TETRA TECH

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Mr. Rom Roman (3HS22)
U.S. Environmental Protection Agency (EPA) Region 3
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Reference: Remedial Action Contract - EPA Region 3 (RAC 3)
EPA Contract No. EP-S3-07-04

Subject: Updated Groundwater Human Health Risk Assessment
Butz Landfill Site
Long-Term Remedial Action (RA)
EPA Work Assignment No. 021-RALR-03Q6

Dear Mr. Roman:

Enclosed please find the updated groundwater risk assessment for the subject site. Cancer and non-cancer risks were estimated to exceed the target risk range for the lifetime and child residents. The chemicals of concern (COC) driving unacceptable risks included tetrachloroethene (PCE), trichloroethene (TCE), vinyl chloride (VC), and cis-1,2-dichloroethene (cis-1,2-DCE).

Copies of this risk assessment are being sent to Jennifer Hubbard of EPA. Please contact me if you have any questions or comments.

Sincerely,

Neil Teamerson

Neil Teamerson
Project Manager

ANT/nfs

Enclosure

c: Jennifer Hubbard (EPA Region 3)
Elaine Spiewak (EPA Region 3 (without enclosure)
File No. 3

Tetra Tech NUS, Inc.
234 Mall Boulevard, Suite 260, King of Prussia, PA 19406
Tel 610.491.9688 Fax 610.491.9645 www.ttnus.com

UPDATED GROUNDWATER HUMAN HEALTH RISK ASSESSMENT
BUTZ LANDFILL SITE
MONROE COUNTY, PENNSYLVANIA
JANUARY 2011

The general scope of the human health risk assessment (HHRA) for the Butz Landfill Site was to estimate potential risks from future residential use of groundwater, using current data, exposure factors, and toxicity factors. EPA intends to apply the results of the risk assessment to help determine whether the existing groundwater remedy is protective of human health.

Risk assessment tables have been prepared following the format adopted by EPA Risk Assessment Guidance for Superfund (RAGS), Volume I, Part D: Standardized Planning, Reporting, and Review of Superfund Risk Assessments (EPA, 2001a). The results of the HHRA are presented in seven sections, including:

- Data evaluation
- Estimation of exposure point concentrations
- Exposure assessment
- Toxicity assessment
- Risk characterization
- Uncertainty analysis
- Summary of risks

1.0 DATA EVALUATION

The following discussion summarizes the data quality evaluation process and the selection of substances of significance for assessing human health risks. Attachment 1 provides the data summary used for the risk assessment.

1.1 Data Quality Evaluation

Data quality evaluation includes a review of validated data for problems with detection limit adequacy, rejected data, blank qualified data, and bias or imprecision. Data quality problems are summarized on Data Usability Worksheets prepared for sampling data from 2007, 2008, 2009, and 2010 (Attachment 2). Based on data validation findings, rejected or blank qualified data were not considered acceptable for use in the risk assessment, while estimated values were accepted for use, but may be associated with caveats in the HHRA uncertainty analysis. No significant issues were identified in data evaluation that would prevent the overall use of the analytical data sets for the HHRA.

1.2 Selection of Chemicals of Potential Concern

EPA's latest residential tap water Regional Screening Levels (RSLs) were used to select chemicals of potential concern (COPCs) (EPA, 2010a). For groundwater, RSLs account for daily ingestion of tap water, dermal contact during bathing, and inhalation of VOCs during showering. Before performing COPC selection, noncancer RSLs were first multiplied by an adjustment factor of 0.1 to account for possible additivity of noncancer effects from different substances. Cancer RSLs were based on a target risk level of 1×10^{-6}. Groundwater COPCs are presented in RAGS D Table 2 and are listed below.

- 1,4-dichlorobenzene (1,4-DCB)
- 1,1,2-Trichloroethane
- 1,1-Dichloroethene (1,1-DCE)
- Cis-1,2-Dichloroethene (Cis-1,2-DCE)
- Benzene
- Bromodichloromethane
- Chloroform
- Tetrachloroethene (PCE)
- Trichloroethene (TCE)
- Vinyl Chloride (VC)

VC was detected in 19 out of 68 samples, with a maximum concentration of 1,700 ug/L that exceeded the EPA Maximum Contaminant Level (MCL). TCE and cis-1,2-DCE were each detected in 67 out of 68 samples, with maximum concentrations of 2700 ug/L and 2900 ug/L, which exceeded their respective MCLs. 1,1-DCE was detected in 4 out of 68 samples, with a maximum concentration of 35 ug/L that exceeded the MCL.

Other COPCs did not exceed MCLs in any sample. PCE was detected in 8 out of 68 samples, with a maximum level of 2.1 ug/L. Chloroform was detected in 5 out of 68 samples, with a maximum concentration of 0.7 ug/L. 1,1,2-Trichloroethane, benzene, and dibromochloromethane were each detected in only one to three samples out of 68.

2.0 EXPOSURE POINT CONCENTRATIONS

The exposure point concentration (EPC) represents an estimated chemical concentration to which a receptor is assumed to be continuously exposed while in contact with an environmental medium. The 95 percent upper confidence limit (95% UCL) on the mean of the data was considered the input concentration of each chemical used to estimate site-associated risks, unless there were too few samples to calculate a reliable statistical UCL. In particular, if there were less than 5 samples overall, or if there were less than 4 or 5 detected sample results, which would preclude an accurate estimate of proxy concentrations to substitute for nondetected results, then the maximum detected concentration was selected as the EPC instead of using a statistical UCL. Also, if the maximum concentration was determined to be less than the statistical UCL, then the maximum was selected as the EPC.

Before EPCs were calculated, the analytical database was manipulated to remove unusable data points qualified "R" and false positives attributable to blank contamination and qualified "B", and substitute the average values in place of field duplicate pairs. For field duplicate pairs, the arithmetic mean was calculated to represent the concentration at that sample location. However, if one result was positive and the other result nondetected and half the detection limit exceeded the positive result, in this situation, the positive result was used alone.

Statistical calculations of the 95% UCL were performed following current risk assessment guidance (EPA 2002a, 2006, 2010b, 2010c) and included a decision scheme to select the optimal UCL method based on several considerations: the number of detected and nondetected data points; the estimated shape of the probability distribution of chemical concentration data (normal, lognormal, gamma, or nonparametric) as determined by distributional fit tests; the estimated standard deviation of the log-transformed data; and the estimated gamma distribution shape parameter (k), which is related to skewness. The software program, ProUCL version 4.00.05 (EPA, 2010b) was used for all calculations. For full data sets without any nondetect sample results, the statistical UCL considers a choice between 15 computational algorithms, including 5 parametric methods and 10 nonparametric methods. The nonparametric methods do not depend upon any assumptions about the data distributions. The five parametric UCL computation methods were student's t-UCL, approximate gamma UCL using chi-square approximation, adjusted gamma UCL (adjusted for level significance), Land's H-UCL, and Chebyshev inequality-based UCL [using minimum variance unbiased estimators (MVUEs) of parameters of a lognormal distribution]. The 10 nonparametric methods were the central limit theorem (CLT)-based UCL, modified-t statistic (adjusted for skewness)-based UCL, adjusted-CLT (adjusted for skewness)-based UCL, Chebyshev inequality-based UCL (using sample mean and sample standard deviation), jackknife method-based UCL, UCL based upon standard bootstrap, UCL based upon percentile bootstrap, UCL based upon bias-corrected accelerated (BCA) bootstrap, UCL based upon bootstrap t, and UCL based upon Hall's bootstrap.

If nondetects were present in a data set, the distribution of concentrations for the positive sample results was used as the basis to estimate proxy values for the nondetected sample results, which were then used in combination with positive results to estimate the UCL. Two approaches were considered for imputing nondetected values, Kaplan-Meier estimation and Regression on Order Statistics (ROS). Kaplan-Meier is a nonparametric approach for estimating the mean and standard deviation of censored data that is commonly used in survival analysis. The Kaplan-Meier method provides an estimate of the sample distribution functions adjusting for censored data. The Kaplan-Meier parameter estimates are used to estimate the UCL parametrically or the mean estimator can be used in a bootstrap re-sampling algorithm. Alternatively, ROS estimates a linear model of the detected sample values versus the quantiles from a hypothesized probability distribution and then uses the linear model to assign values for the nondetects.

The quantiles can be based on an assumed distribution such as a normal, lognormal, or gamma. Published guidance recommends at least 8 to 10 detected values are needed for a reliable ROS model (EPA, 2010c). Both Kaplan-Meier and ROS can handle multiple detection limits. With multiple detection limits, ROS can assign values for nondetects that are higher than some detected values, which is not the case with Kaplan-Meier.

The calculated EPCs for the COPCs associated with each data set are shown in the attached RAGS D Table 3. Supporting documentation for all COPCs, including statistical estimates of distributional shape, mean, variance, and other parameters associated with UCL computation are included in the ProUCL output, Table A-1.

3.0 EXPOSURE ASSESSMENT

The exposure assessment identifies categories of potential human health exposure based upon a characterization of the site setting, potential receptors consistent with current and possible future land use, and possible exposure pathways for each environmental medium of concern. A complete exposure pathway has three components: a source, a route of transport, and an exposure point for receptors. Exposure input parameters for groundwater at the Butz Landfill Site are presented in RAGS D Table 4.

3.1 Potential Exposure Pathways

The possible pathways for contaminant migration which provide a potential route of contact with human receptors are presented in the attached RAGS D Table 1. Only tap water use of groundwater by residents was considered because other exposure pathways (such as construction worker exposure to pooled groundwater during excavation activities) would represent several orders of magnitude lower levels of exposure, and so would not be relevant to setting a PRG protective for the most sensitive receptor.

3.2 Reasonable Maximum Versus Central Tendency Exposure

Two types of exposure estimates were considered: Reasonable Maximum Exposure (RME) is an exposure scenario that is expected to represent a high end, but not usually worst-case, exposure in a given medium of concern. In contrast, Central Tendency Exposure (CTE) is considered to be an estimate of the average or mid-range of exposures that may occur. Different activity pattern variables (days per year exposed, quantity of water consumed, etc.) were assumed under RME versus CTE receptor exposure estimates. CTE analysis is performed only if the overall cumulative cancer risks are above 1×10^{-4} or the non cancer HIs based on the same target organ are above 1.0.

3.3 Receptors and Routes of Exposure

- **Current/Future Residential Child:** This receptor is a child (ages 0 to 6) who resides within the area of influence of groundwater or at a current residence adjacent to the site. This receptor is associated with two potential groundwater exposure pathways: ingestion of tap water and dermal absorption of COPCs while bathing.

- **Current/Future Residential Adult:** This receptor is an adult (24-year exposure duration) who resides within the area of influence of groundwater or at a current residence adjacent to the site. This receptor is associated with three potential groundwater exposure pathways: ingestion of tap water, dermal absorption of COPCs while bathing, and inhalation of VOC vapors generated during showering.

- **Current/Future Lifetime Resident:** Lifetime exposure is a combination of the exposure scenarios for an adult and a child in order to estimate the cumulative lifetime cancer risk under residential land use scenarios. The lifetime cancer risk was estimated by adding the cancer risk for a 24-year adult exposure to the cancer risk for a 6-year child exposure.

3.4 Exposure Estimates

The exposure estimation methods and models applied to evaluate cancer risks and noncancer hazards were in accordance with EPA guidance (EPA, 1986, 1989, 1992a, 1992b, 1993, 1997a, 2001b, 2004, and 2009b).

Noncarcinogenic risks were assessed by estimating a total annual exposure, then converting the dose to an average daily intake. When compared to toxicity benchmarks, daily intake represents the rate of exposure and does not suggest increasing degrees of cumulative toxicity incremental according to years of exposure duration. The intake incorporates terms describing the exposure time and/or frequency that represent the number of hours per day and the number of days per year that exposure occurs. The sum of exposures over one year was divided by 365 days of "averaging time" in order to convert the annual exposure to an average daily intake. Noncarcinogenic risks for some exposure routes were generally greater for children than for adults because of differences in body weight and intake.

Carcinogenic risks, on the other hand, were estimated as an incremental lifetime risk and, therefore, incorporate terms to sum the exposures over an expected exposure duration (years of exposure), and then divide by the total days in a typical lifetime (70 years). The carcinogenic exposure model accounts for the probability of developing cancer increasing with every additional year of cumulative exposure.

Averaging times for air pathway exposures were reported in units of hours, which differs from the units for averaging time, days, that were applied to direct contact (ingestion and dermal) exposure equations. As recommended on page 3 of RAGS Part F inhalation guidance, whenever air pathway exposure is less than 24 hours per day, the exposure time (ET) should be stated in hours per day and the averaging time expressed in units of hours (EPA, 2009).

RME input parameters and equations used to calculate daily intake of COPCs from tap water contact are shown in Tables 4.01.RME through 4.03.RME. CTE parameters and equations are shown in Tables 4.01.CTE through 4.03.CTE. The following pathway-specific assumptions and estimation methods for COPC exposures should be noted:

- **Ingestion of Tap Water:** Residential tap water consumption was assumed to be 2 liters per day for an adult or 1 liter per day for a child, 350 days per year.
- **Dermal Absorption of Tap Water during Bathing:** Skin surface areas available for dermal contact were based on values presented in dermal guidance (EPA, 2004). Activity-specific exposure assumptions are listed in footnotes to RAGS D Table 4s. Chemical-specific dermal absorption constants were based on EPA guidance and are listed in Table A-3 (EPA, 2004).
- **Inhalation during Showering:** Showering exposure was considered for the residential adult only. The residential child was assumed to bathe, not shower. The Foster and Chrostowski showering model was applied to estimate time-varying air concentrations of volatile COPCs and inhaled dose during the time spent showering and while in the bathroom after showering. Showering model input assumptions were adopted from EPA national guidance (EPA, 2004) and regional EPA recommendations and are shown on RAGS D Table 4.02a. Henry's Law constants and other parameters used in this model were obtained from several sources, including EPA (2002b) and Foster and Chrostowski (1987) and are presented in Table A-2 for each COPC. Henry's Law constants published for 25 degrees C were corrected to account for an elevated showering temperature of 45 degrees C (EPA, 2001b).

4.0 TOXICITY ASSESSMENT

The toxicity assessment identifies the potential health hazards associated with exposure to each COPC. Literature references establish that the selected COPCs have the potential to cause carcinogenic and/or noncarcinogenic health effects in humans. Dose-response relationships and the potential for exposure must be evaluated before the risks to receptors can be determined. Dose-response relationships correlate the magnitude of the intake with the probability of toxic effects. As discussed below, dose-response values [reference doses (RfDs) and slope factors (SFs)] have been developed by EPA and

other sources. Oral and inhalation RfDs and SFs were obtained from the following primary recommended sources (ATSDR, 2010, EPA, 1997b, 2010a, 2010d, and 2011b):

- Integrated Risk Information System (IRIS) (Online Database) (EPA, 2011a).

- EPA Provisional Peer Reviewed Toxicity Values (PPRTVs) (EPA, 2010d): The Office of Research and Development/National Center for Environmental Assessment (NCEA) Superfund Health Risk Technical Support Center develops PPRTVs on a chemical specific basis when requested by EPA's Superfund program.

- Other Toxicity Values: These sources may include but are not limited to the Agency for Toxic Substances and Disease Registry (ATSDR, 2010) Minimal Risk Levels (MRLs), the Annual Health Effects Assessment Summary Tables (HEAST) (EPA, 1997b), and California EPA (EPA, 2011b).

Although RfDs and SFs can be found in several toxicological sources, EPA's IRIS online database is the preferred source of toxicity values. This database is continuously updated and values presented have been verified by the agency's consensus peer review process.

4.1 Reference Doses

The RfD is developed by EPA for chronic and/or subchronic human exposure to hazardous chemicals and is based solely on the noncarcinogenic effects of chemical substances. Subchronic RfDs are specifically developed to be protective for a portion of a lifetime exposure to a compound (as a Superfund program guideline, short term). Chronic RfDs are specifically developed to be protective for long-term exposure to a compound (as a Superfund program guideline, long term). The RfD is usually expressed as a dose (mg) per unit body weight (kg) per unit time (day). It is generally derived by dividing a No-Observed-(Adverse)-Effect-Level (NOAEL or NOEL) or a Lowest-Observed-Adverse-Effect-Level (LOAEL) by an appropriate uncertainty factor. NOAELs, etc. are determined from laboratory or epidemiological toxicity studies. The uncertainty factor is based on the availability of toxicity data.

Uncertainty factors are generally applied as multiples of 10 to represent specific areas of uncertainty in the available data. A factor of 10 is used to account for variations in the general population (to protect sensitive subpopulations), when test results from animals are extrapolated to humans (to account for interspecies variability), when a NOAEL derived from a subchronic study (instead of a chronic study) is used to develop the RfD, and when a LOAEL is used instead of a NOAEL. In addition, EPA reserves the use of a modifying factor of up to 10 for professional judgment of uncertainties in the database not already accounted for. The default value of the modifying factor is 1.

The Reference Dose (RfD) incorporates the surety of the evidence for chronic human health effects. Even if applicable human data exist, the RfD (as diminished by the uncertainty factor) still maintains a margin of safety so that chronic human health effects are not underestimated. Thus, the RfD is an acceptable guideline for evaluation of noncarcinogenic risk, although the associated uncertainties preclude its use for precise risk quantitation.

Noncancer hazards are considered to be associated with particular target organs or critical effects, but are not additive across multiple chemicals except when the same target organ is affected. Target organ data have been extracted from the Integrated Risk Information System (IRIS; EPA, 2011a), Health Effect Assessment Summary Tables (HEAST; EPA, 1997b), or other applicable sources. Only the target organs that are affected in the applicable study in which the RfD was derived have been included in RAGS D Tables 5.1 and 5.2. Table 5.1 lists the oral RfDs, primary target organs, uncertainty/modifying factors, and sources for selected COPCs. Table 5.2 lists the Inhalation reference concentrations (RfCs) (mg/m^3), primary target organs, uncertainty/modifying factors, and sources for selected COPCs.

4.2 Cancer Slope Factors

Cancer Slope Factors (SFs) are applicable for estimating the lifetime probability (assumed 70-year lifespan) of human receptors developing cancer as a result of exposure to known or potential carcinogens. The slope factor is generally reported in units of 1/(mg/kg/day), and for most substances is derived through an assumed low-dosage linear relationship extrapolated from high to low dose responses, typically based on animal studies. The value used in reporting the slope factor is the upper 95 percent confidence limit.

Oral and dermal SFs, weight of evidence, and sources for selected COPCs in groundwater and food media are provided in Table 6.1. Inhalation Unit Risks (IURs), weight of evidence, and toxicity data sources for selected COPCs are provided in Table 6.2.

4.3 Inhalation Toxicity

The intake equations presented in RAGS, Part A (EPA, 1989, Exhibit 6-16) are no longer recommended by EPA to be used when evaluating risk from the inhalation pathway. Instead, the revised equations from RAGS, Part F (EPA, 2009) are recommended. The net impact of this change is to use inhalation unit risks (IURs) instead of inhalation slope factors for cancer risk, and reference concentrations (RfCs) instead of inhalation RfDs for noncancer hazards. In addition, on RAGS D Table 7s, receptor inhalation risks are estimated using chemical intakes expressed as a time-averaged concentration, so that body weight and inhalation rate are not directly input into risk calculations. Since the showering exposure

scenarios was less than 24 hours per day, the scenario-specific exposure time (ET) in hours per day was used in the equations and the averaging time was expressed in units of hours.

4.4 EPA Weight of Evidence

A weight-of-evidence approach is used to classify the likelihood that a substance is a carcinogen. This qualitative information is important to consider when using SFs to estimate potential risk. Each substance is assigned a weight-of-evidence for carcinogenicity. EPA has recently revised their weight-of-evidence classifications. The updated categories are listed as follows (EPA, 2005a):

WEIGHT OF EVIDENCE CATEGORY	DEFINITION
Carcinogenic to Humans	There is strong evidence of human carcinogenicity
Likely to be Carcinogenic to Humans	The weight-of-evidence is adequate to demonstrate carcinogenic potential to humans, but does not reach the weight of evidence for the classification of "Carcinogenic to Humans"
Suggestive Evidence of Carcinogenic Potential	The weight of evidence is suggestive of carcinogenicity; a concern for potential carcinogenic effects in humans is raised, but the data are judged not sufficient for a stronger conclusion
Inadequate Information to Assess Carcinogenic Potential	Available data are judged inadequate for applying one of the other classifications
Not Likely to be Carcinogenic to Humans	The available data are considered robust enough for deciding that there is no basis for human health hazard

Weight-of-evidence classifications have not yet been updated for many substances. In these instances, it is appropriate to still list the old weight-of-evidence classifications (EPA, 1986). The older weight-of-evidence categories were used on RAGS D Table 6.1 and 6.2, and are listed as follows:

- **Group A:** Human Carcinogen (sufficient evidence from epidemiological studies to support a causal association between exposure and cancer).
- **Group B1:** Probable Human Carcinogen (limited evidence of carcinogenicity in humans from epidemiological studies; sufficient evidence in animals).
- **Group B2:** Probable Human Carcinogen (sufficient evidence of carcinogenicity in animals and no or inadequate evidence in humans).
- **Group C:** Possible Human Carcinogen (limited evidence of carcinogenicity in animals).
- **Group D:** Not Classified (inadequate evidence of carcinogenicity in animals).
- **Group E:** No Evidence of Carcinogenicity (no evidence of carcinogenicity in at least two adequate animal tests or in both epidemiological and animal studies).

4.5 Adjustment of Dose-Response Parameters for Dermal Exposure

Risks associated with dermal exposures were evaluated using toxicity values that are specific to absorbed dermal doses. Most oral toxicity values are based on administered doses rather than absorbed doses. Therefore, in accordance with EPA guidance (2004), the toxicity values based on administered doses were adjusted before they were used for evaluating absorbed doses.

Dermal RfDs and SFs were obtained from oral RfDs and SFs via the following relationships:

$$RfD_{Adjusted} = RfD_{Oral} \times GI_{Oral}$$

$$SF_{Adjusted} = SF_{Oral} / GI_{Oral}$$

where:

GI_{Oral} = Gastrointestinal (GI) Absorption Efficiency (EPA, 2004)

RfD_{Oral} = Oral Reference Dose (EPA, 2011a; EPA, 2011b; EPA, 1997b; or EPA, 2010d)

SF_{Oral} = Oral Slope Factor (EPA, 2011a; EPA, 2011b; EPA, 1997b; or EPA, 2010d)

Dermally adjusted RfDs and SFs for COPCs are presented in Tables 5.1 and 6.1, respectively. In addition, chemical-specific dermal absorption factors from soil are shown on these tables.

4.6 Carcinogenicity of Vinyl Chloride

EPA has categorized VC as a mutagen having enhanced carcinogenic potency during early life periods of exposure, citing studies which show that VC exposures were most effective at producing cancer when started early in life (EPA, 2005b). Based on current guidance (EPA, 2000), when early life exposures are considered for VC, a second term should be incorporated into the risk calculation, which is not proportional to duration of exposure (non-prorated). This method yields a VC risk that is above and beyond the risk that would have been generated by conventional calculations by an amount equal to the older method's cumulative risk for 70 years of continuous exposure. RAGS D Table 7s take into account two cancer risk terms – "prorated" versus "non-prorated" – which are built into the VC cancer risk calculations, although these terms are not explicitly listed separately on these tables.

5.0 RISK CHARACTERIZATION

This section presents estimates of carcinogenic risks, noncarcinogenic risks, and lead risks for all applicable human receptors that may be exposed to COPCs present in various environmental media and

at each site-related area of interest. The risk characterization quantitatively evaluates the potential for adverse health effects from exposure to COPC concentrations in environmental media by integrating information developed during the toxicity and exposure assessments.

5.1 Noncarcinogenic Risks

Noncarcinogenic risk was assessed using the concept of Hazard Quotients (HQs) and Hazard Indices (HIs). The HQ is defined as the ratio of the estimated intake and the RfD for a selected chemical of concern, as follows:

$$HQ = \frac{Intake}{RfD}$$

HIs were generated by summing individual HQs for COPCs. If the value of the total HI exceeded unity (1.0), the potential for noncarcinogenic health risks associated with exposure to that particular chemical mixture cannot be ruled out (EPA, 1986). In that case, a review of the target organ(s) affected by each chemical was performed, which indicates the most sensitive toxic endpoints used to develop the associated RfDs for each substance. A target organ-specific HI was calculated for the receptor by summing the HQs for similar target organs. Since (HIs) for different organs are not truly additive, if each target organ-specific HI is less than 1, then adverse effects are not anticipated. The HI is not defined as a mathematical prediction of the severity of toxic effects; it is simply a numerical indicator of exceedance of the acceptable threshold for noncarcinogenic effects. Above an HI of 1, toxic effects would not necessarily occur but can no longer be ruled out.

5.2 Carcinogenic Risks

Incremental cancer risk (ICR) estimates were generated for each exposure pathway using the estimated intakes and published SFs, as follows:

$$Risk = Intake \times SF$$

If the above equation results in a risk greater than 0.01, a modified equation should be used, as given below. However, because the modification results in a nonlinear scaling of estimated risks with increasing dose, the unmodified linear estimate is better suited for developing preliminary remediation goals, and so has been utilized in RAGS D Table 7s, 9s, and 10s.

$$Risk = 1 - e^{-(Intake \times SF)}$$

The risk determined using these equations is defined as a unitless expression of an individual's increased likelihood of developing cancer as a result of exposure to carcinogenic chemicals. An ICR of 1×10^{-6} indicates that the exposed receptor has a one in one million chance of developing cancer under the defined exposure scenario. Alternatively, such a risk may be interpreted as representing one additional case of cancer in an exposed population of 1,000,000 persons. The calculated cancer risks should be recognized as upper-limit estimates. SFs are defined as the upper 95 percent confidence limit of a dose-response curve generally derived from animal studies.

5.3 Comparison of Quantitative Risk Estimates to Benchmark Criteria

In order to interpret the quantitative risks and to aid risk managers in determining the need for remediation at a site, quantitative risk estimates are compared to typical benchmarks. COPCs exhibiting an HQ above 1, or otherwise contributing to a noncancer HI greater than 1 on the basis of a single target organ or effect, were considered to be chemicals of concern (COCs). However, remediation decisions are not made strictly based on HIs but are often modified by other regulatory requirements such as chemical-specific clean-up goals.

