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Subject: Avgas Tank F-3 (ADEC Hazard ID: 981 | ADEC File Number: 2320.38.016 | ADEC Status: Active) Soil and Groundwater Investigations Summary

Attached Figures:

- Avgas Tank F-3: Historic Soil Sample Locations
- Avgas Tank F-3: Historic Groundwater Sample Locations

Avgas Tank F-3 Spill Site Summary

- *ADEC Hazard ID: 981 | ADEC File Number: 2320.38.016 | ADEC Status: Active*

In March 1990, approximately 640 gallons of aviation fuel (Avgas) spilled (ADEC Spill #1990230108101) from aboveground storage tank (AST) "Tank F-3", which is located 50 feet east of the helipad.

Analytical soil or groundwater data was not collected as part of the initial site assessment in 1990 (Shannon & Wilson 1991), but field screening and visual and olfactory evidence indicated that contamination on site was primarily located immediately west of Tank F-3 at boring locations B-7 and AF-B5, where 2-3 inches of free product was discovered on the water table at approximately 5 feet below ground surface (bgs). The spill was in the vicinity of the fill lines for the ASTs that run north-south along the west side of the tank farm, but the exact release location is unknown. Results of the 1990 assessment activities are summarized in the included spreadsheet (Tables 1 and 2).

Analytical soil data collected in 2000 (OilRisk Consultants 2001) exceeded current ADEC migration to groundwater cleanup levels for fuel constituents downgradient of the spill at borings AF-1 and SWCOR. No analytical soil data was collected upgradient or crossgradient from the location where free product was previously discovered. Analytical soil data has not been collected since 2000. Soil results from the 2000 sampling activities are summarized in the included spreadsheet (Table 3).

Groundwater data collected in 2000 (OilRisk Consultants 2001) exceeded the current ADEC Table C Human Health cleanup levels for DRO at monitoring well AF-3 (1,800 ug/L), located over 100 feet downgradient of where free product was discovered at location AF-B5 in 1990. DRO was also detected at 540 µg/L in well AF-1, located immediately downgradient from location AF-B5. Although the actual results and laboratory data are not available, Figure 4-6 from the Confirmation Sampling Report, Tank Farm and Avgas Spill Sites, Drift River Terminal (OilRisk Consultants 2001) indicates that groundwater samples were collected several times between 1990 and 2000. Figure 4-6 summaries the benzene and DRO concentrations during that timeframe. At monitoring well AF-1, benzene concentrations exceeded the current cleanup level of 4.6 µg/L between 1990 and 1992 but were below the cleanup level after 1992. At monitoring well AF-2, benzene approached the cleanup level in 1991 but was consistently nondetect thereafter. At monitoring well AF-3, benzene concentrations were consistently greater than the cleanup level between 1990 and1995 but were less than the cleanup level thereafter. At monitoring well M-4, benzene concentrations were initially less than the cleanup level but exceeded the cleanup level in 1993 and 1994; following 1994 the benzene concentrations were again less than the cleanup level. All other monitoring wells reported benzene concentrations less than the cleanup level. At monitoring well AF-1, DRO concentrations were above the current cleanup level of 1,500 µg/L between 1991 and 1996 before falling below the cleanup level in 1999. At monitoring well AF-2, DRO was reported above the cleanup level during only one sampling event in 1995. At monitoring well AF-3, DRO concentrations exceeded the cleanup level in 1991, 1992, 1996, and 1999. All other monitoring wells reported DRO concentrations less than the cleanup level.

Following groundwater sampling in 2000, DRO was not detected in monitoring well AF-3 during five additional sampling events between 2002 and 2009; and has not exceeded cleanup levels in monitoring well AF-1 during five sampling events between 2002 and 2011.

Benzene was reported in 2011 at AF-1 at 24.9 µg/L, which exceeds the current ADEC Table C cleanup level (ADEC 2018). This was the first time since 1992 that benzene exceeded the cleanup level at AF-1. Both GRO and DRO were detected below the current ADEC Table C groundwater cleanup level but were elevated relative to previous sample results. These elevated concentrations were attributed to an increase in groundwater elevation due to an increase in surrounding floodplain elevation post-eruption (OilRisk Consultants 2011). The following sampling event in 2017 no longer detected benzene at AF-1 and detected DRO below the cleanup level at its lowest concentration since sampling began. The compiled groundwater results are summarized in the included spreadsheet (Table 4). The remaining tables on the included spreadsheet provide a cross-reference to the location of the analytical results in the groundwater monitoring report.

