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November 15, 2016

Ms. Karen Calhoun
Calhoun Family LLC
PO Box 928
Tacoma, WA 98401

Re: No Further Action at the following Site:

- **Site Name:** Calhoun's Service Station
- **Site Address:** 4540 Pacific Avenue Tacoma, WA 98408-7736 Pierce Co.
- **Facility/Site No.** 1324
- **Cleanup Site ID No.** 5011
- **VCP Project No.** SW1180

Dear Ms. Calhoun:

The Washington State Department of Ecology (Ecology) received your request for an opinion on your independent cleanup of the Calhoun's Service Station facility (Site). This letter provides our opinion. We are providing this opinion under the authority of the Model Toxics Control Act (MTCA), Chapter 70.105D RCW.

Issue Presented and Opinion

Is further remedial action necessary to clean up contamination at the Site?

NO. Ecology has determined that no further remedial action is necessary to clean up contamination at the Site.

This opinion is based on an analysis of whether the remedial action meets the substantive requirements of MTCA, Chapter 70.105D RCW, and its implementing regulations, Chapter 173-340 WAC (collectively "substantive requirements of MTCA"). The analysis is provided below.

Description of the Site

This opinion applies only to the Site described below. The Site is defined by the nature and extent of contamination associated with the following release:

- Petroleum and constituents into the soil, groundwater, and air.

Enclosure A includes a detailed description and diagram of the Site, as currently known to Ecology.

Please note a parcel of real property can be affected by multiple sites. At this time, we have no information that the parcel(s) associated with this Site are affected by other sites.

Basis for the Opinion

This opinion is based on the information contained in the following documents:

1. *Opinion on Proposed Cleanup*, Ecology, September 2, 2015.

2. *Cleanup Action Report*, Floyd Snider, July, 2016.

These documents are kept in the Central Files of the Southwest Regional Office of Ecology (SWRO) for review by appointment only. You may make an appointment by calling the SWRO resource contact at (360) 407-6365.

This opinion is void if any of the information contained in those documents is materially false or misleading.

Analysis of the Cleanup

Ecology has concluded that **no further remedial action** is necessary to clean up contamination at the Site. That conclusion is based on the following analysis:

1. Characterization of the Site.

Ecology has determined the characterization of the Site is sufficient to establish cleanup standards and select a cleanup action. The Site is described above and in **Enclosure A.**

The Site is a former ARCO gasoline service station located at 4540 Pacific Avenue, Tacoma, Pierce County, Washington (Figure 1). The Site reportedly operated as a gasoline service station from approximately 1926 through 1991.

The Site had four underground storage tanks (USTs) all of which were situated in a nest in the southern area of the Site:

- Two 4000-gallon unleaded-regular gasoline USTs.
- One 6000-gallon compartmentalized unleaded regular and premium gasoline UST.
- One 50 to 200-gallon waste oil UST.

During removal of the USTs in 1991, petroleum contaminated soil (PCS) was found. Final samples at the extent of the excavation had petroleum constituents above the Method A cleanup levels. Approximately 250 cubic yards of excavated PCS was stockpiled on Site for bioremediation. Samples collected from the stockpiled soil approximately 2 years later were tested for Total Petroleum Hydrocarbons-Gasoline and metals, neither of which were detected.

In December 2011 and February 2012, additional Site characterization was done (Figure 2). Soil samples confirmed PCS remained at the Site. Water samples collected from four borings around the pump island and fuel lines had contamination concentrations above Method A cleanup levels.

In December 2014, a geophysical survey was conducted to ascertain if any remaining USTs were at the site. After completion of the survey, 25 soil borings were advanced at the Site to delineate the remaining extent of contamination (Figure 2). The total depth of exploration was 20 feet below ground surface (bgs).

In areas where water samples had previously been collected, only wet soil was found. These wet lenses were randomly encountered were randomly distributed, thin, and discontinuous and at inconsistent depths and not present in all borings. This information, along with the absence of water in the tank excavation, and the regional depth to groundwater of approximately 125 feet bgs, indicates that groundwater is not a complete pathway at the Site.

Contamination in soil was found that exceeded the Method A cleanup levels. A request was submitted to Ecology regarding the use of soil excavation of hot spots to levels below Site-specific Method B values. Ecology agreed to this proposal in an opinion letter dated September 2, 2015. Selected soil samples from the 2014 characterization activities were analyzed for Extractable/Volatile Petroleum Hydrocarbons (EPH/VPH). Data from the EPH/VPH sample results were then used in Tables 1, 2, and 3. Averages were calculated to determine Site-specific Method B cleanup values.

The results of this investigation were used to delineate the remaining soil contamination.

The selected remedy of excavation of hot spots was implemented in February/March, 2016. An area with concentrations above Site-specific Method B cleanup values was then excavated to remove all remaining contaminated soil. The total depth reached in the excavation was approximately 15 feet bgs.

After the excavation activities were completed, confirmation samples were collected along the sidewalls and base. Samples were analyzed for GRO, DRO, and BTEX. Additionally, analyses for ethylene dibromide were done on two soil samples with obvious contamination, the results of which were non-detect. Figure 3 shows the excavated are in relation to surround features. Figure 4 shows the horizontal extent of the excavation, the locations of the confirmation samples, and the sample results. The excavation was then backfilled and compacted to grade.

The excavation work resulted in the removal of approximately 244 tons of petroleum contaminated soil that was transported off Site and disposed of at the Roosevelt Landfill in Roosevelt, Washington.

After completion of the excavation activities, a soil gas vapor survey was done. Three locations were sampled (Figure 3). These locations were selected based on the highest concentrations found during soil boring activities that were outside the excavation boundaries.

The lateral separation from the building to remaining benzene contamination is less than the 30 foot lateral inclusion zone. Results of the soil vapor survey found benzene in SVP-3 (Figure3) at 220 micrograms per cubic meter ($\mu g/m^3$), a Tier II assessment was done. This assessment used two separate Johnson and Ettinger Models (JEM) to predict indoor air concentrations and risk. Model results were then compared to indoor air cleanup levels in Ecology's vapor intrusion guidance. Both JEM model results for default commercial parameters and exposure rates confirmed that benzene concentrations in soil vapor into indoor air is not a risk to the existing or future commercial buildings at the Site. The indoor air simulation results are shown in Figures 5 and 6.

2. Establishment of cleanup standards.

Ecology has determined the cleanup levels and points of compliance you established for the Site meet the substantive requirements of MTCA.

a. Cleanup levels

Site-specific MTCA Method B Cleanup Levels were calculated from EPH/VPH data and were applied to soil results used to characterize the Site.

The Method B cleanup levels are:

Soil:

Total TPH	3,240 mg/kg

Benzene	18 mg/kg
Ethylbenzene	8,000 mg/kg
Total Xylenes	16,000 mg/kg
Naphthalene	1,600 mg/kg

Groundwater:

Not applicable since regional groundwater is approximately 125 feet bgs.

b. Points of compliance

Standard points of compliance for each potential exposure pathway were used for the Site.

The Points of Compliance were:

Soil -Direct Contact: For soil cleanup levels based on human exposure via direct contact, the point of compliance is: "*...throughout the Site from ground surface to 15 feet below the ground surface.*"

All the contaminated soil in the direct-contact pathway has been removed thus resulting in an incomplete exposure route.

Soil- Leaching: For sites where soil cleanup levels are based on the protection of groundwater: "*...the point of compliance is throughout the Site.*

This exposure pathway is incomplete since regional groundwater is approximately 125 feet bgs.

Groundwater: For groundwater, the standard point of compliance as established under WAC 173-340-720(8) is: "*...throughout the site from the uppermost level of the saturated zone extending vertically to the lowest most depth which could potentially be affected by the site.*".

This exposure pathway is incomplete since regional groundwater is approximately 125 feet bgs.

Vapor: Ambient and indoor air throughout the site was determined to be below risk levels and is thus not a complete pathway of exposure.

3. Selection of cleanup action.

Ecology has determined the cleanup action you selected for the Site meets the substantive requirements of MTCA.

Cleanup actions selected for the Site consisted of removal of the USTs and soil excavation.

The selected remedy for the excavated soil was stockpiling on-Site with on-Site bioremediation and off-Site disposal. Sampling of the bioremediated soil was done to confirm contamination levels were below Method A cleanup levels. Soils transported off-Site were taken to a permitted landfill for disposal.

