MEARNS CONSULTING LLC
ENVIRONMENTAL CONSULTANTS
RISK ASSESSORS

738 Ashland Avenue, Santa Monica, California 90405
Cell 310.403.1921
Tel 310.396.9606 Fax 310.396.6878
Mearns@MearnsConsulting.com
www.MearnsConsulting.com

Human Health Risk Assessment
712 Baker Street
Long Beach, California 90806

January 14, 2016

Prepared for:

Integral Communities
888 San Clemente, Suite100
Newport Beach, California 92660

Prepared by:

Mearns Consulting LLC
738 Ashland Avenue
Santa Monica, California 90405

MEARNS CONSULTING LLC
ENVIRONMENTAL CONSULTANTS
RISK ASSESSORS

738 Ashland Avenue, Santa Monica, California 90405
Cell 310.403.1921
Tel 310.396.9606 Fax 310.396.6878
Mearns@MearnsConsulting.com
www.MearnsConsulting.com

January 14, 2016

via email

Mr. Erik Weeks
Vice President – Land Acquisition
Integral Communities
888 San Clemente, Suite 100
Newport Beach, California 92660

RE: **Human Health Risk Assessment**
712 Baker Street, Long Beach, California 90806

Dear Mr. Weeks:

I am pleased to present this Human Health Risk Assessment (HRA) for the 20-acre property located at 712 Baker Street in Long Beach, California (the site) pursuant to your authorization. The site is planned for development of 275 residential units.

This HRA followed the guidance in the Department of Toxic Substances Control (DTSC) *Preliminary Endangerment Assessment* (PEA) guidance manual (DTSC 2013), U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (RAGs) (USEPA 2004), the U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (Part F, Supplemental Guidance for Inhalation Risk Assessment) (USEPA 2009), the Massachusetts Department of Environmental Protection (MADEP) *Characterizing Risks posed by Petroleum Contaminated Sites* manual (MADEP October 31, 2002), the DTSC LeadSpread 8.0 Model, the DTSC modified Johnson & Ettinger soil gas screen, USEPA version 2.0 model (April 2003),and the DTSC modified Johnson & Ettinger groundwater screen, USEPA version 3.0 model (April 2003), both modified by DTSC Office of Human and Ecological Risk (HERO) December 2014.

This human health risk assessment assessed the potential risk and hazard attributable to exposure to 83 constituents, including lead.

DTSC's LeadSpread 8.0 Model results indicate that lead poses an unacceptable hazard to adults and children in a residential exposure scenario; therefore removal of soil to a depth of 10-feet below ground surface (bgs) is necessary at locations that exceed lead concentrations of 80 milligrams per kilogram (mg/kg).

The Johnson & Ettinger soil gas screen and groundwater screen model results indicate that VOCs detected in soil vapor at 5-feet and 15-feet bgs and in groundwater at 47-feet bgs pose an unacceptable risk and hazard to adults and children in a residential exposure scenario. Methane was measured in the subsurface at concentrations that require a methane mitigation system be installed subslab.

The methane mitigation system subslab of all buildings (and paved parking greater than 5000square feet) will consist, at a minimum, of an impermeable barrier beneath which will be either a 4-inch or 6-inch gravel blanket within which will be slotted horizontal piping runs connected to vertical vent pipe risers. Although designed to capture and vent methane to the atmosphere, other VOCs in the subsurface also will be captured and vented by this system.

Even though the noncarcinogenic constituents impact different target organs the estimated hazard quotients of each constituent detected in soil at 5-feet and 10-feet bgs were summed to provide a hazard index. The results of the risk assessment indicate that the estimated summed hazard index of the noncarcinogenic constituents in soil did exceed the target hazard threshold for the residential child. The estimated hazards of the metals cadmium and arsenic via the ingestion and dermal contact exposure routes contributed the greatest hazard to the residential child. The estimated hazard index of the noncarcinogenic constituents detected in soil did not exceed the target threshold for the residential adult, commercial worker and construction worker scenarios.

The estimated risk of each carcinogenic constituent detected in soil at 5-feet and 10-feet bgs were summed to provide a summed risk. The results of the risk assessment indicate the summed risk of the carcinogenic constituents in soil did exceed the target threshold $1x10^{-6}$ for the residential child and residential adult and the target threshold of $1x10^{-5}$ for the commercial worker. The estimated risks due to exposure to arsenic and hexavalent chromium via ingestion and dermal contact pathways for the residential child and due to exposure to arsenic via ingestion and dermal contact pathways for the residential adult and commercial worker contributed the risks.

Therefore removal of soil to a depth of 10-feet bgs containing concentrations of arsenic greater than 16mg/kg is necessary.

The results of the risk assessment indicate that soil removal to a depth of 10-feet bgs, the maximum depth at which residential occupants, construction workers and commercial workers potentially may be exposed to constituents in site soils, at locations with concentrations of lead greater than 80mg/kg and arsenic greater than 16mg/kg is necessary prior to development; additionally subslab methane mitigation will be required during development.

Should you have any questions or desire additional information, please do not hesitate to contact me at 310.403.1921.

Sincerely,

X Susan Mearns

Susan L. Mearns, Ph.D.

Mearns Consulting LLC

TABLE OF CONTENTS

EXECUTIVE SUMMARY

The objectives of this Human Health Risk Assessment (HRA) are: (1) to evaluate potential health risks to human receptors posed by concentrations of constituents detected at least one time in the soil matrix, soil vapor and shallow groundwater underlying the 20-acre property located at 712 Baker Street in Long Beach California 90806 (the site), and (2) to determine risk-based clean-up goals and/or mitigation measures protective of human health.

This HRA followed the guidance in the Department of Toxic Substances Control (DTSC) *Preliminary Endangerment Assessment* (PEA) guidance manual (DTSC 2013), U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (RAGs) (USEPA 2004), the U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (Part F, Supplemental Guidance for Inhalation Risk Assessment) (USEPA 2009), the DTSC *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (DTSC, October 2011), the Massachusetts Department of Environmental Protection (MADEP) *Characterizing Risks posed by Petroleum Contaminated Sites* manual (MADEP October 31, 2002), the DTSC LeadSpread 8.0 Model, the DTSC modified Johnson & Ettinger soil gas screen, USEPA version 2.0 model (April 2003), and the DTSC modified Johnson & Ettinger groundwater screen, USEPA version 3.0 model (April 2003) both modified by DTSC Office of Human and Ecological Risk (HERO) December 2014.

The property is to be developed as a mixture of 275 single family residences and townhomes with two recreation centers and a homeowners' association. The maximum detected concentration or the upper confidence level, whichever was lower pursuant to the ProUCL guidance (USEPA 2004), of the constituent detected in the top 10-feet was used as the exposure point concentration for the residential, commercial worker and construction worker scenarios. Those chemicals of concern that had both reference doses or reference concentrations and slope factors or unit risk factors available, were assessed as both noncarcinogenic and carcinogenic compounds.

DTSC's LeadSpread 8.0 Model estimates the hazard due to exposure to lead in air and onsite soils/dust for adults and children within a residential scenario. Typically lead concentrations in air are not measured onsite. Therefore the model extrapolates these concentrations from the measured concentrations of lead in onsite soils. The percentile blood lead concentration is estimated by the model to provide an estimate of the percentage of a population of children and adults that would be expected to have blood lead levels that exceed the threshold value for a residential exposure scenario.

DTSC's LeadSpread 8.0 Model results indicates that lead does pose an unacceptable hazard to children or adults in a residential exposure scenario; therefore removal of soil to a depth of 10-feet below ground surface (bgs) is necessary at locations that exceed lead concentrations of 80 milligrams per kilogram (mg/kg).

The Johnson & Ettinger soil gas screen model modified by DTSC HERO (December 2014) was used to assess the potential risks and hazards due to exposure to the maximum concentrations of 1,2,4-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene (cumene), naphthalene, n-butylbenzene, n-propylbenzene, toluene, xylenes and styrene detected in the vapor phase at 5-feet and/or 15-feet bgs for a residential exposure scenario. The Johnson & Ettinger model estimated a risk of $8.2x10^{-4}$, greater than the threshold of $1x10^{-6}$, and a hazard of 26 greater than the threshold of 1.

The Johnson & Ettinger groundwater screen model modified by DTSC HERO (December 2014) was used to assess the potential risks and hazards due to exposure to the maximum concentrations of 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2-dichloroethane, 1,2-dichlorobenzene, 1,3,5-trimethylbenzene, 2-butanone (MEK), acetone, benzene, chlorobenzene, chloroform, cis-1,2-dichloroethene, diisopropylether, ethylbenzene, naphthalene, n-butylbenzene, n-propylbenzene, sec-butylbenzene, tert-butylbenzene, toluene, xylenes and vinyl chloride detected in the groundwater at 47-feet bgs for a residential exposure scenario. The Johnson & Ettinger model estimated a risk of $2.6x10^{-4}$, greater than the threshold of $1x10^{-6}$, and a hazard of 8.1 greater than the threshold of 1.

Due to the historic use of the site as a water treatment facility that treated produced water and wastewater recovered during oil well production in settling basins from 1926 to 1998 and the ongoing bioremediation (since 2004) methane is generated at concentrations that requires mitigation. The methane mitigation system subslab of all buildings (and paved parking greater than 5000square feet) will consist of an impermeable barrier beneath which will be either a 4-inch or 6-inch gravel blanket within which will be slotted horizontal piping runs connected to vertical vent pipe risers. Although designed to capture and vent methane to the atmosphere, other VOCs in the subsurface also will be captured and vented by this system.

Additionally the vapor extraction system operated by AECOM Technical Services, Inc. on behalf of Tesoro Logistic Operations, LLC remediating the volatile organic compounds (VOCs) released by Tesoro's pipelines adjacent contiguous to the site along the eastern site boundary with Golden Avenue will continue to operate.

Even though the noncarcinogenic constituents impact different target organs the estimated hazard quotients (HQ) of each constituent detected in soil at 5-feet and 10-feet bgs were summed to provide a hazard index. The results of the HRA indicate that the estimated summed hazard index (HI) of the noncarcinogenic constituents in soil did exceed the target hazard threshold for the residential child. The estimated hazards of the metals cadmium and arsenic via the ingestion and dermal contact exposure routes contributed the greatest hazard to the residential child. The estimated HI of the noncarcinogenic constituents detected in soil did not exceed the target threshold for the residential adult, commercial worker and construction worker scenarios.

The estimated risk of each carcinogenic constituent detected in soil at 5-feet and 10-feet bgs were summed to provide a summed risk. The results of the HRA indicate the summed risk of the carcinogenic constituents in soil did exceed the target threshold $1x10^{-6}$ for the residential child and residential adult and the target threshold of $1x10^{-5}$ for the commercial worker. The estimated risks due to exposure to arsenic and hexavalent chromium via ingestion and dermal contact pathways for the residential child and due to exposure to arsenic via ingestion and dermal contact pathways for the residential adult and commercial worker contributed the risks.

Therefore removal of soil to a depth of 10-feet bgs containing concentrations of arsenic greater than 16mg/kg is necessary.

The results of the HRA indicate that soil removal to a depth of 10-feet bgs at locations with concentrations of lead greater than 80mg/kg and arsenic greater than 16mg/kg is necessary prior to development; additionally subslab methane mitigation will be required during development.

1.0 INTRODUCTION

This report presents the results of a Human Health Risk Assessment (HRA) for the 20-acre property located at 712 Baker Street in Long Beach, California (the site) (Figure 1).

The purpose of this human health risk assessment is to evaluate the potential adverse health impacts due to exposure to concentrations of constituents detected in the soil matrix, soil vapor and shallow groundwater underlying the site. If a constituent was detected one time in soil sampled at 5-feet and 10-feet bgs, and/or one time in soil vapor at 5-feet or 15-feet bgs and/or groundwater at 47-feet bgs it was retained and quantitatively assessed in this human health risk assessment. The following constituents: 1,2,4-trimethylbenzene, benzene, ethylbenzene, naphthalene, n-butylbenzene, n-propylbenzene, toluene and m,p,o-xylenes were detected in all three media and assessed in the risk assessment in each medium. This human health risk assessment assessed the potential risk and hazard attributable to exposure to 13 carcinogenic constituents (including hexavalent chromium, derived by assuming 1/6th the detected concentration of total chromium was hexavalent chromium) and 37 noncarcinogenic constituents, including lead detected in soil at 5-feet and 10-feet bgs; to nine volatile organic compounds (VOCs) detected in soil vapor at 5-feet and 15-feet bgs; and to 24 VOCs detected in groundwater at 47-feet bgs.

This HRA followed the guidance in the Department of Toxic Substances Control (DTSC) *Preliminary Endangerment Assessment* (PEA) guidance manual (DTSC 2013), U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (RAGs) (USEPA 2004), the U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (Part F, Supplemental Guidance for Inhalation Risk Assessment) (USEPA 2009), the DTSC *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (DTSC, October 2011), the Massachusetts Department of Environmental Protection (MADEP) *Characterizing Risks posed by Petroleum Contaminated Sites* manual (MADEP October 31, 2002), and the DTSC LeadSpread 8.0 Model, the DTSC modified Johnson & Ettinger soil gas screen, USEPA version 2.0 model (April 2003) and the DTSC modified Johnson & Ettinger groundwater screen, USEPA version 3.0 model (April 2003), both modified by DTSC Office of Human and Ecological Risk (HERO) December 2014.

As the USEPA and the State of California Office of Environmental Health Hazard Assessment (OEHHA) have not published toxicity values, i.e., Reference Doses (RfDs), for total petroleum hydrocarbons (TPH) the guidance in the Massachusetts Department of Environmental Protection approach to characterizing risks posed by petroleum contaminated sites and in DTSC's PEA Manual (DTSC 2013) were used to obtain surrogate RfDs for C4-C12, C13-C22, C23-C32 and C33-C40 (MADEP 2002, DTSC 2013). As the source of TPH in site soils is from crude oil production and as VOCs and polycyclic aromatic hydrocarbons (PAHs), such as benzene, toluene, ethylbenzene, m,p,o-xylenes (BTEX), hexane, methyl tert-butyl ether, naphthalene and methylnaphthalene were analyzed in soil, soil vapor and groundwater, and BTEX and naphthalene were detected and assessed in this risk assessment in all three media, TPH was assigned aliphatic toxicity criteria. The potential adverse health impacts due to exposure to C4-C12, C13-C22, C23-C32 and C33-C40 and in onsite soils were then assessed by following the appropriate ingestion and dermal contact equations (DTSC 2013).

2.0 SITE BACKGROUND

Background

The 20-acre site located at 712 Baker Street in Long Beach, California 90806 has had historic addresses of 701 Baker Street and 3501, 3539, 3701 and 3801 Golden Avenue. Assessor parcel numbers (APNs) for the site are 7302-002-001, 7302-002-005, 7302-002-007, 7302-002-008, 7302-002-009, and 7302-002-010.

The site is adjacent south of an on-ramp for the I-405 freeway, east of the I-710 freeway and the Los Angeles River, west of Golden Avenue and north of Wardlow Road in Los Angeles County and the City of Long Beach (Figure 1) (Tetra Tech 2015).

The site operated as a water treatment facility that treated produced water and wastewater recovered during oil well production in settling basins from 1926 to 1998. Bioremediation of onsite soils has been ongoing since 2004. A vapor extraction system operated by AECOM Technical Services, Inc. on behalf of Tesoro Logistic Operations, LLC is remediating volatile organic compounds (VOCs) released by Tesoro's pipelines adjacent contiguous to the site along the eastern site boundary with Golden Avenue. The site currently is vacant, unpaved land (Tetra Tech 2015).

The water treatment process initially took place in settling basins. It was designed to remove oil and sediment from the produced water and then discharge the treated water to the Sanitation Districts of Los Angeles County (LACSD) sewer system under a permit issued by the LACSD. Crude oil was recovered for recycling as a by-product of the treatment process. A wastewater treatment plant was constructed onsite in 1959 that consisted of five circular concrete-walled skimming basins and associated pumps, aboveground storage tanks (ASTs), pipelines and related small buildings and facilities (Figure 2). The treatment plant was located north of the two rectangular-shaped, clay-lined settling basins in the southern portion of the site, south of Baker Street. These settling basins were referred to as Basins 1 and 2 (Brycon 2010, 2011).

Basin 1 received oily residual solids that settled out of the produced water. Basin 2 received relatively clean water, after the produced water had undergone retention, skimming, flocculation, and aeration. Treated water was held in Basin 2, until it was discharged offsite. Additional smaller basins were historically present south of Basins 1 and 2. These smaller basins were closed in 1986 and 1987 (Figure 2). The Los Angeles Regional Water Quality Control Board (LARWQCB) issued a waste discharge for land treatment operation related (WDR) Order No. 86-93. This WDR Order was for land treatment by bioremediation of the oily residual solids in Basins 1 and 2 and included monitoring requirements (Brycon 2010, 2011).

The water treatment facility ceased operations in 1988. The City of Long Beach Fire Department (LBFD 2000) directed that liquid hydrocarbon products, wastewater and sludge be removed from the site under a Site Remediation Permit issued by the City of Long Beach, coordinated with the LBFD and City of Long Beach Department of Health Human Services (LBDHHS), and that impacted soil and groundwater be remediated under the oversight of the LBDHHS and LARWQCB in 2002. Buildings, ASTs and related aboveground structures (except for the concrete-walled skimming basins and small, concrete-lined vaults with control valves) were cleaned, demolished and disposed offsite in 2000 and 2001. The August 28, 2002 Consent Decree directed that remediation of Basin 1 take place in accordance with the standards specified by LBDHHS.

Full scale bioremediation commenced in the first quarter 2004 (Brycon 2008) consistent with the LBDHHS approved corrective action plan. Basins 1 and 2 were reconfigured to be used for bioremediation of oil residual solids. Bioremediation activities include periodic disking of the upper 9-inches of oily residual solids and moisture level monitoring. Bioremediated soil, i.e., oily residual solids that conform to remediation standards have been placed in the southern and western portions of the site. The concrete-walled skimming basins were removed in 2011 and bioremediated soil also has been placed at this location. The approximate thickness of the bioremediated soil in these areas is 5-feet to 10-feet. Quarterly soil monitoring reports documenting bioremediation activities have been submitted by Brycon to the LBDHHS since the first quarter 2004.

Quarterly groundwater monitoring has been performed by Brycon since 2001. Prior to 2001, intermittent groundwater monitoring was performed by several consultants. There currently are 14 groundwater monitoring wells onsite. Groundwater monitoring reports are prepared by Brycon and submitted to the LARWQCB. Figure 2 depicts the former configuration of the treatment facility in addition to the groundwater monitoring wells, vapor extraction system and soil boring locations. Figure 3 depicts the bioremediated soil areas.

Previous Environmental Investigations

The site has been investigated extensively by a number of environmental consultants including Emcon Associates (Emcon 1981), Jaykim Engineers, Inc. (JEI 1986 to 1988c), Jack K. Bryant and Associates (JKB 1992), Environmental Science & Engineering, Inc., (ESE) and Brycon, LLC (Brycon 2001 to 2015).

Brycon operated a vapor extraction system in the eastern part of the site from 2012 to 2014 to initially remediate primarily vapor phase benzene adjacent to Golden Avenue (this was performed even though it has not been demonstrated that the benzene in soil gas and groundwater along Golden Avenue at the eastern side of the Site was related to onsite activities). AECOM Technical Services, Inc. on behalf of Tesoro Logistic Operations LLC has been operating a vapor extraction system in the northeastern part of the site since April 2015, and is expected to continue to perform characterization and remediation activities related to one or more Tesoro pipelines beneath Golden Avenue. The Tesoro related activities are in response to a Cleanup and Abatement Order No. R4-2013-0064 (LARWQCB September, 18 2014) (Tetra Tech 2015).

Proposed Development

Current plans are for residential development with a final grade that is expected to be 36 feet to 38 feet above mean sea level (Tetra Tech 2015). It is anticipated that clean fill and native soil on the eastern portion of the site will be excavated to lower the existing grade, and placed in the western part of the site as engineered fill to raise the existing grade.

Site development is planned for townhome-type residences that currently are envisioned to be two- to three stories in height with patio-sized backyards. Recreation centers are planned onsite north of Baker Street and in the southern portion of the site, south of Baker Street. A homeowner’s association is expected to have overall responsibility for maintenance of common areas, the recreation centers, the stormwater detention basin and approving any changes to residences through an architectural review process Tetra Tech 2015). Figure 4 depicts the proposed development.

3.0 SUMMARY OF FIELD ACTIVITIES

Soil vapor 5-feet and 15-feet bgs

Tetra Tech collected soil gas samples from soil vapor probes placed at 5-feet and 15-feet bgs in 2015 (Tetra Tech 2015).

The following VOCs were detected in soil vapor underlying the site: 1,2,4-trimethylbenzene, benzene, ethylbenzene, isopropylbenzene (cumene), naphthalene, n-butylbenzene, n-propylbenzene, toluene and m,p,o-xylenes (Tetra Tech 2015) (Table 1). The maximum concentrations of these VOCs was used at the exposure point concentration in the appropriate Johnson & Ettinger model.

Soil 10-feet bgs and shallower

Soil samples were collected in 2015 by Tetra Tech and submitted for analysis of total petroleum hydrocarbons (TPH), total threshold limit concentration metals, volatile organic compounds, semi-volatile organic compounds, chlorinated pesticides, chlorinated herbicides and polychlorinated biphenyls using the appropriate sampling, collection and analytical methods (Tetra Tech 2015).

Total petroleum hydrocarbons-gasoline range (C4-C12) were detected at concentrations up to 1,500mg/kg in the top 10-feet of soil sampled onsite (Table 2).

Total petroleum hydrocarbons-diesel range (C13-C22) were detected at concentrations up to 15,000mg/kg in the top 10-feet of soil sampled onsite (Table 2).

Total petroleum hydrocarbons-oil range (C23-C32) were detected at concentrations up to 13,000mg/kg in the top 10-feet of soil sampled onsite (Table 2).

Heavy-ends (C33-C40) were detected up to concentration of 8,900mg/kg in the top 10-feet of soil sampled onsite (Table 2).

The following VOCs were detected in the top 10-feet of soil sampled onsite: 1,1,2-trichloroethane, 1,2,4-trimethylbenzene, 1,2-dichlorobenzene, 1,3,5-trimethylbenzene, 2-butanone (MEK), acetone, benzene, cis-1,2-dichloroethene, ethylbenzene, isopropylbenzene, m,p,o-xylenes, naphthalene, n-butylbenzene, n-propylbenzene, p-isopropyltoluene, sec-butylbenzene and toluene (Table 3).

The following metals were detected in the top 10-feet of soil sampled onsite: arsenic, barium, beryllium, cadmium, chromium (although hexavalent chromium was not analyzed, it was assessed in this risk assessment by using the standard practice of assuming 1/6 the concentration of total chromium is hexavalent chromium), cobalt, copper, lead, manganese, mercury, molybdenum, nickel, vanadium and zinc (Table 4).

The following SVOCs, pesticides and polychlorinated biphenyls (PCBs) were detected in the top 10-feet of soil sampled onsite: 2-methylnaphthalene, bis(2-ethylhexyl)phthalate, 4,4'-DDT, chlordane, Aroclor 1254 and Aroclor 1260 (Tables 6, 7 and 8).

Not every soil sample had detected concentrations of the abovementioned constituents. If a constituent was detected one time in the top 10-feet of soil sampled onsite it was retained and quantitatively assessed in this risk assessment.

Tetra Tech measured concentrations of methane greater than 25% of its lower explosive limit (LEL) of 12,500 parts per million by volume (ppmv). Tetra Tech measured methane at 55,900ppmv at 5-feet bgs on the portion of the site north of Baker Street and at 374,000ppmv at 5-feet bgs underlying the former Basins 1 and 2. Based on these concentrations a methane mitigation system subslab of all buildings (and paved parking greater than 5000square feet) will be required and will, at a minimum, consist of an impermeable barrier beneath which will be either a 4-inch or 6-inch gravel blanket within which will be slotted horizontal piping runs connected to vertical vent pipe risers.

Groundwater 47-feet bgs

Total dissolved solids (TDS) ranged from 1,200 milligrams per liter (mg/L) to 4,400 mg/L based on analysis via Untied States Environmental Protection Agency (USEPA) Method No. 160.1, and from 190 mg/L to 3,200 mg/L based on analysis by USEPA Method No. 160.2 during the first quarter groundwater monitoring event in 2015 (Brycon 2015). The pH ranged from 6.7 to 7.1, and the chloride concentration ranged from 340 mg/L to 2,300 mg/L (Brycon, 2015). In general, the TDS and chloride concentrations are high and indicative of water that is not suitable for use as a source of drinking water.

Tetra Tech is not aware of any water supply wells that draw water from the semi-perched zone in the site vicinity. ESE (1999) described the closest water well as located approximately 700 feet west-southwest of the site at 32nd Street and Delta Avenue, west of the Los Angeles River, with a groundwater elevation approximately 25 feet below msl (Los Angeles County Flood Control District [LACFCD] No. 888F). This water well is described as being screened the Gaspur Aquifer. CADWR (1961) shows a water well (ID No. 4W/3S-1404) in a similar location that extends to the top of the Silverado Aquifer at a depth of approximately 650 feet below msl.

VOCs detected in groundwater 47-feet bgs include: 1,1,2,2-tetrachloroethane, 1,1,2-trichloroethane, 1,2,4-trimethylbenzene, 1,2-dibromoethane, 1,2-dichloroethane, 1,4-dichlorobenzene, 1,3,5-trimethylbenzene, 2-butanone (MEK), acetone, benzene, chlorobenzene, chloroform, cis-1,2-dichloroethene, diisopropylether, ethylbenzene, m,o-xylenes, naphthalene, n-butylbenzene, n-propylbenzene, sec-butylbenzene, tert-butylbenzene, toluene and vinyl chloride (Tetra Tech 2015) (Table 5). The maximum concentrations of these VOCs was used as the exposure point concentration in the appropriate Johnson & Ettinger model.

Site Geology and Hydrogeology

Native soil has been characterized as having subtle features such as thin layering, homogeneous coloration, and the presence of thin carbonate stringers. Native soil was encountered beneath the artificial fill north of Baker Street and the western portion of the site south of Baker Street and in the eastern portion of the site south of Baker Street (Tetra Tech 2015).

Native soil was classified as:

- Terrace Deposits: Interbedded silty sand, sand, clayey silt, and sandy silt. Terrace Deposits were encountered in the depth interval of from approximately 18-feet to 2-feet bgs to 5-feet bgs (the maximum depth investigated Tetra Tech, 2015.
- Alluvium: Interbedded sand and silty sand to sandy silt from 26-feet to 30-feet bgs in the southernmost part of the site (Tetra Tech 2015).

The site is located in the floodplain of the Los Angeles River adjacent to the southwest side of Signal Hill. Underlying the Site is the Bellflower aquitard, which American Environmental Management Corporation

(AEM) describes as extending to 65-feet bgs (AEM 1991). Within the Bellflower aquitard is a perched groundwater zone, which is the groundwater zone encountered at the site. Underlying the Bellflower aquiclude is the Gaspur aquifer, which AEM describes as extending from 65-feet bgs to 105-feet bgs. A 5-foot thick clay zone beneath the Gaspur aquifer separates it from the underlying Gage aquifer. The latter extends approximately 50 feet beneath the site (from approximately 110-feet bgs to 160-feet bgs) (Tetra Tech 2015).

The depth to groundwater on May 18, 2015 ranged from 30.28-feet to 50.71-feet bgs. The groundwater flow direction was interpreted to be variable with an overall trend to the west to northwest, with localized flow toward east. A northwest groundwater flow direction at the site was reported by Brycon from October 2007 through March 2015. Prior to 2007, the groundwater flow direction was reported to be variable, including flow directions such as east-northeast, east, east-southeast, southeast, west-southwest, west, northwest, and north (Brycon 2015, ATSI 2015).

The shallow groundwater zone beneath the Site was described in 1999 by ESE (1999) as semi-perched groundwater (the semi-perched zone). According to ESE, the Bellflower Aquiclude usually underlies the semi-perched zone. The Bellflower Aquiclude tends to limit hydraulic communication with the underlying regional groundwater zones. ESE describes the semi-perched zone as degraded by widespread salt water intrusion, industrial wastes, and/or oil field brines.

4.0 CONCEPTUAL SITE MODEL

A conceptual site model was developed to identify the potential complete exposure pathways by which constituents detected in soil could impact human health (Figure 5).

The conceptual site model identifies potential sources, environmental release mechanisms, potential migration pathways, potential exposure pathways, potential exposure routes and potential human receptors onsite.

The conceptual site model identified the following potential complete exposure pathways:

- Future onsite commercial worker
  - ingestion/dermal contact with surface soil
  - inhalation of dust from soil in outdoor air

- Future construction worker
  - ingestion/dermal contact with surface and subsurface soil
  - inhalation of dust from soil in outdoor air

- Future onsite resident
  - ingestion/dermal contact with surface and subsurface soil
  - inhalation of dust that has migrated to indoor air
  - inhalation of soil vapor that has migrated to indoor air

Consumption of fruit or vegetables grown in soil is not considered to be a complete potential exposure pathway under future site conditions because the 20-acre site will be developed as a mixture of 275 single family residences and townhomes with two recreation centers and a homeowners' association.

Potential direct exposures (ingestion and dermal contact) to groundwater are not complete pathways as drinking water is provided by a remote municipal water supply, so there is little chance of incidental exposure. Discharge of groundwater to surface water also is not considered to be a complete migration pathway since there are no surface water bodies that are recharged by artesian flow or groundwater seepage in the vicinity of the site.

The potential for chemicals in soil to leach to underlying groundwater used as a drinking water source is considered very low as several aquitards or aquicludes exist below the maximum depth of impacted soils and groundwater used as a drinking water source.

There is very limited ecological habitat at and near the site. Wetlands were not observed onsite or at adjacent sites. There are no natural or undisturbed areas onsite. Based on the lack of viable ecological habitat at and near the site, there are no complete ecological pathways onsite.

5.0 IDENTIFYING CHEMICALS OF CONCERN

All constituents detected at least one time in the soil matrix sampled in 2015 and VOCs detected in soil vapor and groundwater underlying the site were quantitatively assessed using the appropriate exposure pathway in this risk assessment.

6.0 TOXICITY ASSESSMENT

Toxicity values are combined with exposure factors to estimate noncancer adverse health effects and cancer risks. Toxicity values include reference doses (RfDs), reference concentrations (RfCs), unit risk factors (URFs) and slope factors (SFs) that are used to evaluate noncancer adverse health effects and cancer risks. USEPA (1989) has developed the following hierarchical toxicity identification protocol:

- Integrated Risk Information System (IRIS, USEPA 1999)
- Health Effects Assessment Summary Tables (HEAST, USEPA 1997)
- National Center for Environmental Assessment (NCEA)

The State of California Office of Environmental Health Hazard Assessment (OEHHA) and the State of California Department of Toxic Substances Control (DTSC) Office of Human and Ecological Risk (HERO) have developed URFs SFs, RfCs and RfDs. Pursuant to regulatory agency guidance OEHHA's and HERO’s values are preferentially used instead of USEPA's when available, as OEHHA’s and HERO’s values are generally more conservative than USEPA’s (DTSC 2013, USEPA 2004).

If a constituent had both a risk factor and a reference concentration it was assessed as a carcinogen and as a noncarcinogen. The unit risk factors and reference concentrations were obtained from DTSC HERO (DTSC 2014), ATSDR, IRIS, OEHHA, PPRTV as listed in USEPA’s Regional Screening Levels (November 2015).

The exposure point concentrations, the slope factors and reference doses for the constituents detected in the soil matrix and quantitatively assessed are presented in Table 9.

6.1 Types of Toxicity Values

USEPA recognizes that fundamental differences exist between noncarcinogenic and carcinogenic effects of chemicals. As a result of these differences, the evaluation of potential human health effects associated with noncarcinogenic and carcinogenic chemicals is conducted separately. As summarized in IRIS (USEPA 1999) and HEAST (USEPA 1997), USEPA has developed reference doses to evaluate noncancer effects and slope factors to evaluate carcinogenic effects. If a chemical is considered to cause both noncancer health effects and cancer risks, both reference doses and slope factors may be listed for the chemical. Other chemicals may have only reference doses or slope factors developed, depending on the observed toxic effects.

6.1.1 Reference Doses and Reference Concentrations

Noncancer health effects are evaluated using a reference dose, which is expressed in units of milligrams per kilogram body weight per day (mg/kg-day). A reference dose represents a USEPA-developed, estimated daily exposure level (dose) to which humans may be exposed for a portion of their lifetime (in the case of subchronic reference doses) or for their entire lifetime (in the case of chronic reference doses), without expectation of adverse health effects. USEPA assumes the existence of a threshold concentration for noncancer effects. Below this concentration toxic effects are not expected to occur (USEPA 1989).

Reference doses are often based on animal laboratory studies, from which data are then extrapolated to a chemical concentration considered "safe" for humans. The threshold of observed effects in test animals is divided by uncertainty factors (UFs). Separate uncertainty factors, each of which may be up to 10, are used to account for each of the following:

- Protection of sensitive individuals within the receptor population.
- Extrapolation of toxicity data from animals to humans.
- Extrapolation of subchronic toxicity data to chronic exposure durations.
- Extrapolation from a lowest-observed adverse effect level (LOAEL) to a no-observed adverse effect level (NOAEL) to assess toxicity.

The uncertainty factors for a given chemical are then multiplied together to provide a total uncertainty factor, which is then used to derive a chronic reference dose. In order to derive a reference dose protective of the most sensitive members of the human population, the uncertainty factor may range from one to 10,000. The higher the total uncertainty factor, the more uncertainty and degree of conservativeness there are in the resultant chronic reference dose.

The chronic reference dose is the USEPA-established dose used to evaluate health effects associated with long-term (chronic) exposures of at least seven years (USEPA 1989). The subchronic reference dose is the dose used to evaluate health effects associated with exposures less than seven years (USEPA 1989).

USEPA has developed route-specific reference doses for the oral and inhalation routes of exposure. However, USEPA has not developed reference doses to specifically evaluate possible impacts from dermal (skin) exposure. For this reason, oral reference doses are typically used to estimate possible noncancer health effects from dermal exposure consistent with USEPA (1989) guidance.

USEPA defines a reference concentration as an estimate of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be at appreciable risk of deleterious effects during a lifetime (USEPA 2009). The reference concentration is derived after a review of the health effects database for a chemical and identification of the most sensitive and relevant endpoint along with the principal study or studies demonstrating that endpoint. Uncertainty factors are used to account for uncertainties in the extrapolations from the experimental data conditions to an estimate appropriate to the exposed human scenario (USEPA 2009). The reference concentrations are derived from the following formula:

$$RfC = NOAEL_{[HEC]} /(UF)^1$$

Where: RfC (mg/m^3) = reference concentration
$NOAEL_{[HEC]}$ (mg/m^3) = The NOAEL or analogous exposure level obtained with an alternate approach, dosimetrically adjusted to an HEC
UF = uncertainty factor(s) applied to account for the extrapolations required from the characteristics of the experimental regimen

6.1.2 Cancer Slope Factors and Unit Risk Factors

USEPA has developed route-specific slope factors for chemicals that are known or potential human carcinogens. USEPA (1989) defines a slope factor and a unit risk factor as a plausible upper-bound estimate of the probability of a carcinogenic response in human populations per unit intake of a chemical (averaged over an expected lifetime of 70 years). Slope factors are used to estimate cancer risks and are expressed in units of risk per dose in mg/kg-day ($[mg/kg\text{-}day]^{-1}$).

Most slope factors and unit risk factors are based on a continuous exposure, linear non-threshold extrapolation model (generally the linear multistage model) which is predicated on the assumption that any level of exposure to a carcinogen will result in some degree of carcinogenic risk, however minute (i.e., no threshold is assumed to exist). The extrapolation model derives a mathematical relationship between the generally high chemical doses and resulting effects measured in laboratory animals or epidemiological (human) studies, and applies that relationship to extrapolate effects for the generally lower doses that occur in the environment.

This low-dose extrapolation is generally regarded as a very conservative (health protective) approach. The resulting slope factor typically represents at least the upper 95th percentile of the measured dose-response relationship. USEPA has developed slope factors for oral and inhalation exposure routes but not for the dermal route. Therefore, oral slope factors are typically used to evaluate potential effects from dermal exposure (USEPA 1989).

7.0 EXPOSURE ASSESSMENT

The exposure assessment provides a scientifically defensible basis for the identification of potentially exposed human receptors and the most likely ways they might be exposed to chemicals of concern at the site. As defined by USEPA (1989), the following four components are necessary for chemical exposure to occur:

- A chemical source and a mechanism of chemical release to the environment
- An environmental transport medium (e.g., soil) for the released chemical
- A point of contact between the contaminated medium and the receptor (i.e., the exposure point)
- An exposure route (e.g., ingesting chemically-impacted soil) at the exposure point

All four of these elements must be present for an exposure pathway to be considered complete and for chemical exposure to occur (USEPA 1989).

This HRA evaluated the potential for receptors to be exposed to the maximum detected concentrations or the upper confidence level (UCL), whichever value was less, pursuant to the ProUCL User's Guide (USEPA 2004) of the constituents detected in the top 10-feet of soil. The ProUCL model output is included as Appendix A.

The maximum concentrations of the VOCs detected in soil vapor at 5-feet and 15-feet bgs and from groundwater at 47-feet bgs underlying the site were used as the exposure point concentrations in the appropriate Johnson & Ettinger vapor intrusion models. Data collected from the soil matrix and soil vapor investigation in 2015 (Tetra Tech 2015) and from the groundwater investigation in 2015 (Brycon 2015) were used in the risk assessment. Exposure point concentrations are presented in Table 9.

7.1 Average and Reasonable Maximum Exposures

Typically two types of exposure scenarios are evaluated in a risk assessment; an average exposure scenario, and a reasonable maximum exposure (RME) scenario. The average exposure scenario represents a more typical exposure, believed to be most likely to occur, while the reasonable maximum exposure scenario represents a plausible worst case situation - one that is not very likely to occur. USEPA guidance (1989) recommends evaluating a reasonable maximum exposure scenario. The reasonable maximum exposure scenario estimates the exposure a receptor might receive using highly conservative intake assumptions (e.g., 90^{th} or 95^{th} percentile for most intake assumptions) and the upper confidence limit (UCL) on the mean of the chemical concentrations. It is assumed that by evaluating a reasonable maximum exposure scenario potential health risks to extremely sensitive individuals within a particular receptor population will be adequately addressed. As an added measure of conservatism, only a reasonable maximum exposure scenario was evaluated in this HRA.

The DTSC PEA and USEPA guidance contain formulae that incorporate default values which were selected to be health protective. Some of these default values, such as, the exposure frequency, exposure time and exposure duration, were modified when evaluating the commercial worker and construction worker scenarios (DTSC 2013, USEPA 2004).

8.0 RISK CHARACTERIZATION

The risk characterization process incorporates data from the exposure and toxicity assessments. The exposure assessment information necessary to estimate risks and hazards includes the estimated chemical intakes, exposure modeling assumptions, and the exposure pathways assumed to contribute to the majority of exposure for each receptor over a given time period (USEPA 1989a). The exposure parameters for assessing the constituents detected in the soil matrix are included as Table 10.

The method by which chemicals with carcinogenic and/or noncarcinogenic effects are evaluated to determine whether they pose a risk or an adverse impact to human health is discussed below, relative to the exposure pathways by which the receptors may be exposed to the exposure point concentrations of the chemicals of concern.

8.1 Ingestion and Dermal Contact Pathways

To provide an evaluation of chronic risk along the ingestion and dermal contact pathways the following equations for risk and hazard were used consistent with PEA guidance (DTSC 2013).

$$Risk_{soil} = SF_o \times C_s \times \frac{IR_s \times EF \times ED \times 10^{-6}\ kg/mg}{BW \times AT \times EF} + SF_o \times C_s \times \frac{SA \times AF \times ABS \times EF \times ED \times 10^{-6}\ kg/mg}{BW \times AT \times EF}$$

$$Hazard_{soil} = (1/RfD_o) \times C_s \times \frac{IR \times EF \times ED \times 10^{-6}\ kg/mg}{BW \times AT \times 250\ days/year} + (1/RfD_o) \times C_s \times \frac{SA \times AF \times ABS \times EF \times ED \times 10^{-6}\ kg/mg}{BW \times AT \times EF}$$

Where:
SF_o = oral cancer slope factor (mg/kg-day) $^{-1}$
C_s = concentration in soil (mg/kg)
RfD_o = oral reference dose (mg/kg-day)
ABS = absorption fraction (dimensionless):
Exposure Duration (ED) - years
Exposure Frequency (EF) - days/year

Body Weight (BW) - kg
Incidental Soil Ingestion Rate (IR_s) - mg/day
Exposed Skin (SA) - cm^2
Soil to Skin Adherence Factor (AF) – mg/cm^2
Averaging Time (AT) - years

Chemical specific values for the absorption fractions (ABS) parameter were obtained from USEPA and DTSC (USEPA June 2015; DTSC 2013). Toxicity and exposure point concentrations are found in Table

9. Exposure parameters for assessing constituents detected in the soil matrix are presented in Table 10. The maximum concentration or the upper confidence level, whichever was less, of the constituents detected in the top 10-feet of soils were evaluated in this risk assessment for the residential, commercial worker and construction worker scenarios.

The exposure factors presented in Tables 9 and 10 provide a conservative estimate of chronic risk and hazard to human health due to exposure to the chemicals of concern detected in the soil matrix via the ingestion and dermal contact routes of exposure. The calculated estimates of risk and hazard due to exposure to constituents detected in the soil matrix are provided in Tables 11-15.

8.2 Inhalation Pathway Soil Matrix

To provide an evaluation of chronic risk along the inhalation pathway the following equations (DTSC 2013, USEPA 2009) for estimating risk and hazard due to exposure to constituents of concern detected in the soil matrix were used consistent with PEA guidance (DTSC 2013, USEPA 2009).

Semi-volatile organic compounds and metals in soil are evaluated in outdoor air using particulate emission factors (PEFs) to obtain concentrations of chemicals in dust. PEFs are used to develop an estimate of the concentration of a chemical in dust based on its concentration in soil. It assumes that the dust from the site is caused by the wind and not created by mechanical means (e.g. construction activities, tilling, automobile traffic, etc.) (DTSC 2013).

A default PEF of 1.32E+09 (m^3/kg) is used, because this is the same default value used by the USEPA in its Soil Screening Guidance (USEPA 2009). It assumes an infinite source of chemicals, a vegetative cover of 50%, and a mean annual wind speed of 4.69 m/s. This is equivalent to a dust concentration of 0.76 g/m^3 at the receptor. The default dispersion term (Q/C) of 90.80 (g/m2-s per kg/m3) is based on a site of 0.5 acres and dispersion modeling runs of 29 sites across the United States. The default Q/C provides a conservative estimate of the long-term exposure to dust (DTSC 2013).

$$C_a = (C_s/PEF) \times 1000 \mu g/mg$$

Where:

C_a = concentration in air, mg/m^3
C_s = concentration in soil, mg/kg
PEF = 1.32E09 (default value)

Chronic and SubChronic Exposure

$$EC = CA \times [(ET \times EF \times ED)/AT]$$

Where:

EC = exposure concentration (mg/m^3)
CA = contaminant concentration in air (mg/m^3)
ET = exposure time
EF = exposure frequency
ED = exposure duration
AT = averaging time (varies by receptor and for noncarcinogens and carcinogens)

$$\text{Risk} = \text{EC} \times \text{IUR}$$

Where:

Risk = estimated risk
EC = exposure concentration (µg/m^3)
IUR = inhalation unit risk factor (µg/m^3)$^{-1}$

$$\text{HQ} = \text{EC}/\text{Toxicity value}$$

Where:

HQ = hazard quotient
EC = exposure concentration (mg/m^3)
Toxicity value = inhalation reference concentration (mg/m^3)

The risk and hazard for the air pathway are based on either the exposure to volatile emissions for VOCs or the exposure to fugitive dust emissions for non-VOCs. The Office of Scientific Affairs defines a VOC as a chemical with a vapor pressure of 0.001 mm mercury or higher and a Henry's Law Constant of 1×10^{-5} or higher. Exposure to a chemical via the air pathway can be adequately performed using either volatilization or fugitive dust scenarios; it is not necessary to do both (DTSC 2013).

For this risk assessment exposure to non-VOCs detected in the soil matrix via the inhalation pathway was performed using the fugitive dust scenario.

As the exposure duration was 1 year for construction workers the subchronic exposure was estimated instead of acute exposure, pursuant to USEPA guidance (USEPA 2009). The commercial worker and residential receptors were assessed for chronic exposure.

8.3 The DTSC modified Johnson and Ettinger Model - Soil gas screen, version 2.0 (April 2003; modified by DTSC HERO December 2014)

The exposure point concentrations (the maximum detected concentrations) of VOCs detected at least one time in soil vapor was assessed by the DTSC modified Johnson & Ettinger Model soil gas screen, version 2.0 (April 2003; modified by DTSC HERO December 2014).

The Johnson and Ettinger Model has the following conservative assumptions: (1) steady state conditions exist, (2) an infinite source of contamination exists, (3) the subsurface is homogenous, (4) air mixing within the building is uniform, (5) preferential pathways do not exist, (6) biodegradation of vapors does not occur, (7) contaminants are homogenously distributed, (8) contaminant vapors enter the building primarily through cracks in the foundation and walls, (9) buildings are constructed on slabs or with basements, (10) ventilation rates and pressure differences are assumed to remain constant and (11) the receptors are exposed to these constituents for 350 days per year for 30 years (residential scenario).

