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ADDENDUM TO THIRD FIVE-YEAR REVIEW, WELLS G&H SUPERFUND SITE, DATED APRIL 2012

The third Five-Year Review Report (Report) for the Wells G&H Superfund Site located in Woburn, Massachusetts was signed by James T. Owens, Director of the United States Environmental Protection Agency ("EPA"), New England Office of Site Remediation and Restoration on September 24, 2009. A protectiveness statement could not be made at the time of Report publication. Additional data were needed to evaluate the potential for impacts to indoor air quality (IAQ) associated with current shallow groundwater conditions. This Addendum to the Report provides such additional information, as described below.

This Addendum includes a summary of the issues addressed, a description of progress since the September 24, 2009 Five-Year Review, updated report sections, and two attachments (figures and tables, and the EPA Risk Assessment Report). The Report sections updated in this Addendum include Report Sections 8 (Issues), 9 (Recommendations and Follow-up Actions), and 10 (Protectiveness Statement(s)). Attachment A to this Addendum provides two new figures illustrating maximum tetrachloroethylene (also known as tetrachloroethene and perchloroethylene (PCE)) 2010-2011 groundwater concentrations (Figure 1) and annual monitoring locations (Figure 2), a table summarizing the maximum 2010-2011 groundwater data (Table 1), and a table summarizing the annual monitoring program (Table 2). Attachment B to this Addendum presents EPA's Risk Assessment Report, which provides an evaluation of the potential for impacts to IAQ associated with current groundwater conditions.

Summary of Issues

IAQ can be impacted by the movement of volatile organic compounds (VOCs) from groundwater into soil gas and then into a building, a process and pathway referred to as vapor intrusion (VI). VI has the potential to occur when VOCs are present in groundwater. The aqueous phase VOCs can travel from groundwater into a gas phase and move through the pore spaces between soil particles. This "soil gas," as it is called, can gather under buildings and possibly enter buildings through cracks, holes, or seams present in a floor slab/foundation, through penetrations for utility services, and through basements or crawl spaces into the occupied (e.g., living space) of a structure. Once in a building, the colorless and often odorless gas may travel further to upper levels of the building, depending on its insulation and construction and other features (e.g., heating and cooling systems).

Specifically, the protectiveness statements from Section 10 of the Report concluded the following:

> *"A protectiveness determination of the Source Area (OU-1) remedy at the Wells G&H Superfund Site cannot be made at this time until further information is obtained. Additional data will be collected to evaluate potential vapor intrusion impacts at the existing building on the UniFirst Corporation (UniFirst) Source Area property. Additional data will also be collected to evaluate the potential vapor intrusion pathway near the UniFirst, W.R. Grace Company (Grace) and New*

England Plastic (NEP) Source Area properties. Once the data are collected, it will be assessed and a determination will be made whether or not additional measures are necessary to ensure protection of human health. It is expected that these actions will take approximately 6-12 months to complete at which time a protectiveness determination will be made.

This Addendum to the Report will focus on additional data collected to evaluate potential VI impacts at the existing commercial building on the UniFirst Source Area property, and additional data collected to evaluate the potential VI pathway near the UniFirst, Grace and New England Plastics (NEP) Source Area properties.

Progress since the September 24, 2009 Five-Year Review:

The progress since publication of the Report in September 2009 pertaining to the VI evaluation is outlined below and divided into the following subsections: Additional Data Collected; Risk Assessment Report Summary; Contaminant Source Evaluation; and Conclusions.

Additional Data Collected

The Report concluded that a protectiveness determination of the OU-1 remedy could not be made until additional data were collected to evaluate potential VI impacts at the existing commercial building on the UniFirst Source Area property and impacts associated with contaminated groundwater in downgradient areas encompassing buildings near the UniFirst, Grace, and NEP properties (note that the manufacturing and storage building formerly present at the Grace property was demolished in 2006).

Grace and UniFirst – Pursuant to the Report's conclusion that additional data be collected to evaluate potential VI impacts at the existing commercial building on the UniFirst Source Area property, UniFirst collected subslab soil gas and indoor air samples at the existing commercial building on the UniFirst Source Area property in April 2010 and February 2011.

In April 2010, EPA announced a shallow groundwater monitoring well installation program undertaken by Grace and UniFirst for the Dewey and Olympia Avenues neighborhood as an initial step for investigating the potential for VI downgradient of the UniFirst and Grace Source Area properties. The well installation program included 14 new monitoring wells in the Dewey and Olympia Avenues neighborhood, and two new monitoring wells at the Grace Source Area property. In September 2010 and April 2011, groundwater sampling for VOC analysis was undertaken at approximately 38 groundwater monitoring wells (16 new wells and 22 existing wells), including existing monitoring wells on the Grace and UniFirst Source Area properties.

The September 2010 groundwater sampling results from monitoring wells located in the vicinity of the UniFirst and Grace Source Area properties revealed PCE in some of the monitoring wells. Samples from 14 of the 38 monitoring wells sampled had PCE concentrations equal to or greater than 5 micrograms per liter (ug/L), which is the maximum allowable concentration that EPA has established for public drinking water supplies. All but three shallow groundwater monitoring wells with PCE concentrations equal to, or greater than, 5 ug/L were located on commercial properties.

In January 2011, due to the detection of shallow groundwater concentrations of PCE in excess of VI screening levels, EPA identified the need for additional investigations to evaluate the potential VI pathway downgradient of/near the UniFirst and Grace Source Area properties where groundwater concentrations exceeded 5 ug/L. The investigations collected subslab soil gas, indoor air and outdoor air

samples at a limited number of residential and commercial buildings.

In March/April 2011 and June 2011, UniFirst and Grace collected, with EPA oversight, subslab soil gas, indoor air, and outdoor air samples at the downgradient UniFirst and Grace Source Area properties at a limited number of residential and commercial buildings. Six buildings were sampled from downgradient of/near the UniFirst and Grace Source Area properties (three buildings near UniFirst [1 commercial and 2 residential] and three buildings near Grace [1 commercial and 2 residential]). As previously described, subslab soil gas, indoor air and outdoor air samples were also collected from the existing commercial building located on the UniFirst Source Area property. A total of seven buildings were sampled. The table below provides general numbers and descriptions for each building.

Building #	Building Type	Current Use	General Location
260207	Commercial	Storage Facility (3 spaces)	UniFirst Source Area
260206	Commercial	Day Care Facility (3 spaces)	Downgradient/Near UniFirst
260504	Residential	Residential	Downgradient/Near UniFirst
260505	Residential	Residential	Downgradient/Near UniFirst
260407	Commercial	Multiple Facilities (5 spaces)	Downgradient/ Near Grace
260902	Residential	Residential	Downgradient/ Near Grace
260903	Residential	Residential	Downgradient/ Near Grace

The outcome of this sampling is described in the section below entitled Risk Assessment Report Summary.

New England Plastics – In September 2010, NEP installed two new shallow groundwater monitoring wells on nearby residential properties located downgradient of the NEP Source Area property. In October 2010, NEP collected groundwater samples from these two new monitoring wells and from seventeen existing monitoring wells located within the NEP Source Area property. In April 2011, NEP collected a second round of groundwater samples from the two new monitoring wells and one monitoring well located within the NEP Source Area property. All of the groundwater samples were analyzed at a laboratory for VOCs. Because no VOCs were detected above EPA's groundwater VI screening levels at the two new monitoring wells, no further investigation was performed downgradient of/near the NEP Source Area property.

Risk Assessment Report Summary

In April 2012, EPA prepared a human health risk assessment report for the VI pathway (Risk Assessment Report) based upon the above described data to evaluate potential risk to individuals under current and future building uses. EPA's Risk Assessment Report is provided in its entirety in Attachment B to this Addendum.

The Risk Assessment Report evaluates potential incremental lifetime carcinogenic/cancer risks (ILCRs) and non-carcinogenic hazards (Hazard Indices or HIs) associated with the VI pathway to a receptor (e.g., individuals such as residents, workers, etc.) at each building where indoor air samples were collected. EPA (1991)[1] states that where the cumulative current or future ILCR for a receptor is less than 1×10^{-4}, and where the non-carcinogenic HI is less than 1, action generally is not warranted unless there are adverse environmental impacts or other site-specific considerations. Table ES-1 of the Risk Assessment Report summarizes potential current and future risks. The following information summarizes EPA's

[1] Don R. Clay, "Role of Baseline Risk Assessment in Superfund Remedy Selection Decisions", EPA OSWER Directive 9355.0-30, 22 April 1991

evaluation based on Reasonable Maximum Exposure (RME[2]) estimates of risk.

Summary of EPA's RME Risk Assessment Results

For all commercial and residential properties evaluated (buildings 260207, 260206, 260504, 260505, 260407, 260902 and 260903), all current cancer risks estimated are less than 10^{-4} and all current non-carcinogenic hazards estimated are less than 1. In addition, for most of the properties evaluated (including all residential properties), future cancer risks estimated are less than 10^{-4} and future non-carcinogenic hazards are less than 1. However, if commercial building 260207 is converted to residential use in the future, there is the potential for unacceptable cancer risk and non-carcinogenic hazard associated with the VI pathway. Unacceptable future potential risks are also estimated for commercial building 260407, but are not associated with the VI pathway. Risks are summarized in Table ES-1 of Attachment B.

Future Risk for Commercial Buildings 260207 and 260407

Commercial buildings 260207 and 260407 were both evaluated to determine the ILCR and HI should these buildings be used for residential purposes in the future. The results of these evaluations are discussed below.

Commercial Building 260207

If commercial building 260207 were to be used as a residence in the future (e.g., converted to apartments/condominiums, etc.), the future resident ILCR would be 4×10^{-4} and the non-carcinogenic HI would be 9. The primary risk-contributing contaminants are 1,4-dichlorobenzene (ILCR of 2×10^{-4}) and naphthalene (ILCR of 2×10^{-4}), with a lesser contribution from PCE (ILCR of 9×10^{-6}). Naphthalene and PCE are the risk-contributing contaminants for the non-carcinogenic hazard with HIs of 5 and 2, respectively.

While three contaminants are the primary risk contributors, only one contaminant in indoor air appears to be primarily related to groundwater or soil contamination at the Site. Though naphthalene was detected in shallow groundwater on the UniFirst Source Area property, it was only detected in one monitoring well (UC5) at a low concentration (2 ug/L) over the past two years. Naphthalene was also only detected at one subslab soil gas location (SV-02) at a maximum detected concentration of 1.1 ug/m^3, while it was detected in all but one of the indoor air sampling locations at a maximum detected concentration of 16 ug/m^3. The low concentrations in groundwater and subslab soil gas suggest that naphthalene is present in indoor air primarily due to an indoor source and not from groundwater or soil gas. Similarly, 1,4-dichlorobenzene was only detected in shallow groundwater in one monitoring well (UC18) at a low concentration (1 ug/L) over the past two years, and only sporadically detected at low concentrations in subslab soil gas, suggesting that 1,4-dichlorobenzene is also present in indoor air as a result of an indoor source. In contrast, PCE was detected consistently and at high concentrations in the subslab soil gas, indicating that PCE in indoor air is primarily associated with the VI pathway. Considering only PCE, the future non-carcinogenic HI of 2 would still exceed the EPA risk management guideline if the building was used for residential purposes in the future. The cancer risk for PCE would not exceed the EPA risk management guideline.

[2] The RME is the highest exposure that is reasonably expected to occur..

Commercial Building 260407

If commercial building 260407 were to be used as a residence in the future (e.g., converted to apartments/condominiums, etc.), the future resident ILCR is 6×10^{-4}. The primary risk contributing contaminant is chloroform (ILCR of 6×10^{-4}), with a lesser contribution from naphthalene (9×10^{-6}).

Neither of these primary risk contributors appears to be related to groundwater contamination at the Site. Though chloroform was detected in the subslab soil gas and indoor air samples throughout the building, all indoor air detections of chloroform were low (maximum of 1.2 ug/m^3) and would not be associated with a risk above EPA's risk management guidelines with the exception of the chloroform concentrations detected in Space 5. In addition, chloroform has only been detected at low concentrations (maximum of 3 ug/L) in shallow groundwater in the vicinity of this commercial building. Therefore, the maximum detected concentration of chloroform appears to be associated with an indoor source within Space 5. Naphthalene was detected in shallow groundwater downgradient of the Grace Source Area property, but only in one monitoring well (UC13) at a low concentration (0.6 ug/L) over the past two years. This monitoring well is not located in the vicinity of building 260407. Therefore, although naphthalene was detected in the subslab soil gas and indoor air of building 260407, naphthalene is likely present in indoor air due to an indoor source. Considering chloroform and naphthalene are likely present in indoor air due to an indoor source, there would be no carcinogenic risk estimated for the VI pathway for building 260407.

Potential Future Vapor Intrusion Pathway for Buildings 260207 and 260206 with High PCE Subslab Soil Gas

Although PCE was not identified at significant concentrations in any indoor air samples, EPA notes that subslab soil gas concentrations of PCE are higher than the EPA soil gas screening level for commercial properties at buildings 260207 and 260206. In addition, subslab soil gas concentrations of trichloroethene (TCE) are higher than the EPA soil gas screening level for commercial properties at commercial building 260207. The presence of elevated concentrations of PCE in subslab soil gas beneath commercial buildings 260207 and 260206, as well as elevated concentrations of TCE in subslab soil gas beneath commercial building 260207, indicates a potential for a future VI pathway to the indoor air if building conditions were to change. For example, future cracks could form in the foundation/subslab of these buildings such that soil gas could more easily travel into these buildings. Subslab soil gas results for buildings 260207 and 260206 are found in Attachment B, Tables B-2 and B-1, respectively.

Contaminant Source Evaluation

EPA further evaluated the complete VI pathway and groundwater conditions near the buildings downgradient of/near the UniFirst and Grace Source Area properties to evaluate if some of the primary contaminants were potentially associated with indoor sources and unrelated to the groundwater plume. The Risk Assessment Report identified four primary compounds contributing to potential risks associated with indoor air: PCE, chloroform, naphthalene, and 1,4-dichlorobenzene. Groundwater data were collected in 2010 and 2011 from various monitoring wells downgradient of/near the UniFirst and Grace Source Area properties and the results are summarized below for PCE, chloroform, naphthalene, and 1,4-dichlorobenzene (and in Attachment A Table 1 of this Addendum). The groundwater cleanup standards for the Wells G&H Superfund Site are drinking water standards or Maximum Contaminant Levels (MCLs), and are also included in the summary table below and Attachment A Table 1 of this Addendum.

Summary of Groundwater Monitoring Results for Primary Contaminants of Potential Concern				
Information Summaries	**PCE**	**Naphthalene**	**1,4-Dichlorobenzene**	**Chloroform**
Site Groundwater Cleanup Standard: Maximum Contaminant Level (MCL)	5	None	75	70
Maximum detected groundwater concentration (ug/L)	87,000	2 J	1 J	3
Number of Detects	52	3	1	22
Number of Locations Analyzed	90	83	76	76

Notes:

ug/L - micrograms per liter. J - Estimated value.

PCE – Tetrachloroethylene.

As represented in Attachment A Table 1 of this Addendum and the above summary, the groundwater concentrations that were detected for the compounds naphthalene, 1,4-dichlorobenzene, and chloroform were very low and below MCLs. In addition, naphthalene and 1,4-dichlorobenzene were only sporadically detected in groundwater (in 3 of 83 samples for naphthalene and in 1 of 76 samples for 1,4-dichlorobenzene). EPA has concluded that naphthalene, 1,4-dichlorobenzene, and chloroform found in indoor air are not associated with the Site's groundwater contamination and therefore, not present in indoor air as a result of a complete VI pathway into the buildings investigated. The presence of these three compounds in indoor air at the buildings appears to be associated with some form of indoor source, and not with the site's groundwater plume or the VI pathway for the buildings downgradient of/near the UniFirst and Grace Source Area properties.

With respect to PCE, however, EPA considers this compound to be associated with the Site's groundwater contamination and part of the VI pathway for the building on the UniFirst Source Area property and the buildings downgradient of/near the UniFirst and Grace Source Area properties. Figure 1 illustrates the maximum concentrations of PCE detected in 2010-2011 at and downgradient of/near the UniFirst and Grace Source Area properties. Figure 1 highlights those monitoring well locations with PCE concentrations exceeding the federal drinking water standard of 5ug/L near the UniFirst and Grace Source Area properties.

Conclusions

EPA concludes that the VI pathway is not likely to pose unacceptable current indoor air risk at the UniFirst Source Area property and downgradient of/near the UniFirst, Grace and NEP Source Area properties, including all downgradient residential buildings. The VI pathway is also unlikely to pose unacceptable future risk at buildings downgradient of/near the UniFirst, Grace and NEP Source Area properties, including all downgradient residential buildings.

There is potential unacceptable future indoor air risk associated with the VI pathway at commercial building 260207 should this building be used for residential purposes in the future. The location of building 260207 is illustrated in purple highlight on Attachment A Figure 2 of this Addendum.

Although current indoor air concentrations of PCE do not pose unacceptable risk, subslab soil gas concentrations of PCE beneath commercial buildings 260207 and 260206 are high compared to soil gas VI screening levels. In addition, subslab soil gas concentrations of TCE beneath commercial building 260207 are high compared to soil gas VI screening levels. The presence of elevated concentrations of PCE and TCE in subslab soil gas beneath commercial building 260207, and elevated concentrations of PCE in subslab soil gas beneath commercial building 260206, indicates a potential for a future VI

pathway to the indoor air if buildings conditions were to change (e.g., future cracks could form in the foundation/subslab such that soil gas could more easily travel into the building , etc.). The location of commercial buildings 260207 and 260206 are illustrated in purple highlight on Attachment A Figure 2 of this Addendum.

Updated Report Sections

8.0 ISSUES

The following tables replace and supplement the original Table 5 from Section 8 of the Report.

Table 5a: Issues

Issues from September 2009 Five-Year Review	Affects Current Protectiveness[1] (Y/N)	Affects Future Protectiveness[1] (Y/N)	Current Status
Potential current indoor risks above EPA's risk management guidelines based upon an evaluation of the soil gas to indoor air and soil to indoor air pathways for the existing commercial building at UniFirst property	N	Y	SEE TABULATION OF CURRENT ISSUES BELOW Additional groundwater, subslab soil gas and indoor air samples collected from 2010 - 2011 (2 rounds) in/near existing commercial building. EPA prepared 2012 Risk Assessment Report (Attachment B) and FYR Addendum conclusions.
Uncertain water quality conditions downgradient from/ near the UniFirst, Grace and NEP Source Area properties that may contribute to a potential vapor intrusion pathway.	N	Y	SEE TABULATION OF CURRENT ISSUES BELOW Additional groundwater, subslab soil gas and indoor air samples collected from 2010 - 2011 (2 rounds) from some buildings downgradient of/near UniFirst and Grace Source Area properties. Additional groundwater samples collected downgradient of/near NEP Source Area property. EPA prepared 2012 Risk Assessment Report (Attachment B) and FYR Addendum conclusions.
No soil remedy has been implemented at UniFirst (SVE).	N	Y	ONGOING UniFirst collected additional groundwater, subslab soil gas and indoor air samples collected from 2010 -2011 (2 rounds) on the UniFirst Source Area Property, and prepared an In-situ Soil Volatilization (ISV) pilot work plan. EPA provided comments on the pilot work plan in February 2012.
No property-specific institutional controls implemented at the	N	Y	ONGOING

Table 5a: Issues			
Issues from September 2009 Five-Year Review	**Affects Current Protectiveness[1] (Y/N)**	**Affects Future Protectiveness[1] (Y/N)**	**Current Status**
Source Area properties to prevent public contact with contaminated groundwater and soil above cleanup levels.			
Persistent groundwater contaminant concentrations at all Source Area properties.	N	Y	ONGOING Source Area properties continue to collect groundwater data regarding persistent groundwater contamination
Extraction systems performance (possible insufficient capture of groundwater contamination) at UniFirst, W.R. Grace and Wildwood properties.	N	Y	ONGOING UniFirst and WR Grace have collected additional groundwater data and prepared a December 2010 capture report. EPA prepared a September 29, 2011 response. Wildwood continues to collect additional groundwater data.
No groundwater pump and treatment system implemented at NEP following AS/SVE shutdown.	N	Y	ONGOING
No recent data regarding groundwater contaminant concentrations in deep bedrock at NEP.	N	Y	ONGOING NEP preparing work plan for EPA approval
Area south of Wildwood treatment system may have groundwater contamination in excess of ROD cleanup goals not receiving treatment.	N	Y	ONGOING Wildwood continues to collect additional groundwater data.
No groundwater pump and treatment remedy implemented at Olympia.	N	Y	ONGOING Olympia continues with implementation of In-situ Chemical Oxidation to destroy soil contamination and achieve cleanup levels.
Soil contaminant concentrations at Grace property exceed ROD Action Levels.	N	Y	ONGOING Grace collected additional soil samples on the source area property in Fall 2011 under an EPA approved work plan.
The 1988 Endangerment Assessment did not comprehensively evaluate non-ingestion uses of groundwater such as dermal contact during industrial groundwater usage or direct contact during trench excavation under certain current (commercial worker) and future (commercial worker, residential) scenarios at Source Area properties.	N	Y	ONGOING
Arsenic MCL changed from 50 ug/L to 10 ug/L in 2001. Arsenic was not targeted for cleanup in the 1989 Record of	N	Y	ONGOING

Table 5a: Issues			
Issues from September 2009 Five-Year Review	**Affects Current Protectiveness[1] (Y/N)**	**Affects Future Protectiveness[1] (Y/N)**	**Current Status**
Decision based on prior MCL. Historical arsenic concentrations were either above 10 ug/L, or detection limits exceeded 10 ug/L. In addition, manganese was not identified as a COC in OU-1 groundwater under the 1988 Endangerment Assessment. Manganese toxicity values have been reduced by a factor of 10 since the assessment. Future exposures to manganese in groundwater may exceed EPA's Lifetime Health Advisory.			
An evaluation of the groundwater to indoor air pathway indicates potential future risks at the Olympia property (commercial, residential) and Wildwood property (residential) might exceed EPA risk management guidelines should re-development occur. Newly discovered soil contamination on Grace property may also present vapor intrusion issue should redevelopment occur. Re-development at any of the Source Area properties may present a vapor intrusion risk.	N	Y	ONGOING No redevelopment proposal has been submitted.
AWQCs associated with aquatic life have decreased since the ROD. AWQCs were used to establish effluent limits for remedial system discharges at the UniFirst and Grace properties.	N	Y	ONGOING

Notes:

1. Underscoring indicates protectiveness determinations that have changed since report publication.

Table 5b: Current Issues		
Current Issues	**Affects Current Protectiveness (Y/N)**	**Affects Future Protectiveness (Y/N)**
Potential future indoor air risks above EPA's risk management guidelines based upon the risk evaluation of complete VI pathway at existing commercial building 260207 on the UniFirst Source Area property should the building be used for residential purposes in the future . In addition, potential future VI could occur at existing commercial building 260207 on the UniFirst Source Area property if building conditions (e.g. further cracks in foundation, etc.) were to change due to the presence of elevated concentrations of PCE and TCE in subslab soil gas beneath the building.	N	Y
Potential future VI could occur at existing commercial building 260206 downgradient of/near the UniFirst Source Area property if building conditions (e.g. further cracks in foundation, etc.) were to change due to the presence of elevated concentrations of PCE in subslab soil gas beneath the building.	N	Y
Water quality conditions in groundwater downgradient of/near UniFirst and Grace Source Area properties exceed federal drinking water standards.	N	Y

9.0 RECOMMENDATIONS AND FOLLOW-UP ACTIONS

The following table supplements the original Table 6 from Section 9 of the Report. It excludes the original listed recommendations and follow-up actions that are described in Section 8 (above) as on-going, and provides a listing of recommendations and follow-up issues consistent with this Addendum.

Table 6: Recommendations and Follow-up Actions

Current Issue	Recommendations and Follow-up Actions	Party Responsible	Oversight Agency	Milestone Date
Potential future indoor air risks above EPA's risk management guidelines based upon the risk evaluation of complete VI pathway at existing commercial building 260207 on the UniFirst Source Area property should the building be used for residential purposes in the future. In addition, potential future VI could occur at existing commercial building 260207 on the UniFirst Source Area property if building conditions (e.g. further cracks in foundation, etc.) were to change due to the presence of elevated concentrations of PCE and TCE in subslab soil gas beneath the building.	Design and Implement In Situ Volatilization (ISV) soil remedy in accordance with the Consent Decree. EPA anticipates ISV implementation should sufficiently mitigate the future indoor air risk associated with the VI pathway. In addition, annual groundwater monitoring of wells exceeding federal drinking water standards (e.g., PCE at 5ug/L) to monitor groundwater conditions on the UniFirst Source Area property starting in 2012, and, upon ISV completion, annual VOC subslab soil gas and indoor air monitoring of the existing building 260207 on the UniFirst Source Area property to monitor the performance of the ISV soil remedy to mitigate future indoor air risks associated with the VI pathway. See Attachment A Table 2 and Figure 2 of this Addendum.	PRP	EPA	2012

Table 6: Recommendations and Follow-up Actions				
Current Issue	**Recommendations and Follow-up Actions**	**Party Responsible**	**Oversight Agency**	**Milestone Date**
Potential future VI could occur at existing commercial building 260206 downgradient of/near the UniFirst Source Area property if building conditions (e.g. further cracks in foundation, etc.) were to change due to the presence of elevated concentrations of PCE in subslab soil gas beneath the building.	Annual VOC subslab soil gas and indoor air monitoring of existing building 260206 downgradient of/near the UniFirst Source Area property to monitor the VI pathway and building conditions starting in 2012. In addition, annual groundwater monitoring of wells exceeding federal drinking water standards (e.g., PCE at 5ug/L) by the UniFirst Source Area property to monitor VOC conditions downgradient of/ near the UniFirst Source Area property. See Attachment A Table 2 and Figure 2 of this Addendum.	PRP	EPA	2012
Water quality conditions in groundwater downgradient of/near UniFirst and Grace Source Area properties exceed federal drinking water standards.	Annual groundwater monitoring of wells exceeding federal drinking water standards (e.g., PCE at 5 ug/L) by the UniFirst and Grace Source Area properties to monitor VOC conditions downgradient of/ near the UniFirst and Grace Source Area properties.	PRP	EPA	2012

10.0 ADDENDUM – PROTECTIVENESS STATEMENT

This Addendum provides a protectiveness statement for OU #1.

Protectiveness of Operable Unit 1(OU #1)

The remedy for OU #1 is protective of human health and the environment, and in the interim, exposure pathways that could result in unacceptable risks are being controlled.

Approved by: _____ Date: 4/23/12
James T. Owens III, Director
Office of Site Remediation and Restoration
USEPA Region I

Attachment A – Figures 1 & 2, Table 1: 2010-2011 Maximum Groundwater Concentrations Summary, and Table 2: Annual Monitoring

Attachment B – EPA Risk Assessment Report

ATTACHMENT A

Figures 1 & 2, Table 1: 2010-2011 Maximum Groundwater Concentrations Summary, and Table 2: Annual Monitoring

Figure 1
2010-2011 Maximum PCE Groundwater Concentrations

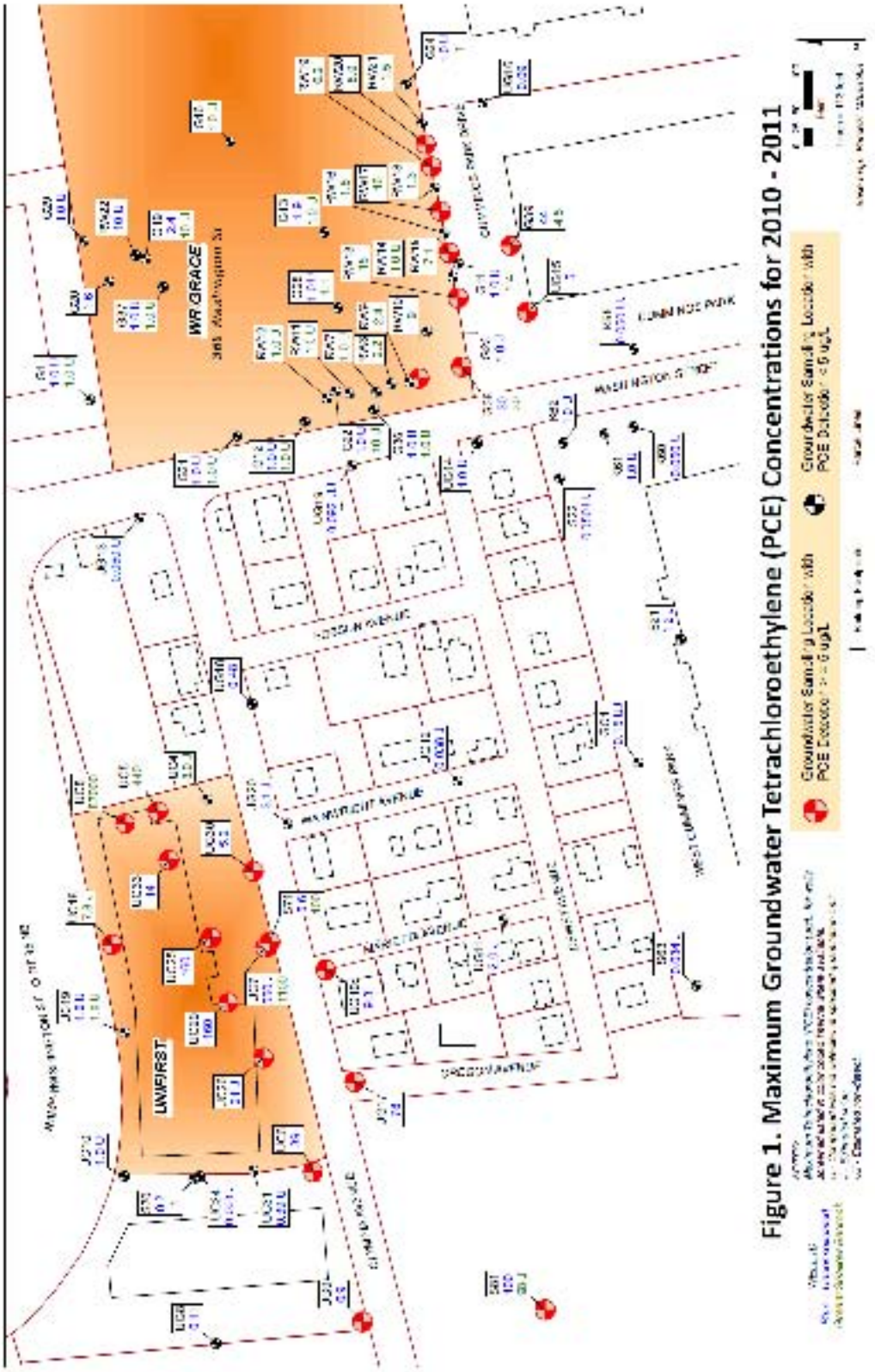

Figure 2
Annual Monitoring

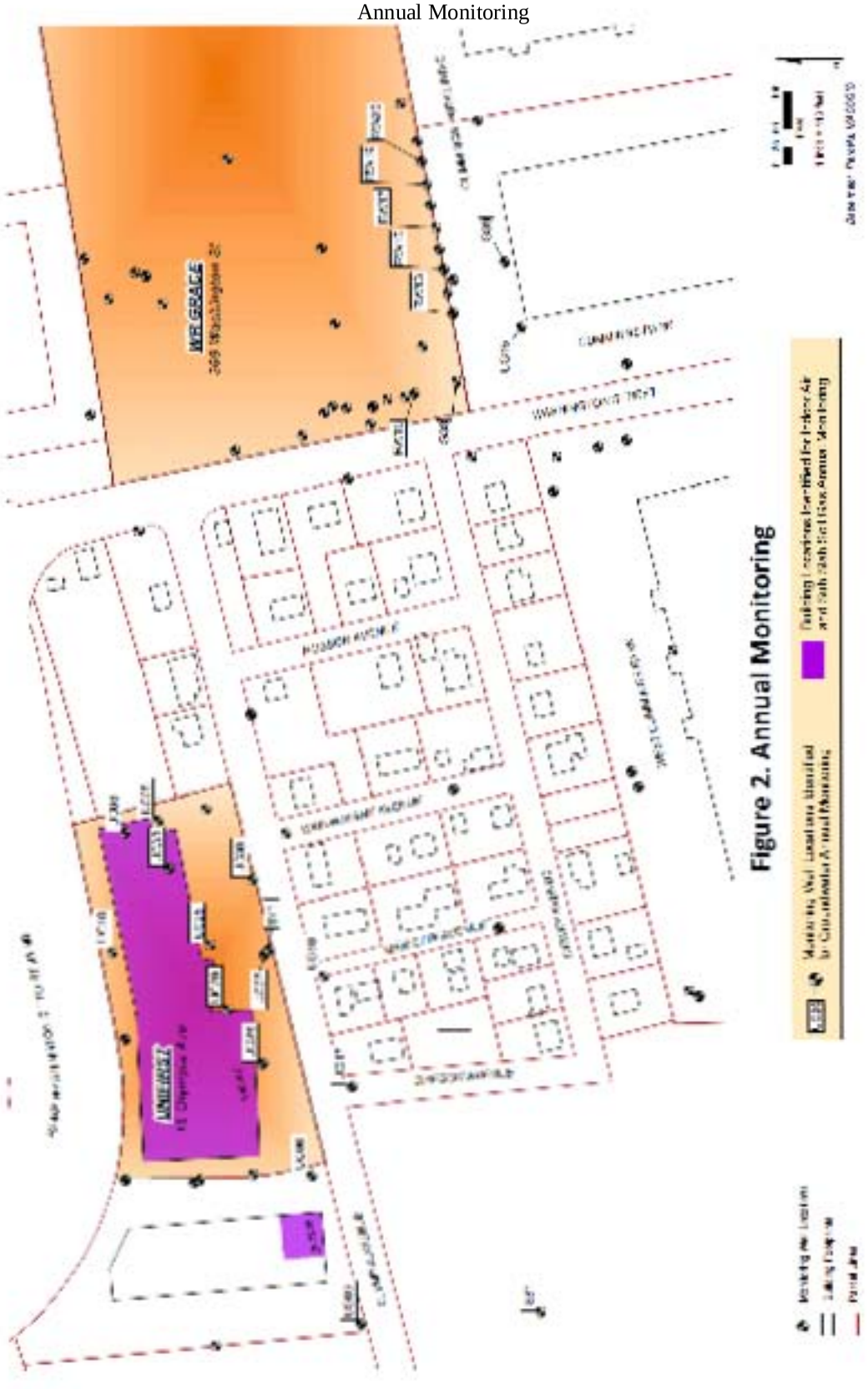

Table 1: 2010-2011 Maximum Groundwater Concentrations Summary					
Well Cluster ID	**Screen Interval**	**PCE**	**Naphthalene**	**1,4-Dichlorobenzene**	**Chloroform**
		(ug/L)			
	MCL	**5**	**None**	**75**	**70**
G1	UNC	1.0 U	5.0 U	1.0 U	1.0 U
	SBR	1.0 U	5.0 U	1.0 U	1.0 U
G11	UNC	1.0 U	2.0 U	1.0 U	1.0 U
	SBR	**1.4**	5.0 U	1.0 U	1.0 U
G12	UNC	1.0 U	5.0 U	1.0 U	1.0 U
	SBR	1.0 U	5.0 U	1.0 U	1.0 U
G13	UNC	**1.9**	2.0 U	1.0 U	1.0 U
	SBR	1.0 U	2.0 U	1.0 U	1.0 U
G16	SBR	1.0 U	2.0 U	1.0 U	1.0 U
G19	UNC	**2.4**	25 U	5.0 U	5.0 U
	SBR	10 U	50 U	10 U	10 U
G20	UNC	**1.6**	25 U	5.0 U	5.0 U
G21	UNC	1.0 U	5.0 U	1.0 U	1.0 U
	SBR	1.0 U	5.0 U	1.0 U	1.0 U
G22	UNC	1.0 U	5.0 U	1.0 U	1.0 U
	SBR	10 U	20 U	10 U	10 U
G23	UNC	1.0 U	5.0 U	1.0 U	1.0 U
G24	UNC	1.0 U	5.0 U	1.0 U	1.0 U
	SBR	**1.0**	5.0 U	1.0 U	1.0 U
G28	UNC	1.0 U	5.0 U	1.0 U	1.0 U
	SBR	**1.1**	5.0 U	1.0 U	1.0 U
G29	UNC	1.0 U	5.0 U	1.0 U	1.0 U
G36	UNC	1.0 U	5.0 U	1.0 U	1.0 U
	SBR	1.0 U	5.0 U	1.0 U	1.0 U
G37	UNC	1.0 U	2.0 U	1.0 U	1.0 U
	SBR	1.0 U	2.0 U	1.0 U	1.0 U
G38	UNC	**30**	2.0 U	1.0 U	1.0 U
	SBR	**30**	2.0 U	1.0 U	1.0 U
G39	UNC	**44**	2.0 U	1.0 U	1.0 U
	SBR	**4.5**	2.0 U	1.0 U	1.0 U
GO1	UNC	0.15 UJ	1.0 U	1.0 U	**0.17**
K55	UNC	0.050 UJ	1.0 U	1.0 U	0.10 U
K60	UNC	0.050 U	1.0 U	1.0 U	**0.025 J**
K61	UNC	1.0 U	2.0 U	1.0 U	1.0 U
K62	UNC	1.0 U	2.0 U	1.0 U	1.0 U
RW7	SBR	1.0 U	5.0 U	1.0 U	1.0 U
RW8	SBR	**2.2**	5.0 U	1.0 U	1.0 U
RW9	SBR	**2.4**	5.0 U	1.0 U	1.0 U
RW10	SBR	**9**	5.0 U	1.0 U	1.0 U
RW11	SBR	1.0 U	5.0 U	1.0 U	1.0 U
RW12	SBR	1.0 U	5.0 U	1.0 U	1.0 U
RW13	SBR	**15**	5.0 U	1.0 U	1.0 U
RW14	SBR	1.0 U	5.0 U	1.0 U	1.0 U
RW15	SBR	**7.1**	5.0 U	1.0 U	1.0 U
RW16	SBR	**1.8**	5.0 U	1.0 U	1.0 U
RW17	SBR	**16**	5.0 U	1.0 U	1.0 U
RW18	SBR	**1.3**	5.0 U	1.0 U	1.0 U
RW19	SBR	**6.2**	5.0 U	1.0 U	1.0 U
RW20	SBR	**8.9**	5.0 U	1.0 U	1.0 U
RW21	SBR	**1.5**	5.0 U	1.0 U	1.0 U
RW22	UNC	10 U	50 U	10 U	10 U
S21	UNC	**1.2 J**	1.0 U	1.0 U	**0.39**
S22	UNC	0.050 UJ	1.0 U	1.0 U	1.0 U
S63	UNC	**0.034 J**	1.0 U	1.0 U	**0.014 J**
S70	UNC	**0.2**	1.0 U	1.0 U	**0.13**
	SBR	**1.0**	NA	NA	1.0 U
S71	UNC	**5.6**	**2.0 J**	1.0 U	0.036 U
	SBR	**100**	NA	NA	1.0 U
S81	UNC	**100**	NA	NA	**0.06**

	SBR	**98 J**	NA	NA	1.0 U
UC4	SBR	**3.0 J**	1.0 U	1.0 U	**0.60 J**
UC5	SBR	**440**	**2.0 J**	1.0 UJ	1.0 U
UC6	UNC	**39**	1.0 U	1.0 U	1.0 U
UC7	UNC	**550 J**	NA	NA	4.0 U
	SBR	**1,100**	NA	NA	1.0 U
UC8	SBR	**87,000**	100 U	100 U	100 U
UC10	UNC	1.0 U	1.0 U	1.0 U	**0.0074 J**
UC18	SBR	**7.8 J**	1.0 U	**1.0 J**	**0.12**
UC19	UNC	1.0 U	1.0 U	1.0 U	1.0 U
	SBR	1.0 U	NA	NA	1.0 U
UC24	UNC	**0.033 J**	1.0 U	1.0 U	**0.1**
UC25	UNC	**160**	1.0 U	1.0 U	1.0 U
UC26	UNC	**21 J**	1.0 U	1.0 U	**0.04 J**
UC29	UNC	**160**	1.0 U	1.0 U	1.0 U
UC30	UNC	**5.2**	1.0 U	1.0 U	**0.1**
UC31	UNC	0.39 U	1.0 U	1.0 U	**0.05**
UC33	UNC	**14**	1.0 U	1.0 U	1.0 U
UG8	UNC	**0.11**	1.0 U	1.0 U	**0.10 J**
UG9	UNC	**6.9**	1.0 U	1.0 U	**0.065 J**
UG10	UNC	**9.3**	1.0 U	1.0 U	**0.026 J**
UG11	UNC	**2.0 J**	1.0 U	1.0 U	**3.0**
UG12	UNC	**0.038 J**	1.0 U	1.0 U	**0.31**
UG13	UNC	0.050 U	**0.60 J**	1.0 U	**0.53 J**
UG14	UNC	1.0 U	1.0 U	1.0 U	1.0 U
UG15	UNC	**5.0**	1.0 U	1.0 U	**3.0**
UG16	UNC	**0.09**	1.0 U	1.0 U	**0.08**
UG17	UNC	**78**	1.0 U	1.0 U	1.0 U
UG18	UNC	**0.48**	1.0 U	1.0 U	**0.2**
UG19	UNC	0.092 UJ	1.0 U	1.0 U	0.1 U
UG20	UNC	**3.1 J**	1.0 U	1.0 U	**0.10 J**
Maximum Concentration		**87,000**	**2.0 J**	**1.0 J**	**3.0**
Number of Detects		**52**	**3**	**1**	**22.0**
Number of Locations Analyzed		**90**	**83**	**76**	**76**

Notes:

UNC - Well screened in the unconsolidated deposits.
SBR - Well screened in the shallow bedrock.
PCE - Tetrachloroethylene
MCL - Maximum Contaminant Level.
Values in **Bold** indicate the compound was detected.
Exceeds MCL.

ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.

TABLE 2: Annual Monitoring		
Media	**UniFirst**	**Downgradient/Near UniFirst**
GW	UC8, UC5, UC33, UC30, UC18, UC25, UC7, S71, UC29, UC26,	UG10, UG17, UC6, UG9, S81
Indoor Air	Building 260207	Building 260206
Subslab	Building 260207	Building 260206
Media	**WR Grace**	**Downgradient/Near WR Grace**
GW	RW10, GW38, RW13, RW15, RW17, RW19, RW20	UG15, G39

ATTACHMENT B

EPA Risk Assessment Report

EPA Contract No. EP-SI-06-01
EPA Task Order No. 0009-RO-BE-0146

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HUMAN HEALTH RISK ASSESSMENT FOR THE VAPOR INTRUSION PATHWAY

Wells G&H Superfund Site
Operable Unit 1
Woburn, Massachusetts

April 2012

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EXECUTIVE SUMMARY

A Human Health Risk Assessment (HHRA) for the Vapor Intrusion (VI) pathway was conducted by AECOM and its Response Action Contract (RAC) Team Subcontractor, TRC Environmental Corporation (TRC), for the United States Environmental Protection Agency (EPA) Region 1 at the Wells G&H Superfund Site, Operable Unit 1 (OU-1), in Woburn, Massachusetts.

EPA performed an evaluation of the VI pathway for OU-1 as part of the 2004 and 2009 five-year reviews conducted for the Wells G&H Superfund Site (EPA, 2004; 2009). Though the 2004 five-year review concluded that the indoor air pathway was unlikely to present a current risk of harm to humans, the 2009 five-year review concluded that, based on current approaches for evaluating the potential for vapor intrusion, a protectiveness determination of the OU-1 remedy could not be made. Additional data were needed to evaluate the potential for VI impacts at the existing building on the UniFirst Source Area property and at the downgradient buildings near the UniFirst, Grace, and New England Plastics (NEP) properties. In April 2010, EPA announced a shallow groundwater monitoring well installation program for the Dewey and Olympia Avenues neighborhood. In addition, EPA requested the installation of shallow groundwater monitoring wells downgradient of the NEP property.

In January 2011, due to shallow groundwater concentrations of tetrachloroethene (PCE) in excess of risk-based screening levels in the vicinity of the UniFirst and Grace Source Area properties, EPA identified the need for a subslab soil gas (also known as soil vapor) and indoor air investigation at a limited number of residential and commercial buildings downgradient of the UniFirst and Grace Source Area properties where groundwater concentrations exceeded 5 ug/L. The recommended vapor intrusion investigation to be initiated consisted of the sampling of subslab soil gas, indoor air, and ambient outdoor air at select commercial and residential buildings. Because no VOCs were detected above EPA's groundwater VI risk-based screening levels downgradient of the NEP Source Area property, no further investigation was performed for this portion of OU-1 (see Appendix A.2 January 2011 EPA Fact Sheet).

The objectives of this report are to document the VI investigation conducted for OU-1 and to determine the potential risk to individuals under current and future potential site uses. These objectives were addressed through the evaluation of Site characterization data for groundwater, subslab soil gas, indoor air and ambient outdoor air samples from the Site. Four residential (including one multi-family with separate and distinct North and South units) and two commercial buildings downgradient of/near the UniFirst and Grace Source Area properties as well as the commercial building on the UniFirst Source Area property were included in the risk evaluation. The HHRA evaluates two rounds (March/April 2011 and June 2011) of sampling conducted for the residential and commercial buildings downgradient of the Source Area properties and two rounds (April 2010 and February 2011) of sampling conducted at the commercial building on the UniFirst Source Area property.

Subslab soil gas, indoor air and ambient outdoor air sampling was conducted according to procedures described in the *"Quality Assurance Project Plan (QAPP), Revision 1, Indoor Air Quality and Vapor Intrusion Assessment, UniFirst Property"* (The Johnson Company, 2010). The analytical data review was conducted according to the EPA Region 2 guidance entitled "USEPA Hazardous Waste Support Branch: Validating Air Samples, Volatile Organic Analysis Of Ambient Air in Canister By Method TO-15 (SOP # HW-31, Revision #4, October 2006)" and included checking holding times, proper chain-of-custody documentation, acceptable detection limits, internal standard recoveries, and laboratory control sample recoveries, and duplicate results.

The buildings and current receptors evaluated in the HHRA include:

- 260207: Commercial workers in the Office (Space 2) and storage unit users in the East and West portions of the building (Spaces 1 and 3);
- 260206: Daycare workers and daycare children in three spaces
- 260504: Residents (basement)
- 260505: Residents (North Unit basement and first floor and South Unit basement);
- 260407: Commercial workers in five spaces;
- 260902: Residents (basement and first floor); and
- 260903: Residents (basement).

For future building use, the following future receptors were identified for evaluation:

- 260207: Commercial workers and residents using the building (all samples combined);
- 260206: Residents (all samples combined);
- 260504: Residents (basement)
- 260505: Residents (North Unit basement and first floor and South Unit basement);
- 260407: Residents (all samples combined);
- 260902: Residents (basement and first floor); and
- 260903: Residents (basement).

Each of these current and future receptors was evaluated for exposure to VOCs in indoor air by inhalation following contaminant migration via the subsurface VI pathway. Receptors were evaluated under both a Reasonable Maximum Exposure (RME) scenario and a Central Tendency Exposure (CTE) scenario.

Chemicals of Potential Concern (COPCs) were selected individually for each property using a two-step process: (1) a risk-based screening of concentrations of VOCs detected in indoor air and (2) an evidence-based screening of VOC detections in both shallow groundwater and subslab soil gas, except for the building at the UniFirst Source Area property (building 260207) where VOC detections in either shallow groundwater or subslab soil gas were considered because soil contamination is present beneath the building. These steps provide a weight-of-evidence indication that a VOC is present in indoor air as a result of the VI pathway rather than from an outdoor background or an indoor source. VOCs were eliminated from the list of COPCs if the maximum detected concentration of a VOC in indoor air was less than a risk-based residential screening value (EPA, 2011a) or if the shallow groundwater and subslab soil gas data indicated that a VOC detected in indoor air was not present as a result of the VI pathway. Chemicals detected indoors that are not associated with the VI pathway for a given property are not included in the risk assessment.

Noncarcinogenic risks, reported as Hazard Indices (HIs), and carcinogenic risks, reported as Incremental Lifetime Cancer Risks (ILCRs), were discussed relative to risk management

guidelines set forth in EPA policy. When a receptor-specific HI for an exposure medium exceeded 1, HIs were segregated by target organ and discussed as to whether target organ-specific HIs exceed the risk management guideline. Estimated ILCRs were compared to the EPA target risk range of 10^{-6} to 10^{-4}.

The following summarizes the major risk drivers (HI >1, ILCR >10^{-6}) for the evaluated receptors for each of the buildings where total receptor ILCRs exceed 1 x 10^{-4} and target organ HIs exceed 1. Table ES-1 provides a comprehensive listing of risk and hazard estimates for each receptor and exposure point, and lists those VOCs contributing to risks in excess of EPA's risk management guidelines.

Target organ HIs are less than or equal to 1 at all buildings including all downgradient residential buildings, except for the future child resident at building 260207 should this building be used for residential purposes in the future. For this exposure point, target organ HIs for the respiratory system (RME HI of 6; CTE HI of 4) and nervous system (RME HI of 2) exceed 1 primarily due to the presence of naphthalene and PCE in indoor air. Though naphthalene was detected in shallow groundwater on the UniFirst Source Area property, it was only detected in one monitoring well (UC5) at a low concentration (2 ug/L) over the past two years. It should further be noted that naphthalene was only detected at one subslab soil gas location (SV-02) at a maximum detected concentration of 1.1 ug/m^3, while it was detected in all but one of the indoor air sampling locations at a maximum detected concentration of 16 ug/m^3. The low concentrations in groundwater and subslab soil gas suggest that naphthalene is present in indoor air primarily due to an indoor source. In contrast, PCE was detected consistently and at high concentrations in the subslab soil gas, indicating that PCE in indoor air is present primarily as a result of a complete VI pathway. Considering only PCE as associated with the VI pathway, the future target organ RME HI of 2 for the nervous system attributable to vapor intrusion would still exceed the EPA risk management guideline of 1**.**

ILCRs are less than or equal to 1 x 10^{-4} for all buildings including all downgradient residential buildings, except for the future resident at buildings 260207 and 260407 should these buildings be used for residential purposes in the future. For commercial building 260207 used as a

residence in the future, the future resident ILCR is 4×10^{-4}. The primary risk contributing COPCs are 1,4-dichlorobenzene (ILCR of 2×10^{-4}) and naphthalene (ILCR of 2×10^{-4}), with a lesser contribution from PCE (ILCR of 9×10^{-6}). As previously discussed, naphthalene is likely present in indoor air primarily due to an indoor source because of the low concentrations in groundwater and subslab soil gas. Similarly, 1,4-dichlorobenzene was only detected in shallow groundwater in one monitoring well (UC18) at a low concentration (1 ug/L) over the past two years, and only sporadically detected at low concentrations in subslab soil gas, suggesting that 1,4-dichlorobenzene is present in indoor air as a result of an indoor source. In contrast, PCE was detected consistently and at high concentrations in the subslab soil gas, indicating that PCE in indoor air is present primarily as a result of a complete VI pathway. Considering only PCE, the future ILCR of 9×10^{-6} would not exceed 1×10^{-4}.

For commercial building 260407 used as a residence in the future, the future resident ILCR is 6×10^{-4}. The primary risk contributing COPC is chloroform (ILCR of 6×10^{-4}), with a lesser contribution from naphthalene (ILCR of 9×10^{-6}). The risk is associated with a maximum detected concentration of chloroform in Space 5. Though chloroform was detected in the subslab soil gas and indoor air samples throughout the building, all other indoor air detections of chloroform (Spaces 1 to 4) were low (maximum of 1.2 ug/m^3) and would not be associated with a risk above EPA's risk management guidelines. In addition, chloroform has only been detected at low concentrations (maximum of 3 ug/L) in shallow groundwater in the vicinity of this commercial building. Therefore, the maximum detected concentration of chloroform appears to be associated with an indoor source within Space 5. Though naphthalene was detected in shallow groundwater downgradient of the Grace Source Area property, it was only detected in one monitoring well (UC13) at a low concentration (0.6 ug/L) over the past two years. This monitoring well is not located in the vicinity of building 260407. In addition, naphthalene was only sporadically detected at low concentrations in the soil gas beneath the building. Therefore, naphthalene is likely present in indoor air due to an indoor source. Considering chloroform and naphthalene are likely present in indoor air due to an indoor source, there would be no carcinogenic risk estimated for the complete VI pathway for building 260407.

As previously mentioned, the subslab soil gas and indoor air data collected to date suggest that some COPCs present in indoor air may not be present primarily as a result of the VI pathway. The following table summarizes the RME ILCRs and HIs that exceed risk management guidelines for buildings with indoor air COPCs that may not be primarily associated with the VI pathway, as well as the RME ILCRs and HIs for the same buildings, following the removal of those COPCs that appear to be present primarily as a result of an indoor source unrelated to the VI pathway.

Building	COPCs Potentially from Indoor Source	Scenario	ILCR / HI (all COPCs)	ILCR / HI without COPCs Potentially from Indoor Source
260207	Naphthalene, 1,4-Dichlorobenzene	Future Resident (Spaces 1 to 3)	**4×10^{-4}; 9**	**2×10^{-5}; 4**
260407	Chloroform, Naphthalene	Future Resident (Spaces 1 to 5)	**6×10^{-4}**; 1	NA; 0.3

NA – No carcinogenic COPCs remain

Bold values exceed ILCR of 1×10^{-5} or HI of 1.

Though PCE was not found at significant concentrations for worker exposure in any indoor air samples, subslab soil gas concentrations of PCE are substantially greater than the EPA soil gas screening level (EPA, 2011a) for commercial properties at commercial buildings 260207 and 260206. In addition, subslab soil gas concentrations of trichloroethene (TCE) are higher than the EPA soil gas screening level for commercial properties at commercial building 260207 though it was not found at significant concentrations in indoor air. The presence of elevated concentrations of PCE in subslab soil gas beneath commercial buildings 260207 and 260206, as well as elevated concentrations of TCE in subslab soil gas beneath commercial building 260207, indicates a potential for future vapor intrusion to occur if building conditions were to change (e.g., if further cracks occurred in the foundation/subslab, etc.).

1.0 INTRODUCTION

1.1 Purpose Scope and Organization of the Report

AECOM received Task Order (TO) No. 0009-RO-BE-0146 under the United States Environmental Protection Agency (EPA) Response Action Contract (RAC) No. EP-SI-06-01 to perform Remedial Design/Remedial Action (RD/RA) Oversight at the Wells G&H Superfund Site Operable Unit 1 (OU-1) in Woburn, Massachusetts (i.e., the Site). AECOM assigned primary responsibilities for most of the tasks in this project to RAC Team Subcontractor, TRC Environmental Corporation (TRC). In May 2011, the TO was amended to include a human health risk assessment (HHRA) in support of the Vapor Intrusion (VI) investigation underway for OU-1.

The objectives of this report are to document the VI investigation conducted for OU-1 and to provide a preliminary evaluation of the potential risk posed to current and future human receptors associated with the VI pathway. These objectives have been addressed through the evaluation of Site characterization data for groundwater, subslab soil gas (also known as soil vapor), indoor air and ambient outdoor air samples from the Site. Four residential (including one multi-family) and two commercial buildings downgradient of/near the UniFirst and Grace Source Area properties as well as the commercial building on the UniFirst Source Area property are included in this risk evaluation. This HHRA evaluates two rounds of sampling conducted for the residential and commercial buildings downgradient of the Source Area properties and two rounds of sampling conducted at the commercial building on the UniFirst Source Area property.

The text of the report is presented in the following five sections:

- Section 1.0, Introduction, presents a description of OU-1, including a discussion of relevant background information and previous investigations, and a description of the buildings that are the subject of this VI investigation;
- Section 2.0, Site Investigation, describes the scope and methods of field studies, laboratory investigations, and data validation;

- Section 3.0, Human Health Risk Assessment, evaluates the current and future human health risks associated with indoor air and lines of evidence that VI is occurring at the Site;
- Section 4.0, Summary and Conclusions, summarizes the report findings and describes the conclusions of the field investigation and HHRA; and
- Section 5.0, References, contains the reference citations for the Executive Summary and Sections 1 through 4.

The appendices provide additional supporting background materials relevant to the Site (Appendix A), analytical results (Appendix B), and HHRA supporting information (Appendix C).

The remainder of this section of the report contains a discussion of the objectives of the project (Section 1.2), historical and prior investigation information relative to the VI pathway at OU-1 (Section 1.3), and a description of the buildings that are the subject of this vapor intrusion HHRA for OU-1 (Section 1.4).

1.2 Project Objectives

The overall purpose of this assignment is to determine if the VI pathway at the Site poses potential risk to human health. The general objectives are summarized below:

- Present the methods, scope and analytical results of the VI sampling conducted to date for OU-1;
- Identify the indoor air contaminants of potential concern (COPCs) associated with the VI pathway, based on shallow groundwater, subslab soil gas, indoor air, and ambient outdoor air analytical data; and
- Identify potential receptors and potential toxicological effects of COPCs associated with the VI pathway at OU-1.

A field sampling program conducted by the Potentially Responsible Parties (PRPs) at the request of EPA was designed to collect the data needed to augment existing data and meet the objectives described above. Sampling objectives and design are described in Section 2.0 of this report. This document addresses the study objectives related to the VI pathway.

1.3 History and Previous Investigations

Between 1981 and 1989, EPA and several property owners conducted a series of studies that revealed groundwater contaminated with volatile organic compounds (VOCs) throughout a one square mile area surrounding the municipal Wells G and H. This one square mile area now approximates the boundaries of OU-1, a portion of the larger Wells G&H Superfund Site. EPA identified five properties surrounding the wells as the sources of the groundwater contamination. These properties belong to W.R. Grace & Co., Connecticut (Grace), UniFirst Corporation (UniFirst), Wildwood Conservation Corporation (Wildwood), New England Plastics Company (NEP), and the Olympia Nominee Trust (Olympia), also known as the Source Area properties. VOCs were detected in the groundwater beneath these five Source Area properties. In addition to the groundwater contamination, EPA identified soil contamination above target levels on the Wildwood, UniFirst, NEP, and Olympia properties.

In September 1989, EPA issued a ROD for the Wells G&H Site. The ROD required, among other things, that groundwater contamination beneath the Grace and UniFirst properties be remediated by extracting the groundwater and removing the contamination (EPA, 1989).

A Consent Decree (CD) was signed by EPA and four of the five PRPs (Grace, UniFirst, Wildwood, and NEP) in 1991. The PRPs then began work on respective areas of the Site. Four source area properties completed Remedial Designs (RDs) in the 1990s per the CD, except for soil contamination at the UniFirst and groundwater contamination at the NEP source area properties. The PRPs implemented Remedial Actions (RAs) at these source area properties in accordance with approved RDs which included extraction and treatment of groundwater to remove VOCs at the UniFirst and Grace properties. The PRPs are currently operating and maintaining these RAs, the standards for which are set forth in the 1991 CD. VOC

contamination in soils at the NEP property was addressed through soil vapor extraction. EPA entered into separate settlement agreements (called Administrative Orders by Consent, or AOCs) with the fifth source area property (Olympia) in 2003 and 2004 to remove PCB contaminated soils and treat TCE contaminated soils at the Former Drum Disposal Area (FDDA) located at the Olympia source area property.

In 1989 (ENSR, 1989), EPA collected indoor air samples from 3 residences in the Dewey and Olympia Avenue Neighborhood downgradient of the UniFirst and Grace Source Area properties. In 1991, EPA also collected indoor air samples from the nearby child daycare facility downgradient of the UniFirst property. The results of those tests did not indicate a potential health threat (ATSDR, 1991).

EPA completed five-year reviews for the Wells G&H Site in August 1999, September 2004, and September 2009 to determine whether the remedy for the Wells G&H Superfund Site continues to be protective of human health and the environment. Five-year reviews are required because hazardous substances, pollutants, or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure.

Though the 1999 five-year review did not further consider the VI pathway, the 2004 five-year review identified vapor intrusion as an emerging issue. A re-evaluation of historical indoor air data at the UniFirst property and a screening-level evaluation of the 2003 groundwater VOC contaminant data was conducted as part of the 2004 five-year review. The evaluation of the historical indoor air results indicated that risks to commercial workers at the UniFirst property may exceed EPA's risk management guidelines. Because the historical indoor air data may no longer be representative of current site conditions, an evaluation of indoor air impacts based on the 2003 groundwater data was also performed using modeling. The groundwater evaluation indicated that potential risks at the UniFirst, Grace, NEP, and Wildwood properties were within or below EPA risk management guidelines, based on assumed commercial site use. Risk associated with future residential use at the UniFirst, Grace, and NEP properties were also within or below EPA risk management guidelines. Estimated future risks at the Olympia property, based on commercial and residential use assumptions, and the Wildwood property, based on

assumed residential use, were determined to possibly exceed EPA risk management guidelines. Based on this evaluation, the 2004 five-year review concluded that the indoor air pathway at the Source Area properties was unlikely to present a current risk of harm to humans and the remedy was determined to be protective with respect to the indoor air pathway. However, the 2004 five-year review noted that should commercial activities be proposed for the Olympia property, land use change to residential for the Olympia and Wildwood properties, or shallow groundwater VOC concentrations change significantly from those present in 2003, indoor air exposures to VOCs from groundwater should be re-evaluated.

The 2009 five-year review evaluated current Source Area property shallow groundwater contaminant concentrations compared to those used in the 2004 five-year review to determine whether the conclusions concerning current and future indoor air impacts, as presented in the 2004 five-year review, required modification.

For the UniFirst Source Area property, concentrations of tetrachloroethene [PCE] and trichloroethene [TCE] increased between 25% and 50% between 2004 and 2009. The increased concentrations suggested an increased potential for vapor intrusion within the occupied commercial building.

To further evaluate the vapor intrusion pathway at the UniFirst property, in 2008, EPA conducted a review of 1994 soil gas and soil data collected in close proximity to and beneath the existing commercial building. The soil gas evaluation indicated a potential for vapor intrusion. Further evaluation using modeling of soil data collected from beneath the current building also indicated potential risk above risk management guidelines for the current and future indoor air pathways. Though the evaluation is uncertain due to the age of the data and the use of fate and transport modeling to estimate exposure point concentrations in indoor air, impacts to this currently occupied building were identified as requiring further investigation and evaluation due to the multiple lines of evidence strongly suggesting that residual soil and groundwater VOC concentrations may, alone or in combination, pose a threat to workers at the UniFirst building.

Additional concerns were identified in the 2009 five-year review with the possible VI pathway downgradient of the UniFirst, Grace and NEP properties based upon indoor air concerns at UniFirst identified above, potential insufficient groundwater capture at UniFirst and Grace, persistent groundwater contamination at UniFirst, Grace, and NEP, and uncertain groundwater conditions downgradient of UniFirst, Grace, and NEP.

The 2009 five-year review concluded that a protectiveness determination of the OU-1 remedy could not be made. Additional data were needed to evaluate the potential for VI impacts at the existing building on the UniFirst Source Area property and at the downgradient buildings near the UniFirst, Grace, and NEP properties.

In April 2010 and February 2011, two rounds of subslab soil gas and indoor air sampling were implemented at the commercial building on the UniFirst Source Area property due to known concentrations of VOCs in groundwater and soil that could pose a vapor intrusion risk to building occupants.

In April 2010, EPA announced a shallow groundwater monitoring well installation program for the Dewey and Olympia Avenues neighborhood (see Appendix A.1 April 2010 EPA Fact Sheet). In addition, EPA requested the installation of shallow groundwater monitoring wells downgradient of the NEP property. The installation of shallow groundwater monitoring wells was an initial step in the process to investigate the potential for vapor intrusion at OU-1. The well installation program included 14 new monitoring wells in the Dewey and Olympia Avenues neighborhood, two new monitoring wells at the Grace Source Area property, and two new monitoring wells downgradient of the NEP property. These wells were primarily installed to collect groundwater from the top portion of the groundwater table (e.g., shallow groundwater). During the summer of 2010, 38 shallow groundwater monitoring wells were sampled for VOCs in support of the UniFirst/Grace and Dewey and Olympia Avenue neighborhood VI investigation, including the 16 new wells and 22 existing wells. Well locations are illustrated in Appendix A.2. The VOCs included in the analytical program encompassed any VOCs detected in OU-1 groundwater since groundwater monitoring began at the Site in the 1980s. A second round of shallow groundwater monitoring was conducted in April 2011.

The two monitoring wells installed downgradient of the NEP property were sampled for VOCs in Fall 2010. Because no VOCs were detected above EPA's groundwater VI screening levels, no further investigation was performed for this portion of OU-1.

In 2010, PCE was detected in some monitoring wells located in the vicinity of the UniFirst and Grace Source Area properties. Samples from 14 of the 38 monitoring wells sampled had PCE concentrations equal to or greater than 5 micrograms per liter (ug/L), which is the maximum allowable concentration that EPA has established for public drinking water supplies. All but three shallow groundwater monitoring wells with PCE concentrations equal to or greater than 5 ug/L were located on commercial properties. No groundwater samples were collected from 4 monitoring wells because no water was present in those wells at the time of sampling. These wells were sampled in Spring 2011. The comprehensive results of the 2010 and 2011 groundwater sampling are presented in Appendix A.3.

In January 2011, due to shallow groundwater concentrations of PCE in excess of vapor intrusion screening levels, EPA identified the need for and initiated a subslab soil gas and indoor air investigation at a limited number of residential and commercial buildings downgradient of the UniFirst and Grace Source Area properties where groundwater concentrations exceeded 5 ug/L (see Appendix A.2). The recommended vapor intrusion investigation to be initiated consisted of the sampling of subslab soil gas, indoor air, and ambient outdoor air at select commercial and residential buildings. The buildings included in the VI investigation are described in Section 1.4.

1.4 Building Descriptions

The following summarizes relevant descriptive information for each building investigated as part of the VI investigation: commercial building 260207, commercial building 260206, residential building 260504, residential building 260505, commercial building 260407, residential building 260902, and residential building 260903. All buildings are located in close proximity to major highways (the Interstate 95 and 93 interchange) and heavily trafficked roadways.

1.4.1 Commercial Building 260207

This commercial building is located on the UniFirst Source Area property. This building was constructed in three phases: Building A, constructed in November 1965; Building B added in 1966; and Building C added in 1978. The current single-story building is slab-on-grade construction with concrete block walls. The concrete slab is approximately 4-inches thick with wire mesh throughout. The building was historically used for office space, garment storage, laundering operations (including dry cleaning) and chemical storage, with primary laundering and chemical storage operations occurring in Building B. An indoor 5000-gallon storage tank for PCE was located at the east end of Building B.

The building is currently leased by a storage company that rents storage units to individual clients. A small office, locker room and bathroom are located in the south central area of the building 260207, referred to as Space 2 throughout the remainder of this report. Buildings A and C comprise the areas referred to throughout the remainder of this report as Space 1, and located mostly in the western half of building 260207. Building B is referred to as Space 3, and located in the eastern half of building 260207.

1.4.2 Commercial Building 260206

This commercial building is located downgradient of/near the UniFirst Source Area property. The building was reportedly constructed sometime during the 1970s or 1980s. The portion of the building that is the subject of the VI investigation is a single-story brick structure with slab-on-grade construction and houses a daycare center. Adult staff and children ages 3 months to 6 years are present at the center Monday through Friday for up to 11 hours each day. This portion of the building's concrete slab is approximately 5-inches thick. It is heated by a forced hot air system fueled by natural gas; central air conditioning is used for cooling. The daycare space is comprised of a central room surrounded by separate rooms used, for example, as office space and space for infants. Three separate spaces were sampled as part of the investigation and are referred to as Spaces 1 through 3 for the remainder of this report.

1.4.3 Residential Building 260504

This residential building is located downgradient of/near the UniFirst Source Area Property. The building was constructed in the 1950s with a block wall basement. The thickness of the basement concrete slab varies between three-quarters of an inch and three inches. Both the basement and first floor levels of the home are used as occupied space. The building is heated by a forced hot air system fueled by fuel oil; window air conditioning units are used for cooling. The fuel oil tank is not located in the basement of the building.

1.4.4 Residential Building 260505

This residential building is a two-story multi-family building located downgradient of/near the UniFirst Source Area Property. The multi-family building has two distinct occupied living units (i.e., the North Unit and the South Unit). The building was constructed in 1985, and the basement concrete slab is approximately 4 inches thick. The basement and two upper floor levels of the units are used as occupied space; a bedroom and a family room occupy the basement level of the multi-family units. The units are heated by baseboard electric heat.