4. Cleanup.

Ecology has determined the cleanup actions taken meets the cleanup standards established for the Site.

The final cleanup actions at the Site consisted of excavation of impacted soils above the Site-specific Method B cleanup values. The final soil excavation resulted in approximately 244 tons of petroleum contaminated soil that was transported off Site and disposed of at the Roosevelt Landfill in Roosevelt, Washington.

Listing of the Site

Based on this opinion, Ecology will initiate the process of removing the Site from our lists of hazardous waste sites, including:

- Hazardous Sites List.
- Confirmed and Suspected Contaminated Sites List.

This process includes public notice and opportunity to comment. Based on the comments received, Ecology will either remove the Site from the applicable lists or withdraw this opinion.

Limitations of the Opinion

1. Opinion does not settle liability with the state.

Liable persons are strictly liable, jointly and severally, for all remedial action costs and for all natural resource damages resulting from the release or releases of hazardous substances at the Site. This opinion **does not**:

- Resolve or alter a person's liability to the state.
- Protect liable persons from contribution claims by third parties.

To settle liability with the state and obtain protection from contribution claims, a person must enter into a consent decree with Ecology under RCW 70.105D.040(4).

2. Opinion does not constitute a determination of substantial equivalence.

To recover remedial action costs from other liable persons under MTCA, one must demonstrate that the action is the substantial equivalent of an Ecology-conducted or Ecology-supervised action. This opinion does not determine whether the action you performed is substantially equivalent. Courts make that determination. *See* RCW 70.105D.080 and WAC 173-340-545.

3. State is immune from liability.

The state, Ecology, and its officers and employees are immune from all liability, and no cause of action of any nature may arise from any act or omission in providing this opinion. *See* RCW 70.105D.030(1)(i).

Termination of Agreement

Thank you for cleaning up the Site under the Voluntary Cleanup Program (VCP). This opinion terminates the VCP Agreement governing this project (SW1180).

For more information about the VCP and the cleanup process, please visit our web site: www.ecy.wa.gov/programs/tcp/vcp/vcpmain.htm. If you have any questions about this opinion or the termination of the Agreement, please contact me by phone at (360) 407-6263 or e-mail at carol.johnston@ecy.wa.gov .

Sincerely,

Carol A. Johnston
SWRO Toxics Cleanup Program

CAJ: hd

By certified mail [91 7199 9991 7037 0221 7560]

Enclosures (6 figures, 3 tables): A – Description and Diagrams of the Site

cc: Mr. Gabe Cisneros, Floyd Snider
Mr. Rob Olsen, Tacoma, Pierce County Health Department
Mr. Nicholas Acklam, Ecology
Mr. Matthew Alexander, Ecology
Mr. Mark Gordon, Ecology

Enclosure A

Description and Diagrams of the Site

Description of Site

The Site is located at 4540 Pacific Avenue in Pierce County, Tacoma, Washington, and situated in Tax Parcel no. 7470024730. The Site is currently utilized as a tire sales and automobile repair facility (Llantora Sinaloa Tire Sales & Service), and is improved with 1,008 square-foot, single-story, wood frame commercial structure, constructed in 1963.

The Site was used as a gasoline station and automobile repair facility since 1926 until 1991. In 1951, the Site was reportedly reconfigured, including the demolition of the former structure, construction of the existing structure, installation of hydraulic hoists, and installation of four USTs, pump islands, and associated ancillary equipment. The four USTs on Site contained gasoline-range fuel and waste oil. Two of the USTs were 4,000-gallons in size, one was 6,000-gallons all of which contained gasoline-range fuel, and the remaining UST was 50 to 200-gallons in size and reportedly contained waste oil.

In 1991, the aforementioned USTs were decommissioned by removal. Approximately 250 yd^3 of PCS was excavated from the UST nest and stockpiled on Site in the southwest corner of the property parcel. The stockpile was sampled in April 1993 for TPH, exhibiting non-detect results. Reportedly, the stockpile was subsequently used as fill off Site.

Soils underlying the Site are comprised of approximately 1 foot of silty, sandy, gravelly fill material, underlain by a soft to hard sandy-silt with trace gravels and organics up to 14 feet in thickness. The sandy-silt layer contains intermittent and non-continuous lenses of silty-sand. The sandy-silt sequence is underlain by a silty-sand with trace gravels up to 9 feet in thickness. A dense, consolidated glacial till underlies the above silty-sand at approximately 17 feet bgs. The dense glacial till material serves as an aquatard, preventing down-profile illuviation.

Area well logs indicate the regional groundwater aquifer is located at a depth of approximately 125 feet bgs. Discontinuous, marginally-wet zones have been encountered in a few of the soil borings in the silty-sand layers that overlie stiff sandy-silt layers as described above (Floyd Snider, December 2014).

Site Diagrams

Legend

- Soil Boring Location Sampled in December 2014
- Soil Boring Location Sampled 2011–2012
- Property Boundary
- All concentrations are less than MTCA Method A cleanup levels for soil.
- Concentrations exceed MTCA Method A cleanup levels for soil.
- Concentrations exceed MTCA Method B cleanup levels for soil.

MTCA Cleanup Level	GRO mg/kg	Benzene mg/kg
MTCA Method A	100	0.03
MTCA Method B	3,240	18

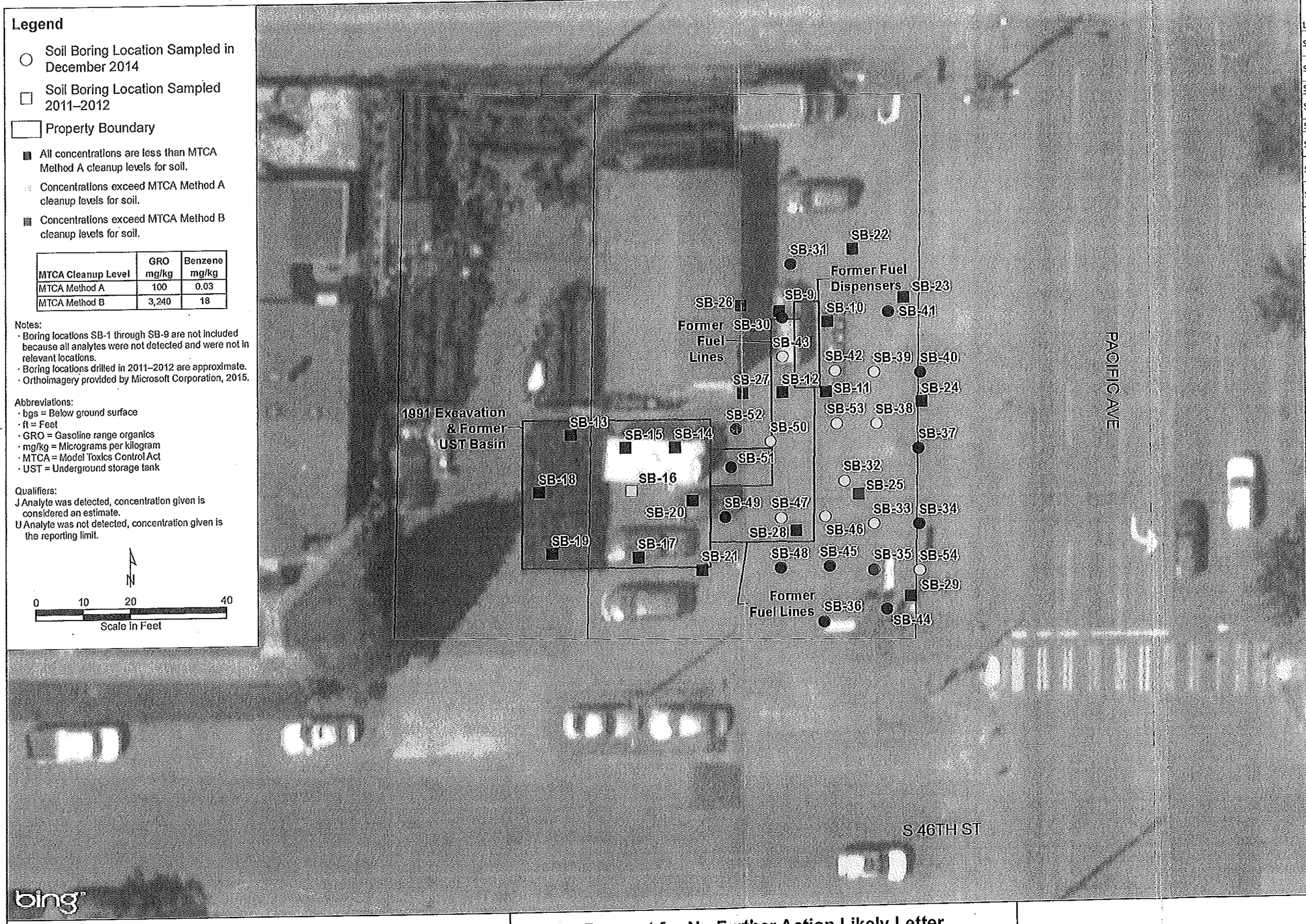
Notes:
- Boring locations SB-1 through SB-9 are not included because all analytes were not detected and were not in relevant locations.
- Boring locations drilled in 2011–2012 are approximate.
- Orthoimagery provided by Microsoft Corporation, 2015.

