1201 3rd Avenue, Suite 2600
Seattle, Washington 98101
206.287.9130

Memorandum

March 31, 2025

To: Tavi Wise, Site Manager
Toxics Cleanup Program
Washington State Department of Ecology

From: Nik Bacher, LG; Heather Gadwa, LG; and Halah Voges, PE, Anchor QEA

cc: Jennifer Sanscrainte, Ogden Murphy Wallace P.L.L.C
Valentine Smith, U-Haul
Andrea Wing, Shell Oil Products US
Renee Knecht, AECOM

Re: Response to Ecology Letter dated March 11, 2024
Yakima Valley Spray//U-Haul Facility
Consent Decree No. 04-2-00908-1
Washington State Department of Ecology Facility Site ID No. 445

This memorandum was prepared in response to the Washington State Department of Ecology (Ecology) response letter dated March 11, 2024 (Response Letter; Ecology 2024), regarding the *2022 Groundwater Monitoring Report* and Request for Closure at the Yakima Valley Spray facility located at 1108 South 1st Street, Yakima, Washington (Site; Facility Site ID No. 445). The *2022 Groundwater Monitoring Report* was prepared by Anchor QEA on behalf of the Yakima Valley Spray Site Remediation Group (YVSSRG) on March 2, 2023 (Anchor QEA 2023).

The performance and confirmational groundwater monitoring events at the Site in 2022 were conducted in accordance with the *Groundwater Compliance Monitoring Plan* (RETEC 2003) as amended (AECOM 2013) and the sampling approach presented in the *2021 Groundwater Monitoring Report* (Anchor QEA 2022) and approved by Ecology via email on March 24, 2022 (Ecology 2022a). Subsequent modifications to the sampling program were approved by Ecology following its review of the previous months' groundwater monitoring results, as documented in emails received on June 3, August 23, and October 26, 2022 (Ecology 2022b, 2022c, 2022d). On August 18, 2019, Ecology confirmed site-specific cleanup goals had been attained for most of the Indicator Hazardous Substances (IHSs; Ecology 2019). In the 2019 letter, Ecology proposed a tiered approach to reach site closure, which included continuing performance monitoring for one IHS (diesel-range total petroleum hydrocarbons [TPH-D]) while proceeding to the confirmational monitoring phase for all other site IHSs for which site-specific cleanup levels have been achieved and maintained.

In the 2019 letter, Ecology required that performance monitoring for TPH-D continue until cleanup levels are achieved and maintained, as defined by two consecutive sampling events achieving the cleanup levels. Once sampling indicates cleanup levels for TPH-D have been achieved and maintained, YVSSRG would be able to propose a confirmation monitoring approach for Ecology's written approval.

Ecology required confirmation monitoring for all other IHSs for at least four consecutive quarters, continuing until either the results from four consecutive quarters return non-detectable concentrations or results from eight consecutive quarters remain below established site-specific cleanup standards. When one or both conditions are met, written approval from Ecology will be required before ending confirmational monitoring for any IHS.

In response to the 2022 groundwater monitoring results, Ecology determined that analytes 4,4'-DDT, aldrin, dieldrin, beta hexachlorocyclohexane (BHC), gamma BHC, benzene, tetrachloroethene (PCE), and arsenic have met the established Site cleanup level standards for the required amount of consecutive quarterly sampling events, and therefore further monitoring of these constituents is not required. Ecology also noted that TPH-D and TPH as gasoline (TPH-G) have not met the cleanup levels for the requisite number of consecutive quarterly sampling events in monitoring well YVS-2. Ecology requires a standard point of compliance at the Site in the absence of providing adequate information to show it is not practical to meet the cleanup levels throughout the Site on a reasonable time frame. Further, Ecology acknowledged that naturally occurring organics may interfere with Northwest TPH (NWTPH)-Dx analysis and can be demonstrated with the use of silica gel cleanup analysis. Ecology indicated that sampling using silica gel cleanup should be conducted in accordance with Ecology's G*uidance for Silica Gel Cleanup in Washington State, Publication No. 22-09-059* (Silica Gel Guidance), dated November 2023 (Ecology 2023), over the course of four consecutive quarters.