Evidence of contamination associated with the spill at former AST Tank F-3 was primarily located to the west of Tank F-3 but the exact location of the release is unknown. Contamination in soil has not been well delineated to the west, crossgradient of the suspected spill area where free product was observed in 1991. However, contamination in groundwater has been well delineated downgradient to the southeast of the suspected spill area in wells AF-1 and AF-3. Contaminant concentrations in these downgradient wells have generally remained nondetect or had contaminant concentrations well below the cleanup level for decades following the implementation of the soil vapor extraction remediation system. Groundwater sampling over the past 30 years suggests that contamination associated with the Tank F-3 spill is no longer present onsite.

References

Alaska Department of Environmental Conservation. 2018 (October). Oil and Other Hazardous Substances Pollution Control. As amended through October 27, 2018. Alaska Administrative Code Title 18, Chapter 75.

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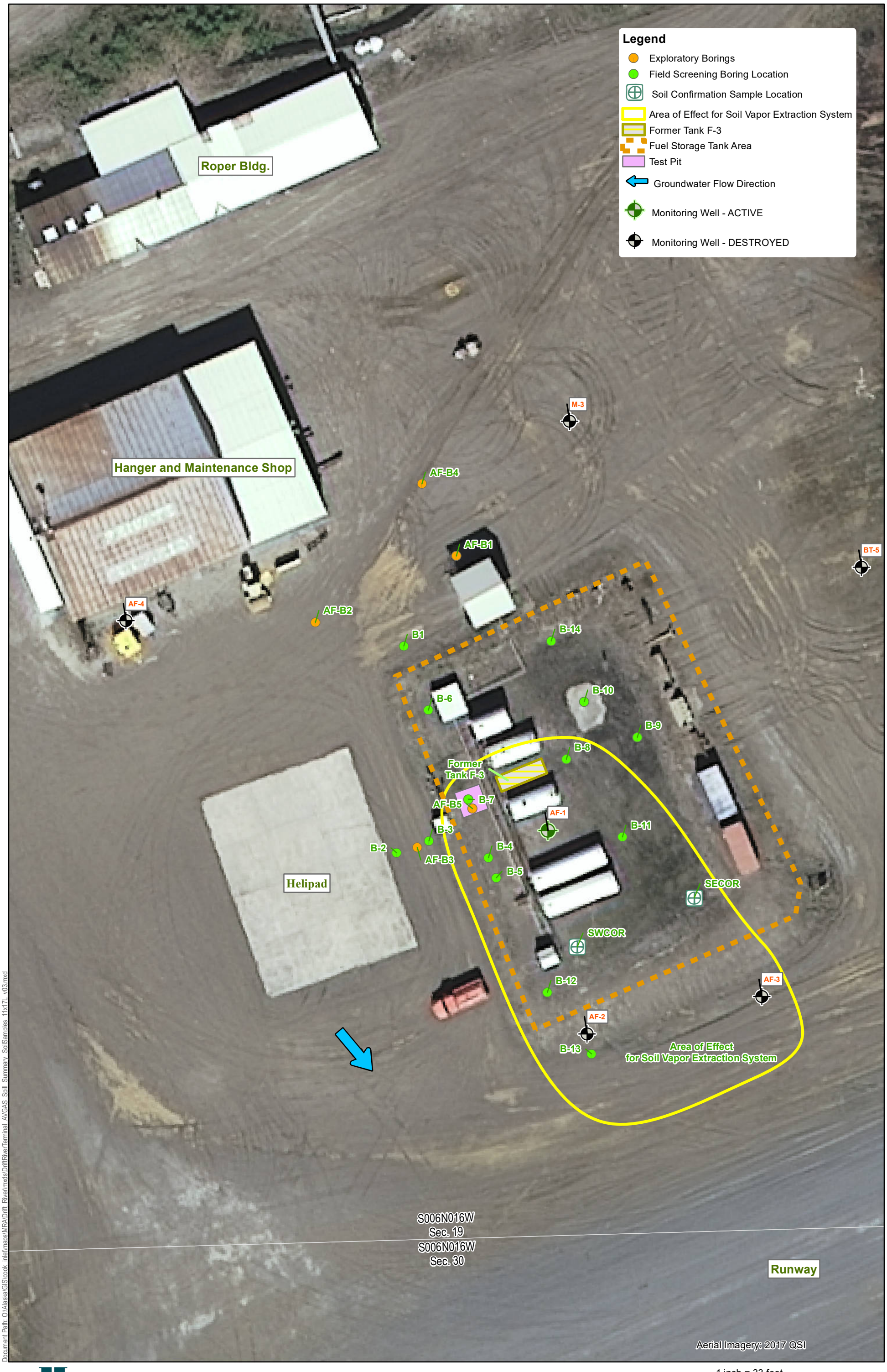
Shannon & Wilson, Inc. 1991 (March). *Site Assessment of the Tank F3 Aviation Fuel Spill, Drift River Terminal, Alaska*. PDF File Name: Site Assessment AV Fuel Spill-7Mar1991



