

March 18, 2001

Don Seagren, Environmental Specialist
Alaska Department of Environmental Conservation
Spill Prevention and Response Program
43335 Kalifornsky Beach Road, Suite 11
Soldotna, Alaska 99669

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Department of
Environmental Conservation

Re: Report of Groundwater Sampling Rounds 2, 3 and 4
Doyle's Fuel Storage Facility, Spill 98-23-01-289-01
SE ¼ B.L.M. Lot 51, S34, T6S, R11W, City of Kenai

Dear Mr. Seagren:

This report provides results for three rounds of groundwater samples collected at the subject property during May 2000, September 2000, and January 2001. This sampling completes the groundwater monitoring program set out in the Interim Site Characterization Plan dated 10-7-99.

SUMMARY

Rozak Engineering conducted the initial environmental investigation at this property during September and October 1998. Nineteen soil borings were advanced to the groundwater table. Field and analytical testing of soil samples indicated that soil and groundwater in the southeast portion of the lot was contaminated with diesel fuel oil. Based on the site characterization plan, four groundwater monitor wells were installed and developed on October 25-26, 1999. All four wells were constructed using 2-inch diameter PVC well pipe and screen (0.01 inch slot). The screen was placed at the groundwater level to accommodate fluctuations in the water table. The first round of groundwater samples and static water elevations were taken on October 27, 1999. The results of the well installation, soil sampling, and groundwater sampling, were described in the Interim Characterization Report dated December 20, 1999. The Interim Report concluded:

- There appeared to have been two major fuel releases at the site in areas adjacent to one another. Analytical testing indicated the contamination was middle distillate (diesel) fuel. This was consistent with site history that showed diesel fuels were stored at the site.
- Low levels of GRO, BTEX, and DRO were detected in water samples from MW-1. This was not expected because MW-1 was 90 feet up gradient from the center of the spill site.
- Levels of soil contamination at the site exceeded the regulated levels by many times. It was unclear to what degree the soil contamination at the site was impacting groundwater.
- Groundwater contamination was present at the site and had migrated beyond the east property boundary. It was unclear from comparison of the contaminant levels found

during the 1998 and the 1999 investigations whether or not the contaminant levels and groundwater plume were increasing, stable, or decreasing. There also appeared to be significant changes in the groundwater flow direction.

- Additional rounds of groundwater samples were needed to determine the status of the groundwater plume.

After evaluating the four rounds of water samples taken so far, the status of the contaminant plume is still not clear. The contamination concentrations and plume associated with the onsite fuel oil spill may be stable. It appears that gasoline, possibly from an off-site source, is contributing to contamination levels, especially at MW-4, the off-site well located on the east side of the Candlelight Drive right-of-way.

MONITOR WELL SAMPLING

The static water level was surveyed and groundwater samples were collected at all four monitor wells on May 23, 2000, September 12, 2000, and January 4, 2001. Prior to collecting water samples, the water level in each well was measured and 4 to 5 gallons of water was bailed from each well. Disposable bailers were used. Water samples were sent to CT&E Environmental Services, Inc. in Anchorage to be analyzed for gas range organics (GRO), aromatic compounds (BTEX), and diesel range organics (DRO). Well elevations were surveyed relative to an on-site benchmark. Figure 1 shows the locations of the wells, the groundwater flow direction and the groundwater gradient. In-situ measurements of pH, electrical conductivity (eC), temperature (T), and dissolved oxygen (DO) were taken using a water analyzer.

ANALYTICAL RESULTS

Results of field and analytical testing on water samples are reported in Tables 1 - 4. The chain of custody, data reports, and analysis reports are attached. For comparative purposes the tables include test results from the October 1999 water samples. Water samples were analyzed using methods AK101 (GRO), AK102 (DRO), and 8021M (BTEX). Figure 1 shows the estimated plume boundary based on overall well data and contaminants that exceed cleanup levels. Analytical testing showed the groundwater cleanup levels were exceeded at MW-2 and MW-4. Analytical chromatography showed the contamination at MW-1, MW-2 and MW-3 was consistent with middle distillate (diesel) fuel. The chromatography for samples from MW-4 showed the contamination at that location was consistent with weathered gasoline—not diesel.