The Johnson & Ettinger Model was used to calculate incremental risks and hazards by the following equations imbedded within the model:

$$\text{Risk} = \frac{\text{URF x EF x ED x } C_{building}}{AT_c \text{ x 365 days/year}}$$

Where: URF = unit risk factor µg/m^3; comparable to a SF
EF = exposure frequency = 350 days/year
ED = exposure duration = 30 years
$C_{building}$ = vapor concentration in the building, milligrams per cubic meter (mg/m^3) per µg/kg soil; calculated by the model
AT_c = averaging time for carcinogens; default value = 70

$$\text{Hazard Quotient} = \frac{\text{EF x ED x 1/RfC x } C_{building}}{AT_{nc} \text{ x 365 days/year}}$$

Where: RfC = Reference Concentration mg/m^3; comparable to a RfD
EF = exposure frequency = 350 days/year
ED = exposure duration = 30 years
$C_{building}$ = vapor concentration in the building, milligrams per cubic meter (mg/m^3) per µg/kg soil; calculated by the model
AT_{nc} = averaging time for noncarcinogens; default value = 25

Site specific variables input into the model include the following:

- The depth at which the maximum concentration of the VOC was detected varied from 152 centimeters (cm) to 457cm.
- The soil type in the top 15-feet as depicted in the cross-section prepared by Tetra-Tech was a combination of silty sand, bioremediated soil, clay and poorly graded sand therefore the soil type selected in the model was silt, SI (Appendix B).
- The temperature of groundwater was changed pursuant to the map in the Johnson & Ettinger User's Manual (page 46) to reflect Southern California temperatures of 62^{o}F or 17^{o}C.

The results of the Johnson & Ettinger model are presented below and in Appendix C. The summed estimated risk is 8.2x10^{-4}, greater than the threshold of 1x10^{-6} and the summed estimated hazard is 26, greater than the threshold of 1 indicating VOCs in soil vapor underlying the site pose an adverse impact to future residential occupants.

	Soil vapor concentration µg/m^3	**Indoor Air Concentration µg/m^3**	**Estimated Risk**	**Estimated Hazard**
1,2,4-trimethylbenzene	5.44E+03	4.5E+00	NA	6.2E-01
Benzene	1.67E+05	7.8E+01	8.0E-04	2.5E+01
Ethylbenzene	4.02E+04	1.5E+01	1.3E-05	1.4E-02
Cumene	1.13E+03	3.8E-01	NA	9.1E-04
Naphthalene	4.10E+02	3.4E-01	4.1E-06	1.1E-01
n-butylbenzene	7.24E+02	2.2E-01	NA	1.2E-03
n-propylbenzene	4.2E+03	3.5E+00	NA	3.3E-03
Toluene	1.67E+04	6.9E+00	NA	2.2E-02
Xylenes	5.11E+04	1.9E+01	NA	1.8E-01
SUM			8.2E-04	26

8.4 The DTSC modified Johnson and Ettinger Model – Groundwater screen, version 3.0 (April 2003; modified by DTSC HERO December 2014)

The maximum detected concentrations of VOCs detected at least one time in groundwater 47-feet bgs was assessed by the DTSC modified Johnson & Ettinger Model groundwater screen, version 3.0 (April 2003; modified by DTSC HERO December 2014) for the residential scenario.

The Johnson and Ettinger Model has the following conservative assumptions: (1) steady state conditions exist, (2) an infinite source of contamination exists, (3) the subsurface is homogenous, (4) air mixing within the building is uniform, (5) preferential pathways do not exist, (6) biodegradation of vapors does not occur, (7) contaminants are homogenously distributed, (8) contaminant vapors enter the building primarily through cracks in the foundation and walls, (9) buildings are constructed on slabs or with basements, (10) ventilation rates and pressure differences are assumed to remain constant and (11) the receptors are exposed to these constituents for 350 days per year for 30 years (residential scenario).

The Johnson & Ettinger Model was used to calculate incremental risks and hazards by the following equations imbedded within the model:

$$\text{Risk} = \frac{\text{URF x EF x ED x } C_{building}}{AT_c \text{ x 365 days/year}}$$

Where: URF = unit risk factor µg/m^3; comparable to a SF
EF = exposure frequency = 350 days/year
ED = exposure duration = 30 years
$C_{building}$ = vapor concentration in the building, milligrams per cubic meter (mg/m^3) per µg/kg soil; calculated by the model
AT_c = averaging time for carcinogens; default value = 70

$$\text{Hazard Quotient} = \frac{\text{EF x ED x 1/RfC x } C_{building}}{AT_{nc} \text{ x 365 days/year}}$$

Where: RfC = Reference Concentration mg/m^3; comparable to a RfD
EF = exposure frequency = 350 days/year
ED = exposure duration = 30 years
$C_{building}$ = vapor concentration in the building, milligrams per cubic meter (mg/m^3) per µg/kg soil; calculated by the model
AT_{nc} = averaging time for noncarcinogens; default value = 25

Site specific variables input into the model include the following:

- The depth of groundwater was changed to 1433cm.
- The soil type was changed to reflect silt, SI.
- The temperature of groundwater was changed pursuant to the map in the Johnson & Ettinger User's Manual (page 46) to reflect Southern California temperatures of 62^{o}F or 17^{o}C.

The results of the Johnson & Ettinger model for the residential scenario are presented below and in Appendix D. The estimated risk $2.5x10^{-4}$ is greater than the threshold $1x10^{-6}$. The estimated hazard 8.1 is greater than the threshold of 1; indicating the VOCs detected in groundwater underlying the site do pose an adverse impact to future residents.

RESIDENTIAL SCENARIO

	Groundwater concentration µg/L	Indoor Air Concentration µg/m³	Estimated Risk	Estimated Hazard
1,1,2,2-tetrachloroethan	4.4E-01	1.5E-04	3.0E-09	2.0E-06
1,1,2-trichlororethane	2.6E+00	1.9E-03	1.1E-08	9.3E-03
1,2,4-trimethylbenzene	1.0E+03	3.6E+00	NA	4.9E-01
1,2-dibromoethane	2.45E+02	1.1E-01	2.4E-05	1.4E-01
1,2-dichloroethane	4.3E+02	5.5E-01	5.1E-06	7.5E-02
1,4-dichlorobenzene	4.0E-01	5.6E-04	2.2E-09	6.7E-07
1,3,5-trimethylbenzene	3.4E+02	1.7E+00	NA	4.6E-02
2-butanone (MEK)	1.3E+02	2.2E-02	NA	4.3E-06
Acetone	4.2E+02	6.1E-02	NA	1.9E-06
Benzene	3.9E+03	2.1E+01	2.2E-04	6.9E+00
Chlorobenzene	8.4E-01	2.0E-03	NA	3.9E-05
Chloroform	1.2E+00	4.3E-03	3.3E-08	3.9E-05
Cis-1,2-dichloroethene	1.8E+00	7.5E-03	NA	1.0E-03
Diisopropylether	2.5E+00	4.9E-03	NA	6.8E-06
Ethylbenzene	1.7E+03	9.2E+00	8.2E-06	8.8E-03
m-xylene	5.9E+03	2.9E+01	NA	2.8E-01
Naphthalene	2.6E+02	9.9E-02	1.2E-06	3.1E-02
n-butylbenzene	5.5E+01	4.2E-01	NA	2.3E-03
n-propylbenzene	1.5E+02	9.0E-01	NA	8.6E-04
o-xylene	3.0E+03	1.1E+01	NA	1.0E_01
sec-butylbenzene	2.8E+01	6.0E-03	NA	1.4E-05
Tert-butylbenzene	2.0E+00	1.4E-02	NA	3.4E-05
Toluene	3.6E+03	2.0E+01	NA	6.3E-02
Vinyl chloride	6.9E-01	2.5E-02	7.1E-07	2.4E-04
SUM			2.6E-04	8.1

8.5 DTSC's LeadSpread 8.0 Model

DTSC's LeadSpread 8.0 Model estimates the hazard due to exposure to lead in air and onsite soils/dust for adults and children within a residential exposure scenario. Typically, lead concentrations in air are not measured onsite. Therefore the model extrapolates these concentrations from the measured concentrations of lead in onsite soils.

DTSC's LeadSpread 8.0 Model results indicate that lead does pose an unacceptable hazard to adults or children exposed to the maximum concentration of lead in site soils, 820mg/kg, used in the model as the exposure point concentration. These results are provided in Table 16.

8.6 Noncancer Adverse Health Effects

Noncarcinogenic effects or hazards are typically evaluated by comparing an exposure level over a specified time period (e.g., a lifetime or 25 years), with a reference dose based on a similar time period.

Hazard quotient values less than 1 indicate that potential exposures to noncarcinogenic COCs are not expected to result in toxicity (USEPA 1989). Summing the hazard quotient values to derive a hazard index (HI) provides an estimation of the total potential hazard due to a simultaneous exposure to all the noncarcinogenic COCs. However, summing hazard quotient values is not necessary when the chemicals of concern target different organs within the body (USEPA 1989, DTSC 2013). Although the noncarcinogenic chemicals of concern quantitatively assessed in this risk assessment target different organs within the body, the estimated hazard quotients were summed to derive a HI.

8.7 Lifetime Excess Cancer Risk

Slope factors are used to estimate the potential risk associated with exposure to individual COCs. The slope factor is multiplied by the chronic daily intake averaged over 70 years to estimate lifetime excess cancer risk. "excess" or "incremental" cancer risk represents the probability of an individual developing cancer over a lifetime as a result of chemical exposure, over and above the baseline or "background" cancer risk in the general population. Cancer risks and noncancer health hazards estimated in the HRA are regarded as estimated or theoretical results developed on the basis of the toxicity factors, chemical fate and transport, exposure assumption, and other inputs previously described. Cancer risks do not represent actual cancer cases in actual people. Rather, risks are calculated on the basis of an entirely hypothetical set of conditions. This assumed "exposure scenario" is developed to protect human health, and is based on standard USEPA and Cal-EPA methods and assumptions.

USEPA characterizes theoretical excess lifetime cancer risks below one in one million (10^{-6}) as not of concern and has stated that risks between 10^{-6} and one in 10,000 (10^{-4}) are "safe and protective of public health" (Federal Register 56(20):3535, 1991). Remedial action is not generally required by USEPA for sites with a theoretical lifetime excess risk of less than 10^{-4}; whereas the State of California uses a risk-management approach (DTSC 2011).

The more stringent target risk of 10^{-6} is typically applied to residential receptors. To provide perspective, a total theoretical lifetime excess cancer risk of one in 100,000 (10^{-5}) is frequently accepted by Cal-EPA for worker receptors at California sites, and the target risk for chemicals evaluated under State Proposition 65 regulations is 10^{-5} (22CCR 12703).

8.8 Multipathway Cancer Risk

Based on regulatory guidelines, it is appropriate to combine risk estimates across exposure pathways for a given receptor. At the same time, exposure to multiple carcinogenic COCs is also typically considered to be additive. For exposures to multiple pathways and chemicals, the following equation was used to estimate total theoretical lifetime excess carcinogenic risks:

$$\text{Total Risk} = \sum_{p=1}^{m} \sum_{i=1}^{n} CR_{i,p}$$

Where:

Total Risk	=	Excess cancer risk from exposure to n chemicals via m pathways
m	=	Number of exposure pathways
n	=	Number of chemicals
$CR_{i,p}$	=	Potential cancer risk from exposure to chemical i via pathway p

This equation was used to estimate the total potential cancer risks due to exposure to the carcinogenic COCs via the ingestion, dermal contact and inhalation routes of exposure. The estimated risks, total risk, estimated hazards and hazard index are presented in Tables 11 - 15.

8.9 Estimation of Risks and Hazards

A total of 83 constituents of concern were quantitatively assessed in the risk assessment.

Residential Scenario Child – Soil Matrix

Estimated Risk Ingestion and Dermal Contact **-** The estimated risk due to exposure to constituents detected in the soil matrix via the ingestion and dermal contact exposure routes 3.17×10^{-5} greater than the target threshold 1×10^{-6}.

Estimated Risk Inhalation **-** The estimated risk due to exposure to constituents detected in the soil matrix via the inhalation exposure route is 2.09×10^{-7} less than the target threshold 1×10^{-6}.

Hazard Quotients Ingestion and Dermal Contact **-** The estimated hazard quotients due to exposure to constituents detected in the soil matrix via the ingestion and dermal contact exposure routes is 3.3, which is greater than 1, the target hazard value.

Hazard Quotients Inhalation **-** The estimated hazard quotients due to exposure to constituents detected in the soil matrix via the inhalation exposure route is 0.008, which is less than 1, the target hazard value.

Summed Risk **-** The total risk, summed across all exposure pathways for all carcinogenic chemicals of concern in the soil matrix, is 3.18×10^{-5}, greater than the target risk.

Hazard Index – The total hazard, summed across all exposure pathways for all noncarcinogenic chemicals of concern in the soil matrix is 3.3, greater than the target hazard value. These estimated risk and hazards values are presented in Table 11.

Residential Scenario Adult – Soil Matrix

Estimated Risk Ingestion and Dermal Contact **-** The estimated risk due to exposure to constituents detected in the soil matrix via the ingestion and dermal contact exposure routes 1.39×10^{-5} greater than the target threshold 1×10^{-6}.

Estimated Risk Inhalation **-** The estimated risk due to exposure to constituents detected in the soil matrix via the inhalation exposure route is 2.09×10^{-7} less than the target threshold 1×10^{-6}.

Hazard Quotients Ingestion and Dermal Contact **-** The estimated hazard quotients due to exposure to constituents detected in the soil matrix via the ingestion and dermal contact exposure routes is 0.3, which is less than 1, the target hazard value.

Hazard Quotients Inhalation **-** The estimated hazard quotients due to exposure to constituents detected in the soil matrix via the inhalation exposure route is 0.008, which is less than 1, the target hazard value.

Summed Risk **-** The total risk, summed across all exposure pathways for all carcinogenic chemicals of concern in the soil matrix, is 1.4×10^{-5}, greater than the target threshold 1×10^{-6}.

Hazard Index – The total hazard, summed across all exposure pathways for all noncarcinogenic chemicals of concern in the soil matrix is 0.3, less than the target hazard value. These estimated risk and hazards values are presented in Table 12.

Construction Worker Scenario – Soil Matrix

Estimated Risk Ingestion and Dermal Contact - The estimated risk due to exposure to constituents detected in the soil matrix via the ingestion and dermal contact exposure routes 1.90 x 10^{-6} less than the target threshold 1 x 10^{-5}.

Estimated Risk Inhalation - The estimated risk due to exposure to constituents detected in the soil matrix via the inhalation exposure route is 2.42 x 10^{-9} less than the target threshold 1 x 10^{-5}.

Hazard Quotients Ingestion and Dermal Contact - The estimated hazard quotients due to exposure to constituents detected in the soil matrix via the ingestion and dermal contact exposure routes is 0.04, which is less than 1, the target hazard value.

Hazard Quotients Inhalation - The estimated hazard quotients due to exposure to constituents detected in the soil matrix via the inhalation exposure route is 0.00009, which is less than 1, the target hazard value.

Summed Risk - The total risk, summed across all exposure pathways for all carcinogenic chemicals of concern in the soil matrix, is 1.9 x 10^{-6}, less than the target threshold 1 x 10^{-5}.

Hazard Index – The total hazard, summed across all exposure pathways for all noncarcinogenic chemicals of concern in the soil matrix is 0.04, less than the target hazard value. These estimated risk and hazards values are presented in Table 13.

Commercial Worker Scenario – Soil Matrix

Estimated Risk Ingestion and Dermal Contact - The estimated risk due to exposure to constituents detected in the soil matrix via the ingestion and dermal contact exposure routes 1.61 x 10^{-5} slightly greater than the target threshold 1 x 10^{-5}.

Estimated Risk Inhalation - The estimated risk due to exposure to constituents detected in the soil matrix via the inhalation exposure route is 4.14 x 10^{-8} less than the target threshold 1 x 10^{-5}.

Hazard Quotients Ingestion and Dermal Contact - The estimated hazard quotients due to exposure to constituents detected in the soil matrix via the ingestion and dermal contact exposure routes is 0.2, which is less than 1, the target hazard value.

Hazard Quotients Inhalation - The estimated hazard quotients due to exposure to constituents detected in the soil matrix via the inhalation exposure route is 0.002, which is less than 1, the target hazard value.

Summed Risk - The total risk, summed across all exposure pathways for all carcinogenic chemicals of concern in the soil matrix, is 1.61 x 10^{-5}, slightly greater than the target threshold 1 x 10^{-5}.

Hazard Index – The total hazard, summed across all exposure pathways for all noncarcinogenic chemicals of concern in the soil matrix is 0.23, less than the target hazard value. These estimated risk and hazards values are presented in Table 14.

9.0 UNCERTAINTY ANALYSIS

The uncertainty analysis characterizes the propagated uncertainty in health risk assessments. These uncertainties are driven by variability in:

- The chemical data selection and assumptions used in the models with which concentrations at receptor locations were estimated.
- The variability of receptor intake parameters.
- The accuracy of toxicity values used to characterize exposure, hazards and cancer risks.

Additionally, uncertainties are introduced in the risk assessment when exposures to several substances across multiple pathways are summed.

Quantifying uncertainty is an essential element of the risk assessment process. According to USEPA's Guidance on Risk Characterization for Risk Managers and Risk Assessors, point estimates of risk "do not fully convey the range of information considered and used in developing the assessment" (USEPA 1992). The following components of the risk assessment process can introduce uncertainties:

- Data Collection and Evaluation
- Exposure Assessment
- Toxicity Assessment
- Risk Characterization

9.1 Data Collection and Evaluation

The techniques used for data sampling and analysis and the methods used for identifying chemicals for evaluation in this risk assessment, may result in a number of uncertainties. These uncertainties are itemized below in the form of assumptions.

- It was assumed that the nature and extent of chemical impacts on and near the site have been adequately characterized. If this assumption is not valid, then potential health impacts may be over- or underestimated.

- Systematic or random errors in the chemical analyses may yield erroneous data. These types of errors may result in a slight over- or underestimation of risk.

9.2 Exposure Assessment

A number of uncertainties are associated with the exposure assessment, including estimation of exposure point concentrations and assumptions used to estimate chemical intakes. Key uncertainties associated with these components of the HRA are summarized below.

9.2.1 Exposure Pathways

The exposure pathways evaluated in this HRA are expected to represent the primary pathways of exposure, based on the results of the chemical analyses, and the expected fate and transport of these chemicals in the environment. Minor or secondary pathways may also exist, but often cannot be identified or evaluated using the available data. The contribution of secondary pathways to the overall risk from the site is not likely to be significant. In addition, intake assumptions are reflective of trends (usually for the most sensitive individual within an entire population), and as such are subject to intrinsic variability. In both cases, their presence introduces a level of uncertainty to this risk assessment process.

9.3 Toxicity Assessment

Toxicity information for many chemicals is often limited. Consequently, there are varying degrees of uncertainty with the calculated toxicity values. Sources of uncertainty associated with toxicity values include:

- Using dose-response information from effects observed at high doses to predict the adverse health effects that may occur following exposure to the low levels expected from human contact with the agent in the environment.
- Using dose-response information from short-term exposures to predict the effects of long-term exposures.
- Using dose-response information from animal studies to predict effects in humans.
- Using dose-response information from homogeneous animal populations or human populations to predict the effects likely to be observed in the general population consisting of individuals with a wide range of sensitivities.

To compensate for these uncertainties, USEPA typically applies a margin of safety when promulgating human toxicity values. Therefore, use of USEPA toxicity values likely results in an overestimation of potential hazard and risk.

9.4 Risk Characterization

The reasonable maximum exposure scenario risk characterization represents an over-estimation of risk. Site-specific information regarding depth below ground at which the constituents of concern were detected was not used in the equations. The reasonable maximum exposure scenario estimated the risk to the receptors based on the maximum detected concentrations or the UCLs for the constituents quantitatively assessed in this risk assessment.

9.5 Summary of Risk Assessment Uncertainties

The analysis of the uncertainties associated with this risk assessment indicates that the estimated risks and hazards derived from the equations in the PEA Manual (DTSC 2013), the RAGs Manual (USEPA 2009), the LeadSpread Model (DTSC) and the J&E Models for the reasonable maximum exposure scenario represent an over-estimation of risk. Although as outlined in the sections above, many factors can contribute to the over- or underestimation of risk, in general, a mixture of conservative and upper-bound input values were identified to estimate potential exposures. Compounding conservative and upper-bound input values in the risk assessment process are intended to lead to reasonable, maximum, health-conservative estimates. The actual impacts to human health are most likely less than those estimated in this HRA for the evaluated receptors and pathways.

10.0 REFERENCES

American Environmental Management Corporation (AEM). December 12, 1991. Subsurface Characterization Report of the Southern Portion of Oil Operators, Inc. – 712 West Baker Street – Long Beach, California.

ATSI. April 30, 2015. Tesoro Logistics Operations LLC Soil Vapor Extraction System Installation and Startup Report – Former BP/ARCO Pipelines, Golden Avenue, between Baker Street and Wardlow Road, Long Beach, California.

Brycon, LLC (Brycon). September 28, 2001. Pilot Test Work Plan for Removal, Handling, Treatment and Disposal of Oily Materials from North Pond (Basin 1) at the Oil Operators Incorporated Property, Long Beach, California

Brycon. September 3, 2003. Basin 1 Corrective Action Plan.

Brycon. September 23, 2003. Revised Corrective Action Plan for Basin 1 at the Oil Operators Incorporated Property, Long Beach California.

Brycon. April 15, 2008. 1st Quarter 2008 Quarterly Monitoring Report for Basin 1 – Land Treatment of Petroleum Hydrocarbon - Impacted Soil – Oil Operators Incorporated Property – 712 West Baker Street – Long Beach, California.

Brycon. November 15, 2010. Report On Additional Site Characterization – Oil Operators, Inc. – 712 West Baker Street – Long Beach, California – SCP Case No. 0093; SCPID No. 2044M00.

Brycon. September 30, 2011. Report On Additional Site Characterization – Oil Operators, Inc. – 712 West Baker Street – Long Beach, California – SCP Case No. 0093; SCPID No. 2044M00.

Brycon. January 15, 2013. September 2012 – Quarterly Groundwater Monitoring – Oil Operators Property – 712 West Baker Street – Long Beach, California.

Brycon. March 12, 2015. Remediated Soil Stockpile Areas w Height.

Brycon. April 15, 2015. March 2015 - Quarterly Groundwater Monitoring – Oil Operators Property – 712 West Baker Street – Long Beach, California.

California Environmental Protection Agency (Cal-EPA). 1992. Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities.

California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC). 1997. Selecting Inorganic Constituents as Chemicals of Potential Concern at Risk Assessments at Hazardous Waste Sites and Permitted Facilities. February 1997.

California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC). 2005. Final Report, Background Metals at Los Angeles Unified School Sites – Arsenic. June 6, 2005.

California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC). 2007. Arsenic Strategies, Determination of Arsenic Remediation, Development of Arsenic Cleanup Goals for Proposed and Existing School Sites. March 21, 2007.

California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC). 2011. Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air October 2011.

California Environmental Protection Agency (Cal-EPA) Department of Toxic Substances Control (DTSC). 2013. Preliminary Endangerment Assessment Guidance Manual.

Chernoff, G., W. Bosan and D. Oudiz. Determination of a Southern California Regional Background Arsenic Concentration in Soil

County of Los Angeles. August 28, 2002. Consent Decree – People of the State of California vs. Oil Operators, Inc., A California Corporation: Document filed in the Municipal Court for the Long Beach Judicial District – County of Los Angeles, State of California, Case # 01LM01702.

DTSC's LeadSpread 8.0 Model.

EMCON Associates. February 1981. Hydrogeologic Investigation – IndustrialWaste Transfer Station – Long Beach, California.

Environmental Science & Engineering, Inc. (ESE). October 26, 1999. Groundwater Monitoring Report – Oil Operators Inc. Property – 712 West Baker Street – Long Beach, California – SLIC No. 093.

ESE. February 21, 2000. Groundwater Monitoring Report for the Fourth Quarter 1999 at the Oil Operators Inc. Property, 712 West Baker Street, Long Beach, California.

Jack K. Bryant and Associates, Inc. July 1992. Investigation of Origination of Groundwater/Soil Contamination – Oil Operators South Site – 712 West Baker Street – Long Beach, California.

Jaykim Engineers, Inc. (JEI). September 9, 1986. Ambient Air Survey for Oil Operators Land Farming Operation.

JEI. October 1986. Hydrogeologic and Soils Report for the Closure of Basins 4, 5, and 14 – Oil Operators, Inc.

JEI. January 6, 1987. Well Logs for Ground Water Monitoring Wells for Oil Operators: Letter transmitting boring logs.

JEI. October 15, 1987b. Quarterly Monitoring Report – Land Treatment Operation – Oil Operators, Inc. – Long Beach, California.

JEI. January 15, 1988a. Quarterly Monitoring Report – Land Treatment Operation – Oil Operators, Inc. – Long Beach, California.

JEI. May 3, 1988b. Quarterly Monitoring Report for Oil Operators, Inc. – Long Beach, California.

JEI. July 11, 1988. Quarterly Monitoring Report for Oil Operators, Inc. – Long Beach, California.

Massachusetts Department of Environmental Protection (MADEP). October 31, 2002. Characterizing Risks posed by Petroleum Contaminated Sites: Implementation of the MADEP VPH/EPH Approach.

National Center for Environmental Assessment (NCEA). *In* USEPA 1989.

Office of Environmental Health Hazard Assessment (OEHHA). Unit Risk Factors and Reference Concentrations.

Tetra Tech, Inc. April 3, 2015. Supplemental Site Investigation (SSI) Work Plan for Oil Operators, Inc. Property – 712 Baker Street, Long Beach, California 90806.

Tetra Tech, Inc. April 24, 2015. Supplemental Site Investigation Work Plan Amendment No. 1 - Oil Operators, Inc. Property at 712 Baker Street, Long Beach, California 90806.

Tetra Tech, Inc. July 17, 2015. Supplemental Site Investigation (SSI) Report for Oil Operators, Inc. Property – 712 Baker Street, Long Beach, California 90806.

United States Environmental Protection Agency (USEPA). September 24, 1986. Guidelines for Health Risk Assessment of Chemical Mixtures. 51 FR 34014-34025.

United States Environmental Protection Agency (USEPA). January, 1992(a). Dermal Exposure Assessment: Principles and Applications. Office of Research and Development Response. EPA/600/8-91/011B.

United States Environmental Protection Agency (USEPA). February, 1992(b). Guidance on Risk Characterization for Risk Managers and Risk Assessors.

United States Environmental Protection Agency (USEPA). July, 1996. Soil Screening Guidance: User's Guide. Office of Solid Waste and Emergency Response. Publication 9355.4-23.

United States Environmental Protection Agency (USEPA). August, 1997(a). Exposure Factors Handbook, Volumes I, II and III. Office of Research and Development. EPA/600/P-95/002F.

United States Environmental Protection Agency (USEPA). July, 1997(b). Health Effects Assessment Summary Tables (HEAST). Office of Solid Waste and Emergency Response. EPA-540-R-97-036.

United States Environmental Protection Agency (USEPA). December, 2004. Risk Assessment Guidance for Superfund (RAGs), Office of Emergency and Remedial Response. EPA/540/1-9/002.

United States Environmental Protection Agency (USEPA). 2004. Risk Assessment Guidance for Superfund - Volume I - Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals). Office of Emergency and Remedial Response. Publication 9285.7-01B.

United States Environmental Protection Agency (USEPA). November 2015. Regional Screening Levels.

United States Environmental Protection Agency (USEPA). 2009. Risk Assessment Guidance for Superfund - Volume I - Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment).

United States Environmental Protection Agency (USEPA). April, 2004. ProUCL Guidance.

United States Environmental Protection Agency (USEPA). ProUCL version 5.0

TABLES

Table 1 Soil Vapor Data

Sample ID	Depth ft	1,2,4-Trimethylbenzene	Benzene	Ethylbenzene	Isopropylbenzene	Naphthalene	n-Butylbenzene	n-Propylbenzene	Toluene	Xylenes
SG1-5	5	**0.112**	<0.008	**0.117**	<0.008	**0.024**	<0.008	**0.083**	<0.008	**0.207**
SG1-15	15	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG2-5	5	**0.855**	**2.02**	<0.008	**0.149**	**0.097**	<0.008	**0.394**	**0.063**	**1.08**
SG2-15 (10P)	15	<0.008	**12.3**	**5.87**	<0.008	<0.008	<0.008	<0.008	**9.55**	**38.4**
SG2-15 (1P)	15	<0.008	**26.4**	<0.008	<0.008	<0.008	<0.008	<0.008	**16.7**	<0.008
SG2-15 (3P)	15	<0.008	**33.7**	**8.67**	<0.008	<0.008	<0.008	<0.008	**10.4**	**18.4**
SG3-5	5	**5.44**	<0.008	**6.56**	<0.008	**0.41**	<0.008	**4.2**	<0.008	**7.71**
SG4-5	5	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG4-15	15	**0.539**	<0.008	**0.674**	**0.17**	**0.042**	<0.008	**0.362**	<0.008	**0.739**
SG5-5	5	**4.97**	<0.008	**5.04**	**0.85**	**0.22**	<0.008	**2.92**	<0.008	**2.75**
SG5-5 dup.	5	**5**	<0.008	**5.4**	**1.13**	**0.304**	<0.008	**3.34**	<0.008	**3.04**
SG5-15	15	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG6-5	5	**0.652**	<0.008	**1.41**	<0.008	<0.008	<0.008	**0.678**	<0.008	**1.97**
SG6-15	15	<0.008	**167**	**40.2**	<0.008	<0.008	<0.008	<0.008	**8.47**	**51.1**
SG7-5	5	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG7-15	15	**0.07**	<0.008	**0.114**	<0.008	**0.01**	**0.042**	**0.07**	<0.008	**0.256**
SG8-5	5	**0.684**	<0.008	**1.3**	<0.008	<0.008	<0.008	<0.008	<0.008	**0.564**
SG8-15	15	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG9-5	5	<0.008	<0.008	**0.65**	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG9-15	15	**1.68**	<0.008	**5.78**	**0.298**	**0.162**	**0.638**	**2.43**	**1.09**	**6.08**
SG10-5	5	**0.546**	<0.008	**1.18**	<0.008	<0.008	**0.388**	**0.742**	<0.008	**1.14**
SG10-15	15	<0.008	**1.85**	**0.632**	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG11-5	5	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG11-15	15	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG12-5	5	**0.06**	<0.008	**0.095**	<0.008	<0.008	<0.008	**0.068**	<0.008	**0.139**
SG12-15	15	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG13-5	5	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG13-5 dup.	5	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008	<0.008
SG13-15	15	**2.58**	<0.008	**3.84**	**0.02**	**0.104**	**0.724**	**2.18**	<0.008	**4.15**

Notes: Concentrations are in micrograms per liter (ug/L)

Table 2 Total Petroleum Hydrocarbons (TPH) in Soil 5-feet and 10-feet bgs

Sample ID	Depth (ft.)	TPH Gasoline (C4-C12)	TPH Diesel (C13-C22)	TPH Oil	
				TPH (C23-C32)	TPH (C33-C40)
B1@5	5	<1	**84**	**460**	**670**
B1@10	10	**33**	**2,300**	**2,200**	**1,600**
B2@5	5	<1	**12**	**19**	**13**
B3@5	5	<1	**2,800**	**3,200**	**2,500**
B3@10	10	<1	**8.4**	**9.7**	**4.9**
B4@5	5	**19**	**3,600**	**3,800**	**2,800**
B4@10	10	**42**	**1,500**	**1,200**	**800**
B5@5	5	**37**	**5,700**	**5,200**	**3,700**
B5@10	10	**18**	**1,500**	**1,300**	**950**
B6@5	5	**35**	**2,100**	**1,700**	**1,200**
B6@10	10	**3.4**	**940**	**5,000**	**6,500**
B7@5	5	**2.4**	**1,200**	**1,100**	**790**
B7@10	10	<1	<1	<1	<1
B8-5	5	<1	<1	<1	<1
B8-10	10	**1,500**	**15,000**	<400	<400
B9@5	5	<1	<1	**1.4**	<1
B9@10	10	<1	**1.2**	**1.1**	<1
B12@5	5	<1	<1	<1	<1
B12@10	10	<1	<1	<1	<1
B13@5	5	<1	**4.4**	**25**	**34**
B13@10	10	<1	**180**	**1,200**	**2,300**
B14@5	5	<1	**490**	**1,100**	**850**
B14@10	10	<1	**60**	**220**	**210**
B15@5	5	<1	<1	**1.7**	**2.1**
B15@10	10	<1	<1	<1	**1.5**
B16@3	3	<1	<10	**81**	**190**
B16@10	10	<1	<1	**1.8**	**1.1**
B17@5	5	<1	**360**	**940**	**790**
B17@10	10	<1	<1	**1.3**	<1
B18@3	3	<1	**6,400**	**13,000**	**8,900**
B18@10	10	**13**	**5,500**	**3,600**	**2,100**
B19@5	5	<1	**1.4**	**2**	**2.2**
B19@10	10	<1	**1.4**	**1.2**	<1
B20-5	5	**20**	**4,900**	**4,000**	**2,400**
B20-10	10	<1	**1**	**1.2**	**1.1**
B21@5	5	<1	**1.5**	**13**	**20**
B21@10	10	<1	**48**	**66**	**39**
B22@5	5	<1	**1,700**	**1,900**	**1,100**
B22@10	10	<1	**5.8**	**5.8**	**3.6**
B23@5	5	<1	**20**	**27**	**19**
B23@10	10	**87**	**6,800**	**8,100**	**4,300**
B24-5	5	<1	**17**	**45**	**34**
B24-10	10	<1	**710**	**3,000**	**3,800**

Table 2 Total Petroleum Hydrocarbons (TPH) in Soil 5-feet and 10-feet bgs

Sample ID	Depth (ft.)	TPH Gasoline (C4-C12)	TPH Diesel (C13-C22)	TPH Oil	
				TPH (C23-C32)	TPH (C33-C40)
B25-5	5	<1	**3**	**6.1**	**4.5**
B25-10	10	<1	<1	**1.4**	**1.5**
B26-5	5	<1	**190**	**840**	**920**
B26-10	10	<1	**2.2**	**3.5**	**2.9**
B27-5	5	<1	**3,000**	**4,900**	**3,200**
B27-10	10	**15**	**2,400**	**2,000**	**1,300**
B28@5	5	<1	**490**	**2,600**	**3,500**
B28@10	10	**25**	**51**	**39**	**25**
B29@2	2	<1	**110**	**340**	**370**
B29@5	5	<1	<1	**1.3**	<1
B29@10	10	<1	**1.6**	**1.4**	**1.1**
B30@5	5	<1	**1,400**	**1,800**	**1,400**
B30@10	10	**1.3**	**3,200**	**4,000**	**2,400**
TSO-7-5	5	<0.2	**10**	**180**	
TSO-8-5	5	**2.02**	**3,310**	**1,300**	
TSO-8-10	10	**17.3**	**3,800**	**820**	
TSO-9-10	10	**16.9**	**250**	**54**	
TSO-20-5	5	<0.2	<10	<20	
TSO-20-10	10	<0.2	<10	<20	
GB-SOIL-TSO-7-3-041415	3	**0.28 J**	**5,300**	**7,600**	**4,500**
GB-SOIL-TSO-7-5-041415	5	**0.33**	**71**	**150**	**110**
GB-SOIL-TSO-7-10-0414	10	<0.27	**4.5 J**	**6.3**	**2.9 J**
GB-SOIL-TSO-8-3-041315	3	**150**	**8,600**	**9,400**	**4,400**
GB-SOIL-TSO-8-5-041315	5	**57**	**3,700**	**6,000**	**3,500**
GB-SOIL-TSO-8-10-041315	10	**420**	**1,100**	**1,000**	**500**
GB-SOIL-TSO-8-10D-041315	10	**470**	**4,100**	**3,300**	**1,700**
GB-SOIL-TSO-9-5-041415	5	<0.24	<5	**3 J**	<5
GB-SOIL-TSO-9-10-041415	10	**370**	**99**	**4.5 J**	<5
GB-SOIL-TSO-10-5-041315	5	<0.29	<5	<5	<5
GB-SOIL-TSO-10-10-041415	10	<0.34	<5	<5	<5
GB-SOIL-TSO-10-10D-041415	10	<0.36	<5	<5	<5
GB-SOIL-TSO-11-5-041515	5	<0.3	<5	<5	<5
GB-SOIL-TSO-11-5D-041515	5	<0.29	<5	<5	<5
GB-SOIL-TSO-11-10-041515	10	<0.31	<5	<5	<5
GB-SOIL-TSO-12-7-041515	7	<0.31	<5	**19**	**20**
GB-SOIL-TSO-12-10-041615	10	<0.32	<4.9	<4.9	<4.9
GB-SOIL-TSO-13-5-041515	5	<0.32	<14	<14	<14
GB-SOIL-TSO-13-10-041515	10	<0.34	<5	<5	<5
GB-SOIL-TSO-16-5-041615	5	<0.31	**44**	**83**	**59**
GB-SOIL-TSO-16-5D-041615	5	<0.31	**78**	**170**	**93**
GB-SOIL-TSO-20-5-042115	5	**0.2 J**	**10**	**10**	**6.3**
GB-SOIL-TSO-20-10-042115	10	<0.28	**11**	**17**	**10**

Notes: Concentrations are in milligrams per kilogram (mg/kg)

Table 3 Volatile Organic Compounds (VOCs) Concentrations in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	1,1,2-Trichloroethane	1,2,4-Trimethylbenzene	1,2-Dichlorobenzene	1,3,5-Trimethylbenzene	2-Butanone (MEK)	Acetone	Benzene	cis-1,2-Dichloroethene	Ethylbenzene	Isopropylbenzene	m,p-Xylenes	Naphthalene	n-Butylbenzene
B1@5	5	<0.0042	<0.0042	<0.0042	<0.0042			<0.0042	<0.0042	<0.0042	<0.0042	<0.0085	<0.0042	<0.0042
B1@10	10	<0.19	**6.3**	<0.19	**0.34**			**0.45**	<0.19	**1.7**	**1**	**1.3**	**3.9**	**0.77**
B2@5	5	<0.0041	**0.0089**	<0.0041	<0.0041			**0.005**	<0.0041	<0.0041	<0.0041	<0.0082	<0.0041	<0.0041
B2@10	10	<0.0047	**0.28**	<0.0047	**0.033**			**0.04**	<0.0047	**0.066**	**0.035**	**0.055**	**0.15**	**0.033**
B3@5	5	<0.0043	<0.0043	<0.0043	<0.0043			<0.0043	<0.0043	<0.0043	<0.0043	<0.0087	<0.0043	<0.0043
B3@10	10	<0.0035	<0.0035	<0.0035	<0.0035			<0.0035	<0.0035	<0.0035	<0.0035	<0.007	<0.0035	<0.0035
B4@5	5	<0.19	**3.5**	<0.19	**0.4**			**0.25**	<0.19	**0.76**	**0.48**	**0.7**	**1.9**	**0.33**
B4@10	10	<0.0038	**0.22**	**0.0064**	**0.091**			**0.047**	<0.0038	**0.06**	**0.031**	**0.043**	**0.13**	**0.045**
B5@5	5	<0.22	**4.1**	<0.22	**0.58**			**0.24**	<0.22	**1.1**	**0.6**	**0.8**	**2.6**	**0.54**
B5@10	10	<0.0042	**0.2**	<0.0042	**0.057**			**0.027**	<0.0042	**0.057**	**0.03**	**0.041**	**0.12**	**0.032**
B6@5	5	<0.26	**7.6**	<0.26	**0.29**			<0.26	<0.26	**1.5**	**1.2**	**0.83**	**4.7**	**1**
B6@10	10	<0.0036	<0.0036	<0.0036	<0.0036			<0.0036	<0.0036	<0.0036	<0.0036	<0.0071	<0.0036	<0.0036
B7@5	5	<0.0041	**0.012**	<0.0041	<0.0041			<0.0041	<0.0041	<0.0041	<0.0041	<0.0082	**0.037**	<0.0041
B7@10	10	<0.004	<0.004	<0.004	<0.004			<0.004	<0.004	<0.004	<0.004	<0.008	<0.004	<0.004
B8-5	5	<0.0037	<0.0037	<0.0037	<0.0037			<0.0037	<0.0037	<0.0037	<0.0037	<0.0074	<0.0037	<0.0037
B8-10	10	<0.24	**13**	<0.24	**4.5**			**3.8**	<0.24	**1.5**	**0.41**	**2.8**	**51**	**3.4**
B9@5	5	<0.004	<0.004	<0.004	<0.004			<0.004	<0.004	<0.004	<0.004	<0.008	<0.004	<0.004
B9@10	10	<0.004	<0.004	<0.004	<0.004			<0.004	<0.004	<0.004	<0.004	<0.0079	<0.004	<0.004
B12@5	5	<0.0045	<0.0045	<0.0045	<0.0045			<0.0045	<0.0045	<0.0045	<0.0045	<0.0089	<0.0045	<0.0045
B12@10	10	<0.0046	<0.0046	<0.0046	<0.0046			<0.0046	<0.0046	<0.0046	<0.0046	<0.0093	<0.0046	<0.0046
B13@5	5	<0.0062	<0.0062	<0.0062	<0.0062			<0.0062	<0.0062	<0.0062	<0.0062	<0.012	<0.0062	<0.0062
B13@10	10	<0.0043	<0.0043	<0.0043	<0.0043			<0.0043	<0.0043	<0.0043	<0.0043	<0.0085	<0.0043	<0.0043
B14@5	5	<0.0056	<0.0056	<0.0056	<0.0056			<0.0056	<0.0056	<0.0056	<0.0056	<0.011	<0.0056	<0.0056
B14@10	10	<0.0027	<0.0027	<0.0027	<0.0027			<0.0027	<0.0027	<0.0027	<0.0027	<0.0054	<0.0027	<0.0027
B15@5	5	<0.0049	<0.0049	<0.0049	<0.0049			<0.0049	<0.0049	<0.0049	<0.0049	<0.0098	<0.0049	<0.0049
B15@10	10	<0.0037	<0.0037	<0.0037	<0.0037			<0.0037	<0.0037	<0.0037	<0.0037	<0.0075	<0.0037	<0.0037
B16@3	3	<0.0041	<0.0041	<0.0041	<0.0041			<0.0041	<0.0041	<0.0041	<0.0041	<0.0083	<0.0041	<0.0041
B16@10	10	<0.0045	<0.0045	<0.0045	<0.0045			<0.0045	<0.0045	<0.0045	<0.0045	<0.009	<0.0045	<0.0045
B17@5	5	<0.0044	<0.0044	<0.0044	<0.0044			<0.0044	<0.0044	<0.0044	<0.0044	<0.0088	<0.0044	<0.0044
B17@10	10	<0.0037	<0.0037	<0.0037	<0.0037			<0.0037	<0.0037	<0.0037	<0.0037	<0.0074	<0.0037	<0.0037
B18@3	3	<0.0052	<0.0052	<0.0052	<0.0052			<0.0052	<0.0052	<0.0052	<0.0052	<0.01	<0.0052	<0.0052
B18@10	10	<0.0048	<0.0048	<0.0048	<0.0048			<0.0048	<0.0048	<0.0048	**0.016**	<0.0096	**6.8**	<0.0048
B19@5	5	<0.0069	<0.0069	<0.0069	<0.0069			<0.0069	<0.0069	<0.0069	<0.0069	<0.014	<0.0069	<0.0069
B19@10	10	<0.0049	<0.0049	<0.0049	<0.0049			<0.0049	<0.0049	<0.0049	<0.0049	<0.0099	<0.0049	<0.0049

Table 3 Volatile Organic Compounds (VOcs) in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	n-Propylbenzene	o-Xylene	p-Isopropyltoluene	sec-Butylbenzene	Toluene
B1@5	5	<0.0042	<0.0042	<0.0042	<0.0042	<0.0042
B1@10	10	**1.6**	<0.19	**1.5**	**0.92**	<0.19
B2@5	5	<0.0041	<0.0041	<0.0041	<0.0041	<0.0041
B2@10	10	**0.055**	**0.0054**	**0.049**	**0.031**	**0.0055**
B3@5	5	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043
B3@10	10	<0.0035	<0.0035	<0.0035	<0.0035	<0.0035
B4@5	5	**0.72**	<0.19	**0.71**	**0.47**	<0.19
B4@10	10	**0.05**	**0.007**	**0.044**	**0.032**	**0.0057**
B5@5	5	**0.9**	<0.22	**0.98**	**0.54**	<0.22
B5@10	10	**0.044**	**0.005**	**0.045**	**0.025**	**0.0047**
B6@5	5	**1.9**	<0.26	**1.9**	**1.2**	<0.26
B6@10	10	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036
B7@5	5	<0.0041	<0.0041	**0.0056**	**0.0042**	<0.0041
B7@10	10	<0.004	<0.004	<0.004	<0.004	<0.004
B8-5	5	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037
B8-10	10	**0.79**	**0.27**	**2.2**	**1.2**	**1.6**
B9@5	5	<0.004	<0.004	<0.004	<0.004	<0.004
B9@10	10	<0.004	<0.004	<0.004	<0.004	<0.004
B12@5	5	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045
B12@10	10	<0.0046	<0.0046	<0.0046	<0.0046	<0.0046
B13@5	5	<0.0062	<0.0062	<0.0062	<0.0062	<0.0062
B13@10	10	<0.0043	<0.0043	<0.0043	<0.0043	<0.0043
B14@5	5	<0.0056	<0.0056	<0.0056	<0.0056	<0.0056
B14@10	10	<0.0027	<0.0027	<0.0027	<0.0027	<0.0027
B15@5	5	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049
B15@10	10	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037
B16@3	3	<0.0041	<0.0041	<0.0041	<0.0041	<0.0041
B16@10	10	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045
B17@5	5	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044
B17@10	10	<0.0037	<0.0037	<0.0037	<0.0037	<0.0037
B18@3	3	<0.0052	<0.0052	<0.0052	<0.0052	<0.0052
B18@10	10	**0.028**	<0.0048	<0.0048	**0.034**	<0.0048
B19@5	5	<0.0069	<0.0069	<0.0069	<0.0069	<0.0069
B19@10	10	<0.0049	<0.0049	<0.0049	<0.0049	<0.0049

