D, URS-9I, URS-9D, 88-12C, 88-12D, URS-14I, and URS-14D).

Following sample collection, the ground water samples were submitted to O'Brien & Gere Laboratories, Inc., for analysis of the parameters shown in Table 1-1.

Table 1-1. *Ground water analytical methods.*

Parameter	Method
VOCs	USEPA Method 8260B
Inorganics	USEPA Methods 6010B/7470A/7841
Cyanide	USEPA Method 9010B/9014

Source: O'Brien & Gere Engineers, Inc.

Ground water sampling logs and chain of custody forms are included in Appendix B.

In accordance with the O&M Manual and as approved by the NYSDEC, sampling and analysis for target compound list (TCL) semi-volatile organic compounds (SVOCs) and polychlorinated biphenyls (PCBs)/pesticides were discontinued for the second through fifth years of monitoring. In accordance with the O&M Manual, sampling is to be continued semi-annually for TCL volatile organic compounds (VOCs) and target analyte list (TAL) metals during the second through fifth years of monitoring. In accordance with the NYSDEC-approved O&M Manual, the required sampling frequency will be re-evaluated after the fifth year of monitoring.

Purge water generated during sampling was contained, passed through a 25-micron bag filter, and discharged to manhole MH-3. The water in manhole MH-3 was conveyed through the pre-treatment system prior to discharge to the Niagara County Sewer District (NCSD) interceptor system at manhole MH-16.

The laboratory analytical data was validated by Data Validation Services of North Creek, New York. The validation was performed in accordance with guidance from the most current editions of the United States Environmental Protection Agency (USEPA) Contract Laboratory Procedures (CLP) National Functional Guidelines for Organic and Inorganic Data Review, and the USEPA Standard Operating Procedures (SOPs) HW-2 and HW-6. Results of the validation indicated that the samples were processed and analyzed in compliance with protocol requirements, and with adherence to quality criteria. All of the analytical results are useable, although minor qualifications are needed for some of the results. A copy of the data validation report is included in Appendix C.

Results of the ground water analyses, along with a comparison of the results with New York State Class GA Standards, are summarized on Table 4. The New York State Class GA Standards presented on Table 4 have been revised to reflect revisions to the New York State water quality standards (NYSDEC, 1999). In general, the August 2000 ground water chemistry is similar to previous sampling events.

Detected constituents exceeding New York State Class GA Standards included iron at four locations (85-5R, URS-5D, 88-12C, and URS-14D) and sodium at ten locations (85-5R, URS-5D, 85-7R, URS-7D, URS-9I, URS-9D, 88-12C, 88-12D, URS-14I, and URS-14D). Concentrations of iron were detected in background well URS-14D and have previously been detected in background well URS-14I at similar concentrations. Concentrations of sodium have also been detected above the New York State Class GA Standards in background wells URS-14I and URS-14D at

similar concentrations. It is likely that the elevated concentrations of sodium are naturally occurring and are not related to previous site activities. VOCs were not detected above the New York State Class GA Standards. The database will be updated with data from future sampling events, and ground water standards will be reviewed annually to evaluate whether standards have been revised.

As specified in the O&M Manual, statistical analyses of the ground water chemistry data have been completed. A preliminary exploratory data analysis, using univariate statistics in SAS®, was performed for fifteen analytes that have been detected a total of ten or more times in various monitoring wells since the initial post-construction sampling event in June 1997. Based on the results of the preliminary exploratory data analysis, concentrations for fourteen analytes (at $\alpha = 0.10$) do not appear to be normally distributed. Magnesium appears to be normally distributed.

The August 2000 data represents the results of the seventh baseline data collection effort. A t-test analysis was conducted based on the data collected from the post-construction sampling events, between June 1997 and August 2000, to evaluate whether downgradient concentrations exceed upgradient concentrations, based on a comparison of downgradient wells with the appropriate upgradient wells, URS-14I or URS-14D. Based on the results of the t-test, Table 1-2 presents a summary of locations where constituent concentrations in downgradient wells exceeded concentrations at the appropriate upgradient comparison well, at a confidence level (α) equal to 0.05.

Table 1-2. *Results of the t-test analysis.*

Monitoring Well	Analytes with Higher Concentrations than in Upgradient Wells
85-5R	Calcium, Magnesium, Sodium
URS-5D	Calcium, Manganese, Sodium
85-7R	Calcium, Magnesium, Sodium
URS-7D	Calcium, Magnesium, Manganese, Potassium, Sodium
URS-9I	Calcium, Magnesium
88-12C	Calcium, Magnesium, Arsenic
88-12D	Calcium, Magnesium, Manganese, Potassium, Sodium

.Source: O'Brien & Gere Engineers, Inc.

It should be noted that there are currently no New York State Class GA Standards for calcium, magnesium, or potassium. Concentrations of arsenic and manganese have not been detected above the New York State Class GA Standards during the post-construction sampling. In addition, it is likely that elevated concentrations of calcium, magnesium, manganese, potassium, and sodium are naturally occurring and are not related to previous site activities.

Results of the t-test analysis also indicate that barium concentrations are greater in upgradient well URS-14I than in corresponding downgradient wells URS-9I and 88-12C, and greater in upgradient well URS-14D than in corresponding downgradient wells URS-9D and 88-12D, at a confidence level of α=0.05. Concentrations of barium in wells URS-9I, URS-9D, 88-12C, 88-12D, URS-14I, and URS-14D are below the New York State Class GA Standard. T-test analysis results also indicate that sodium concentrations are greater in upgradient well URS-14I than in corresponding downgradient wells URS-9I and 88-12C, at a confidence level of α=0.05. In addition, t-test analysis results indicate that calcium concentrations are greater in upgradient well URS-14D than in corresponding downgradient well URS-9D, at a confidence level of α=0.05.

2. Conclusions

Based on the data contained in this semi-annual report, the following conclusions are presented:

- The isolation of ground water within the capped area has been established.

- The ground water elevation data indicates that ground water within the capped area is migrating to the west toward the ground water collection trench.

- The ground water elevation data indicates that the ground water collection trench is effectively removing shallow ground water from within the capped area.

- The August 2000 ground water chemistry is similar to previous sampling events.

- Results of the t-test analysis indicate that concentrations of arsenic (88-12C), calcium (85-5R, URS-5D, 85-7R, URS-7D, URS-9I, 88-12C, and 88-12D), magnesium (85-5R, 85-7R, URS-7D, URS-9I, 88-12C, and 88-12D), manganese (URS-5D, URS-7D, and 88-12D), potassium (URS-7D and 88-12D), and sodium (85-5R, URS-5D, 85-7R, URS-7D, and 88-12D) exceed upgradient concentrations, based on a comparison of downgradient wells with the appropriate upgradient wells, URS-14I or URS-14D. There are currently no New York State Class GA Standards for calcium, magnesium, or potassium. Concentrations of arsenic and manganese have not been detected above the New York State Class GA Standards during the post-construction sampling. It is likely that elevated concentrations of calcium, magnesium, manganese, potassium, and sodium are naturally occurring and are not related to previous site activities.

- Results of the t-test analysis indicate that barium concentrations are greater in upgradient well URS-14I than in corresponding downgradient wells URS-9I and 88-12C, and greater in upgradient well URS-14D than in corresponding downgradient wells URS-9D and 88-12D, at a confidence level of α=0.05. Concentrations of barium in URS-9I, URS-9D, 88-12C, 88-12D, URS-14I, and URS-14D are below the New York State Class GA Standard.

- T-test analysis results indicate that sodium concentrations are greater in upgradient well URS-14I than in corresponding downgradient wells URS-9I and 88-12C, at a confidence level of α=0.05.

- T-test analysis results indicate that calcium concentrations are greater in upgradient well URS-14D than in corresponding downgradient well URS-9D, as a confidence level of α=0.05.

- Iron was detected in four monitoring wells at concentrations above New York State Class GA Standards. Concentrations of iron were detected in background well URS-14D and have previously been detected in the background well URS-14I at similar concentrations. In addition, results of the t-test analysis indicate that concentrations of iron are not statistically higher downgradient than upgradient at the Site, indicating that the capped area is not impacting ground water.

- Sodium was detected in ten monitoring wells at concentrations above New York State Class GA Standards. It is likely that this element is naturally occurring and is not related to previous site activities.

References

New York State Department of Environmental Conservation, 1999. Title 6, Chapter X, Subchapter A, Article 2, Part 703.5, Table 1, Water Quality Standards Surface Waters and Groundwater, Effective August 4, 1999.

O'Brien & Gere Engineers, 1997. Operation and Maintenance Manual, Frontier Chemical - Pendleton Site, Town of Pendleton, Niagara County, New York, Pendleton Site PRP Group, March 1997.

O'Brien & Gere Engineers, 1998. Frontier Chemical - Pendleton Site, Semi-Annual Ground Water Monitoring Report, Pendleton Site PRP Group, March 1998.

TABLES

Table 1

Frontier Chemical - Pendleton Site

Piezometer Ground Water Elevation Summary Table

Piezometer		Location	Top of Riser Elev. (ft)	Top of Cover Elev. (ft)	Depth (ft below riser)	Screened Elev. (ft)	Ground water elevation (ft)								
							6/24/97	9/30/97	2/23/98	4/28/98	9/17/98	2/3/99	8/11/99	2/7/00	8/9/00
P-1	(O)	Eastern portion	583.21	583.30	16.4	576.8 - 566.8	579.54	577.09	579.25	579.60	575.62	572.97	575.83	573.76	576.66
P-2	(I)	of capped area	582.90	583.20	15.7	577.2 - 567.2	579.60	579.24	578.20	578.37	578.76	576.96	578.27	575.59	577.60
P-3	(I)	Center of capped area	606.33	606.64	39.7	586.6 - 566.6	580.36	580.38	580.06	579.94	579.80	579.96	579.38	579.29	578.95
P-4	(I)	Adjacent to	582.31	583.85	15.6	576.7 - 566.7	577.15	577.43	576.70	575.11	575.96	574.58	575.56	573.96	575.11
SP-1	(T)	Quarry Lake	579.86	580.07	15.0	bop = 564.9	<564.9	<564.9	<564.9	<564.9	<564.9	<564.9	<564.9	<564.9	<564.9
P-5	(O)	Southern portion	583.05	583.55	15.5	577.6 - 567.6	576.87	577.25	578.57	579.31	576.13	574.70	576.48	578.16	579.02
P-6	(I)	of capped area	584.45	584.60	16.2	578.3 - 568.3	578.77	579.17	578.14	578.20	578.63	577.94	578.28	577.74	577.78
P-7	(I)	Northern portion	580.97	582.00	15.9	575.0 - 565.0	578.33	578.62	576.45	576.17	577.15	574.43	575.55	573.02	574.97
P-8	(O)	of capped area	582.83	583.00	17.3	575.5 - 565.5	577.76	578.87	578.75	579.61	576.90	574.72	576.15	576.12	578.26

Notes:

1. Elevation based on USGS Datum.
2. bop = bottom of pipe.
3. O = piezometer located outside of capped area.
4. I = piezometer located inside capped area.
5. T = standpipe located within the ground water collection trench.
6. The top of riser of piezometer P-4 was modified on 4/28/98 from 583.68 ft to 582.31 ft to allow clearance for the installation of a locking expansion plug beneath the flush-mounted cover.
7. The top of riser of piezometer P-7 was modified on 4/28/98 from 581.84 ft to 580.97 ft to allow clearance for the installation of a locking expansion plug beneath the flush-mounted cover.