Abbreviations:
- bgs = Below ground surface
- ft = Feet
- GRO = Gasoline range organics
- mg/kg = Micrograms per kilogram
- MTCA = Model Toxics Control Act
- UST = Underground storage tank

Qualifiers:
J Analyte was detected, concentration given is considered an estimate.
U Analyte was not detected, concentration given is the reporting limit.

N

0 10 20 40
Scale in Feet



Location	Depth (ft bgs)	GRO mg/kg	Benzene mg/kg
SB-9	8	99	0.02 U
	17	10 U	0.02 U
SB-10	10	17	0.02 U
	16	10 U	0.02 U
SB-11	17	10 U	0.02 U
SB-12	8	36	0.02 U
	14	10 U	0.02 U
SB-13	14	10 U	0.02 U
SB-14	14	73	0.02 U
	17.5	10 U	0.02 U
SB-15	14	66	0.02 U
	18	10 U	0.02 U
SB-16	12	150	0.02 U
	18	15	0.02 U
SB-17	14	14	0.02 U
	18	10 U	0.02 U
SB-18	14	10 U	0.02 U
SB-19	14	10 U	0.02 U
SB-20	14	10 U	0.02 U
	18	10 U	0.02 U
SB-21	10	10 U	0.02 U
	18	10 U	0.02 U
SB-22	8	10 U	0.02 U
	10	10 U	0.02 U
SB-23	8	10 U	0.02 U
	10	10 U	0.02 U
SB-25	2	10 U	0.02 U
	8	4,500	0.02 U
	13	10 U	0.02 U
SB-26	8	10 U	0.02 U
SB-27	8	10 U	0.02 U
	14	10 U	0.02 U
SB-28	14	10 U	0.02 U
	18	10 U	0.02 U
SB-29	12	10 U	0.02 U
	18	10 U	0.02 U
SB-30	4.5	19	0.02 U
SB-32	14	2,000 J	0.03 U
	17	6.7	0.02 U
SB-33	9	2,700 J	0.14
	17	2 U	0.02 U
SB-34	17	2 U	0.02 U
	6.5	26	0.02 U
SB-35	10	3,400 J	0.31
SB-36	8	2 U	0.02 U
SB-37	7.5	2 U	0.02 U
SB-38	14	2 U	0.02 U
	8	250	0.02 U
SB-39	12	330	0.02 U
	14	2 U	0.02 U
SB-40	7	2 U	0.02 U
SB-41	6	43	0.02 U
	6	9.2	0.02 U
SB-42	13	1,400	0.15
	15	2 U	0.02 U
SB-43	2	190	0.02 U
SB-44	12.5	90	0.02 U
SB-45	9.5	2 U	0.02 U
SB-46	15	2,400	0.84
	19.5	2 U	0.02 U
SB-47	7.5	590	0.02 U
SB-48	8.5	2 U	0.02 U
SB-49	13.5	2 U	0.02 U
SB-50	13	380	0.11
SB-51	7.5	56	0.02 U
SB-52	7.5	6.5	0.02 U
SB-53	10	2,600	1.7
SB-54	5.5	330 J	0.02 U

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Request for No Further Action Likely Letter
Calhoun's Service Station
Tacoma, Washington

Figure 2.
Gasoline-Range Organics and Benzene in Soil
2011–2014

E:\GIS\Projects\GTH-Calhoun\MXD\Site Investigation Report and Cleanup\Figure 1 GRO and Benzene.mxd
7/29/2015

Legend

- Drain
- Light Pole
- Electrical Utility
- Sewer Utility
- Water Utility
- Floyd|Snider Soil Vapor Probe
- Floyd|Snider Soil Boring Location
- Aerotech Soil Boring Location
- 2016 Excavation Extent
- Property Boundary

All concentrations are less than MTCA Method A cleanup levels for soil.

Concentrations exceed MTCA Method A cleanup levels for soil, but are less than MTCA Method B cleanup levels.

Sample location removed during excavation activities.

MTCA Cleanup Level	TPH (mg/kg)	Benzene (mg/kg)
MTCA Method A	30	0.03
MTCA Method B	3,240	18

Notes:
1. Concentrations in bold exceed MTCA Method A cleanup levels for soil, but are less than MTCA Method B cleanup levels.
- Boring locations SB-1 through SB-9 are not included because all analytes were not detected and were not in relevant locations.
- Aerotech boring locations are approximate.
- Orthoimagery provided by NearMap, September 28, 2015.

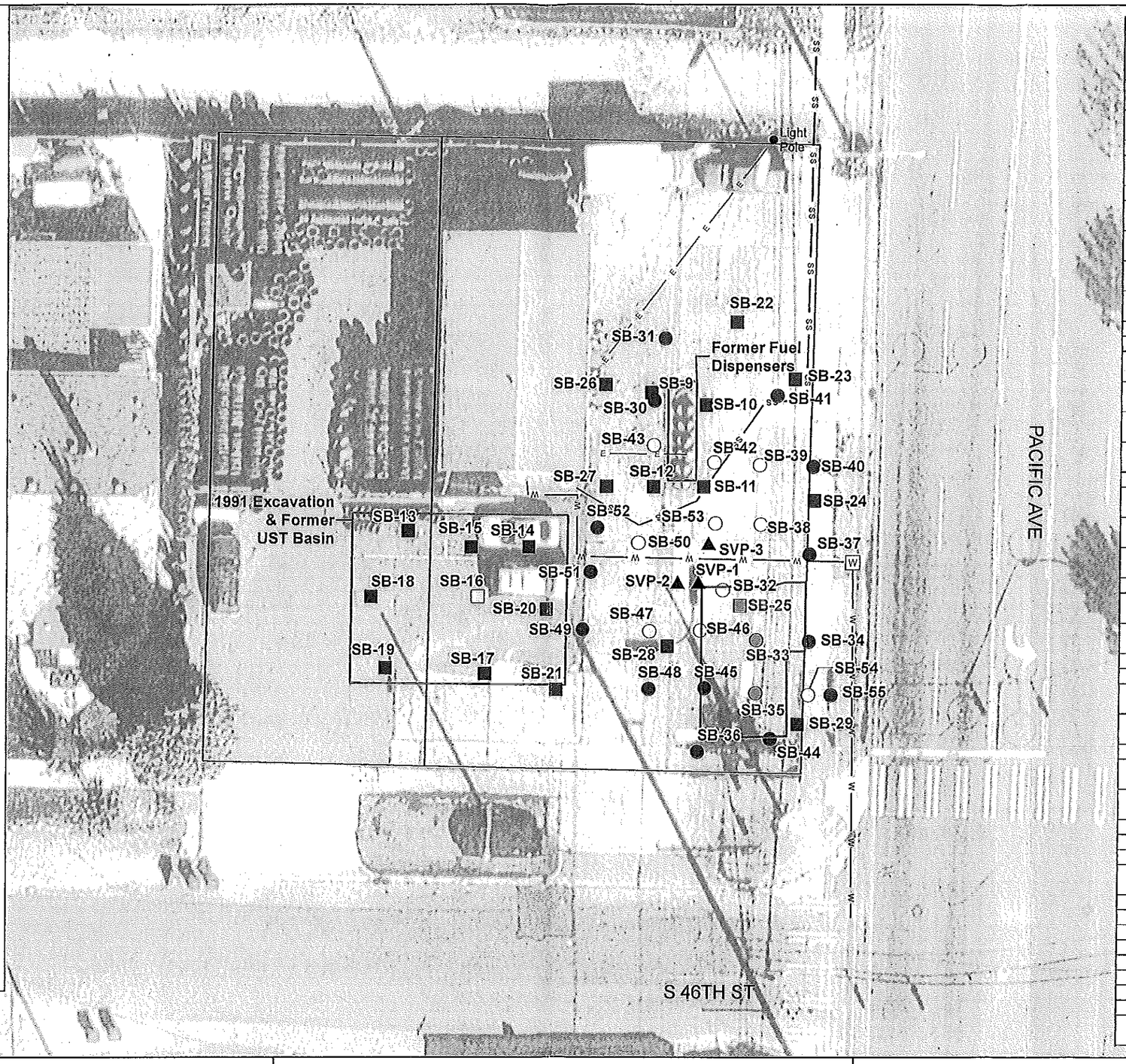
Abbreviations:
- bgs = Below ground surface
- ft = Feet
- GRO = Gasoline-Range Organics
- mg/kg = Micrograms per kilogram
- MTCA = Model Toxics Control Act
- TPH = Total petroleum hydrocarbons
- UST = Underground storage tank

Qualifier:
U = Analyte was not detected, concentration given is the reporting limit.

