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Appendices

Appendix A Human Health Risk Assessment

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Human Health Risk Assessment
Associated Plating Company
9636 Ann Street
Santa Fe Springs, California

June 23, 2006

Prepared for:

WorleyParsons Komex
5455 Garden Grove Boulevard, Second Floor
Westminster, California 92683

Prepared by:

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June 23, 2006

via courier

Ms. Lee Paprocki, R.G.
Project Hydrogeologist, Project Manager
WorleyParsons Komex
5455 Garden Grove Boulevard, Second Floor
Westminster, California 92683-8201

RE: **HUMAN HEALTH RISK ASSESSMENT**
Associated Plating Company
9636 Ann Street, Santa Fe Springs, California

Dear Ms. Paprocki:

I am pleased to present this Human Health Risk Assessment (HRA) for Associated Plating Company located at 9636 Ann Street, Los Angeles County, Santa Fe Springs, California (the site) pursuant to your authorization.

This HRA followed the guidance in the Department of Toxic Substances Control (DTSC) *Preliminary Endangerment Assessment* (PEA) guidance manual (DTSC, 1999), the U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (RAGs) (USEPA, 2004), the Massachusetts Department of Environmental Protection (MADEP) *Characterizing Risks posed by Petroleum Contaminated Sites* manual (MADEP, June, 2001), the DTSC *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (DTSC, February 7, 2005), the DTSC Human and Ecological Risk Division (HERD)-approved Johnson & Ettinger soil gas screen, version 2.0 model (January 21, 2005), the DTSC-HERD-approved Johnson & Ettinger groundwater screen, version 3.0 model (January 21, 2005) and the DTSC LeadSpread 7 Model.

Should you have any questions or desire additional information, please contact me at your earliest convenience at 310.396.9606.

Very truly yours,

Susan L. Mearns, Ph.D., REA II 20032

REGISTERED ENVIRONMENTAL ASSESSOR
SUSAN L. MEARNS, PH.D.
No. 20032
Expires: 10-31-06
STATE OF CALIFORNIA

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EXECUTIVE SUMMARY

The objective of this Human Health Risk Assessment (HRA) was to evaluate potential health risks to human receptors posed by concentrations of 54 constituents detected at least one time in the top 10-feet of the soil matrix, in soil gas or groundwater underlying the property located at 9636 Ann Street Santa Fe Springs, California (the site). Although 48 constituents were detected at least one time in the media sampled, nine constituents were assessed as both carcinogenic and noncarcinogenic constituents and three constituents were not quantitatively assessed due to insufficient toxicological data.

This HRA followed the guidance in the Department of Toxic Substances Control (DTSC) *Preliminary Endangerment Assessment* (PEA) guidance manual (DTSC, 1999), the U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (RAGs) (USEPA, 2004), the Massachusetts Department of Environmental Protection (MADEP) *Characterizing Risks posed by Petroleum Contaminated Sites* manual (MADEP, June, 2001), the DTSC *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (DTSC, February 7, 2005), the DTSC Human and Ecological Risk Division (HERD)-approved Johnson & Ettinger soil gas screen, version 2.0 model (January 21, 2005), the DTSC-HERD-approved Johnson & Ettinger groundwater screen, version 3.0 model (January 21, 2005) and the DTSC LeadSpread 7 Model.

The maximum detected concentration or the upper confidence level, whichever was lower pursuant to the ProUCL guidance (USEPA, 2004), was used as the exposure point concentration in this HRA. One-half the reporting limit was used in the statistical analyses when the constituent was not detected in concentrations greater than the reporting limit (USEPA, 2004). Those chemicals of concern that had both reference doses and slope factors available, were assessed as both noncarcinogenic and carcinogenic compounds. Those constituents that were detected in multiple media were assessed via the appropriate exposure pathway in multiple media.

The results of the HRA indicate that the estimated individual hazard quotients (HQ) of the 39 noncarcinogenic constituents did not exceed the target hazard quotient of 1, except for thallium. The estimated hazard quotient for thallium was 1.4. Thallium was detected in three of 69 soil samples and was not used, handled, stored nor is it a waste by-product of the process operations conducted onsite. Therefore, this hazard quotient more than likely is a reflection of the conservative nature of the risk assessment.

The results of the HRA indicate that the estimated individual risks of the 15 carcinogenic constituents are less than 1×10^{-5} the target risk value, except for arsenic, vinyl chloride and tetrachloroethene (PCE). The estimated risk for arsenic via the oral and dermal contact exposure routes is 2.42×10^{-4}. The estimated risk for PCE via inhalation from soil gas is 5.10×10^{-5} and for vinyl chloride via inhalation from soil gas is 1.30×10^{-3}.

The oral and dermal contact exposure routes assume a child and an adult are onsite consuming soil for 350 days for six and 24 years, respectively. As the site is currently an operating industrial facility, the likelihood of this exposure route is very low.

Additionally, the estimated risks due to exposure to arsenic in the soil matrix via the oral and dermal contact routes and to exposure to PCE in soil vapor via the inhalation exposure route are within USEPA's "safe and protective of public health" risk range of 1×10^{-4} to 1×10^{-6} (Federal Register 56(20):3535, 1991).

Risks were estimated via the inhalation route of exposure to volatile organic compounds (VOCs) detected in the soil vapor underlying the site using the DTSC-HERD modified Johnson & Ettinger soil gas screen model which assumes: (1) a theoretical building is placed onsite, (2) no transformation, i.e., degradation processes occur, (3) the areal extent of contamination is greater than the building floor in contact with the soil, (4) the soil gas is at a steady state condition, (5) the VOCs assessed are homogenously distributed and (6) all vapors originating below the building will enter the building.

The area with the greatest detected concentration of vinyl chloride in soil gas, 210 micrograms per liter (µg/L), is located exterior to the existing plating shop building approximately 2-feet beneath a concrete pad that is 3-feet below ground surface (bgs).

Remediation of the area with the greatest detected concentration of vinyl chloride in soil gas, 210 µg/L, and subsequent recalculation of risk estimates may be warranted.

1.0 INTRODUCTION

This report presents the results of a Human Health Risk Assessment (HRA) for Associated Plating Company located at 9636 Ann Street, Santa Fe Springs, California (the site).

The purpose of this HRA was to evaluate the potential adverse health impacts due to exposure to concentrations of constituents detected in the soil matrix, soil vapor and groundwater underlying the site. If a constituent was detected one time in the media sampled, it was retained and quantitatively assessed in this HRA. This HRA assessed the potential risk and hazard attributable to exposure to 15 carcinogenic constituents and 39 noncarcinogenic constituents which are listed in the *Carcinogens and Noncarcinogens* table.

This HRA followed the guidance in the Department of Toxic Substances Control (DTSC) *Preliminary Endangerment Assessment* (PEA) guidance manual (DTSC, 1999), the U.S. Environmental Protection Agency *Risk Assessment Guidance for Superfund volume 1, Human Health Evaluation Manual* (RAGs) (USEPA, 2004), the Massachusetts Department of Environmental Protection (MADEP) *Characterizing Risks posed by Petroleum Contaminated Sites* manual (MADEP, June, 2001), the DTSC *Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (DTSC, February 7, 2005), the DTSC Human and Ecological Risk Division (HERD)-approved Johnson & Ettinger soil gas screen, version 2.0 model (January 21, 2005), the DTSC-HERD-approved Johnson & Ettinger groundwater screen, version 3.0 model (January 21, 2005) and the DTSC LeadSpread 7 Model.

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 was used to obtain a surrogate RfD for the speciated carbon chains C6-C10, C10-C18 and C18-C40 (MADEP, 2001). The potential adverse health impacts due to exposure to the speciated carbon chains C6-C10, C10-C18 and C18-C40 in onsite soils were then assessed by following the appropriate equations in DTSC's PEA manual.

The Johnson and Ettinger Model (soil gas screen version 2.0; April, 2003) modified by DTSC-HERD to include the OEHHA unit risk factors (URFs) and reference concentrations (RfCs) was used to evaluate the potential adverse health impacts due to inhalation of the detected constituents in soil vapor underlying the site based on the assumptions: (1) the receptors are inside a theoretical onsite building underneath of which these volatile organic compounds (VOCs) are only diffusing upwards and (2) the receptors are exposed to these constituents for 250 days per year for 25 years.

The Johnson and Ettinger Model (groundwater screen version 3.0; April, 2003) modified by DTSC-HERD to include the OEHHA URFs and RfCs was used to evaluate the potential adverse health impacts due to inhalation of the detected constituents in groundwater underlying the site based on the assumptions: (1) the receptors are inside a theoretical onsite building underneath of

which these VOCs are only diffusing upwards and (2) the receptors are exposed to these constituents for 250 days per year for 25 years.

DTSC's LeadSpread 7.0 Model was used to evaluate the potential health impacts due to exposure to lead in onsite soils via the ingestion and inhalation exposure routes. The LeadSpread Model estimates the blood lead levels, expressed as micrograms per deciliter (µg/dl), in the blood of adults and children potentially exposed to the residual concentrations of lead. The Model assumes these receptors will be exposed to the residual concentrations of lead in the air, through the ingestion of soil and particulates, in water and in home-grown produce, overly conservative, i.e., health protective assumptions. The LeadSpread Model does not account for the depth at which the concentration of lead was detected in site soils.

The data collected from previous investigations conducted by URS Corporation (URS) in 2001 and 2002, Komex H2O Science (Komex) in 2004 and WorleyParsons Komex in 2006 was used in the risk assessment.

2.0 SUMMARY OF FIELD ACTIVITIES

Site Description

The site currently operates as the Associated Plating Company (APC), a plating shop for small metallic components.

The site consists of an approximately 17,000 square foot (sq. ft.) concrete tilt-up building situated on approximately 1.25 acres. The plating facility specializes in the use of fused tin and tin/lead alloys using electro- and electroless plating. Nickel and copper are the most commonly used metals. Precious metal plating is also performed using silver, gold, tin, zinc and aluminum. Several plating lines with associated dip tanks are located within the facility. APC handles hazardous waste in two units authorized by the DTSC on August 4, 1993 under Permit By Rule (Komex, 2005).

The site can be divided into six areas, described below:

- Administrative offices
- Shipping, receiving and inspection
- Main plating facility includes lines 1 through 5, a maintenance room and maintenance stockroom
- Exterior storage includes the former tetrachloroethene (PCE) aboveground storage tank (AST), empty drum storage and chemical storage
- Wastewater treatment includes the location of the former vapor degreaser, holding tanks, clarifiers, filter press, batch neutralization tanks, sludge dryer, cyanide destruction unit, stripping department and ion exchange units
- Employee parking and vacant land

Site Background

Previous investigations have been conducted by different environmental consultants and DTSC since 1994. These investigations are summarized in the *Facilities Investigation Report, Associated Plating Company, Santa Fe Springs, California,* prepared by Komex, dated May 9, 2005.

Data from the investigations conducted by URS in 2001 and 2002, Komex in 2004 and WorleyParsons Komex in 2006 was used in this risk assessment.

3.0 IDENTIFYING CHEMICALS OF CONCERN

COC criteria

Typically only the most toxic, persistent and prevalent chemicals detected at the site are quantitatively evaluated in a risk assessment. The risk assessment therefore can focus on those chemicals that are expected to account for the majority of the estimated health impacts at any given site. These identified chemicals are referred to as chemicals of concern (COCs). COCs can be identified based on criteria such as frequency of detection, comparison with background, toxicity or whether a chemical can be considered a common laboratory contaminant (USEPA 1989).

DTSC indicated that if a constituent was detected one time within the media sampled it should be retained and quantitatively assessed within the risk assessment (DTSC, 2006). Therefore, all constituents detected in the soil matrix, in soil gas and groundwater in the previous investigations were retained and quantitatively assessed using the appropriate exposure pathway.

A conceptual site model was developed to identify the potential complete exposure pathways by which constituents detected in soil, and soil vapor and groundwater underlying the site could impact human health (Figure 1).

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:

- Current/future onsite indoor worker
  - inhalation of volatiles in soil and/or groundwater that have migrated to indoor air

- Current/future onsite outdoor worker
  - ingestion and dermal contact with surface soil
  - inhalation of volatiles/dust from soil in outdoor air

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

- Hypothetical future onsite resident
  - ingestion/dermal contact with surface soil
  - inhalation of volatiles in soil and/or groundwater that have migrated to indoor air

Consumption of fruit or vegetables grown in soil is not considered to be a complete potential exposure pathway under current or future site conditions. Under current conditions the site is an operating plating shop. Consumption of garden crops is not considered a complete potential exposure pathway in the future because more than likely the surficial soil would be removed and

replaced from the site during demolition activities to meet compaction standards for a residential building. Any impacted soil remaining onsite will generally be below the root-zone of backyard garden fruit and vegetables.

Potential direct exposures (ingestion and dermal contact) to groundwater are not complete pathways due to the fact that drinking water is provided by a remote municipal water supply and the depth to groundwater underlying the site is at least 34-feet bgs, 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 the Silverado aquifer is at least 210-feet bgs (Komex, 2005).

There is very limited ecological habitat at and near the site. Wetlands were not observed onsite or at adjacent sites. Also no pits, ponds or lagoons were observed onsite. There are no natural or undisturbed areas onsite. The only vegetated area is used as employee parking and storage of discarded equipment. Based on the lack of viable ecological habitat at and near the site, there are no complete ecological pathways onsite.

A total of 54 chemicals of concern were quantitatively assessed in the risk assessment.

4.0 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 1999b)
- Health Effects Assessment Summary Tables (HEAST, USEPA 1997b)
- National Center for Environmental Assessment (NCEA)

The State of California Office of Environmental Health Hazard Assessment (OEHHA) has developed their own URFs SFs, RfCs and RfDs. OEHHA's values are preferentially used instead of USEPA's when available.

Of the 54 chemicals of concern quantitatively assessed in the risk assessment, 15 were assessed as carcinogens and 39 were assessed as noncarcinogens. If a constituent, such as arsenic, had both a slope factor and a reference dose it was assessed both as a carcinogen and as a noncarcinogen.

The slope factors for 1,1,2,2-tetrachloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, benzene, bromodichloromethane, chloroform, naphthalene, PCE, TCE, vinyl chloride and arsenic, beryllium, cadmium, hexavalent chromium and nickel were obtained from OEHHA (Appendix A).

The reference doses for 1,1-dichloroethylene, ethylbenzene, isopropylbenzene, naphthalene, trans-1,2-dichloroethene, toluene, antimony, barium, trivalent chromium, cyanide, mercury, molybdenum, selenium, silver, thallium, zinc and the reference dose for the oral route of exposure for arsenic were obtained from USEPA, IRIS.

The reference doses for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, cis-1,2-dichloroethylene and cobalt are from USEPA, PPRTV. The reference dose for copper is from USEPA, HEAST. The reference doses for sec-butylbenzene, n-butylbenzene, tert-butylbenzene and vanadium are from USEPA, NCEA. The reference doses for C6-C10, C10-C18 and C18-C40 are from MADEP.

Lead was assessed using DTSC's LeadSpread 7 Model. Volatile organic compounds detected in soil vapor and groundwater underlying the site were assessed using the DTSC-HERD modified Johnson & Ettinger models that contain the unit risk factors and reference concentrations from OEHHA.

The exposure point concentrations, the slope factors and reference doses for the 43 constituents detected in the soil matrix and quantitatively assessed are presented in the *Exposure Point*

Concentrations, Slope Factors (SFs) and Reference Doses (RfDs) table.

The exposure point concentrations, unit risk factors and reference concentrations for the 19 volatile organic compounds detected in soil vapor and groundwater underlying the site are presented in the DTSC-HERD modified Johnson & Ettinger model outputs (Appendices B and C).

4.1 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, 1999b) and HEAST (USEPA, 1997b), 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.

4.1.1 Reference Doses

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) and possibly modifying factors (MFs). Separate UFs, 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.

A modifying factor of one to 10 (generally no higher than 3) is typically used to account for other considerations such as the perceived adequacy of the scientific data. The uncertainty factor and the modifying 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 (cRfD). 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 (sRfD) 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.

4.1.2 Cancer Slope Factors

USEPA has developed route-specific slope factors for chemicals that are known or potential human carcinogens. USEPA (1989) defines a slope 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-day] $^{-1}$).

Most slope factors are based on a continuous exposure, linear non-threshold extrapolation model (generally the linear multistage model [LMS]) 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).

5.0 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 the 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 chemicals of concern detected at least one time in the media onsite. Data collected from the top 10-feet of the soil matrix were used in the risk assessment. When the chemical of concern was not detected at a concentration greater than its reporting limit, one-half the reporting limit was used in the statistical calculations pursuant to the ProUCL User's Guide (USEPA, 2004). The ProUCL model output is included as Appendix D.

5.1 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., 90th or 95th percentile for most intake assumptions) and upper-bound estimates of 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 guidance contains formula that incorporates default values which were selected by DTSC to be health protective (please refer to pages 12-19 herein). This approach inherently assumes both an adult and child receptor will be assessed for each complete exposure route.

6.0 RISK CHARACTERIZATION

Equation 2.3 in DTSC's PEA guidance manual was used to evaluate the potential adverse health impacts due to the ingestion of and dermal contact with those constituents detected in the soil matrix. Equations 2.8 and 2.4 in DTSC's PEA guidance manual were used to evaluate the potential adverse health impacts due to the inhalation of non-VOCs, pursuant to DTSC's PEA guidance (page 2-25; DTSC, 1999).

The DTSC-HERD modified Johnson & Ettinger models for soil gas and groundwater were used to evaluate the potential adverse impacts due to inhalation of VOCs detected in these media.

Lead was assessed using the DTSC LeadSpread 7 Model.

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). This information is provided herein for every chemical to which the receptors may be exposed (pages 12-19, Figure 1, Tables 2-4, Appendices A-D).

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.

6.1 Ingestion and Dermal Contact Pathways

To provide an evaluation of chronic risk along the ingestion and dermal contact pathways the following equations (Equation 2.3) for risk and hazard were used consistent with PEA guidance (page 2-23, DTSC, 1999).

$$Risk_{soil} = ((SF_o \times C_s) \times (1.57\times10^{-6}) + (SF_o \times C_s) \times (1.87\times10^{-5}) \times ABS)$$

$$Hazard_{soil} = ((C_s/RfD_o) \times (1.28\times10^{-5}) + (C_s/RfD_o) \times (1.28\times10^{-4}) \times ABS)$$

Where:
SF_o = oral cancer slope factor $(mg/kg\text{-}day)^{-1}$
C_s = concentration in soil (mg/kg)
RfD_o = oral reference dose (mg/kg-day)
ABS = absorption fraction (dimensionless)

These equations incorporate the following default exposure factors for estimating chronic risk or hazard via the ingestion and dermal contact pathways:

Default Exposure Factors: Risk Assessment

Exposure Duration - 24 years (adults), 6 years (children)
Exposure Frequency (ingestion) - 350 days/year
Exposure Frequency (dermal contact) - 100 days/year (adults) and 350 days/year (children)
Body Weight - 70 kg (adults), 15 kg (children)
Incidental Soil Ingestion Rate - 100 mg/day (adults) and 200 mg/day (children)
Exposed Skin Area - 5,800 cm^2 (adult) and 2,000 cm^2 (children)
Soil to Skin Adherence Factor - 1.00 mg/cm^2
Averaging Time - 70 years

Default Exposure Factors: Hazard Assessment

Exposure Duration - 6 years for children (birth to six years);
Exposure Frequency (ingestion and dermal contact) - 350 days/year,
Incidental Soil Ingestion Rate - 200 mg/day (children)
Body Weight - 15 kg (children)
Exposed Skin Area - 2,000 cm2 (children)
Soil to Skin Adherence Factor - 1.00 mg/cm^2
Averaging Time - 6 years

Chemical specific values for the absorption fractions (ABS) parameter were obtained from Table 2 (page A-6, DTSC, 1999). The values used for the absorption fractions parameters are presented in the *Estimated Risks and Hazards* table.

The default exposure factors provide a conservative estimate (i.e., a very health-protective 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 are provided in the *Estimated Risks and Hazards* table.

6.2 Inhalation Pathway

To provide an evaluation of chronic risk along the inhalation pathway the following equations (Equations 2.8 and 2.4) for estimating risk and hazard due to exposure to metals detected in the soil matrix were used consistent with PEA guidance (pages 2-24 and 2-30, DTSC, 1999).

Equation 2.8

$$C_a = C_s \times (5 \times 10^{-8}\ kg/m^3)$$

Where:

C_a = concentration in air, mg/m^3
C_s = concentration in soil, mg/kg

Equation 2.4:

$$Risk_{air} = SF_i \times C_a \times 0.149$$

$$Hazard_{air} = (C_a/RfD_i) \times 0.639$$

Where:

C_a = concentration in air, mg/m^3
SF_i = inhalation cancer slope factor $(mg/kg\text{-}day)^{-1}$
RfD_i = the inhalation reference dose, mg/kg-day

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, 1999).

For this risk assessment exposure to the metals detected in the soil matrix via the air pathway was performed using the fugitive dust scenario.

6.3 The DTSC HERD-modified Johnson and Ettinger Models

Soil gas screen, version 2.0 (April, 2003) January 21, 2005 Model

The exposure point concentrations (either the maximum detected concentration or the upper confidence level as statistically determined using ProUCL) of the VOCs detected at least one time in the vapor phase underlying the site were assessed by the DTSC-HERD-modified Johnson & Ettinger Model soil gas screen, version 2.0; April, 2003 (January 21, 2005).

All values used for the parameters in the model were default values selected to be representative of the most conservative, i.e., health protective, conditions, except for the exposure duration and exposure frequency parameters which were modified to reflect an industrial land use. The exposure duration was changed from 30 years to 25 years and the exposure frequency was changed from 350 days per year to 250 days per year (5 days per week for 50 weeks per year), both indicative of a commercial setting and consistent with USEPA and Cal-EPA guidance (USEPA, 1989).

Additionally, site specific soil type data was used in the model. Based on data previously collected by Komex, the soil type silty clay was used in the model.

The Johnson & Ettinger Model contains a database of VOCs listed by Chemical Abstract Services (CAS) number. A constituent must be contained within the database in the model in order to assess the potential health impacts of the constituent using the model, or chemical and toxicological information specific to the chemical can be added to the model's database.

The Johnson & Ettinger Model estimates the potential adverse health impacts via inhalation due to the vertical migration of the constituents through the soil column into an onsite building. This estimation of the potential adverse health impacts is overly conservative, as the underlying assumption is that the constituents are entirely diffusing vertically.

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 $\mu g/m^3$; comparable to a SF
EF = exposure frequency; indicative of commercial land use, consistent with USEPA and Cal-EPA guidance = 250 days/year
ED = exposure duration; indicative of commercial land use, consistent with USEPA and Cal-EPA guidance = 25 years
$C_{building}$ = vapor concentration in the building, milligrams per cubic meter (mg/m^3) per $\mu g/kg$ 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; value indicative of commercial land use, consistent with USEPA and Cal-EPA guidance = 250 days/year
ED = exposure duration; value indicative of commercial land use, consistent with USEPA and Cal-EPA guidance = 25 years
$C_{building}$ = vapor concentration in the building, milligrams per cubic meter (mg/m^3) per $\mu g/kg$ soil; calculated by the model
AT_{nc} = averaging time for noncarcinogens; default value = 30

Groundwater screen, version 3.0 (April, 2003) January 21, 2005 Model

The exposure point concentrations (either the maximum detected concentration or the upper confidence level as statistically determined using ProUCL) of the VOCs detected at least one time in the groundwater underlying the site were assessed by the DTSC-HERD-modified

Johnson & Ettinger Model groundwater screen, version 3.0; April, 2003 (January 21, 2005).

All values used for the parameters in the model were default values selected to be representative of the most conservative, i.e., health protective, conditions, except for the exposure duration and exposure frequency parameters which were modified to reflect an industrial land use. The exposure duration was changed from 30 years to 25 years and the exposure frequency was changed from 350 days per year to 250 days per year (5 days per week for 50 weeks per year), both indicative of a commercial setting and consistent with USEPA and Cal-EPA guidance (USEPA, 1989).

Additionally, site specific soil type data was used in the model. Based on data previously collected by Komex, the soil type silty clay was used in the model.

The Johnson & Ettinger Model contains a database of VOCs listed by CAS number. A constituent must be contained within the database in the model in order to assess the potential health impacts of the constituent using the model, or chemical and toxicological information specific to the chemical can be added to the model's database.

The Johnson & Ettinger Model estimates the potential adverse health impacts via inhalation due to the vertical migration of the constituents through the soil column into an onsite building. This estimation of the potential adverse health impacts is overly conservative, as the underlying assumption is that the constituents are entirely diffusing vertically.

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 $\mu g/m^3$; comparable to a SF
EF = exposure frequency; indicative of commercial land use, consistent with USEPA and Cal-EPA guidance = 250 days/year
ED = exposure duration; indicative of commercial land use, consistent with USEPA and Cal-EPA guidance = 25 years
$C_{building}$ = vapor concentration in the building, milligrams per cubic meter (mg/m^3) per $\mu g/kg$ 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; value indicative of commercial land use, consistent

with USEPA and Cal-EPA guidance = 250 days/year
ED = exposure duration; value indicative of commercial land use, consistent with USEPA and Cal-EPA guidance = 25 years
$C_{building}$ = vapor concentration in the building, milligrams per cubic meter (mg/m^3) per $\mu g/kg$ soil; calculated by the model
AT_{nc} = averaging time for noncarcinogens; default value = 30

6.4 DTSC's LeadSpread 7.0 Model

DTSC's LeadSpread 7.0 Model estimates the hazard due to exposure to lead in air, onsite soils/dust, water and homegrown produce for adults and children within the residential exposure scenario. Typically lead concentrations in air, water and home-grown produce are not measured onsite. Therefore the model extrapolates these concentrations from the measured concentrations of lead in onsite soils.

The following information contained within the model are model-derived values that represent the percent contribution for each exposure scenario evaluated when the Student's-t UCL of 11.1 mg/kg is used as the exposure point concentration (Appendix D). The percent contributions of each exposure pathway will change as the exposure point concentrations change, because they are model-derived.

Residential Exposure Scenario

Adults:

Soil Contact - 0%
Soil Ingestion - 1%
Background Inhalation - 4%
Site Inhalation - 0%
Drinking Water Ingestion from an onsite source impacted by concentrations of lead detected in onsite soils - 74%
Background Ingestion of Homegrown Produce - 21%
Ingestion of Homegrown Produce planted in onsite soils impacted by concentrations of lead - 0%

Children:

Soil Contact - 0%
Soil Ingestion - 5%
Background Inhalation - 2%
Site Inhalation - 0%
Drinking Water Ingestion from an onsite source impacted by concentrations of lead detected in onsite soils - 59%
Background Ingestion of Homegrown Produce - 33%
Ingestion of Homegrown Produce planted in onsite soils impacted by concentrations of lead - 0%

Occupational Exposure Scenario

Adults:

Soil Contact - 0%
Soil Ingestion - 1%
Background Inhalation - 3%
Site Inhalation - 0%
Drinking Water Ingestion from an onsite source impacted by concentrations of lead detected in onsite soils - 75%
Background Ingestion of Homegrown Produce - 21%
Ingestion of Homegrown Produce planted in onsite soils impacted by concentrations of lead - 0%

Exposure Parameters

The following information contained within the model are default values for the exposure parameters for both residential and occupational exposure scenarios.

Adults:

Days per Week - 7 (residential); 5 (occupational)
Geometric Standard Deviation - 1.6
Blood Lead Level of Concern - 10 micrograms per deciliter of blood (µg/dl)
Skin Area - 5700 square centimeters (cm^2) (residential); 2900 cm^2 (occupational)
Soil Adherence - 70 micrograms per square centimeter (µg/ cm^2)
Dermal Uptake constant - 0.0001 µg/dl
Soil ingestion - 50 milligrams per day (mg/day)
Ingestion constant - 0.04 µg/dl
Bioavailability - 0.44
Breathing rate - 20 cubic meters per day (m^3/day)
Inhalation constant - 0.08 µg/dl
Water ingestion - 1.4 liters per day (L/day)
Food ingestion - 1.9 kilograms per day (kg/day)
Lead in Store purchased produce - 3.1 micrograms per kilogram (µg/kg)
Lead in Homegrown Produce – 9.9 µg/kg

Children:

Days per Week - 7
Geometric Standard Deviation - 1.6
Blood Lead Level of Concern - 10 µg/dl
Skin Area - 2900 cm^2
Soil Adherence - 200 µg/ cm^2
Dermal Uptake constant - 0.0001 µg/dl
Soil ingestion - 100 mg/day
Ingestion constant - 0.16 µg/dl

Bioavailability - 0.44
Breathing rate - 6.8 m^3/day
Inhalation constant - 0.19 µg/dl
Water ingestion - 0.4 L/day
Food ingestion - 1.1 kg/day
Lead in Store purchased produce - 3.1 µg/kg
Lead in Homegrown Produce - 9.9 µg/kg

Estimation of Hazards

The percentile blood lead concentration is estimated by the model to provide an estimate of the percentage of a population of adults and children that would be expected to have blood lead levels that exceed the threshold value if they lived onsite and were exposed to site soils 7 days per week.

DTSC's LeadSpread 7.0 Model results indicate that lead does not pose an unacceptable hazard to adults or children exposed to the exposure point concentration of lead in site soils, 11.1 mg/kg. These results are provided in the *LeadSpread 7.0 Model Results* tables.

6.5 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 appropriate when the chemicals of concern target different organs within the body (USEPA, 1989; DTSC, 1999). Therefore, as the noncarcinogenic chemicals of concern quantitatively assessed in this risk assessment target different organs within the body the estimated hazard quotients were not summed.