Table 2

Frontier Chemical - Pendleton Site

Monitoring Well Ground Water Elevation Summary Table

Monitoring Well	Location	Top of Riser Elev. (ft)	Ground Elev. (ft)	Depth (ft below riser)	Screened Elev. (ft)	Ground water elevation (ft)								
						6/24/97	9/30/97	2/23/98	4/28/98	9/17/98	2/3/99	8/11/99	2/7/00	8/9/00
URS-14I	Upgradient well nest	581.14	580.84	31.0	550.1 - 555.1	577.15	578.77	580.24	580.14	574.76	577.35	575.42	577.68	577.74
URS-14D	in church parking lot	580.71	580.85	41.5	539.2 - 544.2	575.50	574.28	575.87	576.05	573.94	572.89	571.92	571.87	573.05
URS-9I	Southern well nest	581.68	579.90	46.0	535.6 - 540.6	575.38	574.22	575.69	575.91	573.76	572.67	571.82	571.78	572.98
URS-9D	along Town Line Road	580.80	579.00	46.5	534.3 - 539.3	575.36	574.21	575.68	575.89	573.64	572.66	571.24	571.66	572.94
85-5R	Middle well nest	580.84	578.70	40.0	540.9 - 542.9	574.70	573.97	575.39	575.70	574.98	572.78	571.92	571.10	572.95
URS-5D	along Town Line Road	580.60	578.00	49.9	530.8 - 535.8	574.73	574.02	575.42	575.74	573.80	572.12	571.97	571.39	572.89
85-7R	North well nest	577.90	576.60	27.8	550.2 - 552.2	575.09	574.21	575.53	575.87	573.74	572.30	572.04	571.52	573.10
URS-7D	along Town Line Road	579.35	576.50	39.9	539.5 - 544.5	575.15	574.35	575.60	575.99	573.75	572.40	571.99	571.57	573.13
88-12C	Well nest outside northeast	583.12	583.70	31.3	551.8 - 553.8	576.60	574.03	576.53	577.06	572.79	571.72	571.26	571.12	573.01
88-12D	portion of capped area	582.87	583.28	54.5	528.4 - 533.4	575.72	574.54	576.17	576.33	574.00	572.97	572.36	572.33	573.53

Notes:

1. Elevation based on USGS Datum.

Table 3
Frontier Chemical - Pendleton Site
Quarry Lake Surface Water Elevation Summary Table

Date	Quarry Lake Surface Water Elevation (ft) (1)
9/8/97	572.3
2/23/98	578.0
4/30/98	578.26
9/21/98	577.42
2/4/99	577.97
8/4/99	577.60
2/7/00	578.16 (2)
8/10/00	578.07

Notes:
1. Elevation based on USGS Datum.
2. Ice surface elevation.

Table 4
Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Before Remediation | After Remediation

Parameter	Standard ug/L (ppb)	85-5R 7/86	8/90	2/91	10/92	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)												
Acetone	—	NA	R	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	ND	15	ND	ND	ND	0.34 J	ND	ND	0.10 J	ND	ND
2-Butanone	—	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	—	NA	ND	ND	ND	ND	ND	ND	ND	ND	18	ND
Chlorobenzene	5	ND	NA	NA	NA	ND	0.28 J	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	NA	ND	ND	ND	ND	ND	ND	ND	0.17 J	0.10 J	0.11 J
Ethylbenzene	5	ND	ND	ND	ND	ND	0.24 J	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	—	NA	2J	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	2J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	ND	ND	ND	ND	0.14 J	ND	ND	ND	ND	ND
Total Xylenes	5	NA	ND	ND	ND	ND	0.96	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)												
Aluminum	—	1,060	214	37.8B	153	ND	300	ND	ND	ND	ND	ND
Antimony	3	NA	ND	42.4B	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	NA	1B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	1000	20	73.5B	23.4B	15	40	80	50J	ND	60	60	60
Beryllium	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	—	380,000	355,000	378,000	321,000	270,000	220,000	220,000	130,000	220,000	200,000	190,000
Chromium	50	40	7.5B	ND	ND	ND	30	10	ND	ND	ND	ND
Cobalt	—	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	10	ND	ND	11	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	300	1,020	669	915	419	140	2,300	190	ND	100	ND	420
Lead	25	150	ND	1.2B	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	—	179,000	106,000	170,000	139,000	130,000	85,000	110,000	59,000	99,000	90,000	85,000
Manganese	300	100	40	57.5	42	50	260	40	ND	80	110	130 J
Mercury	0.7	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	10	48.1	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	—	9,500	60,700	6,280	6,400	ND	ND	ND	ND	5,000	ND	ND
Selenium	10	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	30	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	126,000	132,000	120,000	100,000	93,000 J	58,000	87,000	52,000	96,000	67,000	69,000
Thallium	—	NA	ND	ND	ND	ND	8	ND	ND	ND	ND	ND
Vanadium	—	35	4B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	—	75	12.9B	17.6B	ND	ND	ND	ND	ND	10 J	10	ND

17 16 11 9 | 6 14 7 3 10 8 7

1 1 2

Notes:
1. R = Indicates compound rejected due to blank contamination.
2. J = Indicates result is less than sample quantitation limit but greater than zero.
3. B = Indicates compound is less than quantitation limits but greater than or equal to instrument detection limits.
4. E = Estimated value due to interferences.
5. W = Post-digestion spike is out of control limits.
6. Sample data presented for 6/97 and subsequent sampling events is for cis-1,2-dichloroethene.
7. NA = Not analyzed; ND = Not detected; N = Tentative.
8. Data validation was performed in accordance with USEPA CLP National Functional Guidelines for Organic and Inorganic Data Review, and the USEPA SOPs HW-2 and HW-6.

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0 EXCEEDANCE DETECTIONS

Table 4
Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Before Remed. | After Remediation

Parameter	Standard ug/L (ppb)	URS-5D 8/90	2/91	10/92	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)											
Acetone	---	250	R	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	ND	ND	1	ND	0.25 J	0.11 J	ND	0.16 J	ND	ND
2-Butanone	---	ND	R	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	---	ND	ND	ND	ND	ND	ND	ND	ND	4.2	ND
Chlorobenzene	5	NA	NA	NA	ND	0.31 J	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5	ND	ND	ND	ND	0.32 J	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	R	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	1J	ND	ND	0.19 J	ND	ND	ND	ND	ND
Total Xylenes	5	ND	0.5J	ND	ND	1.5	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)											
Aluminum	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	300
Antimony	3	ND	31.5B	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	1.3B	1B	ND	ND	ND	ND	ND	ND	ND	ND
Barium	1000	224	71.7B	32	20	ND	ND	ND	20	ND	20
Beryllium	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	---	378,000	407,000	387,000	440,000	300,000	490,000	510,000	490,000	500,000	430,000
Chromium	50	3B	ND	ND	ND	ND	ND	ND	ND	ND	20
Cobalt	---	ND	ND	ND	ND	61	210	850	350	59	50
Copper	200	ND	ND	8	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	300	188	143	25	ND	120	ND	ND	ND	ND	410
Lead	25	ND	1.3B	12	ND	ND	ND	ND	ND	ND	ND
Magnesium	---	33,300	2450B	570,000	100,000	24,000	87,000	76,000	93,000	97,000	52,000
Manganese	300	8.8B	3.5B	ND	50	10	70	70	50	60	20 J
Mercury	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	11.4B	ND	ND	90	ND	180	90	80	50	ND
Potassium	---	22,700	16,900	8,500	ND	ND	ND	5,000	ND	ND	ND
Selenium	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	192,000	194,000	114,000	88,000	93,000	94,000	120,000	110,000	120,000	110,000
Thallium	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	---	3.8B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	---	19.9B	14.7B	ND	ND	10	ND	ND	10 J	10	90
		15	15	9	6	12	7	7	9	8	10
									1	1	2

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EXCEEDANCE
DETECTION

Table 4
Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Before Remediation | After Remediation

Parameter	Standard ug/L (ppb)	85-7R 7/86	8/90	2/91	10/92	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)												
Acetone	—	NA	ND	R	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	ND	6	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	—	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	—	71	ND	ND	ND	ND	ND	ND	0.93 J	ND	32	ND
Chlorobenzene	5	ND	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	NA	ND	ND	ND	0.14J	0.19 J	0.14 J	0.21 J	0.40 J	0.11 J	0.14 J
Ethylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	—	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	ND	1J	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)												
Aluminum	—	1,200	277	265	249	ND	ND	ND	ND	ND	ND	ND
Antimony	3	NA	28.3B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	NA	1.4B	1.7B	ND	ND	ND	ND	ND	ND	ND	ND
Barium	1000	30	91B	143B	106	100	80	50J	ND	40	40	80
Beryllium	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	—	490,000	354,000	298,000	389,000	350,000	350,000	420,000	400,000	440,000	410,000	390,000
Chromium	50	20	ND	ND	ND	ND	ND	ND	10	ND	ND	ND
Cobalt	—	20	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	10	ND	ND	8	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	300	920	586	820	435	190	310	270	170	90	70	210
Lead	25	120	ND	2.6B	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	—	131,000	119,000	42,600	124,000	120,000	120,000	140,000	140,000	130,000	130,000	130,000
Manganese	300	110	40.5	31.5	30	70	80	90	80	40	40	50 J
Mercury	0.7	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	ND	7.4B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	—	28,000	5,540	5,770	6,700	5,000	5,000	6,000	6,000	7,000	6,000	6,000
Selenium	10	NA	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	107,000	67,900	38,900	73,100	66,000 J	67,000	75,000	74,000	85,000	72,000	71,000
Thallium	—	NA	ND	ND	ND	ND	6	ND	ND	ND	ND	ND
Vanadium	—	35	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	—	65	ND	21.5	ND	ND	ND	ND	ND	ND	ND	ND

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DETECTIONS
EXCEEDANCE

Table 4
Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Before Remediation | After Remediation

Parameter	Standard ug/L (ppb)	URS-7D									
		8/90	2/91	10/92	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)											
Acetone	---	120	R	ND	ND	ND	61	6.0 J	ND	ND	ND
Benzene	1	ND	ND	ND	ND	0.11 J	ND	ND	ND	ND	ND
2-Butanone	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	---	0.5J	ND	ND	ND	ND	ND	1.3 J	ND	5.2	ND
Chlorobenzene	5	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	5	ND	ND	ND	ND	0.37 J	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)											
Aluminum	---	167B	52.5B	ND	ND	ND	ND	ND	ND	100	ND
Antimony	3	20.5B	36.3B	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	1000	20.3B	47.2B	29	30	40	ND	ND	30	30	30
Beryllium	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	---	277,000	333,000	403,000	360,000	300,000	480,000	400,000	470,000	420,000	480,000
Chromium	50	ND	ND	ND	ND	ND	10	10	ND	10	20
Cobalt	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	ND	ND	8	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	300	387	283	63	ND	70	ND	100	ND	180	170 J
Lead	25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	---	96,200	115,000	140,000	120,000	89,000	140,000	130,000	140,000	140,000	150,000
Manganese	300	71.2	140	86	40	30	40	50	50	70	50 J
Mercury	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3 J
Nickel	100	23.5B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	---	5,990	8,550	8,300	5,000	ND	6,000	ND	6,000	ND	5,000
Selenium	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	82,700	68,900	78,900	66,000 J	54,000	79,000	74,000	81,000	68,000	78,000
Thallium	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	---	4.2B	6.7B	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	---	5.6B	12.2B	ND	ND	ND	ND	ND	ND	ND	ND