EPA has defined the range of 1×10^{-4} to 1×10^{-6} as the ICR target range such that, when the sum of cancer risks for all COPCs in a given medium is greater than 1×10^{-4}, this generally indicates that EPA will require consideration of remediation options. ICRs below 1×10^{-4} normally do not require remediation of remedial efforts for a given medium. Whenever the overall ICR for a medium was greater than 1×10^{-4}, individual chemicals were selected which contributed significantly to overall risk, typically those chemicals with an individual ICR greater than 1×10^{-6}.

Receptor risks were presented for each area and medium of concern in the form of RAGS D Table 9s (showing all COPCs) and Table 10s (showing only risk drivers). In each risk table where HQs were reported as N/A, the HQs were not calculable because no RfD has been established. Usually in such cases, carcinogenicity is considered to be more important, since carcinogenicity will generally be seen at lower doses than noncarcinogenic effects. Cancer risks that are reported as "N/A" generally indicate that the chemical is not carcinogenic or that an SF has not yet been developed.

Site-specific noncarcinogenic and carcinogenic risks were estimated for potential receptors at the site and are discussed below. If the RME HI exceeded 1.0 for any target organ group or the RME cumulative cancer risk was above 1×10^{-4}, then the CTE cancer risks or noncancer hazards were calculated for the receptor. For each COPC, RAGS D Table 7s present the chemical-specific EPC, estimated noncancer daily intake, the associated noncancer toxicity value (RfD and RfC), and the noncancer HQ. Table 7s also present the cancer dose, associated cancer toxicity values (SF and IUR), and estimated cancer risk.

Associated target organs for noncancer toxicity effects and the cumulative HI for each target organ are presented in RAGS D Table 9s, with a summary of risk drivers in RAGS D Table 10s.

5.4 Noncancer Hazards

Groundwater data were evaluated to estimate potential noncancer hazards for exposure to child and adult residents, as shown in Tables 9.1 and 9.2, respectively. For the residential child, the target organs with RME HIs exceeding 1.0 were the liver (HI of 6.0, primary contributor vinyl chloride with an HQ of 5.9), and kidney (HI of 19, primary contributor 1,2-dichloroethene (cis) with an HQ of 19).

For the residential adult, when RME HIs were grouped according to target organ, the HI for the liver was 2.2 (primary contributor vinyl chloride with an HQ of 2.1) and the HI for the kidney was 6.2 (primary contributor 1,2-dichloroethene (cis) with an HQ of 6.2).

As shown in Table 9.1.CTE, for the CTE analysis of groundwater data, when HIs for the residential child were grouped according to target organ, the HI for the liver was 3.4 (associated with vinyl chloride) and the HI for the kidney was 11 (associated with 1,2-dichloroethene (cis)).

For the residential adult, when CTE HIs were grouped according to target organ, the HI for the liver was 1.4 (associated with vinyl chloride) and the HI for the kidney was 4.3 (associated with 1,2-dichloroethene (cis)).

5.5 Cancer Risks

Groundwater data were evaluated to estimate potential cancer risks for exposure to child, adult, and lifetime residents, as shown in Tables 9.1, 9.2, and 9.3, respectively. To estimate the lifetime cancer risk for a resident exposed to groundwater, the estimated RME ICRs for the child and adult residents were added together to yield a lifetime ICR of 1.6×10^{-2}, which exceeds the upper end of the target risk range of 1×10^{-6} to 1×10^{-4}. Several COPCs contributed to estimated lifetime residential cancer risks: vinyl chloride (ICR of 1.5×10^{-2}), trichloroethene (ICR of 9.8×10^{-5}), tetrachloroethene (ICR of 1.3×10^{-5}), and benzene (ICR of 2.1×10^{-6}).

For the lifetime residential receptor exposed to groundwater, the CTE ICR for was 5.2×10^{-4}, which exceeds the target acceptable risk range of 1×10^{-6} to 1×10^{-4}. CTE cancer risks for the child, adult, and lifetime resident are shown in Tables 9.1.CTE, 9.2.CTE, and 9.3.CTE, respectively. The primary contributors to CTE cancer risks were vinyl chloride (ICR of 5.0×10^{-4}), trichloroethene (ICR of 1.5×10^{-5}), and tetrachloroethene (ICR of 2.4×10^{-6}).

6.0 UNCERTAINTY ANALYSIS

This section discusses the general and site-specific uncertainties associated with the estimated risks, exposure models, and assumptions utilized in the HHRA. The goal of the uncertainty analysis is to identify important uncertainties and limitations associated with the risk assessment. As discussed in EPA (1989a), the risk measures used in risk assessments are not fully probabilistic estimates of risk but rather are conditional estimates based on a considerable number of assumptions about exposure and toxicity. There are uncertainties associated with each aspect of risk assessment, from environmental data collection through risk characterization.

6.1 Uncertainties Associated with Numbers of Samples, Locations, and Sampling Timeframe

The spatial and temporal sampling coverage of the groundwater plume (including the location and depth of wells and the timeframes of sampling) impacts the selection of COPCs, the calculation of EPCs, and consequently the risks estimated for the site. Past remedial investigations have delineated the area of the groundwater plume at the site, so that appropriate monitoring wells were sampled and included in this risk assessment so as to ensure data representative of concentrations within the plume. In addition, the time periods of sampling can affect whether data are representative of current groundwater conditions. Therefore, the groundwater risk assessment only considered data collected from April 2007 forward.

6.2 Uncertainties Regarding the Estimation of the EPC

Other uncertainties exist regarding estimation of an analyte concentration for input into the quantitative risk assessment. The calculated EPC is generally regarded as a conservative estimate since it is based on the 95 percent UCL on the arithmetic mean (based on a normal, lognormal, gamma, or nonparametric data distribution). As discussed in Section 1.2, ProUCL was employed to select the optimal type of 95 percent UCL for any given chemical data set. The goal of this decision scheme was to consider the individual characteristics of each data set, particularly the distributional shape, and pick the most representative UCL calculation that is expected to have a high confidence (at least 95 percent chance) of being greater than the population's true mean. This approach lowers the chances of underestimation of the upper range of human health risks that could be associated with future use of groundwater by residents.

The ability (power) of distributional analysis tests to be able to correctly identify genuine differences between the shape of a sample population versus a reference normal, lognormal, or gamma population is reduced when too few samples are collected or when very few detected sample results exist. If an incorrect distributional assumption is made, this could lead to an over- or underestimate of the upper

95 percent concentration, which in turn would create some additional uncertainty as to whether the calculated risk is a reasonable approximation of high end exposure.

Uncertainty in the calculated UCL was examined and discussed in cases involving data sets with fewer than the recommended number of 8 to 10 detected sample results. If there were fewer than 5 samples or fewer than 5 detected sample results for any substance, the accuracy and reliability of a statistical calculation of the UCL was weighed against the option of using a single data point, such as the maximum detected sample concentration, as an alternative for the selected EPC.

6.3 Uncertainties in Laboratory Data Quality

Validated laboratory data were used to calculate EPCs. Established data validation procedures were applied to define analytical uncertainties in terms of qualifying data as inaccurate or imprecise and to eliminate data points that are unusable for risk assessment. This treatment does not eliminate all uncertainty but focuses attention on potential areas of concern regarding accuracy, precision, and data gaps.

6.4 Uncertainties Associated with Exposure Assessment

If alternative public water supplies are utilized in the future instead of local groundwater, this would render tap water use of groundwater as an incomplete exposure pathway for any residents located near the site.

Uptake dose resulting from tap water dermal contact is associated with several uncertainties. Prediction of absorption rates for lipophilic compounds is difficult due to, among other reasons, the possibility of a second absorption pathway that depends on the lipid content of the stratum corneum at the application site. Experimental determination of absorption rates indicates that interspecies differences are considerable, which, along with other variability's related to condition and age of skin, differences in lag time, and site of application effects, yields appreciable uncertainty in estimated dermal exposures by using published chemical-specific permeation functions. In addition, literature data indicate a variation by as much as a factor of 300 in chemical absorption rates for skin in different anatomical areas of the body. It should also be noted that children generally have greater absorption rates than adults and their activity patterns often result in greater soil-to-skin adherence factors.

Receptor activity patterns and receptor characteristics also contribute uncertainty to the risk assessment process based on input values selected for each exposure route. For example, not all people weigh 70 kilograms or drink 2 liters of water per day. In addition, the typical adult may not take a 30 minute shower and the average child might not bathe exactly one hour each day, and the average duration of

time spent living at the same residence is less than 30 years. Since several of these assumptions are intended to represent the upper range of possible exposure (RME), alternate exposure assumptions that are more typical of the central range of a population (CTE) were used to generate an estimate of CTE risks. The rationale for each input parameter assumption was provided in the RAGS D Table 4s. All receptor characteristics, such as age and body weight, were based on published values.

6.5 Uncertainties Associated With Toxicity Assessment

There is uncertainty associated with the RfDs and SFs. The uncertainty results from the extrapolation of animal data to humans, the extrapolation of carcinogenic effects from the laboratory high-dose to the environmental low-dose scenarios, and interspecies and intraspecies variations in toxicological endpoints caused by chemical exposure. The use of EPA RfD values is generally considered to be conservative because the doses are based on no-effect or lowest-observed-effect levels and then further reduced with uncertainty factors to increase the margin of safety by a factor in the neighborhood of 10 to 1,000 fold. Uncertainty factors for RfDs, RfCs, SFs, and IURs used in this risk assessment are presented on RAGS D Tables 5.1, 5.2, 6.1, and 6.2.

The uncertainty associated with dermal exposure is high because of the derivation of the dermal slope factor and reference dose. The dermal toxicity factors are based on default oral absorption factors. This can result in an overestimation of the toxicity factors.

As discussed in Section 4.1, established RfDs have an inherent amount of uncertainty. Uncertainty factors for RfDs, RfCs, SFs, and IURs used in this risk assessment are presented on Tables 5.1, 5.2, 6.1, and 6.2.

Inhalation risks are uncertain for several reasons. Inhalation risks are subject to modeling uncertainty with regards to accuracy of predictions for inter-media transfer from air to the lungs. In addition, EPA RAGS Part F guidance (EPA, 2009) was applied that utilizes the inhalation unit risk (IUR) for carcinogenic risk and reference concentration (RfC) for noncancer hazards, and which does not directly adjust for the effect of receptor-specific differences in breathing rate and body weight in calculating risk. This approach is generally expected to be more accurate compared to the older approach which estimated chemical toxicities relative to unit air volume inhaled and per kg body weight. However, the approach may or may not be more accurate for some substances, depending on the mechanism of action.

6.6 Uncertainties Associated with Risk Characterization

ICRs and HIs are summed for all potential COPCs and for all applicable routes of exposure. Summing the risks implies that no antagonistic or synergistic effects exist between chemicals. It also assumes that similar mechanisms of action and metabolism are prevalent. Therefore, the use of an additive approach may either underestimate or overestimate risks, depending on the chemical-specific interactions, which cannot necessarily be predicted from single-chemical studies. The direction of the bias associated with non-additive chemical interactions cannot be defined, although the approach is based on current guidance and risk assessment methodology.

7.0 RISK ASSESSMENT SUMMARY

The HHRA for the Butz Landfill Site was performed to evaluate risks to current or future human receptors potentially exposed to groundwater via residential use of tap water. RAGS D Tables 1 through 9 present the exposure scenarios, COPCs, EPCs, input parameters, cancer and noncancer toxicity factors, and associated risks to potentially exposed receptors. Table 9s list the cancer risks and non-cancer hazards estimated for each receptor. Associated target organs for noncancer toxicity effects and the cumulative HI for each target organ are presented in RAGS D Table 9s, with a summary of risk drivers in RAGS D Table 10s.

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TABLES

TABLE 1
SELECTION OF EXPOSURE PATHWAYS - GROUNDWATER CONTACT
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Populations	Receptor Age	Exposure Routes	Type of Analysis	Rationale
Future	Groundwater	Groundwater	Tap Water Contact with Groundwater	Resident	Adult	Ingestion	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Tap Water Contact with Groundwater	Resident	Adult	Dermal	Quant*	Dermal exposure would occur during bathing or showering.
		Vapors	Inhalation of Groundwater Vapors During Show	Resident	Adult	Inhalation	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Tap Water Contact with Groundwater	Resident	Child	Ingestion	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Tap Water Contact with Groundwater	Resident	Child	Dermal	Quant*	Dermal exposure would occur during bathing.
		Vapors	Inhalation of Groundwater Vapors During Bathi	Resident	Child	Inhalation	Qual	Receptor activity patterns could result in exposure, but bathing more likely than showering.
		Groundwater	Tap Water Contact with Groundwater	Resident	Child/Adult**	Ingestion	Quant	Receptor activity patterns could result in exposure.
		Groundwater	Tap Water Contact with Groundwater	Resident	Child/Adult**	Dermal	Quant	Receptor activity patterns could result in exposure.
		Vapors	Inhalation of Groundwater Vapors During Show	Resident	Child/Adult**	Inhalation	Quant	Receptor activity patterns could result in exposure.

*Adult resident is assumed to take showers. Child resident is assumed to bathe, not shower.
**Resident Child/Adult represents cumulative (lifetime) exposure only applied to cancer risk.

4 MCL exceedances:
1,1DCE
c-1,2DCE
TCE
VC

TABLE 2
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN - CONTACT WITH MONITORING WELL GROUNDWATER
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point(s)	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits (2)	Concentration Used for Screening (3)	Background Value (4)	Screening Toxicity Value (N/C) (5)	Potential ARAR/TBC Value	Potential ARAR/TBC Source (6)	COPC Flag (Y/N)	Rationale for Contaminant Selection or Deletion (7,8)
Tap Water Contact and Water Vapors at Showerhead	106-46-7	**1,4-Dichlorobenzene**	0.5 J	0.5 J	ug/L	R2-B-20080416	1/68	0.5-50	0.5	N/A	0.43 C	75	MCL	Y	**ASL**
	79-00-5	**1,1,2-Trichloroethane**	0.34 J	0.47 J	ug/L	R1D-A-20080418	3/68	0.5-50	0.47	N/A	0.24 C	5	MCL	Y	**ASL**
	75-34-3	1,1-Dichloroethane	0.18 J	0.67 J	ug/L	PWA-B-20080421	8/68	0.5-50	0.67	N/A	2.4 C	--	--	N	BSL
	75-35-4	**1,1-Dichloroethene**	2.6 J	35 J	ug/L	R1D-A-20070411	4/68	0.5-50	35	N/A	34 N	7	MCL	Y	**ASL**
	156-59-2	**1,2-Dichloroethene (cis)**	2.4 J	2900	ug/L	R1D-A-20100421	67/68	5-5	2900	N/A	7.3 N	70	MCL	Y	**ASL**
	156-60-5	1,2-Dichloroethene (trans)	0.27 J	11	ug/L	R1D-B-20100421	19/68	0.5-50	11	N/A	11 N	100	MCL	N	BSL
	67-64-1	Acetone	1.5 J	11	ug/L	PWA-D-20070416	3/63	5-500	11	N/A	2200 N	--	--	N	BSL
	71-43-2	**Benzene**	0.26 J	1.7 J	ug/L	R2-A-20070419	2/68	0.5-50	1.7	N/A	0.41 C	5	MCL	Y	**ASL**
	75-27-4	**Bromodichloromethane**	0.21 J	0.21 J	ug/L	R1D-B-20090112	1/68	0.5-50	0.21	N/A	0.12 C	80	Trihalomethane MCL	Y	**ASL**
	75-15-0	Carbon Disulfide	0.73 J	0.73 J	ug/L	PWA-D-20080421	1/68	0.5-50	0.73	N/A	100 N	--	--	N	BSL
	108-90-7	Chlorobenzene	0.47 J	4.6 J	ug/L	R2-B-20070419	4/68	0.5-50	4.6	N/A	9.1 N	100	MCL	N	BSL
	67-66-3	**Chloroform**	0.3 J	0.7 J	ug/L	R1D-B-20080418	5/68	0.5-50	0.7	N/A	0.19 C	80	Trihalomethane MCL	Y	**ASL**
	74-87-3	Chloromethane	0.41 J	0.41 J	ug/L	R1D-A-20080418	1/68	0.5-50	0.41	N/A	19 N	--	--	N	BSL
	100-41-4	Ethylbenzene	0.16 J	0.18 J	ug/L	R1D-A-20080418	2/68	0.5-50	0.18	N/A	1.5 C	700	MCL	N	BSL
	179601-23-1	M,p-xylene	0.11 J	0.11 J	ug/L	R1D-A-20090113	1/68	0.5-50	0.11	N/A	20 N	10000	Total xylenes MCL	N	BSL
	75-09-2	Methylene Chloride	0.69 J	1 J	ug/L	PWA-D-20080421	2/39	0.5-50	1	N/A	4.8 C	5	MCL	N	BSL
	100-42-5	Styrene	0.15 J	0.66 J	ug/L	R1D-A-20090113	3/68	0.5-50	0.66	N/A	160 N	100	MCL	N	BSL
	127-18-4	**Tetrachloroethene**	0.4 J	2.1 J	ug/L	R2-A-20070419	8/68	0.5-50	2.1	N/A	0.11 C	5	MCL	Y	**ASL**
	108-88-3	Toluene	0.17 J	0.85 J	ug/L	R8-A-20080416	4/67	0.5-50	0.85	N/A	230 N	1000	MCL	N	BSL
	79-01-6	**Trichloroethene**	0.73	2700	ug/L	R2-A-20070419	67/68	50-50	2700	N/A	2.0 C	5	MCL	Y	**ASL**
	75-01-4	**Vinyl Chloride**	0.46 J	1700	ug/L	R1D-B-20100421	19/68	0.5-50	1700	N/A	0.016 C	2	MCL	Y	**ASL**

Footnotes:

1 - Sample and duplicate are considered as two separate samples when determining the minimum and maximum concentrations.
2 - Values presented are sample-specific quantitation limits or sample-specific instrument detection limits.
3 - The maximum detected concentration is used for screening purposes.
4 - Background comparison was not used to eliminate COPCs.
5 - The EPA Regional Screening Levels (RSLs) for residential tap water exposure are presented. The noncarcinogenic values (annotated "N") are divided by 10. to correspond to a target hazard quotient of 0.1, or an incremental cancer risk of 1.0E-06 for carcinogens (annotated "C") (USEPA , November 2010).
6 - EPA, 2009. The Maximum Contaminant Level (MCL) is a shown from the website: http://water.epa.gov/drink/contaminants/index.cfm
7 - The chemical is selected as a COPC if the maximum detected concentration exceeds the risk-based COPC screening level.

Definitions:

ARAR/TBC = Applicable or Relevant and Appropriate Requirement/To Be Considered
N/A = Not Applicable or Not Available
COPC = Chemical of Potential Concern
C = Carcinogen
N = Non-Carcinogenic
J = Estimated Value

Samples Compared:

PWA-A-20070416	PWB-A-20070419	R1-1A-A-20090114	R1D-B-20070412	R6-B-20080421	R7-D-20070417
PWA-A-20080421	PWB-A-20080416	R1-1A-A-20100421	R1D-B-20080418	R6-B-20100416	R7-D-20080417
PWA-A-20080421-D	PWB-A-20100413	R1-1A-B-20070412	R1D-B-20090112	R7-A-20070417	R7-D-20100415
PWA-A-20100414	PWB-A-20100413-D	R1-1A-B-20080415	R1D-B-20100421	R7-A-20070417-D	R8-A-20070418
PWA-B-20070416	PWB-B-20070419	R1-1A-B-20090114	R2-A-20070419	R7-A-20080417	R8-A-20080416
PWA-B-20080421	PWB-B-20080416	R1-1A-B-20100421	R2-A-20080416	R7-A-20100415	R8-A-20100413
PWA-B-20100414	PWB-B-20080416-D	R1-1A-C-20070412	R2-B-20070419	R7-B-20070417	R8-B-20070418
PWA-C-20070416	PWB-B-20100413	R1-1A-C-20080415	R2-B-20080416	R7-B-20080417	R8-B-20080416
PWA-C-20080421	PWB-C-20070419	R1-1A-C-20100420	R6-A-20070413	R7-B-20100415	R8-B-20100413
PWA-C-20100414	PWB-C-20080416	R1D-A-20070411	R6-A-20080421	R7-C-20070417	
PWA-D-20070416	PWB-C-20100413	R1D-A-20080418	R6-A-20100415	R7-C-20080417	
PWA-D-20080421	R1-1A-A-20070412	R1D-A-20090113	R6-A-20100415-D	R7-C-20100415	
PWA-D-20100414	R1-1A-A-20080415	R1D-A-20100421	R6-B-20070413	R7-C-20100415-D	

(8) Rationale Codes:

For Selection as a COPC:
ASL = Above Screening Level
For Elimination as a COPC:
BSL = Below Screening Level
NUT = Nutrient
NTX = No Toxicity Data

TABLE 3
EXPOSURE POINT CONCENTRATION SUMMARY - CONTACT WITH GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
Tap Water Contact and Water Vapors at Showerhead	1,4-Dichlorobenzene	ug/L	5.00E-01	NA	0.5 J	5.00E-01	ug/L	Max	Number of detects = 1; use Max
	1,1,2-Trichloroethane	ug/L	3.93E-01	NA	0.47 J	4.70E-01	ug/L	Max	Number of detects = 3; use Max
	1,1-Dichloroethene	ug/L	1.79E+01	2.16E+01	35 J	2.16E+01	ug/L	95% KM (Percentile Bootstrap) UCL	Normal dist.; 1.0 < σ ≤ 1.0; All n; ND ≥ 50%
	1,2-Dichloroethene (cis)	ug/L	1.42E+02	4.22E+02	2900	4.22E+02	ug/L	97.5% KM (Chebyshev) UCL	Lognormal Dist.; 1.5 ≤ σ ≤ 2.0; n ≥ 40; ND < 50%
	Benzene	ug/L	9.80E-01	NA	1.7 J	1.70E+00	ug/L	Max	Number of detects = 2; use Max
	Bromodichloromethane	ug/L	2.10E-01	NA	0.21 J	2.10E-01	ug/L	Max	Number of detects = 1; use Max
	Chloroform	ug/L	4.58E-01	5.04E-01	0.7 J	5.04E-01	ug/L	95% KM (Percentile Bootstrap) UCL	Normal Dist.; All n; ND > 0%; max. UCL chosen
	Tetrachloroethene	ug/L	8.83E-01	9.73E-01	2.1 J	9.73E-01	ug/L	95% KM (Percentile Bootstrap) UCL	Non-Discernable Dist.; 0.5 < σ ≤ 1.0; All n; ND ≥ 40%
	Trichloroethene	ug/L	2.80E+02	6.35E+02	2700	6.35E+02	ug/L	97.5% KM (Chebyshev) UCL	Lognormal Dist.; 1.5 ≤ σ ≤ 2.0; n ≥ 40; ND < 50%
	Vinyl Chloride	ug/L	1.49E+02	2.06E+02	1700	2.06E+02	ug/L	97.5% KM (Chebyshev) UCL	σ > 2.0 to 3.0; n ≥ 50 to 60; ND > 0%

NC

TABLE 4.01.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS - CHILD RESIDENT CONTACT WITH GROUNDWATER

CENTRAL TENDENCY EXPOSURE

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Child	Site 3	CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002	Chronic Daily Intake (CDI) (mg/kg/day) =
				CF	Conversion Factor	0.001	mg/ug	–	
				IR-W	Ingestion Rate of Groundwater	0.74	L/day	USEPA, 1997	$\frac{CW \times CF \times IR\text{-}W \times EF \times ED}{BW \times AT}$
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	2	years	USEPA, 1993	
				BW	Body Weight	15	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
Dermal	Resident	Child	Site 3	CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002	Dermal Absorbed Dose (mg/kg-day) =
				SA	Skin Surface Available for Contact	6,600	cm2	USEPA, 2004	$\frac{CW \times SA \times KP \times Function(ET) \times EV \times EF \times ED \times CF1 \times CF2}{(BW \times AT)}$
				KP	Permeability Constant (Dermal for Liquids)	Chemical-Specific	cm/hr	USEPA, 2004	
				FA	Fraction Absorbed (Unitless)	Chemical-Specific	cm/hr	USEPA, 2004	
				EV	Event Frequency	1	events/day	USEPA, 2004	Where: Function(ET) = ET for inorganics, or
				ET	Exposure Time	0.33	hours/event	USEPA, 2004	FA x 2 x (6 x Tau x ET / Pt)^0.5 for organics where ET < T*
				EF	Exposure Frequency	350	events/year	USEPA, 2004	FA x [ET/(1+B) + Tau x (2+6B+6B^2)/(1+B)^2] for organics, ET > T*.
				ED	Exposure Duration	2	years	USEPA, 1993	See EPA, 2004 for chemical-specific constants Tau, B, T*
				CF1	Conversion Factor 1	0.001	mg/ug	–	
				CF2	Conversion Factor 2	0.001	l/cm3	–	
				BW	Body Weight	15	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 1993: Superfund Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure.

USEPA, 1997. Exposure Factors Handbook. Update to Exposure Factors Handbook. EPA/600/8-89/043 - May 1989. Office of Research and Development.

USEPA, 2002: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

TABLE 4.02.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS - ADULT RESIDENT CONTACT WITH GROUNDWATER

CENTRAL TENDENCY EXPOSURE

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Site 3	CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002	Chronic Daily Intake (CDI) (mg/kg/day) =
				CF	Conversion Factor	0.001	mg/ug	–	
				IR-W	Ingestion Rate of Groundwater	1.4	L/day	USEPA, 1997	CW x CF x IR-W x EF x ED
				EF	Exposure Frequency	350	days/year	USEPA, 2004	BW x AT
				ED	Exposure Duration	7	years	USEPA, 1997	
				BW	Body Weight	70	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	
Dermal	Resident	Adult	Site 3	CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002	Dermal Absorbed Dose (mg/kg-day) =
				SA	Skin Surface Available for Contact	18,000	cm2	USEPA, 2004	CW x SA x KP x Function(ET) x EV x EF x ED x CF1 x CF2
				KP	Permeability Constant (Dermal for Liquids)	Chemical-Specific	cm/hr	USEPA, 2004	(BW x AT)
				FA	Fraction Absorbed (Unitless)	Chemical-Specific	cm/hr	USEPA, 2004	
				EV	Event Frequency	1	events/day	USEPA, 2004	Where: Function(ET) = ET for inorganics, or
				ET	Exposure Time	0.167	hours/event	USEPA, 1997	FA x 2 x (6 x Tau x ET / PI)^0.5 for organics where ET < T*
				EF	Exposure Frequency	350	events/year	USEPA, 2004	FA x [ET/(1+B) + Tau x (2+6B+6B^2)/(1+B)^2] for organics, ET > T*.
				ED	Exposure Duration	7	years	USEPA, 1997	See EPA, 2004 for chemical-specific constants Tau, B, T*
				CF1	Conversion Factor 1	0.001	mg/ug	–	
				CF2	Conversion Factor 2	0.001	l/cm3	–	
				BW	Body Weight	70	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,555	days	USEPA, 1989	

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 1997. Exposure Factors Handbook. Update to Exposure Factors Handbook. EPA/600/8-89/043 - May 1989. Office of Research and Development.