6.6 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}.

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).

6.7 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 the *Estimated Risks and Hazards* table.

6.8 Estimation of Risks and Hazards

Fifteen chemicals of concern were assessed as carcinogens. Seven of these 15 carcinogenic COCs were detected in the soil matrix and were assessed via the ingestion and dermal contact exposure routes. Six metals were assessed via the inhalation exposure route. Four VOCs were detected in soil gas underlying the site and were therefore assessed via the inhalation exposure route. Seven VOCs were detected in groundwater underlying the site and were assessed via the inhalation exposure route.

Thirty-nine chemicals of concern were assessed as non-carcinogens. Thirty of these 39 noncarcinogenic COCs were detected in the soil matrix and were assessed via the ingestion and dermal contact exposure routes. Two metals were assessed via the inhalation route of exposure. Eleven VOCs were detected in the soil gas underlying the site and therefore were assessed via the inhalation route of exposure. Nineteen VOCs were detected in the groundwater underlying the site and therefore were assessed via the inhalation exposure route.

Estimated Risk Oral and Dermal Contact VOCs and non-VOCs – The estimated risk due to exposure to the nine COCs detected in the soil matrix via the oral and dermal contact routes of exposure is 2.54×10^{-4}. This estimated risk value exceeds the target risk of 1×10^{-5} and is attributable to arsenic. However, this risk value is within USEPA's "safe and protective of public health" risk range of 1×10^{-4} to 1×10^{-6} (Federal Register 56(20):3535, 1991). The oral and dermal contact exposure routes assume a child and an adult are onsite consuming soil for 350 days for six and 24 years, respectively. As the site is currently an operating industrial facility, the likelihood of this exposure route is very low.

Estimated Risk Inhalation non-VOCs - The estimated risk due to exposure to the six COCs detected in the soil matrix is 7.64×10^{-6}. This risk value is less than the target risk of 1×10^{-5}.

Estimated Risk Inhalation VOCs Soil gas - The estimated risk due to exposure to the four VOCs detected in soil vapor underlying the site is 1.36×10^{-3}. This estimated risk value exceeds the target risk of 1×10^{-5} and is attributable to vinyl chloride.

Estimated Risk Inhalation VOCs Groundwater - The estimated risk due to exposure to the seven VOCs detected in groundwater underlying the site is 7.65×10^{-6}. This risk value is less than the target risk of 1×10^{-5}.

Hazard Quotients Oral and Dermal Contact - The estimated hazard quotients due to exposure to the 30 COCs detected in the soil matrix are less than 1, the target hazard value, except for thallium. Thallium has a hazard quotient of 1.4. Thallium was detected three times in 69 soil samples. Thallium is not used, handled, stored, nor is it a waste-byproduct of the processes performed onsite. More than likely the estimated hazard quotient of thallium reflects the conservative nature of risk assessments.

Hazard Quotients Inhalation non-VOCs - The estimated hazard quotients due to exposure to the two metals detected in the soil matrix are less than 1, the target hazard value.

Hazard Quotients Inhalation VOCs Soil gas - The estimated hazard quotients due to exposure to the 11 VOCs detected in soil gas underlying the site are less than 1, the target hazard value.

Hazard Quotients Inhalation VOCs Groundwater - The estimated hazard quotients due to exposure to the 19 VOCs detected in groundwater underlying the site are less than 1, the target hazard value.

Summed Risk - The total risk, summed across all exposure pathways for all chemicals of concern, is 1.62×10^{-3}, which exceeds the target risk value of 1×10^{-5} and is attributable to vinyl chloride detected in soil gas.

These estimated risk and hazards values are presented in the *Estimated Risks and Hazards* table.

7.0 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:

1. Data Collection and Evaluation
2. Exposure Assessment
3. Toxicity Assessment
4. Risk Characterization

Key uncertainties associated with these components are described below.

7.1 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.

These types of errors may result in a slight over- or underestimation of risk.

7.2 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.

7.2.1 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 used herein 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.

The DTSC-HERD modified Johnson & Ettinger groundwater screen model did not include isopropyltoluene (cymene). Slope factors or reference doses for bromodichloromethane, isopropyltoluene and tert-butyl alcohol (TBA) were not available from either OEHHA or USEPA references. Therefore these three constituents that were detected at least one time in soil gas, groundwater or the soil matrix were not quantitatively evaluated in the risk assessment. The omission of three constituents from the risk assessment represents an under-estimation of risk, however, the underestimation more than likely is small given the relative universe of the constituents that were quantitatively assessed.

7.3 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.

7.4 Risk Characterization

The reasonable maximum exposure scenario risk characterization represents an over-estimation of risk. Site-specific information regarding soil properties, depth below ground at which the COCs were detected and attenuation factors were 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, whichever value was lower, for the 54 constituents quantitatively assessed in this risk assessment.

7.5 Summary of Risk Assessment Uncertainties

The analysis of the uncertainties associated with this HRA indicates that the estimated risks and hazards derived from the equations in the PEA Manual (DTSC, 1999), from DTSC's LeadSpread Model and from the DTSC-HERD modified soil gas and groundwater screening 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.

8.0 REFERENCES

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TABLES

Carcinogens and Noncarcinogens

CARCINOGENS	NONCARCINOGENS
1,1,2,2-tetrachloroethane	1,1-dichlororethane
1,1-dichloroethane	1,1-dichloroethylene
benzene	1,2,4-trimethylbenzene
chloroform	1,3,5-trimethylbenzene
MTBE	sec-butylbenzene
naphthalene	n-butylbenzene
tetrachloroethylene (PCE)	cis-1,2-dichloroethene
trichloroethylene (TCE)	ethylbenzene
vinyl chloride	isopropylbenzene (cumene)
arsenic	MTBE
beryllium	naphthalene
cadmium	n-propylbenzene
hexavalent chromium	tert-butylbenzene
cobalt	tetrachloroethylene (PCE)
nickel	toluene
	trans-1,2-dichloroethene
	trichloroethylene (TCE)
	vinyl chloride
	o-xylene
	p-xylene
	m-xylene
	antimony and compounds
	arsenic
	barium and compounds
	cadmium
	chromium III
	cobalt
	copper and compounds
	lead
	mercury and compounds
	molybdenum
	selenium
	silver and compounds
	thallium and compounds
	vanadium (fume or dust)
	zinc
	C6-C10
	C10-C18
	C18-C40

Exposure Point Concentrations, Slope Factors (SFs) and Reference Doses (RfDs)

ANALYTE	EPC	SFo	SFi	RfDo	RfDi
nickel	67.13		9.10E-01		
selenium	2.0054			5.00E-03	
silver and compounds	0.7619			5.00E-03	
thallium and compounds	6.5567			6.60E-05	
vanadium (fume or dust)	49.887			1.00E-03	
zinc	67.706			3.00E-01	
C6-C10	221.64			6.00E-02	
C10-C18	190.83			6.00E-01	
C18-C40	539.17			6.00E+00	

Notes:
EPC = Exposure Point Concentration; either the maximum detected concentration of the analyte in the soil matrix or the UCL, whichever value is less. UCL calculated using proUCL version 3.0. Units are expressed in mg/kg
SFo = Slope Factor, oral route of exposure
SFi = Slope factor, inhalation route of exposure
RfDo = Reference Dose, oral route of exposure
RfDi = Reference Dose, inhalation route of exposure
The SFs for 1,1,2,2-tetrachloroethane, 1,1-dichloroethane, 1,1-dichloroethylene, benzene, bromodichloromethane, chloroform, naphthalene, PCE, TCE, vinyl chloride and arsenic, beryllium, cadmium, hexavalent chromium and nickel are from OEHHA
The RfDs for 1,1-dichloroethylene, ethylbenzene, isopropylbenzene, naphthalene, trans-1,2-dichloroethene, toluene, antimony, barium, trivalent chromium, cyanide, mercury, molybdenum, selenium, silver , thallium, zinc and the RfDo for arsenic are from USEPA, IRIS
The RfDs for 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, cis-1,2-dichloroethene and cobalt are from USEPA, PPRTV
The RfD for copper is from USEPA, HEAST
The RfDs for sec-butylbenzene, n-butylbenzene, n-propylbenzene, tert-butylbenzene and vanadium are from USEPA, NCEA
The RfDs for C6-C10, C10-C18 and C18-C40 are from MADEP
A RfD for lead is not listed as lead was assessed usimg the DTSC LeadSpread (7) Model
Blank cell indicates a SF or RfD are not available for the analyte, except for lead (see above)

Estimated Risks and Hazards

ANALYTE	RISKo	RISKi soil matrix	RISKi soil gas	RISKi groundwater	HAZARDo	HAZARDi soil matrix	HAZARDi soil gas	HAZARDi groundwater
1,1,2,2-tetrachloroethane	2.20E-08							
1,1-dichloroethane	6.16E-10		3.00E-07	1.10E-09			8.70E-04	3.30E-06
1,1-dichloroethylene					6.78E-06			
1,2,4-trimethylbenzene					3.47E-04			2.10E-03
1,3,5-trimethylbenzene					1.27E-05			5.80E-04
benzene	8.00E-09			2.80E-08				7.60E-05
sec-butylbenzene					2.46E-04			3.40E-04
bromodichloromethane								
n-butylbenzene					1.68E-05			
cis-1,2-dichloroethene					3.88E-03		7.90E-01	8.70E-05
chloroform	3.00E-09							
cymene (isopropyltoluene)								
ethylbenzene					2.27E-04		6.10E-04	1.60E-05
isopropylbenzene (cumene)					1.36E-04			2.50E-02
MTBE				2.40E-10				7.30E-07
naphthalene				1.10E-07	7.43E-03			2.50E-03
n-propylbenzene					5.37E-04			3.00E-04
tert-butyl alcohol (TBA)								
tert-butylbenzene					8.31E-06			5.90E-05
tetrachloroethylene (PCE)	1.05E-05		5.10E-05	1.10E-08			5.70E-01	1.20E-04
toluene					1.72E-05		2.80E-03	
trans-1,2-dichloroethene					2.78E-04		2.50E-02	7.10E-05
trichloroethylene (TCE)	4.70E-08		7.20E-06	2.30E-09			1.40E-02	4.40E-06
vinyl chloride	2.04E-07		1.30E-03	7.50E-06			3.90E-01	2.30E-03
o-xylene							8.50E-03	1.80E-05
p-xylene							6.70E-03	2.20E-04
m-xylene							6.30E-03	2.00E-04
antimony					2.58E-02			
arsenic	2.42E-04	1.07E-06			6.65E-01			
barium					3.26E-02	3.69E-02		
beryllium		3.90E-08						
cadmium	8.58E-07	1.59E-07						
chromium					3.08E-04			
hexavalent chromium		4.94E-06						

Estimated Risks and Hazards

ANALYTE	RISKo	RISKi soil matrix	RISKi soil gas	RISKi groundwater	HAZARDo	HAZARDi soil matrix	HAZARDi soil gas	HAZARDi groundwater
cobalt		9.75E-07			9.40E-03	7.48E-02		
copper					2.12E-02			
lead								
mercury					3.20E-02			
molybdenum					2.82E-03			
nickel		4.55E-07						
selenium					5.65E-03			
silver					2.15E-03			
thallium					1.40E+00			
vanadium (fume or dust)					7.02E-01			
zinc					3.18E-03			
C6-C10					9.46E-02			
C10-C18					8.14E-03			
C18-C40					2.30E-03			
	2.54E-04	7.64E-06	1.36E-03	7.65E-06				
SUM RISK			**1.62E-03**					

Notes: RISKo = Risk estimated for the ingestion and dermal routes of exposure using Equation 2.3 (DTSC, 1999)

RISKi = For metals, risk was estimated for the inhalation route of exposure using Equations 2.8 and 2.4 (DTSC, 1999)

RISKi and HAZARDi = For VOCs, the inhalation route of exposure was caculated using the DTSC-HERD modified Johnson & Ettinger models for VOCs in soil gas and groundwater

HAZARDo = Hazard estimated for the ingestion and dermal routes of exposure using Equation 2.3 (DTSC, 1999)

HAZARDi = For metals, hazard estimated for the inhalation route of exposure using Equations 2.8 and 2.4 (DTSC, 1999)

ABS = 0.10 for VOCs, 0.15 for naphthalene, 0.03 for Arsenic, 0.10 for Cyanide (free) and 0.01 for all other metals (Table 2, DTSC, 1999)

The exposure point concentration (mg/kg) was either the maximum detected concentration or the UCL, whichever value was less

Those analytes that have RfDs and/or RfCs were evaluated as noncarcinogens, i.e., hazard was estimated.

Those analytes that have SFs were evaluated as carcinogens, i.e., risk was estimated.

Those analytes that have both SFs and RfDs were evaluated as carcinogens and noncarcinogens.

Lead was assessed using DTSC's LeadSpread 7 Model. The Model results indicate that lead does not pose an adverse impact to human health; the 99th percentile estimate of blood lead is less than 10 micrograms/decaliters, the threshold.

Blank cell indicates analyte was not detected in the medium, not assessed due to an incomplete exposure pathway, or either a carcinogen or noncarcinogen, only, not both

LEAD RISK ASSESSMENT SPREADSHEET
CALIFORNIA DEPARTMENT OF TOXIC SUBSTANCES CONTROL

JSER'S GUIDE to version 7

INPUT	
MEDIUM	LEVEL
Lead in Air (ug/m^3)	0.028
Lead in Soil/Dust (ug/g)	11.1
Lead in Water (ug/l)	15
% Home-grown Produce	
ug/m^3)	1.5

OUTPUT							
	Percentile Estimate of Blood Pb (ug/dl)					PRG-99	PRG-95
	50th	90th	95th	98th	99th	(ug/g)	(ug/g)
BLOOD Pb, ADULT	1.1	2.1	2.4	3.0	3.4	2417	3809
BLOOD Pb, CHILD	1.6	3.0	3.5	4.2	4.8	255	435
BLOOD Pb, PICA CHILD	1.7	3.1	3.7	4.4	5.1	128	219
BLOOD Pb, OCCUPATION	1.1	2.0	2.4	2.9	3.3	3475	5464

EXPOSURE PARAMETERS			
	units	adults	children
Days per week	days/wk	7	
Days per week, occupational		5	
Geometric Standard Deviation		1.6	
Blood lead level of concern (ug/dl		10	
Skin area, residential	cm^2	5700	2900
Skin area occupational	cm^2	2900	
Soil adherence	ug/cm^2	70	200
Dermal uptake constant	(ug/dl)/(ug/d	0.0001	
Soil ingestion	mg/day	50	100
Soil ingestion, pica	mg/day		200
ngestion constant	(ug/dl)/(ug/d	0.04	0.16
Bioavailability	unitless	0.44	
Breathing rate	m^3/day	20	6.8
nhalation constant	(ug/dl)/(ug/d	0.08	0.19
Water ingestion	l/day	1.4	0.4
Food ingestion	kg/day	1.9	1.1
Lead in market basket	ug/kg	3.1	
Lead in home-grown produce	ug/kg	5.0	

Click here for REFERENCES

PATHWAYS						
ADULTS	Residential			Occupational		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	3.8E-5	0.00	0%	1.4E-5	0.00	0%
Soil Ingestion	8.8E-4	0.01	1%	6.3E-4	0.01	1%
Inhalation, bkgrnd		0.05	4%		0.03	3%
Inhalation	2.5E-6	0.00	0%	1.8E-6	0.00	0%
Water Ingestion		0.84	74%		0.84	75%
Food Ingestion, bkgrnd		0.23	21%		0.23	21%
Food Ingestion	0.0E+0	0.00	0%			0%

CHILDREN	typical			with pica		
	Pathway contribution			Pathway contribution		
Pathway	PEF	ug/dl	percent	PEF	ug/dl	percent
Soil Contact	5.6E-5	0.00	0%		0.00	0%
Soil Ingestion	7.0E-3	0.08	5%	1.4E-2	0.16	9%
Inhalation	2.0E-6	0.00	0%		0.00	0%
Inhalation, bkgrnd		0.04	2%		0.04	2%
Water Ingestion		0.96	59%		0.96	57%
Food Ingestion, bkgrnd		0.54	33%		0.54	32%
Food Ingestion	0.0E+0	0.00	0%		0.00	0%

FIGURES

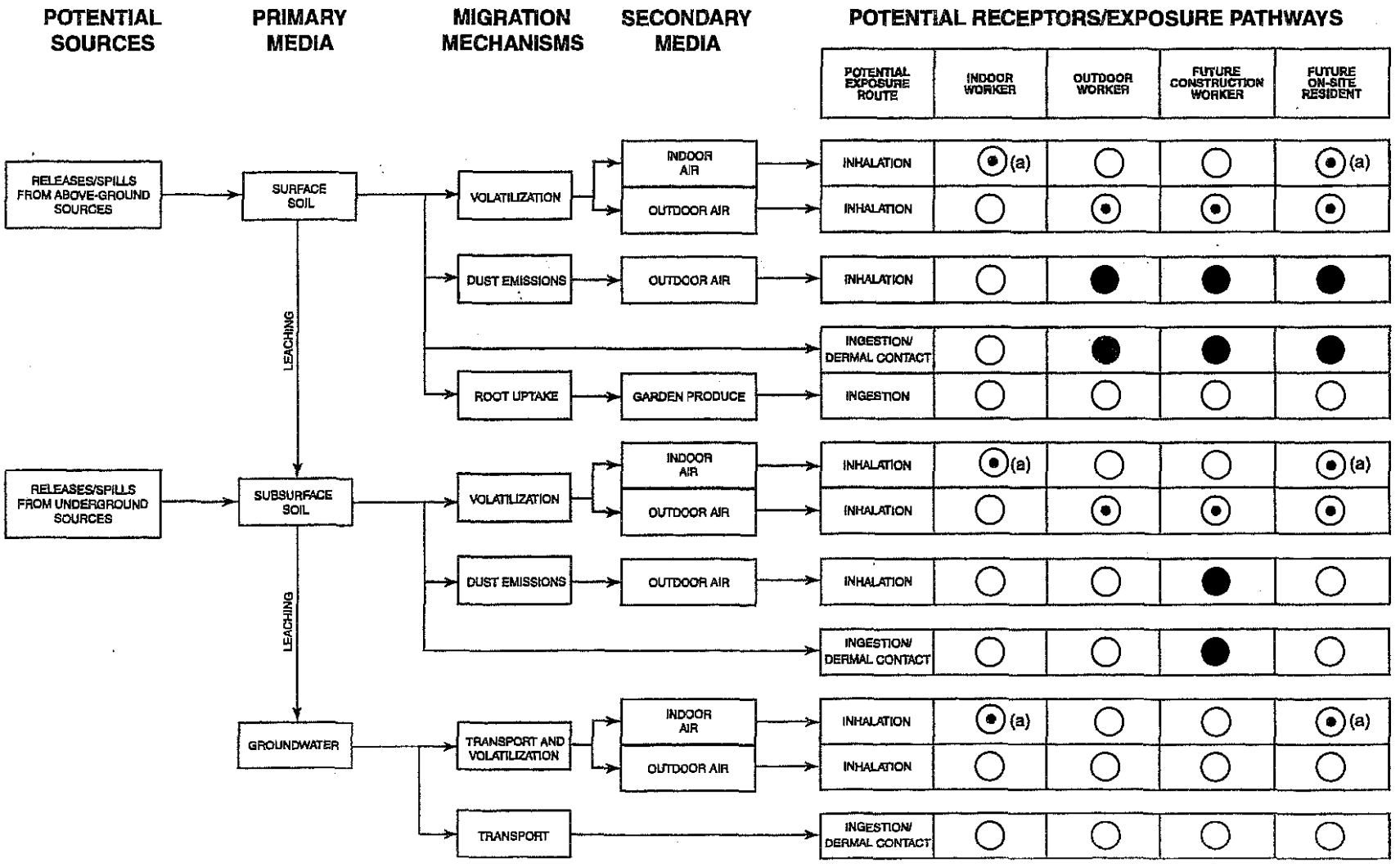

Figure 1
Risk Assessment Conceptual Site Model

APPENDIX A
OEHHA SFs and RfDs

Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

1,1,2,2-tetrachloroethane

OR

CAS Number

79345

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.000058
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.2
Oral Slope Factor (mg/kg-day)$^{-1}$	0.27
USEPA Classification	C: Possible human carcinogen
IARC Classification	3
Comments	"Expedited" cancer potency. . The No Significant Risk Levels based on these potency slopes are cited separately,
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors

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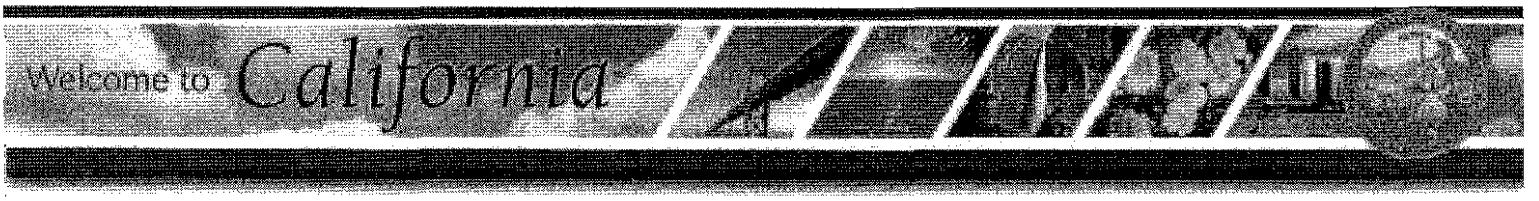

Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

1,1-Dichloroethane

OR

CAS Number

75343

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.0000016
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.0057
Oral Slope Factor (mg/kg-day)$^{-1}$	0.0057
USEPA Classification	C: Possible human carcinogen
IARC Classification	-
Comments	"Expedited" cancer potency. . The No Significant Risk Levels based on these potency slopes are cited separately,
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors OEHHA, 1992

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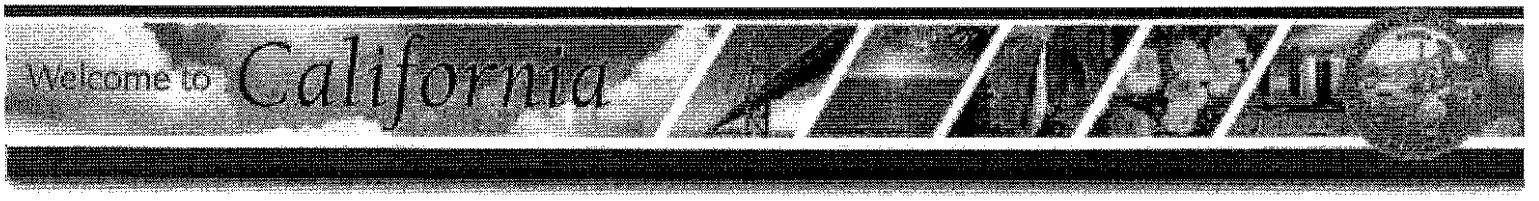

Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Toxicity Criteria Database: Chemicals with PHGs

New Search:

Chemical Name

1,1-Dichloroethylene

OR

CAS Number

75354

New Search

Health Risk Category:	chronic toxicity
California PHG (mg/L):	0.01
Cancer Risk @ PHG:	
California MCL (mg/L):	0.006
Cancer Risk @ MCL:	
Comments:	No cancer risk calculated for noncarcinogens.For noncarcinogens, an exact numerical public health risk cannot be calculated.The PHG for these chemicals is set at a level which is believed to be without significant public health risk to individuals exposed to that chemical over a lifetime.

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Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Benzene

OR

CAS Number

71432

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.000029
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.1
Oral Slope Factor (mg/kg-day)$^{-1}$	0.1
USEPA Classification	A: Human carcinogen
IARC Classification	1
Comments	
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors

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Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Bromodichloromethane

OR

CAS Number

75274

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.000037
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.13
Oral Slope Factor (mg/kg-day)$^{-1}$	0.13
USEPA Classification	B2
IARC Classification	-
Comments	
Reference	US EPA, IRIS; NTP, 1987

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Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Chloroform

OR

CAS Number

67663

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.0000053
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.019
Oral Slope Factor (mg/kg-day)$^{-1}$	0.031
USEPA Classification	B2
IARC Classification	2B: The agent is possibly carcinogenic to humans
Comments	
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors California Department of Health Services (CDHS) 1990. Health Effects of Chloroform. Office of Environmental Health Hazard Assessment, Air Toxicology and Epidemiology Section, Berkeley, CA

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Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Naphthalene

OR

CAS Number

91203

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.000034
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.12
Oral Slope Factor (mg/kg-day)$^{-1}$	
USEPA Classification	
IARC Classification	2B: The agent is possibly carcinogenic to humans
Comments	
Reference	Air Toxic Hot Spots: Adoption of a Unit Risk Value for Naphthalene

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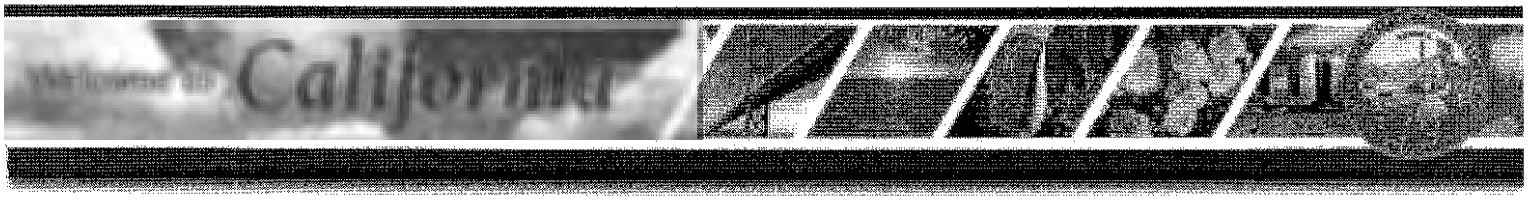

Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Tetrachloroethylene

OR

CAS Number

127184

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.0000059
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.021
Oral Slope Factor (mg/kg-day)$^{-1}$	0.54
USEPA Classification	-
IARC Classification	2B: The agent is possibly carcinogenic to humans
Comments	A change was made on 9/13/02, see history log for an explanation. Number based on calculation from PHG
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors Public Health Goal for Tetrachloroethylene in Drinking Water, Aug. 2001

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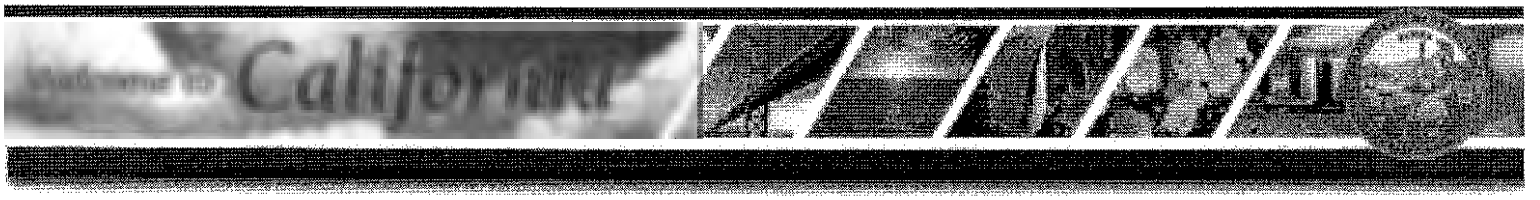

Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Trichloroethylene

OR

CAS Number

79016

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.000002
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.007
Oral Slope Factor (mg/kg-day)$^{-1}$	0.013
USEPA Classification	-
IARC Classification	2A: The agent is probably carcinogenic to humans
Comments	A change was made on 9/24/03, see history log for an explanation.
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors OEHHA, 1999 Public Health Goal for Trichloroethylene in Drinking Water

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Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Vinyl chloride

OR

CAS Number

75014

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.000078
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.27
Oral Slope Factor (mg/kg-day)$^{-1}$	0.27
USEPA Classification	-
IARC Classification	1
Comments	
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors

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Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Toxicity Criteria Database: Chemicals with PHGs

New Search:

Chemical Name
ANTIMONY

OR

CAS Number
7440360

New Search

Health Risk Category: chronic toxicity
California PHG (mg/L): 0.02
Cancer Risk @ PHG:
California MCL (mg/L): 0.006
Cancer Risk @ MCL:
Comments: No cancer risk calculated for noncarcinogens.For noncarcinogens, an exact numerical public health risk cannot be calculated.The PHG for these chemicals is set at a level which is believed to be without significant public health risk to individuals exposed to that chemical over a lifetime.