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DETECTIONS EXCEEDANCE

Table 4
Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Cryo Remediation | Cyto-Remediation

Parameter	Standard ug/L (ppb)	URS-9I									
		8/90	2/91	10/92	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)											
Acetone	---	R	R	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	ND	ND	ND	0.12J	0.29 J	ND	ND	ND	ND	ND
2-Butanone	---	ND	2J	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	---	ND	ND	ND	ND	ND	0.13 J	ND	ND	8.5	ND
Chlorobenzene	5	NA	NA	NA	ND	0.20 J	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5	ND	ND	ND	ND	0.14 J	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	0.7J	ND	ND	ND	0.11 J	ND	ND	0.16 J	ND	ND
Total Xylenes	5	ND	ND	ND	0.29J	0.54	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)											
Aluminum	---	221	197	110	ND	ND	ND	200	ND	200	ND
Antimony	3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	1.7B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	1000	30.1B	22.8B	14	30	ND	ND	ND	ND	ND	ND
Beryllium	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	---	106,000	143,000	123	170,000	150,000	160,000	160,000	160,000	170,000	160,000
Chromium	50	8.6B	10.1	ND	ND	ND	10	10	ND	ND	ND
Cobalt	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	12.7B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	300	1,020	1,170	806	460	440	290	590	480	520	210
Lead	25	ND	1B	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	---	54,500	71,300	63,500	70,000	69,000	77,000	70,000	75,000	76,000	75,000
Manganese	300	67.5	80	75	50	30	40	50	40	50	40 J
Mercury	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	7.6B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	---	3,910B	4,250B	2,900	ND	ND	ND	ND	ND	ND	ND
Selenium	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	34,500	44,000	32,400	43,000 J	45,000	49,000	39,000	41,000	48,000	46,000
Thallium	---	ND	ND	ND	ND	11	ND	ND	ND	ND	ND
Vanadium	---	ND	9.6B	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	---	15.3B	34.6	ND	ND	ND	20	ND	10 J	ND	ND

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DETECTIONS
EXCEEDANCE

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Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Before Remediation | After Remediation

Parameter	Standard ug/L (ppb)	URS-9D 8/90	2/91	10/92	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)											
Acetone	---	R	R	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	ND	ND	ND	ND	1.9	ND	ND	ND	ND	ND
2-Butanone	---	ND	6J	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	---	4J	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	---	ND	ND	ND	ND	ND	ND	ND	ND	16	ND
Chlorobenzene	5	NA	NA	NA	ND	0 79	ND	ND	ND	ND	ND
Chloroform	7	8	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	---	1J	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	0.7	0.37J	0.34 J	0.17 J	0.16 JN	0.15 J	0.14 J	0.14 J
1,2-Dichloroethene	5	ND	ND	1	0.66	0.59	0.33 J	0.35 J	0.29 J	0.25 J	0.23 J
Ethylbenzene	5	ND	ND	ND	ND	0.44 J	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	ND	2	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	0.6J	ND	ND	ND	0.51	ND	ND	ND	ND	ND
Total Xylenes	5	ND	ND	ND	ND	1.8	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	0.8	0 36J	0.24 J	0.20 J	0.21 J	0.14 J	ND	ND
Vinyl Chloride	2	ND	ND	ND	0.26J	0.44 J	0.11 JN	ND	ND	ND	ND
Metals (ppb)											
Aluminum	---	128	64.2B	ND	ND	ND	ND	ND	ND	ND	ND
Antimony	3	ND	28B	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	1.6B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barium	1000	110B	38.2B	23	ND	ND	ND	ND	ND	ND	ND
Beryllium	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	---	56,500	146,000	120,000	200,000	190,000	190,000	200,000	210,000	220,000	210,000
Chromium	50	ND	ND	ND	ND	ND	10	ND	ND	ND	20
Cobalt	---	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	5.2B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	11.1B	ND	ND	ND	ND	ND	ND	ND	ND
Iron	300	127	506	252	ND	70	80	70	60	50	220
Lead	25	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	---	39,900	70,200	60,000	56,000	73,000	71,000	72,000	77,000	78,000	75,000
Manganese	300	20.1	25.5	9	ND	ND	10	10	10	10	10 J
Mercury	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	15.3B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	---	9,980	4,170B	3,600	ND	ND	ND	ND	ND	ND	ND
Selenium	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	27,400	37,000	42,800	46,000 J	52,000	41,000	38,000	42,000	46,000	45,000
Thallium	---	ND	ND	ND	ND	14	ND	ND	ND	ND	ND
Vanadium	---	10.7B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	---	50.5	16.7B	ND	ND	ND	ND	ND	ND	ND	ND

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DETECTIONS EXCEEDANCE

Table 4
Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Before Remediation | After Remediation

Parameter	Standard ug/L (ppb)	88-12C 8/90	2/91	10/92	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)											
Acetone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	—	ND	ND	ND	ND	ND	ND	ND	ND	0.84	ND
Chlorobenzene	5	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	ND	ND	ND	ND	ND	ND	ND	0.19 J	ND
Total Xylenes	5	ND	ND	ND	ND	ND	ND	ND	ND	0.15 J	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)											
Aluminum	—	491	187B	453	ND	600	ND	600	ND	ND	ND
Antimony	3	19.2B	26B	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	10	12.3B	14	9	7	10	12	11 J	12	12 J
Barium	1000	11.4B	17.3	14	ND	ND	ND	ND	ND	ND	ND
Beryllium	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	—	69,600	88,500	66,900	73,000	70,000	71,000	76,000	80,000	76,000	76,000
Chromium	50	21	4.6B	ND	ND	10	10	20	ND	ND	ND
Cobalt	—	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	4.2B	ND	5	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	300	1,530	1,940	1,560	ND	2,200	330	1,600	100	200	590
Lead	25	1.5B	1.2B	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	—	88,500	103,000	92,800	110,000	98,000	110,000	100,000	110,000	110,000	110,000
Manganese	300	45.4	37.6	54	10	70	10	40	20	20	10 J
Mercury	0.7	ND	ND	NA	ND	ND	ND	ND	ND	ND	ND
Nickel	100	14.6B	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	—	2,520B	3,200B	3,000	ND	ND	ND	ND	ND	ND	ND
Selenium	10	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	34,800	41,500	41,300	47,000	43,000	40,000	42,000	50,000	47,000	48,000
Thallium	—	ND	ND	ND	ND	13	ND	ND	ND	ND	ND
Vanadium	—	22.1B	10B	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	—	10.1B	16.7B	ND	20	20	ND	ND	20 J	20	ND

16 14 10 6 10 7 8 7 10 6
1 1 2

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DETECTIONS
EXCEEDANCE
* TRACK

Table 4
Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Before Remediation | After Remediation

Parameter	Standard ug/L (ppb)	88-12D 8/90	2/91	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)										
Acetone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	1J	0.9J	ND	0.13 J	0.13 J	ND	0.16 J	ND	ND
2-Butanone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	—	ND	6	ND	ND	0.86	0.70 J	ND	77	ND
Chlorobenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	ND	2J	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5	ND	ND	ND	0.11 J	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	R	13	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	5	ND	ND	ND	0.48 J	ND	ND	ND	ND	ND
Trichloroethene	5	ND	6	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)										
Aluminum	—	ND	1720	ND	ND	ND	ND	ND	ND	ND
Antimony	3	50.7B	56.1B	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	ND	1.3BW	ND	ND	ND	ND	ND	6	ND
Barium	1000	2.9B	7.9B	ND	ND	ND	ND	ND	ND	ND
Beryllium	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	—	464,000	623,000E	480,000	480,000	630,000	630,000	676,000	720,000	630,000
Chromium	50	7.6B	27.6E	10	30	30	90	ND	20	ND
Cobalt	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	ND	ND	ND	12	ND	ND
Iron	300	168	250	160	480	110	650	90	70	ND
Lead	25	ND	1.8BW	ND	ND	ND	ND	ND	ND	ND
Magnesium	—	109,000	198,000E	130,000	110,000	180,000	180,000	180,000	210,000	160,000
Manganese	300	33.9	696	90	69	46	50	36	30	20 J
Mercury	0.7	ND	ND	ND	ND	ND	ND	ND	0.2 J	0.2
Nickel	100	11.5B	25.5B	ND	ND	ND	70	ND	ND	ND
Potassium	—	5,310	12,000E	600	6,000	10,000	9,600	9,000	11,000	9,600
Selenium	10	ND	ND	ND	ND	6	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	66,400	474,000	140,000 J	100,000	330,000	250,000	630,000	450,000	240,000
Thallium	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	—	51.6	2.4B	ND	ND	ND	ND	ND	ND	ND
Zinc	—	7.9B	ND	ND	10	ND	ND	10 J	10	ND
		13	19	7	11	10	8	9	11	6
								1	1	1

Notes:
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DETECTION > EXCEEDANCE

Table 4
Frontier Chemical-Pendleton Site
Summary of Ground Water Analytical Data
August 2000

Before Remediation | After Remediation

Parameter	Standard ug/L (ppb)	URS-14I 2/91	10/92	6/97	2/98	9/98	2/99	8/99	2/00	8/00
VOCs (ppb)										
Acetone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	ND	ND	ND	1	ND	ND	ND	ND	ND
2-Butanone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	—	ND	ND	ND	ND	ND	ND	ND	1.2	ND
Chlorobenzene	5	NA	NA	ND	**0.81**	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5	ND	ND	ND	**0.13 J**	ND	ND	ND	ND	ND
Methylene Chloride	5	ND	ND	ND	ND	ND	ND	ND	**0.17 J**	ND
4-Methyl-2-Pentanone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	ND	ND	**0.15 J**	ND	ND	ND	ND	ND
Total Xylenes	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)										
Aluminum	—	**7,140**	**1,170**	**1300**	**400**	ND	**300**	ND	ND	ND
Antimony	3	ND	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	**7.2B**	ND	ND	ND	ND	**5**	ND	**6**	ND
Barium	1000	**115B**	**47**	**50**	**40**	**40J**	**40**	**50**	**50**	**69**
Beryllium	—	**1.2B**	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	ND	ND	ND	**1**	ND	ND	ND	**2**	ND
Calcium	—	**73,900**	**35,200**	**28,000 J**	**21,000**	**23,000**	**26,000**	**30,000**	**34,000**	**32,000**
Chromium	50	**30.3**	ND	ND	**16B**	ND	ND	ND	**10**	ND
Cobalt	—	**5.8B**	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	**18.5B**	**8**	ND	**10**	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	ND	ND	ND	ND	ND	ND
Iron	300	**10,400**	**2,060**	**1,800**	**2,300**	ND	**320**	ND	ND	ND
Lead	25	**7.5**	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	—	**32,800**	**22,300**	**21,000**	**17,000**	**21,000**	**23,000**	**25,000**	**29,000**	**26,000**
Manganese	300	**484**	**145**	**70**	**60**	ND	ND	ND	ND	**250 J**
Mercury	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	**39.4B**	ND	ND	**17B**	ND	ND	ND	ND	ND
Potassium	—	**17,100**	**5,500**	ND	**25,000**	**8,000**	**6,000**	**6,000**	ND	ND
Selenium	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	**44,700**	**42,500**	**56,000 J**	**48,000**	**48,000**	**54,000**	**52,000**	**57,000**	**59,000**
Thallium	—	ND	ND	ND	**6**	ND	ND	ND	ND	ND
Vanadium	—	**16.1B**	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	—	**52.9**	ND	**10**	**30**	ND	ND	**30 J**	**20**	ND