Table 3 Volatile Organic Compounds (VOCs) in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	1,1,2-Trichloroethane	1,2,4-Trimethylbenzene	1,2-Dichlorobenzene	1,3,5-Trimethylbenzene	2-Butanone (MEK)	Acetone	Benzene	cis-1,2-Dichloroethene	Ethylbenzene	Isopropylbenzene	m,p-Xylenes	Naphthalene	n-Butylbenzene
B20-5	5	<0.0047	<0.0047	<0.0047	<0.0047			<0.0047	<0.0047	**0.025**	**0.025**	<0.0093	**0.15**	**0.025**
B20-10	10	<0.0039	<0.0039	<0.0039	<0.0039			<0.0039	<0.0039	<0.0039	<0.0039	<0.0079	<0.0039	<0.0039
B21@5	5	<0.0042	<0.0042	<0.0042	<0.0042			<0.0042	<0.0042	<0.0042	<0.0042	<0.0083	<0.0042	<0.0042
B21@10	10	<0.0036	<0.0036	<0.0036	<0.0036			<0.0036	<0.0036	<0.0036	<0.0036	<0.0072	<0.0036	<0.0036
B22@5	5	<0.0058	<0.0058	<0.0058	<0.0058			<0.0058	<0.0058	**0.0064**	**0.014**	<0.012	**0.019**	<0.0058
B22@10	10	<0.0034	<0.0034	<0.0034	<0.0034			**0.0046**	<0.0034	**0.0061**	<0.0034	<0.0068	**0.0062**	<0.0034
B23@5	5	<0.004	<0.004	<0.004	<0.004			**0.015**	<0.004	<0.004	<0.004	<0.0081	<0.004	<0.004
B23@10	10	<0.19	**18**	**0.42**	**4.1**			**1.3**	<0.19	**3.9**	**1.4**	**11**	**9.3**	**2.5**
B24-5	5	<0.0039	<0.0039	<0.0039	<0.0039			<0.0039	<0.0039	<0.0039	<0.0039	<0.0078	<0.0039	<0.0039
B24-10	10	<0.0051	<0.0051	<0.0051	<0.0051			<0.0051	<0.0051	<0.0051	<0.0051	<0.01	<0.0051	<0.0051
B25-5	5	<0.0048	<0.0048	<0.0048	<0.0048			<0.0048	<0.0048	<0.0048	<0.0048	<0.0097	<0.0048	<0.0048
B25-10	10	<0.0044	<0.0044	<0.0044	<0.0044			<0.0044	<0.0044	<0.0044	<0.0044	<0.0088	<0.0044	<0.0044
B26-5	5	<0.0044	<0.0044	<0.0044	<0.0044			<0.0044	<0.0044	<0.0044	<0.0044	<0.0088	<0.0044	<0.0044
B26-10	10	<0.0044	<0.0044	<0.0044	<0.0044			<0.0044	<0.0044	<0.0044	<0.0044	<0.0088	<0.0044	<0.0044
B27-5	5	<0.0088	<0.0088	<0.0088	<0.0088			<0.0088	<0.0088	<0.0088	<0.0088	<0.018	<0.0088	<0.0088
B27-10	10	<0.21	**1**	<0.21	<0.21			<0.21	<0.21	**0.98**	**0.59**	<0.41	**3.1**	**0.56**
B28@5	5	<0.0048	<0.0048	<0.0048	<0.0048			<0.0048	<0.0048	<0.0048	<0.0048	<0.0096	<0.0048	<0.0048
B28@10	10	<0.0044	<0.0044	<0.0044	<0.0044			<0.0044	<0.0044	**0.09**	**0.04**	<0.0089	**0.13**	**0.02**
B29@2	2	<0.0038	<0.0038	<0.0038	<0.0038			<0.0038	<0.0038	<0.0038	<0.0038	<0.0075	<0.0038	<0.0038
B29@5	5	<0.0042	<0.0042	<0.0042	<0.0042			<0.0042	<0.0042	<0.0042	<0.0042	<0.0083	<0.0042	<0.0042
B29@10	10	<0.0039	<0.0039	<0.0039	<0.0039			<0.0039	<0.0039	<0.0039	<0.0039	<0.0078	<0.0039	<0.0039
B30@5	5	<0.0045	<0.0045	<0.0045	<0.0045			<0.0045	<0.0045	<0.0045	<0.0045	<0.009	<0.0045	<0.0045
B30@10	10	<0.0037	**0.017**	<0.0037	**0.0058**	<0.01	<0.1	**0.0088**	**0.005**	**0.0038**	<0.0037	**0.0097**	**0.02**	<0.0037
TSO-7-5	5	<0.003	**0.0024**	<0.001	**0.0056**	<0.01	<0.1	<0.001	<0.002	<0.001	<0.001	<0.002	**0.0056**	<0.002
TSO-8-5	5	<0.003	**0.064**	<0.001	**0.007**	<0.01	<0.1	**0.003**	<0.002	**0.017**	**0.008**	**0.014**	**0.035**	**0.004**
TSO-8-10	10	<0.003	**0.118**	<0.001	**0.011**	<0.01	<0.1	**0.015**	<0.002	**0.056**	**0.024**	**0.023**	**0.228**	**0.017**
TSO-9-10	10	<0.003	**0.6**	<0.001	**0.16**	<0.01	<0.1	<0.001	<0.002	**0.023**	**0.007**	**0.069**	**1.11**	**0.074**
TSO-20-5	5	<0.003	<0.001	<0.001	<0.001	<0.01	<0.1	<0.001	<0.002	<0.001	<0.001	<0.002	<0.002	<0.002
TSO-20-10	10	<0.003	<0.001	<0.001	<0.001	<0.01	<0.1	<0.001	<0.002	<0.001	<0.001	<0.002	<0.002	<0.002
GB-SOIL-TSO-7-3-041415	3	<0.0017	<0.0017	<0.0017	<0.0017	<0.0083	<0.017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0033	<0.0041	<0.0041
GB-SOIL-TSO-7-5-041415	5	<0.0015	**0.014**	<0.0015	**0.002**	<0.0077	<0.015	<0.0015	<0.0015	<0.0015	<0.0015	<0.0031	**0.006**	**0.0011 J**
GB-SOIL-TSO-7-10-0414	10	<0.0016	<0.0016	<0.0016	<0.0016	<0.008	<0.016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0032	<0.004	<0.004
GB-SOIL-TSO-7-15-041515	15	<0.002	<0.002	<0.002	<0.002	<0.01	<0.02	<0.002	<0.002	<0.002	<0.002	<0.0041	<0.0051	<0.0051
GB-SOIL-TSO-8-3-041315	3	<0.078	**2.3**	**0.11**	**0.46**	<0.78	<1.6	**0.053 J**	<0.078	**0.4**	**0.24**	**0.3**	**3.1**	**0.58**

Table 3 Volatile Organic Compounds (VOCs) in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	n-Propylbenzene	o-Xylene	p-Isopropyltoluene	sec-Butylbenzene	Toluene
B20-5	5	**0.039**	<0.0047	**0.017**	**0.024**	<0.0047
B20-10	10	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039
B21@5	5	<0.0042	<0.0042	<0.0042	<0.0042	<0.0042
B21@10	10	<0.0036	<0.0036	<0.0036	<0.0036	<0.0036
B22@5	5	**0.018**	<0.0058	**0.0091**	**0.0089**	<0.0058
B22@10	10	**0.0036**	<0.0034	<0.0034	<0.0034	<0.0034
B23@5	5	<0.004	<0.004	<0.004	<0.004	**0.0092**
B23@10	10	**2.6**	**5.1**	**1.9**	**1.4**	**2.6**
B24-5	5	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039
B24-10	10	<0.0051	<0.0051	<0.0051	<0.0051	<0.0051
B25-5	5	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048
B25-10	10	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044
B26-5	5	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044
B26-10	10	<0.0044	<0.0044	<0.0044	<0.0044	<0.0044
B27-5	5	<0.0088	<0.0088	<0.0088	<0.0088	<0.0088
B27-10	10	**1**	<0.21	**0.51**	**0.59**	<0.21
B28@5	5	<0.0048	<0.0048	<0.0048	<0.0048	<0.0048
B28@10	10	**0.056**	<0.0044	<0.0044	**0.023**	<0.0044
B29@2	2	<0.0038	<0.0038	<0.0038	<0.0038	<0.0038
B29@5	5	<0.0042	<0.0042	<0.0042	<0.0042	<0.0042
B29@10	10	<0.0039	<0.0039	<0.0039	<0.0039	<0.0039
B30@5	5	<0.0045	<0.0045	<0.0045	<0.0045	<0.0045
B30@10	10	<0.0037	<0.0037	<0.0037	<0.0037	**0.0044**
TSO-7-5	5	<0.001	<0.001	<0.002	<0.002	<0.001
TSO-8-5	5	**0.013**	**0.006**	**0.01**	**0.006**	<0.001
TSO-8-10	10	**0.036**	<0.001	**0.026**	**0.016**	<0.001
TSO-9-10	10	**0.02**	**0.017**	**0.026**	**0.009**	**0.002**
TSO-20-5	5	<0.001	<0.001	<0.002	<0.002	<0.001
TSO-20-10	10	<0.001	<0.001	<0.002	<0.002	<0.001
GB-SOIL-TSO-7-3-041415	3	<0.0017	<0.0017	<0.0017	<0.0041	<0.0017
GB-SOIL-TSO-7-5-041415	5	<0.0015	<0.0015	**0.0027**	**0.0011 J**	<0.0015
GB-SOIL-TSO-7-10-0414	10	<0.0016	<0.0016	<0.0016	<0.004	<0.0016
GB-SOIL-TSO-7-15-041515	15	<0.002	<0.002	<0.002	<0.0051	<0.002
GB-SOIL-TSO-8-3-041315	3	**0.46**	**0.048 J**	**0.47**	**0.34**	<0.078

Table 3 Volatile Organic Compounds (VOCs) in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	1,1,2-Trichloroethane	1,2,4-Trimethylbenzene	1,2-Dichlorobenzene	1,3,5-Trimethylbenzene	2-Butanone (MEK)	Acetone	Benzene	cis-1,2-Dichloroethene	Ethylbenzene	Isopropylbenzene	m,p-Xylenes	Naphthalene	n-Butylbenzene
GB-SOIL-TSO-8-5-041315	5	<0.088	**0.89**	<0.088	**0.11**	<0.88	<1.8	**0.047 J**	<0.088	**0.23**	**0.12**	**0.2**	**0.49**	**0.14 J**
GB-SOIL-TSO-8-10-041315	10	<0.071	**2.8**	<0.071	**0.35**	<0.71	<1.4	**0.13**	<0.071	**0.92**	**0.53**	**0.49**	**1.7**	**0.6**
GB-SOIL-TSO-8-10D-041315	10	**0.3**	**2.3**	<0.074	**0.31**	<0.74	<1.5	**0.11**	<0.074	**0.77**	**0.46**	**0.4**	**1.4**	**0.53**
GB-SOIL-TSO-9-5-041415	5	<0.0016	<0.0016	<0.0016	<0.0016	<0.0081	<0.016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0032	<0.004	<0.004
GB-SOIL-TSO-9-10-041415	10	<0.19	**6.7**	<0.19	**2.5**	<1.9	<3.8	<0.19	<0.19	**0.15 J**	<0.19	**1.1**	**2.8**	<0.48
GB-SOIL-TSO-10-5-041315	5	<0.0016	<0.0016	<0.0016	<0.0016	<0.0079	<0.016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0032	<0.004	<0.004
GB-SOIL-TSO-10-10-041415	10	<0.0018	<0.0018	<0.0018	<0.0018	<0.0089	<0.018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0036	<0.0045	<0.0045
GB-SOIL-TSO-10-10D-041415	10	<0.0019	<0.0019	<0.0019	<0.0019	<0.0093	<0.019	<0.0019	<0.0019	<0.0019	<0.0019	<0.0037	<0.0046	<0.0046
GB-SOIL-TSO-11-5-041515	5	<0.0016	<0.0016	<0.0016	<0.0016	<0.0081	<0.016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0032	<0.004	<0.004
GB-SOIL-TSO-11-5D-041515	5	<0.0015	<0.0015	<0.0015	<0.0015	<0.0075	<0.015	<0.0015	<0.0015	<0.0015	<0.0015	<0.003	<0.0037	<0.0037
GB-SOIL-TSO-11-10-041515	10	<0.0016	<0.0016	<0.0016	<0.0016	<0.0081	<0.016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0032	<0.004	<0.004
GB-SOIL-TSO-12-7-041515	7	<0.0018	<0.0018	<0.0018	<0.0018	<0.0089	<0.018	<0.0018	<0.0018	<0.0018	<0.0018	<0.0035	<0.0044	<0.0044
GB-SOIL-TSO-12-10-041615	10	<0.0017	<0.0017	<0.0017	<0.0017	<0.0087	<0.017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0035	<0.0044	<0.0044
GB-SOIL-TSO-13-5-041515	5	<0.0034	<0.0034	<0.0034	<0.0034	<0.017	<0.034	<0.0034	<0.0034	<0.0034	<0.0034	<0.0068	<0.0084	<0.0084
GB-SOIL-TSO-13-10-041515	10	<0.0017	<0.0017	<0.0017	<0.0017	<0.0083	<0.017	<0.0017	<0.0017	<0.0017	<0.0017	<0.0033	<0.0042	<0.0042
GB-SOIL-TSO-16-5-041615	5	<0.0015	<0.0015	<0.0015	<0.0015	<0.0076	<0.015	<0.0015	<0.0015	<0.0015	<0.0015	<0.003	<0.0038	<0.0038
GB-SOIL-TSO-16-5D-041615	5	<0.0016	<0.0016	<0.0016	<0.0016	<0.008	<0.016	<0.0016	<0.0016	<0.0016	<0.0016	<0.0032	<0.004	<0.004
GB-SOIL-TSO-20-5-042115	5	<0.0014	<0.0014	<0.0014	<0.0014	**0.0079**	**0.036**	<0.0014	<0.0014	<0.0014	<0.0014	<0.0028	<0.0035	<0.0035
GB-SOIL-TSO-20-10-042115	10	<0.0014	<0.0014	<0.0014	<0.0014	<0.0071	**0.014**	<0.0014	<0.0014	<0.0014	<0.0014	<0.0029	<0.0036	<0.0036

Table 3 Volatile Organci Compounds (VOCs) in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	n-Propylbenzene	o-Xylene	p-Isopropyltoluene	sec-Butylbenzene	Toluene
GB-SOIL-TSO-8-5-041315	5	**0.21**	**0.089**	**0.16**	**0.12 J**	<0.088
GB-SOIL-TSO-8-10-041315	10	**0.87**	<0.071	**0.89**	**0.56**	<0.071
GB-SOIL-TSO-8-10D-041315	10	**0.76**	<0.074	**0.75**	**0.51**	<0.074
GB-SOIL-TSO-9-5-041415	5	<0.0016	<0.0016	<0.0016	<0.004	<0.0016
GB-SOIL-TSO-9-10-041415	10	<0.19	**0.24**	**0.41**	<0.48	**0.1 J**
GB-SOIL-TSO-10-5-041315	5	<0.0016	<0.0016	<0.0016	<0.004	<0.0016
GB-SOIL-TSO-10-10-041415	10	<0.0018	<0.0018	<0.0018	<0.0045	<0.0018
GB-SOIL-TSO-10-10D-041415	10	<0.0019	<0.0019	<0.0019	<0.0046	<0.0019
GB-SOIL-TSO-11-5-041515	5	<0.0016	<0.0016	<0.0016	<0.004	<0.0016
GB-SOIL-TSO-11-5D-041515	5	<0.0015	<0.0015	<0.0015	<0.0037	<0.0015
GB-SOIL-TSO-11-10-041515	10	<0.0016	<0.0016	<0.0016	<0.004	<0.0016
GB-SOIL-TSO-12-7-041515	7	<0.0018	<0.0018	<0.0018	<0.0044	<0.0018
GB-SOIL-TSO-12-10-041615	10	<0.0017	<0.0017	<0.0017	<0.0044	<0.0017
GB-SOIL-TSO-13-5-041515	5	<0.0034	<0.0034	<0.0034	<0.0084	<0.0034
GB-SOIL-TSO-13-10-041515	10	<0.0017	<0.0017	<0.0017	<0.0042	<0.0017
GB-SOIL-TSO-16-5-041615	5	<0.0015	<0.0015	<0.0015	<0.0038	<0.0015
GB-SOIL-TSO-16-5D-041615	5	<0.0016	<0.0016	<0.0016	<0.004	<0.0016
GB-SOIL-TSO-20-5-042115	5	<0.0014	<0.0014	<0.0014	<0.0035	<0.0014
GB-SOIL-TSO-20-10-042115	10	<0.0014	<0.0014	<0.0014	<0.0036	<0.0014

Notes: Concentrations are in milligrams per kilogram (mg/kg)
Only detected concentrations of VOCs in soil 5-feet and 10-feet bgs are presented

Table 4 Metal Concentrations in Soil 5-feet and 10-feet bgs

Sample ID	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Vanadium	Zinc
B1@5	7.3	98	<1	<1	17	8.5	17	11		<0.1	<1	14	31	53
B1@10	6.6	620	<1	<1	20	7	37	200		0.37	<1	18	29	78
B2@5	2.1	130	<1	<1	18	7.7	26	12		<0.1	<1	15	31	71
B2@10	11	410	<1	<1	24	7.5	30	140		0.17	<1	18	32	400
B3@5	8.2	690	<1	1	22	7.7	55	480		0.83	<1	21	32	95
B3@10	4	84	<1	<1	18	9.2	22	5.2		<0.1	<1	17	28	39
B4@5	11	760	<1	1	21	7.4	74	520		1.5	<1	22	30	120
B4@10	12	370	<1	<1	20	7.3	28	86		0.11	<1	17	29	87
B5@5	5.9	550	<1	<1	19	7.1	44	280		0.52	<1	19	31	90
B5@10	14	350	<1	<1	20	7.7	30	160		0.19	<1	16	29	110
B6@5	6.7	540	<1	<1	20	6.8	33	170		0.31	<1	17	29	93
B6@10	1.2	100	<1	<1	9.9	3.4	13	19		<0.1	<1	13	19	30
B7@5	3.7	210	<1	<1	21	8.9	20	12		<0.1	<1	15	35	40
B7@10	5.2	150	<1	<1	27	11	29	7.5		<0.1	<1	20	46	47
B8-5	2.8	65	<1	<1	20	8.5	20	5.2	410	<0.1	<1	18	36	36
B8-10	24	110	<1	<1	32	6.4	50	11		<0.1	<1	14	59	44
B9@5	1.9	99	<1	<1	20	10	19	5.6		<0.1	<1	18	39	280
B9@10	14	86	<1	<1	19	6.6	20	4.7		<0.1	<1	16	36	65
B10@2	1.4	67	<1	<1	13	5.2	15	8.9	310	<0.1	<1	11	22	34
B11@2	1.7	83	<1	<1	17	5.8	17	21	280	<0.1	<1	24	24	42
B12@2	2.1	71	<1	<1	12	4.8	12	10	230	<0.1	<1	8.9	21	47
B12@5	1.9	45	<1	<1	10	3.9	6.9	2.8		<0.1	<1	7.7	19	20
B12@10	2.4	29	<1	<1	5.7	2.4	5.3	2		<0.1	<1	6.5	12	11
B13@2	12	430	<1	<1	20	6	20	46	290	0.13	<1	17	27	54
B13@5	<1	92	<1	<1	15	6	18	54		<0.1	<1	10	29	88
B13@10	38	200	<1	<1	16	5.9	20	57		<0.1	<1	12	27	56
B14@5	16	500	<1	<1	23	6.5	26	69		0.15	<1	20	27	67
B14@10	20	120	<1	<1	17	7.6	29	32		<0.1	<1	14	29	48
B15@5	<1	130	<1	<1	12	5	14	2.5		<0.1	<1	15	23	30
B15@10	1.1	310	<1	<1	19	6.2	18	5		<0.1	<1	15	27	37
B16@3	1.8	74	<1	<1	13	5.8	14	5.3		<0.1	<1	13	23	32
B16@10	<1	500	<1	<1	61	4.9	40	18		<0.1	<1	15	33	33
B17@5	4.4	64	<1	<1	11	4.1	11	3.9		<0.1	<1	8.9	17	26
B17@10	1.8	84	<1	<1	15	6.6	18	3.1		<0.1	<1	11	28	36
B18@3	2.8	250	<1	<1	14	8.1	28	610		0.36	<1	27	29	210
B18@10	2.1	140	<1	<1	16	6.9	21	4.4		<0.1	<1	16	32	39
B19@5	1.5	190	<1	<1	18	8.5	26	6.5		0.12	<1	15	33	47
B19@10	2.5	120	<1	<1	21	8.2	21	4.6		<0.1	<1	17	33	40
B20-5	<1	130	<1	<1	14	6.1	15	3		<0.1	<1	12	29	36
B20-10	6.1	160	<1	<1	26	10	37	6.8		<0.1	<1	21	45	49
B21@5	6	100	<1	<1	18	6.8	18	30		<0.1	<1	13	31	43
B21@10	11	440	<1	<1	21	7.9	24	28		<0.1	<1	17	36	41
B22@5	2.5	150	<1	<1	16	6.9	17	16		<0.1	<1	16	31	130
B22@10	14	290	<1	<1	22	8.2	25	5.5		<0.1	<1	18	39	65
B23@5	5.2	180	<1	<1	20	11	18	5.8		<0.1	<1	16	33	78
B23@10	26	340	<1	<1	20	7	25	29		<0.1	<1	17	32	53
B24-5	13	90	<1	<1	16	5.8	14	9.1		<0.1	<1	11	25	32
B24-10	<1	170	<1	<1	12	5.7	14	2.6		<0.1	<1	14	27	32

Table 4 Metal Concentrations in Soil 5-feet and 10-feet bgs

Sample ID	Arsenic	Barium	Beryllium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Mercury	Molybdenum	Nickel	Vanadium	Zinc
B25-5	**1.3**	**70**	<1	<1	**12**	**5.4**	**13**	**2.8**		<0.1	<1	**9.3**	**26**	**33**
B25-10	<1	**78**	<1	<1	**13**	**6.2**	**14**	**3.4**		<0.1	<1	**11**	**27**	**37**
B26-5	**9.8**	**350**	<1	<1	**21**	**8.2**	**24**	**21**		<0.1	<1	**18**	**35**	**42**
B26-10	**4.2**	**170**	<1	<1	**21**	**7.2**	**21**	**6.2**		<0.1	<1	**20**	**28**	**36**
B27-5	**4.7**	**160**	<1	**3.2**	**20**	**7.1**	**230**	**65**		**0.44**	<1	**20**	**38**	**4,700**
B27-10	**6**	**360**	<1	<1	**18**	**6.1**	**24**	**28**		**0.13**	<1	**16**	**30**	**66**
B28@5	**1.9**	**52**	<1	<1	**8.4**	**3.6**	**10**	**16**		<0.1	<1	**11**	**21**	**22**
B28@10	**3.2**	**150**	<1	<1	**24**	**9.3**	**28**	**7.5**		<0.1	<1	**17**	**33**	**46**
B29@2	**2.2**	**140**	<1	<1	**14**	**4.7**	**16**	**11**		**0.11**	<1	**33**	**21**	**36**
B29@5	**2**	**230**	<1	<1	**28**	**11**	**35**	**6.5**		<0.1	<1	**36**	**42**	**46**
B29@10	**2.2**	**240**	<1	<1	**26**	**10**	**32**	**6**		<0.1	<1	**25**	**41**	**45**
B30@5	**3**	**130**	<1	<1	**15**	**6.4**	**16**	**18**		**0.14**	<1	**13**	**33**	**43**
B30@10	**120**	**1,100**	<1	**1.1**	**50**	**5.5**	**33**	**820**		**0.21**	<1	**22**	**27**	**130**
TSO-7-5	**4.92**	**124**	<0.5	<0.5	**21.1**	**8.3**	**17.2**	**25.2**		<0.2	**0.5**	**14.5**	**29**	**38.3**
TSO-8-5	**12.2**	**724**	<0.5	<0.5	**23.3**	**9.18**	**48**	**352**		**0.3**	**0.5**	**18.3**	**31.6**	**98.4**
TSO-8-10	**9.53**	**346**	<0.5	<0.5	**18.4**	**8.89**	**27.8**	**72.4**		**0.2**	**0.5**	**15.4**	**29.8**	**61.2**
TSO-9-10	**7.34**	**70.8**	<0.5	<0.5	**15.9**	**6.63**	**23.1**	**8.1**		<0.2	**0.803**	**11.9**	**28.2**	**38.1**
TSO-20-5	**5.65**	**170**	<0.5	<0.5	**17.5**	**7.76**	**17.4**	**2.88**		<0.2	**0.5**	**12.2**	**29.5**	**32.1**
TSO-20-10	**8.51**	**196**	**0.52**	<0.5	**23.8**	**12.9**	**29.9**	**5.97**		<0.2	**0.5**	**19.1**	**45.4**	**45**
GB-SOIL-TSO-7-3-041415								**500**						
GB-SOIL-TSO-7-5-041415								**11**						
GB-SOIL-TSO-7-10-0414								**4.7**						
GB-SOIL-TSO-8-3-041315								**550**						
GB-SOIL-TSO-8-5-041315								**340**						
GB-SOIL-TSO-8-10-041315								**120**						
GB-SOIL-TSO-8-10D-041315								**110**						
GB-SOIL-TSO-9-5-041415								**5.7**						
GB-SOIL-TSO-9-10-041415								**15**						
GB-SOIL-TSO-10-5-041315								**4.5**						
GB-SOIL-TSO-10-10-041415								**10**						
GB-SOIL-TSO-10-10D-041415								**10**						
GB-SOIL-TSO-11-5-041515								**6.3**						
GB-SOIL-TSO-11-5D-041515								**6.1**						
GB-SOIL-TSO-11-10-041515								**4.8**						
GB-SOIL-TSO-12-7-041515								**8.1**						
GB-SOIL-TSO-12-10-041615								**7.2**						
GB-SOIL-TSO-13-5-041515								**4.6**						
GB-SOIL-TSO-13-10-041515								**9.8**						
GB-SOIL-TSO-16-5-041615								**13**						
GB-SOIL-TSO-16-5D-041615								**12**						
GB-SOIL-TSO-20-5-042115								**4.1**						
GB-SOIL-TSO-20-10-042115								**10**						

Notes: Only detected concentrations of metals in soil samples from 5-feet and 10-feet below ground surface are presented.
Concentrations are in milligrams per kilogram (mg/kg)
Blank cell denotes metal was not analyzed

Table 5 Volatile Organic Compounds (VOCs) Concentrations in Groundwater

Sample ID	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene	1,2-Dibromoethane (EDB	1,2-Dichloroethane	1,2-Dichloropropane	1,3,5-Trimethylbenzene	1,4-Dichlorobenzene	2-Butanone (MEK	2-Chlorotoluene	2-Hexanone	4-Chlorotoluene	4-Methyl-2-pentanone (MIBK	Acetone	Benzene	Chlorobenzene	Chloroform	cis-1,2-Dichloroethene	Diisopropyl ether (DIPE
92-MW1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Brycon-MW1	<0.5	<0.5	<1	**760**	<1	**18**	<0.5	**34**	<0.5	<0.5	<0.5	<0.5	<1	<0.5	<0.5	**360**	<0.5	<0.5	<0.5	<1
Brycon-MW2	<0.5	<0.5	<0.5	**1.7**	<0.5	<0.5	<0.5	**6.3**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**180**	<0.5	<0.5	<0.5	**1.5**
Brycon-MW3	<0.5	<0.5	<0.5	**900**	<0.5	<0.5	<0.5	**160**	<0.5	<0.5	<0.5	<0.5	**0.69**	<0.5	<0.5	**400**	<0.5	<0.5	<0.5	<0.5
Brycon-MW4	<0.5	<0.5	**1**	**0.53**	<0.5	**6.2**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**2.5**	<0.5	<0.5	<0.5	<0.5
Brycon-MW5	<0.5	<0.5	<0.5	**2.8**	<0.5	**10**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**26**	<0.5	<0.5	<0.5	<0.5
ESE-MW2	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
ESE-MW1	<0.5	<0.5	<2	**1,000**	<2	**2.1**	<0.5	**240**	<0.5	<0.5	<0.5	<0.5	<2	<0.5	<0.5	**1,000**	<0.5	<0.5	<0.5	<2
TMW1	<0.5	<0.5	<0.5	<0.5	<0.5	**5.5**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TMW1-D1	<0.5	<0.5	<0.5	<0.5	<0.5	**5.6**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TMW2	<0.5	<0.5	<0.5	**0.76**	<0.5	<0.5	<0.5	**0.52**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TMW3	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TMW4	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TMW5	<0.5	<0.5	<0.5	**750**	**72**	**430**	<0.5	**340**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**3,900**	<0.5	<0.5	<0.5	<0.5
TMW6	<0.5	<0.5	<0.5	**3.4**	<0.5	<0.5	<0.5	**1.3**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.68**	<0.5	<0.5	<0.5	<0.5
EB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TB	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
TSO-8-GW	<0.5	<0.5	<0.5	**3.68**	<0.5	<0.5	<0.5	**4.39**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**15.7**	<0.5	<0.5	**1.72**	<0.5
TSO-9-GW	<0.5	<0.5	<0.5	**85.1**	**245**	<0.5	<0.5	**28**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**810**	<0.5	<0.5	<0.5	<0.5
TSO-10-GW	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**688**	<0.5	<0.5	<0.5	<0.5
TSO-11-GW	<0.5	<0.5	<0.5	**4.68**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**116**	<0.5	<0.5	<0.5	<0.5
TSO-12-GW	<0.5	<0.5	<0.5	**61.1**	<0.5	<0.5	<0.5	**50.5**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**1,320**	<0.5	<0.5	<0.5	<0.5
TSO-13-GW	<0.5	<0.5	<0.5	**1.2**	**58**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**39.7**	<0.5	<0.5	<0.5	<0.5
TSO-15-GW	<0.5	<0.5	<0.5	**661**	**18.9**	<0.5	<0.5	**192**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**1,770**	<0.5	<0.5	<0.5	<0.5
TSO-16-GW	<0.5	<0.5	<0.5	**383**	**63.1**	<0.5	<0.5	**133**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**145**	<0.5	<0.5	<0.5	<0.5
TSO-20-GW	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
GB-GW-TSO-08-38.5-041415	<1	<1	<1	**20**	<1	<0.5	<1	**4.2**	**0.4 J**	<10	<1	<10	<1	<10	<10	**21**	**0.84 J**	<1	**1.8**	<1
GB-GW-TSO-09-44-042115	<2	<2	<2	**55**	<2	**180**	**0.5 J**	**19**	<2	<20	<2	**6.1 J**	<2	<20	<20	**510**	<2	<2	<2	<2
GB-GW-TSO-DUP-042115	<2	<2	<2	**62**	<2	**180**	<2	**22**	<2	<20	<2	**5.4 J**	<2	<20	<20	**520**	<2	<2	<2	<2
GB-GW-TSO-10-41.5-041615	<5	<5	<5	<5	<5	<2.5	<5	<5	<5	<50	<5	<50	<5	<50	<50	**990**	<5	<5	<5	<5
GB-GW-TSO-11-43.5-042015	<1	<1	<1	**4.4**	<1	**1.8**	<1	**0.52 J**	<1	**9.8 J**	<1	<10	<1	<10	**180**	**150**	<1	<1	<1	**2.5**
GB-GW-TSO-12-38.5-041715	<5	<5	<5	**100**	<5	<2.5	<5	**82**	<5	<50	<5	<50	<5	<50	**47 J**	**2,400**	<5	<5	<5	**1.3 J**
GB-GW-TSO-13-43-042215	<1	<1	<1	**1.2**	<1	**53**	<1	**0.63 J**	<1	<10	<1	<10	<1	<10	<10	**41**	<1	<1	<1	<1
GB-GW-TSO-14-45-042315	**0.44 J**	**2.6**	<1	**4.3**	<1	**15**	**0.78 J**	<1	<1	<10	<1	<10	<1	<10	**7.8 J**	**0.67**	<1	<1	<1	<1
GB-GW-TSO-15-46-042215	<10	<10	<10	**680**	<10	**89**	<10	**230**	<10	**130**	<10	<100	<10	**38 J**	**420**	**1,700**	<10	<10	<10	<10
GB-GW-TSO-16-40.5-042315	<4	<4	<4	**670**	<4	**72**	**18**	**230**	<4	<40	**49**	<40	**40**	<40	<40	**170**	<4	**1.2 J**	<4	<4
GB-GW-TSO-2028.5-042415	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	**7.8 J**	<0.5	<1	<1	<1	<1
EB-041315	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1

Table 5 Volatile Organic Compounds (VOCs) Concentrations in Groundwater

Sample ID	1,1,2,2-Tetrachloroethane	1,1,2-Trichloroethane	1,2,3-Trichloropropane	1,2,4-Trimethylbenzene	1,2-Dibromoethane (EDB	1,2-Dichloroethane	1,2-Dichloropropane	1,3,5-Trimethylbenzene	1,4-Dichlorobenzene	2-Butanone (MEK	2-Chlorotoluene	2-Hexanone	4-Chlorotoluene	4-Methyl-2-pentanone (MIBK	Acetone	Benzene	Chlorobenzene	Chloroform	cis-1,2-Dichloroethene	Diisopropyl ether (DIPE
EB-041415	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
EB-041515	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
EB-041615	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
EB-041715	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
EB-042115	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
EB-042215	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
EB-042315	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
EB-042415	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
FB-041415	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
FB-041515	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
FB-041615	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
FB-041715	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
FB-042115	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
FB-042215	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
FB-042315	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
FB-042415	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-041315	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-041415	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-041515	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-041615	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-041715	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-042115	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-042215	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-042315	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1
TB-042415	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<10	<1	<10	<10	<0.5	<1	<1	<1	<1

Table 5 Volatile Organic Compounds (VOCs) Concentrations in Groundwater)

Sample ID	Ethylbenzene	Isopropylbenzene	m,p-Xylenes	Naphthalene	n-Butylbenzene	n-Propylbenzene	o-Xylene	p-Isopropyltoluene	sec-Butylbenzene	Styrene	tert-Butyl alcohol (TBA	tert-Butylbenzene	Toluene	Vinyl chloride
92-MW1	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5	<0.5	<0.5
Brycon-MW1	**360**	**72**	**340**	**160**	**20**	**65**	**440**	**39**	**15**	<1	**42**	<1	**26**	<0.5
Brycon-MW2	**14**	**63**	**85**	**38**	**8.8**	**76**	**4.9**	**7.5**	**8.7**	<0.5	**200**	**1**	**7.2**	<0.5
Brycon-MW3	**850**	**140**	**1,100**	**170**	**19**	**150**	**440**	**44**	**18**	**5**	<10	<0.5	**62**	<0.5
Brycon-MW4	**1.2**	**0.72**	**2.2**	<0.5	<0.5	<0.5	<0.5	<0.5	**1.3**	<0.5	**11**	**0.95**	<0.5	<0.5
Brycon-MW5	**1.9**	**18**	**3.4**	**2.5**	**6.8**	**1.6**	**2.3**	<0.5	**14**	<0.5	<10	**1.4**	**4.4**	<0.5
ESE-MW2	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5	<0.5	<0.5
ESE-MW1	**1,500**	**87**	**3,800**	**210**	**22**	**110**	**870**	**19**	**8.4**	**2.2**	<40	<2	**99**	<0.5
TMW1	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**16**	<0.5	<0.5	<0.5
TMW1-D1	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**15**	<0.5	<0.5	<0.5
TMW2	<0.5	<0.5	<1	**0.92**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5	<0.5	<0.5
TMW3	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5	<0.5	<0.5
TMW4	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5	<0.5	<0.5
TMW5	**930**	**58**	**2,100**	**260**	**27**	**99**	**1,300**	**15**	**9.1**	**4.4**	**16**	<0.5	**3,600**	<0.5
TMW6	**2**	**0.89**	**3.8**	**3.5**	**0.68**	**1.4**	**1.8**	**0.71**	<0.5	<0.5	**41**	<0.5	**2.2**	<0.5
EB	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5	<0.5	<0.5
TB	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<10	<0.5	<0.5	<0.5
TSO-8-GW	**9**	**2.94**	**9.6**	**19.8**	**1.65**	**4.39**	**5.1**	**1.98**	**1.34**	<0.5	<0.5	<0.5	**1.74**	<0.5
TSO-9-GW	**94**	**10.6**	**280**	**57.6**	<1	**11.8**	**141**	**1.4**	**2**	<0.5	<0.5	<0.5	**414**	<0.5
TSO-10-GW	**2.55**	**9.76**	**4.41**	<0.5	<1	**12.3**	<0.5	<0.5	**1.35**	<0.5	<0.5	<0.5	**10.6**	<0.5
TSO-11-GW	**22.6**	**6.83**	**4.78**	**7.59**	**1.75**	**5.8**	<0.5	**2.26**	**6.13**	<0.5	<0.5	<0.5	**2**	<0.5
TSO-12-GW	**170**	**29.5**	**470**	**102**	**1.77**	**34.2**	**270**	**5.7**	**1.82**	<0.5	<0.5	<0.5	**77.5**	<0.5
TSO-13-GW	**0.6**	**1.3**	**3**	<0.5	<1	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	**1.6**	<0.5
TSO-15-GW	**1,180**	**67.5**	**3,940**	**106**	**16**	**93.3**	**2,010**	**6**	**2.6**	<0.5	<0.5	<0.5	**900**	<0.5
TSO-16-GW	**306**	**78.4**	**370**	**179**	**19.8**	**82.2**	**265**	<0.5	**15.9**	<0.5	<0.5	<0.5	**50.9**	<0.5
TSO-20-GW	<0.5	<0.5	<1	<0.5	<1	<0.5	<0.5	<0.5	<1	<0.5	<0.5	<0.5	<0.5	<0.5
GB-GW-TSO-08-38.5-041415	**13**	**4.3**	**15**	**17**	**1.7**	**5.6**	**7.7**	**1.9**	**1.6**	<1	<10	<1	**2.5**	**0.69**
GB-GW-TSO-09-44-042115	**66**	**7.5**	**210**	**22**	**1.6 J**	**8.4**	**110**	**1 J**	**1.1 J**	<2	<20	<2	**250**	<1
GB-GW-TSO-DUP-042115	**71**	**8.2**	**220**	**24**	<2	**9.1**	**120**	**1.1 J**	**1.2 J**	<2	<20	<2	**270**	<1
GB-GW-TSO-10-41.5-041615	**5.6**	**15**	**6.1**	<5	<5	**18**	**1.6 J**	<5	**1.9 J**	<5	<50	<5	**15**	<2.5
GB-GW-TSO-11-43.5-042015	**24**	**4.8**	**5.6**	**8.4**	**2.1**	**4.1**	**0.46 J**	**1**	**3.4**	<1	**14**	**0.41 J**	**2.6**	<0.5
GB-GW-TSO-12-38.5-041715	**290**	**51**	**870**	**120**	**4.9 J**	**58**	**500**	**5.4**	**2.6 J**	<5	**36 J**	<5	**150**	<2.5
GB-GW-TSO-13-43-042215	**0.72**	**1.6**	**5**	<1	<1	**0.67 J**	<0.5	<1	**0.26 J**	<1	<10	<1	**2.3**	<0.5
GB-GW-TSO-14-45-042315	**0.43 J**	**2**	<1	**0.4 J**	<1	**0.8 J**	<0.5	**1.5**	**5.6**	<1	**89**	**1.1**	<1	<0.5
GB-GW-TSO-15-46-042215	**1,700**	**93**	**5,900**	**160**	**15**	**110**	**3,000**	**12**	**5.9 J**	**3.7 J**	<100	<10	**1,700**	<5
GB-GW-TSO-16-40.5-042315	**600**	**140**	**840**	**160**	**55**	**140**	**590**	**64**	**28**	**1.3 J**	**71**	**2 J**	**71**	<2
GB-GW-TSO-2028.5-042415	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
EB-041315	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5

Table 5 Volatile Organic Compounds (VOCs) Concentrations in Groundwater)

Sample ID	Ethylbenzene	Isopropylbenzene	m,p-Xylenes	Naphthalene	n-Butylbenzene	n-Propylbenzene	o-Xylene	p-Isopropyltoluene	sec-Butylbenzene	Styrene	tert-Butyl alcohol (TBA	tert-Butylbenzene	Toluene	Vinyl chloride
EB-041415	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
EB-041515	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
EB-041615	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
EB-041715	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
EB-042115	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
EB-042215	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
EB-042315	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
EB-042415	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
FB-041415	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
FB-041515	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
FB-041615	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
FB-041715	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
FB-042115	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
FB-042215	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
FB-042315	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
FB-042415	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-041315	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-041415	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-041515	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-041615	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-041715	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-042115	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-042215	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-042315	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5
TB-042415	<0.5	<1	<1	<1	<1	<1	<0.5	<1	<1	<1	<10	<1	<1	<0.5

Notes: Concentrations are in micrograms per liter (ug/L0
Only Detected concentrations of VOCs are presented

Table 6 Semi-volatile organic compounds (SVOCs) Concentration in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	2-Methylnaphthalene	bis(2-ethylhexyl)phthalate
B2@5	5	<0.33	<0.33
B2@10	10	<16	<16
B4@5	5	<25	<25
B4@10	10	<16	<16
B17@5	5	<3.3	<3.3
B17@10	10	<0.33	<0.33
B22@5	5	<25	<25
B22@10	10	<0.33	**0.4**
B23@5	5	<0.33	<0.33
B23@10	10	<25	<25
B28@5	5	<50	<50
B28@10	10	**2.7**	<1.6

Notes: Concentrations are in milligrams per kilogram (mg/kg)
Only detected concentrations of SVOCs in soil 5-ft and 10-ft bgs are presented

Table 7 Pesticide Concentrations in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	4,4´-DDT	Chlordane
B8-5	5	<0.002	<0.0085
B10@2	2	<0.002	<0.0085
B11@2	2	**0.0031**	<0.0085
B12@2	2	**0.0036**	<0.0085
B13@2	2	**0.011**	**0.042**

Notes: Concentrations are in milligrams per kilogram (mg/kg)
Only detected concentrations of Pesticides in soil 5-feet and 10-feet bgs are presented

Table 8 Polychlorinated biPhenyls (PCBs) Concentrations in Soil 5-feet and 10-feet bgs

Sample ID	Depth ft.	Aroclor 1254	Aroclor 1260
B2@5	5	**0.02**	**0.046**
B2@10	10	<0.16	<0.16
B4@5	5	<0.16	<0.16
B4@10	10	<0.16	<0.16
B17@5	5	<0.016	<0.016
B17@10	10	<0.016	<0.016
B28@5	5	<0.032	<0.032
B28@10	10	<0.016	<0.016

Notes: Concentrations are in milligrams per kilograms (mg/kg)
Only detected concentrations in soil 5-feet and 10-feet bgs are presented

Table 9 Exposure Point Concentrations, Slope Factors and Reference Doses

ANALYTE	Max	95UCL EPC	SFo	IUR	RfDo	RfCi
C4-C12	1500	162.6			2.00E+00	
C13-C22	15000	1824			2.00E+00	
C23-C32	13000	2875			2.00E+00	
C33-C40	8,900	2,130			2.00E+00	
1,1,2-trichloroethane	0.3	0.3	5.70E-02	1.60E-05	4.00E-03	2.00E-04
1,2,4-trimethylbenzene	18	6.482				7.00E-03
1,2-dichlorobenzene	0.42	0.42			9.00E-02	2.00E-01
1,3,5-trimethylbenzene	5	1.124			1.00E-02	3.50E-02
2-butanone (MEK)	0.0079	0.0079			6.00E-01	5.00E+00
acetone	0.036	0.036			9.00E-01	3.10E+01
benzene	3.8	1.122	5.50E-02	2.90E-05	4.00E-03	3.00E-02
cis-1,2-dichloroethene	0.005	0.005			2.00E-03	
ethylbenzene	3.9	1.285	1.10E-02	2.50E-06	1.00E-01	1.00E+00
isopropylbenzene	1.4	0.408			1.00E-01	4.00E-01
m,p-xylenes	11	1.022			2.00E-01	1.00E-01
naphthalene	51	6.376		3.40E-05	2.00E-02	3.00E-03
n-butylbenzene	3.4	0.886				1.75E-01
n-propylbenzene	2.6	0.737			1.00E-01	4.00E-01
o-xylene	5.1	3.23			2.00E-01	1.00E-01
p-isopropyltoluene	2.2	1.141				
sec-butylbenzene	1.4	0.935				4.00E-01
toluene	2.6	2.6			8.00E-02	5.00E+00
arsenic	120	16.49	1.50E+00	4.30E-03	3.00E-04	1.50E-05
barium	1100	287.7			2.00E-01	5.00E-04
beryllium	0.52	0.52		2.40E-03	2.00E-04	7.00E-06
cadmium	3.2	0.645		4.20E-03	6.30E-06	1.00E-05
chromium	61	20.93			1.50E+00	
hexavalent chromium	10.2	3.49	5.00E-01	1.50E-01	3.00E-03	1.00E-04
cobalt	12.9	7.516		9.00E-03	3.00E-04	6.00E-06
copper	230	41.85			4.00E-02	
lead	820	143				
manganese	410	367.1			2.40E-02	5.00E-05
mercury	1.5	0.216				3.00E-04
molybdenum	0.803	0.635			5.00E-03	
nickel	27	17.34		2.60E-04	2.00E-02	9.00E-05
vanadium	59	31.94			5.00E-03	1.00E-04
zinc	4,700	436.50			3.00E-01	
2-methylnaphthalene	2.7	2.7			4.00E-03	1.40E-02
bis(2-ethylhexyl)phthalate	0.4	0.4	1.40E-02	2.40E-06	2.00E-02	
4,4'-DDT	0.011	0.0083				
chlordane	0.042	0.042	3.50E-01	1.00E-04	5.00E-04	7.00E-04
Aroclor 1254	0.02	0.02	2.00E+00	5.70E-04	2.00E-05	
Aroclor 1260	0.046	0.046	2.00E+00	5.70E-04		

Notes:

EPC = Exposure Point Concentration; either the maximum detected concentration or the 95UCL of the analyte in the soil matrix, whichever is less (ProUCL 2004).