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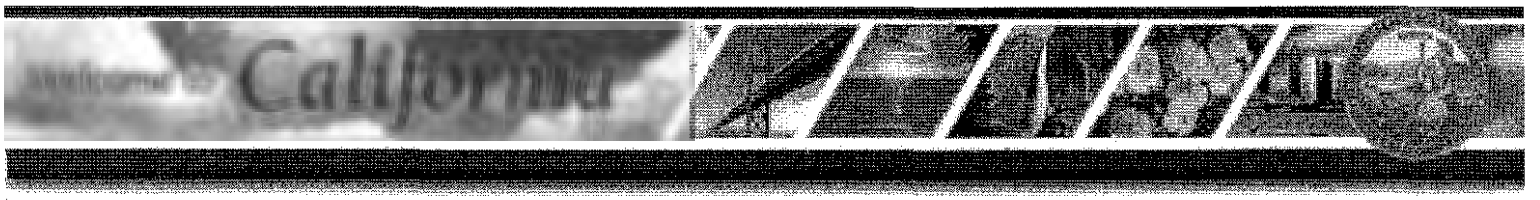

Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Arsenic

OR

CAS Number

7440382

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.0033
Inhalation Slope Factor (mg/kg-day)$^{-1}$	12
Oral Slope Factor (mg/kg-day)$^{-1}$	9.45
USEPA Classification	A: Human carcinogen
IARC Classification	1
Comments	
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors OEHHA, 2004 Public Health Goal for Arsenic in Drinking Water

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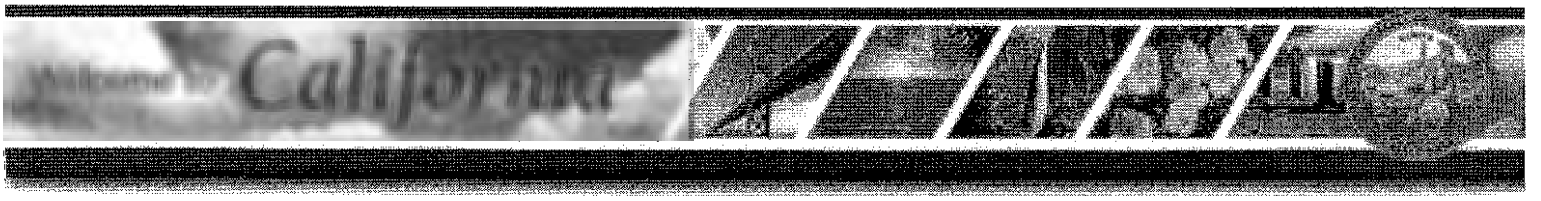

Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Toxicity Criteria Database: Chemicals with PHGs

New Search:

Chemical Name

Barium

OR

CAS Number

7440393

New Search

Health Risk Category:	noncarcinogen (hypertension)
California PHG (mg/L):	2
Cancer Risk @ PHG:	
California MCL (mg/L):	1
Cancer Risk @ MCL:	
Comments:	No cancer risk calculated for noncarcinogens.For noncarcinogens, an exact numerical public health risk cannot be calculated.The PHG for these chemicals is set at a level which is believed to be without significant public health risk to individuals exposed to that chemical over a lifetime.

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Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Beryllium

OR

CAS Number

7440417

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.0024
Inhalation Slope Factor (mg/kg-day)$^{-1}$	8.4
Oral Slope Factor (mg/kg-day)$^{-1}$	
USEPA Classification	
IARC Classification	
Comments	
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors

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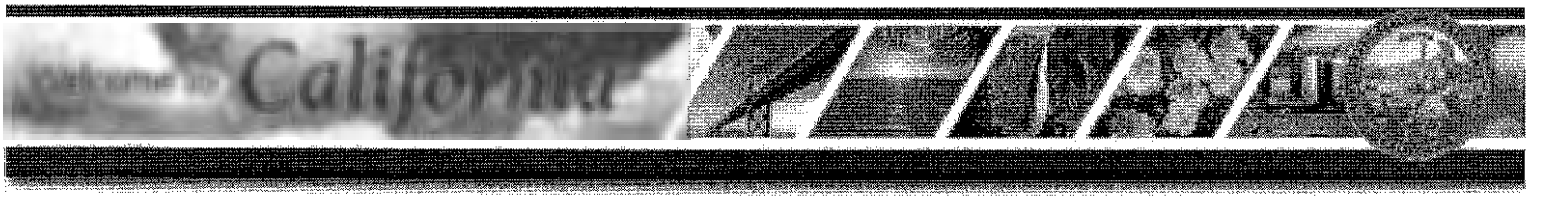

Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Cadmium

OR

CAS Number

7440439

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.0042
Inhalation Slope Factor (mg/kg-day)$^{-1}$	15
Oral Slope Factor (mg/kg-day)$^{-1}$	0.38
USEPA Classification	B1
IARC Classification	2A: The agent is probably carcinogenic to humans
Comments	
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors OEHHA, 1999 Public Health Goal for Cadmium in Drinking Water

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Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Chromium, hexavalent (Chromium VI)

OR

CAS Number

18540299

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.15
Inhalation Slope Factor (mg/kg-day)$^{-1}$	510
Oral Slope Factor (mg/kg-day)$^{-1}$	
USEPA Classification	A: Human carcinogen
IARC Classification	1
Comments	A change was made on 12/19/01, see history log for an explanation.
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors

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Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Toxicity Criteria Database: Chemicals with PHGs

New Search:

Chemical Name

Copper

OR

CAS Number

7440508

New Search

Health Risk Category:	acute toxicity
California PHG (mg/L):	0.17
Cancer Risk @ PHG:	0
California MCL (mg/L):	1.3
Cancer Risk @ MCL:	
Comments:	CA MCL = Action Level. No cancer risk calculated for noncarcinogens.For noncarcinogens, an exact numerical public health risk cannot be calculated.The PHG for these chemicals is set at a level which is believed to be without significant public health risk to individuals exposed to that chemical over a lifetime.

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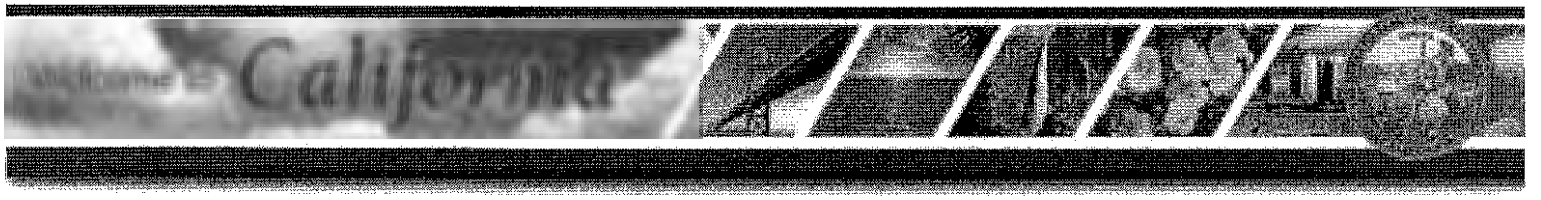

Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Toxicity Criteria Database: Chemicals with PHGs

New Search:

Chemical Name

Cyanide

OR

CAS Number

57125

New Search

Health Risk Category:	chronic toxicity
California PHG (mg/L):	0.15
Cancer Risk @ PHG:	
California MCL (mg/L):	0.2
Cancer Risk @ MCL:	
Comments:	CA MCL to be reviewed for possible revision. No cancer risk calculated for noncarcinogens.For noncarcinogens, an exact numerical public health risk cannot be calculated.The PHG for these chemicals is set at a level which is believed to be without significant public health risk to individuals exposed to that chemical over a lifetime.

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Chronic Reference Exposure Levels (RELs)

Toxicity Criteria Database: Chronic RELs

New Search:

Chemical Name

Mercury (inorganic)

OR

CAS Number

7439976

New Search

Chronic Inhalation REL (µg/m3): 0.09
Listed in CAPCOA: Yes
US EPA RfC: Yes
Target Organ(s): nervous system
Human data: Yes

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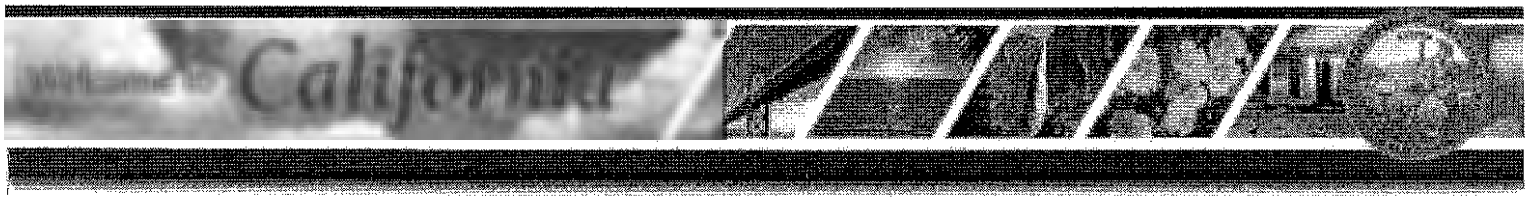

Cancer Potency Information

Toxicity Criteria Database: Cancer Potency

New Search:

Chemical Name

Nickel and Nickel compounds

OR

CAS Number

7440020

New Search

Inhalation Unit Risk (µg/cubic meter)$^{-1}$	0.00026
Inhalation Slope Factor (mg/kg-day)$^{-1}$	0.91
Oral Slope Factor (mg/kg-day)$^{-1}$	
USEPA Classification	A: Human carcinogen
IARC Classification	1
Comments	
Reference	OEHHA, 2002 Technical Support Document for Describing Available Cancer Potency Factors

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Health Risk Categories and Cancer Risk Values for Chemicals without California Public Health Goals (PHGs)

Toxicity Criteria Database: Chemicals without PHGs

New Search:

Chemical Name

Selenium

OR

CAS Number

7782492

New Search

Health Risk Category	chronic toxicity (hair and nail changes, skin lesions, nervous system effects; human data)
U.S. EPA MCLG (mg/L)	0.05
California MCL (mg/L)	0.05
Cancer Risk @ MCL	

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Health Risk Categories and Cancer Risk Values for Chemicals with California Public Health Goals (PHGs)

Toxicity Criteria Database: Chemicals with PHGs

New Search:

Chemical Name

Thallium

OR

CAS Number

7440280

New Search

Health Risk Category:	chronic toxicity
California PHG (mg/L):	0.0001
Cancer Risk @ PHG:	
California MCL (mg/L):	0.002
Cancer Risk @ MCL:	
Comments:	No cancer risk calculated for noncarcinogens.For noncarcinogens, an exact numerical public health risk cannot be calculated.The PHG for these chemicals is set at a level which is believed to be without significant public health risk to individuals exposed to that chemical over a lifetime.

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APPENDIX B
DTSC-HERD modified
JOHNSON & ETTINGER MODEL
SOIL GAS SCREEN

DATA ENTRY SHEET

SG-SCREEN
PA Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	Soil Gas Concentration Data: ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
75343	9.25E+02			1,1-Dichloroethane

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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	1.6E-06	5.0E-01	98.96

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	9.25E+02	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	7,294	5.38E-03	2.21E-01	1.80E-04	5.79E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	9.25E+02	1.25	8.33E+01	5.79E-03	5.00E+03	3.20E+12	8.26E-04	7.64E-01

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.6E-06	5.0E-01

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
3.0E-07	8.7E-04

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

SG-SCREEN
A Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	Soil Gas Concentration Data: ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
156592	5.87E+04			cis-1,2-Dichloroethylene

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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	0.0E+00	3.5E-02	96.94

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	5.87E+04	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	7,592	3.90E-03	1.60E-01	1.80E-04	5.74E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coetticient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	5.87E+04	1.25	8.33E+01	5.74E-03	5.00E+03	4.04E+12	8.21E-04	4.82E+01

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	7.9E-01

MESSAGE SUMMARY BELOW:

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

END

DATA ENTRY SHEET

SG-SCREEN
A Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

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	1.28E+03			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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	0.0E+00	1.0E+00	106.17

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	1.28E+03	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	9,994	7.43E-03	3.05E-01	1.80E-04	5.85E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.28E+03	1.25	8.33E+01	5.85E-03	5.00E+03	2.36E+12	8.32E-04	1.06E+00

Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E+00

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	6.1E-04

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

SG-SCREEN
PA Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

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
127184	4.36E+04			Tetrachloroethylene

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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	5.9E-06	3.5E-02	165.83

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	4.36E+04	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	9,410	1.74E-02	7.14E-01	1.80E-04	5.62E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor affenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	4.36E+04	1.25	8.33E+01	5.62E-03	5.00E+03	7.73E+12	8.09E-04	3.53E+01

Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
5.9E-06	3.5E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
5.1E-05	5.7E-01

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

SG-SCREEN
PA Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

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	1.59E+03			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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
8.70E-02	8.60E-06	6.62E-03	25	7,930	383.78	591.79	0.0E+00	3.0E-01	92.14

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	1.59E+03	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	9,001	6.29E-03	2.58E-01	1.80E-04	6.79E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.59E+03	1.25	8.33E+01	6.79E-03	5.00E+03	4.63E+10	9.15E-04	1.45E+00

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	3.0E-01

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.8E-03

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

SG-SCREEN
?A Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

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
156605	3.78E+03			trans-1,2-Dichloroethylene

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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.07E-02	1.19E-05	9.36E-03	25	6,717	320.85	516.50	0.0E+00	7.0E-02	96.94

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	3.78E+03	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	6,986	8.99E-03	3.69E-01	1.80E-04	5.51E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	3.78E+03	1.25	8.33E+01	5.51E-03	5.00E+03	1.33E+13	7.99E-04	3.03E+00

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	7.0E-02

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.5E-02

MESSAGE SUMMARY BELOW:

MESSAGE: Risk/HQ or risk-based soil concentration is based on a route-to-route extrapolation.

END

DATA ENTRY SHEET

SG-SCREEN
A Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	Soil Gas Concentration Data: ENTER Soil gas conc., C_g ($\mu g/m^3$)	OR	ENTER Soil gas conc., C_g (ppmv)	Chemical
79016	1.72E+04			Trichloroethylene

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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	2.0E-06	6.0E-01	131.39

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	1.72E+04	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	8,382	9.80E-03	4.02E-01	1.80E-04	6.16E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.72E+04	1.25	8.33E+01	6.16E-03	5.00E+03	5.57E+11	8.60E-04	1.48E+01

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
2.0E-06	6.0E-01

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
7.2E-06	1.4E-02

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

SG-SCREEN
A Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

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
75014	6.58E+04			Vinyl chloride (chloroethene)

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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	7.8E-05	1.0E-01	62.50

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	6.58E+04	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	4,840	2.62E-02	1.07E+00	1.80E-04	8.27E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	6.58E+04	1.25	8.33E+01	8.27E-03	5.00E+03	5.68E+08	1.03E-03	6.78E+01

Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.8E-05	1.0E-01

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.3E-03	3.9E-01

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

SG-SCREEN
PA Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

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
106423	1.40E+03			p-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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	0.0E+00	1.0E-01	106.17

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	1.40E+03	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	10,083	7.22E-03	2.96E-01	1.80E-04	6.00E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.40E+03	1.25	8.33E+01	6.00E-03	5.00E+03	1.17E+12	8.45E-04	1.18E+00

Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	6.7E-03

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

SG-SCREEN
?A Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

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
108383	1.40E+03			m-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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, ΔH_{vb} (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
7.00E-02	7.80E-06	7.32E-03	25	8,523	412.27	617.05	0.0E+00	1.0E-01	106.17

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	1.40E+03	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	10,090	6.91E-03	2.84E-01	1.80E-04	5.46E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.40E+03	1.25	8.33E+01	5.46E-03	5.00E+03	1.80E+13	7.94E-04	1.11E+00

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	6.3E-03

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

SG-SCREEN
PA Version 2.0; 04/

Reset to Defaults

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

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	1.63E+03			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	152.4	24	SIC		

MORE ↓

ENTER Vandose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	1.5	0.43	0.15	5

MORE ↓

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)
70	30	25	250

END

CHEMICAL PROPERTIES SHEET

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)	Molecular weight, MW (g/mol)
8.70E-02	1.00E-05	5.18E-03	25	8,661	417.60	630.30	0.0E+00	1.0E-01	106.17

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Soil gas conc. ($\mu g/m^3$)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
137.4	0.280	0.122	1.52E-09	0.937	1.42E-09	4,000	1.63E+03	3.39E+04

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	5.00E-03	15	10,245	4.88E-03	2.00E-01	1.80E-04	6.79E-03	137.4

Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	1.63E+03	1.25	8.33E+01	6.79E-03	5.00E+03	4.63E+10	9.15E-04	1.49E+00

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	1.0E-01

END

RESULTS SHEET

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	8.5E-03

MESSAGE SUMMARY BELOW:

END

APPENDIX C
DTSC-HERD modified
JOHNSON & ETTINGER MODEL
Groundwater Screen

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	2.50E+00	1,1-Dichloroethane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Avaraging 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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	3.16E+01	5.06E+03	1.6E-06	5.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	7,294	5.38E-03	2.21E-01	1.80E-04	5.79E-03	3.53E-05	1.99E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	5.51E+02	1.25	8.33E+01	5.79E-03	5.00E+03	3.20E+12	5.26E-06	2.90E-03	1.6E-06	5.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	5.06E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.1E-09	3.3E-06

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
95636	2.30E+01	1,2,4-Trimethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	5

MORE ↓

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)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
6.06E-02	7.92E-06	6.14E-03	25	9,369	442.30	649.17	1.35E+03	5.70E+01	0.0E+00	6.0E-03

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	11,516	5.76E-03	2.36E-01	1.80E-04	4.73E-03	2.75E-05	1.55E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	5.43E+03	1.25	8.33E+01	4.73E-03	5.00E+03	2.05E+15	4.11E-06	2.23E-02	NA	6.0E-03

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	5.70E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.1E-03

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108678	6.30E+00	1,3,5-Trimethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
6.02E-02	8.67E-06	5.87E-03	25	9,321	437.89	637.25	1.35E+03	2.00E+00	0.0E+00	6.0E-03

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	11,495	5.50E-03	2.25E-01	1.80E-04	4.70E-03	2.86E-05	1.61E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	1.42E+03	1.25	8.33E+01	4.70E-03	5.00E+03	2.59E+15	4.26E-06	6.05E-03	NA	6.0E-03

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	2.00E+03	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	5.8E-04

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
135988	7.30E+01	sec-Butylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
5.70E-02	8.12E-06	1.39E-02	25	88,730	446.50	679.00	9.66E+02	3.94E+00	0.0E+00	1.4E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	106,642	7.56E-03	3.10E-01	1.80E-04	4.45E-03	2.46E-05	1.39E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor affenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URf ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
1112.76	15	2.26E+04	1.25	8.33E+01	4.45E-03	5.00E+03	1.90E+16	3.67E-06	8.30E-02	NA	1.4E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	3.94E+03	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	3.4E-04

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
71432	3.14E+00	Benzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.80E-02	9.80E-06	5.54E-03	25	7,342	353.24	562.16	5.89E+01	1.79E+03	2.9E-05	3.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	7,977	5.29E-03	2.17E-01	1.80E-04	6.86E-03	3.91E-05	2.20E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	6.81E+02	1.25	8.33E+01	6.86E-03	5.00E+03	3.50E+10	5.83E-06	3.97E-03	2.9E-05	3.0E-02

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	1.79E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.8E-08	7.6E-05

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
156592	5.50E+00	cis-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.36E-02	1.13E-05	4.07E-03	25	7,192	333.65	544.00	3.55E+01	3.50E+03	0.0E+00	3.5E-02

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	7,592	3.90E-03	1.60E-01	1.80E-04	5.74E-03	4.09E-05	2.29E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	8.79E+02	1.25	8.33E+01	5.74E-03	5.00E+03	4.04E+12	6.05E-06	5.32E-03	NA	3.5E-02

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	3.50E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	8.7E-05

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
100414	2.10E+01	Ethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250
Used to calculate risk-based groundwater concentration.					

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.50E-02	7.80E-06	7.86E-03	25	8,501	409.34	617.20	3.63E+02	1.69E+02	0.0E+00	1.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	9,994	7.43E-03	3.05E-01	1.80E-04	5.85E-03	3.02E-05	1.70E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	6.40E+03	1.25	8.33E+01	5.85E-03	5.00E+03	2.36E+12	4.51E-06	2.88E-02	NA	1.0E+00

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	1.69E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.6E-05

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
98828	1.29E+02	Cumene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
6.50E-02	7.10E-06	1.16E+00	25	10,335	425.56	631.10	4.89E+02	6.13E+01	0.0E+00	4.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	12,447	1.08E+00	4.42E+01	1.80E-04	5.07E-03	2.07E-05	1.17E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	5.72E+06	1.25	8.33E+01	5.07E-03	5.00E+03	1.89E+14	3.11E-06	1.78E+01	NA	4.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	6.13E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.5E-02

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
1634044	8.00E+00	MTBE

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	5

MORE ↓

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)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.02E-01	1.05E-05	6.23E-04	25	6,678	328.30	497.10	7.26E+00	5.10E+04	2.6E-07	3.0E+00

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	7,113	5.99E-04	2.46E-02	1.80E-04	7.99E-03	1.38E-04	7.39E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	1.96E+02	1.25	8.33E+01	7.99E-03	5.00E+03	1.14E+09	1.95E-05	3.82E-03	2.6E-07	3.0E+00

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	5.10E+07	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.4E-10	7.3E-07

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
91203	4.41E+01	Naphthalene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
5.90E-02	7.50E-06	4.82E-04	25	10,373	491.14	748.40	2.00E+03	3.10E+01	3.4E-05	3.0E-03

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	12,768	4.48E-04	1.84E-02	1.80E-04	4.61E-03	1.20E-04	6.16E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	8.10E+02	1.25	8.33E+01	4.61E-03	5.00E+03	5.18E+15	1.62E-05	1.32E-02	3.4E-05	3.0E-03

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	3.10E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.1E-07	2.5E-03

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
95476	2.60E+00	o-Xylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 (cm²)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm³)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm³/cm³)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
8.70E-02	1.00E-05	5.18E-03	25	8,661	417.60	630.30	3.63E+02	1.78E+02	0.0E+00	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	10,245	4.88E-03	2.00E-01	1.80E-04	6.79E-03	4.00E-05	2.25E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	5.21E+02	1.25	8.33E+01	6.79E-03	5.00E+03	4.63E+10	5.95E-06	3.10E-03	NA	1.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	1.78E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	1.8E-05

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
103651	5.00E+01	n-Propylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
6.01E-02	7.83E-06	1.07E-02	25	9,123	432.20	630.00	5.62E+02	6.00E+01	0.0E+00	1.4E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	11,186	1.00E-02	4.10E-01	1.80E-04	4.69E-03	2.38E-05	1.34E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	2.05E+04	1.25	8.33E+01	4.69E-03	5.00E+03	2.75E+15	3.56E-06	7.30E-02	NA	1.4E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	6.00E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	3.0E-04

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
98066	9.40E+00	tert-Butylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	OR		SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
5.65E-02	8.02E-06	1.19E-02	25	8,980	442.10	1220.00	7.71E+02	2.95E+01	0.0E+00	1.4E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	9,452	1.13E-02	4.62E-01	1.80E-04	4.41E-03	2.22E-05	1.26E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	4.34E+03	1.25	8.33E+01	4.41E-03	5.00E+03	2.65E+16	3.33E-06	1.44E-02	NA	1.4E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	2.95E+04	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	5.9E-05

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
127184	2.70E+00	Tetrachloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	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)
SIC	OR		SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.20E-02	8.20E-06	1.84E-02	25	8,288	394.40	620.20	1.55E+02	2.00E+02	5.9E-06	3.5E-02

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^v (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_v (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	9,410	1.74E-02	7.14E-01	1.80E-04	5.62E-03	2.57E-05	1.46E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	1.93E+03	1.25	8.33E+01	5.62E-03	5.00E+03	7.73E+12	3.85E-06	7.42E-03	5.9E-06	3.5E-02

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	2.00E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
1.1E-08	1.2E-04

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
156605	5.20E+00	trans-1,2-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.07E-02	1.19E-05	9.36E-03	25	6,717	320.85	516.50	5.25E+01	6.30E+03	0.0E+00	7.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	6,986	8.99E-03	3.69E-01	1.80E-04	5.51E-03	3.04E-05	1.72E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenualion coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	1.92E+03	1.25	8.33E+01	5.51E-03	5.00E+03	1.33E+13	4.54E-06	8.71E-03	NA	7.0E-02

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	6.30E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	7.1E-05

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
79016	2.50E+00	Trichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($(\mu g/m^3)^{-1}$)	Reference conc., RfC (mg/m^3)
7.90E-02	9.10E-06	1.03E-02	25	7,505	360.36	544.20	1.66E+02	1.47E+03	2.0E-06	6.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	8,382	9.80E-03	4.02E-01	1.80E-04	6.16E-03	3.07E-05	1.73E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	1.00E+03	1.25	8.33E+01	6.16E-03	5.00E+03	5.57E+11	4.59E-06	4.61E-03	2.0E-06	6.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	1.47E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
2.3E-09	4.4E-06

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75014	6.71E+01	Vinyl chloride (chloroethene)

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundweter concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1.06E-01	1.23E-05	2.69E-02	25	5,250	259.25	432.00	1.86E+01	8.80E+03	7.8E-05	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	4,840	2.62E-02	1.07E+00	1.80E-04	8.27E-03	3.65E-05	2.07E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	7.21E+04	1.25	8.33E+01	8.27E-03	5.00E+03	5.68E+08	5.47E-06	3.95E-01	7.8E-05	1.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	8.80E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
7.5E-06	2.3E-03

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
106423	2.80E+01	p-Xylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.69E-02	8.44E-06	7.64E-03	25	8,525	411.52	616.20	3.89E+02	1.85E+02	0.0E+00	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	10,083	7.22E-03	2.96E-01	1.80E-04	6.00E-03	3.15E-05	1.78E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	8.29E+03	1.25	8.33E+01	6.00E-03	5.00E+03	1.17E+12	4.70E-06	3.90E-02	NA	1.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	1.85E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.2E-04

MESSAGE SUMMARY BELOW:

END

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

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]

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 1/21/05)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
108383	2.80E+01	m-Xylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (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	1127.76	SIC	24	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 Parameters)	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)
SIC			SIC	1.5	0.43	0.15

MORE ↓

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)
1.0E-06	1	70	30	25	250

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H (atm-m^3/mol)	Henry's law constant reference temperature, T_R (°C)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (°K)	Critical temperature, T_C (°K)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF ($\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.00E-02	7.80E-06	7.32E-03	25	8,523	412.27	617.05	4.07E+02	1.61E+02	0.0E+00	1.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
1112.76	0.280	0.122	1.52E-09	0.937	1.42E-09	192.31	0.481	0.057	0.424	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	10,090	6.91E-03	2.84E-01	1.80E-04	5.46E-03	2.90E-05	1.64E-04

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
1112.76	15	7.94E+03	1.25	8.33E+01	5.46E-03	5.00E+03	1.80E+13	4.34E-06	3.44E-02	NA	1.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (µg/L)	Indoor exposure groundwater conc., noncarcinogen (µg/L)	Risk-based indoor exposure groundwater conc., (µg/L)	Pure component water solubility, S (µg/L)	Final indoor exposure groundwater conc., (µg/L)
NA	NA	NA	1.61E+05	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	2.0E-04

MESSAGE SUMMARY BELOW:

END

APPENDIX D
ProUCL Statistics

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Antimony			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.354973
Number of Unique Samples	7	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	0.445	Data not normal at 5% significance level	
Maximum mg/kg	1		
Mean	0.686377	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	0.732823
Standard Deviation	0.231359		
Variance	0.053527	Gamma Distribution Test	
Coefficient of Variation	0.337073	A-D Test Statistic	8.653075
Skewness	0.437472	A-D 5% Critical Value	0.751155
		K-S Test Statistic	0.356059
Gamma Statistics		K-S 5% Critical Value	0.107233
k hat	9.369775	Data do not follow gamma distribution	
k star (bias corrected)	8.972055	at 5% significance level	
Theta hat	0.073254		
Theta star	0.076502	95% UCLs (Assuming Gamma Distribution)	
nu hat	1293.029	Approximate Gamma UCL	0.734243
nu star	1238.144	Adjusted Gamma UCL	0.735292
Approx.Chi Square Value (.05)	1157.428		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	1155.777	Lilliefors Test Statisitic	0.353155
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.809681		
Maximum of log data	0	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.43064	95% H-UCL	0.735919
Standard Deviation of log data	0.328428	95% Chebyshev (MVUE) UCL	0.806475
Variance of log data	0.107865	97.5% Chebyshev (MVUE) UCL	0.858798
		99% Chebyshev (MVUE) UCL	0.961576
		95% Non-parametric UCLs	
		CLT UCL	0.73219
		Adj-CLT UCL (Adjusted for skewness)	0.733757
		Mod-t UCL (Adjusted for skewness)	0.733067
		Jackknife UCL	0.732823
		Standard Bootstrap UCL	0.732574
		Bootstrap-t UCL	0.734743
RECOMMENDATION		Hall's Bootstrap UCL	0.73299
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	0.732101
		BCA Bootstrap UCL	0.737101
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	0.807783
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	0.860315
		99% Chebyshev (Mean, Sd) UCL	0.963505

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Arsenic			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.193203
Number of Unique Samples	39	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	2.5	Data not normal at 5% significance level	
Maximum mg/kg	35		
Mean	8.410145	95% UCL (Assuming Normal Distribution)	
Median	7	Student's-t UCL	9.779962
Standard Deviation	6.823427		
Variance	46.55916	Gamma Distribution Test	
Coefficient of Variation	0.811333	A-D Test Statistic	1.902763
Skewness	2.062922	A-D 5% Critical Value	0.763201
		K-S Test Statistic	0.171728
Gamma Statistics		K-S 5% Critical Value	0.108598
k hat	2.023672	Data do not follow gamma distribution	
k star (bias corrected)	1.945348	at 5% significance level	
Theta hat	4.155883		
Theta star	4.323207	95% UCLs (Assuming Gamma Distribution)	
nu hat	279.2668	Approximate Gamma UCL	9.752482
nu star	268.4581	Adjusted Gamma UCL	9.783235
Approx.Chi Square Value (.05)	231.5074		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	230.7796	Lilliefors Test Statisitic	0.191429
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.916291		
Maximum of log data	3.555348	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.862464	95% H-UCL	10.08103
Standard Deviation of log data	0.733143	95% Chebyshev (MVUE) UCL	11.96039
Variance of log data	0.537499	97.5% Chebyshev (MVUE) UCL	13.50789
		99% Chebyshev (MVUE) UCL	16.54766
		95% Non-parametric UCLs	
		CLT UCL	9.7613
		Adj-CLT UCL (Adjusted for skewness)	9.97928
		Mod-t UCL (Adjusted for skewness)	9.813963
		Jackknife UCL	9.779962
		Standard Bootstrap UCL	9.724815
		Bootstrap-t UCL	10.06267
RECOMMENDATION		Hall's Bootstrap UCL	10.04759
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	9.844928
		BCA Bootstrap UCL	10.03913
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	11.99074
		97.5% Chebyshev (Mean, Sd) UCL	13.54006
		99% Chebyshev (Mean, Sd) UCL	16.58341