17 9 8 18 5 8 6 4 5

1 1 1

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DETECTIONS EXCEEDANCE

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Summary of Ground Water Analytical Data
August 2000

Before Remediation — After Remediation

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VOCs (ppb)										
Acetone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Benzene	1	ND	ND	ND	ND	ND	ND	ND	ND	ND
2-Butanone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bromodichloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Carbon Disulfide	—	ND	ND	ND	ND	0.47 J	1.1 J	ND	6.7	ND
Chlorobenzene	5	NA	NA	ND	ND	ND	ND	ND	ND	ND
Chloroform	7	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dibromochloromethane	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,2-Dichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ethylbenzene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	5	R	ND	ND	ND	ND	ND	ND	ND	ND
4-Methyl-2-Pentanone	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1,2,2,-Tetrachloroethane	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Xylenes	5	ND	ND	0.11J	0.21 J	ND	ND	ND	ND	ND
Trichloroethene	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vinyl Chloride	2	ND	ND	ND	ND	ND	ND	ND	ND	ND
Metals (ppb)										
Aluminum	—	99.8	ND	ND	ND	ND	ND	ND	ND	100
Antimony	3	32.1B	ND	ND	ND	ND	ND	ND	ND	ND
Arsenic	25	2B	ND	ND	ND	ND	ND	ND	ND	ND
Barium	1000	25.5B	23	20	ND	ND	40	30	30	30
Beryllium	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cadmium	5	ND	ND	ND	ND	ND	ND	ND	ND	ND
Calcium	—	255,000	292,000	210,000	250,000	310,000	280,000	360,000	310,000	320,000
Chromium	50	10.3	7	ND	ND	10	ND	ND	ND	20
Cobalt	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Copper	200	ND	8	ND	ND	ND	ND	ND	ND	ND
Cyanide	200	ND	ND	ND	10	10	ND	ND	ND	ND
Iron	300	357	193	ND	ND	ND	80	ND	ND	340
Lead	25	1.1B	ND	ND	ND	ND	ND	ND	ND	ND
Magnesium	—	75,200	78,000	61,000	66,000	81,000	71,000	91,000	83,000	84,000
Manganese	300	30.8	27	ND	ND	ND	ND	10	ND	20 J
Mercury	0.7	ND	ND	ND	ND	ND	ND	ND	ND	ND
Nickel	100	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	—	4,250B	3,700	ND	ND	ND	ND	ND	ND	ND
Selenium	10	ND	ND	ND	ND	ND	ND	ND	ND	ND
Silver	50	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	20,000	40,700	38,700	52,000 J	49,000	50,000	48,000	58,000	47,000	45,000
Thallium	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Vanadium	—	ND	ND	ND	ND	ND	ND	ND	ND	ND
Zinc	—	26.8	ND	ND	10	10	ND	ND	ND	ND
		13	9	5	6	7	6	5	5	8
								1	1	2

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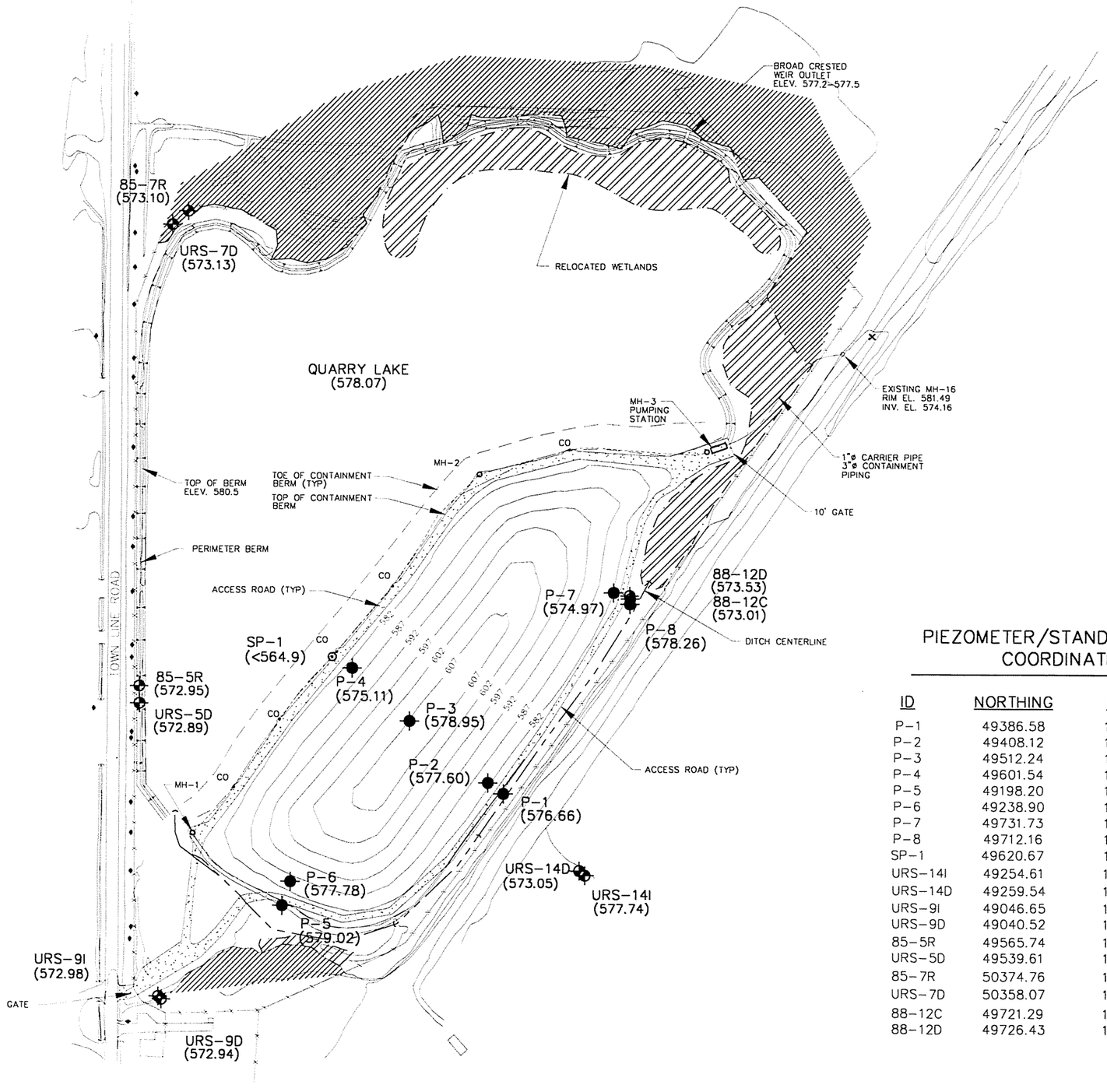
DETECTIONS EXCEEDANCE

FIGURES

FIGURE 1



LEGEND

- URS-7D — MONITORING WELL
- P-1 — PIEZOMETER
- (580.24) — WATER ELEVATION
- CREATED WETLAND AREA
- EXISTING WETLAND AREA
- 6' HIGH CHAIN LINK FENCE
- 580 — GRADE ELEVATION CONTOUR
- CO — GROUND WATER COLLECTION TRENCH & CLEAN OUT
- STANDPIPE
- UTILITY POLE

PIEZOMETER/STANDPIPE AND MONITORING WELL COORDINATES AND ELEVATIONS

ID	NORTHING	EASTING	RISER	COVER
P-1	49386.58	100656.87	583.21	583.30
P-2	49408.12	100630.30	582.90	583.20
P-3	49512.24	100496.39	606.33	606.64
P-4	49601.54	100399.33	583.68	583.85
P-5	49198.20	100282.65	583.05	583.55
P-6	49238.90	100296.52	584.45	584.60
P-7	49731.73	100842.30	581.84	582.00
P-8	49712.16	100869.82	582.83	583.00
SP-1	49620.67	100365.59	579.86	580.07
URS-14I	49254.61	100794.43	581.14	580.84
URS-14D	49259.54	100789.09	580.71	580.85
URS-9I	49046.65	100075.10	581.68	579.90
URS-9D	49040.52	100076.81	580.80	579.00
85-5R	49565.74	100036.14	580.84	578.70
URS-5D	49539.61	100035.69	580.60	578.00
85-7R	50374.76	100115.55	577.90	576.60
URS-7D	50358.07	100095.40	579.35	576.50
88-12C	49721.29	100870.45	583.12	583.70
88-12D	49726.43	100869.13	582.87	583.28

FRONTIER CHEMICAL
PENDLETON SITE
TOWN OF PENDLETON,
NIAGARA COUNTY, NY

HYDRAULIC POTENTIAL MAP (AUGUST 9, 2000)

200 0 200

SCALE IN FEET

FILE NO. 5829.27084.001
DATE: SEPTEMBER 2000

O'BRIEN & GERE
ENGINEERS INC.