USEPA, 2002: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

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TABLE 4.02a.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS - ADULT RESIDENT CONTACT WITH GROUNDWATER

CENTRAL TENDENCY EXPOSURE

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

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Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Inhalation of Vapors During Showering	EF	Exposure Frequency	350	days/year	USEPA, 2004	EC (mg/m3) = (EC-event x ET x EF x ED) / (AT)
				ED	Exposure Duration	7	years	USEPA, 1997	(Exposure Concentration equivalent to continuous exposure over averaging period)
				AT-C	Averaging Time (Cancer)	613200	hours	USEPA, 2009	where:
				AT-N	Averaging Time (Non-Cancer)	61320	hours	USEPA, 2009	AT-C = 24 hrs/day x 365 days/yr x 70 years & AT-N = 24 hrs/day x 365 days/yr x ED yrs
				ET	Exposure Time	derived	hours/day	USEPA, 2009	ET (hours/day) = (Dt min/shower / (60 min/hr)) x (1 shower / day)
				EC-event	Exposure Concentration equivalent to steady exposure during 1 shower	Derived	mg/m3	USEPA, 2009	EC-event (mg/m3) = (S x Q) / (Ra x CF1 x Dt)
				CF1	Conversion Factor	1000	ug/mg		(Exposure Concentration equivalent to steady exposure during one shower event)
				Q	Function of Air Exchange Rate & Time in Shower & Shower Room	2.7897	min	Fos&Chr, 1987	
				Ds	Duration of Shower	10	min	USEPA, 1997	where: Q = Ds + [(exp(-Ra x Dt))/Ra] - [(exp(Ra x (Ds - Dt)))/Ra]
				Dt	Total Time in Shower Room	20	min	USEPA, 1997	
				Ra	Rate of Air Exchange	0.01667	1/min	Fos&Chr, 1987	
				S	Indoor VOC Generation Rate	Chemical Specific	ug/m3/min	Fos&Chr, 1987	where: S = CWD x FR/SV
				FR	Shower Flow Rate	10	l/min	USEPA, 2010	
				SV	Shower Room Air Volume	12	m3	USEPA, 2010	
				CWD	Chemical Concentration Leaving Water Droplet after time ts	Chemical Specific	ug/l	Fos&Chr, 1987	where: CWD = CW x {1-exp[-KaL x ts x (6/d) x CF2 x CF3]}
				CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002a	
				CF2	Conversion Factor	1/3600	hr/sec		
				CF3	Conversion Factor	10	mm/cm		
				ts	Shower Droplet Time	0.5	sec	USEPA, 2010	
				d	Shower Droplet Diameter	1	mm	Fos&Chr, 1987	
				KaL	Adjusted overall mass transfer coefficient	Chemical Specific	cm/hr	Fos&Chr, 1987	where: KaL = KL/SQRT[(T1 x u1)/(Ts x u1)]
				T1	Calibration Water Temperature of KL	293	K	Fos&Chr, 1987	
				Ts	Shower Water Temperature	318	K	Fos&Chr, 1987	
				u1	Water Viscosity at T1	1.002	centipose	Fos&Chr, 1987	
				us	Water Viscosity at Ts	0.596	centipose	Fos&Chr, 1987	

TABLE 4.02a.CTE

VALUES USED FOR DAILY INTAKE CALCULATIONS - ADULT RESIDENT CONTACT WITH GROUNDWATER

CENTRAL TENDENCY EXPOSURE

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Inhalation of Vapors During Showering	KL	Mass Transfer Coefficient	Chemical Specific	cm/hr	Fos&Chr, 1987	where: KL = 1/[(1/Kl) + ((R x T)/(H x kg))]
				R	Ideal Gas law Constant	8.21E-05	atm m3/mole/K	Fos&Chr, 1987	
				T	Absolute Temperature	293	K	Fos&Chr, 1987	
				H	Henry's law Constant	Chemical Specific	atm m3/mole	USEPA, 2002b	
				kg	Gas-film Mass Transfer Coefficient	Chemical Specific	cm/hr	Fos&Chr, 1987	where: kg = kH x SQRT[MWH/MW]
				kl	Liquid-film Mass Transfer Coefficient	Chemical Specific	cm/hr	Fos&Chr, 1987	where kl = kC x SQRT[MWC/MW]
				kH	Gas-film Mass Transfer Coefficient for Water	3000	cm/hr	Fos&Chr, 1987	
				kC	Liquid-film Mass Transfer Coefficient for Carbon Dioxde	20	cm/hr	Fos&Chr, 1987	
				MWH	Molecular Weight of Water	18	g/mole	Fos&Chr, 1987	
				MWC	Molecular Weight of Carbon Dioxde	44	g/mole	Fos&Chr, 1987	
				MW	Molecular Weight of COPC	Chemical Specific	g/mole	Fos&Chr, 1987	

Sources

(a). Professional Judgment. Inhalation rate (IR) during showering corresponds to light activity (1.0 m3/hr) based on IR estimates for activity categories presented in EPA, 1997.

USEPA, 2001. Fact Sheet. Correcting the Henry's Law Constant for Soil Temperature, from website: http://www.USEPA.gov/superfund/programs/risk/airmodel/factsheet.pdf

USEPA, 2002a: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10

USEPA, 2002b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

USEPA, 2009: Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual. (Part F, Supplemental Guidance for Inhalation Risk Assessment). Final. EPA 540-R-070-002.

USEPA, 2010: Recommended by Region 3 EPA.

Foster, S. A. and P.C. Chrostowski, 1987. Inhalation Exposures to Volatile Organic Contaminants in the Shower. Presented at the 80th Annual Meeting of the Air Pollution Control Association. New York, NY June.

Default Henry's Law Constants (HLCs) at 25 degrees C obtained from EPA, 1996. See appendix for conversion of HLCs to showering temperature using EPA, 2001.

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TABLE 4.01.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS - CHILD RESIDENT CONTACT WITH GROUNDWATER

REASONABLE MAXIMUM EXPOSURE

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Child	Site 3	CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002	Chronic Daily Intake (CDI) (mg/kg/day) =
				CF	Conversion Factor	0.001	mg/ug	–	
				IR-W	Ingestion Rate of Groundwater	1.29	L/day	USEPA, 1997	CW x CF x IR-W x EF x ED
				EF	Exposure Frequency	350	days/year	USEPA, 2004	BW x AT
				ED	Exposure Duration	6	years	USEPA, 2004	
				BW	Body Weight	15	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	
Dermal	Resident	Child	Site 3	CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002	Dermal Absorbed Dose (mg/kg-day) =
				SA	Skin Surface Available for Contact	6,600	cm2	USEPA, 2004	CW x SA x KP x Function(ET) x EV x EF x ED x CF1 x CF2
				KP	Permeability Constant (Dermal for Liquids)	Chemical-Specific	cm/hr	USEPA, 2004	(BW x AT)
				FA	Fraction Absorbed (Unitless)	Chemical-Specific	cm/hr	USEPA, 2004	
				EV	Event Frequency	1	events/day	USEPA, 2004	Where: Function(ET) = ET for inorganics, or
				ET	Exposure Time	1	hours/event	USEPA, 2004	FA x 2 x (6 x Tau x ET / PI)^0.5 for organics where ET < T*
				EF	Exposure Frequency	350	events/year	USEPA, 2004	FA x [ET/(1+B) + Tau x (2+6B+6B^2)/(1+B)^2] for organics, ET > T*.
				ED	Exposure Duration	6	years	USEPA, 2004	See EPA, 2004 for chemical-specific constants Tau, B, T*
				CF1	Conversion Factor 1	0.001	mg/ug	–	
				CF2	Conversion Factor 2	0.001	l/cm3	–	
				BW	Body Weight	15	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2,190	days	USEPA, 1989	

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 1997. Exposure Factors Handbook. Update to Exposure Factors Handbook. EPA/600/8-89/043 - May 1989. Office of Research and Development.

USEPA, 2002: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

TABLE 4.02.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS - ADULT RESIDENT CONTACT WITH GROUNDWATER

REASONABLE MAXIMUM EXPOSURE

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Groundwater

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Resident	Adult	Site 3	CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002	Chronic Daily Intake (CDI) (mg/kg/day) =
				CF	Conversion Factor	0.001	mg/ug	--	
				IR-W	Ingestion Rate of Groundwater	2	L/day	USEPA, 1997	CW x CF x IR-W x EF x ED
				EF	Exposure Frequency	350	days/year	USEPA, 2004	BW x AT
				ED	Exposure Duration	24	years	USEPA, 2004	
				BW	Body Weight	70	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	
Dermal	Resident	Adult	Site 3	CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002	Dermal Absorbed Dose (mg/kg-day) =
				SA	Skin Surface Available for Contact	18,000	cm2	USEPA, 2004	CW x SA x KP x Function(ET) x EV x EF x ED x CF1 x CF2
				KP	Permeability Constant (Dermal for Liquids)	Chemical-Specific	cm/hr	USEPA, 2004	(BW x AT)
				FA	Fraction Absorbed (Unitless)	Chemical-Specific	cm/hr	USEPA, 2004	
				EV	Event Frequency	1	events/day	USEPA, 2004	Where: Function(ET) = ET for inorganics, or
				ET	Exposure Time	0.5	hours/event	USEPA, 2010	FA x 2 x (6 x Tau x ET / PI)^0.5 for organics where ET < T*
				EF	Exposure Frequency	350	events/year	USEPA, 2004	FA x [ET/(1+B) + Tau x (2+6B+6B^2)/(1+B)^2] for organics, ET > T*.
				ED	Exposure Duration	24	years	USEPA, 2004	See EPA, 2004 for chemical-specific constants Tau, B, T*
				CF1	Conversion Factor 1	0.001	mg/ug	--	
				CF2	Conversion Factor 2	0.001	l/cm3	--	
				BW	Body Weight	70	kg	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25,550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8,760	days	USEPA, 1989	

Sources:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol 1: Human Health Evaluation Manual, Part A. EPA/540/1-86/060.

USEPA, 1997. Exposure Factors Handbook. Update to Exposure Factors Handbook. EPA/600/8-89/043 - May 1989. Office of Research and Development.

USEPA, 2002: Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites. OSWER 9285.6-10.

USEPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

USEPA, 2010: Recommended by Region 3 EPA.

TABLE 4.02a.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS - ADULT RESIDENT CONTACT WITH GROUNDWATER

REASONABLE MAXIMUM EXPOSURE

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Inhalation of Vapors During Showering	EF	Exposure Frequency	350	days/year	USEPA, 2004	EC (mg/m3) = (EC-event x ET x EF x ED) / (AT)
				ED	Exposure Duration	24	years	USEPA, 2004	(Exposure Concentration equivalent to continuous exposure over averaging period)
				AT-C	Averaging Time (Cancer)	613200	hours	USEPA, 2009	where:
				AT-N	Averaging Time (Non-Cancer)	210240	hours	USEPA, 2009	AT-C = 24 hrs/day x 365 days/yr x 70 years & AT-N = 24 hrs/day x 365 days/yr x ED yrs
				ET	Exposure Time	derived	hours/day	USEPA, 2009	ET (hours/day) = (Dt min/shower / (60 min/hr)) x (1 shower / day)
				EC-event	Exposure Concentration equivalent to steady exposure during 1 shower	Derived	mg/m3	USEPA, 2009	EC-event (mg/m3) = (S x Q) / (Ra x CF1 x Dt)
				CF1	Conversion Factor	1000	ug/mg		(Exposure Concentration equivalent to steady exposure during one shower event)
				Q	Function of Air Exchange Rate & Time in Shower & Shower Room	15.68	min	Calculated	
				Ds	Dunation of Shower	30	min	USEPA, 2010	where: Q = Ds + [(exp(-Ra x Dt))/Ra] - [(exp(Ra x (Ds - Dt))/Ra]
				Dt	Total Time in Shower Room (considered the Micro-Event Time - ET)	60	min	USEPA, 2010	
				Ra	Rate of Air Exchange	0.01667	1/min	Fos&Chr, 1987	
				S	Indoor VOC Generation Rate	Chemical Specific	ug/m3/min	Fos&Chr, 1987	where: S = CWD x FR/SV
				FR	Shower Flow Rate	10	l/min	USEPA, 2010	
				SV	Shower Room Air Volume	12	m3	USEPA, 2010	
				CWD	Chemical Concentration Leaving Water Droplet after time ts	Chemical Specific	ug/l	Fos&Chr, 1987	where: CWD = CW x [1-exp[-KaL x ts x (6/d) x CF2 x CF3]]
				CW	Chemical Concentration in Groundwater	Max or 95% UCL	ug/l	USEPA, 2002a	
				CF2	Conversion Factor	1/3600	hr/sec		
				CF3	Conversion Factor	10	mm/cm		
				ts	Shower Droplet Time	0.5	sec	USEPA, 2010	
				d	Shower Droplet Diameter	1	mm	Fos&Chr, 1987	
				KaL	Adjusted overall mass transfer coefficient	Chemical Specific	cm/hr	Fos&Chr, 1987	where: KaL = KL/SQRT[(T1 x us)/(Ts x u1)]
				T1	Calibration Water Temperature of KL	293	K	Fos&Chr, 1987	
				Ts	Shower Water Temperature	318	K	Fos&Chr, 1987	
				u1	Water Viscosity at T1	1.002	centpose	Fos&Chr, 1987	
				us	Water Viscosity at Ts	0.596	centpose	Fos&Chr, 1987	

TABLE 4.02a.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS - ADULT RESIDENT CONTACT WITH GROUNDWATER

REASONABLE MAXIMUM EXPOSURE

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Medium: Groundwater
Exposure Medium: Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Resident	Adult	Inhalation of Vapors During Showering	KL	Mass Transfer Coefficient	Chemical Specific	cm/hr	Fos&Chr, 1987	where: KL = 1/[(1/kL) + ((R x T)/(H x kg))]
				R	Ideal Gas law Constant	8.21E-05	atm m3/mole/K	Fos&Chr, 1987	
				T	Absolute Temperature	293	K	Fos&Chr, 1987	
				H	Henry's law Constant	Chemical Specific	atm m3/mole	USEPA, 2002b	
				kg	Gas-film Mass Transfer Coefficient	Chemical Specific	cm/hr	Fos&Chr, 1987	where kg = kH x SQRT[MWH/MW]
				kl	Liquid-film Mass Transfer Coefficient	Chemical Specific	cm/hr	Fos&Chr, 1987	where: kl = kC x SQRT[MWC/MW]
				kH	Gas-film Mass Transfer Coefficient for Water	3000	cm/hr	Fos&Chr, 1987	
				kC	Liquid-film Mass Transfer Coefficient for Carbon Dioxide	20	cm/hr	Fos&Chr, 1987	
				MWH	Molecular Weight of Water	18	g/mole	Fos&Chr, 1987	
				MWC	Molecular Weight of Carbon Dioxide	44	g/mole	Fos&Chr, 1987	
				MW	Molecular Weight of COPC	Chemical Specific	g/mole	Fos&Chr, 1987	

Sources

USEPA, 2001. Fact Sheet. Correcting the Henry's Law Constant for Soil Temperature, from website. http://www.USEPA.gov/superfund/programs/risk/airmodel/factsheet.pdf

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USEPA, 2002b: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. OSWER 9355.4-24.

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USEPA, 2010: Recommended by Region 3 EPA

Foster, S. A and P.C. Chrostowski. 1987. Inhalation Exposures to Volatile Organic Contaminants in the Shower. Presented at the 80th Annual Meeting of the Air Pollution Control Association. New York, NY. June.

Default Henry's Law Constants (HLCs) at 25 degrees C obtained from EPA, 1996. See appendix for conversion of HLCs to showering temperature using EPA, 2001.

TABLE 5.1

NON-CANCER TOXICITY DATA – ORAL/DERMAL

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Chemical of Potential Concern	Chronic/ Subchronic	Oral RfD		Oral Absorption Efficiency for Dermal (1)	Absorbed RfD for Dermal (2)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfD: Target Organ(s)	
		Value	Units		Value	Units			Source(s) (3)	Date(s)
1,4-Dichlorobenzene	Chronic	7.00E-02	mg/kg-day	1.00E+00	7.00E-02	mg/kg-day	Liver/Developmental	1000	ATSDR	08/2006
1,1,2-Trichloroethane	Chronic	4.00E-03	mg/kg-day	1.00E+00	4.00E-03	mg/kg-day	Blood/Liver	1000	IRIS	01/11/2011
1,1-Dichloroethene	Chronic	5.00E-02	mg/kg-day	1.00E+00	5.00E-02	mg/kg-day	Liver	100	IRIS	01/11/2011
1,2-Dichloroethene (cis)	Chronic	2.00E-03	mg/kg-day	1.00E+00	2.00E-03	mg/kg-day	Kidney	3000	IRIS	01/11/2011
Benzene	Chronic	4.00E-03	mg/kg-day	1.00E+00	4.00E-03	mg/kg-day	Blood/Immune	300	IRIS	01/11/2011
Bromodichloromethane	Chronic	2.00E-02	mg/kg-day	1.00E+00	2.00E-02	mg/kg-day	Kidney	1000	IRIS	01/11/2011
Chloroform	Chronic	1.00E-02	mg/kg-day	1.00E+00	1.00E-02	mg/kg-day	Liver	100	IRIS	01/11/2011
Tetrachloroethene	Chronic	1.00E-02	mg/kg-day	1.00E+00	1.00E-02	mg/kg-day	Liver	1000	IRIS	01/11/2011
Trichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Vinyl Chloride	Chronic	3.00E-03	mg/kg-day	1.00E+00	3.00E-03	mg/kg-day	Liver	30	IRIS	01/11/2011

1 - U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

2 - Adjusted dermal RfD = Oral RfD x Oral Absorption Efficiency for Dermal.

3 - IRIS - Integrated Risk Information System (EPA, 2011)

ATSDR MRL - Agency for Toxic Substances and Disease Registry Minimal Risk Level

HEAST - EPA Health Effects Assessment Summary Tables

PPRTV - Provisional Peer Reviewed Toxicity Values

TABLE 5.2

NON-CANCER TOXICITY DATA – INHALATION

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD (1)		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC: Target Organ(s)	
		Value	Units	Value	Units			Source(s) (2)	Dates
1,4-Dichlorobenzene	Chronic	8.00E-01	mg/m3	N/A	N/A	Liver	100	IRIS	01/11/2011
1,1,2-Trichloroethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,1-Dichloroethene	Chronic	2.00E-01	mg/m3	N/A	N/A	Liver	30	IRIS	01/11/2011
1,2-Dichloroethene (cis)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	Chronic	3.00E-02	mg/m3	N/A	N/A	Blood/Immune	300	IRIS	01/11/2011
Bromodichloromethane	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chloroform	Chronic	9.80E-02	mg/m3	N/A	N/A	Liver		ATSDR	09/1997
Tetrachloroethene	Chronic	2.70E-01	mg/m3	N/A	N/A	CNS/Kidney	100	ATSDR	09/1997
Trichloroethene	N/A	(N/A) 0.01	N/A	N/A	N/A	N/A	N/A	N/A NYSDOH	N/A
Vinyl Chloride	Chronic	1.00E-01	mg/m3	N/A	N/A	Liver	30	IRIS	01/11/2011

1 - RAGS Part F (EPA, 2009) requires use of the inhalation RfC, so the extrapolated inhalation RfD is obsolete (RFDi = RfC *20m3/day / 70 kg)

2 - IRIS - Integrated Risk Information System (EPA, 2011)

Cal EPA - California Environmental Protection Agency Toxicity Value

PPRTV - Provisional Peer Reviewed Toxicity Values

ATSDR MRL - Agency for Toxic Substances and Disease Registry Minimal Risk Level

TABLE 6.1

CANCER TOXICITY DATA – ORAL/DERMAL

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Chemical of Potential Concern	Oral Cancer Slope Factor		Oral Absorption Efficiency for Dermal(1)	Absorbed Cancer Slope Factor for Dermal(2)		Weight of Evidence/ Cancer Guideline Description	Oral CSF	
	Value	Units		Value	Units		Source(s) (3)	Date(s)
1,4-Dichlorobenzene	5.40E-03	1/(mg/kg-day)	1.00E+00	5.40E-03	1/(mg/kg-day)	C	Cal EPA	01/11/2011
1,1,2-Trichloroethane	5.70E-02	1/(mg/kg-day)	1.00E+00	5.70E-02	1/(mg/kg-day)	C	IRIS	01/11/2011
1,1-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethene (cis)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	5.50E-02	1/(mg/kg-day)	1.00E+00	5.50E-02	1/(mg/kg-day)	A	IRIS	01/11/2011
Bromodichloromethane	6.20E-02	1/(mg/kg-day)	1.00E+00	6.20E-02	1/(mg/kg-day)	B2	IRIS	01/11/2011
Chloroform	3.10E-02	1/(mg/kg-day)	1.00E+00	3.10E-02	1/(mg/kg-day)	B2	Cal EPA	01/11/2011
Tetrachloroethene	5.40E-01	1/(mg/kg-day)	1.00E+00	5.40E-01	1/(mg/kg-day)	B2-C	CalEPA	01/11/2011
Trichloroethene	5.90E-03	1/(mg/kg-day)	1.00E+00	5.90E-03	1/(mg/kg-day)	B2	CalEPA	01/11/2011
Vinyl Chloride *	7.20E-01	1/(mg/kg-day)	1.00E+00	7.20E-01	1/(mg/kg-day)	A	IRIS	01/11/2011

N/A = Not Applicable

* - An asterisk indicates a mutagenic chemical for which ADAFs need to be applied to adjust cancer potency slope factors.

1 - U.S. EPA, 2004: Risk Assessment Guidance for Superfund (Part E, Supplemental Guidance for Dermal Risk Assessment) Final. EPA/540/R/99/005.

2 - Adjusted cancer slope factor for dermal = Oral cancer slope factor / Oral Absorption Efficiency for Dermal.

3 - IRIS - Integrated Risk Information System (EPA, 2011)
EPA - NCEA - EPA National Center for Exposure Assessment
Cal EPA - California Environmental Protection Agency Toxicity Value
NJDEP - New Jersey Department of Environmental Protection

EPA Group:

A - Human carcinogen.

B1 - Probable human carcinogen - indicates that limited human data are available.

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans .

C - Possible human carcinogen.

D - Not classifiable as a human carcinogen.

E - Evidence of noncarcinogenicity.

TABLE 6.2

CANCER TOXICITY DATA – INHALATION

BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor (1)		Weight of Evidence/ Cancer Guideline Description	Unit Risk: Inhalation CSF	
	Value	Units	Value	Units		Sources(s) (2)	Date(s)
1,4-Dichlorobenzene	1.10E-05	1/(ug/m3)	N/A	N/A		Cal EPA	01/11/2011
1,1,2-Trichloroethane	1.60E-05	1/(ug/m3)	N/A	N/A	C	IRIS	01/11/2011
1,1-Dichloroethene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,2-Dichloroethene (cis)	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Benzene	7.80E-06	1/(ug/m3)	N/A	N/A	A	IRIS	01/11/2011
Bromodichloromethane	3.70E-05	1/(ug/m3)	N/A	N/A	B2	Cal EPA	01/11/2011
Chloroform	2.30E-05	1/(ug/m3)	N/A	N/A	B2	IRIS	01/11/2011
Tetrachloroethene	5.90E-06	1/(ug/m3)	N/A	N/A	B2-C	CalEPA	01/11/2011
Trichloroethene	2.00E-06	1/(ug/m3)	N/A	N/A		CalEPA	01/11/2011
Vinyl Chloride*	4.40E-06	1/(ug/m3)	N/A	N/A	A	IRIS	01/11/2011

N/A = Not Applicable

* - An asterisk indicates a mutagenic chemical for which ADAFs need to be applied to adjust cancer slo

1 - RAGS Part F (EPA, 2009) requires use of the inhalation unit risk (IUR), so the extrapolated Inhalation CSF is obsolete (CSFi = IUR * 70 kg / 20m3/day)

2 - IRIS - Integrated Risk Information System (EPA, 2011)

EPA - NCEA - EPA National Center for Exposure Assessment

Cal EPA - California Environmental Protection Agency Toxicity Value

PPRTV - Provisional Peer Reviewed Toxicity Value

EPA Group:

A - Human carcinogen.

B1 - Probable human carcinogen - indicates that limited human data are available.

B2 - Probable human carcinogen - indicates sufficient evidence in animals and inadequate or no evidence in humans .

C - Possible human carcinogen.

D - Not classifiable as a human carcinogen.

E - Evidence of noncarcinogenicity.