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Barium			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.155553
Number of Unique Samples	21	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	42	Data not normal at 5% significance level	
Maximum mg/kg	230		
Mean	153.8696	95% UCL (Assuming Normal Distribution)	
Median	160	Student's-t UCL	161.8408
Standard Deviation	39.70661		
Variance	1576.615	Gamma Distribution Test	
Coefficient of Variation	0.258054	A-D Test Statistic	2.840929
Skewness	-0.818054	A-D 5% Critical Value	0.750511
		K-S Test Statistic	0.186584
Gamma Statistics		K-S 5% Critical Value	0.10716
k hat	11.3876	Data do not follow gamma distribution	
k star (bias corrected)	10.90215	at 5% significance level	
Theta hat	13.51202		
Theta star	14.11369	95% UCLs (Assuming Gamma Distribution)	
nu hat	1571.489	Approximate Gamma UCL	163.5551
nu star	1504.497	Adjusted Gamma UCL	163.7666
Approx.Chi Square Value (.05)	1415.402		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	1413.575	Lilliefors Test Statisitic	0.204216
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	3.73767		
Maximum of log data	5.438079	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	4.991556	95% H-UCL	166.7362
Standard Deviation of log data	0.329946	95% Chebyshev (MVUE) UCL	182.7884
Variance of log data	0.108864	97.5% Chebyshev (MVUE) UCL	194.6961
		99% Chebyshev (MVUE) UCL	218.0865
		95% Non-parametric UCLs	
		CLT UCL	161.7322
		Adj-CLT UCL (Adjusted for skewness)	161.2291
		Mod-t UCL (Adjusted for skewness)	161.7623
		Jackknife UCL	161.8408
		Standard Bootstrap UCL	161.6368
		Bootstrap-t UCL	161.3529
RECOMMENDATION		Hall's Bootstrap UCL	161.6283
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	161.5362
		BCA Bootstrap UCL	160.6522
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	174.7056
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	183.7214
		99% Chebyshev (Mean, Sd) UCL	201.4311

Data File	C:\Documents and Settings\Administrator\De		Variable:	Metals in Soil Samples <= 1 -10 ft	
Beryllium					
Raw Statistics				Normal Distribution Test	
Number of Valid Samples			69	Lilliefors Test Statisitic	0.496579
Number of Unique Samples			11	Lilliefors 5% Critical Value	0.106662
Minimum	mg/kg		0.375	Data not normal at 5% significance level	
Maximum	mg/kg		1.8		
Mean			0.561232	95% UCL (Assuming Normal Distribution)	
Median			0.5	Student's-t UCL	0.619504
Standard Deviation			0.29027		
Variance			0.084257	Gamma Distribution Test	
Coefficient of Variation			0.517202	A-D Test Statistic	14.93326
Skewness			3.244939	A-D 5% Critical Value	0.752723
				K-S Test Statistic	0.482023
Gamma Statistics				K-S 5% Critical Value	0.107383
k hat			7.047646	Data do not follow gamma distribution	
k star (bias corrected)			6.750888	at 5% significance level	
Theta hat			0.079634		
Theta star			0.083135	95% UCLs (Assuming Gamma Distribution)	
nu hat			972.5751	Approximate Gamma UCL	0.606729
nu star			931.6226	Adjusted Gamma UCL	0.607732
Approx.Chi Square Value (.05)			861.7624		
Adjusted Level of Significance			0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value			860.3407	Lilliefors Test Statisitic	0.464481
				Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics				Data not lognormal at 5% significance level	
Minimum of log data			-0.980829		
Maximum of log data			0.587787	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data			-0.650241	95% H-UCL	0.591961
Standard Deviation of log data			0.331845	95% Chebyshev (MVUE) UCL	0.649246
Variance of log data			0.110121	97.5% Chebyshev (MVUE) UCL	0.691757
				99% Chebyshev (MVUE) UCL	0.775262
				95% Non-parametric UCLs	
				CLT UCL	0.61871
				Adj-CLT UCL (Adjusted for skewness)	0.633297
				Mod-t UCL (Adjusted for skewness)	0.621779
				Jackknife UCL	0.619504
				Standard Bootstrap UCL	0.618577
				Bootstrap-t UCL	0.642333
RECOMMENDATION				Hall's Bootstrap UCL	0.620674
Data are Non-parametric (0.05)				Percentile Bootstrap UCL	0.621667
				BCA Bootstrap UCL	0.636594
Use Student's-t UCL				95% Chebyshev (Mean, Sd) UCL	0.713551
or Modified-t UCL				97.5% Chebyshev (Mean, Sd) UCL	0.77946
				99% Chebyshev (Mean, Sd) UCL	0.908925

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Cadmium			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.503175
Number of Unique Samples	13	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	0.255	Data not normal at 5% significance level	
Maximum mg/kg	5		
Mean	0.837609	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	1.061171
Standard Deviation	1.113623		
Variance	1.240157	Gamma Distribution Test	
Coefficient of Variation	1.329527	A-D Test Statistic	15.59199
Skewness	2.78048	A-D 5% Critical Value	0.770293
		K-S Test Statistic	0.494071
Gamma Statistics		K-S 5% Critical Value	0.109403
k hat	1.438467	Data do not follow gamma distribution	
k star (bias corrected)	1.385587	at 5% significance level	
Theta hat	0.582292		
Theta star	0.604515	95% UCLs (Assuming Gamma Distribution)	
nu hat	198.5085	Approximate Gamma UCL	0.999656
nu star	191.211	Adjusted Gamma UCL	1.003428
Approx.Chi Square Value (.05)	160.2152		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	159.6129	Lilliefors Test Statisitic	0.456217
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-1.366492		
Maximum of log data	1.609438	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.563439	95% H-UCL	0.872896
Standard Deviation of log data	0.713181	95% Chebyshev (MVUE) UCL	1.032495
Variance of log data	0.508628	97.5% Chebyshev (MVUE) UCL	1.163066
		99% Chebyshev (MVUE) UCL	1.419546
		95% Non-parametric UCLs	
		CLT UCL	1.058125
		Adj-CLT UCL (Adjusted for skewness)	1.106075
		Mod-t UCL (Adjusted for skewness)	1.06865
		Jackknife UCL	1.061171
		Standard Bootstrap UCL	1.060364
		Bootstrap-t UCL	1.145654
RECOMMENDATION		Hall's Bootstrap UCL	1.066223
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	1.072246
		BCA Bootstrap UCL	1.099203
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	1.421982
		97.5% Chebyshev (Mean, Sd) UCL	1.674841
		99% Chebyshev (Mean, Sd) UCL	2.171534

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Chromium			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.170463
Number of Unique Samples	31	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	8	Data not normal at 5% significance level	
Maximum mg/kg	71		
Mean	30.47826	95% UCL (Assuming Normal Distribution)	
Median	31	Student's-t UCL	32.78463
Standard Deviation	11.48862		
Variance	131.9885	Gamma Distribution Test	
Coefficient of Variation	0.376945	A-D Test Statistic	2.810566
Skewness	0.74859	A-D 5% Critical Value	0.753135
		K-S Test Statistic	0.192975
Gamma Statistics		K-S 5% Critical Value	0.107422
k hat	6.43741	Data do not follow gamma distribution	
k star (bias corrected)	6.167184	at 5% significance level	
Theta hat	4.734554		
Theta star	4.942006	95% UCLs (Assuming Gamma Distribution)	
nu hat	888.3625	Approximate Gamma UCL	33.07085
nu star	851.0714	Adjusted Gamma UCL	33.1281
Approx.Chi Square Value (.05)	784.3515		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	782.9961	Lilliefors Test Statisitic	0.219861
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	2.079442		
Maximum of log data	4.26268	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	3.337337	95% H-UCL	33.89818
Standard Deviation of log data	0.428657	95% Chebyshev (MVUE) UCL	38.01074
Variance of log data	0.183747	97.5% Chebyshev (MVUE) UCL	41.12753
		99% Chebyshev (MVUE) UCL	47.24987
		95% Non-parametric UCLs	
		CLT UCL	32.75321
		Adj-CLT UCL (Adjusted for skewness)	32.88639
		Mod-t UCL (Adjusted for skewness)	32.8054
		Jackknife UCL	32.78463
		Standard Bootstrap UCL	32.75334
		Bootstrap-t UCL	32.94582
RECOMMENDATION		Hall's Bootstrap UCL	33.19777
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	32.71014
		BCA Bootstrap UCL	32.95652
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	36.50691
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	39.11552
		99% Chebyshev (Mean, Sd) UCL	44.23961

Data File	C:\Documents and Settings\Administrator\De		Variable:	Metals in Soil Samples <= 1 -10 ft	
Hexavalent Chromium					
Raw Statistics			Normal Distribution Test		
Number of Valid Samples		49	Shapiro-Wilk Test Statisitic		0.200835
Number of Unique Samples		11	Shapiro-Wilk 5% Critical Value		0.947
Minimum	mg/kg	0.115	Data not normal at 5% significance level		
Maximum	mg/kg	9.5			
Mean		0.473163	95% UCL (Assuming Normal Distribution)		
Median		0.25	Student's-t UCL		0.790836
Standard Deviation		1.325827			
Variance		1.757816	Gamma Distribution Test		
Coefficient of Variation		2.802049	A-D Test Statistic		12.47603
Skewness		6.851736	A-D 5% Critical Value		0.777098
			K-S Test Statistic		0.462795
Gamma Statistics			K-S 5% Critical Value		0.129999
k hat		1.09359	Data do not follow gamma distribution		
k star (bias corrected)		1.040241	at 5% significance level		
Theta hat		0.43267			
Theta star		0.454859	95% UCLs (Assuming Gamma Distribution)		
nu hat		107.1718	Approximate Gamma UCL		0.60565
nu star		101.9436	Adjusted Gamma UCL		0.610225
Approx.Chi Square Value (.05)		79.64328			
Adjusted Level of Significance		0.045102	Lognormal Distribution Test		
Adjusted Chi Square Value		79.04614	Shapiro-Wilk Test Statisitic		0.524986
			Shapiro-Wilk 5% Critical Value		0.947
Log-transformed Statistics			Data not lognormal at 5% significance level		
Minimum of log data		-2.162823			
Maximum of log data		2.251292	95% UCLs (Assuming Lognormal Distribution)		
Mean of log data		-1.270761	95% H-UCL		0.414145
Standard Deviation of log data		0.641202	95% Chebyshev (MVUE) UCL		0.490821
Variance of log data		0.41114	97.5% Chebyshev (MVUE) UCL		0.554808
			99% Chebyshev (MVUE) UCL		0.680497
			95% Non-parametric UCLs		
			CLT UCL		0.784705
			Adj-CLT UCL (Adjusted for skewness)		0.982799
			Mod-t UCL (Adjusted for skewness)		0.821735
			Jackknife UCL		0.790836
			Standard Bootstrap UCL		0.765568
			Bootstrap-t UCL		3.33909
RECOMMENDATION			Hall's Bootstrap UCL		2.03274
Data are Non-parametric (0.05)			Percentile Bootstrap UCL		0.844796
			BCA Bootstrap UCL		1.061224
Use 95% Chebyshev (Mean, Sd) UCL			95% Chebyshev (Mean, Sd) UCL		1.298755
			97.5% Chebyshev (Mean, Sd) UCL		1.65599
			99% Chebyshev (Mean, Sd) UCL		2.357707

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Cobalt			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.168844
Number of Unique Samples	16	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	5	Data not normal at 5% significance level	
Maximum mg/kg	32		
Mean	12.61739	95% UCL (Assuming Normal Distribution)	
Median	12	Student's-t UCL	13.34751
Standard Deviation	3.636941		
Variance	13.22734	Gamma Distribution Test	
Coefficient of Variation	0.288248	A-D Test Statistic	2.415508
Skewness	2.008573	A-D 5% Critical Value	0.750223
		K-S Test Statistic	0.187142
Gamma Statistics		K-S 5% Critical Value	0.107118
k hat	13.21253	Data do not follow gamma distribution	
k star (bias corrected)	12.64773	at 5% significance level	
Theta hat	0.954957		
Theta star	0.997601	95% UCLs (Assuming Gamma Distribution)	
nu hat	1823.329	Approximate Gamma UCL	13.35219
nu star	1745.387	Adjusted Gamma UCL	13.36819
Approx.Chi Square Value (.05)	1649.334		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	1647.36	Lilliefors Test Statisitic	0.204308
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	1.609438		
Maximum of log data	3.465736	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.496756	95% H-UCL	13.42102
Standard Deviation of log data	0.283666	95% Chebyshev (MVUE) UCL	14.54758
Variance of log data	0.080467	97.5% Chebyshev (MVUE) UCL	15.37564
		99% Chebyshev (MVUE) UCL	17.00218
		95% Non-parametric UCLs	
		CLT UCL	13.33757
		Adj-CLT UCL (Adjusted for skewness)	13.45069
		Mod-t UCL (Adjusted for skewness)	13.36516
		Jackknife UCL	13.34751
		Standard Bootstrap UCL	13.32211
		Bootstrap-t UCL	13.48581
RECOMMENDATION		Hall's Bootstrap UCL	13.73293
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	13.35652
		BCA Bootstrap UCL	13.38986
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	14.52588
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	15.35168
		99% Chebyshev (Mean, Sd) UCL	16.97381

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Copper			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.364905
Number of Unique Samples	30	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	10	Data not normal at 5% significance level	
Maximum mg/kg	270		
Mean	37.97101	95% UCL (Assuming Normal Distribution)	
Median	30	Student's-t UCL	46.45222
Standard Deviation	42.24716		
Variance	1784.823	Gamma Distribution Test	
Coefficient of Variation	1.112616	A-D Test Statistic	8.751249
Skewness	4.842632	A-D 5% Critical Value	0.759754
		K-S Test Statistic	0.270626
Gamma Statistics		K-S 5% Critical Value	0.108209
k hat	2.616803	Data do not follow gamma distribution	
k star (bias corrected)	2.512691	at 5% significance level	
Theta hat	14.51046		
Theta star	15.11169	95% UCLs (Assuming Gamma Distribution)	
nu hat	361.1188	Approximate Gamma UCL	43.22655
nu star	346.7513	Adjusted Gamma UCL	43.34573
Approx.Chi Square Value (.05)	304.5929		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	303.7554	Lilliefors Test Statisitic	0.224451
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	2.302585		
Maximum of log data	5.598422	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	3.433748	95% H-UCL	39.66705
Standard Deviation of log data	0.512242	95% Chebyshev (MVUE) UCL	45.26704
Variance of log data	0.262392	97.5% Chebyshev (MVUE) UCL	49.59624
		99% Chebyshev (MVUE) UCL	58.10013
		95% Non-parametric UCLs	
		CLT UCL	46.33668
		Adj-CLT UCL (Adjusted for skewness)	49.50486
		Mod-t UCL (Adjusted for skewness)	46.94639
		Jackknife UCL	46.45222
		Standard Bootstrap UCL	46.4827
		Bootstrap-t UCL	61.42446
RECOMMENDATION		Hall's Bootstrap UCL	87.75001
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	47.10145
		BCA Bootstrap UCL	50.89855
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	60.1402
		97.5% Chebyshev (Mean, Sd) UCL	69.73283
		99% Chebyshev (Mean, Sd) UCL	88.57568

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Cyanide			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	44	Shapiro-Wilk Test Statisitic	0.328769
Number of Unique Samples	2	Shapiro-Wilk 5% Critical Value	0.944
Minimum mg/kg	0.25	Data not normal at 5% significance level	
Maximum mg/kg	1.25		
Mean	1.159091	95% UCL (Assuming Normal Distribution)	
Median	1.25	Student's-t UCL	1.232789
Standard Deviation	0.290803		
Variance	0.084567	Gamma Distribution Test	
Coefficient of Variation	0.250889	A-D Test Statistic	14.88566
Skewness	-2.9475	A-D 5% Critical Value	0.750844
		K-S Test Statistic	0.538073
Gamma Statistics		K-S 5% Critical Value	0.133503
k hat	7.224256	Data do not follow gamma distribution	
k star (bias corrected)	6.746844	at 5% significance level	
Theta hat	0.160444		
Theta star	0.171797	95% UCLs (Assuming Gamma Distribution)	
nu hat	635.7345	Approximate Gamma UCL	1.27869
nu star	593.7223	Adjusted Gamma UCL	1.282946
Approx.Chi Square Value (.05)	538.1898		
Adjusted Level of Significance	0.044545	Lognormal Distribution Test	
Adjusted Chi Square Value	536.4048	Shapiro-Wilk Test Statisitic	0.328769
		Shapiro-Wilk 5% Critical Value	0.944
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-1.386294		
Maximum of log data	0.223144	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.076831	95% H-UCL	1.377078
Standard Deviation of log data	0.46803	95% Chebyshev (MVUE) UCL	1.58706
Variance of log data	0.219052	97.5% Chebyshev (MVUE) UCL	1.753869
		99% Chebyshev (MVUE) UCL	2.081533
		95% Non-parametric UCLs	
		CLT UCL	1.231202
		Adj-CLT UCL (Adjusted for skewness)	1.210386
		Mod-t UCL (Adjusted for skewness)	1.229543
		Jackknife UCL	1.232789
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/A
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	1.350186
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	1.432873
		99% Chebyshev (Mean, Sd) UCL	1.595296

Data File	C:\Documents and Settings\Administrator\De			Variable:	Metals in Soil Samples <= 1 -10 ft
Lead					
Raw Statistics				Normal Distribution Test	
Number of Valid Samples			69	Lilliefors Test Statisitic	0.179664
Number of Unique Samples			40	Lilliefors 5% Critical Value	0.106662
Minimum	mg/kg		3.9	Data not normal at 5% significance level	
Maximum	mg/kg		25		
Mean			10.15652	95% UCL (Assuming Normal Distribution)	
Median			8.1	Student's-t UCL	11.08095
Standard Deviation			4.60484		
Variance			21.20455	Gamma Distribution Test	
Coefficient of Variation			0.453388	A-D Test Statistic	1.672868
Skewness			1.336286	A-D 5% Critical Value	0.753473
				K-S Test Statistic	0.159516
Gamma Statistics				K-S 5% Critical Value	0.107454
k hat			5.935659	Data do not follow gamma distribution	
k star (bias corrected)			5.687249	at 5% significance level	
Theta hat			1.711103		
Theta star			1.785841	95% UCLs (Assuming Gamma Distribution)	
nu hat			819.1209	Approximate Gamma UCL	11.05865
nu star			784.8403	Adjusted Gamma UCL	11.07861
Approx.Chi Square Value (.05)			720.8158		
Adjusted Level of Significance			0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value			719.5173	Lilliefors Test Statisitic	0.141503
				Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics				Data not lognormal at 5% significance level	
Minimum of log data			1.360977		
Maximum of log data			3.218876	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data			2.231521	95% H-UCL	11.0579
Standard Deviation of log data			0.406987	95% Chebyshev (MVUE) UCL	12.34023
Variance of log data			0.165638	97.5% Chebyshev (MVUE) UCL	13.30736
				99% Chebyshev (MVUE) UCL	15.20708
				95% Non-parametric UCLs	
				CLT UCL	11.06836
				Adj-CLT UCL (Adjusted for skewness)	11.16365
				Mod-t UCL (Adjusted for skewness)	11.09582
				Jackknife UCL	11.08095
				Standard Bootstrap UCL	11.06461
				Bootstrap-t UCL	11.22673
RECOMMENDATION				Hall's Bootstrap UCL	11.19996
Data are Non-parametric (0.05)				Percentile Bootstrap UCL	11.08551
				BCA Bootstrap UCL	11.12174
Use Student's-t UCL				95% Chebyshev (Mean, Sd) UCL	12.57291
or Modified-t UCL				97.5% Chebyshev (Mean, Sd) UCL	13.61848
				99% Chebyshev (Mean, Sd) UCL	15.67231

Data File	C:\Documents and Settings\Administrator\De		Variable:	Metals in Soil Samples <= 1 -10 ft	
Mercury					
Raw Statistics				Normal Distribution Test	
Number of Valid Samples			69	Lilliefors Test Statisitic	0.369005
Number of Unique Samples			8	Lilliefors 5% Critical Value	0.106662
Minimum	mg/kg		0.005	Data not normal at 5% significance level	
Maximum	mg/kg		0.9		
Mean			0.386739	95% UCL (Assuming Normal Distribution)	
Median			0.09	Student's-t UCL	0.465667
Standard Deviation			0.39316		
Variance			0.154575	Gamma Distribution Test	
Coefficient of Variation			1.016603	A-D Test Statistic	8.640453
Skewness			0.407714	A-D 5% Critical Value	0.791617
				K-S Test Statistic	0.327019
Gamma Statistics				K-S 5% Critical Value	0.111423
k hat			0.768873	Data do not follow gamma distribution	
k star (bias corrected)			0.745106	at 5% significance level	
Theta hat			0.502995		
Theta star			0.519039	95% UCLs (Assuming Gamma Distribution)	
nu hat			106.1045	Approximate Gamma UCL	0.494466
nu star			102.8246	Adjusted Gamma UCL	0.49707
Approx.Chi Square Value (.05)			80.42275		
Adjusted Level of Significance			0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value			80.00138	Lilliefors Test Statisitic	0.286507
				Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics				Data not lognormal at 5% significance level	
Minimum of log data			-5.298317		
Maximum of log data			-0.105361	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data			-1.725986	95% H-UCL	0.689715
Standard Deviation of log data			1.357422	95% Chebyshev (MVUE) UCL	0.843191
Variance of log data			1.842594	97.5% Chebyshev (MVUE) UCL	1.019255
				99% Chebyshev (MVUE) UCL	1.3651
				95% Non-parametric UCLs	
				CLT UCL	0.464592
				Adj-CLT UCL (Adjusted for skewness)	0.467074
				Mod-t UCL (Adjusted for skewness)	0.466054
				Jackknife UCL	0.465667
				Standard Bootstrap UCL	0.464008
				Bootstrap-t UCL	0.466631
RECOMMENDATION				Hall's Bootstrap UCL	0.46471
Data are Non-parametric (0.05)				Percentile Bootstrap UCL	0.462609
				BCA Bootstrap UCL	0.467246
Use 97.5% Chebyshev (Mean, Sd) UCL				95% Chebyshev (Mean, Sd) UCL	0.59305
				97.5% Chebyshev (Mean, Sd) UCL	0.682321
				99% Chebyshev (Mean, Sd) UCL	0.857676

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Molybdenum			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.355687
Number of Unique Samples	7	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	0.5	Data not normal at 5% significance level	
Maximum mg/kg	2		
Mean	0.914493	95% UCL (Assuming Normal Distribution)	
Median	0.75	Student's-t UCL	1.002338
Standard Deviation	0.437582		
Variance	0.191478	Gamma Distribution Test	
Coefficient of Variation	0.478497	A-D Test Statistic	9.432707
Skewness	1.958407	A-D 5% Critical Value	0.753138
		K-S Test Statistic	0.317273
Gamma Statistics		K-S 5% Critical Value	0.107422
k hat	6.432209	Data do not follow gamma distribution	
k star (bias corrected)	6.16221	at 5% significance level	
Theta hat	0.142174		
Theta star	0.148403	95% UCLs (Assuming Gamma Distribution)	
nu hat	887.6448	Approximate Gamma UCL	0.992316
nu star	850.3849	Adjusted Gamma UCL	0.994035
Approx.Chi Square Value (.05)	783.6925		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	782.3376	Lilliefors Test Statisitic	0.292231
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	0.693147	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.169129	95% H-UCL	0.979592
Standard Deviation of log data	0.370331	95% Chebyshev (MVUE) UCL	1.084141
Variance of log data	0.137145	97.5% Chebyshev (MVUE) UCL	1.162358
		99% Chebyshev (MVUE) UCL	1.315999
		95% Non-parametric UCLs	
		CLT UCL	1.001141
		Adj-CLT UCL (Adjusted for skewness)	1.014412
		Mod-t UCL (Adjusted for skewness)	1.004408
		Jackknife UCL	1.002338
		Standard Bootstrap UCL	0.999651
		Bootstrap-t UCL	1.025959
RECOMMENDATION		Hall's Bootstrap UCL	1.016752
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	1.005072
		BCA Bootstrap UCL	1.012319
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	1.144114
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	1.243471
		99% Chebyshev (Mean, Sd) UCL	1.438639

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Nickel			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.483639
Number of Unique Samples	24	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	7	Data not normal at 5% significance level	
Maximum mg/kg	460		
Mean	34.26087	95% UCL (Assuming Normal Distribution)	
Median	24	Student's-t UCL	46.83553
Standard Deviation	62.63777		
Variance	3923.49	Gamma Distribution Test	
Coefficient of Variation	1.82826	A-D Test Statistic	13.00527
Skewness	5.704713	A-D 5% Critical Value	0.768671
		K-S Test Statistic	0.411454
Gamma Statistics		K-S 5% Critical Value	0.109244
k hat	1.519046	Data do not follow gamma distribution	
k star (bias corrected)	1.462663	at 5% significance level	
Theta hat	22.5542		
Theta star	23.42363	95% UCLs (Assuming Gamma Distribution)	
nu hat	209.6284	Approximate Gamma UCL	40.68693
nu star	201.8475	Adjusted Gamma UCL	40.8361
Approx.Chi Square Value (.05)	169.9678		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	169.347	Lilliefors Test Statisitic	0.316363
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	1.94591		
Maximum of log data	6.131226	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	3.170067	95% H-UCL	33.23402
Standard Deviation of log data	0.615577	95% Chebyshev (MVUE) UCL	38.67706
Variance of log data	0.378935	97.5% Chebyshev (MVUE) UCL	43.00163
		99% Chebyshev (MVUE) UCL	51.49641
		95% Non-parametric UCLs	
		CLT UCL	46.66422
		Adj-CLT UCL (Adjusted for skewness)	52.19774
		Mod-t UCL (Adjusted for skewness)	47.69865
		Jackknife UCL	46.83553
		Standard Bootstrap UCL	46.77055
		Bootstrap-t UCL	70.10203
RECOMMENDATION		Hall's Bootstrap UCL	58.56777
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	48.36232
		BCA Bootstrap UCL	55.18841
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	67.13002
		97.5% Chebyshev (Mean, Sd) UCL	81.35253
		99% Chebyshev (Mean, Sd) UCL	109.2899

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Selenium			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.349708
Number of Unique Samples	10	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	0.7	Data not normal at 5% significance level	
Maximum mg/kg	4.3		
Mean	1.484058	95% UCL (Assuming Normal Distribution)	
Median	0.75	Student's-t UCL	1.68351
Standard Deviation	0.993527		
Variance	0.987095	Gamma Distribution Test	
Coefficient of Variation	0.669466	A-D Test Statistic	9.930754
Skewness	0.90959	A-D 5% Critical Value	0.759776
		K-S Test Statistic	0.360083
Gamma Statistics		K-S 5% Critical Value	0.108212
k hat	2.612971	Data do not follow gamma distribution	
k star (bias corrected)	2.509025	at 5% significance level	
Theta hat	0.567958		
Theta star	0.591488	95% UCLs (Assuming Gamma Distribution)	
nu hat	360.59	Approximate Gamma UCL	1.689631
nu star	346.2455	Adjusted Gamma UCL	1.694293
Approx.Chi Square Value (.05)	304.1186		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	303.2818	Lilliefors Test Statisitic	0.358406
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.356675		
Maximum of log data	1.458615	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.19139	95% H-UCL	1.703189
Standard Deviation of log data	0.623957	95% Chebyshev (MVUE) UCL	1.985082
Variance of log data	0.389323	97.5% Chebyshev (MVUE) UCL	2.209581
		99% Chebyshev (MVUE) UCL	2.650567
		95% Non-parametric UCLs	
		CLT UCL	1.680793
		Adj-CLT UCL (Adjusted for skewness)	1.694788
		Mod-t UCL (Adjusted for skewness)	1.685693
		Jackknife UCL	1.68351
		Standard Bootstrap UCL	1.683046
		Bootstrap-t UCL	1.692588
RECOMMENDATION		Hall's Bootstrap UCL	1.693568
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	1.673913
		BCA Bootstrap UCL	1.7
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	2.005411
		97.5% Chebyshev (Mean, Sd) UCL	2.231001
		99% Chebyshev (Mean, Sd) UCL	2.674128