PLOT DATE: 3/20/2000

APPENDICES

Appendix A

Piezometer/monitoring well inspection forms

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Well Identification : P-1

Personnel : DEC/TPP Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	(Above Ground)	Flush Mounted
Well Construction	(PVC)	Stainless Steel
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	6.55	
Well Depth:	16.43	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	(yes)	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : P-2

Personnel : TPP/DEC Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	~~Flush Mounted~~
Well Construction	~~PVC~~	Stainless Steel
Well Diameter	2-inch	4-inch

Depth to Ground Water : 5.30

Well Depth: 15.73

WELL INTEGRITY

.. Well identification clearly marked ?	yes	no	
Well covers and locks in good condition and secure ?	yes	no	
3 Is the well stand pipe vertically aligned and secure ?	yes	no	
4. Is the concrete pad and surface seal in good condition ?	yes	no	
Are soils surrounding the well pad eroded ?	yes	no	
Is the well casing in good condition ?	yes	no	
7. Is the measuring point on casing well marked ?	yes	no	
8. Is there standing water in the annular space ?	yes	no	
Is the stand pipe vented at the base to allow drainage ?	yes	no	N/A

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : P-3

Personnel : TPP/DEL Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	(Flush Mounted)
Well Construction	(PVC)	Stainless Steel
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	27.38	
Well Depth:	39.77	

WELL INTEGRITY

1.	Well identification clearly marked ?	(yes)	no
	Well covers and locks in good condition and secure ?	(yes)	no
3.	Is the well stand pipe vertically aligned and secure ?	(yes)	no
4.	Is the concrete pad and surface seal in good condition ?	(yes)	no
	Are soils surrounding the well pad eroded ?	yes	(no)
	Is the well casing in good condition ?	(yes)	no
7.	Is the measuring point on casing well marked ?	(yes)	no
8.	Is there standing water in the annular space ?	yes	(no)
	Is the stand pipe vented at the base to allow drainage ?	yes	no N/A

COMMENTS:

IONITORING WELL INTEGRITY CHECKLIST

ite Name: Frontier Chemical Well Identification : P-4

Personnel : TPP/DEL Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	~~Flush Mounted~~
/ell Construction	PVC	Stainless Steel
/ell Diameter	2-inch	4-inch
Depth to Ground Water :	7.20	
Well Depth:	16.92	

WELL INTEGRITY

.. Well identification clearly marked ?	yes	no
Well covers and locks in good condition and secure ?	yes	no
3 Is the well stand pipe vertically aligned and secure ?	yes	no
4. Is the concrete pad and surface seal in good condition ?	yes	no
Are soils surrounding the well pad eroded ?	yes	no
Is the well casing in good condition ?	yes	no
7. Is the measuring point on casing well marked ?	yes	no
8. Is there standing water in the annular space ?	yes	no
Is the stand pipe vented at the base to allow drainage ?	yes	no N/A

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : P-5

Personnel : TPP/DEC Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	(Above Ground)	Flush Mounted
Well Construction	~~PVC~~	Stainless Steel
Well Diameter	~~2-inch~~	4-inch
Depth to Ground Water :	4.03	
Well Depth:	15.58	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	~~yes~~	no
3. Is the well stand pipe vertically aligned and secure ?	~~yes~~	no
4. Is the concrete pad and surface seal in good condition ?	~~yes~~	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	~~yes~~	no
7. Is the measuring point on casing well marked ?	~~yes~~	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	~~yes~~	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chem. Well Identification : P-6

Personnel : TPP/DEL Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	(Flush Mounted)
Well Construction	(PVC)	Stainless Steel
Well Diameter	~~2-inch~~	4-inch
Depth to Ground Water :	6.67	
Well Depth:	16.15	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	yes	no
3. Is the well stand pipe vertically aligned and secure ?	~~yes~~	(no)
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	yes	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	yes	no N/A

COMMENTS: Standpipe leaning 20 - 30° @ Surface

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : P-7

Personnel : TPP / DEC Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	(Flush Mounted)
Well Construction	(PVC)	Stainless Steel
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	6.00	
Well Depth:	16.65	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	yes	no N/A

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : P/8

Personnel : TPP / DEL Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	~~Above Ground~~	Flush Mounted
Well Construction	PVC	Stainless Steel
Well Diameter	~~2-inch~~	4-inch

Depth to Ground Water : 4.57

Well Depth: 17.22

WELL INTEGRITY

Well identification clearly marked ?	yes	no
Well covers and locks in good condition and secure ?	yes	no
3. Is the well stand pipe vertically aligned and secure ?	~~yes~~	no
4. Is the concrete pad and surface seal in good condition ?	yes	~~no~~ TT
Are soils surrounding the well pad eroded ?	yes	no
Is the well casing in good condition ?	yes	no
7. Is the measuring point on casing well marked ?	yes	no
8. Is there standing water in the annular space ?	yes	no
Is the stand pipe vented at the base to allow drainage ?	yes	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : SP-1

Personnel : TPP/DEC Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	(Flush Mounted)
Well Construction	~~PVC~~	~~Stainless Steel~~ (HDPE)
Well Diameter	~~2-inch~~	~~4-inch~~ (6" Φ)
Depth to Ground Water :	DRY	
Well Depth:	14.9'	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no STAND PIPE ANGLED
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	yes	~~no~~ N/A DEC

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : 85-SR

Personnel : TPP | DEC Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	(Above Ground)	Flush Mounted
Well Construction	(PVC)	Stainless Steel
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	7.89	
Well Depth:	38.09	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	(yes)	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : & URS-5D

Personnel : TPP / DEC Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	(Above Ground)	Flush Mounted
Well Construction	PVC	(Stainless Steel)
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	7.71	
Well Depth:	~~49.93~~ 49.84 JS	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	(yes)	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : 85-7R

Personnel : TPP/DEC Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	(Above Ground)	Flush Mounted
Well Construction	(PVC)	Stainless Steel
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	4.80	
Well Depth:	27.78	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	(yes)	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : URS-7D

Personnel : TPP/DEC Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	(Above Ground)	Flush Mounted
Well Construction	PVC	(Stainless Steel)
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	6.22	
Well Depth:	39.89	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	(yes)	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : URS-9I

Personnel : DEC/TPP Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	(Above Ground)	Flush Mounted
Well Construction	PVC	(Stainless Steel)
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	8.70	
Well Depth:	46.18	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	(yes)	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : VRS 9D

Personnel : TPP/DEL Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	Flush Mounted
Well Construction	PVC	Stainless Steel
Well Diameter	2-inch	4-inch
Depth to Ground Water :	7.86	
Well Depth:	50.89	

WELL INTEGRITY

1. Well identification clearly marked ?	yes	no
2. Well covers and locks in good condition and secure ?	yes	no
3. Is the well stand pipe vertically aligned and secure ?	yes	no
4. Is the concrete pad and surface seal in good condition ?	yes	no
5. Are soils surrounding the well pad eroded ?	yes	no
6. Is the well casing in good condition ?	yes	no
7. Is the measuring point on casing well marked ?	yes	no
8. Is there standing water in the annular space ?	yes	no
9. Is the stand pipe vented at the base to allow drainage ?	yes	no

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : 88 12-C

Personnel : TPP/DEZ Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	~~Above Ground~~	Flush Mounted
Well Construction	PVC	~~Stainless Steel~~
Well Diameter	~~2-inch~~	4-inch
Depth to Ground Water :	10.41	
Well Depth:	31.31	

WELL INTEGRITY

1. Well identification clearly marked ?	yes	no
Well covers and locks in good condition and secure ?	yes	no
3. Is the well stand pipe vertically aligned and secure ?	yes	no
4. Is the concrete pad and surface seal in good condition ?	~~yes~~	no
Are soils surrounding the well pad eroded ?	yes	no
6. Is the well casing in good condition ?	yes	no
7. Is the measuring point on casing well marked ?	yes	no
8. Is there standing water in the annular space ?	yes	no
9. Is the stand pipe vented at the base to allow drainage ?	yes	no

COMMENTS: Concrete pad under gravel

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Chemical Well Identification : 88-12-D

Personnel : TPP/DEC Date ~~88-12-D~~ 8/9/00

WELL SPECIFICATIONS

Protective Casing	~~Above Ground~~	Flush Mounted
Well Construction	PVC	~~Stainless Steel~~
Well Diameter	~~2-inch~~	4-inch
Depth to Ground Water :	9.34	
Well Depth:	52.38	

WELL INTEGRITY

1. Well identification clearly marked ?	~~yes~~	no
2. Well covers and locks in good condition and secure ?	yes	no
3. Is the well stand pipe vertically aligned and secure ?	~~yes~~	no
4. Is the concrete pad and surface seal in good condition ?	yes	no
5. Are soils surrounding the well pad eroded ?	yes	no
6. Is the well casing in good condition ?	yes	no
7. Is the measuring point on casing well marked ?	yes	no
8. Is there standing water in the annular space ?	yes	no
9. Is the stand pipe vented at the base to allow drainage ?	yes	no

COMMENTS:

Concrete pad under gravel

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Well Identification : URS-14I

Personnel : DEC/TPP Date : 8/9/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	(Flush Mounted)
Well Construction	PVC	(Stainless Steel)
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	3.40	
Well Depth:	31.08	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	yes	(no)
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	yes	no N/A

COMMENTS:

MONITORING WELL INTEGRITY CHECKLIST

Site Name: Frontier Well Identification : ARS-14D

Personnel : DEC/TPP Date : 8/2/00

WELL SPECIFICATIONS

Protective Casing	Above Ground	(Flush Mounted)
Well Construction	PVC	(Stainless Steel)
Well Diameter	(2-inch)	4-inch
Depth to Ground Water :	7.66	
Well Depth:	41.61	

WELL INTEGRITY

1. Well identification clearly marked ?	(yes)	no
2. Well covers and locks in good condition and secure ?	(yes)	no
3. Is the well stand pipe vertically aligned and secure ?	(yes)	no
4. Is the concrete pad and surface seal in good condition ?	(yes)	no
5. Are soils surrounding the well pad eroded ?	yes	(no)
6. Is the well casing in good condition ?	(yes)	no
7. Is the measuring point on casing well marked ?	(yes)	no
8. Is there standing water in the annular space ?	yes	(no)
9. Is the stand pipe vented at the base to allow drainage ?	yes	no N/A

COMMENTS:

Appendix B

Ground water sampling logs

O'Brien & Gere Engineers, Inc.

Standard Ground Water Sampling Log

Date 8/17/00
Site Name Frontier Chemical
Location Pendleton
Project No. 27054
Personnel DEC / TPP

Weather Sunny 78°F
Well # 85-SR
Evacuation Method Hand Bail
Sampling Method S.S. Bailer

Well Information:

Depth of Well *	35.02	ft.
Depth to Water *	7.89	ft.
Length of Water Column	30.13	ft.
Volume of Water in Well	4.9	gal.(s)
3X Volume of Water in Well	14.7	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- 4" Diameter Well = 0.653 X LWC
- 6" Diameter Well = 1.469 X LWC

Volume removed before sampling 7 gal.(s)
Did well go dry? Yes 7 gal

* Measurements taken from [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard		1413 S Standard	
10.0 Standard			

Water parameters:

	Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial	5	55.7	11.39	1977
	5	52.9	7.85	1472
	~~7.5~~	55.6	8.10	1400
	~~X~~			

Water Sample:
Time Collected 1400

Physical Appearance at Start		Physical Appearance at Sampling	
Color	~~Clear~~ Light Gray	Color	Clear
Odor	None	Odor	None
Turbidity (> 100 NTU)	~~372~~ 230	Turbidity (> 100 NTU)	110
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	YES	HNO3	<2
1L	Plastic	1	NO	NaOH	>10

Notes:

O'Brien & Gere Engineers, Inc.

Standard Ground Water Sampling Log

Date 8/11/00
Site Name Frontier Chemical
Location Pendleton
Project No. 27084
Personnel DEC/TPP

Weather Sunny 75°±
Well # VRS-5D
Evacuation Method Hand Bail
Sampling Method S.S. Bailer

Well Information:

Depth of Well *	49.84	ft.
Depth to Water *	7.71	ft.
Length of Water Column	42.13	ft.
Volume of Water in Well	6.9	gal.(s)
3X Volume of Water in Well	20.6	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- ___ 4" Diameter Well = 0.653 X LWC
- ___ 6" Diameter Well = 1.469 X LWC

Volume removed before sampling 10.5 gal.(s)
Did well go dry? Yes 10 gal.