Prior to Silica Gel Guidance being published, groundwater sampling conducted between April 2020 and November 2022 included TPH-D analysis with and without silica gel cleanup at monitoring well YVS-2. For each of the nine events, the contracted laboratory reported concentrations either below reporting limits and/or the Model Toxics Control Act method A cleanup level of 500 micrograms per liter. Where elevated concentrations of TPH-D were reported, prior to silica gel analysis, these particular samples had relatively higher turbidity levels at the time of sampling. The analytical and field data repeatedly demonstrate that biogenic interferences are occurring with the decrease of TPH-D and TPH as oil (TPH-O) concentrations when silica gel cleanup analysis is performed.

The data also support the findings regarding interferences from non-petroleum hydrocarbons presented in the attached TPH Chromatogram Review Memorandum prepared by Anchor QEA dated February 8, 2013 (Attachment 1). The memorandum provides a review of the analytical results and chromatogram traces for the Site during the September 2010 sampling events. The primary observations from the review were that TPH detections for TPH-D and TPH-O ranges appear to reflect interference from non-petroleum hydrocarbons.

Based on the previously completed sampling analysis and results of the biogenic interference evaluation, Anchor QEA respectively requests that the existing TPH-D analysis with silica gel analysis be accepted to demonstrate TPH-D compliance at the Site and specifically monitoring well YVS-2.

Anchor QEA will perform an additional monitoring event in 2025 to demonstrate TPH-G compliance in monitoring well YVS-2 as requested by Ecology in their March 2024 Response Letter. In the event of favorable TPH-G analysis, Anchor QEA requests administrative closure of the Site, including approval to discontinue groundwater monitoring and abandon all monitoring wells.

References

AECOM, 2013. Letter to: Halah Voges, Anchor QEA. Regarding: Yakima Valley Spray/U-Haul Site (Facility Site ID No. 445) – Compliance Monitoring Plan. February 28, 2013.

Anchor QEA, 2022. *2021 Groundwater Monitoring Report. Yakima ValleySpray/U-Haul Facility*. Consent Decree No. 04-00908-1, Washington State Department of Ecology Facility Site ID No. 445. Prepared for the Yakima Valley Spray Site Remediation Group. March 2022.

Anchor QEA, 2023. *2022 Groundwater Monitoring Report and Request for Closure for the Yakima Valley Spray/U-Haul Facility*. Consent Decree No. 04-00908-1, Washington State Department of Ecology Facility Site ID No. 445. Prepared for the Yakima Valley Spray Site Remediation Group. March 2023.

Ecology (Washington State Department of Ecology), 2019. Letter to: Halah Voges, Anchor QEA. Regarding: Semi-Annual Groundwater Monitoring Report for the Yakima Valley Spray/U-Haul Facility September 2017 and March 2018 Semi-Annual Sampling Events. August 8, 2019.

Ecology, 2022a. Regarding: YVS U-Haul Site 2021 Groundwater Monitoring Report – Email 1 of 1. Email to: Nik Bacher, Anchor QEA. March 24, 2022.

Ecology, 2022b. Regarding: YVS U-Haul Site 2022 Groundwater Monitoring Data and Proposed Changes to Q2 2022 Sampling Program – Email 1 of 1. Email to: Nik Bacher, Anchor QEA. June 3, 2022.

Ecology, 2022c. Regarding: YVS U-Haul Site 2022 Groundwater Monitoring Data and Proposed Changes to Q3 2022 Sampling Program – Email 1 of 1. Email to: Nik Bacher, Anchor QEA. August 23, 2022.

Ecology, 2022d. Regarding: YVS U-Haul Site 2022 Groundwater Monitoring Data and Proposed Changes to Q4 2022 Sampling Program – Email 1 of 1. Email to: Nik Bacher, Anchor QEA. October 26, 2022.

Ecology, 2023. *Guidance for Silica Gel Cleanup in Washington State, Publication No. 22-09-059*. November 2023.

Ecology, 2024. Letter to: Niklas Bacher, Anchor QEA. Regarding 2022 Groundwater Monitoring Report and Request for Closure for the Yakima Valley Spray Facility.