1.4.5 Commercial Building 260407

This commercial building is located downgradient of/near the Grace Source Area property. The portion of the building that is the subject of the VI investigation is a strip of commercial space housing various businesses. The portion of the building housing these commercial establishments is single story with slab-on-grade construction and a concrete slab thickness between 6 and 7 inches. The building was built in 1984 and each of the commercial spaces has an independent heating, ventilation and air conditioning system. The building is heated by a forced hot air system fueled by natural gas; central air conditioning is used for cooling. Five separate spaces were sampled as part of the investigation and are referred to as Spaces 1 through 5 for the remainder of this report.

1.4.6 Residential Building 260902

This residential building is located downgradient of/near the Grace Source Area Property. The home was constructed in 1951, and has a basement concrete slab thickness of approximately 4.5 inches. The basement and upper levels of the home are used as occupied space. The building is heated by a forced hot water system fueled by home heating oil. The fuel oil tank is not located in the basement.

1.4.7 Residential Building 260903

This residential building is located downgradient of/near the Grace Source Area Property. The home was constructed in 1955, and has a basement concrete slab thickness of approximately 6 inches. Both the basement and first floor levels of the home are used as occupied space. The building is heated by a forced hot air system fueled by natural gas.

2.0 SITE INVESTIGATION

The VI investigation was initiated by the PRPs, with oversight provided by TRC on behalf of EPA, to determine the potential risk to current and future building occupants at OU-1. Methods used for the subslab soil gas, indoor air, and ambient outdoor air sampling are described in detail in the Quality Assurance Project Plan (QAPP), Revision 1, Indoor Air Quality and Vapor Intrusion Assessment, UniFirst Property, dated March 2010. Methods used for the VI investigation are briefly described in Section 2.1, along with details related to the sampling and sample-specific results for each building. A summary of the data validation procedures and results is presented in Section 2.2. Treatment of sampling data for the risk assessment is described in Section 2.3.

2.1 Field Investigation Methods and Results

Prior to subslab soil gas, indoor air and ambient outdoor air sampling, a pre-sampling inspection was performed in each building to identify and document any conditions that could interfere with the indoor air sampling results. If possible, an interview was conducted with the occupants of the buildings to obtain specific information about activities that occur within each building. A visual inspection of the slab floor was performed and cracks or other locations of potential VI concern were noted. Screening of the cracks, utility (piping) openings, and sampling locations using a miniRAE 3000 (or equivalent) photoionization detector (PID) were performed at some buildings. To the extent possible, chemicals were removed from the vicinity of the sampling locations prior to initiating sampling.

The indoor air samples were collected within each building, co-located with the subslab soil gas monitoring locations. Pre-cleaned (individually certified), evacuated, 6 liter (6-L) Summa® canisters were used for sample collection. Each Summa canister is under negative pressure or vacuum. Indoor air samples were collected over a target sampling time of 24 hours for residential buildings, 12 hours for commercial building 260206, and 8 hours for the remaining commercial buildings. The sample canister was closed when it reached a target final vacuum reading (typically 2 to 10 inches of mercury, to maintain a negative pressure in the canister following sample collection). Ambient temperature and barometric pressure were

recorded. Canisters were elevated off the floor level to a representative breathing zone exposure height (approximately 3 to 5 feet above the ground).

For the ambient outdoor air sampling, the wind direction was recorded and a handheld digital anemometer with wind direction capability was used to monitor the wind direction at each outdoor sampling location. At the residential buildings, one sample was collected upwind of the building. At the commercial buildings, one sample was collected downwind of the building and a second sample was collected upwind of the building, except for the UniFirst building where two samples were collected upwind of the facility. A PID was used to pre-screen each outdoor sampling location before sampling and sample locations were situated away from potential interfering sources of chemicals. The wind direction was logged at the beginning and end of sample collection at each outdoor sampling location. Samples were collected using the same methods as for indoor sampling. The 6-L canisters were elevated to the approximate breathing zone and pre-calibrated flow controllers were used to collect samples over the appropriate target sampling time to match the indoor air sampling rate. The sample canister was closed when it reached a target final vacuum reading. Ambient temperature and barometric pressure were recorded.

Subslab soil gas samples were collected within each building from the approximate locations of the indoor air samples. Building owners were interviewed regarding the locations for any subsurface utilities. Subslab soil gas samples were collected using 0.25-inch OD stainless-steel tubing installed in a 0.25-inch diameter drill hole advanced no more than 2 inches beneath the bottom of the concrete floor slab. Tubing connecting points to the subsurface were sealed with Portland cement bentonite slurry to ensure the integrity of the sampling point. Sealing gum or modeling clay were used to prevent the cement slurry from leaking around the tubing and served as a secondary seal between the subslab material and ambient outdoor air as part of the sampling conducted at the building located on the UniFirst Source Area property.

All subslab soil gas monitoring points were purged and integrity tested prior to sampling. Integrity testing was conducted through the use of a tracer gas (i.e., high purity helium) test. The monitoring points were isolated from indoor air, and the tracer gas was introduced into an

enclosure surrounding the monitoring point while ambient air was vented from the enclosure. A portable handheld helium detector was used to determine the concentration of the tracer gas within the enclosure. The subslab soil gas monitoring points were field tested for the presence of the tracer gas. A positive indication of the tracer gas was determined if the concentration from the probe was greater than 1 percent (%) of the concentration within the enclosure. If a concentration was detected in excess of 1%, the monitoring point was resealed and the tracer test repeated. Subslab soil gas samples were collected into individually certified clean evacuated 6-L canisters. A pre-calibrated flow regulator was attached to each canister to collect a sample at a flow rate of 100 to 200 mL/min, resulting in an approximate sampling time of one hour or less. The sample canister was closed when it reached a target final vacuum reading rather than after a specified sample collection period. Ambient temperature and barometric pressure were recorded.

Replicate (duplicate) indoor air and ambient outdoor air samples were collected by placing two canisters side by side to allow collection of an indoor air sample in two sample canisters at once by opening and closing both flow controllers at the same time. Replicate subslab soil gas samples were collected using a T-connection and tubing that allowed collection of subslab soil gas from the same probe into two sample canisters at once. All samples were analyzed for VOCs by Alpha Analytical (Alpha) using a modified USEPA Method TO-15 SIM. Select samples were analyzed for petroleum hydrocarbons using the Massachusetts Department of Environmental Protection (MassDEP) Air-Phase Petroleum Hydrocarbon (APH) Method.

The following sections describe specific samples collected for each building included as part of the VI investigation. Data tables in Appendix B present the subslab soil gas, indoor air, and ambient outdoor air samples collected for each building.

2.1.1 Commercial Building 260207

In April 2010 and February 2011, one sample was collected from each of 15 indoor air sampling locations, 15 subslab soil gas sampling locations, and 3 ambient outdoor air sampling locations to assess the potential for VI at the building on the UniFirst Source Area property. Replicate

samples were collected at two of the subslab soil gas and indoor air sampling locations, and at one of the ambient outdoor air sampling locations. Most notable was PCE, which was detected in 100% of the subslab soil gas and indoor air samples collected, but only at one of the upwind ambient outdoor air sampling locations. The subslab samples with the highest PCE concentrations were located under the eastern half of the building's foundation. Indoor air PCE concentrations were much lower than the subslab soil gas concentrations. The comprehensive results of the subslab soil gas, indoor air, and ambient outdoor air sampling at the building on the UniFirst property are presented in Appendix B, Table B.1.

2.1.2 Commercial Building 260206

In March and June 2011, 3 indoor air samples, 3 subslab soil gas samples, and 2 ambient outdoor air samples were collected. Replicate samples were collected at one of the subslab soil gas and indoor air sampling locations. The replicate subslab soil gas sample collected in June 2011 was not used due to its extremely low volume at the end of the collection period. PCE and chloroform were detected in 100% of the subslab soil gas and indoor air samples collected, but not in the ambient outdoor air samples. Indoor air PCE and chloroform concentrations were lower than the subslab soil gas concentrations. The comprehensive results of the subslab soil gas, indoor air, and ambient outdoor air sampling are presented in Appendix B, Table B.2.

2.1.3 Residential Building 260504

In March and June 2011, 2 basement indoor air samples, 2 subslab soil gas samples, and 1 ambient outdoor air sample were collected. A replicate indoor air sample was collected in June 2011. PCE and carbon tetrachloride were detected in 100% of the subslab soil gas and indoor air samples collected. Carbon tetrachloride was detected in the ambient outdoor air samples at concentrations similar to those detected in both the indoor air and subslab soil gas samples. Indoor air PCE concentrations were much lower than the subslab soil gas concentrations. The comprehensive results of the subslab soil gas, indoor air, and ambient outdoor air sampling are presented in Appendix B, Table B.3.

2.1.4 Residential Building 260505

In April and June 2011, 5 indoor air samples (2 basement samples from the South Unit, 2 basement samples from the North Unit, and one first floor sample from the North Unit), 4 subslab soil gas samples (2 from each unit), and 1 ambient outdoor air sample were collected. Replicate indoor air and subslab soil gas samples were collected from one location at the South Unit. PCE and chloroform were frequently detected in the subslab soil gas and indoor air samples collected, but not in the ambient outdoor air sample. Indoor air PCE concentrations were generally lower than the subslab soil gas concentrations, while indoor air chloroform concentrations were comparable to or slightly higher than the subslab soil gas concentrations. The comprehensive results of the subslab soil gas, indoor air, and ambient outdoor air sampling are presented in Appendix B, Table B.4.

2.1.5 Commercial Building 260407

In March/April and June 2011, 5 indoor air samples, 5 subslab soil gas samples, and 2 ambient outdoor air samples were collected. Replicate samples were collected at two of the subslab soil gas sampling locations in March/April 2011, and at one subslab soil gas and indoor air sampling location in June 2011. Acetone and PCE were detected in 100% of the subslab soil gas and indoor air samples collected; of those two analytes, only acetone was detected in the ambient outdoor air samples. Indoor air PCE concentrations were consistently lower than the subslab soil gas concentrations, while indoor air concentrations of acetone tended to be higher than subslab soil gas and outdoor air concentrations. The concentrations of chloroform in Space 5 were significantly higher than the subslab soil gas concentrations. The comprehensive results of the subslab soil gas, indoor air, and ambient outdoor air sampling are presented in Appendix B, Table B.5.

2.1.6 Residential Building 260902

In March and June 2011, 2 basement indoor air samples, 2 subslab soil gas samples, and 1 ambient outdoor air sample were collected. In addition, a first floor indoor air sample was collected in March 2011. Replicate indoor air samples were collected at one of the indoor air

sampling locations. Chloroform and C5-C8 aliphatics were detected in 100% of the subslab soil gas and indoor air samples collected. Chloroform and C5-C8 aliphatics were also detected in the ambient outdoor air sample, but at lower concentrations than those detected in the indoor air and subslab soil gas samples. The indoor air chloroform concentrations were generally lower than the subslab soil gas concentrations; concentrations of C5-C8 aliphatics were higher in the indoor air samples than in the subslab soil gas samples. The comprehensive results of the subslab soil gas, indoor air, and ambient outdoor air sampling are presented in Appendix B, Table B.6.

2.1.7 Residential Building 260903

In March and June 2011, 2 basement, 2 subslab soil gas samples, and 1 ambient outdoor air sample were collected. Replicate subslab soil gas samples were collected at one location. Chloroform, PCE, and toluene were detected in the subslab soil gas and indoor air samples collected. Each of these compounds were also detected in the ambient outdoor air samples, but at comparable or lower concentrations than those detected in the indoor air and subslab soil gas samples. Of these compounds, PCE and toluene were detected at higher concentrations in indoor air than in the subslab soil gas; chloroform was detected at lower concentrations in indoor air than in the subslab soil gas. The comprehensive results of the subslab soil gas, indoor air, and ambient outdoor air sampling are presented in Appendix B, Table B.7.

2.2 Data Validation

Data validation was performed on all data generated by the analytical laboratory. The Region I, EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses (12/96) and the National Functional Guidelines for Superfund Organic Methods Data Review (06/08) do not address protocols for validation of air analyses; therefore, the data review was conducted according to the EPA Region 2 guidance entitled "USEPA Hazardous Waste Support Branch: Validating Air Samples, Volatile Organic Analysis Of Ambient Air in Canister By Method TO-15 (SOP # HW-31, Revision #4, October 2006)" and included checking holding times, proper chain-of-custody documentation, tune and calibration results, method and trip blank results, reporting limits, internal standard recoveries, laboratory control sample (LCS) recoveries, and field and laboratory duplicate results.

During the validation process, laboratory data were verified against all available supporting documentation. Based on this evaluation, qualifier codes were added, deleted, or modified by the data validator. Using a Region I Tier IV assessment procedure, raw data were examined in detail to check calculations, compound identification, and/or transcription errors. Validated results were either qualified or unqualified; if results are unqualified, this means that the reported values should be used without reservation. Final validated results are annotated with the qualification codes defined in the EPA Region I Functional Guidelines.

The data validation process results in an assessment of the accuracy, precision, sensitivity, and completeness of the data sets. These parameters are defined below.

- Accuracy: The closeness of agreement between an observed value and an accepted reference value. The difference between the observed value and the reference value includes components of both systematic error (bias) and random error. Accuracy therefore reflects the total error associated with a measurement. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard. To assess the accuracy of the laboratory measurements, continuing calibration results, method and trip blank results, percent recoveries of spiked analytes in LCSs, percent recoveries of internal standards and the accuracy of the analytical system near the reporting limits were taken into account.
- Precision: The agreement among a set of replicate measurements without consideration of the "true" or accurate value: i.e., variability between measurements of the same material for the same analyte. Precision can be expressed as the percent relative standard deviation (%RSD) between initial calibration standards or as the relative percent difference (RPD) between duplicate samples. To assess the precision of the laboratory measurements, initial calibration %RSDs and RPDs of detected analytes in field and laboratory duplicate samples were taken into account.
- Sensitivity: The reporting limits for each analyte were evaluated to ensure these were at or below the project action levels. In addition, the lowest standard used in the initial calibration of each analyte must be at or below the reporting limit.

- Completeness: The measure of the amount of validated data obtained compared to that which was expected to be obtained. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of a data set. For completeness requirements, valid results are all results not qualified with an "R" flag. An "R" flag placed on the data by the data validator indicates that the data are unusable due to deficiencies in the ability to analyze the sample and meet QC criteria. Results with an "R" flag that are replaced by other analyses, as in the case of diluted analyses, are not included in the assessment of completeness. None of the data generated for this program were rejected during validation, indicating 100% completeness.

The Data Validation Reports are presented in Appendix A.4. The following bullets summarize the results of the validation:

- Results for select analytes were qualified as estimated (J/UJ) due to initial and/or continuing calibration nonconformances. Affected analytes and samples were as follows:
    - Building 260206 (Rounds 1 and 2; March and June 2011): Naphthalene in AA-CP-1, AA-CP-2, IA-CP-1, IA-CP-2, IA-CP-3, SS-CP-1, SS-CP-2, SS-CP-3;
    - Building 260206 (Round 2; June 2011): 1,3-Butadiene, MTBE, toluene, and ethylbenzene in AA-CP-1, AA-CP-2, IA-CP-1, IA-CP-2, IA-CP-3, SS-CP-1, SS-CP-2, SS-CP-3;
    - Building 260207 (Round 1; April 2010): Trans-1,3-dichloropropene in IA-02, IA-03, IA-07, SV-01 through SV-15;
    - Building 260207 (Round 2; February 2011): Naphthalene in IA-01 through IA-15, OA-R2-1, OA-R2-2, OA-R2-3, SV-01 through SV-15;
    - Building 260407 (Round 1; March & April 2011): Naphthalene in OA-1, OA-2, 19-SS1, 20-SS1;
    - Building 260407 (Round 2; June 2011): Naphthalene in 17-IA1, 19-IA1, 20-IA1, 22-IA1, 22-IA2, OA-1, OA-2;
    - Building 260407 (Round 2; June 2011): MTBE and toluene in OA-1 and OA-2;

- Building 260504 (Round 1; March 2011): Naphthalene in IA-10M-1, IA-10M-2, SS-10M-1, SS-10M-2, AA-10M-1;
- Building 260504 (Round 2; June 2011): Naphthalene, 1,3-butadiene, MTBE, toluene, and ethylbenzene in IA-10M-1, IA-10M-2, SS-10M-1, SS-10M-2, AA-10M-1;
- Building 260505 (Round 1; April 2011): MTBE and trans-1,3-dichloropropene in AA-57O-1, IA-7O-1, IA-7O-2, IA-7O-3, IA-5O-4, IA-5O-5, SS-7O-1, SS-7O-2, SS-5O-4, SS-5O-5;
- Building 260505 (Round 2; June 2011): Naphthalene and 1,3-butadiene in AA-57O-1, IA-7O-1, IA-7O-2, IA-7O-3, IA-5O-4, IA-5O-5, SS-7O-1, SS-7O-2, SS-5O-4, SS-5O-5;
- Building 260902 (Round 1; March 2011): Naphthalene in OA, SS1;
- Building 260902 (Round 2; June 2011): Naphthalene, MTBE and toluene in IA-1, IA-2, OA;
- Building 260903 (Round 1; March 2011): Naphthalene in OA;
- Building 260903 (Round 2; June 2011): Naphthalene in IA1, IA2, OA; and
- Building 260903 (Round 2; June 2011): MTBE and toluene in OA.

- Results for select analytes were qualified as nondetects due to method blank contamination. Affected analytes and samples were as follows:
  - Building 260207 (Round 1; April 2010): Tetrachloroethene in OA-01, OA-02, OA-03;
  - Building 260407 (Round 1; March and April 2011): Naphthalene in 17-IA1, 22-IA1, 22-IA2, 19-IA-1, 20-IA1, 17-SS1, 22-SS1, 22-SS2;
  - Building 260407 (Round 1; March and April 2011): C_5-C_8 Aliphatics in 22-SS2;
  - Building 260505 (Round 1; April 2011): Naphthalene in IA-7O-1, IA-7O-2, IA-5O-4;
  - Building 260902 (Round 1; March 2011): Naphthalene in IA1, IA2, IA3, SS2; and
  - Building 260903 (Round 1; March 2011): Naphthalene in IA1, IA2, SS1, SS2.

- Results for select analytes were qualified as nondetects due to trip blank contamination. Affected analytes and samples were as follows:
    - Building 260206 (Round 1; March 2011): Toluene in AA-CP-1, AA-CP-2, SS-CP-3;
    - Building 260207 (Round 1; April 2010): C_9-C_{12} Aliphatics in IA-13, IA-13A, SV-03, SV-14;
    - Building 260207 (Round 2; February 2011): C_5-C_8 Aliphatics in IA-01, IA-02, IA-03, IA-05, IA-07, IA-11, IA-15, SV-01, SV-04, SV-08, SV-14, SV-15;
    - Building 260207 (Round 2; February 2011): Naphthalene in IA-05, IA-15, SV-01, SV-15;
    - Building 260505 (Round 2; June 2011): Methylene chloride in AA-57O-1, IA-7O-1, IA-7O-2, IA-7O-3, SS-7O-1; and
    - Building 260505 (Round 2; June 2011): Toluene in SS-7O-1, SS-5O-4, SS-5O-5.

- Results for all TO-15 and APH target analytes were qualified as estimated (J/UJ) due to a potential leak in the sample train based on the tracer gas test results. Affected samples were as follows:
    - Building 260902 (Round 1; March 2011): SS1.

- Results for select analytes were qualified as estimated (J) due to co-elution with a non-target analyte. Affected analytes and samples were as follows:
    - Building 260407 (Round 1; March and April 2011): Acetone in 19-IA1; and
    - Building 260505 (Round 1; April 2011): o-Xylene in SS-7O-1.

- Results for select analytes were qualified as estimated (J/UJ) due to field duplicate variability. Affected analytes and samples were as follows:
    - Building 260407 (Round 2; June 2011): 1,2,4-Trimethylbenzene, 1,2-dichloroethane, chloroform, ethylbenzene, total xylenes, ethyl acetate, acetone, carbon tetrachloride, tetrachloroethene, toluene, and trichloroethene in 22-S1;

- Building 260407 (Round 2; June 2011): Chloroform, methylene chloride, and naphthalene in 19-IA1;
- Building 260504 (Round 2; June 2011): Methylene chloride in IA-10M-1; and
- Building 260902 (Round 2; June 2011): Methylene chloride, 1,3-butadiene, chloroform, ethylbenzene, and total xylenes in IA2.

- Results for select analytes were qualified as estimated (J/UJ) due to low recoveries in the laboratory control samples. Affected analytes and samples were as follows:
  - Building 260407 (Round 2; June 2011): Naphthalene in 17-IA1, 19-IA1, 20-IA1, 22-IA1, 22-IA2;
  - Building 260407 (Round 2; June 2011): MTBE in OA1 and OA2;
  - Building 260902 (Round 2; June 2011): MTBE in IA1, IA2, OA;
  - Building 260903 (Round 2; June 2011): Naphthalene in IA1, IA2; and
  - Building 260903 (Round 2; June 2011): MTBE in OA.

2.3 Data Treatment

This subsection discusses the use and treatment of the analytical data prior to use in the HHRA.

The following guidelines were applied to the analytical data:

- If a value is not flagged, the value was used as reported (a detected value);
- If a value is flagged with "J", the value was used as reported (a detected value);
- If a value is flagged with "R", the value was considered not to exist and was not used (a rejected value); and
- If the value is flagged with "U" or "UJ", the result was considered a nondetect (an undetected) value.

Prior to using analytical data for a primary sample with an associated replicate, the analytical values for the primary sample and the replicate were averaged together (EPA 1989a and 1989b)

to provide a single set of values for the field duplicate pair. The following conventions were used for averaging samples together:

- If both samples have detected values (flagged with "J" or unflagged), the average of the values was used. If one value or both values are flagged with "J" prior to averaging, the resulting averaged value was flagged with "J", as appropriate.

- If both samples have nondetected values (flagged with "U" or "UJ"), the lower value and its flag were used.

- If one sample has a nondetect value (flagged with "U" or "UJ") and the other sample has a detected value (flagged with "J" or unflagged) the following is done:

  - If the detected value is less than or equal to the nondetected value, the detected value and its flag were used; or

  - If the detected value is greater than the nondetected value, the average of detected value and ½ the nondetected value were used. The resulting averaged value was flagged with "J".

  - If one sample has a nonrejected value (flagged with "J", "U", "UJ" or unflagged) and one sample has a rejected value (flagged with "R"), the nonrejected value and its flag were used.

The range of detection limits was determined based on the individual sample-specific detection limit (or sample quantitation limit) for each analyte. Because of sample dilution, laboratory detection limits for individual samples can be higher than the method-specified detection limits. Minimum and maximum SQLs were determined for each non-detect analyte using the sample's SQL.

The frequency of detection is the number of samples with detected values per the number of samples analyzed. The number of samples with detected values was determined by totaling all samples with detected values. The number of samples analyzed was determined by totaling all samples with detected or nondetected values (flagged with "U", "UJ", "J" or unflagged).

Rejected values (flagged with "R") were not included in the total number of samples analyzed. For replicate samples, only one value was used when determining the number of samples analyzed and the number of detected values (as determined using the procedure described above).

Arithmetic mean concentrations and 95-percent Upper Confidence Limits (UCLs) were calculated using EPA's Pro UCL version 4.1 and included all detected values and ½ of the SQL for non-detected values, used for the calculation of the mean concentrations. When the mean or 95-percent UCL was greater than the maximum value because of high or widely varying detection limits, or because a detected value is below the SQL (flagged with "J" on the laboratory report), or because a small data set was used, then the maximum detected result was used. Detected values below the SQL are considered to be estimated concentrations, but are used in the HHRA.

3.0 HUMAN HEALTH RISK ASSESSMENT

3.1 Introduction

This section of the report contains the HHRA for the VI pathway for OU-1. The focus of this risk assessment is the quantitative, and in some cases qualitative, evaluation of potential risks to human receptors who have the potential for current and/or future exposure to volatile contaminants in indoor air attributed to vapor intrusion. Vapor intrusion is a concern for chemicals that may migrate from the subsurface into a building as a result of contamination in shallow groundwater throughout the area of interest, originating from the UniFirst and Grace Source Area properties, or soil and groundwater at the UniFirst Source Area property. As previously described, three commercial and four residential (including one multi-family) buildings have been quantitatively evaluated.

3.1.1 Purpose and Scope

The purposes of this HHRA are: 1) to evaluate the potential human health risks that may be posed by chemical contamination in indoor air within a select number of currently occupied buildings at the Site; 2) to qualitatively evaluate groundwater and subslab soil gas as evidence that VI is occurring, and 3) to provide a basis for decisions as to whether response actions to mitigate the VI pathway are necessary. This risk assessment may also be used qualitatively to identify site conditions (chemicals, future exposure pathways, locations) of greatest potential concern.

According to EPA guidelines (EPA, 1989), the risk assessment generally consists of four basic steps summarized below:

- **Hazard Identification.** Selection of those chemicals that are of potential concern for the assessment of the impact on human health.

- **Exposure Assessment.** Quantification of the magnitude, frequency, duration and route (e.g., inhalation) of actual or potential exposure to chemicals relevant to a site.

- **Toxicity Assessment.** Identification of the types of health effects that could be associated with exposure to these chemicals, determination of the relationship between exposure (concentration) and the probability of occurrence of the health impact (response).

- **Risk Characterization.** Estimation of the probability that an adverse health impact may occur as a result of exposure to chemicals in the amount identified and the uncertainty in those estimates.

The HHRA for the Site was conducted using methodologies required by EPA guidelines (EPA, 1989; 1992; 2001; 2002a; 2002b; 2004; and 2011c). A risk assessment is intended to be site-specific; therefore, site-specific information was incorporated into the evaluation whenever available. In the absence of site-specific information, default assumptions, as specified by EPA guidance, or professional judgment were used.

The HHRA provides estimates of risk, under both current use and potential future use scenarios, to both the central tendency exposure (CTE) receptor and the reasonable maximum exposure (RME) receptor. The CTE receptor is used to represent average exposures occurring at an exposure point while the RME receptor is used to represent the maximum (upper-bound) exposure that is reasonably expected to occur at an exposure point. Exposure pathways are selected based on current and future land use. Exposure assessments model human exposure according to algorithms in relevant guidelines. Variables contributing most to estimates of risk or to the uncertainty in the risk assessment have been identified. Each of these steps is discussed in more detail in the appropriate sections of the report.

This HHRA consists of several sections. Subsection 3.1.2 identifies current and future exposure points and receptors. Section 3.2, Hazard Identification, describes the selection of chemicals of potential concern (COPCs) from among the chemicals identified at the Site, and the determination of Exposure Point Concentrations (EPCs). Section 3.3, Exposure Assessment, describes the selection of receptors to be evaluated and the calculation of exposure to the receptors selected. Section 3.4, Toxicity Assessment, summarizes the toxicity of the COPCs

including both potential carcinogens and noncarcinogens. Section 3.5, Risk Characterization, includes a summary of Site risks and an uncertainty analysis. Table 1 (Selection of Exposure Pathways) provides a conceptual model for the Site, identifying the exposure media, exposure points, receptors, and routes of exposure quantitatively evaluated as part of the HHRA.

3.1.2 Identification of Current/Future Exposure Points and Receptors

The purpose of this section is to briefly describe current and future exposure points and receptors selected for evaluation in the HHRA, based on land use, Site characteristics, and history.

EPA selected a small number of buildings to be included in the preliminary VI investigation. A summary of the exposure points evaluated in this risk assessment is provided below by scenario.

Exposure Point	Current Scenario	Future Scenario
Commercial Building 260207 – Spaces 1, 2, and 3	X	N/A
Commercial Building 260207 – Combined	N/A	X
Commercial Building 260206 – Spaces 1, 2, and 3	X	N/A
Commercial Building 260206 - Combined	N/A	X
Residential Building 260504 – Basement	X	X
Residential Building 260505 – North Unit Basement and First Floor	X	X
Residential Building 260505 – South Unit Basement	X	X
Commercial Building 260407 – Spaces 1, 2, 3, 4, and 5	X	N/A
Commercial Building 260407 – Combined	N/A	X
Residential Building 260902 – Basement and First Floor	X	X
Residential Building 260903 – Basement	X	X

Notes: N/A – Not applicable X – Included exposure point

Current Receptors. Current building use includes the following receptors:

- 260207: Commercial workers in Space 2 and storage unit users in Spaces 1 and 3;
- 260206: Daycare workers and daycare children in Spaces 1, 2, and 3;
- 260504: Residents (basement)
- 260505: Residents (North Unit basement and first floor, and South Unit basement);
- 260407: Commercial workers in Spaces 1, 2, 3, 4, and 5;

- 260902: Residents (basement and first floor); and
- 260903: Residents (basement).

Each of these current receptors is evaluated for exposure to VOCs in indoor air by inhalation following contaminant migration via the subsurface VI pathway.

Future Receptors. Current residential buildings are assumed to remain residential in the future. In addition, current commercial buildings are assumed to be used as residences (e.g., condominiums) in the future. Because the building located on the UniFirst Source Area property is currently used for limited occupancy (i.e., storage), future unlimited commercial use was also evaluated. The future receptors are assumed to be exposed to VOCs in indoor air by inhalation following contaminant migration via the subsurface IV pathway.

The following future receptors are identified for each building:

- 260207: Commercial workers and residents using the building (all samples combined);
- 260206: Residents (all samples combined);
- 260504: Residents (basement)
- 260505: Residents (North Unit basement and first floor and South Unit basement);
- 260407: Residents (all samples combined);
- 260902: Residents (basement and first floor); and
- 260903: Residents (basement).

3.2 Hazard Identification

The purpose of this section is the determination of the type and concentration of chemicals present at the Site and the selection of the COPCs with regard to human health. In addition, this section summarizes the methodology used to determine exposure point concentrations (EPCs) for COPCs in indoor air.

Environmental data used in this hazard identification are from samples that were collected in 2010 and 2011 as part of the VI investigation conducted by the PRPs. These data are presented in Appendix B and discussed in Section 2.0.

3.2.1 Identification of COPCs

The scope of the HHRA includes identification of COPCs based on the volatile chemical substances found at the Site. The list of COPCs was developed using the screening process described below. COPCs were selected individually for each building using a two-step process: (1) a risk-based screening of concentrations of VOCs detected in indoor air and (2) an evidence-based screening of VOC detections in both shallow groundwater and subslab soil gas, except for the building at the UniFirst Source Area property (building 260207) where VOC detections in either shallow groundwater or subslab soil gas were considered because soil contamination is present beneath the building. The evidence-based screening was used to indicate that a VOC is present in indoor air as a result of the VI pathway rather than from an indoor source. The two-step COPC selection process is described in the following sections.

3.2.1.1 Risk-Based Screening

The maximum detected concentration of each VOC in indoor air at each building was compared to Regional Screening Levels (RSLs) for residential air published by EPA in November 2011 (EPA, 2011a). RSLs are risk-based concentrations that are intended to assist risk assessors and others in initial screening-level evaluations of environmental contaminant concentrations. RSLs are chemical concentrations associated with either a $1x10^{-6}$ target risk level for potential carcinogens or a hazard quotient (HQ) of 1 for noncarcinogens. For purposes of COPC selection, a HQ of 0.1 was used to add a ten-fold measure of safety to reduce the chance of omitting chemicals from the list of COPCs that could contribute to a total hazard index (HI) of 1. To accomplish this, RSLs for noncarcinogenic chemicals were divided by 10 prior to comparison to maximum detected values. Due to the change in toxicity values for PCE, finalized by EPA in February 2012, RSLs for PCE were calculated using the EPA's on-line RSL calculator using default assumptions for residential air (http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search).

RSLs are not provided for petroleum hydrocarbon fraction data obtained using the Massachusetts Department of Environmental Protection (MassDEP) Air-Phase Petroleum Hydrocarbon (APH) method for C5-C8 aliphatics, C9-C12 aliphatics, and C9-C10 aromatic analyses. In lieu of RSLs, the maximum detected hydrocarbon fraction concentrations in indoor air were compared to screening values calculated using the same assumptions used to develop the residential air RSLs and inhalation Provisional Peer-Reviewed Toxicity Values (PPRTVs) for the APH fractions developed by the Superfund Health Risk Technical Support Center (EPA, 2009). Screening values for the hydrocarbon fractions were set at a HQ of 0.1, consistent with the COPC screening performed for those VOCs with RSLs.

A maximum detected chemical concentration less than its RSL or screening value indicated that the excess lifetime cancer risk associated with exposure to that chemical concentration would be less than one in one million and the HQ associated with exposure would be less than 0.1. Chemicals detected at concentrations below their screening levels were, therefore, eliminated from further evaluation. Comparisons of maximum concentrations to screening levels are presented in Table 2.

3.2.1.2 Evidence-Based Screening

Because indoor air may be impacted by many types of sources, including VI impacts from VOCs in groundwater migrating from the UniFirst and Grace Source Area properties, VI impacts from VOCs in soils beneath and adjacent to the UniFirst Source Area building, the indoor use of VOC containing products and equipment, off-gassing from building materials and furnishings, and ambient outdoor air quality, selecting COPCs for indoor air needs to consider the following lines of evidence:

- The potential for Source Area site-related VOCs in groundwater to migrate to downgradient locations;
- Whether concentrations of site-related volatile groundwater compounds that have migrated downgradient of the Source Area properties are present at sufficient

concentrations to impact soil gas beneath the downgradient buildings, and potentially impact indoor air quality within the buildings;

- The presence of contaminated soil beneath or near a building;
- The potential for indoor sources to contribute to concentrations of contaminants measured in indoor air;
- The concentrations of volatile compounds in upwind ambient outdoor air with the potential to impact indoor air quality; and
- The presence of potential breakdown products of chlorinated VOCs that may have been produced following migration of parent compounds from groundwater.

Figures 1 through 7 outline the procedure used to determine indoor air COPCs for each of the buildings included in the VI investigation. As previously mentioned, COPCs were selected independently for each building.

As the first step in the evidence-based COPC selection process, comprehensive lists of VOCs detected in groundwater at and downgradient of the UniFirst and Grace Source Area properties were compiled using 2010 and 2011 groundwater investigation data (see Appendix A.3). Buildings 260206, 260504, and 260505 are downgradient of the UniFirst Source Area property; buildings 260407, 260902, and 260903 are downgradient of the Grace Source Area property. These two lists of detected groundwater VOCs, one for each Source Area property, provides the site-related VOCs that could potentially be considered indoor air COPCs at the downgradient buildings. If a VOC was not detected in groundwater, but was detected in indoor air at a downgradient property, then the finding is likely related to a source other than the Site. Compounds detected in groundwater include primarily chlorinated VOCs and petroleum-related compounds. The VOCs detected in groundwater from the UniFirst or Grace Source Area properties, as appropriate, are shown under the "Groundwater" column of Figures 1 through 7.

For building 260207, the commercial building located on the UniFirst Source Area property, any indoor air VOCs detected in either groundwater or subslab soil gas were selected as indoor air COPCs. This approach was used for the building on the UniFirst Source Area property since

VOCs in groundwater and source soils beneath and adjacent to the building are both sources of indoor air VOCs. VOCs that were not detected in either groundwater or subslab soil gas were not considered indoor air COPCs for the VI pathway, even if the maximum detected indoor air concentration was greater than its residential RSL. Figure 1 shows the evidence-based COPC selection for building 260207, with indoor air COPCs (also present in either groundwater or subslab soil gas) highlighted in black.

For the downgradient buildings, subslab soil gas sampling data were then considered to assist in establishing whether a complete VI pathway exists between groundwater and indoor air. Many of the same compounds detected in groundwater were also detected in subslab soil gas samples, with exceedances of EPA soil gas screening levels (i.e., 10-times the residential air RSLs) identified, including PCE which was consistently detected (see tables in Appendix B). However, some VOCs that were never detected in groundwater at the Site were detected in the soil gas samples at the downgradient buildings (e.g., benzene, carbon tetrachloride, and 1,2-dichloroethane), indicating that the presence of these compounds in soil gas is unrelated to the Site and suggestive of an unrelated source (e.g., a localized release from a leaking sewer or fuel line). Some of the compounds not related to the VI pathway exceeded soil gas screening levels (Appendix B).

For each of the downgradient buildings, any indoor air VOCs detected in both groundwater and subslab soil gas were selected as COPCs. This approach was used for the downgradient buildings since only groundwater serves as a source of site-related VOCs to subslab soil gas and ultimately indoor air. Available indoor air data for each building were considered in the selection of indoor air COPCs. VOCs that were not detected in both groundwater and subslab soil gas were considered unrelated to the Site, and not selected as COPCs. Figures 2 through 7 show the evidence-based COPC selection for the six downgradient buildings, with indoor air COPCs (present in both groundwater and subslab soil gas) highlighted in black.

As a final step of the COPC selection process, the lists of indoor air COPCs were reviewed to assure that all breakdown products of the significant chlorinated site-related VOCs (PCE, TCE, and 1,1,1-trichloroethane) had been selected as indoor air COPCs, even if the compound was not

detected in the subslab soil gas samples or in groundwater. PCE breakdown products include: TCE, cis- and trans-1,2-dichloroethene, 1,1-dichloroethene, and vinyl chloride; TCE breakdown products include: cis- and trans-1,2-dichloroethene, 1,1-dichloroethene, and vinyl chloride; and 1,1,1-trichloroethane breakdown products include: 1,1-dichloroethane, 1,1-dichloroethene, and vinyl chloride. None of these breakdown products had been omitted from the lists of COPCs.

Detections of VOCs in upwind ambient outdoor air samples are also included in Figures 1 through 7. Though these results are not used in the COPC screening process, the ambient outdoor air sampling results may be used to frame the risk characterization results, as necessary. Indoor air COPCs for each building included in the VI investigation, considering both the risk-based and evidence-based screening, are presented in Table 2.

3.2.1.3 Chemicals Selected as COPCs

The following lists the indoor air COPCs selected for each building:

- 260207: 1,2,4-Trimethylbenzene, 1,4-dichlorobenzene, benzene, carbon tetrachloride, chloroform, ethylbenzene, naphthalene, PCE, TCE, C5-C8 aliphatics, and C9-C12 aliphatics;
- 260206: Bromodichloromethane, chloroform, ethylbenzene, and xylenes;
- 260504: Chloroform, ethylbenzene, naphthalene, and xylenes;
- 260505: Chloroform, ethylbenzene, and naphthalene;
- 260407: Acetone, chloroform, and naphthalene;
- 260902: Chloroform and naphthalene; and
- 260903: Chloroform.

3.2.2 Determination of Exposure Point Concentrations

To evaluate the magnitude of potential human exposures, the concentration of each COPC in indoor air must be estimated. An estimate of this concentration is referred to as an EPC. EPCs were determined for the COPCs for each exposure point.

For the building located on the UniFirst Source Area property, whenever possible, the 95% UCL on the arithmetic mean has been calculated and used as the EPC for both the RME and CTE exposure cases, except when the 95% UCL was greater than the maximum detected concentration, in which case the maximum detected concentration was used. The 95% UCLs were calculated using EPA's program ProUCL Statistical Software Version 4.1 (EPA, 2011b). Appendix C contains documentation for the calculation and selection of the 95% UCL values.

For the remaining commercial buildings and all the residential buildings where a small number of indoor air samples were collected or the samples were collected from unique exposure locations (e.g., Space 1 at building 260206), the maximum detected concentration at each exposure point was used as the EPC for both the RME and CTE scenarios. In addition, for the future scenario where building usage and configuration is unknown, the maximum detected concentration of each COPC was used as the EPC for both the RME and CTE scenarios.

EPCs for the COPCs selected for the current exposure points are presented on Tables 3.1.RME and 3.1.CT; EPCs for the COPCs selected for the future exposure points are presented on Tables 3.2.RME and 3.2.CT.

3.3 Exposure Assessment

The purpose of the exposure assessment is the quantification of the extent, frequency and duration of actual or potential exposure to chemicals by pathways relevant to the Site, and activities of the potential receptors.

Consistent with EPA (1989 and 1991) guidance, plausible exposures under both current and future land-use scenarios were evaluated in the HHRA. Accordingly, potential human receptors were identified for both current and potential future land-use scenarios at the Site. The current land-use scenario examines the potential for human exposure under current site conditions, while the future land-use scenario evaluates potential exposures following possible changes in site land use (assuming no remedial action occurs).

3.3.1 Calculation of Dose

Part of the exposure assessment is to identify exposure equations to be used in the risk assessment and to document assumptions made for each of the parameters used in these equations. The selection of exposure equations and assumptions is based both on available guidance and professional judgment.

EPA guidance or documents used in the exposure assessment include *RAGS, Part A* (EPA, 1989); *Exposure Factors Handbook* (EPA, 2011c); *RAGS, Part E Supplemental Guidance for Dermal Risk Assessment* (EPA, 2004).

3.3.1.1 Selection of Exposure Equations

Tables 4.1.RME and CT and 4.2.RME and CT provide the medium-specific equations used for the calculation of carcinogenic and noncarcinogenic chronic daily exposure. The equations are used for calculating a lifetime average daily dose (LADD) relevant to cancer risk (i.e., cancer intake) or for calculating an average daily dose (ADD) relevant to noncancer risk (i.e., noncancer intake).

3.3.1.2 Exposure Parameters

The exposure parameters used for each of the receptors evaluated in the risk assessment are described below and are presented in Tables 4.1.RME and CT (current scenario) and 4.2.RME and CT (future scenario). The exposure parameters are presented below, discussed by receptor.

Current and Future Commercial Worker Exposure Parameters. For commercial workers exposed via the inhalation pathway, the exposure time was assumed equivalent to a typical 8-hour work day for both the CTE and RME cases (EPA, 2011c). It was assumed that commercial workers are exposed to indoor air for 250 days/year for the RME case and 219 days/year for the CTE case (EPA, 2004). The default high-end exposure duration of 25 years was used for the

RME case, while an average exposure duration of 9 years was used for the CTE case (EPA, 2004). As recommended in RAGS (EPA, 1989), the averaging time for non-carcinogens was set equal to the exposure duration, and the averaging time for carcinogens was the standard EPA lifetime duration (70 years).

Current Storage Unit User Exposure Parameters. For the storage unit user at building 270207, the exposure time was assumed to be 4 hours per day for the RME case and 2 hours per day for the CTE case (professional judgment). It was assumed that storage unit users are exposed to indoor air for 250 days/year for the RME case (EPA, 2004) and 125 days/year for the CTE case (professional judgment). The default high-end exposure duration of 25 years was used for the RME case (EPA, 2004), while an average exposure duration of 9 years was used for the CTE case (professional judgment). The averaging time for non-carcinogens was set equal to the exposure duration, and the averaging time for carcinogens was the standard EPA lifetime duration (70 years).

Current Daycare Worker Exposure Parameters. For daycare workers at building 260206, the exposure time was assumed to be 11 hours per day for the RME scenario (based on site-specific information) and 8 hours per day for the CTE scenario (EPA, 2011c). All other exposure parameters were the same as those used for the current and future commercial worker.

Current Daycare Child Exposure Parameters. For a daycare child at building 260206, the exposure time was assumed to be 11 hours per day for the RME scenario (based on site-specific information) and 8 hours per day for the CTE scenario (professional judgment). It was assumed that the daycare child is exposed to indoor air for 250 days/year (50 weeks) for the RME case and 225 days/year (45 weeks) for the CTE case (professional judgment). The exposure duration of 7 years was used for the RME case (based on site-specific information), while an average exposure duration of 4 years was used for the CTE case (professional judgment). The averaging time for non-carcinogens was set equal to the exposure duration, and the averaging time for carcinogens was the standard EPA lifetime duration (70 years).

Current and Future Resident Exposure Parameters. For the adult and child resident, the exposure time was assumed to be 24 hours per day for the RME scenario (EPA, 2011c) and 16 hours per day for the CTE scenario (EPA, 2011c). It was assumed that adult and child residents are exposed to indoor air for 350 days/year (50 weeks) for both the RME and CTE cases (EPA, 2004). The exposure durations of 24 years and 6 years, respectively, were used for the RME adult and child, while exposure durations of 7 years and 2 years, respectively, were used for the CTE adult and child (EPA, 2004). The averaging time for non-carcinogens was set equal to the exposure duration, and the averaging time for carcinogens was the standard EPA lifetime duration (70 years).

3.4 Toxicity Assessment

The toxicity assessment identifies the potential effects that are associated with exposure to a given chemical. The USEPA evaluates two types of toxic effects: carcinogenic effects and non-carcinogenic effects.

To quantify non-carcinogenic effects, EPA has derived inhalation reference concentrations (RfCs) in units of ug/m^3 that are "an estimate (with uncertainty spanning perhaps an order of magnitude) of a daily exposure to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of deleterious effects during a lifetime" (USEPA, 1989). Table 5 presents non-cancer toxicity data for the inhalation pathway.

To quantify carcinogenic effects for inhalation exposures, EPA has derived unit risk (UR) factors for those chemicals found to cause a concentration-related, statistically significant increase in tumor incidence in an exposed population relative to the incidence of tumors observed in an unexposed population. These concentration-related incidence rates may be derived from animal or human studies. Unit risk factors are upperbound estimates of the excess lifetime cancer risk estimated to result from continuous exposure to 1 ug/m^3 in air. Unit risk factors are expressed as risk per ug/m^3 or $(ug/m^3)^{-1}$. The weight-of-evidence classifications for carcinogenic COPCs for the inhalation pathway are presented in Table 6.

Toxicity data presented are from the EPA Integrated Risk Information System on-line database (USEPA, 2012), the EPA Superfund Technical Support Center (STSC), the California Environmental Protection Agency (CalEPA), and the Agency for Toxic Substances and Disease Registry (ATSDR). The selection of toxicity values was based on the EPA (2003) recommended hierarchy for human health toxicity values. The EPA (2003) memorandum on human health toxicity values describes a three-tiered hierarchy that consists of: Tier 1 – Integrated Risk Information System (IRIS); Tier 2 – Provisional Peer Reviewed Toxicity Values developed by STSC; and Tier 3 – Other Toxicity Values, including EPA and non-EPA sources, such as CalEPA, ATSDR, and the Health Effects Assessment Summary Tables.

The quantitative evaluation of potential risks for carcinogens with a mutagenic mode of action (i.e., TCE-induced kidney tumors) followed EPA guidance entitled *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (EPA, 2005). Specifically, the quantification of cancer risks for child receptor involves the use of age-dependent adjustment factors (ADAFs). An ADAF of 10 was used for childhood exposures occurring from birth to 2 years of age, and an ADAF of 3 was used for exposures occurring between the ages of 2 and 16 (EPA, 2005). An ADAF of 1 was used for adult exposures. This methodology is further discussed in Section 3.5.1.

MassDEP has developed UR values for TCE and PCE that are different than those used by EPA. The MassDEP UR for TCE is 1.7×10^{-6} $(ug/m^3)^{-1}$ compared to EPA's value of 4×10^{-6} $(ug/m^3)^{-1}$ for all types of cancers combined (non-Hodgkins lymphoma and kidney and liver tumors). The MassDEP UR for PCE is 1×10^{-5} $(ug/m^3)^{-1}$ compared to EPA's value of 2.6×10^{-7} $(ug/m^3)^{-1}$. The impact of the MassDEP UR values on the conclusions of this risk evaluation is discussed in Section 3.5.3 Description of Uncertainties.

3.5 Risk Characterization

Risk characterization combines estimates of exposure with toxicity data to develop estimates of the probability that an adverse effect will occur under the specified conditions of exposure. The

risk characterization was divided into three phases: 1) risk estimation; 2) risk description; and 3) uncertainty analysis.

Risk estimation is undertaken by combining the toxicity factors and exposure assessment equations to calculate estimates of risks. Noncarcinogenic risks are reported as Hazard Indices (HIs), which are the sum of individual COPC Hazard Quotients (HQs) for the pathway. Only HQs from COPCs that affect the same target organ are summed to generate HIs. Estimates of carcinogenic risks are reported as incremental lifetime cancer risks (ILCRs). Current practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances. Risk estimation discusses the calculation of ILCRs and HI. The significance of the risk estimates are discussed relative to risk management guidelines set forth in EPA policy. The uncertainty analysis describes and quantifies, where possible, the impact of data uncertainty and variability, exposure assumptions, and toxicity values on estimates of risk.

3.5.1 Risk Estimation

Noncancer risk is estimated by means of a HQ. To calculate noncarcinogenic HQs, the ADDs, calculated as described in subsection 3.3.1, were divided by the RfCs as follows:

$$HQ = ADD / RfC$$

The sum of this ratio for all COPCs that have the same target organ or type of toxicity is termed the pathway HI. The HI is useful as a reference point for gauging potential effects of environmental exposures to complex mixtures. In general, HIs that are less than 1 indicate that adverse health effects are unlikely; if the HI is greater than 1, there may be an increased concern for potential non-cancer health effects, although the relative value of a HI above 1 cannot be translated into an estimate of the severity of the hazard.

Total pathway HIs, assuming additivity of effects, are presented on Tables 7.1 through 7.9. However, in cases where the total pathway HI for a receptor exceeded 1, only COPCs having

similar systemic effects (i.e., target organs) were summed for each pathway and medium. Target organ HIs are presented on Tables 9.1 through 9.32.

The cancer risk of each receptor is estimated by means of an ILCR. EPA (1991) states that where the cumulative incremental current or future carcinogenic risk to a receptor is less than 10^{-4}, and where the noncarcinogenic HI is less than 1, action generally is not warranted unless there are adverse environmental impacts or other site-specific considerations.

To calculate the ILCR, the chemical-specific LADDs, calculated as described in subsection 3.3.1, were multiplied by URs as follows:

$$ILCR = UR \times LADD$$

The resulting value represents the upper-bound probability that an individual could develop cancer over his or her lifetime due to exposure to potential carcinogens under the conditions specified in the exposure scenario. For example, carcinogenic risk levels of 10^{-6} and 10^{-4} represent a one-in-one-million chance and a one-in-ten-thousand chance, respectively, that an individual could develop cancer over a lifetime.

TCE was selected as a COPC at Building 260207. For the future resident at this building, the quantification of potential cancer risks for carcinogens with a mutagenic mode of action (i.e., TCE-induced kidney tumors) followed the EPA guidance entitled *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens* (EPA, 2005). The quantification of cancer risks for future residents involves the use of ADAFs. Specifically, an ADAF of 10 was used for exposures occurring to children from birth to 2 years of age and an ADAF of 3 was used for exposures occurring between the ages of 2 and 16. The following general equation demonstrates how ADAFs were incorporated into the risk calculations:

Risk = Exposure concentration (ug/m^3) x UR $(ug/m^3)^{-1}$ x ADAF

The ADAFs are only applicable to the unit risk for kidney tumors associated with TCE exposure (1×10^{-6} [ug/m^3]$^{-1}$). ADAFs were not applied to the unit risk associated with TCE-induced liver tumors and non-Hodgkins lymphoma (3.1×10^{-6} [ug/m^3]$^{-1}$) since these types of cancers were not associated with a mutagenic mode of action. The early life cancer risk calculation for the child resident (ages birth to 6 years) is provided in Table 7.9.RME and CT.

The older child was included with the 24-year adult exposure to TCE in order to include the ADAF of 3 applicable to ages 6 through 16. These calculations are provided in Table 7.8.RME and CT. The total receptor ILCRs are presented on Tables 9.1 through 9.32.

3.5.2 Risk Description

This subsection summarizes the human health risks potentially associated with exposures to COPCs in indoor air. Individual chemical-specific carcinogenic risks are expressed as probabilities of developing cancer (i.e., ILCRs), while noncarcinogenic risks are expressed as HIs. All carcinogenic and noncarcinogenic risks were calculated using both CTE and RME methods. The RME represents the reasonable maximum exposure and risk a receptor may receive from a property/area. The CTE represents the average exposure and risk at a property.

Tables 9.1 through 9.32 present target-organ specific HIs, which are discussed if a medium-specific HI exceeds 1. For the residential receptors, child and adult ILCRs have been summed to present the total receptor cancer risk. However, because the child receptor is the most sensitive receptor for the estimation of noncarcinogenic risks, only the child receptor HIs have been presented on these tables for this receptor.

3.5.2.1 Description of HI Estimates

HI estimates represent the risk of health effects other than cancer from exposure to COPCs. Tables 7.1 through 7.9 present the non-carcinogenic risks by receptor for each of the exposure points. When a receptor-specific HI for an exposure medium exceeded 1, HIs were segregated

by target organ and discussed as to whether target organ-specific HIs exceed the risk management guideline. Target organ HIs are presented on Tables 9.1 through 9.32.

Target organ HIs are less than or equal to 1 at all buildings including all downgradient residential buildings, except for the future child resident at building 260207 should this building be used for residential purposes in the future. For this exposure point, target organ HIs for the respiratory system (RME HI of 6; CTE HI of 4) and nervous system (RME HI of 2) exceed 1 primarily due to the presence of naphthalene and PCE in indoor air. Though naphthalene was detected in shallow groundwater on the UniFirst Source Area property, it was only detected in one monitoring well (UC5) at a low concentration (2 ug/L) over the past two years. It should further be noted that naphthalene was only detected at one subslab soil gas location (SV-02) at a maximum detected concentration of 1.1 ug/m^3, while it was detected in all but one of the indoor air sampling locations at a maximum detected concentration of 16 ug/m^3. The low concentrations in groundwater and subslab soil gas suggest that naphthalene is present in indoor air primarily due to an indoor source. In contrast, PCE was detected consistently and at high concentrations in the subslab soil gas, indicating that PCE in indoor air is present primarily as a result of a complete VI pathway. Considering only PCE, the future target organ RME HI of 2 for the nervous system attributable to vapor intrusion would still exceed the EPA risk management guideline of 1**.**

3.5.2.2 Description of ILCR Estimates

Estimates of ILCR represent the incremental risk of cancer from the Site. Tables 7.1 through 7.9 present the cancer risks by receptor. ILCRs were summed for the young child and adult receptors to derive a total receptor risk for the residential receptors. The total receptor cancer risks, summed for the adult and child receptors where appropriate, are presented on Tables 9.1 through 9.32.

ILCRs are less than or equal to 1 x 10^{-4} for all buildings including all downgradient residential buildings except for the future resident at buildings 260207 and 260407 (described in paragraphs

further below) should these buildings be used for residential purposes in the future. Current ILCRs are estimated to be within the risk range for:

- the commercial worker at building 260207 (Space 2, 1×10^{-5} [RME] and 4×10^{-6} [CTE]);
- the commercial worker at building 260407 (Space 1, 2×10^{-6} [RME]; Spaces 2, 3 and 4, 3×10^{-6} [RME]; Space 5, 1×10^{-4} [RME] and 4×10^{-5} [CTE]);
- the storage unit user at building 260207 (Space 1, 2×10^{-5} [RME] and 2×10^{-6} [CTE] and Space 3, 1×10^{-5} [RME]);
- the daycare worker at building 260206 (Space 1, 2×10^{-5} [RME] and 3×10^{-6} [CTE] and Spaces 2 and 3, 2×10^{-5} [RME] and 4×10^{-6} [CTE]);
- the daycare child at building 260206 (Spaces 1 and 3, 4×10^{-6} [RME] and 2×10^{-6} [CTE]; Space 2, 5×10^{-6} [RME] and 2×10^{-6} [CTE]);
- the resident at building 260504 (Basement; 3×10^{-5} [RME] and 7×10^{-6} [CTE]);
- the resident at building 260505 (North Unit, Basement, 6×10^{-6} [RME], and First Floor, 5×10^{-6} [RME]; South Unit, Basement, 3×10^{-5} [RME] and 5×10^{-6} [CTE]);
- the resident at building 260902 (Basement, 8×10^{-6} [RME] and 2×10^{-6} [CTE]; First Floor, 2×10^{-6} [RME]); and
- the resident at building 260903 (Basement, 1×10^{-5} [RME] and 3×10^{-6} [CTE]).

Future ILCRs are estimated to be within the risk range for:

- the commercial worker at building 260207 (8×10^{-5} [RME] and 3×10^{-5} [CTE]);
- the resident at building 260206 (6×10^{-5} [RME] and 1×10^{-5} [CTE]);
- the resident at building 260504 (3×10^{-5} [RME] and 7×10^{-6} [CTE]);
- the resident at building 260207 (8×10^{-5} [CTE]);
- the resident at building 260505 (North Unit, Basement, 6×10^{-6} [RME], and First Floor, 5×10^{-6} [RME]; South Unit, Basement, 3×10^{-5} [RME] and 5×10^{-6} [CTE]);
- the resident at building 260902 (Basement, 8×10^{-6} [RME] and 2×10^{-6} [CTE], and First Floor, 2×10^{-6} [RME]);
- the resident at building 260903 (Basement, 1×10^{-5} [RME] and 3×10^{-6} [CTE]); and
- the resident at building 260407 (1×10^{-4} [CTE]).

ILCRs for all other current and future receptors and exposure points are less than or equal to 1 x 10^{-6}.

For commercial building 260207 used as a residence in the future, the future resident ILCR is 4 x 10^{-4}. The primary risk contributing COPCs are 1,4-dichlorobenzene (ILCR of 2 x 10^{-4}) and naphthalene (ILCR of 2 x 10^{-4}), with a lesser contribution from PCE (ILCR of 9 x 10^{-6}). As previously discussed in Section 3.5.2.1, naphthalene is likely present in indoor air primarily due to an indoor source because of the low concentrations in groundwater and subslab soil gas. Similarly, 1,4-dichlorobenzene was only detected in shallow groundwater in one monitoring well (UC18) at a low concentration (1 ug/L) over the past two years, and only sporadically detected at low concentrations in subslab soil gas, suggesting that 1,4-dichlorobenzene is present in indoor air as a result of an indoor source. In contrast, PCE was detected consistently and at high concentrations in the subslab soil gas, indicating that PCE in indoor air is present primarily as a result of a complete VI pathway. Considering only PCE, the future ILCR of 9 x 10^{-6} would not exceed 1 x 10^{-4}.

For commercial building 260407 used as a residence in the future, the future resident ILCR is 6 x 10^{-4}. The primary risk contributing COPC is chloroform (ILCR of 6 x 10^{-4}), with a lesser contribution from naphthalene (ILCR of 9 x 10^{-6}). The risk is associated with a maximum detected concentration of chloroform in Space 5. Though chloroform was detected in the subslab soil gas and indoor air samples throughout the building, all other indoor air detections of chloroform (Spaces 1 to 4) were low (maximum of 1.2 ug/m^3) and would not be associated with a risk above EPA's risk management guidelines. In addition, chloroform has only been detected at low concentrations (maximum of 3 ug/L) in shallow groundwater in the vicinity of this commercial building. Therefore, the maximum detected concentration of chloroform appears to be associated with an indoor source within Space 5. Though naphthalene was detected in shallow groundwater downgradient of the Grace Source Area property, it was only detected in one monitoring well (UC13) at a low concentration (0.6 ug/L) over the past two years. This monitoring well is not located in the vicinity of building 260407. In addition, naphthalene was only sporadically detected at low concentrations in the soil gas beneath the building. Therefore,

naphthalene is likely present in indoor air due to an indoor source. Considering chloroform and naphthalene are likely present in indoor air due to an indoor source, there would be no carcinogenic risk estimated for the complete VI pathway for building 260407.

As previously mentioned, the subslab soil gas and indoor air data collected to date suggests that some COPCs present in indoor air may not be present primarily as a result of the VI pathway. The following table summarizes the RME ILCRs and HIs for buildings with indoor air COPCs that may not be primarily associated with the VI pathway, as well as the RME ILCRs and HIs for the same buildings, following the removal of those COPCs that appear to be present primarily as a result of an indoor source unrelated to the VI pathway.

Building	COPCs Potentially from Indoor Source	Scenario	ILCR / HI (all COPCs)	ILCR / HI without COPCs Potentially from Indoor Source
260207	Naphthalene, 1,4-Dichlorobenzene	Commercial Worker (Space 2)	1×10^{-5}; 0.6	2×10^{-6}; 0.4
		Storage Unit User (Space 3)	1×10^{-5}; 0.5	1×10^{-6}; 0.2
		Storage Unit User (Space 1)	2×10^{-5}; 0.2	8×10^{-7}; 0.1
		Commercial Worker (Spaces 1 to 3)	8×10^{-5}; 2	4×10^{-6}; 0.9
		Future Resident (Spaces 1 to 3)	4×10^{-4}; 9	2×10^{-5}; 4
260504	Ethylbenzene, Xylenes	Resident	3×10^{-5}; 0.7	3×10^{-5}; 0.6
260407	Chloroform, Naphthalene	Commercial Worker (Space 5)	1×10^{-4}; 0.2	NA; 0.008
		Future Resident (Spaces 1 to 5)	6×10^{-4}; 1	NA; 0.3

NA – No carcinogenic COPCs remain

Though PCE was not found at significant concentrations for worker exposure in any indoor air samples, subslab soil gas concentrations of PCE are substantially greater than the EPA soil gas screening level (EPA, 2011a) for commercial properties at commercial buildings 260207 and 260206. In addition, subslab soil gas concentrations of TCE are higher than the EPA soil gas screening level for commercial properties at commercial building 260207. The presence of elevated concentrations of PCE in subslab soil gas beneath commercial buildings 260207 and 260206, as well as elevated concentrations of TCE in subslab soil gas beneath commercial building 260207, indicates a potential for future vapor intrusion to occur if building conditions were to change (e.g., if further cracks occurred in the foundation/subslab, etc.).

3.5.3 Description of Uncertainties

Estimation of risks to human health that may result from exposure to chemicals in the environment is a complex process that often requires the combined efforts of multiple disciplines. Each assumption, whether regarding the toxicity value to use for a particular chemical or the value of a parameter in an exposure equation, has a degree of variability and uncertainty associated with it. In each step of the risk assessment process, beginning with the data collection and analysis and continuing through the toxicity assessment, exposure assessment, and risk characterization, conservative assumptions are made that are intended to be protective of human health and to ensure that risks are not underestimated. The following subsections provide a discussion of the key uncertainties that may affect the final estimates of human health risk in this risk assessment. Uncertainties are arranged by topic.

3.5.3.1 Environmental Sampling and Analysis

The process of environmental sampling and analysis results in uncertainties from several sources, including errors inherent in sampling procedures or analytical methods. One area of uncertainty is sampling procedures. Since it is not possible to continuously sample the indoor air of a building, two or more samples were taken from each building on a given day during the heating season and the results were considered to be representative of the VOCs present in

indoor air throughout the building over time. To try to reduce this uncertainty, two rounds of indoor air sampling were conducted for the downgradient buildings, one during the heating season and one during the cooling season. Two rounds of indoor air sampling were also conducted at the UniFirst Source Area property building.

3.5.3.2 Analytical Data Quality

Errors (e.g., over- or underestimation of concentrations) can occur during sample analysis. Data were qualified during validation due to various quality control nonconformances. The data validation reports that summarize these nonconformances, and the potential biases on the data, are included in Appendix A.4.

Due to uncertainty of quantification, individual chemicals were sometimes listed as detected, but with the value qualified as estimated by laboratory qualification or validation procedures. The estimated value was used in the risk assessment. In some cases, analytical errors or sampling errors resulted in the rejection of data, which decreased the amount of data available and increased uncertainty associated with the representativeness of the detected chemical concentrations.

In addition, the values reported as non-detected may actually range from non-detect (i.e., not present) up to the value of the SQL. The replacement of non-detects with a value equal to one-half the SQL for calculation of the arithmetic mean is intended to be reasonably conservative, but could over- or underestimate the actual constituent concentrations present in the environmental media.

3.5.3.3 Selection of Chemicals for Evaluation

The maximum detected chemical concentrations in indoor air were compared to EPA RSLs for residential air. Chemicals whose maximum concentrations were below their respective cancer screening value or 10-percent of their noncancer screening value were not carried through the assessment. It is unlikely that this risk-based screening excluded chemicals that would be of

concern, based on the conservative exposure assumptions and conservatively derived toxicity values that are the basis of the screening levels. Although following this methodology does not provide a quantitative risk estimate for all chemicals, it focuses the assessment on the chemicals accounting for the greatest risks (i.e., chemicals whose maximum concentrations exceeded their respective screening value), and, although the overall risk estimates are uncertain, it is not expected that actual risks will be significantly greater than estimated risks.

In addition, VOCs in indoor air that were determined to be present as a result of a background indoor source, unrelated to the VI pathway, were not quantitatively evaluated. Some of these VOCs that were not related to the VI pathway exceeded residential air RSLs and may be associated with increased risk to building occupants. Other indoor sources of VOCs may be investigated and addressed by building occupants to reduce the risk associated with the presence of VOCs from indoor sources (e.g., hobbies, cleaning products, fuel oil leakage).

3.5.3.4 Toxicological Data

Uncertainty is associated with the toxicity values and toxicity information available to assess potential adverse effects.

The unit risk, or UR, is a plausible upper bound estimate of carcinogenic potency used to calculate cancer risk from exposure to carcinogens, by relating estimates of lifetime average chemical exposure to the incremental probability of an individual developing cancer over a lifetime. The URs developed by the USEPA are plausible upper bound estimates, which means that the USEPA is reasonably confident that the actual cancer risk will not exceed the estimated risk calculated using the UR. There are uncertainties associated with the use of animal studies to predict cancer risk in humans.

MassDEP has developed UR values for PCE and TCE that are different than those used by EPA. To address this difference the MassDEP UR values for these two compounds have been used to estimate the carcinogenic risk to receptors. Footnotes on Tables 9.1 through 9.32 present the

cumulative receptor cancer risks using the MassDEP unit risk values for PCE and TCE. No differences in the conclusions of the risk assessment occur using MassDEP toxicity values.

3.5.3.5 Exposure Assessment

The primary areas of uncertainty affecting exposure parameter estimation involve the assumptions regarding the estimation of exposure point concentrations and the parameters used to estimate chemical doses. The uncertainties associated with these various sources are discussed below.

Because few samples are collected in most buildings, the maximum concentration is used in the estimation of potential risks. This may over or underestimate the concentration that individuals may be exposed to.

Conservative estimates of the mean exposure point concentrations could be calculated for 2 locations. EPA's software program, Pro UCL version 4.1, was used to determine 95-percent UCLs for the eastern and western portions of the building on the UniFirst Source Area property. The use of this program is believed to result in the more accurate estimation of EPCs than previously used methods.

The exposure assumptions selected for this evaluation were based on CTE and RME cases. The exposure assumptions were selected to produce an upper-bound estimate of exposure in accordance with EPA guidance regarding evaluation of potential exposures at Superfund sites. Therefore, exposures and estimated potential risks for the majority of the evaluated receptors are likely to be overestimated. For example, the exposure time assumed for the RME residential scenario in this analysis is 24 hours per day. It is likely that residential exposures occur less frequently than assumed, which may result in an overestimate of risk.

3.5.3.6 Risk Characterization

The summing of cancer risks may over or underestimate risk because constituents may act synergistically (1 + 1 > 2) or antagonistically (1 + 1 < 2). The nature of the impact of the assumption of additivity on the risk estimates for the Site is unknown. However, as a guide, if compounds act synergistically, then assuming additivity would underestimate risk; if they act antagonistically, then risk is overestimated.

4.0 SUMMARY AND CONCLUSIONS

This section summarizes the findings and conclusions of the VI HHRA conducted for OU-1 of the Wells G&H Superfund Site in Woburn, Massachusetts. The purpose of this report was to document the VI investigation conducted for OU-1 and to determine the potential risk posed to current and future human receptors associated with the VI pathway. Chemicals detected indoors that are not associated with the VI pathway for a given property are not included in the risk assessment.

Overall summaries of cancer and noncancer risks estimates for each of the evaluated scenarios and buildings are presented in Tables 9.1 through 9.32. Risks are summarized for both the RME and CTE receptors. When risks were estimated for a child and adult receptor, the child HIs are presented as the most conservative, while incremental lifetime cancer risks (ILCRs) are the sum of the child and adult risks (i.e., a total receptor cancer risk).

When a receptor-specific HI for an exposure medium exceeded 1, HIs were segregated by target organ and discussed as to whether target organ-specific HIs exceed the risk management guideline. Estimated ILCRs were compared to the EPA target risk range of 10^{-6} to 10^{-4}.

The following summarizes the major risk drivers (HI >1, ILCR >10^{-6}) for the evaluated receptors for each of the buildings where total receptor ILCRs exceed 1 x 10^{-4} and target organ HIs exceed 1. Tables 10.1 and 10.2 present the risks and hazards associated with the major risk drivers. Other contaminants that contribute to risk at the site below these thresholds are discussed in Section 3.5.2. This summary focuses on the major risk contributors.