* Measurements taken from [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard		1413 S Standard	
10.0 Standard			

Water parameters:

	Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial	0.5	57.5	8.25	1830
	7	57.0	10.00	2090
	T+ 16.5	55.8	7.81	2270
	21			

Water Sample:
Time Collected 1345

Physical Appearance at Start		Physical Appearance at Sampling	
Color	Clear	Color	Clear
Odor	None	Odor	None
Turbidity (> 100 NTU)	37.2	Turbidity (> 100 NTU)	33.5
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	NO	HNO_3	<2
1L	Plastic	1	NO	NaOH	>10

Notes:

O'Brien & Gere Engineers, Inc. — **Standard Ground Water Sampling Log**

Date: 8/10/00
Site Name: Frontier Chemical
Location: Pendleton
Project No.: 27054
Personnel: DEC/TPP

Weather: Sunny 70
Well #: 85-7R
Evacuation Method: Hand Bail
Sampling Method: SS Bailer

Well Information:

Depth of Well *	27.78	ft.
Depth to Water *	4.80	ft.
Length of Water Column	22.98	ft.
Volume of Water in Well	3.74	gal.(s)
3X Volume of Water in Well	11.2	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- ___ 4" Diameter Well = 0.653 X LWC
- ___ 6" Diameter Well = 1.469 X LWC

Volume removed before sampling: 12 gal.(s)
Did well go dry? No

* Measurements taken from: [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard	X	1413 S Standard	
10.0 Standard	X		

Water parameters:

	Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial	0	63.4	10.81	541
	4	51.2	7.72	918
	8	51.5	7.19	760
	12	50.3	7.20	730

Water Sample:
Time Collected: 1500

Physical Appearance at Start		Physical Appearance at Sampling	
Color	Lt Sandy White	Color	Sandy White
Odor	None	Odor	None
Turbidity (> 100 NTU)	242	Turbidity (> 100 NTU)	270
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1 L	Plastic	1	YES	HNO3	<2
1L	Plastic	1	NO	NaOH	>10

Notes:
MS/MSD

O'Brien & Gere Engineers, Inc. — Standard Ground Water Sampling Log

Date 8/16/00
Site Name Frontier Chemical
Location Pendleton
Project No. 27054
Personnel DEC/TPP

Weather Sunny 70
Well # URS-7D
Evacuation Method Hand Bail
Sampling Method S.S Bailer

Well Information:

Depth of Well *	39.89	ft.
Depth to Water *	6.22	ft.
Length of Water Column	33.67	ft.
Volume of Water in Well	5.49	gal.(s)
3X Volume of Water in Well	16.5	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- ____ 4" Diameter Well = 0.653 X LWC
- ____ 6" Diameter Well = 1.469 X LWC

Volume removed before sampling 16.5 gal.(s)
Did well go dry? N/A

* Measurements taken from [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard	X	1413 S Standard	
10.0 Standard	X		

Water parameters:

Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial 0.5	initial 69.9	initial 6.54	initial 620
5.5	56.5	7.89	920
10.5	51.8	6.44	940
16.5	56.7	6.12	1510

Water Sample:
Time Collected 1545

Physical Appearance at Start		Physical Appearance at Sampling	
Color	Clear	Color	Clear
Odor	None	Odor	Slight Sulfur
Turbidity (> 100 NTU)	10.0	Turbidity (> 100 NTU)	39.8
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	No	HNO3	<2
1L	Plastic	1	No	NaOH	>10

Notes:
BLIND DUPE

O'Brien & Gere Engineers, Inc. — **Standard Ground Water Sampling Log**

Date: 8/11/00
Site Name: Frontier Chemical
Location: Pendleton
Project No.: 27084
Personnel: DEC / TPP

Weather: ~~SUNS QT~~ Partly Cloudy 65°
Well #: URS-9I
Evacuation Method: Hand Bail
Sampling Method: S.S. Bailer

Well Information:

Depth of Well *	46.18	ft.
Depth to Water *	8.70	ft.
Length of Water Column	37.48	ft.
Volume of Water in Well	6.1	gal.(s)
3X Volume of Water in Well	18.3	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- ___ 4" Diameter Well = 0.653 X LWC
- ___ 6" Diameter Well = 1.469 X LWC

Volume removed before sampling: 18.5 gal.(s)
Did well go dry? NO

* Measurements taken from: [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard	X	1413 S Standard	
10.0 Standard	X		

Water parameters:

	Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial	0.5	56.4	8.69	1352
	6	54.9	8.95	1396
	12	54.6	7.51	1334
		55.6	7.47	1344

Water Sample:
Time Collected: N15

Physical Appearance at Start		Physical Appearance at Sampling	
Color	Lt. Brown	Color	Lgt. Brown
Odor	None	Odor	None
Turbidity (> 100 NTU)	101.8	Turbidity (> 100 NTU)	308
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	YES	HNO_3	<2
1L	Plastic	1	NO	NaOH	>10

Notes:

O'Brien & Gere Engineers, Inc.

Standard Ground Water Sampling Log

Date: 8/11/00
Site Name: Frontier Chemical
Location: Pendleton
Project No.: 270845
Personnel: DEC/TPD

Weather: Partly Cloudy 65°
Well #: URS-9D
Evacuation Method: Hand Bail
Sampling Method: SS Bailer

Well Information:

Depth of Well *	7.96	ft.
Depth to Water *	50.89	ft.
Length of Water Column	43.03	ft.
Volume of Water in Well	7.01	gal.(s)
3X Volume of Water in Well	21.0	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- 4" Diameter Well = 0.653 X LWC
- 6" Diameter Well = 1.469 X LWC

Volume removed before sampling: 21 gal.(s)
Did well go dry? NO

* Measurements taken from: [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard	X	1413 S Standard	
10.0 Standard	X		

Water parameters:

Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial 0.5	initial 60.0	initial 8.01	initial 1673
7	56.2	8.18	1643
14	56.5	8.00	1638
21	56.5	7.50	1582

Water Sample:
Time Collected: 1100

Physical Appearance at Start		Physical Appearance at Sampling	
Color	Clear	Color	Clear
Odor	slight sulfur	Odor	light sulfur
Turbidity (> 100 NTU)	9.5	Turbidity (> 100 NTU)	22.4
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	NO	HNO_3	<2
1L	Plastic	1	NO	NaOH	>10

Notes:

O'Brien & Gere Engineers, Inc. — **Standard Ground Water Sampling Log**

Date: 8/10/00
Site Name: Frontier Chemical
Location: Pendelton
Project No.: 27084
Personnel: TPP/ DEZ

Weather: Sunny 68° I am
Well #: EB-12C
Evacuation Method: Hand Bail
Sampling Method: SS. BAILER

Well Information:

Depth of Well *	31.31	ft.
Depth to Water *	10.11	ft.
Length of Water Column	21.2	ft.
Volume of Water in Well	3.5	gal.(s)
3X Volume of Water in Well	10.4	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- 4" Diameter Well = 0.653 X LWC
- 6" Diameter Well = 1.469 X LWC

Volume removed before sampling: 11 gal.(s)
Did well go dry? No

* Measurements taken from: [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard	X	1413 S Standard	
10.0 Standard	X		

Water parameters:

Gallons Removed	Temperature Readings °C	pH Readings	Conductivity Readings uS/cm
initial 0	initial 59.5	initial ~~11.78~~ 7.23	initial 1178
4	55.5	7.23	1146
8	55.7	6.48	1217
11	55.2	6.51	1210

Water Sample:
Time Collected: 0945

Physical Appearance at Start		Physical Appearance at Sampling	
Color	lt Sandy BR.	Color	lt Milky wht.
Odor	slight	Odor	Slight
Turbidity (> 100 NTU)	> 100	Turbidity (> 100 NTU)	712
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	YES	HNO3	<2
1L	Plastic	1	NO	Nitric	>10

Notes:

O'Brien & Gere Engineers, Inc.

Standard Ground Water Sampling Log

Date: 8/10/00
Site Name: Frontier Chemical
Location: Pendelton
Project No.: 27084
Personnel: TPP / DEZ

Weather: Sunny 65° +/- am
Well #: 88-12D
Evacuation Method: Hand Bail
Sampling Method: SS. Bailer

Well Information:

Depth of Well *: 52.38 ft.
Depth to Water *: 9.34 ft.
Length of Water Column: 43.04 ft.
Volume of Water in Well: 7.02 gal.(s)
3X Volume of Water in Well: 21.0 gal.(s)

Water Volume /ft. for:	
X	2" Diameter Well = 0.163 X LWC
	4" Diameter Well = 0.653 X LWC
	6" Diameter Well = 1.469 X LWC

Volume removed before sampling: 16 gal.(s)
Did well go dry? YES

* Measurements taken from: [X] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings	
4.0 Standard	
7.0 Standard	X
10.0 Standard	X

Conductivity Standard Readings	
84 S Standard	
1413 S Standard	

Water parameters:

	Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial	0.5	60.0	5.50	3520
	7.5	55.8	5.60	9680 ?
	14.5	58.9	5.90	730 ?
	16	59.0	6.10	6.35

Water Sample:
Time Collected: 10:15

Physical Appearance at Start	
Color	Clear
Odor	Sulfur odor
Turbidity (> 100 NTU)	37.0
Sheen/Free Product	None

Physical Appearance at Sampling	
Color	Clear
Odor	slight sulfur
Turbidity (> 100 NTU)	77.0
Sheen/Free Product	NONE

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	YES	HNO_3	<2
1L	Plastic	1	NO	NaOH	>10

Notes:

O'Brien & Gere Engineers, Inc. — **Standard Ground Water Sampling Log**

Date: 5/10/00
Site Name: Fenton Chemical
Location: Pendleton
Project No.: 270841
Personnel: TPP/DEC

Weather: Sunny 65°
Well #: UPS-14I
Evacuation Method: Hand Bail
Sampling Method: SS. Bailer

Well Information:

Depth of Well *	31.08	ft.
Depth to Water *	3.40	ft.
Length of Water Column	27.68	ft.
Volume of Water in Well	4.5	gal.(s)
3X Volume of Water in Well	13.5	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- ____ 4" Diameter Well = 0.653 X LWC
- ____ 6" Diameter Well = 1.469 X LWC

Volume removed before sampling: 10 gal.(s)
Did well go dry? YES

* Measurements taken from: [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard		1413 S Standard	
10.0 Standard			

Water parameters:

	Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial	0	64.5	8.52	261
	5	58.7	7.82	366
	10	48.4	7.86	355

Water Sample:
Time Collected: 1320

Physical Appearance at Start		Physical Appearance at Sampling	
Color	Clear	Color	Clear
Odor	None	Odor	None
Turbidity (> 100 NTU)	305	Turbidity (> 100 NTU)	139
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	YES	HNO_3	<2
1L	Plastic	1	NO	NaOH	>10

Notes:
Dry @ 10gal

JAM:ers/div76/admin/4_notes/stad9log

April 25, 1997

O'Brien & Gere Engineers, Inc.