N

0 10 20 40

Scale in Feet



Location	Depth (ft bgs)	Gasoline Range Organics (mg/kg)	Benzene (mg/kg)
		Remaining Soil Data[1]	
SB-9	8	99	0.02 U
	17	10 U	0.02 U
SB-10	10	17	0.02 U
	16	10 U	0.02 U
SB-11	17	10 U	0.02 U
SB-12	8	36	0.02 U
	14	10 U	0.02 U
SB-13	14	10 U	0.02 U
SB-14	14	73	0.02 U
	17.5	10 U	0.02 U
SB-15	14	66	0.02 U
	18	10 U	0.02 U
SB-16	12	150	0.02 U
	18	15	0.02 U
SB-17	14	14	0.02 U
	18	10 U	0.02 U
SB-18	14	10 U	0.02 U
SB-19	14	10 U	0.02 U
SB-20	14	10 U	0.02 U
	18	10 U	0.02 U
SB-21	10	10 U	0.02 U
	18	10 U	0.02 U
SB-22	8	10 U	0.02 U
	10	10 U	0.02 U
SB-23	8	10 U	0.02 U
	10	10 U	0.02 U
SB-26	8	10 U	0.02 U
SB-27	8	10 U	0.02 U
	14	10 U	0.02 U
SB-28	14	10 U	0.02 U
	18	10 U	0.02 U
SB-29	12	10 U	0.02 U
	18	10 U	0.02 U
SB-30	4.5	19	0.02 U
SB-32	14	2,000	0.03 U
	17	6.7	0.02 U
SB-34	17	2 U	0.02 U
	6.5	26	0.02 U
SB-36	8	2 U	0.02 U
SB-37	7.5	2 U	0.02 U
SB-38	14	2 U	0.02 U
	8	250	0.02 U
SB-39	12	330	0.02 U
	14	2 U	0.02 U
SB-40	7	2 U	0.02 U
SB-41	6	43	0.02 U
	6	9.2	0.02 U
SB-42	13	1,400	0.15
	15	2 U	0.02 U
SB-43	2	190	0.02 U
SB-44	12.5	90	0.02 U
SB-45	9.5	2 U	0.02 U
SB-46	15	2,400	0.84
	19.5	2 U	0.02 U
SB-47	7.5	590	0.02 U
SB-48	8.5	2 U	0.02 U
SB-49	13.5	2 U	0.02 U
SB-50	13	380	0.11
SB-51	7.5	56	0.02 U
SB-52	7.5	6.5	0.02 U
SB-53	10	2,600	1.7
SB-54	5.5	330	0.02 U
SB-55	5.5	3	0.02 U
	5.5 (Dup)	2.6	0.02 U

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Cleanup Action Report
Calhoun's Service Station
Tacoma, Washington

Figure 3 |
Site Map, Excavation, and Remaining Soil Data

I:\GIS\Projects\GTH-Calhoun\MXD\Site Investigation Report and Cleanup\Figure 2.1 Site Map, Excavation, and Remaining Soil Data.mxd
7/13/2016

Legend

- Water Utility
- Floyd|Snider Excavation Confirmation Sample (2016)
- Floyd|Snider Soil Boring Location
- Aerotech Soil Boring Location
- Floyd|Snider Soil Vapor Probe
- 2016 Excavation Extent
- Property Boundary

- All concentrations are less than MTCA Method A cleanup levels for soil.
- Concentrations exceed MTCA Method A cleanup levels for soil, but are less than MTCA Method B cleanup levels.
- Confirmation samples with a concentration less than MTCA Method B cleanup level for soils.
- Sample location removed during excavation activities.

MTCA Cleanup Level	TPH (mg/kg)	Benzene (mg/kg)
MTCA Method A	30	0.03
MTCA Method B	3,240	18

Notes:
1. Sum of detected concentrations of gasoline-range organics, diesel-range organics, and oil-range organics rounded to two significant figures. When all concentrations are non-detect, the greatest reporting limit is given.
2. Sample location was over-excavated and removed.
- Aerotech boring locations are approximate.
- Orthoimagery provided by NearMap, September 28, 2015.
- Soil at locations SB-25, SB-33, SB-36, and EX-8 were removed during excavation activities.

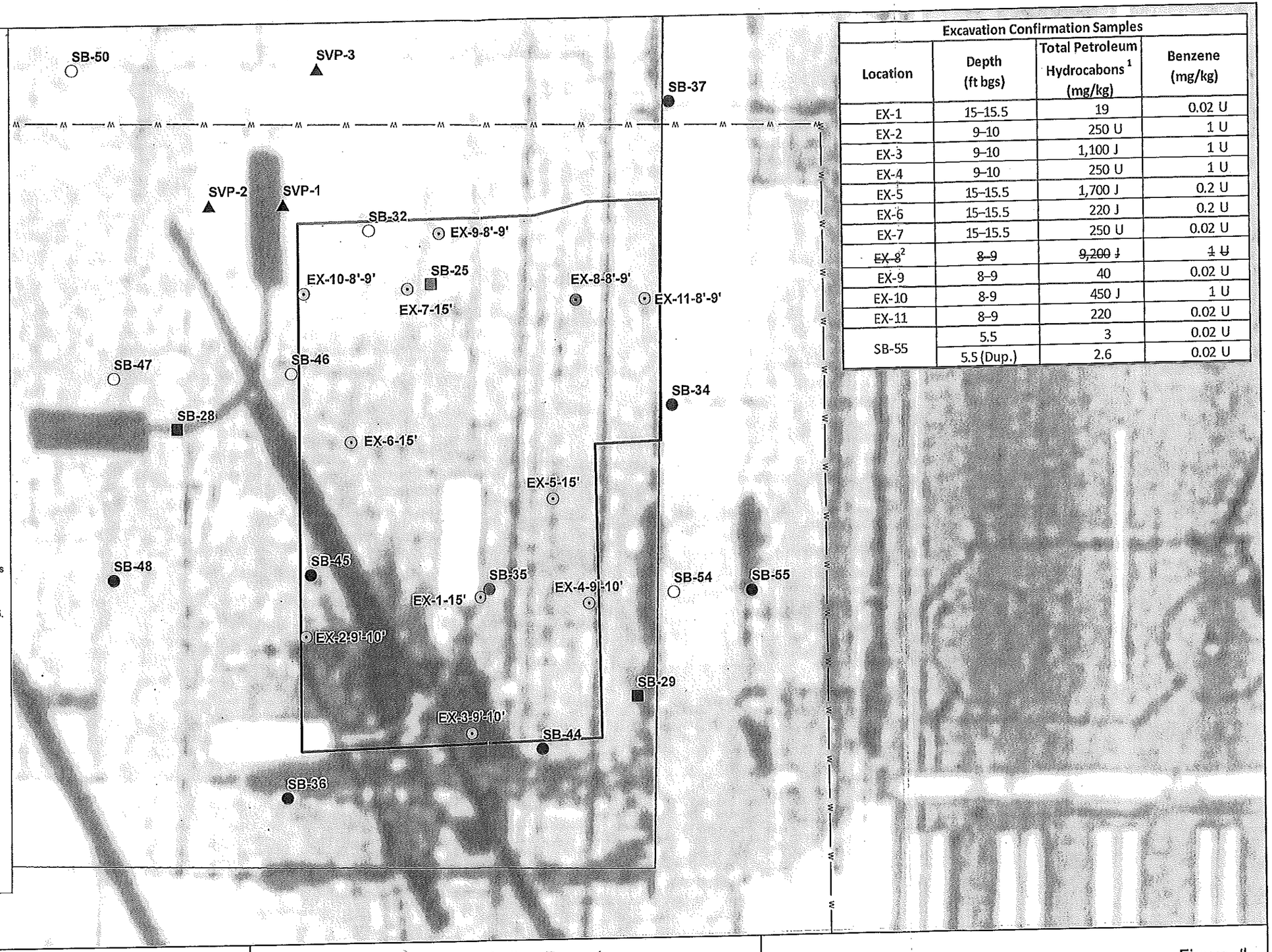
Abbreviations:
- bgs = Below ground surface
- ft = Feet
- mg/kg = Micrograms per kilogram
- MTCA = Model Toxics Control Act
- TPH = Total petroleum hydrocarbons

Qualifiers:
J = Analyte was detected, concentration given is considered an estimate.
U = Analyte was not detected, concentration given is the reporting limit.