Target organ HIs are less than or equal to 1 at all buildings including all downgradient residential buildings, except for the future child resident at building 260207 should this building be used for residential purposes in the future. For this exposure point, target organ HIs for the respiratory system (RME HI of 6; CTE HI of 4) and nervous system (RME HI of 2) exceed 1 primarily due to the presence of naphthalene and PCE in indoor air. Though naphthalene was detected in shallow groundwater on the UniFirst Source Area property, it was only detected in one

monitoring well (UC5) at a low concentration (2 ug/L) over the past two years. It should further be noted that naphthalene was only detected at one subslab soil gas location (SV-02) at a maximum detected concentration of 1.1 ug/m^3, while it was detected in all but one of the indoor air sampling locations at a maximum detected concentration of 16 ug/m^3. The low concentrations in groundwater and subslab soil gas suggest that naphthalene is present in indoor air primarily due to an indoor source. In contrast, PCE was detected consistently and at high concentrations in the subslab soil gas, indicating that PCE in indoor air is present primarily as a result of a complete VI pathway. Considering only PCE, the future target organ RME HI of 2 for the nervous system attributable to vapor intrusion would still exceed the EPA risk management guideline of 1.

ILCRs are less than or equal to 1 x 10^{-4} at all buildings including all downgradient residential buildings, except for the future resident at buildings 260207 and 260407 (described in paragraphs further below) should these buildings be used for residential purposes in the future. Current ILCRs are estimated to be within the risk range for:

- the commercial worker at building 260207 (Space 2, 1 x 10^{-5} [RME] and 4 x 10^{-6} [CTE]);
- the commercial worker at building 260407 (Space 1, 2 x 10^{-6} [RME]; Spaces 2, 3 and 4, 3 x 10^{-6} [RME]; Space 5, 1 x 10^{-4} [RME] and 4 x 10^{-5} [CTE]);
- the storage unit user at building 260207 (Space 1, 2 x 10^{-5} [RME] and 2 x 10^{-6} [CTE] and Space 3, 1 x 10^{-5} [RME]);
- the daycare worker at building 260206 (Space 1, 2 x 10^{-5} [RME] and 3 x 10^{-6} [CTE] and Spaces 2 and 3, 2 x 10^{-5} [RME] and 4 x 10^{-6} [CTE]);
- the daycare child at building 260206 (Spaces 1 and 3, 4 x 10^{-6} [RME] and 2 x 10^{-6} [CTE]; Space 2, 5 x 10^{-6} [RME] and 2 x 10^{-6} [CTE]);
- the resident at building 260504 (Basement; 3 x 10^{-5} [RME] and 7 x 10^{-6} [CTE]);
- the resident at building 260505 (North Unit, Basement, 6 x 10^{-6} [RME], and First Floor, 5 x 10^{-6} [RME]; South Unit, Basement, 3 x 10^{-5} [RME] and 5 x 10^{-6} [CTE]);
- the resident at building 260902 (Basement, 8 x 10^{-6} [RME] and 2 x 10^{-6} [CTE]; First Floor, 2 x 10^{-6} [RME]); and
- the resident at building 260903 (Basement, 1 x 10^{-5} [RME] and 3 x 10^{-6} [CTE]).

Future ILCRs are estimated to be within the risk range for:

- the commercial worker at building 260207 (8×10^{-5} [RME] and 3×10^{-5} [CTE]);
- the resident at building 260206 (6×10^{-5} [RME] and 1×10^{-5} [CTE]);
- the resident at building 260504 (3×10^{-5} [RME] and 7×10^{-6} [CTE]);
- the resident at building 260207 (8×10^{-5} [CTE]);
- the resident at building 260505 (North Unit, Basement, 6×10^{-6} [RME], and First Floor, 5×10^{-6} [RME]; South Unit, Basement, 3×10^{-5} [RME] and 5×10^{-6} [CTE]);
- the resident at building 260902 (Basement, 8×10^{-6} [RME] and 2×10^{-6} [CTE], and First Floor, 2×10^{-6} [RME]);
- the resident at building 260903 (Basement, 1×10^{-5} [RME] and 3×10^{-6} [CTE]); and
- the resident at building 260407 (1×10^{-4} [CTE]).

ILCRs for all other current and future receptors and exposure points are less than or equal to 1×10^{-6}.

For commercial building 260207 used as a residence in the future, the future resident ILCR is 4×10^{-4}. The primary risk contributing COPCs are 1,4-dichlorobenzene (ILCR of 2×10^{-4}) and naphthalene (ILCR of 2×10^{-4}), with a lesser contribution from PCE (ILCR of 9×10^{-6}). As previously discussed, naphthalene is likely present in indoor air primarily due to an indoor source because of the low concentrations in groundwater and subslab soil gas. Similarly, 1,4-dichlorobenzene was only detected in shallow groundwater in one monitoring well (UC18) at a low concentration (1 ug/L) over the past two years, and only sporadically detected at low concentrations in subslab soil gas, suggesting that 1,4-dichlorobenzene is present in indoor air as a result of an indoor source. In contrast, PCE was detected consistently and at high concentrations in the subslab soil gas, indicating that PCE in indoor air is present primarily as a result of a complete VI pathway. Considering only PCE, the future ILCR of 9×10^{-6} would not exceed 1×10^{-4}.

For commercial building 260407 used as a residence in the future, the future resident ILCR is 6×10^{-4}. The primary risk contributing COPC is chloroform (ILCR of 6×10^{-4}), with a lesser

contribution from naphthalene (ILCR of 9 x 10^{-6}). The risk is associated with a maximum detected concentration of chloroform in Space 5. Though chloroform was detected in the subslab soil gas and indoor air samples throughout the building, all other indoor air detections of chloroform (Spaces 1 to 4) were low (maximum of 1.2 ug/m^3) and would not be associated with a risk above EPA's risk management guidelines. In addition, chloroform has only been detected at low concentrations (maximum of 3 ug/L) in shallow groundwater in the vicinity of this commercial building. Therefore, the maximum detected concentration of chloroform appears to be associated with an indoor source within Space 5. Though naphthalene was detected in shallow groundwater downgradient of the Grace Source Area property, it was only detected in one monitoring well (UC13) at a low concentration (0.6 ug/L) over the past two years. This monitoring well is not located in the vicinity of building 260407. In addition, naphthalene was only sporadically detected at low concentrations in the soil gas beneath the building. Therefore, naphthalene is likely present in indoor air due to an indoor source. Considering chloroform and naphthalene are likely present in indoor air due to an indoor source, there would be no carcinogenic risk estimated for the complete VI pathway for building 260407.

As previously mentioned, the subslab soil gas and indoor air data collected to date suggests that some COPCs present in indoor air may not be present primarily as a result of the VI pathway. The following table summarizes the RME ILCRs and HIs that exceed risk management guidelines for buildings with indoor air COPCs that may not be primarily associated with the VI pathway, as well as the RME ILCRs and HIs for the same buildings, following the removal of those COPCs that appear to be present primarily as a result of an indoor source unrelated to the VI pathway.

Building	COPCs Potentially from Indoor Source	Scenario	ILCR / HI (all COPCs)	ILCR / HI without COPCs Potentially from Indoor Source
260207	Naphthalene, 1,4-Dichlorobenzene	Future Resident (Spaces 1 to 3)	**4 x 10^{-4}; 9**	**2 x 10^{-5}; 4**
260407	Chloroform, Naphthalene	Future Resident (Spaces 1 to 5)	**6 x 10^{-4}**; 1	NA; 0.3

NA – No carcinogenic COPCs remain Bold values exceed ILCR of 1 x 10^{-5} or HI of 1.

Though PCE was not found at significant concentrations for worker exposure in any indoor air samples, subslab soil gas concentrations of PCE are substantially greater than the EPA soil gas screening level (EPA, 2011a) for commercial properties at commercial buildings 260207 and 260206. In addition, subslab soil gas concentrations of TCE are higher than the EPA soil gas screening level for commercial properties at commercial building 260207. The presence of elevated concentrations of PCE in subslab soil gas beneath commercial buildings 260207 and 260206, as well as elevated concentrations of TCE in subslab soil gas beneath commercial building 260207, indicates a potential for future vapor intrusion to occur if building conditions were to change (e.g., if further cracks occurred in the foundation/subslab, etc.).

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FIGURES

Figure 1
Determination of VOCs in Indoor Air Related to Vapor Intrusion
Commercial Parcel 260207 (UniFirst Building)
Wells G&H Operable Unit 1
Woburn, Massachusetts

GROUNDWATER UniFirst	SOIL GAS 260207	INDOOR AIR 260207	OUTDOOR AMBIENT AIR Upwind of 260207
1,1,1-Trichloroethane	1,1,1-Trichloroethane	1,1,1-Trichloroethane (a)	1,1,1-Trichloroethane
1,1-Dichloroethane	1,1-Dichloroethane	1,1-Dichloroethane (a)	1,2,4-Trimethylbenzene
1,1-Dichloroethene	1,1-Dichloroethene	1,1-Dichloroethene (a)	1,3-Butadiene
1,3-Dichlorobenzene	1,2,4-Trimethylbenzene	1,2,4-Trimethylbenzene	Benzene
1,4-Dichlorobenzene	1,4-Dichlorobenzene	1,2-Dichloroethane	Carbon Tetrachloride
cis-1,2-Dichloroethene	Benzene	1,3-Butadiene	Chloroform
trans-1,2-Dichloroethene	Bromodichloromethane	1,4-Dichlorobenzene	Ethylbenzene
2-Butanone	Carbon tetrachloride	Benzene	Naphthalene
Acetone	Chlorobenzene	Carbon tetrachloride	Toluene
Bromodichloromethane	Chloroform	Chloroform	Trichloroethene
Carbon disulfide	cis-1,2-Dichloroethene	cis-1,2-Dichloroethene (a)	Xylenes (total)
Chlorobenzene	Ethylbenzene	Ethylbenzene	C5-C8 Aliphatics
Chloroform	Methyl tert butyl ether	Methyl tert butyl ether (a)	
Ethylbenzene	Methylene chloride	Methylene chloride (a)	
Naphthalene	Naphthalene	Naphthalene	
Tetrachloroethene	Tetrachloroethene	Tetrachloroethene	
Toluene	Toluene	Toluene (a)	
Trichloroethene	trans-1,2-Dichloroethene	Trichloroethene	
Vinyl Chloride	Trichloroethene	Xylenes (total) (a)	
Xylenes (total)	Xylenes (total)	C5-C8 Aliphatics	
	C5-C8 Aliphatics	C9-C12 Aliphatics	
	C9-C12 Aliphatics		

NOTES:

Only detected compounds shown.

Shaded compounds were detected in shallow groundwater or soil gas and indoor air, indicating a potential vapor intrusion pathway.

(a) Though this compound may be present in indoor air due to vapor intrusion, the maximum detected concentration was below the risk-based screening value. Therefore, this compound is not an indoor air COPC.

Figure 2
Determination of VOCs in Indoor Air Related to Vapor Intrusion
Commercial Parcel 260206
Wells G&H Operable Unit 1
Woburn, Massachusetts

GROUNDWATER UniFirst	SOIL GAS 260206	INDOOR AIR 260206	OUTDOOR AMBIENT AIR Upwind of 260206
1,1,1-Trichloroethane	1,1,1-Trichloroethane	1,1,1-Trichloroethane (a)	1,2,4-Trimethylbenzene
1,1-Dichloroethane	1,1-Dichloroethane	1,2,4-Trimethylbenzene	Benzene
1,1-Dichloroethene	1,2,4-Trimethylbenzene	1,2-Dichloroethane	Carbon tetrachloride
1,3-Dichlorobenzene	Bromodichloromethane	1,3-Butadiene	Ethylbenzene
1,4-Dichlorobenzene	Carbon tetrachloride	1,4-Dichlorobenzene	Methylene chloride
cis-1,2-Dichloroethene	Chloroform	Benzene	Naphthalene
trans-1,2-Dichloroethene	cis-1,2-Dichloroethene	Bromodichloromethane	Toluene
2-Butanone	Ethylbenzene	Carbon tetrachloride	Xylenes (total)
Acetone	Tetrachloroethene	Chloroform	
Bromodichloromethane	trans-1,2-Dichloroethene	Ethylbenzene	
Carbon disulfide	Trichloroethene	Methylene chloride	
Chlorobenzene	Xylenes (total)	Naphthalene	
Chloroform		Tetrachloroethene (a)	
Ethylbenzene		Toluene	
Naphthalene		Xylenes (total)	
Tetrachloroethene			
Toluene			
Trichloroethene			
Vinyl Chloride			
Xylenes (total)			

NOTES:

Only detected compounds shown.

Shaded compounds were detected in shallow groundwater or soil gas and indoor air, indicating a potential vapor intrusion pathway.

(a) Though this compound may be present in indoor air due to vapor intrusion, the maximum detected concentration was below the risk-based screening value. Therefore, this compound is not an indoor air COPC.

Figure 3
Determination of VOCs in Indoor Air Related to Vapor Intrusion
Residential Parcel 260504
Wells G&H Operable Unit 1
Woburn, Massachusetts

GROUNDWATER UniFirst	SOIL GAS 260504	INDOOR AIR 260504	OUTDOOR AMBIENT AIR Upwind of 260504
1,1,1-Trichloroethane	1,1,1-Trichloroethane	1,2,4-Trimethylbenzene	1,2,4-Trimethylbenzene
1,1-Dichloroethane	1,2,4-Trimethylbenzene	1,2-Dichloroethane	1,3-Butadiene
1,1-Dichloroethene	1,3-Butadiene	1,3-Butadiene	Benzene
1,3-Dichlorobenzene	Benzene	1,4-Dichlorobenzene	Carbon tetrachloride
1,4-Dichlorobenzene	Carbon tetrachloride	Benzene	Chloroform
cis-1,2-Dichloroethene	Chloroform	Carbon tetrachloride	Ethylbenzene
trans-1,2-Dichloroethene	Ethylbenzene	Chloroform	Naphthalene
2-Butanone	Naphthalene	Ethylbenzene	Toluene
Acetone	Tetrachloroethene	Methylene chloride	Xylenes (total)
Bromodichloromethane	Toluene	Naphthalene	
Carbon disulfide	Xylenes (total)	Tetrachloroethene (a)	
Chlorobenzene		Toluene (a)	
Chloroform		Trichloroethene	
Ethylbenzene		Xylenes (total)	
Naphthalene			
Tetrachloroethene			
Toluene			
Trichloroethene			
Vinyl Chloride			
Xylenes (total)			

NOTES:

Only detected compounds shown.

Shaded compounds were detected in shallow groundwater or soil gas and indoor air, indicating a potential vapor intrusion pathway.

(a) Though this compound may be present in indoor air due to vapor intrusion, the maximum detected concentration was below the risk-based screening value. Therefore, this compound is not an indoor air COPC.

Figure 4
Determination of VOCs in Indoor Air Related to Vapor Intrusion
Residential Parcel 260505
Wells G&H Operable Unit 1
Woburn, Massachusetts

GROUNDWATER UniFirst	SOIL GAS 260505	INDOOR AIR 260505	OUTDOOR AMBIENT AIR Upwind of 260505
1,1,1-Trichloroethane	1,1,1-Trichloroethane	1,2,4-Trimethylbenzene	1,2,4-Trimethylbenzene
1,1-Dichloroethane	1,2,4-Trimethylbenzene	1,2-Dichloroethane	Benzene
1,1-Dichloroethene	Benzene	1,2-Dichloropropane	Carbon tetrachloride
1,3-Dichlorobenzene	Carbon tetrachloride	1,3-Butadiene	Chloroform
1,4-Dichlorobenzene	Chloroform	Benzene	Ethylbenzene
cis-1,2-Dichloroethene	Ethylbenzene	Bromodichloromethane	Naphthalene
trans-1,2-Dichloroethene	Naphthalene	Carbon tetrachloride	Toluene
2-Butanone	Tetrachloroethene	Chloroform	Xylenes (total)
Acetone	Toluene	Ethylbenzene	
Bromodichloromethane	Trichloroethene	Naphthalene	
Carbon disulfide	Xylenes (total)	Tetrachloroethene (a)	
Chlorobenzene		Toluene (a)	
Chloroform		Xylenes (total) (a)	
Ethylbenzene		C9-C12 Aliphatics	
Naphthalene			
Tetrachloroethene			
Toluene			
Trichloroethene			
Vinyl Chloride			
Xylenes (total)			

NOTES:

Only detected compounds shown.

Shaded compounds were detected in shallow groundwater or soil gas and indoor air, indicating a potential vapor intrusion pathway.

(a) Though this compound may be present in indoor air due to vapor intrusion, the maximum detected concentration was below the risk-based screening value. Therefore, this compound is not an indoor air COPC.

Figure 5
Determination of VOCs in Indoor Air Related to Vapor Intrusion
Commercial Parcel 260407
Wells G&H Operable Unit 1
Woburn, Massachusetts

GROUNDWATER W. R. Grace	SOIL GAS 260407	INDOOR AIR 260407	OUTDOOR AMBIENT AIR Upwind of 260407
1,1-Dichloroethane	1,1,1-Trichloroethane	1,1,1-Trichloroethane	1,2,4-Trimethylbenzene
1,1-Dichloroethene	1,2,4-Trimethylbenzene	1,2,4-Trimethylbenzene	1,3-Butadiene
2-Butanone	1,2-Dichloroethane	1,2-Dichloroethane	Acetone
2-Hexanone	1,3-Butadiene	1,3-Butadiene	Benzene
cis-1,2-Dichloroethene	1,4-Dichlorobenzene	1,4-Dichlorobenzene	Carbon tetrachloride
trans-1,2-Dichloroethene	Acetone	Acetone	Ethylbenzene
Acetone	Benzene	Benzene	Methylene chloride
Bromodichloromethane	Bromoform	Bromodichloromethane	Toluene
Carbon disulfide	Carbon tetrachloride	Carbon tetrachloride	Xylenes (total)
Chloroform	Chloroform	Chlorobenzene	C5-C8 Aliphatics
Methyl tert butyl ether	Ethyl acetate	Chloroform	
Naphthalene	Ethylbenzene	Ethyl acetate	
Tetrachloroethene	Isopropylbenzene	Ethylbenzene	
Toluene	Methyl tert butyl ether	Methylene chloride	
Trichloroethene	Methylene chloride	Naphthalene	
Vinyl Chloride	Naphthalene	Tetrachloroethene (a)	
	Tetrachloroethene	Toluene (a)	
	Toluene	Trichloroethene (a)	
	Trichloroethene	Xylenes (total)	
	Xylenes (total)	C5-C8 Aliphatics	
	C5-C8 Aliphatics	C9-C12 Aliphatics	
	C9-C12 Aliphatics	C9-C10 Aromatics	
	C9-C10 Aromatics		

NOTES:

Only detected compounds shown.

Shaded compounds were detected in shallow groundwater or soil gas and indoor air, indicating a potential vapor intrusion pathway.

(a) Though this compound may be present in indoor air due to vapor intrusion, the maximum detected concentration was below the risk-based screening value. Therefore, this compound is not an indoor air COPC.

Figure 6
Determination of VOCs in Indoor Air Related to Vapor Intrusion
Residential Parcel 260902
Wells G&H Operable Unit 1
Woburn, Massachusetts

GROUNDWATER W. R. Grace	SOIL GAS 260902	INDOOR AIR 260902	OUTDOOR AMBIENT AIR Upwind of 260902
1,1-Dichloroethane	1,2,4-Trimethylbenzene	1,2,4-Trimethylbenzene	1,2,4-Trimethylbenzene
1,1-Dichloroethene	1,2-Dichloroethane	1,2-Dichloroethane	1,3-Butadiene
2-Butanone	1,3-Butadiene	1,3-Butadiene	Benzene
2-Hexanone	1,3-Dichlorobenzene	Benzene	Carbon tetrachloride
cis-1,2-Dichloroethene	1,4-Dichlorobenzene	Bromodichloromethane	Chloroform
trans-1,2-Dichloroethene	Benzene	Carbon tetrachloride	Ethylbenzene
Acetone	Carbon tetrachloride	Chloroform	Naphthalene
Bromodichloromethane	Chloroform	Ethylbenzene	Tetrachloroethene
Carbon disulfide	Ethylbenzene	Methylene chloride	Toluene
Chloroform	Methyl tert butyl ether	Naphthalene	Xylenes (total)
Methyl tert butyl ether	Methylene chloride	Tetrachloroethene (a)	C5-C8 Aliphatics
Naphthalene	Naphthalene	Toluene (a)	C9-C12 Aliphatics
Tetrachloroethene	Tetrachloroethene	Xylenes (total)	
Toluene	Toluene	C5-C8 Aliphatics	
Trichloroethene	Xylenes (total)	C9-C12 Aliphatics	
Vinyl Chloride	C5-C8 Aliphatics	C9-C10 Aromatics	
	C9-C12 Aliphatics		

NOTES:

Only detected compounds shown.

Shaded compounds were detected in shallow groundwater or soil gas and indoor air, indicating a potential vapor intrusion pathway.

(a) Though this compound may be present in indoor air due to vapor intrusion, the maximum detected concentration was below the risk-based screening value. Therefore, this compound is not an indoor air COPC.

Figure 7
Determination of VOCs in Indoor Air Related to Vapor Intrusion
Residential Parcel 260903
Wells G&H Operable Unit 1
Woburn, Massachusetts

GROUNDWATER W. R. Grace	SOIL GAS 260903	INDOOR AIR 260903	OUTDOOR AMBIENT AIR Upwind of 260903
1,1-Dichloroethane	1,2,4-Trimethylbenzene	1,1,1-Trichloroethane	1,2,4-Trimethylbenzene
1,1-Dichloroethene	1,2-Dichloroethane	1,2,4-Trimethylbenzene	1,2-Dichloroethane
2-Butanone	1,4-Dichlorobenzene	1,2-Dichloroethane	1,3-Butadiene
2-Hexanone	Carbon tetrachloride	1,2-Dichloropropane	Benzene
cis-1,2-Dichloroethene	Chloroform	1,3-Butadiene	Carbon tetrachloride
trans-1,2-Dichloroethene	Ethylbenzene	1,4-Dichlorobenzene	Chloroform
Acetone	Methylene chloride	Benzene	Ethylbenzene
Bromodichloromethane	Tetrachloroethene	Bromodichloromethane	Methylene chloride
Carbon disulfide	Toluene	Carbon tetrachloride	Naphthalene
Chloroform	Trichloroethene	Chloroform	Tetrachloroethene
Methyl tert butyl ether	Xylenes (total)	Ethylbenzene	Toluene
Naphthalene	C5-C8 Aliphatics	Naphthalene	Xylenes (total)
Tetrachloroethene	C9-C12 Aliphatics	Tetrachloroethene (a)	C5-C8 Aliphatics
Toluene		Toluene (a)	
Trichloroethene		Xylenes (total)	
Vinyl Chloride		C5-C8 Aliphatics	
		C9-C12 Aliphatics	

NOTES:

Only detected compounds shown.

Shaded compounds were detected in shallow groundwater or soil gas and indoor air, indicating a potential vapor intrusion pathway.

(a) Though this compound may be present in indoor air due to vapor intrusion, the maximum detected concentration was below the risk-based screening value. Therefore, this compound is not an indoor air COPC.

TABLES

TABLE ES-1
SUMMARY OF RECEPTOR RISKS
HUMAN HEALTH RISK ASSESSMENT
WELLS G&H SUPERFUND SITE - OU-1

Exposure Point	Scenario/ Receptor	Exposure Media	RME or CTE	Total Cancer Risks	Total Noncancer Risks	Major contributors to risk (> 1E-06, HI > 1)
260207 [Space 2]	Current Commercial Worker	Indoor Air	RME	1E-05	6E-01	N/A
			CTE	4E-06	5E-01	
260407 [Space 1]	Current Commercial Worker	Indoor Air	RME	2E-06	9E-02	N/A
			CTE	5E-07	8E-02	
260407 [Space 2]	Current Commercial Worker	Indoor Air	RME	3E-06	5E-02	N/A
			CTE	9E-07	4E-02	
260407 [Space 3]	Current Commercial Worker	Indoor Air	RME	3E-06	3E-02	N/A
			CTE	8E-07	3E-02	
260407 [Space 4]	Current Commercial Worker	Indoor Air	RME	3E-06	2E-02	N/A
			CTE	1E-06	2E-02	
260407 [Space 5]	Current Commercial Worker	Indoor Air	RME	1E-04	2E-01	N/A
			CTE	4E-05	1E-01	
260207 [Space 3]	Current Storage Unit Worker	Indoor Air	RME	1E-05	5E-01	N/A
			CTE	1E-06	1E-01	
260207 [Space 1]	Current Storage Unit Worker	Indoor Air	RME	2E-05	2E-01	N/A
			CTE	2E-06	5E-02	
260206 [Space 3]	Current Day Care Worker	Indoor Air	RME	2E-05	8E-02	N/A
			CTE	4E-06	5E-02	
260206 [Space 1]	Current Day Care Worker	Indoor Air	RME	2E-05	8E-02	N/A
			CTE	3E-06	5E-02	
260206 [Space 2]	Current Day Care Worker	Indoor Air	RME	2E-05	8E-02	N/A
			CTE	4E-06	5E-02	
260206 [Space 3]	Current Day Care Child	Indoor Air	RME	4E-06	8E-02	N/A
			CTE	2E-06	5E-02	
260206 [Space 1]	Current Day Care Child	Indoor Air	RME	4E-06	8E-02	N/A
			CTE	2E-06	5E-02	
260206 [Space 2]	Current Day Care Child	Indoor Air	RME	5E-06	8E-02	N/A
			CTE	2E-06	5E-02	
260504 [Basement]	Current Resident (Young Child/Adult)	Indoor Air	RME	3E-05	7E-01	N/A
			CTE	7E-06	5E-01	
260505 [North unit basement]	Current Resident (Young Child/Adult)	Indoor Air	RME	6E-06	6E-02	N/A
			CTE	1E-06	4E-02	
260505 [North unit 1st Floor]	Current Resident (Young Child/Adult)	Indoor Air	RME	5E-06	5E-02	N/A
			CTE	1E-06	3E-02	
260505 [South unit basement]	Current Resident (Young Child/Adult)	Indoor Air	RME	3E-05	1E-01	N/A
			CTE	5E-06	1E-01	

TABLE ES-1
SUMMARY OF RECEPTOR RISKS
HUMAN HEALTH RISK ASSESSMENT
WELLS G&H SUPERFUND SITE - OU-1

Exposure Point	Scenario/ Receptor	Exposure Media	RME or CTE	Total Cancer Risks	Total Noncancer Risks	Major contributors to risk (> 1E-06, HI > 1)
260902 [Basement]	Current Resident (Young Child/Adult)	Indoor Air	RME	8E-06	1E-01	N/A
			CTE	2E-06	7E-02	
260902 [1st Floor]	Current Resident (Young Child/Adult)	Indoor Air	RME	2E-06	2E-03	N/A
			CTE	4E-07	1E-03	
260903 [Basement]	Current Resident (Young Child/Adult)	Indoor Air	RME	1E-05	1E-02	N/A
			CTE	3E-06	9E-03	
260207 [Spaces 1 to 3]	Future Commercial Worker	Indoor Air	RME	8E-05	2E+00	N/A
			CTE	3E-05	2E+00	
260206 [Spaces 1 to 3]	Future Resident (Young Child/Adult)	Indoor Air	RME	6E-05	2E-01	N/A
			CTE	1E-05	2E-01	
260504 [Basement]	Future Resident (Young Child/Adult)	Indoor Air	RME	3E-05	7E-01	N/A
			CTE	7E-06	5E-01	
260207 [Spaces 1 to 3]	Future Resident (Young Child/Adult)	Indoor Air	RME	**4E-04**	**9E+00**	(C) - 1,4-dichlorobenzene, benzene, chloroform, ethylbenzene, naphthalene, tetrachloroethene, trichloroethene
			CTE	8E-05	**6E+00**	(NC) - naphthalene, tetrachloroethene
260505 [North unit basement]	Future Resident (Young Child/Adult)	Indoor Air	RME	6E-06	6E-02	N/A
			CTE	1E-06	4E-02	
260505 [North unit 1st Floor]	Future Resident (Young Child/Adult)	Indoor Air	RME	5E-06	5E-02	N/A
			CTE	1E-06	3E-02	
260505 [South unit basement]	Future Resident (Young Child/Adult)	Indoor Air	RME	3E-05	1E-01	N/A
			CTE	5E-06	1E-01	
260902 [Basement]	Future Resident (Young Child/Adult)	Indoor Air	RME	8E-06	1E-01	N/A
			CTE	2E-06	7E-02	
260902 [1st Floor]	Future Resident (Young Child/Adult)	Indoor Air	RME	2E-06	2E-03	N/A
			CTE	4E-07	1E-03	
260903 [Basement]	Future Resident (Young Child/Adult)	Indoor Air	RME	1E-05	1E-02	N/A
			CTE	3E-06	9E-03	
260407 [Spaces 1 to 5]	Future Resident (Young Child/Adult)	Indoor Air	RME	**6E-04**	1E+00	(C) - chloroform, naphthalene
			CTE	1E-04	7E-01	

Notes
Bolded values exceed a cancer risk of 1E-04 or a target organ HI of 1.
HI - Hazard Index
RME - Reasonable Maximum Exposure
CTE - Central Tendency Exposure
(C) - Carcinogenic Risk
(NC) - Noncarcinogenic Risk
N/A - Not Applicable

TABLE 1

SELECTION OF EXPOSURE PATHWAYS

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current	Air	Indoor Air	260206	Daycare Worker	Adult	Inhalation	Quant	Volatile compounds present in shallow groundwater may impact indoor air at daycare center via migration through subslab soil gas.
				Daycare Child	Child	Inhalation	Quant	Volatile compounds present in shallow groundwater may impact indoor air at daycare center via migration through subslab soil gas.
			260207 (Space 1 and Space 3)	Storage Unit User	Adult	Inhalation	Quant	Volatile compounds present in either shallow groundwater or soil gas (from impacted soils beneath building) may impact indoor air in current building used for storage.
			260207 (Space 2)	Commercial Worker	Adult	Inhalation	Quant	Volatile compounds present in either shallow groundwater or soil gas (from impacted soils beneath building) may impact indoor air in current buiilding used for storage.
			260407	Commercial Worker	Adult	Inhalation	Quant	Volatile compounds present in shallow groundwater may impact indoor air at commercial building via migration through subslab soil gas.
			260504; 260902; 260903; 260505	Resident	Adult	Inhalation	Quant	Volatile compounds present in shallow groundwater may impact indoor air at residence via migration through subslab soil gas.
					Child	Inhalation	Quant	Volatile compounds present in shallow groundwater may impact indoor air at residence via migration through subslab soil gas.
Future	Air	Indoor Air	260207	Commercial Worker	Adult	Inhalation	Quant	Volatile compounds present in either shallow groundwater or soil gas (from impacted soils beneath building) may impact indoor air if the current building is converted for commercial use.
			260207	Resident	Adult	Inhalation	Quant	Volatile compounds present in either shallow groundwater or soil gas (from impacted soils beneath building) may impact indoor air of a future residence.
					Child	Inhalation	Quant	Volatile compounds present in either shallow groundwater or soil gas (from impacted soils beneath building) may impact indoor air of a future residence.
			260504; 260902; 260903; 260505 260407; 260206	Resident	Adult	Inhalation	Quant	Volatile compounds present in shallow groundwater may impact indoor air of a future residence via migration through subslab soil gas.
					Child	Inhalation	Quant	Volatile compounds present in shallow groundwater may impact indoor air of a future residence via migration through subslab soil gas.

TABLE 2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current/Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
260206	71-55-6	1,1,1-Trichloroethane	1.1E-01	1.1E-01	ug/m3	IA-CP-1; IA-CP-2	2 / 6	0.109	1.1E-01	N/A	5.2E+02 N	N/A	N/A	N	BSL
(a)	95-63-6	1,2,4-Trimethylbenzene	2.4E-01	2.7E+00	ug/m3	IA-CP-3	6 / 6	N/A	2.7E+00	N/A	7.3E-01 N	N/A	N/A	N	NVI
	107-06-2	1,2-Dichloroethane	1.3E-01	3.7E-01	ug/m3	IA-CP-3	5 / 6	0.081	3.7E-01	N/A	9.4E-02 C	N/A	N/A	N	NVI
	106-99-0	1,3-Butadiene	5.8E-02	1.0E-01 J	ug/m3	IA-CP-2	6 / 6	N/A	1.0E-01	N/A	8.1E-02 C	N/A	N/A	N	NVI
	106-46-7	1,4-Dichlorobenzene	1.7E-01	1.8E-01	ug/m3	IA-CP-1	3 / 6	0.12	1.8E-01	N/A	2.2E-01 C	N/A	N/A	N	BSL
	71-43-2	Benzene	6.9E-01	3.2E+00	ug/m3	IA-CP-1	6 / 6	N/A	3.2E+00	N/A	3.1E-01 C	N/A	N/A	N	NVI
	75-27-4	Bromodichloromethane	7.4E-02 J	3.2E-01	ug/m3	IA-3	4 / 6	0.134	3.2E-01	N/A	6.6E-02 C	N/A	N/A	Y	ASL
	56-23-5	Carbon tetrachloride	6.7E-01	1.5E+00	ug/m3	IA-3	6 / 6	N/A	1.5E+00	N/A	4.1E-01 C	N/A	N/A	N	NVI
	67-66-3	Chloroform	3.2E+00	5.6E+00	ug/m3	IA-CP-3	6 / 6	N/A	5.6E+00	N/A	1.1E-01 C	N/A	N/A	Y	ASL
	100-41-4	Ethylbenzene	4.9E-01	3.6E+00 J	ug/m3	IA-CP-2	6 / 6	N/A	3.6E+00	N/A	9.7E-01 C	N/A	N/A	Y	ASL
	75-09-2	Methylene chloride	2.0E+00	6.8E+00	ug/m3	IA-CP-1	4 / 6	1.74	6.8E+00	N/A	5.2E+00 C	N/A	N/A	N	NVI
	91-20-3	Naphthalene	5.5E-01 J	6.0E-01 J	ug/m3	IA-CP-3	3 / 6	0.262	6.0E-01	N/A	7.2E-02 C	N/A	N/A	N	NVI
	127-18-4	Tetrachloroethene	9.8E-01	1.2E+00	ug/m3	IA-2	6 / 6	N/A	1.2E+00	N/A	4.2E+00 N	N/A	N/A	N	BSL
	108-88-3	Toluene	3.6E+00	2.8E+01 J	ug/m3	IA-CP-2	6 / 6	N/A	2.8E+01	N/A	5.2E+02 N	N/A	N/A	N	BSL
	1330-20-7	Xylenes (total)	2.5E+00	1.9E+01	ug/m3	IA-CP-2	6 / 6	N/A	1.9E+01	N/A	1.0E+01 N	N/A	N/A	Y	ASL
260504	95-63-6	1,2,4-Trimethylbenzene	1.3E+00	3.9E+00	ug/m3	IA-1	4 / 4	N/A	3.9E+00	N/A	7.3E-01 N	N/A	N/A	N	NVI
(a)	107-06-2	1,2-Dichloroethane	1.3E-01	1.4E-01	ug/m3	IA-10M-1	2 / 4	0.081	1.4E-01	N/A	9.4E-02 C	N/A	N/A	N	NVI
	106-99-0	1,3-Butadiene	1.1E-01 J	3.5E-01	ug/m3	IA-1	4 / 4	N/A	3.5E-01	N/A	8.1E-02 C	N/A	N/A	N	NVI
	106-46-7	1,4-Dichlorobenzene	1.1E-01 J	1.1E-01 J	ug/m3	IA-1	1 / 4	0.079	1.1E-01	N/A	2.2E-01 C	N/A	N/A	N	BSL
	71-43-2	Benzene	7.3E-01	5.9E+00	ug/m3	IA-1	4 / 4	N/A	5.9E+00	N/A	3.1E-01 C	N/A	N/A	N	NVI
	56-23-5	Carbon tetrachloride	4.6E-01	5.3E-01	ug/m3	IA-1	4 / 4	N/A	5.3E-01	N/A	4.1E-01 C	N/A	N/A	N	NVI
	67-66-3	Chloroform	3.5E-01	5.8E-01	ug/m3	IA-10M-1	4 / 4	N/A	5.8E-01	N/A	1.1E-01 C	N/A	N/A	Y	ASL
	100-41-4	Ethylbenzene	7.3E-01 J	2.5E+00	ug/m3	IA-1	4 / 4	N/A	2.5E+00	N/A	9.7E-01 C	N/A	N/A	Y	ASL
	75-09-2	Methylene chloride	2.5E+00	1.2E+01 J	ug/m3	IA-10M-1	2 / 4	1.74	1.2E+01	N/A	5.2E+00 C	N/A	N/A	N	NVI
	91-20-3	Naphthalene	5.0E-01 J	1.8E+00 J	ug/m3	IA-10M-1	4 / 4	N/A	1.8E+00	N/A	7.2E-02 C	N/A	N/A	Y	ASL
	127-18-4	Tetrachloroethene	5.4E-01	7.9E-01	ug/m3	IA-10M-1	4 / 4	N/A	7.9E-01	N/A	4.2E+00 N	N/A	N/A	N	BSL
	108-88-3	Toluene	4.2E+00 J	2.5E+01	ug/m3	IA-1	4 / 4	N/A	2.5E+01	N/A	5.2E+02 N	N/A	N/A	N	BSL
	79-01-6	Trichloroethene	9.7E-02 J	9.7E-02 J	ug/m3	IA-10M-1	1 / 4	0.107	9.7E-02	N/A	2.1E-01 N	N/A	N/A	N	BSL
	1330-20-7	Xylenes (total)	3.1E+00	1.4E+01	ug/m3	IA-1	4 / 4	N/A	1.4E+01	N/A	1.0E+01 N	N/A	N/A	Y	ASL

TABLE 2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current/Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
260207	71-55-6	1,1,1-Trichloroethane	1.4E-01	2.7E+00	ug/m3	IA-15	28 / 32	0.109	2.7E+00	N/A	5.2E+02 N	N/A	N/A	N	BSL
(a)	75-34-3	1,1-Dichloroethane	8.7E-02	9.3E-01	ug/m3	IA-15	7 / 32	0.081	9.3E-01	N/A	1.5E+00 C	N/A	N/A	N	BSL
	75-35-4	1,1-Dichloroethene	1.3E-01	1.8E-01	ug/m3	IA-15	2 / 32	0.079	1.8E-01	N/A	2.1E+01 N	N/A	N/A	N	BSL
	95-63-6	1,2,4-Trimethylbenzene	1.4E-01	1.6E+00	ug/m3	IA-04	32 / 32	N/A	1.6E+00	N/A	7.3E-01 N	N/A	N/A	Y	ASL
	107-06-2	1,2-Dichloroethane	9.3E-02	8.7E-01	ug/m3	IA-10A	31 / 32	0.081	8.7E-01	N/A	9.4E-02 C	N/A	N/A	N	NVI
	106-99-0	1,3-Butadiene	3.4E-02 J	1.1E-01	ug/m3	IA-09	22 / 32	0.044	1.1E-01	N/A	8.1E-02 C	N/A	N/A	N	NVI
	106-46-7	1,4-Dichlorobenzene	1.4E-01	4.0E+01	ug/m3	IA-02	31 / 32	0.12	4.0E+01	N/A	2.2E-01 C	N/A	N/A	Y	ASL
	71-43-2	Benzene	5.2E-01	1.4E+00	ug/m3	IA-09	32 / 32	N/A	1.4E+00	N/A	3.1E-01 C	N/A	N/A	Y	ASL
	56-23-5	Carbon tetrachloride	4.0E-01	5.1E-01	ug/m3	IA-14	32 / 32	N/A	5.1E-01	N/A	4.1E-01 C	N/A	N/A	Y	ASL
	67-66-3	Chloroform	9.8E-02	4.1E-01	ug/m3	IA-14	23 / 32	0.098	4.1E-01	N/A	1.1E-01 C	N/A	N/A	Y	ASL
	156-59-2	cis-1,2-Dichloroethene	9.5E-02	1.4E+00	ug/m3	IA-15	14 / 32	0.079	1.4E+00	N/A	6.3E+00 N	N/A	N/A	N	BSL
	100-41-4	Ethylbenzene	1.3E-01	1.5E+00	ug/m3	IA-08	32 / 32	N/A	1.5E+00	N/A	9.7E-01 C	N/A	N/A	Y	ASL
	1634-04-4	Methyl tert butyl ether	6.0E-02 J	1.0E+00	ug/m3	IA-09	16 / 32	0.072	1.0E+00	N/A	9.4E+00 C	N/A	N/A	N	BSL
	75-09-2	Methylene chloride	1.7E+00	3.8E+00	ug/m3	IA-10	12 / 32	1.74	3.8E+00	N/A	5.2E+00 C	N/A	N/A	N	BSL
	91-20-3	Naphthalene	4.7E-01 J	1.6E+01	ug/m3	IA-13A	28 / 32	0.26 - 0.267	1.6E+01	N/A	7.2E-02 C	N/A	N/A	Y	ASL
	127-18-4	Tetrachloroethene	8.6E-01	8.1E+01	ug/m3	IA-11	32 / 32	N/A	8.1E+01	N/A	4.2E+00 N	N/A	N/A	Y	ASL
	108-88-3	Toluene	6.2E-01	2.1E+01	ug/m3	IA-04	32 / 32	N/A	2.1E+01	N/A	5.2E+02 N	N/A	N/A	N	BSL
	79-01-6	Trichloroethene	1.1E-01	1.0E+00	ug/m3	IA-11	22 / 32	0.107	1.0E+00	N/A	2.1E-01 N	N/A	N/A	Y	ASL
	1330-20-7	Xylenes (total)	4.2E-01	5.4E+00	ug/m3	IA-08	32 / 32	N/A	5.4E+00	N/A	1.0E+01 N	N/A	N/A	N	BSL
	N/A	C5-C8 Aliphatics	1.7E+01	1.5E+02	ug/m3	IA-14	24 / 32	12 - 32	1.5E+02	N/A	6.3E+01 N	N/A	N/A	Y	ASL
	N/A	C9-C12 Aliphatics	1.5E+01	8.7E+01	ug/m3	IA-01	14 / 32	14 - 18	8.7E+01	N/A	1.0E+01 N	N/A	N/A	Y	ASL
260505	95-63-6	1,2,4-Trimethylbenzene	1.6E-01	5.8E-01	ug/m3	IA-5O-5	10 / 10	N/A	5.8E-01	N/A	7.3E-01 N	N/A	N/A	N	BSL
(a)	107-06-2	1,2-Dichloroethane	1.2E-01	7.2E-01	ug/m3	IA-5O-4	10 / 10	N/A	7.2E-01	N/A	9.4E-02 C	N/A	N/A	N	NVI
	78-87-5	1,2-Dichloropropane	9.7E-02	1.0E-01	ug/m3	IA-5O-5	2 / 10	0.092	1.0E-01	N/A	2.4E-01 C	N/A	N/A	N	NVI
	106-99-0	1,3-Butadiene	1.2E-01	2.3E-01	ug/m3	IA-03	7 / 10	0.044	2.3E-01	N/A	8.1E-02 C	N/A	N/A	N	NVI
	71-43-2	Benzene	2.8E-01	9.9E-01	ug/m3	IA-03	10 / 10	N/A	9.9E-01	N/A	3.1E-01 C	N/A	N/A	N	NVI
	75-27-4	Bromodichloromethane	1.5E-01	1.6E-01	ug/m3	IA-5O-4	2 / 10	0.134	1.6E-01	N/A	6.6E-02 C	N/A	N/A	N	NVI
	56-23-5	Carbon tetrachloride	3.3E-01	4.9E-01	ug/m3	IA-5O-4	10 / 10	N/A	4.9E-01	N/A	4.1E-01 C	N/A	N/A	N	NVI
	67-66-3	Chloroform	1.4E-01	2.0E+00	ug/m3	IA-5O-5	10 / 10	N/A	2.0E+00	N/A	1.1E-01 C	N/A	N/A	Y	ASL
	100-41-4	Ethylbenzene	2.0E-01	1.8E+00	ug/m3	IA-5O-5	10 / 10	N/A	1.8E+00	N/A	9.7E-01 C	N/A	N/A	Y	ASL
	91-20-3	Naphthalene	1.4E-01 J	3.8E-01 J	ug/m3	IA-5O-5	5 / 10	0.131 - 0.262	3.8E-01	N/A	7.2E-02 C	N/A	N/A	Y	ASL
	127-18-4	Tetrachloroethene	2.9E-01	2.3E+00	ug/m3	IA-5O-5	7 / 10	0.136	2.3E+00	N/A	4.2E+00 N	N/A	N/A	N	BSL
	108-88-3	Toluene	1.2E+00	1.7E+01	ug/m3	IA-5O-5	10 / 10	N/A	1.7E+01	N/A	5.2E+02 N	N/A	N/A	N	BSL
	1330-20-7	Xylenes (total)	6.2E-01	3.7E+00	ug/m3	IA-5O-5	10 / 10	N/A	3.7E+00	N/A	1.0E+01 N	N/A	N/A	N	BSL
	N/A	C9-C12 Aliphatics	1.1E+02	1.1E+02	ug/m3	IA-01	1 / 1	N/A	1.1E+02	N/A	1.0E+01 N	N/A	N/A	N	NVI

TABLE 2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current/Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
260902	95-63-6	1,2,4-Trimethylbenzene	7.3E-01	1.3E+01	ug/m3	IA1	5 / 5	N/A	1.3E+01	N/A	7.3E-01 N	N/A	N/A	N	NVI
(a)	107-06-2	1,2-Dichloroethane	1.3E+00	4.7E+00	ug/m3	IA3	5 / 5	N/A	4.7E+00	N/A	9.4E-02 C	N/A	N/A	N	NVI
	106-99-0	1,3-Butadiene	8.2E-02 J	1.2E-01	ug/m3	IA3	5 / 5	N/A	1.2E-01	N/A	8.1E-02 C	N/A	N/A	N	NVI
	71-43-2	Benzene	7.4E-01	1.1E+01	ug/m3	IA1	5 / 5	N/A	1.1E+01	N/A	3.1E-01 C	N/A	N/A	N	NVI
	75-27-4	Bromodichloromethane	1.1E-01 J	1.1E-01 J	ug/m3	IA1; IA2	2 / 5	0.134	1.1E-01	N/A	6.6E-02 C	N/A	N/A	N	NVI
	56-23-5	Carbon tetrachloride	4.0E-01	5.8E-01	ug/m3	IA2	5 / 5	N/A	5.8E-01	N/A	4.1E-01 C	N/A	N/A	N	NVI
	67-66-3	Chloroform	1.9E-01	3.4E-01 J	ug/m3	IA2	5 / 5	N/A	3.4E-01	N/A	1.1E-01 C	N/A	N/A	Y	ASL
	100-41-4	Ethylbenzene	5.3E-01	1.5E+01	ug/m3	IA1	5 / 5	N/A	1.5E+01	N/A	9.7E-01 C	N/A	N/A	N	NVI
	75-09-2	Methylene chloride	7.2E+00 J	7.2E+00 J	ug/m3	IA2	1 / 5	1.74	7.2E+00	N/A	5.2E+00 C	N/A	N/A	N	NVI
	91-20-3	Naphthalene	3.4E-01 J	3.4E-01 J	ug/m3	IA2	1 / 5	0.131 - 0.723	3.4E-01	N/A	7.2E-02 C	N/A	N/A	Y	ASL
	127-18-4	Tetrachloroethene	1.1E-01 J	2.6E-01	ug/m3	IA3	4 / 5	0.136	2.6E-01	N/A	4.2E+00 N	N/A	N/A	N	BSL
	108-88-3	Toluene	4.1E+00	6.6E+01	ug/m3	IA1	5 / 5	N/A	6.6E+01	N/A	5.2E+02 N	N/A	N/A	N	BSL
	1330-20-7	Xylenes (total)	2.2E+00	6.7E+01	ug/m3	IA1	5 / 5	N/A	6.7E+01	N/A	1.0E+01 N	N/A	N/A	N	NVI
	N/A	C5-C8 Aliphatics	8.4E+01	5.9E+02	ug/m3	IA1	5 / 5	N/A	5.9E+02	N/A	6.3E+01 N	N/A	N/A	N	NVI
	N/A	C9-C12 Aliphatics	5.2E+01	1.7E+02	ug/m3	IA3	5 / 5	N/A	1.7E+02	N/A	1.0E+01 N	N/A	N/A	N	NVI
	N/A	C9-C10 Aromatics	1.4E+01	6.7E+01	ug/m3	IA1	3 / 5	10	6.7E+01	N/A	1.0E+01 N	N/A	N/A	N	NVI
260903	71-55-6	1,1,1-Trichloroethane	1.1E-01	1.6E-01	ug/m3	IA1	4 / 4	N/A	1.6E-01	N/A	5.2E+02 N	N/A	N/A	N	BSL
(a)	95-63-6	1,2,4-Trimethylbenzene	6.2E-01	8.9E-01	ug/m3	IA2	4 / 4	N/A	8.9E-01	N/A	7.3E-01 N	N/A	N/A	N	NVI
	107-06-2	1,2-Dichloroethane	1.2E+00	8.0E+00	ug/m3	IA1	4 / 4	N/A	8.0E+00	N/A	9.4E-02 C	N/A	N/A	N	NVI
	78-87-5	1,2-Dichloropropane	4.9E-01	5.1E-01	ug/m3	IA1	2 / 4	0.092	5.1E-01	N/A	2.4E-01 C	N/A	N/A	N	NVI
	106-99-0	1,3-Butadiene	4.4E-02	5.3E-02	ug/m3	IA1	4 / 4	N/A	5.3E-02	N/A	8.1E-02 C	N/A	N/A	N	BSL
	106-46-7	1,4-Dichlorobenzene	9.9E-01	3.2E+00	ug/m3	IA1	4 / 4	N/A	3.2E+00	N/A	2.2E-01 C	N/A	N/A	N	NVI
	71-43-2	Benzene	5.0E-01	6.8E-01	ug/m3	IA2	4 / 4	N/A	6.8E-01	N/A	3.1E-01 C	N/A	N/A	N	NVI
	75-27-4	Bromodichloromethane	1.4E-01	1.4E-01	ug/m3	IA1	2 / 4	0.134	1.4E-01	N/A	6.6E-02 C	N/A	N/A	N	NVI
	56-23-5	Carbon tetrachloride	6.2E-01	7.2E-01	ug/m3	IA2	4 / 4	N/A	7.2E-01	N/A	4.1E-01 C	N/A	N/A	N	NVI
	67-66-3	Chloroform	5.9E-01	1.4E+00	ug/m3	IA2	4 / 4	N/A	1.4E+00	N/A	1.1E-01 C	N/A	N/A	Y	ASL
	100-41-4	Ethylbenzene	5.6E-01	8.8E-01	ug/m3	IA2	4 / 4	N/A	8.8E-01	N/A	9.7E-01 C	N/A	N/A	N	BSL
	91-20-3	Naphthalene	2.9E-01 J	3.7E-01 J	ug/m3	IA1	2 / 4	0.262	3.7E-01	N/A	7.2E-02 C	N/A	N/A	N	NVI
	127-18-4	Tetrachloroethene	5.5E-01	1.1E+00	ug/m3	IA2	4 / 4	N/A	1.1E+00	N/A	4.2E+00 N	N/A	N/A	N	BSL
	108-88-3	Toluene	4.4E+00	5.2E+00	ug/m3	IA1	4 / 4	N/A	5.2E+00	N/A	5.2E+02 N	N/A	N/A	N	BSL
	1330-20-7	Xylenes (total)	1.9E+00	3.0E+00	ug/m3	IA2	4 / 4	N/A	3.0E+00	N/A	1.0E+01 N	N/A	N/A	N	BSL
	N/A	C5-C8 Aliphatics	1.1E+02	1.5E+02	ug/m3	IA2	4 / 4	N/A	1.5E+02	N/A	6.3E+01 N	N/A	N/A	N	NVI
	N/A	C9-C12 Aliphatics	5.6E+01	8.3E+01	ug/m3	IA1	4 / 4	N/A	8.3E+01	N/A	1.0E+01 N	N/A	N/A	N	NVI

TABLE 2
OCCURRENCE, DISTRIBUTION AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current/Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value	Screening Toxicity Value (N/C) (3)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
260407	71-55-6	1,1,1-Trichloroethane	1.5E-01	3.1E+00	ug/m^3	20-IA1	7 / 10	0.109	3.1E+00	N/A	5.2E+02 N	N/A	N/A	N	BSL
(a)	95-63-6	1,2,4-Trimethylbenzene	4.2E-01	2.4E+00	ug/m^3	19-IA1	10 / 10	N/A	2.4E+00	N/A	7.3E-01 N	N/A	N/A	N	NVI
	107-06-2	1,2-Dichloroethane	1.6E-01	2.0E+01	ug/m^3	20-IA1	10 / 10	N/A	2.0E+01	N/A	9.4E-02 C	N/A	N/A	N	NVI
	106-99-0	1,3-Butadiene	3.9E-02 J	2.1E-01	ug/m^3	19-IA1	8 / 10	0.044	2.1E-01	N/A	8.1E-02 C	N/A	N/A	N	NVI
	106-46-7	1,4-Dichlorobenzene	1.2E+00	3.2E+00	ug/m^3	19-IA1	2 / 10	0.12	3.2E+00	N/A	2.2E-01 C	N/A	N/A	N	NVI
	67-64-1	Acetone	5.6E+01 J	8.7E+03	ug/m^3	17-IA1	10 / 10	N/A	8.7E+03	N/A	3.2E+03 N	N/A	N/A	Y	ASL
	71-43-2	Benzene	6.3E-01	9.4E-01	ug/m^3	20-IA1	10 / 10	N/A	9.4E-01	N/A	3.1E-01 C	N/A	N/A	N	NVI
	75-27-4	Bromodichloromethane	8.0E-02 J	8.0E-02 J	ug/m^3	20-IA1	1 / 10	0.067 - 0.134	8.0E-02	N/A	6.6E-02 C	N/A	N/A	N	NVI
	56-23-5	Carbon tetrachloride	3.9E-01	6.5E-01	ug/m^3	17-IA1	10 / 10	N/A	6.5E-01	N/A	4.1E-01 C	N/A	N/A	N	NVI
	108-90-7	Chlorobenzene	9.7E-02	2.0E-01	ug/m^3	19-IA1	2 / 10	0.092	2.0E-01	N/A	5.2E+00 N	N/A	N/A	N	BSL
	67-66-3	Chloroform	1.9E-01	6.3E+01	ug/m^3	22-IA2	10 / 10	N/A	6.3E+01	N/A	1.1E-01 C	N/A	N/A	Y	ASL
	141-78-6	Ethyl Acetate	4.8E+00	3.7E+02	ug/m^3	17-IA1	10 / 10	N/A	3.7E+02	N/A	NS	N/A	N/A	N	NVI
	100-41-4	Ethylbenzene	4.3E-01	1.5E+00	ug/m^3	20-IA1	10 / 10	N/A	1.5E+00	N/A	9.7E-01 C	N/A	N/A	N	NVI
	75-09-2	Methylene chloride	3.2E+00	5.0E+00	ug/m^3	20-IA1	5 / 10	1.74	5.0E+00	N/A	5.2E+00 C	N/A	N/A	N	BSL
	91-20-3	Naphthalene	1.7E-01 J	6.2E-01 J	ug/m^3	19-IA1	5 / 10	0.32 - 0.581	6.2E-01	N/A	7.2E-02 C	N/A	N/A	Y	ASL
	127-18-4	Tetrachloroethene	1.5E-01	6.3E-01	ug/m^3	22-IA2	10 / 10	N/A	6.3E-01	N/A	4.2E+00 N	N/A	N/A	N	BSL
	108-88-3	Toluene	8.6E+00	7.1E+01	ug/m^3	17-IA1	10 / 10	N/A	7.1E+01	N/A	5.2E+02 N	N/A	N/A	N	BSL
	79-01-6	Trichloroethene	1.1E-01	1.1E-01	ug/m^3	22-IA1	3 / 10	0.107	1.1E-01	N/A	2.1E-01 N	N/A	N/A	N	BSL
	1330-20-7	Xylenes (total)	1.5E+00	6.9E+00	ug/m^3	20-IA1	10 / 10	N/A	6.9E+00	N/A	1.0E+01 N	N/A	N/A	N	BSL
	N/A	C5-C8 Aliphatics	1.3E+02	2.2E+03	ug/m^3	17-IA1	10 / 10	N/A	2.2E+03	N/A	6.3E+01 N	N/A	N/A	N	NVI
	N/A	C9-C12 Aliphatics	2.8E+01	4.6E+02	ug/m^3	17-IA1	10 / 10	N/A	4.6E+02	N/A	1.0E+01 N	N/A	N/A	N	NVI
	N/A	C9-C10 Aromatics	1.0E+01	1.5E+01	ug/m^3	20-IA1	5 / 10	10	1.5E+01	N/A	1.0E+01 N	N/A	N/A	N	NVI

(a) Refer to text for sample groupings.
(1) J = Estimated Value
(2) Maximum concentration used for screening.
(3) ORNL Regional Screening Levels for residential air (adjusted to an hazard quotient = 0.1 for noncarcinogens), November 2011.
RSL for trans-1,2-dichloroethene used for cis-1,2-dichloroethene
(4) Rationale Codes:
Selection Reason: Above Screening Levels (ASL)
No Screening Level (NSL)
Deletion Reason: No Toxicity Information (NTX)
Below Screening Level (BSL)
Not present as a result of vapor intrusion pathway (NVI)

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

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260206 Space 3	Bromodichloromethane	ug/m^3	1.9E-01	N/A	3.2E-01	3.2E-01	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	4.2E+00	N/A	5.3E+00	5.3E+00	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	2.0E+00	N/A	3.5E+00 J	3.5E+00	ug/m^3	Maximum Concentration	(a)
	Xylenes (total)	ug/m^3	1.1E+01	N/A	1.9E+01	1.9E+01	ug/m^3	Maximum Concentration	(a)
260206 Space 1	Bromodichloromethane	ug/m^3	1.9E-01	N/A	3.2E-01	3.2E-01	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	4.2E+00	N/A	5.0E+00	5.0E+00	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	2.1E+00	N/A	3.6E+00 J	3.6E+00	ug/m^3	Maximum Concentration	(a)
	Xylenes (total)	ug/m^3	1.1E+01	N/A	1.9E+01	1.9E+01	ug/m^3	Maximum Concentration	(a)
260206 Space 2	Bromodichloromethane	ug/m^3	1.9E-01	N/A	3.2E-01	3.2E-01	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	4.8E+00	N/A	5.6E+00	5.6E+00	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	2.0E+00	N/A	3.6E+00 J	3.6E+00	ug/m^3	Maximum Concentration	(a)
	Xylenes (total)	ug/m^3	1.1E+01	N/A	1.9E+01	1.9E+01	ug/m^3	Maximum Concentration	(a)
260504 Basement (IA-1, 2)	Chloroform	ug/m^3	4.8E-01	N/A	5.8E-01	5.8E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	1.6E+00	N/A	2.5E+00	2.5E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.2E+00	N/A	1.8E+00 J	1.8E+00	ug/m^3	Maximum Concentration	(a)
	Xylenes (total)	ug/m^3	8.5E+00	N/A	1.4E+01	1.4E+01	ug/m^3	Maximum Concentration	(a)

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260207									
Space 2	1,2,4-Trimethylbenzene	ug/m^3	8.5E-01	N/A	1.4E+00	1.4E+00	ug/m^3	Maximum Concentration	(a)
	1,4-Dichlorobenzene	ug/m^3	2.5E+00	N/A	4.2E+00	4.2E+00	ug/m^3	Maximum Concentration	(a)
	Benzene	ug/m^3	8.5E-01	N/A	1.1E+00	1.1E+00	ug/m^3	Maximum Concentration	(a)
	Carbon tetrachloride	ug/m^3	4.8E-01	N/A	5.1E-01	5.1E-01	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	2.2E-01	N/A	4.1E-01	4.1E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	9.2E-01	N/A	1.5E+00	1.5E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.4E+00	N/A	2.7E+00	2.7E+00	ug/m^3	Maximum Concentration	(a)
	Tetrachloroethene	ug/m^3	1.7E+01	N/A	1.8E+01	1.8E+01	ug/m^3	Maximum Concentration	(a)
	Trichloroethene	ug/m^3	9.1E-02	N/A	1.4E-01	1.4E-01	ug/m^3	Maximum Concentration	(a)
	C5-C8 Aliphatics	ug/m^3	1.1E+02	N/A	1.5E+02	1.5E+02	ug/m^3	Maximum Concentration	(a)
	C9-C12 Aliphatics	ug/m^3	4.3E+01	N/A	8.2E+01	8.2E+01	ug/m^3	Maximum Concentration	(a)
260207									
Space 3	1,2,4-Trimethylbenzene	ug/m^3	6.6E-01	9.3E-01 (LN)	1.6E+00	9.3E-01	ug/m^3	95% H-UCL	
	1,4-Dichlorobenzene	ug/m^3	2.2E+00	3.5E+00 (G)	1.2E+01	3.5E+00	ug/m^3	95% Approx. Gamma UCL	
	Benzene	ug/m^3	7.8E-01	8.5E-01 (N)	1.2E+00	8.5E-01	ug/m^3	95% Student's-t UCL	
	Carbon tetrachloride	ug/m^3	4.5E-01	4.6E-01 (N)	5.0E-01	4.6E-01	ug/m^3	95% Student's-t UCL	
	Chloroform	ug/m^3	1.3E-01	1.6E-01 (NP)	2.9E-01	1.6E-01	ug/m^3	95% KM (BCA) UCL	
	Ethylbenzene	ug/m^3	6.0E-01	7.3E-01 (G)	1.1E+00	7.3E-01	ug/m^3	95% Approx. Gamma UCL	
	Naphthalene	ug/m^3	2.8E+00	6.2E+00 (NP)	1.6E+01	6.2E+00	ug/m^3	95% KM (Chebyshev) UCL	
	Tetrachloroethene	ug/m^3	3.6E+01	4.4E+01 (N)	8.1E+01	4.4E+01	ug/m^3	95% Student's-t UCL	
	Trichloroethene	ug/m^3	2.9E-01	5.1E-01 (NP)	1.0E+00	5.1E-01	ug/m^3	95% KM (Chebyshev) UCL	
	C5-C8 Aliphatics	ug/m^3	3.6E+01	4.3E+01 (NP)	6.6E+01	4.3E+01	ug/m^3	95% KM (t) UCL	
	C9-C12 Aliphatics	ug/m^3	2.0E+01	3.2E+01 (NP)	7.3E+01	3.2E+01	ug/m^3	95% KM (t) UCL	

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260207									
Space 1	1,2,4-Trimethylbenzene	ug/m3	6.3E-01	1.1E+00 (G)	1.2E+00	1.1E+00	ug/m3	95% Approx. Gamma UCL	
	1,4-Dichlorobenzene	ug/m3	1.2E+01	3.8E+01 (NP)	4.0E+01	3.8E+01	ug/m3	95% KM (Chebyshev) UCL	
	Benzene	ug/m3	7.8E-01	1.0E+00 (G)	1.4E+00	1.0E+00	ug/m3	95% Approx. Gamma UCL	
	Carbon tetrachloride	ug/m3	4.6E-01	4.9E-01 (G)	4.9E-01	4.9E-01	ug/m3	95% Approx. Gamma UCL	
	Chloroform	ug/m3	1.3E-01	2.2E-01 (NP)	2.6E-01	2.2E-01	ug/m3	95% KM (t) UCL	
	Ethylbenzene	ug/m3	5.9E-01	8.3E-01 (N)	1.1E+00	8.3E-01	ug/m3	95% Student's-t UCL	
	Naphthalene	ug/m3	1.1E+00	1.7E+00 (NP)	2.3E+00	1.7E+00	ug/m3	95% KM (% Bootstrap) UCL	
	Tetrachloroethene	ug/m3	3.7E+00	5.3E+00 (N)	8.8E+00	5.3E+00	ug/m3	95% Student's-t UCL	
	Trichloroethene	ug/m3	6.8E-02	N/A	1.1E-01	1.1E-01	ug/m3	Maximum Concentration	(b)
	C5-C8 Aliphatics	ug/m3	3.7E+01	6.4E+01 (NP)	7.0E+01	6.4E+01	ug/m3	95% KM (t) UCL	
	C9-C12 Aliphatics	ug/m3	3.3E+01	7.6E+01 (NP)	8.7E+01	7.6E+01	ug/m3	95% KM (t) UCL	
260505									
North unit basement (IA-1, 2)									
	Chloroform	ug/m3	2.3E-01	N/A	2.5E-01	2.5E-01	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	5.3E-01	N/A	6.1E-01	6.1E-01	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	1.5E-01	N/A	1.9E-01 J	1.9E-01	ug/m3	Maximum Concentration	(a)
260505									
North unit 1st floor (IA-3)									
	Chloroform	ug/m3	2.0E-01	N/A	2.5E-01	2.5E-01	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	4.1E-01	N/A	6.3E-01	6.3E-01	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	1.3E-01	N/A	1.4E-01 J	1.4E-01	ug/m3	Maximum Concentration	(a)
260505									
South unit Basement (IA-4, 5)									
	Chloroform	ug/m3	1.4E+00	N/A	2.0E+00	2.0E+00	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	1.1E+00	N/A	1.8E+00	1.8E+00	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	2.2E-01	N/A	3.8E-01 J	3.8E-01	ug/m3	Maximum Concentration	(a)

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260902 Basement (IA-1, 2)									
	Chloroform	ug/m3	2.6E-01	N/A	3.4E-01 J	3.4E-01	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	2.6E-01	N/A	3.4E-01 J	3.4E-01	ug/m3	Maximum Concentration	(a)
260902 1st Floor (IA-3)									
	Chloroform	ug/m3	N/A	N/A	2.3E-01	2.3E-01	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	N/A	N/A	ND	ND	ug/m3		
260903 Basement (IA-1, 2)									
	Chloroform	ug/m3	9.5E-01	N/A	1.4E+00	1.4E+00	ug/m3	Maximum Concentration	(a)
260407 Space 1									
	Acetone	ug/m3	6.1E+03	N/A	8.7E+03	8.7E+03	ug/m3	Maximum Concentration	(a)
	Chloroform	ug/m3	4.0E-01	N/A	4.5E-01	4.5E-01	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	2.2E-01	N/A	2.7E-01 J	2.7E-01	ug/m3	Maximum Concentration	(a)
260407 Space 2									
	Acetone	ug/m3	1.5E+02	N/A	2.4E+02	2.4E+02	ug/m3	Maximum Concentration	(a)
	Chloroform	ug/m3	4.1E-01	N/A	6.3E-01 J	6.3E-01	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	4.5E-01	N/A	6.2E-01 J	6.2E-01	ug/m3	Maximum Concentration	(a)
260407 Space 3									
	Acetone	ug/m3	1.5E+02	N/A	2.1E+02	2.1E+02	ug/m3	Maximum Concentration	(a)
	Chloroform	ug/m3	7.3E-01	N/A	8.3E-01	8.3E-01	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	2.9E-01	N/A	3.5E-01 J	3.5E-01	ug/m3	Maximum Concentration	(a)

TABLE 3.1.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point (1)	Chemical of Potential Concern	Units	Arithmetic Mean (1)	95% UCL (Distribution) (2)	Maximum Concentration (Qualifier) (3)	Exposure Point Concentration			
						Value	Units	Statistic (4)	Rationale (5)
260407 Space 4									
	Acetone	ug/m^3	1.8E+02	N/A	2.3E+02	2.3E+02	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	1.2E+00	N/A	1.2E+00	1.2E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.2E-01	N/A	2.6E-01 J	2.6E-01	ug/m^3	Maximum Concentration	(a)
260407 Space 5									
	Acetone	ug/m^3	6.7E+02	N/A	1.1E+03	1.1E+03	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	3.5E+01	N/A	6.3E+01	6.3E+01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.8E-01	N/A	1.7E-01 J	1.7E-01	ug/m^3	Maximum Concentration	(a)

Notes:
(1) Arithmetic means were calculated assuming 1/2 the detection limit for non-detects. N/A = Not applicable.
(2) UCL calculations were performed using ProUCL software version 4.1, developed by Lockheed-Martin for USEPA.
NP = Non-parametric; N = Normal; LN = Lognormal; G = Gamma; N/A = Not applicable.
(3) J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
(4) 95% Student's-t UCL = Calculated using a normal Student's t approximation procedure.
95% Modified-t UCL = Calculated using a modified Student's t approximation procedure.
95% Approx. Gamma UCL = Calculated using an Approximate Gamma distribution procedure.
95% H-UCL = Calculated using Land's H-stat for lognormal distributions.
95% Chebyshev (Mean, Sd) UCL = Calculated using Chebyshev inequality non-parametric procedure.
95% KM (t) UCL = Calculated using 95% Kaplan Meier (Student's t approximation) non-parametric procedure.
95% KM (BCA) UCL = Calculated using 95% Kaplan Meier (Bias-corrected accelerated bootstrap) non-parametric procedure.
95% KM (Chebyshev) UCL = Calculated using 95% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
95% KM (% Bootstrap) UCL = Calculated using 95% Kaplan Meier (Percentile Bootstrap) non-parametric procedure.
97.5% KM (Chebyshev) UCL = Calculated using 97.5% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
99% KM (Chebyshev) UCL = Calculated using 99% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
(5) For data sets with multiple detection limits for non-detects, the use of the Kaplan Meier non-parametric test procedure is recommended and used to calculate an appropriate UCL. For the Kaplan Meier test procedure, the type of data distribution was determined using a series of tests (Shapiro-Wilk, Kolmogorov-Smirnov, Anderson-Darling) for normal, lognormal, or gamma data distributions. The results of these distribution tests determined which UCL calculation was performed.
(a) Due to small sample size, the maximum detected concentration is used.
(b) Maximum detected concentration used for EPC due to the low number of detections.