RETEC (The RETEC Group, Inc.), 2003. *Groundwater Compliance Monitoring Plan, Yakima Valley Spray/U-Haul Site, Yakima, Washington*. Seattle, Washington. October 16, 2003.

Attachment

Attachment 1 TPH Chromatogram Review Memorandum

Attachment 1

TPH Chromatogram Review Memorandum

421 SW Sixth Avenue, Suite 750
Portland, Oregon 97204
Phone 503.688.5057
www.anchorqea.com

MEMORANDUM

To:	Jason Shira, Site Manager Toxics Cleanup Program Department of Ecology	**Date:**	February 8, 2013
From:	Jessica Goin and Halah Voges, Anchor QEA	**Project:**	Yakima Valley Spray/U-Haul Site
Cc:	Tom Kilbane – Short Cressman & Burgess Larry Hine – AMERCO Real Estate Carol Campagna – Shell Clarence Lo – AECOM		
Re:	TPH Chromatogram Review		

This memorandum presents the findings of a review of analytical results and chromatogram traces for the Yakima Valley Spray/U-Haul (YVS) site samples collected during the September 2010 sampling event. The primary observations from this review were that total petroleum hydrocarbon (TPH) detections in the diesel (TPHd) and motor oil (TPHmo) ranges appear to reflect interference from non-petroleum hydrocarbons. This conclusion is based on the following:

- The sample chromatogram traces consist of an unresolved complex mixture (UCM) signal, and the effective carbon number (EC) range and lack of clear peaks appear to be inconsistent with diesel, motor oil, mineral oil, or mixtures thereof
- Silica gel cleanup removes the entire UCM signal and the resulting chromatogram traces lack any peaks, indicating that the samples do not contain non-polar hydrocarbons.

TOTAL PETROLEUM HYDROCARBONS

Chromatogram Traces and Petroleum Fractions

Petroleum products such as diesel fuels, gasoline, or motor oil are composed of complex mixtures of aromatic and aliphatic hydrocarbons. TPH is measured as a proxy for the components of these mixtures. TPH is reported for representative fractions; for example, gasoline range TPH (TPHg; up to 12 equivalent carbons [C12]), TPHd (C12 to C24) or

TPHmo (C24 to C38), Figure 1. TPHd concentrations are measured by gas chromatography using a flame ionization detector (Ecology 1997).

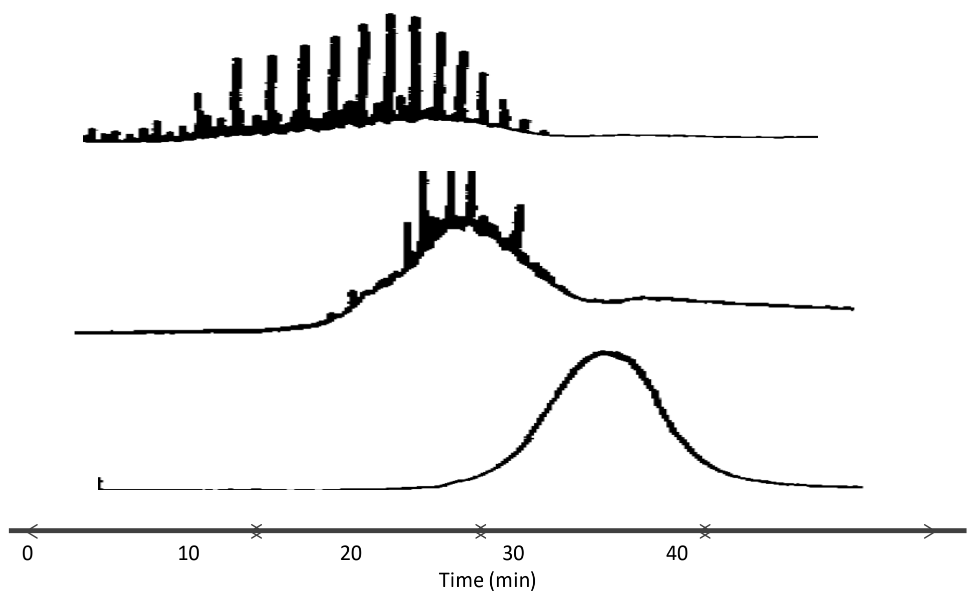

Figure 1
GC-FID Chromatogram Traces of Diesel (C12-C24), Mineral Oil (C15-C50), and Motor Oil (C24 to C38) Standards (Zemo et al. 1993)

The analytical laboratory (Pace Analytical) performed chromatography of a mixed diesel and motor oil standard in parallel with the groundwater sample analyses (Figure 2). Note that the chromatogram trace for this mixed standard "dips" where the diesel range and the motor oil range meet (C24). The internal standards shown on this and other site sample chromatogram traces are o-terphenyl (C18) and n-octacosane (C28).