N

0 2.5 5 10

Scale in Feet



Excavation Confirmation Samples			
Location	Depth (ft bgs)	Total Petroleum Hydrocabons [1] (mg/kg)	Benzene (mg/kg)
EX-1	15–15.5	19	0.02 U
EX-2	9–10	250 U	1 U
EX-3	9–10	1,100 J	1 U
EX-4	9–10	250 U	1 U
EX-5	15–15.5	1,700 J	0.2 U
EX-6	15–15.5	220 J	0.2 U
EX-7	15–15.5	250 U	0.02 U
~~EX-8~~ [2]	~~8–9~~	~~9,200 J~~	~~1 U~~
EX-9	8–9	40	0.02 U
EX-10	8-9	450 J	1 U
EX-11	8–9	220	0.02 U
SB-55	5.5	3	0.02 U
	5.5 (Dup.)	2.6	0.02 U

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Cleanup Action Report
Calhoun's Service Station
Tacoma, Washington

Figure 4
2016 Excavation Extent and Confirmation Sample Locations

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7/13/2016

INDOOR AIR SIMULATION RESULTS

Screening-Level Johnson and Ettinger Model

Site Name:
Report Date: Tue Apr 05 2016 14:15:08 GMT-0700 (Pacific Daylight Time)
Report Generated From: https://www3.epa.gov/ceampubl/learn2model/part-two/onsite/JnE_lite_forward.htm
Type of sample: SOIL GAS Concentration = 220[µg/m^3]
Depth of soil gas sample: 5.5ft +/- 0.5ft
Average soil/ground water temperature: 55F

CHEMICAL PROPERTIES
Chemical of Concern: Benzene CAS Number: 71432
Molecular Weight: 78.11 [g/mole] Henrys Constant: 0.1316031 [unitless]
Diffusivity in Air: 8.800e-2 [cm^2/sec] Diffusivity in Water: 9.800e-6 [cm^2/sec]
Unit Risk Factor: 0.0000078 [(µg/m^3)$^{-1}$] Reference Concentration: 0 [mg/m^3]

SOIL PROPERTIES
Soil Type: Loam Total Porosity: 0.399
Unsaturated Zone Moisture Content:
low= 0.061 best estimate= 0.148 high= 0.24
Capillary Zone Moisture Content: 0.332 Height of Capillary Rise: 0.375 [m]
Soil-Gas Flow Rate into Building: 5 [L/min]

BUILDING PROPERTIES
Building Type: Slab-on-Grade Air Exchange Rate: 0.5[hr^{-1}]
Building Mixing Height: 2.5[m] Building Footprint Area: 100[m^2]
Subsurface Foundation Area: 106[m^2] Building Crack Ratio: 0.00038[unitless]
Foundation Slab Thickness: 0.1[m]

EXPOSURE PARAMETERS
Exposure Duration: carcinogens 30 [years] non-carcinogens: 30 [years]
Exposure Frequency: carcinogens 350 [days/year] non-carcinogens: 365 [days/year]
Averaging Time: carcinogens 70 [years] non-carcinogens: 30 [years]

JOHNSON & ETTINGER SIMULATION RESULTS
Effective Diffusion Coefficient (D_{eff}): 0.00554[cm^2/s]
Soil Gas to Indoor Air Attenuation Factor (α_{SG}) = 0.0007103

[1]Low Indoor Air Prediction: 0.04115 [µg/m^3] or 0.01289 [ppbv]
Cancer Risk of this concentration: 1.319e-7 Hazard Risk of this concentration: 0.

Best Estimate Indoor Air Prediction: 0.1563[µg/m^3] or 0.04895 [ppbv]
Cancer Risk of this concentration: 5.009e-7 Hazard Risk of this concentration: 0.

[2]High Indoor Air Prediction: 0.2929[µg/m^3] or 0.09173 [ppbv]
Cancer Risk of this concentration: 9.388e-7 Hazard Risk of this concentration: 0.

Based on parameter analysis: Advection is the dominant mechanism across foundation.

[1]"Low Prediction" concentrations produced with HIGHEST moisture content and DEEPEST depth to contamination.
[2]"High Prediction" concentrations produced with LOWEST moisture content and SHALLOWEST depth to contamination.

FIGURE 5

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Soil Gas

DATA ENTRY SHEET

Scenario: Commercial
Chemical: Benzene

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
2.20E+02	4.5E-04	9.9E-02	2.3E-07	7.5E-03

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
71432	2.20E+02			Benzene

MESSAGE: See VLOOKUP table comments on chemical properties and/or toxicity criteria for this chemical.

MORE ⇩

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Soil gas sampling depth below grade, L_s (cm)	ENTER Average soil temperature, T_S (°C)	ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vadose zone soil vapor permeability, k_v (cm^2)
15.24	168	24	SI		

Depth to bottom of enclosed space floor must be = 15 or 200 cm.

MORE ⇩

Lookup Soil Parameters

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SI	1.35	0.489	0.167	5

MORE ⇩

Lookup Receptor Parameters

	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)	ENTER Exposure Time ET (hrs/day)	ENTER Air Exchange Rate ACH $(hour)^{-1}$
NEW=> Commercial	70	25	25	250	8 (NEW)	1 (NEW)

END

FIGURE 6

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 12/30/2014
Site Name: GTH-Calhoun
Sample Name: SB-32-14
Measured Soil TPH Concentration, mg/kg: 818.617

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	3,585	3.95E-08	2.28E-01	Pass
	Method C	66,691	5.29E-09	1.23E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	32	7.99E-05	3.67E+00	Fail
	Target TPH GW Conc. @ 800 ug/L	121	NA	NA	Fail

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through -7494).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	3,585.24	66,690.93
Most Stringent Criterion	HI =1	HI =1

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	YES	3.59E+03	1.73E-07	1.00E+00	YES	6.67E+04	4.31E-07	1.00E+00
Total Risk=1E-5	*NO*	2.07E+05	1.00E-05	5.78E+01	*NO*	1.55E+06	1.00E-05	2.32E+01
Risk of Benzene= 1E-6	*NO*	2.07E+04	1.00E-06	5.78E+00	NA			
Risk of cPAHs mixture= 1E-6	NA	NA	NA	NA				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	Benzene MCL = 5 ug/L
Protective Ground Water Concentration, ug/L	356.87
Protective Soil Concentration, mg/kg	32.35

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	*NO*	4.34E+02	8.03E-06	1.00E+00	4.16E+01
Total Risk = 1E-5	*NO*	5.10E+02	1.00E-05	1.17E+00	5.23E+01
Total Risk = 1E-6	YES	5.94E+01	1.00E-06	1.38E-01	5.12E+00
Risk of cPAHs mixture= 1E-5	NA	NA	NA	NA	NA
Benzene MCL = 5 ug/L	YES	3.57E+02	6.29E-06	8.25E-01	3.24E+01
MTBE = 20 ug/L	*NO*	3.84E+02	6.88E-06	8.88E-01	3.55E+01

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 800 ug/L	8.00E+02	2.16E-05	1.86E+00	1.21E+02

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 12/30/14
Site Name: GTH-Calhoun
Sample Name: SB-32-14