TABLE 7 (RAGS D 7.1.CTE)
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - CHILD RESIDENT TAP WATER EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap Water Contact With Groundwater	Ingestion	1,4-Dichlorobenzene	5.00E-01	ug/l	6.76E-07	mg/kg-day	5.40E-03	mg/kg-day	3.65E-09	2.37E-05	mg/kg-day	7.00E-02	mg/kg-day	3.38E-04
				1,1,2-Trichloroethane	4.70E-01	ug/l	6.35E-07	mg/kg-day	5.70E-02	mg/kg-day	3.62E-08	2.22E-05	mg/kg-day	4.00E-03	mg/kg-day	5.56E-03
				1,1-Dichloroethene	2.16E+01	ug/l	2.92E-05	mg/kg-day	--	mg/kg-day	--	1.02E-03	mg/kg-day	5.00E-02	mg/kg-day	2.04E-02
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	5.70E-04	mg/kg-day	--	mg/kg-day	--	2.00E-02	mg/kg-day	2.00E-03	mg/kg-day	9.98E+00
				Benzene	1.70E+00	ug/l	2.30E-06	mg/kg-day	5.50E-02	mg/kg-day	1.26E-07	8.04E-05	mg/kg-day	4.00E-03	mg/kg-day	2.01E-02
				Bromodichloromethane	2.10E-01	ug/l	2.84E-07	mg/kg-day	6.20E-02	mg/kg-day	1.76E-08	9.93E-06	mg/kg-day	2.00E-02	mg/kg-day	4.97E-04
				Chloroform	5.04E-01	ug/l	6.81E-07	mg/kg-day	3.10E-02	mg/kg-day	2.11E-08	2.38E-05	mg/kg-day	1.00E-02	mg/kg-day	2.38E-03
				Tetrachloroethene	9.73E-01	ug/l	1.32E-06	mg/kg-day	5.40E-01	mg/kg-day	7.10E-07	4.60E-05	mg/kg-day	1.00E-02	mg/kg-day	4.60E-03
				Trichloroethene	6.35E+02	ug/l	8.58E-04	mg/kg-day	5.90E-03	mg/kg-day	5.06E-06	3.00E-02	mg/kg-day	--	mg/kg-day	--
				Vinyl Chloride	2.06E+02	ug/l	2.78E-04	mg/kg-day	7.20E-01	mg/kg-day	2.00E-04	9.75E-03	mg/kg-day	3.00E-03	mg/kg-day	3.25E+00
			Exp. Route Total								2.06E-04					1.33E+01
			Dermal	1,4-Dichlorobenzene	5.00E-01	ug/l	3.39E-07	mg/kg-day	5.40E-03	mg/kg-day	1.83E-09	1.19E-05	mg/kg-day	7.00E-02	mg/kg-day	1.69E-04
				1,1,2-Trichloroethane	4.70E-01	ug/l	4.46E-08	mg/kg-day	5.70E-02	mg/kg-day	2.54E-09	1.56E-06	mg/kg-day	4.00E-03	mg/kg-day	3.90E-04
				1,1-Dichloroethene	2.16E+01	ug/l	3.02E-06	mg/kg-day	--	mg/kg-day	--	1.06E-04	mg/kg-day	5.00E-02	mg/kg-day	2.11E-03
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	3.78E-05	mg/kg-day	--	mg/kg-day	--	1.32E-03	mg/kg-day	2.00E-03	mg/kg-day	6.62E-01
				Benzene	1.70E+00	ug/l	2.63E-07	mg/kg-day	5.50E-02	mg/kg-day	1.45E-08	9.20E-06	mg/kg-day	4.00E-03	mg/kg-day	2.30E-03
				Bromodichloromethane	2.10E-01	ug/l	1.73E-08	mg/kg-day	6.20E-02	mg/kg-day	1.08E-09	6.07E-07	mg/kg-day	2.00E-02	mg/kg-day	3.04E-05
				Chloroform	5.04E-01	ug/l	4.64E-08	mg/kg-day	3.10E-02	mg/kg-day	1.44E-09	1.62E-06	mg/kg-day	1.00E-02	mg/kg-day	1.62E-04
				Tetrachloroethene	9.73E-01	ug/l	5.86E-07	mg/kg-day	5.40E-01	mg/kg-day	3.17E-07	2.05E-05	mg/kg-day	1.00E-02	mg/kg-day	2.05E-03
				Trichloroethene	6.35E+02	ug/l	1.11E-04	mg/kg-day	5.90E-03	mg/kg-day	6.55E-07	3.89E-03	mg/kg-day	--	mg/kg-day	--
				Vinyl Chloride	2.06E+02	ug/l	1.08E-05	mg/kg-day	7.20E-01	mg/kg-day	7.79E-06	3.79E-04	mg/kg-day	3.00E-03	mg/kg-day	1.26E-01
			Exp. Route Total								8.78E-06					7.95E-01
		Exposure Point Total									2.15E-04					1.41E+01
	Exposure Medium Total										2.15E-04					1.41E+01
Medium Total											2.15E-04					1.41E+01
											Total of Receptor Risks Across All Media					1.41E+01

NC

TABLE 7 (RAGS D 7.1.RME)
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - CHILD RESIDENT TAP WATER EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap Water Contact With Groundwater	Ingestion	1,4-Dichlorobenzene	5.00E-01	ug/l	3.53E-06	mg/kg-day	5.40E-03	mg/kg-day	1.91E-08	4.12E-05	mg/kg-day	7.00E-02	mg/kg-day	5.89E-04
				1,1,2-Trichloroethane	4.70E-01	ug/l	3.32E-06	mg/kg-day	5.70E-02	mg/kg-day	1.89E-07	3.88E-05	mg/kg-day	4.00E-03	mg/kg-day	9.69E-03
				1,1-Dichloroethene	2.16E+01	ug/l	1.53E-04	mg/kg-day	--	mg/kg-day	--	1.78E-03	mg/kg-day	5.00E-02	mg/kg-day	3.56E-02
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	2.98E-03	mg/kg-day	--	mg/kg-day	--	3.48E-02	mg/kg-day	2.00E-03	mg/kg-day	1.74E+01
				Benzene	1.70E+00	ug/l	1.20E-05	mg/kg-day	5.50E-02	mg/kg-day	6.61E-07	1.40E-04	mg/kg-day	4.00E-03	mg/kg-day	3.50E-02
				Bromodichloromethane	2.10E-01	ug/l	1.48E-06	mg/kg-day	6.20E-02	mg/kg-day	9.20E-08	1.73E-05	mg/kg-day	2.00E-02	mg/kg-day	8.66E-04
				Chloroform	5.04E-01	ug/l	3.56E-06	mg/kg-day	3.10E-02	mg/kg-day	1.10E-07	4.16E-05	mg/kg-day	1.00E-02	mg/kg-day	4.16E-03
				Tetrachloroethene	9.73E-01	ug/l	6.88E-06	mg/kg-day	5.40E-01	mg/kg-day	3.71E-06	8.02E-05	mg/kg-day	1.00E-02	mg/kg-day	8.02E-03
				Trichloroethene	6.35E+02	ug/l	4.49E-03	mg/kg-day	5.90E-03	mg/kg-day	2.65E-05	5.24E-02	mg/kg-day	--	mg/kg-day	--
				Vinyl Chloride	2.06E+02	ug/l	1.46E-03	mg/kg-day	7.20E-01	mg/kg-day	1.33E-02	1.70E-02	mg/kg-day	3.00E-03	mg/kg-day	5.66E+00
			Exp. Route Total								1.33E-02					2.32E+01
			Dermal	1,4-Dichlorobenzene	5.00E-01	ug/l	1.77E-06	mg/kg-day	5.40E-03	mg/kg-day	9.55E-09	2.06E-05	mg/kg-day	7.00E-02	mg/kg-day	2.95E-04
				1,1,2-Trichloroethane	4.70E-01	ug/l	2.33E-07	mg/kg-day	5.70E-02	mg/kg-day	1.33E-08	2.72E-06	mg/kg-day	4.00E-03	mg/kg-day	6.79E-04
				1,1-Dichloroethene	2.16E+01	ug/l	1.63E-05	mg/kg-day	--	mg/kg-day	--	1.90E-04	mg/kg-day	5.00E-02	mg/kg-day	3.81E-03
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	2.04E-04	mg/kg-day	--	mg/kg-day	--	2.39E-03	mg/kg-day	2.00E-03	mg/kg-day	1.19E+00
				Benzene	1.70E+00	ug/l	1.43E-06	mg/kg-day	5.50E-02	mg/kg-day	7.84E-08	1.66E-05	mg/kg-day	4.00E-03	mg/kg-day	4.16E-03
				Bromodichloromethane	2.10E-01	ug/l	9.06E-08	mg/kg-day	6.20E-02	mg/kg-day	5.62E-09	1.06E-06	mg/kg-day	2.00E-02	mg/kg-day	5.28E-05
				Chloroform	5.04E-01	ug/l	2.42E-07	mg/kg-day	3.10E-02	mg/kg-day	7.51E-09	2.83E-06	mg/kg-day	1.00E-02	mg/kg-day	2.83E-04
				Tetrachloroethene	9.73E-01	ug/l	3.06E-06	mg/kg-day	5.40E-01	mg/kg-day	1.65E-06	3.57E-05	mg/kg-day	1.00E-02	mg/kg-day	3.57E-03
				Trichloroethene	6.35E+02	ug/l	5.80E-04	mg/kg-day	5.90E-03	mg/kg-day	3.42E-06	6.77E-03	mg/kg-day	--	mg/kg-day	--
				Vinyl Chloride	2.06E+02	ug/l	6.17E-05	mg/kg-day	7.20E-01	mg/kg-day	5.63E-04	7.20E-04	mg/kg-day	3.00E-03	mg/kg-day	2.40E-01
			Exp. Route Total								5.68E-04					1.45E+00
		Exposure Point Total									1.39E-02					2.46E+01
	Exposure Medium Total										1.39E-02					2.46E+01
Medium Total											1.39E-02					2.46E+01
											Total of Receptor Risks Across All Media	1.39E-02		Total of Receptor Hazards Across All Media		2.46E+01

drivers: VC, cis-1,2-DCE
C (TCE), VC

TABLE 7 (RAGS D 7.2.CTE)
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - ADULT RESIDENT TAP WATER EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

NC

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap Water Contact With Groundwater	Ingestion	1,4-Dichlorobenzene	5.00E-01	ug/l	9.59E-07	mg/kg-day	5.40E-03	mg/kg-day	5.18E-09	9.59E-06	mg/kg-day	7.00E-02	mg/kg-day	1.37E-04
				1,1,2-Trichloroethane	4.70E-01	ug/l	9.01E-07	mg/kg-day	5.70E-02	mg/kg-day	5.14E-08	9.01E-06	mg/kg-day	4.00E-03	mg/kg-day	2.25E-03
				1,1-Dichloroethene	2.16E+01	ug/l	4.14E-05	mg/kg-day	--	mg/kg-day	--	4.14E-04	mg/kg-day	5.00E-02	mg/kg-day	8.28E-03
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	8.09E-04	mg/kg-day	--	mg/kg-day	--	8.09E-03	mg/kg-day	2.00E-03	mg/kg-day	4.05E+00
				Benzene	1.70E+00	ug/l	3.26E-06	mg/kg-day	5.50E-02	mg/kg-day	1.79E-07	3.26E-05	mg/kg-day	4.00E-03	mg/kg-day	8.15E-03
				Bromodichloromethane	2.10E-01	ug/l	4.03E-07	mg/kg-day	6.20E-02	mg/kg-day	2.50E-08	4.03E-06	mg/kg-day	2.00E-02	mg/kg-day	2.01E-04
				Chloroform	5.04E-01	ug/l	9.67E-07	mg/kg-day	3.10E-02	mg/kg-day	3.00E-08	9.67E-06	mg/kg-day	1.00E-02	mg/kg-day	9.67E-04
				Tetrachloroethene	9.73E-01	ug/l	1.87E-06	mg/kg-day	5.40E-01	mg/kg-day	1.01E-06	1.87E-05	mg/kg-day	1.00E-02	mg/kg-day	1.87E-03
				Trichloroethene	6.35E+02	ug/l	1.22E-03	mg/kg-day	5.90E-03	mg/kg-day	7.19E-06	1.22E-02	mg/kg-day	--	mg/kg-day	--
				Vinyl Chloride	2.06E+02	ug/l	3.95E-04	mg/kg-day	7.20E-01	mg/kg-day	2.84E-04	3.95E-03	mg/kg-day	3.00E-03	mg/kg-day	1.32E+00
			Exp. Route Total								2.93E-04					5.39E+00
			Dermal	1,4-Dichlorobenzene	5.00E-01	ug/l	4.37E-07	mg/kg-day	5.40E-03	mg/kg-day	2.36E-09	4.37E-06	mg/kg-day	7.00E-02	mg/kg-day	6.25E-05
				1,1,2-Trichloroethane	4.70E-01	ug/l	5.77E-08	mg/kg-day	5.70E-02	mg/kg-day	3.29E-09	5.77E-07	mg/kg-day	4.00E-03	mg/kg-day	1.44E-04
				1,1-Dichloroethene	2.16E+01	ug/l	3.78E-06	mg/kg-day	--	mg/kg-day	--	3.78E-05	mg/kg-day	5.00E-02	mg/kg-day	7.55E-04
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	4.75E-05	mg/kg-day	--	mg/kg-day	--	4.75E-04	mg/kg-day	2.00E-03	mg/kg-day	2.37E-01
				Benzene	1.70E+00	ug/l	3.24E-07	mg/kg-day	5.50E-02	mg/kg-day	1.78E-08	3.24E-06	mg/kg-day	4.00E-03	mg/kg-day	8.10E-04
				Bromodichloromethane	2.10E-01	ug/l	2.26E-08	mg/kg-day	6.20E-02	mg/kg-day	1.40E-09	2.26E-07	mg/kg-day	2.00E-02	mg/kg-day	1.13E-05
				Chloroform	5.04E-01	ug/l	5.91E-08	mg/kg-day	3.10E-02	mg/kg-day	1.83E-09	5.91E-07	mg/kg-day	1.00E-02	mg/kg-day	5.91E-05
				Tetrachloroethene	9.73E-01	ug/l	7.60E-07	mg/kg-day	5.40E-01	mg/kg-day	4.10E-07	7.60E-06	mg/kg-day	1.00E-02	mg/kg-day	7.60E-04
				Trichloroethene	6.35E+02	ug/l	1.42E-04	mg/kg-day	5.90E-03	mg/kg-day	8.38E-07	1.42E-03	mg/kg-day	--	mg/kg-day	--
				Vinyl Chloride	2.06E+02	ug/l	1.30E-05	mg/kg-day	7.20E-01	mg/kg-day	9.39E-06	1.30E-04	mg/kg-day	3.00E-03	mg/kg-day	4.35E-02
			Exp. Route Total								1.07E-05					2.84E-01
		Exposure Point Total									3.04E-04					5.67E+00
	Exposure Medium Total										3.04E-04					5.67E+00
	Air	Groundwater Vapors During Showering	Inhalation	1,4-Dichlorobenzene	5.00E-01	ug/l	4.12E-07	mg/m3	1.10E-02	1/(mg/m3)	4.54E-09	4.12E-06	mg/m3	8.00E-01	mg/m3	5.15E-06
				1,1,2-Trichloroethane	4.70E-01	ug/l	3.81E-07	mg/m3	1.60E-02	1/(mg/m3)	6.09E-09	3.81E-06	mg/m3	--	mg/m3	--
				1,1-Dichloroethene	2.16E+01	ug/l	2.22E-05	mg/m3	--	1/(mg/m3)	--	2.22E-04	mg/m3	2.00E-01	mg/m3	1.11E-03
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	4.24E-04	mg/m3	--	1/(mg/m3)	--	4.24E-03	mg/m3	--	mg/m3	--
				Benzene	1.70E+00	ug/l	1.90E-06	mg/m3	7.80E-03	1/(mg/m3)	1.48E-08	1.90E-05	mg/m3	3.00E-02	mg/m3	6.35E-04
				Bromodichloromethane	2.10E-01	ug/l	1.60E-07	mg/m3	3.70E-02	1/(mg/m3)	5.91E-09	1.60E-06	mg/m3	--	mg/m3	--
				Chloroform	5.04E-01	ug/l	4.59E-07	mg/m3	2.30E-02	1/(mg/m3)	1.05E-08	4.59E-06	mg/m3	9.80E-02	mg/m3	4.68E-05
				Tetrachloroethene	9.73E-01	ug/l	7.78E-07	mg/m3	5.90E-03	1/(mg/m3)	4.59E-09	7.78E-06	mg/m3	2.70E-01	mg/m3	2.88E-05
				Trichloroethene	6.35E+02	ug/l	5.63E-04	mg/m3	2.00E-03	1/(mg/m3)	1.13E-06	5.63E-03	mg/m3	--	mg/m3	--
				Vinyl Chloride	2.06E+02	ug/l	2.59E-04	mg/m3	4.40E-03	1/(mg/m3)	1.14E-06	2.59E-03	mg/m3	1.00E-01	mg/m3	2.59E-02
			Exp. Route Total								2.31E-06					2.77E-02
		Exposure Point Total									2.31E-06					2.77E-02
	Exposure Medium Total										2.31E-06					2.77E-02
Medium Total											3.06E-04					5.70E+00
											Total of Receptor Risks Across All Media					Total of Receptor Hazards Across All Media
											3.06E-04					5.70E+00

TABLE 7 (RAGS D 7.2.RME)
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - ADULT RESIDENT TAP WATER EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap Water Contact With Groundwater	Ingestion	1,4-Dichlorobenzene	5.00E-01	ug/l	4.70E-06	mg/kg-day	5.40E-03	mg/kg-day	2.54E-08	1.37E-05	mg/kg-day	7.00E-02	mg/kg-day	1.96E-04
				1,1,2-Trichloroethane	4.70E-01	ug/l	4.41E-06	mg/kg-day	5.70E-02	mg/kg-day	2.52E-07	1.29E-05	mg/kg-day	4.00E-03	mg/kg-day	3.22E-03
				1,1-Dichloroethene	2.16E+01	ug/l	2.03E-04	mg/kg-day	--	mg/kg-day	--	5.92E-04	mg/kg-day	5.00E-02	mg/kg-day	1.18E-02
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	3.96E-03	mg/kg-day	--	mg/kg-day	--	1.16E-02	mg/kg-day	2.00E-03	mg/kg-day	5.78E+00
				Benzene	1.70E+00	ug/l	1.60E-05	mg/kg-day	5.50E-02	mg/kg-day	8.78E-07	4.66E-05	mg/kg-day	4.00E-03	mg/kg-day	1.16E-02
				Bromodichloromethane	2.10E-01	ug/l	1.97E-06	mg/kg-day	6.20E-02	mg/kg-day	1.22E-07	5.75E-06	mg/kg-day	2.00E-02	mg/kg-day	2.88E-04
				Chloroform	5.04E-01	ug/l	4.73E-06	mg/kg-day	3.10E-02	mg/kg-day	1.47E-07	1.38E-05	mg/kg-day	1.00E-02	mg/kg-day	1.38E-03
				Tetrachloroethene	9.73E-01	ug/l	9.14E-06	mg/kg-day	5.40E-01	mg/kg-day	4.94E-06	2.67E-05	mg/kg-day	1.00E-02	mg/kg-day	2.67E-03
				Trichloroethene	6.35E+02	ug/l	5.96E-03	mg/kg-day	5.90E-03	mg/kg-day	3.52E-05	1.74E-02	mg/kg-day	--	mg/kg-day	--
				Vinyl Chloride	2.06E+02	ug/l	1.94E-03	mg/kg-day	7.20E-01	mg/kg-day	1.39E-03	5.64E-03	mg/kg-day	3.00E-03	mg/kg-day	1.88E+00
			Exp. Route Total								1.43E-03					7.69E+00
			Dermal	1,4-Dichlorobenzene	5.00E-01	ug/l	2.59E-06	mg/kg-day	5.40E-03	mg/kg-day	1.40E-08	7.57E-06	mg/kg-day	7.00E-02	mg/kg-day	1.08E-04
				1,1,2-Trichloroethane	4.70E-01	ug/l	3.42E-07	mg/kg-day	5.70E-02	mg/kg-day	1.95E-08	9.99E-07	mg/kg-day	4.00E-03	mg/kg-day	2.50E-04
				1,1-Dichloroethene	2.16E+01	ug/l	2.24E-05	mg/kg-day	--	mg/kg-day	--	6.53E-05	mg/kg-day	5.00E-02	mg/kg-day	1.31E-03
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	2.82E-04	mg/kg-day	--	mg/kg-day	--	8.22E-04	mg/kg-day	2.00E-03	mg/kg-day	4.11E-01
				Benzene	1.70E+00	ug/l	1.92E-06	mg/kg-day	5.50E-02	mg/kg-day	1.06E-07	5.61E-06	mg/kg-day	4.00E-03	mg/kg-day	1.40E-03
				Bromodichloromethane	2.10E-01	ug/l	1.34E-07	mg/kg-day	6.20E-02	mg/kg-day	8.32E-09	3.91E-07	mg/kg-day	2.00E-02	mg/kg-day	1.96E-05
				Chloroform	5.04E-01	ug/l	3.51E-07	mg/kg-day	3.10E-02	mg/kg-day	1.09E-08	1.02E-06	mg/kg-day	1.00E-02	mg/kg-day	1.02E-04
				Tetrachloroethene	9.73E-01	ug/l	4.51E-06	mg/kg-day	5.40E-01	mg/kg-day	2.44E-06	1.32E-05	mg/kg-day	1.00E-02	mg/kg-day	1.32E-03
				Trichloroethene	6.35E+02	ug/l	8.43E-04	mg/kg-day	5.90E-03	mg/kg-day	4.97E-06	2.46E-03	mg/kg-day	--	mg/kg-day	--
				Vinyl Chloride	2.06E+02	ug/l	7.74E-05	mg/kg-day	7.20E-01	mg/kg-day	5.57E-05	2.26E-04	mg/kg-day	3.00E-03	mg/kg-day	7.52E-02
			Exp. Route Total								6.33E-05					4.91E-01
		Exposure Point Total									1.50E-03					8.18E+00
	Exposure Medium Total										1.50E-03					8.18E+00
	Air	Groundwater Vapors During Showering	Inhalation	1,4-Dichlorobenzene	5.00E-01	ug/l	1.01E-05	mg/m3	1.10E-02	1/(mg/m3)	1.11E-07	2.93E-05	mg/m3	8.00E-01	mg/m3	3.67E-05
				1,1,2-Trichloroethane	4.70E-01	ug/l	9.29E-06	mg/m3	1.60E-02	1/(mg/m3)	1.49E-07	2.71E-05	mg/m3	--	mg/m3	--
				1,1-Dichloroethene	2.16E+01	ug/l	5.42E-04	mg/m3	--	1/(mg/m3)	--	1.58E-03	mg/m3	2.00E-01	mg/m3	7.90E-03
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	1.04E-02	mg/m3	--	1/(mg/m3)	--	3.02E-02	mg/m3	--	mg/m3	--
				Benzene	1.70E+00	ug/l	4.65E-05	mg/m3	7.80E-03	1/(mg/m3)	3.62E-07	1.35E-04	mg/m3	3.00E-02	mg/m3	4.52E-03
				Bromodichloromethane	2.10E-01	ug/l	3.90E-06	mg/m3	3.70E-02	1/(mg/m3)	1.44E-07	1.14E-05	mg/m3	--	mg/m3	--
				Chloroform	5.04E-01	ug/l	1.12E-05	mg/m3	2.30E-02	1/(mg/m3)	2.57E-07	3.26E-05	mg/m3	9.80E-02	mg/m3	3.33E-04
				Tetrachloroethene	9.73E-01	ug/l	1.90E-05	mg/m3	5.90E-03	1/(mg/m3)	1.12E-07	5.54E-05	mg/m3	2.70E-01	mg/m3	2.05E-04
				Trichloroethene	6.35E+02	ug/l	1.38E-02	mg/m3	2.00E-03	1/(mg/m3)	2.75E-05	4.01E-02	mg/m3	--	mg/m3	--
				Vinyl Chloride	2.06E+02	ug/l	6.31E-03	mg/m3	4.40E-03	1/(mg/m3)	2.78E-05	1.84E-02	mg/m3	1.00E-01	mg/m3	1.84E-01
			Exp. Route Total								5.64E-05					1.97E-01
		Exposure Point Total									5.64E-05					1.97E-01
	Exposure Medium Total										5.64E-05					1.97E-01
Medium Total											1.55E-03					8.38E+00
										Total of Receptor Risks Across All Media	1.55E-03			Total of Receptor Hazards Across All Media		8.38E+00

drivers: CA TCE VC; NC CH2Cl2 TCE VC

TABLE 7 (RAGS D 7.3.CTE)
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - LIFETIME RESIDENT TAP WATER EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