ND = Non-detect
NC = Not calculated
N/A = Not Applicable
UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
RME = Reasonable Maximum Exposure
CT = Central Tendency

TABLE 3.1.CT
EXPOSURE POINT CONCENTRATION SUMMARY
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260206 Space 3									
	Bromodichloromethane	ug/m3	1.9E-01	N/A	3.2E-01	3.2E-01	ug/m3	Maximum Concentration	(a)
	Chloroform	ug/m3	4.2E+00	N/A	5.3E+00	5.3E+00	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	2.0E+00	N/A	3.5E+00 J	3.5E+00	ug/m3	Maximum Concentration	(a)
	Xylenes (total)	ug/m3	1.1E+01	N/A	1.9E+01	1.9E+01	ug/m3	Maximum Concentration	(a)
260206 Space 1									
	Bromodichloromethane	ug/m3	1.9E-01	N/A	3.2E-01	3.2E-01	ug/m3	Maximum Concentration	(a)
	Chloroform	ug/m3	4.2E+00	N/A	5.0E+00	5.0E+00	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	2.1E+00	N/A	3.6E+00 J	3.6E+00	ug/m3	Maximum Concentration	(a)
	Xylenes (total)	ug/m3	1.1E+01	N/A	1.9E+01	1.9E+01	ug/m3	Maximum Concentration	(a)
260206 Space 2									
	Bromodichloromethane	ug/m3	1.9E-01	N/A	3.2E-01	3.2E-01	ug/m3	Maximum Concentration	(a)
	Chloroform	ug/m3	4.8E+00	N/A	5.6E+00	5.6E+00	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	2.0E+00	N/A	3.6E+00 J	3.6E+00	ug/m3	Maximum Concentration	(a)
	Xylenes (total)	ug/m3	1.1E+01	N/A	1.9E+01	1.9E+01	ug/m3	Maximum Concentration	(a)
260504 Basement (IA-1, 2)									
	Chloroform	ug/m3	4.8E-01	N/A	5.8E-01	5.8E-01	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	1.6E+00	N/A	2.5E+00	2.5E+00	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	1.2E+00	N/A	1.8E+00 J	1.8E+00	ug/m3	Maximum Concentration	(a)
	Xylenes (total)	ug/m3	8.5E+00	N/A	1.4E+01	1.4E+01	ug/m3	Maximum Concentration	(a)

TABLE 3.1.CT
EXPOSURE POINT CONCENTRATION SUMMARY
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260207									
Space 2	1,2,4-Trimethylbenzene	ug/m^3	8.5E-01	N/A	1.4E+00	1.4E+00	ug/m^3	Maximum Concentration	(a)
	1,4-Dichlorobenzene	ug/m^3	2.5E+00	N/A	4.2E+00	4.2E+00	ug/m^3	Maximum Concentration	(a)
	Benzene	ug/m^3	8.5E-01	N/A	1.1E+00	1.1E+00	ug/m^3	Maximum Concentration	(a)
	Carbon tetrachloride	ug/m^3	4.8E-01	N/A	5.1E-01	5.1E-01	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	2.2E-01	N/A	4.1E-01	4.1E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	9.2E-01	N/A	1.5E+00	1.5E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.4E+00	N/A	2.7E+00	2.7E+00	ug/m^3	Maximum Concentration	(a)
	Tetrachloroethene	ug/m^3	1.7E+01	N/A	1.8E+01	1.8E+01	ug/m^3	Maximum Concentration	(a)
	Trichloroethene	ug/m^3	9.1E-02	N/A	1.4E-01	1.4E-01	ug/m^3	Maximum Concentration	(a)
	C5-C8 Aliphatics	ug/m^3	1.1E+02	N/A	1.5E+02	1.5E+02	ug/m^3	Maximum Concentration	(a)
	C9-C12 Aliphatics	ug/m^3	4.3E+01	N/A	8.2E+01	8.2E+01	ug/m^3	Maximum Concentration	(a)
260207									
Space 3	1,2,4-Trimethylbenzene	ug/m^3	6.6E-01	9.3E-01 (NP)	1.6E+00	9.3E-01	ug/m^3	95% H-UCL	
	1,4-Dichlorobenzene	ug/m^3	2.2E+00	3.5E+00 (G)	1.2E+01	3.5E+00	ug/m^3	95% Approx. Gamma UCL	
	Benzene	ug/m^3	7.8E-01	8.5E-01 (N)	1.2E+00	8.5E-01	ug/m^3	95% Student's-t UCL	
	Carbon tetrachloride	ug/m^3	4.5E-01	4.6E-01 (N)	5.0E-01	4.6E-01	ug/m^3	95% Student's-t UCL	
	Chloroform	ug/m^3	1.3E-01	1.6E-01 (NP)	2.9E-01	1.6E-01	ug/m^3	95% KM (BCA) UCL	
	Ethylbenzene	ug/m^3	6.0E-01	7.3E-01 (G)	1.1E+00	7.3E-01	ug/m^3	95% Approx. Gamma UCL	
	Naphthalene	ug/m^3	2.8E+00	6.2E+00 (NP)	1.6E+01	6.2E+00	ug/m^3	95% KM (Chebyshev) UCL	
	Tetrachloroethene	ug/m^3	3.6E+01	4.4E+01 (N)	8.1E+01	4.4E+01	ug/m^3	95% Student's-t UCL	
	Trichloroethene	ug/m^3	2.9E-01	5.1E-01 (NP)	1.0E+00	5.1E-01	ug/m^3	95% KM (Chebyshev) UCL	
	C5-C8 Aliphatics	ug/m^3	3.6E+01	4.3E+01 (NP)	6.6E+01	4.3E+01	ug/m^3	95% KM (t) UCL	
	C9-C12 Aliphatics	ug/m^3	2.0E+01	3.2E+01 (NP)	7.3E+01	3.2E+01	ug/m^3	95% KM (t) UCL	

TABLE 3.1.CT
EXPOSURE POINT CONCENTRATION SUMMARY
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260207									
Space 1	1,2,4-Trimethylbenzene	ug/m^3	6.3E-01	1.1E+00 (G)	1.2E+00	1.1E+00	ug/m^3	95% Approx. Gamma UCL	
	1,4-Dichlorobenzene	ug/m^3	1.2E+01	3.8E+01 (NP)	4.0E+01	3.8E+01	ug/m^3	95% KM (Chebyshev) UCL	
	Benzene	ug/m^3	7.8E-01	1.0E+00 (G)	1.4E+00	1.0E+00	ug/m^3	95% Approx. Gamma UCL	
	Carbon tetrachloride	ug/m^3	4.6E-01	4.9E-01 (G)	4.9E-01	4.9E-01	ug/m^3	95% Approx. Gamma UCL	
	Chloroform	ug/m^3	1.3E-01	2.2E-01 (NP)	2.6E-01	2.2E-01	ug/m^3	95% KM (t) UCL	
	Ethylbenzene	ug/m^3	5.9E-01	8.3E-01 (N)	1.1E+00	8.3E-01	ug/m^3	95% Student's-t UCL	
	Naphthalene	ug/m^3	1.1E+00	1.7E+00 (NP)	2.3E+00	1.7E+00	ug/m^3	95% KM (% Bootstrap) UCL	
	Tetrachloroethene	ug/m^3	3.7E+00	5.3E+00 (N)	8.8E+00	5.3E+00	ug/m^3	95% Student's-t UCL	
	Trichloroethene	ug/m^3	6.8E-02	N/A	1.1E-01	1.1E-01	ug/m^3	Maximum Concentration	(b)
	C5-C8 Aliphatics	ug/m^3	3.7E+01	6.4E+01 (NP)	7.0E+01	6.4E+01	ug/m^3	95% KM (t) UCL	
	C9-C12 Aliphatics	ug/m^3	3.3E+01	7.6E+01 (NP)	8.7E+01	7.6E+01	ug/m^3	95% KM (t) UCL	
260505									
North unit basement (IA-1, 2)									
	Chloroform	ug/m^3	2.3E-01	N/A	2.5E-01	2.5E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	5.3E-01	N/A	6.1E-01	6.1E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.5E-01	N/A	1.9E-01 J	1.9E-01	ug/m^3	Maximum Concentration	(a)
260505									
North unit 1st floor (IA-3)									
	Chloroform	ug/m^3	2.0E-01	N/A	2.5E-01	2.5E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	4.1E-01	N/A	6.3E-01	6.3E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.3E-01	N/A	1.4E-01 J	1.4E-01	ug/m^3	Maximum Concentration	(a)
260505									
South unit Basement (IA-4, 5)									
	Chloroform	ug/m^3	1.4E+00	N/A	2.0E+00	2.0E+00	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	1.1E+00	N/A	1.8E+00	1.8E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.2E-01	N/A	3.8E-01 J	3.8E-01	ug/m^3	Maximum Concentration	(a)

TABLE 3.1.CT
EXPOSURE POINT CONCENTRATION SUMMARY
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260902 Basement (IA-1, 2)									
	Chloroform	ug/m^3	2.6E-01	N/A	3.4E-01 J	3.4E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.6E-01	N/A	3.4E-01 J	3.4E-01	ug/m^3	Maximum Concentration	(a)
260902 1st Floor (IA-3)									
	Chloroform	ug/m^3	N/A	N/A	2.3E-01	2.3E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	N/A	N/A	ND	ND	ug/m^3		
260903 Basement (IA-1, 2)									
	Chloroform	ug/m^3	9.5E-01	N/A	1.4E+00	1.4E+00	ug/m^3	Maximum Concentration	(a)
260407 Space 1									
	Acetone	ug/m^3	6.1E+03	N/A	8.7E+03	8.7E+03	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	4.0E-01	N/A	4.5E-01	4.5E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.2E-01	N/A	2.7E-01 J	2.7E-01	ug/m^3	Maximum Concentration	(a)
260407 Space 2									
	Acetone	ug/m^3	1.5E+02	N/A	2.4E+02	2.4E+02	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	4.1E-01	N/A	6.3E-01 J	6.3E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	4.5E-01	N/A	6.2E-01 J	6.2E-01	ug/m^3	Maximum Concentration	(a)
260407 Space 3									
	Acetone	ug/m^3	1.5E+02	N/A	2.1E+02	2.1E+02	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	7.3E-01	N/A	8.3E-01	8.3E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.9E-01	N/A	3.5E-01 J	3.5E-01	ug/m^3	Maximum Concentration	(a)

TABLE 3.1.CT
EXPOSURE POINT CONCENTRATION SUMMARY
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260407 Space 4									
	Acetone	ug/m^3	1.8E+02	N/A	2.3E+02	2.3E+02	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	1.2E+00	N/A	1.2E+00	1.2E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.2E-01	N/A	2.6E-01 J	2.6E-01	ug/m^3	Maximum Concentration	(a)
260407 Space 5									
	Acetone	ug/m^3	6.7E+02	N/A	1.1E+03	1.1E+03	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	3.5E+01	N/A	6.3E+01	6.3E+01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.8E-01	N/A	1.7E-01 J	1.7E-01	ug/m^3	Maximum Concentration	(a)

Notes:
(1) Arithmetic means were calculated assuming 1/2 the detection limit for non-detects. N/A = Not applicable.
(2) UCL calculations were performed using ProUCL software version 4.1, developed by Lockheed-Martin for USEPA.
NP = Non-parametric; N = Normal; LN = Lognormal; G = Gamma; N/A = Not applicable.
(3) J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
(4) 95% Student's-t UCL = Calculated using a normal Student's t approximation procedure.
95% Modified-t UCL = Calculated using a modified Student's t approximation procedure.
95% Approx. Gamma UCL = Calculated using an Approximate Gamma distribution procedure.
95% H-UCL = Calculated using Land's H-stat for lognormal distributions.
95% Chebyshev (Mean, Sd) UCL = Calculated using Chebyshev inequality non-parametric procedure.
95% KM (t) UCL = Calculated using 95% Kaplan Meier (Student's t approximation) non-parametric procedure.
95% KM (BCA) UCL = Calculated using 95% Kaplan Meier (Bias-corrected accelerated bootstrap) non-parametric procedure.
95% KM (Chebyshev) UCL = Calculated using 95% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
95% KM (% Bootstrap) UCL = Calculated using 95% Kaplan Meier (Percentile Bootstrap) non-parametric procedure.
97.5% KM (Chebyshev) UCL = Calculated using 97.5% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
99% KM (Chebyshev) UCL = Calculated using 99% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
(5) For data sets with multiple detection limits for non-detects, the use of the Kaplan Meier non-parametric test procedure is recommended and used to calculate an appropriate UCL. For the Kaplan Meier test procedure, the type of data distribution was determined using a series of tests (Shapiro-Wilk, Kolmogorov-Smirnov, Anderson-Darling) for normal, lognormal, or gamma data distributions. The results of these distribution tests determined which UCL calculation was performed.
(a) Due to small sample size, the maximum detected concentration is used.
(b) Maximum detected concentration used for EPC due to the low number of detections.

ND = Non-detect
NC = Not calculated
N/A = Not Applicable
UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
RME = Reasonable Maximum Exposure
CT = Central Tendency

TABLE 3.2.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)
260206									
All Samples (Spaces 1 to 3)									
	Bromodichloromethane	ug/m^3	1.9E-01	N/A	3.2E-01	3.2E-01	ug/m^3	Maximum Concentration	(a)
	Chloroform	ug/m^3	4.4E+00	N/A	5.6E+00	5.6E+00	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	2.0E+00	N/A	3.6E+00 J	3.6E+00	ug/m^3	Maximum Concentration	(a)
	Xylenes (total)	ug/m^3	1.1E+01	N/A	1.9E+01	1.9E+01	ug/m^3	Maximum Concentration	(a)
260504									
Basement (IA-1, 2)									
	Chloroform	ug/m^3	4.8E-01	N/A	5.8E-01	5.8E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	1.6E+00	N/A	2.5E+00	2.5E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.2E+00	N/A	1.8E+00 J	1.8E+00	ug/m^3	Maximum Concentration	(a)
	Xylenes (total)	ug/m^3	8.5E+00	N/A	1.4E+01	1.4E+01	ug/m^3	Maximum Concentration	(a)
260207									
All Samples (Spaces 1 to 3)	1,2,4-Trimethylbenzene	ug/m^3	6.8E-01	N/A	1.6E+00	1.6E+00	ug/m^3	Maximum Concentration	(c)
	1,4-Dichlorobenzene	ug/m^3	4.8E+00	N/A	4.0E+01	4.0E+01	ug/m^3	Maximum Concentration	(c)
	Benzene	ug/m^3	7.9E-01	N/A	1.4E+00	1.4E+00	ug/m^3	Maximum Concentration	(c)
	Carbon tetrachloride	ug/m^3	4.6E-01	N/A	5.1E-01	5.1E-01	ug/m^3	Maximum Concentration	(c)
	Chloroform	ug/m^3	1.4E-01	N/A	4.1E-01	4.1E-01	ug/m^3	Maximum Concentration	(c)
	Ethylbenzene	ug/m^3	6.4E-01	N/A	1.5E+00	1.5E+00	ug/m^3	Maximum Concentration	(c)
	Naphthalene	ug/m^3	2.2E+00	N/A	1.6E+01	1.6E+01	ug/m^3	Maximum Concentration	(c)
	Tetrachloroethene	ug/m^3	2.6E+01	N/A	8.1E+01	8.1E+01	ug/m^3	Maximum Concentration	(c)
	Trichloroethene	ug/m^3	2.1E-01	N/A	1.0E+00	1.0E+00	ug/m^3	Maximum Concentration	(c)
	C5-C8 Aliphatics	ug/m^3	4.5E+01	N/A	1.5E+02	1.5E+02	ug/m^3	Maximum Concentration	(c)
	C9-C12 Aliphatics	ug/m^3	2.6E+01	N/A	8.7E+01	8.7E+01	ug/m^3	Maximum Concentration	(c)
260505									
North unit basement (IA-1, 2)									
	Chloroform	ug/m^3	2.3E-01	N/A	2.5E-01	2.5E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	5.3E-01	N/A	6.1E-01	6.1E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.5E-01	N/A	1.9E-01 J	1.9E-01	ug/m^3	Maximum Concentration	(a)

TABLE 3.2.RME
EXPOSURE POINT CONCENTRATION SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point (1)	Chemical of Potential Concern	Units	Arithmetic Mean (1)	95% UCL (Distribution) (2)	Maximum Concentration (Qualifier) (3)	Exposure Point Concentration			
						Value	Units	Statistic (4)	Rationale (5)
260505 North unit 1st floor (IA-3)									
	Chloroform	ug/m^3	2.0E-01	N/A	2.5E-01	2.5E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	4.1E-01	N/A	6.3E-01	6.3E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.3E-01	N/A	1.4E-01 J	1.4E-01	ug/m^3	Maximum Concentration	(a)
260505 South unit Basement (IA-4, 5)									
	Chloroform	ug/m^3	1.4E+00	N/A	2.0E+00	2.0E+00	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	1.1E+00	N/A	1.8E+00	1.8E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.2E-01	N/A	3.8E-01 J	3.8E-01	ug/m^3	Maximum Concentration	(a)
260902 Basement (IA-1, 2)									
	Chloroform	ug/m^3	2.6E-01	N/A	3.4E-01 J	3.4E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.6E-01	N/A	3.4E-01 J	3.4E-01	ug/m^3	Maximum Concentration	(a)
260902 1st Floor (IA-3)									
	Chloroform	ug/m^3	N/A	N/A	2.3E-01	2.3E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	N/A	N/A	ND	ND	ug/m^3		
260903 Basement (IA-1, 2)									
	Chloroform	ug/m^3	9.5E-01	N/A	1.4E+00	1.4E+00	ug/m^3	Maximum Concentration	(a)
260407 All Samples (Spaces 1 to 5)									
	Acetone	ug/m^3	1.4E+03	N/A	8.7E+03	8.7E+03	ug/m^3	Maximum Concentration	(c)
	Chloroform	ug/m^3	7.6E+00	N/A	6.3E+01	6.3E+01	ug/m^3	Maximum Concentration	(c)
	Naphthalene	ug/m^3	2.7E-01	N/A	6.2E-01 J	6.2E-01	ug/m^3	Maximum Concentration	(c)

TABLE 3.2.RME

EXPOSURE POINT CONCENTRATION SUMMARY

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point	Chemical of Potential Concern	Units	Arithmetic Mean	95% UCL (Distribution)	Maximum Concentration (Qualifier)	Exposure Point Concentration			
						Value	Units	Statistic	Rationale
(1)			(1)	(2)	(3)			(4)	(5)

Notes:
(1) Arithmetic means were calculated assuming 1/2 the detection limit for non-detects. N/A = Not applicable.
(2) UCL calculations were performed using ProUCL software version 4.1, developed by Lockheed-Martin for USEPA.
NP = Non-parametric; N = Normal; LN = Lognormal; G = Gamma; N/A = Not applicable.
(3) J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
(4) 95% Student's-t UCL = Calculated using a normal Student's t approximation procedure.
95% Modified-t UCL = Calculated using a modified Student's t approximation procedure.
95% Approx. Gamma UCL = Calculated using an Approximate Gamma distribution procedure.
95% H-UCL = Calculated using Land's H-stat for lognormal distributions.
95% Chebyshev (Mean, Sd) UCL = Calculated using Chebyshev inequality non-parametric procedure.
95% KM (t) UCL = Calculated using 95% Kaplan Meier (Student's t approximation) non-parametric procedure.
95% KM (BCA) UCL = Calculated using 95% Kaplan Meier (Bias-corrected accelerated bootstrap) non-parametric procedure.
95% KM (Chebyshev) UCL = Calculated using 95% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
95% KM (% Bootstrap) UCL = Calculated using 95% Kaplan Meier (Percentile Bootstrap) non-parametric procedure.
97.5% KM (Chebyshev) UCL = Calculated using 97.5% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
99% KM (Chebyshev) UCL = Calculated using 99% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
(5) For data sets with multiple detection limits for non-detects, the use of the Kaplan Meier non-parametric test procedure is recommended and used to calculate an appropriate UCL. For the Kaplan Meier test procedure, the type of data distribution was determined using a series of tests (Shapiro-Wilk, Kolmogorov-Smirnov, Anderson-Darling) for normal, lognormal, or gamma data distributions. The results of these distribution tests determined which UCL calculation was performed.
(a) Due to small sample size, the maximum detected concentration is used.
(b) Maximum detected concentration used for EPC due to the low number of detections.
(c) Future use of building is unknown. Therefore, maximum concentration used for EPC.

ND = Non-detect
NC = Not calculated
N/A = Not Applicable
UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
RME = Reasonable Maximum Exposure
CT = Central Tendency

TABLE 3.2.CT
EXPOSURE POINT CONCENTRATION SUMMARY
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point (1)	Chemical of Potential Concern	Units	Arithmetic Mean (1)	95% UCL (Distribution) (2)	Maximum Concentration (Qualifier) (3)	Exposure Point Concentration			
						Value	Units	Statistic (4)	Rationale (5)
260206									
All Samples (Spaces 1 to 3)									
	Bromodichloromethane	ug/m3	1.9E-01	N/A	3.2E-01	3.2E-01	ug/m3	Maximum Concentration	(a)
	Chloroform	ug/m3	4.4E+00	N/A	5.6E+00	5.6E+00	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	2.0E+00	N/A	3.6E+00 J	3.6E+00	ug/m3	Maximum Concentration	(a)
	Xylenes (total)	ug/m3	1.1E+01	N/A	1.9E+01	1.9E+01	ug/m3	Maximum Concentration	(a)
260504									
Basement (IA-1, 2)									
	Chloroform	ug/m3	4.8E-01	N/A	5.8E-01	5.8E-01	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	1.6E+00	N/A	2.5E+00	2.5E+00	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	1.2E+00	N/A	1.8E+00 J	1.8E+00	ug/m3	Maximum Concentration	(a)
	Xylenes (total)	ug/m3	8.5E+00	N/A	1.4E+01	1.4E+01	ug/m3	Maximum Concentration	(a)
260207									
All Samples (Spaces 1 to 3)	1,2,4-Trimethylbenzene	ug/m3	6.8E-01	N/A	1.6E+00	1.6E+00	ug/m3	Maximum Concentration	(c)
	1,4-Dichlorobenzene	ug/m3	4.8E+00	N/A	4.0E+01	4.0E+01	ug/m3	Maximum Concentration	(c)
	Benzene	ug/m3	7.9E-01	N/A	1.4E+00	1.4E+00	ug/m3	Maximum Concentration	(c)
	Carbon tetrachloride	ug/m3	4.6E-01	N/A	5.1E-01	5.1E-01	ug/m3	Maximum Concentration	(c)
	Chloroform	ug/m3	1.4E-01	N/A	4.1E-01	4.1E-01	ug/m3	Maximum Concentration	(c)
	Ethylbenzene	ug/m3	6.4E-01	N/A	1.5E+00	1.5E+00	ug/m3	Maximum Concentration	(c)
	Naphthalene	ug/m3	2.2E+00	N/A	1.6E+01	1.6E+01	ug/m3	Maximum Concentration	(c)
	Tetrachloroethene	ug/m3	2.6E+01	N/A	8.1E+01	8.1E+01	ug/m3	Maximum Concentration	(c)
	Trichloroethene	ug/m3	2.1E-01	N/A	1.0E+00	1.0E+00	ug/m3	Maximum Concentration	(c)
	C5-C8 Aliphatics	ug/m3	4.5E+01	N/A	1.5E+02	1.5E+02	ug/m3	Maximum Concentration	(c)
	C9-C12 Aliphatics	ug/m3	2.6E+01	N/A	8.7E+01	8.7E+01	ug/m3	Maximum Concentration	(c)
260505									
North unit basement (IA-1, 2)									
	Chloroform	ug/m3	2.3E-01	N/A	2.5E-01	2.5E-01	ug/m3	Maximum Concentration	(a)
	Ethylbenzene	ug/m3	5.3E-01	N/A	6.1E-01	6.1E-01	ug/m3	Maximum Concentration	(a)
	Naphthalene	ug/m3	1.5E-01	N/A	1.9E-01 J	1.9E-01	ug/m3	Maximum Concentration	(a)

TABLE 3.2.CT
EXPOSURE POINT CONCENTRATION SUMMARY
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point (1)	Chemical of Potential Concern	Units	Arithmetic Mean (1)	95% UCL (Distribution) (2)	Maximum Concentration (Qualifier) (3)	Exposure Point Concentration			
						Value	Units	Statistic (4)	Rationale (5)
260505 North unit 1st floor (IA-3)									
	Chloroform	ug/m^3	2.0E-01	N/A	2.5E-01	2.5E-01	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	4.1E-01	N/A	6.3E-01	6.3E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	1.3E-01	N/A	1.4E-01 J	1.4E-01	ug/m^3	Maximum Concentration	(a)
260505 South unit Basement (IA-4, 5)									
	Chloroform	ug/m^3	1.4E+00	N/A	2.0E+00	2.0E+00	ug/m^3	Maximum Concentration	(a)
	Ethylbenzene	ug/m^3	1.1E+00	N/A	1.8E+00	1.8E+00	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.2E-01	N/A	3.8E-01 J	3.8E-01	ug/m^3	Maximum Concentration	(a)
260902 Basement (IA-1, 2)									
	Chloroform	ug/m^3	2.6E-01	N/A	3.4E-01 J	3.4E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	2.6E-01	N/A	3.4E-01 J	3.4E-01	ug/m^3	Maximum Concentration	(a)
260902 1st Floor (IA-3)									
	Chloroform	ug/m^3	N/A	N/A	2.3E-01	2.3E-01	ug/m^3	Maximum Concentration	(a)
	Naphthalene	ug/m^3	N/A	N/A	ND	ND	ug/m^3		
260903 Basement (IA-1, 2)									
	Chloroform	ug/m^3	9.5E-01	N/A	1.4E+00	1.4E+00	ug/m^3	Maximum Concentration	(a)
260407 All Samples (Spaces 1 to 5)									
	Acetone	ug/m^3	1.4E+03	N/A	8.7E+03	8.7E+03	ug/m^3	Maximum Concentration	(c)
	Chloroform	ug/m^3	7.6E+00	N/A	6.3E+01	6.3E+01	ug/m^3	Maximum Concentration	(c)
	Naphthalene	ug/m^3	2.7E-01	N/A	6.2E-01 J	6.2E-01	ug/m^3	Maximum Concentration	(c)

TABLE 3.2.CT

EXPOSURE POINT CONCENTRATION SUMMARY

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Point (1)	Chemical of Potential Concern	Units	Arithmetic Mean (1)	95% UCL (Distribution) (2)	Maximum Concentration (Qualifier) (3)	Exposure Point Concentration			
						Value	Units	Statistic (4)	Rationale (5)

Notes:
(1) Arithmetic means were calculated assuming 1/2 the detection limit for non-detects. N/A = Not applicable.
(2) UCL calculations were performed using ProUCL software version 4.1, developed by Lockheed-Martin for USEPA.
NP = Non-parametric; N = Normal; LN = Lognormal; G = Gamma; N/A = Not applicable.
(3) J = The compound was positively identified; however, the associated numerical value is an estimated concentration only.
(4) 95% Student's-t UCL = Calculated using a normal Student's t approximation procedure.
95% Modified-t UCL = Calculated using a modified Student's t approximation procedure.
95% Approx. Gamma UCL = Calculated using an Approximate Gamma distribution procedure.
95% H-UCL = Calculated using Land's H-stat for lognormal distributions.
95% Chebyshev (Mean, Sd) UCL = Calculated using Chebyshev inequality non-parametric procedure.
95% KM (t) UCL = Calculated using 95% Kaplan Meier (Student's t approximation) non-parametric procedure.
95% KM (BCA) UCL = Calculated using 95% Kaplan Meier (Bias-corrected accelerated bootstrap) non-parametric procedure.
95% KM (Chebyshev) UCL = Calculated using 95% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
95% KM (% Bootstrap) UCL = Calculated using 95% Kaplan Meier (Percentile Bootstrap) non-parametric procedure.
97.5% KM (Chebyshev) UCL = Calculated using 97.5% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
99% KM (Chebyshev) UCL = Calculated using 99% Kaplan Meier (Chebyshev inequality) non-parametric procedure.
(5) For data sets with multiple detection limits for non-detects, the use of the Kaplan Meier non-parametric test procedure is recommended and used to calculate an appropriate UCL. For the Kaplan Meier test procedure, the type of data distribution was determined using a series of tests (Shapiro-Wilk, Kolmogorov-Smirnov, Anderson-Darling) for normal, lognormal, or gamma data distributions. The results of these distribution tests determined which UCL calculation was performed.
(a) Due to small sample size, the maximum detected concentration is used.
(b) Maximum detected concentration used for EPC due to the low number of detections.
(c) Future use of building is unknown. Therefore, maximum concentration used for EPC.

ND = Non-detect
NC = Not calculated
N/A = Not Applicable
UCL = Upper Confidence Limit
EPC = Exposure Point Concentration
RME = Reasonable Maximum Exposure
CT = Central Tendency

TABLE 4.1.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Commercial Worker	Adult	260206; 260407	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	8	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9125	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
	Storage Unit User	Adult	260207	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	4	hrs/day	Site-specific assumption	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9125	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
	Daycare Worker	Adult	260206	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	11	hrs/day	Site-specific assumption	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9125	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
	Daycare	Child	260206	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	11	hrs/day	Site-specific assumption	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	7	years	Site-specific assumption	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2555	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	

TABLE 4.1.RME

VALUES USED FOR DAILY INTAKE CALCULATIONS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Resident	Adult	260504; 260505; 260902; 260903	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	24	hrs/day	USEPA, 2004	CA x ET x EF x ED / CF x AT
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	24	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8760	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
		Child	260504; 260505; 260902; 260903	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	24	hrs/day	USEPA, 2004	CA x ET x EF x ED / CF x AT
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	6	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	

TABLE 4.1.CT
VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Commercial Worker	Adult	260206; 260407	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	8	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	219	days/year	USEPA, 2004	
				ED	Exposure Duration	9	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3285	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
	Storage Unit User	Adult	260207	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	2	hrs/day	Site-specific assumption	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	125	days/year	Site-specific assumption	
				ED	Exposure Duration	9	years	Site-specific assumption	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3285	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
	Daycare Worker	Adult	260206	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	8	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	219	days/year	USEPA, 2004	
				ED	Exposure Duration	9	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3285	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
	Daycare	Child	260206	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	8	hrs/day	Site-specific assumption	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	225	days/year	Site-specific assumption	
				ED	Exposure Duration	4	years	Site-specific assumption	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	1460	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	

TABLE 4.1.CT
VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
	Resident	Adult	260504; 260505; 260902; 260903	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	16	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	7	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2555	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
		Child	260504; 260505; 260902; 260903	CA	Modeled Concentration in Air	see Table 3.1	ug/m^3	see Table 3.1	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	16	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	2	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	

TABLE 4.2.RME
VALUES USED FOR DAILY INTAKE CALCULATIONS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Medium: Air
Exposure Medium: Indoor Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Commercial Worker	Adult	260207	CA	Concentration in Air	see Table 3.2	ug/m^3	see Table 3.2	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	8	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	250	days/year	USEPA, 2004	
				ED	Exposure Duration	25	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	9125	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
	Resident	Adult	260504; 260505; 260902; 260903; 260207; 260206; 260407	CA	Concentration in Air	see Table 3.2	ug/m^3	see Table 3.2	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	24	hrs/day	USEPA, 2004	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	24	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	8760	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
		Child	260504; 260505; 260902; 260903; 260207; 260206; 260407	CA	Concentration in Air	see Table 3.2	ug/m^3	see Table 3.2	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	24	hrs/day	USEPA, 2004	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	6	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2190	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	

TABLE 4.2.CT
VALUES USED FOR DAILY INTAKE CALCULATIONS
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Medium: Air
Exposure Medium: Indoor Air

Exposure Route	Receptor Population	Receptor Age	Exposure Point	Parameter Code	Parameter Definition	Value	Units	Rationale/ Reference	Intake Equation/ Model Name
Inhalation	Commercial Worker	Adult	260207	CA	Concentration in Air	see Table 3.2	ug/m^3	see Table 3.2	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	8	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	219	days/year	USEPA, 2004	
				ED	Exposure Duration	9	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	3285	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
	Resident	Adult	260504; 260505; 260902; 260903; 260207; 260206; 260407	CA	Concentration in Air	see Table 3.2	ug/m^3	see Table 3.2	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	16	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	7	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	2555	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	
		Child	260504; 260505; 260902; 260903; 260207; 260206; 260407	CA	Concentration in Air	see Table 3.2	ug/m^3	see Table 3.2	Chronic Daily Intake (CDI) (ug/m^3) =
				ET	Exposure Time	16	hrs/day	USEPA, 2011d	$\frac{CA \times ET \times EF \times ED}{CF \times AT}$
				EF	Exposure Frequency	350	days/year	USEPA, 2004	
				ED	Exposure Duration	2	years	USEPA, 2004	
				AT-C	Averaging Time (Cancer)	25550	days	USEPA, 1989	
				AT-N	Averaging Time (Non-Cancer)	730	days	USEPA, 1989	
				CF	Conversion Factor	24	hrs/day	- -	

TABLE 5

NON-CANCER TOXICITY DATA -- INHALATION

WELLS G&H SUPERFUND SITE - OU-1

Chemical of Potential Concern	Chronic/ Subchronic	Inhalation RfC		Extrapolated RfD		Primary Target Organ(s)	Combined Uncertainty/Modifying Factors	RfC : Target Organ(s)	
		Value	Units	Value	Units			Source(s)	Date(s) (MM/DD/YYYY)
1,2,4-Trimethylbenzene	Chronic	7.0E+00	ug/m^3	N/A	N/A	Blood	3000	PPRTV	02/13/12
1,4-Dichlorobenzene	Chronic	8.0E+02	ug/m^3	N/A	N/A	Liver	100	IRIS	02/13/12
Acetone	Chronic	3.1E+04	ug/m^3	N/A	N/A	CNS	100	ATSDR	02/13/12
Benzene	Chronic	3.0E+01	ug/m^3	N/A	N/A	Immune System	300	IRIS	02/13/12
Bromodichloromethane	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Carbon tetrachloride	Chronic	1.0E+02	ug/m^3	N/A	N/A	Liver	100	IRIS	02/13/12
Chloroform	Chronic	9.8E+01	ug/m^3	N/A	N/A	Liver	100	ATSDR	02/13/12
cis-1,2-Dichloroethene	Chronic	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ethylbenzene	Chronic	1.0E+03	ug/m^3	N/A	N/A	Developmental	300	IRIS	02/13/12
Naphthalene	Chronic	3.0E+00	ug/m^3	N/A	N/A	Respiratory	3000	IRIS	02/13/12
Tetrachloroethene	Chronic	4.0E+01	ug/m^3	N/A	N/A	CNS	1000	IRIS	02/13/12
Trichloroethene	Chronic	2.0E+00	ug/m^3	N/A	N/A	Developmental, Immune System	10 (Dev.) / 100 (Immune System)	IRIS	02/13/12
Xylenes (Total)	Chronic	1.0E+02	ug/m^3	N/A	N/A	CNS	300	IRIS	02/13/12
C5-C8 Aliphatics	Chronic	6E+02	ug/m^3	N/A	N/A	Respiratory	30	PPRTV	02/13/12
C9-C10 Aromatics	Chronic	1E+02	ug/m^3	N/A	N/A	Liver, Kidney	1000	PPRTV	02/13/12
C9-C12 Aliphatics	Chronic	1E+02	ug/m^3	N/A	N/A	Respiratory	100	PPRTV	02/13/12

IRIS = Integrated Risk Information System

PPRTV = Provisional Peer Reviewed Toxicity Value developed by STSC

STSC = Superfund Technical Support Center

ATSDR = Agency for Toxic Substances and Disease Registry

NYSDOH = New York State Department of Health

N/A = Not Applicable or Not Available

TABLE 6

CANCER TOXICITY DATA -- INHALATION

WELLS G&H SUPERFUND SITE - OU-1

Chemical of Potential Concern	Unit Risk		Inhalation Cancer Slope Factor		Weight of Evidence/ Cancer Guideline Description	Unit Risk : Inhalation CSF	
	Value	Units	Value	Units		Source(s)	Date(s) (MM/DD/YYYY)
1,2,4-Trimethylbenzene	N/A	N/A	N/A	N/A	N/A	N/A	N/A
1,4-Dichlorobenzene	1.1E-05	$(ug/m^3)^{-1}$	N/A	N/A	C	CalEPA	02/13/12
Acetone	N/A	N/A	N/A	N/A	D	IRIS	02/13/12
Benzene	7.8E-06	$(ug/m^3)^{-1}$	N/A	N/A	A	IRIS	02/13/12
Bromodichloromethane	3.70E-05	$(ug/m^3)^{-1}$	N/A	N/A	B2	CalEPA	02/13/12
Carbon tetrachloride	6.0E-06	$(ug/m^3)^{-1}$	N/A	N/A	Likely	IRIS	02/13/12
Chloroform	2.3E-05	$(ug/m^3)^{-1}$	N/A	N/A	B2	IRIS	02/13/12
cis-1,2-Dichloroethene	N/A	N/A	N/A	N/A	D	IRIS	02/13/12
Ethylbenzene	2.5E-06	$(ug/m^3)^{-1}$	N/A	N/A	B2	CalEPA	02/13/12
Naphthalene	3.4E-05	$(ug/m^3)^{-1}$	N/A	N/A	C	IRIS	02/13/12
Tetrachloroethene	2.6E-07	$(ug/m^3)^{-1}$	N/A	N/A	Likely	IRIS	02/13/12
Trichloroethene	4.0E-06	$(ug/m^3)^{-1}$	N/A	N/A	Carcinogenic to Humans	IRIS	02/13/12
Xylenes (Total)	N/A	N/A	N/A	N/A	D	IRIS	02/13/12
C5-C8 Aliphatics	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C9-C10 Aromatics	N/A	N/A	N/A	N/A	N/A	N/A	N/A
C9-C12 Aliphatics	N/A	N/A	N/A	N/A	N/A	N/A	N/A

IRIS = Integrated Risk Information System

CalEPA = California Environmental Protection Agency, Office of Environmental Health Hazard Assessment

N/A = Not Applicable

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 (by the oral route)

E - Evidence of noncarcinogenicity

The unit risk presented for benzene is the high end of the range from 2.2E-06 to 7E-06 per ug/m^3.

Trichloroethene unit risk from MassDEP = 1.7E-06 $(ug/m^3)^{-1}$

Tetrachloroethene unit risk from MassDEP = 1E-05 $(ug/m^3)^{-1}$

The unit risk presented for trichloroethene is the adult-based value. For early-life exposures, tumor-specific unit risk values of 1E-06 $(ug/m^3)^{-1}$ for kidney tumors and 3.1E-06 $(ug/m^3)^{-1}$ for combined liver tumors and non-Hodgkins lymphoma (NHL) are used in conjuction with age-dependent adjustment factors, as appropriate.

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
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	
Air	Indoor Air	260207 [Space 2]	Inhalation													
				1,2,4-Trimethylbenzene	1E+00	ug/m3	1.1E-01	ug/m3	N/A	N/A	N/A	3.2E-01	ug/m3	7.0E+00	ug/m3	4.6E-02
				1,4-Dichlorobenzene	4E+00	ug/m3	3.4E-01	ug/m3	1.1E-05	(ug/m3)-1	3.8E-06	9.6E-01	ug/m3	8.0E+02	ug/m3	1.2E-03
				Benzene	1E+00	ug/m3	9.1E-02	ug/m3	7.8E-06	(ug/m3)-1	7.1E-07	2.5E-01	ug/m3	3.0E+01	ug/m3	8.4E-03
				Carbon tetrachloride	5E-01	ug/m3	4.2E-02	ug/m3	6.0E-06	(ug/m3)-1	2.5E-07	1.2E-01	ug/m3	1.0E+02	ug/m3	1.2E-03
				Chloroform	4E-01	ug/m3	3.3E-02	ug/m3	2.3E-05	(ug/m3)-1	7.6E-07	9.2E-02	ug/m3	9.8E+01	ug/m3	9.4E-04
				Ethylbenzene	2E+00	ug/m3	1.2E-01	ug/m3	2.5E-06	(ug/m3)-1	3.1E-07	3.5E-01	ug/m3	1.0E+03	ug/m3	3.5E-04
				Naphthalene	3E+00	ug/m3	2.2E-01	ug/m3	3.4E-05	(ug/m3)-1	7.4E-06	6.1E-01	ug/m3	3.0E+00	ug/m3	2.0E-01
				Tetrachloroethene	2E+01	ug/m3	1.5E+00	ug/m3	2.6E-07	(ug/m3)-1	3.9E-07	4.2E+00	ug/m3	4.0E+01	ug/m3	1.0E-01
				Trichloroethene	1E-01	ug/m3	1.1E-02	ug/m3	4.0E-06	(ug/m3)-1	4.6E-08	3.2E-02	ug/m3	2.0E+00	ug/m3	1.6E-02
				C5-C8 Aliphatics	2E+02	ug/m3	1.2E+01	ug/m3	N/A	N/A	N/A	3.4E+01	ug/m3	6.0E+02	ug/m3	5.7E-02
				C9-C12 Aliphatics	8E+01	ug/m3	6.7E+00	ug/m3	N/A	N/A	N/A	1.9E+01	ug/m3	1.0E+02	ug/m3	1.9E-01
			Exp. Route Total								1E-05					6E-01
		Exposure Point Total									1E-05					6E-01
		260407 [Space 1]	Inhalation													
				Acetone	9E+03	ug/m3	7.1E+02	ug/m3	N/A	N/A	N/A	2.0E+03	ug/m3	3.1E+04	ug/m3	6.4E-02
				Chloroform	5E-01	ug/m3	3.7E-02	ug/m3	2.3E-05	(ug/m3)-1	8.5E-07	1.0E-01	ug/m3	9.8E+01	ug/m3	1.1E-03
				Naphthalene	3E-01	ug/m3	2.2E-02	ug/m3	3.4E-05	(ug/m3)-1	7.6E-07	6.2E-02	ug/m3	3.0E+00	ug/m3	2.1E-02
			Exp. Route Total								2E-06					9E-02
		Exposure Point Total									2E-06					9E-02
		260407 [Space 2]	Inhalation													
				Acetone	2E+02	ug/m3	1.9E+01	ug/m3	N/A	N/A	N/A	5.4E+01	ug/m3	3.1E+04	ug/m3	1.7E-03
				Chloroform	6E-01	ug/m3	5.1E-02	ug/m3	2.3E-05	(ug/m3)-1	1.2E-06	1.4E-01	ug/m3	9.8E+01	ug/m3	1.5E-03
				Naphthalene	6E-01	ug/m3	5.0E-02	ug/m3	3.4E-05	(ug/m3)-1	1.7E-06	1.4E-01	ug/m3	3.0E+00	ug/m3	4.7E-02
			Exp. Route Total								3E-06					5E-02
		Exposure Point Total									3E-06					5E-02
		260407 [Space 3]	Inhalation													
				Acetone	2E+02	ug/m3	1.7E+01	ug/m3	N/A	N/A	N/A	4.9E+01	ug/m3	3.1E+04	ug/m3	1.6E-03
				Chloroform	8E-01	ug/m3	6.7E-02	ug/m3	2.3E-05	(ug/m3)-1	1.5E-06	1.9E-01	ug/m3	9.8E+01	ug/m3	1.9E-03
				Naphthalene	4E-01	ug/m3	2.9E-02	ug/m3	3.4E-05	(ug/m3)-1	9.7E-07	8.0E-02	ug/m3	3.0E+00	ug/m3	2.7E-02
			Exp. Route Total								3E-06					3E-02
		Exposure Point Total									3E-06					3E-02

TABLE 7.1.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
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	
		260407 [Space 4]	Inhalation													
				Acetone	2E+02	ug/m^3	1.9E+01	ug/m3	N/A	N/A	N/A	5.3E+01	ug/m3	3.1E+04	ug/m3	1.7E-03
				Chloroform	1E+00	ug/m^3	1.0E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.3E-06	2.8E-01	ug/m3	9.8E+01	ug/m3	2.9E-03
				Naphthalene	3E-01	ug/m^3	2.1E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	7.1E-07	5.9E-02	ug/m3	3.0E+00	ug/m3	2.0E-02
			Exp. Route Total								3E-06					2E-02
		Exposure Point Total									3E-06					2E-02
		260407 [Space 5]	Inhalation													
				Acetone	1E+03	ug/m^3	8.6E+01	ug/m3	N/A	N/A	N/A	2.4E+02	ug/m3	3.1E+04	ug/m3	7.7E-03
				Chloroform	6E+01	ug/m^3	5.2E+00	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.2E-04	1.4E+01	ug/m3	9.8E+01	ug/m3	1.5E-01
				Naphthalene	2E-01	ug/m^3	1.4E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	4.7E-07	3.8E-02	ug/m3	3.0E+00	ug/m3	1.3E-02
			Exp. Route Total								1E-04					2E-01
		Exposure Point Total									1E-04					2E-01
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
					Unit Risk (ug/m3)$^{-1}$				Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		N/A
				Cancer Risk with MassDEP unit risk for PCE:	1.0E-05				260207 [Space 2]		3E-05					
				Cancer Risk with MassDEP unit risk for TCE:	1.7E-06				260207 [Space 2]		1E-05					

TABLE 7.1.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
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	
Air	Indoor Air	260207 [Space 2]	Inhalation													
				1,2,4-Trimethylbenzene	1E+00	ug/m3	3.6E-02	ug/m3	N/A	N/A	N/A	2.8E-01	ug/m3	7.0E+00	ug/m3	4.0E-02
				1,4-Dichlorobenzene	4E+00	ug/m3	1.1E-01	ug/m3	1.1E-05	(ug/m3)-1	1.2E-06	8.4E-01	ug/m3	8.0E+02	ug/m3	1.1E-03
				Benzene	1E+00	ug/m3	2.9E-02	ug/m3	7.8E-06	(ug/m3)-1	2.2E-07	2.2E-01	ug/m3	3.0E+01	ug/m3	7.4E-03
				Carbon tetrachloride	5E-01	ug/m3	1.3E-02	ug/m3	6.0E-06	(ug/m3)-1	7.9E-08	1.0E-01	ug/m3	1.0E+02	ug/m3	1.0E-03
				Chloroform	4E-01	ug/m3	1.0E-02	ug/m3	2.3E-05	(ug/m3)-1	2.4E-07	8.1E-02	ug/m3	9.8E+01	ug/m3	8.3E-04
				Ethylbenzene	2E+00	ug/m3	3.9E-02	ug/m3	2.5E-06	(ug/m3)-1	9.8E-08	3.1E-01	ug/m3	1.0E+03	ug/m3	3.1E-04
				Naphthalene	3E+00	ug/m3	6.9E-02	ug/m3	3.4E-05	(ug/m3)-1	2.3E-06	5.4E-01	ug/m3	3.0E+00	ug/m3	1.8E-01
				Tetrachloroethene	2E+01	ug/m3	4.7E-01	ug/m3	2.6E-07	(ug/m3)-1	1.2E-07	3.7E+00	ug/m3	4.0E+01	ug/m3	9.2E-02
				Trichloroethene	1E-01	ug/m3	3.6E-03	ug/m3	4.0E-06	(ug/m3)-1	1.4E-08	2.8E-02	ug/m3	2.0E+00	ug/m3	1.4E-02
				C5-C8 Aliphatics	2E+02	ug/m3	3.9E+00	ug/m3	N/A	N/A	N/A	3.0E+01	ug/m3	6.0E+02	ug/m3	5.0E-02
				C9-C12 Aliphatics	8E+01	ug/m3	2.1E+00	ug/m3	N/A	N/A	N/A	1.6E+01	ug/m3	1.0E+02	ug/m3	1.6E-01
			Exp. Route Total								4E-06					5E-01
		Exposure Point Total									4E-06					5E-01
		260407 [Space 1]	Inhalation													
				Acetone	9E+03	ug/m3	2.2E+02	ug/m3	N/A	N/A	N/A	1.7E+03	ug/m3	3.1E+04	ug/m3	5.6E-02
				Chloroform	5E-01	ug/m3	1.2E-02	ug/m3	2.3E-05	(ug/m3)-1	2.7E-07	9.1E-02	ug/m3	9.8E+01	ug/m3	9.3E-04
				Naphthalene	3E-01	ug/m3	7.0E-03	ug/m3	3.4E-05	(ug/m3)-1	2.4E-07	5.5E-02	ug/m3	3.0E+00	ug/m3	1.8E-02
			Exp. Route Total								5E-07					8E-02
		Exposure Point Total									5E-07					8E-02
		260407 [Space 2]	Inhalation													
				Acetone	2E+02	ug/m3	6.0E+00	ug/m3	N/A	N/A	N/A	4.7E+01	ug/m3	3.1E+04	ug/m3	1.5E-03
				Chloroform	6E-01	ug/m3	1.6E-02	ug/m3	2.3E-05	(ug/m3)-1	3.7E-07	1.3E-01	ug/m3	9.8E+01	ug/m3	1.3E-03
				Naphthalene	6E-01	ug/m3	1.6E-02	ug/m3	3.4E-05	(ug/m3)-1	5.4E-07	1.2E-01	ug/m3	3.0E+00	ug/m3	4.1E-02
			Exp. Route Total								9E-07					4E-02
		Exposure Point Total									9E-07					4E-02
		260407 [Space 3]	Inhalation													
				Acetone	2E+02	ug/m3	5.5E+00	ug/m3	N/A	N/A	N/A	4.3E+01	ug/m3	3.1E+04	ug/m3	1.4E-03
				Chloroform	8E-01	ug/m3	2.1E-02	ug/m3	2.3E-05	(ug/m3)-1	4.9E-07	1.7E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Naphthalene	4E-01	ug/m3	9.0E-03	ug/m3	3.4E-05	(ug/m3)-1	3.1E-07	7.0E-02	ug/m3	3.0E+00	ug/m3	2.3E-02
			Exp. Route Total								8E-07					3E-02
		Exposure Point Total									8E-07					3E-02

TABLE 7.1.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
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	
		260407 [Space 4]	Inhalation													
				Acetone	2E+02	ug/m^3	6.0E+00	ug/m3	N/A	N/A	N/A	4.7E+01	ug/m3	3.1E+04	ug/m3	1.5E-03
				Chloroform	1E+00	ug/m^3	3.2E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	7.3E-07	2.5E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Naphthalene	3E-01	ug/m^3	6.6E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	2.2E-07	5.1E-02	ug/m3	3.0E+00	ug/m3	1.7E-02
			Exp. Route Total								1E-06					2E-02
		Exposure Point Total									1E-06					2E-02
		260407 [Space 5]	Inhalation													
				Acetone	1E+03	ug/m^3	2.7E+01	ug/m3	N/A	N/A	N/A	2.1E+02	ug/m3	3.1E+04	ug/m3	6.8E-03
				Chloroform	6E+01	ug/m^3	1.6E+00	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.7E-05	1.3E+01	ug/m3	9.8E+01	ug/m3	1.3E-01
				Naphthalene	2E-01	ug/m^3	4.3E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.5E-07	3.4E-02	ug/m3	3.0E+00	ug/m3	1.1E-02
			Exp. Route Total								4E-05					1E-01
		Exposure Point Total									4E-05					1E-01
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
						Unit Risk (ug/m3)$^{-1}$			Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		N/A
				Cancer Risk with MassDEP unit risk for PCE:		1.0E-05			260207 [Space 2]		9E-06					
				Cancer Risk with MassDEP unit risk for TCE:		1.7E-06			260207 [Space 2]		4E-06					

TABLE 7.2.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Storage Unit User
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	
Air	Indoor Air	260207 [Space 3]	Inhalation													
				1,2,4-Trimethylbenzene	9E-01	ug/m3	3.8E-02	ug/m3	N/A	N/A	N/A	1.1E-01	ug/m3	7.0E+00	ug/m3	1.5E-02
				1,4-Dichlorobenzene	4E+00	ug/m3	1.4E-01	ug/m3	1.1E-05	(ug/m3)-1	1.6E-06	4.0E-01	ug/m3	8.0E+02	ug/m3	5.0E-04
				Benzene	9E-01	ug/m3	3.5E-02	ug/m3	7.8E-06	(ug/m3)-1	2.7E-07	9.7E-02	ug/m3	3.0E+01	ug/m3	3.2E-03
				Carbon tetrachloride	5E-01	ug/m3	1.9E-02	ug/m3	6.0E-06	(ug/m3)-1	1.1E-07	5.3E-02	ug/m3	1.0E+02	ug/m3	5.3E-04
				Chloroform	2E-01	ug/m3	6.6E-03	ug/m3	2.3E-05	(ug/m3)-1	1.5E-07	1.9E-02	ug/m3	9.8E+01	ug/m3	1.9E-04
				Ethylbenzene	7E-01	ug/m3	3.0E-02	ug/m3	2.5E-06	(ug/m3)-1	7.5E-08	8.3E-02	ug/m3	1.0E+03	ug/m3	8.3E-05
				Naphthalene	6E+00	ug/m3	2.5E-01	ug/m3	3.4E-05	(ug/m3)-1	8.5E-06	7.0E-01	ug/m3	3.0E+00	ug/m3	2.3E-01
				Tetrachloroethene	4E+01	ug/m3	1.8E+00	ug/m3	2.6E-07	(ug/m3)-1	4.6E-07	5.0E+00	ug/m3	4.0E+01	ug/m3	1.3E-01
				Trichloroethene	5E-01	ug/m3	2.1E-02	ug/m3	4.0E-06	(ug/m3)-1	8.3E-08	5.8E-02	ug/m3	2.0E+00	ug/m3	2.9E-02
				C5-C8 Aliphatics	4E+01	ug/m3	1.7E+00	ug/m3	N/A	N/A	N/A	4.9E+00	ug/m3	6.0E+02	ug/m3	8.1E-03
				C9-C12 Aliphatics	3E+01	ug/m3	1.3E+00	ug/m3	N/A	N/A	N/A	3.6E+00	ug/m3	1.0E+02	ug/m3	3.6E-02
			Exp. Route Total								1E-05					5E-01
		Exposure Point Total									1E-05					5E-01
		260207 [Space 1]	Inhalation													
				1,2,4-Trimethylbenzene	1E+00	ug/m3	4.5E-02	ug/m3	N/A	N/A	N/A	1.3E-01	ug/m3	7.0E+00	ug/m3	1.8E-02
				1,4-Dichlorobenzene	4E+01	ug/m3	1.6E+00	ug/m3	1.1E-05	(ug/m3)-1	1.7E-05	4.4E+00	ug/m3	8.0E+02	ug/m3	5.5E-03
				Benzene	1E+00	ug/m3	4.1E-02	ug/m3	7.8E-06	(ug/m3)-1	3.2E-07	1.1E-01	ug/m3	3.0E+01	ug/m3	3.8E-03
				Carbon tetrachloride	5E-01	ug/m3	2.0E-02	ug/m3	6.0E-06	(ug/m3)-1	1.2E-07	5.5E-02	ug/m3	1.0E+02	ug/m3	5.5E-04
				Chloroform	2E-01	ug/m3	8.8E-03	ug/m3	2.3E-05	(ug/m3)-1	2.0E-07	2.5E-02	ug/m3	9.8E+01	ug/m3	2.5E-04
				Ethylbenzene	8E-01	ug/m3	3.4E-02	ug/m3	2.5E-06	(ug/m3)-1	8.5E-08	9.5E-02	ug/m3	1.0E+03	ug/m3	9.5E-05
				Naphthalene	2E+00	ug/m3	6.8E-02	ug/m3	3.4E-05	(ug/m3)-1	2.3E-06	1.9E-01	ug/m3	3.0E+00	ug/m3	6.3E-02
				Tetrachloroethene	5E+00	ug/m3	2.2E-01	ug/m3	2.6E-07	(ug/m3)-1	5.6E-08	6.1E-01	ug/m3	4.0E+01	ug/m3	1.5E-02
				Trichloroethene	1E-01	ug/m3	4.6E-03	ug/m3	4.0E-06	(ug/m3)-1	1.8E-08	1.3E-02	ug/m3	2.0E+00	ug/m3	6.4E-03
				C5-C8 Aliphatics	6E+01	ug/m3	2.6E+00	ug/m3	N/A	N/A	N/A	7.3E+00	ug/m3	6.0E+02	ug/m3	1.2E-02
				C9-C12 Aliphatics	8E+01	ug/m3	3.1E+00	ug/m3	N/A	N/A	N/A	8.6E+00	ug/m3	1.0E+02	ug/m3	8.6E-02
			Exp. Route Total								2E-05					2E-01
		Exposure Point Total									2E-05					2E-01
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
									Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		N/A

	Unit Risk (ug/m3)-1		
Cancer Risk with MassDEP unit risk for PCE:	1.0E-05	260207 [Space 3]	3E-05
		260207 [Space 1]	2E-05
Cancer Risk with MassDEP unit risk for TCE:	1.7E-06	260207 [Space 3]	1E-05
		260207 [Space 1]	2E-05

TABLE 7.2.CT
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Storage Unit User
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	
Air	Indoor Air	260207 [Space 3]	Inhalation													
				1,2,4-Trimethylbenzene	9E-01	ug/m3	3.4E-03	ug/m3	N/A	N/A	N/A	2.7E-02	ug/m3	7.0E+00	ug/m3	3.8E-03
				1,4-Dichlorobenzene	4E+00	ug/m3	1.3E-02	ug/m3	1.1E-05	(ug/m3)-1	1.4E-07	1.0E-01	ug/m3	8.0E+02	ug/m3	1.3E-04
				Benzene	9E-01	ug/m3	3.1E-03	ug/m3	7.8E-06	(ug/m3)-1	2.4E-08	2.4E-02	ug/m3	3.0E+01	ug/m3	8.1E-04
				Carbon tetrachloride	5E-01	ug/m3	1.7E-03	ug/m3	6.0E-06	(ug/m3)-1	1.0E-08	1.3E-02	ug/m3	1.0E+02	ug/m3	1.3E-04
				Chloroform	2E-01	ug/m3	6.0E-04	ug/m3	2.3E-05	(ug/m3)-1	1.4E-08	4.7E-03	ug/m3	9.8E+01	ug/m3	4.7E-05
				Ethylbenzene	7E-01	ug/m3	2.7E-03	ug/m3	2.5E-06	(ug/m3)-1	6.7E-09	2.1E-02	ug/m3	1.0E+03	ug/m3	2.1E-05
				Naphthalene	6E+00	ug/m3	2.3E-02	ug/m3	3.4E-05	(ug/m3)-1	7.7E-07	1.8E-01	ug/m3	3.0E+00	ug/m3	5.9E-02
				Tetrachloroethene	4E+01	ug/m3	1.6E-01	ug/m3	2.6E-07	(ug/m3)-1	4.2E-08	1.3E+00	ug/m3	4.0E+01	ug/m3	3.1E-02
				Trichloroethene	5E-01	ug/m3	1.9E-03	ug/m3	4.0E-06	(ug/m3)-1	7.5E-09	1.5E-02	ug/m3	2.0E+00	ug/m3	7.3E-03
				C5-C8 Aliphatics	4E+01	ug/m3	1.6E-01	ug/m3	N/A	N/A	N/A	1.2E+00	ug/m3	6.0E+02	ug/m3	2.0E-03
				C9-C12 Aliphatics	3E+01	ug/m3	1.2E-01	ug/m3	N/A	N/A	N/A	9.1E-01	ug/m3	1.0E+02	ug/m3	9.1E-03
			Exp. Route Total								1E-06					1E-01
		Exposure Point Total									1E-06					1E-01
		260207 [Space 1]	Inhalation													
				1,2,4-Trimethylbenzene	1E+00	ug/m3	4.1E-03	ug/m3	N/A	N/A	N/A	3.2E-02	ug/m3	7.0E+00	ug/m3	4.5E-03
				1,4-Dichlorobenzene	4E+01	ug/m3	1.4E-01	ug/m3	1.1E-05	(ug/m3)-1	1.5E-06	1.1E+00	ug/m3	8.0E+02	ug/m3	1.4E-03
				Benzene	1E+00	ug/m3	3.7E-03	ug/m3	7.8E-06	(ug/m3)-1	2.9E-08	2.9E-02	ug/m3	3.0E+01	ug/m3	9.5E-04
				Carbon tetrachloride	5E-01	ug/m3	1.8E-03	ug/m3	6.0E-06	(ug/m3)-1	1.1E-08	1.4E-02	ug/m3	1.0E+02	ug/m3	1.4E-04
				Chloroform	2E-01	ug/m3	8.0E-04	ug/m3	2.3E-05	(ug/m3)-1	1.8E-08	6.2E-03	ug/m3	9.8E+01	ug/m3	6.3E-05
				Ethylbenzene	8E-01	ug/m3	3.1E-03	ug/m3	2.5E-06	(ug/m3)-1	7.7E-09	2.4E-02	ug/m3	1.0E+03	ug/m3	2.4E-05
				Naphthalene	2E+00	ug/m3	6.1E-03	ug/m3	3.4E-05	(ug/m3)-1	2.1E-07	4.8E-02	ug/m3	3.0E+00	ug/m3	1.6E-02
				Tetrachloroethene	5E+00	ug/m3	2.0E-02	ug/m3	2.6E-07	(ug/m3)-1	5.1E-09	1.5E-01	ug/m3	4.0E+01	ug/m3	3.8E-03
				Trichloroethene	1E-01	ug/m3	4.1E-04	ug/m3	4.0E-06	(ug/m3)-1	1.7E-09	3.2E-03	ug/m3	2.0E+00	ug/m3	1.6E-03
				C5-C8 Aliphatics	6E+01	ug/m3	2.4E-01	ug/m3	N/A	N/A	N/A	1.8E+00	ug/m3	6.0E+02	ug/m3	3.1E-03
				C9-C12 Aliphatics	8E+01	ug/m3	2.8E-01	ug/m3	N/A	N/A	N/A	2.2E+00	ug/m3	1.0E+02	ug/m3	2.2E-02
			Exp. Route Total								2E-06					5E-02
		Exposure Point Total									2E-06					5E-02
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
									Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		N/A

	Unit Risk (ug/m3)-1		
Cancer Risk with MassDEP unit risk for PCE:	1.0E-05	260207 [Space 3]	3E-06
		260207 [Space 1]	2E-06
Cancer Risk with MassDEP unit risk for TCE:	1.7E-06	260207 [Space 3]	1E-06
		260207 [Space 1]	2E-06

TABLE 7.3.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare Worker
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	
Air	Indoor Air	260206 [Space 3]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	3.5E-02	ug/m3	3.7E-05	(ug/m3)$^{-1}$	1.3E-06	9.9E-02	ug/m3	N/A	N/A	N/A
				Chloroform	5E+00	ug/m^3	5.9E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.4E-05	1.7E+00	ug/m3	9.8E+01	ug/m3	1.7E-02
				Ethylbenzene	3E+00	ug/m^3	3.9E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	9.7E-07	1.1E+00	ug/m3	1.0E+03	ug/m3	1.1E-03
				Xylenes (total)	2E+01	ug/m^3	2.1E+00	ug/m3	N/A	N/A	N/A	5.9E+00	ug/m3	1.0E+02	ug/m3	5.9E-02
			Exp. Route Total								2E-05					8E-02
		Exposure Point Total									2E-05					8E-02
		260206 [Space 1]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	3.6E-02	ug/m3	3.7E-05	(ug/m3)$^{-1}$	1.3E-06	1.0E-01	ug/m3	N/A	N/A	N/A
				Chloroform	5E+00	ug/m^3	5.6E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.3E-05	1.6E+00	ug/m3	9.8E+01	ug/m3	1.6E-02
				Ethylbenzene	4E+00	ug/m^3	4.1E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.0E-06	1.1E+00	ug/m3	1.0E+03	ug/m3	1.1E-03
				Xylenes (total)	2E+01	ug/m^3	2.2E+00	ug/m3	N/A	N/A	N/A	6.1E+00	ug/m3	1.0E+02	ug/m3	6.1E-02
			Exp. Route Total								2E-05					8E-02
		Exposure Point Total									2E-05					8E-02
		260206 [Space 2]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	3.5E-02	ug/m3	3.7E-05	(ug/m3)$^{-1}$	1.3E-06	9.9E-02	ug/m3	N/A	N/A	N/A
				Chloroform	6E+00	ug/m^3	6.2E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.4E-05	1.7E+00	ug/m3	9.8E+01	ug/m3	1.8E-02
				Ethylbenzene	4E+00	ug/m^3	4.0E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.0E-06	1.1E+00	ug/m3	1.0E+03	ug/m3	1.1E-03
				Xylenes (total)	2E+01	ug/m^3	2.2E+00	ug/m3	N/A	N/A	N/A	6.1E+00	ug/m3	1.0E+02	ug/m3	6.1E-02
			Exp. Route Total								2E-05					8E-02
		Exposure Point Total									2E-05					8E-02
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
											Total of Receptor Risks Across All Media					N/A
																Total of Receptor Hazards Across All Media					N/A

TABLE 7.3.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare Worker
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	
Air	Indoor Air	260206 [Space 3]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	8.1E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	3.0E-07	6.3E-02	ug/m3	N/A	N/A	N/A
				Chloroform	5E+00	ug/m^3	1.4E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.1E-06	1.1E+00	ug/m3	9.8E+01	ug/m3	1.1E-02
				Ethylbenzene	3E+00	ug/m^3	8.9E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.2E-07	6.9E-01	ug/m3	1.0E+03	ug/m3	6.9E-04
				Xylenes (total)	2E+01	ug/m^3	4.8E-01	ug/m3	N/A	N/A	N/A	3.8E+00	ug/m3	1.0E+02	ug/m3	3.8E-02
			Exp. Route Total								4E-06					5E-02
		Exposure Point Total									4E-06					5E-02
		260206 [Space 1]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	8.3E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	3.1E-07	6.4E-02	ug/m3	N/A	N/A	N/A
				Chloroform	5E+00	ug/m^3	1.3E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.9E-06	9.9E-01	ug/m3	9.8E+01	ug/m3	1.0E-02
				Ethylbenzene	4E+00	ug/m^3	9.3E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.3E-07	7.2E-01	ug/m3	1.0E+03	ug/m3	7.2E-04
				Xylenes (total)	2E+01	ug/m^3	5.0E-01	ug/m3	N/A	N/A	N/A	3.9E+00	ug/m3	1.0E+02	ug/m3	3.9E-02
			Exp. Route Total								3E-06					5E-02
		Exposure Point Total									3E-06					5E-02
		260206 [Space 2]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	8.1E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	3.0E-07	6.3E-02	ug/m3	N/A	N/A	N/A
				Chloroform	6E+00	ug/m^3	1.4E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.3E-06	1.1E+00	ug/m3	9.8E+01	ug/m3	1.1E-02
				Ethylbenzene	4E+00	ug/m^3	9.2E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.3E-07	7.1E-01	ug/m3	1.0E+03	ug/m3	7.1E-04
				Xylenes (total)	2E+01	ug/m^3	5.0E-01	ug/m3	N/A	N/A	N/A	3.9E+00	ug/m3	1.0E+02	ug/m3	3.9E-02
			Exp. Route Total								4E-06					5E-02
		Exposure Point Total									4E-06					5E-02
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
										Total of Receptor Risks Across All Media	N/A			Total of Receptor Hazards Across All Media		N/A