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6	24.5	2.99%
AL_EC >6-8	226	27.61%
AL_EC >8-10	161	19.67%
AL_EC >10-12	104	12.70%
AL_EC >12-16	23	2.81%
AL_EC >16-21	2.845	0.35%
AL_EC >21-34	0	0.00%
AR_EC >8-10	157.1	19.19%
AR_EC >10-12	77.35	9.45%
AR_EC >12-16	12.03	1.47%
AR_EC >16-21	2.845	0.35%
AR_EC >21-34	0	0.00%
Benzene	0.717	0.09%
Toluene	1.15	0.14%
Ethylbenzene	1.83	0.22%
Total Xylenes	5.07	0.62%
Naphthalene	4.25	0.52%
1-Methyl Naphthalene	0.67	0.08%
2-Methyl Naphthalene	1.3	0.16%
n-Hexane	11	1.34%
MTBE	1.96	0.24%
Ethylene Dibromide (EDB)	0	0.00%
1,2 Dichloroethane (EDC)	0	0.00%
Benzo(a)anthracene	0	0.00%
Benzo(b)fluoranthene	0	0.00%
Benzo(k)fluoranthene	0	0.00%
Benzo(a)pyrene	0	0.00%
Chrysene	0	0.00%
Dibenz(a,h)anthracene	0	0.00%
Indeno(1,2,3-cd)pyrene	0	0.00%
Sum	818.617	100.00%

Notes for Data Entry | Set Default Hydrogeology

Clear All Soil Concentration Data Entry Cells

Restore All Soil Concentration Data cleared previously

REMARK:
Half detection limits were used for AL_EC>16-21 and AR_EC>16-21.

The following constituents have never been detected; therefore, zero was entered: AL_EC>21-34, AR_EC>21-34, EDB, EDC, benzo(a)anthracene, benzo(b)flouranthene, benzo(k)flouranthene, benzo(a)pyrene, chrysene, dibenz(a,h)anthrancene, and indeno(1,2,3-cd)pyrene.

Default values were used for total soil porosity, volumetric water content, soil bulk density, and fraction organic carbon.

Groundwater was not encountered; therefore the default value of 20 was used for the dilution factor.

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here:	800	ug/L

A2. 1B Worksheet for Calculating Soil Cleanup Levels for Protection of Human Health: (Soil Direct Contact Pathway)
Method B: Unrestricted Land Use (WAC 173-340-740)

Date: 12/30/2014
Site Name: GTH-Calhoun
Sample Name: SB-32-14

Chemical of Concern or EC group	Current Condition				Adjusted Condition			
	Measured Soil Conc @dry basis	HQ	RISK	Pass or Fail?	Soil Conc being tested	HQ	RISK	Pass or Fail?
	mg/kg	unitless	unitless		mg/kg	unitless	unitless	
Petroleum EC Fraction								
AL_EC >5-6	24.5	1.95E-04			1.07E+02	8.54E-04		
AL_EC >6-8	226	1.80E-03			9.90E+02	7.88E-03		
AL_EC >8-10	161	7.26E-02			7.05E+02	3.18E-01		
AL_EC >10-12	104	4.69E-02			4.55E+02	2.05E-01		
AL_EC >12-16	23	1.38E-02			1.01E+02	6.04E-02		
AL_EC >16-21	2.845	2.56E-05			1.25E+01	1.12E-04		
AL_EC >21-34	0				0.00E+00			
AR_EC >8-10	157.1	2.13E-02			6.88E+02	9.31E-02		
AR_EC >10-12	77.35	5.23E-02			3.39E+02	2.29E-01		
AR_EC >12-16	12.03	4.33E-03			5.27E+01	1.90E-02		
AR_EC >16-21	2.845	1.71E-03			1.25E+01	7.48E-03		
AR_EC >21-34	0				0.00E+00			
Benzene	0.717	2.24E-03	3.95E-08		3.14E+00	9.82E-03	1.73E-07	
Toluene	1.15	1.92E-04			5.04E+00	8.39E-04		
Ethylbenzene	1.83	2.45E-04			8.01E+00	1.07E-03		
Total Xylenes	5.07	3.40E-04			2.22E+01	1.49E-03		
Naphthalene	4.25	3.51E-03			1.86E+01	1.54E-02		
1-Methyl Naphthalene	0.67	1.72E-04			2.93E+00	7.54E-04		
2-Methyl Naphthalene	1.3	4.17E-03			5.69E+00	1.83E-02		
n-Hexane	11	2.48E-03			4.82E+01	1.09E-02		
MTBE	1.96				8.58E+00			
Ethylene Dibromide (EDB)	0		0.00E+00		0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0		0.00E+00		0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0		0.00E+00	*For*	0.00E+00		0.00E+00	*For*
Benzo(b)fluoranthene	0		0.00E+00	*all*	0.00E+00		0.00E+00	*all*
Benzo(k)fluoranthene	0		0.00E+00	*cPAHs*	0.00E+00		0.00E+00	*cPAHs*
Benzo(a)pyrene	0		0.00E+00		0.00E+00		0.00E+00	
Chrysene	0		0.00E+00		0.00E+00		0.00E+00	
Dibenz(a,h)anthracene	0		0.00E+00	ΣRisk=	0.00E+00		0.00E+00	ΣRisk=
Indeno(1,2,3-cd)pyrene	0		0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
Sum	818.617	2.28E-01	3.95E-08		3.59E+03	1.00E+00	1.73E-07	

TEST CURRENT CONDITION

Measured TPH Soil Conc, mg/kg= 818.617
HI= 2.283E-01
RISK= 3.948E-08
Pass or Fail? Pass

CALCULATE PROTECTIVE CONDITION

This tool allows the user to calculate protective TPH soil concentration based on various soil quality criteria. The Workbook uses the same composition ratio as for the measured data.

Calculate Protective TPH Soil Conc

Selected Criterion:
Most Stringent?
Protctive TPH Soil Conc, mg/kg =
HI =
RISK =

TEST ADJUSTED CONDITION

This tool allows the user to test whether a particular TPH soil concentration is protective of human health. The Workbook uses the same composition ratio as for the measured data.

Test Adjusted TPH Soil Conc

Tested TPH Soil Conc, mg/kg =
HI =
RISK =
Pass or Fail?

TABLE 1

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 12/30/14
Site Name: GTH-Calhoun
Sample Name: SB-33-9

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6	25	1.97%
AL_EC >6-8	182	14.33%
AL_EC >8-10	214	16.85%
AL_EC >10-12	189	14.88%
AL_EC >12-16	99.4	7.83%
AL_EC >16-21	13.6	1.07%
AL_EC >21-34	0	0.00%
AR_EC >8-10	293.31	23.09%
AR_EC >10-12	158.27	12.46%
AR_EC >12-16	46.2	3.64%
AR_EC >16-21	6.29	0.50%
AR_EC >21-34	0	0.00%
Benzene	0.477	0.04%
Toluene	1.13	0.09%
Ethylbenzene	6.6	0.52%
Total Xylenes	14.1	1.11%
Naphthalene	8.73	0.69%
1-Methyl Naphthalene	2.5	0.20%
2-Methyl Naphthalene	3.6	0.28%
n-Hexane	5.1	0.40%
MTBE	0.843	0.07%
Ethylene Dibromide (EDB)	0	0.00%
1,2 Dichloroethane (EDC)	0	0.00%
Benzo(a)anthracene	0	0.00%
Benzo(b)fluoranthene	0	0.00%
Benzo(k)fluoranthene	0	0.00%
Benzo(a)pyrene	0	0.00%
Chrysene	0	0.00%
Dibenz(a,h)anthracene	0	0.00%
Indeno(1,2,3-cd)pyrene	0	0.00%
Sum	1270.15	100.00%

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here: 800 ug/L

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARK:

The following constituents have never been detected; therefore, zero was entered: AL_EC>21-34, AR_EC>21-34, EDB, EDC, benzo(a)anthracene, benzo(b)flouranthene, benzo(k)flouranthene, benzo(a)pyrene, chrysene, dibenz(a,h)anthrancene, and indeno(1,2,3-cd)pyrene.

Default values were used for total soil porosity, volumetric water content, soil bulk density, and fraction organic carbon.

Groundwater was not encountered; therefore the default value of 20 was used for the dilution factor.