Standard Ground Water Sampling Log

Date: 8/16/00
Site Name: Frontier Chemical
Location: Pendleton
Project No.: 270841
Personnel: TPP / DEC

Weather: Sunny 65
Well #: UPS-14D
Evacuation Method: Hand Bail
Sampling Method: SS Bailer

Well Information:

Depth of Well *	41.61	ft.
Depth to Water *	7.66	ft.
Length of Water Column	33.95	ft.
Volume of Water in Well	5.53	gal.(s)
3X Volume of Water in Well	16.6	gal.(s)

Water Volume /ft. for:
- X 2" Diameter Well = 0.163 X LWC
- 4" Diameter Well = 0.653 X LWC
- 6" Diameter Well = 1.469 X LWC

Volume removed before sampling: 17 gal.(s)
Did well go dry? No

* Measurements taken from: [x] Well Casing [ ] Protective Casing [ ] (Other, Specify)

Instrument Calibration:

pH Buffer Readings		Conductivity Standard Readings	
4.0 Standard		84 S Standard	
7.0 Standard	X	1413 S Standard	
10.0 Standard	X		

Water parameters:

	Gallons Removed	Temperature Readings	pH Readings	Conductivity Readings uS/cm
initial	0.5	59.1	5.35	424
	6.0	55.5	6.20	1190
	11	57.5	5.62	1670
	17	58.2	5.80	1550

Water Sample:
Time Collected: 1320

Physical Appearance at Start		Physical Appearance at Sampling	
Color	Clear	Color	Clear
Odor	None	Odor	Sulfur
Turbidity (> 100 NTU)	42	Turbidity (> 100 NTU)	35.0
Sheen/Free Product	None	Sheen/Free Product	None

Samples collected:

Container Size	Container Type	# Collected	Field Filtered	Preservative	Container pH
40ml	Glass	2	NO	1:1HCL	<2
1L	Plastic	1	No	HNO_3	<2
1L	Plastic	1	No	NaOH	>10

Notes:

CALIBRATION DATA SHEET **O'BRIEN & GERE ENGINEERS, INC.**

Equipment Name	HYDAC TEMP, CONDUCTIVITY, PH
Model Number	DIG DCT / pH COMP
Serial Number	9705634669
☐ New	Serviced ☐ As Found ☐ As Left ☐ In Tolerance ☐ Out of Tolerance

Routine Calibration Due Date: _____

Standards Used: DH 7, pH 10

	pH	
	7	10
start	6.28	–
CALIB	6.99	10.00
END	6.99	9.68

☐ **Environmental Conditions are Suitable for Calibration**

TEMPERATURE =
ATMOSHPHERIC PRESSURE =

Comments: _____

This equipment has been calibrated using standards whose accuracies are traceable to the National Institute of Standards & Technology (NIST) within the limits of the Institutes's calibration service.

Calibration Performed By: Donald E. Canistraci

Date: 8/11/00

CALIBRATION DATA SHEET **O'BRIEN & GERE ENGINEERS, INC.**

Equipment Name	HYDAC TEMPERATURE, CONDUCTIVITY, pH
Model Number	DIG PCT/PH COMP
Serial Number	9705634[illegible]
☐ New	Serviced ☐ As Found ☐ As Left ☐ In Tolerance ☐ Out of Tolerance

Routine Calibration Due Date: ______

Standards Used: pH 7, pH 10 pH 7 10

START 7.11 10.04

CALIB 7.00 10.00

Probe [illegible] at [illegible] END OF DAY 6.12 9.25

☐ **Environmental Conditions are Suitable for Calibration**

TEMPERATURE =

ATMOSHPHERIC PRESSURE =

Comments: ______

This equipment has been calibrated using standards whose accuracies are traceable to the National Institute of Standards & Technology (NIST) within the limits of the Institutes's calibration service.

Calibration Performed By: Don Canestrari

Date: 8/10/00

training\calibsht.wpd

O'Brien & Gere Laboratories, Inc.

5000 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain of Custody

Client: FRONTIER CHEMICAL
Project: PENDELTON
Sampled by: T. Prawel, D. Canestrari
Client Contact: **Phone #**

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers	Analysis/Method: 95-1	Metals *	CN					Comments
88-12C	8/10/00	945	Water	Grab	5	3	1	1					
88-12D	8/10/00	1015	Water	Grab	5	3	1	1					
URS 14D	8/10/00	1320	Water	Grab	5	3	1	1					Unfiltered Mtls
85-7R MS/MSD	8/10/00	1500	Water	Grab	15	9	3	3					
URS-7D	8/10/00	1545	Water	Grab	5	3	1	1					Unfiltered Mtls
Blind Dup	—	—	Water	Grab	5	3	1	1					
Trip Blank	8/10	—	Water		2	2							

Relinquished by:	**Date:**	**Time:**	**Received by:**	**Date:**	**Time:**
Relinquished by:	**Date:**	**Time:**	**Received by:**	**Date:**	**Time:**
Relinquished by:	**Date:**	**Time:**	**Received by Lab:**	**Date:**	**Time.**
Shipment Method:			**Airbill Number:**		

Turnaround Time Required:
Routine_____
Rush (Specify)_____

Comments: * metals Field Filtered (Turbidity > 50)
FILE 8184 8066 5705

Cooler Temperature:_____

Original-Laboratory Copy-Client

O'Brien & Gere Laboratories, Inc.

5000 Brittonfield Parkway
East Syracuse, New York 13057
(315) 437-0200

Chain of Custody

Client: Frontier Chemical
Project: Pendleton
Sampled by: T. Prawel, D Canestrari
Client Contact: **Phone #**

Sample Description

Sample Location	Date Collected	Time Collected	Sample Matrix	Comp. or Grab	No. of Containers	Analysis/Method: 95.1	Metals	CN					Comments
URS-9I	8/11/00	1115	Water	Grab	5	3	1	1					
URS-9D	8/11/00	1100	Water	Grab	5	3	1	1					Unfiltered Mtls
85-5R	8/11/00	1400	water	Grab	5	3	1	1					
URS-5D						3	1	1					Unfiltered Mtls.
URS-14I	8/11/00	1320	Water	Grab	5 5	3	1	1					
EQUIPMENT BLANK	8/11/00	1440	WATER	GRAB	5	3	1	1					
TRIP Blank	8/11/00	—	water	—	2	2							

Relinquished by: David S Canestrari	**Date:** 8/11/00	**Time:** 1545	**Received by:**	**Date:**	**Time:**
Relinquished by:	**Date:**	**Time:**	**Received by:**	**Date:**	**Time:**
Relinquished by:	**Date:**	**Time:**	**Received by Lab:**	**Date:**	**Time:**
Shipment Method:			**Airbill Number:**		

Turnaround Time Required:
Routine_____
Rush (Specify)_____

Comments: * metals field filtered
Fed Ex - 8184 8066 5727

Cooler Temperature:_____

Original-Laboratory Copy-Client

Appendix C

Data validation report

Data Validation Services

120 Cobble Creek Road P. O. Box 208
North Creek, N. Y. 12853
Phone 518-251-4429

September 25, 2000

Jennifer Smith
O'Brien & Gere Engineers
5000 Brittonfield Parkway
P. O. Box 4873
Syracuse, NY 13221

RE: Validation of Frontier Chemical Site Data Packages
OBG Labs Report for Samples Collected 8/10/00 and 8/11/00

Dear Ms. Smith:

Review has been completed for the data packages generated by OBG Laboratories, pertaining to samples collected at the Frontier Chemical Site on August 10 and August 11, 2000. Eleven aqueous samples were analyzed for TCL volatiles and TAL metals/cyanide parameters. Matrix spikes/ duplicates, and equipment and trip blanks were also processed. Methodologies utilized are those of the USEPA SW846.

Data validation was performed with guidance from the most current editions of the USEPA CLP National Functional Guidelines for Organic and Inorganic Data Review and the USEPA SOPs HW-2 and HW-6. The following items were reviewed:

* Data Completeness
* Custody Documentation
* Holding Times
* Surrogate and Internal Standard Recoveries
* Matrix Spike Recoveries/Duplicate Correlations
* Preparation/Calibration Blanks
* Control Spike/Laboratory Control Samples
* Instrumental Tunes
* Calibration Standards
* Instrument IDLs
* Method Compliance
* Sample Result Verification

Those items showing deficiencies are discussed in the following sections of this report. All others were found to be acceptable as outlined in the above-mentioned validation procedures, and as applicable for the methodology. Unless noted specifically in the following text, reported results are substantiated by the raw data, and generated in compliance with protocol requirements.

In summary, sample processing was primarily conducted with compliance to protocol requirements and with adherence to quality criteria, and most reported results are usable as reported, or with minor qualification as estimated. Certain edits to, and qualification of, reported results are indicated. These issues are discussed in the following analytical sections.

Copies of sample report forms, with recommended qualifiers applied in red ink, are attached to this narrative, and should be reviewed in conjunction with this text.

Data Completeness

The laboratory data packages were not directly in compliance with the required NYSDEC ASP Category B deliverables, but the information needed for validation of the data was present. Volatile summary forms 2, 4, and 5 were not present, the laboratory NYSDEC Sample Preparation and Analysis Summary Forms were not provided, and no verbatim certification statement was made in the case narrative.

Volatile Analyses

Acetone, carbon disulfide, and methylene chloride were detected at levels similar to those of the samples in the associated blanks. The sample carbon disulfide detections should have been flagged as "B" by the laboratory. Sample reported detections which fall at or below the following levels are considered external contamination, and are to be edited to nondetection ("U") at either the CRDL, or the originally reported values, whichever are greater:

Analyte	Concentration, ug/L
Carbon disulfide	3
Acetone	13
Methylene chloride	9

Due to low response factors in the calibration standards, results for acetone should be considered estimated ("J") in the project samples.

Matrix spikes of 85-7R involved evaluation of recoveries of all target analytes. Those for five compounds produced low recoveries (10% to 61%), indicating that the results for these analytes in the sample itself should be considered estimated ("J" or "UJ"). They are the following:
carbon disulfide, 1,1-dichloroethene, cis-1,3-dichloropropene, trans-1,3-dichloropropene, and styrene.

Sample URS-14I produced one slightly low recovery (80%) of one of the four surrogate standards. Upon evaluation of the system sensitivity and the relative difference between the reported CRDLs and the IDLs, it is determined that no qualification of the sample data (which all shows nondetection) is indicated.

The calibration standard of 8/23/00 showed low responses for five analytes (30%D to 44%D). Results for the following analytes in the associated samples, which are all project samples **except** 88-12C, 88-14D, and 85-7R, and considered estimated ("J" and "UJ"), biased low:
bromomethane, carbon disulfide, cis-1,3-dichloropropene, trans-1,3-dichloropropene, and bromoform

One of the samples was processed after a method blank which was not used, but before the method blank which was used, for the 8/23/00 analysis. This is not in compliance with the required protocol, but because the sample showed no detection of target analytes, there is no effect on the reported results.

The Tentatively Identified Compounds should be qualified as estimated in value, and should be reported to one significant figure. Those identified as "solvent" or "column bleed" are analysis artifacts and should be disregarded as sample components.

Field duplicate correlation of URS-7D and Blind Dup was acceptable.

Reported results are substantiated by the raw data.

Metals/CN Analyses

Accuracy and precision evaluations for 85-7R were acceptable, although the duplicate correlations for the elements were performed on matrix spikes rather than the sample itself.

Due to low recovery of the arsenic CRI standard (66%), the reported results in sample 88-12C, 88-12D, 85-7R, URS-14D, and URS-7D should be regarded as estimated, possibly biased low.

The serial dilution determinations for 85-7R produced acceptable correlations for all elements except manganese (14%D). Results for all samples with manganese values above 0.01 mg/L should be considered estimated, with a possible low bias.

