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September 28, 1999

Mr. Colin J. Basye, Engineering Associate  
Alaska Dept. of Environmental Conservation  
Division of Spill Prevention and Response  
Storage Tank Program  
43335 Kalifornsky Beach Rd, Suite 11  
Soldotna, Alaska 99669

**RECEIVED**

**SEP 30 1999**

Department of  
Environmental Conservation  
KDO

RE: Kenai Airport Fuel Service  
UST Facility ID #2187, Reckey #90230026801  
Interim Remedial Action Report #2

Dear Mr. Basye:

This document reports the findings of soil and groundwater sampling performed on 9-10-99. Sampling was performed in accordance with the scope of work we proposed in the Interim Remedial Action Report dated 8-31-99. Eight temporary sampling wells were installed and two soil borings were drilled. The sample locations are shown on Figure 1. All but one of the sampling wells were installed by Hughes Drilling using a hollow stem rotary auger. A hydraulic hammer was used to drive a 2-inch diameter split-spoon sampler to collect soil samples.

**Drilling and Sample Collection**

Seven temporary sampling wells, that consisted of ten feet of 2-inch diameter PVC pipe and 5 feet of 2-inch diameter PVC slotted screen, were installed using a hollow stem rotary auger. An additional sample well was installed next to MW-2 using a hand auger, but it was used only as a background vapor sampling point. The sampling wells were installed so that the well screen extended about 4 feet below and about 1 foot above the groundwater level. In addition, two soil borings were drilled immediately down-gradient from the old UST site, an area previously known to be contaminated.

Soil samples were collected from each sampling site using a 2-inch diameter split spoon sampler driven by a 140 pound hydraulic hammer. In general, split spoon samples were collected at 5 to 7, and 7 to 9 feet below ground surface (bgs), but depended upon depth to groundwater. Ziploc™ bag samples for field screening, and grab samples for laboratory analysis, were collected from each split spoon soil sample. Field samples (baggie samples) were screened using a MicroTip 2000 Photoionization Detector (PID) with a 10.6 eV lamp. Analytical samples were collected in accordance with DEC regulations and were stored temporarily in a refrigerator until the samples could be sorted and shipped to CT&E Environmental Services for analysis. Samples that were sent in for analytical analysis were selected based on location and field screen results.

About 5 to 10 gallons of water were bailed from each of the temporary sampling wells using disposable polypropylene bailers. The wells were bailed until the water appeared clear of sediment. After groundwater had returned to static level, the water level was measured, and a groundwater sample was collected from each of the seven wells. Groundwater samples were collected in accordance with regulated practices.

In addition, soil vapor sampling was performed in each temporary well using a soil vapor sampling probe and PID. The probe, essentially an extension of the PID intake, consisted of 1/2-inch diameter steel pipe with a rubber packer attached to one end, and an 1/8-inch ID polypropylene tube that was inserted down through the steel tubing and packer. The vapor probe was pushed down inside the 2-inch diameter PVC sampling wells until the sample head was about 1 foot above the water table or at the top of the well screen. The rubber packer sealed the sample head from atmospheric air and insured that gas being drawn into the PID was coming from the soil. The tubing was connected to the PID and the soil gas sampled for about 60 seconds. Vapor sample results correlated well with analytical results from groundwater samples. However, because we were unsure if a direct correlation existed between groundwater contamination levels and soil vapor analysis, all of the groundwater samples were analyzed.

**Analytical Results**

Table 1 reports analytical results of soil and groundwater analysis. Inspection of results for sample KAFS99-12W (sample site PSP-6) show that up-gradient groundwater contamination was not evident.