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 12/30/2014
Site Name: GTH-Calhoun
Sample Name: SB-33-9
Measured Soil TPH Concentration, mg/kg: **1,270.150**

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	2,925	2.63E-08	4.34E-01	Pass
	Method C	51,326	3.52E-09	2.47E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	36	4.28E-05	3.37E+00	Fail
	Target TPH GW Conc. @ 800 ug/L	98	NA	NA	Fail

Warning! Check to detennine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through ~7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	2,925.35	51,326.24
Most Stringent Criterion	HI =1	HI =1

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	YES	2.93E+03	6.05E-08	1.00E+00	YES	5.13E+04	1.42E-07	1.00E+00
Total Risk=1E-5	*NO*	4.84E+05	1.00E-05	1.65E+02	*NO*	3.61E+06	1.00E-05	7.04E+01
Risk of Benzene= 1E-6	*NO*	4.84E+04	1.00E-06	1.65E+01	NA			
Risk of cPAHs mixture= 1E-6	NA	NA	NA	NA				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	HI=1
Protective Ground Water Concentration, ug/L	425.54
Protective Soil Concentration, mg/kg	36.40

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	4.26E+02	3.02E-06	1.00E+00	3.64E+01
Total Risk = 1E-5	*NO*	9.08E+02	1.00E-05	2.04E+00	1.32E+02
Total Risk = 1E-6	YES	1.54E+02	1.00E-06	3.66E-01	1.19E+01
Risk of cPAHs mixture= 1E-5	NA	NA	NA	NA	NA
Benzene MCL = 5 ug/L	*NO*	7.15E+02	6.29E-06	1.64E+00	7.85E+01
MTBE = 20 ug/L	*NO*	9.01E+02	9.81E-06	2.03E+00	1.29E+02

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 800 ug/L	8.00E+02	7.68E-06	1.81E+00	9.77E+01

A2. 1B Worksheet for Calculating Soil Cleanup Levels for Protection of Human Health: (Soil Direct Contact Pathway)

Method B: Unrestricted Land Use (WAC 173-340-740)

Date: 12/30/2014
Site Name: GTH-Calhoun
Sample Name: SB-33-9

Chemical of Concern or EC group	Current Condition				Adjusted Condition			
	Measured Soil Conc @dry basis	HQ	RISK	Pass or Fail?	Soil Conc being tested	HQ	RISK	Pass or Fail?
	mg/kg	unitless	unitless		mg/kg	unitless	unitless	
Petroleum EC Fraction								
AL_EC >5-6	25	1.99E-04			5.76E+01	4.58E-04		
AL_EC >6-8	182	1.45E-03			4.19E+02	3.34E-03		
AL_EC >8-10	214	9.65E-02			4.93E+02	2.22E-01		
AL_EC >10-12	189	8.52E-02			4.35E+02	1.96E-01		
AL_EC >12-16	99.4	5.96E-02			2.29E+02	1.37E-01		
AL_EC >16-21	13.6	1.22E-04			3.13E+01	2.82E-04		
AL_EC >21-34	0				0.00E+00			
AR_EC >8-10	293.31	3.97E-02			6.76E+02	9.14E-02		
AR_EC >10-12	158.27	1.07E-01			3.65E+02	2.47E-01		
AR_EC >12-16	46.2	1.66E-02			1.06E+02	3.83E-02		
AR_EC >16-21	6.29	3.77E-03			1.45E+01	8.69E-03		
AR_EC >21-34	0				0.00E+00			
Benzene	0.477	1.49E-03	2.63E-08		1.10E+00	3.44E-03	6.05E-08	
Toluene	1.13	1.88E-04			2.60E+00	4.33E-04		
Ethylbenzene	6.6	8.84E-04			1.52E+01	2.04E-03		
Total Xylenes	14.1	9.46E-04			3.25E+01	2.18E-03		
Naphthalene	8.73	7.21E-03			2.01E+01	1.66E-02		
1-Methyl Naphthalene	2.5	6.42E-04			5.76E+00	1.48E-03		
2-Methyl Naphthalene	3.6	1.16E-02			8.29E+00	2.66E-02		
n-Hexane	5.1	1.15E-03			1.17E+01	2.65E-03		
MTBE	0.843				1.94E+00			
Ethylene Dibromide (EDB)	0		0.00E+00		0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0		0.00E+00		0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0		0.00E+00	*For*	0.00E+00		0.00E+00	*For*
Benzo(b)fluoranthene	0		0.00E+00	*all*	0.00E+00		0.00E+00	*all*
Benzo(k)fluoranthene	0		0.00E+00	*cPAHs*	0.00E+00		0.00E+00	*cPAHs*
Benzo(a)pyrene	0		0.00E+00		0.00E+00		0.00E+00	
Chrysene	0		0.00E+00		0.00E+00		0.00E+00	
Dibenz(a,h)anthracene	0		0.00E+00	ΣRisk=	0.00E+00		0.00E+00	ΣRisk=
Indeno(1,2,3-cd)pyrene	0		0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
Sum	**1270.15**	4.34E-01	2.63E-08		2.93E+03	1.00E+00	6.05E-08	

TEST CURRENT CONDITION

Measured TPH Soil Conc, mg/kg= 1270.150
HI= 4.344E-01
RISK= 2.627E-08

Pass or Fail? Pass

Check Residual Saturation (WAC340-747(10))

CALCULATE PROTECTIVE CONDITION

This tool allows the user to calculate protective TPH soil concentration based on various soil quality criteria. The Workbook uses the same composition ratio as for the measured data.

Calculate Protective TPH Soil Conc

Selected Criterion: Most Stringent?

Protctive TPH Soil Conc, mg/kg =
HI =
RISK =

TEST ADJUSTED CONDITION

This tool allows the user to test whether a particular TPH soil concentration is protective of human health. The Workbook uses the same composition ratio as for the measured data.

Test Adjusted TPH Soil Conc

Tested TPH Soil Conc, mg/kg =
HI =
RISK =

Pass or Fail?

TABLE 2

A1 Soil Cleanup Levels: Worksheet for Soil Data Entry: Refer to WAC 173-340-720, 740,745, 747, 750

1. Enter Site Information

Date: 12/30/14
Site Name: GTH-Calhoun
Sample Name: SB-35-10

2. Enter Soil Concentration Measured

Chemical of Concern or Equivalent Carbon Group	Measured Soil Conc dry basis mg/kg	Composition Ratio %
Petroleum EC Fraction		
AL_EC >5-6	10.1	0.53%
AL_EC >6-8	397	20.95%
AL_EC >8-10	199	10.50%
AL_EC >10-12	318	16.78%
AL_EC >12-16	18	0.95%
AL_EC >16-21	2.64	0.14%
AL_EC >21-34	0	0.00%
AR_EC >8-10	530	27.97%
AR_EC >10-12	304.5	16.07%
AR_EC >12-16	44.7	2.36%
AR_EC >16-21	2.64	0.14%
AR_EC >21-34	0	0.00%
Benzene	0.418	0.02%
Toluene	1.2	0.06%
Ethylbenzene	5.65	0.30%
Total Xylenes	21.85	1.15%
Naphthalene	19.5	1.03%
1-Methyl Naphthalene	3.7	0.20%
2-Methyl Naphthalene	7.8	0.41%
n-Hexane	7.5	0.40%
MTBE	0.402	0.02%
Ethylene Dibromide (EDB)	0	0.00%
1,2 Dichloroethane (EDC)	0	0.00%
Benzo(a)anthracene	0	0.00%
Benzo(b)fluoranthene	0	0.00%
Benzo(k)fluoranthene	0	0.00%
Benzo(a)pyrene	0	0.00%
Chrysene	0	0.00%
Dibenz(a,h)anthracene	0	0.00%
Indeno(1,2,3-cd)pyrene	0	0.00%
Sum	1894.6	100.00%

Notes for Data Entry | Set Default Hydrogeology
Clear All Soil Concentration Data Entry Cells
Restore All Soil Concentration Data cleared previously

REMARKS:

Half detection limits were used for AL_EC>16-21 and AR_EC>16-21.

The following constituents have never been detected; therefore, zero was entered: AL_EC>21-34, AR_EC>21-34, EDB, EDC, benzo(a)anthracene, benzo(b)flouranthene, benzo(k)flouranthene, benzo(a)pyrene, chrysene, dibenz(a,h)anthrancene, and indeno(1,2,3-cd)pyrene.

Default values were used for total soil porosity, volumetric water content, soil bulk density, and fraction organic carbon.

Groundwater was not encountered; therefore the default value of 20 was used for the dilution factor.