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Silver			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.348097
Number of Unique Samples	7	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	0.4	Data not normal at 5% significance level	
Maximum mg/kg	3.7		
Mean	0.673188	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	0.761898
Standard Deviation	0.441887		
Variance	0.195264	Gamma Distribution Test	
Coefficient of Variation	0.656409	A-D Test Statistic	8.126819
Skewness	4.914787	A-D 5% Critical Value	0.754345
		K-S Test Statistic	0.375124
Gamma Statistics		K-S 5% Critical Value	0.107545
k hat	4.820525	Data do not follow gamma distribution	
k star (bias corrected)	4.620599	at 5% significance level	
Theta hat	0.13965		
Theta star	0.145693	95% UCLs (Assuming Gamma Distribution)	
nu hat	665.2324	Approximate Gamma UCL	0.740029
nu star	637.6426	Adjusted Gamma UCL	0.741515
Approx.Chi Square Value (.05)	580.0499		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	578.8869	Lilliefors Test Statisitic	0.372675
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.916291		
Maximum of log data	1.308333	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.503024	95% H-UCL	0.721161
Standard Deviation of log data	0.413859	95% Chebyshev (MVUE) UCL	0.806022
Variance of log data	0.171279	97.5% Chebyshev (MVUE) UCL	0.870121
		99% Chebyshev (MVUE) UCL	0.996032
		95% Non-parametric UCLs	
		CLT UCL	0.76069
		Adj-CLT UCL (Adjusted for skewness)	0.794321
		Mod-t UCL (Adjusted for skewness)	0.767144
		Jackknife UCL	0.761898
		Standard Bootstrap UCL	0.760005
		Bootstrap-t UCL	0.81968
RECOMMENDATION		Hall's Bootstrap UCL	1.153575
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	0.769348
		BCA Bootstrap UCL	0.797174
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	0.905068
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	1.005403
		99% Chebyshev (Mean, Sd) UCL	1.202491

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Thallium			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.504755
Number of Unique Samples	12	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	0.445	Data not normal at 5% significance level	
Maximum mg/kg	27		
Mean	2.310145	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	3.444071
Standard Deviation	5.64839		
Variance	31.90431	Gamma Distribution Test	
Coefficient of Variation	2.445037	A-D Test Statistic	17.10275
Skewness	3.351166	A-D 5% Critical Value	0.807044
		K-S Test Statistic	0.459404
Gamma Statistics		K-S 5% Critical Value	0.112681
k hat	0.599681	Data do not follow gamma distribution	
k star (bias corrected)	0.583269	at 5% significance level	
Theta hat	3.852293		
Theta star	3.960683	95% UCLs (Assuming Gamma Distribution)	
nu hat	82.75591	Approximate Gamma UCL	3.057575
nu star	80.49116	Adjusted Gamma UCL	3.07599
Approx.Chi Square Value (.05)	60.81495		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	60.45087	Lilliefors Test Statisitic	0.338235
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.809681		
Maximum of log data	3.295837	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.193113	95% H-UCL	1.847572
Standard Deviation of log data	1.023767	95% Chebyshev (MVUE) UCL	2.261252
Variance of log data	1.048098	97.5% Chebyshev (MVUE) UCL	2.64405
		99% Chebyshev (MVUE) UCL	3.395983
		95% Non-parametric UCLs	
		CLT UCL	3.428623
		Adj-CLT UCL (Adjusted for skewness)	3.721747
		Mod-t UCL (Adjusted for skewness)	3.489792
		Jackknife UCL	3.444071
		Standard Bootstrap UCL	3.416866
		Bootstrap-t UCL	4.054811
RECOMMENDATION		Hall's Bootstrap UCL	3.424325
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	3.457101
		BCA Bootstrap UCL	3.688478
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	5.274136
		97.5% Chebyshev (Mean, Sd) UCL	6.556658
		99% Chebyshev (Mean, Sd) UCL	9.075923

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Vanadium			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.120851
Number of Unique Samples	35	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	9	Data not normal at 5% significance level	
Maximum mg/kg	84		
Mean	47	95% UCL (Assuming Normal Distribution)	
Median	48	Student's-t UCL	49.88668
Standard Deviation	14.37932		
Variance	206.7647	Gamma Distribution Test	
Coefficient of Variation	0.305943	A-D Test Statistic	3.433686
Skewness	-0.696327	A-D 5% Critical Value	0.752479
		K-S Test Statistic	0.188034
Gamma Statistics		K-S 5% Critical Value	0.107359
k hat	7.409553	Data do not follow gamma distribution	
k star (bias corrected)	7.09706	at 5% significance level	
Theta hat	6.343163		
Theta star	6.62246	95% UCLs (Assuming Gamma Distribution)	
nu hat	1022.518	Approximate Gamma UCL	50.71029
nu star	979.3943	Adjusted Gamma UCL	50.79196
Approx.Chi Square Value (.05)	907.7356		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	906.276	Lilliefors Test Statisitic	0.219302
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	2.197225		
Maximum of log data	4.430817	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	3.781152	95% H-UCL	52.67204
Standard Deviation of log data	0.424074	95% Chebyshev (MVUE) UCL	59.00296
Variance of log data	0.179839	97.5% Chebyshev (MVUE) UCL	63.79601
		99% Chebyshev (MVUE) UCL	73.21103
		95% Non-parametric UCLs	
		CLT UCL	49.84735
		Adj-CLT UCL (Adjusted for skewness)	49.6923
		Mod-t UCL (Adjusted for skewness)	49.86249
		Jackknife UCL	49.88668
		Standard Bootstrap UCL	49.8581
		Bootstrap-t UCL	49.71253
RECOMMENDATION		Hall's Bootstrap UCL	49.78321
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	49.7971
		BCA Bootstrap UCL	49.68116
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	54.54554
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	57.8105
		99% Chebyshev (Mean, Sd) UCL	64.22389

Data File	C:\Documents and Settings\Administrator\De	Variable:	Metals in Soil Samples <= 1 -10 ft
Zinc			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	69	Lilliefors Test Statisitic	0.120747
Number of Unique Samples	51	Lilliefors 5% Critical Value	0.106662
Minimum mg/kg	6	Data not normal at 5% significance level	
Maximum mg/kg	130		
Mean	55.24638	95% UCL (Assuming Normal Distribution)	
Median	62	Student's-t UCL	60.01315
Standard Deviation	23.7446		
Variance	563.8061	Gamma Distribution Test	
Coefficient of Variation	0.429795	A-D Test Statistic	2.935314
Skewness	-0.047183	A-D 5% Critical Value	0.755877
		K-S Test Statistic	0.173641
Gamma Statistics		K-S 5% Critical Value	0.107741
k hat	3.790663	Data do not follow gamma distribution	
k star (bias corrected)	3.635513	at 5% significance level	
Theta hat	14.57433		
Theta star	15.19631	95% UCLs (Assuming Gamma Distribution)	
nu hat	523.1114	Approximate Gamma UCL	61.49138
nu star	501.7008	Adjusted Gamma UCL	61.63124
Approx.Chi Square Value (.05)	450.7486		
Adjusted Level of Significance	0.046522	Lognormal Distribution Test	
Adjusted Chi Square Value	449.7257	Lilliefors Test Statisitic	0.195358
		Lilliefors 5% Critical Value	0.106662
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	1.791759		
Maximum of log data	4.867534	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	3.874139	95% H-UCL	66.75934
Standard Deviation of log data	0.60828	95% Chebyshev (MVUE) UCL	77.5917
Variance of log data	0.370005	97.5% Chebyshev (MVUE) UCL	86.18057
		99% Chebyshev (MVUE) UCL	103.0518
		95% Non-parametric UCLs	
		CLT UCL	59.94821
		Adj-CLT UCL (Adjusted for skewness)	59.93086
		Mod-t UCL (Adjusted for skewness)	60.01045
		Jackknife UCL	60.01315
		Standard Bootstrap UCL	59.84704
		Bootstrap-t UCL	59.90626
RECOMMENDATION		Hall's Bootstrap UCL	60.14007
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	59.94203
		BCA Bootstrap UCL	59.81159
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	67.70635
		97.5% Chebyshev (Mean, Sd) UCL	73.09779
		99% Chebyshev (Mean, Sd) UCL	83.68823

Data File	C:\Documents and Settings\Administrator\De	Variable:	1,1-DICHLOROETHANE
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	40	Shapiro-Wilk Test Statisitic	0.288421
Number of Unique Samples	6	Shapiro-Wilk 5% Critical Value	0.94
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	5		
Mean	0.70625	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	0.924772
Standard Deviation	0.820271		
Variance	0.672845	Gamma Distribution Test	
Coefficient of Variation	1.161446	A-D Test Statistic	12.15142
Skewness	4.615906	A-D 5% Critical Value	0.756302
		K-S Test Statistic	0.499388
Gamma Statistics		K-S 5% Critical Value	0.140733
k hat	2.627841	Data do not follow gamma distribution	
k star (bias corrected)	2.447419	at 5% significance level	
Theta hat	0.268757		
Theta star	0.288569	95% UCLs (Assuming Gamma Distribution)	
nu hat	210.2272	Approximate Gamma UCL	0.841043
nu star	195.7935	Adjusted Gamma UCL	0.846578
Approx.Chi Square Value (.05)	164.414		
Adjusted Level of Significance	0.044	Lognormal Distribution Test	
Adjusted Chi Square Value	163.3389	Shapiro-Wilk Test Statisitic	0.352146
		Shapiro-Wilk 5% Critical Value	0.94
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	1.609438	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.54996	95% H-UCL	0.745442
Standard Deviation of log data	0.474839	95% Chebyshev (MVUE) UCL	0.863666
Variance of log data	0.225472	97.5% Chebyshev (MVUE) UCL	0.958794
		99% Chebyshev (MVUE) UCL	1.145653
		95% Non-parametric UCLs	
		CLT UCL	0.919581
		Adj-CLT UCL (Adjusted for skewness)	1.020724
		Mod-t UCL (Adjusted for skewness)	0.940548
		Jackknife UCL	0.924772
		Standard Bootstrap UCL	0.915591
		Bootstrap-t UCL	2.382402
RECOMMENDATION		Hall's Bootstrap UCL	2.567467
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	0.945
		BCA Bootstrap UCL	1.03375
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	1.271583
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	1.516203
		99% Chebyshev (Mean, Sd) UCL	1.996711

Data File	C:\Documents and Settings\Administrator\De	Variable:	1,1-Difluorethane

Raw Statistics		Normal Distribution Test	
Number of Valid Samples	38	Shapiro-Wilk Test Statisitic	0.165559
Number of Unique Samples	2	Shapiro-Wilk 5% Critical Value	0.938
Minimum ug/L	5	Data not normal at 5% significance level	
Maximum ug/L	49		
Mean	6.157895	95% UCL (Assuming Normal Distribution)	
Median	5	Student's-t UCL	8.111371
Standard Deviation	7.137743		
Variance	50.94737	Gamma Distribution Test	
Coefficient of Variation	1.159121	A-D Test Statistic	14.44727
Skewness	6.164414	A-D 5% Critical Value	0.753368
		K-S Test Statistic	0.551773
Gamma Statistics		K-S 5% Critical Value	0.143959
k hat	3.531016	Data do not follow gamma distribution	
k star (bias corrected)	3.269795	at 5% significance level	
Theta hat	1.743944		
Theta star	1.883266	95% UCLs (Assuming Gamma Distribution)	
nu hat	268.3572	Approximate Gamma UCL	7.184369
nu star	248.5044	Adjusted Gamma UCL	7.230474
Approx.Chi Square Value (.05)	212.9991		
Adjusted Level of Significance	0.0434	Lognormal Distribution Test	
Adjusted Chi Square Value	211.6409	Shapiro-Wilk Test Statisitic	0.165559
		Shapiro-Wilk 5% Critical Value	0.938
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	1.609438		
Maximum of log data	3.89182	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.669501	95% H-UCL	6.353206
Standard Deviation of log data	0.370251	95% Chebyshev (MVUE) UCL	7.20062
Variance of log data	0.137086	97.5% Chebyshev (MVUE) UCL	7.86062
		99% Chebyshev (MVUE) UCL	9.157063
		95% Non-parametric UCLs	
		CLT UCL	8.062462
		Adj-CLT UCL (Adjusted for skewness)	9.299689
		Mod-t UCL (Adjusted for skewness)	8.304354
		Jackknife UCL	8.111371
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/A
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	11.20504
or Modified-t UCL		97.5% Chebyshev (Mean, Sd) UCL	13.38895
		99% Chebyshev (Mean, Sd) UCL	17.6788

Data File	C:\Documents and Settings\Administrator\De	Variable:	cis-1,2-dichloroethene

Raw Statistics			
Number of Valid Samples			40
Number of Unique Samples			11
Minimum	ug/L		0.5
Maximum	ug/L		210
Mean			6.6675
Median			0.5
Standard Deviation			33.06132
Variance			1093.051
Coefficient of Variation			4.958578
Skewness			6.273315

Gamma Statistics	
k hat	0.338854
k star (bias corrected)	0.330106
Theta hat	19.67664
Theta star	20.19804
nu hat	27.10829
nu star	26.4085
Approx.Chi Square Value (.05)	15.69244
Adjusted Level of Significance	0.044
Adjusted Chi Square Value	15.38198

Log-transformed Statistics	
Minimum of log data	-0.693147
Maximum of log data	5.347108
Mean of log data	-0.097698
Standard Deviation of log data	1.261501
Variance of log data	1.591384

RECOMMENDATION

Data are Non-parametric (0.05)

Use 99% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.194947
Shapiro-Wilk 5% Critical Value	0.94
Data not normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	15.47511

Gamma Distribution Test	
A-D Test Statistic	10.29187
A-D 5% Critical Value	0.849023
K-S Test Statistic	0.42921
K-S 5% Critical Value	0.150686
Data do not follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	11.2206
Adjusted Gamma UCL	11.44707

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.556786
Shapiro-Wilk 5% Critical Value	0.94
Data not lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	3.45382
95% Chebyshev (MVUE) UCL	4.03276
97.5% Chebyshev (MVUE) UCL	4.937124
99% Chebyshev (MVUE) UCL	6.713573

95% Non-parametric UCLs	
CLT UCL	15.2659
Adj-CLT UCL (Adjusted for skewness)	20.80625
Mod-t UCL (Adjusted for skewness)	16.33929
Jackknife UCL	15.47511
Standard Bootstrap UCL	14.92586
Bootstrap-t UCL	136.7
Hall's Bootstrap UCL	76.64402
Percentile Bootstrap UCL	17.095
BCA Bootstrap UCL	22.795
95% Chebyshev (Mean, Sd) UCL	29.45344
97.5% Chebyshev (Mean, Sd) UCL	39.31294
99% Chebyshev (Mean, Sd) UCL	58.68001

Data File	C:\Documents and Settings\Administrator\De	Variable:	Ethylbenzene

Raw Statistics			
Number of Valid Samples			40
Number of Unique Samples			7
Minimum	ug/L		0.5
Maximum	ug/L		5
Mean			0.74125
Median			0.5
Standard Deviation			0.780277
Variance			0.608832
Coefficient of Variation			1.05265
Skewness			4.590068

Gamma Statistics	
k hat	2.6999
k star (bias corrected)	2.514074
Theta hat	0.274547
Theta star	0.29484
nu hat	215.992
nu star	201.1259
Approx.Chi Square Value (.05)	169.3055
Adjusted Level of Significance	0.044
Adjusted Chi Square Value	168.214

Log-transformed Statistics	
Minimum of log data	-0.693147
Maximum of log data	1.609438
Mean of log data	-0.495894
Standard Deviation of log data	0.501039
Variance of log data	0.25104

RECOMMENDATION
Data are Non-parametric (0.05)
Use 95% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.36629
Shapiro-Wilk 5% Critical Value	0.94
Data not normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	0.949117

Gamma Distribution Test	
A-D Test Statistic	10.1004
A-D 5% Critical Value	0.755995
K-S Test Statistic	0.479311
K-S 5% Critical Value	0.140678
Data do not follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	0.880565
Adjusted Gamma UCL	0.886279

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.46891
Shapiro-Wilk 5% Critical Value	0.94
Data not lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	0.804522
95% Chebyshev (MVUE) UCL	0.937089
97.5% Chebyshev (MVUE) UCL	1.044843
99% Chebyshev (MVUE) UCL	1.256504

95% Non-parametric UCLs	
CLT UCL	0.94418
Adj-CLT UCL (Adjusted for skewness)	1.039853
Mod-t UCL (Adjusted for skewness)	0.96404
Jackknife UCL	0.949117
Standard Bootstrap UCL	0.937514
Bootstrap-t UCL	1.291472
Hall's Bootstrap UCL	1.540291
Percentile Bootstrap UCL	0.9525
BCA Bootstrap UCL	1.07125
95% Chebyshev (Mean, Sd) UCL	1.279019
97.5% Chebyshev (Mean, Sd) UCL	1.511712
99% Chebyshev (Mean, Sd) UCL	1.968792

Data File	C:\Documents and Settings\Administrator\De	Variable:	Tetrachloroethene (PCE)

Raw Statistics				Normal Distribution Test	
Number of Valid Samples			40	Shapiro-Wilk Test Statisitic	0.339884
Number of Unique Samples			11	Shapiro-Wilk 5% Critical Value	0.94
Minimum	ug/L		0.5	Data not normal at 5% significance level	
Maximum	ug/L		110		
Mean			7.3875	95% UCL (Assuming Normal Distribution)	
Median			0.5	Student's-t UCL	13.51404
Standard Deviation			22.99736		
Variance			528.8786	Gamma Distribution Test	
Coefficient of Variation			3.11301	A-D Test Statistic	8.864988
Skewness			4.041108	A-D 5% Critical Value	0.845895
				K-S Test Statistic	0.426367
Gamma Statistics				K-S 5% Critical Value	0.150414
k hat			0.352897	Data do not follow gamma distribution	
k star (bias corrected)			0.343096	at 5% significance level	
Theta hat			20.93389		
Theta star			21.53187	95% UCLs (Assuming Gamma Distribution)	
nu hat			28.23173	Approximate Gamma UCL	12.29147
nu star			27.44768	Adjusted Gamma UCL	12.53388
Approx.Chi Square Value (.05)			16.49679		
Adjusted Level of Significance			0.044	Lognormal Distribution Test	
Adjusted Chi Square Value			16.17773	Shapiro-Wilk Test Statisitic	0.590632
				Shapiro-Wilk 5% Critical Value	0.94
Log-transformed Statistics				Data not lognormal at 5% significance level	
Minimum of log data			-0.693147		
Maximum of log data			4.70048	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data			0.096866	95% H-UCL	7.27226
Standard Deviation of log data			1.519168	95% Chebyshev (MVUE) UCL	7.806134
Variance of log data			2.307871	97.5% Chebyshev (MVUE) UCL	9.757188
				99% Chebyshev (MVUE) UCL	13.58966
				95% Non-parametric UCLs	
				CLT UCL	13.36852
				Adj-CLT UCL (Adjusted for skewness)	15.85107
				Mod-t UCL (Adjusted for skewness)	13.90127
				Jackknife UCL	13.51404
				Standard Bootstrap UCL	13.46151
				Bootstrap-t UCL	36.89699
RECOMMENDATION				Hall's Bootstrap UCL	39.96261
Data are Non-parametric (0.05)				Percentile Bootstrap UCL	13.8575
				BCA Bootstrap UCL	17.1525
Use 99% Chebyshev (Mean, Sd) UCL				95% Chebyshev (Mean, Sd) UCL	23.23734
				97.5% Chebyshev (Mean, Sd) UCL	30.09557
				99% Chebyshev (Mean, Sd) UCL	43.56725

Data File	C:\Documents and Settings\Administrator\De	Variable:	Toluene

Raw Statistics			
Number of Valid Samples			40
Number of Unique Samples			13
Minimum	ug/L		0.5
Maximum	ug/L		5
Mean			1.02875
Median			0.725
Standard Deviation			0.810341
Variance			0.656652
Coefficient of Variation			0.787695
Skewness			3.220969

Gamma Statistics	
k hat	2.751501
k star (bias corrected)	2.561805
Theta hat	0.373887
Theta star	0.401572
nu hat	220.1201
nu star	204.9444
Approx.Chi Square Value (.05)	172.8119
Adjusted Level of Significance	0.044
Adjusted Chi Square Value	171.7088

Log-transformed Statistics	
Minimum of log data	-0.693147
Maximum of log data	1.609438
Mean of log data	-0.164244
Standard Deviation of log data	0.586474
Variance of log data	0.343952

RECOMMENDATION
Data are Non-parametric (0.05)
Use 95% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.651597
Shapiro-Wilk 5% Critical Value	0.94
Data not normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1.244626

Gamma Distribution Test	
A-D Test Statistic	2.80917
A-D 5% Critical Value	0.755776
K-S Test Statistic	0.279125
K-S 5% Critical Value	0.140639
Data do not follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1.220035
Adjusted Gamma UCL	1.227873

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.812334
Shapiro-Wilk 5% Critical Value	0.94
Data not lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1.212601
95% Chebyshev (MVUE) UCL	1.434269
97.5% Chebyshev (MVUE) UCL	1.620984
99% Chebyshev (MVUE) UCL	1.987751

95% Non-parametric UCLs	
CLT UCL	1.239499
Adj-CLT UCL (Adjusted for skewness)	1.309222
Mod-t UCL (Adjusted for skewness)	1.255502
Jackknife UCL	1.244626
Standard Bootstrap UCL	1.240557
Bootstrap-t UCL	1.354297
Hall's Bootstrap UCL	2.215695
Percentile Bootstrap UCL	1.25
BCA Bootstrap UCL	1.3075
95% Chebyshev (Mean, Sd) UCL	1.587239
97.5% Chebyshev (Mean, Sd) UCL	1.828897
99% Chebyshev (Mean, Sd) UCL	2.303589

Data File	C:\Documents and Settings\Administrator\De	Variable:	trans-1,2-dichloroethene

Raw Statistics		Normal Distribution Test	
Number of Valid Samples	38	Shapiro-Wilk Test Statisitic	0.353817
Number of Unique Samples	7	Shapiro-Wilk 5% Critical Value	0.938
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	16		
Mean	1.486842	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	2.376255
Standard Deviation	3.249796		
Variance	10.56117	Gamma Distribution Test	
Coefficient of Variation	2.185703	A-D Test Statistic	10.59411
Skewness	3.826728	A-D 5% Critical Value	0.786391
		K-S Test Statistic	0.507399
Gamma Statistics		K-S 5% Critical Value	0.148522
k hat	0.798586	Data do not follow gamma distribution	
k star (bias corrected)	0.753084	at 5% significance level	
Theta hat	1.861843		
Theta star	1.974338	95% UCLs (Assuming Gamma Distribution)	
nu hat	60.69255	Approximate Gamma UCL	2.083649
nu star	57.23436	Adjusted Gamma UCL	2.113364
Approx.Chi Square Value (.05)	40.84107		
Adjusted Level of Significance	0.0434	Lognormal Distribution Test	
Adjusted Chi Square Value	40.26683	Shapiro-Wilk Test Statisitic	0.450293
		Shapiro-Wilk 5% Critical Value	0.938
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	2.772589	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.346697	95% H-UCL	1.471136
Standard Deviation of log data	0.893928	95% Chebyshev (MVUE) UCL	1.785083
Variance of log data	0.799107	97.5% Chebyshev (MVUE) UCL	2.10778
		99% Chebyshev (MVUE) UCL	2.741656
		95% Non-parametric UCLs	
		CLT UCL	2.353987
		Adj-CLT UCL (Adjusted for skewness)	2.703675
		Mod-t UCL (Adjusted for skewness)	2.430799
		Jackknife UCL	2.376255
		Standard Bootstrap UCL	2.343181
		Bootstrap-t UCL	4.852902
RECOMMENDATION		Hall's Bootstrap UCL	5.475783
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	2.384211
		BCA Bootstrap UCL	2.684211
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	3.784795
		97.5% Chebyshev (Mean, Sd) UCL	4.779121
		99% Chebyshev (Mean, Sd) UCL	6.732282

Data File	C:\Documents and Settings\Administrator\De	Variable:	Trichloroethylene (TCE)
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	40	Shapiro-Wilk Test Statisitic	0.300218
Number of Unique Samples	7	Shapiro-Wilk 5% Critical Value	0.94
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	54		
Mean	2.84625	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	5.279951
Standard Deviation	9.135444		
Variance	83.45633	Gamma Distribution Test	
Coefficient of Variation	3.209642	A-D Test Statistic	12.00759
Skewness	4.965464	A-D 5% Critical Value	0.81792
		K-S Test Statistic	0.513905
Gamma Statistics		K-S 5% Critical Value	0.147978
k hat	0.478456	Data do not follow gamma distribution	
k star (bias corrected)	0.459239	at 5% significance level	
Theta hat	5.948817		
Theta star	6.197755	95% UCLs (Assuming Gamma Distribution)	
nu hat	38.27652	Approximate Gamma UCL	4.382205
nu star	36.73911	Adjusted Gamma UCL	4.454977
Approx.Chi Square Value (.05)	23.86212		
Adjusted Level of Significance	0.044	Lognormal Distribution Test	
Adjusted Chi Square Value	23.47233	Shapiro-Wilk Test Statisitic	0.424661
		Shapiro-Wilk 5% Critical Value	0.94
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	3.988984	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.290706	95% H-UCL	2.160069
Standard Deviation of log data	1.110707	95% Chebyshev (MVUE) UCL	2.591232
Variance of log data	1.23367	97.5% Chebyshev (MVUE) UCL	3.127089
		99% Chebyshev (MVUE) UCL	4.179676
		95% Non-parametric UCLs	
		CLT UCL	5.222143
		Adj-CLT UCL (Adjusted for skewness)	6.433885
		Mod-t UCL (Adjusted for skewness)	5.468959
		Jackknife UCL	5.279951
		Standard Bootstrap UCL	5.165163
		Bootstrap-t UCL	10.55591
RECOMMENDATION		Hall's Bootstrap UCL	11.58357
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	5.4875
		BCA Bootstrap UCL	6.8
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	9.14242
		97.5% Chebyshev (Mean, Sd) UCL	11.86678
		99% Chebyshev (Mean, Sd) UCL	17.21825

Data File	C:\Documents and Settings\Administrator\De	Variable:	Vinyl chloride

Raw Statistics		
Number of Valid Samples		40
Number of Unique Samples		9
Minimum	ug/L	0.5
Maximum	ug/L	210
Mean		10.77
Median		0.5
Standard Deviation		34.96881
Variance		1222.818
Coefficient of Variation		3.246872
Skewness		5.059538

Gamma Statistics	
k hat	0.300452
k star (bias corrected)	0.294585
Theta hat	35.84596
Theta star	36.5599
nu hat	24.03618
nu star	23.5668
Approx.Chi Square Value (.05)	13.51801
Adjusted Level of Significance	0.044
Adjusted Chi Square Value	13.23195

Log-transformed Statistics	
Minimum of log data	-0.693147
Maximum of log data	5.347108
Mean of log data	0.082237
Standard Deviation of log data	1.701574
Variance of log data	2.895354

RECOMMENDATION
Data are Non-parametric (0.05)
Use 99% Chebyshev (Mean, Sd) UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.339925
Shapiro-Wilk 5% Critical Value	0.94
Data not normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	20.08576

Gamma Distribution Test	
A-D Test Statistic	10.25683
A-D 5% Critical Value	0.857579
K-S Test Statistic	0.492294
K-S 5% Critical Value	0.151431
Data do not follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	18.77603
Adjusted Gamma UCL	19.18195

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.509527
Shapiro-Wilk 5% Critical Value	0.94
Data not lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	11.23352
95% Chebyshev (MVUE) UCL	11.0044
97.5% Chebyshev (MVUE) UCL	13.92332
99% Chebyshev (MVUE) UCL	19.65697

95% Non-parametric UCLs	
CLT UCL	19.86448
Adj-CLT UCL (Adjusted for skewness)	24.59068
Mod-t UCL (Adjusted for skewness)	20.82296
Jackknife UCL	20.08576
Standard Bootstrap UCL	19.75049
Bootstrap-t UCL	36.97638
Hall's Bootstrap UCL	48.90961
Percentile Bootstrap UCL	21.075
BCA Bootstrap UCL	27.13
95% Chebyshev (Mean, Sd) UCL	34.87059
97.5% Chebyshev (Mean, Sd) UCL	45.29893
99% Chebyshev (Mean, Sd) UCL	65.78339

Data File	C:\Documents and Settings\Administrator\De	Variable:	p,m-Xylenes

Raw Statistics			
Number of Valid Samples			40
Number of Unique Samples			6
Minimum	ug/L		0.5
Maximum	ug/L		5.1
Mean			1.1475
Median			1
Standard Deviation			0.941082
Variance			0.885635
Coefficient of Variation			0.820115
Skewness			3.795167

Gamma Statistics	
k hat	3.427729
k star (bias corrected)	3.187316
Theta hat	0.33477
Theta star	0.360021
nu hat	274.2183
nu star	254.9853
Approx.Chi Square Value (.05)	219.0043
Adjusted Level of Significance	0.044
Adjusted Chi Square Value	217.7583

Log-transformed Statistics	
Minimum of log data	-0.693147
Maximum of log data	1.629241
Mean of log data	-0.015318
Standard Deviation of log data	0.483072
Variance of log data	0.233358

RECOMMENDATION
Data are Non-parametric (0.05)
Use Student's-t UCL
or Modified-t UCL

Normal Distribution Test	
Shapiro-Wilk Test Statisitic	0.423539
Shapiro-Wilk 5% Critical Value	0.94
Data not normal at 5% significance level	
95% UCL (Assuming Normal Distribution)	
Student's-t UCL	1.398206

Gamma Distribution Test	
A-D Test Statistic	6.960493
A-D 5% Critical Value	0.75377
K-S Test Statistic	0.426295
K-S 5% Critical Value	0.140292
Data do not follow gamma distribution	
at 5% significance level	
95% UCLs (Assuming Gamma Distribution)	
Approximate Gamma UCL	1.336027
Adjusted Gamma UCL	1.343672