Contamination levels at MW-1 appear to be declining. Low levels of GRO, BTEX and DRO were detected in the sample collected 5-23-00, comparable to the levels detected in the sample collected 10-27-99. Only GRO was detected in the sample collected 9-12-00. No contamination was detected on 1-04-01. All of the contamination levels were well below the cleanup levels, but the presence of contamination was not expected at this location. Dissolved oxygen levels at MW-1 have been variable, but higher than MW-2.

TABLE 1 – SUMMARY OF ANALYTICAL RESULTS AT MW-1

DATE SAMPLED	SWL ELEV.	T °F	pH	eC μ S	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
10-27-99 ¹	90.41	4.1	6.1	95	1.9	0.13	0.32	0.002U
5-23-00 ¹	90.85	13.1	6.1	43	0.9	0.16	0.68	0.0006
9-12-00	89.94	5.4	5.8	51	1.1	0.14	0.3U	0.0005U
1-04-01	90.77	5.3	4.6	63	1.4	0.09U	0.3U	0.0005U
CLEANUP STANDARDS						1.3	1.5	0.02

0.005

U = Analyte was not detected during analysis.

1) Lab Sample Remarks: DRO/RRO Pattern consistent with weathered middle distillate.

Analytical testing of water samples collected from MW-2 continued to show contamination at levels exceeding cleanup standards. However, the sample collected on 9-12-00 is not consistent with the other three rounds, and there is no explanation at this time. The GRO/BTEX levels on 9-12-00 are much greater than the other samples, while the DRO level was much less than previous samples, and the GRO to DRO ratio is significantly different than the other samples. On 1-04-01, the GRO/BTEX/DRO levels were less than the first two samples, and much less than the levels on 5-23-00. The highest water table was measured on 5-23-00; the water table was about a foot lower on the following two sample rounds. Dissolved oxygen levels at MW-2 have been uniformly low and less than the other wells. The reduced DO is probably due to the low permeability surface and bioremediation of the petroleum hydrocarbons at that location.

TABLE 2 – SUMMARY OF ANALYTICAL RESULTS AT MW-2

DATE SAMPLED	SWL ELEV.	T °F	pH	eC μ S	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
10-27-99 ¹	90.17	4.8	6.1	210	0.6	2.4	14	0.001U
5-23-00 ¹	90.44	10.1	6.5	219	0.8	1.3	26	0.029
9-12-00 ¹	89.65	5.5	5.8	231	0.6	9.0	3.1	0.463
1-04-01 ¹	89.43	4.0	5.1	77	0.6	0.22	6.0	0.0039
CLEANUP STANDARDS						1.3	1.5	0.02 (Sm)

0.005

U = Analyte was not detected during analysis.

1) Lab Sample Remarks: DRO Pattern consistent with middle distillate.

Analytical results of water samples collected from MW-3 are well below the cleanup standards. GRO has not been detected. Slight BTEX concentrations have been detected in three of the samples. DRO was detected only in the sample collected on 9-12-00, and the level was less than half the cleanup standard.

TABLE 3 – SUMMARY OF ANALYTICAL RESULTS AT MW-3

DATE SAMPLED	SWL ELEV.	T °F	pH	eC μ S	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
10-27-99	89.91	4.5	5.1	70	0.8	0.10U	0.3U	0.0023
5-23-00	90.29	11.7	6.1	245	1.4	0.09U	0.3U	0.0005U
9-12-00 ¹	89.34	6.6	5.6	63	1.2	0.09U	0.60	0.0034
1-04-01	89.10	5.3	4.6	63	1.4	0.09U	0.3U	0.0006
CLEANUP STANDARDS						1.3	1.5	0.02 (Sol) 0.005

U = Analyte was not detected during analysis.

1) Lab Sample Remarks: DRO Pattern consistent with weathered middle distillate.

Analytical testing of water samples collected from MW-4 continued to show contaminants at levels exceeding cleanup standards, but the analytical results from the last three samples are not consistent with the first sample. In the first sample the GRO/BTEX levels are significantly less. In the subsequent samples at MW-4, the DRO level increased only slightly, but the GRO/BTEX levels at MW-4 are much greater (8-17 times) than the levels detected at the other three wells. For the last three samples the laboratory reports stated "DRO pattern consistent with weathered gasoline." This was not consistent with the laboratory's remark on analysis results for samples from the other wells, "DRO pattern consistent with weathered middle distillate."