UCL calculated using ProUCL version 5.0. Units are expressed in mg/kg

Lead was assessed with DTSC's LeadSpread 8.0 Model using the maximum concentration as the EPC

Table 9 Exposure Point Concentrations, Slope Factors and Reference Doses

SFo = Slope Factor, oral route of exposure $(mg/kg\text{-}day)^{-1}$
IUR = inhalation unit risk factor, inhalation route of exposure $(\mu g/m3)^{-1}$
USEPA RSLs November 2015
RfDo = Reference Dose, oral route of exposure (mg/kg-day)
RfCi = Reference Concentration, inhalation route of exposure (mg/m^3)
Blank cell indicates a SF or RfD are not available for the analyte

Table 10 - Exposure Parameters

Exposure Parameter	Notation	Receptor Populations				Units	Reference
		Commercial Worker	Construction Worker	Residential User			
				Adult	Child		
General Parameters							
Body Weight	BW	70	70	70	15	kg	DTSC
Exposure Duration	ED	25	1	24	6	years	DTSC
Site Visit Duration	SVD	8	8	24	24	hours/day	
Soil Ingestion Pathway							
Exposure Frequency	EF	250	365	350	350	days/year	
Averaging Time c 70yrs x 365days	ATc	25,550	25,550	25,550	25,550	days	DTSC
Averaging Time nc 6yrs x 365days child, 30yrs	ATnc	10,950	10,950	10,950	2,190	days	DTSC
Soil Ingestion Rate	IR	100	330	100	200	mg/day	DTSC
Dermal Contact with Soil							
Averaging Time c 70yrs x 365days	ATc	25,550	25,550	25,550	25,550	days	DTSC
Averaging Time nc 6yrs x 365days child, 30yrs	ATnc	10,950	10,950	10,950	2,190	days	DTSC
Skin Surface Area	SA	3,300	3,300	5,700	2,900	cm^2/event	OEHHA
Soil-to-Skin Adherence factor	AF	0.2	0.2	0.07	0.21	mg/cm^2	OEHHA
Fraction of Chemical Dermally Absorbed	ABS	chem specific	chem specific	ch sp	ch sp	unitless	DTSC
Inhalation of Outdoor Air							
Exposure Frequency	EF	250	365	350	350	days/year	
Averaging Time 365 d/yr x 70 yr x 24 hr/d	ATc	613,200	613,200	613,200	613,200	hours	DTSC
Averaging Time 365 d/yr x 6 yr x 24 hr/d child	ATnc	613,200	613,200	613,200	52,560	hours	DTSC

Notes:

ABS = 0.1 for VOCs, 0.13 for naphthalene, 0.01 for most metals (DTSC 2013; USEPA RSL November 2015)

Table 11
Estimated Risks and Hazards SOIL - Residential Child Scenario

ANALYTE	RISKo	RISKi	HAZARDo	HAZARDi
C4-C12			6.78E-02	
C13-C22			3.04E-01	
C23-C32			2.40E-02	
C33-C40			1.78E-02	
1,1,2-trichloroethane	2.44E-08		1.25E-03	
1,2-dichlorobenzene			1.19E-03	
1,3,5-trimethylbenzene			1.87E-03	
2-butanone (MEK)			1.32E-07	
acetone			6.00E-07	
benzene	8.82E-08		4.68E-03	
cis-1,2-dichloroethene			4.17E-05	
ethylbenzene	2.02E-08		2.14E-04	
isopropylbenzene			6.80E-05	
m,p-xylenes			8.52E-05	
naphthalene			5.94E-03	
n-propylbenzene			0.0002694	
o-xylene			0.0002694	
toluene			0.0005204	
arsenic	**2.958E-05**	2.20757E-08	**0.7668915**	0.0007906
barium			0.0189518	0.000418
beryllium		3.88543E-10	0.0342542	5.364E-05
cadmium		8.49938E-10	**1.3129647**	4.722E-05
chromium			0.000182	
hexavalent chromium	**1.912E-06**	1.62983E-07	0.0148588	2.535E-05
cobalt		2.1071E-08	0.3293346	0.0009068
copper			0.013784	
manganese			0.1982938	0.0053335
mercury				4.707E-07
molybdenum			0.0016732	
nickel		1.40361E-09	0.0114225	0.0001386
vanadium			0.08416	0.000232
zinc			0.0172523	
2-methylnaphthalene			0.012572	
bis(2-ethylhexyl)phthalate	8.006E-09		0.0003336	
chlordane	2.347E-08	1.3076E-12	0.0003092	3.051E-08
Aroclor 1254	6.386E-08	3.54919E-12	0.0186247	
Aroclor 1260	1.469E-07	8.16314E-12		
SUM RISK	3.17E-05	2.09E-07		
SUM HAZARD			3.27E+00	7.95E-03
HAZARD INDEX = 3.3				
SUM RISK = 3.18E-05				

Table 12
Estimated Risks and Hazards SOIL - Residential Adult Scenario

ANALYTE	RISKo	RISKi	HAZARDo	HAZARDi
C4-C12			6.23E-03	
C13-C22			2.80E-02	
C23-C32			2.20E-03	
C33-C40			1.63E-03	
1,1,2-trichloroethane	1.12E-08		1.15E-04	
1,2-dichlorobenzene			1.09E-04	
1,3,5-trimethylbenzene			1.72E-04	
2-butanone (MEK)			1.21E-08	
acetone			5.52E-08	
benzene	4.055E-08		4.30E-04	
cis-1,2-dichloroethene			3.83E-06	
ethylbenzene	9.29E-09		1.97E-05	
isopropylbenzene			6.26E-06	
m,p-xylenes			7.83E-06	
naphthalene			5.58E-04	
n-propylbenzene			1.13E-05	
o-xylene			2.476E-05	
toluene			4.783E-05	
arsenic	**1.301E-05**	2.20757E-08	0.0674411	0.0007906
barium			0.0016393	0.000418
beryllium		3.88543E-10	0.002963	5.364E-05
cadmium		8.49938E-10	0.1126459	4.722E-05
chromium			1.574E-05	
hexavalent chromium	8.196E-07	1.62983E-07	0.0012736	2.535E-05
cobalt		2.1071E-08	0.0284876	0.0009068
copper			0.0011923	
manganese			0.0171525	0.0053335
mercury				4.707E-07
molybdenum			0.0001447	
nickel		1.40361E-09	0.000988	0.0001386
vanadium			0.0072799	0.000232
zinc			0.0014923	
2-methylnaphthalene			0.0011825	
bis(2-ethylhexyl)phthalate	3.68E-09		3.066E-05	
chlordane	1.104E-08	1.3076E-12	2.908E-05	3.051E-08
Aroclor 1254	3.003E-08	3.54919E-12	0.0017517	
Aroclor 1260	6.907E-08	8.16314E-12		
SUM RISK	1.39E-05	2.09E-07		
SUM HAZARD			2.85E-01	7.95E-03
HAZARD INDEX = 0.3				
SUM RISK = 1.4E-05				

Table 13
Estimated Risks and Hazards SOIL - Construction Worker Scenario

ANALYTE	RISKo	RISKi	HAZARDo	HAZARDi
C4-C12			7.67E-04	
C13-C22			3.44E-03	
C23-C32			2.71E-04	
C33-C40			2.01E-04	
1,1,2-trichloroethane	1.38E-09		1.41E-05	
1,2-dichlorobenzene			1.34E-05	
1,3,5-trimethylbenzene			2.12E-05	
2-butanone (MEK)			1.49E-09	
acetone			6.79E-09	
benzene	4.987E-09		5.29E-05	
cis-1,2-dichloroethene			4.71E-07	
ethylbenzene	1.14E-09		2.42E-06	
isopropylbenzene			7.69E-07	
m,p-xylenes			9.64E-07	
naphthalene			6.51E-05	
n-propylbenzene			1.39E-06	
o-xylene			3.05E-06	
toluene			5.883E-06	
arsenic	1.766E-06	2.55797E-10	0.009155	9.161E-06
barium			0.0002306	4.843E-06
beryllium		4.50216E-12	0.0004167	6.215E-07
cadmium		9.84849E-12	0.0161206	5.471E-07
chromium			2.214E-06	
hexavalent chromium	1.175E-07	1.88853E-09	0.0001826	2.938E-07
cobalt		2.44156E-10	0.0040067	1.051E-05
copper			0.0001677	
manganese			0.0024125	6.18E-05
mercury				5.455E-09
molybdenum			2.036E-05	
nickel		1.62641E-11	0.000139	1.606E-06
vanadium			0.0010239	2.689E-06
zinc			0.0002099	
2-methylnaphthalene			0.0001379	
bis(2-ethylhexyl)phthalate	4.526E-10		3.771E-06	
chlordane	1.287E-09	1.51515E-14	3.391E-06	3.535E-10
Aroclor 1254	3.502E-09	4.11255E-14	0.0002043	
Aroclor 1260	8.055E-09	9.45887E-14		
SUM RISK	1.90E-06	2.42E-09		
SUM HAZARD			3.93E-02	9.21E-05
HAZARD INDEX = 0.04				
SUM RISK = 1.9E-06				

Table 14
Estimated Risks and Hazards SOIL - Commercial Worker Scenario

ANALYTE	RISKo	RISKi	HAZARDo	HAZARDi
C4-C12			5.50E-03	
C13-C22			2.47E-02	
C23-C32			1.95E-03	
C33-C40			1.44E-03	
1,1,2-trichloroethane	1.45E-08		1.02E-04	
1,2-dichlorobenzene			9.65E-05	
1,3,5-trimethylbenzene			1.52E-04	
2-butanone (MEK)			1.07E-08	
acetone			4.87E-08	
benzene	5.226E-08		3.80E-04	
cis-1,2-dichloroethene			3.38E-06	
ethylbenzene	1.20E-08		1.74E-05	
isopropylbenzene			5.52E-06	
m,p-xylenes			6.92E-06	
naphthalene			5.17E-04	
n-propylbenzene			9.98E-06	
o-xylene			2.19E-05	
toluene			4.223E-05	
arsenic	**1.512E-05**	4.38009E-09	0.0536884	0.0001569
barium			0.0012504	8.294E-05
beryllium		7.70919E-11	0.0022599	1.064E-05
cadmium		1.68638E-10	0.0840318	9.369E-06
chromium			1.201E-05	
hexavalent chromium	8.903E-07	3.23378E-08	0.0009476	5.03E-06
cobalt		4.18075E-09	0.0217281	0.0001799
copper			0.0009094	
manganese			0.0130826	0.0010582
mercury				9.34E-08
molybdenum			0.0001104	
nickel		2.78494E-10	0.0007536	2.749E-05
vanadium			0.0055525	4.604E-05
zinc			0.0011382	
2-methylnaphthalene			0.0010953	
bis(2-ethylhexyl)phthalate	4.743E-09		2.707E-05	
chlordane	1.492E-08	2.59444E-13	2.694E-05	6.054E-09
Aroclor 1254	4.061E-08	7.04204E-13	0.0016226	
Aroclor 1260	9.341E-08	1.61967E-12		
SUM RISK	1.61E-05	4.14E-08		
SUM HAZARD			2.23E-01	1.58E-03
HAZARD INDEX = 0.23				
SUM RISK = 1.61E-05				

Table 15 - Summary of Risks and Hazards

	Receptor Populations			
			Residential	
	Commercial Worker	Construction Worker	Adult	Child
Hazard Index	0.23	0.04	34.4	37.4
∑ Risk	1.61E-05	1.90E-06	1.10E-03	1.11E-03

Notes:
Hazard Index Residential = J&E model results + estimated hazards due to inhalation of constituents in soil
∑Risk Residential = J&E model results + estimated risks due to inhalation of constituents in soil

LEAD RISK ASSESSMENT SPREADSHEET 8

CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

Click here for ABBREVIATED INSTRUCTIONS FOR LEADSPREAD 8

INPUT	
MEDIUM	LEVEL
Lead in Soil/Dust (ug/g)	820.0
Respirable Dust (ug/m^3)	1.5

OUTPUT						
Percentile Estimate of Blood Pb (ug/dl)						PRG-90
	50th	90th	95th	98th	99th	(ug/g)
BLOOD Pb, CHILD	5.8	10.6	12.6	15.3	17.4	77
BLOOD Pb, PICA CHILD	11.6	21.2	25.1	30.5	34.7	39

EXPOSURE PARAMETERS		
	units	children
Days per week	days/wk	7
Geometric Standard Deviation		1.6
Blood lead level of concern (ug/dl)		1
Skin area, residential	cm^2	2900
Soil adherence	ug/cm^2	200
Dermal uptake constant	(ug/dl)/(ug/day)	0.0001
Soil ingestion	mg/day	100
Soil ingestion, pica	mg/day	200
Ingestion constant	(ug/dl)/(ug/day)	0.16
Bioavailability	unitless	0.44
Breathing rate	m^3/day	6.8
Inhalation constant	(ug/dl)/(ug/day)	0.192

PATHWAYS						
CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.8E-5	0.05	1%		0.05	0%
Soil Ingestion	7.0E-3	5.77	99%	1.4E-2	####	100%
Inhalation	2.0E-6	0.00	0%		0.00	0%

Click here for REFERENCES

MODIFIED VERSION OF USEPA ADULT LEAD MODEL

CALCULATIONS OF BLOOD LEAD CONCENTRATIONS (PbBs) AND PRELMIINARY REMEDIATION GOAL (PRG)

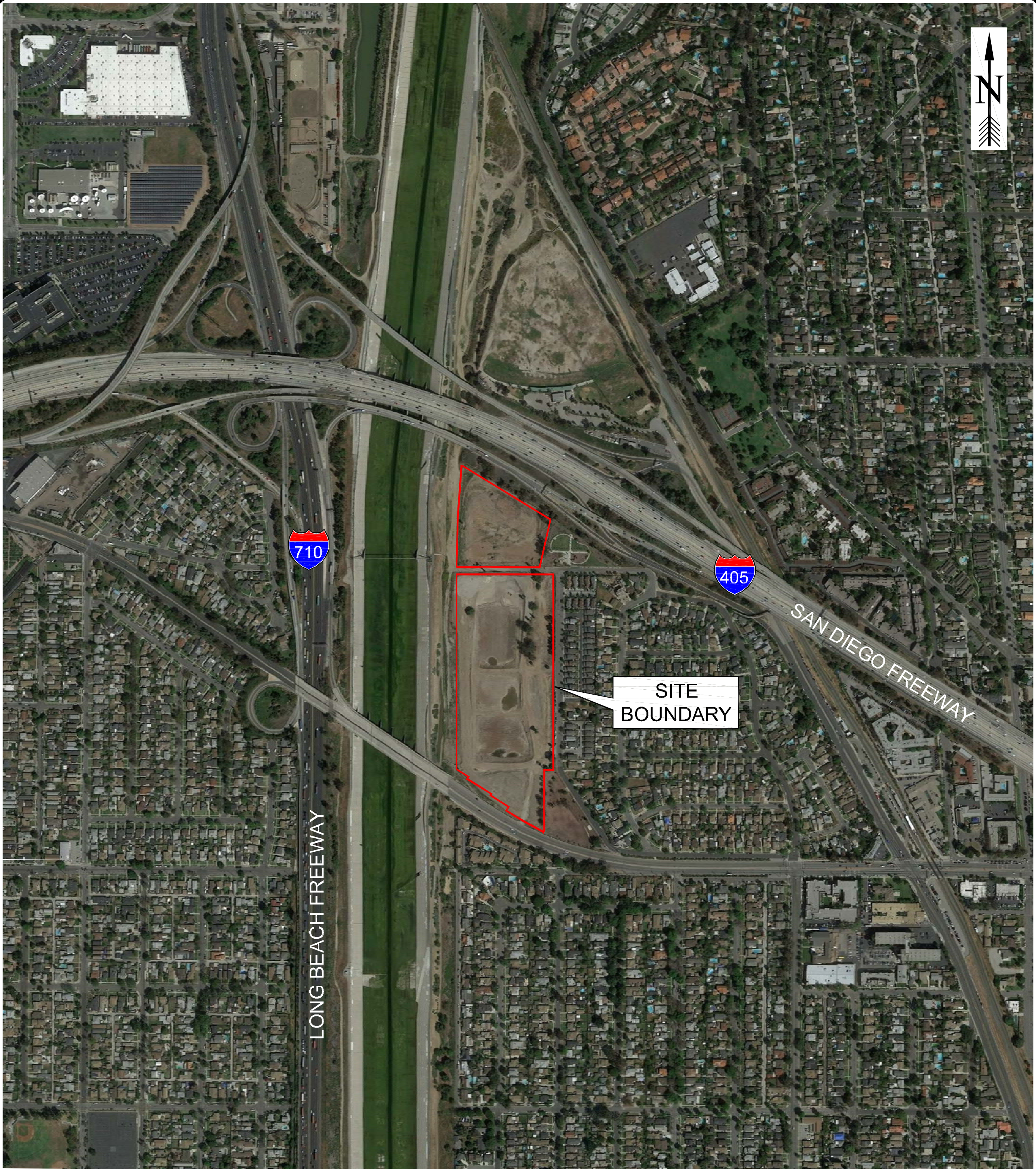
EDIT RED CELL

Variable	Description of Variable	Units	
PbS	Soil lead concentration	ug/g or ppm	820
$R_{fetal/maternal}$	Fetal/maternal PbB ratio	--	0.9
BKSF	Biokinetic Slope Factor	ug/dL per ug/day	0.4
GSD_i	Geometric standard deviation PbB	--	1.8
PbB_0	Baseline PbB	ug/dL	0.0
IR_S	Soil ingestion rate (including soil-derived indoor dust)	g/day	0.050
$AF_{S, D}$	Absorption fraction (same for soil and dust)	--	0.12
$EF_{S, D}$	Exposure frequency (same for soil and dust)	days/yr	250
$AT_{S, D}$	Averaging time (same for soil and dust)	days/yr	365
PbB_{adult}	**PbB of adult worker, geometric mean**	**ug/dL**	**1.3**
$PbB_{fetal, 0.90}$	90th percentile PbB among fetuses of adult workers	ug/dL	2.6
PbB_t	Target PbB level of concern (e.g., 10 ug/dL)	ug/dL	**1.0**
$P(PbB_{fetal} > PbB_t)$	**Probability that fetal PbB > PbB_t, assuming lognormal distributio**	**%**	**62.9%**

PRG90 **318**

Click here for REFERENCES

FIGURES

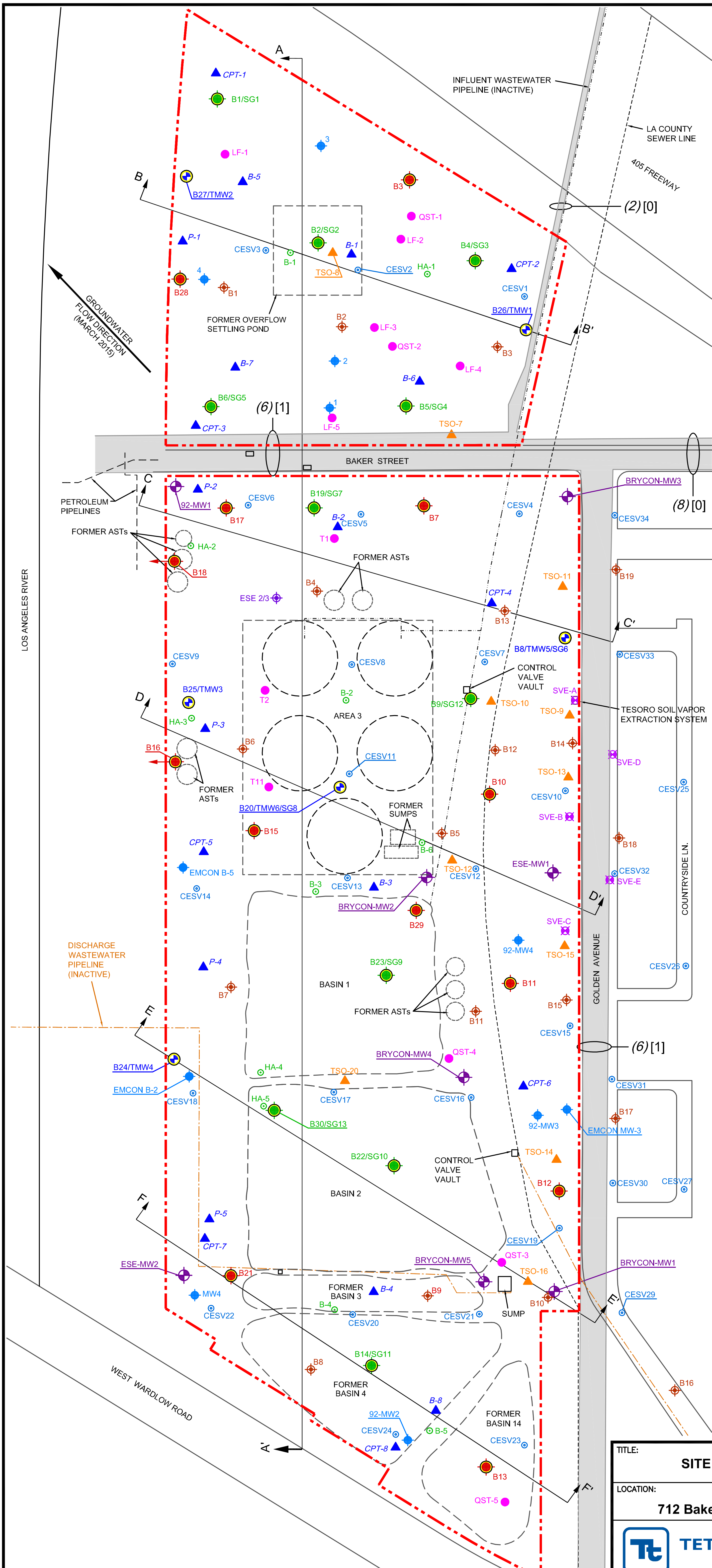


0 800 1600

SCALE IN FEET

P:\ACAD\100-PPG-T33843\T33843_FIGURE 1_SITE LOCATION (2015-07-17).DWG

TITLE:	SITE LOCATION			
LOCATION:	Oil Operators, Inc. Property 712 Baker Street, Long Beach, California			
TETRA TECH	APPROVED	JL	FIGURE	
	DRAFTED	CP	1	
	PROJECT#	T33843.01		
	DATE	9-4-15		



LEGEND

(red dash-dot line)	SITE BOUNDARY
AST	ABOVEGROUND STORAGE TANK
3	HISTORIC GROUNDWATER MONITORING WELL LOCATION (JKB, 1992)
92-MW1	EXISTING GROUNDWATER MONITORING WELL LOCATION
LF-1	SOIL BORINGS (QST ENVIRONMENTAL, INC 1998b)
B1	SOIL BORINGS (BRYCON 2010g; 2011e)
CESV1	SOIL VAPOR PROBE (CEGE, 2011)
ESE 2/3	BORING (ESE, 1999)
SVE-A	VAPOR EXTRACTION SYSTEM WELL (CEGE, 2012b)
B-1	SOIL BORING (AEMC, 1991b)
B25/TMW1	TETRA TECH TEMPORARY DUE DILIGENCE GROUNDWATER MONITORING WELL LOCATION (MAY 2015)
B3	TETRA TECH SOIL BORING LOCATION (MAY 2015)
B18	TETRA TECH ANGLE (22° FROM VERTICAL) SOIL BORING LOCATION (MAY 2015)
B2/SG2	TETRA TECH SOIL BORING / SOIL GAS LOCATION (MAY 2015)
TSO-16	TESORO BORING LOCATION (APRIL 2015)
CPT-7 B-1 P-1	PETRA GEOTECHNICAL BORING LOCATION (MARCH AND MAY 2015)
A A'	SECTION LOCATION
(dashed circle)	FORMER CONCRETE-WALLED SKIMMING BASIN
(6) [1]	REPORTED PIPELINE CORRIDOR WITH NUMBER OF PETROLEUM PIPELINES (6) AND WATERLINE [1]

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. BASE MAP AND SITE BOUNDARIES DERIVED FROM LOS ANGELES COUNTY ASSESSOR'S PARCEL MAP.
3. SELECTED SITE FEATURES OBTAINED DURING A SITE RECONNAISSANCE BY PERSONNEL FROM TETRA TECH.
4. HISTORICAL SITE FEATURES OBTAINED FROM BRYCON (2011e), ESE (1999) AND ATSI (2014a).
5. GROUNDWATER FLOW DIRECTION FROM BRYCON (2015c) MEASUREMENTS ON 18 MARCH 2015.
6. INFLUENT AND DISCHARGE WASTEWATER PIPELINES AND LOS ANGELES COUNTY SEWER LINE OBTAINED FROM ATSI (2014b) AND FIELD OBSERVATIONS.
7. FORMER BASIN NUMBERS 3, 4, AND 14 LOCATION AND DESIGNATION OBTAINED FROM ESE (1999).
8. PIPELINES BENEATH BAKER STREET AND GOLDEN AVENUE OBTAINED FROM ASTI (2014a).

0 125 250

SCALE IN FEET

TITLE:

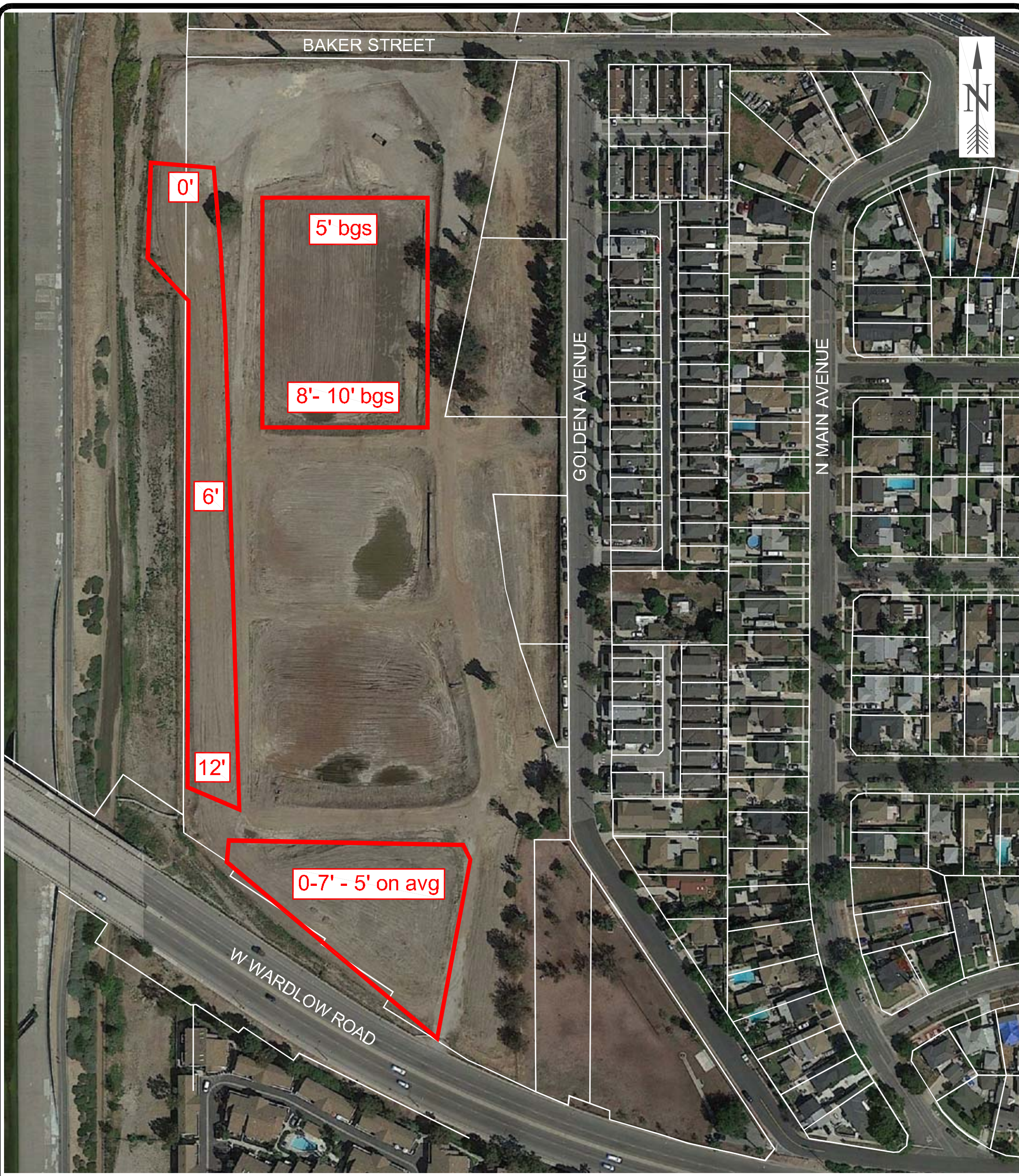
SITE FIGURE WITH ALL DATA POINTS

LOCATION:

Oil Operators, Inc. Property
712 Baker Street, Long Beach, California 90806

TETRA TECH

APPROVED	JL	FIGURE
DRAFTED	CP	2
PROJECT#	T33843.01	
DATE	9-4-15	



LEGEND

APPROXIMATE LIMIT OF BIOREMEDIATED SOIL

0 200 400

SCALE IN FEET

NOTES:

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. NUMBERS IN RED INDICATED THICKNESS OF REMEDIATED SOIL IN FEET IN MARCH 2015 (BRYCON, 2015b).
3. IMAGE FROM GOOGLE EARTH PRO, DATED MARCH 2015.

TITLE:

REMEDIATED SOIL STOCKPILE AREAS

LOCATION:

Oil Operators, Inc. Property
712 Baker Street, Long Beach, California

TETRA TECH

APPROVED	JL	FIGURE
DRAFTED	CP	3
PROJECT#	T33843.01	
DATE	9-4-15	

P:\ACAD\100-PPG-T33843\T33843_FIGURE 3_REMEDIATED SOIL STOCKPILE AREAS (2015-07-01).DWG

PLAN SUMMARY:

TOWNHOMES PRODUCT:	144 units
CLUSTER PRODUCT:	71 units
S.F.D. (43'x68' lot) PRODUCT:	60 units
GRAND TOTAL:	275 units

PARKING SUMMARY:

PARKING REQUIRED:	
2.5 spaces / unit = (275 x 2.5) =	687.5 spaces Req'd
PARKING PROVIDED:	
2-car garage unit = (275 x 2) =	550 spaces
Open guest parking space =	109 spaces
Driveway space (TH) =	15 spaces
Driveway space (SFD) =	120 spaces
TOTAL PARKING PROVIDED:	794 spaces Prov'd

URBAN ARENA

INTEGRAL Communities
A DIVERSIFIED REAL ESTATE COMPANY

RIVER PARK
LONG BEACH, CA

DATE: 06.15.15 | UA JOB # 15-028

Figure 4

SP-1

CONCEPTUAL ARCHITECTURAL SITE PLAN 275 UNITS

N

SCALE: 1"=50' - 0"

0 25 50 100

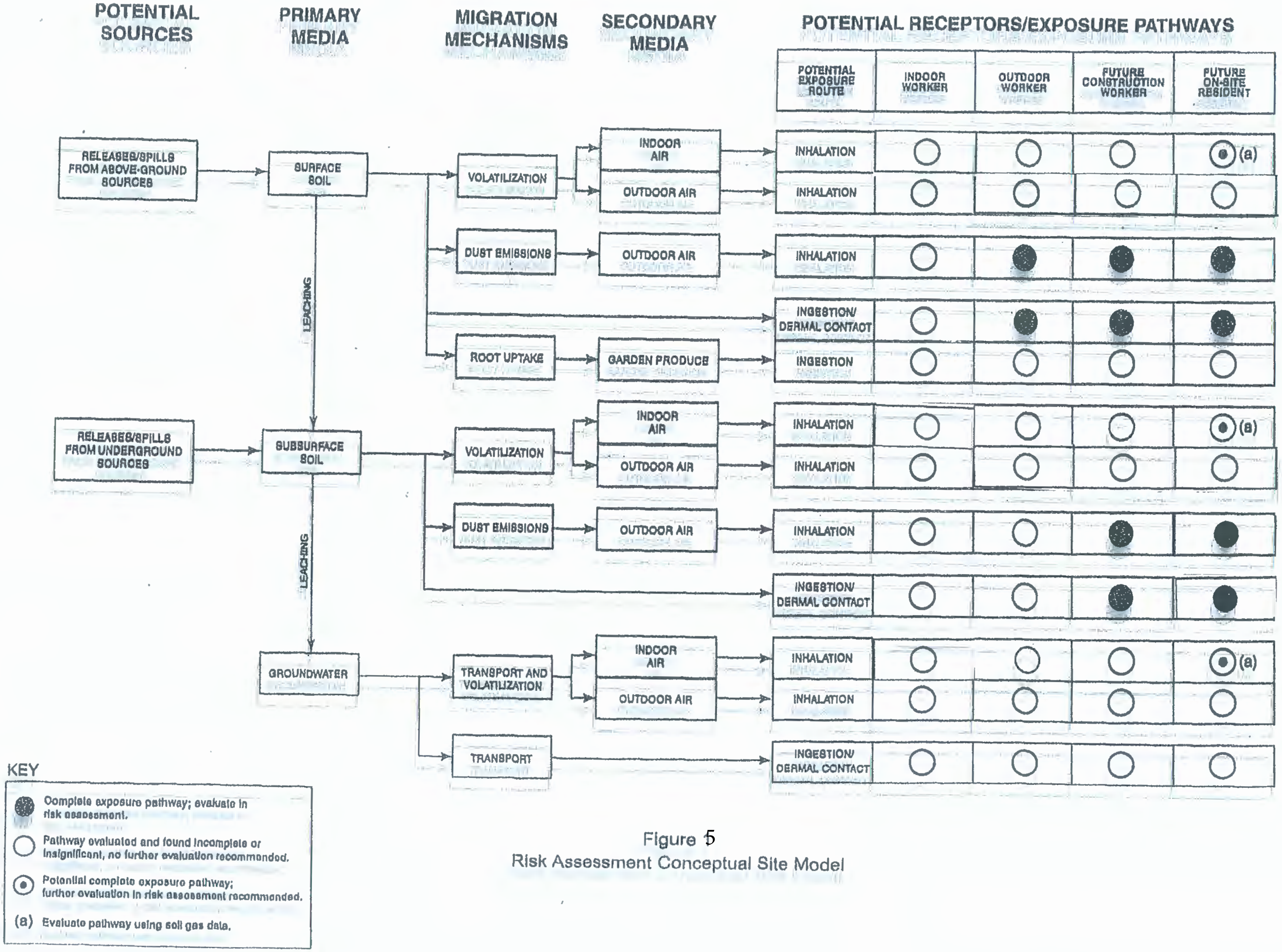


Figure 5
Risk Assessment Conceptual Site Model

APPENDIX A

ProUCL Statistics
Soil Matrix

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	1/9/2016 2:24:59 PM
From File	TPH Soil.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

TPH Gasoline (C4-C12)

General Statistics

Total Number of Observations	85	Number of Distinct Observations	35
		Number of Missing Observations	1
Number of Detects	26	Number of Non-Detects	59
Number of Distinct Detects	26	Number of Distinct Non-Detects	11
Minimum Detect	0.2	Minimum Non-Detect	0.2
Maximum Detect	1500	Maximum Non-Detect	1
Variance Detects	95709	Percent Non-Detects	69.41%
Mean Detects	129	SD Detects	309.4
Median Detects	19.5	CV Detects	2.397
Skewness Detects	3.843	Kurtosis Detects	16.37
Mean of Logged Detects	2.901	SD of Logged Detects	2.298

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.456	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.362	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.174	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	39.62	Standard Error of Mean	19.69
SD	178	95% KM (BCA) UCL	77.89
95% KM (t) UCL	72.36	95% KM (Percentile Bootstrap) UCL	74.13
95% KM (z) UCL	72	95% KM Bootstrap t UCL	131.9
90% KM Chebyshev UCL	98.68	95% KM Chebyshev UCL	125.4
97.5% KM Chebyshev UCL	162.6	99% KM Chebyshev UCL	235.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.123	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.842	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.185	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.344	k star (bias corrected MLE)	0.33
Theta hat (MLE)	375	Theta star (bias corrected MLE)	391
nu hat (MLE)	17.89	nu star (bias corrected)	17.16

	A-E	F	G-K	L
51	MLE Mean (bias corrected)	129	MLE Sd (bias corrected)	224.6
52				
53	**Gamma Kaplan-Meier (KM) Statistics**			
54	k hat (KM)	0.0496	nu hat (KM)	8.425
55	Approximate Chi Square Value (8.43, α)	2.984	Adjusted Chi Square Value (8.43, β)	2.928
56	95% Gamma Approximate KM-UCL (use when n>=50)	111.9	95% Gamma Adjusted KM-UCL (use when n<50)	114
57	Gamma (KM) may not be used when k hat (KM) is < 0.1			
58				
59	**Gamma ROS Statistics using Imputed Non-Detects**			
60	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
61	GROS may not be used when kstar of detected data is small such as < 0.1			
62	For such situations, GROS method tends to yield inflated values of UCLs and BTVs			
63	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
64	Minimum	0.01	Mean	39.48
65	Maximum	1500	Median	0.01
66	SD	179.1	CV	4.536
67	k hat (MLE)	0.131	k star (bias corrected MLE)	0.134
68	Theta hat (MLE)	301.5	Theta star (bias corrected MLE)	294.3
69	nu hat (MLE)	22.26	nu star (bias corrected)	22.81
70	MLE Mean (bias corrected)	39.48	MLE Sd (bias corrected)	107.8
71			Adjusted Level of Significance (β)	0.0472
72	Approximate Chi Square Value (22.81, α)	12.94	Adjusted Chi Square Value (22.81, β)	12.82
73	95% Gamma Approximate UCL (use when n>=50)	69.56	95% Gamma Adjusted UCL (use when n<50)	70.25
74				
75	**Lognormal GOF Test on Detected Observations Only**			
76	Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**	
77	5% Shapiro Wilk Critical Value	0.92	Detected Data appear Lognormal at 5% Significance Level	
78	Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**	
79	5% Lilliefors Critical Value	0.174	Detected Data appear Lognormal at 5% Significance Level	
80	**Detected Data appear Lognormal at 5% Significance Level**			
81				
82	**Lognormal ROS Statistics Using Imputed Non-Detects**			
83	Mean in Original Scale	39.59	Mean in Log Scale	-1.771
84	SD in Original Scale	179	SD in Log Scale	3.987
85	95% t UCL (assumes normality of ROS data)	71.89	95% Percentile Bootstrap UCL	73.45
86	95% BCA Bootstrap UCL	93.51	95% Bootstrap t UCL	128.4
87	95% H-UCL (Log ROS)	6714		
88				
89	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**			
90	KM Mean (logged)	-0.191	95% H-UCL (KM -Log)	41.19
91	KM SD (logged)	2.403	95% Critical H Value (KM-Log)	3.891
92	KM Standard Error of Mean (logged)	0.268		
93				
94	**DL/2 Statistics**			
95	**DL/2 Normal**		**DL/2 Log-Transformed**	
96	Mean in Original Scale	39.74	Mean in Log Scale	0.14
97	SD in Original Scale	179	SD in Log Scale	2.283
98	95% t UCL (Assumes normality)	72.04	95% H-Stat UCL	39.51
99	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
100				

	A	B	C	D	E	F	G	H	I	J	K	L
101	**Nonparametric Distribution Free UCL Statistics**											
102	**Detected Data appear Lognormal Distributed at 5% Significance Level**											
103												
104	**Suggested UCL to Use**											
105					97.5% KM (Chebyshev) UCL	162.6						
106												
107	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
108	Recommendations are based upon data size, data distribution, and skewness.											
109	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
110	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
111												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:28:19 PM								
5	From File			TPH Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	TPH Diesel (C13-C22)											
11												
12	General Statistics											
13	Total Number of Observations					85	Number of Distinct Observations					59
14							Number of Missing Observations					1
15	Number of Detects					60	Number of Non-Detects					25
16	Number of Distinct Detects					56	Number of Distinct Non-Detects					5
17	Minimum Detect					1	Minimum Non-Detect					1
18	Maximum Detect					15000	Maximum Non-Detect					14
19	Variance Detects					7488817	Percent Non-Detects					29.41%
20	Mean Detects					1755	SD Detects					2737
21	Median Detects					305	CV Detects					1.56
22	Skewness Detects					2.523	Kurtosis Detects					8.598
23	Mean of Logged Detects					5.229	SD of Logged Detects					2.934
24												
25	Normal GOF Test on Detects Only											
26	Shapiro Wilk Test Statistic					0.696	Normal GOF Test on Detected Observations Only					
27	5% Shapiro Wilk P Value					5.551E-16	Detected Data Not Normal at 5% Significance Level					
28	Lilliefors Test Statistic					0.261	Lilliefors GOF Test					
29	5% Lilliefors Critical Value					0.114	Detected Data Not Normal at 5% Significance Level					
30	Detected Data Not Normal at 5% Significance Level											
31												
32	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
33	Mean					1239	Standard Error of Mean					264.2
34	SD					2416	95% KM (BCA) UCL					1698
35	95% KM (t) UCL					1679	95% KM (Percentile Bootstrap) UCL					1704
36	95% KM (z) UCL					1674	95% KM Bootstrap t UCL					1811
37	90% KM Chebyshev UCL					2032	95% KM Chebyshev UCL					2391
38	97.5% KM Chebyshev UCL					2889	99% KM Chebyshev UCL					3868
39												
40	Gamma GOF Tests on Detected Observations Only											
41	A-D Test Statistic					1.18	Anderson-Darling GOF Test					
42	5% A-D Critical Value					0.862	Detected Data Not Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.119	Kolmogrov-Smirnoff GOF					
44	5% K-S Critical Value					0.124	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
46												
47	Gamma Statistics on Detected Data Only											
48	k hat (MLE)					0.307	k star (bias corrected MLE)					0.302
49	Theta hat (MLE)					5723	Theta star (bias corrected MLE)					5803
50	nu hat (MLE)					36.79	nu star (bias corrected)					36.29

	A–E	F	G–K	L
51	MLE Mean (bias corrected)	1755	MLE Sd (bias corrected)	3191
52				
53	**Gamma Kaplan-Meier (KM) Statistics**			
54	k hat (KM)	0.263	nu hat (KM)	44.72
55	Approximate Chi Square Value (44.72, α)	30.38	Adjusted Chi Square Value (44.72, β)	30.17
56	95% Gamma Approximate KM-UCL (use when n>=50)	1824	95% Gamma Adjusted KM-UCL (use when n<50)	1836
57				
58	**Gamma ROS Statistics using Imputed Non-Detects**			
59	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
60	GROS may not be used when kstar of detected data is small such as < 0.1			
61	For such situations, GROS method tends to yield inflated values of UCLs and BTVs			
62	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
63	Minimum	0.01	Mean	1239
64	Maximum	15000	Median	20
65	SD	2430	CV	1.962
66	k hat (MLE)	0.159	k star (bias corrected MLE)	0.161
67	Theta hat (MLE)	7779	Theta star (bias corrected MLE)	7672
68	nu hat (MLE)	27.07	nu star (bias corrected)	27.45
69	MLE Mean (bias corrected)	1239	MLE Sd (bias corrected)	3083
70			Adjusted Level of Significance (β)	0.0472
71	Approximate Chi Square Value (27.45, α)	16.5	Adjusted Chi Square Value (27.45, β)	16.35
72	95% Gamma Approximate UCL (use when n>=50)	2061	95% Gamma Adjusted UCL (use when n<50)	2079
73				
74	**Lognormal GOF Test on Detected Observations Only**			
75	Lilliefors Test Statistic	0.144	**Lilliefors GOF Test**	
76	5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level	
77	**Detected Data Not Lognormal at 5% Significance Level**			
78				
79	**Lognormal ROS Statistics Using Imputed Non-Detects**			
80	Mean in Original Scale	1239	Mean in Log Scale	3.466
81	SD in Original Scale	2430	SD in Log Scale	3.807
82	95% t UCL (assumes normality of ROS data)	1677	95% Percentile Bootstrap UCL	1694
83	95% BCA Bootstrap UCL	1749	95% Bootstrap t UCL	1869
84	95% H-UCL (Log ROS)	499967		
85				
86	**DL/2 Statistics**			
87	**DL/2 Normal**		**DL/2 Log-Transformed**	
88	Mean in Original Scale	1239	Mean in Log Scale	3.789
89	SD in Original Scale	2430	SD in Log Scale	3.37
90	95% t UCL (Assumes normality)	1678	95% H-Stat UCL	87257
91	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
92				
93	**Nonparametric Distribution Free UCL Statistics**			
94	**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**			
95				
96	**Suggested UCL to Use**			
97	95% KM (Chebyshev) UCL	2391	95% GROS Approximate Gamma UCL	2061
98	95% Approximate Gamma KM-UCL	1824		
99				
100	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			

	A	B	C	D	E	F	G	H	I	J	K	L
101	Recommendations are based upon data size, data distribution, and skewness.											
102	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
103	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
104												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:53:36 PM								
5	From File			TPH Soil 1.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	TPH (C23-C32)											
11												
12	General Statistics											
13	Total Number of Observations					86	Number of Distinct Observations					66
14	Number of Detects					68	Number of Non-Detects					18
15	Number of Distinct Detects					59	Number of Distinct Non-Detects					7
16	Minimum Detect					1.1	Minimum Non-Detect					0.28
17	Maximum Detect					13000	Maximum Non-Detect					400
18	Variance Detects					6638858	Percent Non-Detects					20.93%
19	Mean Detects					1605	SD Detects					2577
20	Median Detects					200	CV Detects					1.605
21	Skewness Detects					2.307	Kurtosis Detects					6.029
22	Mean of Logged Detects					4.941	SD of Logged Detects					3.062
23												
24	Normal GOF Test on Detects Only											
25	Shapiro Wilk Test Statistic					0.685	Normal GOF Test on Detected Observations Only					
26	5% Shapiro Wilk P Value					0	Detected Data Not Normal at 5% Significance Level					
27	Lilliefors Test Statistic					0.267	Lilliefors GOF Test					
28	5% Lilliefors Critical Value					0.107	Detected Data Not Normal at 5% Significance Level					
29	Detected Data Not Normal at 5% Significance Level											
30												
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
32	Mean					1270	Standard Error of Mean					257
33	SD					2366	95% KM (BCA) UCL					1713
34	95% KM (t) UCL					1697	95% KM (Percentile Bootstrap) UCL					1723
35	95% KM (z) UCL					1693	95% KM Bootstrap t UCL					1815
36	90% KM Chebyshev UCL					2041	95% KM Chebyshev UCL					2390
37	97.5% KM Chebyshev UCL					2875	99% KM Chebyshev UCL					3827
38												
39	Gamma GOF Tests on Detected Observations Only											
40	A-D Test Statistic					1.583	Anderson-Darling GOF Test					
41	5% A-D Critical Value					0.873	Detected Data Not Gamma Distributed at 5% Significance Level					
42	K-S Test Statistic					0.125	Kolmogrov-Smirnoff GOF					
43	5% K-S Critical Value					0.118	Detected Data Not Gamma Distributed at 5% Significance Level					
44	Detected Data Not Gamma Distributed at 5% Significance Level											
45												
46	Gamma Statistics on Detected Data Only											
47	k hat (MLE)					0.285	k star (bias corrected MLE)					0.282
48	Theta hat (MLE)					5634	Theta star (bias corrected MLE)					5689
49	nu hat (MLE)					38.76	nu star (bias corrected)					38.38
50	MLE Mean (bias corrected)					1605	MLE Sd (bias corrected)					3022

Gamma Kaplan-Meier (KM) Statistics

k hat (KM)	0.288	nu hat (KM)	49.57
Approximate Chi Square Value (49.57, α)	34.41	Adjusted Chi Square Value (49.57, β)	34.19
95% Gamma Approximate KM-UCL (use when n>=50)	1830	95% Gamma Adjusted KM-UCL (use when n<50)	1841

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detected data is small such as < 0.1

For such situations, GROS method tends to yield inflated values of UCLs and BTVs

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1269
Maximum	13000	Median	33
SD	2380	CV	1.875
k hat (MLE)	0.178	k star (bias corrected MLE)	0.18
Theta hat (MLE)	7123	Theta star (bias corrected MLE)	7062
nu hat (MLE)	30.65	nu star (bias corrected)	30.92
MLE Mean (bias corrected)	1269	MLE Sd (bias corrected)	2994
		Adjusted Level of Significance (β)	0.0472
Approximate Chi Square Value (30.92, α)	19.22	Adjusted Chi Square Value (30.92, β)	19.06
95% Gamma Approximate UCL (use when n>=50)	2043	95% Gamma Adjusted UCL (use when n<50)	2059

Lognormal GOF Test on Detected Observations Only

Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.107	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1270	Mean in Log Scale	3.821
SD in Original Scale	2380	SD in Log Scale	3.587
95% t UCL (assumes normality of ROS data)	1697	95% Percentile Bootstrap UCL	1711
95% BCA Bootstrap UCL	1786	95% Bootstrap t UCL	1795
95% H-UCL (Log ROS)	242330		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1272	Mean in Log Scale	4.067
SD in Original Scale	2379	SD in Log Scale	3.293
95% t UCL (Assumes normality)	1699	95% H-Stat UCL	81597

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	2875

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.