Lognormal Distribution Test	
Shapiro-Wilk Test Statisitic	0.652987
Shapiro-Wilk 5% Critical Value	0.94
Data not lognormal at 5% significance level	
95% UCLs (Assuming Lognormal Distribution)	
95% H-UCL	1.281133
95% Chebyshev (MVUE) UCL	1.486847
97.5% Chebyshev (MVUE) UCL	1.652892
99% Chebyshev (MVUE) UCL	1.979054

95% Non-parametric UCLs	
CLT UCL	1.392251
Adj-CLT UCL (Adjusted for skewness)	1.487658
Mod-t UCL (Adjusted for skewness)	1.413088
Jackknife UCL	1.398206
Standard Bootstrap UCL	1.388166
Bootstrap-t UCL	1.982422
Hall's Bootstrap UCL	2.862803
Percentile Bootstrap UCL	1.41
BCA Bootstrap UCL	1.485
95% Chebyshev (Mean, Sd) UCL	1.796096
97.5% Chebyshev (Mean, Sd) UCL	2.076744
99% Chebyshev (Mean, Sd) UCL	2.628022

Data File	C:\Documents and Settings\Administrator\De	Variable:	Total Xylenes

Raw Statistics		Normal Distribution Test	
Number of Valid Samples	38	Shapiro-Wilk Test Statisitic	0.267574
Number of Unique Samples	4	Shapiro-Wilk 5% Critical Value	0.938
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	6.4		
Mean	0.786842	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	1.111864
Standard Deviation	1.187587		
Variance	1.410363	Gamma Distribution Test	
Coefficient of Variation	1.509308	A-D Test Statistic	13.04017
Skewness	4.272257	A-D 5% Critical Value	0.762359
		K-S Test Statistic	0.539371
Gamma Statistics		K-S 5% Critical Value	0.145358
k hat	1.774493	Data do not follow gamma distribution	
k star (bias corrected)	1.651945	at 5% significance level	
Theta hat	0.443418		
Theta star	0.476312	95% UCLs (Assuming Gamma Distribution)	
nu hat	134.8615	Approximate Gamma UCL	0.981346
nu star	125.5478	Adjusted Gamma UCL	0.990418
Approx.Chi Square Value (.05)	100.6641		
Adjusted Level of Significance	0.0434	Lognormal Distribution Test	
Adjusted Chi Square Value	99.74208	Shapiro-Wilk Test Statisitic	0.291283
		Shapiro-Wilk 5% Critical Value	0.938
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	1.856298	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.547221	95% H-UCL	0.807831
Standard Deviation of log data	0.556845	95% Chebyshev (MVUE) UCL	0.952542
Variance of log data	0.310077	97.5% Chebyshev (MVUE) UCL	1.073742
		99% Chebyshev (MVUE) UCL	1.311816
		95% Non-parametric UCLs	
		CLT UCL	1.103727
		Adj-CLT UCL (Adjusted for skewness)	1.246392
		Mod-t UCL (Adjusted for skewness)	1.134117
		Jackknife UCL	1.111864
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	1.626593
		97.5% Chebyshev (Mean, Sd) UCL	1.989954
		99% Chebyshev (Mean, Sd) UCL	2.703706

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
1,1-Dichloroethane			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.72228
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	2.5		
Mean	1.02	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	1.846761
Standard Deviation	0.867179		
Variance	0.752	Gamma Distribution Test	
Coefficient of Variation	0.850176	A-D Test Statistic	0.712449
Skewness	1.802125	A-D 5% Critical Value	0.683912
		K-S Test Statistic	0.368348
Gamma Statistics		K-S 5% Critical Value	0.36016
k hat	2.295356	Data do not follow gamma distribution	
k star (bias corrected)	1.051476	at 5% significance level	
Theta hat	0.444376		
Theta star	0.970065	95% UCLs (Assuming Gamma Distribution)	
nu hat	22.95356	Approximate Gamma UCL	2.514598
nu star	10.51476	Adjusted Gamma UCL	3.953803
Approx.Chi Square Value (.05)	4.265115		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	2.712591	Shapiro-Wilk Test Statisitic	0.769804
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	0.916291	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.213568	95% H-UCL	3.990647
Standard Deviation of log data	0.717979	95% Chebyshev (MVUE) UCL	2.338856
Variance of log data	0.515494	97.5% Chebyshev (MVUE) UCL	2.924199
		99% Chebyshev (MVUE) UCL	4.073992
		95% Non-parametric UCLs	
		CLT UCL	1.657898
		Adj-CLT UCL (Adjusted for skewness)	1.991866
		Mod-t UCL (Adjusted for skewness)	1.898853
		Jackknife UCL	1.846761
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are lognormal (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use H-UCL		95% Chebyshev (Mean, Sd) UCL	2.710444
		97.5% Chebyshev (Mean, Sd) UCL	3.4419
		99% Chebyshev (Mean, Sd) UCL	4.878704
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
1,2,4-Trimethylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.610644
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	23		
Mean	5.4	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	14.81639
Standard Deviation	9.87674		
Variance	97.55	Gamma Distribution Test	
Coefficient of Variation	1.829026	A-D Test Statistic	0.810526
Skewness	2.194502	A-D 5% Critical Value	0.71198
		K-S Test Statistic	0.357135
Gamma Statistics		K-S 5% Critical Value	0.37192
k hat	0.492767	Data follow approximate gamma distibution	
k star (bias corrected)	0.33044	at 5% significance level	
Theta hat	10.95852		
Theta star	16.34184	95% UCLs (Assuming Gamma Distribution)	
nu hat	4.927673	Approximate Gamma UCL	38.14216
nu star	3.304402	Adjusted Gamma UCL	100.3606
Approx.Chi Square Value (.05)	0.467823		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.177797	Shapiro-Wilk Test Statisitic	0.758916
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	3.135494	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.394469	95% H-UCL	4916.518
Standard Deviation of log data	1.683318	95% Chebyshev (MVUE) UCL	15.22277
Variance of log data	2.833561	97.5% Chebyshev (MVUE) UCL	20.10694
		99% Chebyshev (MVUE) UCL	29.70094
		95% Non-parametric UCLs	
		CLT UCL	12.66534
		Adj-CLT UCL (Adjusted for skewness)	17.29725
		Mod-t UCL (Adjusted for skewness)	15.53887
		Jackknife UCL	14.81639
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Assuming gamma distribution (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Adjusted Gamma UCL		95% Chebyshev (Mean, Sd) UCL	24.65331
		97.5% Chebyshev (Mean, Sd) UCL	32.98423
		99% Chebyshev (Mean, Sd) UCL	49.34872
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
1,3,5-Trimethylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.738536
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	6.3		
Mean	2.06	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	4.465871
Standard Deviation	2.52349		
Variance	6.368	Gamma Distribution Test	
Coefficient of Variation	1.224995	A-D Test Statistic	0.690274
Skewness	1.683329	A-D 5% Critical Value	0.691762
		K-S Test Statistic	0.381115
Gamma Statistics		K-S 5% Critical Value	0.364548
k hat	0.984736	Data follow approximate gamma distibution	
k star (bias corrected)	0.527228	at 5% significance level	
Theta hat	2.091931		
Theta star	3.90723	95% UCLs (Assuming Gamma Distribution)	
nu hat	9.84736	Approximate Gamma UCL	8.487754
nu star	5.272277	Adjusted Gamma UCL	17.78505
Approx.Chi Square Value (.05)	1.279595		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.610675	Shapiro-Wilk Test Statisitic	0.770017
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	1.84055	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.13548	95% H-UCL	66.2772
Standard Deviation of log data	1.180762	95% Chebyshev (MVUE) UCL	6.05679
Variance of log data	1.394199	97.5% Chebyshev (MVUE) UCL	7.849352
		99% Chebyshev (MVUE) UCL	11.37049
		95% Non-parametric UCLs	
		CLT UCL	3.916281
		Adj-CLT UCL (Adjusted for skewness)	4.824062
		Mod-t UCL (Adjusted for skewness)	4.607466
		Jackknife UCL	4.465871
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Assuming gamma distribution (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	6.979187
		97.5% Chebyshev (Mean, Sd) UCL	9.107723
		99% Chebyshev (Mean, Sd) UCL	13.28882
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
sec-Butylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.73825
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	73		
Mean	24.3	95% UCL (Assuming Normal Distribution)	
Median	16	Student's-t UCL	51.03236
Standard Deviation	28.03926		
Variance	786.2	Gamma Distribution Test	
Coefficient of Variation	1.153879	A-D Test Statistic	0.528944
Skewness	1.895878	A-D 5% Critical Value	0.698636
		K-S Test Statistic	0.325765
Gamma Statistics		K-S 5% Critical Value	0.36682
k hat	0.742405	Data follow gamma distribution	
k star (bias corrected)	0.430295	at 5% significance level	
Theta hat	32.73147		
Theta star	56.47285	95% UCLs (Assuming Gamma Distribution)	
nu hat	7.424049	Approximate Gamma UCL	123.8023
nu star	4.302953	Adjusted Gamma UCL	289.2632
Approx.Chi Square Value (.05)	0.844587		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.361476	Shapiro-Wilk Test Statisitic	0.809214
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	4.290459	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.383016	95% H-UCL	171357.4
Standard Deviation of log data	1.840952	95% Chebyshev (MVUE) UCL	137.2949
Variance of log data	3.389105	97.5% Chebyshev (MVUE) UCL	182.0377
		99% Chebyshev (MVUE) UCL	269.9263
		95% Non-parametric UCLs	
		CLT UCL	44.9257
		Adj-CLT UCL (Adjusted for skewness)	56.28594
		Mod-t UCL (Adjusted for skewness)	52.80433
		Jackknife UCL	51.03236
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	78.95858
		97.5% Chebyshev (Mean, Sd) UCL	102.6094
		99% Chebyshev (Mean, Sd) UCL	149.0668
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
Benzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.967269
Number of Unique Samples	5	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	1.3	Data are normal at 5% significance level	
Maximum ug/L	3.6		
Mean	2.34	95% UCL (Assuming Normal Distribution)	
Median	2.3	Student's-t UCL	3.139371
Standard Deviation	0.838451		
Variance	0.703	Gamma Distribution Test	
Coefficient of Variation	0.358312	A-D Test Statistic	0.216735
Skewness	0.593963	A-D 5% Critical Value	0.679029
		K-S Test Statistic	0.1766
Gamma Statistics		K-S 5% Critical Value	0.357649
k hat	9.593712	Data follow gamma distribution	
k star (bias corrected)	3.970818	at 5% significance level	
Theta hat	0.24391		
Theta star	0.589299	95% UCLs (Assuming Gamma Distribution)	
nu hat	95.93712	Approximate Gamma UCL	3.537113
nu star	39.70818	Adjusted Gamma UCL	4.298851
Approx.Chi Square Value (.05)	26.26921		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	21.61442	Shapiro-Wilk Test Statisitic	0.977515
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	0.262364		
Maximum of log data	1.280934	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.797129	95% H-UCL	3.820597
Standard Deviation of log data	0.369572	95% Chebyshev (MVUE) UCL	4.022263
Variance of log data	0.136583	97.5% Chebyshev (MVUE) UCL	4.749043
		99% Chebyshev (MVUE) UCL	6.17666
		95% Non-parametric UCLs	
		CLT UCL	2.956765
		Adj-CLT UCL (Adjusted for skewness)	3.063191
		Mod-t UCL (Adjusted for skewness)	3.155971
		Jackknife UCL	3.139371
		Standard Bootstrap UCL	2.906151
		Bootstrap-t UCL	3.291408
RECOMMENDATION		Hall's Bootstrap UCL	3.643625
Data are normal (0.05)		Percentile Bootstrap UCL	2.9
		BCA Bootstrap UCL	2.88
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	3.974442
		97.5% Chebyshev (Mean, Sd) UCL	4.681666
		99% Chebyshev (Mean, Sd) UCL	6.070871

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
cis-1,2-dichloroethene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.754302
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	5.5		
Mean	1.9	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	3.988774
Standard Deviation	2.19089		
Variance	4.8	Gamma Distribution Test	
Coefficient of Variation	1.1531	A-D Test Statistic	0.695572
Skewness	1.530961	A-D 5% Critical Value	0.690616
		K-S Test Statistic	0.383993
Gamma Statistics		K-S 5% Critical Value	0.364009
k hat	1.07313	Data do not follow gamma distribution	
k star (bias corrected)	0.562585	at 5% significance level	
Theta hat	1.770522		
Theta star	3.377266	95% UCLs (Assuming Gamma Distribution)	
nu hat	10.7313	Approximate Gamma UCL	7.365277
nu star	5.625852	Adjusted Gamma UCL	14.92609
Approx.Chi Square Value (.05)	1.451285		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.716137	Shapiro-Wilk Test Statisitic	0.765986
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	1.704748	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.108319	95% H-UCL	47.0805
Standard Deviation of log data	1.132304	95% Chebyshev (MVUE) UCL	5.533394
Variance of log data	1.282112	97.5% Chebyshev (MVUE) UCL	7.152119
		99% Chebyshev (MVUE) UCL	10.33179
		95% Non-parametric UCLs	
		CLT UCL	3.511621
		Adj-CLT UCL (Adjusted for skewness)	4.228416
		Mod-t UCL (Adjusted for skewness)	4.100579
		Jackknife UCL	3.988774
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are lognormal (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use 95% Chebyshev (MVUE) UCL		95% Chebyshev (Mean, Sd) UCL	6.170831
		97.5% Chebyshev (Mean, Sd) UCL	8.018823
		99% Chebyshev (Mean, Sd) UCL	11.64885
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
Cymene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.905289
Number of Unique Samples	4	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	1.4	Data are normal at 5% significance level	
Maximum ug/L	4.1		
Mean	3.06	95% UCL (Assuming Normal Distribution)	
Median	3.2	Student's-t UCL	4.152454
Standard Deviation	1.145862		
Variance	1.313	Gamma Distribution Test	
Coefficient of Variation	0.374465	A-D Test Statistic	0.379241
Skewness	-0.691651	A-D 5% Critical Value	0.679897
		K-S Test Statistic	0.228375
Gamma Statistics		K-S 5% Critical Value	0.35799
k hat	7.221025	Data follow gamma distribution	
k star (bias corrected)	3.021743	at 5% significance level	
Theta hat	0.423763		
Theta star	1.01266	95% UCLs (Assuming Gamma Distribution)	
nu hat	72.21025	Approximate Gamma UCL	4.954791
nu star	30.21743	Adjusted Gamma UCL	6.233127
Approx.Chi Square Value (.05)	18.66181		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	14.8345	Shapiro-Wilk Test Statisitic	0.867957
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	0.336472		
Maximum of log data	1.410987	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.047578	95% H-UCL	5.874238
Standard Deviation of log data	0.447325	95% Chebyshev (MVUE) UCL	5.756066
Variance of log data	0.200099	97.5% Chebyshev (MVUE) UCL	6.911804
		99% Chebyshev (MVUE) UCL	9.182028
		95% Non-parametric UCLs	
		CLT UCL	3.902897
		Adj-CLT UCL (Adjusted for skewness)	3.73353
		Mod-t UCL (Adjusted for skewness)	4.126036
		Jackknife UCL	4.152454
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are normal (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	5.293696
		97.5% Chebyshev (Mean, Sd) UCL	6.260219
		99% Chebyshev (Mean, Sd) UCL	8.158765
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
Ethylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.632162
Number of Unique Samples	4	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	21		
Mean	5.2	95% UCL (Assuming Normal Distribution)	
Median	1.5	Student's-t UCL	13.65781
Standard Deviation	8.871302		
Variance	78.7	Gamma Distribution Test	
Coefficient of Variation	1.70602	A-D Test Statistic	0.59794
Skewness	2.188055	A-D 5% Critical Value	0.706454
		K-S Test Statistic	0.318271
Gamma Statistics		K-S 5% Critical Value	0.369865
k hat	0.58863	Data follow gamma distribution	
k star (bias corrected)	0.368785	at 5% significance level	
Theta hat	8.834077		
Theta star	14.10035	95% UCLs (Assuming Gamma Distribution)	
nu hat	5.886297	Approximate Gamma UCL	31.84739
nu star	3.687852	Adjusted Gamma UCL	80.40219
Approx.Chi Square Value (.05)	0.602148		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.238511	Shapiro-Wilk Test Statisitic	0.872362
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	3.044522	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.595997	95% H-UCL	1608.166
Standard Deviation of log data	1.537689	95% Chebyshev (MVUE) UCL	15.34618
Variance of log data	2.364488	97.5% Chebyshev (MVUE) UCL	20.18371
		99% Chebyshev (MVUE) UCL	29.68609
		95% Non-parametric UCLs	
		CLT UCL	11.72574
		Adj-CLT UCL (Adjusted for skewness)	15.8739
		Mod-t UCL (Adjusted for skewness)	14.30484
		Jackknife UCL	13.65781
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	22.49335
		97.5% Chebyshev (Mean, Sd) UCL	29.9762
		99% Chebyshev (Mean, Sd) UCL	44.6748
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
Isopropylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.923301
Number of Unique Samples	5	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	1.9	Data are normal at 5% significance level	
Maximum ug/L	150		
Mean	79.18	95% UCL (Assuming Normal Distribution)	
Median	83	Student's-t UCL	129.3265
Standard Deviation	52.59812		
Variance	2766.562	Gamma Distribution Test	
Coefficient of Variation	0.664285	A-D Test Statistic	0.785127
Skewness	-0.30362	A-D 5% Critical Value	0.692403
		K-S Test Statistic	0.415148
Gamma Statistics		K-S 5% Critical Value	0.364758
k hat	0.961557	Data do not follow gamma distribution	
k star (bias corrected)	0.517956	at 5% significance level	
Theta hat	82.34561		
Theta star	152.8701	95% UCLs (Assuming Gamma Distribution)	
nu hat	9.615571	Approximate Gamma UCL	331.9113
nu star	5.179562	Adjusted Gamma UCL	701.9856
Approx.Chi Square Value (.05)	1.235624		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.584225	Shapiro-Wilk Test Statisitic	0.689104
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.641854		
Maximum of log data	5.010635	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	3.768633	95% H-UCL	329029.7
Standard Deviation of log data	1.768724	95% Chebyshev (MVUE) UCL	498.1905
Variance of log data	3.128383	97.5% Chebyshev (MVUE) UCL	659.4538
		99% Chebyshev (MVUE) UCL	976.2242
		95% Non-parametric UCLs	
		CLT UCL	117.8712
		Adj-CLT UCL (Adjusted for skewness)	114.4584
		Mod-t UCL (Adjusted for skewness)	128.7942
		Jackknife UCL	129.3265
		Standard Bootstrap UCL	113.8087
		Bootstrap-t UCL	117.029
RECOMMENDATION		Hall's Bootstrap UCL	118.4894
Data are normal (0.05)		Percentile Bootstrap UCL	111.6
		BCA Bootstrap UCL	108.8
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	181.7126
		97.5% Chebyshev (Mean, Sd) UCL	226.0785
		99% Chebyshev (Mean, Sd) UCL	313.2268

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
MTBE			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	4	Shapiro-Wilk Test Statisitic	0.818999
Number of Unique Samples	4	Shapiro-Wilk 5% Critical Value	0.748
Minimum ug/L	1.9	Data are normal at 5% significance level	
Maximum ug/L	8.9		
Mean	4.325	95% UCL (Assuming Normal Distribution)	
Median	3.25	Student's-t UCL	7.99903
Standard Deviation	3.122366		
Variance	9.749167	Gamma Distribution Test	
Coefficient of Variation	0.721934	A-D Test Statistic	0.386492
Skewness	1.721598	A-D 5% Critical Value	0.659354
		K-S Test Statistic	0.316227
Gamma Statistics		K-S 5% Critical Value	0.396518
k hat	3.10494	Data follow gamma distribution	
k star (bias corrected)	0.942902	at 5% significance level	
Theta hat	1.392942		
Theta star	4.586905	95% UCLs (Assuming Gamma Distribution)	
nu hat	24.83952	Approximate Gamma UCL	13.19333
nu star	7.543213	Adjusted Gamma UCL	N/A
Approx.Chi Square Value (.05)	2.472794		
Adjusted Level of Significance	N/A	Lognormal Distribution Test	
Adjusted Chi Square Value	N/A	Shapiro-Wilk Test Statisitic	0.937106
		Shapiro-Wilk 5% Critical Value	0.748
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	0.641854		
Maximum of log data	2.186051	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.29482	95% H-UCL	41.8049
Standard Deviation of log data	0.648312	95% Chebyshev (MVUE) UCL	10.07746
Variance of log data	0.420308	97.5% Chebyshev (MVUE) UCL	12.59749
		99% Chebyshev (MVUE) UCL	17.54759
		95% Non-parametric UCLs	
		CLT UCL	6.892917
		Adj-CLT UCL (Adjusted for skewness)	8.328856
		Mod-t UCL (Adjusted for skewness)	8.223008
		Jackknife UCL	7.99903
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are normal (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	11.13004
		97.5% Chebyshev (Mean, Sd) UCL	14.07458
		99% Chebyshev (Mean, Sd) UCL	19.85857

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
Naphthalene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.826411
Number of Unique Samples	5	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	1.6	Data are normal at 5% significance level	
Maximum ug/L	47		
Mean	23.02	95% UCL (Assuming Normal Distribution)	
Median	16	Student's-t UCL	44.09299
Standard Deviation	22.10321		
Variance	488.552	Gamma Distribution Test	
Coefficient of Variation	0.960174	A-D Test Statistic	0.36819
Skewness	0.362655	A-D 5% Critical Value	0.694162
		K-S Test Statistic	0.259351
Gamma Statistics		K-S 5% Critical Value	0.365333
k hat	0.897904	Data follow gamma distribution	
k star (bias corrected)	0.492495	at 5% significance level	
Theta hat	25.63749		
Theta star	46.7416	95% UCLs (Assuming Gamma Distribution)	
nu hat	8.979038	Approximate Gamma UCL	101.4721
nu star	4.924949	Adjusted Gamma UCL	220.4405
Approx.Chi Square Value (.05)	1.117276		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.514299	Shapiro-Wilk Test Statisitic	0.89824
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	0.470004		
Maximum of log data	3.850148	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.485092	95% H-UCL	6575.066
Standard Deviation of log data	1.481058	95% Chebyshev (MVUE) UCL	94.16625
Variance of log data	2.193532	97.5% Chebyshev (MVUE) UCL	123.6162
		99% Chebyshev (MVUE) UCL	181.465
		95% Non-parametric UCLs	
		CLT UCL	39.27914
		Adj-CLT UCL (Adjusted for skewness)	40.99215
		Mod-t UCL (Adjusted for skewness)	44.36019
		Jackknife UCL	44.09299
		Standard Bootstrap UCL	37.81842
		Bootstrap-t UCL	67.74616
RECOMMENDATION		Hall's Bootstrap UCL	61.95532
Data are normal (0.05)		Percentile Bootstrap UCL	38.1
		BCA Bootstrap UCL	38.1
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	66.10709
		97.5% Chebyshev (Mean, Sd) UCL	84.75091
		99% Chebyshev (Mean, Sd) UCL	121.3731

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
o-Xylene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.698863
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	2.6		
Mean	1.32	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	2.391027
Standard Deviation	1.123388		
Variance	1.262	Gamma Distribution Test	
Coefficient of Variation	0.851051	A-D Test Statistic	0.919091
Skewness	0.613099	A-D 5% Critical Value	0.685558
		K-S Test Statistic	0.394665
Gamma Statistics		K-S 5% Critical Value	0.361155
k hat	1.714377	Data do not follow gamma distribution	
k star (bias corrected)	0.819084	at 5% significance level	
Theta hat	0.769959		
Theta star	1.611556	95% UCLs (Assuming Gamma Distribution)	
nu hat	17.14377	Approximate Gamma UCL	3.799882
nu star	8.19084	Adjusted Gamma UCL	6.514934
Approx.Chi Square Value (.05)	2.845328		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	1.659558	Shapiro-Wilk Test Statisitic	0.691427
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	0.955511	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.041528	95% H-UCL	10.38391
Standard Deviation of log data	0.892374	95% Chebyshev (MVUE) UCL	3.48647
Variance of log data	0.796332	97.5% Chebyshev (MVUE) UCL	4.432938
		99% Chebyshev (MVUE) UCL	6.29209
		95% Non-parametric UCLs	
		CLT UCL	2.146365
		Adj-CLT UCL (Adjusted for skewness)	2.293552
		Mod-t UCL (Adjusted for skewness)	2.413985
		Jackknife UCL	2.391027
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	3.509886
		97.5% Chebyshev (Mean, Sd) UCL	4.457451
		99% Chebyshev (Mean, Sd) UCL	6.31876
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
n-Propylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.78365
Number of Unique Samples	5	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data are normal at 5% significance level	
Maximum ug/L	72		
Mean	22.78	95% UCL (Assuming Normal Distribution)	
Median	10	Student's-t UCL	50.0058
Standard Deviation	28.55682		
Variance	815.492	Gamma Distribution Test	
Coefficient of Variation	1.253592	A-D Test Statistic	0.262755
Skewness	1.855364	A-D 5% Critical Value	0.701464
		K-S Test Statistic	0.215076
Gamma Statistics		K-S 5% Critical Value	0.367922
k hat	0.686786	Data follow gamma distribution	
k star (bias corrected)	0.408048	at 5% significance level	
Theta hat	33.16898		
Theta star	55.82679	95% UCLs (Assuming Gamma Distribution)	
nu hat	6.867863	Approximate Gamma UCL	123.3705
nu star	4.080478	Adjusted Gamma UCL	296.4451
Approx.Chi Square Value (.05)	0.753448		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.31356	Shapiro-Wilk Test Statisitic	0.913012
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	4.276666	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.243571	95% H-UCL	141205.3
Standard Deviation of log data	1.835721	95% Chebyshev (MVUE) UCL	118.5895
Variance of log data	3.369872	97.5% Chebyshev (MVUE) UCL	157.2184
		99% Chebyshev (MVUE) UCL	233.0974
		95% Non-parametric UCLs	
		CLT UCL	43.78642
		Adj-CLT UCL (Adjusted for skewness)	55.1091
		Mod-t UCL (Adjusted for skewness)	51.77191
		Jackknife UCL	50.0058
		Standard Bootstrap UCL	41.2871
		Bootstrap-t UCL	122.0168
RECOMMENDATION		Hall's Bootstrap UCL	170.2002
Data are normal (0.05)		Percentile Bootstrap UCL	45.3
		BCA Bootstrap UCL	49.48
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	78.44749
		97.5% Chebyshev (Mean, Sd) UCL	102.5349
		99% Chebyshev (Mean, Sd) UCL	149.8498