TABLE 7.4.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare
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	
Air	Indoor Air	260206 [Space 3]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	9.9E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	3.7E-07	9.9E-02	ug/m3	N/A	N/A	N/A
				Chloroform	5E+00	ug/m^3	1.7E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.8E-06	1.7E+00	ug/m3	9.8E+01	ug/m3	1.7E-02
				Ethylbenzene	3E+00	ug/m^3	1.1E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.7E-07	1.1E+00	ug/m3	1.0E+03	ug/m3	1.1E-03
				Xylenes (total)	2E+01	ug/m^3	5.9E-01	ug/m3	N/A	N/A	N/A	5.9E+00	ug/m3	1.0E+02	ug/m3	5.9E-02
			Exp. Route Total								4E-06					8E-02
		Exposure Point Total									4E-06					8E-02
		260206 [Space 1]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	1.0E-02	ug/m3	3.7E-05	(ug/m3)$^{-1}$	3.7E-07	1.0E-01	ug/m3	N/A	N/A	N/A
				Chloroform	5E+00	ug/m^3	1.6E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.6E-06	1.6E+00	ug/m3	9.8E+01	ug/m3	1.6E-02
				Ethylbenzene	4E+00	ug/m^3	1.1E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.8E-07	1.1E+00	ug/m3	1.0E+03	ug/m3	1.1E-03
				Xylenes (total)	2E+01	ug/m^3	6.1E-01	ug/m3	N/A	N/A	N/A	6.1E+00	ug/m3	1.0E+02	ug/m3	6.1E-02
			Exp. Route Total								4E-06					8E-02
		Exposure Point Total									4E-06					8E-02
		260206 [Space 2]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	9.9E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	3.7E-07	9.9E-02	ug/m3	N/A	N/A	N/A
				Chloroform	6E+00	ug/m^3	1.7E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.0E-06	1.7E+00	ug/m3	9.8E+01	ug/m3	1.8E-02
				Ethylbenzene	4E+00	ug/m^3	1.1E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.8E-07	1.1E+00	ug/m3	1.0E+03	ug/m3	1.1E-03
				Xylenes (total)	2E+01	ug/m^3	6.1E-01	ug/m3	N/A	N/A	N/A	6.1E+00	ug/m3	1.0E+02	ug/m3	6.1E-02
			Exp. Route Total								5E-06					8E-02
		Exposure Point Total									5E-06					8E-02
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
											Total of Receptor Risks Across All Media	N/A		Total of Receptor Hazards Across All Media		N/A

TABLE 7.4.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare
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	
Air	Indoor Air	260206 [Space 3]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	3.7E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	1.4E-07	6.5E-02	ug/m3	N/A	N/A	N/A
				Chloroform	5E+00	ug/m^3	6.2E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.4E-06	1.1E+00	ug/m3	9.8E+01	ug/m3	1.1E-02
				Ethylbenzene	3E+00	ug/m^3	4.1E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.0E-07	7.1E-01	ug/m3	1.0E+03	ug/m3	7.1E-04
				Xylenes (total)	2E+01	ug/m^3	2.2E-01	ug/m3	N/A	N/A	N/A	3.9E+00	ug/m3	1.0E+02	ug/m3	3.9E-02
			Exp. Route Total								2E-06					5E-02
		Exposure Point Total									2E-06					5E-02
		260206 [Space 1]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	3.8E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	1.4E-07	6.6E-02	ug/m3	N/A	N/A	N/A
				Chloroform	5E+00	ug/m^3	5.8E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.3E-06	1.0E+00	ug/m3	9.8E+01	ug/m3	1.0E-02
				Ethylbenzene	4E+00	ug/m^3	4.3E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.1E-07	7.4E-01	ug/m3	1.0E+03	ug/m3	7.4E-04
				Xylenes (total)	2E+01	ug/m^3	2.3E-01	ug/m3	N/A	N/A	N/A	4.0E+00	ug/m3	1.0E+02	ug/m3	4.0E-02
			Exp. Route Total								2E-06					5E-02
		Exposure Point Total									2E-06					5E-02
		260206 [Space 2]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	3.7E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	1.4E-07	6.5E-02	ug/m3	N/A	N/A	N/A
				Chloroform	6E+00	ug/m^3	6.5E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.5E-06	1.1E+00	ug/m3	9.8E+01	ug/m3	1.2E-02
				Ethylbenzene	4E+00	ug/m^3	4.2E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.0E-07	7.3E-01	ug/m3	1.0E+03	ug/m3	7.3E-04
				Xylenes (total)	2E+01	ug/m^3	2.3E-01	ug/m3	N/A	N/A	N/A	4.0E+00	ug/m3	1.0E+02	ug/m3	4.0E-02
			Exp. Route Total								2E-06					5E-02
		Exposure Point Total									2E-06					5E-02
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
										Total of Receptor Risks Across All Media	N/A			Total of Receptor Hazards Across All Media		N/A

TABLE 7.5.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
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	
Air	Indoor Air	260504 [Basement]	Inhalation	Chloroform	6E-01	ug/m^3	1.9E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.4E-06	5.6E-01	ug/m3	9.8E+01	ug/m3	5.7E-03
				Ethylbenzene	3E+00	ug/m^3	8.2E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.1E-06	2.4E+00	ug/m3	1.0E+03	ug/m3	2.4E-03
				Naphthalene	2E+00	ug/m^3	5.9E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	2.0E-05	1.7E+00	ug/m3	3.0E+00	ug/m3	5.8E-01
				Xylenes (total)	1E+01	ug/m^3	4.7E+00	ug/m3	N/A	N/A	N/A	1.4E+01	ug/m3	1.0E+02	ug/m3	1.4E-01
			Exp. Route Total								3E-05					7E-01
		Exposure Point Total									3E-05					7E-01
		260505 [North unit basement]	Inhalation	Chloroform	3E-01	ug/m^3	8.4E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.9E-06	2.4E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Ethylbenzene	6E-01	ug/m^3	2.0E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	5.0E-07	5.9E-01	ug/m3	1.0E+03	ug/m3	5.9E-04
				Naphthalene	2E-01	ug/m^3	6.2E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	2.1E-06	1.8E-01	ug/m3	3.0E+00	ug/m3	6.0E-02
			Exp. Route Total								5E-06					6E-02
		Exposure Point Total									5E-06					6E-02
		260505 [North unit 1st Floor]	Inhalation	Chloroform	3E-01	ug/m^3	8.4E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.9E-06	2.4E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Ethylbenzene	6E-01	ug/m^3	2.1E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	5.1E-07	6.0E-01	ug/m3	1.0E+03	ug/m3	6.0E-04
				Naphthalene	1E-01	ug/m^3	4.5E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.5E-06	1.3E-01	ug/m3	3.0E+00	ug/m3	4.3E-02
			Exp. Route Total								4E-06					5E-02
		Exposure Point Total									4E-06					5E-02
		260505 [South unit basement]	Inhalation	Chloroform	2E+00	ug/m^3	6.6E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.5E-05	1.9E+00	ug/m3	9.8E+01	ug/m3	2.0E-02
				Ethylbenzene	2E+00	ug/m^3	6.0E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.5E-06	1.8E+00	ug/m3	1.0E+03	ug/m3	1.8E-03
				Naphthalene	4E-01	ug/m^3	1.3E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	4.3E-06	3.7E-01	ug/m3	3.0E+00	ug/m3	1.2E-01
			Exp. Route Total								2E-05					1E-01
		Exposure Point Total									2E-05					1E-01
		260902 [Basement]	Inhalation	Chloroform	3E-01	ug/m^3	1.1E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.5E-06	3.2E-01	ug/m3	9.8E+01	ug/m3	3.3E-03
				Naphthalene	3E-01	ug/m^3	1.1E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.8E-06	3.3E-01	ug/m3	3.0E+00	ug/m3	1.1E-01
			Exp. Route Total								6E-06					1E-01
		Exposure Point Total									6E-06					1E-01

TABLE 7.5.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
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	
		260902 [1st Floor]	Inhalation	Chloroform	2E-01	ug/m^3	7.5E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.7E-06	2.2E-01	ug/m3	9.8E+01	ug/m3	2.2E-03
				Naphthalene	ND	ug/m^3	N/A	N/A	3.4E-05	(ug/m3)$^{-1}$	N/A	N/A	N/A	3.0E+00	ug/m3	N/A
			Exp. Route Total								2E-06					2E-03
		Exposure Point Total									2E-06					2E-03
		260903 [Basement]	Inhalation	Chloroform	1E+00	ug/m^3	4.4E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.0E-05	1.3E+00	ug/m3	9.8E+01	ug/m3	1.3E-02
			Exp. Route Total								1E-05					1E-02
		Exposure Point Total									1E-05					1E-02
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
										Total of Receptor Risks Across All Media	N/A			Total of Receptor Hazards Across All Media		N/A

TABLE 7.5.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
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	
Air	Indoor Air	260504 [Basement]	Inhalation	Chloroform	6E-01	ug/m^3	3.7E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	8.5E-07	3.7E-01	ug/m3	9.8E+01	ug/m3	3.8E-03
				Ethylbenzene	3E+00	ug/m^3	1.6E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	4.0E-07	1.6E+00	ug/m3	1.0E+03	ug/m3	1.6E-03
				Naphthalene	2E+00	ug/m^3	1.2E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.9E-06	1.2E+00	ug/m3	3.0E+00	ug/m3	3.8E-01
				Xylenes (total)	1E+01	ug/m^3	9.2E-01	ug/m3	N/A	N/A	N/A	9.2E+00	ug/m3	1.0E+02	ug/m3	9.2E-02
			Exp. Route Total								5E-06					5E-01
		Exposure Point Total									5E-06					5E-01
		260505 [North unit basement]	Inhalation	Chloroform	3E-01	ug/m^3	1.6E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.7E-07	1.6E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Ethylbenzene	6E-01	ug/m^3	3.9E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	9.8E-08	3.9E-01	ug/m3	1.0E+03	ug/m3	3.9E-04
				Naphthalene	2E-01	ug/m^3	1.2E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	4.1E-07	1.2E-01	ug/m3	3.0E+00	ug/m3	4.0E-02
			Exp. Route Total								9E-07					4E-02
		Exposure Point Total									9E-07					4E-02
		260505 [North unit 1st Floor]	Inhalation	Chloroform	3E-01	ug/m^3	1.6E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.7E-07	1.6E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Ethylbenzene	6E-01	ug/m^3	4.0E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.0E-07	4.0E-01	ug/m3	1.0E+03	ug/m3	4.0E-04
				Naphthalene	1E-01	ug/m^3	8.7E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.0E-07	8.7E-02	ug/m3	3.0E+00	ug/m3	2.9E-02
			Exp. Route Total								8E-07					3E-02
		Exposure Point Total									8E-07					3E-02
		260505 [South unit basement]	Inhalation	Chloroform	2E+00	ug/m^3	1.3E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.9E-06	1.3E+00	ug/m3	9.8E+01	ug/m3	1.3E-02
				Ethylbenzene	2E+00	ug/m^3	1.2E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.9E-07	1.2E+00	ug/m3	1.0E+03	ug/m3	1.2E-03
				Naphthalene	4E-01	ug/m^3	2.4E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	8.3E-07	2.4E-01	ug/m3	3.0E+00	ug/m3	8.2E-02
			Exp. Route Total								4E-06					1E-01
		Exposure Point Total									4E-06					1E-01
		260902 [Basement]	Inhalation	Chloroform	3E-01	ug/m^3	2.2E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	5.0E-07	2.2E-01	ug/m3	9.8E+01	ug/m3	2.2E-03
				Naphthalene	3E-01	ug/m^3	2.2E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	7.4E-07	2.2E-01	ug/m3	3.0E+00	ug/m3	7.3E-02
			Exp. Route Total								1E-06					7E-02
		Exposure Point Total									1E-06					7E-02

TABLE 7.5.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
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	
		260902 [1st Floor]	Inhalation	Chloroform	2E-01	ug/m^3	1.5E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.4E-07	1.5E-01	ug/m3	9.8E+01	ug/m3	1.5E-03
				Naphthalene	ND	ug/m^3	N/A	N/A	3.4E-05	(ug/m3)$^{-1}$	N/A	N/A	N/A	3.0E+00	ug/m3	N/A
			Exp. Route Total								3E-07					1E-03
		Exposure Point Total									3E-07					1E-03
		260903 [Basement]	Inhalation	Chloroform	1E+00	ug/m^3	8.6E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.0E-06	8.6E-01	ug/m3	9.8E+01	ug/m3	8.8E-03
			Exp. Route Total								2E-06					9E-03
		Exposure Point Total									2E-06					9E-03
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
										Total of Receptor Risks Across All Media	N/A			Total of Receptor Hazards Across All Media		N/A

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young 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	
Air	Indoor Air	260504 [Basement]	Inhalation	Chloroform	6E-01	ug/m^3	4.8E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.1E-06	5.6E-01	ug/m3	9.8E+01	ug/m3	5.7E-03
				Ethylbenzene	3E+00	ug/m^3	2.1E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	5.1E-07	2.4E+00	ug/m3	1.0E+03	ug/m3	2.4E-03
				Naphthalene	2E+00	ug/m^3	1.5E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	5.0E-06	1.7E+00	ug/m3	3.0E+00	ug/m3	5.8E-01
				Xylenes (total)	1E+01	ug/m^3	1.2E+00	ug/m3	N/A	N/A	N/A	1.4E+01	ug/m3	1.0E+02	ug/m3	1.4E-01
			Exp. Route Total								7E-06					7E-01
		Exposure Point Total									7E-06					7E-01
		260505 [North unit basement]	Inhalation	Chloroform	3E-01	ug/m^3	2.1E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.8E-07	2.4E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Ethylbenzene	6E-01	ug/m^3	5.0E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.3E-07	5.9E-01	ug/m3	1.0E+03	ug/m3	5.9E-04
				Naphthalene	2E-01	ug/m^3	1.6E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	5.3E-07	1.8E-01	ug/m3	3.0E+00	ug/m3	6.0E-02
			Exp. Route Total								1E-06					6E-02
		Exposure Point Total									1E-06					6E-02
		260505 [North unit 1st Floor]	Inhalation	Chloroform	3E-01	ug/m^3	2.1E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.8E-07	2.4E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Ethylbenzene	6E-01	ug/m^3	5.1E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.3E-07	6.0E-01	ug/m3	1.0E+03	ug/m3	6.0E-04
				Naphthalene	1E-01	ug/m^3	1.1E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.8E-07	1.3E-01	ug/m3	3.0E+00	ug/m3	4.3E-02
			Exp. Route Total								1E-06					5E-02
		Exposure Point Total									1E-06					5E-02
		260505 [South unit basement]	Inhalation	Chloroform	2E+00	ug/m^3	1.6E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.8E-06	1.9E+00	ug/m3	9.8E+01	ug/m3	2.0E-02
				Ethylbenzene	2E+00	ug/m^3	1.5E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	3.8E-07	1.8E+00	ug/m3	1.0E+03	ug/m3	1.8E-03
				Naphthalene	4E-01	ug/m^3	3.1E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.1E-06	3.7E-01	ug/m3	3.0E+00	ug/m3	1.2E-01
			Exp. Route Total								5E-06					1E-01
		Exposure Point Total									5E-06					1E-01
		260902 [Basement]	Inhalation	Chloroform	3E-01	ug/m^3	2.8E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	6.4E-07	3.2E-01	ug/m3	9.8E+01	ug/m3	3.3E-03
				Naphthalene	3E-01	ug/m^3	2.8E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	9.5E-07	3.3E-01	ug/m3	3.0E+00	ug/m3	1.1E-01
			Exp. Route Total								2E-06					1E-01
		Exposure Point Total									2E-06					1E-01

TABLE 7.6.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young 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	
		260902 [1st Floor]	Inhalation	Chloroform	2E-01	ug/m^3	1.9E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.3E-07	2.2E-01	ug/m3	9.8E+01	ug/m3	2.2E-03
				Naphthalene	ND	ug/m^3	N/A	N/A	3.4E-05	(ug/m3)$^{-1}$	N/A	N/A	N/A	3.0E+00	ug/m3	N/A
			Exp. Route Total								4E-07					2E-03
		Exposure Point Total									4E-07					2E-03
		260903 [Basement]	Inhalation	Chloroform	1E+00	ug/m^3	1.1E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.6E-06	1.3E+00	ug/m3	9.8E+01	ug/m3	1.3E-02
			Exp. Route Total								3E-06					1E-02
		Exposure Point Total									3E-06					1E-02
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
										Total of Receptor Risks Across All Media	N/A			Total of Receptor Hazards Across All Media		N/A

TABLE 7.6.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young 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	
Air	Indoor Air	260504 [Basement]	Inhalation	Chloroform	6E-01	ug/m^3	1.1E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.4E-07	3.7E-01	ug/m3	9.8E+01	ug/m3	3.8E-03
				Ethylbenzene	3E+00	ug/m^3	4.6E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.1E-07	1.6E+00	ug/m3	1.0E+03	ug/m3	1.6E-03
				Naphthalene	2E+00	ug/m^3	3.3E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.1E-06	1.2E+00	ug/m3	3.0E+00	ug/m3	3.8E-01
				Xylenes (total)	1E+01	ug/m^3	2.6E-01	ug/m3	N/A	N/A	N/A	9.2E+00	ug/m3	1.0E+02	ug/m3	9.2E-02
			Exp. Route Total								1E-06					5E-01
		Exposure Point Total									1E-06					5E-01
		260505 [North unit basement]	Inhalation	Chloroform	3E-01	ug/m^3	4.6E-03	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.1E-07	1.6E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Ethylbenzene	6E-01	ug/m^3	1.1E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.8E-08	3.9E-01	ug/m3	1.0E+03	ug/m3	3.9E-04
				Naphthalene	2E-01	ug/m^3	3.5E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.2E-07	1.2E-01	ug/m3	3.0E+00	ug/m3	4.0E-02
			Exp. Route Total								3E-07					4E-02
		Exposure Point Total									3E-07					4E-02
		260505 [North unit 1st Floor]	Inhalation	Chloroform	3E-01	ug/m^3	4.6E-03	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.1E-07	1.6E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Ethylbenzene	6E-01	ug/m^3	1.1E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.9E-08	4.0E-01	ug/m3	1.0E+03	ug/m3	4.0E-04
				Naphthalene	1E-01	ug/m^3	2.5E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	8.4E-08	8.7E-02	ug/m3	3.0E+00	ug/m3	2.9E-02
			Exp. Route Total								2E-07					3E-02
		Exposure Point Total									2E-07					3E-02
		260505 [South unit basement]	Inhalation	Chloroform	2E+00	ug/m^3	3.7E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	8.4E-07	1.3E+00	ug/m3	9.8E+01	ug/m3	1.3E-02
				Ethylbenzene	2E+00	ug/m^3	3.4E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	8.4E-08	1.2E+00	ug/m3	1.0E+03	ug/m3	1.2E-03
				Naphthalene	4E-01	ug/m^3	7.0E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	2.4E-07	2.4E-01	ug/m3	3.0E+00	ug/m3	8.2E-02
			Exp. Route Total								1E-06					1E-01
		Exposure Point Total									1E-06					1E-01
		260902 [Basement]	Inhalation	Chloroform	3E-01	ug/m^3	6.2E-03	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.4E-07	2.2E-01	ug/m3	9.8E+01	ug/m3	2.2E-03
				Naphthalene	3E-01	ug/m^3	6.2E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	2.1E-07	2.2E-01	ug/m3	3.0E+00	ug/m3	7.3E-02
			Exp. Route Total								4E-07					7E-02
		Exposure Point Total									4E-07					7E-02

TABLE 7.6.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young 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	
		260902 [1st Floor]	Inhalation	Chloroform	2E-01	ug/m^3	4.2E-03	ug/m3	2.3E-05	(ug/m3)$^{-1}$	9.6E-08	1.5E-01	ug/m3	9.8E+01	ug/m3	1.5E-03
				Naphthalene	ND	ug/m^3	N/A	N/A	3.4E-05	(ug/m3)$^{-1}$	N/A	N/A	N/A	3.0E+00	ug/m3	N/A
			Exp. Route Total								1E-07					1E-03
		Exposure Point Total									1E-07					1E-03
		260903 [Basement]	Inhalation	Chloroform	1E+00	ug/m^3	2.5E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	5.7E-07	8.6E-01	ug/m3	9.8E+01	ug/m3	8.8E-03
			Exp. Route Total								6E-07					9E-03
		Exposure Point Total									6E-07					9E-03
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A
										Total of Receptor Risks Across All Media	N/A			Total of Receptor Hazards Across All Media		N/A

TABLE 7.7.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Commercial Worker
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	
Air	Indoor Air	260207 [Spaces 1 to 3]	Inhalation													
				1,2,4-Trimethylbenzene	2E+00	ug/m^3	1.3E-01	ug/m3	N/A	N/A	N/A	3.7E-01	ug/m3	7.0E+00	ug/m3	5.2E-02
				1,4-Dichlorobenzene	4E+01	ug/m^3	3.3E+00	ug/m3	1.1E-05	(ug/m3)$^{-1}$	3.6E-05	9.2E+00	ug/m3	8.0E+02	ug/m3	1.1E-02
				Benzene	1E+00	ug/m^3	1.2E-01	ug/m3	7.8E-06	(ug/m3)$^{-1}$	9.1E-07	3.3E-01	ug/m3	3.0E+01	ug/m3	1.1E-02
				Carbon tetrachloride	5E-01	ug/m^3	4.2E-02	ug/m3	6.0E-06	(ug/m3)$^{-1}$	2.5E-07	1.2E-01	ug/m3	1.0E+02	ug/m3	1.2E-03
				Chloroform	4E-01	ug/m^3	3.3E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	7.6E-07	9.2E-02	ug/m3	9.8E+01	ug/m3	9.4E-04
				Ethylbenzene	2E+00	ug/m^3	1.2E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	3.1E-07	3.5E-01	ug/m3	1.0E+03	ug/m3	3.5E-04
				Naphthalene	2E+01	ug/m^3	1.3E+00	ug/m3	3.4E-05	(ug/m3)$^{-1}$	4.3E-05	3.6E+00	ug/m3	3.0E+00	ug/m3	1.2E+00
				Tetrachloroethene	8E+01	ug/m^3	6.6E+00	ug/m3	2.6E-07	(ug/m3)$^{-1}$	1.7E-06	1.9E+01	ug/m3	4.0E+01	ug/m3	4.6E-01
				Trichloroethene	1E+00	ug/m^3	8.5E-02	ug/m3	4.0E-06	(ug/m3)$^{-1}$	3.4E-07	2.4E-01	ug/m3	2.0E+00	ug/m3	1.2E-01
				C5-C8 Aliphatics	2E+02	ug/m^3	1.2E+01	ug/m3	N/A	N/A	N/A	3.4E+01	ug/m3	6.0E+02	ug/m3	5.7E-02
				C9-C12 Aliphatics	9E+01	ug/m^3	7.1E+00	ug/m3	N/A	N/A	N/A	2.0E+01	ug/m3	1.0E+02	ug/m3	2.0E-01
			Exp. Route Total								8E-05					2E+00
		Exposure Point Total									8E-05					2E+00
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A

Unit Risk $(ug/m3)^{-1}$

Total of Receptor Risks Across All Media: N/A

Total of Receptor Hazards Across All Media: N/A

Cancer Risk with MassDEP unit risk for PCE: 1.0E-05 — 260207 [Spaces 1 to 3]: 1E-04

Cancer Risk with MassDEP unit risk for TCE: 1.7E-06 — 260207 [Spaces 1 to 3]: 8E-05

TABLE 7.7.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Commercial Worker
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	
Air	Indoor Air	260207 [Spaces 1 to 3]	Inhalation													
				1,2,4-Trimethylbenzene	2E+00	ug/m^3	4.1E-02	ug/m3	N/A	N/A	N/A	3.2E-01	ug/m3	7.0E+00	ug/m3	4.6E-02
				1,4-Dichlorobenzene	4E+01	ug/m^3	1.0E+00	ug/m3	1.1E-05	(ug/m3)$^{-1}$	1.1E-05	8.0E+00	ug/m3	8.0E+02	ug/m3	1.0E-02
				Benzene	1E+00	ug/m^3	3.7E-02	ug/m3	7.8E-06	(ug/m3)$^{-1}$	2.9E-07	2.9E-01	ug/m3	3.0E+01	ug/m3	9.5E-03
				Carbon tetrachloride	5E-01	ug/m^3	1.3E-02	ug/m3	6.0E-06	(ug/m3)$^{-1}$	7.9E-08	1.0E-01	ug/m3	1.0E+02	ug/m3	1.0E-03
				Chloroform	4E-01	ug/m^3	1.0E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.4E-07	8.1E-02	ug/m3	9.8E+01	ug/m3	8.3E-04
				Ethylbenzene	2E+00	ug/m^3	3.9E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	9.8E-08	3.1E-01	ug/m3	1.0E+03	ug/m3	3.1E-04
				Naphthalene	2E+01	ug/m^3	4.0E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.4E-05	3.1E+00	ug/m3	3.0E+00	ug/m3	1.0E+00
				Tetrachloroethene	8E+01	ug/m^3	2.1E+00	ug/m3	2.6E-07	(ug/m3)$^{-1}$	5.4E-07	1.6E+01	ug/m3	4.0E+01	ug/m3	4.1E-01
				Trichloroethene	1E+00	ug/m^3	2.7E-02	ug/m3	4.0E-06	(ug/m3)$^{-1}$	1.1E-07	2.1E-01	ug/m3	2.0E+00	ug/m3	1.0E-01
				C5-C8 Aliphatics	2E+02	ug/m^3	3.9E+00	ug/m3	N/A	N/A	N/A	3.0E+01	ug/m3	6.0E+02	ug/m3	5.0E-02
				C9-C12 Aliphatics	9E+01	ug/m^3	2.2E+00	ug/m3	N/A	N/A	N/A	1.7E+01	ug/m3	1.0E+02	ug/m3	1.7E-01
			Exp. Route Total								3E-05					2E+00
		Exposure Point Total									3E-05					2E+00
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A

Unit Risk $(ug/m3)^{-1}$

Total of Receptor Risks Across All Media: N/A

Total of Receptor Hazards Across All Media: N/A

Cancer Risk with MassDEP unit risk for PCE: 1.0E-05 — 260207 [Spaces 1 to 3]: 5E-05

Cancer Risk with MassDEP unit risk for TCE: 1.7E-06 — 260207 [Spaces 1 to 3]: 3E-05

TABLE 7.8.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

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	
Air	Indoor Air	260206 [Spaces 1 to 3]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	1.1E-01	ug/m3	3.7E-05	(ug/m3)$^{-1}$	3.9E-06	3.1E-01	ug/m3	N/A	N/A	N/A
				Chloroform	6E+00	ug/m^3	1.8E+00	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.2E-05	5.3E+00	ug/m3	9.8E+01	ug/m3	5.5E-02
				Ethylbenzene	4E+00	ug/m^3	1.2E+00	ug/m3	2.5E-06	(ug/m3)$^{-1}$	3.0E-06	3.5E+00	ug/m3	1.0E+03	ug/m3	3.5E-03
				Xylenes (total)	2E+01	ug/m^3	6.4E+00	ug/m3	N/A	N/A	N/A	1.9E+01	ug/m3	1.0E+02	ug/m3	1.9E-01
			Exp. Route Total								5E-05					2E-01
		Exposure Point Total									5E-05					2E-01
		260504 [Basement]	Inhalation													
				Chloroform	6E-01	ug/m^3	1.9E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.4E-06	5.6E-01	ug/m3	9.8E+01	ug/m3	5.7E-03
				Ethylbenzene	3E+00	ug/m^3	8.2E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.1E-06	2.4E+00	ug/m3	1.0E+03	ug/m3	2.4E-03
				Naphthalene	2E+00	ug/m^3	5.9E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	2.0E-05	1.7E+00	ug/m3	3.0E+00	ug/m3	5.8E-01
				Xylenes (total)	1E+01	ug/m^3	4.7E+00	ug/m3	N/A	N/A	N/A	1.4E+01	ug/m3	1.0E+02	ug/m3	1.4E-01
			Exp. Route Total								3E-05					7E-01
		Exposure Point Total									3E-05					7E-01
		260207 [Spaces 1 to 3]	Inhalation													
				1,2,4-Trimethylbenzene	2E+00	ug/m^3	5.3E-01	ug/m3	N/A	N/A	N/A	1.5E+00	ug/m3	7.0E+00	ug/m3	2.2E-01
				1,4-Dichlorobenzene	4E+01	ug/m^3	1.3E+01	ug/m3	1.1E-05	(ug/m3)$^{-1}$	1.5E-04	3.8E+01	ug/m3	8.0E+02	ug/m3	4.8E-02
				Benzene	1E+00	ug/m^3	4.7E-01	ug/m3	7.8E-06	(ug/m3)$^{-1}$	3.7E-06	1.4E+00	ug/m3	3.0E+01	ug/m3	4.6E-02
				Carbon tetrachloride	5E-01	ug/m^3	1.7E-01	ug/m3	6.0E-06	(ug/m3)$^{-1}$	1.0E-06	4.9E-01	ug/m3	1.0E+02	ug/m3	4.9E-03
				Chloroform	4E-01	ug/m^3	1.3E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.1E-06	3.9E-01	ug/m3	9.8E+01	ug/m3	4.0E-03
				Ethylbenzene	2E+00	ug/m^3	5.0E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.3E-06	1.5E+00	ug/m3	1.0E+03	ug/m3	1.5E-03
				Naphthalene	2E+01	ug/m^3	5.1E+00	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.7E-04	1.5E+01	ug/m3	3.0E+00	ug/m3	5.0E+00
				Tetrachloroethene	8E+01	ug/m^3	2.7E+01	ug/m3	2.6E-07	(ug/m3)$^{-1}$	6.9E-06	7.8E+01	ug/m3	4.0E+01	ug/m3	1.9E+00
				Trichloroethene	1E+00	ug/m^3	3.4E-01	ug/m3	1E-06/ 3.1E-6	(ug/m3)$^{-1}$	1.7E-06	1.0E+00	ug/m3	2.0E+00	ug/m3	5.0E-01
				C5-C8 Aliphatics	2E+02	ug/m^3	4.9E+01	ug/m3	N/A	N/A	N/A	1.4E+02	ug/m3	6.0E+02	ug/m3	2.4E-01
				C9-C12 Aliphatics	9E+01	ug/m^3	2.9E+01	ug/m3	N/A	N/A	N/A	8.3E+01	ug/m3	1.0E+02	ug/m3	8.3E-01
			Exp. Route Total								3E-04					9E+00
		Exposure Point Total									3E-04					9E+00
		260505 [North unit basement]	Inhalation													
				Chloroform	3E-01	ug/m^3	8.4E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.9E-06	2.4E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Ethylbenzene	6E-01	ug/m^3	2.0E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	5.0E-07	5.9E-01	ug/m3	1.0E+03	ug/m3	5.9E-04
				Naphthalene	2E-01	ug/m^3	6.2E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	2.1E-06	1.8E-01	ug/m3	3.0E+00	ug/m3	6.0E-02
			Exp. Route Total								5E-06					6E-02
		Exposure Point Total									5E-06					6E-02

TABLE 7.8.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

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	
		260505 [North unit 1st Floor]	Inhalation													
				Chloroform	3E-01	ug/m^3	8.4E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.9E-06	2.4E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Ethylbenzene	6E-01	ug/m^3	2.1E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	5.1E-07	6.0E-01	ug/m3	1.0E+03	ug/m3	6.0E-04
				Naphthalene	1E-01	ug/m^3	4.5E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.5E-06	1.3E-01	ug/m3	3.0E+00	ug/m3	4.3E-02
			Exp. Route Total								4E-06					5E-02
		Exposure Point Total									4E-06					5E-02
		260505 [South unit basement]	Inhalation													
				Chloroform	2E+00	ug/m^3	6.6E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.5E-05	1.9E+00	ug/m3	9.8E+01	ug/m3	2.0E-02
				Ethylbenzene	2E+00	ug/m^3	6.0E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.5E-06	1.8E+00	ug/m3	1.0E+03	ug/m3	1.8E-03
				Naphthalene	4E-01	ug/m^3	1.3E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	4.3E-06	3.7E-01	ug/m3	3.0E+00	ug/m3	1.2E-01
			Exp. Route Total								2E-05					1E-01
		Exposure Point Total									2E-05					1E-01
		260902 [Basement]	Inhalation													
				Chloroform	3E-01	ug/m^3	1.1E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.5E-06	3.2E-01	ug/m3	9.8E+01	ug/m3	3.3E-03
				Naphthalene	3E-01	ug/m^3	1.1E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.8E-06	3.3E-01	ug/m3	3.0E+00	ug/m3	1.1E-01
			Exp. Route Total								6E-06					1E-01
		Exposure Point Total									6E-06					1E-01
		260902 [1st Floor]	Inhalation													
				Chloroform	2E-01	ug/m^3	7.5E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.7E-06	2.2E-01	ug/m3	9.8E+01	ug/m3	2.2E-03
				Naphthalene	ND	ug/m^3	N/A	N/A	3.4E-05	(ug/m3)$^{-1}$	N/A	N/A	N/A	3.0E+00	ug/m3	N/A
			Exp. Route Total								2E-06					2E-03
		Exposure Point Total									2E-06					2E-03
		260903 [Basement]	Inhalation													
				Chloroform	1E+00	ug/m^3	4.4E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.0E-05	1.3E+00	ug/m3	9.8E+01	ug/m3	1.3E-02
			Exp. Route Total								1E-05					1E-02
		Exposure Point Total									1E-05					1E-02
		260407 [Spaces 1 to 5]	Inhalation													
				Acetone	9E+03	ug/m^3	2.9E+03	ug/m3	N/A	N/A	N/A	8.3E+03	ug/m3	3.1E+04	ug/m3	2.7E-01
				Chloroform	6E+01	ug/m^3	2.1E+01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.8E-04	6.1E+01	ug/m3	9.8E+01	ug/m3	6.2E-01
				Naphthalene	6E-01	ug/m^3	2.0E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	6.9E-06	5.9E-01	ug/m3	3.0E+00	ug/m3	2.0E-01
			Exp. Route Total								5E-04					1E+00
		Exposure Point Total									5E-04					1E+00
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A

TABLE 7.8.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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	
					Unit Risk				Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		N/A
					$(ug/m3)^{-1}$											
		Cancer Risk with MassDEP unit risk for PCE:			1.0E-05				260207 [Spaces 1 to 3]		6E-04					
		Cancer Risk with MassDEP unit risk for TCE:			1.7E-06				260207 [Spaces 1 to 3]		3E-04					

Notes

Early-life cancer risk calculations for TCE calculated by multiplying the intake/exposure concentration by the default age-dependent adjustment factor (ADAF) of 3 for 10/24 of the result (ages 7-16) and by the default ADAF of 1 for 14/24 of the result (ages 17-30), but only for exposures associated with the production of kidney tumors. This requires splitting the unit risk by tumor effects [kidney = 1E-06 $(ug/m^3)^{-1}$ and non-Hodgkins lymphoma (NHL)/liver = 3.1E-6 $(ug/m^3)^{-1}$].

Inhalation early-life cancer risk = [intake/exposure concentration (ug/m^3) x kidney Unit Risk $(ug/m^3)^{-1}$ x 3 + intake/exposure concentration (ug/m^3) x NHL/liver Unit Risk $(ug/m^3)^{-1}$] x 10/24 +
[intake/exposure concentration (ug/m^3) x kidney Unit Risk $(ug/m^3)^{-1}$ x 1 + intake/exposure concentration (ug/m^3) x NHL/liver Unit Risk $(ug/m^3)^{-1}$] x 14/24

TABLE 7.8.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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	
Air	Indoor Air	260206 [Spaces 1 to 3]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	2.1E-02	ug/m3	3.7E-05	(ug/m3)$^{-1}$	7.6E-07	2.1E-01	ug/m3	N/A	N/A	N/A
				Chloroform	6E+00	ug/m^3	3.6E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	8.2E-06	3.6E+00	ug/m3	9.8E+01	ug/m3	3.6E-02
				Ethylbenzene	4E+00	ug/m^3	2.3E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	5.8E-07	2.3E+00	ug/m3	1.0E+03	ug/m3	2.3E-03
				Xylenes (total)	2E+01	ug/m^3	1.2E+00	ug/m3	N/A	N/A	N/A	1.2E+01	ug/m3	1.0E+02	ug/m3	1.2E-01
			Exp. Route Total								1E-05					2E-01
		Exposure Point Total									1E-05					2E-01
		260504 [Basement]	Inhalation													
				Chloroform	6E-01	ug/m^3	3.7E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	8.5E-07	3.7E-01	ug/m3	9.8E+01	ug/m3	3.8E-03
				Ethylbenzene	3E+00	ug/m^3	1.6E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	4.0E-07	1.6E+00	ug/m3	1.0E+03	ug/m3	1.6E-03
				Naphthalene	2E+00	ug/m^3	1.2E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.9E-06	1.2E+00	ug/m3	3.0E+00	ug/m3	3.8E-01
				Xylenes (total)	1E+01	ug/m^3	9.2E-01	ug/m3	N/A	N/A	N/A	9.2E+00	ug/m3	1.0E+02	ug/m3	9.2E-02
			Exp. Route Total								5E-06					5E-01
		Exposure Point Total									5E-06					5E-01
		260207 [Spaces 1 to 3]	Inhalation													
				1,2,4-Trimethylbenzene	2E+00	ug/m^3	1.0E-01	ug/m3	N/A	N/A	N/A	1.0E+00	ug/m3	7.0E+00	ug/m3	1.5E-01
				1,4-Dichlorobenzene	4E+01	ug/m^3	2.6E+00	ug/m3	1.1E-05	(ug/m3)$^{-1}$	2.8E-05	2.6E+01	ug/m3	8.0E+02	ug/m3	3.2E-02
				Benzene	1E+00	ug/m^3	9.1E-02	ug/m3	7.8E-06	(ug/m3)$^{-1}$	7.1E-07	9.1E-01	ug/m3	3.0E+01	ug/m3	3.0E-02
				Carbon tetrachloride	5E-01	ug/m^3	3.3E-02	ug/m3	6.0E-06	(ug/m3)$^{-1}$	2.0E-07	3.3E-01	ug/m3	1.0E+02	ug/m3	3.3E-03
				Chloroform	4E-01	ug/m^3	2.6E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	6.0E-07	2.6E-01	ug/m3	9.8E+01	ug/m3	2.6E-03
				Ethylbenzene	2E+00	ug/m^3	9.8E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.4E-07	9.8E-01	ug/m3	1.0E+03	ug/m3	9.8E-04
				Naphthalene	2E+01	ug/m^3	1.0E+00	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.4E-05	1.0E+01	ug/m3	3.0E+00	ug/m3	3.3E+00
				Tetrachloroethene	8E+01	ug/m^3	5.2E+00	ug/m3	2.6E-07	(ug/m3)$^{-1}$	1.3E-06	5.2E+01	ug/m3	4.0E+01	ug/m3	1.3E+00
				Trichloroethene	1E+00	ug/m^3	6.6E-02	ug/m3	1E-06/ 3.1E-6	(ug/m3)$^{-1}$	3.3E-07	6.6E-01	ug/m3	2.0E+00	ug/m3	3.3E-01
				C5-C8 Aliphatics	2E+02	ug/m^3	9.6E+00	ug/m3	N/A	N/A	N/A	9.6E+01	ug/m3	6.0E+02	ug/m3	1.6E-01
				C9-C12 Aliphatics	9E+01	ug/m^3	5.6E+00	ug/m3	N/A	N/A	N/A	5.6E+01	ug/m3	1.0E+02	ug/m3	5.6E-01
			Exp. Route Total								7E-05					6E+00
		Exposure Point Total									7E-05					6E+00
		260505 [North unit basement]	Inhalation													
				Chloroform	3E-01	ug/m^3	1.6E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.7E-07	1.6E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Ethylbenzene	6E-01	ug/m^3	3.9E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	9.8E-08	3.9E-01	ug/m3	1.0E+03	ug/m3	3.9E-04
				Naphthalene	2E-01	ug/m^3	1.2E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	4.1E-07	1.2E-01	ug/m3	3.0E+00	ug/m3	4.0E-02
			Exp. Route Total								9E-07					4E-02
		Exposure Point Total									9E-07					4E-02

TABLE 7.8.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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	
		260505 [North unit 1st Floor]	Inhalation													
				Chloroform	3E-01	ug/m^3	1.6E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.7E-07	1.6E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Ethylbenzene	6E-01	ug/m^3	4.0E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.0E-07	4.0E-01	ug/m3	1.0E+03	ug/m3	4.0E-04
				Naphthalene	1E-01	ug/m^3	8.7E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.0E-07	8.7E-02	ug/m3	3.0E+00	ug/m3	2.9E-02
			Exp. Route Total								8E-07					3E-02
		Exposure Point Total									8E-07					3E-02
		260505 [South unit basement]	Inhalation													
				Chloroform	2E+00	ug/m^3	1.3E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.9E-06	1.3E+00	ug/m3	9.8E+01	ug/m3	1.3E-02
				Ethylbenzene	2E+00	ug/m^3	1.2E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.9E-07	1.2E+00	ug/m3	1.0E+03	ug/m3	1.2E-03
				Naphthalene	4E-01	ug/m^3	2.4E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	8.3E-07	2.4E-01	ug/m3	3.0E+00	ug/m3	8.2E-02
			Exp. Route Total								4E-06					1E-01
		Exposure Point Total									4E-06					1E-01
		260902 [Basement]	Inhalation													
				Chloroform	3E-01	ug/m^3	2.2E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	5.0E-07	2.2E-01	ug/m3	9.8E+01	ug/m3	2.2E-03
				Naphthalene	3E-01	ug/m^3	2.2E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	7.4E-07	2.2E-01	ug/m3	3.0E+00	ug/m3	7.3E-02
			Exp. Route Total								1E-06					7E-02
		Exposure Point Total									1E-06					7E-02
		260902 [1st Floor]	Inhalation													
				Chloroform	2E-01	ug/m^3	1.5E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.4E-07	1.5E-01	ug/m3	9.8E+01	ug/m3	1.5E-03
				Naphthalene	ND	ug/m^3	N/A	N/A	3.4E-05	(ug/m3)$^{-1}$	N/A	N/A	N/A	3.0E+00	ug/m3	N/A
			Exp. Route Total								3E-07					1E-03
		Exposure Point Total									3E-07					1E-03
		260903 [Basement]	Inhalation													
				Chloroform	1E+00	ug/m^3	8.6E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.0E-06	8.6E-01	ug/m3	9.8E+01	ug/m3	8.8E-03
			Exp. Route Total								2E-06					9E-03
		Exposure Point Total									2E-06					9E-03
		260407 [Spaces 1 to 5]	Inhalation													
				Acetone	9E+03	ug/m^3	5.6E+02	ug/m3	N/A	N/A	N/A	5.6E+03	ug/m3	3.1E+04	ug/m3	1.8E-01
				Chloroform	6E+01	ug/m^3	4.0E+00	ug/m3	2.3E-05	(ug/m3)$^{-1}$	9.3E-05	4.0E+01	ug/m3	9.8E+01	ug/m3	4.1E-01
				Naphthalene	6E-01	ug/m^3	4.0E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.3E-06	4.0E-01	ug/m3	3.0E+00	ug/m3	1.3E-01
			Exp. Route Total								9E-05					7E-01
		Exposure Point Total									9E-05					7E-01
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A

TABLE 7.8.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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	
					Unit Risk				Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		N/A
					$(ug/m3)^{-1}$											
		Cancer Risk with MassDEP unit risk for PCE:			1.0E-05				260207 [Spaces 1 to 3]		1E-04					
		Cancer Risk with MassDEP unit risk for TCE:			1.7E-06				260207 [Spaces 1 to 3]		7E-05					

Notes

Early-life cancer risk calculations for TCE calculated by multiplying the intake/exposure concentration by the default age-dependent adjustment factor (ADAF) of 3 for 10/24 of the result (ages 7-16) and by the default ADAF of 1 for 14/24 of the result (ages 17-30), but only for exposures associated with the production of kidney tumors. This requires splitting the unit risk by tumor effects [kidney = 1E-06 $(ug/m^3)^{-1}$ and non-Hodgkins lymphoma (NHL)/liver = 3.1E-6 $(ug/m^3)^{-1}$].

Inhalation early-life cancer risk = [intake/exposure concentration (ug/m^3) x kidney Unit Risk $(ug/m^3)^{-1}$ x 3 + intake/exposure concentration (ug/m^3) x NHL/liver Unit Risk $(ug/m^3)^{-1}$] x 10/24 +
[intake/exposure concentration (ug/m^3) x kidney Unit Risk $(ug/m^3)^{-1}$ x 1 + intake/exposure concentration (ug/m^3) x NHL/liver Unit Risk $(ug/m^3)^{-1}$] x 14/24

TABLE 7.9.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young 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	
Air	Indoor Air	260206 [Spaces 1 to 3]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	2.6E-02	ug/m3	3.7E-05	(ug/m3)$^{-1}$	9.8E-07	3.1E-01	ug/m3	N/A	N/A	N/A
				Chloroform	6E+00	ug/m^3	4.6E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.1E-05	5.3E+00	ug/m3	9.8E+01	ug/m3	5.5E-02
				Ethylbenzene	4E+00	ug/m^3	3.0E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	7.4E-07	3.5E+00	ug/m3	1.0E+03	ug/m3	3.5E-03
				Xylenes (total)	2E+01	ug/m^3	1.6E+00	ug/m3	N/A	N/A	N/A	1.9E+01	ug/m3	1.0E+02	ug/m3	1.9E-01
			Exp. Route Total								1E-05					2E-01
		Exposure Point Total									1E-05					2E-01
		260504 [Basement]	Inhalation													
				Chloroform	6E-01	ug/m^3	4.8E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.1E-06	5.6E-01	ug/m3	9.8E+01	ug/m3	5.7E-03
				Ethylbenzene	3E+00	ug/m^3	2.1E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	5.1E-07	2.4E+00	ug/m3	1.0E+03	ug/m3	2.4E-03
				Naphthalene	2E+00	ug/m^3	1.5E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	5.0E-06	1.7E+00	ug/m3	3.0E+00	ug/m3	5.8E-01
				Xylenes (total)	1E+01	ug/m^3	1.2E+00	ug/m3	N/A	N/A	N/A	1.4E+01	ug/m3	1.0E+02	ug/m3	1.4E-01
			Exp. Route Total								7E-06					7E-01
		Exposure Point Total									7E-06					7E-01
		260207 [Spaces 1 to 3]	Inhalation													
				1,2,4-Trimethylbenzene	2E+00	ug/m^3	1.3E-01	ug/m3	N/A	N/A	N/A	1.5E+00	ug/m3	7.0E+00	ug/m3	2.2E-01
				1,4-Dichlorobenzene	4E+01	ug/m^3	3.3E+00	ug/m3	1.1E-05	(ug/m3)$^{-1}$	3.6E-05	3.8E+01	ug/m3	8.0E+02	ug/m3	4.8E-02
				Benzene	1E+00	ug/m^3	1.2E-01	ug/m3	7.8E-06	(ug/m3)$^{-1}$	9.2E-07	1.4E+00	ug/m3	3.0E+01	ug/m3	4.6E-02
				Carbon tetrachloride	5E-01	ug/m^3	4.2E-02	ug/m3	6.0E-06	(ug/m3)$^{-1}$	2.5E-07	4.9E-01	ug/m3	1.0E+02	ug/m3	4.9E-03
				Chloroform	4E-01	ug/m^3	3.3E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	7.7E-07	3.9E-01	ug/m3	9.8E+01	ug/m3	4.0E-03
				Ethylbenzene	2E+00	ug/m^3	1.3E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	3.1E-07	1.5E+00	ug/m3	1.0E+03	ug/m3	1.5E-03
				Naphthalene	2E+01	ug/m^3	1.3E+00	ug/m3	3.4E-05	(ug/m3)$^{-1}$	4.4E-05	1.5E+01	ug/m3	3.0E+00	ug/m3	5.0E+00
				Tetrachloroethene	8E+01	ug/m^3	6.7E+00	ug/m3	2.6E-07	(ug/m3)$^{-1}$	1.7E-06	7.8E+01	ug/m3	4.0E+01	ug/m3	1.9E+00
				Trichloroethene	1E+00	ug/m^3	8.5E-02	ug/m3	1E-06/ 3.1E-6	(ug/m3)$^{-1}$	7.2E-07	1.0E+00	ug/m3	2.0E+00	ug/m3	5.0E-01
				C5-C8 Aliphatics	2E+02	ug/m^3	1.2E+01	ug/m3	N/A	N/A	N/A	1.4E+02	ug/m3	6.0E+02	ug/m3	2.4E-01
				C9-C12 Aliphatics	9E+01	ug/m^3	7.2E+00	ug/m3	N/A	N/A	N/A	8.3E+01	ug/m3	1.0E+02	ug/m3	8.3E-01
			Exp. Route Total								8E-05					9E+00
		Exposure Point Total									8E-05					9E+00
		260505 [North unit basement]	Inhalation													
				Chloroform	3E-01	ug/m^3	2.1E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.8E-07	2.4E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Ethylbenzene	6E-01	ug/m^3	5.0E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.3E-07	5.9E-01	ug/m3	1.0E+03	ug/m3	5.9E-04
				Naphthalene	2E-01	ug/m^3	1.6E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	5.3E-07	1.8E-01	ug/m3	3.0E+00	ug/m3	6.0E-02
			Exp. Route Total								1E-06					6E-02
		Exposure Point Total									1E-06					6E-02

TABLE 7.9.RME
CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young 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	
		260505 [North unit 1st Floor]	Inhalation													
				Chloroform	3E-01	ug/m^3	2.1E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.8E-07	2.4E-01	ug/m3	9.8E+01	ug/m3	2.5E-03
				Ethylbenzene	6E-01	ug/m^3	5.1E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.3E-07	6.0E-01	ug/m3	1.0E+03	ug/m3	6.0E-04
				Naphthalene	1E-01	ug/m^3	1.1E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	3.8E-07	1.3E-01	ug/m3	3.0E+00	ug/m3	4.3E-02
			Exp. Route Total								1E-06					5E-02
		Exposure Point Total									1E-06					5E-02
		260505 [South unit basement]	Inhalation													
				Chloroform	2E+00	ug/m^3	1.6E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	3.8E-06	1.9E+00	ug/m3	9.8E+01	ug/m3	2.0E-02
				Ethylbenzene	2E+00	ug/m^3	1.5E-01	ug/m3	2.5E-06	(ug/m3)$^{-1}$	3.8E-07	1.8E+00	ug/m3	1.0E+03	ug/m3	1.8E-03
				Naphthalene	4E-01	ug/m^3	3.1E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.1E-06	3.7E-01	ug/m3	3.0E+00	ug/m3	1.2E-01
			Exp. Route Total								5E-06					1E-01
		Exposure Point Total									5E-06					1E-01
		260902 [Basement]	Inhalation													
				Chloroform	3E-01	ug/m^3	2.8E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	6.4E-07	3.2E-01	ug/m3	9.8E+01	ug/m3	3.3E-03
				Naphthalene	3E-01	ug/m^3	2.8E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	9.5E-07	3.3E-01	ug/m3	3.0E+00	ug/m3	1.1E-01
			Exp. Route Total								2E-06					1E-01
		Exposure Point Total									2E-06					1E-01
		260902 [1st Floor]	Inhalation													
				Chloroform	2E-01	ug/m^3	1.9E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	4.3E-07	2.2E-01	ug/m3	9.8E+01	ug/m3	2.2E-03
				Naphthalene	ND	ug/m^3	N/A	N/A	3.4E-05	(ug/m3)$^{-1}$	N/A	N/A	N/A	3.0E+00	ug/m3	N/A
			Exp. Route Total								4E-07					2E-03
		Exposure Point Total									4E-07					2E-03
		260903 [Basement]	Inhalation													
				Chloroform	1E+00	ug/m^3	1.1E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.6E-06	1.3E+00	ug/m3	9.8E+01	ug/m3	1.3E-02
			Exp. Route Total								3E-06					1E-02
		Exposure Point Total									3E-06					1E-02
		260407 [Spaces 1 to 5]	Inhalation													
				Acetone	9E+03	ug/m^3	7.1E+02	ug/m3	N/A	N/A	N/A	8.3E+03	ug/m3	3.1E+04	ug/m3	2.7E-01
				Chloroform	6E+01	ug/m^3	5.2E+00	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.2E-04	6.1E+01	ug/m3	9.8E+01	ug/m3	6.2E-01
				Naphthalene	6E-01	ug/m^3	5.1E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.7E-06	5.9E-01	ug/m3	3.0E+00	ug/m3	2.0E-01
			Exp. Route Total								1E-04					1E+00
		Exposure Point Total									1E-04					1E+00
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A

TABLE 7.9.RME

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young 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	
					Unit Risk $(ug/m3)^{-1}$				Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		N/A
		Cancer Risk with MassDEP unit risk for PCE:			1.0E-05				260207 [Spaces 1 to 3]		1E-04					
		Cancer Risk with MassDEP unit risk for TCE:			1.7E-06				260207 [Spaces 1 to 3]		8E-05					

Notes

Early-life cancer risk calculations for TCE calculated by multiplying the intake/exposure concentration by the default age-dependent adjustment factor (ADAF) of 10 for 2/6 of the result (ages 1-2) and by the default ADAF of 3 for 4/6 of the result (ages 3-6), but only for exposures associated with the production of kidney tumors. This requires splitting the unit risk by tumor effects [kidney = 1E-06 $(ug/m^3)^{-1}$ and non-Hodgkins lymphoma (NHL)/liver = 3.1E-6 $(ug/m^3)^{-1}$].

Inhalation early-life cancer risk = [intake/exposure concentration (ug/m^3) x kidney Unit Risk $(ug/m^3)^{-1}$ x 10 + intake/exposure concentration (ug/m^3) x NHL/liver Unit Risk $(ug/m^3)^{-1}$] x 2/6 +
[intake/exposure concentration (ug/m^3) x kidney Unit Risk $(ug/m^3)^{-1}$ x 3 + intake/exposure concentration (ug/m^3) x NHL/liver Unit Risk $(ug/m^3)^{-1}$] x 4/6

TABLE 7.9.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young 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	
Air	Indoor Air	260206 [Spaces 1 to 3]	Inhalation													
				Bromodichloromethane	3E-01	ug/m^3	5.9E-03	ug/m3	3.7E-05	(ug/m3)$^{-1}$	2.2E-07	2.1E-01	ug/m3	N/A	N/A	N/A
				Chloroform	6E+00	ug/m^3	1.0E-01	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.3E-06	3.6E+00	ug/m3	9.8E+01	ug/m3	3.6E-02
				Ethylbenzene	4E+00	ug/m^3	6.6E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.7E-07	2.3E+00	ug/m3	1.0E+03	ug/m3	2.3E-03
				Xylenes (total)	2E+01	ug/m^3	3.6E-01	ug/m3	N/A	N/A	N/A	1.2E+01	ug/m3	1.0E+02	ug/m3	1.2E-01
			Exp. Route Total								3E-06					2E-01
		Exposure Point Total									3E-06					2E-01
		260504 [Basement]	Inhalation													
				Chloroform	6E-01	ug/m^3	1.1E-02	ug/m3	2.3E-05	(ug/m3)$^{-1}$	2.4E-07	3.7E-01	ug/m3	9.8E+01	ug/m3	3.8E-03
				Ethylbenzene	3E+00	ug/m^3	4.6E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	1.1E-07	1.6E+00	ug/m3	1.0E+03	ug/m3	1.6E-03
				Naphthalene	2E+00	ug/m^3	3.3E-02	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.1E-06	1.2E+00	ug/m3	3.0E+00	ug/m3	3.8E-01
				Xylenes (total)	1E+01	ug/m^3	2.6E-01	ug/m3	N/A	N/A	N/A	9.2E+00	ug/m3	1.0E+02	ug/m3	9.2E-02
			Exp. Route Total								1E-06					5E-01
		Exposure Point Total									1E-06					5E-01
		260207 [Spaces 1 to 3]	Inhalation													
				1,2,4-Trimethylbenzene	2E+00	ug/m^3	2.9E-02	ug/m3	N/A	N/A	N/A	1.0E+00	ug/m3	7.0E+00	ug/m3	1.5E-01
				1,4-Dichlorobenzene	4E+01	ug/m^3	7.3E-01	ug/m3	1.1E-05	(ug/m3)$^{-1}$	8.1E-06	2.6E+01	ug/m3	8.0E+02	ug/m3	3.2E-02
				Benzene	1E+00	ug/m^3	2.6E-02	ug/m3	7.8E-06	(ug/m3)$^{-1}$	2.0E-07	9.1E-01	ug/m3	3.0E+01	ug/m3	3.0E-02
				Carbon tetrachloride	5E-01	ug/m^3	9.3E-03	ug/m3	6.0E-06	(ug/m3)$^{-1}$	5.6E-08	3.3E-01	ug/m3	1.0E+02	ug/m3	3.3E-03
				Chloroform	4E-01	ug/m^3	7.4E-03	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.7E-07	2.6E-01	ug/m3	9.8E+01	ug/m3	2.6E-03
				Ethylbenzene	2E+00	ug/m^3	2.8E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	7.0E-08	9.8E-01	ug/m3	1.0E+03	ug/m3	9.8E-04
				Naphthalene	2E+01	ug/m^3	2.8E-01	ug/m3	3.4E-05	(ug/m3)$^{-1}$	9.7E-06	1.0E+01	ug/m3	3.0E+00	ug/m3	3.3E+00
				Tetrachloroethene	8E+01	ug/m^3	1.5E+00	ug/m3	2.6E-07	(ug/m3)$^{-1}$	3.9E-07	5.2E+01	ug/m3	4.0E+01	ug/m3	1.3E+00
				Trichloroethene	1E+00	ug/m^3	1.9E-02	ug/m3	1E-06/ 3.1E-6	(ug/m3)$^{-1}$	1.6E-07	6.6E-01	ug/m3	2.0E+00	ug/m3	3.3E-01
				C5-C8 Aliphatics	2E+02	ug/m^3	2.7E+00	ug/m3	N/A	N/A	N/A	9.6E+01	ug/m3	6.0E+02	ug/m3	1.6E-01
				C9-C12 Aliphatics	9E+01	ug/m^3	1.6E+00	ug/m3	N/A	N/A	N/A	5.6E+01	ug/m3	1.0E+02	ug/m3	5.6E-01
			Exp. Route Total								2E-05					6E+00
		Exposure Point Total									2E-05					6E+00
		260505 [North unit basement]	Inhalation													
				Chloroform	3E-01	ug/m^3	4.6E-03	ug/m3	2.3E-05	(ug/m3)$^{-1}$	1.1E-07	1.6E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Ethylbenzene	6E-01	ug/m^3	1.1E-02	ug/m3	2.5E-06	(ug/m3)$^{-1}$	2.8E-08	3.9E-01	ug/m3	1.0E+03	ug/m3	3.9E-04
				Naphthalene	2E-01	ug/m^3	3.5E-03	ug/m3	3.4E-05	(ug/m3)$^{-1}$	1.2E-07	1.2E-01	ug/m3	3.0E+00	ug/m3	4.0E-02
			Exp. Route Total								3E-07					4E-02
		Exposure Point Total									3E-07					4E-02

TABLE 7.9.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young 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	
		260505 [North unit 1st Floor]	Inhalation													
				Chloroform	3E-01	ug/m^3	4.6E-03	ug/m3	2.3E-05	(ug/m3) $^{-1}$	1.1E-07	1.6E-01	ug/m3	9.8E+01	ug/m3	1.7E-03
				Ethylbenzene	6E-01	ug/m^3	1.1E-02	ug/m3	2.5E-06	(ug/m3) $^{-1}$	2.9E-08	4.0E-01	ug/m3	1.0E+03	ug/m3	4.0E-04
				Naphthalene	1E-01	ug/m^3	2.5E-03	ug/m3	3.4E-05	(ug/m3) $^{-1}$	8.4E-08	8.7E-02	ug/m3	3.0E+00	ug/m3	2.9E-02
			Exp. Route Total								2E-07					3E-02
		Exposure Point Total									2E-07					3E-02
		260505 [South unit basement]	Inhalation													
				Chloroform	2E+00	ug/m^3	3.7E-02	ug/m3	2.3E-05	(ug/m3) $^{-1}$	8.4E-07	1.3E+00	ug/m3	9.8E+01	ug/m3	1.3E-02
				Ethylbenzene	2E+00	ug/m^3	3.4E-02	ug/m3	2.5E-06	(ug/m3) $^{-1}$	8.4E-08	1.2E+00	ug/m3	1.0E+03	ug/m3	1.2E-03
				Naphthalene	4E-01	ug/m^3	7.0E-03	ug/m3	3.4E-05	(ug/m3) $^{-1}$	2.4E-07	2.4E-01	ug/m3	3.0E+00	ug/m3	8.2E-02
			Exp. Route Total								1E-06					1E-01
		Exposure Point Total									1E-06					1E-01
		260902 [Basement]	Inhalation													
				Chloroform	3E-01	ug/m^3	6.2E-03	ug/m3	2.3E-05	(ug/m3) $^{-1}$	1.4E-07	2.2E-01	ug/m3	9.8E+01	ug/m3	2.2E-03
				Naphthalene	3E-01	ug/m^3	6.2E-03	ug/m3	3.4E-05	(ug/m3) $^{-1}$	2.1E-07	2.2E-01	ug/m3	3.0E+00	ug/m3	7.3E-02
			Exp. Route Total								4E-07					7E-02
		Exposure Point Total									4E-07					7E-02
		260902 [1st Floor]	Inhalation													
				Chloroform	2E-01	ug/m^3	4.2E-03	ug/m3	2.3E-05	(ug/m3) $^{-1}$	9.6E-08	1.5E-01	ug/m3	9.8E+01	ug/m3	1.5E-03
				Naphthalene	ND	ug/m^3	N/A	N/A	3.4E-05	(ug/m3) $^{-1}$	N/A	N/A	N/A	3.0E+00	ug/m3	N/A
			Exp. Route Total								1E-07					1E-03
		Exposure Point Total									1E-07					1E-03
		260903 [Basement]	Inhalation													
				Chloroform	1E+00	ug/m^3	2.5E-02	ug/m3	2.3E-05	(ug/m3) $^{-1}$	5.7E-07	8.6E-01	ug/m3	9.8E+01	ug/m3	8.8E-03
			Exp. Route Total								6E-07					9E-03
		Exposure Point Total									6E-07					9E-03
		260407 [Spaces 1 to 5]	Inhalation													
				Acetone	9E+03	ug/m^3	1.6E+02	ug/m3	N/A	N/A	N/A	5.6E+03	ug/m3	3.1E+04	ug/m3	1.8E-01
				Chloroform	6E+01	ug/m^3	1.2E+00	ug/m3	2.3E-05	(ug/m3) $^{-1}$	2.7E-05	4.0E+01	ug/m3	9.8E+01	ug/m3	4.1E-01
				Naphthalene	6E-01	ug/m^3	1.1E-02	ug/m3	3.4E-05	(ug/m3) $^{-1}$	3.8E-07	4.0E-01	ug/m3	3.0E+00	ug/m3	1.3E-01
			Exp. Route Total								3E-05					7E-01
		Exposure Point Total									3E-05					7E-01
	Exposure Medium Total										N/A					N/A
Medium Total											N/A					N/A

TABLE 7.9.CT

CALCULATION OF CHEMICAL CANCER RISKS AND NON-CANCER HAZARDS

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Resident
Receptor Age: Young 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	
					Unit Risk $(ug/m3)^{-1}$				Total of Receptor Risks Across All Media		N/A			Total of Receptor Hazards Across All Media		N/A
		Cancer Risk with MassDEP unit risk for PCE:			1.0E-05				260207 [Spaces 1 to 3]		3E-05					
		Cancer Risk with MassDEP unit risk for TCE:			1.7E-06				260207 [Spaces 1 to 3]		2E-05					

Notes

Early-life cancer risk calculations for TCE calculated by multiplying the intake/exposure concentration by the default age-dependent adjustment factor (ADAF) of 10 for 2/6 of the result (ages 1-2) and by the default ADAF of 3 for 4/6 of the result (ages 3-6), but only for exposures associated with the production of kidney tumors. This requires splitting the unit risk by tumor effects [kidney = 1E-06 $(ug/m^3)^{-1}$ and non-Hodgkins lymphoma (NHL)/liver = 3.1E-6 $(ug/m^3)^{-1}$].