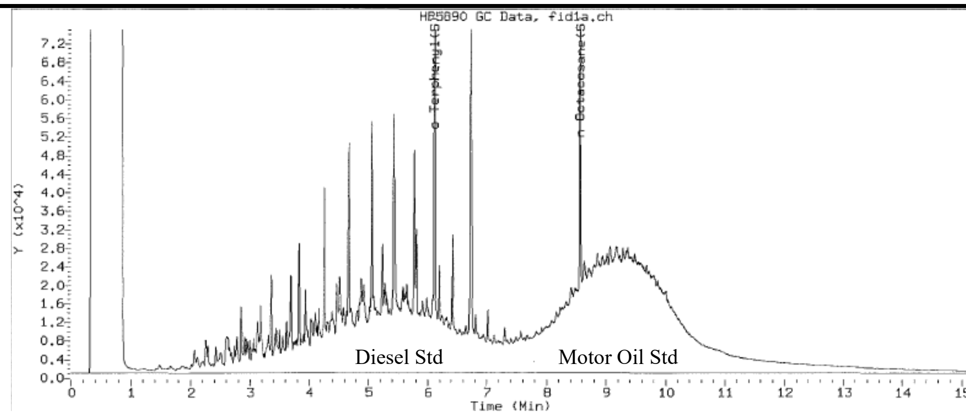

Figure 2
GC-FID Chromatogram for a Mixed Diesel and Motor Oil Standard Run Performed in September 2010

The YVS analytical results have a weak to moderate UCM hump that falls directly between the diesel and motor oil range (Figure 3). No significantly distinct peaks were observed compared to the UCM signal (with the exception of the internal standards o-terphenyl and n-octacosane). The lack of individual peaks and the size range of the maximum signal strength are not consistent with diesel, motor oil, or mineral oil, or a mixture thereof.

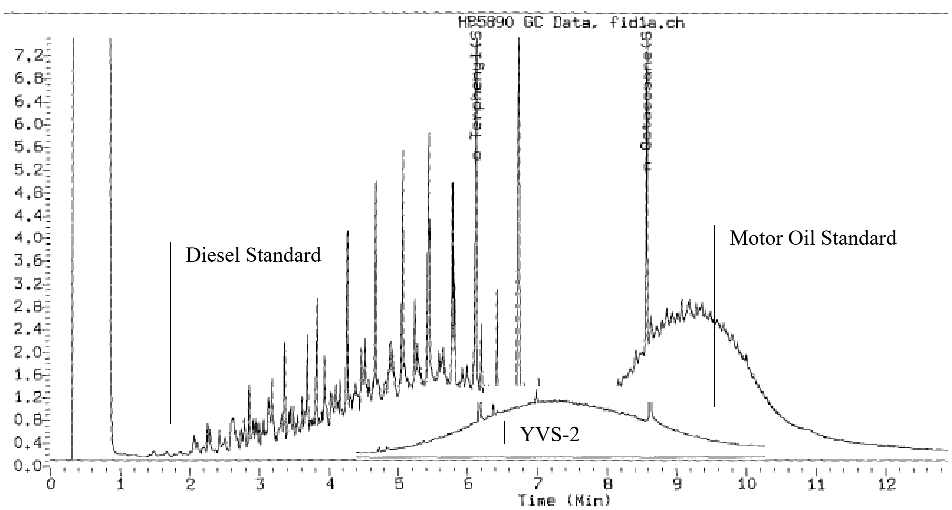

Figure 3
Chromatogram Trace for the Laboratory Control Sample (Diesel and Motor Oil Standards in Water, Also Shown in Figure 2), with the YVS UCM Chromatogram from the Sample Number YVS-2, Inset at the Same Vertical and Horizontal Scale