**TABLE 1 - <sup>Soil?</sup> Groundwater Analytical Results\*\***

Sample ID	Location	Matrix	GRO	DRO	B *	T *	E *	X *
		SOIL	300	250	0.02	5.4	5.5	78
		WATER	1.3	1.5	0.005	1.0	0.7	10
KAFS99-6S	PSP-3	Soil	U	NT	U	U	U	U
KAFS99-7S	PSP-2	Soil	U	NT	U	U	U	U
KAFS99-8S	PSP-5	Soil	U	NT	U	U	U	U
KAFS99-9S	PSP-1	Soil	U	NT	U	U	U	U
KAFS99-10S	PSB-2	Soil	947 <100>	29.1	25.4	177 <1.0>	34.9 <.7>	188.8 <10>
KAFS99-11S	PSB-1	Soil	163	NT	2.51	17.7	4.93	26.4
KAFS99-12W	PSP-6	Water	U	NT	U	U	U	U
KAFS99-13W	PSP-9	Water	U	NT	U	U	U	U
KAFS99-14W	PSP-3	Water	U	NT	U	U	U	U
KAFS99-15W	PSP-4	Water	0.11	NT	0.017 ,005	0.003	0.003	0.007
KAFS99-16W	PSP-2	Water	0.69 <1.3>	NT	0.11 ,005	0.122	0.032	0.098
KAFS99-17W	PSP-5	Water	4.2 <1.3>	NT	2.04 ,005	0.09	0.04	0.124
KAFS99-18W	PSP-1	Water	120 <1.3>	NT	23.2 ,005	31.1 <1.0>	1.92	9.69
KAFS99-19TB	Trip Blank	Water	U	NT	U	U	U	U
KAFS99-20TB	Trip Blank	Soil	U	NT	U	U	U	U
KAFS99-21W	MW-1	Water	3.4	NT	0.489	0.653	0.127	0.412

NT Analysis was not performed for specific item.

\* B=Benzene, T= toluene, E=Ethylbenzene, X=Total Xylenes.

\* \* Units are (mg/kg) for soil samples and (mg/l) for water samples.

In addition, contamination was not found in sample wells located towards the west side of the site. Contamination was not found in groundwater sample KAFS99-13W (PSP-9), or in soil (KAFS99-6S) and groundwater (KAFS99-14W) from sample site PSP-3.

Groundwater contamination was encountered at the PSP-1 location that is down-gradient from the old UST pit. BTEX levels greater than cleanup levels were detected in the groundwater sample from PSP-1. Contamination at PSP-5, located about 100 feet down-gradient of PSP-1, while greater than cleanup levels, was much less than levels measured at PSP-1. Benzene was the only contaminant that exceeded cleanup levels at PSP-5 (2 ppm). Benzene contamination greater than cleanup levels was also found in groundwater samples from PSP-2 and PSP-4 (0.11 ppm and 0.017 ppm, respectively). Analysis of groundwater from MW-1 indicates that Benzene contamination has dropped to 0.49 ppm from a previous level of 12.6 ppm (6-16-99). *(check next quarter)*

*MAY BE HELPFUL TO INCLUDE THE SITE CLEANUP LEVELS, FOR COMARISON OF SEVERITY OF*

Overall, a good correlation between vapor sampling and groundwater contamination was found. *GW CONTAMINATION.* Soil vapor sampling also indicated that hydrocarbon contamination existed at the PSP-1 location. A PID reading of 350 ppm was recorded from vapor sampling at PSP-1 and analytical results showed that benzene contamination in the groundwater at 23 ppm. However, analysis of a soil sample collected from below the water table at the PSP-1 location (sample KAFS99-9S) showed no evidence of contamination. Vapor sampling at PSP-5 produced a PID reading of 14 ppm. Analytical results from PSP-5 were non-detect in the soil above groundwater, and 2 ppm benzene in groundwater. At the PSP-2 location the results were consistent with those found at the other locations; vapor sample was 1.5 ppm, soil was non-detect, groundwater was 0.11 ppm benzene.

Analytical analysis of soil samples indicates that soil in the area immediately south of the old UST pit is still contaminated. BTEX levels in soil at PSB-2 are one to two orders of magnitude greater than the cleanup levels, and the GRO level is three times greater than the cleanup level. However, soil contamination at PSB-1, about 35 feet south of PSB-2, drops significantly when compared to levels at PSB-2. Only the benzene and toluene levels exceed the cleanup standards at that site.

### Interpretation of Results

Analytical data from the soil borings indicate that soil contamination still exists in the area around the south side of the old UST site. BTEX levels from PSB-2 are comparable to levels found during a previous site assessment performed by Northern Test Labs in 1991. However, BTEX and GRO levels found in the soil at PSB-1 were reduced appreciably from previously reported levels found in Test Pit #4 which is located about 10 feet south of PSB-1. Total BTEX levels dropped from 257.6 to 51.5 mg/kg, and GRO levels dropped from 743 to 160 mg/kg. The reduction occurred over an approximate six year period between 10-29-93 and 9-10-99. Additionally, BTEX levels at the PSB-1 location would probably have been much higher than those found at TP-4 because of closer proximity to the spill, so the decrease may be even more dramatic than illustrated by the comparison. The overall interpretation is that soil contamination levels are decreasing and only a limited area of concern still exists.