Inhalation early-life cancer risk = [intake/exposure concentration (ug/m^3) x kidney Unit Risk $(ug/m^3)^{-1}$ x 10 + intake/exposure concentration (ug/m^3) x NHL/liver Unit Risk $(ug/m^3)^{-1}$] x 2/6 +
[intake/exposure concentration (ug/m^3) x kidney Unit Risk $(ug/m^3)^{-1}$ x 3 + intake/exposure concentration (ug/m^3) x NHL/liver Unit Risk $(ug/m^3)^{-1}$] x 4/6

TABLE 9.1.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Space 2]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	5E-02	- -	5E-02
			1,4-Dichlorobenzene	- -	4E-06	- -	- -	4E-06	Liver	- -	1E-03	- -	1E-03
			Benzene	- -	7E-07	- -	- -	7E-07	Immune System	- -	8E-03	- -	8E-03
			Carbon tetrachloride	- -	2E-07	- -	- -	2E-07	Liver	- -	1E-03	- -	1E-03
			Chloroform	- -	8E-07	- -	- -	8E-07	Liver	- -	9E-04	- -	9E-04
			Ethylbenzene	- -	3E-07	- -	- -	3E-07	Developmental	- -	3E-04	- -	3E-04
			Naphthalene	- -	7E-06	- -	- -	7E-06	Respiratory	- -	2E-01	- -	2E-01
			Tetrachloroethene	- -	4E-07	- -	- -	4E-07	CNS	- -	1E-01	- -	1E-01
			Trichloroethene	- -	5E-08	- -	- -	5E-08	Developmental, Immune System	- -	2E-02	- -	2E-02
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	6E-02	- -	6E-02
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	2E-01	- -	2E-01
			Chemical Total	- -	1E-05	- -	- -	1E-05		- -	6E-01	- -	6E-01
			Radionuclide Total										
		Exposure Point Total						1E-05					6E-01
	Exposure Medium Total							1E-05					6E-01
Medium Total								1E-05					6E-01
Receptor Total								1E-05					6E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 1E-05

Total Hazard Across All Media: 6E-01

Cancer Risk with MassDEP unit risk for PCE: 3E-05
Cancer Risk with MassDEP unit risk for TCE: 1E-05

Total Blood HI =	5E-02
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-02
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	2E-02
Total Kidney HI =	N/A
Total Liver HI =	3E-03
Total Nervous System HI =	1E-01
Total Skin HI =	N/A
Total Respiratory HI =	4E-01

TABLE 9.1.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Space 2]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	4E-02	- -	4E-02
			1,4-Dichlorobenzene	- -	1E-06	- -	- -	1E-06	Liver	- -	1E-03	- -	1E-03
			Benzene	- -	2E-07	- -	- -	2E-07	Immune System	- -	7E-03	- -	7E-03
			Carbon tetrachloride	- -	8E-08	- -	- -	8E-08	Liver	- -	1E-03	- -	1E-03
			Chloroform	- -	2E-07	- -	- -	2E-07	Liver	- -	8E-04	- -	8E-04
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	3E-04	- -	3E-04
			Naphthalene	- -	2E-06	- -	- -	2E-06	Respiratory	- -	2E-01	- -	2E-01
			Tetrachloroethene	- -	1E-07	- -	- -	1E-07	CNS	- -	9E-02	- -	9E-02
			Trichloroethene	- -	1E-08	- -	- -	1E-08	Developmental, Immune System	- -	1E-02	- -	1E-02
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	5E-02	- -	5E-02
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	2E-01	- -	2E-01
			Chemical Total	- -	4E-06	- -	- -	4E-06		- -	5E-01	- -	5E-01
			Radionuclide Total										
		Exposure Point Total						4E-06					5E-01
	Exposure Medium Total							4E-06					5E-01
Medium Total								4E-06					5E-01
Receptor Total								4E-06					5E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media	4E-06
Cancer Risk with MassDEP unit risk for PCE:	9E-06
Cancer Risk with MassDEP unit risk for TCE:	4E-06

Total Hazard Across All Media	5E-01
Total Blood HI =	4E-02
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-02
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	2E-02
Total Kidney HI =	N/A
Total Liver HI =	3E-03
Total Nervous System HI =	9E-02
Total Skin HI =	N/A
Total Respiratory HI =	4E-01

TABLE 9.2.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 1]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	6E-02	- -	6E-02
			Chloroform	- -	9E-07	- -	- -	9E-07	Liver	- -	1E-03	- -	1E-03
			Naphthalene	- -	8E-07	- -	- -	8E-07	Respiratory	- -	2E-02	- -	2E-02
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	9E-02	- -	9E-02
			Radionuclide Total										
		Exposure Point Total						2E-06					9E-02
	Exposure Medium Total							2E-06					9E-02
Medium Total								2E-06					9E-02
Receptor Total								2E-06					9E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-06

Total Hazard Across All Media: 9E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-03
Total Nervous System HI =	6E-02
Total Skin HI =	N/A
Total Respiratory HI =	2E-02

TABLE 9.2.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 1]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	6E-02	- -	6E-02
			Chloroform	- -	3E-07	- -	- -	3E-07	Liver	- -	9E-04	- -	9E-04
			Naphthalene	- -	2E-07	- -	- -	2E-07	Respiratory	- -	2E-02	- -	2E-02
			Chemical Total	- -	5E-07	- -	- -	5E-07		- -	8E-02	- -	8E-02
			Radionuclide Total										
		Exposure Point Total						5E-07					8E-02
	Exposure Medium Total							5E-07					8E-02
Medium Total								5E-07					8E-02
Receptor Total								5E-07					8E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 5E-07

Total Hazard Across All Media: 8E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	9E-04
Total Nervous System HI =	6E-02
Total Skin HI =	N/A
Total Respiratory HI =	2E-02

TABLE 9.3.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 2]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	2E-03	- -	2E-03
			Chloroform	- -	1E-06	- -	- -	1E-06	Liver	- -	1E-03	- -	1E-03
			Naphthalene	- -	2E-06	- -	- -	2E-06	Respiratory	- -	5E-02	- -	5E-02
			Chemical Total	- -	3E-06	- -	- -	3E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						3E-06					5E-02
	Exposure Medium Total							3E-06					5E-02
Medium Total								3E-06					5E-02
Receptor Total								3E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 3E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-03
Total Nervous System HI =	2E-03
Total Skin HI =	N/A
Total Respiratory HI =	5E-02

TABLE 9.3.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 2]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	2E-03	- -	2E-03
			Chloroform	- -	4E-07	- -	- -	4E-07	Liver	- -	1E-03	- -	1E-03
			Naphthalene	- -	5E-07	- -	- -	5E-07	Respiratory	- -	4E-02	- -	4E-02
			Chemical Total	- -	9E-07	- -	- -	9E-07		- -	4E-02	- -	4E-02
			Radionuclide Total										
		Exposure Point Total						9E-07					4E-02
	Exposure Medium Total							9E-07					4E-02
Medium Total								9E-07					4E-02
Receptor Total								9E-07					4E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 9E-07

Total Hazard Across All Media: 4E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-03
Total Nervous System HI =	2E-03
Total Skin HI =	N/A
Total Respiratory HI =	4E-02

TABLE 9.4.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 3]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	2E-03	- -	2E-03
			Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	2E-03	- -	2E-03
			Naphthalene	- -	1E-06	- -	- -	1E-06	Respiratory	- -	3E-02	- -	3E-02
			Chemical Total	- -	3E-06	- -	- -	3E-06		- -	3E-02	- -	3E-02
			Radionuclide Total										
		Exposure Point Total						3E-06					3E-02
	Exposure Medium Total							3E-06					3E-02
Medium Total								3E-06					3E-02
Receptor Total								3E-06					3E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 3E-06

Total Hazard Across All Media: 3E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	2E-03
Total Skin HI =	N/A
Total Respiratory HI =	3E-02

TABLE 9.4.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 3]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	1E-03	- -	1E-03
			Chloroform	- -	5E-07	- -	- -	5E-07	Liver	- -	2E-03	- -	2E-03
			Naphthalene	- -	3E-07	- -	- -	3E-07	Respiratory	- -	2E-02	- -	2E-02
			Chemical Total	- -	8E-07	- -	- -	8E-07		- -	3E-02	- -	3E-02
			Radionuclide Total										
		Exposure Point Total						8E-07					3E-02
	Exposure Medium Total							8E-07					3E-02
Medium Total								8E-07					3E-02
Receptor Total								8E-07					3E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 8E-07

Total Hazard Across All Media: 3E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	1E-03
Total Skin HI =	N/A
Total Respiratory HI =	2E-02

TABLE 9.5.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 4]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	2E-03	- -	2E-03
			Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	3E-03	- -	3E-03
			Naphthalene	- -	7E-07	- -	- -	7E-07	Respiratory	- -	2E-02	- -	2E-02
			Chemical Total	- -	3E-06	- -	- -	3E-06		- -	2E-02	- -	2E-02
			Radionuclide Total										
		Exposure Point Total						3E-06					2E-02
	Exposure Medium Total							3E-06					2E-02
Medium Total								3E-06					2E-02
Receptor Total								3E-06					2E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 3E-06

Total Hazard Across All Media: 2E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	3E-03
Total Nervous System HI =	2E-03
Total Skin HI =	N/A
Total Respiratory HI =	2E-02

TABLE 9.5.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 4]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	2E-03	- -	2E-03
			Chloroform	- -	7E-07	- -	- -	7E-07	Liver	- -	3E-03	- -	3E-03
			Naphthalene	- -	2E-07	- -	- -	2E-07	Respiratory	- -	2E-02	- -	2E-02
			Chemical Total	- -	1E-06	- -	- -	1E-06		- -	2E-02	- -	2E-02
			Radionuclide Total										
		Exposure Point Total						1E-06					2E-02
	Exposure Medium Total							1E-06					2E-02
Medium Total								1E-06					2E-02
Receptor Total								1E-06					2E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 1E-06

Total Hazard Across All Media: 2E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	3E-03
Total Nervous System HI =	2E-03
Total Skin HI =	N/A
Total Respiratory HI =	2E-02

TABLE 9.6.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 5]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	8E-03	- -	8E-03
			Chloroform	- -	1E-04	- -	- -	1E-04	Liver	- -	1E-01	- -	1E-01
			Naphthalene	- -	5E-07	- -	- -	5E-07	Respiratory	- -	1E-02	- -	1E-02
			Chemical Total	- -	1E-04	- -	- -	1E-04		- -	2E-01	- -	2E-01
			Radionuclide Total										
		Exposure Point Total						1E-04					2E-01
	Exposure Medium Total							1E-04					2E-01
Medium Total								1E-04					2E-01
Receptor Total								1E-04					2E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 1E-04

Total Hazard Across All Media: 2E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-01
Total Nervous System HI =	8E-03
Total Skin HI =	N/A
Total Respiratory HI =	1E-02

TABLE 9.6.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Space 5]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	7E-03	- -	7E-03
			Chloroform	- -	4E-05	- -	- -	4E-05	Liver	- -	1E-01	- -	1E-01
			Naphthalene	- -	1E-07	- -	- -	1E-07	Respiratory	- -	1E-02	- -	1E-02
			Chemical Total	- -	4E-05	- -	- -	4E-05		- -	1E-01	- -	1E-01
			Radionuclide Total										
		Exposure Point Total						4E-05					1E-01
	Exposure Medium Total							4E-05					1E-01
Medium Total								4E-05					1E-01
Receptor Total								4E-05					1E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 4E-05

Total Hazard Across All Media: 1E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-01
Total Nervous System HI =	7E-03
Total Skin HI =	N/A
Total Respiratory HI =	1E-02

TABLE 9.7.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Storage Unit User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Space 3]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	2E-02	- -	2E-02
			1,4-Dichlorobenzene	- -	2E-06	- -	- -	2E-06	Liver	- -	5E-04	- -	5E-04
			Benzene	- -	3E-07	- -	- -	3E-07	Immune System	- -	3E-03	- -	3E-03
			Carbon tetrachloride	- -	1E-07	- -	- -	1E-07	Liver	- -	5E-04	- -	5E-04
			Chloroform	- -	2E-07	- -	- -	2E-07	Liver	- -	2E-04	- -	2E-04
			Ethylbenzene	- -	7E-08	- -	- -	7E-08	Developmental	- -	8E-05	- -	8E-05
			Naphthalene	- -	9E-06	- -	- -	9E-06	Respiratory	- -	2E-01	- -	2E-01
			Tetrachloroethene	- -	5E-07	- -	- -	5E-07	CNS	- -	1E-01	- -	1E-01
			Trichloroethene	- -	8E-08	- -	- -	8E-08	Developmental, Immune System	- -	3E-02	- -	3E-02
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	8E-03	- -	8E-03
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	4E-02	- -	4E-02
			Chemical Total	- -	1E-05	- -	- -	1E-05		- -	5E-01	- -	5E-01
			Radionuclide Total										
		Exposure Point Total						1E-05					5E-01
	Exposure Medium Total							1E-05					5E-01
Medium Total								1E-05					5E-01
Receptor Total								1E-05					5E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media	1E-05
Cancer Risk with MassDEP unit risk for PCE:	3E-05
Cancer Risk with MassDEP unit risk for TCE:	1E-05

Total Hazard Across All Media	5E-01
Total Blood HI =	2E-02
Total Cardiovascular HI =	N/A
Total Developmental HI =	3E-02
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	3E-02
Total Kidney HI =	N/A
Total Liver HI =	1E-03
Total Nervous System HI =	1E-01
Total Skin HI =	N/A
Total Respiratory HI =	3E-01

TABLE 9.7.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Storage Unit User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Space 3]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	4E-03	- -	4E-03
			1,4-Dichlorobenzene	- -	1E-07	- -	- -	1E-07	Liver	- -	1E-04	- -	1E-04
			Benzene	- -	2E-08	- -	- -	2E-08	Immune System	- -	8E-04	- -	8E-04
			Carbon tetrachloride	- -	1E-08	- -	- -	1E-08	Liver	- -	1E-04	- -	1E-04
			Chloroform	- -	1E-08	- -	- -	1E-08	Liver	- -	5E-05	- -	5E-05
			Ethylbenzene	- -	7E-09	- -	- -	7E-09	Developmental	- -	2E-05	- -	2E-05
			Naphthalene	- -	8E-07	- -	- -	8E-07	Respiratory	- -	6E-02	- -	6E-02
			Tetrachloroethene	- -	4E-08	- -	- -	4E-08	CNS	- -	3E-02	- -	3E-02
			Trichloroethene	- -	8E-09	- -	- -	8E-09	Developmental, Immune System	- -	7E-03	- -	7E-03
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	2E-03	- -	2E-03
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	9E-03	- -	9E-03
			Chemical Total	- -	1E-06	- -	- -	1E-06		- -	1E-01	- -	1E-01
			Radionuclide Total										
		Exposure Point Total						1E-06					1E-01
	Exposure Medium Total							1E-06					1E-01
Medium Total								1E-06					1E-01
Receptor Total								1E-06					1E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media	1E-06
Cancer Risk with MassDEP unit risk for PCE:	3E-06
Cancer Risk with MassDEP unit risk for TCE:	1E-06

Total Hazard Across All Media	1E-01
Total Blood HI =	4E-03
Total Cardiovascular HI =	N/A
Total Developmental HI =	7E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	8E-03
Total Kidney HI =	N/A
Total Liver HI =	3E-04
Total Nervous System HI =	3E-02
Total Skin HI =	N/A
Total Respiratory HI =	7E-02

TABLE 9.8.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Storage Unit User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Space 1]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	2E-02	- -	2E-02
			1,4-Dichlorobenzene	- -	2E-05	- -	- -	2E-05	Liver	- -	5E-03	- -	5E-03
			Benzene	- -	3E-07	- -	- -	3E-07	Immune System	- -	4E-03	- -	4E-03
			Carbon tetrachloride	- -	1E-07	- -	- -	1E-07	Liver	- -	6E-04	- -	6E-04
			Chloroform	- -	2E-07	- -	- -	2E-07	Liver	- -	3E-04	- -	3E-04
			Ethylbenzene	- -	9E-08	- -	- -	9E-08	Developmental	- -	1E-04	- -	1E-04
			Naphthalene	- -	2E-06	- -	- -	2E-06	Respiratory	- -	6E-02	- -	6E-02
			Tetrachloroethene	- -	6E-08	- -	- -	6E-08	CNS	- -	2E-02	- -	2E-02
			Trichloroethene	- -	2E-08	- -	- -	2E-08	Developmental, Immune System	- -	6E-03	- -	6E-03
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	1E-02	- -	1E-02
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	9E-02	- -	9E-02
			Chemical Total	- -	2E-05	- -	- -	2E-05		- -	2E-01	- -	2E-01
			Radionuclide Total										
		Exposure Point Total						2E-05					2E-01
	Exposure Medium Total							2E-05					2E-01
Medium Total								2E-05					2E-01
Receptor Total								2E-05					2E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-05

Total Hazard Across All Media: 2E-01

Cancer Risk with MassDEP unit risk for PCE: 2E-05
Cancer Risk with MassDEP unit risk for TCE: 2E-05

Total Blood HI =	2E-02
Total Cardiovascular HI =	N/A
Total Developmental HI =	7E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	1E-02
Total Kidney HI =	N/A
Total Liver HI =	6E-03
Total Nervous System HI =	2E-02
Total Skin HI =	N/A
Total Respiratory HI =	2E-01

TABLE 9.8.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Storage Unit User
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Space 1]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	5E-03	- -	5E-03
			1,4-Dichlorobenzene	- -	2E-06	- -	- -	2E-06	Liver	- -	1E-03	- -	1E-03
			Benzene	- -	3E-08	- -	- -	3E-08	Immune System	- -	1E-03	- -	1E-03
			Carbon tetrachloride	- -	1E-08	- -	- -	1E-08	Liver	- -	1E-04	- -	1E-04
			Chloroform	- -	2E-08	- -	- -	2E-08	Liver	- -	6E-05	- -	6E-05
			Ethylbenzene	- -	8E-09	- -	- -	8E-09	Developmental	- -	2E-05	- -	2E-05
			Naphthalene	- -	2E-07	- -	- -	2E-07	Respiratory	- -	2E-02	- -	2E-02
			Tetrachloroethene	- -	5E-09	- -	- -	5E-09	CNS	- -	4E-03	- -	4E-03
			Trichloroethene	- -	2E-09	- -	- -	2E-09	Developmental, Immune System	- -	2E-03	- -	2E-03
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	3E-03	- -	3E-03
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	2E-02	- -	2E-02
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						2E-06					5E-02
	Exposure Medium Total							2E-06					5E-02
Medium Total								2E-06					5E-02
Receptor Total								2E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media	2E-06
Cancer Risk with MassDEP unit risk for PCE:	2E-06
Cancer Risk with MassDEP unit risk for TCE:	2E-06

Total Hazard Across All Media	5E-02
Total Blood HI =	5E-03
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	3E-03
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	4E-03
Total Skin HI =	N/A
Total Respiratory HI =	4E-02

TABLE 9.9.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 3]											
			Bromodichloromethane	- -	1E-06	- -	- -	1E-06	N/A	- -	N/A	- -	N/A
			Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	2E-02	- -	2E-02
			Ethylbenzene	- -	1E-06	- -	- -	1E-06	Developmental	- -	1E-03	- -	1E-03
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	6E-02	- -	6E-02
			Chemical Total	- -	2E-05	- -	- -	2E-05		- -	8E-02	- -	8E-02
			Radionuclide Total										
		Exposure Point Total						2E-05					8E-02
	Exposure Medium Total							2E-05					8E-02
Medium Total								2E-05					8E-02
Receptor Total								2E-05					8E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-05

Total Hazard Across All Media: 8E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-02
Total Nervous System HI =	6E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.9.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 3]											
			Bromodichloromethane	- -	3E-07	- -	- -	3E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	3E-06	- -	- -	3E-06	Liver	- -	1E-02	- -	1E-02
			Ethylbenzene	- -	2E-07	- -	- -	2E-07	Developmental	- -	7E-04	- -	7E-04
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	4E-02	- -	4E-02
			Chemical Total	- -	4E-06	- -	- -	4E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						4E-06					5E-02
	Exposure Medium Total							4E-06					5E-02
Medium Total								4E-06					5E-02
Receptor Total								4E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 4E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	7E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	4E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.10.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 1]											
			Bromodichloromethane	- -	1E-06	- -	- -	1E-06	N/A	- -	N/A	- -	N/A
			Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	2E-02	- -	2E-02
			Ethylbenzene	- -	1E-06	- -	- -	1E-06	Developmental	- -	1E-03	- -	1E-03
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	6E-02	- -	6E-02
			Chemical Total	- -	2E-05	- -	- -	2E-05		- -	8E-02	- -	8E-02
			Radionuclide Total										
		Exposure Point Total						2E-05					8E-02
	Exposure Medium Total							2E-05					8E-02
Medium Total								2E-05					8E-02
Receptor Total								2E-05					8E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-05

Total Hazard Across All Media: 8E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-02
Total Nervous System HI =	6E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.10.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 1]											
			Bromodichloromethane	- -	3E-07	- -	- -	3E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	3E-06	- -	- -	3E-06	Liver	- -	1E-02	- -	1E-02
			Ethylbenzene	- -	2E-07	- -	- -	2E-07	Developmental	- -	7E-04	- -	7E-04
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	4E-02	- -	4E-02
			Chemical Total	- -	3E-06	- -	- -	3E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						3E-06					5E-02
	Exposure Medium Total							3E-06					5E-02
Medium Total								3E-06					5E-02
Receptor Total								3E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 3E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	7E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	4E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.11.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 2]											
			Bromodichloromethane	- -	1E-06	- -	- -	1E-06	N/A	- -	N/A	- -	N/A
			Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	2E-02	- -	2E-02
			Ethylbenzene	- -	1E-06	- -	- -	1E-06	Developmental	- -	1E-03	- -	1E-03
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	6E-02	- -	6E-02
			Chemical Total	- -	2E-05	- -	- -	2E-05		- -	8E-02	- -	8E-02
			Radionuclide Total										
		Exposure Point Total						2E-05					8E-02
	Exposure Medium Total							2E-05					8E-02
Medium Total								2E-05					8E-02
Receptor Total								2E-05					8E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-05

Total Hazard Across All Media: 8E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-02
Total Nervous System HI =	6E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.11.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 2]											
			Bromodichloromethane	- -	3E-07	- -	- -	3E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	3E-06	- -	- -	3E-06	Liver	- -	1E-02	- -	1E-02
			Ethylbenzene	- -	2E-07	- -	- -	2E-07	Developmental	- -	7E-04	- -	7E-04
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	4E-02	- -	4E-02
			Chemical Total	- -	4E-06	- -	- -	4E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						4E-06					5E-02
	Exposure Medium Total							4E-06					5E-02
Medium Total								4E-06					5E-02
Receptor Total								4E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 4E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	7E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	4E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.12.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 3]											
			Bromodichloromethane	- -	4E-07	- -	- -	4E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	4E-06	- -	- -	4E-06	Liver	- -	2E-02	- -	2E-02
			Ethylbenzene	- -	3E-07	- -	- -	3E-07	Developmental	- -	1E-03	- -	1E-03
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	6E-02	- -	6E-02
			Chemical Total	- -	4E-06	- -	- -	4E-06		- -	8E-02	- -	8E-02
			Radionuclide Total										
		Exposure Point Total						4E-06					8E-02
	Exposure Medium Total							4E-06					8E-02
Medium Total								4E-06					8E-02
Receptor Total								4E-06					8E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 4E-06

Total Hazard Across All Media: 8E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-02
Total Nervous System HI =	6E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.12.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 3]											
			Bromodichloromethane	- -	1E-07	- -	- -	1E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	1E-06	- -	- -	1E-06	Liver	- -	1E-02	- -	1E-02
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	7E-04	- -	7E-04
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	4E-02	- -	4E-02
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						2E-06					5E-02
	Exposure Medium Total							2E-06					5E-02
Medium Total								2E-06					5E-02
Receptor Total								2E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	7E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	4E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.13.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 1]											
			Bromodichloromethane	- -	4E-07	- -	- -	4E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	4E-06	- -	- -	4E-06	Liver	- -	2E-02	- -	2E-02
			Ethylbenzene	- -	3E-07	- -	- -	3E-07	Developmental	- -	1E-03	- -	1E-03
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	6E-02	- -	6E-02
			Chemical Total	- -	4E-06	- -	- -	4E-06		- -	8E-02	- -	8E-02
			Radionuclide Total										
		Exposure Point Total						4E-06					8E-02
	Exposure Medium Total							4E-06					8E-02
Medium Total								4E-06					8E-02
Receptor Total								4E-06					8E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 4E-06

Total Hazard Across All Media: 8E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-02
Total Nervous System HI =	6E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.13.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 1]											
			Bromodichloromethane	- -	1E-07	- -	- -	1E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	1E-06	- -	- -	1E-06	Liver	- -	1E-02	- -	1E-02
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	7E-04	- -	7E-04
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	4E-02	- -	4E-02
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						2E-06					5E-02
	Exposure Medium Total							2E-06					5E-02
Medium Total								2E-06					5E-02
Receptor Total								2E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	7E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	4E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.14.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 2]											
			Bromodichloromethane	- -	4E-07	- -	- -	4E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	4E-06	- -	- -	4E-06	Liver	- -	2E-02	- -	2E-02
			Ethylbenzene	- -	3E-07	- -	- -	3E-07	Developmental	- -	1E-03	- -	1E-03
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	6E-02	- -	6E-02
			Chemical Total	- -	5E-06	- -	- -	5E-06		- -	8E-02	- -	8E-02
			Radionuclide Total										
		Exposure Point Total						5E-06					8E-02
	Exposure Medium Total							5E-06					8E-02
Medium Total								5E-06					8E-02
Receptor Total								5E-06					8E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 5E-06

Total Hazard Across All Media: 8E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-02
Total Nervous System HI =	6E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.14.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Daycare
Receptor Age: Child

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Space 2]	Bromodichloromethane	- -	1E-07	- -	- -	1E-07	N/A	- -	N/A	- -	N/A
			Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	1E-02	- -	1E-02
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	7E-04	- -	7E-04
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	4E-02	- -	4E-02
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						2E-06					5E-02
	Exposure Medium Total							2E-06					5E-02
Medium Total								2E-06					5E-02
Receptor Total								2E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	7E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	4E-02
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.15.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260504 [Basement]											
			Chloroform	- -	5E-06	- -	- -	5E-06	Liver	- -	6E-03	- -	6E-03
			Ethylbenzene	- -	3E-06	- -	- -	3E-06	Developmental	- -	2E-03	- -	2E-03
			Naphthalene	- -	3E-05	- -	- -	3E-05	Respiratory	- -	6E-01	- -	6E-01
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	1E-01	- -	1E-01
			Chemical Total	- -	3E-05	- -	- -	3E-05		- -	7E-01	- -	7E-01
			Radionuclide Total										
		Exposure Point Total						3E-05					7E-01
	Exposure Medium Total							3E-05					7E-01
Medium Total								3E-05					7E-01
Receptor Total								3E-05					7E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 3E-05

Total Hazard Across All Media: 7E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	6E-03
Total Nervous System HI =	1E-01
Total Skin HI =	N/A
Total Respiratory HI =	6E-01

TABLE 9.15.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260504 [Basement]											
			Chloroform	- -	1E-06	- -	- -	1E-06	Liver	- -	4E-03	- -	4E-03
			Ethylbenzene	- -	5E-07	- -	- -	5E-07	Developmental	- -	2E-03	- -	2E-03
			Naphthalene	- -	5E-06	- -	- -	5E-06	Respiratory	- -	4E-01	- -	4E-01
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	9E-02	- -	9E-02
			Chemical Total	- -	7E-06	- -	- -	7E-06		- -	5E-01	- -	5E-01
			Radionuclide Total										
		Exposure Point Total						7E-06					5E-01
	Exposure Medium Total							7E-06					5E-01
Medium Total								7E-06					5E-01
Receptor Total								7E-06					5E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 7E-06

Total Hazard Across All Media: 5E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	4E-03
Total Nervous System HI =	9E-02
Total Skin HI =	N/A
Total Respiratory HI =	4E-01

TABLE 9.16.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [North unit basement]											
			Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	2E-03	- -	2E-03
			Ethylbenzene	- -	6E-07	- -	- -	6E-07	Developmental	- -	6E-04	- -	6E-04
			Naphthalene	- -	3E-06	- -	- -	3E-06	Respiratory	- -	6E-02	- -	6E-02
			Chemical Total	- -	6E-06	- -	- -	6E-06		- -	6E-02	- -	6E-02
			Radionuclide Total										
		Exposure Point Total						6E-06					6E-02
	Exposure Medium Total							6E-06					6E-02
Medium Total								6E-06					6E-02
Receptor Total								6E-06					6E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 6E-06

Total Hazard Across All Media: 6E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	6E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	6E-02

TABLE 9.16.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [North unit basement]											
			Chloroform	- -	5E-07	- -	- -	5E-07	Liver	- -	2E-03	- -	2E-03
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	4E-04	- -	4E-04
			Naphthalene	- -	5E-07	- -	- -	5E-07	Respiratory	- -	4E-02	- -	4E-02
			Chemical Total	- -	1E-06	- -	- -	1E-06		- -	4E-02	- -	4E-02
			Radionuclide Total										
		Exposure Point Total						1E-06					4E-02
	Exposure Medium Total							1E-06					4E-02
Medium Total								1E-06					4E-02
Receptor Total								1E-06					4E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 1E-06

Total Hazard Across All Media: 4E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	4E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	4E-02

TABLE 9.17.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [North unit 1st Floor]											
			Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	2E-03	- -	2E-03
			Ethylbenzene	- -	6E-07	- -	- -	6E-07	Developmental	- -	6E-04	- -	6E-04
			Naphthalene	- -	2E-06	- -	- -	2E-06	Respiratory	- -	4E-02	- -	4E-02
			Chemical Total	- -	5E-06	- -	- -	5E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						5E-06					5E-02
	Exposure Medium Total							5E-06					5E-02
Medium Total								5E-06					5E-02
Receptor Total								5E-06					5E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 5E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	6E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	4E-02

TABLE 9.17.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [North unit 1st Floor]											
			Chloroform	- -	5E-07	- -	- -	5E-07	Liver	- -	2E-03	- -	2E-03
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	4E-04	- -	4E-04
			Naphthalene	- -	4E-07	- -	- -	4E-07	Respiratory	- -	3E-02	- -	3E-02
			Chemical Total	- -	1E-06	- -	- -	1E-06		- -	3E-02	- -	3E-02
			Radionuclide Total										
		Exposure Point Total						1E-06					3E-02
	Exposure Medium Total							1E-06					3E-02
Medium Total								1E-06					3E-02
Receptor Total								1E-06					3E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 1E-06

Total Hazard Across All Media: 3E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	4E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	3E-02

TABLE 9.18.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [South unit basement]											
			Chloroform	- -	2E-05	- -	- -	2E-05	Liver	- -	2E-02	- -	2E-02
			Ethylbenzene	- -	2E-06	- -	- -	2E-06	Developmental	- -	2E-03	- -	2E-03
			Naphthalene	- -	5E-06	- -	- -	5E-06	Respiratory	- -	1E-01	- -	1E-01
			Chemical Total	- -	3E-05	- -	- -	3E-05		- -	1E-01	- -	1E-01
			Radionuclide Total										
		Exposure Point Total						3E-05					1E-01
	Exposure Medium Total							3E-05					1E-01
Medium Total								3E-05					1E-01
Receptor Total								3E-05					1E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 3E-05

Total Hazard Across All Media: 1E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-02
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	1E-01

TABLE 9.18.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [South unit basement]											
			Chloroform	- -	4E-06	- -	- -	4E-06	Liver	- -	1E-02	- -	1E-02
			Ethylbenzene	- -	4E-07	- -	- -	4E-07	Developmental	- -	1E-03	- -	1E-03
			Naphthalene	- -	1E-06	- -	- -	1E-06	Respiratory	- -	8E-02	- -	8E-02
			Chemical Total	- -	5E-06	- -	- -	5E-06		- -	1E-01	- -	1E-01
			Radionuclide Total										
		Exposure Point Total						5E-06					1E-01
	Exposure Medium Total							5E-06					1E-01
Medium Total								5E-06					1E-01
Receptor Total								5E-06					1E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 5E-06

Total Hazard Across All Media: 1E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	8E-02

TABLE 9.19.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260902 [Basement]	Chloroform	- -	3E-06	- -	- -	3E-06	Liver	- -	3E-03	- -	3E-03
			Naphthalene	- -	5E-06	- -	- -	5E-06	Respiratory	- -	1E-01	- -	1E-01
			Chemical Total	- -	8E-06	- -	- -	8E-06		- -	1E-01	- -	1E-01
			Radionuclide Total										
		Exposure Point Total						8E-06					1E-01
	Exposure Medium Total							8E-06					1E-01
Medium Total								8E-06					1E-01
Receptor Total								8E-06					1E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 8E-06

Total Hazard Across All Media: 1E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	3E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	1E-01

TABLE 9.19.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260902 [Basement]	Chloroform	- -	6E-07	- -	- -	6E-07	Liver	- -	2E-03	- -	2E-03
			Naphthalene	- -	1E-06	- -	- -	1E-06	Respiratory	- -	7E-02	- -	7E-02
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	7E-02	- -	7E-02
			Radionuclide Total										
		Exposure Point Total						2E-06					7E-02
	Exposure Medium Total							2E-06					7E-02
Medium Total								2E-06					7E-02
Receptor Total								2E-06					7E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-06

Total Hazard Across All Media: 7E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	7E-02

TABLE 9.20.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260902 [1st Floor]	Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	2E-03	- -	2E-03
			Naphthalene	- -	N/A	- -	- -	N/A	Respiratory	- -	N/A	- -	N/A
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	2E-03	- -	2E-03
			Radionuclide Total										
		Exposure Point Total						2E-06					2E-03
	Exposure Medium Total							2E-06					2E-03
Medium Total								2E-06					2E-03
Receptor Total								2E-06					2E-03

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-06

Total Hazard Across All Media: 2E-03

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.20.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260902 [1st Floor]	Chloroform	- -	4E-07	- -	- -	4E-07	Liver	- -	1E-03	- -	1E-03
			Naphthalene	- -	N/A	- -	- -	N/A	Respiratory	- -	N/A	- -	N/A
			Chemical Total	- -	4E-07	- -	- -	4E-07		- -	1E-03	- -	1E-03
			Radionuclide Total										
		Exposure Point Total						4E-07					1E-03
	Exposure Medium Total							4E-07					1E-03
Medium Total								4E-07					1E-03
Receptor Total								4E-07					1E-03

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 4E-07

Total Hazard Across All Media: 1E-03

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.21.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260903 [Basement]	Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	1E-02	- -	1E-02
			Chemical Total	- -	1E-05	- -	- -	1E-05		- -	1E-02	- -	1E-02
			Radionuclide Total										
		Exposure Point Total						1E-05					1E-02
	Exposure Medium Total							1E-05					1E-02
Medium Total								1E-05					1E-02
Receptor Total								1E-05					1E-02

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 1E-05

Total Hazard Across All Media: 1E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.21.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Current
Receptor Population: Resident
Receptor Age: Young Child/Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260903 [Basement]	Chloroform	- -	3E-06	- -	- -	3E-06	Liver	- -	9E-03	- -	9E-03
			Chemical Total	- -	3E-06	- -	- -	3E-06		- -	9E-03	- -	9E-03
			Radionuclide Total										
		Exposure Point Total						3E-06					9E-03
	Exposure Medium Total							3E-06					9E-03
Medium Total								3E-06					9E-03
Receptor Total								3E-06					9E-03

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 3E-06

Total Hazard Across All Media: 9E-03

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	9E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.22.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Spaces 1 to 3]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	5E-02	- -	5E-02
			1,4-Dichlorobenzene	- -	4E-05	- -	- -	4E-05	Liver	- -	1E-02	- -	1E-02
			Benzene	- -	9E-07	- -	- -	9E-07	Immune System	- -	1E-02	- -	1E-02
			Carbon tetrachloride	- -	2E-07	- -	- -	2E-07	Liver	- -	1E-03	- -	1E-03
			Chloroform	- -	8E-07	- -	- -	8E-07	Liver	- -	9E-04	- -	9E-04
			Ethylbenzene	- -	3E-07	- -	- -	3E-07	Developmental	- -	3E-04	- -	3E-04
			Naphthalene	- -	4E-05	- -	- -	4E-05	Respiratory	- -	1E+00	- -	1E+00
			Tetrachloroethene	- -	2E-06	- -	- -	2E-06	CNS	- -	5E-01	- -	5E-01
			Trichloroethene	- -	3E-07	- -	- -	3E-07	Developmental, Immune System	- -	1E-01	- -	1E-01
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	6E-02	- -	6E-02
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	2E-01	- -	2E-01
			Chemical Total	- -	8E-05	- -	- -	8E-05		- -	2E+00	- -	2E+00
			Radionuclide Total										
		Exposure Point Total						8E-05					2E+00
	Exposure Medium Total							8E-05					2E+00
Medium Total								8E-05					2E+00
Receptor Total								8E-05					2E+00

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media	8E-05
Cancer Risk with MassDEP unit risk for PCE:	1E-04
Cancer Risk with MassDEP unit risk for TCE:	8E-05

Total Hazard Across All Media	2E+00
Total Blood HI =	5E-02
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-01
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	1E-01
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	5E-01
Total Skin HI =	N/A
Total Respiratory HI =	1E+00

TABLE 9.22.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

Scenario Timeframe: Future
Receptor Population: Commercial Worker
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk					Non-Carcinogenic Hazard Quotient				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Spaces 1 to 3]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	5E-02	- -	5E-02
			1,4-Dichlorobenzene	- -	1E-05	- -	- -	1E-05	Liver	- -	1E-02	- -	1E-02
			Benzene	- -	3E-07	- -	- -	3E-07	Immune System	- -	1E-02	- -	1E-02
			Carbon tetrachloride	- -	8E-08	- -	- -	8E-08	Liver	- -	1E-03	- -	1E-03
			Chloroform	- -	2E-07	- -	- -	2E-07	Liver	- -	8E-04	- -	8E-04
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	3E-04	- -	3E-04
			Naphthalene	- -	1E-05	- -	- -	1E-05	Respiratory	- -	1E+00	- -	1E+00
			Tetrachloroethene	- -	5E-07	- -	- -	5E-07	CNS	- -	4E-01	- -	4E-01
			Trichloroethene	- -	1E-07	- -	- -	1E-07	Developmental, Immune System	- -	1E-01	- -	1E-01
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	5E-02	- -	5E-02
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	2E-01	- -	2E-01
			Chemical Total	- -	3E-05	- -	- -	3E-05		- -	2E+00	- -	2E+00
			Radionuclide Total										
		Exposure Point Total						3E-05					2E+00
	Exposure Medium Total							3E-05					2E+00
Medium Total								3E-05					2E+00
Receptor Total								3E-05					2E+00

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media	3E-05
Cancer Risk with MassDEP unit risk for PCE:	5E-05
Cancer Risk with MassDEP unit risk for TCE:	3E-05

Total Hazard Across All Media	2E+00
Total Blood HI =	5E-02
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-01
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	1E-01
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	4E-01
Total Skin HI =	N/A
Total Respiratory HI =	1E+00

TABLE 9.23.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Spaces 1 to 3]	Bromodichloromethane	- -	5E-06	- -	- -	5E-06	N/A	- -	N/A	- -	N/A
			Chloroform	- -	5E-05	- -	- -	5E-05	Liver	- -	5E-02	- -	5E-02
			Ethylbenzene	- -	4E-06	- -	- -	4E-06	Developmental	- -	3E-03	- -	3E-03
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	2E-01	- -	2E-01
			Chemical Total	- -	6E-05	- -	- -	6E-05		- -	2E-01	- -	2E-01
			Radionuclide Total										
		Exposure Point Total						6E-05					2E-01
	Exposure Medium Total							6E-05					2E-01
Medium Total								6E-05					2E-01
Receptor Total								6E-05					2E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 6E-05

Total Hazard Across All Media: 2E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	3E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	5E-02
Total Nervous System HI =	2E-01
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.23.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260206 [Spaces 1 to 3]											
			Bromodichloromethane	- -	1E-06	- -	- -	1E-06	N/A	- -	N/A	- -	N/A
			Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	4E-02	- -	4E-02
			Ethylbenzene	- -	7E-07	- -	- -	7E-07	Developmental	- -	2E-03	- -	2E-03
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	1E-01	- -	1E-01
			Chemical Total	- -	1E-05	- -	- -	1E-05		- -	2E-01	- -	2E-01
			Radionuclide Total										
		Exposure Point Total						1E-05					2E-01
	Exposure Medium Total							1E-05					2E-01
Medium Total								1E-05					2E-01
Receptor Total								1E-05					2E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 1E-05

Total Hazard Across All Media: 2E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	4E-02
Total Nervous System HI =	1E-01
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.24.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260504 [Basement]											
			Chloroform	- -	5E-06	- -	- -	5E-06	Liver	- -	6E-03	- -	6E-03
			Ethylbenzene	- -	3E-06	- -	- -	3E-06	Developmental	- -	2E-03	- -	2E-03
			Naphthalene	- -	3E-05	- -	- -	3E-05	Respiratory	- -	6E-01	- -	6E-01
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	1E-01	- -	1E-01
			Chemical Total	- -	3E-05	- -	- -	3E-05		- -	7E-01	- -	7E-01
			Radionuclide Total										
		Exposure Point Total						3E-05					7E-01
	Exposure Medium Total							3E-05					7E-01
Medium Total								3E-05					7E-01
Receptor Total								3E-05					7E-01

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 3E-05

Total Hazard Across All Media: 7E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	6E-03
Total Nervous System HI =	1E-01
Total Skin HI =	N/A
Total Respiratory HI =	6E-01

TABLE 9.24.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260504 [Basement]											
			Chloroform	- -	1E-06	- -	- -	1E-06	Liver	- -	4E-03	- -	4E-03
			Ethylbenzene	- -	5E-07	- -	- -	5E-07	Developmental	- -	2E-03	- -	2E-03
			Naphthalene	- -	5E-06	- -	- -	5E-06	Respiratory	- -	4E-01	- -	4E-01
			Xylenes (total)	- -	N/A	- -	- -	N/A	CNS	- -	9E-02	- -	9E-02
			Chemical Total	- -	7E-06	- -	- -	7E-06		- -	5E-01	- -	5E-01
			Radionuclide Total										
		Exposure Point Total						7E-06					5E-01
	Exposure Medium Total							7E-06					5E-01
Medium Total								7E-06					5E-01
Receptor Total								7E-06					5E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 7E-06

Total Hazard Across All Media: 5E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	4E-03
Total Nervous System HI =	9E-02
Total Skin HI =	N/A
Total Respiratory HI =	4E-01

TABLE 9.25.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Spaces 1 to 3]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	2E-01	- -	2E-01
			1,4-Dichlorobenzene	- -	2E-04	- -	- -	2E-04	Liver	- -	5E-02	- -	5E-02
			Benzene	- -	5E-06	- -	- -	5E-06	Immune System	- -	5E-02	- -	5E-02
			Carbon tetrachloride	- -	1E-06	- -	- -	1E-06	Liver	- -	5E-03	- -	5E-03
			Chloroform	- -	4E-06	- -	- -	4E-06	Liver	- -	4E-03	- -	4E-03
			Ethylbenzene	- -	2E-06	- -	- -	2E-06	Developmental	- -	1E-03	- -	1E-03
			Naphthalene	- -	2E-04	- -	- -	2E-04	Respiratory	- -	5E+00	- -	5E+00
			Tetrachloroethene	- -	9E-06	- -	- -	9E-06	CNS	- -	2E+00	- -	2E+00
			Trichloroethene	- -	2E-06	- -	- -	2E-06	Developmental, Immune System	- -	5E-01	- -	5E-01
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	2E-01	- -	2E-01
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	8E-01	- -	8E-01
			Chemical Total	- -	4E-04	- -	- -	4E-04		- -	9E+00	- -	9E+00
			Radionuclide Total										
		Exposure Point Total						4E-04					9E+00
	Exposure Medium Total							4E-04					9E+00
Medium Total								4E-04					9E+00
Receptor Total								4E-04					9E+00

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media	4E-04
Cancer Risk with MassDEP unit risk for PCE:	7E-04
Cancer Risk with MassDEP unit risk for TCE:	4E-04

Total Hazard Across All Media	9E+00
Total Blood HI =	2E-01
Total Cardiovascular HI =	N/A
Total Developmental HI =	5E-01
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	5E-01
Total Kidney HI =	N/A
Total Liver HI =	6E-02
Total Nervous System HI =	2E+00
Total Skin HI =	N/A
Total Respiratory HI =	6E+00

TABLE 9.25.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Spaces 1 to 3]											
			1,2,4-Trimethylbenzene	- -	N/A	- -	- -	N/A	Blood	- -	1E-01	- -	1E-01
			1,4-Dichlorobenzene	- -	4E-05	- -	- -	4E-05	Liver	- -	3E-02	- -	3E-02
			Benzene	- -	9E-07	- -	- -	9E-07	Immune System	- -	3E-02	- -	3E-02
			Carbon tetrachloride	- -	3E-07	- -	- -	3E-07	Liver	- -	3E-03	- -	3E-03
			Chloroform	- -	8E-07	- -	- -	8E-07	Liver	- -	3E-03	- -	3E-03
			Ethylbenzene	- -	3E-07	- -	- -	3E-07	Developmental	- -	1E-03	- -	1E-03
			Naphthalene	- -	4E-05	- -	- -	4E-05	Respiratory	- -	3E+00	- -	3E+00
			Tetrachloroethene	- -	2E-06	- -	- -	2E-06	CNS	- -	1E+00	- -	1E+00
			Trichloroethene	- -	5E-07	- -	- -	5E-07	Developmental, Immune System	- -	3E-01	- -	3E-01
			C5-C8 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	2E-01	- -	2E-01
			C9-C12 Aliphatics	- -	N/A	- -	- -	N/A	Respiratory	- -	6E-01	- -	6E-01
			Chemical Total	- -	8E-05	- -	- -	8E-05		- -	6E+00	- -	6E+00
			Radionuclide Total										
		Exposure Point Total						8E-05					6E+00
	Exposure Medium Total							8E-05					6E+00
Medium Total								8E-05					6E+00
Receptor Total								8E-05					6E+00

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media	8E-05
Cancer Risk with MassDEP unit risk for PCE:	1E-04
Cancer Risk with MassDEP unit risk for TCE:	8E-05

Total Hazard Across All Media	6E+00
Total Blood HI =	1E-01
Total Cardiovascular HI =	N/A
Total Developmental HI =	3E-01
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	4E-01
Total Kidney HI =	N/A
Total Liver HI =	4E-02
Total Nervous System HI =	1E+00
Total Skin HI =	N/A
Total Respiratory HI =	4E+00

TABLE 9.26.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [North unit basement]											
			Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	2E-03	- -	2E-03
			Ethylbenzene	- -	6E-07	- -	- -	6E-07	Developmental	- -	6E-04	- -	6E-04
			Naphthalene	- -	3E-06	- -	- -	3E-06	Respiratory	- -	6E-02	- -	6E-02
			Chemical Total	- -	6E-06	- -	- -	6E-06		- -	6E-02	- -	6E-02
			Radionuclide Total										
		Exposure Point Total						6E-06					6E-02
	Exposure Medium Total							6E-06					6E-02
Medium Total								6E-06					6E-02
Receptor Total								6E-06					6E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 6E-06

Total Hazard Across All Media: 6E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	6E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	6E-02

TABLE 9.26.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [North unit basement]											
			Chloroform	- -	5E-07	- -	- -	5E-07	Liver	- -	2E-03	- -	2E-03
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	4E-04	- -	4E-04
			Naphthalene	- -	5E-07	- -	- -	5E-07	Respiratory	- -	4E-02	- -	4E-02
			Chemical Total	- -	1E-06	- -	- -	1E-06		- -	4E-02	- -	4E-02
			Radionuclide Total										
		Exposure Point Total						1E-06					4E-02
	Exposure Medium Total							1E-06					4E-02
Medium Total								1E-06					4E-02
Receptor Total								1E-06					4E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 1E-06

Total Hazard Across All Media: 4E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	4E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	4E-02

TABLE 9.27.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [North unit 1st Floor]											
			Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	2E-03	- -	2E-03
			Ethylbenzene	- -	6E-07	- -	- -	6E-07	Developmental	- -	6E-04	- -	6E-04
			Naphthalene	- -	2E-06	- -	- -	2E-06	Respiratory	- -	4E-02	- -	4E-02
			Chemical Total	- -	5E-06	- -	- -	5E-06		- -	5E-02	- -	5E-02
			Radionuclide Total										
		Exposure Point Total						5E-06					5E-02
	Exposure Medium Total							5E-06					5E-02
Medium Total								5E-06					5E-02
Receptor Total								5E-06					5E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 5E-06

Total Hazard Across All Media: 5E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	6E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	4E-02

TABLE 9.27.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [North unit 1st Floor]											
			Chloroform	- -	5E-07	- -	- -	5E-07	Liver	- -	2E-03	- -	2E-03
			Ethylbenzene	- -	1E-07	- -	- -	1E-07	Developmental	- -	4E-04	- -	4E-04
			Naphthalene	- -	4E-07	- -	- -	4E-07	Respiratory	- -	3E-02	- -	3E-02
			Chemical Total	- -	1E-06	- -	- -	1E-06		- -	3E-02	- -	3E-02
			Radionuclide Total										
		Exposure Point Total						1E-06					3E-02
	Exposure Medium Total							1E-06					3E-02
Medium Total								1E-06					3E-02
Receptor Total								1E-06					3E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 1E-06

Total Hazard Across All Media: 3E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	4E-04
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	3E-02

TABLE 9.28.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [South unit basement]											
			Chloroform	- -	2E-05	- -	- -	2E-05	Liver	- -	2E-02	- -	2E-02
			Ethylbenzene	- -	2E-06	- -	- -	2E-06	Developmental	- -	2E-03	- -	2E-03
			Naphthalene	- -	5E-06	- -	- -	5E-06	Respiratory	- -	1E-01	- -	1E-01
			Chemical Total	- -	3E-05	- -	- -	3E-05		- -	1E-01	- -	1E-01
			Radionuclide Total										
		Exposure Point Total						3E-05					1E-01
	Exposure Medium Total							3E-05					1E-01
Medium Total								3E-05					1E-01
Receptor Total								3E-05					1E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 3E-05

Total Hazard Across All Media: 1E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	2E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-02
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	1E-01

TABLE 9.28.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260505 [South unit basement]											
			Chloroform	- -	4E-06	- -	- -	4E-06	Liver	- -	1E-02	- -	1E-02
			Ethylbenzene	- -	4E-07	- -	- -	4E-07	Developmental	- -	1E-03	- -	1E-03
			Naphthalene	- -	1E-06	- -	- -	1E-06	Respiratory	- -	8E-02	- -	8E-02
			Chemical Total	- -	5E-06	- -	- -	5E-06		- -	1E-01	- -	1E-01
			Radionuclide Total										
		Exposure Point Total						5E-06					1E-01
	Exposure Medium Total							5E-06					1E-01
Medium Total								5E-06					1E-01
Receptor Total								5E-06					1E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 5E-06

Total Hazard Across All Media: 1E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	1E-03
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	8E-02

TABLE 9.29.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260902 [Basement]	Chloroform	- -	3E-06	- -	- -	3E-06	Liver	- -	3E-03	- -	3E-03
			Naphthalene	- -	5E-06	- -	- -	5E-06	Respiratory	- -	1E-01	- -	1E-01
			Chemical Total	- -	8E-06	- -	- -	8E-06		- -	1E-01	- -	1E-01
			Radionuclide Total										
		Exposure Point Total						8E-06					1E-01
	Exposure Medium Total							8E-06					1E-01
Medium Total								8E-06					1E-01
Receptor Total								8E-06					1E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 8E-06

Total Hazard Across All Media: 1E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	3E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	1E-01

TABLE 9.29.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260902 [Basement]	Chloroform	- -	6E-07	- -	- -	6E-07	Liver	- -	2E-03	- -	2E-03
			Naphthalene	- -	1E-06	- -	- -	1E-06	Respiratory	- -	7E-02	- -	7E-02
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	7E-02	- -	7E-02
			Radionuclide Total										
		Exposure Point Total						2E-06					7E-02
	Exposure Medium Total							2E-06					7E-02
Medium Total								2E-06					7E-02
Receptor Total								2E-06					7E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 2E-06

Total Hazard Across All Media: 7E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	7E-02

TABLE 9.30.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260902 [1st Floor]	Chloroform	- -	2E-06	- -	- -	2E-06	Liver	- -	2E-03	- -	2E-03
			Naphthalene	- -	N/A	- -	- -	N/A	Respiratory	- -	N/A	- -	N/A
			Chemical Total	- -	2E-06	- -	- -	2E-06		- -	2E-03	- -	2E-03
			Radionuclide Total										
		Exposure Point Total						2E-06					2E-03
	Exposure Medium Total							2E-06					2E-03
Medium Total								2E-06					2E-03
Receptor Total								2E-06					2E-03

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 2E-06

Total Hazard Across All Media: 2E-03

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	2E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.30.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260902 [1st Floor]	Chloroform	- -	4E-07	- -	- -	4E-07	Liver	- -	1E-03	- -	1E-03
			Naphthalene	- -	N/A	- -	- -	N/A	Respiratory	- -	N/A	- -	N/A
			Chemical Total	- -	4E-07	- -	- -	4E-07		- -	1E-03	- -	1E-03
			Radionuclide Total										
		Exposure Point Total						4E-07					1E-03
	Exposure Medium Total							4E-07					1E-03
Medium Total								4E-07					1E-03
Receptor Total								4E-07					1E-03

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 4E-07

Total Hazard Across All Media: 1E-03

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.31.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260903 [Basement]	Chloroform	- -	1E-05	- -	- -	1E-05	Liver	- -	1E-02	- -	1E-02
			Chemical Total	- -	1E-05	- -	- -	1E-05		- -	1E-02	- -	1E-02
			Radionuclide Total										
		Exposure Point Total						1E-05					1E-02
	Exposure Medium Total							1E-05					1E-02
Medium Total								1E-05					1E-02
Receptor Total								1E-05					1E-02

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 1E-05

Total Hazard Across All Media: 1E-02

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	1E-02
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.31.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260903 [Basement]	Chloroform	- -	3E-06	- -	- -	3E-06	Liver	- -	9E-03	- -	9E-03
			Chemical Total	- -	3E-06	- -	- -	3E-06		- -	9E-03	- -	9E-03
			Radionuclide Total										
		Exposure Point Total						3E-06					9E-03
	Exposure Medium Total							3E-06					9E-03
Medium Total								3E-06					9E-03
Receptor Total								3E-06					9E-03

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 3E-06

Total Hazard Across All Media: 9E-03

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	9E-03
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

TABLE 9.32.RME

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

REASONABLE MAXIMUM EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Spaces 1 to 5]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	3E-01	- -	3E-01
			Chloroform	- -	6E-04	- -	- -	6E-04	Liver	- -	6E-01	- -	6E-01
			Naphthalene	- -	9E-06	- -	- -	9E-06	Respiratory	- -	2E-01	- -	2E-01
			Chemical Total	- -	6E-04	- -	- -	6E-04		- -	1E+00	- -	1E+00
			Radionuclide Total										
		Exposure Point Total						6E-04					1E+00
	Exposure Medium Total							6E-04					1E+00
Medium Total								6E-04					1E+00
Receptor Total								6E-04					1E+00

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 6E-04

Total Hazard Across All Media: 1E+00

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	6E-01
Total Nervous System HI =	3E-01
Total Skin HI =	N/A
Total Respiratory HI =	2E-01

TABLE 9.32.CT

SUMMARY OF RECEPTOR RISKS AND HAZARDS FOR COPCs

CENTRAL TENDENCY EXPOSURE

WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Spaces 1 to 5]											
			Acetone	- -	N/A	- -	- -	N/A	CNS	- -	2E-01	- -	2E-01
			Chloroform	- -	1E-04	- -	- -	1E-04	Liver	- -	4E-01	- -	4E-01
			Naphthalene	- -	2E-06	- -	- -	2E-06	Respiratory	- -	1E-01	- -	1E-01
			Chemical Total	- -	1E-04	- -	- -	1E-04		- -	7E-01	- -	7E-01
			Radionuclide Total										
		Exposure Point Total						1E-04					7E-01
	Exposure Medium Total							1E-04					7E-01
Medium Total								1E-04					7E-01
Receptor Total								1E-04					7E-01

- - = Not Evaluated

N/A = Not Applicable

Total Risk Across All Media: 1E-04

Total Hazard Across All Media: 7E-01

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	4E-01
Total Nervous System HI =	2E-01
Total Skin HI =	N/A
Total Respiratory HI =	1E-01

TABLE 10.1.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Spaces 1 to 3]											
			1,4-Dichlorobenzene	- -	2E-04	- -	- -	2E-04					
			Benzene	- -	5E-06	- -	- -	5E-06					
			Chloroform	- -	4E-06	- -	- -	4E-06					
			Ethylbenzene	- -	2E-06	- -	- -	2E-06					
			Naphthalene	- -	2E-04	- -	- -	2E-04	Respiratory	- -	5E+00	- -	5E+00
			Tetrachloroethene	- -	9E-06	- -	- -	9E-06	CNS	- -	2E+00	- -	2E+00
			Trichloroethene	- -	2E-06	- -	- -	2E-06					
			Chemical Total	- -	4E-04	- -	- -	4E-04		- -	7E+00	- -	7E+00
			Radionuclide Total										
		Exposure Point Total						4E-04					7E+00
	Exposure Medium Total							4E-04					7E+00
Medium Total								4E-04					7E+00
Receptor Total								4E-04					7E+00

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 4E-04

Total Hazard Across All Media: 7E+00

Cancer Risk with MassDEP unit risk for PCE: 7E-04
Cancer Risk with MassDEP unit risk for TCE: 4E-04

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	N/A
Total Nervous System HI =	2E+00
Total Skin HI =	N/A
Total Respiratory HI =	5E+00

TABLE 10.1.CT
RISK SUMMARY
CENTRAL TENDENCY EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260207 [Spaces 1 to 3]	Naphthalene						Respiratory	- -	3E+00	- -	3E+00
			Chemical Total	- -	- -	- -	- -	N/A		- -	3E+00	- -	3E+00
			Radionuclide Total										
		Exposure Point Total						N/A					3E+00
	Exposure Medium Total							N/A					3E+00
Medium Total								N/A					3E+00
Receptor Total								N/A					3E+00

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: N/A

Total Hazard Across All Media: 3E+00

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	N/A
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	3E+00

TABLE 10.2.RME
RISK SUMMARY
REASONABLE MAXIMUM EXPOSURE
WELLS G&H SUPERFUND SITE - OU-1

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

Medium	Exposure Medium	Exposure Point	Chemical of Potential Concern	Carcinogenic Risk Young Child + Adult					Non-Carcinogenic Hazard Quotient Young Child				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total	Primary Target Organ	Ingestion	Inhalation	Dermal	Exposure Routes Total
Air	Indoor Air	260407 [Spaces 1 to 5]	Chloroform	- -	6E-04	- -	- -	6E-04					
			Naphthalene	- -	9E-06	- -	- -	9E-06					
			Chemical Total	- -	6E-04	- -	- -	6E-04		- -	- -	- -	N/A
			Radionuclide Total										
		Exposure Point Total						6E-04					N/A
	Exposure Medium Total							6E-04					N/A
Medium Total								6E-04					N/A
Receptor Total								6E-04					N/A

- - = Not Evaluated
N/A = Not Applicable

Total Risk Across All Media: 6E-04

Total Hazard Across All Media: N/A

Total Blood HI =	N/A
Total Cardiovascular HI =	N/A
Total Developmental HI =	N/A
Total General Toxicity HI =	N/A
Total GI System HI =	N/A
Total Immune System HI =	N/A
Total Kidney HI =	N/A
Total Liver HI =	N/A
Total Nervous System HI =	N/A
Total Skin HI =	N/A
Total Respiratory HI =	N/A

APPENDIX A

RELEVANT SITE-RELATED INFORMATION

Appendix A

Contents

Appendix A.1

April 2010 EPA Fact Sheet: Dewey and Olympia Avenue Neighborhood Notice, Environmental Fieldwork Planned at Wells G&H Superfund Site

NEIGHBORHOOD NOTICE!

Environmental fieldwork planned at Wells G&H Superfund Site

Wells G&H Superfund Site: Dewey & Olympia Avenue Neighborhood Notice
May 2010 Well Installation Program and May 6, 2010 public meeting

August, 2009

EPA would like to provide the Dewey & Olympia Avenue neighborhood within the Wells G&H Superfund Site notice of a shallow monitoring well installation program scheduled for May 10, 2010, and announce a **public meeting scheduled for 7:00 PM, May 6, 2010 at Woburn City Hall, Council Chamber.** The public meeting will provide a status of the Site, summarize the well installation program and answer any questions.

At the request of the United States Environmental Protection Agency (EPA) and the Connecticut Department of Environmental Protection (DEP), the Performing Settling Defendants (PSDs) for the Old Southington Landfill Superfund Project (OSL) will conduct a study to confirm the effectiveness of the passive gas collection system installed as part of the capping remedy for the Landfill. This program will supplement the information collected through the normal monitoring of the Landfill cap.

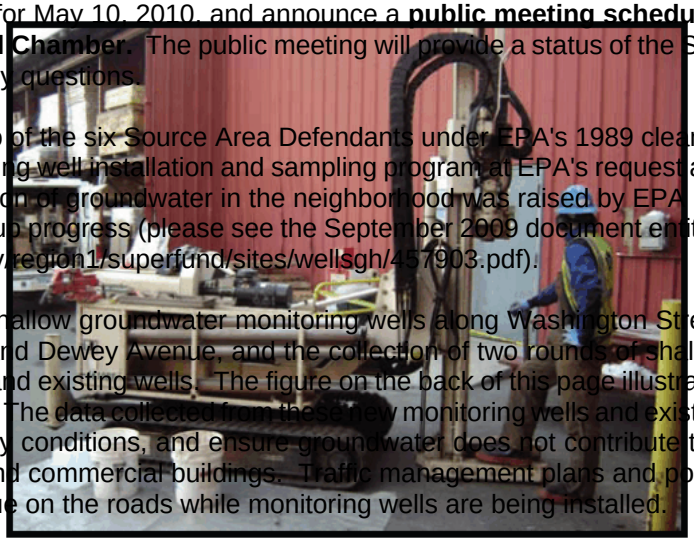
A small volume of helium (a non-toxic, odorless gas) will be injected into the Landfill beneath the cap and measurements for helium will be taken at existing gas vents, existing Landfill perimeter gas monitoring probes and new probes installed for the study. The test will be conducted at the north end of the Landfill and along the south side of Rejean Road.

The study will begin on Monday, August 17th and will be conducted over a period of one to two weeks. Access to the north end of the Landfill will be restricted during this timeframe.

Subsurface injection/monitoring probes will be installed with a compact drill rig.

The remainder of the study will involve field personnel injecting a small amount of gas and collecting periodic measurements with handheld equipment. Measurements will be taken during the day and possibly intermittently at night. The study will be performed on behalf of the PSDs by Loureiro Engineering Associates, Inc. of Plainville, Connecticut under supervision of the EPA and DEP.

If you have questions concerning the study, please contact Annerinda Silva, EPA Remedial Project Manager for the project at 617-918-1246, or Jim Murphy, EPA Community Involvement Coordinator at 617-918-1028. If you have any health related questions, you may contact Sharon Pusnik, CT Dept of Public Health Epidemiologist, at 860-509-7983.



UniFirst Corporation and the W.R. Grace Company (two of the six Source Area Defendants under EPA's 1989 cleanup settlement) have agreed to implement this limited monitoring well installation and sampling program at EPA's request and under its oversight. The recommendation for investigation of groundwater in the neighborhood was raised by EPA last Fall during its scheduled review of the Wells G&H cleanup progress (please see the September 2009 document entitled "Third Five Year Review Report" at: http://www.epa.gov/region1/superfund/sites/wellsgh/457903.pdf).

The sampling program will focus on the installation of shallow groundwater monitoring wells along Washington Street, Olympia Avenue, Marietta Street, Wainwright Avenue and Dewey Avenue, and the collection of two rounds of shallow groundwater samples from these new monitoring wells and existing wells. The figure on the back of this page illustrates the approximate locations of these new monitoring wells. The data collected from these new monitoring wells and existing wells will be used to assess shallow groundwater quality conditions, and ensure groundwater does not contribute to a potential indoor air concern inside existing residential and commercial buildings. Traffic management plans and police details will be established, and vehicle traffic will continue on the roads while monitoring wells are being installed.

Anticipated Schedule:

- 7:00 PM, May 6, 2010, EPA public meeting at Woburn City Hall, Council Chamber
- May 10, 2010: install new monitoring wells (approximately 2 weeks)
- June 2010: develop and sample monitoring wells
- August 2010: validated data
- September 2010: initial data evaluation

As validated data become available, EPA will post the results on its web page at http://www.epa.gov/region1/superfund/sites/wellsgh. EPA also coordinated the preparation of this notice with Mayor Scott Galvin and Alderman City Councilor Darlene Mercer Bruen, who can be reached at telephone # 781.897.5901, email mayor@cityofwoburn.com, and 781.937.3161, email bruen-h-bruen@comcast.net, respectively.

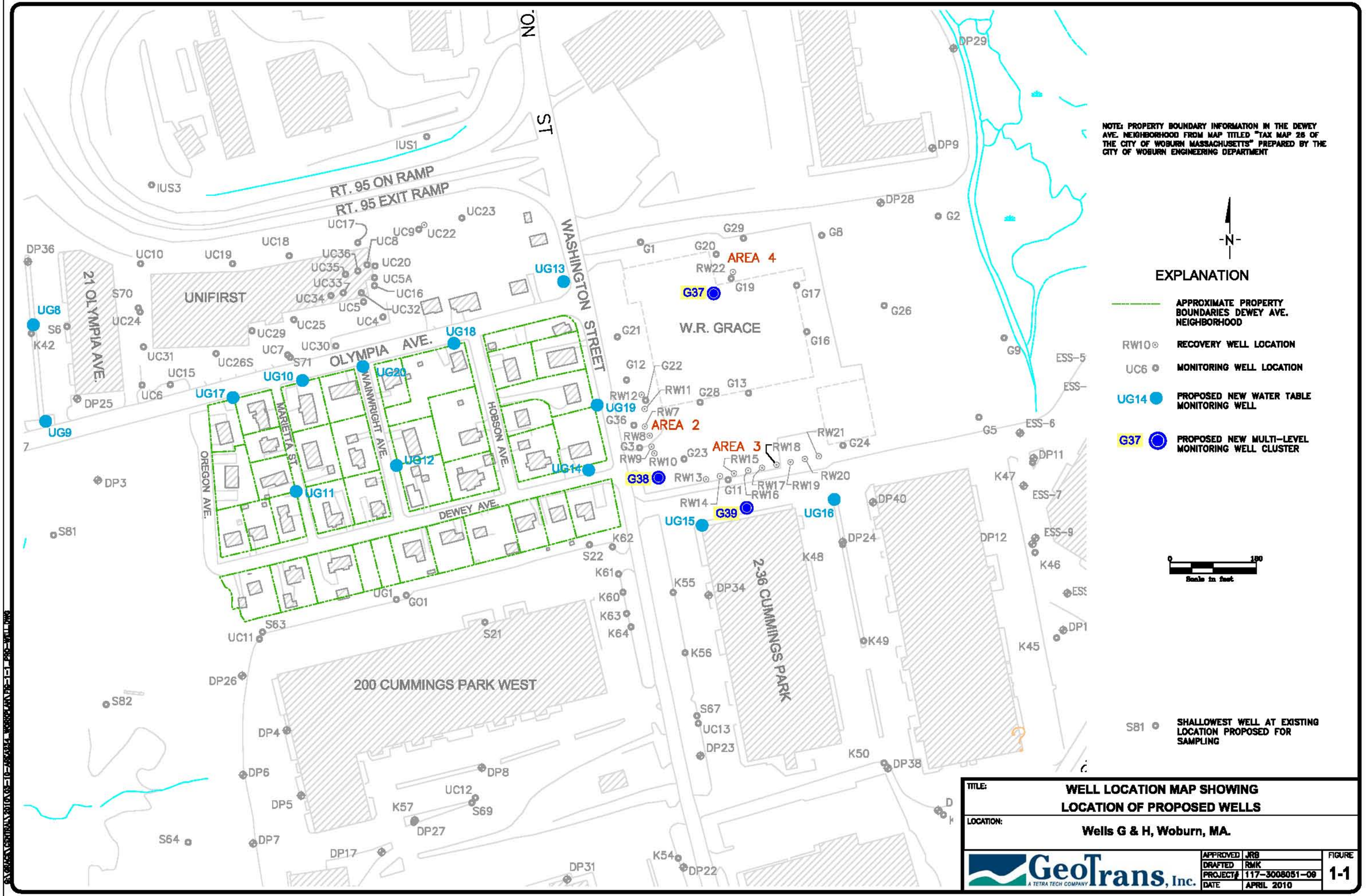
If there are any questions regarding this sampling program or the current status of the Wells G&H Superfund Site, please contact the following personnel:

Joseph F. LeMay, P.E.
Remedial Project Manager
U.S. EPA Region 1 - New England
Five Post Office Square
Suite 100 (mail code: OSRR07-4)
Boston, MA 02109-3912
Telephone # 617.918.1323
Email: lemay.joe@epa.gov

Doug Gutro
Public Affairs Coordinator
U.S. EPA Region 1 - New England
Five Post Office Square
Suite 100 (mail code: OEA01-1)
Boston, MA 02109-3912
Telephone # 617.918.1021
Email: gutro.doug@epa.gov

Joseph Coyne
Project Manager
Massachusetts Department of Environmental Protection
2 Winter Street
Boston, MA 02109
Telephone # 617.348.4066
Email: joseph.coyne@state.ma.us

EPA United States Environmental Protection Agency



NOTE: PROPERTY BOUNDARY INFORMATION IN THE DEWEY AVE. NEIGHBORHOOD FROM MAP TITLED "TAX MAP 26 OF THE CITY OF WOBURN MASSACHUSETTS" PREPARED BY THE CITY OF WOBURN ENGINEERING DEPARTMENT

N

EXPLANATION

- APPROXIMATE PROPERTY BOUNDARIES DEWEY AVE. NEIGHBORHOOD
- RW10 ⊙ RECOVERY WELL LOCATION
- UC6 ⊙ MONITORING WELL LOCATION
- UG14 ● PROPOSED NEW WATER TABLE MONITORING WELL
- G37 ◎ PROPOSED NEW MULTI-LEVEL MONITORING WELL CLUSTER
- S81 ⊙ SHALLOWEST WELL AT EXISTING LOCATION PROPOSED FOR SAMPLING

0 180
Scale in feet

TITLE: **WELL LOCATION MAP SHOWING LOCATION OF PROPOSED WELLS**

LOCATION: **Wells G & H, Woburn, MA.**

GeoTrans, Inc. A TETRA TECH COMPANY

APPROVED	JRB
DRAFTED	RMK
PROJECT #	117-3008051-09
DATE	APRIL 2010

FIGURE 1-1

Appendix A.2

January 2011 EPA Fact Sheet: Site Update, Wells G&H Site, Woburn, MA

Wells G&H Site Woburn, MA

U.S. EPA | HAZARDOUS WASTE PROGRAM AT EPA NEW ENGLAND

THE SUPERFUND PROGRAM *protects human health and the environment by investigating and cleaning up often-abandoned hazardous waste sites and engaging communities throughout the process. Many of these sites are complex and need long-term cleanup actions. Those responsible for contamination are held liable for cleanup costs. EPA strives to return previously contaminated land and groundwater to productive use.*

VAPOR INTRUSION INVESTIGATION:

EPA is evaluating chemicals once used at industries at the Wells G&H Site which seeped into the groundwater. Although groundwater treatment systems installed as part of the EPA-approved remedy have removed chemicals from over 400 million gallons of ground water, some concentrations of these chemicals remain in the groundwater. These chemicals are known as volatile organic compounds (VOCs). VOCs can travel from groundwater into a gas and move through the tiny open spaces between soil particles. This "soil gas," as it is called, can gather under buildings and possibly enter buildings through cracks or holes present in a floor slab, a basement or crawl space (for example, where utility services enter a home). Once in a building, the colorless and often odorless gas may travel further to upper levels of the building, depending on its insulation and construction. The movement of VOCs from groundwater into soil gas and then into a building is referred to as vapor intrusion.

COMMUNITY MEETING:

The Environmental Protection Agency (EPA) will hold a public meeting at 7:00 p.m. on January 26, 2011 at Woburn City Hall to present recent groundwater sampling results; describe how EPA investigates potential instances of vapor intrusion; and identify next steps at the Wells G&H Superfund Site (Site).

The purpose of this fact sheet is to:

- Explain the potential mechanism for chemicals to move from groundwater into the air below or inside buildings (vapor intrusion);
- Present the results of shallow groundwater samples recently collected from monitoring wells installed in the Dewey and Olympia Avenues Neighborhood; and
- Identify the next steps for a vapor intrusion investigation.

HISTORICAL TESTING FOR VAPOR INTRUSION:

In 1989, EPA collected indoor air samples from 3 residences in the Dewey and Olympia Avenue Neighborhood. In 1991, EPA also collected indoor air samples from the nearby child day care facility. The results of those tests did not indicate a potential health threat.