Recommendations are based upon data size, data distribution, and skewness.

These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).

	A	B	C	D	E	F	G	H	I	J	K	L
101	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
102												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:54:26 PM								
5	From File			TPH Soil 1.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	TPH (C33-C40)											
11												
12	General Statistics											
13	Total Number of Observations					80	Number of Distinct Observations					54
14	Number of Detects					59	Number of Non-Detects					21
15	Number of Distinct Detects					50	Number of Distinct Non-Detects					5
16	Minimum Detect					1.1	Minimum Non-Detect					1
17	Maximum Detect					8900	Maximum Non-Detect					400
18	Variance Detects					3365223	Percent Non-Detects					26.25%
19	Mean Detects					1299	SD Detects					1834
20	Median Detects					500	CV Detects					1.412
21	Skewness Detects					1.957	Kurtosis Detects					4.547
22	Mean of Logged Detects					5.051	SD of Logged Detects					2.896
23												
24	Normal GOF Test on Detects Only											
25	Shapiro Wilk Test Statistic					0.744	Normal GOF Test on Detected Observations Only					
26	5% Shapiro Wilk P Value					2.641E-13	Detected Data Not Normal at 5% Significance Level					
27	Lilliefors Test Statistic					0.24	Lilliefors GOF Test					
28	5% Lilliefors Critical Value					0.115	Detected Data Not Normal at 5% Significance Level					
29	Detected Data Not Normal at 5% Significance Level											
30												
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
32	Mean					959	Standard Error of Mean					187.5
33	SD					1663	95% KM (BCA) UCL					1266
34	95% KM (t) UCL					1271	95% KM (Percentile Bootstrap) UCL					1260
35	95% KM (z) UCL					1267	95% KM Bootstrap t UCL					1349
36	90% KM Chebyshev UCL					1522	95% KM Chebyshev UCL					1776
37	97.5% KM Chebyshev UCL					2130	99% KM Chebyshev UCL					2825
38												
39	Gamma GOF Tests on Detected Observations Only											
40	A-D Test Statistic					1.455	Anderson-Darling GOF Test					
41	5% A-D Critical Value					0.858	Detected Data Not Gamma Distributed at 5% Significance Level					
42	K-S Test Statistic					0.139	Kolmogrov-Smirnoff GOF					
43	5% K-S Critical Value					0.125	Detected Data Not Gamma Distributed at 5% Significance Level					
44	Detected Data Not Gamma Distributed at 5% Significance Level											
45												
46	Gamma Statistics on Detected Data Only											
47	k hat (MLE)					0.322	k star (bias corrected MLE)					0.317
48	Theta hat (MLE)					4037	Theta star (bias corrected MLE)					4102
49	nu hat (MLE)					37.98	nu star (bias corrected)					37.38
50	MLE Mean (bias corrected)					1299	MLE Sd (bias corrected)					2309

Gamma Kaplan-Meier (KM) Statistics			
k hat (KM)	0.333	nu hat (KM)	53.21
Approximate Chi Square Value (53.21, α)	37.45	Adjusted Chi Square Value (53.21, β)	37.21
95% Gamma Approximate KM-UCL (use when n>=50)	1362	95% Gamma Adjusted KM-UCL (use when n<50)	1371
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detected data is small such as < 0.1			
For such situations, GROS method tends to yield inflated values of UCLs and BTVs			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	0.01	Mean	958.4
Maximum	8900	Median	22.5
SD	1674	CV	1.746
k hat (MLE)	0.176	k star (bias corrected MLE)	0.178
Theta hat (MLE)	5446	Theta star (bias corrected MLE)	5393
nu hat (MLE)	28.16	nu star (bias corrected)	28.43
MLE Mean (bias corrected)	958.4	MLE Sd (bias corrected)	2273
		Adjusted Level of Significance (β)	0.047
Approximate Chi Square Value (28.43, α)	17.27	Adjusted Chi Square Value (28.43, β)	17.11
95% Gamma Approximate UCL (use when n>=50)	1578	95% Gamma Adjusted UCL (use when n<50)	1593
Lognormal GOF Test on Detected Observations Only			
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.115	Detected Data Not Lognormal at 5% Significance Level	
Detected Data Not Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	958.8	Mean in Log Scale	3.597
SD in Original Scale	1674	SD in Log Scale	3.602
95% t UCL (assumes normality of ROS data)	1270	95% Percentile Bootstrap UCL	1280
95% BCA Bootstrap UCL	1317	95% Bootstrap t UCL	1332
95% H-UCL (Log ROS)	237206		
DL/2 Statistics			
DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	961.2	Mean in Log Scale	3.852
SD in Original Scale	1672	SD in Log Scale	3.279
95% t UCL (Assumes normality)	1272	95% H-Stat UCL	69194
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution at 5% Significance Level			
Suggested UCL to Use			
97.5% KM (Chebyshev) UCL	2130		
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			

	A	B	C	D	E	F	G	H	I	J	K	L
101	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
102												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	1/9/2016 2:29:59 PM
From File	VOCs Soil.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1,2-Trichloroethane

General Statistics

Total Number of Observations	1	Number of Distinct Observations	1
		Number of Missing Observations	86
Minimum	0.3	Mean	0.3
Maximum	0.3	Median	0.3

Warning: This data set only has 1 observations!

Data set is too small to compute reliable and meaningful statistics and estimates!

The data set for variable 1,1,2-Trichloroethane was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!

If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

1	UCL Statistics for Data Sets with Non-Detects			
2				
3	User Selected Options			
4	Date/Time of Computation	1/9/2016 2:31:25 PM		
5	From File	VOCs Soil.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	**1,2,4-Trimethylbenzene**			
12				
13	**General Statistics**			
14	Total Number of Observations	23	Number of Distinct Observations	22
15			Number of Missing Observations	64
16	Minimum	0.0024	Mean	3.045
17	Maximum	18	Median	0.89
18	SD	4.632	Std. Error of Mean	0.966
19	Coefficient of Variation	1.521	Skewness	2.114
20				
21	**Normal GOF Test**			
22	Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**	
23	5% Shapiro Wilk Critical Value	0.914	Data Not Normal at 5% Significance Level	
24	Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**	
25	5% Lilliefors Critical Value	0.185	Data Not Normal at 5% Significance Level	
26	**Data Not Normal at 5% Significance Level**			
27				
28	**Assuming Normal Distribution**			
29	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
30	95% Student's-t UCL	4.703	95% Adjusted-CLT UCL (Chen-1995)	5.088
31			95% Modified-t UCL (Johnson-1978)	4.774
32				
33	**Gamma GOF Test**			
34	A-D Test Statistic	0.294	**Anderson-Darling Gamma GOF Test**	
35	5% A-D Critical Value	0.835	Detected data appear Gamma Distributed at 5% Significance Level	
36	K-S Test Statistic	0.11	**Kolmogrov-Smirnoff Gamma GOF Test**	
37	5% K-S Critical Value	0.195	Detected data appear Gamma Distributed at 5% Significance Level	
38	**Detected data appear Gamma Distributed at 5% Significance Level**			
39				
40	**Gamma Statistics**			
41	k hat (MLE)	0.362	k star (bias corrected MLE)	0.344
42	Theta hat (MLE)	8.404	Theta star (bias corrected MLE)	8.85
43	nu hat (MLE)	16.66	nu star (bias corrected)	15.82
44	MLE Mean (bias corrected)	3.045	MLE Sd (bias corrected)	5.191
45			Approximate Chi Square Value (0.05)	7.838
46	Adjusted Level of Significance	0.0389	Adjusted Chi Square Value	7.433
47				
48	**Assuming Gamma Distribution**			
49	95% Approximate Gamma UCL (use when n>=50)	6.147	95% Adjusted Gamma UCL (use when n<50)	6.482
50				

	A	B	C	D	E	F	G	H	I	J	K	L
51	**Lognormal GOF Test**											
52					Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**					
53					5% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.159	**Lilliefors Lognormal GOF Test**					
55					5% Lilliefors Critical Value	0.185	Data appear Lognormal at 5% Significance Level					
56	**Data appear Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59					Minimum of Logged Data	-6.032					Mean of logged Data	-0.732
60					Maximum of Logged Data	2.89					SD of logged Data	2.626
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	264.7					90% Chebyshev (MVUE) UCL	28.45
64					95% Chebyshev (MVUE) UCL	37.17					97.5% Chebyshev (MVUE) UCL	49.27
65					99% Chebyshev (MVUE) UCL	73.03						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71					95% CLT UCL	4.633					95% Jackknife UCL	4.703
72					95% Standard Bootstrap UCL	4.543					95% Bootstrap-t UCL	5.825
73					95% Hall's Bootstrap UCL	6.081					95% Percentile Bootstrap UCL	4.714
74					95% BCA Bootstrap UCL	4.93						
75					90% Chebyshev(Mean, Sd) UCL	5.942					95% Chebyshev(Mean, Sd) UCL	7.254
76					97.5% Chebyshev(Mean, Sd) UCL	9.076					99% Chebyshev(Mean, Sd) UCL	12.65
77												
78	**Suggested UCL to Use**											
79					95% Adjusted Gamma UCL	6.482						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:32:17 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	1,2-Dichlorobenzene											
12												
13	General Statistics											
14	Total Number of Observations					3	Number of Distinct Observations					3
15							Number of Missing Observations					84
16	Minimum					0.0064	Mean					0.179
17	Maximum					0.42	Median					0.11
18	SD					0.215	Std. Error of Mean					0.124
19	Coefficient of Variation					1.204	Skewness					1.292
20												
21	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use											
22	guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.											
23	For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).											
24	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.0											
25												
26	Normal GOF Test											
27	Shapiro Wilk Test Statistic					0.923	Shapiro Wilk GOF Test					
28	5% Shapiro Wilk Critical Value					0.767	Data appear Normal at 5% Significance Level					
29	Lilliefors Test Statistic					0.292	Lilliefors GOF Test					
30	5% Lilliefors Critical Value					0.512	Data appear Normal at 5% Significance Level					
31	Data appear Normal at 5% Significance Level											
32												
33	Assuming Normal Distribution											
34	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
35	95% Student's-t UCL					0.542	95% Adjusted-CLT UCL (Chen-1995)					0.482
36							95% Modified-t UCL (Johnson-1978)					0.557
37												
38	Gamma GOF Test											
39	Not Enough Data to Perform GOF Test											
40												
41	Gamma Statistics											
42	k hat (MLE)					0.622	k star (bias corrected MLE)					N/A
43	Theta hat (MLE)					0.287	Theta star (bias corrected MLE)					N/A
44	nu hat (MLE)					3.735	nu star (bias corrected)					N/A
45	MLE Mean (bias corrected)					N/A	MLE Sd (bias corrected)					N/A
46							Approximate Chi Square Value (0.05)					N/A
47	Adjusted Level of Significance					N/A	Adjusted Chi Square Value					N/A
48												
49	Assuming Gamma Distribution											
50	95% Approximate Gamma UCL (use when n>=50))					N/A	95% Adjusted Gamma UCL (use when n<50)					N/A

51				
52	**Lognormal GOF Test**			
53	Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk Lognormal GOF Test**	
54	5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level	
55	Lilliefors Test Statistic	0.259	**Lilliefors Lognormal GOF Test**	
56	5% Lilliefors Critical Value	0.512	Data appear Lognormal at 5% Significance Level	
57	**Data appear Lognormal at 5% Significance Level**			
58				
59	**Lognormal Statistics**			
60	Minimum of Logged Data	-5.051	Mean of logged Data	-2.709
61	Maximum of Logged Data	-0.868	SD of logged Data	2.137
62				
63	**Assuming Lognormal Distribution**			
64	95% H-UCL	1.378E+18	90% Chebyshev (MVUE) UCL	0.746
65	95% Chebyshev (MVUE) UCL	0.987	97.5% Chebyshev (MVUE) UCL	1.321
66	99% Chebyshev (MVUE) UCL	1.978		
67				
68	**Nonparametric Distribution Free UCL Statistics**			
69	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
70				
71	**Nonparametric Distribution Free UCLs**			
72	95% CLT UCL	0.383	95% Jackknife UCL	0.542
73	95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
74	95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
75	95% BCA Bootstrap UCL	N/A		
76	90% Chebyshev(Mean, Sd) UCL	0.552	95% Chebyshev(Mean, Sd) UCL	0.72
77	97.5% Chebyshev(Mean, Sd) UCL	0.955	99% Chebyshev(Mean, Sd) UCL	1.415
78				
79	**Suggested UCL to Use**			
80	95% Student's-t UCL	0.542		
81				
82	**Recommended UCL exceeds the maximum observation**			
83				
84	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
85	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
86	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
87	For additional insight the user may want to consult a statistician.			
88				

	A	B	C	D	E	F	G	H	I	J	K	L
1	**UCL Statistics for Data Sets with Non-Detects**											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:33:10 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	**1,3,5-Trimethylbenzene**											
11												
12	**General Statistics**											
13	Total Number of Observations					20	Number of Distinct Observations					20
14							Number of Missing Observations					67
15	Number of Detects					19	Number of Non-Detects					1
16	Number of Distinct Detects					19	Number of Distinct Non-Detects					1
17	Minimum Detect					0.002	Minimum Non-Detect					4.1
18	Maximum Detect					4.5	Maximum Non-Detect					4.1
19	Variance Detects					1.233	Percent Non-Detects					5%
20	Mean Detects					0.537	SD Detects					1.11
21	Median Detects					0.16	CV Detects					2.066
22	Skewness Detects					3.109	Kurtosis Detects					9.809
23	Mean of Logged Detects					-2.268	SD of Logged Detects					2.149
24												
25	**Normal GOF Test on Detects Only**											
26	Shapiro Wilk Test Statistic					0.508	**Shapiro Wilk GOF Test**					
27	5% Shapiro Wilk Critical Value					0.901	Detected Data Not Normal at 5% Significance Level					
28	Lilliefors Test Statistic					0.379	**Lilliefors GOF Test**					
29	5% Lilliefors Critical Value					0.203	Detected Data Not Normal at 5% Significance Level					
30	**Detected Data Not Normal at 5% Significance Level**											
31												
32	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
33	Mean					0.526	Standard Error of Mean					0.246
34	SD					1.062	95% KM (BCA) UCL					1.01
35	95% KM (t) UCL					0.951	95% KM (Percentile Bootstrap) UCL					0.962
36	95% KM (z) UCL					0.931	95% KM Bootstrap t UCL					2.591
37	90% KM Chebyshev UCL					1.264	95% KM Chebyshev UCL					1.597
38	97.5% KM Chebyshev UCL					2.061	99% KM Chebyshev UCL					2.971
39												
40	**Gamma GOF Tests on Detected Observations Only**											
41	A-D Test Statistic					0.631	**Anderson-Darling GOF Test**					
42	5% A-D Critical Value					0.823	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.177	**Kolmogrov-Smirnoff GOF**					
44	5% K-S Critical Value					0.213	Detected data appear Gamma Distributed at 5% Significance Level					
45	**Detected data appear Gamma Distributed at 5% Significance Level**											
46												
47	**Gamma Statistics on Detected Data Only**											
48	k hat (MLE)					0.4	k star (bias corrected MLE)					0.372
49	Theta hat (MLE)					1.345	Theta star (bias corrected MLE)					1.446
50	nu hat (MLE)					15.18	nu star (bias corrected)					14.12

	A	B	C	D	E	F	G	H	I	J	K	L
51					MLE Mean (bias corrected)	0.537					MLE Sd (bias corrected)	0.882
52												
53	Gamma Kaplan-Meier (KM) Statistics											
54					k hat (KM)	0.246					nu hat (KM)	9.836
55					Approximate Chi Square Value (9.84, α)	3.839					Adjusted Chi Square Value (9.84, β)	3.548
56					95% Gamma Approximate KM-UCL (use when n>=50)	1.349					95% Gamma Adjusted KM-UCL (use when n<50)	1.46
57												
58	Gamma ROS Statistics using Imputed Non-Detects											
59	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
60	GROS may not be used when kstar of detected data is small such as < 0.1											
61	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
62	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
63					Minimum	0.002					Mean	0.514
64					Maximum	4.5					Median	0.135
65					SD	1.086					CV	2.111
66					k hat (MLE)	0.405					k star (bias corrected MLE)	0.378
67					Theta hat (MLE)	1.269					Theta star (bias corrected MLE)	1.361
68					nu hat (MLE)	16.21					nu star (bias corrected)	15.12
69					MLE Mean (bias corrected)	0.514					MLE Sd (bias corrected)	0.837
70											Adjusted Level of Significance (β)	0.038
71					Approximate Chi Square Value (15.12, α)	7.342					Adjusted Chi Square Value (15.12, β)	6.916
72					95% Gamma Approximate UCL (use when n>=50)	1.059					95% Gamma Adjusted UCL (use when n<50)	1.124
73												
74	**Lognormal GOF Test on Detected Observations Only**											
75					Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**					
76					5% Shapiro Wilk Critical Value	0.901	Detected Data appear Lognormal at 5% Significance Level					
77					Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**					
78					5% Lilliefors Critical Value	0.203	Detected Data appear Lognormal at 5% Significance Level					
79	**Detected Data appear Lognormal at 5% Significance Level**											
80												
81	**Lognormal ROS Statistics Using Imputed Non-Detects**											
82					Mean in Original Scale	0.515					Mean in Log Scale	-2.277
83					SD in Original Scale	1.085					SD in Log Scale	2.092
84					95% t UCL (assumes normality of ROS data)	0.935					95% Percentile Bootstrap UCL	0.936
85					95% BCA Bootstrap UCL	1.127					95% Bootstrap t UCL	2.655
86					95% H-UCL (Log ROS)	7.82						
87												
88	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**											
89					KM Mean (logged)	-2.278					95% H-UCL (KM -Log)	7.595
90					KM SD (logged)	2.085					95% Critical H Value (KM-Log)	4.459
91					KM Standard Error of Mean (logged)	0.49						
92												
93	**DL/2 Statistics**											
94	**DL/2 Normal**						**DL/2 Log-Transformed**					
95					Mean in Original Scale	0.613					Mean in Log Scale	-2.119
96					SD in Original Scale	1.132					SD in Log Scale	2.195
97					95% t UCL (Assumes normality)	1.051					95% H-Stat UCL	13.99
98	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
99												
100	**Nonparametric Distribution Free UCL Statistics**											

	A	B	C	D	E	F	G	H	I	J	K	L
101	**Detected Data appear Gamma Distributed at 5% Significance Level**											
102												
103	**Suggested UCL to Use**											
104	95% KM (Chebyshev) UCL					1.597	95% GROS Adjusted Gamma UCL					1.124
105	95% Adjusted Gamma KM-UCL					1.46						
106												
107	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
108	Recommendations are based upon data size, data distribution, and skewness.											
109	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
110	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
111												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:34:05 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	2-Butanone (MEK											
12												
13	General Statistics											
14	Total Number of Observations					1	Number of Distinct Observations					1
15							Number of Missing Observations					86
16	Minimum					0.0079	Mean					0.0079
17	Maximum					0.0079	Median					0.0079
18												
19	Warning: This data set only has 1 observations!											
20	Data set is too small to compute reliable and meaningful statistics and estimates!											
21	The data set for variable 2-Butanone (MEK was not processed!											
22												
23	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
24	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
25												
26												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:34:51 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	Acetone											
12												
13	General Statistics											
14	Total Number of Observations					2	Number of Distinct Observations					2
15							Number of Missing Observations					85
16	Minimum					0.014	Mean					0.025
17	Maximum					0.036	Median					0.025
18												
19	Warning: This data set only has 2 observations!											
20	Data set is too small to compute reliable and meaningful statistics and estimates!											
21	The data set for variable Acetone was not processed!											
22												
23	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
24	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
25												
26												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:35:32 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	**Benzene**											
12												
13	**General Statistics**											
14	Total Number of Observations					16	Number of Distinct Observations					15
15							Number of Missing Observations					71
16	Minimum					0.003	Mean					0.403
17	Maximum					3.8	Median					0.0435
18	SD					0.962	Std. Error of Mean					0.241
19	Coefficient of Variation					2.389	Skewness					3.365
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic					0.47	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk Critical Value					0.887	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.376	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.222	Data Not Normal at 5% Significance Level					
26	**Data Not Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL					0.825	95% Adjusted-CLT UCL (Chen-1995)					1.015
31							95% Modified-t UCL (Johnson-1978)					0.858
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					0.929	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.828	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.196	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.232	Detected data appear Gamma Distributed at 5% Significance Level					
38	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)					0.345	k star (bias corrected MLE)					0.322
42	Theta hat (MLE)					1.167	Theta star (bias corrected MLE)					1.25
43	nu hat (MLE)					11.05	nu star (bias corrected)					10.31
44	MLE Mean (bias corrected)					0.403	MLE Sd (bias corrected)					0.71
45							Approximate Chi Square Value (0.05)					4.138
46	Adjusted Level of Significance					0.0335	Adjusted Chi Square Value					3.702
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50)					1.004	95% Adjusted Gamma UCL (use when n<50)					1.122
50												

	A–E	F	G–K	L
51	Lognormal GOF Test			
52	Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk Lognormal GOF Test**	
53	5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.114	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.222	Data appear Lognormal at 5% Significance Level	
56	**Data appear Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	-5.809	Mean of logged Data	-2.861
60	Maximum of Logged Data	1.335	SD of logged Data	2.094
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	6.321	90% Chebyshev (MVUE) UCL	1.04
64	95% Chebyshev (MVUE) UCL	1.345	97.5% Chebyshev (MVUE) UCL	1.768
65	99% Chebyshev (MVUE) UCL	2.6		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	0.799	95% Jackknife UCL	0.825
72	95% Standard Bootstrap UCL	0.786	95% Bootstrap-t UCL	2.913
73	95% Hall's Bootstrap UCL	2.387	95% Percentile Bootstrap UCL	0.815
74	95% BCA Bootstrap UCL	1.105		
75	90% Chebyshev(Mean, Sd) UCL	1.125	95% Chebyshev(Mean, Sd) UCL	1.451
76	97.5% Chebyshev(Mean, Sd) UCL	1.905	99% Chebyshev(Mean, Sd) UCL	2.797
77				
78	**Suggested UCL to Use**			
79	95% Adjusted Gamma UCL	1.122		
80				
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
84	For additional insight the user may want to consult a statistician.			
85				

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:36:17 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	cis-1,2-Dichloroethene											
12												
13	General Statistics											
14	Total Number of Observations					1	Number of Distinct Observations					1
15							Number of Missing Observations					86
16	Minimum					0.005	Mean					0.005
17	Maximum					0.005	Median					0.005
18												
19	Warning: This data set only has 1 observations!											
20	Data set is too small to compute reliable and meaningful statistics and estimates!											
21	The data set for variable cis-1,2-Dichloroethene was not processed!											
22												
23	It is suggested to collect at least 8 to 10 observations before using these statistical methods!											
24	If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.											
25												
26												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:37:16 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	**Ethylbenzene**											
12												
13	**General Statistics**											
14	Total Number of Observations					22	Number of Distinct Observations					21
15							Number of Missing Observations					65
16	Minimum					0.0038	Mean					0.644
17	Maximum					3.9	Median					0.16
18	SD					0.923	Std. Error of Mean					0.197
19	Coefficient of Variation					1.433	Skewness					2.3
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic					0.712	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk Critical Value					0.911	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.244	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.189	Data Not Normal at 5% Significance Level					
26	**Data Not Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL					0.983	95% Adjusted-CLT UCL (Chen-1995)					1.071
31							95% Modified-t UCL (Johnson-1978)					0.999
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					0.63	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.815	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.182	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.197	Detected data appear Gamma Distributed at 5% Significance Level					
38	**Detected data appear Gamma Distributed at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)					0.451	k star (bias corrected MLE)					0.42
42	Theta hat (MLE)					1.428	Theta star (bias corrected MLE)					1.535
43	nu hat (MLE)					19.84	nu star (bias corrected)					18.47
44	MLE Mean (bias corrected)					0.644	MLE Sd (bias corrected)					0.994
45							Approximate Chi Square Value (0.05)					9.73
46	Adjusted Level of Significance					0.0386	Adjusted Chi Square Value					9.258
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50)					1.223	95% Adjusted Gamma UCL (use when n<50)					1.285
50												

	A	B	C	D	E	F	G	H	I	J	K	L
51	Lognormal GOF Test											
52	Shapiro Wilk Test Statistic					0.931	Shapiro Wilk Lognormal GOF Test					
53	5% Shapiro Wilk Critical Value					0.911	Data appear Lognormal at 5% Significance Level					
54	Lilliefors Test Statistic					0.185	Lilliefors Lognormal GOF Test					
55	5% Lilliefors Critical Value					0.189	Data appear Lognormal at 5% Significance Level					
56	Data appear Lognormal at 5% Significance Level											
57												
58	Lognormal Statistics											
59	Minimum of Logged Data					-5.573	Mean of logged Data					-1.872
60	Maximum of Logged Data					1.361	SD of logged Data					2.107
61												
62	Assuming Lognormal Distribution											
63	95% H-UCL					10.56	90% Chebyshev (MVUE) UCL					2.946
64	95% Chebyshev (MVUE) UCL					3.788	97.5% Chebyshev (MVUE) UCL					4.955
65	99% Chebyshev (MVUE) UCL					7.248						
66												
67	Nonparametric Distribution Free UCL Statistics											
68	Data appear to follow a Discernible Distribution at 5% Significance Level											
69												
70	Nonparametric Distribution Free UCLs											
71	95% CLT UCL					0.968	95% Jackknife UCL					0.983
72	95% Standard Bootstrap UCL					0.956	95% Bootstrap-t UCL					1.155
73	95% Hall's Bootstrap UCL					1.594	95% Percentile Bootstrap UCL					0.97
74	95% BCA Bootstrap UCL					1.083						
75	90% Chebyshev(Mean, Sd) UCL					1.235	95% Chebyshev(Mean, Sd) UCL					1.502
76	97.5% Chebyshev(Mean, Sd) UCL					1.873	99% Chebyshev(Mean, Sd) UCL					2.602
77												
78	Suggested UCL to Use											
79	95% Adjusted Gamma UCL					1.285						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:38:07 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	**Isopropylbenzene**											
11												
12	**General Statistics**											
13	Total Number of Observations					21	Number of Distinct Observations					21
14							Number of Missing Observations					66
15	Number of Detects					16	Number of Non-Detects					5
16	Number of Distinct Detects					16	Number of Distinct Non-Detects					5
17	Minimum Detect					0.007	Minimum Non-Detect					0.014
18	Maximum Detect					1.2	Maximum Non-Detect					1.4
19	Variance Detects					0.138	Percent Non-Detects					23.81%
20	Mean Detects					0.326	SD Detects					0.371
21	Median Detects					0.18	CV Detects					1.139
22	Skewness Detects					1.203	Kurtosis Detects					0.787
23	Mean of Logged Detects					-2.124	SD of Logged Detects					1.728
24												
25	**Normal GOF Test on Detects Only**											
26	Shapiro Wilk Test Statistic					0.822	**Shapiro Wilk GOF Test**					
27	5% Shapiro Wilk Critical Value					0.887	Detected Data Not Normal at 5% Significance Level					
28	Lilliefors Test Statistic					0.217	**Lilliefors GOF Test**					
29	5% Lilliefors Critical Value					0.222	Detected Data appear Normal at 5% Significance Level					
30	**Detected Data appear Approximate Normal at 5% Significance Level**											
31												
32	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
33	Mean					0.27	Standard Error of Mean					0.0802
34	SD					0.345	95% KM (BCA) UCL					0.399
35	95% KM (t) UCL					0.408	95% KM (Percentile Bootstrap) UCL					0.411
36	95% KM (z) UCL					0.402	95% KM Bootstrap t UCL					0.458
37	90% KM Chebyshev UCL					0.51	95% KM Chebyshev UCL					0.619
38	97.5% KM Chebyshev UCL					0.771	99% KM Chebyshev UCL					1.068
39												
40	**Gamma GOF Tests on Detected Observations Only**											
41	A-D Test Statistic					0.615	**Anderson-Darling GOF Test**					
42	5% A-D Critical Value					0.786	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.216	**Kolmogrov-Smirnoff GOF**					
44	5% K-S Critical Value					0.225	Detected data appear Gamma Distributed at 5% Significance Level					
45	**Detected data appear Gamma Distributed at 5% Significance Level**											
46												
47	**Gamma Statistics on Detected Data Only**											
48	k hat (MLE)					0.614	k star (bias corrected MLE)					0.541
49	Theta hat (MLE)					0.531	Theta star (bias corrected MLE)					0.603
50	nu hat (MLE)					19.65	nu star (bias corrected)					17.3

	A–E	F	G–K	L
51	MLE Mean (bias corrected)	0.326	MLE Sd (bias corrected)	0.443
52				
53	**Gamma Kaplan-Meier (KM) Statistics**			
54	k hat (KM)	0.612	nu hat (KM)	25.72
55	Approximate Chi Square Value (25.72, α)	15.17	Adjusted Chi Square Value (25.72, β)	14.54
56	95% Gamma Approximate KM-UCL (use when n>=50)	0.457	95% Gamma Adjusted KM-UCL (use when n<50)	0.477
57				
58	**Gamma ROS Statistics using Imputed Non-Detects**			
59	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
60	GROS may not be used when kstar of detected data is small such as < 0.1			
61	For such situations, GROS method tends to yield inflated values of UCLs and BTVs			
62	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
63	Minimum	0.007	Mean	0.261
64	Maximum	1.2	Median	0.0898
65	SD	0.344	CV	1.321
66	k hat (MLE)	0.549	k star (bias corrected MLE)	0.502
67	Theta hat (MLE)	0.475	Theta star (bias corrected MLE)	0.519
68	nu hat (MLE)	23.05	nu star (bias corrected)	21.09
69	MLE Mean (bias corrected)	0.261	MLE Sd (bias corrected)	0.368
70			Adjusted Level of Significance (β)	0.0383
71	Approximate Chi Square Value (21.09, α)	11.66	Adjusted Chi Square Value (21.09, β)	11.12
72	95% Gamma Approximate UCL (use when n>=50)	0.471	95% Gamma Adjusted UCL (use when n<50)	0.494
73				
74	**Lognormal GOF Test on Detected Observations Only**			
75	Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**	
76	5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level	
77	Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
78	5% Lilliefors Critical Value	0.222	Detected Data appear Lognormal at 5% Significance Level	
79	**Detected Data appear Lognormal at 5% Significance Level**			
80				
81	**Lognormal ROS Statistics Using Imputed Non-Detects**			
82	Mean in Original Scale	0.256	Mean in Log Scale	-2.554
83	SD in Original Scale	0.347	SD in Log Scale	1.758
84	95% t UCL (assumes normality of ROS data)	0.386	95% Percentile Bootstrap UCL	0.384
85	95% BCA Bootstrap UCL	0.393	95% Bootstrap t UCL	0.443
86	95% H-UCL (Log ROS)	1.582		
87				
88	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**			
89	KM Mean (logged)	-2.572	95% H-UCL (KM -Log)	1.902
90	KM SD (logged)	1.819	95% Critical H Value (KM-Log)	3.835
91	KM Standard Error of Mean (logged)	0.43		
92				
93	**DL/2 Statistics**			
94	**DL/2 Normal**		**DL/2 Log-Transformed**	
95	Mean in Original Scale	0.297	Mean in Log Scale	-2.368
96	SD in Original Scale	0.353	SD in Log Scale	1.843
97	95% t UCL (Assumes normality)	0.43	95% H-Stat UCL	2.527
98	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
99				
100	**Nonparametric Distribution Free UCL Statistics**			

	A	B	C	D	E	F	G	H	I	J	K	L
101	**Detected Data appear Approximate Normal Distributed at 5% Significance Level**											
102												
103	**Suggested UCL to Use**											
104	95% KM (t) UCL					0.408	95% KM (Percentile Bootstrap) UCL					0.411
105												
106	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
107	Recommendations are based upon data size, data distribution, and skewness.											
108	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
109	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
110												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	1/9/2016 2:38:52 PM
From File	VOCs Soil.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

m,p-Xylenes

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	69
Number of Detects	17	Number of Non-Detects	1
Number of Distinct Detects	17	Number of Distinct Non-Detects	1
Minimum Detect	0.0097	Minimum Non-Detect	11
Maximum Detect	2.8	Maximum Non-Detect	11
Variance Detects	0.509	Percent Non-Detects	5.556%
Mean Detects	0.54	SD Detects	0.714
Median Detects	0.3	CV Detects	1.322
Skewness Detects	2.193	Kurtosis Detects	5.827
Mean of Logged Detects	-1.671	SD of Logged Detects	1.747

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.744	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.892	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.215	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.54	Standard Error of Mean	0.173
SD	0.692	95% KM (BCA) UCL	0.847
95% KM (t) UCL	0.841	95% KM (Percentile Bootstrap) UCL	0.857
95% KM (z) UCL	0.824	95% KM Bootstrap t UCL	1.057
90% KM Chebyshev UCL	1.059	95% KM Chebyshev UCL	1.294
97.5% KM Chebyshev UCL	1.621	99% KM Chebyshev UCL	2.262

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.367	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.79	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.174	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.22	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.588	k star (bias corrected MLE)	0.523
Theta hat (MLE)	0.918	Theta star (bias corrected MLE)	1.032
nu hat (MLE)	19.98	nu star (bias corrected)	17.79

	A	B	C	D	E	F	G	H	I	J	K	L
51					MLE Mean (bias corrected)	0.54					MLE Sd (bias corrected)	0.746
52												
53	**Gamma Kaplan-Meier (KM) Statistics**											
54					k hat (KM)	0.608					nu hat (KM)	21.87
55					Approximate Chi Square Value (21.87, α)	12.24					Adjusted Chi Square Value (21.87, β)	11.55
56					95% Gamma Approximate KM-UCL (use when n>=50)	0.964					95% Gamma Adjusted KM-UCL (use when n<50)	1.022
57												
58	**Gamma ROS Statistics using Imputed Non-Detects**											
59	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
60	GROS may not be used when kstar of detected data is small such as < 0.1											
61	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
62	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
63					Minimum	0.0097					Mean	0.526
64					Maximum	2.8					Median	0.292
65					SD	0.695					CV	1.322
66					k hat (MLE)	0.613					k star (bias corrected MLE)	0.548
67					Theta hat (MLE)	0.857					Theta star (bias corrected MLE)	0.959
68					nu hat (MLE)	22.07					nu star (bias corrected)	19.72
69					MLE Mean (bias corrected)	0.526					MLE Sd (bias corrected)	0.71
70											Adjusted Level of Significance (β)	0.0357
71					Approximate Chi Square Value (19.72, α)	10.65					Adjusted Chi Square Value (19.72, β)	10.01
72					95% Gamma Approximate UCL (use when n>=50)	0.974					95% Gamma Adjusted UCL (use when n<50)	1.035
73												
74	**Lognormal GOF Test on Detected Observations Only**											
75					Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**					
76					5% Shapiro Wilk Critical Value	0.892	Detected Data appear Lognormal at 5% Significance Level					
77					Lilliefors Test Statistic	0.138	**Lilliefors GOF Test**					
78					5% Lilliefors Critical Value	0.215	Detected Data appear Lognormal at 5% Significance Level					
79	**Detected Data appear Lognormal at 5% Significance Level**											
80												
81	**Lognormal ROS Statistics Using Imputed Non-Detects**											
82					Mean in Original Scale	0.52					Mean in Log Scale	-1.671
83					SD in Original Scale	0.697					SD in Log Scale	1.695
84					95% t UCL (assumes normality of ROS data)	0.806					95% Percentile Bootstrap UCL	0.814
85					95% BCA Bootstrap UCL	0.899					95% Bootstrap t UCL	0.966
86					95% H-UCL (Log ROS)	3.727						
87												
88	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**											
89					KM Mean (logged)	-1.671					95% H-UCL (KM -Log)	3.727
90					KM SD (logged)	1.695					95% Critical H Value (KM-Log)	3.77
91					KM Standard Error of Mean (logged)	0.424						
92												
93	**DL/2 Statistics**											
94	**DL/2 Normal**						**DL/2 Log-Transformed**					
95					Mean in Original Scale	0.815					Mean in Log Scale	-1.484
96					SD in Original Scale	1.359					SD in Log Scale	1.873
97					95% t UCL (Assumes normality)	1.372					95% H-Stat UCL	8.372
98	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
99												
100	**Nonparametric Distribution Free UCL Statistics**											

	A	B	C	D	E	F	G	H	I	J	K	L
101	**Detected Data appear Gamma Distributed at 5% Significance Level**											
102												
103	**Suggested UCL to Use**											
104	95% KM (Chebyshev) UCL					1.294	95% GROS Adjusted Gamma UCL					1.035
105	95% Adjusted Gamma KM-UCL					1.022						
106												
107	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
108	Recommendations are based upon data size, data distribution, and skewness.											
109	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
110	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
111												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:39:46 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	Naphthalene											
11												
12	General Statistics											
13	Total Number of Observations					27	Number of Distinct Observations					24
14							Number of Missing Observations					60
15	Number of Detects					21	Number of Non-Detects					6
16	Number of Distinct Detects					20	Number of Distinct Non-Detects					6
17	Minimum Detect					0.0056	Minimum Non-Detect					0.0062
18	Maximum Detect					51	Maximum Non-Detect					9.3
19	Variance Detects					120	Percent Non-Detects					22.22%
20	Mean Detects					3.598	SD Detects					10.96
21	Median Detects					0.49	CV Detects					3.045
22	Skewness Detects					4.455	Kurtosis Detects					20.17
23	Mean of Logged Detects					-0.932	SD of Logged Detects					2.399
24												
25	Normal GOF Test on Detects Only											
26	Shapiro Wilk Test Statistic					0.328	Shapiro Wilk GOF Test					
27	5% Shapiro Wilk Critical Value					0.908	Detected Data Not Normal at 5% Significance Level					
28	Lilliefors Test Statistic					0.412	Lilliefors GOF Test					
29	5% Lilliefors Critical Value					0.193	Detected Data Not Normal at 5% Significance Level					
30	Detected Data Not Normal at 5% Significance Level											
31												
32	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
33	Mean					2.903	Standard Error of Mean					1.881
34	SD					9.53	95% KM (BCA) UCL					6.925
35	95% KM (t) UCL					6.112	95% KM (Percentile Bootstrap) UCL					6.599
36	95% KM (z) UCL					5.997	95% KM Bootstrap t UCL					20.63
37	90% KM Chebyshev UCL					8.547	95% KM Chebyshev UCL					11.1
38	97.5% KM Chebyshev UCL					14.65	99% KM Chebyshev UCL					21.62
39												
40	Gamma GOF Tests on Detected Observations Only											
41	A-D Test Statistic					0.979	Anderson-Darling GOF Test					
42	5% A-D Critical Value					0.844	Detected Data Not Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.181	Kolmogrov-Smirnoff GOF					
44	5% K-S Critical Value					0.205	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
46												
47	Gamma Statistics on Detected Data Only											
48	k hat (MLE)					0.31	k star (bias corrected MLE)					0.297
49	Theta hat (MLE)					11.61	Theta star (bias corrected MLE)					12.1
50	nu hat (MLE)					13.02	nu star (bias corrected)					12.49

	A	B	C	D	E	F	G	H	I	J	K	L
51					MLE Mean (bias corrected)	3.598					MLE Sd (bias corrected)	6.598
52												
53	**Gamma Kaplan-Meier (KM) Statistics**											
54					k hat (KM)	0.0928					nu hat (KM)	5.01
55					Approximate Chi Square Value (5.01, α)	1.157					Adjusted Chi Square Value (5.01, β)	1.045
56					95% Gamma Approximate KM-UCL (use when n>=50)	12.57					95% Gamma Adjusted KM-UCL (use when n<50)	13.92
57	Gamma (KM) may not be used when k hat (KM) is < 0.1											
58												
59	**Gamma ROS Statistics using Imputed Non-Detects**											
60	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
61	GROS may not be used when kstar of detected data is small such as < 0.1											
62	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
63	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
64					Minimum	0.0056					Mean	2.801
65					Maximum	51					Median	0.13
66					SD	9.729					CV	3.473
67					k hat (MLE)	0.255					k star (bias corrected MLE)	0.251
68					Theta hat (MLE)	10.99					Theta star (bias corrected MLE)	11.15
69					nu hat (MLE)	13.76					nu star (bias corrected)	13.57
70					MLE Mean (bias corrected)	2.801					MLE Sd (bias corrected)	5.588
71											Adjusted Level of Significance (β)	0.0401
72					Approximate Chi Square Value (13.57, α)	6.275					Adjusted Chi Square Value (13.57, β)	5.959
73					95% Gamma Approximate UCL (use when n>=50)	6.055					95% Gamma Adjusted UCL (use when n<50)	6.376
74												
75	**Lognormal GOF Test on Detected Observations Only**											
76					Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**					
77					5% Shapiro Wilk Critical Value	0.908	Detected Data appear Lognormal at 5% Significance Level					
78					Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**					
79					5% Lilliefors Critical Value	0.193	Detected Data appear Lognormal at 5% Significance Level					
80	**Detected Data appear Lognormal at 5% Significance Level**											
81												
82	**Lognormal ROS Statistics Using Imputed Non-Detects**											
83					Mean in Original Scale	2.821					Mean in Log Scale	-1.404
84					SD in Original Scale	9.723					SD in Log Scale	2.391
85					95% t UCL (assumes normality of ROS data)	6.012					95% Percentile Bootstrap UCL	6.501
86					95% BCA Bootstrap UCL	8.514					95% Bootstrap t UCL	21.4
87					95% H-UCL (Log ROS)	38.74						
88												
89	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**											
90					KM Mean (logged)	-1.444					95% H-UCL (KM -Log)	63.29
91					KM SD (logged)	2.517					95% Critical H Value (KM-Log)	4.911
92					KM Standard Error of Mean (logged)	0.525						
93												
94	**DL/2 Statistics**											
95	**DL/2 Normal**						**DL/2 Log-Transformed**					
96					Mean in Original Scale	3.157					Mean in Log Scale	-1.089
97					SD in Original Scale	9.685					SD in Log Scale	2.535
98					95% t UCL (Assumes normality)	6.337					95% H-Stat UCL	97.77
99	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
100												