3. Enter Site-Specific Hydrogeological Data

Total soil porosity:	0.43	Unitless
Volumetric water content:	0.3	Unitless
Volumetric air content:	0.13	Unitless
Soil bulk density measured:	1.5	kg/L
Fraction Organic Carbon:	0.001	Unitless
Dilution Factor:	20	Unitless

4. Target TPH Ground Water Concentation (if adjusted)

If you adjusted the target TPH ground water concentration, enter adjusted value here: 800 ug/L

A2 Soil Cleanup Levels: Calculation and Summary of Results. Refer to WAC 173-340-720, 740, 745, 747, 750

Site Information

Date: 12/30/2014
Site Name: GTH-Calhoun
Sample Name: SB-35-10
Measured Soil TPH Concentration, mg/kg: 1,894.600

1. Summary of Calculation Results

Exposure Pathway	Method/Goal	Protective Soil TPH Conc, mg/kg	With Measured Soil Conc		Does Measured Soil Conc Pass or Fail?
			RISK @	HI @	
Protection of Soil Direct Contact: Human Health	Method B	3,210	2.30E-08	5.90E-01	Pass
	Method C	60,929	3.08E-09	3.11E-02	Pass
Protection of Method B Ground Water Quality (Leaching)	Potable GW: Human Health Protection	28	2.79E-05	3.42E+00	Fail
	Target TPH GW Conc. @ 800 ug/L	72	NA	NA	Fail

Warning! Check to determine if a simplified or site-specific Terrestrial Ecological Evaluation may be required (Refer to WAC 173-340-7490 through -7494).

Warning! Check Residual Saturation (WAC340-747(10)).

2. Results for Protection of Soil Direct Contact Pathway: Human Health

	Method B: Unrestricted Land Use	Method C: Industrial Land Use
Protective Soil Concentration, TPH mg/kg	3,210.21	60,929.30
Most Stringent Criterion	HI =1	HI =1

Soil Criteria	Protective Soil Concentration @Method B				Protective Soil Concentration @Method C			
	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @	Most Stringent?	TPH Conc, mg/kg	RISK @	HI @
HI =1	YES	3.21E+03	3.90E-08	1.00E+00	YES	6.09E+04	9.91E-08	1.00E+00
Total Risk=1E-5	*NO*	8.23E+05	1.00E-05	2.56E+02	*NO*	6.15E+06	1.00E-05	1.01E+02
Risk of Benzene= 1E-6	*NO*	8.23E+04	1.00E-06	2.56E+01	NA			
Risk of cPAHs mixture= 1E-6	NA	NA	NA	NA				
EDB	NA	NA	NA	NA				
EDC	NA	NA	NA	NA				

3. Results for Protection of Ground Water Quality (Leaching Pathway)

3.1. Protection of Potable Ground Water Quality (Method B): Human Health Protection

Most Stringent Criterion	HI=1
Protective Ground Water Concentration, ug/L	405.20
Protective Soil Concentration, mg/kg	28.09

Ground Water Criteria	Protective Potable Ground Water Concentration @Method B				Protective Soil Conc, mg/kg
	Most Stringent?	TPH Conc, ug/L	RISK @	HI @	
HI=1	YES	4.05E+02	1.38E-06	1.00E+00	2.81E+01
Total Risk = 1E-5	*NO*	1.21E+03	1.00E-05	2.74E+00	2.54E+02
Total Risk = 1E-6	YES	2.97E+02	1.00E-06	7.35E-01	2.03E+01
Risk of cPAHs mixture= 1E-5	NA	NA	NA	NA	NA
Benzene MCL = 5 ug/L	*NO*	1.06E+03	6.29E-06	2.43E+00	1.42E+02
MTBE = 20 ug/L	*NO*	1.30E+03	1.40E-05	2.95E+00	4.10E+02

3.2 Protection of Ground Water Quality for TPH Ground Water Concentration previously adjusted and entered

Ground Water Criteria	Protective Ground Water Concentration			Protective Soil Conc, mg/kg
	TPH Conc, ug/L	Risk @	HI @	
Target TPH GW Conc = 800 ug/L	8.00E+02	3.42E-06	1.90E+00	7.20E+01

A2. 1B Worksheet for Calculating Soil Cleanup Levels for Protection of Human Health: (Soil Direct Contact Pathway)

Method B: Unrestricted Land Use (WAC 173-340-740)

Date: 12/30/2014
Site Name: GTH-Calhoun
Sample Name: SB-35-10

Chemical of Concern or EC group	Current Condition				Adjusted Condition			
	Measured Soil Conc @dry basis	HQ	RISK	Pass or Fail?	Soil Conc being tested	HQ	RISK	Pass or Fail?
	mg/kg	unitless	unitless		mg/kg	unitless	unitless	
Petroleum EC Fraction								
AL_EC >5-6	10.1	8.04E-05			1.71E+01	1.36E-04		
AL_EC >6-8	397	3.16E-03			6.73E+02	5.35E-03		
AL_EC >8-10	199	8.98E-02			3.37E+02	1.52E-01		
AL_EC >10-12	318	1.43E-01			5.39E+02	2.43E-01		
AL_EC >12-16	18	1.08E-02			3.05E+01	1.83E-02		
AL_EC >16-21	2.64	2.38E-05			4.47E+00	4.03E-05		
AL_EC >21-34	0				0.00E+00			
AR_EC >8-10	530	7.17E-02			8.98E+02	1.22E-01		
AR_EC >10-12	304.5	2.06E-01			5.16E+02	3.49E-01		
AR_EC >12-16	44.7	1.61E-02			7.57E+01	2.73E-02		
AR_EC >16-21	2.64	1.58E-03			4.47E+00	2.68E-03		
AR_EC >21-34	0				0.00E+00			
Benzene	0.418	1.31E-03	2.30E-08		7.08E-01	2.22E-03	3.90E-08	
Toluene	1.2	2.00E-04			2.03E+00	3.39E-04		
Ethylbenzene	5.65	7.57E-04			9.57E+00	1.28E-03		
Total Xylenes	21.85	1.47E-03			3.70E+01	2.48E-03		
Naphthalene	19.5	1.61E-02			3.30E+01	2.73E-02		
1-Methyl Naphthalene	3.7	9.50E-04			6.27E+00	1.61E-03		
2-Methyl Naphthalene	7.8	2.50E-02			1.32E+01	4.24E-02		
n-Hexane	7.5	1.69E-03			1.27E+01	2.87E-03		
MTBE	0.402				6.81E-01			
Ethylene Dibromide (EDB)	0		0.00E+00		0.00E+00	0.00E+00	0.00E+00	
1,2 Dichloroethane (EDC)	0		0.00E+00		0.00E+00	0.00E+00	0.00E+00	
Benzo(a)anthracene	0		0.00E+00	*For*	0.00E+00		0.00E+00	*For*
Benzo(b)fluoranthene	0		0.00E+00	*all*	0.00E+00		0.00E+00	*all*
Benzo(k)fluoranthene	0		0.00E+00	*cPAHs*	0.00E+00		0.00E+00	*cPAHs*
Benzo(a)pyrene	0		0.00E+00		0.00E+00		0.00E+00	
Chrysene	0		0.00E+00		0.00E+00		0.00E+00	
Dibenz(a,h)anthracene	0		0.00E+00	ΣRisk=	0.00E+00		0.00E+00	ΣRisk=
Indeno(1,2,3-cd)pyrene	0		0.00E+00	0.00E+00	0.00E+00		0.00E+00	0.00E+00
Sum	**1894.6**	5.90E-01	2.30E-08		3.21E+03	1.00E+00	3.90E-08	

TEST CURRENT CONDITION

Measured TPH Soil Conc, mg/kg= 1894.600
HI= 5.902E-01
RISK= 2.302E-08
Pass or Fail? Pass
Check Residual Saturation (WAC340-747(10))

CALCULATE PROTECTIVE CONDITION

This tool allows the user to calculate protective TPH soil concentration based on various soil quality criteria. The Workbook uses the same composition ratio as for the measured data.

Calculate Protective TPH Soil Conc

Selected Criterion:
Most Stringent?
Protctive TPH Soil Conc, mg/kg =
HI =
RISK =

TEST ADJUSTED CONDITION

This tool allows the user to test whether a particular TPH soil concentration is protective of human health. The Workbook uses the same composition ratio as for the measured data.

Test Adjusted TPH Soil Conc

Tested TPH Soil Conc, mg/kg =
HI =
RISK =
Pass or Fail?

TABLE 3