Since that time, investigation techniques have evolved and improved. EPA believes an updated assessment of the potential for vapor intrusion is needed to reflect current conditions and improved investigation methods. This updated assessment for vapor intrusion is more commonly being applied to many historical superfund sites across the country in response to evolving standards for assessing this potential vapor pathway.

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www.epa.gov/region1/superfund/sites/wellsgh

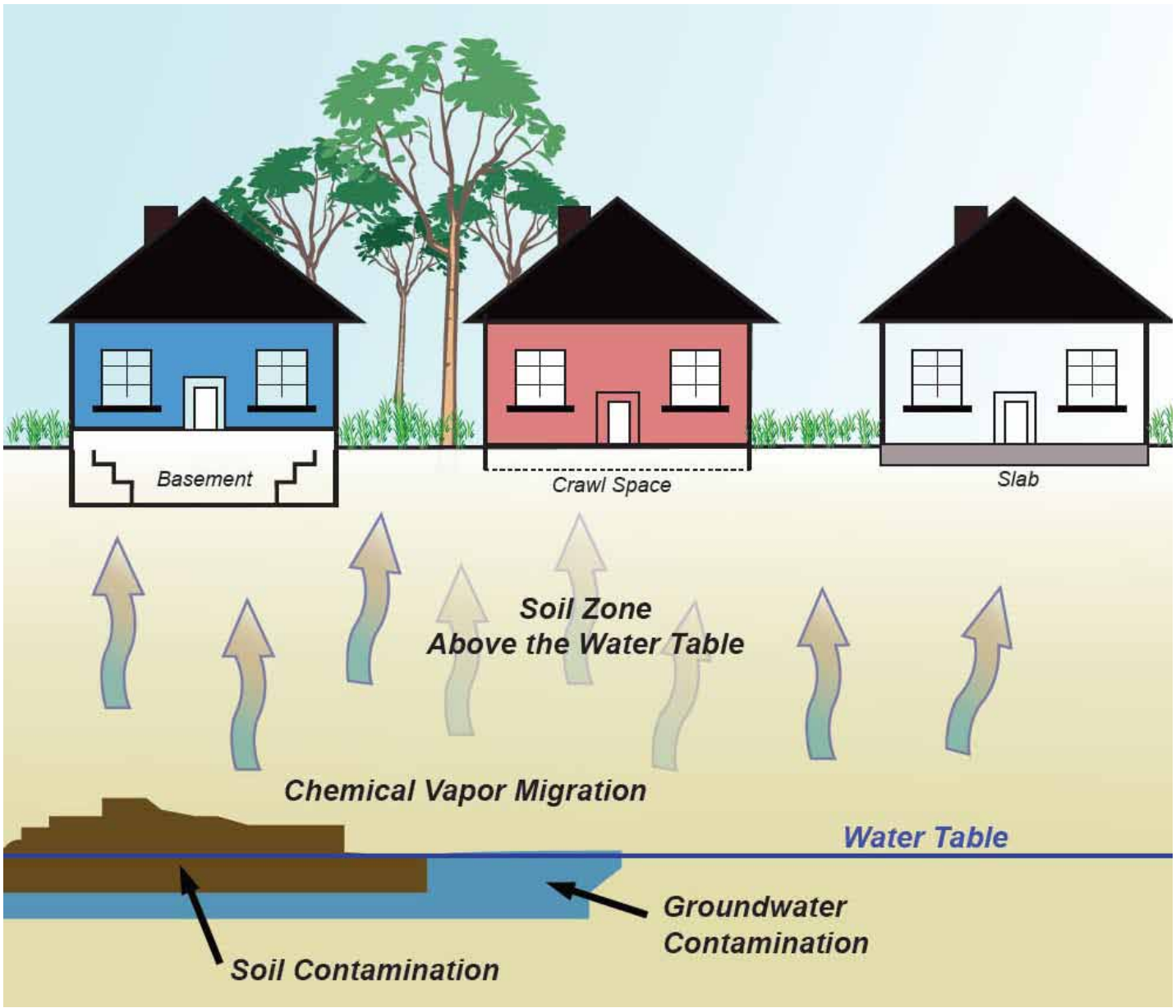
2010 VAPOR INTRUSION TESTING RESULTS:

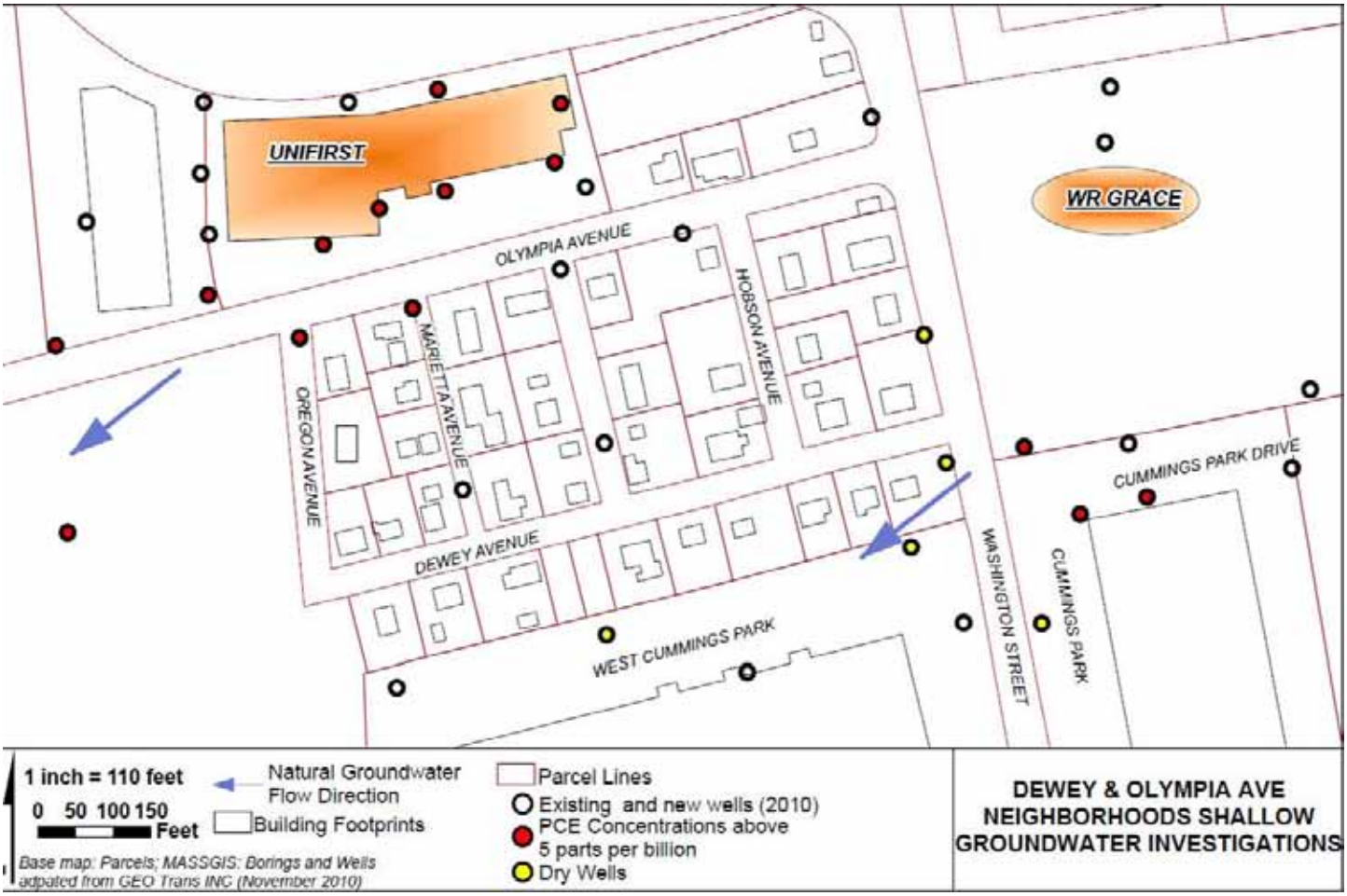
In Spring 2010, indoor air and sub-slab soil gas samples were collected in the building on the UniFirst property at 15 Olympia Avenue for assessing potential for vapor intrusion. Tetrachloroethylene, also known as perchloroethylene (PCE), was detected in both sub-slab and indoor air sample results. The sub-slab samples had the highest PCE concentrations under the eastern half of the building's foundation, while indoor air PCE concentrations were much lower. The comprehensive results of the sub-slab and indoor air sampling at the building on the UniFirst property are presented on EPA's web page at http://www.epa.gov/region1/superfund/sites/wellsgh.

2010 GROUNDWATER MONITORING RESULTS:

In April 2010, EPA announced a groundwater monitoring well installation program for the Dewey and Olympia Avenues neighborhood. The installation of shallow groundwater monitoring wells was an initial step in the process to investigate the potential for vapor intrusion. The well installation program included 14 new monitoring wells in the neighborhood and 2 new monitoring wells at the W.R. Grace property. During the summer, 38 groundwater monitoring wells were sampled for VOCs, including the 16 new wells and 22 existing wells. Well locations are illustrated in the figure on the next page.

PCE was detected in some monitoring wells located in the vicinity of the UniFirst and W.R. Grace properties. Samples from 14 of the 38 monitoring wells had PCE concentrations equal to or greater than 5 micrograms per liter (ug/L) or parts per billion (ppb) (see well locations with red highlights on figure), which is the maximum allowable concentration that EPA has established for public drinking water supplies. All but three shallow groundwater monitoring wells with





PCE concentrations equal to or great than 5 ppb were located on commercial properties. No groundwater samples were collected from 4 of the 38 monitoring wells because no water was present in those wells at the time of sampling (see well locations with yellow highlights). The comprehensive results of the shallow groundwater sampling are presented on EPA's web page at http://www.epa.gov/ne/superfund/sites/wellsgh.

PROPOSED INDOOR MONITORING FOR VAPOR INTRUSION:

EPA recommends additional indoor air sampling take place within a small number of buildings and dwellings near those shallow groundwater monitoring wells where PCE was measured at a concentration equal to or greater than 5 ppb. This recommendation is based on the results of recent groundwater tests and models that EPA uses as screening tools to determine where further investigation steps are prudent to check for movement of VOCs into buildings.

Specifically, EPA is proposing the collection of sub-slab (below the basement or bottom floor) soil gas and indoor air sampling at a limited number of locations during the winter months (e.g. February 2011) when heating systems are fully functional, and likely in the spring or summer 2011 to reflect seasonal differences in fresh air exchange. Samples will be collected in canisters over an 8-24 hour period. During the same time period, sub-slab soil gas samples will be collected beneath the building slab. Sub-slab sampling requires drilling a small (~1/2 inch) hole through the slab that is sealed with a sampling tube. These samples can often be taken in closets or utility rooms to avoid damaging flooring.

This sampling is precautionary in nature, but necessary to ensure there are no health hazards in the dwellings caused by the groundwater contaminants. UniFirst and W.R. Grace have agreed to conduct this important sampling and analysis with EPA's oversight. EPA will use these data from the indoor investigation to evaluate potential health risks, if any, at these buildings due to vapor intrusion. Where sampling is recommended, every effort will be made to minimize disruption to homes and businesses during these sampling activities. The cooperation of all property owners is necessary to fully assess the absence or presence of vapor intrusion into buildings.

NEXT STEPS:

Property Access: This month, EPA and UniFirst and/or W.R. Grace will contact a limited number of property owners near the monitoring wells where PCE concentrations in groundwater equal or exceed 5 ppb to request access to building basements/bottom floors.

Indoor Air Sampling: During the winter, sub-slab and indoor air samples will be collected from homes and businesses where access is sought.

Groundwater Sampling: If any additional shallow groundwater data is available from previously dry wells, EPA will consider this information prior to the sub-slab and indoor air sampling.

In spring 2011, sampling results will be evaluated, validated, and shared with property owners. The need for additional rounds of sampling will be made at that time. EPA does anticipate, however, that at least one more additional round of samples will be necessary in the Spring/Summer to fully evaluate vapor intrusion.

Contact information: If you have any questions regarding the on-going investigation or the current status of the Wells G&H Superfund, or you would like to be added to EPA's mailing list for the Wells G&H Superfund Site, please contact the EPA personnel on page 1 of this fact sheet.

EPA is working closely with the City of Woburn, including Mayor Scott Galvin's office and Alderman City Councilor Darlene Mercer-Bruen regarding this investigation and all matters regarding the Wells G&H site. If there are any questions for Mayor Galvin and Councilor Mercer-Bruen, they can be reached at telephone # 781.897.5901, email: mayor@cityofwoburn.com, and 781.937.3161, email: bruen-n-bruen@comcast.net, respectively.

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Appendix A.3

2010 and 2011 Groundwater Data for UniFirst and W.R. Grace Source Area Properties and Downgradient Areas – Complied by TRC

Table A.3-1. Summary of Analytical Results for Groundwater Samples Associated with UniFirst Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	S63S S63S-VIA2010 8/3/2010	S70D S70DA 7/21/2010	S70S S70S-VIA2010 7/28/2010	S71D S71DA 7/21/2010	S81D S81DA 7/27/2010	S81M S81MA 7/27/2010	S81S S81S-VIA2010 7/27/2010	UC4 UC4-VIA2010 7/30/2010	UC5 UC5-VIA2010 7/30/2010	UC6 XUC6A 7/21/2010	UC6S UC6S-VIA2010 7/29/2010	UC7-1 UC71A 7/22/2010	UC7-2 UC72A 7/22/2010
VOCs															
(ug/L)	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 UJ	1.0 U	1.0 U	**6.0**	**9.0**
	Chloroform		**0.014 J**	1.0 U	**0.13**	1.0 U	1.0 U	1.0 U	**0.060**	**0.60 J**	1.0 U	1.0 U	0.050 U	1.0 U	1.0 U
	Tetrachloroethene		**0.034 J**	**1.0**	**0.20**	**100**	**90**	**88**	**9.1**	**3.0 J**	**440**	**39**	**15 J**	**2,500**	**1,700**
	1,1,1-Trichloroethane		1.0 U	1.0 U	1.0 U	**0.90 J**	**0.60 J**	**4.0**	1.0 U	1.0 U	**15**	1.0 U	1.0 U	**32**	**40**
	Bromodichloromethane		0.050 U	1.0 U	0.050 U	1.0 U	1.0 U	1.0 U	0.050 U	0.050 U	1.0 U	1.0 U	0.050 U	1.0 U	1.0 U
	Toluene		**10**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**50**	**34**
	Ethylbenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.20 J**	1.0 U
	Vinyl chloride		0.050 U	2.0 U	0.050 U	2.0 U	2.0 U	2.0 U	0.050 U	0.050 U	1.0 U	2.0 U	0.050 U	2.0 U	2.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.90 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**5.0**	**7.0**
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.40 J**	**0.70 J**
	Trichloroethene		1.0 U	**0.30 J**	1.0 U	**0.80 J**	**5.0**	**4.0**	1.0 U	1.0 U	**4.0**	**9.0**	1.0 U	**420**	**440**
	1,3-Dichlorobenzene		0.050 U	NA	**0.004 J**	NA	NA	NA	0.050 U	0.050 U	1.0 U	NA	0.050 U	NA	NA
	cis-1,2-Dichloroethene		**0.0063 J**	1.0 U	0.050 U	1.0 U	1.0 U	1.0 U	**0.052**	**0.10 J**	**1.0**	**2.0**	**0.072**	**13**	**14**
	Carbon disulfide		NA	1.0 U	NA	1.0 U	1.0 U	1.0 U	NA	NA	NA	1.0 U	NA	**0.40 J**	**0.30 J**
	2-Butanone		NA	5.0 U	NA	5.0 U	5.0 U	5.0 U	NA	NA	NA	5.0 U	NA	5.0 U	5.0 U

Notes:
ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-1. Summary of Analytical Results for Groundwater Samples Associated with UniFirst Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location:	UC7-3	UC7-4	UC8	UC10-1	UC10-2	UC10-3	UC10-4	UC10-4	UC10-5	UC10-6	UC10D	UC10M	UC10S
		Sample ID:	UC73A	UC74A	UC08-V1A2010	U101A	U102A	U103A	U104A	U104B	U105A	U106A	UC10DA	UC10MA	UC10S-VIA2010
		Sample Date:	7/22/2010	7/22/2010	7/30/2010	7/23/2010	7/22/2010	7/22/2010	7/22/2010	7/22/2010 Field Dup	7/22/2010	7/21/2010	7/21/2010	7/21/2010	7/28/2010
VOCs															
(ug/L)	1,1-Dichloroethane		**5.0**	**2.0**	100 U	**1.0**	**0.40 J**	**0.30 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.0074 J**
	Tetrachloroethene		**1,900**	**1,100**	**87,000**	**98**	**93**	**91**	**100**	**84**	**30**	**9.0**	1.0 U	1.0 U	0.050 U
	1,1,1-Trichloroethane		**33**	**17**	100 U	**1.0 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Bromodichloromethane		1.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.050 U
	Toluene		**13**	**6.0**	100 U	**35**	**30**	**28**	**24**	**22**	**15**	**4.0**	1.0 U	1.0 U	1.0 U
	Ethylbenzene		1.0 U	1.0 U	100 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl chloride		2.0 U	2.0 U	100 U	**0.40 J**	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	0.050 U
	1,1-Dichloroethene		**3.0**	**1.0**	100 U	**1.0 J**	1.0 U	**0.50 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		**0.40 J**	1.0 U	**32 J**	**3.0**	**1.0**	**1.0**	**0.60 J**	**0.60 J**	**0.80 J**	**0.40 J**	1.0 U	1.0 U	1.0 U
	Trichloroethene		**440**	**73**	**510**	**51**	**52**	**32**	**27**	**25**	**16**	**5.0**	1.0 U	1.0 U	1.0 U
	1,3-Dichlorobenzene		NA	NA	100 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.050 U
	cis-1,2-Dichloroethene		**62**	**17**	**670**	**540 J**	**170**	**180**	**71**	**87**	**110**	**60**	1.0 U	1.0 U	0.050 U
	Carbon disulfide		**0.50 J**	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA
	2-Butanone		**3.0 J**	5.0 U	NA	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NA

Notes:
ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-1. Summary of Analytical Results for Groundwater Samples Associated with UniFirst Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location:	UC11-2	UC18	UC18	UC19	UC19M	UC19S	UC24S	UC25	UC26S	UC29S	UC29S	UC29S	UC31S	UG8
		Sample ID:	U112A	UC18EB-VIA2010	UC18-VIA2010	U19A	U19MA	UC19S-VIA2010	UC24S-VIA2010	UC25-VIA2010	UC26S-VIA2010	UC29S-VIA2010	UC29SDUP-VIA2010	UC29SEB-VIA2010	UC31S-VIA2010	UG8-VIA2010
		Sample Date:	7/23/2010	7/29/2010	7/29/2010	7/27/2010	7/28/2010	7/29/2010	7/28/2010	7/30/2010	7/30/2010	7/29/2010	7/29/2010 Field Dup	7/29/2010	7/29/2010	8/4/2010
VOCs																
(ug/L)	1,1-Dichloroethane		**0.90 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.050 U	1.0 U	1.0 U
	Chloroform		1.0 U	**0.12**	0.085 U	1.0 U	1.0 U	0.050 U	**0.10**	1.0 U	**0.040 J**	0.26 U	0.25 U	0.050 U	0.050 U	**0.098 J**
	Tetrachloroethene		**37**	**0.054**	**7.8 J**	1.0 U	1.0 U	0.14 UJ	**0.033 J**	**160**	**21 J**	**160**	**160**	**0.70 J**	0.39 U	0.16 U
	1,1,1-Trichloroethane		1.0 UJ	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Bromodichloromethane		1.0 U	0.050 U	0.050 U	1.0 U	1.0 U	0.050 U	0.050 U	1.0 U	0.050 U	**0.19**	**0.18**	1.0 U	0.050 U	0.050 U
	Toluene		**13**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Ethylbenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl chloride		2.0 U	0.050 U	0.050 U	2.0 U	2.0 U	0.050 U	0.050 U	1.0 U	0.050 U	0.050 U	0.050 U	1.0 U	0.050 U	0.050 U
	1,1-Dichloroethene		**0.80 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		**18**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.050 U	1.0 U	1.0 U
	Trichloroethene		**39**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.70 J**	1.0 U	**1.0**	**1.0**	1.0 U	1.0 U	1.0 U
	1,3-Dichlorobenzene		NA	**0.004 J**	0.050 U	NA	NA	0.050 U	0.050 U	1.0 U	0.050 U	0.050 U	0.050 U	1.0 U	0.050 U	0.050 U
	cis-1,2-Dichloroethene		**330 J**	0.050 U	**0.0084 J**	1.0 U	1.0 U	0.050 U	0.050 U	**4.0**	**0.10**	**4.0**	**3.0**	1.0 U	0.050 U	0.050 U
	Carbon disulfide		**0.50 J**	NA	NA	1.0 U	1.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-Butanone		**8.0**	NA	NA	5.0 U	5.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-1. Summary of Analytical Results for Groundwater Samples Associated with UniFirst Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UG8 UG8DUP-VIA2010 8/4/2010 Field Dup	UG9 UG9-VIA2010 8/3/2010	UG9 UG9EB-VIA2010 8/3/2010	UG10 UG10-VIA2010 8/3/2010	UG11 UG11-VIA2010 8/3/2010	UG12 UG12-VIA2010 8/3/2010	UG17 UG17-VIA2010 8/3/2010	UG18 UG18-VIA2010 8/2/2010	UG20 UG20-VIA2010 8/2/2010
VOCs											
(ug/L)	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		**0.098**	**0.065 J**	0.050 U	**0.026 J**	**3.0**	**0.31**	1.0 U	**0.20**	**0.10 J**
	Tetrachloroethene		0.14 U	**6.9**	0.050 U	**9.3**	**2.0 J**	**0.038 J**	**78 J**	**0.10**	**2.0 J**
	1,1,1-Trichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Bromodichloromethane		0.050 U	0.050 U	0.050 U	0.050 U	**0.10**	0.050 U	1.0 U	0.050 U	0.050 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Ethylbenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl chloride		0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	1.0 U	0.050 U	0.050 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.70 J**	1.0 U	1.0 U
	1,3-Dichlorobenzene		0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U	1.0 U	0.050 U	0.050 U
	cis-1,2-Dichloroethene		0.050 U	**0.029 J**	0.050 U	0.050 U	0.050 U	0.050 U	**0.60 J**	0.050 U	0.050 UJ
	Carbon disulfide		NA	NA	NA	NA	NA	NA	NA	NA	NA
	2-Butanone		NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:
ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-2. Summary of Analytical Results for Groundwater Samples Associated with W.R. Grace Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location:	G1D	G1DB	G1DB	G1DB2	G1DB3	G1S	G11D	G12D	G12S	G19D	G19M	G19M	G19S	G20D
		Sample ID:	G1D-AS10	G1DB-AS10	G1DBDUP-AS10	G1DB2-AS10	G1DB3-AS10	G1S-AS10	G11D-AS10	G12D-AS10	G12S-AS10	G19D-AS10	G19M-AS10	G19MDUP-AS10	G19S-AS10	G20D-AS10
		Sample Date:	6/16/2010	6/16/2010	6/16/2010 Field Dup	6/16/2010	6/16/2010	6/16/2010	6/16/2010	6/16/2010	6/16/2010	6/16/2010	6/16/2010	6/16/2010 Field Dup	6/16/2010	6/16/2010
VOCs																
(ug/L)	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	1.0 U	5.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	1.0 U	5.0 U	1.0 U	1.0 U
	Dibromochloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	1.0 U	5.0 U	1.0 U	1.0 U
	Tetrachloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.4**	1.0 U	1.0 U	10 U	**2.2**	5.0 U	1.0 U	1.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	1.0 U	5.0 U	1.0 U	1.0 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	**3.7**	1.0 U	1.0 U	1.0 U	1.0 U	10 U	1.0 U	5.0 U	1.0 U	1.0 U
	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	**4.8**	1.0 U	1.0 U	1.0 U	1.0 U	**12**	**5.2**	5.0 U	1.0 U	1.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	1.0 U	5.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	10 U	**7.4**	**5.8**	1.0 U	1.0 U
	Trichloroethene		1.0 U	**41**	**36**	**2.2**	1.0 U	1.0 U	**2.2**	**1.3**	**2.7**	**220**	**240**	**220**	1.0 U	**5.1**
	cis-1,2-Dichloroethene		1.0 U	**51**	**46**	**2.1**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**350**	**130**	**110**	1.0 U	**28**
	Acetone		**12 J**	**51**	**64**	**46**	**61**	5.0 U	5.0 U	**63**	5.0 U	50 U	5.0 U	25 U	**5.5**	**12**
	Carbon disulfide		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	20 U	2.0 U	10 U	2.0 U	2.0 U
	2-Butanone		5.0 U	**7.4**	**8.4**	**6.3**	**9.2**	5.0 U	5.0 U	**8.5**	5.0 U	50 U	5.0 U	25 U	5.0 U	5.0 U
	2-Hexanone		5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ	5.0 UJ	5.0 U	5.0 UJ	5.0 U	5.0 U	50 U	5.0 UJ	25 U	5.0 UJ	5.0 U

Notes:
ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-2. Summary of Analytical Results for Groundwater Samples Associated with W.R. Grace Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G20D G20D-AS10-AUG 8/27/2010	G20M G20M-AS10 6/16/2010	G20M G20M-AS10-AUG 8/27/2010	G20M G20M-D-AS10-AUG 8/27/2010 Field Dup	G20S G20S-AS10 6/16/2010	G20S G20S-AS10-AUG 8/27/2010	G21D G21D-AS10 6/16/2010	G21S G21S-AS10 6/16/2010	G22D G22D-AS10 6/16/2010	G22S G22S-AS10 6/16/2010	G23D G23D-AS10 6/16/2010	G23S G23S-AS10 6/16/2010	G24D G24D-AS10 6/16/2010	G24D G24DDUP-AS10 6/16/2010 Field Dup
VOCs																
(ug/L)	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Dibromochloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Tetrachloroethene		1.0 U	1.0 U	1.0 U	1.0 U	**1.6**	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.0**	**1.0**
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	**5.9**	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	**1.2**	5.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		**4.7**	**5.3**	1.0 U	1.0 U	**48**	**26**	1.0 U	1.0 U	**1.4**	**1.1**	**4.0**	1.0 U	**19**	**19**
	cis-1,2-Dichloroethene		**29**	**52**	**2.8**	**3.2**	**290**	**220**	1.0 U	1.0 U	1.0 U	1.0 U	**1.4**	1.0 U	**3.4**	**3.1**
	Acetone		5.0 U	**10**	25 UJ	**8.8 J**	5.0 U	25 U	**24**	**14**	**5.8**	**5.9**	**7.5**	**5.8**	**8.2**	**9.0**
	Carbon disulfide		2.0 UJ	2.0 U	2.0 UJ	2.0 UJ	2.0 U	10 UJ	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	25 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 UJ	25 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

Notes:
ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
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Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-2. Summary of Analytical Results for Groundwater Samples Associated with W.R. Grace Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G24S G24S-AS10 6/16/2010	G28D G28D-AS10 6/16/2010	G28S G28S-AS10 6/16/2010	G29S G29S-AS10 6/16/2010	G36D G36D-AS10 6/16/2010	G36DB2 G36DB2-AS10 6/16/2010	G36DBR G36DBR-AS10 6/16/2010	G36S G36S-AS10 6/16/2010	G37D G37D-L1 10/6/2010	G37D G37D-L2 10/6/2010	G37D G37D-L2D 10/6/2010 Field Dup	G37S G37S-L1 10/6/2010	G37S G37S-L2 10/6/2010	G38D G38D-L1 10/6/2010
VOCs																
(ug/L)	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Dibromochloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Tetrachloroethene		1.0 U	**1.1**	1.0 U	1.0 U	1.0 U	1.0 U	**3.1**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**30**
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl chloride		1.0 U	1.0 U	1.0 U	**6.8**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		**5.0**	**3.7**	**1.8**	**1.5**	1.0 U	**14**	**15**	1.0 U	**11**	**11**	**11**	**54**	**33**	**2.0**
	cis-1,2-Dichloroethene		1.0 U	**2.8**	1.0 U	**1.2**	1.0 U	**9.6**	**20**	1.0 U	**1.0**	1.0 U	**1.0**	**4.4**	**3.0**	**1.8**
	Acetone		**5.0**	**8.3**	**7.8**	**9.4**	**9.4**	**53**	**19**	**8.7**	**22**	**15**	**15**	**21**	**21**	**20**
	Carbon disulfide		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	**7.0**	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

Notes:
ug/L - micrograms per liter.
J - Estimated value.
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U - Compound was not detected at specified quantitation limit.
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Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-2. Summary of Analytical Results for Groundwater Samples Associated with W.R. Grace Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G38D G38D-L2 10/6/2010	G38S G38S-L1 10/6/2010	G38S G38S-L2 10/6/2010	G39D G39D-L1 10/6/2010	G39D G39D-L2 10/6/2010	G39S G39S-L2 10/6/2010	GO1DB GO1BA 7/23/2010	K60S K60S-VIA2010 8/4/2010	RW7 RW7-AS10 6/17/2010	RW8 RW8-AS10 6/17/2010	RW8 RW8DUP-AS10 6/17/2010 Field Dup	RW9 RW9-AS10 6/17/2010	RW9 RW9DUP-AS10 6/17/2010 Field Dup	RW10 RW10-AS10 6/17/2010
VOCs																
(ug/L)	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.40 J**	**0.025 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Dibromochloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Tetrachloroethene		**27 J**	**30**	**31**	**4.5**	**3.7**	**44**	**6.0**	0.050 U	1.0 U	1.0 U	**2.2**	**2.4**	**2.1**	**8.6**
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.050 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	2.0 U	0.050 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		**1.8**	**2.4**	**2.5**	**1.7**	**1.0**	**1.0**	**1.0**	1.0 U	**1.7**	**2.4 J**	**2.3**	**1.7**	1.0 U	**2.0**
	cis-1,2-Dichloroethene		**1.6**	**2.1**	**2.3**	**6.8**	**3.5**	1.0 U	1.0 U	0.050 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Acetone		**23 J**	**20**	**22**	**20**	**17**	**22**	5.0 U	NA	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Carbon disulfide		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	1.0 U	NA	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NA	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NA	5.0 U	5.0 UJ	5.0 U	5.0 U	5.0 U	5.0 U

Notes:
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Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-2. Summary of Analytical Results for Groundwater Samples Associated with W.R. Grace Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	RW10 RW10DUP-AS10 6/17/2010 Field Dup	RW11 RW11-AS10 6/17/2010	RW12 RW12-AS10 6/17/2010	RW13 RW13-AS10 6/17/2010	RW13 RW13-AS10 6/17/2010 Field Dup	RW14 RW14-AS10 6/17/2010	RW15 RW15-AS10 6/17/2010	RW16 RW16-AS10 6/17/2010	RW17 RW17-AS10 6/17/2010	RW17 RW17DUP-AS10 6/17/2010 Field Dup	RW18 RW18-AS10 6/17/2010	RW19 RW19-AS10 6/17/2010	RW20 RW20-AS10 6/17/2010	RW21 RW21-AS10 6/17/2010
VOCs																
(ug/L)	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Dibromochloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Tetrachloroethene		**9.0**	1.0 U	1.0 U	**15**	**14**	1.0 U	**7.1**	**1.8**	**16**	**16**	**1.3**	**3.4**	**8.9**	1.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		**2.1**	**2.6**	**3.3**	**1.6**	**1.6**	1.0 U	**3.4**	**3.7**	**7.5**	**7.4**	**1.7**	**2.8**	**4.0**	**3.4**
	cis-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	**1.1**	**1.0**	1.0 U	1.0 U	1.0 U	**5.1**	**5.2**	1.0 U	**2.8**	**2.0**	1.0 U
	Acetone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Carbon disulfide		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U

Notes:
ug/L - micrograms per liter.
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Table A.3-2. Summary of Analytical Results for Groundwater Samples Associated with W.R. Grace Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	RW22RE RW22-AS10 8/30/2010	RW22RE RW22-AS10 9/3/2010	RW22RE RW22-AS10 9/13/2010	RW22RE RW22-AS10 12/10/2010	RW22RE RW22D-AS10 6/17/2010	S21 S21EB-VIA2010 8/3/2010	S21 S21-VIA2010 8/3/2010	S63S S63S-VIA2010 8/3/2010	UC11-2 U112A 7/23/2010	UG11 UG11-VIA2010 8/3/2010	UG12 UG12-VIA2010 8/3/2010	UG13 UG13-VIA2010 8/4/2010	UG14 UG14A 7/23/2010	UG15 UG15-VIA2010 8/2/2010
VOCs																
(ug/L)	1,1-Dichloroethane		10 U	10 U	5.0 U	5.0 U	10 U	1.0 U	1.0 U	1.0 U	**0.90 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		10 U	10 U	5.0 U	5.0 U	10 U	0.050 U	**0.39**	**0.014 J**	1.0 U	**3.0**	**0.31**	**0.53 J**	1.0 U	**3.0**
	Dibromochloromethane		10 U	10 U	5.0 U	5.0 U	10 U	NA	NA	NA	1.0 U	NA	NA	NA	NA	NA
	Tetrachloroethene		10 U	10 U	5.0 U	5.0 U	10 U	0.050 U	**0.42**	**0.034 J**	**37**	**2.0 J**	**0.038 J**	0.050 U	1.0 U	**5.0**
	Bromodichloromethane		10 U	10 U	5.0 U	5.0 U	10 U	0.050 U	0.050 U	0.050 U	1.0 U	**0.10**	0.050 U	**0.030 J**	1.0 U	0.050 U
	Toluene		10 U	10 U	5.0 U	5.0 U	10 U	1.0 U	1.0 U	**10**	**13**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Vinyl chloride		10 U	**27**	**18**	5.0 U	10 U	0.050 U	0.050 U	0.050 U	2.0 U	0.050 U	0.050 U	0.050 U	2.0 U	0.050 U
	1,1-Dichloroethene		10 U	10 U	5.0 U	5.0 U	10 U	1.0 U	1.0 U	1.0 U	**0.80 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		10 U	10 U	**5.5**	5.0 U	10 U	1.0 U	1.0 U	1.0 U	**18**	1.0 U	1.0 U	1.0 U	**0.50 J**	1.0 U
	Trichloroethene		**73**	**220**	**180**	**140**	**46**	1.0 U	1.0 U	1.0 U	**39**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		**460**	**500**	**420**	**340**	**340**	0.050 U	**0.073**	**0.0063 J**	**330 J**	0.050 U	0.050 U	0.050 U	**20**	**0.040 J**
	Acetone		50 U	50 U	25 UJ	25 U	50 U	NA	NA	NA	6.0 U	NA	NA	NA	**240**	NA
	Carbon disulfide		20 UJ	20 U	10 UJ	10 U	20 U	NA	NA	NA	**0.50 J**	NA	NA	NA	**0.30 J**	NA
	2-Butanone		50 U	50 U	25 UJ	25 U	50 U	NA	NA	NA	**8.0**	NA	NA	NA	**420**	NA
	2-Hexanone		50 U	50 U	25 U	25 U	50 U	NA	NA	NA	5.0 U	NA	NA	NA	**3.0 J**	NA

Notes:
ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-2. Summary of Analytical Results for Groundwater Samples Associated with W.R. Grace Source Area Property -- 2010
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UG16 UG16-VIA2010 8/2/2010	UG18 UG18-VIA2010 8/2/2010
VOCs				
(ug/L)	1,1-Dichloroethane		1.0 U	1.0 U
	Chloroform		**0.080**	**0.20**
	Dibromochloromethane		NA	NA
	Tetrachloroethene		**0.090**	**0.10**
	Bromodichloromethane		0.050 U	0.050 U
	Toluene		1.0 U	1.0 U
	Vinyl chloride		0.050 U	0.050 U
	1,1-Dichloroethene		1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U
	Trichloroethene		**1.0**	1.0 U
	cis-1,2-Dichloroethene		**0.10**	0.050 U
	Acetone		NA	NA
	Carbon disulfide		NA	NA
	2-Butanone		NA	NA
	2-Hexanone		NA	NA

Notes:
ug/L - micrograms per liter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
VOCs - Volatile Organic Compounds.

Table A.3-3. Summary of Detected Compounds for Groundwater Samples Associated with Unifirst Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	S63S S63S- 4/12/2011	S70D S70DA 4/18/2011	S70S S70S- 4/7/2011	S71D S71DA 4/20/2011	S71S S71S- 4/11/2011	S81D S81DA 4/19/2011	S81M S81MA 4/19/2011
VOCs									
(ug/L)	Acetone		NA	5.0 U	NA	5.0 U	NA	5.0 U	5.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.0**
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		0.050 U	1.0 U	0.050 U	1.0 U	0.25 U	**0.40 J**	**0.80 J**
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		**0.10 J**	1.0 U	**0.10 J**	1.0 U	**0.036 J**	1.0 U	1.0 U
	1,1,1-Trichloroethane		1.0 U	1.0 U	1.0 U	**1.0**	1.0 U	**0.30 J**	**3.0**
	Bromodichloromethane		0.050 U	1.0 U	0.050 U	1.0 U	0.25 U	1.0 U	1.0 U
	Trichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**3.0**	**1.0**
	Tetrachloroethene		**0.076**	**0.80 J**	**0.048 J**	**35**	**5.6**	**98**	**100**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chlorobenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	p/m-Xylene		NA	2.0 U	NA	2.0 U	NA	2.0 U	2.0 U
	o-Xylene		NA	1.0 U	NA	1.0 U	NA	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	2.0 U	NA	2.0 U	NA	**0.40 J**	**0.80 J**
	Xylenes (total)		3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
	1,4-Dichlorobenzene		1.0 U	NA	1.0 U	NA	1.0 U	NA	NA
	1,3-Dichlorobenzene		0.050 U	NA	0.050 U	NA	0.25 U	NA	NA
	Naphthalene		1.0 U	NA	1.0 U	NA	**2.0**	NA	NA

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-3. Summary of Detected Compounds for Groundwater Samples Associated with Unifirst Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	S81S S81S-4/19/2011	UC4 UC4-4/7/2011	UC5 UC5-4/11/2011	UC6 XUC6A 4/18/2011	UC6S UC6S-4/8/2011	UC6S UC6S-4/8/2011 Field Dup	UC7-1 UC71A 4/22/2011
VOCs									
(ug/L)	Acetone		NA	NA	NA	5.0 U	NA	NA	5.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**7.0**
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**9.0**
	cis-1,2-Dichloroethene		0.050 U	0.050 U	**2.0**	**2.0**	2.0 U	**3.9**	**29**
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**0.40 J**
	Chloroform		**0.12**	**0.10 J**	1.0 U	1.0 U	0.10 U	0.20 U	**0.30 J**
	1,1,1-Trichloroethane		**0.20 J**	1.0 U	**9.0**	1.0 U	1.0 U	1.0 U	**46**
	Bromodichloromethane		0.050 U	0.050 U	1.0 U	1.0 U	0.20 U	0.20 U	1.0 U
	Trichloroethene		1.0 U	**0.50 J**	**4.0**	**8.0**	1.0 U	1.0 U	**160**
	Tetrachloroethene		**11**	0.050 U	**130**	**28**	0.10 U	2.0 U	**1,800**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**38**
	Chlorobenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	p/m-Xylene		NA	NA	NA	2.0 U	NA	NA	2.0 U
	o-Xylene		NA	NA	NA	1.0 U	NA	NA	**0.30 J**
	1,2-Dichloroethylene (total)		NA	NA	NA	**2.0**	NA	NA	**29**
	Xylenes (total)		3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	**0.30 J**
	1,4-Dichlorobenzene		1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	NA
	1,3-Dichlorobenzene		0.050 U	0.050 U	1.0 U	NA	**4.0**	0.20 U	NA
	Naphthalene		1.0 U	1.0 U	**2.0**	NA	1.0 U	1.0 U	NA

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-3. Summary of Detected Compounds for Groundwater Samples Associated with Unifirst Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UC7-2 UC72A 4/22/2011	UC7-3 UC73A 4/22/2011	UC7-4 UC74A 4/22/2011	UC7-4 UC74B 4/22/2011	UC7-5 UC75A 4/22/2011	UC10-1 U101A 4/21/2011	UC10-2 U102A 4/21/2011
VOCs									
(ug/L)	Acetone		5.0 U	5.0 U	5.0 U	5.0 U	20 U	5.0 U	5.0 U
	1,1-Dichloroethene		**10**	**6.0**	**2.0**	**3.0**	4.0 U	**0.40 J**	1.0 U
	1,1-Dichloroethane		**12**	**7.0**	**2.0**	**3.0**	4.0 U	**0.90 J**	**0.30 J**
	cis-1,2-Dichloroethene		**25**	**48**	**22**	**22**	**40**	**150**	**97**
	trans-1,2-Dichloroethene		**0.90 J**	**0.40 J**	1.0 U	1.0 U	4.0 U	**2.0**	**0.60 J**
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	4.0 U	1.0 U	1.0 U
	1,1,1-Trichloroethane		**51**	**42**	**20**	**23**	**4.0 J**	**0.40 J**	**0.50 J**
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	4.0 U	1.0 U	1.0 U
	Trichloroethene		**410**	**410**	**93**	**100**	**28**	**120**	**65**
	Tetrachloroethene		**1,700**	**2,000**	**610**	**1,100**	**550**	**120**	**140**
	Toluene		**43**	**23**	**9.0**	**10**	**5.0**	**43**	**46**
	Chlorobenzene		**0.40 J**	1.0 U	1.0 U	1.0 U	4.0 U	1.0 U	1.0 U
	p/m-Xylene		**0.70 J**	2.0 U	2.0 U	2.0 U	8.0 U	2.0 U	**0.60 J**
	o-Xylene		**0.30 J**	1.0 U	1.0 U	1.0 U	4.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		**26**	**48**	**22**	**22**	**40**	**150**	**98**
	Xylenes (total)		**1.0 J**	3.0 U	3.0 U	3.0 U	12 U	3.0 U	**0.60 J**
	1,4-Dichlorobenzene		NA	NA	NA	NA	NA	NA	NA
	1,3-Dichlorobenzene		NA	NA	NA	NA	NA	NA	NA
	Naphthalene		NA	NA	NA	NA	NA	NA	NA

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-3. Summary of Detected Compounds for Groundwater Samples Associated with Unifirst Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UC10-3 U103A 4/21/2011	UC10-4 U104A 4/21/2011	UC10-5 U105A 4/21/2011	UC10-6 U106A 4/21/2011	UC10D UC10DA 4/19/2011	UC10M UC10MA 4/19/2011	UC10S UC10S-4/5/2011
VOCs									
(ug/L)	Acetone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	NA
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		**0.30 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		**110**	**56**	**80**	**99**	1.0 U	1.0 U	0.050 U
	trans-1,2-Dichloroethene		**0.80 J**	**0.50 J**	**0.70 J**	**1.0**	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.10 U
	1,1,1-Trichloroethane		1.0 U	**0.30 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	0.050 U
	Trichloroethene		**46**	**33**	**27**	**19**	1.0 U	1.0 U	1.0 U
	Tetrachloroethene		**140**	**110**	**86**	**47**	1.0 U	1.0 U	0.050 U
	Toluene		**44**	**32**	**25**	**18**	1.0 U	1.0 U	1.0 U
	Chlorobenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	p/m-Xylene		**0.60 J**	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	NA
	o-Xylene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA
	1,2-Dichloroethylene (total)		**110**	**57**	**81**	**100**	2.0 U	2.0 U	NA
	Xylenes (total)		**0.60 J**	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
	1,4-Dichlorobenzene		NA	NA	NA	NA	NA	NA	1.0 U
	1,3-Dichlorobenzene		NA	NA	NA	NA	NA	NA	0.050 U
	Naphthalene		NA	NA	NA	NA	NA	NA	1.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-3. Summary of Detected Compounds for Groundwater Samples Associated with Unifirst Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UC11-2 U112A 4/22/2011	UC18 UC18-4/7/2011	UC19 U19A 4/20/2011	UC19M U19MA 4/20/2011	UC19S UC19S-4/5/2011	UC24S UC24S-4/5/2011	UC25 UC25-4/11/2011
VOCs									
(ug/L)	Acetone		5.0 U	NA	**53**	5.0 U	NA	NA	NA
	1,1-Dichloroethene		**0.50 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		**0.70 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		**100**	0.050 U	1.0 U	1.0 U	0.050 U	0.050 U	1.0 U
	trans-1,2-Dichloroethene		**9.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	0.10 U	1.0 U	1.0 U	**0.10 J**	0.10 U	1.0 U
	1,1,1-Trichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.0**
	Bromodichloromethane		1.0 U	0.050 U	1.0 U	1.0 U	0.050 U	0.050 U	1.0 U
	Trichloroethene		**96**	**0.70 J**	1.0 U	1.0 U	1.0 U	1.0 U	**0.50 J**
	Tetrachloroethene		**110**	**0.090**	1.0 U	1.0 U	0.050 U	0.050 U	**110**
	Toluene		**14**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chlorobenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	p/m-Xylene		2.0 U	NA	2.0 U	2.0 U	NA	NA	NA
	o-Xylene		1.0 U	NA	1.0 U	1.0 U	NA	NA	NA
	1,2-Dichloroethylene (total)		**110**	NA	2.0 U	2.0 U	NA	NA	NA
	Xylenes (total)		3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
	1,4-Dichlorobenzene		NA	**1.0 J**	NA	NA	1.0 U	1.0 U	1.0 U
	1,3-Dichlorobenzene		NA	0.050 U	NA	NA	0.050 U	0.050 U	1.0 U
	Naphthalene		NA	1.0 U	NA	NA	1.0 U	1.0 U	1.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-3. Summary of Detected Compounds for Groundwater Samples Associated with Unifirst Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UC26S UC26S- 4/11/2011	UC29S UC29S- 4/11/2011	UC30 UC30- 4/7/2011	UC31S UC31S- 4/5/2011	UC33 UC33- 4/8/2011	UG8 UG8- 4/12/2011	UG9 UG9- 4/13/2011
VOCs									
(ug/L)	Acetone		NA	NA	NA	NA	NA	NA	NA
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		0.10 U	**3.0**	0.050 U	0.050 U	0.50 U	0.050 U	0.050 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		**0.20 J**	1.0 U	**0.10 J**	0.10 U	1.0 U	**0.10 J**	**0.10 J**
	1,1,1-Trichloroethane		1.0 U	1.0 U	**0.70 J**	1.0 U	**7.0**	1.0 U	1.0 U
	Bromodichloromethane		0.10 U	1.0 U	0.050 U	0.050 U	0.50 U	0.050 U	0.050 U
	Trichloroethene		1.0 U	**2.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Tetrachloroethene		**6.0**	**150**	**5.2**	0.050 U	**14**	**0.11**	**0.91**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chlorobenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	p/m-Xylene		NA	NA	NA	NA	NA	NA	NA
	o-Xylene		NA	NA	NA	NA	NA	NA	NA
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Xylenes (total)		3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
	1,4-Dichlorobenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,3-Dichlorobenzene		0.10 U	1.0 U	0.050 U	0.050 U	**0.081 J**	0.050 U	0.050 U
	Naphthalene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-3. Summary of Detected Compounds for Groundwater Samples Associated with Unifirst Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UG10 / UG10-4/15/2011	UG10 / UG10-4/15/2011 Field Dup	UG11 / UG11-4/14/2011	UG12 / UG12-4/12/2011	UG17 / UG17-4/15/2011	UG18 / UG18-4/12/2011	UG20 / UG20-4/13/2011
VOCs									
(ug/L)	Acetone		NA	NA	NA	NA	NA	NA	NA
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		0.50 U	1.0 U	0.050 U	0.050 U	1.0 U	0.050 U	0.050 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	2.0 U	**0.58**	**0.10 J**	1.0 U	**0.10 J**	**0.10 J**
	1,1,1-Trichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Bromodichloromethane		0.50 U	1.0 U	**0.027 J**	0.050 U	1.0 U	0.050 U	0.050 U
	Trichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Tetrachloroethene		**6.7 B**	**6.8 B**	**1.0 B**	**0.050 J**	**46**	**0.48**	**3.1**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chlorobenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	p/m-Xylene		NA	NA	NA	NA	NA	NA	NA
	o-Xylene		NA	NA	NA	NA	NA	NA	NA
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Xylenes (total)		3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U	3.0 U
	1,4-Dichlorobenzene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,3-Dichlorobenzene		0.50 U	1.0 U	0.050 U	0.050 U	1.0 U	0.050 U	0.050 U
	Naphthalene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G1D G1D-AS11 4/25/2011	G1DB G1DB-AS11 4/25/2011	G1DB G1DBDUP- 4/25/2011 Field Dup	G1DB G1DB-AS11 4/27/2011	G1DB2 G1DB2- 4/25/2011	G1S G1S-AS11 4/25/2011	G11D G11D-AS11 4/25/2011
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	10 U	NA	1.0 U	1.0 U	1.0 U
	Acetone		**50**	**36**	**2,000**	NA	**51**	**78**	**10**
	1,1-Dichloroethene		1.0 U	1.0 U	10 U	NA	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	10 U	NA	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		1.0 U	**14**	**14**	NA	**2.0**	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	10 U	NA	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	10 U	NA	1.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	5.0 U	50 U	NA	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	1.0 U	10 U	NA	1.0 U	1.0 U	1.0 U
	Trichloroethene		1.0 U	**10**	10 U	NA	**1.7**	1.0 U	**1.8**
	2-Hexanone		5.0 U	5.0 U	50 U	NA	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		1.0 U	1.0 U	10 U	NA	1.0 U	1.0 U	1.0 U
	Toluene		1.0 U	1.0 U	10 U	NA	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	**2.8**	20 U	NA	2.0 U	2.0 U	2.0 U
	Naphthalene		2.0 U	2.0 U	20 U	NA	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G11S G11S-AS11 4/27/2011	G12D G12D-AS11 4/25/2011	G12S G12S-AS11 4/25/2011	G13D G13D-AS11- 4/25/2011	G13D G13D-AS11- 4/25/2011	G13D G13D-AS11- 4/25/2011	G13S G13S-AS11- 4/25/2011
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Acetone		5.0 U	**170**	**10**	5.0 U	**14**	**9.8**	5.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	**11**	**11**	**11**	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		1.0 U	1.0 U	1.0 U	**48**	**49**	**49**	**1.6**
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**1.9**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	Naphthalene		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G13S G13S-AS11- 4/25/2011	G16D G16D-AS11- 4/25/2011	G16D G16D-AS11- 4/25/2011	G16D G16D-AS11- 4/25/2011	G19D G19D-AS11 4/25/2011	G19M G19M-AS11 4/25/2011	G19M G19MDUP- 4/25/2011 Field Dup
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	**2.4**	1.0 U	1.0 U
	Acetone		5.0 U	5.0 U	5.0 U	5.0 U	**6.9**	**7.1**	**6.9**
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	**66**	**17**	**17**
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	**3.4**	**3.5**
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		**1.7**	**9.6**	**10**	**11**	**80**	**240**	**250**
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		**1.9**	1.0 U	1.0 U	1.0 U	1.0 U	**2.3**	**2.4**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	Naphthalene		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G19S G19S-AS11 4/25/2011	G20D G20D-AS11 4/25/2011	G20M G20M-AS11 4/25/2011	G20M G20MDUP- 4/25/2011 Field Dup	G20S G20S-AS11 4/25/2011	G21D G21D-AS11 4/25/2011	G21S G21S-AS11 4/25/2011
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Acetone		**8.5**	**10**	**7.1**	**7.0**	**53**	**340**	**10**
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		1.0 U	**4.9**	1.0 U	1.0 U	**130**	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		1.0 U	**1.2**	1.0 U	1.0 U	**19**	1.0 U	1.0 U
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	Naphthalene		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G22D G22D-AS11 4/25/2011	G22S G22S-AS11 4/25/2011	G23D G23D-AS11 4/25/2011	G23S G23S-AS11 4/25/2011	G24D G24D-AS11 4/25/2011	G24D G24DDUP- 4/25/2011 Field Dup	G24S G24S-AS11 4/25/2011
VOCs									
(ug/L)	Vinyl chloride		10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Acetone		**330**	5.0 U	5.0 U	5.0 U	**120**	**120**	5.0 U
	1,1-Dichloroethene		10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		10 U	1.0 U	**1.3**	1.0 U	**2.1**	**2.3**	**1.4**
	trans-1,2-Dichloroethene		10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Butanone		50 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		10 U	1.0 U	**5.0**	1.0 U	**22**	**23**	**26**
	2-Hexanone		50 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Toluene		10 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		20 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	Naphthalene		20 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G28D G28D-AS11 4/25/2011	G28D G28DDUP- 4/25/2011 Field Dup	G28S G28S-AS11 4/25/2011	G36D G36D-AS11 4/25/2011	G36DB2 G36DB2- 4/25/2011	G36DBR G36DBR- 4/25/2011	G36S G36S-AS11 4/25/2011
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U
	Acetone		**120**	**220**	5.0 U	**8.0**	**530**	**8.4**	**7.0**
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		**2.8**	**4.1**	1.0 U	1.0 U	**11**	**13**	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	25 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U
	Trichloroethene		**5.3**	**6.0**	**3.7**	1.0 U	**15**	**16**	1.0 U
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	25 U	5.0 U	5.0 U
	Tetrachloroethene		1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	**4.4**	1.0 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	5.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	2.0 U	2.0 U	2.0 U	10 U	2.0 U	2.0 U
	Naphthalene		2.0 U	2.0 U	2.0 U	2.0 U	10 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	G37D G37D-AS11 4/25/2011	G37S G37S-AS11 4/25/2011	G38D G38D-AS11 4/25/2011	G38S G38S-AS11 4/25/2011	G39D G39D-AS11 4/25/2011	G39D G39DDUP- 4/25/2011 Field Dup	G39S G39S-AS11 4/25/2011
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Acetone		**8.0**	**11**	**7.0**	**8.8**	**42**	**41**	**61**
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		1.0 U	**2.9**	**1.1**	1.0 U	**22**	**23**	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		**14**	**35**	**2.2**	**2.0**	**6.6**	**6.8**	1.0 U
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		1.0 U	1.0 U	**18**	**16**	**3.6**	**3.5**	**11**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	Naphthalene		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	GO1DB GO1BA 4/18/2011	GO1S G01S- 4/14/2011	K55S K55S- 4/15/2011	K60S K60S- 4/13/2011	K61M K61M-AS11 4/27/2011	K62S K62S-AS11 4/27/2011	RW7 RW7-AS11 4/26/2011
VOCs									
(ug/L)	Vinyl chloride		2.0 U	0.050 U	0.050 U	0.050 U	1.0 U	1.0 U	1.0 U
	Acetone		5.0 U	NA	NA	NA	5.0 U	5.0 U	5.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		1.0 U	0.050 U	0.050 U	0.050 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	**0.17**	**0.10 J**	**0.10 J**	1.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	NA	NA	NA	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	0.050 U	0.050 U	0.050 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Hexanone		5.0 U	NA	NA	NA	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		**6.0**	**0.15 B**	**0.050 JB**	**0.050 J**	1.0 U	1.0 U	1.0 U
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		2.0 U	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		NA	NA	NA	NA	2.0 U	2.0 U	2.0 U
	Naphthalene		NA	1.0 U	1.0 U	1.0 U	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location:	RW7	RW8	RW9	RW10	RW11	RW12	RW13
		Sample ID:	RW7D-AS11	RW8-AS11	RW9-AS11	RW10-AS11	RW11-AS11	RW12-AS11	RW13-AS11
		Sample Date:	4/26/2011	4/26/2011	4/26/2011	4/26/2011	4/26/2011	4/26/2011	4/26/2011
			Field Dup						
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Acetone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		1.0 U	1.0 U	**1.1**	1.0 U	**2.5**	**2.2**	**1.6**
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		1.0 U	1.0 U	**2.2**	1.0 U	1.0 U	1.0 U	**15**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	Naphthalene		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	RW14 RW14-AS11 4/26/2011	RW15 RW15-AS11 4/26/2011	RW16 RW16-AS11 4/26/2011	RW17 RW17-AS11 4/26/2011	RW17 RW17D- 4/26/2011 Field Dup	RW18 RW18-AS11 4/26/2011	RW19 RW19-AS11 4/26/2011
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Acetone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	**5.2**	**4.7**	1.0 U	**1.7**
	trans-1,2-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Trichloroethene		1.0 U	1.0 U	**2.2**	**6.3**	**5.8**	1.0 U	**2.3**
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
	Tetrachloroethene		1.0 U	**7.1**	**1.1**	**12**	**10**	1.0 U	**6.2**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U
	Naphthalene		2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U	2.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	RW20 / RW20-AS11 / 4/26/2011	RW21 / RW21-AS11 / 4/26/2011	RW22RE / RW22-AS11 / 4/26/2011	RW22RE / RW22D- / 4/26/2011 Field Dup	S21 / S21- / 4/15/2011	S22 / S22- / 4/15/2011	S63S / S63S- / 4/12/2011
VOCs									
(ug/L)	Vinyl chloride		1.0 U	1.0 U	1.0 U	1.0 U	0.050 U	0.050 U	0.050 U
	Acetone		5.0 U	5.0 U	5.0 U	5.0 U	NA	NA	NA
	1,1-Dichloroethene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		**2.0**	1.0 U	**270**	**340**	0.050 U	0.050 U	0.050 U
	trans-1,2-Dichloroethene		1.0 U	1.0 U	**3.9**	**3.1**	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	1.0 U	1.0 U	**0.10 J**	**0.10 J**	**0.10 J**
	2-Butanone		5.0 U	5.0 U	5.0 U	5.0 U	NA	NA	NA
	Bromodichloromethane		1.0 U	1.0 U	1.0 U	1.0 U	0.050 U	0.050 U	0.050 U
	Trichloroethene		**3.4**	**2.8**	**110**	**98**	1.0 U	1.0 U	1.0 U
	2-Hexanone		5.0 U	5.0 U	5.0 U	5.0 U	NA	NA	NA
	Tetrachloroethene		**7.0**	**1.5**	1.0 U	1.0 U	**1.2**	**0.050 JB**	**0.076**
	Toluene		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		2.0 U	2.0 U	2.0 U	2.0 U	NA	NA	NA
	Naphthalene		2.0 U	2.0 U	2.0 U	2.0 U	1.0 U	1.0 U	1.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UC11-2 U112A 4/22/2011	UG1-4 UG14A 4/22/2011	UG11 UG11- 4/14/2011	UG12 UG12- 4/12/2011	UG13 UG13- 4/12/2011	UG14 UG14- 4/14/2011	UG15 UG15- 4/14/2011
VOCs									
(ug/L)	Vinyl chloride		2.0 U	2.0 U	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
	Acetone		5.0 U	**300**	NA	NA	NA	NA	NA
	1,1-Dichloroethene		**0.50 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,1-Dichloroethane		**0.70 J**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	cis-1,2-Dichloroethene		**100**	**39**	0.050 U	0.050 U	0.050 U	0.050 U	0.050 U
	trans-1,2-Dichloroethene		**9.0**	**1.0**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	Chloroform		1.0 U	1.0 U	**0.58**	**0.10 J**	**0.10 J**	**0.10 J**	**0.10 J**
	2-Butanone		5.0 U	**340**	NA	NA	NA	NA	NA
	Bromodichloromethane		1.0 U	1.0 U	**0.027 J**	0.050 U	0.050 U	0.050 U	0.050 U
	Trichloroethene		**96**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	2-Hexanone		5.0 U	**2.0 J**	NA	NA	NA	NA	NA
	Tetrachloroethene		**110**	**1.0 J**	**1.0 B**	**0.050 J**	**0.050 J**	**0.63 B**	**1.0 B**
	Toluene		**14**	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
	1,2-Dichloroethylene (total)		**110**	**40**	NA	NA	NA	NA	NA
	Methyl tert butyl ether		NA	NA	NA	NA	NA	NA	NA
	Naphthalene		NA	NA	1.0 U	1.0 U	**0.60 J**	1.0 U	1.0 U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Table A.3-4. Summary of Detected Compounds for Groundwater Samples Associated with W.R.Grace Source Area Property -- April 2011
Wells G & H
Woburn, Massachusetts

Analysis	Analyte	Sample Location: / Sample ID: / Sample Date:	UG16 / UG16-4/13/2011		UG18 / UG18-4/12/2011		UG19 / UG19-4/14/2011	
VOCs								
(ug/L)	Vinyl chloride		0.050	U	0.050	U	0.050	U
	Acetone		NA		NA		NA	
	1,1-Dichloroethene		1.0	U	1.0	U	1.0	U
	1,1-Dichloroethane		1.0	U	1.0	U	1.0	U
	cis-1,2-Dichloroethene		0.050	U	0.050	U	0.050	U
	trans-1,2-Dichloroethene		1.0	U	1.0	U	1.0	U
	Chloroform		**0.10**	**J**	**0.10**	**J**	**0.10**	**J**
	2-Butanone		NA		NA		NA	
	Bromodichloromethane		0.050	U	0.050	U	0.050	U
	Trichloroethene		1.0	U	1.0	U	1.0	U
	2-Hexanone		NA		NA		NA	
	Tetrachloroethene		**0.054**		**0.48**		**0.092**	**B**
	Toluene		1.0	U	1.0	U	1.0	U
	1,2-Dichloroethylene (total)		NA		NA		NA	
	Methyl tert butyl ether		NA		NA		NA	
	Naphthalene		1.0	U	1.0	U	1.0	U

Notes:

ug/L - micrograms per liter.

B - Compound detected in associated method blank

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

Values in **Bold** indicate the compound was detected.

VOCs - Volatile Organic Compounds.

Appendix A.4

Data Validation Reports

Phoenix Chemistry Services

April 28, 2011

Nadine Weinberg
ARCADIS, U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Reference #: 2011-0330-001-CP

Dear Nadine,

Enclosed please find the results of the data validation of Sample Delivery Group No. L1103364 from the Indoor Air Quality/Vapor Intrusion (IAQ/VI) assessment work at a commercial property in Woburn, MA. The indoor and outdoor air and sub-slab vapor samples in SDG No. L1103364 were collected on March 11 - 12, 2011. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA.

The data package and an electronic deliverable were received on March 30 and 31, 2011, and a separate data package for the canister certifications (SDG No. L1102539) was received on April 12, 2011. The validation has been performed by Phoenix Chemistry Services according to the Tier III guidelines as defined by USEPA Region I, as presented in "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. The EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999), the IAQ/VI Quality Assurance Project Plan (QAPP), and the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate. Data qualifiers have been applied in the final validation report as necessary and appropriate, in accordance with these guidelines.

Thank you for this opportunity to provide data validation services to ARCADIS. We look forward to continuing to work with you on this and other projects. If there are any questions or concerns about the material in this report, please do not hesitate to contact me for help and clarification.

Sincerely,

Deborah H. Gaynor, Ph.D.
Principal, Phoenix Chemistry Services

Phoenix Chemistry Services | 126 Covered Bridge Road | North Ferrisburg | Vermont | 05473
Telephone: (802) 233-2473 | Website: www.phoenixchemistryservices.com | Email: dgaynor@phoenixchemistryservices.com

DATA VALIDATION

FOR

UniFirst-Woburn Vapor Intrusion Assessment
UniFirst Property
Woburn, MA

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
L1103364: CP

Chemical Analyses Performed by:

Alpha Analytical Laboratories, Inc.
320 Forbes Blvd.
Mansfield, MA 02048

FOR

ARCADIS U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
April 28, 2011

Reference #2011-0330-001-CP
VOA Air Validation Report/L1103364-CP/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the Method TO-15 Selected Ion Monitoring (SIM) volatiles in air analysis data prepared by Alpha Analytical Laboratories of Mansfield, MA, for 10 air samples and one (1) trip blank (TB) from Woburn, MA. The laboratory reported the data under Sample Delivery Group (SDG*)* No. L1103364, which was submitted as a single data package received by Phoenix on March 30, 2011, and includes the following samples:

Sample Location	Sample ID	Laboratory ID
AA-CP-1	AA-1	L1103364-07
IA-CP-1	IA-1	L1103364-08
IA-CP-2	IA-2	L1103364-09
IA-CP-3	IA-3	L1103364-10
AA-CP-2	AA-2	L1103364-11
IA-CP-1	DUP IA-3-12-11	L1103364-12
(trip blank)	TRIP BLANK	L1103364-13
SS-CP-1	SS-1	L1103364-15
SS-CP-2	SS-2	L1103364-16
SS-CP-3	SS-3	L1103364-17
SS-CP-1	DUPSS-3-12-11	L1103364-18

A cross-reference table of sample IDs was provided in the data package. The Sample Location name is being presented in this sample list to aid in identifying project samples with non-unique Sample IDs. The location name will be given as needed in this report to maintain clarity. A separate data package, L1102539, containing the supporting documentation (clean can certifications) for the preparation and analysis of the sampling canisters was submitted on April 12, 2011.

The samples in this data set represent the indoor air and the sub-slab soil vapor samples (matched to the indoor sampling locations) collected from March 11 to 12, 2011 at a commercial property identified as location CP, and the ambient air samples collected outdoors at the sample location. All samples were kept in the engineer's custody after sampling until hand-delivered by laboratory courier to the laboratory on March 15, 2011.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for naphthalene in all samples analyzed by Method TO-15 SIM were qualified as estimated (J, UJ).

- Positive results for toluene greater than the sample-specific (adjusted) quantitation limit (QL) but less than the action limit in samples AA-1 (at location AA-CP-1), AA-2 (at AA-CP-2), and SS-3 (at SS-CP-3) were qualified as less than the reported value (U).

- Results for tetrachloroethene in samples SS-1 (at SS-CP-1), SS-2 (at SS-CP-2), SS-3 (at SS-CP-3), and DUPSS-3-12-11 (at SS-CP-1) were rejected (R) and replaced with the acceptable concentrations

from the more diluted analyses of these samples (samples SS-1DL [at SS-CP-1], SS-2DL [at SS-CP-2], SS-3DL [at SS-CP-3], and DUPSS-3-12-11DL [at SS-CP-1]).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane.

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered part of the data package for all future distributions of TO-15 SIM (volatiles in air) analysis data for the commercial property reported in SDG No. L1103364.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, as modified for Selected Ion Monitoring (SIM) in the laboratory standard operating procedure (SOP) No. A-001, and in accordance with requirements in the Quality Assurance Project Plan (QAPP) for Indoor Air Quality and Vapor Intrusion Assessment, Rev. 2, March, 2010. The target compound list was limited to the compounds listed in Form K of the QAPP, and reporting limits are as specified there.

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) and the QAPP were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the USEPA Contract Laboratory Program (CLP) or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit.

In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded in the "Validator_Qualifier" column, and are also found with the validated laboratory-applied qualifiers in the "Qualifier" column in the electronic spreadsheet contained in Attachment A.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The indoor air samples at a commercial property (CP) were collected for approximately 24 hours from March 11 to 12, 2011, and the matching soil vapor samples were collected for 30 to 45 minutes in the early evening of March 12, 2011. Ambient air samples were collected outside this location on March 12, 2011. The property is located in Woburn, MA. All analyses were performed within twelve (12) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The canisters were delivered by laboratory courier to the field sampler's possession prior to the sample collection period; however, the custody transfer was not recorded on the Chain of Custody documents as required in the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010). The canisters were hand-delivered by laboratory courier to the laboratory three days after collection ended; the canisters were kept in the field engineer's office during the intervening days. A separate data package, L1102539, was submitted on April 12, 2011, containing the supporting documentation (clean can certification) for the preparation and analysis of the sampling canisters.

The Chain of Custody (COC) and the Canister and Flow Controller Information records show that the sample canisters were collected and transported according to method specifications.

All canisters submitted to the field for use met all applicable method requirements, with the exception of one canister that was not used due to equipment failure. The Case Narrative notes that the canister which was not used due to equipment failure was incorrectly referenced in the chain of custody document, and the canister used as the trip blank was recorded instead. Based on the corrected sample identification for the Trip Blank, sample integrity was deemed acceptable for all samples. Raw data for the canister vacuum and flow controller checks following sample receipt was not included in the data package; the validator has requested that the laboratory provide the date these measurements were taken, and assert that the raw data is properly archived.

Correspondence between the laboratory and the field sampler is contained in the data package which explains the correction for the sample identification error on the chain of custody documents. Review of these corrections was performed during the validation effort.

Field log books containing records of height of canister intake, barometric pressure, and ambient temperature at sampling locations were submitted for review as part of this validation effort, and are complete and acceptable. The final collection time and canister field vacuum measurement missing from the chain of custody for sample AA-2 at location AA-CP-2 are present in the field notes, and are acceptable.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analyses from SDG No. L1103364 were analyzed on a single GC/MS system identified as instrument Airpiano2. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or

associated standards were analyzed. All four (4) BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form 5 summaries in the data package.