	A	B	C	D	E	F	G	H	I	J	K	L
101	**Nonparametric Distribution Free UCL Statistics**											
102	**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**											
103												
104	**Suggested UCL to Use**											
105	95% KM (Chebyshev) UCL					11.1	95% GROS Adjusted Gamma UCL					6.376
106	95% Adjusted Gamma KM-UCL					13.92						
107												
108	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
109	Recommendations are based upon data size, data distribution, and skewness.											
110	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
111	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
112												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:40:32 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	n-Butylbenzene											
11												
12	General Statistics											
13	Total Number of Observations					20	Number of Distinct Observations					20
14							Number of Missing Observations					67
15	Number of Detects					17	Number of Non-Detects					3
16	Number of Distinct Detects					17	Number of Distinct Non-Detects					3
17	Minimum Detect					0.0011	Minimum Non-Detect					0.025
18	Maximum Detect					3.4	Maximum Non-Detect					2.5
19	Variance Detects					0.668	Percent Non-Detects					15%
20	Mean Detects					0.477	SD Detects					0.817
21	Median Detects					0.14	CV Detects					1.712
22	Skewness Detects					3.162	Kurtosis Detects					11.33
23	Mean of Logged Detects					-2.194	SD of Logged Detects					2.163
24												
25	Normal GOF Test on Detects Only											
26	Shapiro Wilk Test Statistic					0.587	Shapiro Wilk GOF Test					
27	5% Shapiro Wilk Critical Value					0.892	Detected Data Not Normal at 5% Significance Level					
28	Lilliefors Test Statistic					0.28	Lilliefors GOF Test					
29	5% Lilliefors Critical Value					0.215	Detected Data Not Normal at 5% Significance Level					
30	Detected Data Not Normal at 5% Significance Level											
31												
32	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
33	Mean					0.427	Standard Error of Mean					0.173
34	SD					0.746	95% KM (BCA) UCL					0.776
35	95% KM (t) UCL					0.726	95% KM (Percentile Bootstrap) UCL					0.756
36	95% KM (z) UCL					0.712	95% KM Bootstrap t UCL					1.085
37	90% KM Chebyshev UCL					0.946	95% KM Chebyshev UCL					1.182
38	97.5% KM Chebyshev UCL					1.508	99% KM Chebyshev UCL					2.15
39												
40	Gamma GOF Tests on Detected Observations Only											
41	A-D Test Statistic					0.393	Anderson-Darling GOF Test					
42	5% A-D Critical Value					0.81	Detected data appear Gamma Distributed at 5% Significance Level					
43	K-S Test Statistic					0.14	Kolmogrov-Smirnoff GOF					
44	5% K-S Critical Value					0.223	Detected data appear Gamma Distributed at 5% Significance Level					
45	Detected data appear Gamma Distributed at 5% Significance Level											
46												
47	Gamma Statistics on Detected Data Only											
48	k hat (MLE)					0.445	k star (bias corrected MLE)					0.405
49	Theta hat (MLE)					1.073	Theta star (bias corrected MLE)					1.177
50	nu hat (MLE)					15.12	nu star (bias corrected)					13.79

51	MLE Mean (bias corrected)	0.477	MLE Sd (bias corrected)	0.75
52				
53	**Gamma Kaplan-Meier (KM) Statistics**			
54	k hat (KM)	0.327	nu hat (KM)	13.07
55	Approximate Chi Square Value (13.07, α)	5.939	Adjusted Chi Square Value (13.07, β)	5.562
56	95% Gamma Approximate KM-UCL (use when n>=50)	0.939	95% Gamma Adjusted KM-UCL (use when n<50)	1.003
57				
58	**Gamma ROS Statistics using Imputed Non-Detects**			
59	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
60	GROS may not be used when kstar of detected data is small such as < 0.1			
61	For such situations, GROS method tends to yield inflated values of UCLs and BTVs			
62	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
63	Minimum	0.0011	Mean	0.411
64	Maximum	3.4	Median	0.0824
65	SD	0.767	CV	1.865
66	k hat (MLE)	0.419	k star (bias corrected MLE)	0.39
67	Theta hat (MLE)	0.981	Theta star (bias corrected MLE)	1.055
68	nu hat (MLE)	16.78	nu star (bias corrected)	15.59
69	MLE Mean (bias corrected)	0.411	MLE Sd (bias corrected)	0.659
70			Adjusted Level of Significance (β)	0.038
71	Approximate Chi Square Value (15.59, α)	7.676	Adjusted Chi Square Value (15.59, β)	7.239
72	95% Gamma Approximate UCL (use when n>=50)	0.836	95% Gamma Adjusted UCL (use when n<50)	0.886
73				
74	**Lognormal GOF Test on Detected Observations Only**			
75	Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**	
76	5% Shapiro Wilk Critical Value	0.892	Detected Data appear Lognormal at 5% Significance Level	
77	Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
78	5% Lilliefors Critical Value	0.215	Detected Data appear Lognormal at 5% Significance Level	
79	**Detected Data appear Lognormal at 5% Significance Level**			
80				
81	**Lognormal ROS Statistics Using Imputed Non-Detects**			
82	Mean in Original Scale	0.412	Mean in Log Scale	-2.393
83	SD in Original Scale	0.767	SD in Log Scale	2.078
84	95% t UCL (assumes normality of ROS data)	0.709	95% Percentile Bootstrap UCL	0.719
85	95% BCA Bootstrap UCL	0.909	95% Bootstrap t UCL	1.108
86	95% H-UCL (Log ROS)	6.592		
87				
88	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**			
89	KM Mean (logged)	-2.412	95% H-UCL (KM -Log)	8.652
90	KM SD (logged)	2.15	95% Critical H Value (KM-Log)	4.578
91	KM Standard Error of Mean (logged)	0.523		
92				
93	**DL/2 Statistics**			
94	**DL/2 Normal**		**DL/2 Log-Transformed**	
95	Mean in Original Scale	0.483	Mean in Log Scale	-2.136
96	SD in Original Scale	0.779	SD in Log Scale	2.131
97	95% t UCL (Assumes normality)	0.784	95% H-Stat UCL	10.53
98	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
99				
100	**Nonparametric Distribution Free UCL Statistics**			

	A	B	C	D	E	F	G	H	I	J	K	L
101	**Detected Data appear Gamma Distributed at 5% Significance Level**											
102												
103	**Suggested UCL to Use**											
104	95% KM (Chebyshev) UCL					1.182	95% GROS Adjusted Gamma UCL					0.886
105	95% Adjusted Gamma KM-UCL					1.003						
106												
107	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
108	Recommendations are based upon data size, data distribution, and skewness.											
109	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
110	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
111												

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	1/9/2016 2:41:20 PM
From File	VOCs Soil.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

n-Propylbenzene

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	65
Number of Detects	16	Number of Non-Detects	6
Number of Distinct Detects	16	Number of Distinct Non-Detects	6
Minimum Detect	0.013	Minimum Non-Detect	0.0036
Maximum Detect	1.9	Maximum Non-Detect	2.6
Variance Detects	0.348	Percent Non-Detects	27.27%
Mean Detects	0.53	SD Detects	0.59
Median Detects	0.335	CV Detects	1.113
Skewness Detects	1.132	Kurtosis Detects	0.633
Mean of Logged Detects	-1.612	SD of Logged Detects	1.694

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.823	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.222	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

Mean	0.419	Standard Error of Mean	0.124
SD	0.545	95% KM (BCA) UCL	0.633
95% KM (t) UCL	0.633	95% KM (Percentile Bootstrap) UCL	0.621
95% KM (z) UCL	0.623	95% KM Bootstrap t UCL	0.697
90% KM Chebyshev UCL	0.791	95% KM Chebyshev UCL	0.96
97.5% KM Chebyshev UCL	1.194	99% KM Chebyshev UCL	1.653

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.775	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.785	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	**Kolmogrov-Smirnoff GOF**
5% K-S Critical Value	0.225	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.628	k star (bias corrected MLE)	0.552
Theta hat (MLE)	0.844	Theta star (bias corrected MLE)	0.961
nu hat (MLE)	20.09	nu star (bias corrected)	17.66

	A–E	F	G–K	L
51	MLE Mean (bias corrected)	0.53	MLE Sd (bias corrected)	0.714
52				
53	**Gamma Kaplan-Meier (KM) Statistics**			
54	k hat (KM)	0.592	nu hat (KM)	26.03
55	Approximate Chi Square Value (26.03, α)	15.41	Adjusted Chi Square Value (26.03, β)	14.8
56	95% Gamma Approximate KM-UCL (use when n>=50)	0.708	95% Gamma Adjusted KM-UCL (use when n<50)	0.737
57				
58	**Gamma ROS Statistics using Imputed Non-Detects**			
59	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
60	GROS may not be used when kstar of detected data is small such as < 0.1			
61	For such situations, GROS method tends to yield inflated values of UCLs and BTVs			
62	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
63	Minimum	0.01	Mean	0.404
64	Maximum	1.9	Median	0.108
65	SD	0.543	CV	1.344
66	k hat (MLE)	0.504	k star (bias corrected MLE)	0.466
67	Theta hat (MLE)	0.802	Theta star (bias corrected MLE)	0.868
68	nu hat (MLE)	22.18	nu star (bias corrected)	20.49
69	MLE Mean (bias corrected)	0.404	MLE Sd (bias corrected)	0.592
70			Adjusted Level of Significance (β)	0.0386
71	Approximate Chi Square Value (20.49, α)	11.21	Adjusted Chi Square Value (20.49, β)	10.7
72	95% Gamma Approximate UCL (use when n>=50)	0.739	95% Gamma Adjusted UCL (use when n<50)	0.774
73				
74	**Lognormal GOF Test on Detected Observations Only**			
75	Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk GOF Test**	
76	5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level	
77	Lilliefors Test Statistic	0.213	**Lilliefors GOF Test**	
78	5% Lilliefors Critical Value	0.222	Detected Data appear Lognormal at 5% Significance Level	
79	**Detected Data appear Lognormal at 5% Significance Level**			
80				
81	**Lognormal ROS Statistics Using Imputed Non-Detects**			
82	Mean in Original Scale	0.396	Mean in Log Scale	-2.257
83	SD in Original Scale	0.548	SD in Log Scale	1.902
84	95% t UCL (assumes normality of ROS data)	0.597	95% Percentile Bootstrap UCL	0.594
85	95% BCA Bootstrap UCL	0.629	95% Bootstrap t UCL	0.685
86	95% H-UCL (Log ROS)	3.378		
87				
88	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**			
89	KM Mean (logged)	-2.295	95% H-UCL (KM -Log)	4.779
90	KM SD (logged)	2.009	95% Critical H Value (KM-Log)	4.201
91	KM Standard Error of Mean (logged)	0.471		
92				
93	**DL/2 Statistics**			
94	**DL/2 Normal**		**DL/2 Log-Transformed**	
95	Mean in Original Scale	0.469	Mean in Log Scale	-2.066
96	SD in Original Scale	0.57	SD in Log Scale	2.036
97	95% t UCL (Assumes normality)	0.678	95% H-Stat UCL	6.655
98	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
99				
100	**Nonparametric Distribution Free UCL Statistics**			

	A	B	C	D	E	F	G	H	I	J	K	L
101	**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**											
102												
103	**Suggested UCL to Use**											
104	95% KM (Chebyshev) UCL					0.96	95% GROS Adjusted Gamma UCL					0.774
105	95% Adjusted Gamma KM-UCL					0.737						
106												
107	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
108	Recommendations are based upon data size, data distribution, and skewness.											
109	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
110	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
111												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:42:08 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	o-Xylene											
12												
13	**General Statistics**											
14	Total Number of Observations					10	Number of Distinct Observations					10
15							Number of Missing Observations					77
16	Minimum					0.005	Mean					0.579
17	Maximum					5.1	Median					0.0325
18	SD					1.592	Std. Error of Mean					0.503
19	Coefficient of Variation					2.75	Skewness					3.14
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic					0.414	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk Critical Value					0.842	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.477	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.28	Data Not Normal at 5% Significance Level					
26	**Data Not Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL					1.501	95% Adjusted-CLT UCL (Chen-1995)					1.941
31							95% Modified-t UCL (Johnson-1978)					1.585
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					1.174	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.825	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.284	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.29	Detected data appear Gamma Distributed at 5% Significance Level					
38	**Detected data follow Appr. Gamma Distribution at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)					0.272	k star (bias corrected MLE)					0.257
42	Theta hat (MLE)					2.128	Theta star (bias corrected MLE)					2.252
43	nu hat (MLE)					5.439	nu star (bias corrected)					5.141
44	MLE Mean (bias corrected)					0.579	MLE Sd (bias corrected)					1.142
45							Approximate Chi Square Value (0.05)					1.218
46	Adjusted Level of Significance					0.0267	Adjusted Chi Square Value					0.921
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50)					2.443	95% Adjusted Gamma UCL (use when n<50)					3.23
50												

Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.19	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.28	Data appear Lognormal at 5% Significance Level	
Data appear Lognormal at 5% Significance Level			
Lognormal Statistics			
Minimum of Logged Data	-5.298	Mean of logged Data	-3.123
Maximum of Logged Data	1.629	SD of logged Data	2.277
Assuming Lognormal Distribution			
95% H-UCL	58.8	90% Chebyshev (MVUE) UCL	1.014
95% Chebyshev (MVUE) UCL	1.328	97.5% Chebyshev (MVUE) UCL	1.764
99% Chebyshev (MVUE) UCL	2.62		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	1.407	95% Jackknife UCL	1.501
95% Standard Bootstrap UCL	1.382	95% Bootstrap-t UCL	12.04
95% Hall's Bootstrap UCL	10.27	95% Percentile Bootstrap UCL	1.566
95% BCA Bootstrap UCL	2.102		
90% Chebyshev(Mean, Sd) UCL	2.089	95% Chebyshev(Mean, Sd) UCL	2.773
97.5% Chebyshev(Mean, Sd) UCL	3.722	99% Chebyshev(Mean, Sd) UCL	5.587
Suggested UCL to Use			
95% Adjusted Gamma UCL	3.23		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:42:51 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	p-Isopropyltoluene											
12												
13	General Statistics											
14	Total Number of Observations					22	Number of Distinct Observations					20
15							Number of Missing Observations					65
16	Minimum					0.0027	Mean					0.573
17	Maximum					2.2	Median					0.285
18	SD					0.71	Std. Error of Mean					0.151
19	Coefficient of Variation					1.238	Skewness					1.191
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.791	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk Critical Value					0.911	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.225	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.189	Data Not Normal at 5% Significance Level					
26	Data Not Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					0.834	95% Adjusted-CLT UCL (Chen-1995)					0.863
31							95% Modified-t UCL (Johnson-1978)					0.84
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.698	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.814	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.2	Kolmogrov-Smirnoff Gamma GOF Test					
37	5% K-S Critical Value					0.197	Data Not Gamma Distributed at 5% Significance Level					
38	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					0.454	k star (bias corrected MLE)					0.423
42	Theta hat (MLE)					1.262	Theta star (bias corrected MLE)					1.357
43	nu hat (MLE)					19.99	nu star (bias corrected)					18.6
44	MLE Mean (bias corrected)					0.573	MLE Sd (bias corrected)					0.882
45							Approximate Chi Square Value (0.05)					9.824
46	Adjusted Level of Significance					0.0386	Adjusted Chi Square Value					9.349
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50)					1.085	95% Adjusted Gamma UCL (use when n<50)					1.141
50												

	A	B	C	D	E	F	G	H	I	J	K	L
51	**Lognormal GOF Test**											
52					Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**					
53					5% Shapiro Wilk Critical Value	0.911	Data appear Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.192	**Lilliefors Lognormal GOF Test**					
55					5% Lilliefors Critical Value	0.189	Data Not Lognormal at 5% Significance Level					
56	**Data appear Approximate Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59					Minimum of Logged Data	-5.915					Mean of logged Data	-1.975
60					Maximum of Logged Data	0.788					SD of logged Data	2.16
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	11.74					90% Chebyshev (MVUE) UCL	2.966
64					95% Chebyshev (MVUE) UCL	3.821					97.5% Chebyshev (MVUE) UCL	5.007
65					99% Chebyshev (MVUE) UCL	7.338						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71					95% CLT UCL	0.822					95% Jackknife UCL	0.834
72					95% Standard Bootstrap UCL	0.817					95% Bootstrap-t UCL	0.898
73					95% Hall's Bootstrap UCL	0.843					95% Percentile Bootstrap UCL	0.835
74					95% BCA Bootstrap UCL	0.854						
75					90% Chebyshev(Mean, Sd) UCL	1.027					95% Chebyshev(Mean, Sd) UCL	1.233
76					97.5% Chebyshev(Mean, Sd) UCL	1.518					99% Chebyshev(Mean, Sd) UCL	2.079
77												
78	**Suggested UCL to Use**											
79					95% Adjusted Gamma UCL	1.141						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 2:43:38 PM								
5	From File			VOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	sec-Butylbenzene											
12												
13	General Statistics											
14	Total Number of Observations					23	Number of Distinct Observations					22
15							Number of Missing Observations					64
16	Minimum					0.0011	Mean					0.351
17	Maximum					1.4	Median					0.034
18	SD					0.449	Std. Error of Mean					0.0936
19	Coefficient of Variation					1.28	Skewness					1.182
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.772	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk Critical Value					0.914	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.282	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.185	Data Not Normal at 5% Significance Level					
26	Data Not Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					0.511	95% Adjusted-CLT UCL (Chen-1995)					0.529
31							95% Modified-t UCL (Johnson-1978)					0.515
32												
33	Gamma GOF Test											
34	A-D Test Statistic					1.016	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.819	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.242	Kolmogrov-Smirnoff Gamma GOF Test					
37	5% K-S Critical Value					0.193	Data Not Gamma Distributed at 5% Significance Level					
38	Data Not Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					0.438	k star (bias corrected MLE)					0.41
42	Theta hat (MLE)					0.801	Theta star (bias corrected MLE)					0.856
43	nu hat (MLE)					20.13	nu star (bias corrected)					18.84
44	MLE Mean (bias corrected)					0.351	MLE Sd (bias corrected)					0.548
45							Approximate Chi Square Value (0.05)					10
46	Adjusted Level of Significance					0.0389	Adjusted Chi Square Value					9.535
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50))					0.661	95% Adjusted Gamma UCL (use when n<50)					0.693
50												

	A–E	F	G–K	L
51	**Lognormal GOF Test**			
52	Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk Lognormal GOF Test**	
53	5% Shapiro Wilk Critical Value	0.914	Data appear Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.185	Data Not Lognormal at 5% Significance Level	
56	**Data appear Approximate Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	-6.812	Mean of logged Data	-2.53
60	Maximum of Logged Data	0.336	SD of logged Data	2.152
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	5.811	90% Chebyshev (MVUE) UCL	1.678
64	95% Chebyshev (MVUE) UCL	2.159	97.5% Chebyshev (MVUE) UCL	2.826
65	99% Chebyshev (MVUE) UCL	4.137		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	0.504	95% Jackknife UCL	0.511
72	95% Standard Bootstrap UCL	0.495	95% Bootstrap-t UCL	0.541
73	95% Hall's Bootstrap UCL	0.526	95% Percentile Bootstrap UCL	0.503
74	95% BCA Bootstrap UCL	0.521		
75	90% Chebyshev(Mean, Sd) UCL	0.631	95% Chebyshev(Mean, Sd) UCL	0.758
76	97.5% Chebyshev(Mean, Sd) UCL	0.935	99% Chebyshev(Mean, Sd) UCL	1.281
77				
78	**Suggested UCL to Use**			
79	97.5% Chebyshev (Mean, Sd) UCL	0.935		
80				
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
84	For additional insight the user may want to consult a statistician.			
85				

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	1/9/2016 2:44:36 PM
From File	VOCs Soil.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Toluene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	79
Minimum	0.002	Mean	0.529
Maximum	2.6	Median	0.0056
SD	1.006	Std. Error of Mean	0.356
Coefficient of Variation	1.902	Skewness	1.731

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use
guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.0

Normal GOF Test

Shapiro Wilk Test Statistic	0.61	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.447	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.313	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.203	95% Adjusted-CLT UCL (Chen-1995)	1.346
		95% Modified-t UCL (Johnson-1978)	1.239

Gamma GOF Test

A-D Test Statistic	1.446	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.826	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.437	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.321	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.226	k star (bias corrected MLE)	0.225
Theta hat (MLE)	2.339	Theta star (bias corrected MLE)	2.355
nu hat (MLE)	3.618	nu star (bias corrected)	3.594
MLE Mean (bias corrected)	0.529	MLE Sd (bias corrected)	1.116
		Approximate Chi Square Value (0.05)	0.568

	A	B	C	D	E	F	G	H	I	J	K	L
51					Adjusted Level of Significance	0.0195					Adjusted Chi Square Value	0.338
52												
53	**Assuming Gamma Distribution**											
54					95% Approximate Gamma UCL (use when n>=50))	3.345					95% Adjusted Gamma UCL (use when n<50)	5.629
55												
56	**Lognormal GOF Test**											
57					Shapiro Wilk Test Statistic	0.709	**Shapiro Wilk Lognormal GOF Test**					
58					5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level					
59					Lilliefors Test Statistic	0.369	**Lilliefors Lognormal GOF Test**					
60					5% Lilliefors Critical Value	0.313	Data Not Lognormal at 5% Significance Level					
61	**Data Not Lognormal at 5% Significance Level**											
62												
63	**Lognormal Statistics**											
64					Minimum of Logged Data	-6.215					Mean of logged Data	-3.829
65					Maximum of Logged Data	0.956					SD of logged Data	2.838
66												
67	**Assuming Lognormal Distribution**											
68					95% H-UCL	11550					90% Chebyshev (MVUE) UCL	1.184
69					95% Chebyshev (MVUE) UCL	1.568					97.5% Chebyshev (MVUE) UCL	2.102
70					99% Chebyshev (MVUE) UCL	3.151						
71												
72	**Nonparametric Distribution Free UCL Statistics**											
73	**Data do not follow a Discernible Distribution (0.05)**											
74												
75	**Nonparametric Distribution Free UCLs**											
76					95% CLT UCL	1.114					95% Jackknife UCL	1.203
77					95% Standard Bootstrap UCL	1.078					95% Bootstrap-t UCL	266.1
78					95% Hall's Bootstrap UCL	128.5					95% Percentile Bootstrap UCL	1.126
79					95% BCA Bootstrap UCL	1.303						
80					90% Chebyshev(Mean, Sd) UCL	1.596					95% Chebyshev(Mean, Sd) UCL	2.079
81					97.5% Chebyshev(Mean, Sd) UCL	2.75					99% Chebyshev(Mean, Sd) UCL	4.067
82												
83	**Suggested UCL to Use**											
84					95% Hall's Bootstrap UCL	128.5						
85												
86	**Recommended UCL exceeds the maximum observation**											
87												
88	**In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL**											
89												
90	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
91	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
92	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
93	For additional insight the user may want to consult a statistician.											
94												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:41:51 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	Arsenic											
11												
12	General Statistics											
13	Total Number of Observations					67	Number of Distinct Observations					47
14	Number of Detects					61	Number of Non-Detects					6
15	Number of Distinct Detects					46	Number of Distinct Non-Detects					1
16	Minimum Detect					1.1	Minimum Non-Detect					1
17	Maximum Detect					120	Maximum Non-Detect					1
18	Variance Detects					256.1	Percent Non-Detects					8.955%
19	Mean Detects					8.976	SD Detects					16
20	Median Detects					5.2	CV Detects					1.783
21	Skewness Detects					5.862	Kurtosis Detects					39.76
22	Mean of Logged Detects					1.635	SD of Logged Detects					0.961
23												
24	Normal GOF Test on Detects Only											
25	Shapiro Wilk Test Statistic					0.437	Normal GOF Test on Detected Observations Only					
26	5% Shapiro Wilk P Value					0	Detected Data Not Normal at 5% Significance Level					
27	Lilliefors Test Statistic					0.311	Lilliefors GOF Test					
28	5% Lilliefors Critical Value					0.113	Detected Data Not Normal at 5% Significance Level					
29	Detected Data Not Normal at 5% Significance Level											
30												
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
32	Mean					8.262	Standard Error of Mean					1.887
33	SD					15.32	95% KM (BCA) UCL					11.72
34	95% KM (t) UCL					11.41	95% KM (Percentile Bootstrap) UCL					11.62
35	95% KM (z) UCL					11.37	95% KM Bootstrap t UCL					15.51
36	90% KM Chebyshev UCL					13.92	95% KM Chebyshev UCL					16.49
37	97.5% KM Chebyshev UCL					20.04	99% KM Chebyshev UCL					27.03
38												
39	Gamma GOF Tests on Detected Observations Only											
40	A-D Test Statistic					2.035	Anderson-Darling GOF Test					
41	5% A-D Critical Value					0.779	Detected Data Not Gamma Distributed at 5% Significance Level					
42	K-S Test Statistic					0.117	Kolmogrov-Smirnoff GOF					
43	5% K-S Critical Value					0.117	Detected Data Not Gamma Distributed at 5% Significance Level					
44	Detected Data Not Gamma Distributed at 5% Significance Level											
45												
46	Gamma Statistics on Detected Data Only											
47	k hat (MLE)					1.028	k star (bias corrected MLE)					0.988
48	Theta hat (MLE)					8.735	Theta star (bias corrected MLE)					9.085
49	nu hat (MLE)					125.4	nu star (bias corrected)					120.5
50	MLE Mean (bias corrected)					8.976	MLE Sd (bias corrected)					9.03

	A	B	C	D	E	F	G	H	I	J	K	L
51												
52	**Gamma Kaplan-Meier (KM) Statistics**											
53					k hat (KM)	0.291					nu hat (KM)	39
54					Approximate Chi Square Value (39.00, α)	25.69					Adjusted Chi Square Value (39.00, β)	25.45
55					95% Gamma Approximate KM-UCL (use when n>=50)	12.54					95% Gamma Adjusted KM-UCL (use when n<50)	12.66
56												
57	**Gamma ROS Statistics using Imputed Non-Detects**											
58	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
59	GROS may not be used when kstar of detected data is small such as < 0.1											
60	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
61	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
62					Minimum	0.01					Mean	8.173
63					Maximum	120					Median	4.4
64					SD	15.48					CV	1.893
65					k hat (MLE)	0.602					k star (bias corrected MLE)	0.585
66					Theta hat (MLE)	13.57					Theta star (bias corrected MLE)	13.96
67					nu hat (MLE)	80.73					nu star (bias corrected)	78.45
68					MLE Mean (bias corrected)	8.173					MLE Sd (bias corrected)	10.68
69											Adjusted Level of Significance (β)	0.0464
70					Approximate Chi Square Value (78.45, α)	59.04					Adjusted Chi Square Value (78.45, β)	58.67
71					95% Gamma Approximate UCL (use when n>=50)	10.86					95% Gamma Adjusted UCL (use when n<50)	10.93
72												
73	**Lognormal GOF Test on Detected Observations Only**											
74					Lilliefors Test Statistic	0.1	**Lilliefors GOF Test**					
75					5% Lilliefors Critical Value	0.113	Detected Data appear Lognormal at 5% Significance Level					
76	**Detected Data appear Approximate Lognormal at 5% Significance Level**											
77												
78	**Lognormal ROS Statistics Using Imputed Non-Detects**											
79					Mean in Original Scale	8.224					Mean in Log Scale	1.436
80					SD in Original Scale	15.45					SD in Log Scale	1.122
81					95% t UCL (assumes normality of ROS data)	11.37					95% Percentile Bootstrap UCL	11.95
82					95% BCA Bootstrap UCL	13.66					95% Bootstrap t UCL	15.32
83					95% H-UCL (Log ROS)	10.75						
84												
85	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**											
86					KM Mean (logged)	1.488					95% H-UCL (KM -Log)	9.927
87					KM SD (logged)	1.023					95% Critical H Value (KM-Log)	2.258
88					KM Standard Error of Mean (logged)	0.126						
89												
90	**DL/2 Statistics**											
91	**DL/2 Normal**						**DL/2 Log-Transformed**					
92					Mean in Original Scale	8.217					Mean in Log Scale	1.426
93					SD in Original Scale	15.45					SD in Log Scale	1.135
94					95% t UCL (Assumes normality)	11.37					95% H-Stat UCL	10.84
95	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
96												
97	**Nonparametric Distribution Free UCL Statistics**											
98	**Detected Data appear Approximate Lognormal Distributed at 5% Significance Level**											
99												
100	**Suggested UCL to Use**											

	A	B	C	D	E	F	G	H	I	J	K	L
101					95% KM (Chebyshev) UCL	16.49						
102												
103	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
104	Recommendations are based upon data size, data distribution, and skewness.											
105	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
106	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
107												

	A–E	F	G–K	L
1	UCL Statistics for Data Sets with Non-Detects			
2				
3	User Selected Options			
4	Date/Time of Computation	1/9/2016 3:43:24 PM		
5	From File	Metals Soil.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	Barium			
12				
13	**General Statistics**			
14	Total Number of Observations	67	Number of Distinct Observations	53
15			Number of Missing Observations	0
16	Minimum	29	Mean	236.3
17	Maximum	1100	Median	150
18	SD	208.2	Std. Error of Mean	25.43
19	Coefficient of Variation	0.881	Skewness	1.858
20				
21	**Normal GOF Test**			
22	Shapiro Wilk Test Statistic	0.796	**Shapiro Wilk GOF Test**	
23	5% Shapiro Wilk P Value	1.610E-12	Data Not Normal at 5% Significance Level	
24	Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**	
25	5% Lilliefors Critical Value	0.108	Data Not Normal at 5% Significance Level	
26	**Data Not Normal at 5% Significance Level**			
27				
28	**Assuming Normal Distribution**			
29	**95% Normal UCL**		**95% UCLs (Adjusted for Skewness)**	
30	95% Student's-t UCL	278.7	95% Adjusted-CLT UCL (Chen-1995)	284.3
31			95% Modified-t UCL (Johnson-1978)	279.7
32				
33	**Gamma GOF Test**			
34	A-D Test Statistic	1.49	**Anderson-Darling Gamma GOF Test**	
35	5% A-D Critical Value	0.766	Data Not Gamma Distributed at 5% Significance Level	
36	K-S Test Statistic	0.142	**Kolmogrov-Smirnoff Gamma GOF Test**	
37	5% K-S Critical Value	0.111	Data Not Gamma Distributed at 5% Significance Level	
38	**Data Not Gamma Distributed at 5% Significance Level**			
39				
40	**Gamma Statistics**			
41	k hat (MLE)	1.736	k star (bias corrected MLE)	1.668
42	Theta hat (MLE)	136.1	Theta star (bias corrected MLE)	141.6
43	nu hat (MLE)	232.6	nu star (bias corrected)	223.6
44	MLE Mean (bias corrected)	236.3	MLE Sd (bias corrected)	182.9
45			Approximate Chi Square Value (0.05)	190
46	Adjusted Level of Significance	0.0464	Adjusted Chi Square Value	189.3
47				
48	**Assuming Gamma Distribution**			
49	95% Approximate Gamma UCL (use when n>=50))	278.1	95% Adjusted Gamma UCL (use when n<50)	279.1
50				

	A	B	C	D	E	F	G	H	I	J	K	L
51	**Lognormal GOF Test**											
52					Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**					
53					5% Shapiro Wilk P Value	0.28	Data appear Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.0894	**Lilliefors Lognormal GOF Test**					
55					5% Lilliefors Critical Value	0.108	Data appear Lognormal at 5% Significance Level					
56	**Data appear Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59					Minimum of Logged Data	3.367					Mean of logged Data	5.15
60					Maximum of Logged Data	7.003					SD of logged Data	0.787
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	287.7					90% Chebyshev (MVUE) UCL	309.3
64					95% Chebyshev (MVUE) UCL	343.6					97.5% Chebyshev (MVUE) UCL	391.2
65					99% Chebyshev (MVUE) UCL	484.7						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
69												
70	**Nonparametric Distribution Free UCLs**											
71					95% CLT UCL	278.1					95% Jackknife UCL	278.7
72					95% Standard Bootstrap UCL	278.4					95% Bootstrap-t UCL	286.8
73					95% Hall's Bootstrap UCL	284.5					95% Percentile Bootstrap UCL	275.2
74					95% BCA Bootstrap UCL	282.8						
75					90% Chebyshev(Mean, Sd) UCL	312.6					95% Chebyshev(Mean, Sd) UCL	347.2
76					97.5% Chebyshev(Mean, Sd) UCL	395.1					99% Chebyshev(Mean, Sd) UCL	489.4
77												
78	**Suggested UCL to Use**											
79					95% H-UCL	287.7						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												
86	**ProUCL computes and outputs H-statistic based UCLs for historical reasons only.**											
87	**H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.**											
88	**It is therefore recommended to avoid the use of H-statistic based 95% UCLs.**											
89	**Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.**											
90												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:44:05 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	Beryllium											
11												
12	General Statistics											
13	Total Number of Observations					67	Number of Distinct Observations					3
14	Number of Detects					1	Number of Non-Detects					66
15	Number of Distinct Detects					1	Number of Distinct Non-Detects					2
16												
17	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
18	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
19												
20	The data set for variable Beryllium was not processed!											
21												
22												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:44:49 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	Cadmium											
11												
12	General Statistics											
13	Total Number of Observations					67	Number of Distinct Observations					4
14	Number of Detects					4	Number of Non-Detects					63
15	Number of Distinct Detects					3	Number of Distinct Non-Detects					2
16	Minimum Detect					1	Minimum Non-Detect					0.5
17	Maximum Detect					3.2	Maximum Non-Detect					1
18	Variance Detects					1.176	Percent Non-Detects					94.03%
19	Mean Detects					1.575	SD Detects					1.084
20	Median Detects					1.05	CV Detects					0.688
21	Skewness Detects					1.989	Kurtosis Detects					3.961
22	Mean of Logged Detects					0.315	SD of Logged Detects					0.567
23												
24	Normal GOF Test on Detects Only											
25	Shapiro Wilk Test Statistic					0.662	Shapiro Wilk GOF Test					
26	5% Shapiro Wilk Critical Value					0.748	Detected Data Not Normal at 5% Significance Level					
27	Lilliefors Test Statistic					0.419	Lilliefors GOF Test					
28	5% Lilliefors Critical Value					0.443	Detected Data appear Normal at 5% Significance Level					
29	Detected Data appear Approximate Normal at 5% Significance Level											
30												
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
32	Mean					0.564	Standard Error of Mean					0.0484
33	SD					0.343	95% KM (BCA) UCL					N/A
34	95% KM (t) UCL					0.645	95% KM (Percentile Bootstrap) UCL					N/A
35	95% KM (z) UCL					0.644	95% KM Bootstrap t UCL					N/A
36	90% KM Chebyshev UCL					0.709	95% KM Chebyshev UCL					0.775
37	97.5% KM Chebyshev UCL					0.866	99% KM Chebyshev UCL					1.045
38												
39	Gamma GOF Tests on Detected Observations Only											
40	A-D Test Statistic					0.837	Anderson-Darling GOF Test					
41	5% A-D Critical Value					0.659	Detected Data Not Gamma Distributed at 5% Significance Level					
42	K-S Test Statistic					0.433	Kolmogrov-Smirnoff GOF					
43	5% K-S Critical Value					0.396	Detected Data Not Gamma Distributed at 5% Significance Level					
44	Detected Data Not Gamma Distributed at 5% Significance Level											
45												
46	Gamma Statistics on Detected Data Only											
47	k hat (MLE)					3.739	k star (bias corrected MLE)					1.101
48	Theta hat (MLE)					0.421	Theta star (bias corrected MLE)					1.43
49	nu hat (MLE)					29.91	nu star (bias corrected)					8.812
50	MLE Mean (bias corrected)					1.575	MLE Sd (bias corrected)					1.501

51				
52	**Gamma Kaplan-Meier (KM) Statistics**			
53	k hat (KM)	2.708	nu hat (KM)	362.9
54	Approximate Chi Square Value (362.92, α)	319.8	Adjusted Chi Square Value (362.92, β)	318.9
55	95% Gamma Approximate KM-UCL (use when n>=50)	0.64	95% Gamma Adjusted KM-UCL (use when n<50)	0.642
56				
57	**Gamma ROS Statistics using Imputed Non-Detects**			
58	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
59	GROS may not be used when kstar of detected data is small such as < 0.1			
60	For such situations, GROS method tends to yield inflated values of UCLs and BTVs			
61	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
62	Minimum	0.01	Mean	0.103
63	Maximum	3.2	Median	0.01
64	SD	0.439	CV	4.248
65	k hat (MLE)	0.332	k star (bias corrected MLE)	0.327
66	Theta hat (MLE)	0.312	Theta star (bias corrected MLE)	0.316
67	nu hat (MLE)	44.49	nu star (bias corrected)	43.83
68	MLE Mean (bias corrected)	0.103	MLE Sd (bias corrected)	0.181
69			Adjusted Level of Significance (β)	0.0464
70	Approximate Chi Square Value (43.83, α)	29.65	Adjusted Chi Square Value (43.83, β)	29.39
71	95% Gamma Approximate UCL (use when n>=50)	0.153	95% Gamma Adjusted UCL (use when n<50)	N/A
72				
73	**Lognormal GOF Test on Detected Observations Only**			
74	Shapiro Wilk Test Statistic	0.688	**Shapiro Wilk GOF Test**	
75	5% Shapiro Wilk Critical Value	0.748	Detected Data Not Lognormal at 5% Significance Level	
76	Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**	
77	5% Lilliefors Critical Value	0.443	Detected Data appear Lognormal at 5% Significance Level	
78	**Detected Data appear Approximate Lognormal at 5% Significance Level**			
79				
80	**Lognormal ROS Statistics Using Imputed Non-Detects**			
81	Mean in Original Scale	0.159	Mean in Log Scale	-3.513
82	SD in Original Scale	0.439	SD in Log Scale	1.888
83	95% t UCL (assumes normality of ROS data)	0.249	95% Percentile Bootstrap UCL	0.26
84	95% BCA Bootstrap UCL	0.304	95% Bootstrap t UCL	0.367
85	95% H-UCL (Log ROS)	0.343		
86				
87	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**			
88	KM Mean (logged)	-0.633	95% H-UCL (KM -Log)	0.583
89	KM SD (logged)	0.267	95% Critical H Value (KM-Log)	1.741
90	KM Standard Error of Mean (logged)	0.0377		
91				
92	**DL/2 Statistics**			
93	**DL/2 Normal**		**DL/2 Log-Transformed**	
94	Mean in Original Scale	0.542	Mean in Log Scale	-0.695
95	SD in Original Scale	0.357	SD in Log Scale	0.346
96	95% t UCL (Assumes normality)	0.615	95% H-Stat UCL	0.572
97	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
98				
99	**Nonparametric Distribution Free UCL Statistics**			
100	**Detected Data appear Approximate Normal Distributed at 5% Significance Level**			

	A	B	C	D	E	F	G	H	I	J	K	L
101												
102	**Suggested UCL to Use**											
103	95% KM (t) UCL					0.645	95% KM (Percentile Bootstrap) UCL					N/A
104	**Warning: One or more Recommended UCL(s) not available!**											
105												
106	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
107	Recommendations are based upon data size, data distribution, and skewness.											
108	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
109	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
110												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:45:37 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	Chromium											
12												
13	General Statistics											
14	Total Number of Observations					67	Number of Distinct Observations					30
15							Number of Missing Observations					0
16	Minimum					5.7	Mean					19.28
17	Maximum					61	Median					19
18	SD					8.076	Std. Error of Mean					0.987
19	Coefficient of Variation					0.419	Skewness					2.866
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.766	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk P Value					2.465E-14	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.202	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.108	Data Not Normal at 5% Significance Level					
26	Data Not Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					20.93	95% Adjusted-CLT UCL (Chen-1995)					21.28
31							95% Modified-t UCL (Johnson-1978)					20.99
32												
33	Gamma GOF Test											
34	A-D Test Statistic					1.551	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.752	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.145	Kolmogrov-Smirnoff Gamma GOF Test					
37	5% K-S Critical Value					0.109	Data Not Gamma Distributed at 5% Significance Level					
38	Data Not Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					7.745	k star (bias corrected MLE)					7.409
42	Theta hat (MLE)					2.49	Theta star (bias corrected MLE)					2.603
43	nu hat (MLE)					1038	nu star (bias corrected)					992.7
44	MLE Mean (bias corrected)					19.28	MLE Sd (bias corrected)					7.085
45							Approximate Chi Square Value (0.05)					920.6
46	Adjusted Level of Significance					0.0464	Adjusted Chi Square Value					919.1
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50))					20.79	95% Adjusted Gamma UCL (use when n<50)					20.83
50												

	A	B	C	D	E	F	G	H	I	J	K	L
51	Lognormal GOF Test											
52					Shapiro Wilk Test Statistic	0.949	Shapiro Wilk Lognormal GOF Test					
53					5% Shapiro Wilk P Value	0.0188	Data Not Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.122	Lilliefors Lognormal GOF Test					
55					5% Lilliefors Critical Value	0.108	Data Not Lognormal at 5% Significance Level					
56	Data Not Lognormal at 5% Significance Level											
57												
58	Lognormal Statistics											
59					Minimum of Logged Data	1.74					Mean of logged Data	2.893
60					Maximum of Logged Data	4.111					SD of logged Data	0.357
61												
62	Assuming Lognormal Distribution											
63					95% H-UCL	20.81					90% Chebyshev (MVUE) UCL	21.81
64					95% Chebyshev (MVUE) UCL	22.98					97.5% Chebyshev (MVUE) UCL	24.61
65					99% Chebyshev (MVUE) UCL	27.8						
66												
67	Nonparametric Distribution Free UCL Statistics											
68	Data do not follow a Discernible Distribution (0.05)											
69												
70	Nonparametric Distribution Free UCLs											
71					95% CLT UCL	20.91					95% Jackknife UCL	20.93
72					95% Standard Bootstrap UCL	20.93					95% Bootstrap-t UCL	21.5
73					95% Hall's Bootstrap UCL	23.19					95% Percentile Bootstrap UCL	20.97
74					95% BCA Bootstrap UCL	21.26						
75					90% Chebyshev(Mean, Sd) UCL	22.24					95% Chebyshev(Mean, Sd) UCL	23.58
76					97.5% Chebyshev(Mean, Sd) UCL	25.45					99% Chebyshev(Mean, Sd) UCL	29.1
77												
78	Suggested UCL to Use											
79					95% Student's-t UCL	20.93					or 95% Modified-t UCL	20.99
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:46:21 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	Cobalt											
12												
13	General Statistics											
14	Total Number of Observations					67	Number of Distinct Observations					46
15							Number of Missing Observations					0
16	Minimum					2.4	Mean					7.117
17	Maximum					12.9	Median					7
18	SD					1.956	Std. Error of Mean					0.239
19	Coefficient of Variation					0.275	Skewness					0.319
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.987	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk P Value					0.919	Data appear Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.0608	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.108	Data appear Normal at 5% Significance Level					
26	Data appear Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					7.516	95% Adjusted-CLT UCL (Chen-1995)					7.52
31							95% Modified-t UCL (Johnson-1978)					7.518
32												
33	Gamma GOF Test											
34	A-D Test Statistic					0.335	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.75	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.0783	Kolmogrov-Smirnoff Gamma GOF Test					
37	5% K-S Critical Value					0.109	Detected data appear Gamma Distributed at 5% Significance Level					
38	Detected data appear Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					12.56	k star (bias corrected MLE)					12.01
42	Theta hat (MLE)					0.567	Theta star (bias corrected MLE)					0.593
43	nu hat (MLE)					1683	nu star (bias corrected)					1609
44	MLE Mean (bias corrected)					7.117	MLE Sd (bias corrected)					2.054
45							Approximate Chi Square Value (0.05)					1517
46	Adjusted Level of Significance					0.0464	Adjusted Chi Square Value					1515
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50))					7.55	95% Adjusted Gamma UCL (use when n<50)					7.559
50												

	A–E	F	G–K	L
51	**Lognormal GOF Test**			
52	Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk Lognormal GOF Test**	
53	5% Shapiro Wilk P Value	0.15	Data appear Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.0957	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.108	Data appear Lognormal at 5% Significance Level	
56	**Data appear Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	0.875	Mean of logged Data	1.922
60	Maximum of Logged Data	2.557	SD of logged Data	0.296
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	7.615	90% Chebyshev (MVUE) UCL	7.929
64	95% Chebyshev (MVUE) UCL	8.287	97.5% Chebyshev (MVUE) UCL	8.784
65	99% Chebyshev (MVUE) UCL	9.76		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	7.51	95% Jackknife UCL	7.516
72	95% Standard Bootstrap UCL	7.503	95% Bootstrap-t UCL	7.527
73	95% Hall's Bootstrap UCL	7.525	95% Percentile Bootstrap UCL	7.514
74	95% BCA Bootstrap UCL	7.511		
75	90% Chebyshev(Mean, Sd) UCL	7.834	95% Chebyshev(Mean, Sd) UCL	8.159
76	97.5% Chebyshev(Mean, Sd) UCL	8.61	99% Chebyshev(Mean, Sd) UCL	9.496
77				
78	**Suggested UCL to Use**			
79	95% Student's-t UCL	7.516		
80				
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
84	For additional insight the user may want to consult a statistician.			
85				

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	1/9/2016 3:47:07 PM
From File	Metals Soil.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	67	Number of Distinct Observations	37
		Number of Missing Observations	0
Minimum	5.3	Mean	27.07
Maximum	230	Median	21
SD	27.75	Std. Error of Mean	3.39
Coefficient of Variation	1.025	Skewness	6.173

Normal GOF Test

Shapiro Wilk Test Statistic	0.458	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.266	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.108	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	32.72	95% Adjusted-CLT UCL (Chen-1995)	35.38
		95% Modified-t UCL (Johnson-1978)	33.15

Gamma GOF Test

A-D Test Statistic	2.613	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.759	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.16	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.11	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.786	k star (bias corrected MLE)	2.671
Theta hat (MLE)	9.716	Theta star (bias corrected MLE)	10.13
nu hat (MLE)	373.3	nu star (bias corrected)	357.9
MLE Mean (bias corrected)	27.07	MLE Sd (bias corrected)	16.56
		Approximate Chi Square Value (0.05)	315.1
Adjusted Level of Significance	0.0464	Adjusted Chi Square Value	314.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	30.75	95% Adjusted Gamma UCL (use when n<50)	30.84

51	**Lognormal GOF Test**			
52	Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**	
53	5% Shapiro Wilk P Value	0.00907	Data Not Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.101	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.108	Data appear Lognormal at 5% Significance Level	
56	**Data appear Approximate Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	1.668	Mean of logged Data	3.108
60	Maximum of Logged Data	5.438	SD of logged Data	0.543
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	29.44	90% Chebyshev (MVUE) UCL	31.34
64	95% Chebyshev (MVUE) UCL	33.82	97.5% Chebyshev (MVUE) UCL	37.25
65	99% Chebyshev (MVUE) UCL	44		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	32.65	95% Jackknife UCL	32.72
72	95% Standard Bootstrap UCL	32.75	95% Bootstrap-t UCL	39.8
73	95% Hall's Bootstrap UCL	55.69	95% Percentile Bootstrap UCL	33.18
74	95% BCA Bootstrap UCL	35.31		
75	90% Chebyshev(Mean, Sd) UCL	37.24	95% Chebyshev(Mean, Sd) UCL	41.85
76	97.5% Chebyshev(Mean, Sd) UCL	48.24	99% Chebyshev(Mean, Sd) UCL	60.8
77				
78	**Suggested UCL to Use**			
79	95% Chebyshev (Mean, Sd) UCL	41.85		
80				
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
84	For additional insight the user may want to consult a statistician.			
85				