Benzene concentration contours were developed using the analytical data and are plotted in Figure 1. Recent analytical results from MW-2 and MW-4 (quarterly water samples collected on 6-16-99) were also used in estimation of the contours. It is evident from the contour map that contamination, in excess of cleanup standards, has moved off-site from the KAFS facility. The groundwater direction and gradient fluctuate during the year, but the average gradient is about 0.002 ft/ft, and the general direction is south to southeast.

Calculations, using the average gradient and estimated hydraulic conductivity and porosity (K=100 ft/day, n=0.35) estimate that the average groundwater velocity is about 0.6 ft/day. Over

a ten year period, groundwater that had flowed through the contaminated area would be estimated to have traveled about 2200 feet down-gradient. Because the soil at this site does not appear to contain much organic carbon, the retardation factor was estimated to be about 1.5. The retardation factor was calculated using an  $f_{oc}$  value of 0.001 (fraction of organic carbon), a  $K_{oc}$  value of 75 ml/g (benzene), an effective porosity value of 0.25, and a soil bulk density value of 1.7 g/cm<sup>3</sup>. Using this retardation factor, the leading edge of the plume would be expected to be about 1500 feet down-gradient from the source area. The location of the leading edge of the plume is only about 600 feet down-gradient, which would correlate to a retardation factor of about 3.7, much greater than expected for this soil. In the absence of organic carbon, hydrocarbon sorption would occur on the mineral surfaces and in effect be controlled by surface area. Because of the low surface area of sands and gravels, the retardation factor would most likely be less than 1.5.

THE LEADING  
EDGE OF THIS  
PLUME IS  
FARTHER  
OUT THAN  
600'

A generally accepted explanation for the retardation of the plume would be that the plume is naturally attenuating. However, without further monitoring it is not possible to determine if the plume has stabilized (degradation is equal to contaminant input), or is shrinking (degradation is greater than input). Additional evidence is present that suggests that significant degradation of the plume is occurring in areas not covered by asphalt.

Historical BTEX contamination levels for MW-1 are plotted in Figure 2. It is evident from the figure that the levels of BTEX are decreasing at the MW-1 location. Contamination levels have dropped significantly since 1994. Additionally, it does not appear that the contamination is moving down-gradient as a pulse, as is reflected by relatively low BTEX contamination levels found at sites PSP-2, PSP-4, and PSP-5 (see Figure 1).

Figure 3 shows groundwater contamination levels as a function of distance from the source area. Groundwater contamination level at the source was not measured, but was estimated using soil concentration data from PSB-2. It appears from the data that degradation is occurring beneath the asphalt, but this drop in concentration could be due more to dilution of the contaminant than to biodegradation. However, a dramatic decrease in benzene level can be seen between the PSP-1 and PSP-5 locations. This is probably due to volatilization and biodegradation of contaminants in the uncovered area between PSP-1 and PSP-5. There is a shallow swale located between PSP-1 and PSP-5, and groundwater is only about 3 feet below ground surface during most of the year. Given the physical characteristics of the soil, diurnal temperature fluctuations and barometric tides would cause significant gaseous exchange between the atmosphere and the soil to depths of several feet. Diurnal water fluctuations of up to 6 cm have been recorded in fine grained unconfined aquifers with shallow water tables (less than 10 feet). More than sufficient oxygen would be available for microbial degradation of the contaminants under this scenario.

## Recommended Action

The next step in the remedial action is to install several additional monitor wells at locations PSP-1, PSP-5, PSP-6, and another well farther down-gradient in the Kenai Airport parking lot. In addition, we propose to confirm the assumptions used to calculate groundwater velocity and retardation. Specifically, we will measure the hydraulic conductivity of the aquifer by performing a slug test using MW-1, we will collect two soil samples to measure bulk density, porosity, and fraction of organic carbon, and we will measure the dissolved oxygen content in the up-gradient and down-gradient groundwater to quantify biological activity.

Another important issue is the point of compliance. The DEC regulations state that the point of compliance must be within the plume and may not exceed the property boundary. However, due to recent property transactions, the property boundary is now only about 50 feet down-gradient

from the old UST site. Thus, compliance with groundwater cleanup standards at the property boundary are not practical.

In addition, all of the property, that is or could be affected by the release, is leased from the city of Kenai and not owned by the patrons. Therefore, if agreeable to the City of Kenai, we propose to establish the point of compliance at the down-gradient well that will be placed in the airport parking lot. Down-gradient groundwater on the PSP-4 contour would currently meet the 10-times cleanup standard, if applicable. There are currently no drinking water wells within the effected area, and the city currently provides water service to all users in the effected area.