NC

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap Water Contact With Groundwater	Ingestion	1,4-Dichlorobenzene	5.00E-01	ug/l	1.63E-06	mg/kg-day	5.40E-03	mg/kg-day	8.83E-09					N/A
				1,1,2-Trichloroethane	4.70E-01	ug/l	1.54E-06	mg/kg-day	5.70E-02	mg/kg-day	8.76E-08					N/A
				1,1-Dichloroethene	2.16E+01	ug/l	4.14E-05	mg/kg-day	--	mg/kg-day	--					N/A
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	8.09E-04	mg/kg-day	--	mg/kg-day	--					N/A
				Benzene	1.70E+00	ug/l	5.56E-06	mg/kg-day	5.50E-02	mg/kg-day	3.06E-07					N/A
				Bromodichloromethane	2.10E-01	ug/l	6.87E-07	mg/kg-day	6.20E-02	mg/kg-day	4.26E-08					N/A
				Chloroform	5.04E-01	ug/l	1.65E-06	mg/kg-day	3.10E-02	mg/kg-day	5.11E-08					N/A
				Tetrachloroethene	9.73E-01	ug/l	3.18E-06	mg/kg-day	5.40E-01	mg/kg-day	1.72E-06					N/A
				Trichloroethene	6.35E+02	ug/l	2.08E-03	mg/kg-day	5.90E-03	mg/kg-day	1.22E-05					N/A
				Vinyl Chloride	2.06E+02	ug/l	6.73E-04	mg/kg-day	7.20E-01	mg/kg-day	4.85E-04					N/A
			Exp. Route Total								4.99E-04					-
			Dermal	1,4-Dichlorobenzene	5.00E-01	ug/l	7.76E-07	mg/kg-day	5.40E-03	mg/kg-day	4.19E-09					N/A
				1,1,2-Trichloroethane	4.70E-01	ug/l	1.02E-07	mg/kg-day	5.70E-02	mg/kg-day	5.83E-09					N/A
				1,1-Dichloroethene	2.16E+01	ug/l	3.78E-06	mg/kg-day	--	mg/kg-day	--					N/A
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	4.75E-05	mg/kg-day	--	mg/kg-day	--					N/A
				Benzene	1.70E+00	ug/l	5.87E-07	mg/kg-day	5.50E-02	mg/kg-day	3.23E-08					N/A
				Bromodichloromethane	2.10E-01	ug/l	4.00E-08	mg/kg-day	6.20E-02	mg/kg-day	2.48E-09					N/A
				Chloroform	5.04E-01	ug/l	1.06E-07	mg/kg-day	3.10E-02	mg/kg-day	3.27E-09					N/A
				Tetrachloroethene	9.73E-01	ug/l	1.35E-06	mg/kg-day	5.40E-01	mg/kg-day	7.27E-07					N/A
				Trichloroethene	6.35E+02	ug/l	2.53E-04	mg/kg-day	5.90E-03	mg/kg-day	1.49E-06					N/A
				Vinyl Chloride	2.06E+02	ug/l	2.39E-05	mg/kg-day	7.20E-01	mg/kg-day	1.72E-05					N/A
			Exp. Route Total								1.94E-05					-
		Exposure Point Total									5.19E-04					-
	Exposure Medium Total										5.19E-04					-
	Air	Groundwater Vapors During Showering	Inhalation	1,4-Dichlorobenzene	5.00E-01	ug/l	4.12E-07	mg/m3	1.10E-02	1/(mg/m3)	4.54E-09					N/A
				1,1,2-Trichloroethane	4.70E-01	ug/l	3.81E-07	mg/m3	1.60E-02	1/(mg/m3)	6.09E-09					N/A
				1,1-Dichloroethene	2.16E+01	ug/l	2.22E-05	mg/m3	--	1/(mg/m3)	--					N/A
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	4.24E-04	mg/m3	--	1/(mg/m3)	--					N/A
				Benzene	1.70E+00	ug/l	1.90E-06	mg/m3	7.80E-03	1/(mg/m3)	1.48E-08					N/A
				Bromodichloromethane	2.10E-01	ug/l	1.60E-07	mg/m3	3.70E-02	1/(mg/m3)	5.91E-09					N/A
				Chloroform	5.04E-01	ug/l	4.59E-07	mg/m3	2.30E-02	1/(mg/m3)	1.05E-08					N/A
				Tetrachloroethene	9.73E-01	ug/l	7.78E-07	mg/m3	5.90E-03	1/(mg/m3)	4.59E-09					N/A
				Trichloroethene	6.35E+02	ug/l	5.63E-04	mg/m3	2.00E-03	1/(mg/m3)	1.13E-06					N/A
				Vinyl Chloride	2.06E+02	ug/l	2.59E-04	mg/m3	4.40E-03	1/(mg/m3)	1.14E-06					N/A
			Exp. Route Total								2.31E-06					-
		Exposure Point Total									2.31E-06					-
	Exposure Medium Total										2.31E-06					-
Medium Total											5.21E-04					-
										Total of Receptor Risks Across All Media	5.21E-04			Total of Receptor Hazards Across All Media			-

TABLE 7 (RAGS D 7.3.RME)
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS - LIFETIME RESIDENT TAP WATER EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Exposure Route	Chemical of Potential Concern	EPC		Cancer Risk Calculations					Non-Cancer Hazard Calculations				
					Value	Units	Intake/Exposure Concentration		CSF/Unit Risk		Cancer Risk	Intake/Exposure Concentration		RfD/RfC		Hazard Quotient
							Value	Units	Value	Units		Value	Units	Value	Units	
Groundwater	Groundwater	Tap Water Contact With Groundwater	Ingestion	1,4-Dichlorobenzene	5.00E-01	ug/l	8.23E-06	mg/kg-day	5.40E-03	mg/kg-day	4.44E-08					NA
				1,1,2-Trichloroethane	4.70E-01	ug/l	7.74E-06	mg/kg-day	5.70E-02	mg/kg-day	4.41E-07					NA
				1,1-Dichloroethene	2.16E+01	ug/l	2.03E-04	mg/kg-day	--	mg/kg-day	--					NA
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	3.96E-03	mg/kg-day	--	mg/kg-day	--					NA
				Benzene	1.70E+00	ug/l	2.80E-05	mg/kg-day	5.50E-02	mg/kg-day	1.54E-06					NA
				Bromodichloromethane	2.10E-01	ug/l	3.46E-06	mg/kg-day	6.20E-02	mg/kg-day	2.14E-07					NA
				Chloroform	5.04E-01	ug/l	8.30E-06	mg/kg-day	3.10E-02	mg/kg-day	2.57E-07					NA
				Tetrachloroethene	9.73E-01	ug/l	1.60E-05	mg/kg-day	5.40E-01	mg/kg-day	8.65E-06					NA
				Trichloroethene	6.35E+02	ug/l	1.05E-02	mg/kg-day	5.90E-03	mg/kg-day	6.17E-05					NA
				Vinyl Chloride	2.06E+02	ug/l	3.39E-03	mg/kg-day	7.20E-01	mg/kg-day	1.47E-02					NA
			Exp. Route Total								1.47E-02	✓				--
			Dermal	1,4-Dichlorobenzene	5.00E-01	ug/l	4.36E-06	mg/kg-day	5.40E-03	mg/kg-day	2.36E-08					NA
				1,1,2-Trichloroethane	4.70E-01	ug/l	5.75E-07	mg/kg-day	5.70E-02	mg/kg-day	3.28E-08					NA
				1,1-Dichloroethene	2.16E+01	ug/l	2.24E-05	mg/kg-day	--	mg/kg-day	--					NA
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	2.82E-04	mg/kg-day	--	mg/kg-day	--					NA
				Benzene	1.70E+00	ug/l	3.35E-06	mg/kg-day	5.50E-02	mg/kg-day	1.84E-07					NA
				Bromodichloromethane	2.10E-01	ug/l	2.25E-07	mg/kg-day	6.20E-02	mg/kg-day	1.39E-08					NA
				Chloroform	5.04E-01	ug/l	5.93E-07	mg/kg-day	3.10E-02	mg/kg-day	1.84E-08					NA
				Tetrachloroethene	9.73E-01	ug/l	7.57E-06	mg/kg-day	5.40E-01	mg/kg-day	4.09E-06					NA
				Trichloroethene	6.35E+02	ug/l	1.42E-03	mg/kg-day	5.90E-03	mg/kg-day	8.40E-06					NA
				Vinyl Chloride	2.06E+02	ug/l	1.39E-04	mg/kg-day	7.20E-01	mg/kg-day	6.19E-04					NA
			Exp. Route Total								6.32E-04	✓				--
		Exposure Point Total									1.54E-02					--
	Exposure Medium Total										1.54E-02					--
	Air	Groundwater Vapors During Showering	Inhalation	1,4-Dichlorobenzene	5.00E-01	ug/l	1.01E-05	mg/m3	1.10E-02	1/(mg/m3)	1.11E-07					NA
				1,1,2-Trichloroethane	4.70E-01	ug/l	9.29E-06	mg/m3	1.60E-02	1/(mg/m3)	1.49E-07					NA
				1,1-Dichloroethene	2.16E+01	ug/l	5.42E-04	mg/m3	--	1/(mg/m3)	--					NA
				1,2-Dichloroethene (cis)	4.22E+02	ug/l	1.04E-02	mg/m3	--	1/(mg/m3)	--					NA
				Benzene	1.70E+00	ug/l	4.65E-05	mg/m3	7.80E-03	1/(mg/m3)	3.62E-07					NA
				Bromodichloromethane	2.10E-01	ug/l	3.90E-06	mg/m3	3.70E-02	1/(mg/m3)	1.44E-07					NA
				Chloroform	5.04E-01	ug/l	1.12E-05	mg/m3	2.30E-02	1/(mg/m3)	2.57E-07					NA
				Tetrachloroethene	9.73E-01	ug/l	1.90E-05	mg/m3	5.90E-03	1/(mg/m3)	1.12E-07					NA
				Trichloroethene	6.35E+02	ug/l	1.38E-02	mg/m3	2.00E-03	1/(mg/m3)	2.75E-05					NA
				Vinyl Chloride	2.06E+02	ug/l	6.31E-03	mg/m3	4.40E-03	1/(mg/m3)	2.78E-05					NA
			Exp. Route Total								5.64E-05	✓				--
		Exposure Point Total									5.64E-05					--
	Exposure Medium Total										5.64E-05					--
Medium Total											1.54E-02	✓				--
										Total of Receptor Risks Across All Media	1.54E-02	✓	Total of Receptor Hazards Across All Media			--

TABLE 9 (RAGS D 9.1.CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RESIDENT EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

NC

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact With Groundwater	1,4-Dichlorobenzene	3.65E-09	--	1.83E-09	--	5.48E-09	Liver/Developmental	3.38E-04	--	1.69E-04	5.07E-04
			1,1,2-Trichloroethane	3.62E-08	--	2.54E-09	--	3.88E-08	Blood/Liver	5.56E-03	--	3.90E-04	5.95E-03
			1,1-Dichloroethene	--	--	--	--	--	Liver	2.04E-02	--	2.11E-03	2.25E-02
			1,2-Dichloroethene (cis)	--	--	--	--	--	Kidney	9.98E+00	--	6.62E-01	1.06E+01
			Benzene	1.26E-07	--	1.45E-08	--	1.41E-07	Blood/Immune	2.01E-02	--	2.30E-03	2.24E-02
			Bromodichloromethane	1.76E-08	--	1.08E-09	--	1.87E-08	Kidney	4.97E-04	--	3.04E-05	5.27E-04
			Chloroform	2.11E-08	--	1.44E-09	--	2.26E-08	Liver	2.38E-03	--	1.62E-04	2.55E-03
			Tetrachloroethene	7.10E-07	--	3.17E-07	--	1.03E-06	Liver	4.60E-03	--	2.05E-03	6.65E-03
			Trichloroethene	5.06E-06	--	6.55E-07	--	5.72E-06	N/A	--	--	--	--
			Vinyl Chloride	2.00E-04	--	7.79E-06	--	2.08E-04	Liver	3.25E+00	--	1.26E-01	3.37E+00
			(Total)	2.06E-04	--	8.78E-06		2.15E-04		1.33E+01	--	7.95E-01	1.41E+01
		Exposure Point Total						2.15E-04					1.41E+01
	Exposure Medium Total							2.15E-04					1.41E+01
Groundwater Total								2.15E-04					1.41E+01
Receptor Total								2.15E-04					1.41E+01

Total Risk Across All Media: 2.15E-04

Total Hazard Index Across All Media: 1.41E+01

Total Blood HI =	2.84E-02
Total Developmental HI =	5.07E-04
Total Immune HI =	2.24E-02
Total Kidney HI =	1.06E+01
Total Liver HI =	3.41E+00

TABLE 9 (RAGS D 9.1.RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - CHILD RESIDENT EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact With Groundwater	1,4-Dichlorobenzene	1.91E-08	--	9.55E-09	--	2.86E-08	Liver/Developmental	5.89E-04	--	2.95E-04	8.84E-04
			1,1,2-Trichloroethane	1.89E-07	--	1.33E-08	--	2.03E-07	Blood/Liver	9.69E-03	--	6.79E-04	1.04E-02
			1,1-Dichloroethene	--	--	--	--	--	Liver	3.56E-02	--	3.81E-03	3.94E-02
			1,2-Dichloroethene (cis)	--	--	--	--	--	Kidney	1.74E+01	--	1.19E+00	1.86E+01
			Benzene	6.61E-07	--	7.84E-08	--	7.39E-07	Blood/Immune	3.50E-02	--	4.16E-03	3.92E-02
			Bromodichloromethane	9.20E-08	--	5.62E-09	--	9.76E-08	Kidney	8.66E-04	--	5.28E-05	9.19E-04
			Chloroform	1.10E-07	--	7.51E-09	--	1.18E-07	Liver	4.16E-03	--	2.83E-04	4.44E-03
			Tetrachloroethene	3.71E-06	--	1.65E-06	--	5.37E-06	Liver	8.02E-03	--	3.57E-03	1.16E-02
			Trichloroethene	2.65E-05	--	3.42E-06	--	2.99E-05	N/A	--	--	--	--
			Vinyl Chloride	1.33E-02	--	5.63E-04	--	1.38E-02	Liver	5.66E+00	--	2.40E-01	5.90E+00
			(Total)	1.33E-02	--	5.68E-04		1.39E-02		2.32E+01	--	1.45E+00	2.46E+01
		Exposure Point Total						1.39E-02					2.46E+01
	Exposure Medium Total							1.39E-02					2.46E+01
Groundwater Total								1.39E-02					2.46E+01
Receptor Total								1.39E-02					2.46E+01

Total Risk Across All Media: 1.39E-02

Total Hazard Index Across All Media: 2.46E+01

Total Blood HI =	4.96E-02
Total Developmental HI =	8.84E-04
Total Immune HI =	3.92E-02
Total Kidney HI =	1.86E+01
Total Liver HI =	5.97E+00

TABLE 9 (RAGS D 9.2.CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RESIDENT EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

NC

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact With Groundwater											
			1,4-Dichlorobenzene	5.18E-09	--	2.36E-09	--	7.54E-09	Liver/Developmental	1.37E-04	--	6.25E-05	1.99E-04
			1,1,2-Trichloroethane	5.14E-08	--	3.29E-09	--	5.47E-08	Blood/Liver	2.25E-03	--	1.44E-04	2.40E-03
			1,1-Dichloroethene	--	--	--	--	--	Liver	8.28E-03	--	7.55E-04	9.04E-03
			1,2-Dichloroethene (cis)	--	--	--	--	--	Kidney	4.05E+00	--	2.37E-01	4.28E+00
			Benzene	1.79E-07	--	1.78E-08	--	1.97E-07	Blood/Immune	8.15E-03	--	8.10E-04	8.96E-03
			Bromodichloromethane	2.50E-08	--	1.40E-09	--	2.64E-08	Kidney	2.01E-04	--	1.13E-05	2.13E-04
			Chloroform	3.00E-08	--	1.83E-09	--	3.18E-08	Liver	9.67E-04	--	5.91E-05	1.03E-03
			Tetrachloroethene	1.01E-06	--	4.10E-07	--	1.42E-06	Liver	1.87E-03	--	7.60E-04	2.63E-03
			Trichloroethene	7.19E-06	--	8.38E-07	--	8.02E-06	N/A	--	--	--	--
			Vinyl Chloride	2.84E-04	--	9.39E-06	--	2.94E-04	Liver	1.32E+00	--	4.35E-02	1.36E+00
			(Total)	2.93E-04	--	1.07E-05		3.04E-04		5.39E+00	--	2.84E-01	5.67E+00
		Exposure Point Total						3.04E-04					5.67E+00
	Exposure Medium Total							3.04E-04					5.67E+00
	Air	Inhalation of Groundwater Vapors During Showering											
			1,4-Dichlorobenzene	--	4.54E-09	--	--	4.54E-09	Liver	--	5.15E-06	--	5.15E-06
			1,1,2-Trichloroethane	--	6.09E-09	--	--	6.09E-09	N/A	--	--	--	--
			1,1-Dichloroethene	--	--	--	--	--	Liver	--	1.11E-03	--	1.11E-03
			1,2-Dichloroethene (cis)	--	--	--	--	--	N/A	--	--	--	--
			Benzene	--	1.48E-08	--	--	1.48E-08	Blood/Immune	--	6.35E-04	--	6.35E-04
			Bromodichloromethane	--	5.91E-09	--	--	5.91E-09	N/A	--	--	--	--
			Chloroform	--	1.05E-08	--	--	1.05E-08	Liver	--	4.68E-05	--	4.68E-05
			Tetrachloroethene	--	4.59E-09	--	--	4.59E-09	CNS/Kidney	--	2.88E-05	--	2.88E-05
			Trichloroethene	--	1.13E-06	--	--	1.13E-06	N/A	--	--	--	--
			Vinyl Chloride	--	1.14E-06	--	--	1.14E-06	Liver	--	2.59E-02	--	2.59E-02
			(Total)	--	2.31E-06	--		2.31E-06		--	2.77E-02	--	2.77E-02
		Exposure Point Total						2.31E-06					2.77E-02
	Exposure Medium Total							2.31E-06					2.77E-02
Groundwater Total								3.06E-04					5.70E+00
Receptor Total								3.06E-04					5.70E+00

Total Risk Across All Media: 3.06E-04

Total Hazard Index Across All Media: 5.70E+00

Total Blood HI =	1.20E-02
Total CNS HI =	2.88E-05
Total Developmental HI =	1.99E-04
Total Immune HI =	9.60E-03
Total Kidney HI =	4.28E+00
Total Liver HI =	1.40E+00

TABLE 9 (RAGS D 9.2.RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - ADULT RESIDENT EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact With Groundwater	1,4-Dichlorobenzene	2.54E-08	--	1.40E-08	--	3.94E-08	Liver/Developmental	1.96E-04	--	1.08E-04	3.04E-04
			1,1,2-Trichloroethane	2.52E-07	--	1.95E-08	--	2.71E-07	Blood/Liver	3.22E-03	--	2.50E-04	3.47E-03
			1,1-Dichloroethene	--	--	--	--	--	Liver	1.18E-02	--	1.31E-03	1.31E-02
			1,2-Dichloroethene (cis)	--	--	--	--	--	Kidney	5.78E+00	--	4.11E-01	6.19E+00
			Benzene	8.78E-07	--	1.06E-07	--	9.84E-07	Blood/Immune	1.16E-02	--	1.40E-03	1.30E-02
			Bromodichloromethane	1.22E-07	--	8.32E-09	--	1.31E-07	Kidney	2.88E-04	--	1.96E-05	3.07E-04
			Chloroform	1.47E-07	--	1.09E-08	--	1.58E-07	Liver	1.38E-03	--	1.02E-04	1.48E-03
			Tetrachloroethene	4.94E-06	--	2.44E-06	--	7.37E-06	Liver	2.67E-03	--	1.32E-03	3.98E-03
			Trichloroethene	3.52E-05	--	4.97E-06	--	4.02E-05	N/A	--	--	--	--
			Vinyl Chloride	1.39E-03	--	5.57E-05	--	1.45E-03	Liver	1.88E+00	--	7.52E-02	1.96E+00
			(Total)	1.43E-03	--	6.33E-05		1.50E-03		7.69E+00	--	4.91E-01	8.18E+00
		Exposure Point Total						1.50E-03					8.18E+00
	Exposure Medium Total							1.50E-03					8.18E+00
	Air	Inhalation of Groundwater Vapors During Showering	1,4-Dichlorobenzene	--	1.11E-07	--	--	1.11E-07	Liver	--	3.67E-05	--	3.67E-05
			1,1,2-Trichloroethane	--	1.49E-07	--	--	1.49E-07	N/A	--	--	--	--
			1,1-Dichloroethene	--	--	--	--	--	Liver	--	7.90E-03	--	7.90E-03
			1,2-Dichloroethene (cis)	--	--	--	--	--	N/A	--	--	--	--
			Benzene	--	3.62E-07	--	--	3.62E-07	Blood/Immune	--	4.52E-03	--	4.52E-03
			Bromodichloromethane	--	1.44E-07	--	--	1.44E-07	N/A	--	--	--	--
			Chloroform	--	2.57E-07	--	--	2.57E-07	Liver	--	3.33E-04	--	3.33E-04
			Tetrachloroethene	--	1.12E-07	--	--	1.12E-07	CNS/Kidney	--	2.05E-04	--	2.05E-04
			Trichloroethene	--	2.75E-05	--	--	2.75E-05	N/A	--	--	--	--
			Vinyl Chloride	--	2.78E-05	--	--	2.78E-05	Liver	--	1.84E-01	--	1.84E-01
			(Total)	--	5.64E-05	--		5.64E-05		--	1.97E-01	--	1.97E-01
		Exposure Point Total						5.64E-05					1.97E-01
	Exposure Medium Total							5.64E-05					1.97E-01
Groundwater Total								1.56E-03					8.38E+00
Receptor Total								1.56E-03					8.38E+00

Total Risk Across All Media: 1.56E-03

Total Hazard Index Across All Media: 8.38E+00

Total Blood HI =	2.10E-02
Total CNS HI =	2.05E-04
Total Developmental HI =	3.04E-04
Total Immune HI =	1.76E-02
Total Kidney HI =	6.19E+00
Total Liver HI =	2.17E+00

TABLE 9 (RAGS D 9.3.CTE)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - LIFETIME RESIDENT EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

NC

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact With Groundwater											
			1,4-Dichlorobenzene	8.83E-09	--	4.19E-09	--	1.30E-08	N/A	N/A	--	N/A	--
			1,1,2-Trichloroethane	8.76E-08	--	5.83E-09	--	9.34E-08	N/A	N/A	--	N/A	--
			1,1-Dichloroethene	--	--	--	--	--	N/A	N/A	--	N/A	--
			1,2-Dichloroethene (cis)	--	--	--	--	--	N/A	N/A	--	N/A	--
			Benzene	3.06E-07	--	3.23E-08	--	3.38E-07	N/A	N/A	--	N/A	--
			Bromodichloromethane	4.26E-08	--	2.48E-09	--	4.50E-08	N/A	N/A	--	N/A	--
			Chloroform	5.11E-08	--	3.27E-09	--	5.44E-08	N/A	N/A	--	N/A	--
			Tetrachloroethene	1.72E-06	--	7.27E-07	--	2.44E-06	N/A	N/A	--	N/A	--
			Trichloroethene	1.22E-05	--	1.49E-06	--	1.37E-05	N/A	N/A	--	N/A	--
			Vinyl Chloride	4.85E-04	--	1.72E-05	--	5.02E-04	N/A	N/A	--	N/A	--
			(Total)	4.99E-04	--	1.94E-05		5.19E-04		--	--	--	--
		Exposure Point Total						5.19E-04					--
	Exposure Medium Total							5.19E-04					--
	Air	Inhalation of Groundwater Vapors During Showering											
			1,4-Dichlorobenzene	--	4.54E-09	--	--	4.54E-09	N/A	--	N/A	--	--
			1,1,2-Trichloroethane	--	6.09E-09	--	--	6.09E-09	N/A	--	N/A	--	--
			1,1-Dichloroethene	--	--	--	--	--	N/A	--	N/A	--	--
			1,2-Dichloroethene (cis)	--	--	--	--	--	N/A	--	N/A	--	--
			Benzene	--	1.48E-08	--	--	1.48E-08	N/A	--	N/A	--	--
			Bromodichloromethane	--	5.91E-09	--	--	5.91E-09	N/A	--	N/A	--	--
			Chloroform	--	1.05E-08	--	--	1.05E-08	N/A	--	N/A	--	--
			Tetrachloroethene	--	4.59E-09	--	--	4.59E-09	N/A	--	N/A	--	--
			Trichloroethene	--	1.13E-06	--	--	1.13E-06	N/A	--	N/A	--	--
			Vinyl Chloride	--	1.14E-06	--	--	1.14E-06	N/A	--	N/A	--	--
			(Total)	--	2.31E-06	--		2.31E-06		--	--	--	--
		Exposure Point Total						2.31E-06					--
	Exposure Medium Total							2.31E-06					--
Groundwater Total								5.21E-04					--
Receptor Total								5.21E-04					--

Total Risk Across All Media: 5.21E-04

Total Hazard Index Across All Media: --

TABLE 9 (RAGS D 9.3.RME)
SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs - LIFETIME RESIDENT EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact With Groundwater											
			1,4-Dichlorobenzene	4.44E-08	--	2.36E-08	--	6.80E-08	N/A	N/A	--	N/A	--
			1,1,2-Trichloroethane	4.41E-07	--	3.28E-08	--	4.74E-07	N/A	N/A	--	N/A	--
			1,1-Dichloroethene	--	--	--	--	--	N/A	N/A	--	N/A	--
			1,2-Dichloroethene (cis)	--	--	--	--	--	N/A	N/A	--	N/A	--
			Benzene	1.54E-06	--	1.84E-07	--	1.72E-06	N/A	N/A	--	N/A	--
			Bromodichloromethane	2.14E-07	--	1.39E-08	--	2.28E-07	N/A	N/A	--	N/A	--
			Chloroform	2.57E-07	--	1.84E-08	--	2.76E-07	N/A	N/A	--	N/A	--
			Tetrachloroethene	8.65E-06	--	4.09E-06	--	1.27E-05	N/A	N/A	--	N/A	--
			Trichloroethene	6.17E-05	--	8.40E-06	--	7.01E-05	N/A	N/A	--	N/A	--
			Vinyl Chloride	1.47E-02	--	6.19E-04	--	1.53E-02	N/A	N/A	--	N/A	--
			(Total)	1.47E-02	--	6.32E-04		1.54E-02		--	--	--	--
		Exposure Point Total						1.54E-02					--
	Exposure Medium Total							1.54E-02					--
	Air	Inhalation of Groundwater Vapors During Showering											
			1,4-Dichlorobenzene	--	1.11E-07	--	--	1.11E-07	N/A	--	N/A	--	--
			1,1,2-Trichloroethane	--	1.49E-07	--	--	1.49E-07	N/A	--	N/A	--	--
			1,1-Dichloroethene	--	--	--	--	--	N/A	--	N/A	--	--
			1,2-Dichloroethene (cis)	--	--	--	--	--	N/A	--	N/A	--	--
			Benzene	--	3.62E-07	--	--	3.62E-07	N/A	--	N/A	--	--
			Bromodichloromethane	--	1.44E-07	--	--	1.44E-07	N/A	--	N/A	--	--
			Chloroform	--	2.57E-07	--	--	2.57E-07	N/A	--	N/A	--	--
			Tetrachloroethene	--	1.12E-07	--	--	1.12E-07	N/A	--	N/A	--	--
			Trichloroethene	--	2.75E-05	--	--	2.75E-05	N/A	--	N/A	--	--
			Vinyl Chloride	--	2.78E-05	--	--	2.78E-05	N/A	--	N/A	--	--
			(Total)	--	5.64E-05	--		5.64E-05		--	--	--	--
		Exposure Point Total						5.64E-05					--
	Exposure Medium Total							5.64E-05					--
Groundwater Total								1.55E-02					--
Receptor Total								1.55E-02					--

Total Risk Across All Media: 1.55E-02

Total Hazard Index Across All Media: --

TABLE 10 (RAGS D 10.1.CTE)
RISK ASSESSMENT SUMMARY - CHILD RESIDENT EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