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	1/9/2016 3:47:47 PM
From File	Metals Soil.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	90	Number of Distinct Observations	71
		Number of Missing Observations	0
Minimum	2	Mean	71.95
Maximum	820	Median	10
SD	154.7	Std. Error of Mean	16.31
Coefficient of Variation	2.15	Skewness	2.97

Normal GOF Test

Shapiro Wilk Test Statistic	0.508	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.357	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0934	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	99.06	95% Adjusted-CLT UCL (Chen-1995)	104.2
		95% Modified-t UCL (Johnson-1978)	99.91

Gamma GOF Test

A-D Test Statistic	8.897	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.832	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.251	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.1	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.445	k star (bias corrected MLE)	0.438
Theta hat (MLE)	161.7	Theta star (bias corrected MLE)	164.4
nu hat (MLE)	80.12	nu star (bias corrected)	78.78
MLE Mean (bias corrected)	71.95	MLE Sd (bias corrected)	108.8
		Approximate Chi Square Value (0.05)	59.33
Adjusted Level of Significance	0.0473	Adjusted Chi Square Value	59.06

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	95.54	95% Adjusted Gamma UCL (use when n<50)	95.98

	A	B	C	D	E	F	G	H	I	J	K	L
51	**Lognormal GOF Test**											
52					Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk Lognormal GOF Test**					
53					5% Shapiro Wilk P Value	7.087E-11	Data Not Lognormal at 5% Significance Level					
54					Lilliefors Test Statistic	0.175	**Lilliefors Lognormal GOF Test**					
55					5% Lilliefors Critical Value	0.0934	Data Not Lognormal at 5% Significance Level					
56	**Data Not Lognormal at 5% Significance Level**											
57												
58	**Lognormal Statistics**											
59					Minimum of Logged Data	0.693					Mean of logged Data	2.823
60					Maximum of Logged Data	6.709					SD of logged Data	1.549
61												
62	**Assuming Lognormal Distribution**											
63					95% H-UCL	88.94					90% Chebyshev (MVUE) UCL	91.44
64					95% Chebyshev (MVUE) UCL	108.3					97.5% Chebyshev (MVUE) UCL	131.6
65					99% Chebyshev (MVUE) UCL	177.5						
66												
67	**Nonparametric Distribution Free UCL Statistics**											
68	**Data do not follow a Discernible Distribution (0.05)**											
69												
70	**Nonparametric Distribution Free UCLs**											
71					95% CLT UCL	98.78					95% Jackknife UCL	99.06
72					95% Standard Bootstrap UCL	98.28					95% Bootstrap-t UCL	107.7
73					95% Hall's Bootstrap UCL	102.1					95% Percentile Bootstrap UCL	100.3
74					95% BCA Bootstrap UCL	105						
75					90% Chebyshev(Mean, Sd) UCL	120.9					95% Chebyshev(Mean, Sd) UCL	143
76					97.5% Chebyshev(Mean, Sd) UCL	173.8					99% Chebyshev(Mean, Sd) UCL	234.2
77												
78	**Suggested UCL to Use**											
79					95% Chebyshev (Mean, Sd) UCL	143						
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
84	For additional insight the user may want to consult a statistician.											
85												

	A–E	F	G–K	L
1	UCL Statistics for Data Sets with Non-Detects			
2				
3	User Selected Options			
4	Date/Time of Computation	1/9/2016 3:48:26 PM		
5	From File	Metals Soil.xls		
6	Full Precision	OFF		
7	Confidence Coefficient	95%		
8	Number of Bootstrap Operations	2000		
9				
10				
11	Manganese			
12				
13	General Statistics			
14	Total Number of Observations	5	Number of Distinct Observations	5
15			Number of Missing Observations	0
16	Minimum	230	Mean	304
17	Maximum	410	Median	290
18	SD	66.18	Std. Error of Mean	29.6
19	Coefficient of Variation	0.218	Skewness	1.106
20				
21	Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use			
22	guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.			
23	For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).			
24	Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.0			
25				
26	Normal GOF Test			
27	Shapiro Wilk Test Statistic	0.919	Shapiro Wilk GOF Test	
28	5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level	
29	Lilliefors Test Statistic	0.264	Lilliefors GOF Test	
30	5% Lilliefors Critical Value	0.396	Data appear Normal at 5% Significance Level	
31	Data appear Normal at 5% Significance Level			
32				
33	Assuming Normal Distribution			
34	95% Normal UCL		95% UCLs (Adjusted for Skewness)	
35	95% Student's-t UCL	367.1	95% Adjusted-CLT UCL (Chen-1995)	368.3
36			95% Modified-t UCL (Johnson-1978)	369.5
37				
38	Gamma GOF Test			
39	A-D Test Statistic	0.305	Anderson-Darling Gamma GOF Test	
40	5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level	
41	K-S Test Statistic	0.234	Kolmogrov-Smirnoff Gamma GOF Test	
42	5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level	
43	Detected data appear Gamma Distributed at 5% Significance Level			
44				
45	Gamma Statistics			
46	k hat (MLE)	28.05	k star (bias corrected MLE)	11.35
47	Theta hat (MLE)	10.84	Theta star (bias corrected MLE)	26.78
48	nu hat (MLE)	280.5	nu star (bias corrected)	113.5
49	MLE Mean (bias corrected)	304	MLE Sd (bias corrected)	90.22
50			Approximate Chi Square Value (0.05)	89.93

	A	B	C	D	E	F	G	H	I	J	K	L
51					Adjusted Level of Significance	0.0086					Adjusted Chi Square Value	80.77
52												
53	**Assuming Gamma Distribution**											
54					95% Approximate Gamma UCL (use when n>=50))	383.8					95% Adjusted Gamma UCL (use when n<50)	427.3
55												
56	**Lognormal GOF Test**											
57					Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk Lognormal GOF Test**					
58					5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level					
59					Lilliefors Test Statistic	0.229	**Lilliefors Lognormal GOF Test**					
60					5% Lilliefors Critical Value	0.396	Data appear Lognormal at 5% Significance Level					
61	**Data appear Lognormal at 5% Significance Level**											
62												
63	**Lognormal Statistics**											
64					Minimum of Logged Data	5.438					Mean of logged Data	5.699
65					Maximum of Logged Data	6.016					SD of logged Data	0.209
66												
67	**Assuming Lognormal Distribution**											
68					95% H-UCL	384.8					90% Chebyshev (MVUE) UCL	389
69					95% Chebyshev (MVUE) UCL	427.6					97.5% Chebyshev (MVUE) UCL	481.1
70					99% Chebyshev (MVUE) UCL	586.3						
71												
72	**Nonparametric Distribution Free UCL Statistics**											
73	**Data appear to follow a Discernible Distribution at 5% Significance Level**											
74												
75	**Nonparametric Distribution Free UCLs**											
76					95% CLT UCL	352.7					95% Jackknife UCL	367.1
77					95% Standard Bootstrap UCL	347.4					95% Bootstrap-t UCL	392.7
78					95% Hall's Bootstrap UCL	651.5					95% Percentile Bootstrap UCL	346
79					95% BCA Bootstrap UCL	358						
80					90% Chebyshev(Mean, Sd) UCL	392.8					95% Chebyshev(Mean, Sd) UCL	433
81					97.5% Chebyshev(Mean, Sd) UCL	488.8					99% Chebyshev(Mean, Sd) UCL	598.5
82												
83	**Suggested UCL to Use**											
84					95% Student's-t UCL	367.1						
85												
86	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
87	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)											
88	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.											
89	For additional insight the user may want to consult a statistician.											
90												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:49:06 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	Mercury											
11												
12	General Statistics											
13	Total Number of Observations					67	Number of Distinct Observations					18
14	Number of Detects					19	Number of Non-Detects					48
15	Number of Distinct Detects					17	Number of Distinct Non-Detects					2
16	Minimum Detect					0.11	Minimum Non-Detect					0.1
17	Maximum Detect					1.5	Maximum Non-Detect					0.2
18	Variance Detects					0.113	Percent Non-Detects					71.64%
19	Mean Detects					0.331	SD Detects					0.336
20	Median Detects					0.2	CV Detects					1.016
21	Skewness Detects					2.705	Kurtosis Detects					8.214
22	Mean of Logged Detects					-1.407	SD of Logged Detects					0.727
23												
24	Normal GOF Test on Detects Only											
25	Shapiro Wilk Test Statistic					0.658	Shapiro Wilk GOF Test					
26	5% Shapiro Wilk Critical Value					0.901	Detected Data Not Normal at 5% Significance Level					
27	Lilliefors Test Statistic					0.256	Lilliefors GOF Test					
28	5% Lilliefors Critical Value					0.203	Detected Data Not Normal at 5% Significance Level					
29	Detected Data Not Normal at 5% Significance Level											
30												
31	Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs											
32	Mean					0.166	Standard Error of Mean					0.0255
33	SD					0.203	95% KM (BCA) UCL					0.21
34	95% KM (t) UCL					0.208	95% KM (Percentile Bootstrap) UCL					0.211
35	95% KM (z) UCL					0.208	95% KM Bootstrap t UCL					0.261
36	90% KM Chebyshev UCL					0.242	95% KM Chebyshev UCL					0.277
37	97.5% KM Chebyshev UCL					0.325	99% KM Chebyshev UCL					0.42
38												
39	Gamma GOF Tests on Detected Observations Only											
40	A-D Test Statistic					0.998	Anderson-Darling GOF Test					
41	5% A-D Critical Value					0.754	Detected Data Not Gamma Distributed at 5% Significance Level					
42	K-S Test Statistic					0.201	Kolmogrov-Smirnoff GOF					
43	5% K-S Critical Value					0.201	Detected data appear Gamma Distributed at 5% Significance Level					
44	Detected data follow Appr. Gamma Distribution at 5% Significance Level											
45												
46	Gamma Statistics on Detected Data Only											
47	k hat (MLE)					1.808	k star (bias corrected MLE)					1.558
48	Theta hat (MLE)					0.183	Theta star (bias corrected MLE)					0.212
49	nu hat (MLE)					68.72	nu star (bias corrected)					59.2
50	MLE Mean (bias corrected)					0.331	MLE Sd (bias corrected)					0.265

	A	B	C	D	E	F	G	H	I	J	K	L
51												
52	**Gamma Kaplan-Meier (KM) Statistics**											
53	k hat (KM)					0.668	nu hat (KM)					89.5
54	Approximate Chi Square Value (89.50, α)					68.69	Adjusted Chi Square Value (89.50, β)					68.29
55	95% Gamma Approximate KM-UCL (use when n>=50)					0.216	95% Gamma Adjusted KM-UCL (use when n<50)					0.217
56												
57	**Gamma ROS Statistics using Imputed Non-Detects**											
58	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs											
59	GROS may not be used when kstar of detected data is small such as < 0.1											
60	For such situations, GROS method tends to yield inflated values of UCLs and BTVs											
61	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates											
62	Minimum					0.01	Mean					0.101
63	Maximum					1.5	Median					0.01
64	SD					0.228	CV					2.259
65	k hat (MLE)					0.458	k star (bias corrected MLE)					0.447
66	Theta hat (MLE)					0.221	Theta star (bias corrected MLE)					0.226
67	nu hat (MLE)					61.37	nu star (bias corrected)					59.96
68	MLE Mean (bias corrected)					0.101	MLE Sd (bias corrected)					0.151
69							Adjusted Level of Significance (β)					0.0464
70	Approximate Chi Square Value (59.96, α)					43.15	Adjusted Chi Square Value (59.96, β)					42.84
71	95% Gamma Approximate UCL (use when n>=50)					0.14	95% Gamma Adjusted UCL (use when n<50)					0.141
72												
73	**Lognormal GOF Test on Detected Observations Only**											
74	Shapiro Wilk Test Statistic					0.905	**Shapiro Wilk GOF Test**					
75	5% Shapiro Wilk Critical Value					0.901	Detected Data appear Lognormal at 5% Significance Level					
76	Lilliefors Test Statistic					0.163	**Lilliefors GOF Test**					
77	5% Lilliefors Critical Value					0.203	Detected Data appear Lognormal at 5% Significance Level					
78	**Detected Data appear Lognormal at 5% Significance Level**											
79												
80	**Lognormal ROS Statistics Using Imputed Non-Detects**											
81	Mean in Original Scale					0.116	Mean in Log Scale					-3.199
82	SD in Original Scale					0.223	SD in Log Scale					1.477
83	95% t UCL (assumes normality of ROS data)					0.161	95% Percentile Bootstrap UCL					0.163
84	95% BCA Bootstrap UCL					0.176	95% Bootstrap t UCL					0.194
85	95% H-UCL (Log ROS)					0.186						
86												
87	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**											
88	KM Mean (logged)					-2.045	95% H-UCL (KM -Log)					0.171
89	KM SD (logged)					0.552	95% Critical H Value (KM-Log)					1.902
90	KM Standard Error of Mean (logged)					0.0694						
91												
92	**DL/2 Statistics**											
93	**DL/2 Normal**						**DL/2 Log-Transformed**					
94	Mean in Original Scale					0.133	Mean in Log Scale					-2.504
95	SD in Original Scale					0.216	SD in Log Scale					0.809
96	95% t UCL (Assumes normality)					0.177	95% H-Stat UCL					0.14
97	**DL/2 is not a recommended method, provided for comparisons and historical reasons**											
98												
99	**Nonparametric Distribution Free UCL Statistics**											
100	**Detected Data appear Approximate Gamma Distributed at 5% Significance Level**											

	A	B	C	D	E	F	G	H	I	J	K	L
101												
102	Suggested UCL to Use											
103	95% KM (t) UCL					0.208	95% GROS Approximate Gamma UCL					0.14
104	95% Approximate Gamma KM-UCL					0.216						
105												
106	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
107	Recommendations are based upon data size, data distribution, and skewness.											
108	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
109	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
110												

UCL Statistics for Data Sets with Non-Detects				
User Selected Options				
Date/Time of Computation	1/9/2016 4:21:34 PM			
From File	Metals Soil.xls			
Full Precision	OFF			
Confidence Coefficient	95%			
Number of Bootstrap Operations	2000			
Molybdenum				
General Statistics				
Total Number of Observations	67		Number of Distinct Observations	3
Number of Detects	6		Number of Non-Detects	61
Number of Distinct Detects	2		Number of Distinct Non-Detects	1
Minimum Detect	0.5		Minimum Non-Detect	1
Maximum Detect	0.803		Maximum Non-Detect	1
Variance Detects	0.0153		Percent Non-Detects	91.04%
Mean Detects	0.551		SD Detects	0.124
Median Detects	0.5		CV Detects	0.225
Skewness Detects	2.449		Kurtosis Detects	6
Mean of Logged Detects	-0.614		SD of Logged Detects	0.193
Normal GOF Test on Detects Only				
Shapiro Wilk Test Statistic	0.496	**Shapiro Wilk GOF Test**		
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level		
Lilliefors Test Statistic	0.492	**Lilliefors GOF Test**		
5% Lilliefors Critical Value	0.362	Detected Data Not Normal at 5% Significance Level		
Detected Data Not Normal at 5% Significance Level				
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs				
Mean	0.551		Standard Error of Mean	0.0505
SD	0.113		95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.635		95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.634		95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.702		95% KM Chebyshev UCL	0.771
97.5% KM Chebyshev UCL	0.866		99% KM Chebyshev UCL	1.053
Gamma GOF Tests on Detected Observations Only				
A-D Test Statistic	1.719	**Anderson-Darling GOF Test**		
5% A-D Critical Value	0.697	Detected Data Not Gamma Distributed at 5% Significance Level		
K-S Test Statistic	0.507	**Kolmogrov-Smirnoff GOF**		
5% K-S Critical Value	0.332	Detected Data Not Gamma Distributed at 5% Significance Level		
Detected Data Not Gamma Distributed at 5% Significance Level				
Gamma Statistics on Detected Data Only				
k hat (MLE)	29.13		k star (bias corrected MLE)	14.68
Theta hat (MLE)	0.0189		Theta star (bias corrected MLE)	0.0375
nu hat (MLE)	349.6		nu star (bias corrected)	176.1
MLE Mean (bias corrected)	0.551		MLE Sd (bias corrected)	0.144

	A–E	F	G–K	L
51				
52	**Gamma Kaplan-Meier (KM) Statistics**			
53	k hat (KM)	23.77	nu hat (KM)	3185
54	Approximate Chi Square Value (N/A, α)	3055	Adjusted Chi Square Value (N/A, β)	3052
55	95% Gamma Approximate KM-UCL (use when n>=50)	0.574	95% Gamma Adjusted KM-UCL (use when n<50)	0.574
56				
57	**Gamma ROS Statistics using Imputed Non-Detects**			
58	GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
59	GROS may not be used when kstar of detected data is small such as < 0.1			
60	For such situations, GROS method tends to yield inflated values of UCLs and BTVs			
61	For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
62	Minimum	0.338	Mean	0.553
63	Maximum	0.82	Median	0.538
64	SD	0.108	CV	0.195
65	k hat (MLE)	27.15	k star (bias corrected MLE)	25.94
66	Theta hat (MLE)	0.0204	Theta star (bias corrected MLE)	0.0213
67	nu hat (MLE)	3638	nu star (bias corrected)	3477
68	MLE Mean (bias corrected)	0.553	MLE Sd (bias corrected)	0.109
69			Adjusted Level of Significance (β)	0.0464
70	Approximate Chi Square Value (N/A, α)	3341	Adjusted Chi Square Value (N/A, β)	3338
71	95% Gamma Approximate UCL (use when n>=50)	0.575	95% Gamma Adjusted UCL (use when n<50)	0.576
72				
73	**Lognormal GOF Test on Detected Observations Only**			
74	Shapiro Wilk Test Statistic	0.496	**Shapiro Wilk GOF Test**	
75	5% Shapiro Wilk Critical Value	0.788	Detected Data Not Lognormal at 5% Significance Level	
76	Lilliefors Test Statistic	0.492	**Lilliefors GOF Test**	
77	5% Lilliefors Critical Value	0.362	Detected Data Not Lognormal at 5% Significance Level	
78	**Detected Data Not Lognormal at 5% Significance Level**			
79				
80	**Lognormal ROS Statistics Using Imputed Non-Detects**			
81	Mean in Original Scale	0.548	Mean in Log Scale	-0.614
82	SD in Original Scale	0.091	SD in Log Scale	0.162
83	95% t UCL (assumes normality of ROS data)	0.567	95% Percentile Bootstrap UCL	0.566
84	95% BCA Bootstrap UCL	0.567	95% Bootstrap t UCL	0.567
85	95% H-UCL (Log ROS)	0.567		
86				
87	**DL/2 Statistics**			
88	**DL/2 Normal**		**DL/2 Log-Transformed**	
89	Mean in Original Scale	0.505	Mean in Log Scale	-0.686
90	SD in Original Scale	0.037	SD in Log Scale	0.0579
91	95% t UCL (Assumes normality)	0.512	95% H-Stat UCL	N/A
92	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
93				
94	**Nonparametric Distribution Free UCL Statistics**			
95	**Data do not follow a Discernible Distribution at 5% Significance Level**			
96				
97	**Suggested UCL to Use**			
98	95% KM (t) UCL	0.635	95% KM (% Bootstrap) UCL	N/A
99	**Warning: One or more Recommended UCL(s) not available!**			
100				

	A	B	C	D	E	F	G	H	I	J	K	L
101	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
102	Recommendations are based upon data size, data distribution, and skewness.											
103	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
104	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
105												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:50:29 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	Nickel											
12												
13	General Statistics											
14	Total Number of Observations					67	Number of Distinct Observations					28
15							Number of Missing Observations					0
16	Minimum					6.5	Mean					16.26
17	Maximum					36	Median					16
18	SD					5.196	Std. Error of Mean					0.635
19	Coefficient of Variation					0.319	Skewness					1.274
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.922	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk P Value					3.0663E-4	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.13	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.108	Data Not Normal at 5% Significance Level					
26	**Data Not Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL					17.32	95% Adjusted-CLT UCL (Chen-1995)					17.41
31							95% Modified-t UCL (Johnson-1978)					17.34
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					0.553	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.751	Detected data appear Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.0914	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.109	Detected data appear Gamma Distributed at 5% Significance Level					
38	**Detected data appear Gamma Distributed at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)					10.76	k star (bias corrected MLE)					10.29
42	Theta hat (MLE)					1.511	Theta star (bias corrected MLE)					1.581
43	nu hat (MLE)					1442	nu star (bias corrected)					1379
44	MLE Mean (bias corrected)					16.26	MLE Sd (bias corrected)					5.071
45							Approximate Chi Square Value (0.05)					1293
46	Adjusted Level of Significance					0.0464	Adjusted Chi Square Value					1292
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50)					17.34	95% Adjusted Gamma UCL (use when n<50)					17.36
50												

	A–E	F	G–K	L
51	**Lognormal GOF Test**			
52	Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk Lognormal GOF Test**	
53	5% Shapiro Wilk P Value	0.667	Data appear Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.0985	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.108	Data appear Lognormal at 5% Significance Level	
56	**Data appear Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	1.872	Mean of logged Data	2.742
60	Maximum of Logged Data	3.584	SD of logged Data	0.31
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	17.41	90% Chebyshev (MVUE) UCL	18.16
64	95% Chebyshev (MVUE) UCL	19.01	97.5% Chebyshev (MVUE) UCL	20.2
65	99% Chebyshev (MVUE) UCL	22.53		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	17.31	95% Jackknife UCL	17.32
72	95% Standard Bootstrap UCL	17.3	95% Bootstrap-t UCL	17.49
73	95% Hall's Bootstrap UCL	17.51	95% Percentile Bootstrap UCL	17.35
74	95% BCA Bootstrap UCL	17.48		
75	90% Chebyshev(Mean, Sd) UCL	18.17	95% Chebyshev(Mean, Sd) UCL	19.03
76	97.5% Chebyshev(Mean, Sd) UCL	20.23	99% Chebyshev(Mean, Sd) UCL	22.58
77				
78	**Suggested UCL to Use**			
79	95% Approximate Gamma UCL	17.34		
80				
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
84	For additional insight the user may want to consult a statistician.			
85				

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:51:16 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	Vanadium											
12												
13	General Statistics											
14	Total Number of Observations					67	Number of Distinct Observations					30
15							Number of Missing Observations					0
16	Minimum					12	Mean					30.44
17	Maximum					59	Median					29.5
18	SD					7.362	Std. Error of Mean					0.899
19	Coefficient of Variation					0.242	Skewness					0.869
20												
21	Normal GOF Test											
22	Shapiro Wilk Test Statistic					0.949	Shapiro Wilk GOF Test					
23	5% Shapiro Wilk P Value					0.017	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.155	Lilliefors GOF Test					
25	5% Lilliefors Critical Value					0.108	Data Not Normal at 5% Significance Level					
26	Data Not Normal at 5% Significance Level											
27												
28	Assuming Normal Distribution											
29	95% Normal UCL						95% UCLs (Adjusted for Skewness)					
30	95% Student's-t UCL					31.94	95% Adjusted-CLT UCL (Chen-1995)					32.02
31							95% Modified-t UCL (Johnson-1978)					31.96
32												
33	Gamma GOF Test											
34	A-D Test Statistic					1.1	Anderson-Darling Gamma GOF Test					
35	5% A-D Critical Value					0.75	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.146	Kolmogrov-Smirnoff Gamma GOF Test					
37	5% K-S Critical Value					0.109	Data Not Gamma Distributed at 5% Significance Level					
38	Data Not Gamma Distributed at 5% Significance Level											
39												
40	Gamma Statistics											
41	k hat (MLE)					17.48	k star (bias corrected MLE)					16.71
42	Theta hat (MLE)					1.741	Theta star (bias corrected MLE)					1.822
43	nu hat (MLE)					2343	nu star (bias corrected)					2239
44	MLE Mean (bias corrected)					30.44	MLE Sd (bias corrected)					7.447
45							Approximate Chi Square Value (0.05)					2130
46	Adjusted Level of Significance					0.0464	Adjusted Chi Square Value					2128
47												
48	Assuming Gamma Distribution											
49	95% Approximate Gamma UCL (use when n>=50))					32	95% Adjusted Gamma UCL (use when n<50)					32.03
50												

	A–E	F	G–K	L
51	Lognormal GOF Test			
52	Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk Lognormal GOF Test**	
53	5% Shapiro Wilk P Value	0.0779	Data appear Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.162	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.108	Data Not Lognormal at 5% Significance Level	
56	**Data appear Approximate Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	2.485	Mean of logged Data	3.387
60	Maximum of Logged Data	4.078	SD of logged Data	0.246
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	32.13	90% Chebyshev (MVUE) UCL	33.26
64	95% Chebyshev (MVUE) UCL	34.52	97.5% Chebyshev (MVUE) UCL	36.27
65	99% Chebyshev (MVUE) UCL	39.71		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data appear to follow a Discernible Distribution at 5% Significance Level**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	31.92	95% Jackknife UCL	31.94
72	95% Standard Bootstrap UCL	31.95	95% Bootstrap-t UCL	32.06
73	95% Hall's Bootstrap UCL	32.16	95% Percentile Bootstrap UCL	31.96
74	95% BCA Bootstrap UCL	32.03		
75	90% Chebyshev(Mean, Sd) UCL	33.14	95% Chebyshev(Mean, Sd) UCL	34.36
76	97.5% Chebyshev(Mean, Sd) UCL	36.06	99% Chebyshev(Mean, Sd) UCL	39.39
77				
78	**Suggested UCL to Use**			
79	95% Student's-t UCL	31.94	or 95% Modified-t UCL	31.96
80				
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
84	For additional insight the user may want to consult a statistician.			
85				

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:51:54 PM								
5	From File			Metals Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10												
11	Zinc											
12												
13	**General Statistics**											
14	Total Number of Observations					67	Number of Distinct Observations					46
15							Number of Missing Observations					0
16	Minimum					11	Mean					133.3
17	Maximum					4700	Median					45
18	SD					569.5	Std. Error of Mean					69.57
19	Coefficient of Variation					4.273	Skewness					8.053
20												
21	**Normal GOF Test**											
22	Shapiro Wilk Test Statistic					0.176	**Shapiro Wilk GOF Test**					
23	5% Shapiro Wilk P Value					0	Data Not Normal at 5% Significance Level					
24	Lilliefors Test Statistic					0.443	**Lilliefors GOF Test**					
25	5% Lilliefors Critical Value					0.108	Data Not Normal at 5% Significance Level					
26	**Data Not Normal at 5% Significance Level**											
27												
28	**Assuming Normal Distribution**											
29	**95% Normal UCL**						**95% UCLs (Adjusted for Skewness)**					
30	95% Student's-t UCL					249.3	95% Adjusted-CLT UCL (Chen-1995)					320.8
31							95% Modified-t UCL (Johnson-1978)					260.7
32												
33	**Gamma GOF Test**											
34	A-D Test Statistic					11.99	**Anderson-Darling Gamma GOF Test**					
35	5% A-D Critical Value					0.798	Data Not Gamma Distributed at 5% Significance Level					
36	K-S Test Statistic					0.311	**Kolmogrov-Smirnoff Gamma GOF Test**					
37	5% K-S Critical Value					0.114	Data Not Gamma Distributed at 5% Significance Level					
38	**Data Not Gamma Distributed at 5% Significance Level**											
39												
40	**Gamma Statistics**											
41	k hat (MLE)					0.687	k star (bias corrected MLE)					0.666
42	Theta hat (MLE)					194	Theta star (bias corrected MLE)					200
43	nu hat (MLE)					92.06	nu star (bias corrected)					89.27
44	MLE Mean (bias corrected)					133.3	MLE Sd (bias corrected)					163.3
45							Approximate Chi Square Value (0.05)					68.49
46	Adjusted Level of Significance					0.0464	Adjusted Chi Square Value					68.09
47												
48	**Assuming Gamma Distribution**											
49	95% Approximate Gamma UCL (use when n>=50))					173.7	95% Adjusted Gamma UCL (use when n<50)					174.7
50												

	A-E	F	G-K	L
51	**Lognormal GOF Test**			
52	Shapiro Wilk Test Statistic	0.784	**Shapiro Wilk Lognormal GOF Test**	
53	5% Shapiro Wilk P Value	2.847E-13	Data Not Lognormal at 5% Significance Level	
54	Lilliefors Test Statistic	0.17	**Lilliefors Lognormal GOF Test**	
55	5% Lilliefors Critical Value	0.108	Data Not Lognormal at 5% Significance Level	
56	**Data Not Lognormal at 5% Significance Level**			
57				
58	**Lognormal Statistics**			
59	Minimum of Logged Data	2.398	Mean of logged Data	4.01
60	Maximum of Logged Data	8.455	SD of logged Data	0.807
61				
62	**Assuming Lognormal Distribution**			
63	95% H-UCL	94.21	90% Chebyshev (MVUE) UCL	101.3
64	95% Chebyshev (MVUE) UCL	112.8	97.5% Chebyshev (MVUE) UCL	128.7
65	99% Chebyshev (MVUE) UCL	160.1		
66				
67	**Nonparametric Distribution Free UCL Statistics**			
68	**Data do not follow a Discernible Distribution (0.05)**			
69				
70	**Nonparametric Distribution Free UCLs**			
71	95% CLT UCL	247.7	95% Jackknife UCL	249.3
72	95% Standard Bootstrap UCL	245.3	95% Bootstrap-t UCL	1249
73	95% Hall's Bootstrap UCL	714.9	95% Percentile Bootstrap UCL	268.8
74	95% BCA Bootstrap UCL	347.7		
75	90% Chebyshev(Mean, Sd) UCL	342	95% Chebyshev(Mean, Sd) UCL	436.5
76	97.5% Chebyshev(Mean, Sd) UCL	567.7	99% Chebyshev(Mean, Sd) UCL	825.5
77				
78	**Suggested UCL to Use**			
79	95% Chebyshev (Mean, Sd) UCL	436.5		
80				
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
82	These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)			
83	and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.			
84	For additional insight the user may want to consult a statistician.			
85				

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 4:31:40 PM								
5	From File			SVOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	**2-Methylnaphthalene**											
11												
12	**General Statistics**											
13	Total Number of Observations					12	Number of Distinct Observations					6
14	Number of Detects					1	Number of Non-Detects					11
15	Number of Distinct Detects					1	Number of Distinct Non-Detects					5
16												
17	**Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!**											
18	**It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).**											
19												
20	**The data set for variable 2-Methylnaphthalene was not processed!**											
21												
22												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 4:32:41 PM								
5	From File			SVOCs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	bis(2-ethylhexylphthalate											
11												
12	General Statistics											
13	Total Number of Observations					12	Number of Distinct Observations					7
14	Number of Detects					1	Number of Non-Detects					11
15	Number of Distinct Detects					1	Number of Distinct Non-Detects					6
16												
17	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
18	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
19												
20	The data set for variable bis(2-ethylhexylphthalate was not processed!											
21												
22												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:39:59 PM								
5	From File			Pesticides Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	**4,4´-DDT**											
11												
12	**General Statistics**											
13	Total Number of Observations					5	Number of Distinct Observations					4
14	Number of Detects					3	Number of Non-Detects					2
15	Number of Distinct Detects					3	Number of Distinct Non-Detects					1
16	Minimum Detect					0.0031	Minimum Non-Detect					0.002
17	Maximum Detect					0.011	Maximum Non-Detect					0.002
18	Variance Detects					1.9570E-5	Percent Non-Detects					40%
19	Mean Detects					0.0059	SD Detects					0.00442
20	Median Detects					0.0036	CV Detects					0.75
21	Skewness Detects					1.707	Kurtosis Detects					N/A
22	Mean of Logged Detects					-5.304	SD of Logged Detects					0.692
23												
24	**Warning: Data set has only 3 Detected Values.**											
25	**This is not enough to compute meaningful or reliable statistics and estimates.**											
26												
27												
28	**Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use**											
29	**guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.**											
30	**For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).**											
31	**Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.0**											
32												
33	**Normal GOF Test on Detects Only**											
34	Shapiro Wilk Test Statistic					0.797	**Shapiro Wilk GOF Test**					
35	5% Shapiro Wilk Critical Value					0.767	Detected Data appear Normal at 5% Significance Level					
36	Lilliefors Test Statistic					0.365	**Lilliefors GOF Test**					
37	5% Lilliefors Critical Value					0.512	Detected Data appear Normal at 5% Significance Level					
38	**Detected Data appear Normal at 5% Significance Level**											
39												
40	**Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs**											
41	Mean					0.00434	Standard Error of Mean					0.00186
42	SD					0.00339	95% KM (BCA) UCL					N/A
43	95% KM (t) UCL					0.0083	95% KM (Percentile Bootstrap) UCL					N/A
44	95% KM (z) UCL					0.00739	95% KM Bootstrap t UCL					N/A
45	90% KM Chebyshev UCL					0.00991	95% KM Chebyshev UCL					0.0124
46	97.5% KM Chebyshev UCL					0.0159	99% KM Chebyshev UCL					0.0228
47												
48	**Gamma GOF Tests on Detected Observations Only**											
49	**Not Enough Data to Perform GOF Test**											
50												

	A–E	F	G–K	L
51	**Gamma Statistics on Detected Data Only**			
52	k hat (MLE)	3.071	k star (bias corrected MLE)	N/A
53	Theta hat (MLE)	0.00192	Theta star (bias corrected MLE)	N/A
54	nu hat (MLE)	18.43	nu star (bias corrected)	N/A
55	MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
56				
57	**Gamma Kaplan-Meier (KM) Statistics**			
58	k hat (KM)	1.641	nu hat (KM)	16.41
59			Adjusted Level of Significance (β)	0.0086
60	Approximate Chi Square Value (16.41, α)	8.252	Adjusted Chi Square Value (16.41, β)	5.897
61	95% Gamma Approximate KM-UCL (use when n>=50)	0.00863	95% Gamma Adjusted KM-UCL (use when n<50)	0.0121
62				
63	**Lognormal GOF Test on Detected Observations Only**			
64	Shapiro Wilk Test Statistic	0.837	**Shapiro Wilk GOF Test**	
65	5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
66	Lilliefors Test Statistic	0.346	**Lilliefors GOF Test**	
67	5% Lilliefors Critical Value	0.512	Detected Data appear Lognormal at 5% Significance Level	
68	**Detected Data appear Lognormal at 5% Significance Level**			
69				
70	**Lognormal ROS Statistics Using Imputed Non-Detects**			
71	Mean in Original Scale	0.00381	Mean in Log Scale	-6.12
72	SD in Original Scale	0.00424	SD in Log Scale	1.244
73	95% t UCL (assumes normality of ROS data)	0.00786	95% Percentile Bootstrap UCL	0.00687
74	95% BCA Bootstrap UCL	0.00741	95% Bootstrap t UCL	0.012
75	95% H-UCL (Log ROS)	0.196		
76				
77	**UCLs using Lognormal Distribution and KM Estimates when Detected data are Lognormally Distributed**			
78	KM Mean (logged)	-5.668	95% H-UCL (KM -Log)	0.0121
79	KM SD (logged)	0.625	95% Critical H Value (KM-Log)	3.377
80	KM Standard Error of Mean (logged)	0.342		
81				
82	**DL/2 Statistics**			
83	**DL/2 Normal**		**DL/2 Log-Transformed**	
84	Mean in Original Scale	0.00394	Mean in Log Scale	-5.946
85	SD in Original Scale	0.00412	SD in Log Scale	1.005
86	95% t UCL (Assumes normality)	0.00787	95% H-Stat UCL	0.0517
87	**DL/2 is not a recommended method, provided for comparisons and historical reasons**			
88				
89	**Nonparametric Distribution Free UCL Statistics**			
90	**Detected Data appear Normal Distributed at 5% Significance Level**			
91				
92	**Suggested UCL to Use**			
93	95% KM (t) UCL	0.0083	95% KM (Percentile Bootstrap) UCL	N/A
94	**Warning: One or more Recommended UCL(s) not available!**			
95				
96	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
97	Recommendations are based upon data size, data distribution, and skewness.			
98	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
99	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
100				

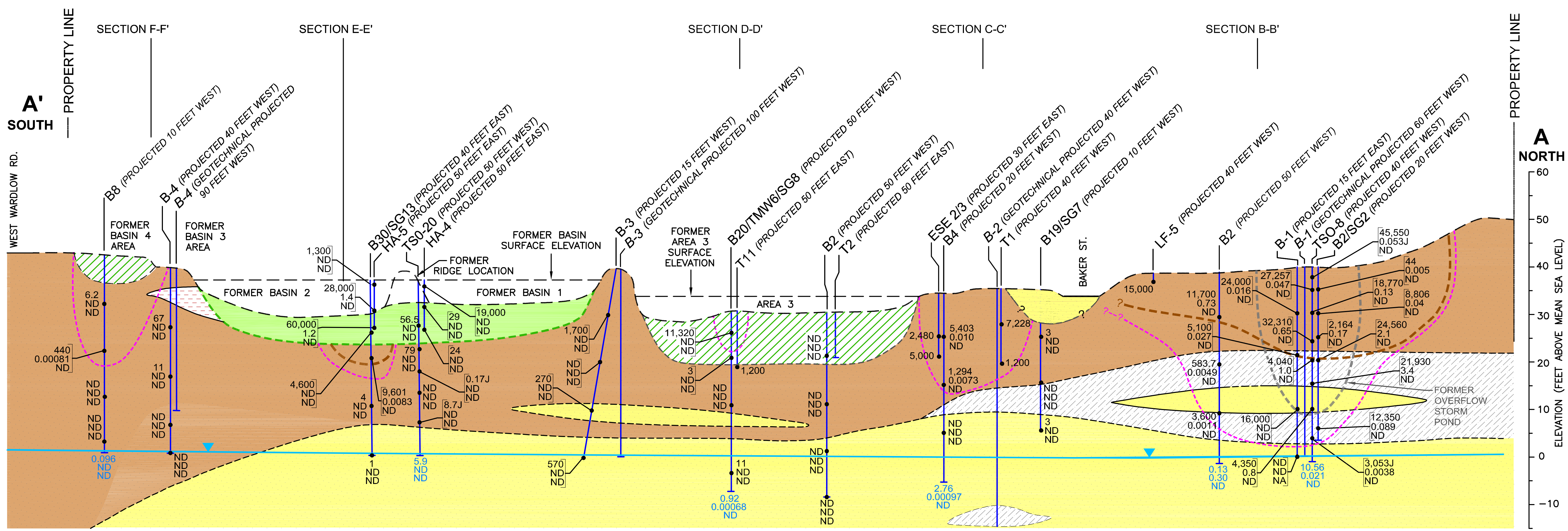
	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:40:50 PM								
5	From File			Pesticides Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	**Chlordane**											
11												
12	General Statistics											
13	Total Number of Observations					5	Number of Distinct Observations					2
14	Number of Detects					1	Number of Non-Detects					4
15	Number of Distinct Detects					1	Number of Distinct Non-Detects					1
16												
17	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
18	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
19												
20	The data set for variable Chlordane was not processed!											
21												
22												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:37:48 PM								
5	From File			PCBs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	Aroclor 1254											
11												
12	General Statistics											
13	Total Number of Observations					8	Number of Distinct Observations					4
14	Number of Detects					1	Number of Non-Detects					7
15	Number of Distinct Detects					1	Number of Distinct Non-Detects					3
16												
17	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
18	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
19												
20	The data set for variable Aroclor 1254 was not processed!											
21												
22												

	A	B	C	D	E	F	G	H	I	J	K	L
1	UCL Statistics for Data Sets with Non-Detects											
2												
3	User Selected Options											
4	Date/Time of Computation			1/9/2016 3:38:50 PM								
5	From File			PCBs Soil.xls								
6	Full Precision			OFF								
7	Confidence Coefficient			95%								
8	Number of Bootstrap Operations			2000								
9												
10	Aroclor 1260											
11												
12	General Statistics											
13	Total Number of Observations					8	Number of Distinct Observations					4
14	Number of Detects					1	Number of Non-Detects					7
15	Number of Distinct Detects					1	Number of Distinct Non-Detects					3
16												
17	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
18	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
19												
20	The data set for variable Aroclor 1260 was not processed!											
21												
22												

APPENDIX B

Tetra Tech
Geologic Cross Sections



LEGEND

B20/TMW6 — BORING (B20) / GROUNDWATER MONITORING WELL (TMW6) LOCATION AND DESIGNATION

GROUND SURFACE

11,320 — TRPH AND/OR TPH CONCENTRATION IN SOIL (mg/kg)

ND — BENZENE CONCENTRATION IN SOIL (mg/kg)

ND — 1,2-DICHLOROETHANE (1,2-DCA) CONCENTRATION IN SOIL (mg/kg)

LITHOLOGIC CONTACT

INTERPRETED TPH AND/OR TRPH 8,500 mg/kg EXTENT LINE

INTERPRETED TOTAL LEAD EXTENT LINE

GROUNDWATER ON MAY 18, 2015

0.92 — TRPH AND/OR TPH CONCENTRATION IN GROUNDWATER (mg/L)

0.00068 — BENZENE CONCENTRATION IN GROUNDWATER (mg/L)

ND — 1,2-DCA CONCENTRATION IN GROUNDWATER (mg/L)

B-1 AND HA-4	SOIL BORING AEMC (1991b)
B2	SOIL BORING BRYCON (2010g; 2011e)
T1 & LF-5	TRENCH AND SOIL BORING QST ENVIRONMENTAL, INC. (1998b)
TSO-8	ATSI BORING LOCATION (APRIL 2015)
B-2	GEOTECHNICAL BORING PGI (2015a)

BIOREMEDIATED SOIL

SOIL BEING BIOREMEDIATED

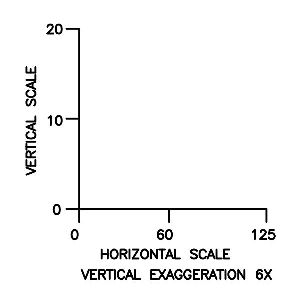
CLAY - CL

SILT - ML

SILTY SAND - SM

POORLY GRADED SAND - SP

mg/kg	MILLIGRAMS PER KILOGRAM
mg/L	MILLIGRAMS PER LITER
J	ESTIMATED VALUE BY THE LABORATORY



NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SCHEMATIC SECTION LOCATION SHOWN ON FIGURE 2.
3. DEPTH TO GROUNDWATER OBTAINED ON MAY 18, 2015 FROM GROUNDWATER MONITORING WELLS BRYCON-MW1 TO BRYCON-MW5, ESE-MW1, ESE-MW2, 92-MW1, AND TMW1 TO TMW6.
4. THIS FIGURE SHOWS ONE INTERPRETATION OF THE DATA, OTHER INTERPRETATIONS ARE POSSIBLE.
5. CURRENT GROUND SURFACE ELEVATION MAY NOT BE THE SAME AS WHEN THE FORMER BORINGS WERE DRILLED.
6. BIOREMEDIATED SOILS LOCATION AND THICKNESS OBTAINED FROM FIGURE 3.
7. TPH CONCENTRATIONS IN GROUNDWATER FROM GRAB GROUNDWATER SAMPLE SPLIT COLLECTED IN APRIL 2015, AND GROUNDWATER MONITORING WELLS IN MAY 2015.
8. FORMER BASIN NUMBERS 3 AND 4 LOCATION AND DESIGNATION OBTAINED FROM ESE (1999).
9. THE LEAD CONCENTRATIONS ARE SHOWN ON FIGURE 6C, ALSO IN APPENDIX E.
10. TPH = TOTAL PETROLEUM HYDROCARBONS.
11. TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS.
12. ND = NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT.
13. INTERPRETED TPH AND/OR TRPH EXTENT LINES ARE BASED ON CONCENTRATIONS EXCEEDING 8,500 mg/kg, AND/OR TPH CONCENTRATIONS EXCEEDING THE SITE-SPECIFIC CLEANUP GOALS (SSCGs).
14. INTERPRETED TOTAL LEAD EXTENT LINES ARE BASED ON SSCG OF 80 mg/kg.
15. THE LEAD CONCENTRATIONS ARE SHOWN ON FIGURE 5.