Given the lack of significant peaks, and the location of the strongest signal between the diesel and motor oil ranges, the Hydrocarbon Identification Method (NWTPH-HCID) for Soil and Water provides the following guidance (Ecology 1997):

> “Since the water extraction procedure in this method is identical to that found in the water portion of NWTPH-Dx (semi-volatile petroleum products, i.e. from kerosene through heavy fuel oils), these products may be quantitated using this extract.”
>
> “Note: The Diesel and Motor Oil Stock Standards required in this method are identical to those required for NWTPH-Dx (extended diesel method including all semi-volatile petroleum products eluting after gasoline, e.g. kerosene, diesels, mineral oils, lubricating oils, heavy fuel oils, etc.).”
>
> “For those samples which consist primarily of only an unresolved chromatographic envelope of components eluting after tetracosane, compare their area to the area of the motor oil standard by integrating the unresolved envelope to baseline. If the sample exceeds the standard area, then proceed to method NWTPH-Dx. If the sample area is less than the standard, then report the lube oil concentration as less than 0.63 mg/L for water or 100 mg/Kg for soil.”

The water samples do not have distinct peaks, and greater than half of the UCM signal appears to fall in the range greater than tetracosane (Figure 4). Chromatogram traces from YVS-2, YVS-3, YVS-20, and MW-6 samples have moderate UCM signals. The YVS-3 sample has a similar but weaker UCM signal, and the YVS-1, YVS-1B, and MW-12 samples have a very weak UCM signal.

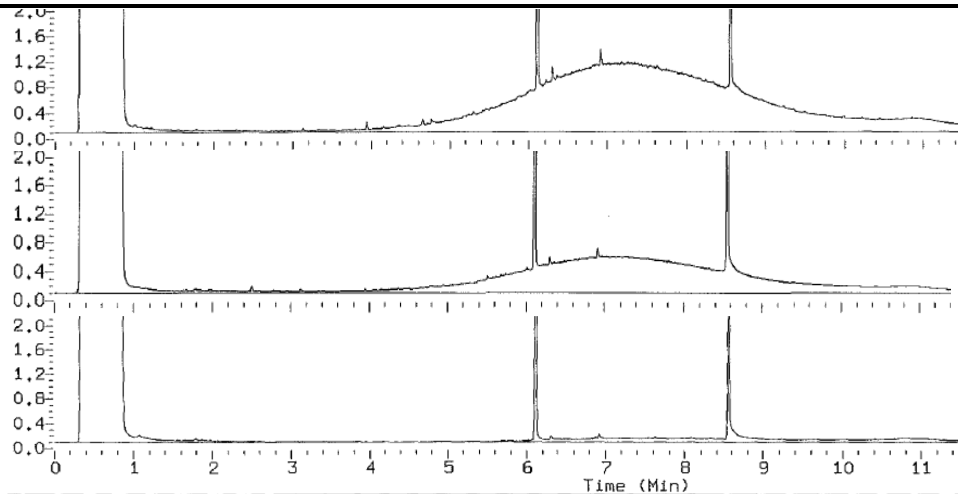

Figure 4
Overlay of Typical GC-FID Chromatogram Traces for Samples YVS-2 (Top), YVS-3 (Middle), and YVS-1B (Pace Analytical 2010)

Additionally, even for the samples with the strongest UCM signal, the area under the UCM curve is much less than the area under the motor oil standard curve. A rough approximation (Figure 5) indicates that the area under the UCM signal for YVS-20 (the sample with the greatest signal strength) is 48% of the area under the motor oil curve.