NC

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total ##	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total **
Groundwater	Groundwater	Tap Water Contact With Groundwater	1,2-Dichloroethene (cis)						Kidney	9.98E+00	--	6.62E-01	1.06E+01
			Tetrachloroethene	7.10E-07	--	3.17E-07	--	1.03E-06					
			Trichloroethene	5.06E-06	--	6.55E-07	--	5.72E-06					
			Vinyl Chloride	2.00E-04	--	7.79E-06	--	2.08E-04	Liver	3.25E+00	--	1.26E-01	3.37E+00
			(Total ##)	2.06E-04	--	8.76E-06		2.15E-04	(Total **)	1.32E+01	--	7.88E-01	1.40E+01
		Exposure Point Total						2.15E-04					1.40E+01
	Exposure Medium Total							2.15E-04					1.40E+01
Groundwater Total								2.15E-04					1.40E+01
Receptor Total								2.15E-04					1.40E+01

Total Risk Across All Media ## 2.15E-04

Total Hazard Index Across All Media ** 1.40E+01

Total Kidney HI = 1.06E+01
Total Liver HI = 3.37E+00

All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

TABLE 10 (RAGS D 10.1.RME)
RISK ASSESSMENT SUMMARY - CHILD RESIDENT EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total ##	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total **
Groundwater	Groundwater	Tap Water Contact With Groundwater	1,2-Dichloroethene (cis)						Kidney	1.74E+01	--	1.19E+00	1.86E+01
			Benzene	6.61E-07	--	7.84E-08	--	7.39E-07					
			Tetrachloroethene	3.71E-06	--	1.65E-06	--	5.37E-06					
			Trichloroethene	2.65E-05	--	3.42E-06	--	2.99E-05					
			Vinyl Chloride	1.33E-02	--	5.63E-04	--	1.38E-02	Liver	5.66E+00	--	2.40E-01	5.90E+00
			(Total ##)	1.33E-02	--	5.68E-04		1.38E-02	(Total **)	2.31E+01	--	1.43E+00	2.45E+01
		Exposure Point Total						1.38E-02					2.45E+01
	Exposure Medium Total							1.38E-02					2.45E+01
Groundwater Total								1.38E-02					2.45E+01
Receptor Total								1.38E-02					2.45E+01

Total Risk Across All Media ## 1.38E-02

Total Hazard Index Across All Media ** 2.45E+01

Total Kidney HI = 1.86E+01
Total Liver HI = 5.90E+00

All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

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TABLE 10 (RAGS D 10.2.CTE)
RISK ASSESSMENT SUMMARY - ADULT RESIDENT EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total ##	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total **
Groundwater	Groundwater	Tap Water Contact With Groundwater	1,2-Dichloroethene (cis)						Kidney	4.05E+00	--	2.37E-01	4.28E+00
			Tetrachloroethene	1.01E-06	--	4.10E-07	--	1.42E-06					
			Trichloroethene	7.19E-06	--	8.38E-07	--	8.02E-06					
			Vinyl Chloride	2.84E-04	--	9.39E-06	--	2.94E-04	Liver	1.32E+00	--	4.35E-02	1.36E+00
			(Total ##)	2.92E-04	--	1.06E-05		3.03E-04		5.37E+00	--	2.81E-01	5.64E+00
		Exposure Point Total						3.03E-04					5.64E+00
	Exposure Medium Total							3.03E-04					5.64E+00
	Air	Inhalation of Groundwater Vapors During Showering	1,2-Dichloroethene (cis)						N/A	--	--	--	--
			Tetrachloroethene	--	4.59E-09	--	--	4.59E-09					
			Trichloroethene	--	1.13E-06	--	--	1.13E-06					
			Vinyl Chloride	--	1.14E-06	--	--	1.14E-06	Liver	--	2.59E-02	--	2.59E-02
			(Total ##)	--	2.27E-06	--		2.27E-06		--	2.59E-02	--	2.59E-02
		Exposure Point Total						2.27E-06					2.59E-02
	Exposure Medium Total							2.27E-06					2.59E-02
Groundwater Total								3.06E-04					5.67E+00
Receptor Total								3.06E-04					5.67E+00

Total Risk Across All Media ## 3.06E-04

Total Hazard Index Across All Media ** 5.67E+00

Total Kidney HI = 4.28E+00
Total Liver HI = 1.39E+00

All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

TABLE 10 (RAGS D 10.2.RME)
RISK ASSESSMENT SUMMARY - ADULT RESIDENT EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total ##	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total **
Groundwater	Groundwater	Tap Water Contact With Groundwater	1,2-Dichloroethene (cis)						Kidney	5.78E+00	--	4.11E-01	6.19E+00
			Benzene	8.78E-07	--	1.06E-07	--	9.84E-07					
			Tetrachloroethene	4.94E-06	--	2.44E-06	--	7.37E-06					
			Trichloroethene	3.52E-05	--	4.97E-06	--	4.02E-05					
			Vinyl Chloride	1.39E-03	--	5.57E-05	--	1.45E-03	Liver	1.88E+00	--	7.52E-02	1.96E+00
			(Total ##)	1.43E-03	--	6.32E-05		1.50E-03		7.66E+00	--	4.86E-01	8.15E+00
		Exposure Point Total						1.50E-03					8.15E+00
	Exposure Medium Total							1.50E-03					8.15E+00
	Air	Inhalation of Groundwater Vapors During Showering	1,2-Dichloroethene (cis)						N/A	--	--	--	--
			Benzene	--	3.62E-07	--	--	3.62E-07					
			Tetrachloroethene	--	1.12E-07	--	--	1.12E-07					
			Trichloroethene	--	2.75E-05	--	--	2.75E-05					
			Vinyl Chloride	--	2.78E-05	--	--	2.78E-05	Liver	--	1.84E-01	--	1.84E-01
			(Total ##)	--	5.58E-05	--		5.58E-05		--	1.84E-01	--	1.84E-01
		Exposure Point Total						5.58E-05					1.84E-01
	Exposure Medium Total							5.58E-05					1.84E-01
Groundwater Total								1.55E-03					8.33E+00
Receptor Total								1.55E-03					8.33E+00

Total Risk Across All Media ## 1.55E-03

Total Hazard Index Across All Media ** 8.33E+00

Total Kidney HI = 6.19E+00
Total Liver HI = 2.14E+00

All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.
** All chemicals associated with noncarcinogenic toxicity are omitted and total noncancer hazard indices (HIs) for an exposure medium are listed as "0.0E+0" if all target organ-specific HIs <=1 and all HQs <= 1.0 for this receptor.
If a noncancer target organic HI exceeds 1.0 or if any HQ exceeds 1.0, then all COPCs are shown which individually contribute an HQ of at least 0.2 to the target organ HI that exceeds 1.0 or to an HQ that exceeds 1.0.

TABLE 10 (RAGS D 10.3.CTE)
RISK ASSESSMENT SUMMARY - LIFETIME RESIDENT EXPOSURE TO GROUNDWATER
CENTRAL TENDENCY EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

NC

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total ##	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact With Groundwater	Tetrachloroethene	1.72E-06	--	7.27E-07	--	2.44E-06	N/A	N/A	--	N/A	--
			Trichloroethene	1.22E-05	--	1.49E-06	--	1.37E-05	N/A	N/A	--	N/A	--
			Vinyl Chloride	4.85E-04	--	1.72E-05	--	5.02E-04	N/A	N/A	--	N/A	--
			(Total ##)	4.99E-04	--	1.94E-05		5.18E-04		--	--	--	--
		Exposure Point Total						5.18E-04					--
	Exposure Medium Total							5.18E-04					--
	Air	Inhalation of Groundwater Vapors During Showering	Tetrachloroethene	--	4.59E-09	--	--	4.59E-09	N/A	--	N/A	--	--
			Trichloroethene	--	1.13E-06	--	--	1.13E-06	N/A	--	N/A	--	--
			Vinyl Chloride	--	1.14E-06	--	--	1.14E-06	N/A	--	N/A	--	--
			(Total ##)	--	2.27E-06	--		2.27E-06		--	--	--	--
		Exposure Point Total						2.27E-06					--
	Exposure Medium Total							2.27E-06					--
Groundwater Total								5.20E-04					--
Receptor Total								5.20E-04					--

Total Risk Across All Media: 5.20E-04

Total Hazard Index Across All Media: --

All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.

TABLE 10 (RAGS D 10.3.RME)
RISK ASSESSMENT SUMMARY - LIFETIME RESIDENT EXPOSURE TO GROUNDWATER
REASONABLE MAXIMUM EXPOSURE
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total ##	Primary Target Organ(s)	Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Tap Water Contact With Groundwater	Benzene	1.54E-06	--	1.84E-07	--	1.72E-06	N/A	N/A	--	N/A	--
			Tetrachloroethene	8.65E-06	--	4.09E-06	--	1.27E-05	N/A	N/A	--	N/A	--
			Trichloroethene	6.17E-05	--	8.40E-06	--	7.01E-05	N/A	N/A	--	N/A	--
			Vinyl Chloride	1.47E-02	--	6.19E-04	--	1.53E-02	N/A	N/A	--	N/A	--
			(Total ##)	1.48E-02	--	6.32E-04		1.54E-02		--	--	--	--
		Exposure Point Total						1.54E-02					--
	Exposure Medium Total							1.54E-02					--
	Air	Inhalation of Groundwater Vapors During Showering	Benzene	--	3.62E-07	--	--	3.62E-07	N/A	--	N/A	--	--
			Tetrachloroethene	--	1.12E-07	--	--	1.12E-07	N/A	--	N/A	--	--
			Trichloroethene	--	2.75E-05	--	--	2.75E-05	N/A	--	N/A	--	--
			Vinyl Chloride	--	2.78E-05	--	--	2.78E-05	N/A	--	N/A	--	--
			(Total ##)	--	5.58E-05	--		5.58E-05		--	--	--	--
		Exposure Point Total						5.58E-05					--
	Exposure Medium Total							5.58E-05					--
Groundwater Total								1.54E-02					--
Receptor Total								1.54E-02					--

Total Risk Across All Media: 1.54E-02

Total Hazard Index Across All Media: --

All carcinogenic chemicals are omitted and total cancer risks for an exposure medium are listed as "0.0E+0" if the associated total cancer risk from all COPCs for this receptor and the lifetime receptor are <= 1.0E-04.
If cumulative cancer risk (individual receptor or lifetime receptor) for an exposure medium exceeds 1.0E-04, then all COPCs are listed that individually contribute at least 1.0E-06 cancer risk to this receptor or to the lifetime receptor.

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TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

1				General UCL Statistics for Data Sets with Non-Detects								
2			User Selected Options									
3			From File	C:\ButzLF\ProUCL\Bzcogw_ProUCLinput.wst								
4			Full Precision	ON								
5			Confidence Coefficient	95%								
6			Number of Bootstrap Operations	2000								
7												
8												
9	1,4-Dichlorobenzene											
10												
11						General Statistics						
12						Number of Valid Data	68			Number of Detected Data		1
13						Number of Distinct Detected Data	1			Number of Non-Detect Data		67
14										Percent Non-Detects		98.53%
15												
16						Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!						
17						It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).						
18												
19						The data set for variable 1,4-Dichlorobenzene was not processed!						
20												
21												
22												
23	1,1,2-Trichloroethane											
24												
25						General Statistics						
26						Number of Valid Data	68			Number of Detected Data		3
27						Number of Distinct Detected Data	3			Number of Non-Detect Data		65
28										Percent Non-Detects		95.59%
29												
30						Raw Statistics				Log-transformed Statistics		
31						Minimum Detected	0.34			Minimum Detected		-1.07881
32						Maximum Detected	0.47			Maximum Detected		-0.755023
33						Mean of Detected	0.3933333			Mean of Detected		-0.942695
34						SD of Detected	0.0680686			SD of Detected		0.1679379
35						Minimum Non-Detect	0.5			Minimum Non-Detect		-0.693147
36						Maximum Non-Detect	50			Maximum Non-Detect		3.912023
37												
38	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		68
39	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		0
40	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		100.00%
41												
42						Warning: There are only 3 Distinct Detected Values in this data set						
43						The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.						
44						Those methods will return a 'N/A' value on your output display!						

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
45												
46	It is necessary to have 4 or more Distinct Values for bootstrap methods.											
47	However, results obtained using 4 to 9 distinct values may not be reliable.											
48	It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.											
49												
50												
51	UCL Statistics											
52	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
53					*Shapiro Wilk Test Statistic*	0.911853				*Shapiro Wilk Test Statistic*	0.9292941	
54					5% Shapiro Wilk Critical Value	0.767				5% Shapiro Wilk Critical Value	0.767	
55	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
56												
57	Assuming Normal Distribution						Assuming Lognormal Distribution					
58					DL/2 Substitution Method					DL/2 Substitution Method		
59					Mean	2.7195588				Mean	0.7294105	
60					SD	3.0027547				SD	0.7942207	
61					95% DL/2 (t) UCL	3.3269096				95% H-Stat (DL/2) UCL	3.483836	
62												
63					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
64	MLE method failed to converge properly									Mean in Log Scale	-0.942695	
65										SD in Log Scale	0.2144901	
66										Mean in Original Scale	0.3985013	
67										SD in Original Scale	0.0861743	
68										95% t UCL	0.4159313	
69										95% Percentile Bootstrap UCL	0.4159516	
70										95% BCA Bootstrap UCL	0.4157046	
71												
72	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
73					k star (bias corrected)	N/A	Data appear Normal at 5% Significance Level					
74					Theta Star	N/A						
75					nu star	N/A						
76												
77					A-D Test Statistic	N/A	Nonparametric Statistics					
78					5% A-D Critical Value	N/A				Kaplan-Meier (KM) Method		
79					K-S Test Statistic	N/A				Mean	0.3933333	
80					5% K-S Critical Value	N/A				SD	0.0555778	
81	Data not Gamma Distributed at 5% Significance Level									SE of Mean	0.0392994	
82										95% KM (t) UCL	0.4588815	
83	Assuming Gamma Distribution									95% KM (z) UCL	0.4579751	
84					Gamma ROS Statistics using Extrapolated Data					95% KM (jackknife) UCL	0.4730206	
85					Minimum	N/A				95% KM (bootstrap t) UCL	0.6143829	
86					Maximum	N/A				95% KM (BCA) UCL	0.47	
87					Mean	N/A				95% KM (Percentile Bootstrap) UCL	0.47	
88					Median	N/A				95% KM (Chebyshev) UCL	0.5646355	

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
89					SD	N/A				97.5% KM (Chebyshev) UCL		0.6387581
90					k star	N/A				99% KM (Chebyshev) UCL		0.7843576
91					Theta star	N/A						
92					Nu star	N/A			Potential UCLs to Use			
93					AppChi2	N/A				95% KM (t) UCL		0.4588815
94				95% Gamma Approximate UCL		N/A				95% KM (Percentile Bootstrap) UCL		0.47
95				95% Adjusted Gamma UCL		N/A						
96	Note: DL/2 is not a recommended method.											
97												
98	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
99	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
100	For additional insight, the user may want to consult a statistician.											
101												
102												
103	1,1-Dichloroethene											
104												
105	General Statistics											
106					Number of Valid Data	68				Number of Detected Data		4
107					Number of Distinct Detected Data	4				Number of Non-Detect Data		64
108										Percent Non-Detects		94.12%
109												
110	Raw Statistics						Log-transformed Statistics					
111					Minimum Detected	2.6				Minimum Detected		0.9555114
112					Maximum Detected	35				Maximum Detected		3.5553481
113					Mean of Detected	17.9				Mean of Detected		2.5300828
114					SD of Detected	13.664065				SD of Detected		1.1249159
115					Minimum Non-Detect	0.5				Minimum Non-Detect		-0.693147
116					Maximum Non-Detect	50				Maximum Non-Detect		3.912023
117												
118	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		68
119	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		0
120	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		100.00%
121												
122	Warning: There are only 4 Distinct Detected Values in this data											
123	Note: It should be noted that even though bootstrap may be performed on this data set											
124	the resulting calculations may not be reliable enough to draw conclusions											
125												
126	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
127												
128												
129	UCL Statistics											
130	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
131					Shapiro Wilk Test Statistic	0.9949382				Shapiro Wilk Test Statistic		0.9182104
132					5% Shapiro Wilk Critical Value	0.748				5% Shapiro Wilk Critical Value		0.748

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
133	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
134												
135	Assuming Normal Distribution						Assuming Lognormal Distribution					
136	DL/2 Substitution Method						DL/2 Substitution Method					
137	Mean					3.6852941	Mean					0.872492
138	SD					5.4804269	SD					0.8944164
139	95% DL/2 (t) UCL					4.7937901	95% H-Stat (DL/2) UCL					4.5335051
140												
141	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
142	MLE method failed to converge properly						Mean in Log Scale					-1.755592
143							SD in Log Scale					2.1744289
144							Mean in Original Scale					1.5978955
145							SD in Original Scale					5.1382194
146							95% t UCL					2.6371751
147							95% Percentile Bootstrap UCL					2.6980968
148							95% BCA Bootstrap UCL					3.2275371
149												
150	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
151	k star (bias corrected)					0.5554865	Data appear Normal at 5% Significance Level					
152	Theta Star					32.224005						
153	nu star					4.4438921						
154												
155	A-D Test Statistic					0.2499453	Nonparametric Statistics					
156	5% A-D Critical Value					0.6621688	Kaplan-Meier (KM) Method					
157	K-S Test Statistic					0.6621688	Mean					3.5158582
158	5% K-S Critical Value					0.3993142	SD					4.6391756
159	Data appear Gamma Distributed at 5% Significance Level						SE of Mean					0.6548277
160							95% KM (t) UCL					4.6080559
161	Assuming Gamma Distribution						95% KM (z) UCL					4.592954
162	Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL					10.098269
163	Minimum					1.2741187	95% KM (bootstrap t) UCL					4.4019126
164	Maximum					120.23456	95% KM (BCA) UCL					N/A
165	Mean					41.818875	95% KM (Percentile Bootstrap) UCL					21.617647
166	Median					35.101725	95% KM (Chebyshev) UCL					6.3701861
167	SD					34.395135	97.5% KM (Chebyshev) UCL					7.6052561
168	k star					1.0645948	99% KM (Chebyshev) UCL					10.031312
169	Theta star					39.281493						
170	Nu star					144.7849	Potential UCLs to Use					
171	AppChi2					117.97709	95% KM (t) UCL					4.6080559
172	95% Gamma Approximate UCL					51.321332	95% KM (Percentile Bootstrap) UCL					21.617647
173	95% Adjusted Gamma UCL					N/A						
174	Note: DL/2 is not a recommended method.											
175												
176	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
177	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
178	For additional insight, the user may want to consult a statistician.											
179												
180												
181	1,2-Dichloroethene (cis)											
182												
183	General Statistics											
184					Number of Valid Data	68				Number of Detected Data		67
185					Number of Distinct Detected Data	51				Number of Non-Detect Data		1
186										Percent Non-Detects		1.47%
187												
188	Raw Statistics						Log-transformed Statistics					
189					Minimum Detected	2.4				Minimum Detected		0.8754687
190					Maximum Detected	2900				Maximum Detected		7.972466
191					Mean of Detected	142.32985				Mean of Detected		3.6159681
192					SD of Detected	374.25641				SD of Detected		1.6571982
193					Minimum Non-Detect	5				Minimum Non-Detect		1.6094379
194					Maximum Non-Detect	5				Maximum Non-Detect		1.6094379
195												
196												
197	UCL Statistics											
198	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
199					Lilliefors Test Statistic	0.354244				Lilliefors Test Statistic		0.099567
200					5% Lilliefors Critical Value	0.1082421				5% Lilliefors Critical Value		0.1082421
201	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
202												
203	Assuming Normal Distribution						Assuming Lognormal Distribution					
204					DL/2 Substitution Method					DL/2 Substitution Method		
205					Mean	140.27353				Mean		3.576267
206					SD	371.83979				SD		1.6770499
207					95% DL/2 (t) UCL	215.48353				95% H-Stat (DL/2) UCL		246.3791
208												
209					Maximum Likelihood Estimate(MLE) Method					Log ROS Method		
210					Mean	107.05383				Mean in Log Scale		3.5757948
211					SD	399.32753				SD in Log Scale		1.6778145
212					95% MLE (t) UCL	187.82363				Mean in Original Scale		140.27237
213					95% MLE (Tiku) UCL	182.20058				SD in Original Scale		371.84023
214										95% t UCL		215.48246
215										95% Percentile Bootstrap UCL		222.48235
216										95% BCA Bootstrap UCL		270.76397
217												
218	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
219					k star (bias corrected)	0.4653721	Data appear Lognormal at 5% Significance Level					
220					Theta Star	305.84094						

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GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

221					nu star	62.359865						
222												
223					A-D Test Statistic	2.2991156	**Nonparametric Statistics**					
224					5% A-D Critical Value	0.8221402					Kaplan-Meier (KM) Method	
225					K-S Test Statistic	0.8221402					Mean	140.28393
226					5% K-S Critical Value	0.1155721					SD	369.09169
227	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	45.096752
228											95% KM (t) UCL	215.50153
229	**Assuming Gamma Distribution**										95% KM (z) UCL	214.46148
230	Gamma ROS Statistics using Extrapolated Data										95% KM (jackknife) UCL	215.49315
231					Minimum	1E-12					95% KM (bootstrap t) UCL	335.30328
232					Maximum	2900					95% KM (BCA) UCL	235.99044
233					Mean	140.23676					95% KM (Percentile Bootstrap) UCL	218.69191
234					Median	26.5					95% KM (Chebyshev) UCL	336.85611
235					SD	371.85374					97.5% KM (Chebyshev) UCL	421.91305
236					k star	0.3658923					99% KM (Chebyshev) UCL	588.99094
237					Theta star	383.27339						
238					Nu star	49.761346	**Potential UCLs to Use**					
239					AppChi2	34.565122					97.5% KM (Chebyshev) UCL	421.91305
240					95% Gamma Approximate UCL	201.89051						
241					95% Adjusted Gamma UCL	203.50472						
242	**Note: DL/2 is not a recommended method.**											
243												
244	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
245	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
246	**For additional insight, the user may want to consult a statistician.**											
247												
248												
249	**Benzene**											
250												
251	**General Statistics**											
252					Number of Valid Data	68					Number of Detected Data	2
253					Number of Distinct Detected Data	2					Number of Non-Detect Data	66
254											Percent Non-Detects	97.06%
255												
256	**Raw Statistics**						**Log-transformed Statistics**					
257					Minimum Detected	0.26					Minimum Detected	-1.347074
258					Maximum Detected	1.7					Maximum Detected	0.5306283
259					Mean of Detected	0.98					Mean of Detected	-0.408223
260					SD of Detected	1.0182338					SD of Detected	1.3277357
261					Minimum Non-Detect	0.5					Minimum Non-Detect	-0.693147
262					Maximum Non-Detect	50					Maximum Non-Detect	3.912023
263												
264	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	68

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GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
265	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		0
266	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		100.00%
267												
268	Warning: Data set has only 2 Distinct Detected Values.											
269	This may not be adequate enough to compute meaningful and reliable test statistics and estimates.											
270	The Project Team may decide to use alternative site specific values to estimate environmental parameters (e.g., EPC, BTV).											
271												
272	Unless Data Quality Objectives (DQOs) have been met, it is suggested to collect additional observations.											
273												
274	The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.											
275	Those methods will return a 'N/A' value on your output display!											
276												
277	It is necessary to have 4 or more Distinct Values for bootstrap methods.											
278	However, results obtained using 4 to 9 distinct values may not be reliable.											
279	It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.											
280												
281												
282	UCL Statistics											
283	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
284	Shapiro Wilk Test Statistic					N/A	Shapiro Wilk Test Statistic					N/A
285	5% Shapiro Wilk Critical Value					N/A	5% Shapiro Wilk Critical Value					N/A
286	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
287												
288	Assuming Normal Distribution						Assuming Lognormal Distribution					
289	DL/2 Substitution Method						DL/2 Substitution Method					
290	Mean					2.7347059	Mean					0.7386067
291	SD					2.9951122	SD					0.7977603
292	95% DL/2 (t) UCL					3.3405109	95% H-Stat (DL/2) UCL					3.5302018
293												
294	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
295	MLE method failed to converge properly						Mean in Log Scale					N/A
296							SD in Log Scale					N/A
297							Mean in Original Scale					N/A
298							SD in Original Scale					N/A
299							95% t UCL					N/A
300							95% Percentile Bootstrap UCL					N/A
301							95% BCA Bootstrap UCL					N/A
302												
303	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
304	k star (bias corrected)					N/A	Data do not follow a Discernable Distribution (0.05)					
305	Theta Star					N/A						
306	nu star					N/A						
307												
308	A-D Test Statistic					N/A	Nonparametric Statistics					

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
309					5% A-D Critical Value	N/A					Kaplan-Meier (KM) Method	
310					K-S Test Statistic	N/A					Mean	0.44
311					5% K-S Critical Value	N/A					SD	0.4762352
312				Data not Gamma Distributed at 5% Significance Level							SE of Mean	0.2381176
313											95% KM (t) UCL	0.8371602
314				Assuming Gamma Distribution							95% KM (z) UCL	0.8316686
315				Gamma ROS Statistics using Extrapolated Data							95% KM (jackknife) UCL	1.3190836
316					Minimum	N/A					95% KM (bootstrap t) UCL	0.6328973
317					Maximum	N/A					95% KM (BCA) UCL	1.7
318					Mean	N/A					95% KM (Percentile Bootstrap) UCL	1.7
319					Median	N/A					95% KM (Chebyshev) UCL	1.4779306
320					SD	N/A					97.5% KM (Chebyshev) UCL	1.927044
321					k star	N/A					99% KM (Chebyshev) UCL	2.8092404
322					Theta star	N/A						
323					Nu star	N/A				Potential UCLs to Use		
324					AppChi2	N/A					95% KM (BCA) UCL	1.7
325					95% Gamma Approximate UCL	N/A						
326					95% Adjusted Gamma UCL	N/A						
327	Note: DL/2 is not a recommended method.											
328												
329	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
330	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
331	For additional insight, the user may want to consult a statistician.											
332												
333												
334	Bromodichloromethane											
335												
336	General Statistics											
337					Number of Valid Data	68					Number of Detected Data	1
338					Number of Distinct Detected Data	1					Number of Non-Detect Data	67
339											Percent Non-Detects	98.53%
340												
341	Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!											
342	It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).											
343												
344	The data set for variable Bromodichloromethane was not processed!											
345												
346												
347												
348	Chloroform											
349												
350	General Statistics											
351					Number of Valid Data	68					Number of Detected Data	5
352					Number of Distinct Detected Data	5					Number of Non-Detect Data	63