TITLE:

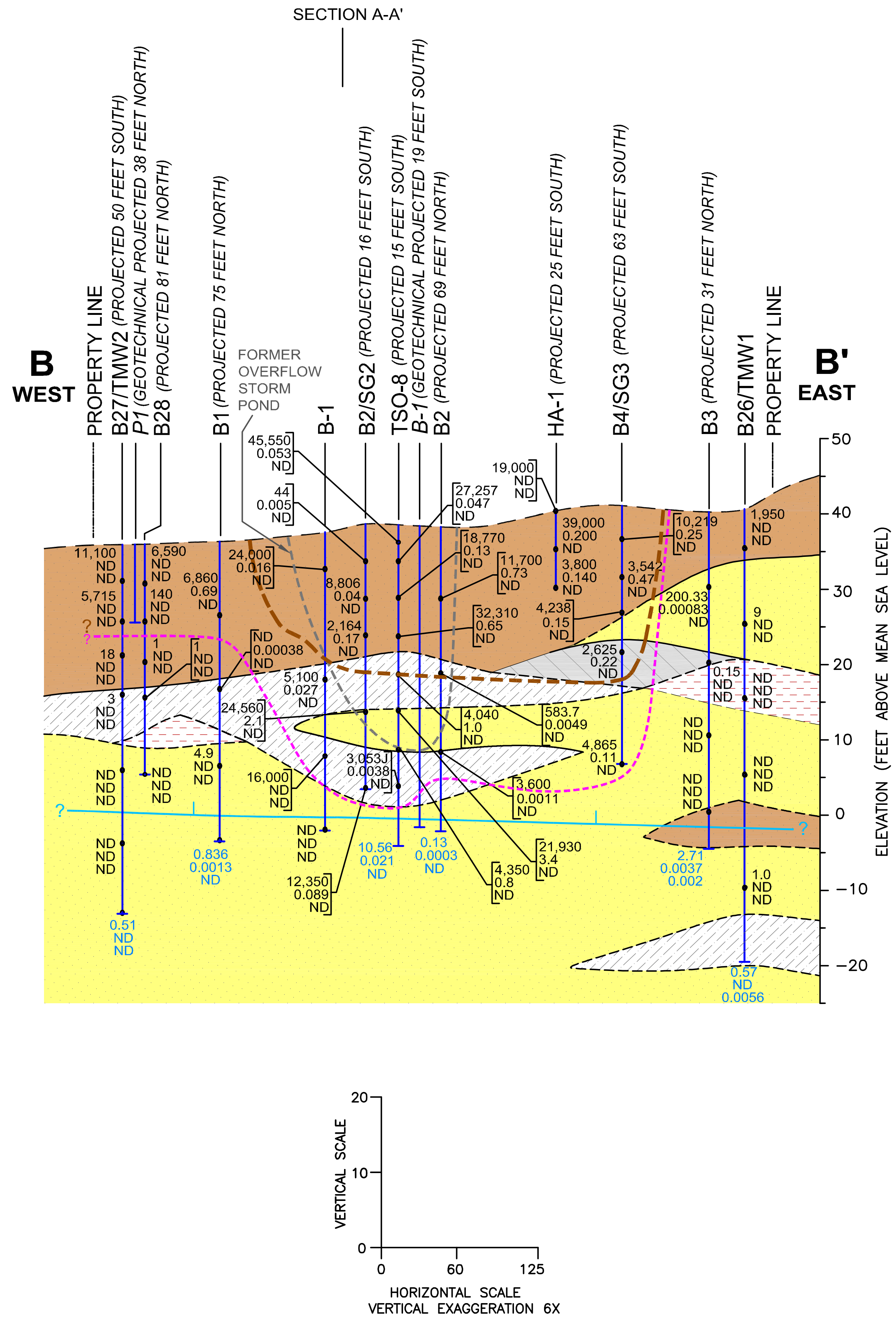
SCHEMATIC SECTION A-A'

LOCATION:

Oil Operators, Inc. Property
712 Baker Street, Long Beach, California 90806

TETRA TECH

APPROVED	JL	FIGURE
DRAFTED	CP	6A
PROJECT#	T33843.01	
DATE	9–4–15	



LEGEND

B27/TWW2	BORING (B27) / GROUNDWATER MONITORING WELL (TMW2) LOCATION AND DESIGNATION
	GROUND SURFACE
11,100	TRPH AND/OR TPH CONCENTRATION IN SOIL (mg/kg)
ND	BENZENE CONCENTRATION IN SOIL (mg/kg)
ND	1,2-DCA CONCENTRATION IN SOIL (mg/kg)
	LITHOLOGIC CONTACT
	INTERPRETED TPH AND/OR TRPH 8,500 mg/kg EXTENT LINE
	INTERPRETED TOTAL LEAD EXTENT LINE
	GROUNDWATER ON MAY 18, 2015
0.51	TRPH AND/OR TPH CONCENTRATION IN GROUNDWATER (mg/L)
ND	BENZENE CONCENTRATION IN GROUNDWATER (mg/L)
ND	1,2-DCA CONCENTRATION IN GROUNDWATER (mg/L)
B-1 AND HA-4	SOIL BORING AEMC (1991b)
B2	SOIL BORING BRYCON (2010g; 2011e)
T1 & LF-5	TRENCH AND SOIL BORING QST ENVIRONMENTAL, INC. (1998b)
TSO-8	ATSI BORING LOCATION (APRIL 2015)
B-2	GEOTECHNICAL BORING PGI (2015a)
	CLAY - CL
	SILT - ML
	SILTY SAND - SM
	POORLY GRADED SAND - SP
	CLAYEY SAND - SC
mg/kg	MILLIGRAMS PER KILOGRAM
mg/L	MILLIGRAMS PER LITER

NOTES

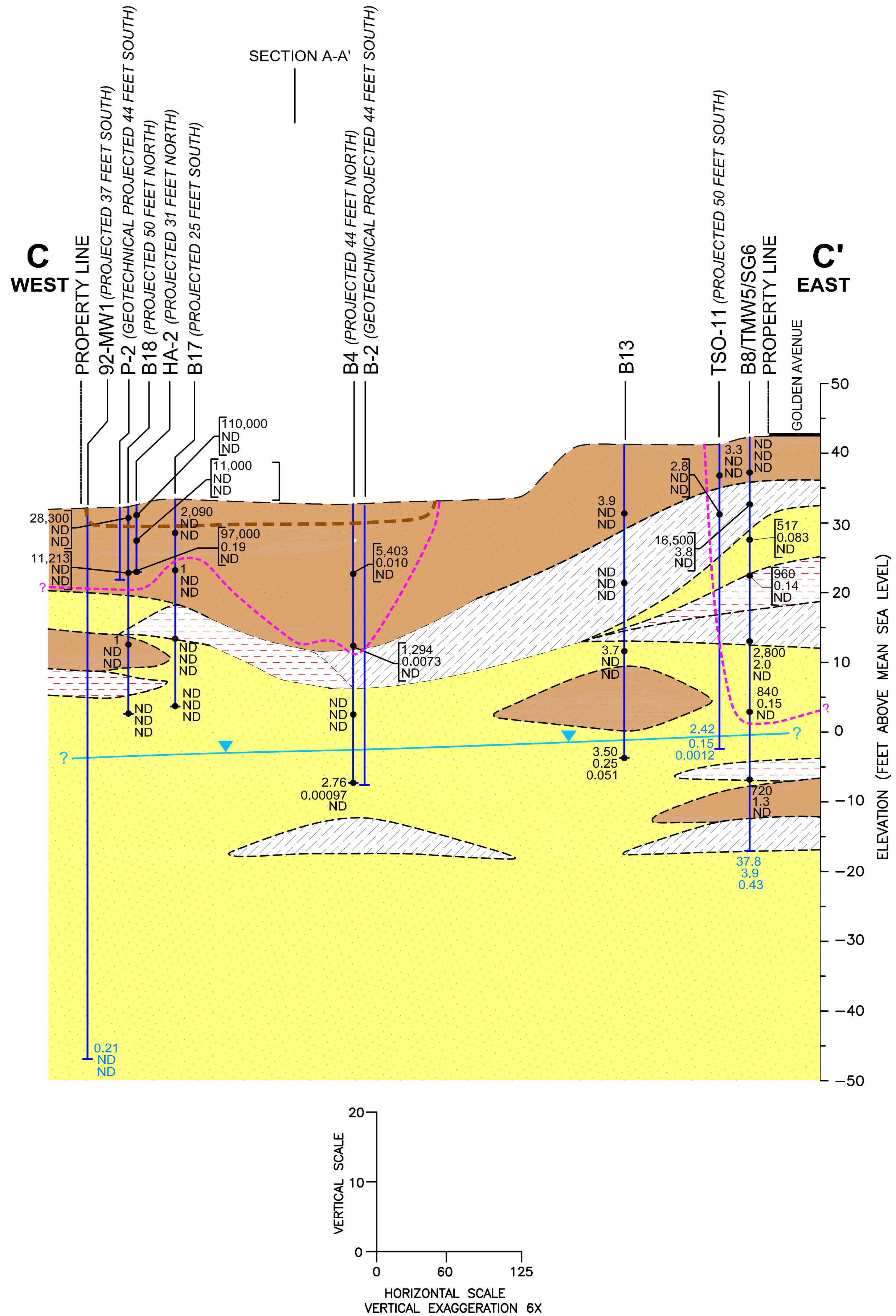
1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SCHEMATIC SECTION LOCATION SHOWN ON FIGURE 2.
3. DEPTH TO GROUNDWATER OBTAINED ON MAY 18, 2015 FROM GROUNDWATER MONITORING WELLS BRYCON-MW1 TO BRYCON-MW5, ESE-MW1, ESE-MW2, 92-MW1, AND TMW1 TO TMW6.
4. THIS FIGURE SHOWS ONE INTERPRETATION OF THE DATA, OTHER INTERPRETATIONS ARE POSSIBLE.
5. CURRENT GROUND SURFACE ELEVATION MAY NOT BE THE SAME AS WHEN THE FORMER BORINGS WERE DRILLED.
6. TPH CONCENTRATIONS IN GROUNDWATER FROM GRAB GROUNDWATER SAMPLE SPLIT COLLECTED IN APRIL 2015, AND GROUNDWATER MONITORING WELLS IN MAY 2015.
7. TPH = TOTAL PETROLEUM HYDROCARBONS.
8. TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS.
9. ND = NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT.
10. INTERPRETED TPH AND/OR TRPH EXTENT LINES ARE BASED ON CONCENTRATIONS EXCEEDING 8,500 mg/kg, AND/OR TPH CONCENTRATIONS EXCEEDING THE SITE-SPECIFIC CLEANUP GOALS (SSCGs).
11. INTERPRETED TOTAL LEAD EXTENT LINES ARE BASED ON SSCG OF 80 mg/kg.
12. THE LEAD CONCENTRATIONS ARE SHOWN ON FIGURE 5.

TITLE: **SCHEMATIC SECTION B-B'**

LOCATION: **Oil Operators, Inc. Property**
712 Baker Street, Long Beach, California 90806

TETRA TECH

APPROVED	JL	FIGURE
DRAFTED	CP	6B
PROJECT#	T33843.01	
DATE	9-4-15	



LEGEND

B8/TWW5/SG6	BORING (B8) / GROUNDWATER MONITORING WELL (TMW5) SOIL GAS (SG6) LOCATION AND DESIGNATION
	GROUND SURFACE
2,800	TRPH AND/OR TPH CONCENTRATION IN SOIL (mg/kg)
2.0	BENZENE CONCENTRATION IN SOIL (mg/kg)
ND	1,2-DCA CONCENTRATION IN SOIL (mg/kg)
	LITHOLOGIC CONTACT
	INTERPRETED TPH AND/OR TRPH 8,500 mg/kg EXTENT LINE
	INTERPRETED TOTAL LEAD EXTENT LINE
	GROUNDWATER ON MAY 18, 2015
37.8	TRPH AND/OR TPH CONCENTRATION IN GROUNDWATER (mg/L)
3.9	BENZENE CONCENTRATION IN GROUNDWATER (mg/L)
0.43	1,2-DCA CONCENTRATION IN GROUNDWATER (mg/L)
B-1 AND HA-4	SOIL BORING AEMC (1991b)
B2	SOIL BORING BRYCON (2010g; 2011e)
T1 & LF-5	TRENCH AND SOIL BORING QST ENVIRONMENTAL, INC. (1998b)
TSO-8	ATSI BORING LOCATION (APRIL 2015)
B-2	GEOTECHNICAL BORING PGI (2015a)
	CLAY - CL
	SILT - ML
	SILTY SAND - SM
	POORLY GRADED SAND - SP
mg/kg	MILLIGRAMS PER KILOGRAM
mg/L	MILLIGRAMS PER LITER

NOTES

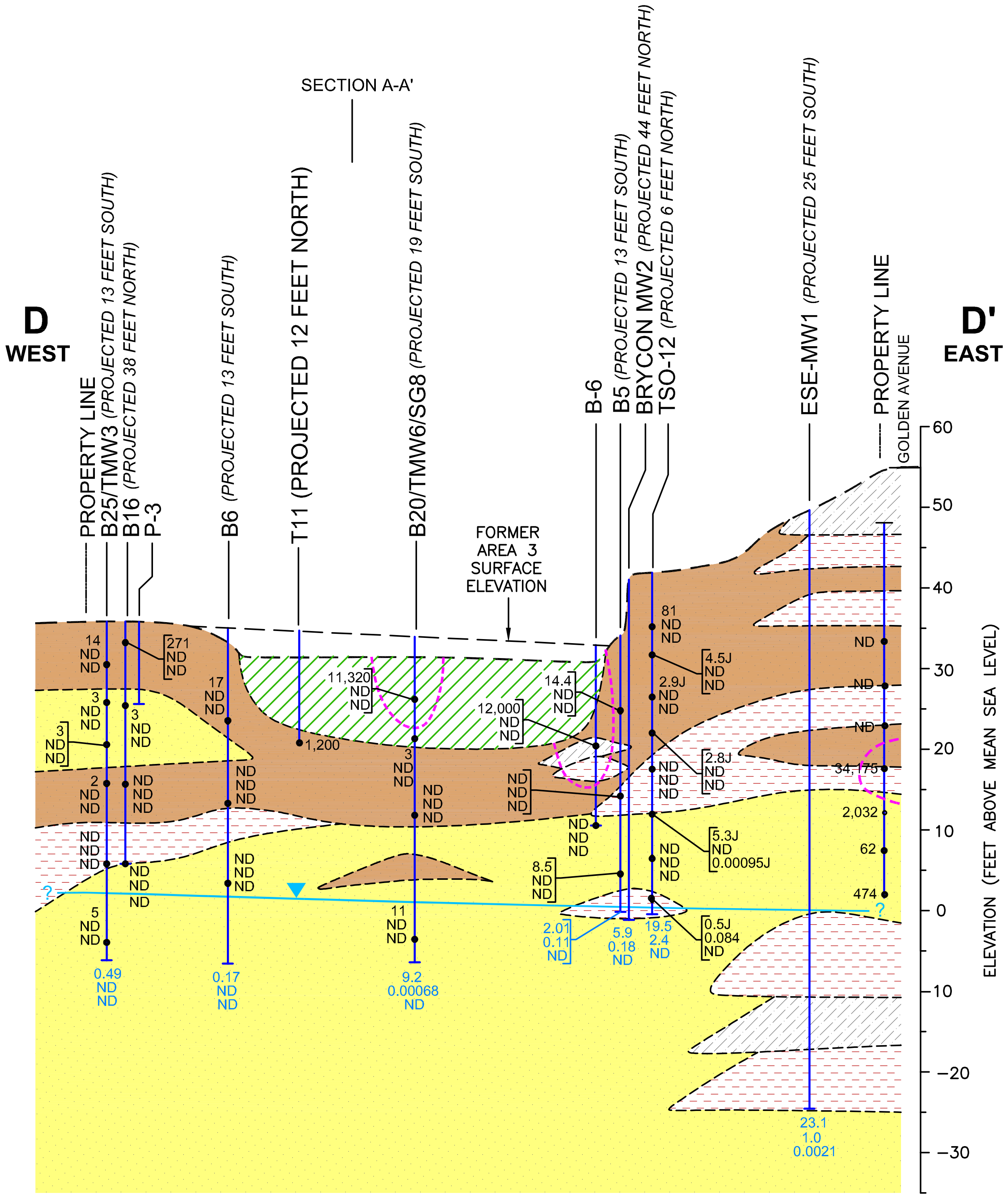
1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SCHEMATIC SECTION LOCATION SHOWN ON FIGURE 2.
3. DEPTH TO GROUNDWATER OBTAINED ON MAY 18, 2015 FROM GROUNDWATER MONITORING WELLS BRYCON-MW1 TO BRYCON-MW5, ESE-MW1, ESE-MW2, 92-MW1, AND TMW1 TO TMW6.
4. THIS FIGURE SHOWS ONE INTERPRETATION OF THE DATA, OTHER INTERPRETATIONS ARE POSSIBLE.
5. CURRENT GROUND SURFACE ELEVATION MAY NOT BE THE SAME AS WHEN THE FORMER BORINGS WERE DRILLED.
6. TPH CONCENTRATIONS IN GROUNDWATER FROM GRAB GROUNDWATER SAMPLE SPLIT COLLECTED IN APRIL 2015, AND GROUNDWATER MONITORING WELLS IN MAY 2015.
7. TPH = TOTAL PETROLEUM HYDROCARBONS.
8. TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS.
9. ND = NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT.
10. INTERPRETED TPH AND/OR TRPH EXTENT LINES ARE BASED ON CONCENTRATIONS EXCEEDING 8,500 mg/kg, AND/OR TPH CONCENTRATIONS EXCEEDING THE SITE-SPECIFIC CLEANUP GOALS (SSCGs).
11. THE LEAD CONCENTRATIONS ARE SHOWN ON FIGURE 5.

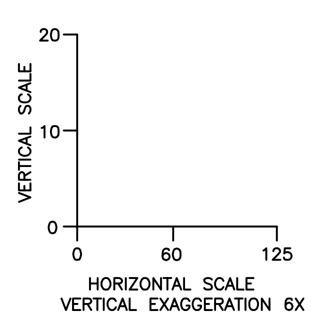
TITLE: **SCHEMATIC SECTION C-C'**

LOCATION: **Oil Operators, Inc. Property**
712 Baker Street, Long Beach, California 90806

TETRA TECH

APPROVED	JL	FIGURE
DRAFTED	CP	6C
PROJECT#	T33843.01	
DATE	9-4-15	





LEGEND

- B25/TMW3 — BORING (B25) / GROUNDWATER MONITORING WELL (TMW3) LOCATION AND DESIGNATION
- GROUND SURFACE
- 14 — TRPH AND/OR TPH CONCENTRATION IN SOIL (mg/kg)
- ND — BENZENE CONCENTRATION IN SOIL (mg/kg)
- ND — 1,2-DCA CONCENTRATION IN SOIL (mg/kg)
- LITHOLOGIC CONTACT
- INTERPRETED TPH AND/OR TRPH 8,500 mg/kg EXTENT LINE
- GROUNDWATER ON MAY 18, 2015
- 0.49 — TRPH AND/OR TPH CONCENTRATION IN GROUNDWATER (mg/L)
- ND — BENZENE CONCENTRATION IN GROUNDWATER (mg/L)
- ND — 1,2-DCA CONCENTRATION IN GROUNDWATER (mg/L)
- B-1 AND HA-4 — SOIL BORING AEMC (1991b)
- B2 — SOIL BORING BRYCON (2010g; 2011e)
- T1 & LF-5 — TRENCH AND SOIL BORING QST ENVIRONMENTAL, INC. (1998b)
- TSO-8 — ATSI BORING LOCATION (APRIL 2015)
- *B-2* — GEOTECHNICAL BORING PGI (2015a)
- BIOREMEDIATED SOIL
- CLAY - CL
- SILT - ML
- SILTY SAND - SM
- POORLY GRADED SAND - SP
- mg/kg — MILLIGRAMS PER KILOGRAM
- mg/L — MILLIGRAMS PER LITER
- J — ESTIMATED VALUE BY THE LABORATORY

NOTES

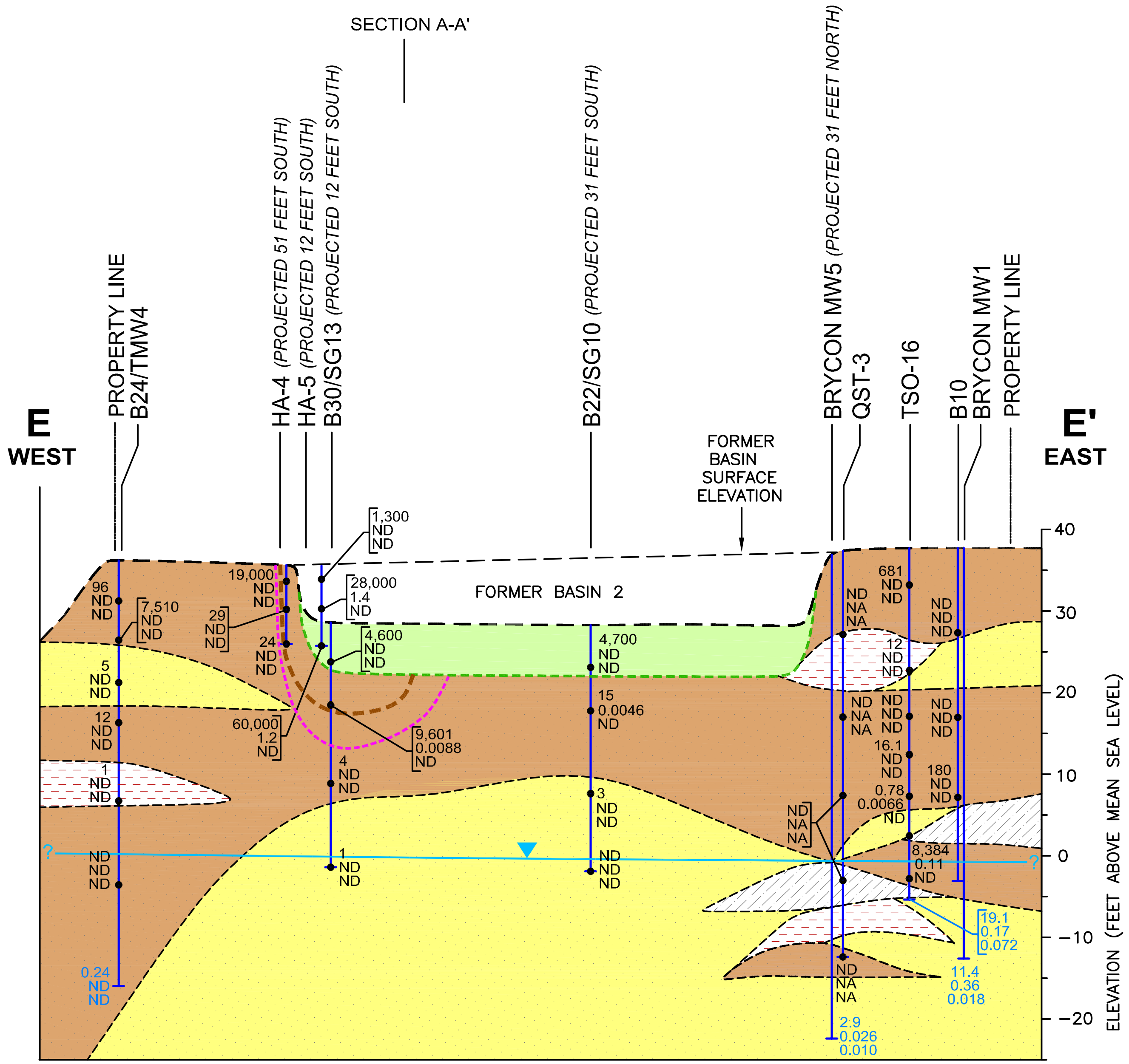
1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SCHEMATIC SECTION LOCATION SHOWN ON FIGURE 2.
3. DEPTH TO GROUNDWATER OBTAINED ON MAY 18, 2015 FROM GROUNDWATER MONITORING WELLS BRYCON-MW1 TO BRYCON-MW5, ESE-MW1, ESE-MW2, 92-MW1, AND TMW1 TO TMW6.
4. THIS FIGURE SHOWS ONE INTERPRETATION OF THE DATA, OTHER INTERPRETATIONS ARE POSSIBLE.
5. CURRENT GROUND SURFACE ELEVATION MAY NOT BE THE SAME AS WHEN THE FORMER BORINGS WERE DRILLED.
6. TPH CONCENTRATIONS IN GROUNDWATER FROM GRAB GROUNDWATER SAMPLE SPLIT COLLECTED IN APRIL 2015, AND GROUNDWATER MONITORING WELLS IN MAY 2015.
7. TPH = TOTAL PETROLEUM HYDROCARBONS.
8. TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS.
9. ND = NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT.
10. INTERPRETED TPH AND/OR TRPH EXTENT LINES ARE BASED ON CONCENTRATIONS EXCEEDING 8,500 mg/kg, AND/OR TPH CONCENTRATIONS EXCEEDING THE SITE-SPECIFIC CLEANUP GOALS (SSCGs).
11. THE LEAD CONCENTRATIONS ARE SHOWN ON FIGURE 5.

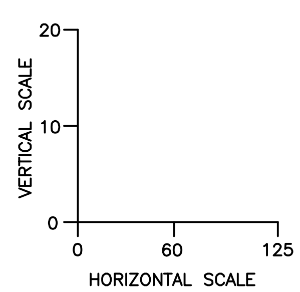
TITLE: **SCHEMATIC SECTION D-D'**

LOCATION: **Oil Operators, Inc. Property**
712 Baker Street, Long Beach, California 90806

TETRA TECH

APPROVED	JL	FIGURE
DRAFTED	CP	6D
PROJECT#	T33843.01	
DATE	9-4-15	





LEGEND

B24/TMW4 — BORING (B24) / GROUNDWATER MONITORING WELL (TMW4) LOCATION AND DESIGNATION

GROUND SURFACE

5 — TRPH AND/OR TPH CONCENTRATION IN SOIL (mg/kg)

ND — BENZENE CONCENTRATION IN SOIL (mg/kg)

ND — 1,2-DCA CONCENTRATION IN SOIL (mg/kg)

LITHOLOGIC CONTACT

INTERPRETED TPH AND/OR TRPH 8,500 mg/kg EXTENT LINE

INTERPRETED TOTAL LEAD EXTENT LINE

GROUNDWATER ON MAY 18, 2015

0.24 — TRPH AND/OR TPH CONCENTRATION IN GROUNDWATER (mg/L)

ND — BENZENE CONCENTRATION IN GROUNDWATER (mg/L)

ND — 1,2-DCA CONCENTRATION IN GROUNDWATER (mg/L)

B-1 AND HA-4	SOIL BORING AEMC (1991b)
B2	SOIL BORING BRYCON (2010g; 2011e)
T1 & LF-5	TRENCH AND SOIL BORING QST ENVIRONMENTAL, INC. (1998b)
TSO-8	ATSI BORING LOCATION (APRIL 2015)
B-2	GEOTECHNICAL BORING PGI (2015a)
	SOIL BEING BIOREMEDIATED
	CLAY - CL
	SILT - ML
	SILTY SAND - SM
	POORLY GRADED SAND - SP
mg/kg	MILLIGRAMS PER KILOGRAM
mg/L	MILLIGRAMS PER LITER

NOTES

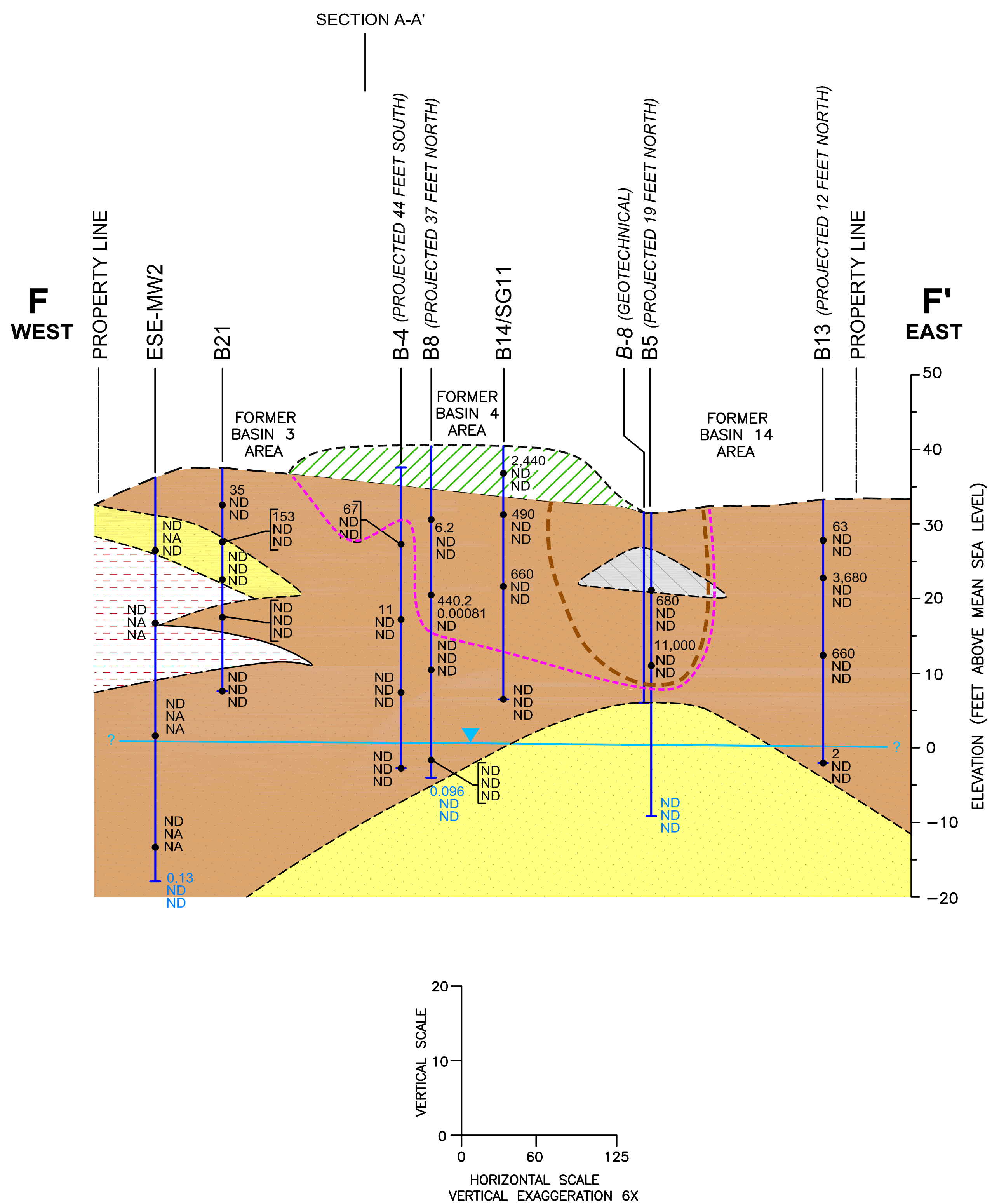
1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SCHEMATIC SECTION LOCATION SHOWN ON FIGURE 2.
3. DEPTH TO GROUNDWATER OBTAINED ON MAY 18, 2015 FROM GROUNDWATER MONITORING WELLS BRYCON-MW1 TO BRYCON-MW5, ESE-MW1, ESE-MW2, 92-MW1, AND TMW1 TO TMW6.
4. THIS FIGURE SHOWS ONE INTERPRETATION OF THE DATA, OTHER INTERPRETATIONS ARE POSSIBLE.
5. CURRENT GROUND SURFACE ELEVATION MAY NOT BE THE SAME AS WHEN THE FORMER BORINGS WERE DRILLED.
6. TPH CONCENTRATIONS IN GROUNDWATER FROM GRAB GROUNDWATER SAMPLE SPLIT COLLECTED IN APRIL 2015, AND GROUNDWATER MONITORING WELLS IN MAY 2015.
7. TPH = TOTAL PETROLEUM HYDROCARBONS.
8. TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS.
9. NA = NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT.
10. ND = NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT.
11. INTERPRETED TPH AND/OR TRPH EXTENT LINES ARE BASED ON CONCENTRATIONS EXCEEDING 8,500 mg/kg, AND/OR TPH CONCENTRATIONS EXCEEDING THE SITE-SPECIFIC CLEANUP GOALS (SSCGs).
12. INTERPRETED TOTAL LEAD EXTENT LINES ARE BASED ON SSCG OF 80 mg/kg.
13. THE LEAD CONCENTRATIONS ARE SHOWN ON FIGURE 5.

TITLE: **SCHEMATIC SECTION E-E'**

LOCATION: **Oil Operators, Inc. Property**
712 Baker Street, Long Beach, California 90806

TETRA TECH

APPROVED	JL	FIGURE
DRAFTED	CP	6E
PROJECT#	T33843.01	
DATE	9-4-15	



LEGEND

ESE-MW2 — BORING (ESE) / GROUNDWATER MONITORING WELL (MW2) LOCATION AND DESIGNATION

GROUND SURFACE

ND — TRPH AND/OR TPH CONCENTRATION IN SOIL (mg/kg)
NA — BENZENE CONCENTRATION IN SOIL (mg/kg)
NA — 1,2-DCA CONCENTRATION IN SOIL (mg/kg)

LITHOLOGIC CONTACT

INTERPRETED TPH AND/OR TRPH 8,500 mg/kg EXTENT LINE

INTERPRETED TOTAL LEAD EXTENT LINE

GROUNDWATER ON MAY 18, 2015

0.13 — TRPH AND/OR TPH CONCENTRATION IN GROUNDWATER (mg/L)
ND — BENZENE CONCENTRATION IN GROUNDWATER (mg/L)
ND — 1,2-DCA CONCENTRATION IN GROUNDWATER (mg/L)

B-1 AND HA-4	SOIL BORING AEMC (1991b)
B2	SOIL BORING BRYCON (2010g; 2011e)
T1 & LF-5	TRENCH AND SOIL BORING QST ENVIRONMENTAL, INC. (1998b)
TSO-8	ATSI BORING LOCATION (APRIL 2015)
B-2	GEOTECHNICAL BORING PGI (2015a)
	BIOREMEDIATED SOIL
	CLAY - CL
	SILTY SAND - SM
	POORLY GRADED SAND - SP
	CLAYEY SAND - SC
mg/kg	MILLIGRAMS PER KILOGRAM
mg/L	MILLIGRAMS PER LITER

NOTES

1. ALL LOCATIONS AND DIMENSIONS ARE APPROXIMATE.
2. SCHEMATIC SECTION LOCATION SHOWN ON FIGURE 2.
3. DEPTH TO GROUNDWATER OBTAINED ON MAY 18, 2015 FROM GROUNDWATER MONITORING WELLS BRYCON-MW1 TO BRYCON-MW5, ESE-MW1, ESE-MW2, 92-MW1, AND TMW1 TO TMW6.
4. THIS FIGURE SHOWS ONE INTERPRETATION OF THE DATA, OTHER INTERPRETATIONS ARE POSSIBLE.
5. CURRENT GROUND SURFACE ELEVATION MAY NOT BE THE SAME AS WHEN THE FORMER BORINGS WERE DRILLED.
6. BIOREMEDIATED SOILS LOCATION AND THICKNESS OBTAINED FROM FIGURE 3.
7. TPH CONCENTRATIONS IN GROUNDWATER FROM GRAB GROUNDWATER SAMPLE SPLIT COLLECTED IN APRIL 2015, AND GROUNDWATER MONITORING WELLS IN MAY 2015.
8. FORMER BASIN NUMBERS 3, 4 AND 14 LOCATION AND DESIGNATION OBTAINED FROM ESE (1999).
9. TPH = TOTAL PETROLEUM HYDROCARBONS.
10. TRPH = TOTAL RECOVERABLE PETROLEUM HYDROCARBONS.
11. NA = SAMPLE NOT ANALYZED.
12. ND = NOT DETECTED ABOVE LABORATORY PRACTICAL QUANTITATION LIMIT.
13. INTERPRETED TPH AND/OR TRPH EXTENT LINES ARE BASED ON CONCENTRATIONS EXCEEDING 8,500 mg/kg, AND/OR TPH CONCENTRATIONS EXCEEDING THE SITE-SPECIFIC CLEANUP GOALS (SSCGs).
14. INTERPRETED TOTAL LEAD EXTENT LINES ARE BASED ON SSCG OF 80 mg/kg.
15. THE LEAD CONCENTRATIONS ARE SHOWN ON FIGURE 5.

TITLE:

SCHEMATIC SECTION F-F'

LOCATION:

Oil Operators, Inc. Property
712 Baker Street, Long Beach, California 90806

TETRA TECH

APPROVED	JL	FIGURE
DRAFTED	CP	6F
PROJECT#	T33843.01	
DATE	9-4-15	

APPENDIX C

Johnson & Ettinger Model Results
Soil Vapor

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: Residential
Chemical: 1,2,4-Trimethylbenzene

Results Summary

Soil Gas Conc. (μg/m^3)	Attenuation Factor (unitless)	Indoor Air Conc. (μg/m^3)	Cancer Risk	Noncancer Hazard
5.44E+03	8.3E-04	4.5E+00	NA	6.2E-01

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
95636	5.44E+03			1,2,4-Trimethylbenzene

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	152	17	SI		

MORE ↓

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

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

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: **Residential**
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
1.67E+05	4.7E-04	7.8E+01	8.0E-04	2.5E+01

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	1.67E+05			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 (^oC)	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	457	17	SI		

MORE ↓

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

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

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

Scenario: Residential
Chemical: Ethylbenzene

DATA ENTRY SHEET

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
4.02E+04	3.7E-04	1.5E+01	1.3E-05	1.4E-02

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
100414	4.02E+04			Ethylbenzene

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	457	17	SI		

MORE ↓

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

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

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: Residential
Chemical: Cumene

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
1.13E+03	3.3E-04	3.8E-01	NA	9.1E-04

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
98828	1.13E+03			Cumene

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	457	17	SI		

MORE ↓

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

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

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: Residential
Chemical: Naphthalene

Results Summary

Soil Gas Conc. (μg/m³)	Attenuation Factor (unitless)	Indoor Air Conc. (μg/m³)	Cancer Risk	Noncancer Hazard
4.10E+02	8.3E-04	3.4E-01	4.1E-06	1.1E-01

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m³)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
91203	4.10E+02			Naphthalene

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 (cm²)
15	152	17	SI		

MORE ↓

ENTER Vandose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^A (g/cm³)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
SI	1.35	0.489	0.167	5

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

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: **Residential**
Chemical: **n-Butylbenzene**

Results Summary

Soil Gas Conc. (μg/m^3)	Attenuation Factor (unitless)	Indoor Air Conc. (μg/m^3)	Cancer Risk	Noncancer Hazard
7.24E+02	**3.0E-04**	**2.2E-01**	**NA**	**1.2E-03**

MESSAGE: Risk and/or hazard quotient is based on route-to-route extrapolation.

Reset to Defaults

Soil Gas Concentration Data

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Soil gas conc., C_g (μg/m^3)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
104518	7.24E+02			n-Butylbenzene

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	457	17	SI		

MORE ↓

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

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

USEPA SG-SCREEN
Version 2.0, 04/2003

DTSC Modification
December 2014

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

Scenario: **Residential**
Chemical: **n-Propylbenzene**

DATA ENTRY SHEET

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
4.20E+03	8.3E-04	3.5E+00	NA	3.3E-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
103651	4.20E+03			n-Propylbenzene

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 (^oC)	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	152	17	SI		

MORE ↓

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

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

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: Residential
Chemical: Toluene

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
1.67E+04	4.1E-04	6.9E+00	NA	2.2E-02

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
108883	1.67E+04			Toluene

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	457	17	SI		

MORE ↓

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

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

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: **Residential**
Chemical: **o-Xylene**

Results Summary

Soil Gas Conc. ($\mu g/m^3$)	Attenuation Factor (unitless)	Indoor Air Conc. ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard
5.11E+04	3.7E-04	1.9E+01	NA	1.8E-01

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
95476	5.11E+04			o-Xylene

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	457	17	SI		

MORE ↓

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

Lookup Soil

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=> Residential	70	26	26	350	24	0.5
					(NEW)	(NEW)

END

APPENDIX D

Johnson & Ettinger Model Results
Groundwater

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **1,1,2,2-Tetrachloroethane**

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk $= 10^{-6}$ ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
4.17E+00	3.5E-05	1.5E-04	3.0E-09	2.0E-06	NA	NA

MESSAGE: Risk and/or HQ (or risk-based groundwater concentration) is based on route-to-route extrapolation.
MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
79345	4.40E-01	1,1,2,2-Tetrachloroethane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **1,1,2-Trichloroethane**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk $= 10^{-6}$ ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
5.78E+01	3.3E-05	1.9E-03	1.1E-08	9.3E-03	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
79005	2.60E+00	1,1,2-Trichloroethane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **1,2,4-Trimethylbenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
1.51E+05	2.4E-05	3.6E+00	NA	4.9E-01	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
95636	1.00E+03	1,2,4-Trimethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)
15	1433	SI	17

ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil)	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **1,2-Dibromoethane (ethylene dibromide)**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
106934	2.45E+02	1,2-Dibromoethane (ethylene dibromide)

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) (μg/m^3)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) (μg/m^3)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} (μg/L)	Noncancer HQ = 1 (μg/L)
4.18E+03	2.7E-05	1.1E-01	2.4E-05	1.4E-01	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil)	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **1,2-Dichloroethane**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) (μg/m^3)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) (μg/m^3)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} (μg/L)	Noncancer HQ = 1 (μg/L)
1.44E+04	3.8E-05	5.5E-01	5.1E-06	7.5E-02	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
107062	4.30E+02	1,2-Dichloroethane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **1,3,5-Trimethylbenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk $= 10^{-6}$ ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
7.30E+04	2.3E-05	1.7E+00	NA	4.6E-02	NA	NA

MESSAGE: Risk and/or HQ (or risk-based groundwater concentration) is based on route-to-route extrapolation.
MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
108678	3.40E+02	1,3,5-Trimethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **1,4-Dichlorobenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk $= 10^{-6}$ ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
2.41E+01	2.3E-05	5.6E-04	2.2E-09	6.7E-07	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
106467	4.00E-01	1,4-Dichlorobenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil)	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Methylethylketone (2-butanone)**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary

Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Risk-Based Groundwater Concentration: Cancer Risk $= 10^{-6}$ (μg/L)	Risk-Based Groundwater Concentration: Noncancer HQ = 1 (μg/L)
2.11E+02	1.1E-04	2.2E-02	NA	4.3E-06	NA	NA

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
78933	1.30E+02	Methylethylketone (2-butanone)

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Acetone**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
4.36E+02	1.4E-04	6.1E-02	NA	1.9E-06	NA	NA

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
67641	4.20E+02	Acetone

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil)	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Benzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk $= 10^{-6}$ (μg/L)	Noncancer HQ = 1 (μg/L)
6.25E+05	3.4E-05	2.1E+01	2.2E-04	6.9E+00	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
71432	3.90E+03	**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 Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^{o}C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Chlorobenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
6.98E+01	2.9E-05	2.0E-03	NA	3.9E-05	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
108907	8.40E-01	Chlorobenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Chloroform**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
67663	1.20E+00	Chloroform

Results Summary

Soil Gas Conc. (C_{source}) (µg/m^3)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) (µg/m^3)	Cancer Risk	Noncancer Hazard	Risk-Based Groundwater Concentration: Cancer Risk = 10^{-6} (µg/L)	Risk-Based Groundwater Concentration: Noncancer HQ = 1 (µg/L)
1.31E+02	3.0E-05	4.0E-03	3.3E-08	3.9E-05	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil)	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24 (NEW)	0.5 (NEW)

Used to calculate risk-based groundwater concentration.

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **cis-1,2-Dichloroethylene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
2.16E+02	3.5E-05	7.5E-03	NA	1.0E-03	NA	NA

MESSAGE: Risk and/or HQ (or risk-based groundwater concentration) is based on route-to-route extrapolation.
MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
156592	1.80E+00	cis-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Diisopropyl ether (DIPE)**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk $= 10^{-6}$ ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
1.87E+02	2.6E-05	4.9E-03	NA	6.8E-06	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
108203	2.50E+00	Diisopropyl ether (DIPE)

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Ethylbenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

	Results Summary				Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk $= 10^{-6}$ (μg/L)	Noncancer HQ = 1 (μg/L)
3.52E+05	2.6E-05	9.2E+00	8.2E-06	8.8E-03	NA	NA

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
100414	1.70E+03	Ethylbenzene

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil)	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **m-Xylene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk $= 10^{-6}$ ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
1.11E+06	2.6E-05	2.9E+01	NA	2.8E-01	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
108383	5.90E+03	**m-Xylene**

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (^oC)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Naphthalene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
2.64E+03	3.7E-05	9.9E-02	1.2E-06	3.1E-02	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
91203	2.60E+02	Naphthalene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S ($^{\circ}C$)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **n-Butylbenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
104518	5.50E+01	n-Butylbenzene

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) (μg/m^3)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) (μg/m^3)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} (μg/L)	Noncancer HQ = 1 (μg/L)
2.12E+04	2.0E-05	4.2E-01	NA	2.3E-03	NA	NA

MESSAGE: Risk and/or HQ (or risk-based groundwater concentration) is based on route-to-route extrapolation.
MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil)	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
							(NEW)	(NEW)

Used to calculate risk-based groundwater concentration.

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **n-Propylbenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
103651	1.50E+02	n-Propylbenzene

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) (μg/m^3)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) (μg/m^3)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} (μg/L)	Noncancer HQ = 1 (μg/L)
3.91E+04	2.3E-05	9.0E-01	NA	8.6E-04	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	1433	SI	17

ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **o-Xylene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
95476	3.00E+03	o-Xylene

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) (μg/m^3)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) (μg/m^3)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} (μg/L)	Noncancer HQ = 1 (μg/L)
4.04E+05	2.7E-05	1.1E+01	NA	1.0E-01	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **sec-Butylbenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
1.40E+02	4.3E-05	6.0E-03	NA	1.4E-05	NA	NA

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
135988	2.80E+01	sec-Butylbenzene

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

Reset to Defaults

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **tert-Butylbenzene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) (μg/m^3)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) (μg/m^3)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} (μg/L)	Noncancer HQ = 1 (μg/L)
7.13E+02	2.0E-05	1.4E-02	NA	3.4E-05	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (μg/L)	Chemical
98066	2.00E+00	tert-Butylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Toluene**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108883	3.60E+03	Toluene

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) (µg/m^3)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) (µg/m^3)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} (µg/L)	Noncancer HQ = 1 (µg/L)
6.58E+05	3.0E-05	2.0E+01	NA	6.3E-02	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)
15	1433	SI	17

ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END

USEPA GW-SCREEN
Version 3.0, 04/2003

DTSC Modification
December 2014

Reset to Defaults

Department of Toxic Substances Control
Vapor Intrusion Screening Model - Groundwater

DATA ENTRY SHEET

Scenario: **Residential**
Chemical: **Vinyl chloride (chloroethene)**

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES [ ]

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION
(enter "X" in "YES" box and initial groundwater conc. below)

YES [X]

Results Summary					Risk-Based Groundwater Concentration	
Soil Gas Conc. (C_{source}) ($\mu g/m^3$)	Attenuation Factor (alpha) (unitless)	Indoor Air Conc. ($C_{building}$) ($\mu g/m^3$)	Cancer Risk	Noncancer Hazard	Cancer Risk = 10^{-6} ($\mu g/L$)	Noncancer HQ = 1 ($\mu g/L$)
6.41E+02	4.0E-05	2.5E-02	7.1E-07	2.4E-04	NA	NA

MESSAGE: Attenuation factor < 6E-05 is unreasonably low.

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W ($\mu g/L$)	Chemical
75014	6.90E-01	Vinyl chloride (chloroethene)

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	1433	SI	17	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type	ENTER Vadose zone soil dry bulk density, ρ_b^V (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)
SI			SI	1.35	0.489	0.167

Lookup Soil

MORE ↓

Lookup Receptor Parameters

	ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	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=> Residential	1.0E-06	1	70	26	26	350	24	0.5
	Used to calculate risk-based groundwater concentration.						(NEW)	(NEW)

END