The new monitor wells, combined with the existing wells, will serve to monitor the progress of the plume and will provide evidence to establish whether or not the plume is expanding, stable, or shrinking. If initial monitoring over a three year period indicates that the plume is not expanding and the cleanup levels are met at the point of compliance, we propose that no further action be taken, since natural attenuation will eventually reduce contamination to levels below cleanup standards.

Sincerely,



Mark Priksat, Ph.D.  
Soil Physicist




Ronald T. Rozak, PE  
Principal Investigator

Attachments:

1. Figure 1. Estimated Benzene Contamination Contours
2. Figure 2. Historical benzene levels measured in MW-1.
3. Figure 3. Benzene concentration as a function of distance from source.
4. Laboratory Analysis Report, Soil and Water, September 20, 1999.

cc: Dan Pitts, Kenai Airport Fuel Service

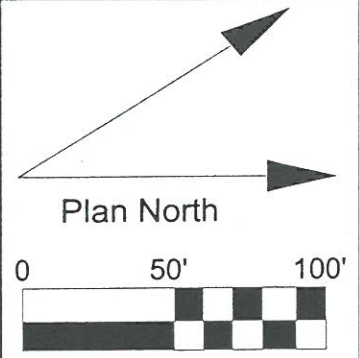
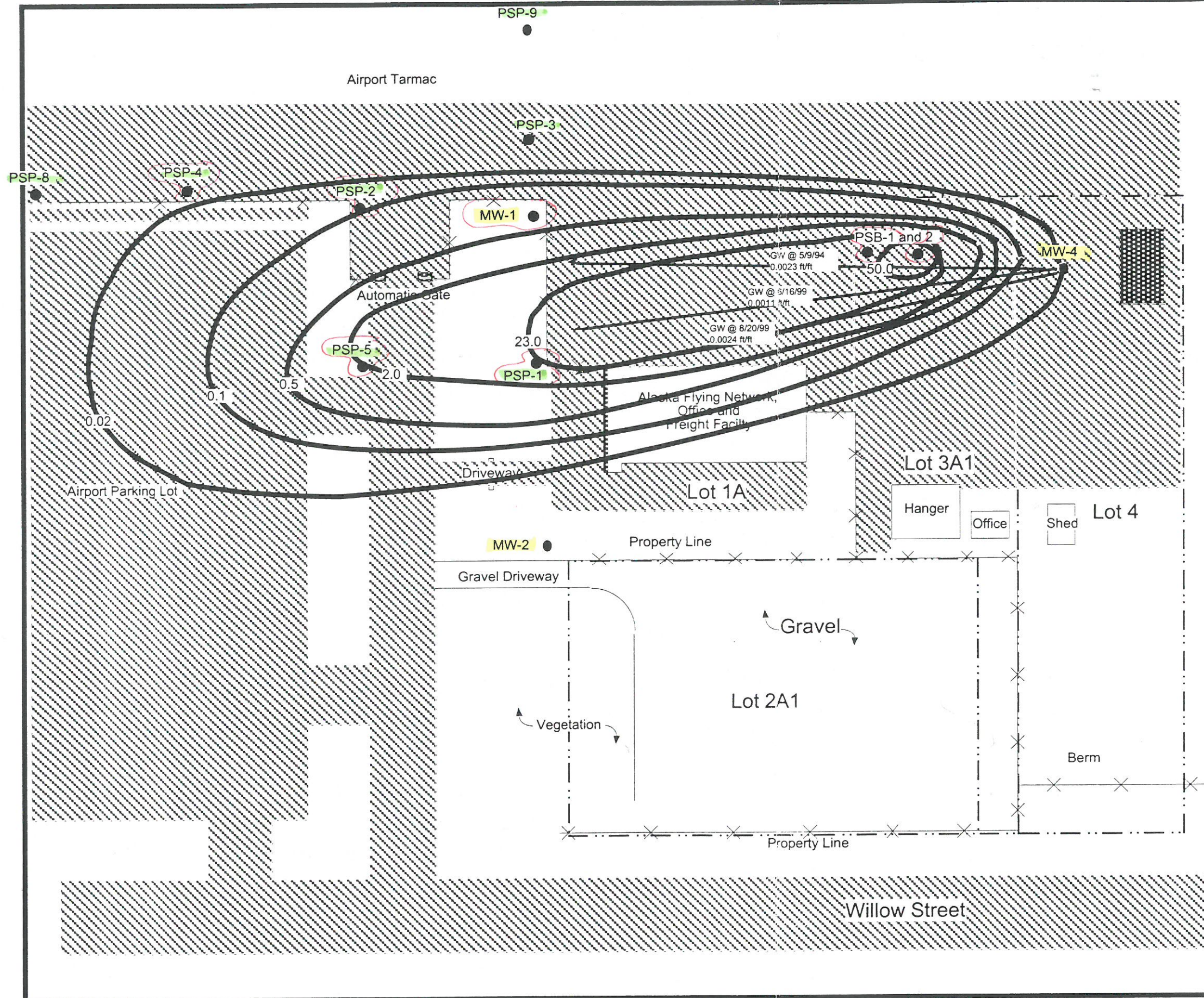