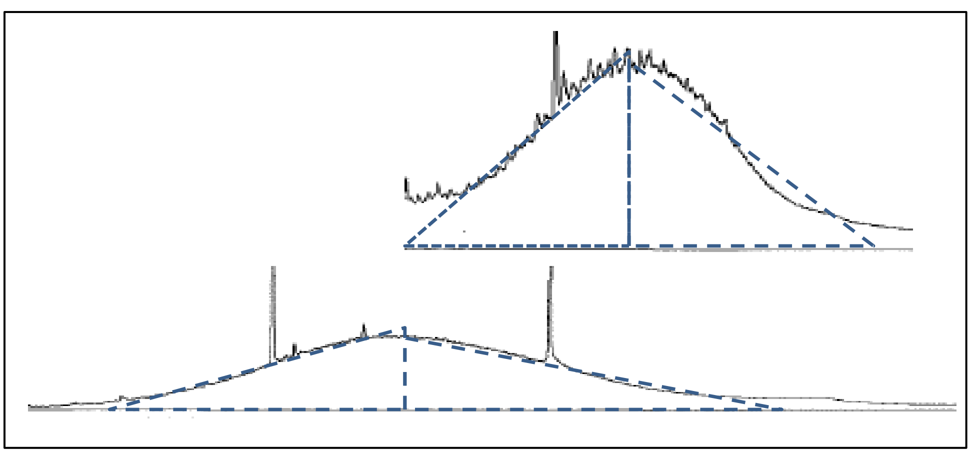

Figure 5
Overlay of Typical GC-FID Chromatogram Traces of the Motor Oil Standard Curve (Top) and the UCM Signal from YVS-20 (Bottom) cropped from the traces for comparison. The image size was first adjusted to put both traces on the same vertical and horizontal scale. The triangles were used to approximate the area under the curves.

This observation suggests that these analytical results should be reported as an unidentified "Lube Oil" fraction; additionally, if reported as such, the Ecology guidance states that these should be reported as below the reporting limit for this method.

In addition to the carbon range of the UCM signal and lack of distinctive peaks, the complete removal of the TPHd and TPHmo signal by silica gel cleanup indicates that these analytical results do not represent petroleum hydrocarbons.

Silica Gel Protocol

TPH concentrations measured by GC-FID may overestimate the concentration of petroleum hydrocarbons in the sample as the analysis also measures polar non-petroleum hydrocarbons produced by bacteria or degradation of plant material (Zemo and Foote 2003; Zemo et al. 1993; Mračnová et al. 2002). A few potential sources of erroneously high TPH concentrations are illustrated in Figure 6.

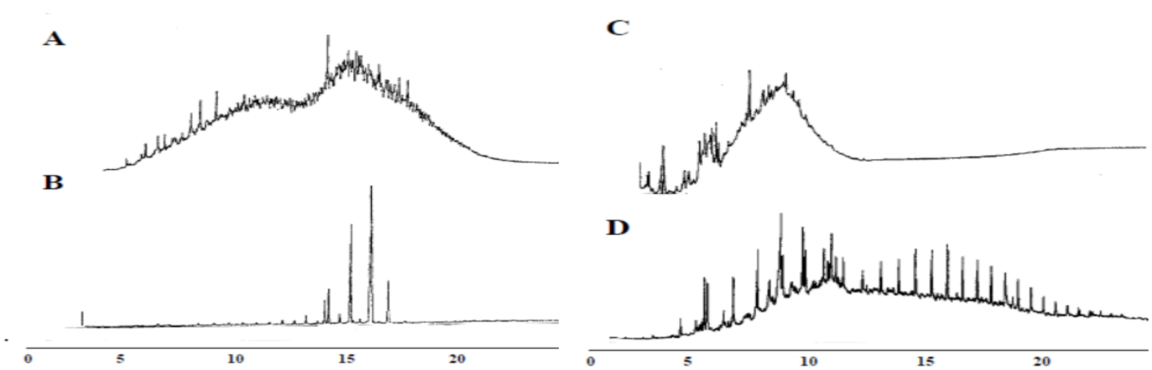

Figure 6
GC-FID Chromatograms of Petroleum (A) and Biogenically Derived Straw (B), Wooden Sawdust (C), and Paper Mill Waste (D) (Mračnová et al. 2002)

The guidance for analysis of petroleum hydrocarbons (Ecology 1997) indicates that the silica gel cleanup step is appropriate if matrix interference by non-petroleum hydrocarbons is indicated. Silica gel cleanup generally reduces the UCM signal without removing the individual peaks (see Figure 7).