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Hilcorp Alaska, LLC
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Map Date: 2/13/2020

DRIFT RIVER TERMINAL
Avgas Soil Sample Locations

1 inch = 33 feet

Alaska State Plane Zone 5 NAD 1983

0 25 50 Feet

N

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Map Date: 2/5/2020

DRIFT RIVER TERMINAL
Avgas Groundwater Monitoring

1 inch = 100 feet
Alaska State Plane Zone 5 NAD 1983

0 50 100
Feet

N

Table 1: 1990 Field Screening Results

Sample ID	Depth (ft bgs)	Maximum Headspace Reading (ppm)
B-1	3	>200
B-2	3	7.5
B-3	3	48.1
B-4	1	>200
B-5	1	141.4
B-6	3	105.9
B-7	2.7	197
B-8	1	13.1
B-9	2	20.5
B-10	3	131.3
B-11	1	64.6
B-12	1	160.3
B-13	1	34.8
B-14	1	133.8

Results from the Site Assessment of the Tank F3 Aviation Fuel Spill, Drift River Terminal, Alaska (Shannon and Wilson 1991). Samples were collected between 14 and 15 September 1990.

Table 2: 1990 Exploratory Borings

Sample ID	Depth (ft bgs)	Observation of Contamination
AF-B1	3	Strong Hydrocabon Odor and Discoloration
AF-B2	-	None
AF-B3	3	Strong Hydrocabon Odor and Discoloration
AF-B4	-	None
AF-B5	5	Free Product

Results from the Site Assessment of the Tank F3 Aviation Fuel Spill, Drift River Terminal, Alaska (Shannon and Wilson 1991). Borings were collected between 10 and 11 November 1990.

Table 3: 2000 Avgas Soil Sampling Results

Sample ID	Location ID	Units	Sample Depth (feet bgs)	DRO	GRO	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthanlene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Beno(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-cd)pyrene	Dibenz(a,h)anthracene	Benzo(g,h,i)perylene
Cleanup Level (mg/kg):				250	300	0.022	6.7	0.13	1.5	0.038	18	37	36	39	390	590	87	0.7	600	15	150	1.5	15	1.5	2,300
AF-1/1	AF-1	mg/kg	1	570	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
AF-1/5	AF-1	mg/kg	5	24	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SWCOR/1	SWCOR	mg/kg	1	740	2.3	ND	ND	ND	0.057	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SWCOR/5	SWCOR	mg/kg	5	2,800	330	ND	0.59	2.6	19	0.42	ND	ND	ND	0.084	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SWCOR/6 (Duplicate of SWCOR/5)	SWCOR	mg/kg	5	1,500	380	ND	0.72	2.6	22	0.44	ND	ND	0.36	0.084	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
SECOR/1	SECOR	mg/kg	1	43	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
SECOR/3	SECOR	mg/kg	3	150	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
AF-3/0.5	AF-3	mg/kg	0.5	58	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Cleanup level is the most stringent between the Tables B1 and B2 Method Two Under 40 Inch Zone human health and migration to groundwater cleanup levels (ADEC 2018).

Shaded = Exceeds ADEC cleanup levels (ADEC 2018).

ND = Analyte not detected

NS = Analyte not sampled

Analytical results from the Confirmation Sampling Report, Tank Farm and Avgas Spill Sites, Drift River Terminal (OilRisk Consultants 2001)

Table 4: 2000-2017 Groundwater Results

Analyte		DRO (Cleanup Level = 1,500 µg/L)								RRO (Cleanup Level = 1,100 µg/L)								GRO (Cleanup Level = 2,200 µg/L)							
Well ID	Units	2000	2002	2003	2005	2007	2009	2011	2017	2000	2002	2003	2005	2007	2009	2011	2017	2000	2002	2003	2005	2007	2009	2011	2017
AF-1	µg/L	540	1460	ND	570	740	NS	1,090	246	ND	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	NS	81	ND
AF-2	µg/L	ND	ND	ND	NS	NS	NS	NS	NS	ND	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS
AF-3	µg/L	1,800	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	NS	NS
AF-4	µg/L	ND	ND	ND	ND	ND	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	ND	ND	ND	ND	NS
M-4	µg/L	150	ND	ND	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	ND	NS	NS