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
tert-Butylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.693357
Number of Unique Samples	4	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	9.4		
Mean	2.78	95% UCL (Assuming Normal Distribution)	
Median	1.6	Student's-t UCL	6.359597
Standard Deviation	3.754597		
Variance	14.097	Gamma Distribution Test	
Coefficient of Variation	1.350575	A-D Test Statistic	0.504704
Skewness	2.078968	A-D 5% Critical Value	0.693388
		K-S Test Statistic	0.294104
Gamma Statistics		K-S 5% Critical Value	0.36508
k hat	0.925892	Data follow gamma distribution	
k star (bias corrected)	0.50369	at 5% significance level	
Theta hat	3.002509		
Theta star	5.519264	95% UCLs (Assuming Gamma Distribution)	
nu hat	9.258924	Approximate Gamma UCL	11.9796
nu star	5.036903	Adjusted Gamma UCL	25.71417
Approx.Chi Square Value (.05)	1.16887		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.544548	Shapiro-Wilk Test Statisitic	0.883684
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	2.24071	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.393255	95% H-UCL	103.2917
Standard Deviation of log data	1.208441	95% Chebyshev (MVUE) UCL	8.126323
Variance of log data	1.46033	97.5% Chebyshev (MVUE) UCL	10.54643
		99% Chebyshev (MVUE) UCL	15.30026
		95% Non-parametric UCLs	
		CLT UCL	5.541885
		Adj-CLT UCL (Adjusted for skewness)	7.209983
		Mod-t UCL (Adjusted for skewness)	6.619787
		Jackknife UCL	6.359597
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data follow gamma distribution (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Approximate Gamma UCL		95% Chebyshev (Mean, Sd) UCL	10.09906
		97.5% Chebyshev (Mean, Sd) UCL	13.26602
		99% Chebyshev (Mean, Sd) UCL	19.4869
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
Tetrachloroethene (PCE)			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.711961
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	2.7		
Mean	1.34	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	2.438677
Standard Deviation	1.152389		
Variance	1.328	Gamma Distribution Test	
Coefficient of Variation	0.859992	A-D Test Statistic	0.897336
Skewness	0.62573	A-D 5% Critical Value	0.685699
		K-S Test Statistic	0.394573
Gamma Statistics		K-S 5% Critical Value	0.361243
k hat	1.67802	Data do not follow gamma distribution	
k star (bias corrected)	0.804541	at 5% significance level	
Theta hat	0.79856		
Theta star	1.665545	95% UCLs (Assuming Gamma Distribution)	
nu hat	16.7802	Approximate Gamma UCL	3.905171
nu star	8.045413	Adjusted Gamma UCL	6.741958
Approx.Chi Square Value (.05)	2.760661		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	1.599069	Shapiro-Wilk Test Statisitic	0.69825
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	0.993252	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.03398	95% H-UCL	11.03768
Standard Deviation of log data	0.903012	95% Chebyshev (MVUE) UCL	3.561787
Variance of log data	0.815431	97.5% Chebyshev (MVUE) UCL	4.532646
		99% Chebyshev (MVUE) UCL	6.439709
		95% Non-parametric UCLs	
		CLT UCL	2.187698
		Adj-CLT UCL (Adjusted for skewness)	2.341796
		Mod-t UCL (Adjusted for skewness)	2.462713
		Jackknife UCL	2.438677
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	3.586419
		97.5% Chebyshev (Mean, Sd) UCL	4.558447
		99% Chebyshev (Mean, Sd) UCL	6.467807
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
trans-1,2-dichloroethene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.759983
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	5.2		
Mean	1.84	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	3.811929
Standard Deviation	2.068333		
Variance	4.278	Gamma Distribution Test	
Coefficient of Variation	1.124094	A-D Test Statistic	0.700038
Skewness	1.459892	A-D 5% Critical Value	0.690228
		K-S Test Statistic	0.385158
Gamma Statistics		K-S 5% Critical Value	0.363794
k hat	1.11236	Data do not follow gamma distribution	
k star (bias corrected)	0.578277	at 5% significance level	
Theta hat	1.654141		
Theta star	3.181864	95% UCLs (Assuming Gamma Distribution)	
nu hat	11.1236	Approximate Gamma UCL	6.957154
nu star	5.782773	Adjusted Gamma UCL	13.90575
Approx.Chi Square Value (.05)	1.529405		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.765173	Shapiro-Wilk Test Statisitic	0.763739
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	1.648659	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.097102	95% H-UCL	41.13074
Standard Deviation of log data	1.112641	95% Chebyshev (MVUE) UCL	5.33323
Variance of log data	1.23797	97.5% Chebyshev (MVUE) UCL	6.885626
		99% Chebyshev (MVUE) UCL	9.935006
		95% Non-parametric UCLs	
		CLT UCL	3.361467
		Adj-CLT UCL (Adjusted for skewness)	4.006752
		Mod-t UCL (Adjusted for skewness)	3.91258
		Jackknife UCL	3.811929
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are lognormal (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use 95% Chebyshev (MVUE) UCL		95% Chebyshev (Mean, Sd) UCL	5.871923
		97.5% Chebyshev (Mean, Sd) UCL	7.616539
		99% Chebyshev (Mean, Sd) UCL	11.0435
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
Trichloroethylene (TCE)			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.754302
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	2.5		
Mean	1.06	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	1.89551
Standard Deviation	0.876356		
Variance	0.768	Gamma Distribution Test	
Coefficient of Variation	0.826751	A-D Test Statistic	0.692325
Skewness	1.530961	A-D 5% Critical Value	0.683996
		K-S Test Statistic	0.378404
Gamma Statistics		K-S 5% Critical Value	0.360208
k hat	2.249624	Data do not follow gamma distribution	
k star (bias corrected)	1.033183	at 5% significance level	
Theta hat	0.47119		
Theta star	1.025956	95% UCLs (Assuming Gamma Distribution)	
nu hat	22.49624	Approximate Gamma UCL	2.639391
nu star	10.33183	Adjusted Gamma UCL	4.172968
Approx.Chi Square Value (.05)	4.149343		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	2.624448	Shapiro-Wilk Test Statisitic	0.772806
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	0.916291	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	-0.180157	95% H-UCL	4.502595
Standard Deviation of log data	0.73951	95% Chebyshev (MVUE) UCL	2.487354
Variance of log data	0.546875	97.5% Chebyshev (MVUE) UCL	3.117241
		99% Chebyshev (MVUE) UCL	4.354533
		95% Non-parametric UCLs	
		CLT UCL	1.704648
		Adj-CLT UCL (Adjusted for skewness)	1.991366
		Mod-t UCL (Adjusted for skewness)	1.940232
		Jackknife UCL	1.89551
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Data are lognormal (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use H-UCL		95% Chebyshev (Mean, Sd) UCL	2.768333
		97.5% Chebyshev (Mean, Sd) UCL	3.507529
		99% Chebyshev (Mean, Sd) UCL	4.959538
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
Vinyl chloride			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.889726
Number of Unique Samples	5	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	20	Data are normal at 5% significance level	
Maximum ug/L	69		
Mean	49.8	95% UCL (Assuming Normal Distribution)	
Median	53	Student's-t UCL	67.11132
Standard Deviation	18.15764		
Variance	329.7	Gamma Distribution Test	
Coefficient of Variation	0.364611	A-D Test Statistic	0.591803
Skewness	-1.320989	A-D 5% Critical Value	0.680103
		K-S Test Statistic	0.35564
Gamma Statistics		K-S 5% Critical Value	0.358071
k hat	6.657943	Data follow gamma distribution	
k star (bias corrected)	2.796511	at 5% significance level	
Theta hat	7.479788		
Theta star	17.80791	95% UCLs (Assuming Gamma Distribution)	
nu hat	66.57943	Approximate Gamma UCL	82.41107
nu star	27.96511	Adjusted Gamma UCL	104.8236
Approx.Chi Square Value (.05)	16.89897		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	13.28577	Shapiro-Wilk Test Statisitic	0.78446
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data are lognormal at 5% significance level	
Minimum of log data	2.995732		
Maximum of log data	4.234107	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	3.831041	95% H-UCL	104.064
Standard Deviation of log data	0.482468	95% Chebyshev (MVUE) UCL	97.67331
Variance of log data	0.232775	97.5% Chebyshev (MVUE) UCL	118.0683
		99% Chebyshev (MVUE) UCL	158.1302
		95% Non-parametric UCLs	
		CLT UCL	63.15678
		Adj-CLT UCL (Adjusted for skewness)	58.03089
		Mod-t UCL (Adjusted for skewness)	66.31179
		Jackknife UCL	67.11132
		Standard Bootstrap UCL	61.77628
		Bootstrap-t UCL	61.02133
RECOMMENDATION		Hall's Bootstrap UCL	58.93123
Data are normal (0.05)		Percentile Bootstrap UCL	60.2
		BCA Bootstrap UCL	58.6
Use Student's-t UCL		95% Chebyshev (Mean, Sd) UCL	85.19576
		97.5% Chebyshev (Mean, Sd) UCL	100.5115
		99% Chebyshev (Mean, Sd) UCL	130.5964

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Groundwater Samples
m,p-Xylenes			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	5	Shapiro-Wilk Test Statisitic	0.600314
Number of Unique Samples	3	Shapiro-Wilk 5% Critical Value	0.762
Minimum ug/L	0.5	Data not normal at 5% significance level	
Maximum ug/L	28		
Mean	6.4	95% UCL (Assuming Normal Distribution)	
Median	0.5	Student's-t UCL	17.94154
Standard Deviation	12.10578		
Variance	146.55	Gamma Distribution Test	
Coefficient of Variation	1.891529	A-D Test Statistic	0.833735
Skewness	2.208215	A-D 5% Critical Value	0.717527
		K-S Test Statistic	0.354424
Gamma Statistics		K-S 5% Critical Value	0.373551
k hat	0.453424	Data follow approximate gamma distibution	
k star (bias corrected)	0.314703	at 5% significance level	
Theta hat	14.11483		
Theta star	20.33665	95% UCLs (Assuming Gamma Distribution)	
nu hat	4.534238	Approximate Gamma UCL	48.29006
nu star	3.147028	Adjusted Gamma UCL	128.5422
Approx.Chi Square Value (.05)	0.417083		
Adjusted Level of Significance	0.0086	Lognormal Distribution Test	
Adjusted Chi Square Value	0.156688	Shapiro-Wilk Test Statisitic	0.754259
		Shapiro-Wilk 5% Critical Value	0.762
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	3.332205	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.433811	95% H-UCL	11157.85
Standard Deviation of log data	1.763773	95% Chebyshev (MVUE) UCL	17.62888
Variance of log data	3.110894	97.5% Chebyshev (MVUE) UCL	23.33254
		99% Chebyshev (MVUE) UCL	34.53628
		95% Non-parametric UCLs	
		CLT UCL	15.30503
		Adj-CLT UCL (Adjusted for skewness)	21.01777
		Mod-t UCL (Adjusted for skewness)	18.83261
		Jackknife UCL	17.94154
		Standard Bootstrap UCL	N/R
		Bootstrap-t UCL	N/R
RECOMMENDATION		Hall's Bootstrap UCL	N/R
Assuming gamma distribution (0.05)		Percentile Bootstrap UCL	N/R
		BCA Bootstrap UCL	N/R
Use Adjusted Gamma UCL		95% Chebyshev (Mean, Sd) UCL	29.99852
		97.5% Chebyshev (Mean, Sd) UCL	40.20961
		99% Chebyshev (Mean, Sd) UCL	60.26734
Recommended UCL exceeds the maximum observation			

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
1,1,2,2-Tetrachloroethane			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.487847
Number of Unique Samples	15	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	6.618056	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	13.16455
Standard Deviation	33.33065		
Variance	1110.932	Gamma Distribution Test	
Coefficient of Variation	5.03632	A-D Test Statistic	23.62739
Skewness	8.438865	A-D 5% Critical Value	0.801303
		K-S Test Statistic	0.528551
Gamma Statistics		K-S 5% Critical Value	0.109931
k hat	0.662116	Data do not follow gamma distribution	
k star (bias corrected)	0.643788	at 5% significance level	
Theta hat	9.995305		
Theta star	10.27988	95% UCLs (Assuming Gamma Distribution)	
nu hat	95.34477	Approximate Gamma UCL	8.581155
nu star	92.7054	Adjusted Gamma UCL	8.626924
Approx.Chi Square Value (.05)	71.49731		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	71.11799	Lilliefors Test Statisitic	0.463687
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.969863	95% H-UCL	3.76701
Standard Deviation of log data	0.64434	95% Chebyshev (MVUE) UCL	4.397977
Variance of log data	0.415173	97.5% Chebyshev (MVUE) UCL	4.901244
		99% Chebyshev (MVUE) UCL	5.889814
		95% Non-parametric UCLs	
		CLT UCL	13.07913
		Adj-CLT UCL (Adjusted for skewness)	17.25335
		Mod-t UCL (Adjusted for skewness)	13.81564
		Jackknife UCL	13.16455
		Standard Bootstrap UCL	12.97216
		Bootstrap-t UCL	139.6408
RECOMMENDATION		Hall's Bootstrap UCL	130.3429
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	14.37778
		BCA Bootstrap UCL	22.10486
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	23.74005
		97.5% Chebyshev (Mean, Sd) UCL	31.14875
		99% Chebyshev (Mean, Sd) UCL	45.7017

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
1,1-Dichloroethane			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.487981
Number of Unique Samples	19	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	10.8	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	18.68662
Standard Deviation	40.15373		
Variance	1612.322	Gamma Distribution Test	
Coefficient of Variation	3.717938	A-D Test Statistic	22.40331
Skewness	5.640623	A-D 5% Critical Value	0.816724
		K-S Test Statistic	0.507688
Gamma Statistics		K-S 5% Critical Value	0.111125
k hat	0.504658	Data do not follow gamma distribution	
k star (bias corrected)	0.49289	at 5% significance level	
Theta hat	21.40061		
Theta star	21.91157	95% UCLs (Assuming Gamma Distribution)	
nu hat	72.67082	Approximate Gamma UCL	14.57962
nu star	70.9762	Adjusted Gamma UCL	14.6697
Approx.Chi Square Value (.05)	52.57635		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	52.25349	Lilliefors Test Statisitic	0.461138
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.122717	95% H-UCL	6.173482
Standard Deviation of log data	0.948558	95% Chebyshev (MVUE) UCL	7.507581
Variance of log data	0.899762	97.5% Chebyshev (MVUE) UCL	8.689348
		99% Chebyshev (MVUE) UCL	11.0107
		95% Non-parametric UCLs	
		CLT UCL	18.58372
		Adj-CLT UCL (Adjusted for skewness)	21.94497
		Mod-t UCL (Adjusted for skewness)	19.21091
		Jackknife UCL	18.68662
		Standard Bootstrap UCL	18.43317
		Bootstrap-t UCL	28.68716
RECOMMENDATION		Hall's Bootstrap UCL	20.60495
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	19.31111
		BCA Bootstrap UCL	23.65278
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	31.42702
		97.5% Chebyshev (Mean, Sd) UCL	40.35235
		99% Chebyshev (Mean, Sd) UCL	57.88443

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
1,1-Dichloroethylene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.479077
Number of Unique Samples	17	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	8.427778	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	15.3188
Standard Deviation	35.08475		
Variance	1230.94	Gamma Distribution Test	
Coefficient of Variation	4.16299	A-D Test Statistic	22.74576
Skewness	7.297831	A-D 5% Critical Value	0.809508
		K-S Test Statistic	0.522155
Gamma Statistics		K-S 5% Critical Value	0.110566
k hat	0.578339	Data do not follow gamma distribution	
k star (bias corrected)	0.563501	at 5% significance level	
Theta hat	14.57238		
Theta star	14.9561	95% UCLs (Assuming Gamma Distribution)	
nu hat	83.28084	Approximate Gamma UCL	11.14091
nu star	81.14414	Adjusted Gamma UCL	11.20484
Approx.Chi Square Value (.05)	61.38319		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	61.03297	Lilliefors Test Statisitic	0.470497
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.057325	95% H-UCL	4.974752
Standard Deviation of log data	0.826842	95% Chebyshev (MVUE) UCL	5.969442
Variance of log data	0.683668	97.5% Chebyshev (MVUE) UCL	6.810197
		99% Chebyshev (MVUE) UCL	8.461697
		95% Non-parametric UCLs	
		CLT UCL	15.22888
		Adj-CLT UCL (Adjusted for skewness)	19.02868
		Mod-t UCL (Adjusted for skewness)	15.91149
		Jackknife UCL	15.3188
		Standard Bootstrap UCL	15.08453
		Bootstrap-t UCL	41.67871
RECOMMENDATION		Hall's Bootstrap UCL	45.94582
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	16.39514
		BCA Bootstrap UCL	22.23681
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	26.45086
		97.5% Chebyshev (Mean, Sd) UCL	34.24946
		99% Chebyshev (Mean, Sd) UCL	49.5683

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
1,2,4-Trimethylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.50803
Number of Unique Samples	19	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	6700		
Mean	97.92292	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	252.9137
Standard Deviation	789.1162		
Variance	622704.4	Gamma Distribution Test	
Coefficient of Variation	8.058545	A-D Test Statistic	25.93048
Skewness	8.482144	A-D 5% Critical Value	0.904108
		K-S Test Statistic	0.515137
Gamma Statistics		K-S 5% Critical Value	0.116154
k hat	0.21286	Data do not follow gamma distribution	
k star (bias corrected)	0.21325	at 5% significance level	
Theta hat	460.0351		
Theta star	459.1936	95% UCLs (Assuming Gamma Distribution)	
nu hat	30.65179	Approximate Gamma UCL	157.8633
nu star	30.70797	Adjusted Gamma UCL	159.4357
Approx.Chi Square Value (.05)	19.04821		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	18.86035	Lilliefors Test Statisitic	0.459471
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	8.809863	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.160509	95% H-UCL	8.506396
Standard Deviation of log data	1.144707	95% Chebyshev (MVUE) UCL	10.46509
Variance of log data	1.310354	97.5% Chebyshev (MVUE) UCL	12.37305
		99% Chebyshev (MVUE) UCL	16.12086
		95% Non-parametric UCLs	
		CLT UCL	250.8914
		Adj-CLT UCL (Adjusted for skewness)	350.2246
		Mod-t UCL (Adjusted for skewness)	268.4077
		Jackknife UCL	252.9137
		Standard Bootstrap UCL	254.1515
		Bootstrap-t UCL	18194.36
RECOMMENDATION		Hall's Bootstrap UCL	11148.52
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	283.7097
		BCA Bootstrap UCL	382.3333
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	503.2928
		97.5% Chebyshev (Mean, Sd) UCL	678.6967
		99% Chebyshev (Mean, Sd) UCL	1023.244

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
1,3,5-Trimethylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.470789
Number of Unique Samples	17	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	7.548611	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	14.15641
Standard Deviation	33.6428		
Variance	1131.838	Gamma Distribution Test	
Coefficient of Variation	4.45682	A-D Test Statistic	21.81689
Skewness	8.136405	A-D 5% Critical Value	0.804592
		K-S Test Statistic	0.518428
Gamma Statistics		K-S 5% Critical Value	0.110185
k hat	0.628536	Data do not follow gamma distribution	
k star (bias corrected)	0.611606	at 5% significance level	
Theta hat	12.00983		
Theta star	12.34227	95% UCLs (Assuming Gamma Distribution)	
nu hat	90.5092	Approximate Gamma UCL	9.859099
nu star	88.07131	Adjusted Gamma UCL	9.913182
Approx.Chi Square Value (.05)	67.43173		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	67.06384	Lilliefors Test Statisitic	0.468475
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.044988	95% H-UCL	4.650075
Standard Deviation of log data	0.777964	95% Chebyshev (MVUE) UCL	5.543609
Variance of log data	0.605228	97.5% Chebyshev (MVUE) UCL	6.286204
		99% Chebyshev (MVUE) UCL	7.744886
		95% Non-parametric UCLs	
		CLT UCL	14.0702
		Adj-CLT UCL (Adjusted for skewness)	18.1325
		Mod-t UCL (Adjusted for skewness)	14.79005
		Jackknife UCL	14.15641
		Standard Bootstrap UCL	14.12286
		Bootstrap-t UCL	49.98023
RECOMMENDATION		Hall's Bootstrap UCL	47.33094
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	15.01875
		BCA Bootstrap UCL	20.13542
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	24.83096
		97.5% Chebyshev (Mean, Sd) UCL	32.30904
		99% Chebyshev (Mean, Sd) UCL	46.99829

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Benzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.489766
Number of Unique Samples	15	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	6.465278	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	13.00774
Standard Deviation	33.31013		
Variance	1109.565	Gamma Distribution Test	
Coefficient of Variation	5.152157	A-D Test Statistic	24.11413
Skewness	8.46821	A-D 5% Critical Value	0.800832
		K-S Test Statistic	0.52471
Gamma Statistics		K-S 5% Critical Value	0.109894
k hat	0.666921	Data do not follow gamma distribution	
k star (bias corrected)	0.648392	at 5% significance level	
Theta hat	9.694217		
Theta star	9.971249	95% UCLs (Assuming Gamma Distribution)	
nu hat	96.03663	Approximate Gamma UCL	8.374741
nu star	93.36844	Adjusted Gamma UCL	8.419236
Approx.Chi Square Value (.05)	72.08019		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	71.69925	Lilliefors Test Statisitic	0.455142
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.954074	95% H-UCL	3.602587
Standard Deviation of log data	0.612688	95% Chebyshev (MVUE) UCL	4.18265
Variance of log data	0.375386	97.5% Chebyshev (MVUE) UCL	4.641297
		99% Chebyshev (MVUE) UCL	5.542218
		95% Non-parametric UCLs	
		CLT UCL	12.92237
		Adj-CLT UCL (Adjusted for skewness)	17.10853
		Mod-t UCL (Adjusted for skewness)	13.6607
		Jackknife UCL	13.00774
		Standard Bootstrap UCL	12.70551
		Bootstrap-t UCL	352.7053
RECOMMENDATION		Hall's Bootstrap UCL	171.0412
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	14.31806
		BCA Bootstrap UCL	22.11042
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	23.57673
		97.5% Chebyshev (Mean, Sd) UCL	30.98087
		99% Chebyshev (Mean, Sd) UCL	45.52487

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
sec-Butylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.476735
Number of Unique Samples	37	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	3700		
Mean	63.91944	95% UCL (Assuming Normal Distribution)	
Median	2.75	Student's-t UCL	149.3366
Standard Deviation	434.8908		
Variance	189130	Gamma Distribution Test	
Coefficient of Variation	6.803732	A-D Test Statistic	13.1601
Skewness	8.465041	A-D 5% Critical Value	0.864187
		K-S Test Statistic	0.301176
Gamma Statistics		K-S 5% Critical Value	0.114103
k hat	0.305586	Data do not follow gamma distribution	
k star (bias corrected)	0.302113	at 5% significance level	
Theta hat	209.1699		
Theta star	211.5748	95% UCLs (Assuming Gamma Distribution)	
nu hat	44.00442	Approximate Gamma UCL	94.6585
nu star	43.50424	Adjusted Gamma UCL	95.4289
Approx.Chi Square Value (.05)	29.37683		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	29.13967	Lilliefors Test Statisitic	0.263121
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	8.216088	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.907875	95% H-UCL	27.15413
Standard Deviation of log data	1.384162	95% Chebyshev (MVUE) UCL	33.22192
Variance of log data	1.915905	97.5% Chebyshev (MVUE) UCL	40.18594
		99% Chebyshev (MVUE) UCL	53.86542
		95% Non-parametric UCLs	
		CLT UCL	148.2221
		Adj-CLT UCL (Adjusted for skewness)	202.8554
		Mod-t UCL (Adjusted for skewness)	157.8583
		Jackknife UCL	149.3366
		Standard Bootstrap UCL	148.942
		Bootstrap-t UCL	1799.56
RECOMMENDATION		Hall's Bootstrap UCL	720.2168
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	166.2118
		BCA Bootstrap UCL	222.3431
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	287.3233
		97.5% Chebyshev (Mean, Sd) UCL	383.9904
		99% Chebyshev (Mean, Sd) UCL	573.8741

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Bromodichloromethane			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.498538
Number of Unique Samples	14	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	6.348611	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	12.89033
Standard Deviation	33.30634		
Variance	1109.312	Gamma Distribution Test	
Coefficient of Variation	5.246241	A-D Test Statistic	24.99885
Skewness	8.481816	A-D 5% Critical Value	0.800883
		K-S Test Statistic	0.534211
Gamma Statistics		K-S 5% Critical Value	0.109898
k hat	0.6664	Data do not follow gamma distribution	
k star (bias corrected)	0.647893	at 5% significance level	
Theta hat	9.526725		
Theta star	9.798861	95% UCLs (Assuming Gamma Distribution)	
nu hat	95.96163	Approximate Gamma UCL	8.224499
nu star	93.29656	Adjusted Gamma UCL	8.268214
Approx.Chi Square Value (.05)	72.01698		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	71.63622	Lilliefors Test Statisitic	0.45716
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.93505	95% H-UCL	3.460321
Standard Deviation of log data	0.588439	95% Chebyshev (MVUE) UCL	3.99978
Variance of log data	0.346261	97.5% Chebyshev (MVUE) UCL	4.423572
		99% Chebyshev (MVUE) UCL	5.256029
		95% Non-parametric UCLs	
		CLT UCL	12.80497
		Adj-CLT UCL (Adjusted for skewness)	16.99738
		Mod-t UCL (Adjusted for skewness)	13.54426
		Jackknife UCL	12.89033
		Standard Bootstrap UCL	12.57386
		Bootstrap-t UCL	484.5597
RECOMMENDATION		Hall's Bootstrap UCL	190.3545
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	14.17917
		BCA Bootstrap UCL	18.17292
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	23.45812
		97.5% Chebyshev (Mean, Sd) UCL	30.86142
		99% Chebyshev (Mean, Sd) UCL	45.40376

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
n-Butylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.419722
Number of Unique Samples	23	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	8.730556	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	15.40072
Standard Deviation	33.96033		
Variance	1153.304	Gamma Distribution Test	
Coefficient of Variation	3.889824	A-D Test Statistic	17.27799
Skewness	7.827794	A-D 5% Critical Value	0.804689
		K-S Test Statistic	0.450758
Gamma Statistics		K-S 5% Critical Value	0.110193
k hat	0.62754	Data do not follow gamma distribution	
k star (bias corrected)	0.610652	at 5% significance level	
Theta hat	13.91235		
Theta star	14.29712	95% UCLs (Assuming Gamma Distribution)	
nu hat	90.36573	Approximate Gamma UCL	11.40538
nu star	87.93382	Adjusted Gamma UCL	11.468
Approx.Chi Square Value (.05)	67.31133		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	66.94379	Lilliefors Test Statisitic	0.425318
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.188678	95% H-UCL	6.145855
Standard Deviation of log data	0.893492	95% Chebyshev (MVUE) UCL	7.43299
Variance of log data	0.798328	97.5% Chebyshev (MVUE) UCL	8.548077
		99% Chebyshev (MVUE) UCL	10.73845
		95% Non-parametric UCLs	
		CLT UCL	15.31369
		Adj-CLT UCL (Adjusted for skewness)	19.2588
		Mod-t UCL (Adjusted for skewness)	16.01608
		Jackknife UCL	15.40072
		Standard Bootstrap UCL	15.34354
		Bootstrap-t UCL	36.71956
RECOMMENDATION		Hall's Bootstrap UCL	35.28441
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	16.70903
		BCA Bootstrap UCL	22.36944
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	26.17602
		97.5% Chebyshev (Mean, Sd) UCL	33.72468
		99% Chebyshev (Mean, Sd) UCL	48.55257

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
cis-1,2-dichloroethene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.363188
Number of Unique Samples	44	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	5500		
Mean	349.3354	95% UCL (Assuming Normal Distribution)	
Median	5.25	Student's-t UCL	544.3622
Standard Deviation	992.9543		
Variance	985958.2	Gamma Distribution Test	
Coefficient of Variation	2.842409	A-D Test Statistic	7.131883
Skewness	3.935124	A-D 5% Critical Value	0.8884
		K-S Test Statistic	0.243625
Gamma Statistics		K-S 5% Critical Value	0.115353
k hat	0.248349	Data do not follow gamma distribution	
k star (bias corrected)	0.247261	at 5% significance level	
Theta hat	1406.63		
Theta star	1412.823	95% UCLs (Assuming Gamma Distribution)	
nu hat	35.76228	Approximate Gamma UCL	541.9931
nu star	35.60552	Adjusted Gamma UCL	546.9443
Approx.Chi Square Value (.05)	22.94913		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	22.74138	Lilliefors Test Statisitic	0.269396
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	8.612503	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.992932	95% H-UCL	1497.106
Standard Deviation of log data	2.497257	95% Chebyshev (MVUE) UCL	1199.926
Variance of log data	6.236294	97.5% Chebyshev (MVUE) UCL	1552.984
		99% Chebyshev (MVUE) UCL	2246.5
		95% Non-parametric UCLs	
		CLT UCL	541.8175
		Adj-CLT UCL (Adjusted for skewness)	599.8051
		Mod-t UCL (Adjusted for skewness)	553.4071
		Jackknife UCL	544.3622
		Standard Bootstrap UCL	533.4061
		Bootstrap-t UCL	697.4687
RECOMMENDATION		Hall's Bootstrap UCL	548.6678
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	552.2104
		BCA Bootstrap UCL	604.1007
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	859.4172
		97.5% Chebyshev (Mean, Sd) UCL	1080.13
		99% Chebyshev (Mean, Sd) UCL	1513.678

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Chloroform			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.498521
Number of Unique Samples	14	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	6.347222	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	12.88894
Standard Deviation	33.30636		
Variance	1109.313	Gamma Distribution Test	
Coefficient of Variation	5.247391	A-D Test Statistic	25.00985
Skewness	8.481935	A-D 5% Critical Value	0.800884
		K-S Test Statistic	0.534158
Gamma Statistics		K-S 5% Critical Value	0.109898
k hat	0.666393	Data do not follow gamma distribution	
k star (bias corrected)	0.647886	at 5% significance level	
Theta hat	9.524739		
Theta star	9.796817	95% UCLs (Assuming Gamma Distribution)	
nu hat	95.96064	Approximate Gamma UCL	8.222711
nu star	93.29561	Adjusted Gamma UCL	8.266417
Approx.Chi Square Value (.05)	72.01615		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	71.63539	Lilliefors Test Statisitic	0.457012
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.93482	95% H-UCL	3.458506
Standard Deviation of log data	0.588097	95% Chebyshev (MVUE) UCL	3.997429
Variance of log data	0.345858	97.5% Chebyshev (MVUE) UCL	4.420762
		99% Chebyshev (MVUE) UCL	5.252317
		95% Non-parametric UCLs	
		CLT UCL	12.80359
		Adj-CLT UCL (Adjusted for skewness)	16.99606
		Mod-t UCL (Adjusted for skewness)	13.54288
		Jackknife UCL	12.88894
		Standard Bootstrap UCL	12.84153
		Bootstrap-t UCL	437.6628
RECOMMENDATION		Hall's Bootstrap UCL	190.9606
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	14.17361
		BCA Bootstrap UCL	18.16667
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	23.45674
		97.5% Chebyshev (Mean, Sd) UCL	30.86004
		99% Chebyshev (Mean, Sd) UCL	45.40239

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Cymene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.498327
Number of Unique Samples	23	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	2400		
Mean	38.51181	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	94.037
Standard Deviation	282.6996		
Variance	79919.05	Gamma Distribution Test	
Coefficient of Variation	7.340595	A-D Test Statistic	24.11844
Skewness	8.442864	A-D 5% Critical Value	0.873773
		K-S Test Statistic	0.461138
Gamma Statistics		K-S 5% Critical Value	0.114608
k hat	0.281396	Data do not follow gamma distribution	
k star (bias corrected)	0.27893	at 5% significance level	
Theta hat	136.8598		
Theta star	138.0696	95% UCLs (Assuming Gamma Distribution)	
nu hat	40.52102	Approximate Gamma UCL	58.06054
nu star	40.16598	Adjusted Gamma UCL	58.55522
Approx.Chi Square Value (.05)	26.64227		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	26.41719	Lilliefors Test Statisitic	0.418494
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	7.783224	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.174744	95% H-UCL	7.270969
Standard Deviation of log data	1.030153	95% Chebyshev (MVUE) UCL	8.898723
Variance of log data	1.061216	97.5% Chebyshev (MVUE) UCL	10.39409
		99% Chebyshev (MVUE) UCL	13.33145
		95% Non-parametric UCLs	
		CLT UCL	93.31251
		Adj-CLT UCL (Adjusted for skewness)	128.7337
		Mod-t UCL (Adjusted for skewness)	99.56199
		Jackknife UCL	94.037
		Standard Bootstrap UCL	92.91294
		Bootstrap-t UCL	3729.149
RECOMMENDATION		Hall's Bootstrap UCL	2242.238
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	104.7208
		BCA Bootstrap UCL	170.2764
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	183.7349
		97.5% Chebyshev (Mean, Sd) UCL	246.5731
		99% Chebyshev (Mean, Sd) UCL	370.0064