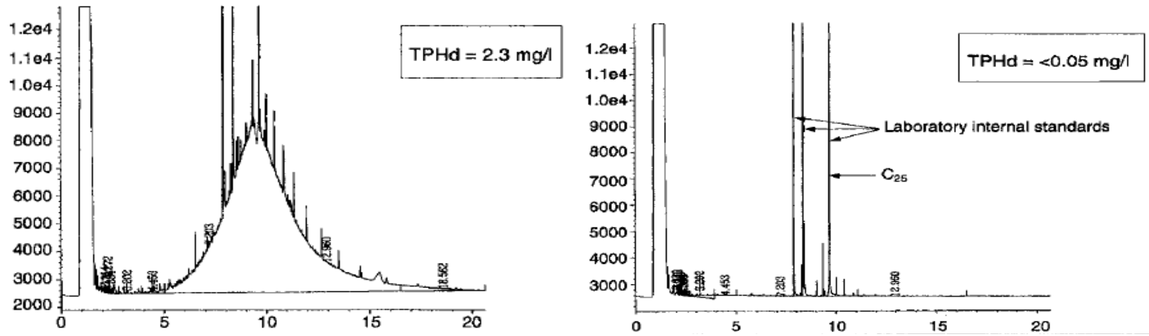

Figure 7
GC-FID Chromatogram Traces of a Groundwater Sample Without (Left) and With Silica Gel Cleanup (Right) (Zemo and Foote 2003)

As expected, the standard curves were not significantly altered by silica gel cleanup (Figure 8). The method blank chromatogram had minor peaks that are removed by silica gel cleanup (Figure 9).

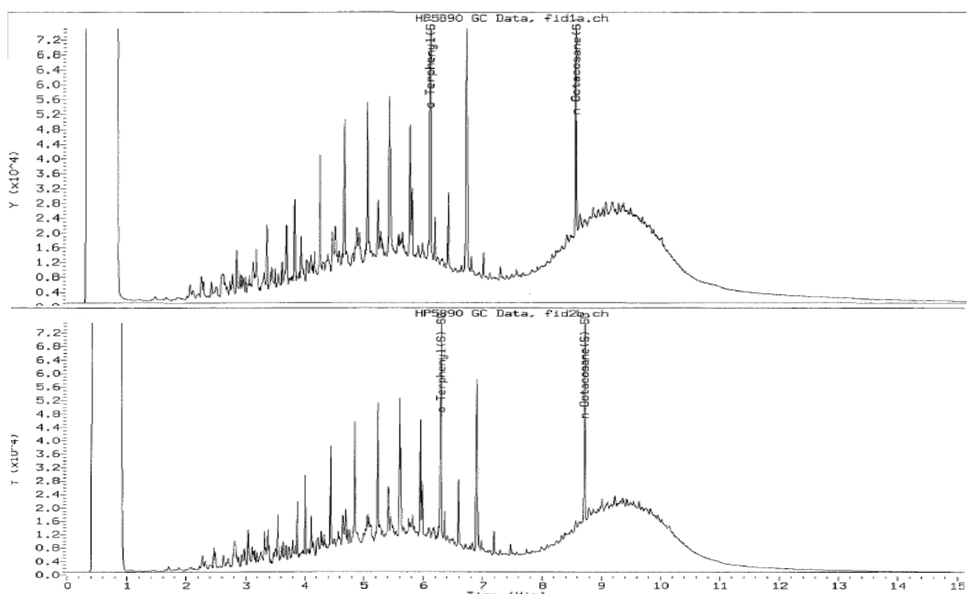

Figure 8
GC-FID Traces of the Laboratory Control Sample (Diesel and Motor Oil Standards in Water) without Silica Gel Cleanup (Top) and with Silica Gel Cleanup (Bottom)