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
353										Percent Non-Detects		92.65%
354												
355	Raw Statistics						Log-transformed Statistics					
356					Minimum Detected	0.3				Minimum Detected		-1.203973
357					Maximum Detected	0.7				Maximum Detected		-0.356675
358					Mean of Detected	0.458				Mean of Detected		-0.834608
359					SD of Detected	0.1710848				SD of Detected		0.3625106
360					Minimum Non-Detect	0.5				Minimum Non-Detect		-0.693147
361					Maximum Non-Detect	50				Maximum Non-Detect		3.912023
362												
363	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		68
364	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		0
365	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		100.00%
366												
367	Warning: There are only 5 Detected Values in this data											
368	Note: It should be noted that even though bootstrap may be performed on this data set											
369	the resulting calculations may not be reliable enough to draw conclusions											
370												
371	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
372												
373												
374	UCL Statistics											
375	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
376					Shapiro Wilk Test Statistic	0.8952456				Shapiro Wilk Test Statistic		0.9188871
377					5% Shapiro Wilk Critical Value	0.762				5% Shapiro Wilk Critical Value		0.762
378	Data appear Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
379												
380	Assuming Normal Distribution						Assuming Lognormal Distribution					
381					DL/2 Substitution Method					DL/2 Substitution Method		
382					Mean	2.5925				Mean		0.6386272
383					SD	3.0254125				SD		0.8608082
384					95% DL/2 (t) UCL	3.2044337				95% H-Stat (DL/2) UCL		3.4412135
385												
386					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
387	MLE method failed to converge properly									Mean in Log Scale		-0.975497
388										SD in Log Scale		0.3322528
389										Mean in Original Scale		0.3981603
390										SD in Original Scale		0.1356973
391										95% t UCL		0.4256071
392										95% Percentile Bootstrap UCL		0.4258267
393										95% BCA Bootstrap UCL		0.4253309
394												
395	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
396					k star (bias corrected)	3.9216819	Data appear Normal at 5% Significance Level					

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GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
397					Theta Star	0.1167866						
398					nu star	39.216819						
399												
400					A-D Test Statistic	0.3477728	**Nonparametric Statistics**					
401					5% A-D Critical Value	0.6790737					Kaplan-Meier (KM) Method	
402					K-S Test Statistic	0.6790737					Mean	0.3936364
403					5% K-S Critical Value	0.3576662					SD	0.1218996
404	**Data appear Gamma Distributed at 5% Significance Level**										SE of Mean	0.0441465
405											95% KM (t) UCL	0.467269
406			**Assuming Gamma Distribution**								95% KM (z) UCL	0.4662508
407			Gamma ROS Statistics using Extrapolated Data								95% KM (jackknife) UCL	0.4709471
408					Minimum	0.2779788					95% KM (bootstrap t) UCL	0.5010686
409					Maximum	0.7					95% KM (BCA) UCL	0.49
410					Mean	0.4117091					95% KM (Percentile Bootstrap) UCL	0.5042857
411					Median	0.3877013					95% KM (Chebyshev) UCL	0.5860664
412					SD	0.1024397					97.5% KM (Chebyshev) UCL	0.669331
413					k star	17.03311					99% KM (Chebyshev) UCL	0.8328882
414					Theta star	0.0241711						
415					Nu star	2316.503	**Potential UCLs to Use**					
416					AppChi2	2205.6926					95% KM (t) UCL	0.467269
417					95% Gamma Approximate UCL	0.4323927					95% KM (Percentile Bootstrap) UCL	0.5042857
418					95% Adjusted Gamma UCL	0.4328479						
419	**Note: DL/2 is not a recommended method.**											
420												
421	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
422	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
423	**For additional insight, the user may want to consult a statistician.**											
424												
425												
426	**Tetrachloroethene**											
427												
428	**General Statistics**											
429					Number of Valid Data	68					Number of Detected Data	8
430					Number of Distinct Detected Data	8					Number of Non-Detect Data	60
431											Percent Non-Detects	88.24%
432												
433	**Raw Statistics**						**Log-transformed Statistics**					
434					Minimum Detected	0.4					Minimum Detected	-0.916291
435					Maximum Detected	2.1					Maximum Detected	0.7419373
436					Mean of Detected	0.8825					Mean of Detected	-0.291174
437					SD of Detected	0.6158096					SD of Detected	0.5755047
438					Minimum Non-Detect	0.5					Minimum Non-Detect	-0.693147
439					Maximum Non-Detect	50					Maximum Non-Detect	3.912023
440												

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
441	Note: Data have multiple DLs - Use of KM Method is recommended										Number treated as Non-Detect	68
442	For all methods (except KM, DL/2, and ROS Methods),										Number treated as Detected	0
443	Observations < Largest ND are treated as NDs										Single DL Non-Detect Percentage	100.00%
444												
445	Warning: There are only 8 Detected Values in this data											
446	Note: It should be noted that even though bootstrap may be performed on this data set											
447	the resulting calculations may not be reliable enough to draw conclusions											
448												
449	It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.											
450												
451												
452	UCL Statistics											
453	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
454	Shapiro Wilk Test Statistic					0.7041341	Shapiro Wilk Test Statistic					0.7873467
455	5% Shapiro Wilk Critical Value					0.818	5% Shapiro Wilk Critical Value					0.818
456	Data not Normal at 5% Significance Level						Data not Lognormal at 5% Significance Level					
457												
458	Assuming Normal Distribution						Assuming Lognormal Distribution					
459	DL/2 Substitution Method						DL/2 Substitution Method					
460	Mean					2.4420588	Mean					0.6049284
461	SD					2.8910095	SD					0.8150005
462	95% DL/2 (t) UCL					3.0268075	95% H-Stat (DL/2) UCL					3.1503728
463												
464	Maximum Likelihood Estimate(MLE) Method					N/A	Log ROS Method					
465	MLE method failed to converge properly						Mean in Log Scale					-0.70923
466							SD in Log Scale					0.6855123
467							Mean in Original Scale					0.6218293
468							SD in Original Scale					0.467246
469							95% t UCL					0.7163365
470							95% Percentile Bootstrap UCL					0.7184449
471							95% BCA Bootstrap UCL					0.7300155
472												
473	Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only					
474	k star (bias corrected)					2.0619154	Data do not follow a Discernable Distribution (0.05)					
475	Theta Star					0.4280001						
476	nu star					32.990647						
477												
478	A-D Test Statistic					1.1149856	Nonparametric Statistics					
479	5% A-D Critical Value					0.7209894	Kaplan-Meier (KM) Method					
480	K-S Test Statistic					0.7209894	Mean					0.6757143
481	5% K-S Critical Value					0.2961392	SD					0.496613
482	Data not Gamma Distributed at 5% Significance Level						SE of Mean					0.1418894
483							95% KM (t) UCL					0.912374
484	Assuming Gamma Distribution						95% KM (z) UCL					0.9091016

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
485				Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL		0.8845818
486					Minimum	1E-12				95% KM (bootstrap t) UCL		1.9232174
487					Maximum	2.358478				95% KM (BCA) UCL		1.0030769
488					Mean	1.253709				95% KM (Percentile Bootstrap) UCL		0.9726667
489					Median	1.2978953				95% KM (Chebyshev) UCL		1.294196
490					SD	0.6910843				97.5% KM (Chebyshev) UCL		1.5618135
491					k star	0.5941504				99% KM (Chebyshev) UCL		2.0874963
492					Theta star	2.110087						
493					Nu star	80.804451				Potential UCLs to Use		
494					AppChi2	61.091308				95% KM (t) UCL		0.912374
495				95% Gamma Approximate UCL		1.6582599				95% KM (% Bootstrap) UCL		0.9726667
496				95% Adjusted Gamma UCL		1.6683738						
497	Note: DL/2 is not a recommended method.											
498												
499	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
500	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
501	For additional insight, the user may want to consult a statistician.											
502												
503												
504	Trichloroethene											
505												
506	General Statistics											
507					Number of Valid Data	68				Number of Detected Data		67
508					Number of Distinct Detected Data	57				Number of Non-Detect Data		1
509										Percent Non-Detects		1.47%
510												
511	Raw Statistics						Log-transformed Statistics					
512					Minimum Detected	0.73				Minimum Detected		-0.314711
513					Maximum Detected	2700				Maximum Detected		7.9010071
514					Mean of Detected	279.79746				Mean of Detected		4.6245552
515					SD of Detected	476.74987				SD of Detected		1.5498933
516					Minimum Non-Detect	50				Minimum Non-Detect		3.912023
517					Maximum Non-Detect	50				Maximum Non-Detect		3.912023
518												
519												
520	UCL Statistics											
521	Normal Distribution Test with Detected Values Only						Lognormal Distribution Test with Detected Values Only					
522					Lilliefors Test Statistic	0.2828816				Lilliefors Test Statistic		0.0885117
523					5% Lilliefors Critical Value	0.1082421				5% Lilliefors Critical Value		0.1082421
524	Data not Normal at 5% Significance Level						Data appear Lognormal at 5% Significance Level					
525												
526	Assuming Normal Distribution						Assuming Lognormal Distribution					
527					DL/2 Substitution Method					DL/2 Substitution Method		
528					Mean	276.05044				Mean		4.6038835

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
529					SD	474.18643					SD	1.5476995
530					95% DL/2 (t) UCL	371.96154					95% H-Stat (DL/2) UCL	522.15338
531												
532					Maximum Likelihood Estimate(MLE) Method						Log ROS Method	
533					Mean	164.00212					Mean in Log Scale	4.5987818
534					SD	584.04055					SD in Log Scale	1.552896
535					95% MLE (t) UCL	282.13281					Mean in Original Scale	275.94267
536					95% MLE (Tiku) UCL	285.28823					SD in Original Scale	474.24517
537											95% t UCL	371.86565
538											95% Percentile Bootstrap UCL	369.42544
539											95% BCA Bootstrap UCL	402.37794
540												
541			Gamma Distribution Test with Detected Values Only						Data Distribution Test with Detected Values Only			
542					k star (bias corrected)	0.5931101			Data appear Lognormal at 5% Significance Level			
543					Theta Star	471.74622						
544					nu star	79.476757						
545												
546					A-D Test Statistic	1.6902966			Nonparametric Statistics			
547					5% A-D Critical Value	0.8058686					Kaplan-Meier (KM) Method	
548					K-S Test Statistic	0.8058686					Mean	276.0365
549					5% K-S Critical Value	0.1143371					SD	470.69827
550			Data not Gamma Distributed at 5% Significance Level								SE of Mean	57.511864
551											95% KM (t) UCL	371.96146
552				Assuming Gamma Distribution							95% KM (z) UCL	370.63509
553					Gamma ROS Statistics using Extrapolated Data						95% KM (jackknife) UCL	371.95088
554					Minimum	1E-12					95% KM (bootstrap t) UCL	415.00636
555					Maximum	2700					95% KM (BCA) UCL	374.89853
556					Mean	275.68279					95% KM (Percentile Bootstrap) UCL	375.52059
557					Median	90					95% KM (Chebyshev) UCL	526.7249
558					SD	474.39363					97.5% KM (Chebyshev) UCL	635.19797
559					k star	0.4313423					99% KM (Chebyshev) UCL	848.27232
560					Theta star	639.12765						
561					Nu star	58.662553			Potential UCLs to Use			
562					AppChi2	42.053259					97.5% KM (Chebyshev) UCL	635.19797
563					95% Gamma Approximate UCL	384.56607						
564					95% Adjusted Gamma UCL	387.3684						
565	Note: DL/2 is not a recommended method.											
566												
567	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
568	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
569	For additional insight, the user may want to consult a statistician.											
570												
571												
572	Vinyl Chloride											

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
573												
574					General Statistics							
575					Number of Valid Data	68				Number of Detected Data		19
576					Number of Distinct Detected Data	19				Number of Non-Detect Data		49
577										Percent Non-Detects		72.06%
578												
579					Raw Statistics					Log-transformed Statistics		
580					Minimum Detected	0.495				Minimum Detected		-0.703198
581					Maximum Detected	1700				Maximum Detected		7.4383835
582					Mean of Detected	149.05711				Mean of Detected		2.785144
583					SD of Detected	388.9633				SD of Detected		2.303464
584					Minimum Non-Detect	0.5				Minimum Non-Detect		-0.693147
585					Maximum Non-Detect	50				Maximum Non-Detect		3.912023
586												
587	Note: Data have multiple DLs - Use of KM Method is recommended									Number treated as Non-Detect		62
588	For all methods (except KM, DL/2, and ROS Methods),									Number treated as Detected		6
589	Observations < Largest ND are treated as NDs									Single DL Non-Detect Percentage		91.18%
590												
591					UCL Statistics							
592					Normal Distribution Test with Detected Values Only					Lognormal Distribution Test with Detected Values Only		
593					Shapiro Wilk Test Statistic	0.4206997				Shapiro Wilk Test Statistic		0.9571142
594					5% Shapiro Wilk Critical Value	0.901				5% Shapiro Wilk Critical Value		0.901
595					Data not Normal at 5% Significance Level					Data appear Lognormal at 5% Significance Level		
596												
597					Assuming Normal Distribution					Assuming Lognormal Distribution		
598					DL/2 Substitution Method					DL/2 Substitution Method		
599					Mean	43.729191				Mean		1.2997426
600					SD	212.18038				SD		1.6901109
601					95% DL/2 (t) UCL	86.645757				95% H-Stat (DL/2) UCL		26.037999
602												
603					Maximum Likelihood Estimate(MLE) Method	N/A				Log ROS Method		
604					MLE yields a negative mean					Mean in Log Scale		-0.272902
605										SD in Log Scale		2.8823418
606										Mean in Original Scale		42.427932
607										SD in Original Scale		212.42088
608										95% t UCL		85.393143
609										95% Percentile Bootstrap UCL		90.662454
610										95% BCA Bootstrap UCL		128.47755
611												
612					Gamma Distribution Test with Detected Values Only					Data Distribution Test with Detected Values Only		
613					k star (bias corrected)	0.2954673				Data appear Lognormal at 5% Significance Level		
614					Theta Star	504.47917						
615					nu star	11.227758						
616												

TABLE A-1
GROUNDWATER DATA PROUCL SUPPORT DOCUMENTATION
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

	A	B	C	D	E	F	G	H	I	J	K	L
617					A-D Test Statistic	1.0605799	**Nonparametric Statistics**					
618					5% A-D Critical Value	0.8409694					Kaplan-Meier (KM) Method	
619					K-S Test Statistic	0.8409694					Mean	42.347384
620					5% K-S Critical Value	0.2148935					SD	210.86636
621	**Data not Gamma Distributed at 5% Significance Level**										SE of Mean	26.272712
622											95% KM (t) UCL	86.168063
623	**Assuming Gamma Distribution**										95% KM (z) UCL	85.562149
624	Gamma ROS Statistics using Extrapolated Data										95% KM (jackknife) UCL	85.113681
625					Minimum	1E-12					95% KM (bootstrap t) UCL	222.30017
626					Maximum	1700					95% KM (BCA) UCL	96.455478
627					Mean	140.84132					95% KM (Percentile Bootstrap) UCL	92.010916
628					Median	148.3008					95% KM (Chebyshev) UCL	156.86748
629					SD	210.28339					97.5% KM (Chebyshev) UCL	206.42042
630					k star	0.2105141					99% KM (Chebyshev) UCL	303.75756
631					Theta star	669.03495						
632					Nu star	28.629924	**Potential UCLs to Use**					
633					AppChi2	17.419224					97.5% KM (Chebyshev) UCL	206.42042
634					95% Gamma Approximate UCL	231.48426						
635					95% Adjusted Gamma UCL	234.03299						
636	**Note: DL/2 is not a recommended method.**											
637												
638	**Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.**											
639	**These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).**											
640	**For additional insight, the user may want to consult a statistician.**											
641												

TABLE A-2
CHEMICAL-SPECIFIC PARAMETERS FOR SHOWER MODELING
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

COPC	Molecular Weight (g/mol)	Henry's Law at 25°C (l*atm/mol)	Henry's Law at 45°C (l*atm/mol)	Source of Shower Parameters
1,1,2-TRICHLOROETHANE	133.41	9.13E-04	2.40E-03	EPA, 2001
1,2-DICHLOROETHENE (CIS)	96.94	4.07E-03	8.85E-03	EPA, 2001
CHLOROFORM	119.38	3.67E-03	7.82E-03	EPA, 2001
VINYL CHLORIDE	62.5	2.71E-02	4.39E-02	EPA, 2001
1,1-DICHLOROETHENE	96.94	2.61E-02	4.99E-02	EPA, 2001
1,4-DICHLOROBENZENE	147	2.43E-03	7.64E-03	EPA, 2001
BENZENE	78.12	5.56E-03	1.26E-02	EPA, 2001
BROMODICHLOROMETHANE	163.83	1.60E-03	3.84E-03	EPA, 2001
TETRACHLOROETHENE	165.83	1.84E-02	4.85E-02	EPA, 2001
TRICHLOROETHENE	131.39	1.03E-02	2.42E-02	EPA, 2001

Notes:
Henry's Law constant at 45 degrees converted using data and formulas presented in the following references:

Sander, Rolf, 1999. Compilation of Henry's Law Constants for Inorganic and Organic Species of Potential Importance in Environmental Chemistry. Internet Website: http://www.mpch-mainz.mpg.de/~sander/res/henry.html. Air Chemistry Department. Max-Planck Institute of Chemistry. PO Box 3060. 55020 Mainz, Germany. Version 3: April 8.

EPA, 2001. Fact Sheet. Correcting the Henry's Law Constant for Soil Temperature. from website: http://www.epa.gov/superfund/programs/risk/airmodel/factsheet.pdf

TABLE A-3
CHEMICAL-SPECIFIC PARAMETERS FOR DERMAL ABSORPTION
BUTZ LANDFILL SITE, MONROE COUNTRY, PENNSYLVANIA

COPC	B	Permeability Coefficient (Kp)	Tau (hr)	T* (hr)	B	FA	Source of Dermal Parameters
ORGANIC COMPOUNDS							
1,1,2-TRICHLOROETHANE	.029	6.40E-03 ✓	6.00E-01 ✓	1.43E+00 ✓	0.00E+00	1.00E+00 ✓	EPA, 2004
1,2-DICHLOROETHENE (CIS)	.029	7.70E-03 ✓	3.70E-01 ✓	8.90E-01 ✓	0.00E+00	1.00E+00 ✓	EPA, 2004
CHLOROFORM	.029	6.80E-03 ✓	5.00E-01 ✓	1.19E+00 ✓	0.00E+00	1.00E+00 ✓	EPA, 2004
VINYL CHLORIDE	.017	5.60E-03 ✓	2.40E-01 ✓	5.70E-01 ✓	0.00E+00	1.00E+00 ✓	EPA, 2004
1,1-DICHLOROETHENE	.044	1.20E-02 ✓	3.70E-01 ✓	8.90E-01 ✓	0.00E+00	1.00E+00 ✓	EPA, 2004
1,4-DICHLOROBENZENE	.2	4.20E-02 ✓	7.10E-01 ✓	1.71E+00 ✓	2.00E-01	1.00E+00 ✓	EPA, 2004
BENZENE	.051	1.50E-02 ✓	2.90E-01 ✓	7.00E-01 ✓	1.00E-01	1.00E+00 ✓	EPA, 2004
BROMODICHLOROMETHANE	.023	4.60E-03 ✓	8.80E-01 ✓	2.12E+00 ✓	0.00E+00	1.00E+00 ✓	EPA, 2004
TETRACHLOROETHENE	.17	3.30E-02 ✓	9.10E-01 ✓	2.18E+00 ✓	2.00E-01	1.00E+00 ✓	EPA, 2004
TRICHLOROETHENE	.051	1.20E-02 ✓	5.80E-01 ✓	1.39E+00 ✓	1.00E-01	1.00E+00 ✓	EPA, 2004

Notes:
Permeability constant and other dermal absorption parameters (Tau, T*, B, and FA) from tables and equations in EPA, 2004.

ATTACHMENT 1

DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	PWA-A		PWA-A		PWA-A		PWA-A		PWA-B		PWA-B		PWA-B	
Sample ID:	PWA-A-20070416		PWA-A-20080421		PWA-A-20080421-D		PWA-A-20100414		PWA-B-20070416		PWA-B-20080421		PWA-B-20100414	
Sample Date:	04/16/07		04/21/08		04/21/08		04/14/10		04/16/07		04/21/08		04/14/10	
Duplicate:			PWA-A-20080421-D		PWA-A-20080421									
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U	0.67	J	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	23		23		28		15		130		160		150	
1,2-Dichloroethene (trans)	5	U	5	U	5	U	5	U	5	U	1.2	J	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dioxane	100	U	100	R	100	R	100	U	2	U	100	R	100	U
2-Butanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	0.8	B	5	U	5	U	11	B	0.61	B	0.69	J	5	U
O-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	150		130		140		80		480	J	290		190	
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	0.53	J	0.46	J	5	U	5	U	14		12	

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	PWA-C		PWA-C		PWA-C		PWA-D		PWA-D		PWA-D		PWB-A	
Sample ID:	PWA-C-20070416		PWA-C-20080421		PWA-C-20100414		PWA-D-20070416		PWA-D-20080421		PWA-D-20100414		PWB-A-20070419	
Sample Date:	04/16/07		04/21/08		04/14/10		04/16/07		04/21/08		04/14/10		04/19/07	
Duplicate:														
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	0.4	J	5	U	5	U	0.35	J	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	98		95		72		140		120		120		13	
1,2-Dichloroethene (trans)	5	U	5	U	5	U	5	U	0.67	J	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dioxane	100	U	100	R	100	U	100	U	100	R	100	U	100	U
2-Butanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	10	U	11		6.3	J	10	U	10	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	0.73	J	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	0.95	B	5	U	13	B	8	B	1	J	5	U	0.54	B
O-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U	0.33	J	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	630	J	490		470		120		79		73		110	
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	1.8	J	0.99	J	5	U	9.4		10		13		5	U

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	PWB-A		PWB-A		PWB-A		PWB-B		PWB-B		PWB-B		PWB-B	
Sample ID:	PWB-A-20080416		PWB-A-20100413		PWB-A-20100413-D		PWB-B-20070419		PWB-B-20080416		PWB-B-20080416-D		PWB-B-20100413	
Sample Date:	04/16/08		04/13/10		04/13/10		04/19/07		04/16/08		04/16/08		04/13/10	
Duplicate:			PWB-A-20100413-D		PWB-A-20100413				PWB-B-20080416-D		PWB-B-20080416			
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	12		10		11		580		210		290		83	
1,2-Dichloroethene (trans)	5	U	5	U	5	U	2.3	J	0.93	J	1.2	J	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dioxane	100	R	100	U	100	U	2	U	100	R	100	R	100	U
2-Butanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	U	4.8	B	5.1	B	0.7	B	5	U	5	U	5	U
O-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	0.4	J	5	U
Toluene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	79		73		69		250		150		170		90	
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	140		47		52		160	J

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	PWB-C		PWB-C		PWB-C		R1-1A-A		R1-1A-A		R1-1A-A		R1-1A-A	
Sample ID:	PWB-C-20070419		PWB-C-20080416		PWB-C-20100413		R1-1A-A-20070412		R1-1A-A-20080415		R1-1A-A-20090114		R1-1A-A-20100421	
Sample Date:	04/19/07		04/16/08		04/13/10		04/12/07		04/15/08		01/14/09		04/21/10	
Duplicate:														
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,1-Dichloroethane	5	U	0.32	J	5	U	5	U	0.33	J	0.18	J	0.5	U
1,1-Dichloroethene	5	U	2.6	J	5	U	5	U	5	U	0.5	U	0.5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,2-Dichloroethene (cis)	580		830		52		26		30		27		30	
1,2-Dichloroethene (trans)	2	J	1.9	J	5	U	5	U	0.37	J	0.34	J	0.27	J
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
1,4-Dioxane	100	U	100	U	100	U	100	U	100	R	NA		NA	
2-Butanone	10	U	10	U	10	U	10	U	10	U	5	U	5	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	5	U	5	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	5	U	5	U
Acetone	10	U	10	U	10	U	10	U	10	U	5	UR	5	U
Benzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Methylene Chloride	0.68	B	5	U	5	U	0.62	B	5	U	0.21	B	0.3	B
O-xylene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Styrene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	0.59	J	0.5	U	0.5	U
Toluene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Trichloroethene	830		630		300		120		140		78		150	
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	0.5	U	0.5	U
Vinyl Chloride	5	U	2.9	J	5	U	5	U	5	U	0.5	U	0.5	U

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	R1-1A-B		R1-1A-B		R1-1A-B		R1-1A-B		R1-1A-C		R1-1A-C		R1-1A-C	
Sample ID:	R1-1A-B-20070412		R1-1A-B-20080415		R1-1A-B-20090114		R1-1A-B-20100421		R1-1A-C-20070412		R1-1A-C-20080415		R1-1A-C-20100420	
Sample Date:	04/12/07		04/15/08		01/12/09		04/21/10		04/12/07		04/15/08		04/21/10	
Duplicate:														
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,1,2-Trichloroethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,1-Dichloroethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,1-Dichloroethene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,2,3-Trichlorobenzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,2,4-Trichlorobenzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,2-Dibromoethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,2-Dichlorobenzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,2-Dichloroethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,2-Dichloroethene (cis)	17		17		16		120		14		25		23	
1,2-Dichloroethene (trans)	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,2-Dichloropropane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,3-Dichlorobenzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,4-Dichlorobenzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
1,4-Dioxane	100	U	100	R	NA		NA		100	U	100	R	NA	
2-Butanone	10	U	10	U	5	U	5	U	10	U	10	U	5	U
2-Hexanone	10	U	10	U	5	U	5	U	10	U	10	U	5	U
4-Methyl-2-pentanone	10	U	10	U	5	U	5	U	10	U	10	U	5	U
Acetone	10	U	10	U	5	UR	5	U	10	U	10	U	5	U
Benzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Bromochloromethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Bromodichloromethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Bromoform	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Bromomethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Carbon Disulfide	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Carbon Tetrachloride	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Chlorobenzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Chloroethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Chloroform	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Chloromethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
cis-1,3-Dichloropropene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Cyclohexane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Dibromochloromethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Dichlorodifluoromethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Ethylbenzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Isopropylbenzene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
M,p-xylene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Methyl Acetate	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Methyl Tert-butyl Ether	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Methylcyclohexane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Methylene Chloride	1.2	B	5	U	0.15	B	0.5	U	2.1	B	5	U	0.5	U
O-xylene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Styrene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Tetrachloroethene	5	U	0.63	J	0.5	U	0.5	U	5	U	5	U	0.5	U
Toluene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
trans-1,3-Dichloropropene	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Trichloroethene	120		100		90		0.73		59		78		53	
Trichlorofluoromethane	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U
Vinyl Chloride	5	U	5	U	0.5	U	0.5	U	5	U	5	U	0.5	U