After receiving the analysis results for the sample taken on 5-23-00 we asked the laboratory to verify this sample was from our shipment—they confirmed that it was. We also requested the laboratory to reexamine the results to see if the GRO/BTEX was from gasoline or if it might be associated with diesel fuel. On 7-6-2000, CT&E laboratory manager Stephen Ede responded, "The sample in question does not appear to be significantly contaminated with a middle distillate fuel. The DRO pattern indicates a significantly 50-80% weathered gasoline."

TABLE 4 – SUMMARY OF ANALYTICAL RESULTS AT MW-4

DATE SAMPLED	SWL ELEV.	T °F	pH	eC μ S	DO ppm	GRO mg/L	DRO mg/L	Benzene mg/L
10-27-99	89.74	4.8	5.9	286	6.5	1.2	1.0	0.10
5-23-00 ²	90.13	10.2	6.4	295	1.1	54	3.2	2.66
9-12-00 ²	89.22	6.1	5.8	378	0.6	24	1.4	1.50
1-04-01 ²	89.01	4.0	5.2	377	0.9	18	2.2	1.81
CLEANUP STANDARDS						1.3	1.5	0.02 (Sol) 0.005

2) Sample Remarks: DRO Pattern consistent with weathered gasoline.

On 10-27-99, the DO is significantly higher than the subsequent sample rounds. Environmental conditions, such as surface water infiltration after a large rainfall or snowmelt event, may have elevated the DO at MW-4. The high reading could also be due to a sampling error.

QUALITY CONTROL SUMMARY

Each sample was a discrete sample and handled according to approved sampling procedures for the analytical methods used. Samples were stored in a cooler with ice and delivered to CT&E Environmental Services, Inc. in Anchorage. The laboratory reported the samples were received in good condition and quality assurance/quality control criteria were in compliance with ADEC and/or CT&E's Quality Assurance Program Plan. Analysis of the trip blanks showed that no contamination was attributable to shipping or field handling.

CONCLUSIONS

Inspection of the site-specific data shows that contamination is present at the site and that contamination levels exceed the current regulatory standards. Besides the two major diesel fuel releases described in the 12-20-99 report, analytical results from the last three sample rounds indicate at least part of the subject site has been impacted by a gasoline release. The highest GRO/BTEX levels were detected at MW-4. The source of the gasoline contamination has not been determined. There is no record of gasoline being stored at the subject site, drums of fuel products used to be stored on property [no longer occupied] north of the subject property. Aerial photographs reviewed during the initial site assessment indicated there had been drums, fuel tanks, and trucks parked around the site. Groundwater flow at the site has varied slightly but in general has been to the southeast, from the former aboveground diesel storage tank location toward MW-4. The GRO/BTEX levels were less at MW-2 than at MW-4, which indicates the source of gasoline contamination was not directly up gradient of well MW-2.

It is still not clear to what degree soil contamination at the site is impacting the groundwater. The DRO contamination plume is not expanding at MW-3, but it is not clear whether the DRO plume is stable or changing at MW-4. DRO levels have fluctuated at MW-4, and no trend is apparent at this time. The fluctuation could be associated with the 50-80% weathered gasoline contamination detected at MW-4, especially if diesel fuel was also spilled at the source of the gasoline contamination.

Additional groundwater sampling points are needed to determine the status of the contamination plume and whether the gasoline contamination is from an on-site or off-site source. To help define the extent of the plume at least one sample point should be placed along the Candlelight Drive right-of-way, 30 to 40 feet north of MW-4. Further research of historical uses of the subject property and nearby up-gradient properties may help identify the source of the gasoline contamination. If historical information is not helpful, an additional sample point along the north property line may be needed, probably one point between MW-1 and Candlelight Drive, and maybe another to the west of MW-1. Another round of water samples should be collected this spring during the high water table, from the existing wells and any additional sample points.

CLOSURE

The findings and conclusions in this report describe the conditions at the time the samples were collected. The work was performed in general accordance with the standards of care and diligence normally practiced by recognized consulting firms in performing services of a similar nature. The information is, to the best of my knowledge and belief, true, accurate, and complete.