Analyte		Benzene (Cleanup Level = 4.6 µg/L)								Toluene (Cleanup Level = 1,100 µg/L)								Ethylbenzene (Cleanup Level = 15 µg/L)								Xylenes (Cleanup Level = 190 µg/L)							
Well ID	Units	2000	2002	2003	2005	2007	2009	2011	2017	2000	2002	2003	2005	2007	2009	2011	2017	2000	2002	2003	2005	2007	2009	2011	2017	2000	2002	2003	2005	2007	2009	2011	2017
AF-1	µg/L	ND	ND	ND	ND	ND	NS	24.9	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND
AF-2	µg/L	ND	ND	ND	NS	NS	NS	NS	NS	4.1	ND	ND	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS
AF-3	µg/L	ND	ND	ND	ND	ND	ND	NS	NS	ND	ND	ND	ND	ND	ND	NS	NS	1.6	ND	ND	ND	ND	ND	NS	NS	ND	ND	ND	ND	ND	ND	NS	NS
AF-4	µg/L	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS	ND	ND	ND	ND	ND	ND	ND	NS
M-4	µg/L	ND	ND	ND	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS	ND	ND	ND	NS	NS	NS	NS	NS

Shaded = Exceeds ADEC Table C Groundwater Cleanup levels (ADEC 2018).
ND - Nondetect
NS - Not sampled

Table 5: 2000 Sample Summaries

2000 Avgas Soil Sample Summary					
Sample ID	Sample Depth (feet bgs)	BTEX Results PDF Page #	DRO Results PDF Page #	PAH Results PDF Page #	Figure Reference
AF-1/1	1	232	240	-	Figure 2-2
AF-1/5	5	233	240	-	Figure 2-2
SWCOR/1	1	234	241	259	Figure 2-2
SWCOR/5	5	235	241	260	Figure 2-2
SWCOR/6 (Duplicate of SWCOR/5)	5	236	242	261	Figure 2-2
SECOR/1	1	237	242	-	Figure 2-2
SECOR/3	3	238	243	-	Figure 2-2
AF-3/0.5	0.5	239	243	-	Figure 4-2

2000 Avgas Groundwater Sample Summary				
Sample ID	BTEX/GRO Results PDF Page #	DRO Results PDF Page #	RRO Results PDF Page #	Figure Reference
AF-1	48	65	65	Figure 4-2
AF-2	48	64	64	Figure 4-2
AF-3	49	58	-	Figure 4-2
AF-4	47	61	-	Figure 4-2
AF-5 (Duplicate of AF-3)	49	58	-	Figure 4-2
M-4	47	58	-	Figure 4-2
BT-4	Well associated with the Ballast Water Tank site.			
BT-6	Well associated with the Ballast Water Tank site.			

See the Confirmation Sampling Report, Tank Farm and Avgas Spill Sites, Drift River Terminal (OilRisk Consultants 2001).

Table 6: 2002 Sample Summary

Sample ID	Results PDF Page #
AF-1	3
AF-2	3
AF-3	3
AF-4	3
M-4	3

Results from the Groundwater Sampling at the Avgas Spill Site, Drift River Terminal Report (OilRisk Consultants 2003).

Table 7: 2003 Sample Summary

Sample ID	Results PDF Page #
AF-1	7-11 (ND)
AF-2	7-11 (ND)
AF-3	7-11 (ND)
AF-4	7-11 (ND)
M-4	7-11 (ND)

Results from the Groundwater Sampling at the Avgas Spill Site, Drift River Terminal Report (OilRisk Consultants 2004).

Table 8: 2005 Sample Summary

Sample ID	Results PDF Page #
AF-1	3
AF-2	3
AF-3	3
AF-4	3

Results from the 2005 Biennial Groundwater Monitoring, Avgas Spill Site Report (OilRisk Consultants 2005).

Table 9: 2007 Sample Summary

Sample ID	Results PDF Page #
AF-1	2
AF-2	2
AF-3	2
AF-4	2

Results from the 2007 Groundwater Sampling at the Avgas Spill Site, Drift River Terminal Report (OilRisk Consultants 2007).

Table 10: 2009 Sample Summary

Sample ID	Results PDF Page #
AF-1	2
AF-2	2
AF-3	2
AF-4	2

Results from the 2009 Groundwater Sampling at the Avgas Spill Site, Drift River Terminal Report (OilRisk Consultants 2010).

Table 11: 2011 Sample Summary

Sample ID	Results PDF Page #
AF-1	18-21
AF-4	18-21

Results from the 2011 Groundwater Sampling at the Avgas Spill Site, Drift River Terminal Report (OilRisk Consultants 2011).