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Ethylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.451046
Number of Unique Samples	33	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	7900		
Mean	170.0924	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	361.5654
Standard Deviation	974.8609		
Variance	950353.7	Gamma Distribution Test	
Coefficient of Variation	5.731362	A-D Test Statistic	16.73289
Skewness	7.442567	A-D 5% Critical Value	0.901074
		K-S Test Statistic	0.360645
Gamma Statistics		K-S 5% Critical Value	0.115999
k hat	0.219714	Data do not follow gamma distribution	
k star (bias corrected)	0.219819	at 5% significance level	
Theta hat	774.1528		
Theta star	773.7848	95% UCLs (Assuming Gamma Distribution)	
nu hat	31.63884	Approximate Gamma UCL	271.9826
nu star	31.65389	Adjusted Gamma UCL	274.6438
Approx.Chi Square Value (.05)	19.7957		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	19.60388	Lilliefors Test Statisitic	0.349277
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	8.974618	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.836064	95% H-UCL	60.31747
Standard Deviation of log data	1.788198	95% Chebyshev (MVUE) UCL	68.80045
Variance of log data	3.197653	97.5% Chebyshev (MVUE) UCL	85.85652
		99% Chebyshev (MVUE) UCL	119.3599
		95% Non-parametric UCLs	
		CLT UCL	359.067
		Adj-CLT UCL (Adjusted for skewness)	466.7417
		Mod-t UCL (Adjusted for skewness)	378.3604
		Jackknife UCL	361.5654
		Standard Bootstrap UCL	360.512
		Bootstrap-t UCL	2519.605
RECOMMENDATION		Hall's Bootstrap UCL	1673.895
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	379.5285
		BCA Bootstrap UCL	568.6028
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	670.8795
		97.5% Chebyshev (Mean, Sd) UCL	887.5705
		99% Chebyshev (Mean, Sd) UCL	1313.218

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Isopropylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.44633
Number of Unique Samples	39	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	5100		
Mean	91.06181	95% UCL (Assuming Normal Distribution)	
Median	4.575	Student's-t UCL	208.8182
Standard Deviation	599.542		
Variance	359450.6	Gamma Distribution Test	
Coefficient of Variation	6.583902	A-D Test Statistic	11.60692
Skewness	8.445653	A-D 5% Critical Value	0.87023
		K-S Test Statistic	0.263258
Gamma Statistics		K-S 5% Critical Value	0.114427
k hat	0.289399	Data do not follow gamma distribution	
k star (bias corrected)	0.2866	at 5% significance level	
Theta hat	314.6586		
Theta star	317.7317	95% UCLs (Assuming Gamma Distribution)	
nu hat	41.67342	Approximate Gamma UCL	136.4407
nu star	41.27036	Adjusted Gamma UCL	137.5853
Approx.Chi Square Value (.05)	27.54422		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	27.31509	Lilliefors Test Statisitic	0.251816
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	8.536996	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.114765	95% H-UCL	46.96274
Standard Deviation of log data	1.554804	95% Chebyshev (MVUE) UCL	56.34321
Variance of log data	2.417414	97.5% Chebyshev (MVUE) UCL	69.13121
		99% Chebyshev (MVUE) UCL	94.25075
		95% Non-parametric UCLs	
		CLT UCL	207.2817
		Adj-CLT UCL (Adjusted for skewness)	282.4268
		Mod-t UCL (Adjusted for skewness)	220.5393
		Jackknife UCL	208.8182
		Standard Bootstrap UCL	204.9626
		Bootstrap-t UCL	1771.612
RECOMMENDATION		Hall's Bootstrap UCL	834.058
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	231.8708
		BCA Bootstrap UCL	308.0118
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	399.0472
		97.5% Chebyshev (Mean, Sd) UCL	532.3127
		99% Chebyshev (Mean, Sd) UCL	794.0871

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Naphthalene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.482725
Number of Unique Samples	45	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	30000		
Mean	502.9271	95% UCL (Assuming Normal Distribution)	
Median	13	Student's-t UCL	1196.15
Standard Deviation	3529.456		
Variance	12457057	Gamma Distribution Test	
Coefficient of Variation	7.017828	A-D Test Statistic	9.78526
Skewness	8.454432	A-D 5% Critical Value	0.901254
		K-S Test Statistic	0.244585
Gamma Statistics		K-S 5% Critical Value	0.116008
k hat	0.219309	Data do not follow gamma distribution	
k star (bias corrected)	0.21943	at 5% significance level	
Theta hat	2293.237		
Theta star	2291.968	95% UCLs (Assuming Gamma Distribution)	
nu hat	31.58047	Approximate Gamma UCL	804.5739
nu star	31.59795	Adjusted Gamma UCL	812.4545
Approx.Chi Square Value (.05)	19.7514		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	19.55982	Lilliefors Test Statisitic	0.239453
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	10.30895	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.913099	95% H-UCL	472.9373
Standard Deviation of log data	2.156293	95% Chebyshev (MVUE) UCL	467.6029
Variance of log data	4.6496	97.5% Chebyshev (MVUE) UCL	596.1473
		99% Chebyshev (MVUE) UCL	848.6479
		95% Non-parametric UCLs	
		CLT UCL	1187.104
		Adj-CLT UCL (Adjusted for skewness)	1629.938
		Mod-t UCL (Adjusted for skewness)	1265.223
		Jackknife UCL	1196.15
		Standard Bootstrap UCL	1160.405
		Bootstrap-t UCL	15205.39
RECOMMENDATION		Hall's Bootstrap UCL	6460.488
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	1328.736
		BCA Bootstrap UCL	1764.446
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	2316.013
		97.5% Chebyshev (Mean, Sd) UCL	3100.536
		99% Chebyshev (Mean, Sd) UCL	4641.581

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
n-Propylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.467126
Number of Unique Samples	40	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	8100		
Mean	137.8285	95% UCL (Assuming Normal Distribution)	
Median	4.575	Student's-t UCL	324.9632
Standard Deviation	952.773		
Variance	907776.3	Gamma Distribution Test	
Coefficient of Variation	6.912744	A-D Test Statistic	12.34882
Skewness	8.452628	A-D 5% Critical Value	0.884359
		K-S Test Statistic	0.272909
Gamma Statistics		K-S 5% Critical Value	0.115147
k hat	0.257478	Data do not follow gamma distribution	
k star (bias corrected)	0.256009	at 5% significance level	
Theta hat	535.3013		
Theta star	538.3729	95% UCLs (Assuming Gamma Distribution)	
nu hat	37.07688	Approximate Gamma UCL	212.0303
nu star	36.86534	Adjusted Gamma UCL	213.9285
Approx.Chi Square Value (.05)	23.964		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	23.75136	Lilliefors Test Statisitic	0.249076
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	8.999619	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.180471	95% H-UCL	63.06516
Standard Deviation of log data	1.659876	95% Chebyshev (MVUE) UCL	74.22856
Variance of log data	2.755187	97.5% Chebyshev (MVUE) UCL	91.80462
		99% Chebyshev (MVUE) UCL	126.3294
		95% Non-parametric UCLs	
		CLT UCL	322.5215
		Adj-CLT UCL (Adjusted for skewness)	442.0383
		Mod-t UCL (Adjusted for skewness)	343.6054
		Jackknife UCL	324.9632
		Standard Bootstrap UCL	318.9126
		Bootstrap-t UCL	3478.412
RECOMMENDATION		Hall's Bootstrap UCL	1691.075
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	362.0639
		BCA Bootstrap UCL	583.6229
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	627.2691
		97.5% Chebyshev (Mean, Sd) UCL	839.0504
		99% Chebyshev (Mean, Sd) UCL	1255.054

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
tert-butyl alcohol (TBA)			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	25	Shapiro-Wilk Test Statisitic	0.216208
Number of Unique Samples	9	Shapiro-Wilk 5% Critical Value	0.918
Minimum ug/kg	9	Data not normal at 5% significance level	
Maximum ug/kg	1450		
Mean	69.54	95% UCL (Assuming Normal Distribution)	
Median	10	Student's-t UCL	167.9731
Standard Deviation	287.6676		
Variance	82752.67	Gamma Distribution Test	
Coefficient of Variation	4.136722	A-D Test Statistic	8.41855
Skewness	4.995979	A-D 5% Critical Value	0.828636
		K-S Test Statistic	0.496672
Gamma Statistics		K-S 5% Critical Value	0.186907
k hat	0.40312	Data do not follow gamma distribution	
k star (bias corrected)	0.381412	at 5% significance level	
Theta hat	172.5045		
Theta star	182.3224	95% UCLs (Assuming Gamma Distribution)	
nu hat	20.15599	Approximate Gamma UCL	130.432
nu star	19.07061	Adjusted Gamma UCL	136.3697
Approx.Chi Square Value (.05)	10.16752		
Adjusted Level of Significance	0.0395	Lognormal Distribution Test	
Adjusted Chi Square Value	9.724818	Shapiro-Wilk Test Statisitic	0.371828
		Shapiro-Wilk 5% Critical Value	0.918
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	2.197225		
Maximum of log data	7.279319	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.611581	95% H-UCL	38.93257
Standard Deviation of log data	1.021438	95% Chebyshev (MVUE) UCL	44.89106
Variance of log data	1.043336	97.5% Chebyshev (MVUE) UCL	54.6799
		99% Chebyshev (MVUE) UCL	73.90817
		95% Non-parametric UCLs	
		CLT UCL	164.1742
		Adj-CLT UCL (Adjusted for skewness)	225.6002
		Mod-t UCL (Adjusted for skewness)	177.5543
		Jackknife UCL	167.9731
		Standard Bootstrap UCL	161.8733
		Bootstrap-t UCL	7928.217
RECOMMENDATION		Hall's Bootstrap UCL	6717.03
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	184.04
		BCA Bootstrap UCL	244.82
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	320.3228
		97.5% Chebyshev (Mean, Sd) UCL	428.8368
		99% Chebyshev (Mean, Sd) UCL	641.9914

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Tert-butylbenzene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.47129
Number of Unique Samples	17	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	6.522222	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	13.06223
Standard Deviation	33.29762		
Variance	1108.732	Gamma Distribution Test	
Coefficient of Variation	5.105257	A-D Test Statistic	23.00475
Skewness	8.47247	A-D 5% Critical Value	0.799993
		K-S Test Statistic	0.501648
Gamma Statistics		K-S 5% Critical Value	0.109829
k hat	0.67549	Data do not follow gamma distribution	
k star (bias corrected)	0.656604	at 5% significance level	
Theta hat	9.655537		
Theta star	9.933263	95% UCLs (Assuming Gamma Distribution)	
nu hat	97.27062	Approximate Gamma UCL	8.433788
nu star	94.55101	Adjusted Gamma UCL	8.47829
Approx.Chi Square Value (.05)	73.12048		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	72.73668	Lilliefors Test Statisitic	0.4413
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	0.976048	95% H-UCL	3.699829
Standard Deviation of log data	0.617896	95% Chebyshev (MVUE) UCL	4.299554
Variance of log data	0.381795	97.5% Chebyshev (MVUE) UCL	4.774416
		99% Chebyshev (MVUE) UCL	5.707191
		95% Non-parametric UCLs	
		CLT UCL	12.9769
		Adj-CLT UCL (Adjusted for skewness)	17.16359
		Mod-t UCL (Adjusted for skewness)	13.71527
		Jackknife UCL	13.06223
		Standard Bootstrap UCL	12.80541
		Bootstrap-t UCL	201.7168
RECOMMENDATION		Hall's Bootstrap UCL	131.5442
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	14.32361
		BCA Bootstrap UCL	18.40486
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	23.62725
		97.5% Chebyshev (Mean, Sd) UCL	31.02861
		99% Chebyshev (Mean, Sd) UCL	45.56715

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Tetrachloroethen (PCE)			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.4308
Number of Unique Samples	31	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	35000		
Mean	733.3625	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	1553.005
Standard Deviation	4173.105		
Variance	17414806	Gamma Distribution Test	
Coefficient of Variation	5.690371	A-D Test Statistic	15.28838
Skewness	8.033895	A-D 5% Critical Value	0.932899
		K-S Test Statistic	0.381225
Gamma Statistics		K-S 5% Critical Value	0.117472
k hat	0.172481	Data do not follow gamma distribution	
k star (bias corrected)	0.174553	at 5% significance level	
Theta hat	4251.848		
Theta star	4201.363	95% UCLs (Assuming Gamma Distribution)	
nu hat	24.83725	Approximate Gamma UCL	1252.813
nu star	25.1357	Adjusted Gamma UCL	1266.867
Approx.Chi Square Value (.05)	14.71375		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	14.55053	Lilliefors Test Statisitic	0.384718
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	10.4631	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.232877	95% H-UCL	606.6187
Standard Deviation of log data	2.454443	95% Chebyshev (MVUE) UCL	501.4004
Variance of log data	6.02429	97.5% Chebyshev (MVUE) UCL	647.8439
		99% Chebyshev (MVUE) UCL	935.504
		95% Non-parametric UCLs	
		CLT UCL	1542.31
		Adj-CLT UCL (Adjusted for skewness)	2039.856
		Mod-t UCL (Adjusted for skewness)	1630.612
		Jackknife UCL	1553.005
		Standard Bootstrap UCL	1549.176
		Bootstrap-t UCL	5266.975
RECOMMENDATION		Hall's Bootstrap UCL	4111.436
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	1668.393
		BCA Bootstrap UCL	2350.148
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	2877.091
		97.5% Chebyshev (Mean, Sd) UCL	3804.685
		99% Chebyshev (Mean, Sd) UCL	5626.762

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Toluene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.480831
Number of Unique Samples	16	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	285		
Mean	7.224306	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	13.83552
Standard Deviation	33.66017		
Variance	1133.007	Gamma Distribution Test	
Coefficient of Variation	4.659295	A-D Test Statistic	23.23367
Skewness	8.160587	A-D 5% Critical Value	0.804192
		K-S Test Statistic	0.52433
Gamma Statistics		K-S 5% Critical Value	0.110154
k hat	0.632614	Data do not follow gamma distribution	
k star (bias corrected)	0.615514	at 5% significance level	
Theta hat	11.41977		
Theta star	11.73703	95% UCLs (Assuming Gamma Distribution)	
nu hat	91.09638	Approximate Gamma UCL	9.42691
nu star	88.63403	Adjusted Gamma UCL	9.478442
Approx.Chi Square Value (.05)	67.92463		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	67.55533	Lilliefors Test Statisitic	0.467316
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	5.652489	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.008279	95% H-UCL	4.226306
Standard Deviation of log data	0.7226	95% Chebyshev (MVUE) UCL	4.997663
Variance of log data	0.522151	97.5% Chebyshev (MVUE) UCL	5.627319
		99% Chebyshev (MVUE) UCL	6.864155
		95% Non-parametric UCLs	
		CLT UCL	13.74926
		Adj-CLT UCL (Adjusted for skewness)	17.82574
		Mod-t UCL (Adjusted for skewness)	14.47137
		Jackknife UCL	13.83552
		Standard Bootstrap UCL	13.84057
		Bootstrap-t UCL	237.2982
RECOMMENDATION		Hall's Bootstrap UCL	120.1153
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	14.77986
		BCA Bootstrap UCL	18.91389
Use 95% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	24.51558
		97.5% Chebyshev (Mean, Sd) UCL	31.99752
		99% Chebyshev (Mean, Sd) UCL	46.69436

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Trans-1,2-dichloroethene			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.339321
Number of Unique Samples	33	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	1100		
Mean	79.40208	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	116.1663
Standard Deviation	187.1804		
Variance	35036.51	Gamma Distribution Test	
Coefficient of Variation	2.357374	A-D Test Statistic	10.08346
Skewness	3.720039	A-D 5% Critical Value	0.861319
		K-S Test Statistic	0.352782
Gamma Statistics		K-S 5% Critical Value	0.113924
k hat	0.31745	Data do not follow gamma distribution	
k star (bias corrected)	0.313482	at 5% significance level	
Theta hat	250.1244		
Theta star	253.2903	95% UCLs (Assuming Gamma Distribution)	
nu hat	45.71285	Approximate Gamma UCL	116.6525
nu star	45.14148	Adjusted Gamma UCL	117.582
Approx.Chi Square Value (.05)	30.72654		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	30.48363	Lilliefors Test Statisitic	0.354372
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	7.003065	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.222281	95% H-UCL	152.2237
Standard Deviation of log data	1.998666	95% Chebyshev (MVUE) UCL	161.6088
Variance of log data	3.994667	97.5% Chebyshev (MVUE) UCL	204.3042
		99% Chebyshev (MVUE) UCL	288.171
		95% Non-parametric UCLs	
		CLT UCL	115.6866
		Adj-CLT UCL (Adjusted for skewness)	126.0203
		Mod-t UCL (Adjusted for skewness)	117.7782
		Jackknife UCL	116.1663
		Standard Bootstrap UCL	115.9955
		Bootstrap-t UCL	140.6428
RECOMMENDATION		Hall's Bootstrap UCL	154.2909
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	116.6944
		BCA Bootstrap UCL	130.6965
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	175.5569
		97.5% Chebyshev (Mean, Sd) UCL	217.1631
		99% Chebyshev (Mean, Sd) UCL	298.8906

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Trichloroethylene (TCE)			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.433999
Number of Unique Samples	34	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	4600		
Mean	203.1472	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	344.9291
Standard Deviation	721.8648		
Variance	521088.8	Gamma Distribution Test	
Coefficient of Variation	3.553407	A-D Test Statistic	14.11869
Skewness	4.509176	A-D 5% Critical Value	0.898371
		K-S Test Statistic	0.343694
Gamma Statistics		K-S 5% Critical Value	0.115861
k hat	0.22582	Data do not follow gamma distribution	
k star (bias corrected)	0.22567	at 5% significance level	
Theta hat	899.5964		
Theta star	900.1941	95% UCLs (Assuming Gamma Distribution)	
nu hat	32.51814	Approximate Gamma UCL	322.5936
nu star	32.49655	Adjusted Gamma UCL	325.7018
Approx.Chi Square Value (.05)	20.46409		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	20.2688	Lilliefors Test Statisitic	0.342085
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	8.433812	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.116849	95% H-UCL	176.7519
Standard Deviation of log data	2.090822	95% Chebyshev (MVUE) UCL	180.3423
Variance of log data	4.371535	97.5% Chebyshev (MVUE) UCL	229.1427
		99% Chebyshev (MVUE) UCL	325.0016
		95% Non-parametric UCLs	
		CLT UCL	343.0792
		Adj-CLT UCL (Adjusted for skewness)	391.3852
		Mod-t UCL (Adjusted for skewness)	352.4639
		Jackknife UCL	344.9291
		Standard Bootstrap UCL	341.085
		Bootstrap-t UCL	504.5183
RECOMMENDATION		Hall's Bootstrap UCL	383.2273
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	350.7799
		BCA Bootstrap UCL	406.6347
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	573.97
		97.5% Chebyshev (Mean, Sd) UCL	734.4253
		99% Chebyshev (Mean, Sd) UCL	1049.609

Data File	C:\Documents and Settings\Administrator\De	Variable:	VOCs in Soil Samples 1 - 10 ft bg
Vinyl chloride			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	72	Lilliefors Test Statisitic	0.441008
Number of Unique Samples	21	Lilliefors 5% Critical Value	0.104416
Minimum ug/kg	1.85	Data not normal at 5% significance level	
Maximum ug/kg	2000		
Mean	42.96389	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	89.95831
Standard Deviation	239.2662		
Variance	57248.33	Gamma Distribution Test	
Coefficient of Variation	5.569008	A-D Test Statistic	20.35367
Skewness	7.956244	A-D 5% Critical Value	0.870515
		K-S Test Statistic	0.49288
Gamma Statistics		K-S 5% Critical Value	0.114442
k hat	0.288755	Data do not follow gamma distribution	
k star (bias corrected)	0.285982	at 5% significance level	
Theta hat	148.7903		
Theta star	150.2326	95% UCLs (Assuming Gamma Distribution)	
nu hat	41.58067	Approximate Gamma UCL	64.40547
nu star	41.18147	Adjusted Gamma UCL	64.94639
Approx.Chi Square Value (.05)	27.47152		
Adjusted Level of Significance	0.046667	Lognormal Distribution Test	
Adjusted Chi Square Value	27.24272	Lilliefors Test Statisitic	0.458405
		Lilliefors 5% Critical Value	0.104416
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	0.615186		
Maximum of log data	7.600902	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.357368	95% H-UCL	15.63708
Standard Deviation of log data	1.383432	95% Chebyshev (MVUE) UCL	19.13234
Variance of log data	1.913883	97.5% Chebyshev (MVUE) UCL	23.14139
		99% Chebyshev (MVUE) UCL	31.0164
		95% Non-parametric UCLs	
		CLT UCL	89.34513
		Adj-CLT UCL (Adjusted for skewness)	117.5964
		Mod-t UCL (Adjusted for skewness)	94.36494
		Jackknife UCL	89.95831
		Standard Bootstrap UCL	89.97576
		Bootstrap-t UCL	274.9501
RECOMMENDATION		Hall's Bootstrap UCL	252.5814
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	96.33333
		BCA Bootstrap UCL	128.8715
Use 97.5% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	165.8752
		97.5% Chebyshev (Mean, Sd) UCL	219.0591
		99% Chebyshev (Mean, Sd) UCL	323.5284

Data File	C:\Documents and Settings\Administrator\De	Variable:	TPH in Soil Samples > = 1 - 10 ft
C6-C10			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	139	Lilliefors Test Statisitic	0.396495
Number of Unique Samples	48	Lilliefors 5% Critical Value	0.07515
Minimum mg/kg	0.5	Data not normal at 5% significance level	
Maximum mg/kg	1700		
Mean	52.9554	95% UCL (Assuming Normal Distribution)	
Median	2.5	Student's-t UCL	81.03039
Standard Deviation	199.8824		
Variance	39952.98	Gamma Distribution Test	
Coefficient of Variation	3.774543	A-D Test Statistic	16.51211
Skewness	6.156948	A-D 5% Critical Value	0.885924
		K-S Test Statistic	0.300347
Gamma Statistics		K-S 5% Critical Value	0.086872
k hat	0.260515	Data do not follow gamma distribution	
k star (bias corrected)	0.259689	at 5% significance level	
Theta hat	203.2718		
Theta star	203.9188	95% UCLs (Assuming Gamma Distribution)	
nu hat	72.42322	Approximate Gamma UCL	71.29105
nu star	72.19346	Adjusted Gamma UCL	71.51363
Approx.Chi Square Value (.05)	53.62571		
Adjusted Level of Significance	0.048273	Lognormal Distribution Test	
Adjusted Chi Square Value	53.4588	Lilliefors Test Statisitic	0.203343
		Lilliefors 5% Critical Value	0.07515
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	7.438384	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.26106	95% H-UCL	60.75296
Standard Deviation of log data	2.116782	95% Chebyshev (MVUE) UCL	72.5782
Variance of log data	4.480768	97.5% Chebyshev (MVUE) UCL	90.33373
		99% Chebyshev (MVUE) UCL	125.211
		95% Non-parametric UCLs	
		CLT UCL	80.84192
		Adj-CLT UCL (Adjusted for skewness)	90.30224
		Mod-t UCL (Adjusted for skewness)	82.50601
		Jackknife UCL	81.03039
		Standard Bootstrap UCL	81.65609
		Bootstrap-t UCL	106.2925
RECOMMENDATION		Hall's Bootstrap UCL	112.0093
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	83.15324
		BCA Bootstrap UCL	95.24317
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	126.8553
		97.5% Chebyshev (Mean, Sd) UCL	158.8319
		99% Chebyshev (Mean, Sd) UCL	221.6436

Data File	C:\Documents and Settings\Administrator\De	Variable:	TPH in Soil Samples > = 1 - 10 ft
C10-C18			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	185	Lilliefors Test Statisitic	0.315462
Number of Unique Samples	84	Lilliefors 5% Critical Value	0.06514
Minimum mg/kg	0.5	Data not normal at 5% significance level	
Maximum mg/kg	910		
Mean	75.94919	95% UCL (Assuming Normal Distribution)	
Median	5	Student's-t UCL	95.03717
Standard Deviation	157.0459		
Variance	24663.4	Gamma Distribution Test	
Coefficient of Variation	2.067775	A-D Test Statistic	10.81312
Skewness	3.192988	A-D 5% Critical Value	0.873134
		K-S Test Statistic	0.198078
Gamma Statistics		K-S 5% Critical Value	0.073459
k hat	0.290672	Data do not follow gamma distribution	
k star (bias corrected)	0.289562	at 5% significance level	
Theta hat	261.2883		
Theta star	262.2899	95% UCLs (Assuming Gamma Distribution)	
nu hat	107.5486	Approximate Gamma UCL	96.58749
nu star	107.1379	Adjusted Gamma UCL	96.76932
Approx.Chi Square Value (.05)	84.24527		
Adjusted Level of Significance	0.048703	Lognormal Distribution Test	
Adjusted Chi Square Value	84.08698	Lilliefors Test Statisitic	0.231596
		Lilliefors 5% Critical Value	0.06514
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	6.813445	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	1.945497	95% H-UCL	329.7207
Standard Deviation of log data	2.5122	95% Chebyshev (MVUE) UCL	383.231
Variance of log data	6.311151	97.5% Chebyshev (MVUE) UCL	482.6639
		99% Chebyshev (MVUE) UCL	677.9805
		95% Non-parametric UCLs	
		CLT UCL	94.94106
		Adj-CLT UCL (Adjusted for skewness)	97.83729
		Mod-t UCL (Adjusted for skewness)	95.48892
		Jackknife UCL	95.03717
		Standard Bootstrap UCL	94.78372
		Bootstrap-t UCL	98.65512
RECOMMENDATION		Hall's Bootstrap UCL	97.41244
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	95.21135
		BCA Bootstrap UCL	97.76486
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	126.2781
		97.5% Chebyshev (Mean, Sd) UCL	148.0554
		99% Chebyshev (Mean, Sd) UCL	190.8328

Data File	C:\Documents and Settings\Administrator\De	Variable:	TPH in Soil Samples > = 1 - 10 ft
C18-C40			
Raw Statistics		Normal Distribution Test	
Number of Valid Samples	205	Lilliefors Test Statisitic	0.343209
Number of Unique Samples	109	Lilliefors 5% Critical Value	0.061881
Minimum mg/kg	0.5	Data not normal at 5% significance level	
Maximum mg/kg	4200		
Mean	198.4463	95% UCL (Assuming Normal Distribution)	
Median	19	Student's-t UCL	255.0301
Standard Deviation	490.3032		
Variance	240397.2	Gamma Distribution Test	
Coefficient of Variation	2.470709	A-D Test Statistic	7.427288
Skewness	4.911653	A-D 5% Critical Value	0.880048
		K-S Test Statistic	0.14906
Gamma Statistics		K-S 5% Critical Value	0.068828
k hat	0.276039	Data do not follow gamma distribution	
k star (bias corrected)	0.275252	at 5% significance level	
Theta hat	718.9059		
Theta star	720.9629	95% UCLs (Assuming Gamma Distribution)	
nu hat	113.1762	Approximate Gamma UCL	250.7165
nu star	112.8532	Adjusted Gamma UCL	251.1301
Approx.Chi Square Value (.05)	89.32526		
Adjusted Level of Significance	0.048829	Lognormal Distribution Test	
Adjusted Chi Square Value	89.17814	Lilliefors Test Statisitic	0.150208
		Lilliefors 5% Critical Value	0.061881
Log-transformed Statistics		Data not lognormal at 5% significance level	
Minimum of log data	-0.693147		
Maximum of log data	8.34284	95% UCLs (Assuming Lognormal Distribution)	
Mean of log data	2.758341	95% H-UCL	1183.869
Standard Deviation of log data	2.676131	95% Chebyshev (MVUE) UCL	1354.934
Variance of log data	7.161675	97.5% Chebyshev (MVUE) UCL	1714.202
		99% Chebyshev (MVUE) UCL	2419.912
		95% Non-parametric UCLs	
		CLT UCL	254.7731
		Adj-CLT UCL (Adjusted for skewness)	267.3253
		Mod-t UCL (Adjusted for skewness)	256.988
		Jackknife UCL	255.0301
		Standard Bootstrap UCL	253.8203
		Bootstrap-t UCL	269.6021
RECOMMENDATION		Hall's Bootstrap UCL	274.0111
Data are Non-parametric (0.05)		Percentile Bootstrap UCL	255.5663
		BCA Bootstrap UCL	267.3298
Use 99% Chebyshev (Mean, Sd) UCL		95% Chebyshev (Mean, Sd) UCL	347.7136
		97.5% Chebyshev (Mean, Sd) UCL	412.3017
		99% Chebyshev (Mean, Sd) UCL	539.1724