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	R1D-A		R1D-A		R1D-A		R1D-A		R1D-B		R1D-B		R1D-B	
Sample ID:	R1D-A-20070411		R1D-A-20080418		R1D-A-20090113		R1D-A-20100421		R1D-B-20070412		R1D-B-20080418		R1D-B-20090112	
Sample Date:	04/11/07		04/18/08		01/13/09		04/21/10		04/12/07		04/18/08		01/12/09	
Duplicate:														
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,1,2-Trichloroethane	5	U	0.47	J	0.34	J	50	U	5	U	10	U	0.37	J
1,1-Dichloroethane	5	U	5	U	0.18	J	50	U	5	U	10	U	0.5	U
1,1-Dichloroethene	35	J	21		13	J	50	U	5	U	10	U	0.5	U
1,2,3-Trichlorobenzene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,2,4-Trichlorobenzene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,2-Dibromoethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,2-Dichlorobenzene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,2-Dichloroethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,2-Dichloroethene (cis)	290	J	190		180		2900		180		190		180	
1,2-Dichloroethene (trans)	5.2		4.2	J	4	K	50	U	1.3	J	1.3	J	1.3	
1,2-Dichloropropane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,3-Dichlorobenzene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,4-Dichlorobenzene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
1,4-Dioxane	2	U	100	R	NA		NA		2	U	200	R	NA	
2-Butanone	10	U	10	U	5	U	500	U	10	U	20	U	5	U
2-Hexanone	10	U	10	U	5	U	500	U	10	U	20	U	5	U
4-Methyl-2-pentanone	10	U	10	U	5	U	500	U	10	U	20	U	5	U
Acetone	10	U	10	U	1.5	J	500	U	10	U	20	U	5	UR
Benzene	5	U	5	U	0.26	J	50	U	5	U	10	U	0.5	U
Bromochloromethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Bromodichloromethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.21	J
Bromoform	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Bromomethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Carbon Disulfide	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Carbon Tetrachloride	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Chlorobenzene	5	U	0.47	J	0.53		50	U	5	U	10	U	0.5	U
Chloroethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Chloroform	5	U	5	U	0.5	U	50	U	5	U	0.7	J	0.57	
Chloromethane	5	U	0.41	J	0.5	U	50	U	5	U	10	U	0.5	U
cis-1,3-Dichloropropene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Cyclohexane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Dibromochloromethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Dichlorodifluoromethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Ethylbenzene	5	U	0.18	J	0.16	J	50	U	5	U	10	U	0.5	U
Isopropylbenzene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
M,p-xylene	5	U	5	U	0.11	J	50	U	5	U	10	U	0.5	U
Methyl Acetate	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Methyl Tert-butyl Ether	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Methylcyclohexane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Methylene Chloride	3.2	B	5	U	0.5	U	50	U	5	B	10	U	0.22	B
O-xylene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Styrene	5	U	0.59	J	0.66	J	50	U	5	U	10	U	0.5	U
Tetrachloroethene	5	U	5	U	0.5	U	50	U	5	U	0.6	J	0.56	
Toluene	5	U	0.2	J	0.2	B	50	U	5	U	10	U	0.5	U
trans-1,3-Dichloropropene	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Trichloroethene	340	J	200		180		50	U	1400	J	1300		910	
Trichlorofluoromethane	5	U	5	U	0.5	U	50	U	5	U	10	U	0.5	U
Vinyl Chloride	370	J	250		87		50	U	5	U	10	U	0.5	U

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	R1D-B		R2-A		R2-A		R2-B		R2-B		R6-A		R6-A	
Sample ID:	R1D-B-20100421		R2-A-20070419		R2-A-20080416		R2-B-20070419		R2-B-20080416		R6-A-20070413		R6-A-20080421	
Sample Date:	04/21/10		04/19/07		04/16/08		04/19/07		04/16/08		04/13/07		04/21/08	
Duplicate:														
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	20	U	5	U	0.47	J	5	U	5	U
1,1-Dichloroethene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	350		280	J	310		72		150		72		84	
1,2-Dichloroethene (trans)	11		1.6	J	1.4	J	5	U	0.72	J	5	U	5	U
1,2-Dichloropropane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	20	U	5	U	0.5	J	5	U	5	U
1,4-Dioxane	NA		2	U	400	U	2	U	100	R	2	U	100	R
2-Butanone	50	U	10	U	40	U	10	U	10	U	10	U	10	U
2-Hexanone	50	U	10	U	40	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	50	U	10	U	40	U	10	U	10	U	10	U	10	U
Acetone	50	U	10	U	40	U	3.1	B	10	U	10	U	10	U
Benzene	5	U	1.7	J	20	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	20	U	4.6	J	2.6	J	5	U	5	U
Chloroethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	U	2	B	20	U	1.4	B	5	U	3.9	B	5	U
O-xylene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	2.1	J	1.6	J	5	U	0.58	J	5	U	5	U
Toluene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Trichloroethene	6.2		2700		2000		360		1100		380	J	220	
Trichlorofluoromethane	5	U	5	U	20	U	5	U	5	U	5	U	5	U
Vinyl Chloride	1700		5	U	20	U	5	U	1.4	J	5	U	5	U

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	R6-A		R6-A		R6-B		R6-B		R6-B		R7-A		R7-A	
Sample ID:	R6-A-20100415		R6-A-20100415-D		R6-B-20070413		R6-B-20080421		R6-B-20100416		R7-A-20070417		R7-A-20070417-D	
Sample Date:	04/15/10		04/15/10		04/13/07		04/21/08		04/16/10		04/17/07		04/17/07	
Duplicate:	R6-A-20100415-D		R6-A-20100415								R7-A-20070417-D		R7-A-20070417	
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	61		64		3.6	J	2.4	J	2.5	J	4.3	J	5.4	
1,2-Dichloroethene (trans)	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dioxane	100	U	100	U	100	U	100	R	100	U	100	U	100	U
2-Butanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	U	5	U	0.13	B	5	U	5	U	7.9	B	2.1	B
O-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	180		190		18		9.9		11		40		57	
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	R7-A		R7-A		R7-B		R7-B		R7-B		R7-C		R7-C	
Sample ID:	R7-A-20080417		R7-A-20100415		R7-B-20070417		R7-B-20080417		R7-B-20100415		R7-C-20070417		R7-C-20080417	
Sample Date:	04/17/08		04/15/10		04/17/07		04/17/08		04/15/10		04/17/07		04/17/08	
Duplicate:														
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	5	J	5.5		2.6	J	2.7	J	5	U	5.2		3.8	J
1,2-Dichloroethene (trans)	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dioxane	100	R	100	U	100	U	100	R	100	U	100	U	100	R
2-Butanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	0.3	J	5	U	5	U	0.39	J	5	U	5	U	0.33	J
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	U	5	U	8.6	B	5	U	5	U	8.7	B	5	U
O-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	44		56		42		39		34		56		44	
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	R7-C		R7-C		R7-D		R7-D		R7-D		R8-A		R8-A	
Sample ID:	R7-C-20100415		R7-C-20100415-D		R7-D-20070417		R7-D-20080417		R7-D-20100415		R8-A-20070418		R8-A-20080416	
Sample Date:	04/15/10		04/15/10		04/17/07		04/17/08		04/15/10		04/18/07		04/16/08	
Duplicate:	R7-C-20100415-D		R7-C-20100415											
VOLATILES	ug/L		ug/L		ug/L		ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	8.3		7.2		12		12		13		9.3		7.7	
1,2-Dichloroethene (trans)	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	6	U
1,4-Dioxane	100	U	100	U	100	U	100	R	100	U	100	U	100	R
2-Butanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	10	U	7.3	B	10	U	10	U	10	U
Benzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Methylene Chloride	5	U	5	U	8.5	B	5	U	5	U	8.8	B	5	U
O-xylene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	0.15	J	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	0.17	J	5	U	5	U	0.85	J
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Trichloroethene	73		68		84		2.6	J	77		25		24	
Trichlorofluoromethane	5	U	5	U	5	U	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	1	J	5	U	5	U	5	U

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Location:	R8-A		R8-B		R8-B		R8-B	
Sample ID:	R8-A-20100413		R8-B-20070418		R8-B-20080416		R8-B-20100413	
Sample Date:	04/13/10		04/18/07		04/16/08		04/13/10	
Duplicate:								
VOLATILES	ug/L		ug/L		ug/L		ug/L	
1,1,1-Trichloroethane	5	U	5	U	5	U	5	U
1,1,2,2-Tetrachloroethane	5	U	5	U	5	U	5	U
1,1,2-Trichloro-1,2,2-trifluoroethane	5	U	5	U	5	U	5	U
1,1,2-Trichloroethane	5	U	5	U	5	U	5	U
1,1-Dichloroethane	5	U	5	U	5	U	5	U
1,1-Dichloroethene	5	U	5	U	5	U	5	U
1,2,3-Trichlorobenzene	5	U	5	U	5	U	5	U
1,2,4-Trichlorobenzene	5	U	5	U	5	U	5	U
1,2-Dibromo-3-chloropropane	5	U	5	U	5	U	5	U
1,2-Dibromoethane	5	U	5	U	5	U	5	U
1,2-Dichlorobenzene	5	U	5	U	5	U	5	U
1,2-Dichloroethane	5	U	5	U	5	U	5	U
1,2-Dichloroethene (cis)	12		7		7.3		5.4	
1,2-Dichloroethene (trans)	5	U	5	U	5	U	5	U
1,2-Dichloropropane	5	U	5	U	5	U	5	U
1,3-Dichlorobenzene	5	U	5	U	5	U	5	U
1,4-Dichlorobenzene	5	U	5	U	5	U	5	U
1,4-Dioxane	100	U	100	U	100	R	100	U
2-Butanone	10	U	10	U	10	U	10	U
2-Hexanone	10	U	10	U	10	U	10	U
4-Methyl-2-pentanone	10	U	10	U	10	U	10	U
Acetone	10	U	10	U	10	U	10	U
Benzene	5	U	5	U	5	U	5	U
Bromochloromethane	5	U	5	U	5	U	5	U
Bromodichloromethane	5	U	5	U	5	U	5	U
Bromoform	5	U	5	U	5	U	5	U
Bromomethane	5	U	5	U	5	U	5	U
Carbon Disulfide	5	U	5	U	5	U	5	U
Carbon Tetrachloride	5	U	5	U	5	U	5	U
Chlorobenzene	5	U	5	U	5	U	5	U
Chloroethane	5	U	5	U	5	U	5	U
Chloroform	5	U	5	U	5	U	5	U
Chloromethane	5	U	5	U	5	U	5	U
cis-1,3-Dichloropropene	5	U	5	U	5	U	5	U
Cyclohexane	5	U	5	U	5	U	5	U
Dibromochloromethane	5	U	5	U	5	U	5	U
Dichlorodifluoromethane	5	U	5	U	5	U	5	U
Ethylbenzene	5	U	5	U	5	U	5	U
Isopropylbenzene	5	U	5	U	5	U	5	U
M,p-xylene	5	U	5	U	5	U	5	U
Methyl Acetate	5	U	5	U	5	U	5	U
Methyl Tert-butyl Ether	5	U	5	U	5	U	5	U
Methylcyclohexane	5	U	5	U	5	U	5	U
Methylene Chloride	5	U	0.66	B	5	U	5	U
O-xylene	5	U	5	U	5	U	5	U
Styrene	5	U	5	U	5	U	5	U
Tetrachloroethene	5	U	5	U	5	U	5	U
Toluene	5	U	5	U	5	U	5	U
trans-1,3-Dichloropropene	5	U	5	U	5	U	5	U
Trichloroethene	11		40		29		6	
Trichlorofluoromethane	5	U	5	U	5	U	5	U
Vinyl Chloride	5	U	5	U	5	U	8.6	

ATTACHMENT 1
DATA SUMMARY OF ANALYTICAL RESULTS
GROUNDWATER SAMPLES
BUTZ LANDFILL SITE, MONROE COUNTY, PENNSYLVANIA

Data Qualifiers:
B -- Positive result is considered to be an artifact of blank contamination, and should not be considered present.
J -- Value is considered estimated due to exceedance of technical quality control criteria or because result is less than the Contract Required Quantitation Limit (CRQL).
K -- Positive result is considered biased high due to exceedance of technical quality control criteria.
R -- Positive result is considered unusable due to exceedance of technical quality control criteria.
U -- Value is a non-detected result as reported by the laboratory.
UR -- Non-detected result is considered unusable due to exceedance of technical quality control criteria.
NA -- No result is available/applicable for this parameter in this sample.

Database source file: C:\BUTZLF\DATASUMMARY\BZMWGW.DBF data retrieved on: 01/20/11

ATTACHMENT 2

DATA USABILITY WORKSHEET
MEDIUM: GROUNDWATER

ATTACHMENT 2
DATA USABILITY WORKSHEET
BUTZ LANDFILL SITE
MEDIUM: GROUNDWATER

REQUIREMENT	COMMENTS
Field Sampling	
Discuss sampling problems and field conditions that affect data usability.	No field problems or conditions that affect data usability.
Are samples representative of receptor exposure for this medium (e.g. sample depth, grab vs. composite, filtered vs. unfiltered, low flow, etc.)?	All samples are representative of the groundwater plume.
Assess the effect of field QC results on data usability.	Contaminants found in the QC blanks at concentrations similar to the environmental sample concentrations were qualified "B". Results qualified "B" were not used in the risk assessment. The following compounds were contaminants in the QC blanks: • Acetone • Methylene Chloride • Chloroform • Toluene • Trichloroethene (TCE) Acetone, methylene chloride, and toluene are common laboratory contaminants. Chloroform is not a compound of concern (COC) at the site. Two TCE results were qualified for blank contamination.
Summarize the effect of field sampling issues on the risk assessment, if applicable.	No field problems or conditions that affect data usability.
Analytical Techniques	
Were the analytical methods appropriate for quantitative risk assessment?	The analytical methods CLP SOM01.2 Low and Trace were used to analyze the groundwater samples. For two events, the SOM01.2 SIM method was used to analyze for 1,4-Dioxane. The Contract Required Quantitation Limits (CRQLs) in Trace method were sufficiently low in most cases; however, several CRQLs in the Low method were greater than Region 3 Screening Levels (SLs) (EPA Region 3, November 2010).

ATTACHMENT 2
DATA USABILITY WORKSHEET
BUTZ LANDFILL SITE
MEDIUM: GROUNDWATER

REQUIREMENT	COMMENTS
Were detection limits adequate?	Several well samples were analyzed using CLP SOM01.2 Low method which has a CRQL of 5 µg/L for most compounds and 10 µg/L for ketones. These CRQLs were sufficient for Long-Term Remedial Action (LTRA) monitoring since concentrations of analytes in these wells are detected at high concentrations. Compounds in which CRQLs did not meet Region 3 SLs are listed in a table at the end of this worksheet. NOTE: Positive results detected at concentrations between the MDL and CRQL were reported with a "J" qualifier and these results are considered usable.
Summarize the effect of analytical technique issues on the risk assessment, if applicable.	If a sample has a concentration below the MDL but exceeds the SL, then it was reported as non-detect and was not included in the risk assessment. Compounds in which CRQLs did not meet Region 3 SLs are listed in a Table at the end of this worksheet.
Data Quality Objectives	
Precision - How were duplicates handled?	The average of positive field duplicate results was used in the risk assessment.
Accuracy - How were split samples handled?	No split samples were collected during the four groundwater sampling events.
Representativeness – Indicate any problems associated with data representativeness (e.g., trip blank or rinsate blank contamination, COC problems, etc.).	Data from the four annual events are representative of the groundwater plume.
Completeness – Indicate any problems associated with data completeness (e.g., incorrect sample analysis, incomplete sample records, problems with field procedures, etc.).	There are no problems associated with completeness.
Comparability - Indicate any problems associated with data comparability.	Data from the four annual events are comparable.
Were the DQOs specified in the QAPP satisfied?	Yes, with the exception of the listed compounds where CRQLs exceeded the SL.

ATTACHMENT 2
DATA USABILITY WORKSHEET
BUTZ LANDFILL SITE
MEDIUM: GROUNDWATER

REQUIREMENT	COMMENTS
Summarize the effect of DQO issues on the risk assessment, if applicable.	If a sample had a concentration below the MDL but exceeded the SL, then it was reported as non-detect and was not included in the risk assessment. Compounds in which CRQLs did not meet Region 3 SLs are listed in a Table at the end of this worksheet.
Data Validation and Interpretation	
What are the data validation requirements for this region?	Either Level M2 or Level M3 (full validation) is required for risk assessment. Level M2 is sufficient for "Risk Assessments of Known High Levels Toxins" (EPA Region III User's Guide to Acquiring Analytical Services, Version 6, July 2007).
What method or guidance was used to validate the data?	Data were validated in according to Region 3 Modifications to the National Functional Guidelines for Organic Data Review.
Was the data validation method consistent with regional guidance? Discuss any discrepancies.	The 2007 data were validated by Level M3. Beginning in 2008 the data were validated by Level M2 which is consistent with LTRA requirements and the DQOs.
Were all data qualifiers defined? Discuss those which were not.	Yes, all qualifiers were defined in the narrative of the data validation reports.
Which qualifiers represent usable data?	J, K, and U
Which qualifiers represent unusable data?	B, R, and UR
How are tentatively identified compounds handled?	Tentatively identified compounds (TICs) were not considered in this risk assessment. COCs have already been established for the site.
Summarize the effect of data validation and interpretation issues on the risk assessment, if applicable.	None.
Additional notes:	None.

Note: The purpose of this Worksheet is to succinctly summarize the data usability analysis and conclusions.

ATTACHMENT 2
DATA USABILITY WORKSHEET
BUTZ LANDFILL SITE
MEDIUM: GROUNDWATER

List of Target Compounds where CRQL Exceeded EPA Region 3 SL

Compound	RBC (µg/L)	Exceeding CRQL Range (µg/L)	# of Samples where CRQL Exceeded SL
Compounds that were detected (at least once) in Environmental Samples			
1,1,2-Trichloroethane	0.24	0.5-5.0 (10, 20, and 50 due to dilution)	71
1,1-Dichloroethane	2.4	5.0 (10, 20, and 50 due to dilution)	62
1,4-Dichlorobenzene	0.43	0.5-5.0 (10, 20, and 50 due to dilution)	73
Benzene	0.41	0.5-5.0 (10, 20, and 50 due to dilution) *The lowest positive detection of 0.26 J µg/L indicates that the MDL was below the SL for samples analyzed using the trace method.	72
Bromodichloromethane	0.12	0.5-5.0 (10, 20, and 50 due to dilution)	74
Chloroform	0.19	0.5-5.0 (20 and 50 due to dilution)	69
Ethylbenzene	1.5	5.0 (10, 20, and 50 due to dilution) *The lowest positive detection of 0.16 J µg/L indicates that the MDL was below the SL for samples analyzed using the trace method.	66
Methylene Chloride	4.8	5.0 (10, 20, and 50 due to dilution) *The lowest positive detections of 0.13B µg/L (trace) and 0.54 B µg/L (low) indicate that the MDLs were below the SL for samples analyzed using both methods.	38
Tetrachloroethene	0.11	0.5-5.0 (50 due to dilution)	66
Trichloroethene	2.0	50 due to dilution NOTE: This was the only non-detection.	1
Vinyl Chloride	0.016	0.5-5.0 (10, 20, and 50 due to dilution)	53

ATTACHMENT 2
DATA USABILITY WORKSHEET
BUTZ LANDFILL SITE
MEDIUM: GROUNDWATER

Compound	RBC (µg/L)	Exceeding CRQL Range (µg/L)	# of Samples where CRQL Exceeded SL
Compounds that were not detected in any Environmental Sample			
1,1,2,2-Tetrachloroethane	0.067	0.5-5.0 (10, 20, and 50 due to dilution)	74
1,2,3-Trichlorobenzene	29	50 due to dilution	1
1,2,4-Trichlorobenzene	8.2	10, 20, and 50 due to dilution	3
1,2-Dibromo-3-chloropropane	0.00032	0.5-5.0 (10, 20, and 50 due to dilution)	74
1,2-Dibromoethane	0.0065	0.5-5.0 (10, 20, and 50 due to dilution)	74
1,2-Dichloroethane	0.15	0.5-5.0 (10, 20, and 50 due to dilution)	74
1,2-Dichloropropane	0.39	0.5-5.0 (10, 20, and 50 due to dilution)	74
1,4-Dioxane	6.1	100 (200 and 400 due to dilution)	36
Bromoform	8.5	10, 20, and 50 due to dilution	3
Bromomethane	8.7	10, 20, and 50 due to dilution	3
Carbon Tetrachloride	0.44	0.5-5.0 (10, 20, and 50 due to dilution)	74
cis-1,3-Dichloropropene	0.44	0.5-5.0 (10, 20, and 50 due to dilution)	74
Dibromochloromethane	0.15	0.5-5.0 (10, 20, and 50 due to dilution)	74
trans-1,3-Dichloropropene	0.077	0.5-5.0 (10, 20, and 50 due to dilution)	74

NARRATIVE

The data generated during the Butz Landfill Site groundwater sampling events in April 2007, April 2008, January 2009, and April 2010 were evaluated to determine the data usability for the updated groundwater HHRA. All proposed sample locations as described in the Sampling and Analysis Plan (SAP) for Long-Term Remedial Action at Operable Unit 2 (Tetra Tech, March 2008) were collected. Several field duplicate pairs were also obtained as shown in Attachment 1 (Data Summary of Analytical Results) along with trip blanks and other QA/QC samples. The air samples were analyzed by various laboratories using Contract Laboratory Program (CLP) Method SOM01.2 (Low).

ATTACHMENT 2
DATA USABILITY WORKSHEET
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Data validation was performed by the EPA Region 3 Environmental Services Assistance Team (ESAT) according to EPA Region 3 Modifications to the National Functional Guidelines for Organic Data Review (September 1994), Level M2. Level M2 is outlined in the EPA Region 3 Innovative Approaches to Data Validation (1995).

All groundwater data were successfully analyzed by the laboratory. All reporting limits were sufficiently sensitive to meet the Project Action Limits (PALs) specified in the Sampling and Analysis Plan (SAP) for Long-Term Remedial Action at Operable Unit 2 (Tetra Tech, March 2008) and the SAP for Bioremediation Treatability Pilot Study (Tetra Tech, November 2008). All samples were analyzed within holding times.

Data validation procedures (as described in SAP Worksheets 35 and 36) were used to help determine which data were usable. Qualifiers were applied to each value based on the results of the data validation. Rejected values (qualified with "R") and blank qualified values ("B") were eliminated from further consideration. Estimated and biased values (J [estimated], K [biased high], and L [biased low]) were used as the reported values. The quantitation limits from the data were evaluated for sensitivity to the PALs. Limitations on the use of the data due to lack of project-required sensitivity were discussed in the individual data validation packages. Also, the data were reviewed by the project team to evaluate if samples were collected from the intended locations and were representative of site conditions.

After data validation and an overall review of data quality indicators, the data were reconciled with measurement performance criteria (MPCs) to determine whether sufficient data of acceptable quality were available for decision making. A series of checks was performed to estimate several of the data set characteristics. Simple summary statistics for target analytes were evaluated, such as the maximum concentration, minimum concentration, number of samples exhibiting no detectable analyte, the number of samples exhibiting detectable analytes, and the proportion of samples with detectable and undetectable analytes. Rejected values and significant deviations from planning documents, if any, were identified so the planning team could assess their impacts to the attainment of project objectives. Project assumptions were also evaluated to determine their validity. All assumptions were determined to be valid.

As part of data validation, ESAT reviewed the quantitative bias and precision data quality indicators to

determine whether any significant bias or significant imprecision existed in the data. A significant bias was a bias greater than +/- 30 percent (corresponding to consistent analyte recoveries of 70 to 130 percent in LCSs, MSs, or surrogate compound concentrations). Laboratory precision and field precision (based on RPD values from duplicate samples) were compared to ensure that laboratory precision is not significantly worse (i.e., exhibits greater RPD values) than field precision.

Potential data outliers were also be investigated to determine whether they represented unanticipated site conditions or if they were true outliers. No statistical outlier was removed from a data set unless a physical reason could be assigned to the datum to demonstrate that it was not representative of the intended population.

The comparability among data sets was evaluated to ensure it is satisfactory. Comparability and representativeness assessments were based on professional judgment with consideration of the quantitative quality indicators such as precision, accuracy, and completeness of data sets.

Duplicate pairs included:

- Samples R7-A-20070417 and R7-A-20070417-D (April 2007)
- Samples PWA-A-20080421 and PWA-A-20080421-D (April 2008)
- Samples PWB-B-20080416 and PWB-B-20080416-D (April 2008)
- Samples PWB-A-20100413 and PWB-A-20100413-D (April 2010)
- Samples R6-A-20100415 and R6-A-20100415-D (April 2010)
- Samples R7-C-20100415 and R7-C-20100415-D (April 2010)

While other duplicate pair samples were obtained as part of the various groundwater sampling events, those samples were not used for the updated groundwater HHRA.

All data were considered usable with the following qualifications:

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- Several VOC results (e.g., TCE, methylene chloride, trans-1,2-DCE, 1,1-DCA, vinyl chloride) were qualified as estimated (J) due to the exceedance of technical quality control criteria or because the result was less than the Contract Required Quantitation Limit (CRQL). These results were considered useable.

- Some results were flagged as blank (B) since the positive result was considered to be an artifact of blank contamination, and was not considered as present.

- A few results (i.e., 1,4-dioxane) were flagged as rejected (R) since the positive result was considered unusable due to exceedance of technical quality control criteria.