Figure 1. Estimated Benzene Contamination Contours

Kenai Airport Fuel Service  
Rozak Engineering, 10/99

Legend

TP - Test Pit	⊗
SB - Soil Boring	⊗
MW - Monitor Well	⊗
P - Piezometer	---
PI - Pump Island	▨
T - Tank	■
PSP - Proposed Sampling Point	●
PSB - Proposed Soil Boring	●
Chain Link Fence	⊗
Property Line	---
Asphalt	▨
Concrete	■

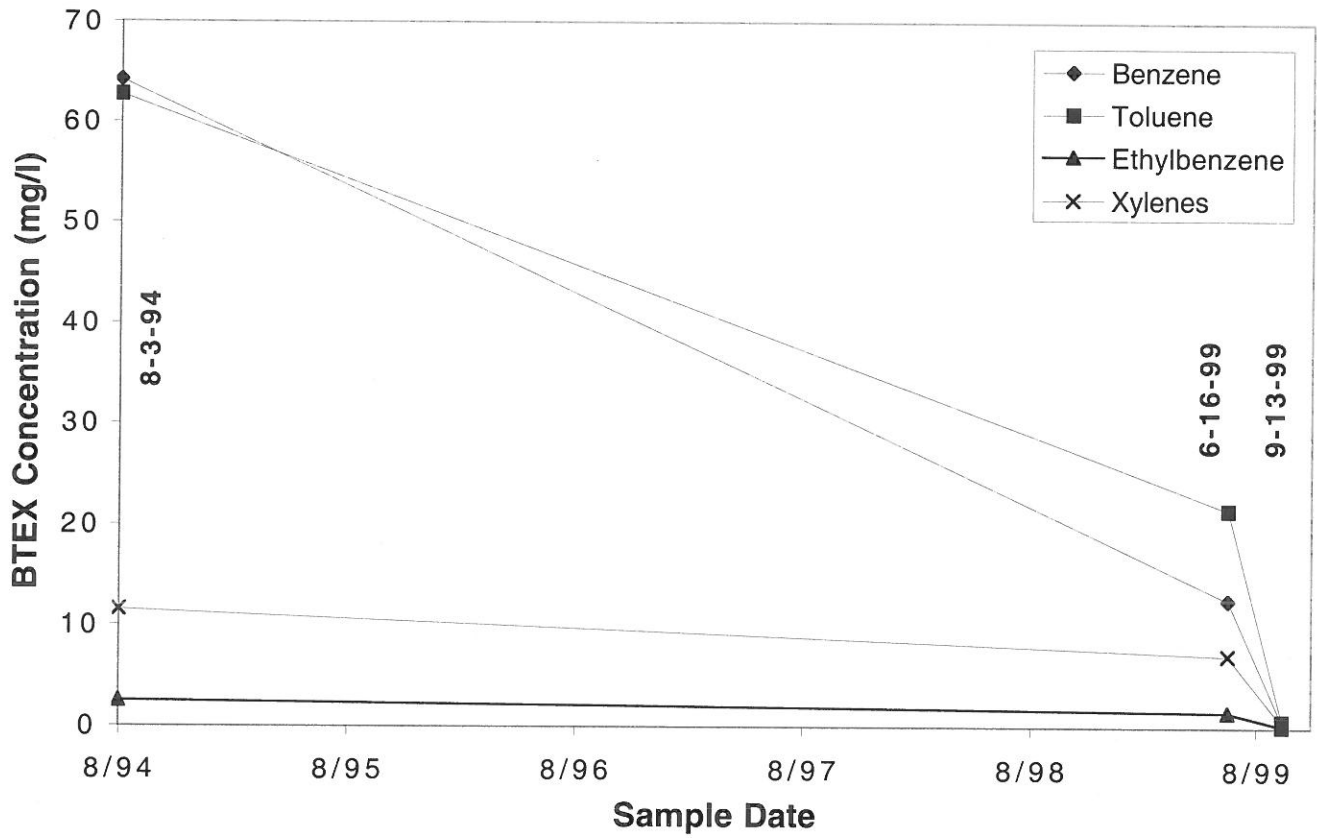


Figure 2. Historical benzene levels measured in MW-1.