Prepared by,



Ronald T. Rozak, PE
Principal Investigator



cc: James Doyle, Doyle's Fuel Service

Attachments:

- Figure 1. Groundwater Contamination Map (1-4-01)
- Figure 2. Soil Contamination Map (12-2-99)
- Laboratory Analysis Reports

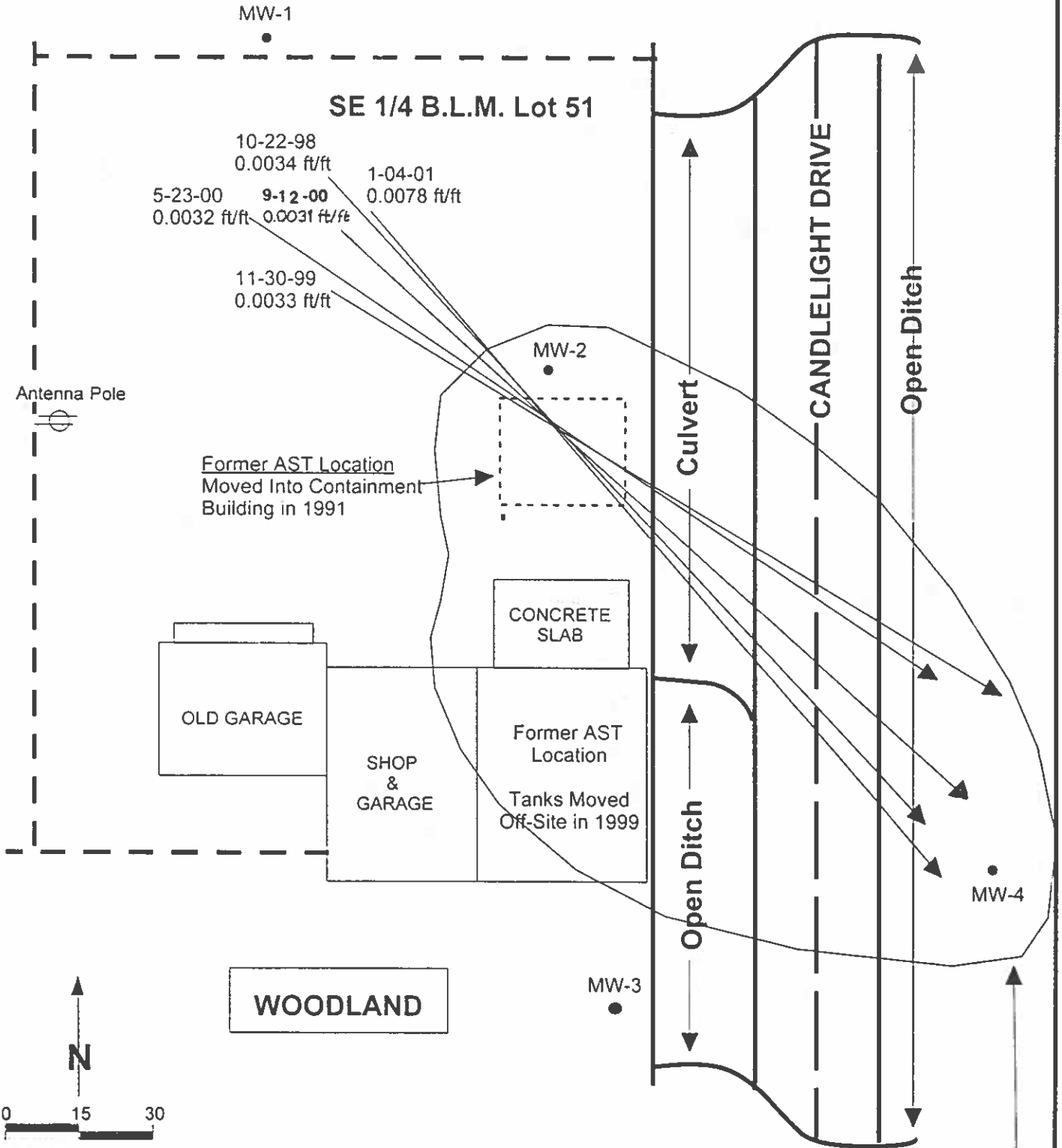
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Fig. 1. Groundwater Contamination Map
Formerly Doyle's Fuel Service
Mile 8.5 Kenai Spur Highway

1-04-01

LEGEND

MONITOR WELL •
MW-2



Estimated plume boundary based on overall well data and contaminants that exceed cleanup levels.

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Figure 2. Soil
 Contamination Map
 Doyles Fuel Service
 12-2-99

LEGEND

- Monitor Well MW-2
- Soil Boring Number
- Soil Boring Location
- u DRO Concentration