Field duplicate correlation between URS-7D and Blind Dup showed values for iron and mercury just above validation action levels. Results for these two analytes in the two samples are therefore to be qualified as estimated. The bias is not expected to be great.

Reported results are substantiated by the raw data.

Please do not hesitate to contact me if questions or comments arise during your review of this report.

Very truly yours,

Judy Harry

NARRATIVE

INTRODUCTION/ANALYTICAL RESULTS

This report summarizes the laboratory results for samples from Frontier Chemical - Pendleton Site, Town of Pendleton, Niagara County, NY. Immediately following the narrative is the Cross Reference Table that lists the site descriptions, sample numbers, dates collected, dates received and package numbers.

CONDITION UPON RECEIPT/CHAIN OF CUSTODY

The coolers were received intact. When the coolers were received by the laboratory, the sample custodian(s) opened and inspected the shipments for damage and custody inconsistencies. The chain of custody forms documenting receipt are presented in the chain of custody section. Each sample was assigned a unique laboratory number and a custody file created. The samples were placed in a secured walk-in cooler and signed in and out by the chemists performing the tests. The sign out record, or lab chronicle, is presented in the chain of custody section.

No discrepancies were noted upon receipt. The cooler temperatures upon receipt were 3°C and 4°C.

METHODOLOGY

The following methods were used to perform the analyses:

PARAMETER	METHOD	REFERENCE
Volatile Organics	8260B	1

1) Test Methods for Evaluating Solid Wastes, SW-846 Third Edition, Final Update III, December 1996.

Metals and wet chemistry data requested on the Chain of Custody is presented in a separate report.

QUALITY CONTROL

The quality control for this program includes internal standards, surrogates, matrix spike (MS), matrix spike duplicate (MSD), equipment blank, laboratory control sample (LCS) samples, and QC trip blanks. QA/QC results are summarized in the Sample Data Package and are also included in the raw data.

RAW DATA

The raw data is organized in a format similar to the US EPA Contract Laboratory Program order of data requirements.

GC/MS Volatile Organics Case Narrative

Client:	Frontier Chemical
Job Number:	5829.001.517
Package #:	6532, 6542
Methodology:	8260B
Analyzed/Reviewed by (Date/Initials):	SG 9-18-00
Supervisor/Reviewed by (Date/Initials):	@ 9-18-00
QA/QC Review (Date/Initials):	9/18/00
File Name in G/ Drive:	C:\WPWIN60\WPDOCS\V6532.NAR

GC/MS Volatile Organics

The GC/MS Volatile instruments used a J&W DB-VRX, 60 m x 0.25 mm ID capillary column and a Vocarb 3000 trap.

Holding Times and Sample Preservation

All samples were prepared and analyzed within the method and/or QAPP specified holding time requirements. Samples had a pH of less than 2.

Laboratory Control Sample

All spike recoveries met method and/or project specific QC criteria.

MS/MSD

The following compound(s) did not meet matrix spike/matrix spike duplicate percent recovery and/or RPD criteria:

Sample Description	Sample #	Compound	% REC	RPD	Corrective Action
85-7R	R0179	1,1-Dichloroethene	X		1
		Methylene chloride		X	2
		Carbon disulfide	X		1
		cis-1,3-Dichloropropene	X		1
		trans-1,3-Dichloropropene	X		1
		Dibromochloromethane	X		1
		Styrene	X		1

1. No corrective action was taken. The RPD and the associated LCS met criteria for this compound.

2. No corrective action was taken. The recovery and the associated LCS met criteria for this compound.

Client: Frontier Chemical
Job Number: 5829.001.517
Package #: 6532, 6542
Methodology: 8260B

Surrogate
The following sample(s) did not meet surrogate recovery criteria:

Sample Description	Sample #	Surrogate	Corrective Action
URS-14I	R0362	Toluene-d8	1

1. Three of four surrogates met method QC criteria. No corrective action is required.

Internal Standards
All internal standard areas met method and/or project specific QC criteria.

Calibrations
All calibrations and calibration verifications met method and/or project specific QC criteria.

Preparation Blanks
All preparation blanks met method and/or project specific QC criteria.

NARRATIVE

INTRODUCTION/ANALYTICAL RESULTS

This report summarizes the laboratory results for samples from Frontier Chemical - Pendleton Site, Town of Pendleton, Niagara County, NY. Immediately following the narrative is the Cross Reference Table that lists the site descriptions, sample numbers, dates collected, dates received and package numbers.

CONDITION UPON RECEIPT/CHAIN OF CUSTODY

The coolers were received intact. When the coolers were received by the laboratory, the sample custodian(s) opened and inspected the shipments for damage, custody inconsistencies and proper preservation. The chain of custody forms documenting receipt are presented in the chain of custody section. Each sample was assigned a unique laboratory number and a custody file created. The samples were placed in a secured walk-in cooler and signed in and out by the chemists performing the tests. The sign out record, or lab chronicle, is presented in the chain of custody section.

No discrepancies were noted upon receipt. The cooler temperatures upon receipt were 3°C and 4°C.

METHODOLOGY

The following methods were used to perform the analyses:

PARAMETER	METHOD	REFERENCE
ICP Metals	6010B	1
Mercury	7470A	1
Thallium	7841	1
Cyanide	9010B/9014	1

1) Test Methods for Evaluating Solid Wastes, SW-846 Third Edition, Final Update III, December 1996.

Volatile Organics data requested on the Chain of Custody is presented in a separate report.

QUALITY CONTROL

The quality control for this program includes internal standards, surrogates, matrix spike (MS), matrix spike duplicate (MSD), laboratory duplicate (D), equipment blank, laboratory control sample (LCS), prep blank and QC trip blank samples. QA/QC results are summarized in the Sample Data Summary Package and are also included in the raw data.

RAW DATA

The raw data is organized in a format similar to the US EPA Contract Laboratory Program order of data requirements.

Trace Metals Case Narrative

Client:	Frontier Chemical
Job Number:	5829.001.517
Package #:	6532,6542
Methodology:	ICP metals - 6010B
Analyzed/Reviewed by (Date/Initials):	9-13 [illegible]
Supervisor/Reviewed by (Date/Initials):	9-13 [illegible]
QA/QC Review (Date/Initials):	9/13/00
File Name in G/ Drive:	G:\NARRATIV\6532FROT.ICP

Trace Metals

Holding Times
All samples were prepared and analyzed within the method and/or QAPP specified holding time requirements.

Laboratory Control Sample
All spike recoveries met method and/or project specific QC criteria.

MS/MSD AND MS/MSD RPD
The following analyte did not meet matrix spike/matrix spike duplicate percent recovery criteria:

Sample Description	Sample #	Analyte	% REC	RPD	Corrective Action
85-7R (Field Filtered)	R0185	Calcium	X		1

1. The concentration of the analyte in the sample was much greater than the concentration of the spike added. A post-digestion spike was performed as required. No further corrective action was taken.

ICP Serial Dilution
The following analyte did not meet ICP serial dilution recovery criteria:

Sample Description	Sample #	Analyte	Corrective Action
85-7R (Field Filtered)	R0185	Manganese	1

1. A post-digestion spike was performed. No further corrective action was taken.

Calibrations
All calibrations and calibration verifications met method and/or project specific QC criteria.

Preparation Blanks
All preparation blanks met method and/or project specific QC criteria.

Trace Metals Case Narrative

Client:	Frontier Chemical
Job Number:	5829.001.517
Package #:	6532,6542
Methodology	Mercury - 7470A
Analyzed/Reviewed by (Date/Initials):	9-13-00
Supervisor/Reviewed by (Date/Initials):	9 13 00
QA/QC Review (Date/Initials):	9/13/00
File Name in G/ Drive:	G:\NARRATIV\6532FRON.HG

Trace Metals

There were no excursions to note. All QC results were within established control limits.

Trace Metals Case Narrative

Client:	Frontier Chemical
Job Number:	5829.001.517
Package #:	6532,6542
Methodology	Thallium - 7841
Analyzed/Reviewed by (Date/Initials):	9-13-00 MT
Supervisor/Reviewed by (Date/Initials):	9-13-00 MT
QA/QC Review (Date/Initials):	9/13/00
File Name in G/ Drive:	G:\NARRATIV\6532FRON.TL

Trace Metals

There were no excursions to note. All QC results were within established control limits.

A

Wet Chemistry Case Narrative

Client:	Frontier Chemical
Job Number:	5829.001.517
Package #:	6532, 6542
Methodology:	Total cyanide - 9010B/9014
Analyzed/Reviewed by (Date/Initials):	BB 9/11/00
Supervisor/Reviewed by (Date/Initials):	[illegible] 9/11/00
QA/QC Review (Date/Initials):	[illegible] 9/13/00
File Name in G/ Drive:	G:\NARRATIV\6532FRON.WC

Wet Chemistry

There were no excursions to note. All QC results were within established control limits.

CROSS REFERENCE TABLE

Site	Sample Number	Date Collected	Received	Package
88-12C	R 176	08/10/2000	08/11/2000	6532
88-12D	R 177	08/10/2000	08/11/2000	6532
URS-14D	R 178	08/10/2000	08/11/2000	6532
85-7R	R 179D	08/10/2000	08/11/2000	6532
85-7R	R 179MS	08/10/2000	08/11/2000	6532
85-7R	R 179MSD	08/10/2000	08/11/2000	6532
85-7R	R 179	08/10/2000	08/11/2000	6532
URS-7D	R 180	08/10/2000	08/11/2000	6532
Blind Dup	R 181	08/10/2000	08/11/2000	6532
QC Trip Blank	R 182	08/10/2000	08/11/2000	6532
88-12C (Field Filtered)	R 183	08/10/2000	08/11/2000	6532
88-12D (Field Filtered)	R 184	08/10/2000	08/11/2000	6532
85-7R (Field Filtered)	R 185D	08/10/2000	08/11/2000	6532
85-7R (Field Filtered)	R 185MS	08/10/2000	08/11/2000	6532
85-7R (Field Filtered)	R 185MSD	08/10/2000	08/11/2000	6532
85-7R (Field Filtered)	R 185	08/10/2000	08/11/2000	6532
Blind Dup (Field Filtered)	R 186	08/10/2000	08/11/2000	6532
URS-9I	R 358	08/11/2000	08/12/2000	6542
URS-9D	R 359	08/11/2000	08/12/2000	6542
85-5R	R 360	08/11/2000	08/12/2000	6542
URS-5D	R 361	08/11/2000	08/12/2000	6542
URS-14I	R 362	08/11/2000	08/12/2000	6542
Equipment Blank(Equipment Blank)	R 363	08/11/2000	08/12/2000	6542
QC Trip BLank	R 364	08/11/2000	08/12/2000	6542
URS-9I (Field Filtered)	R 365	08/11/2000	08/12/2000	6542
85-5R (Field Filtered)	R 366	08/11/2000	08/12/2000	6542
URS-14I (Field Filtered)	R 367	08/11/2000	08/12/2000	6542
Equipment Blank (Field Filtered)(Equipment Blank)	R 368	08/11/2000	08/12/2000	6542

Volumes 1 of 1 of the metals and wet chemistry and volatile organics validated analytical data packages are separately bound.