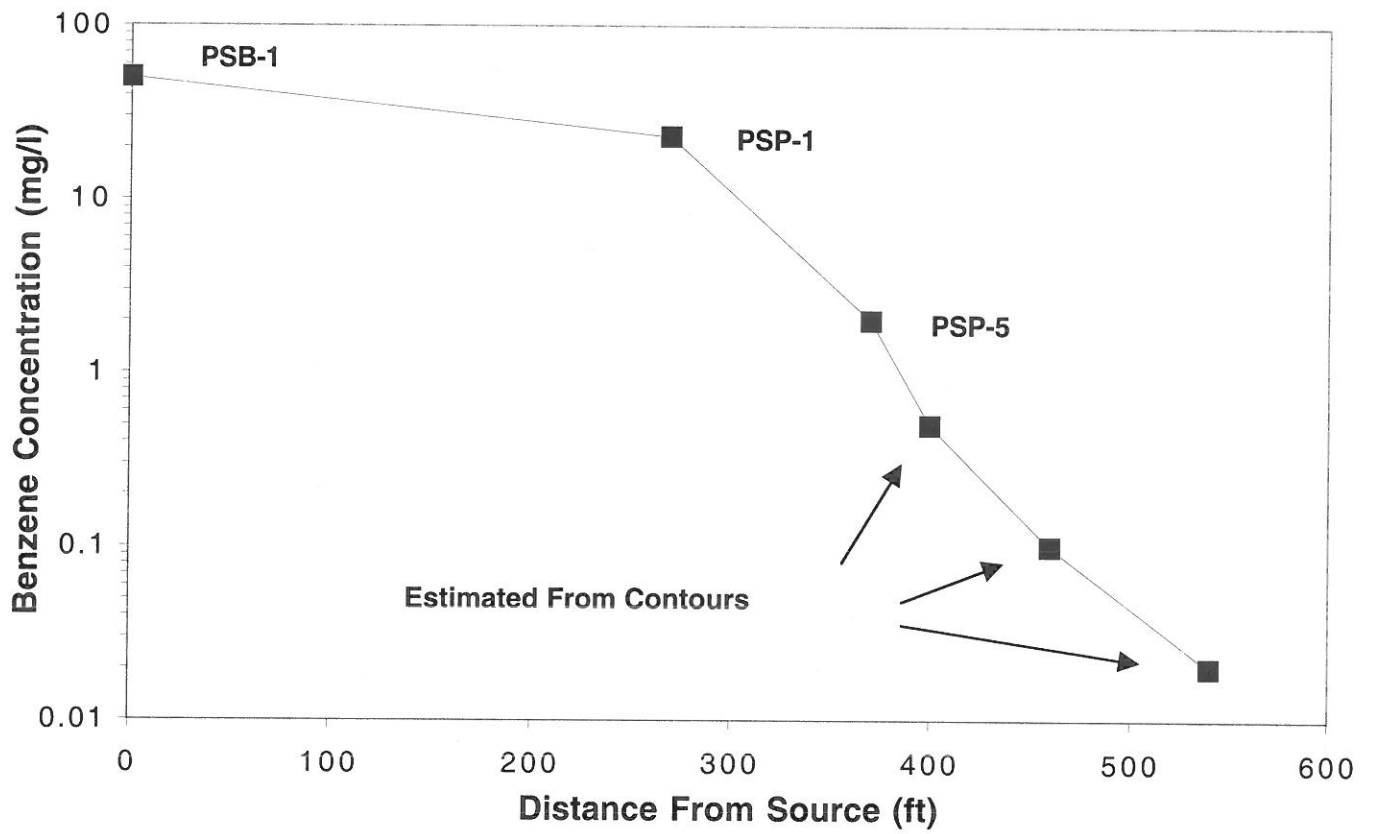


Figure 3. Benzene concentration as a function of distance from source.