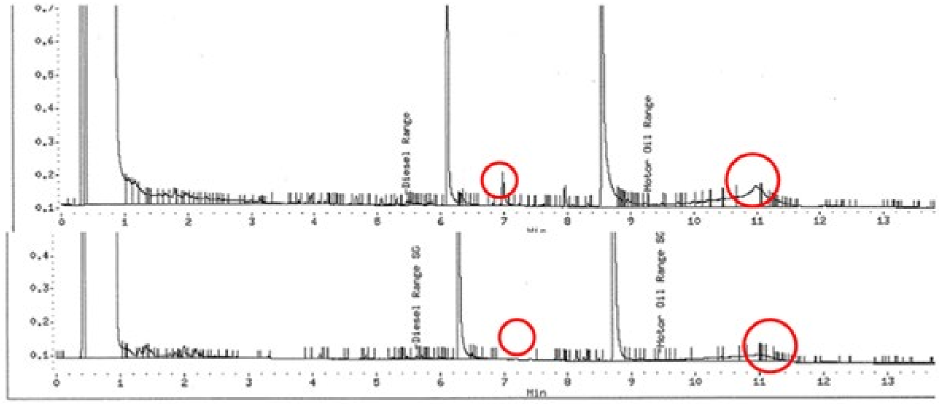

Figure 9

GC-FID Traces of the Laboratory Method Blank without Silica Gel Cleanup (Top) and with Silica Gel Cleanup (Bottom)

TPHd or TPHmo was not detected in groundwater samples when the silica gel cleanup step was included. Following silica gel cleanup, the entire UCM signal is removed, and no individual peaks remain (Figure10). This suggests that the entire UCM signal is due to polar hydrocarbons (i.e. suggesting bacteria and/or degrading plant matter), without the non-polar hydrocarbons that are a significant component of petroleum hydrocarbon fractions.

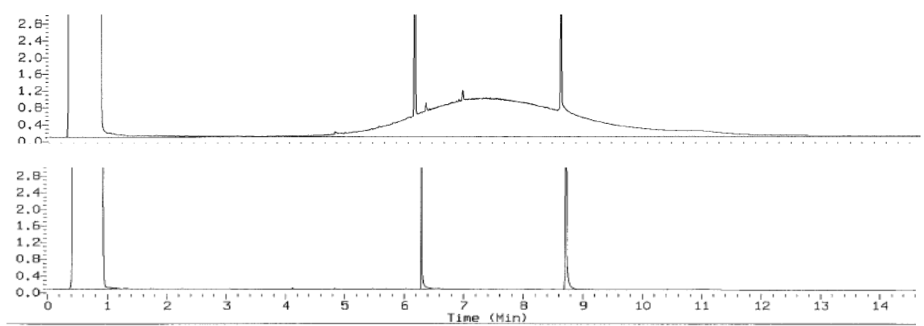

Figure 10

MW-6 without Silica Gel Cleanup (Top) and with Silica Gel Cleanup (Bottom)

TPH Summary

Examination of the chromatogram traces and the effect of silica gel cleanup on these samples indicates that the reported TPHd and TPHmo concentrations in groundwater are not, in fact TPH; rather, they reflect interference from polar non-petroleum hydrocarbons such as those generated by plant waste or microbial activity. Given that the site is in a highly productive agricultural area, the high proportion of shallow aquifer recharge from agricultural activity, and the proximity of the site to a potentially contaminated lake (Figure 11), the recent appearance of TPHd and TPHmo detections in the groundwater samples, and the consistent removal of those concentrations by silica gel cleanup suggest that these detections likely reflect interference rather than petroleum hydrocarbons.

Figure 11
An Image of Buchanan Lake (about 1/3 of a Mile from the Site) (Image from a KIMA TV March 29, 2012 news story regarding potential pollution entering the lake via a drain)

REFERENCES

Mračnová, R., L. Soják, R. Kubinec, A. Kraus, A. Eszényiová, and I. Ostrovský, 2002. *Analysis of petroleum hydrocarbons in soil from view of bioremediation process.* Proceedings of the First International Conference on Environmental Recovery of Yugoslavia, 852 p, ISBN 86-7306-054-0, May 2002, p. 435-454.

Washington State Department of Ecology–Toxics Cleanup Program, 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602: June 1997.

Zemo, D.A., T.E. Graf, and J.E. Bruya, 1993. *The importance and benefit of fingerprint characterization in site investigation and remediation focusing on petroleum hydrocarbons.* Proceedings, Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Restoration. National Ground Water Assoc. Columbus, OH, p. 39-54.

Zemo, D.A., and G.R. Foote, 2003. The technical case for eliminating the use of the TPH analysis in assessing and regulating dissolved petroleum hydrocarbons in ground water. *Ground Water Monitoring & Remediation* 23:3 95–104.