III. Initial Calibration (IC)

One IC (1/14/11, 17:38 – 23:48) was performed on instrument Airpiano2 in support of the TO-15 SIM sample analyses. The IC was performed at ten concentration levels (0.02, 0.04, 0.1, 0.2, 0.5, 1.0, 2.5, 5.0, 10, and 50 part per billion by volume [ppbv]). Documentation of all individual IC standards was present in the data package and relative response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form 6 summary.

Manual integrations for some target analytes, internal standards, or surrogate standards were performed in some standards and samples in this data set. The before and after ion chromatograms, the reason for the manual integration, and the analyst's initials and date were printed for each manual integration.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I, with the exception that naphthalene exhibited a 34.78%RSD in the TO-15 IC.

An Independent Calibration Verification (ICV) sample analysis at 5 ppbv was analyzed after the IC. All spiked analytes were recovered within 70 – 130 % recovery of expected values in the ICV analysis.

On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples analyzed by Method TO-15 were qualified as estimated (J, UJ).

IV. Continuing Calibration (CC)

Two continuing calibration (CC) standards were run in support of the T)-15 SIM sample analyses reported in this data package. Documentation of the CC standards was present and RRF as well as percent difference (%D) values were reported on the Form 7 summaries within the data package. Sample results were properly reported using the average RRF of the calibration curve for quantitation.

It should be noted that a positive % D value (the CC response factor is <u>less than</u> the IC response factor) will result in a low bias for positive detects, and a negative % D will result in a high bias for positive detects.

V. Blanks

Results for two air-matrix laboratory method blanks (MBs) were reported in association with the TO-15 SIM sample analyses. No target compounds were found in either MB.

One trip blank (TB), which was used as a field blank, was reported in this data package. No target compounds were found in the TB, with the exception that 0.211 ug/m^3 toluene was detected in sample Trip Blank.

Neither a trip blank nor a field blank is required for Method TO-15, and there are no established guidelines for qualification on the basis of an air matrix trip blank or field blank. On the basis of professional judgment, an action limit (0.422 ug/m^3 for toluene) of twice the detected concentration in the TB was used for qualification based on field contamination.

On the basis of field contamination, positive results for toluene greater than the sample-specific (adjusted) quantitation limit (QL) but less than the action limit in samples AA-1 (at location AA-CP-1), AA-2 (at AA-CP-2), and SS-3 (at SS-CP-3) were qualified as less than the reported value (U).

VI. Surrogate Compounds

No surrogate compounds are used in these methods.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

VIII. Laboratory Duplicates

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method. A laboratory duplicate analysis of a field sample (matrix duplicate) analysis is also not required but was performed per laboratory protocols on another project sample which was analyzed with these samples.

Precision in the laboratory duplicate analyses (range: 0 - 18 %RPD) was acceptable (less than 30 % RPD, for all analytes greater than five times the reporting limit) on the basis of professional judgment.

IX. Field Duplicates

The sample designated as a field duplicate at the 10M sampling location was not collected due to equipment failure. No other field duplicate samples were collected with this sample set, so field precision could not be evaluated.

X. Sensitivity Check

An MDL study for the TO-15 SIM method was analyzed by the laboratory on May 7, 2009, and the most recent verification study was performed between on February 3 and 4, 2010. All target analytes in the statistical study had calculated MDLs below the method quantitation limits (QLs), and demonstrated acceptable ratios (at least 3:1) of the QL to the MDL. The QLs are also supported by the low concentration standard (at 0.020 ppbv) in the initial calibration.

Project objectives required a low reporting limit (RL) for naphthalene, and in order to achieve project objectives for detection limits, the analytes 1,2-dibromoethane (EDB), bromodichloromethane, and naphthalene were evaluated by the laboratory down to one-half the RL; concentrations between one-half the RL and the RL were reported with a "J" qualifier to indicate that this was an estimated concentration on the Form 1 summaries.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the MDL study and supported by the initial calibration, all results for the TO-15 SIM method (detects and non-detects) not qualified for other reasons are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

Two zero blind PE samples (commonly known as a laboratory control sample, LCS) were prepared and analyzed by the laboratory in support of the TO-15 SIM sample analyses. All target analytes were spiked into the QC samples at 5 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form 3 summaries in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes. No spiked duplicate analyses were performed for either method, so laboratory precision was not evaluated using spiked analyses.

No external single-blind PES sample for either method was required or submitted with the samples in this data set.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form 1 summaries. Results below the RL are not reported by the laboratory for this method. However, at the client's request, positive results for naphthalene, bromodichloromethane, and 1,2-dibromoethane (EDB) were evaluated down to one-half the RL, and reported with a "J" qualifier by the laboratory on the Form 1s.

One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.260 ug/m^3. No qualifications were deemed necessary on the basis of the RL slightly above that specified in the QAPP for total xylenes, since this concentration is still well below the risk screening level.

On the basis of screen results, original dilutions were performed for four of the six sub-slab samples and field duplicate for tetrachloroethene concentrations above the linear calibrated range of the instrument. No dilution was required for any indoor or outdoor air samples, or for sub-slab sample SS-2 at location SS-10M-2.

Tetrachloroethene was detected above the calibration range in the original analyses of samples SS-1

(at SS-CP-1), SS-2 (at SS-CP-2), SS-3 (at SS-CP-3), and DUPSS-3-12-11 (at SS-CP-1). The samples were appropriately reanalyzed at a greater dilution, bringing the concentration of tetrachloroethene within the upper half of the calibration range, and both sets of analyses were reported in the data package. Only the tetrachloroethene results were reported for the more diluted sample analyses.

Results for tetrachloroethene in samples SS-1 (at SS-CP-1), SS-2 (at SS-CP-2), SS-3 (at SS-CP-3), and DUPSS-3-12-11 (at SS-CP-1) were rejected (R) due to detection of this compound outside the linear range of the instrument for method TO-15 SIM. Results for tetrachloroethene were replaced with the acceptable concentrations from the more diluted analyses of these samples (samples SS-1DL [at SS-CP-1], SS-2DL [at SS-CP-2], SS-3DL [at SS-CP-3], and DUPSS-3-12-11DL [at SS-CP-1]).

"E" qualifiers were appropriately applied by the laboratory to sample Form 1 results when concentrations of target analytes were greater than the instrument calibration range.. The validator removed all laboratory-applied "E" qualifiers. Only the analyte originally detected above the calibration range was reported in the dilution analyses "D" qualifiers were not applied to the results in the dilution analyses, nor was the sample ID given the "DL" suffix as required in standard CLP reporting.

The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

The values that the validator has judged to be acceptable are presented on the electronic deliverable generated from the project database (Attachment A). Qualifiers applied by the validator during the validation effort have been listed on the electronic spreadsheet in an additional column labeled "Validator_Qualifier". The column labeled "Qualifier" contains both qualifiers applied by the laboratory and those applied by the validator; all qualifiers in this column have been accepted or changed during the validation effort. The column labeled "PreValidationFlag", which is generated by the database utility, also indicates which qualifiers were changed by the validator. Sample-specific quantitation limits may be found on the Form 1 for each sample or in the electronic deliverable (Attachment A, column "ReportingLimit").

The Form 1s submitted in the data package present results in units of ug/m^3 as well as in ppbv. Results are also presented almost entirely in units of ug/m^3 in the electronic data deliverable (EDD). Both the forms and the EDD were examined during the data validation process.

All positive results are listed on the electronic data deliverable, whether or not the value or qualifier was changed as a result of the validation. All non-detected results are listed on the electronic data deliverable with a Qualifier of "U" or "UJ"; these are also found as less-than (<) values in the "TextResult" column. If the reported result value was changed during the validation effort from a positive result to a value representing a concentration not detected at or below, the value representing the new reporting limit is reported as the Result with a Validator Qualifier of "U" or "UJ" and a "<" sign in the "TextResult" column.

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working acceptably, based on instrument printouts and spectral quality.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples analyzed by Method TO-15 SIM were qualified as estimated (J, UJ).

- On the basis of field contamination, positive results for toluene greater than the sample-specific (adjusted) quantitation limit (QL) but less than the action limit in samples AA-1 (at location AA-CP-1), AA-2 (at AA-CP-2), and SS-3 (at SS-CP-3) were qualified as less than the reported value (U).

- Results for tetrachloroethene in samples SS-1 (at SS-CP-1), SS-2 (at SS-CP-2), SS-3 (at SS-CP-3), and DUPSS-3-12-11 (at SS-CP-1) were rejected (R) due to detection of this compound outside the linear range of the instrument for method TO-15 SIM. Results for tetrachloroethene were replaced with the acceptable concentrations from the more diluted analyses of these samples (samples SS-1DL [at SS-CP-1], SS-2DL [at SS-CP-2], SS-3DL [at SS-CP-3], and DUPSS-3-12-11DL [at SS-CP-1]).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

XVII. Documentation

The required records for canister cleanliness were submitted as a separate data package, SDG No. L1102539, and all required records were properly included with this data package. Canister cleanliness and auxiliary equipment status was acceptable upon release from the laboratory, and appropriate checks and actions were performed as required upon sample and equipment receipt.

The chain of custody (COC) records were present and accurately completed for all reported samples, with the following exception:

- The canisters were delivered by laboratory courier to the field sampler's possession, according to communication from the ARCADIS field engineer; however, the custody transfer was not recorded on the Chain of Custody documents as required in the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010). For future sampling efforts, it is recommended that the laboratory COC record be initiated at the time of release of the canisters from the laboratory.

- Improper edits were noted on the COC records. All edits should be made with a single line cross-out and include the date and initials of the person performing the edit.

Data presentation was acceptable, with the following observations and exceptions:

- Raw data for the canister vacuum and flow controller checks following sample receipt was not included in the data package; the validator has requested that the laboratory provide the date these measurements were taken, and assert that the raw data is properly archived.

- The Case Narrative does not include bromodichloromethane in the list of compounds which were evaluated below the standard reporting limit, although this evaluation was performed. The validator requested that the Narrative be revised to include this compound.

- One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.260 ug/m^3.

Additional materials and revisions requested by the validator from the laboratory should be appended to the original data package, or should replace the appropriate pages, in accordance with laboratory instructions accompanying these submissions. All revisions and additional submissions should become a permanent part of the data package for all future distributions.

This validation report should be considered part of the data package for all future distributions of the TO-15 SIM (volatiles in air) analysis data for the commercial property (CP) under SDG No. L1103364.

ATTACHMENT A

ELECTRONIC DELIVERABLE (EDD)
SDG No. L1103364: CP
Selected Volatiles in Air Samples
(submitted electronically)

Phoenix Chemistry Services

April 28, 2011

Nadine Weinberg
ARCADIS, U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Reference #: 2011-0330-001-10M

Dear Nadine,

Enclosed please find the results of the data validation of Sample Delivery Group No. L1103364 from the Indoor Air Quality/Vapor Intrusion (IAQ/VI) assessment work at a residential property in Woburn, MA. The indoor and outdoor air and sub-slab vapor samples in SDG No. L1103364 were collected on March 10 - 11, 2011. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA.

The data package and an electronic deliverable were received on March 30 and 31, 2011, and a separate data package for the canister certifications (SDG No. L1102539) was received on April 12, 2011. The validation has been performed by Phoenix Chemistry Services according to the Tier III guidelines as defined by USEPA Region I, as presented in "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. The EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999), the IAQ/VI Quality Assurance Project Plan (QAPP), and the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate. Data qualifiers have been applied in the final validation report as necessary and appropriate, in accordance with these guidelines.

Thank you for this opportunity to provide data validation services to ARCADIS. We look forward to continuing to work with you on this and other projects. If there are any questions or concerns about the material in this report, please do not hesitate to contact me for help and clarification.

Sincerely,

Deborah H. Gaynor, Ph.D.
Principal, Phoenix Chemistry Services

Phoenix Chemistry Services | 126 Covered Bridge Road | North Ferrisburg | Vermont | 05473
Telephone: (802) 233-2473 | Website: www.phoenixchemistryservices.com | Email: dgaynor@phoenixchemistryservices.com

DATA VALIDATION

FOR

UniFirst-Woburn Vapor Intrusion Assessment
UniFirst Property
Woburn, MA

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
L1103364: 10M

Chemical Analyses Performed by:

Alpha Analytical Laboratories, Inc.
320 Forbes Blvd.
Mansfield, MA 02048

FOR

ARCADIS U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
April 28, 2011

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the Method TO-15 Selected Ion Monitoring (SIM) volatiles in air analysis data prepared by Alpha Analytical Laboratories of Mansfield, MA, for 5 air samples and one (1) trip blank (TB) from a residential property in Woburn, MA. The laboratory reported the data under Sample Delivery Group (SDG) No. L1103364, which was submitted as a single data package received by Phoenix on March 30, 2011, and includes the following samples:

Sample Location	Sample ID	Laboratory ID
IA-10M-1	IA-1	L1103364-01
AA-10M-1	AA-1	L1103364-02
SS-10M-1	SS-1	L1103364-03
SS-10M-2	SS-2	L1103364-04
IA-10M-2	IA-2	L1103364-05

A cross-reference table of sample IDs was provided in the data package. The Sample Location name is being presented in this sample list to aid in identifying project samples with non-unique Sample IDs. The location name will be given as needed in this report to maintain clarity. A separate data package, L1102539, containing the supporting documentation (clean can certifications) for the preparation and analysis of the sampling canisters was submitted on April 12, 2011.

The samples in this data set represent the indoor air and the sub-slab soil vapor samples (matched to the indoor sampling locations) collected from March 10 to 11, 2011 in Woburn, MA inside a residential building identified as location 10M, and an ambient air sample collected outdoors at the sample location. All samples were kept in the engineer's custody after sampling until hand-delivered by laboratory courier to the laboratory on March 15, 2011.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for naphthalene in all samples analyzed by Method TO-15 SIM were qualified as estimated (J, UJ).

- The result for tetrachloroethene in sample SS-1 (at location SS-10M-1) was rejected (R) and replaced with the acceptable concentration from the more diluted analysis of sample SS-1DL (at location SS-10M-1).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane (none were reported in this data set).

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered part of the data package for all future distributions of TO - 15 SIM (volatiles in air) analysis data for the residential property reported in SDG No. L1103364.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, as modified for Selected Ion Monitoring (SIM) in the laboratory standard operating procedure (SOP) No. A-001, and in accordance with requirements in the Quality Assurance Project Plan (QAPP) for Indoor Air Quality and Vapor Intrusion Assessment, Rev. 2, March, 2010. The target compound list was limited to the compounds listed in Form K of the QAPP, and reporting limits are as specified there.

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) and the QAPP were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the USEPA Contract Laboratory Program (CLP) or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit.

In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded in the "Validator_Qualifier" column, and are also found with the validated laboratory-applied qualifiers in the "Qualifier" column in the electronic spreadsheet contained in Attachment A.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The indoor air samples at the residential location "10M" for volatiles analysis were collected over an approximately 24-hour period from March 10 to 11, 2011, and the matching sub-slab (soil vapor) samples were collected during the late afternoon of March 11, 2011 for an approximately 30-minute period. An ambient air sample was collected outdoors at this location on March 10, 2011. The property is located in Woburn, MA. All analyses were performed within thirteen (13) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The canisters were delivered by laboratory courier to the field sampler's possession prior to the sample collection period; however, the custody transfer was not recorded on the Chain of Custody documents as required in the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010). The canisters were hand-delivered by laboratory courier to the laboratory three days after collection ended; the canisters were kept in the field engineer's office during the intervening days. A separate data package, L1102539, was submitted on April 12, 2011, containing the supporting documentation (clean can certification) for the preparation and analysis of the sampling canisters.

The Chain of Custody (COC) and the Canister and Flow Controller Information records show that the sample canisters were collected and transported according to method specifications, with the following exceptions:

Table 1. Sampling Equipment Exceedances

Sample ID	Flow Controller ID	Rate on release (mL/min)	Rate on return (mL/min)	Change	Final Vacuum* (inches Hg)	Field Sample Location
DUPIA-3-10-2011	320	3.3	6.0	+58 %	0.6	IA-10M-1

*as measured at the laboratory following sample receipt; field measurements showed slightly greater vacuum.

All canisters submitted to the field for use met all applicable method requirements, with the exception of one canister that was not used due to equipment failure, and one canister (sample DUPIA-3-10-2011), which went to ambient pressure before collection ended, so the analysis was cancelled. The flow controller rate exceedances for this sample were properly noted in the Case Narrative. The Case Narrative notes that the canister which was not used due to equipment failure was incorrectly referenced in the chain of custody document, and the canister used as the trip blank was recorded instead. Based on otherwise acceptable sampling equipment conditions at receipt, and the corrected sample identification for the Trip Blank, sample integrity was deemed acceptable for all samples. Raw data for the canister vacuum and flow controller checks following sample receipt was not included in the data package; the validator has requested that the laboratory provide the date these measurements were taken, and assert that the raw data is properly archived.

Correspondence between the laboratory and the field sampler is contained in the data package which explains the correction for the sample identification error on the chain of custody documents. Review of these corrections was performed during the validation effort.

Field log books containing records of height of canister intake, barometric pressure, and ambient temperature at sampling locations were submitted for review as part of this validation effort, and are complete and acceptable.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analyses from SDG No. L1103364 were analyzed on a single GC/MS system identified as instrument Airpiano2. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or associated standards were analyzed. All four (4) BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form 5 summaries in the data package.

III. Initial Calibration (IC)

One IC (1/14/11, 17:38 – 23:48) was performed on instrument Airpiano2 in support of the TO-15 SIM sample analyses. The IC was performed at ten concentration levels (0.02, 0.04, 0.1, 0.2, 0.5, 1.0, 2.5, 5.0, 10, and 50 part per billion by volume [ppbv]). Documentation of all individual IC standards was present in the data package and relative response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form 6 summary.

Manual integrations for some target analytes, internal standards, or surrogate standards were performed in some standards and samples in this data set. The before and after ion chromatograms, the reason for the manual integration, and the analyst's initials and date were printed for each manual integration.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I, with the exception that naphthalene exhibited a 34.78%RSD in the TO-15 IC.

An Independent Calibration Verification (ICV) sample analysis at 5 ppbv was analyzed after the IC. All spiked analytes were recovered within 70 – 130 % recovery of expected values in the ICV analysis.

On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples analyzed by Method TO-15 were qualified as estimated (J, UJ).

IV. Continuing Calibration (CC)

Two continuing calibration (CC) standards were run in support of the T)-15 SIM sample analyses reported in this data package. Documentation of the CC standards was present and RRF as well as percent difference (%D) values were reported on the Form 7 summaries within the data package. Sample results were properly reported using the average RRF of the calibration curve for quantitation.

It should be noted that a positive % D value (the CC response factor is <u>less than</u> the IC response factor) will result in a low bias for positive detects, and a negative % D will result in a high bias for positive detects.

V. Blanks

Results for two air-matrix laboratory method blanks (MBs) were reported in association with the TO-15 SIM sample analyses. No target compounds were found in either MB.

One trip blank (TB), which was used as a field blank, was reported in this data package. No target compounds were found in the TB, with the exception that 0.211 ug/m^3 toluene was detected in sample Trip Blank.

Neither a trip blank nor a field blank is required for Method TO-15, and there are no established guidelines for qualification on the basis of an air matrix trip blank or field blank. On the basis of professional judgment, an action limit (0.422 ug/m^3 for toluene) of twice the detected concentration in the TB was used for qualification based on field contamination.

Since toluene was not reported in any samples in this data set at concentrations greater than the sample-specific (adjusted) quantitation limit (QL) but less than the action limit, no qualifications were required on the basis of field contamination.

VI. Surrogate Compounds

No surrogate compounds are used in these methods.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

VIII. Laboratory Duplicates

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method. A laboratory duplicate analysis of a field sample (matrix duplicate) analysis is also not required but was performed per laboratory protocols. Sample SS-2 at location SS-10M-2 was reported for laboratory duplicate analysis. Relative percent difference (RPD) values were reported on a Form 3 summary within the data package.

Precision in the laboratory duplicate analyses (range: 0 - 18 %RPD) was acceptable (less than 30 % RPD, for all analytes greater than five times the reporting limit) on the basis of professional judgment.

IX. Field Duplicates

No field duplicates were collected at this sample location, so field precision could not be evaluated for this sample set.

X. Sensitivity Check

An MDL study for the TO-15 SIM method was analyzed by the laboratory on May 7, 2009, and the most recent verification study was performed between on February 3 and 4, 2010. All target analytes in the statistical study had calculated MDLs below the method quantitation limits (QLs), and demonstrated acceptable ratios (at least 3:1) of the QL to the MDL. The QLs are also supported by the low concentration standard (at 0.020 ppbv) in the initial calibration.

Project objectives required a low reporting limit (RL) for naphthalene, and in order to achieve project objectives for detection limits, the analytes 1,2-dibromoethane (EDB), bromodichloromethane, and naphthalene were evaluated by the laboratory down to one-half the RL; concentrations between one-half the RL and the RL were reported with a "J" qualifier to indicate that this was an estimated concentration on the Form 1 summaries; none were reported in this sample set.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the MDL study and supported by the initial calibration, all results for the TO-15 SIM method (detects and non-detects) not qualified for other reasons are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

Two zero blind PE samples (commonly known as a laboratory control sample, LCS) were prepared and analyzed by the laboratory in support of the TO-15 SIM sample analyses. All target analytes were spiked into the QC samples at 5 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form 3 summaries in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes. No spiked duplicate analyses were performed for either method, so laboratory precision was not evaluated using spiked analyses.

No external single-blind PES sample for either method was required or submitted with the samples in this data set.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form 1 summaries. Results below the RL are not reported by the laboratory for this method. However, at the client's request, positive results for naphthalene, bromodichloromethane, and 1,2-dibromoethane (EDB) were evaluated down to one-half the RL, and reported with a "J" qualifier by the laboratory on the Form 1s.

One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.260 ug/m^3. No qualifications were deemed necessary on

the basis of the RL slightly above that specified in the QAPP for total xylenes, since this concentration is still well below the risk screening level.

On the basis of screen results, original dilutions were performed for one sub-slab sample for tetrachloroethene concentration above the linear calibrated range of the instrument. No dilution was required for any indoor or outdoor air samples, or for sub-slab sample SS-2 at location SS-10M-2.

Tetrachloroethene was detected above the calibration range in the original analysis of sample SS-1 (at location SS-10M-1). The sample was appropriately reanalyzed at a greater dilution, bringing the concentration of tetrachloroethene within the upper half of the calibration range, and both sets of analyses were reported in the data package. Only the tetrachloroethene result was reported from the more diluted sample analysis.

The result for tetrachloroethene in sample SS-1 (at location SS-10M-1) was rejected (R) due to detection of this compound outside the linear range of the instrument for method TO-15 SIM. The result for tetrachloroethene was replaced with the acceptable concentration from the more diluted analysis of sample SS-1DL (at location SS-10M-1)

"E" qualifiers were appropriately applied by the laboratory to sample Form 1 results when concentrations of target analytes were greater than the instrument calibration range.. The validator removed all laboratory-applied "E" qualifiers. Only the analyte originally detected above the calibration range was reported in the dilution analysis "D" qualifiers were not applied to the results in the dilution analysis, nor was the sample ID given the "DL" suffix as required in standard CLP reporting.

The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers (none were reported in this sample set).

The values that the validator has judged to be acceptable are presented on the electronic deliverable generated from the project database (Attachment A). Qualifiers applied by the validator during the validation effort have been listed on the electronic spreadsheet in an additional column labeled "Validator_Qualifier". The column labeled "Qualifier" contains both qualifiers applied by the laboratory and those applied by the validator; all qualifiers in this column have been accepted or changed during the validation effort. The column labeled "PreValidationFlag", which is generated by the database utility, also indicates which qualifiers were changed by the validator. Sample-specific quantitation limits may be found on the Form 1 for each sample or in the electronic deliverable (Attachment A, column "ReportingLimit").

The Form 1s submitted in the data package present results in units of ug/m^3 as well as in ppbv. Results are also presented almost entirely in units of ug/m^3 in the electronic data deliverable (EDD). Both the forms and the EDD were examined during the data validation process.

All positive results are listed on the electronic data deliverable, whether or not the value or qualifier was changed as a result of the validation. All non-detected results are listed on the electronic data deliverable with a Qualifier of "U" or "UJ"; these are also found as less-than (<) values in the "TextResult" column. If the reported result value was changed during the validation effort from a positive result to a value representing a concentration not detected at or below, the value representing the new reporting limit is

reported as the Result with a Validator Qualifier of "U" or "UJ" and a "<" sign in the "TextResult" column.

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working acceptably, based on instrument printouts and spectral quality.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples analyzed by Method TO-15 SIM were qualified as estimated (J, UJ).

- The result for tetrachloroethene in sample SS-1 (at location SS-10M-1) was rejected (R) due to detection of this compound outside the linear range of the instrument for method TO-15 SIM. The result for tetrachloroethene was replaced with the acceptable concentration from the more diluted analysis of sample SS-1DL (at location SS-10M-1).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

XVII. Documentation

The required records for canister cleanliness were submitted as a separate data package, SDG No. L1102539, and all required records were properly included with this data package. Canister cleanliness and auxiliary equipment status was acceptable upon release from the laboratory, and appropriate checks and actions were performed as required upon sample and equipment receipt.

The chain of custody (COC) records were present and accurately completed for all reported samples, with the following exception:

- The canisters were delivered by laboratory courier to the field sampler's possession, according to communication from the ARCADIS field engineer; however, the custody transfer was not recorded on the Chain of Custody documents as required in the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010). For future sampling efforts, it is

recommended that the laboratory COC record be initiated at the time of release of the canisters from the laboratory.

- Improper edits were noted on the COC records. All edits should be made with a single line cross-out and include the date and initials of the person performing the edit.

Data presentation was acceptable, with the following observations and exceptions:

- Raw data for the canister vacuum and flow controller checks following sample receipt was not included in the data package; the validator has requested that the laboratory provide the date these measurements were taken, and assert that the raw data is properly archived.

- The Case Narrative does not include bromodichloromethane in the list of compounds which were evaluated below the standard reporting limit, although this evaluation was performed. The validator requested that the Narrative be revised to include this compound.

- One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.260 ug/m^3.

Additional materials and revisions requested by the validator from the laboratory should be appended to the original data package, or should replace the appropriate pages, in accordance with laboratory instructions accompanying these submissions. All revisions and additional submissions should become a permanent part of the data package for all future distributions.

This validation report should be considered part of the data package for all future distributions of the TO-15 SIM (volatiles in air) analysis data for the residential property "10M" under SDG No. L1103364.

Phoenix Chemistry Services

May 16, 2011

Nadine Weinberg
ARCADIS, U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Reference #: 2011-0510-001

Dear Nadine,

Enclosed please find the results of the data validation of Sample Delivery Group No. L1105581 from the Indoor Air Quality/Vapor Intrusion (IAQ/VI) assessment work at a residential property in Woburn, MA. The indoor and outdoor air and sub-slab vapor samples in SDG No. L1105581 were collected on April 21 - 22, 2011. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA.

The data package and an electronic deliverable were received on May 10, 2011, and a separate data package for the canister certifications (SDG No. L1105086), and two supplemental files L1105581A.pdf and L1105581B.pdf, were also received on May 10, 2011. The validation has been performed by Phoenix Chemistry Services according to the Tier III guidelines as defined by USEPA Region I, as presented in "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. The EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999), the IAQ/VI Quality Assurance Project Plan (QAPP), and the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate. Data qualifiers have been applied in the final validation report as necessary and appropriate, in accordance with these guidelines.

Thank you for this opportunity to provide data validation services to ARCADIS. We look forward to continuing to work with you on this and other projects. If there are any questions or concerns about the material in this report, please do not hesitate to contact me for help and clarification.

Sincerely,

Deborah H. Gaynor, Ph.D.
Principal, Phoenix Chemistry Services

Phoenix Chemistry Services | 126 Covered Bridge Road | North Ferrisburg | Vermont | 05473
Telephone: (802) 233-2473 | Website: www.phoenixchemistryservices.com | Email: dgaynor@phoenixchemistryservices.com

DATA VALIDATION

FOR

UniFirst-Woburn Vapor Intrusion Assessment
Woburn, MA

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
L1105581

Chemical Analyses Performed by:

Alpha Analytical Laboratories, Inc.
320 Forbes Blvd.
Mansfield, MA 02048

FOR

ARCADIS U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
May 19, 2011

Reference #2011-0510-001
VOA Air Validation Report/L1105581_7O/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the Method TO-15 Selected Ion Monitoring (SIM) volatiles in air analysis data prepared by Alpha Analytical Laboratories of Mansfield, MA, for 6 air samples and one (1) trip blank (TB) from a residential property in Woburn, MA. The laboratory reported the data under Sample Delivery Group (SDG) No. L1105581, which was submitted as a single data package received by Phoenix on May 10, 2011, and includes the following samples:

Sample Location	Sample ID	Laboratory ID
AA-57O-1	OA-01	L1105581-01
IA-7O-1	IA-01	L1105581-02
IA-7O-2	IA-02	L1105581-03
IA-7O-3	IA-03	L1105581-04
Field QC	TRIP BLANK	L1105581-08
SS-7O-1	SS-1	L1105581-09
SS-7O-2	SS-2	L1105581-10

A cross-reference table of sample IDs was provided in the data package. The Sample Location name is being presented in this sample list to aid in identifying project samples with non-unique Sample IDs. The location name will be given as needed in this report to maintain clarity. A separate data package, L1105086, containing the supporting documentation (clean can certifications) for the preparation and analysis of the sampling canisters, and two files (L110581A.pdf and L110581B.pdf), containing the raw data for the vacuum check upon receipt and the flow controller rate checks, were also submitted on May 10, 2011.

The samples in this data set represent the indoor air and the sub-slab soil vapor samples (matched to the indoor sampling locations) collected from April 21 to 22, 2011 in Woburn, MA inside a residential building, and an ambient air sample collected outdoors at the sample location. All samples were kept in the engineer's custody after sampling until hand-delivered by laboratory courier to the laboratory on April 25, 2011.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for methyl tert-butyl ether (MTBE) and trans-1,3-dichloropropene in all samples were qualified as estimated (UJ).
- Positive results for naphthalene greater than the sample-specific (adjusted) QL but less than the action limit in samples IA-01 (location IA-7O-01) and IA-02 (IA-7O-02) were qualified as less than the reported value (U).
- The result for xylenes (total) in SS-1 (SS-7O-1) was qualified as estimated (J).
- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered part of the data package for all future distributions of TO - 15 SIM (volatiles in air) analysis data for SDG No. L1105581.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, as modified for Selected Ion Monitoring (SIM) in the laboratory standard operating procedure (SOP) No. A-001, and in accordance with requirements in the Quality Assurance Project Plan (QAPP) for Indoor Air Quality and Vapor Intrusion Assessment, Rev. 2, March, 2010. The target compound list was limited to the compounds listed in Form K of the QAPP, and reporting limits are as specified there.

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) and the QAPP were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the USEPA Contract Laboratory Program (CLP) or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit.

In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded in the "Validator_Qualifier" column, and are also found with the validated laboratory-applied qualifiers in the "Qualifier" column in the electronic spreadsheet contained in Attachment A.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The outdoor and indoor air samples for volatiles analysis were collected over an approximately 24-hour period from April 21 to 22, 2011, and the matching sub-slab (soil vapor) samples were collected at mid-day on April 22, 2011 for an approximately 30-minute period. The property is located in Woburn, MA. All analyses were performed within ten (10) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The canisters were delivered by laboratory courier to the field sampler's possession prior to the sample collection period; however, the custody transfer was not recorded on the Chain of Custody documents as required in the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010). The canisters were hand-delivered by laboratory courier to the laboratory three days after collection ended; the canisters were kept in the field engineer's office during the intervening days. A separate data package, L1105086, was also submitted on May 10, 2011, containing the supporting documentation (clean can certification) for the preparation and analysis of the sampling canisters, along with the raw data for the vacuum and flow controller checks, respectively, in files L1105581A.pdf and L110581B.pdf, also submitted on May 10, 2011.

The Chain of Custody (COC) and the Canister and Flow Controller Information records show that the sample canisters were collected and transported according to method specifications.

All canisters submitted to the field for use met all applicable method requirements. Based on acceptable sampling equipment conditions at receipt, sample integrity was deemed acceptable for all samples.

Field log books containing records of height of canister intake, barometric pressure, and ambient temperature at sampling locations were not submitted for review as part of this validation effort.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analyses from SDG No. L1105581 were analyzed on a single GC/MS system identified as instrument Airpiano2. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or associated standards were analyzed. Both BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form 5 summaries in the data package.

III. Initial Calibration (IC)

One IC (4/6/11, 01:07 – 07:25) was performed on instrument Airpiano2 in support of the TO-15 SIM sample analyses. The IC was performed at ten concentration levels (0.02, 0.04, 0.1, 0.2, 0.5, 1.0, 2.5, 5.0, 10, and 50 part per billion by volume [ppbv]), except that the 0.02 ppbv standard was not used for calibration of naphthalene. Documentation of all individual IC standards was present in the data package and relative

response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form 6 summary.

Manual integrations for some target analytes, internal standards, or surrogate standards were performed in some standards and samples in this data set. The before and after ion chromatograms, the reason for the manual integration, and the analyst's initials and date were printed for each manual integration.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I.

An Independent Calibration Verification (ICV) sample analysis at 5 ppbv was analyzed after the IC. All spiked analytes were recovered within 70 – 130 % recovery of expected values in the ICV analysis.

Since the reporting limit for naphthalene is set above the lowest standard used in the calibration, no actions are necessary on the basis of the modification of the initial calibration range for this compound.

IV. Continuing Calibration (CC)

One continuing calibration (CC) standard was run in support of the TO-15 SIM sample analyses reported in this data package. Documentation of the CC standard was present and RRF as well as percent difference (%D) values were reported on the Form 7 summary within the data package. Sample results were properly reported using the average RRF of the calibration curve for quantitation. All RRF values were above the 0.05 minimum criterion, and al %D values were below the maximum limit (25%) specified by Region 1, with the following exceptions:

Table 1. Continuing Calibration (CC) Standard Exceedances

Method	CC Date & Time	Analyte	%D	Associated Samples
TO-15 SIM	4/30/10 16:24	methyl tert-butyl ether (MTBE)	+25.7	all samples
		trans-1,3-dichloropropene	+28.7	

It should be noted that a positive % D value (the CC response factor is less than the IC response factor) will result in a low bias for positive detects, and a negative % D will result in a high bias for positive detects.

On the basis of the unacceptably high %D value in the associated CC standard, results for methyl tert-butyl ether (MTBE) and trans-1,3-dichloropropene in all samples were qualified as estimated (UJ).

V. Blanks

Results for one air-matrix laboratory method blank (MB) were reported in association with the TO-15 SIM sample analyses. No target compounds were found in the MB, with the exception that 0.131 ug/m^3 naphthalene (action limit 0.262 ug/m^3) was detected in the MB identified as WG465568-4BLANK.

One trip blank (TB), which was used as a field blank, was reported in this data package. No target compounds were found in the TB.

Neither a trip blank nor a field blank is required for Method TO-15.

On the basis of laboratory contamination, positive results for naphthalene greater than the sample-specific (adjusted) QL but less than the action limit (at twice the detected concentration) in samples IA-01 (location IA-7O-1) and IA-02 (IA-7O-2) were qualified as less than the reported value (U).

VI. Surrogate Compounds

No surrogate compounds are used in these methods.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

VIII. Laboratory Duplicates

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method. A laboratory duplicate analysis of a field sample (matrix duplicate) analysis is also not required but was performed per laboratory protocols. A field sample from another Woburn location was used for laboratory duplicate analysis (L1105581-13) for this project. Relative percent difference (RPD) values were reported on a Form 3 summary within the data package.

Precision in the laboratory duplicate analyses (6.0 %RPD) was acceptable (less than 30 % RPD, for all analytes greater than five times the reporting limit) on the basis of professional judgment.

IX. Field Duplicates

No field duplicates were collected in this sample set,so field precision could not be evaluated.

X. Sensitivity Check

An MDL study for the TO-15 SIM method was analyzed by the laboratory on May 7, 2009, and the most recent verification study was performed between on February 3 and 4, 2010. All target analytes in the statistical study had calculated MDLs below the method quantitation limits (QLs), and demonstrated acceptable ratios (at least 3:1) of the QL to the MDL. The QLs are also supported by the low concentration standard (at 0.020 ppbv) in the initial calibration.

Project objectives required a low reporting limit (RL) for naphthalene, and in order to achieve project objectives for detection limits, the analytes 1,2-dibromoethane (EDB), bromodichloromethane, and naphthalene were evaluated by the laboratory down to one-half the RL; concentrations between one-half the RL and the RL were reported with a "J" qualifier to indicate that this was an estimated concentration on the Form 1 summaries; results below the QL were only detected for naphthalene in this sample set.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the MDL study and supported by the initial calibration, all results for the TO-15 SIM method (detects and non-detects) not qualified for other reasons are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

One zero blind PE samples (commonly known as a laboratory control sample, LCS) was prepared and analyzed by the laboratory in support of the TO-15 SIM sample analyses. All target analytes were spiked into the QC samples at 5 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form 3 summaries in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes. No spiked duplicate analyses were performed for either method, so laboratory precision was not evaluated using spiked analyses.

No external single-blind PES sample for either method was required or submitted with the samples in this data set.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form 1 summaries. Results below the RL are not reported by the laboratory for this method. However, at the client's request, positive results for naphthalene, bromodichloromethane, and 1,2-dibromoethane (EDB) were evaluated down to one-half the RL, and reported with a "J" qualifier by the laboratory on the Form 1s.

One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.260 ug/m^3. No qualifications were deemed necessary on the basis of the RL slightly above that specified in the QAPP for total xylenes, since this concentration is still well below the risk screening level. However, in sample SS-1 (location SS-7O-1; laboratory ID L1105581-09), the laboratory recommends that the concentration of total xylenes should be considered estimated due to the do-elution of a non-target peak in this analysis.

On the basis of co-elution of a non-target peak with o-xylene, the result for xylenes (total)in SS-1 (SS-7O-1) was qualified as estimated (J).

The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers (results below the QL were only detected for naphthalene in this sample set).

The values that the validator has judged to be acceptable are presented on the electronic deliverable generated from the project database (Attachment A). Qualifiers applied by the validator during the validation effort have been listed on the electronic spreadsheet in an additional column labeled "Validator_Qualifier". The column labeled "Qualifier" contains both qualifiers applied by the laboratory and those applied by the validator; all qualifiers in this column have been accepted or changed during the validation effort. The column labeled "PreValidationFlag", which is generated by the database utility, also indicates which qualifiers were changed by the validator. Sample-specific quantitation limits may be found on the Form 1 for each sample or in the electronic deliverable (Attachment A, column "ReportingLimit").

The Form 1s submitted in the data package present results in units of ug/m^3 as well as in ppbv. Results are also presented almost entirely in units of ug/m^3 in the electronic data deliverable (EDD). Both the forms and the EDD were examined during the data validation process.

All positive results are listed on the electronic data deliverable, whether or not the value or qualifier was changed as a result of the validation. All non-detected results are listed on the electronic data deliverable with a Qualifier of "U" or "UJ"; these are also found as less-than (<) values in the "TextResult" column. If the reported result value was changed during the validation effort from a positive result to a value representing a concentration not detected at or below, the value representing the new reporting limit is reported as the Result with a Validator Qualifier of "U" or "UJ" and a "<" sign in the "TextResult" column.

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working acceptably, based on instrument printouts and spectral quality.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- On the basis of the unacceptably high %D value in the associated CC standard, results for methyl tert-butyl ether (MTBE) and trans-1,3-dichloropropene in all samples were qualified as estimated (UJ).

- On the basis of laboratory contamination, positive results for naphthalene greater than the sample-

specific (adjusted) QL but less than the action limit in samples IA-01 (IA-7O-01) and IA-02 (IA-7O-02) were qualified as less than the reported value (U).

- On the basis of co-elution of a non-target peak with o-xylene, the result for xylenes (total) in SS-1 (SS-7O-1) was qualified as estimated (J).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

XVII. Documentation

The required records for canister cleanliness were submitted as a separate data package, SDG No. L1102539, and all required records were properly included with this data package. Canister cleanliness and auxiliary equipment status was acceptable upon release from the laboratory, and appropriate checks and actions were performed as required upon sample and equipment receipt.

The chain of custody (COC) records were present and accurately completed for all reported samples.

Data presentation was acceptable, with the following observations:

- The canisters were delivered by laboratory courier to the field sampler's possession; however, the custody transfer was not recorded on the Chain of Custody documents as required in the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010). For future sampling efforts, it is recommended that the laboratory COC record be initiated at the time of release of the canisters from the laboratory.

- One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.260 ug/m^3.

This validation report should be considered part of the data package for all future distributions of the TO-15 SIM (volatiles in air) analysis data for SDG No. L1105581.

ATTACHMENT A

ELECTRONIC DELIVERABLE (EDD)
SDG No. L1105581
Selected Volatiles in Air Samples
(submitted electronically)

Phoenix Chemistry Services

May 16, 2011

Nadine Weinberg
ARCADIS, U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Reference #: 2011-0510-001

Dear Nadine,

Enclosed please find the results of the data validation of Sample Delivery Group No. L1105581 from the Indoor Air Quality/Vapor Intrusion (IAQ/VI) assessment work at a residential property in Woburn, MA. The indoor and outdoor air and sub-slab vapor samples in SDG No. L1105581 were collected on April 21 - 22, 2011. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA.

The data package and an electronic deliverable were received on May 10, 2011, and a separate data package for the canister certifications (SDG No. L1105086), and two supplemental files L1105581A.pdf and L1105581B.pdf, were also received on May 10, 2011. The validation has been performed by Phoenix Chemistry Services according to the Tier III guidelines as defined by USEPA Region I, as presented in "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. The EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999), the IAQ/VI Quality Assurance Project Plan (QAPP), and the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate. Data qualifiers have been applied in the final validation report as necessary and appropriate, in accordance with these guidelines.

Thank you for this opportunity to provide data validation services to ARCADIS. We look forward to continuing to work with you on this and other projects. If there are any questions or concerns about the material in this report, please do not hesitate to contact me for help and clarification.

Sincerely,

Deborah H. Gaynor, Ph.D.
Principal, Phoenix Chemistry Services

Phoenix Chemistry Services | 126 Covered Bridge Road | North Ferrisburg | Vermont | 05473
Telephone: (802) 233-2473 | Website: www.phoenixchemistryservices.com | Email: dgaynor@phoenixchemistryservices.com

DATA VALIDATION

FOR

UniFirst-Woburn Vapor Intrusion Assessment
Woburn, MA

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
L1105581

Chemical Analyses Performed by:

Alpha Analytical Laboratories, Inc.
320 Forbes Blvd.
Mansfield, MA 02048

FOR

ARCADIS U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
May 19, 2011

Reference #2011-0510-001
VOA Air Validation Report/L1105581_5O/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the Method TO-15 Selected Ion Monitoring (SIM) volatiles in air analysis data prepared by Alpha Analytical Laboratories of Mansfield, MA, for 7 air samples and one (1) trip blank (TB) from a residential property in Woburn, MA. The laboratory reported the data under Sample Delivery Group (SDG) No. L1105581, which was submitted as a single data package received by Phoenix on May 10, 2011, and includes the following samples:

Sample Location	Sample ID	Laboratory ID
AA-57O-1	OA-01	L1105581-01
IA-5O-4	IA-04	L1105581-05
IA-5O-5	IA-05	L1105581-06
IA-5O-5	DUPIA042111	L1105581-07
Field QC	TRIP BLANK	L1105581-08
SS-5O-4	SS-4	L1105581-11
SS-5O-5	SS-5	L1105581-12
SS-5O-4	DUPSS42211	L1105581-13

A cross-reference table of sample IDs was provided in the data package. The Sample Location name is being presented in this sample list to aid in identifying project samples with non-unique Sample IDs. The location name will be given as needed in this report to maintain clarity. A separate data package, L1105086, containing the supporting documentation (clean can certifications) for the preparation and analysis of the sampling canisters, and two files (L110581A.pdf and L110581B.pdf), containing the raw data for the vacuum check upon receipt and the flow controller rate checks, were also submitted on May 10, 2011.

The samples in this data set represent the indoor air and the sub-slab soil vapor samples (matched to the indoor sampling locations) collected from April 21 to 22, 2011 in Woburn, MA inside a residential building, and an ambient air sample collected outdoors at the sample location. All samples were kept in the engineer's custody after sampling until hand-delivered by laboratory courier to the laboratory on April 25, 2011.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for methyl tert-butyl ether (MTBE) and trans-1,3-dichloropropene in all samples were qualified as estimated (UJ).

- Positive results for naphthalene greater than the sample-specific (adjusted) QL but less than the action limit in samples IA-04 (location IA-5O-04) and DUPIA042111 (IA-5O-5) were qualified as less than the reported value (U).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered part of the data package for all future distributions of TO - 15 SIM (volatiles in air) analysis data for SDG No. L1105581.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, as modified for Selected Ion Monitoring (SIM) in the laboratory standard operating procedure (SOP) No. A-001, and in accordance with requirements in the Quality Assurance Project Plan (QAPP) for Indoor Air Quality and Vapor Intrusion Assessment, Rev. 2, March, 2010. The target compound list was limited to the compounds listed in Form K of the QAPP, and reporting limits are as specified there.

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) and the QAPP were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the USEPA Contract Laboratory Program (CLP) or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit.

In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded in the "Validator_Qualifier" column, and are also found with the validated laboratory-applied qualifiers in the "Qualifier" column in the electronic spreadsheet contained in Attachment A.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The outdoor and indoor air samples for volatiles analysis were collected over an approximately 24-hour period from April 21 to 22, 2011, and the matching sub-slab (soil vapor) samples were collected at mid-day on April 22, 2011 for an approximately 30-minute period. The property is located in Woburn, MA. All analyses were performed within ten (10) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The canisters were delivered by laboratory courier to the field sampler's possession prior to the sample collection period; however, the custody transfer was not recorded on the Chain of Custody documents as required in the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010). The canisters were hand-delivered by laboratory courier to the laboratory three days after collection ended; the canisters were kept in the field engineer's office during the intervening days. A separate data package, L1105086, was also submitted on May 10, 2011, containing the supporting documentation (clean can certification) for the preparation and analysis of the sampling canisters, along with the raw data for the vacuum and flow controller checks, respectively, in files L1105581A.pdf and L110581B.pdf, also submitted on May 10, 2011.

The Chain of Custody (COC) and the Canister and Flow Controller Information records show that the sample canisters were collected and transported according to method specifications.

All canisters submitted to the field for use met all applicable method requirements. Based on acceptable sampling equipment conditions at receipt, sample integrity was deemed acceptable for all samples.

Field log books containing records of height of canister intake, barometric pressure, and ambient temperature at sampling locations were not submitted for review as part of this validation effort.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analyses from SDG No. L1105581 were analyzed on a single GC/MS system identified as instrument Airpiano2. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or associated standards were analyzed. Both BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form 5 summaries in the data package.

III. Initial Calibration (IC)

One IC (4/6/11, 01:07 – 07:25) was performed on instrument Airpiano2 in support of the TO-15 SIM sample analyses. The IC was performed at ten concentration levels (0.02, 0.04, 0.1, 0.2, 0.5, 1.0, 2.5, 5.0, 10, and 50 part per billion by volume [ppbv]), except that the 0.02 ppbv standard was not used for calibration of naphthalene. Documentation of all individual IC standards was present in the data package and relative

response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form 6 summary.

Manual integrations for some target analytes, internal standards, or surrogate standards were performed in some standards and samples in this data set. The before and after ion chromatograms, the reason for the manual integration, and the analyst's initials and date were printed for each manual integration.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I.

An Independent Calibration Verification (ICV) sample analysis at 5 ppbv was analyzed after the IC. All spiked analytes were recovered within 70 – 130 % recovery of expected values in the ICV analysis.

Since the reporting limit for naphthalene is set above the lowest standard used in the calibration, no actions are necessary on the basis of the modification of the initial calibration range for this compound.

IV. Continuing Calibration (CC)

One continuing calibration (CC) standard was run in support of the TO-15 SIM sample analyses reported in this data package. Documentation of the CC standard was present and RRF as well as percent difference (%D) values were reported on the Form 7 summary within the data package. Sample results were properly reported using the average RRF of the calibration curve for quantitation. All RRF values were above the 0.05 minimum criterion, and al %D values were below the maximum limit (25%) specified by Region 1, with the following exceptions:

Table 1. Continuing Calibration (CC) Standard Exceedances

Method	CC Date & Time	Analyte	%D	Associated Samples
TO-15 SIM	4/30/10 16:24	methyl tert-butyl ether (MTBE)	+25.7	all samples
		trans-1,3-dichloropropene	+28.7	

It should be noted that a positive % D value (the CC response factor is less than the IC response factor) will result in a low bias for positive detects, and a negative % D will result in a high bias for positive detects.

On the basis of the unacceptably high %D value in the associated CC standard, results for methyl tert-butyl ether (MTBE) and trans-1,3-dichloropropene in all samples were qualified as estimated (UJ).

V. Blanks

Results for one air-matrix laboratory method blank (MB) were reported in association with the TO-15 SIM sample analyses. No target compounds were found in the MB, with the exception that 0.131 ug/m^3 naphthalene (action limit 0.262 ug/m^3) was detected in the MB identified as WG465568-4BLANK.

One trip blank (TB), which was used as a field blank, was reported in this data package. No target compounds were found in the TB.

Neither a trip blank nor a field blank is required for Method TO-15.

On the basis of laboratory contamination, positive results for naphthalene greater than the sample-specific (adjusted) QL but less than the action limit (at twice the detected concentration) in samples IA-04 (location IA-5O-4) and DUPIA042111 (IA-5O-5) were qualified as less than the reported value (U).

VI. Surrogate Compounds

No surrogate compounds are used in these methods.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

VIII. Laboratory Duplicates

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method. A laboratory duplicate analysis of a field sample (matrix duplicate) analysis is also not required but was performed per laboratory protocols. Sample SS-4 at location SS-5O-4 was reported for laboratory duplicate analysis (L1105581-13). Relative percent difference (RPD) values were reported on a Form 3 summary within the data package.

Precision in the laboratory duplicate analyses (6.0 %RPD) was acceptable (less than 30 % RPD, for all analytes greater than five times the reporting limit) on the basis of professional judgment.

IX. Field Duplicates

Two field duplicates were collected in this sample set. Sample DUPIA042111 was identified as the field duplicate of sample IA-05 (location IA-5O-5), and sample DUPSS42211 was identified as the field duplicate of sample SS-4 (SS-5O-4).

Relative percent difference (RPD) values for compounds detected at greater than five times the quantitation limit in at least one member of a field duplicate pair must be less than 25 %RPD as per the QAPP. The paired values in both field duplicate pairs for all detected target compounds meeting threshold criteria were acceptable (range 0.0 - 10.1 %RPD).

X. Sensitivity Check

An MDL study for the TO-15 SIM method was analyzed by the laboratory on May 7, 2009, and the most recent verification study was performed between on February 3 and 4, 2010. All target analytes in the statistical study had calculated MDLs below the method quantitation limits (QLs), and demonstrated acceptable ratios (at least 3:1) of the QL to the MDL. The QLs are also supported by the low concentration standard (at 0.020 ppbv) in the initial calibration.

Project objectives required a low reporting limit (RL) for naphthalene, and in order to achieve project objectives for detection limits, the analytes 1,2-dibromoethane (EDB), bromodichloromethane, and naphthalene were evaluated by the laboratory down to one-half the RL; concentrations between one-half the RL and the RL were reported with a "J" qualifier to indicate that this was an estimated concentration on the Form 1 summaries; results below the QL were only detected for naphthalene in this sample set.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the MDL study and supported by the initial calibration, all results for the TO-15 SIM method (detects and non-detects) not qualified for other reasons are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

One zero blind PE samples (commonly known as a laboratory control sample, LCS) was prepared and analyzed by the laboratory in support of the TO-15 SIM sample analyses. All target analytes were spiked into the QC samples at 5 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form 3 summaries in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes. No spiked duplicate analyses were performed for either method, so laboratory precision was not evaluated using spiked analyses.

No external single-blind PES sample for either method was required or submitted with the samples in this data set.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form 1 summaries. Results below the RL are not reported by the laboratory for this method. However, at the client's request, positive results for naphthalene, bromodichloromethane, and 1,2-dibromoethane (EDB) were evaluated down to one-half the RL, and reported with a "J" qualifier by the laboratory on the Form 1s.

One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.260 ug/m^3. No qualifications were deemed necessary on the basis of the RL slightly above that specified in the QAPP for total xylenes, since this concentration is still

well below the risk screening level.

The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers (results below the QL were only detected for naphthalene in this sample set).

The values that the validator has judged to be acceptable are presented on the electronic deliverable generated from the project database (Attachment A). Qualifiers applied by the validator during the validation effort have been listed on the electronic spreadsheet in an additional column labeled "Validator_Qualifier". The column labeled "Qualifier" contains both qualifiers applied by the laboratory and those applied by the validator; all qualifiers in this column have been accepted or changed during the validation effort. The column labeled "PreValidationFlag", which is generated by the database utility, also indicates which qualifiers were changed by the validator. Sample-specific quantitation limits may be found on the Form 1 for each sample or in the electronic deliverable (Attachment A, column "ReportingLimit").

The Form 1s submitted in the data package present results in units of ug/m^3 as well as in ppbv. Results are also presented almost entirely in units of ug/m^3 in the electronic data deliverable (EDD). Both the forms and the EDD were examined during the data validation process.

All positive results are listed on the electronic data deliverable, whether or not the value or qualifier was changed as a result of the validation. All non-detected results are listed on the electronic data deliverable with a Qualifier of "U" or "UJ"; these are also found as less-than (<) values in the "TextResult" column. If the reported result value was changed during the validation effort from a positive result to a value representing a concentration not detected at or below, the value representing the new reporting limit is reported as the Result with a Validator Qualifier of "U" or "UJ" and a "<" sign in the "TextResult" column.

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working acceptably, based on instrument printouts and spectral quality.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- On the basis of the unacceptably high %D value in the associated CC standard, results for methyl tert-butyl ether (MTBE) and trans-1,3-dichloropropene in all samples were qualified as estimated (UJ).

- On the basis of laboratory contamination, positive results for naphthalene greater than the sample-specific (adjusted) QL but less than the action limit in samples IA-04 (IA-5O-04) and DUPIA042111 (IA-5O-5) were qualified as less than the reported value (U).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

XVII. Documentation

The required records for canister cleanliness were submitted as a separate data package, SDG No. L1102539, and all required records were properly included with this data package. Canister cleanliness and auxiliary equipment status was acceptable upon release from the laboratory, and appropriate checks and actions were performed as required upon sample and equipment receipt.

The chain of custody (COC) records were present and accurately completed for all reported samples.

Data presentation was acceptable, with the following observations:

- The canisters were delivered by laboratory courier to the field sampler's possession; however, the custody transfer was not recorded on the Chain of Custody documents as required in the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010). For future sampling efforts, it is recommended that the laboratory COC record be initiated at the time of release of the canisters from the laboratory.

- One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.260 ug/m^3.

This validation report should be considered part of the data package for all future distributions of the TO-15 SIM (volatiles in air) analysis data for SDG No. L1105581.

ATTACHMENT A

ELECTRONIC DELIVERABLE (EDD)
SDG No. L1105581_5O
Selected Volatiles in Air Samples
(submitted electronically)

Phoenix Chemistry Services

Aug. 8, 2011

Nadine Weinberg
ARCADIS, U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Reference #s: 2011-0705-001 & -002, and 2011-0715-001 & -002

Dear Nadine,

Phoenix Chemistry Services has submitted four reports on August 4 - 5, 2011 presenting the results of the data validation of Sample Delivery Group (SD) Nos. L1108879, L1108880, L1108884, and L1108885 from the Indoor Air Quality/Vapor Intrusion (IAQ/VI) assessment work at several residential and/or commercial properties in Woburn, MA. The indoor and outdoor air and sub-slab vapor samples in these SDGs were collected June 16 - 18, 2011. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA.

The data packages and electronic deliverables were received on July 5 and 15, 2011. Two separate data packages for the canister certifications (SDG Nos. L1108049 and L1108435), and associated files L1108879.pdf, L1108880.pdf, L1108884.pdf, L1108885A.pdf, and L1108885B.pdf were received on June 16, 2011. The validation has been performed by Phoenix Chemistry Services according to the Tier III guidelines as defined by USEPA Region I, as presented in "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. The EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999), the IAQ/VI Quality Assurance Project Plan (QAPP), and the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate. Data qualifiers have been applied in the final validation report as necessary and appropriate, in accordance with these guidelines.

The samples in these four data packages were collected as a single sampling round, and utilized shared quality control (QC) samples, including two trip blanks, four outdoor air samples, four field duplicate pairs, and two laboratory replicates. The trip blanks and laboratory replicates were each logged in and reported in at least two data packages to avoid collecting redundant QC samples, as requested by the field engineer. Only one set of results for these QC samples was retained in the project database to avoid duplications; the earliest laboratory identifier was selected to be validated and reported. The laboratory is maintaining the original reporting packages.

A reporting error was noted in the clean canister certification package SDG No. L1108435; an incorrect copy of the initial calibration was included in the raw data section, and the continuing calibration presented incorrect percent difference values, as the compounds were evaluated against the incorrect initial calibration. The laboratory quickly responded to the validator's request for a copy of the missing initial calibration, however, a revision of the data package with the corrected continuing calibration has not yet been received (the validator performed the checks manually after receiving the correct initial calibration). The laboratory should be reminded that this is still outstanding.

Thank you for this opportunity to provide data validation services to ARCADIS. If there are any questions or concerns about the material in this report, please do not hesitate to contact me for help and clarification.

Sincerely,

Deborah H. Gaynor, Ph.D.
Principal, Phoenix Chemistry Services

Phoenix Chemistry Services | 126 Covered Bridge Road | North Ferrisburg | Vermont | 05473
Telephone: (802) 233-2473 | Website: www.phoenixchemistryservices.com | Email: dgaynor@phoenixchemistryservices.com

DATA VALIDATION

FOR

UniFirst-Woburn Vapor Intrusion Assessment
Woburn, MA

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
L1108885

Chemical Analyses Performed by:

Alpha Analytical Laboratories, Inc.
320 Forbes Blvd.
Mansfield, MA 02048

FOR

ARCADIS U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
Aug. 5, 2011

Reference #2011-0715-002
VOA Air Validation Report/L1108885/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the Method TO-15 Selected Ion Monitoring (SIM) volatiles in air analysis data prepared by Alpha Analytical Laboratories of Mansfield, MA, for 10 air samples from a residential property in Woburn, MA. The laboratory reported the data under Sample Delivery Group (SDG*)* No. L1108885, which was submitted as a single data package received by Phoenix on July 15, 2011, and includes the following samples:

Sample ID	Laboratory ID
AA-CP-1-06182011	L1108885-02
AA-CP-2-06182011	L1108885-03
IA-CP-1-06182011	L1108885-04
IA-CP-2-06182011	L1108885-05
DUPIA-06182011	L1108885-06
IA-CP-3-06182011	L1108885-07
SS-CP-1-06182011	L1108885-08
SS-CP-2-06182011	L1108885-09
SS-CP-3-06182011	L1108885-10
DUPSS-06182011	L1108885-11

A cross-reference table of sample IDs was provided in the data package. Two separate data packages, SDG Nos. L1108049 and L1108435, containing the supporting documentation (clean can certifications) for the preparation and analysis of the sampling canisters, and two filew (L1108885A.pdf and L1108885B.pdf) containing the raw data for the vacuum check upon receipt and the flow controller rate checks, were also submitted on June 16 and July 15, 2011, respectively.

The samples in this data set represent the indoor air and the sub-slab soil vapor samples (matched to the indoor sampling locations) collected on June 18, 2011 in Woburn, MA inside a residential building, and two ambient air samplew collected outdoors at the sample location on June 18, 2011. All samples were kept in the engineer's custody after sampling until hand-delivered by laboratory courier to the laboratory on June 21, 2011.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for naphthalene and 1,3-butadiene in all samples were qualified as estimated (J, UJ).
- Results for methyl tert-butyl ether (MTBE), toluene, ethylbenzene, and naphthalene in all samples were qualified as estimated (J, UJ).
- Results for tetrachloroethene initially outside the calibration range in the original analyses of samples SS-CP-1-6182011, SS-CP-3-06182011, and SS-CP-2-06182011 were rejected (R), and replaced with the acceptable concentrations from the corresponding diluted samples (SS-CP-1-6182011DL, SS-CP-3-06182011DL, and SS-CP-2-06182011DL.
- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the

concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered part of the data package for all future distributions of TO-15 SIM (volatiles in air) analysis data for SDG No. L1108885.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, as modified for Selected Ion Monitoring (SIM) in the laboratory standard operating procedure (SOP) No. A-001, and in accordance with requirements in the Quality Assurance Project Plan (QAPP) for Indoor Air Quality and Vapor Intrusion Assessment, Rev. 2, March, 2010. The target compound list was limited to the compounds listed in Form K of the QAPP, and reporting limits are as specified there.

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) and the QAPP were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the USEPA Contract Laboratory Program (CLP) or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit.

In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded in the "Validator_Qualifier" column, and are also found with the validated laboratory-applied qualifiers in the "Qualifier" column in the electronic spreadsheet contained in Attachment A.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The outdoor and indoor air samples for volatiles analysis were collected over an 8 to 12 hour period on June 18, 2011, and the matching sub-slab (soil vapor) samples were collected in the early afternoon of June 18, 2011 for an approximately 30-minute period. The property is located in Woburn, MA. All analyses were performed within eleven (11) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The canisters were delivered by laboratory courier to the field sampler's possession and after sampling the canisters were hand-delivered by laboratory courier to the laboratory three days after collection ended; the canisters were kept in the field engineer's office during the intervening days. Two separate data packages, SDG Nos. L1108049 and L1108435, were also submitted (on June 16, 2011), containing the supporting documentation (clean can certification) for the preparation and pre-sampling cleanliness check analysis of the canisters; the raw data for the vacuum and flow controller checks, as documented in the files L1108885A.pdf and L1108885B.pdf were submitted on June 16, 2011.

The Chain of Custody (COC) and the Canister and Flow Controller Information records show that the sample canisters were collected and transported according to method specifications.

All canisters submitted to the field for use met all applicable method requirements. Raw data for the initial calibration used for the analysis of one of the canisters used in this sampling round was not submitted in the data package L11088435; the laboratory supplied the missing documentation at the validator's request. An incorrect version of the continuing calibration for this canister certification analysis was not supplied as requested, so the validator calculated the percent difference values for this analysis from the raw data. The laboratrory has been informed that this data is still missing and should be submitted.

The canister used for collection of the field duplicate sample DUPSS-06182011 failed to collect a full sample volume; consultation betwee tn the field sampler and the data validator determined that the expected analyte concnetrations in this sample were sufficiently high that the dilution necessitated by the limited sample volume would not prevent an acceptable analysis, and the laboratory was instructed to proceed with a dilution analysis for this canister. Based on otherwise acceptable sampling equipment conditions at receipt, and the expected high conentrations for the limited volume sample DUPSS-06182011, sample integrity was deemed acceptable for all samples.

Field log books containing records of height of canister intake, barometric pressure, and ambient temperature at sampling locations were not submitted for review as part of this validation effort.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analyses from SDG No. L1108885 were analyzed on a single GC/MS system identified as instrument Airlab7. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or

associated standards were analyzed. All three BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form 5 summaries in the data package.

III. Initial Calibration (IC)

One IC (6/25/11) was performed on instrument Airlab7 in support of the TO-15 SIM sample analyses. The IC was performed at ten concentration levels (0.02, 0.04, 0.1, 0.2, 0.5, 1.0, 2.5, 5.0, 10, and 50 part per billion by volume [ppbv]), except that the 0.02 ppbv standard was not used for calibration of naphthalene. It was noted that a standard at 20 ppbv was also analyzed and included in the data package, but was not used in the instrument calibration. Documentation of all individual IC standards was present in the data package and relative response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form 6 summary.

Manual integrations for some target analytes, internal standards, or surrogate standards were performed in some standards and samples in this data set. The before and after ion chromatograms, the reason for the manual integration, and the analyst's initials and date were printed for each manual integration.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I, with the exception that naphthalene exhibited a 37.3 %RSD.

An Independent Calibration Verification (ICV) sample analysis at 20 ppbv was analyzed on 6/27/11. All spiked analytes were recovered within 70 – 130 % recovery of expected values in the ICV analysis, with the exception of 1,3-butadiene, which was recovered at -41.7 % recovery.

Since the reporting limit for naphthalene is set above the lowest standard used in the calibration, no actions are necessary on the basis of the modification of the initial calibration range for this compound. On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples were qualified as estimated (J, UJ). On the basis of the unacceptably low recovery in the associated ICV analysis, results for 1,3-butadiene in all samples were qualified as estimated (J, UJ).

IV. Continuing Calibration (CC)

One continuing calibration (CC) standard performed on 6/29/11 was reported in support of the TO-15 SIM sample analyses reported in this data package; this analysis is also reported as the laboratory control sample analysis for this analytical window. Since this is an independent standard, this is acceptable, although redundant. Sample results were properly reported using the average RRF of the calibration curve for quantitation. Documentation of the standard analysis was present, and RRF as well as percent difference (%D) values were reported on the Form 7 summary within the data package.

All RRF values were above the 0.05 minimum criterion, and all %D values were below the maximum limit (25%) specified by Region 1, with the following exceptions:

Table 1. Continuing Calibration (CC) Standard Exceedances

CC Date & Time	Analyte	%D	Associated Samples
6/29/11 14:07	methyl tert-butyl ether (MTBE)	+26.9	all samples
	toluene	+27.1	
	ethylbenzene	+25.8	
	naphthalene	-27.2	

It should be noted that a positive % D value (the CC response factor is less than the IC response factor) will result in a low bias for positive detects, and a negative % D will result in a high bias for positive detects.

On the basis of the unacceptably high %D values in the associated CC standard, results for methyl tert-butyl ether (MTBE), toluene, ethylbenzene, and naphthalene in all samples were qualified as estimated (J, UJ).

V. Blanks

Results for one air-matrix laboratory method blank (MB) were reported in association with the TO-15 SIM sample analyses. No target compounds were found in the MB.

One trip blank (TB), which was used as a field blank, was reported in this data package. The date of collection for the TB was set as 6/18/11, since it was used for sample canisters collected between 6/16/11 and 6/18/11 at two locations submitted to the lab at the same time. No target compounds were found in the TB.

Neither a trip blank nor a field blank is required for Method TO-15.

VI. Surrogate Compounds

No surrogate compounds are used in these methods.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

VIII. Laboratory Duplicates

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method. A laboratory duplicate analysis of a field sample (matrix duplicate) analysis is also not required but was performed per laboratory protocols. A laboratory duplicate was selected from the samples collected during the same

sampling set on June 18, 2011, and reported in SDG No. L1108884. Relative percent difference (RPD) values were reported on a Form 3 summary within that data package.

Precision in the laboratory duplicate analyses (5.5 %RPD) was acceptable (less than 30 % RPD, for the single analyte greater than five times the reporting limit, on the basis of professional judgment).

IX. Field Duplicates

Two field duplicate pairs were collected in this sample set. Sample IA-CP-2-06182011 was identified as the field duplicate of DUPIA-06182011, and sample SS-CP-1-06182011 was identified as the field duplicate of DUPSS-06182011.

Relative percent difference (RPD) values for compounds detected at greater than five times the quantitation limit in at least one member of a field duplicate pair must be less than 25 %RPD as per the QAPP. Precision (range, 1.8 – 14.8 %RPD) in the indoor air field duplicate pair was acceptable (less than 30 %RPD for all analytes detected at values greater than five times the reporting limit, on the basis of professional judgment), and precision in the sub-slab field duplicate pair (samples SS-CP-1-06182011 and DUPSS-06182011; range 0.0 to8.8 %RPD) was acceptable for all anlaytes greater than five times the sample-specific reporting limit (adjusted for sample volume and dilution).

X. Sensitivity Check

An MDL study for the TO-15 SIM method was analyzed by the laboratory on May 7, 2009, and the most recent verification study was performed between February 3 and 4, 2010. All target analytes in the statistical study had calculated MDLs below the method quantitation limits (QLs), and demonstrated acceptable ratios (at least 3:1) of the QL to the MDL. The QLs are also supported by the low concentration standard (at 0.020 ppbv) in the initial calibration.

Project objectives required a low reporting limit (RL) for naphthalene, and in order to achieve project objectives for detection limits, the analytes 1,2-dibromoethane (EDB), bromodichloromethane, and naphthalene were evaluated by the laboratory down to one-half the RL; concentrations between one-half the RL and the RL were reported with a “J” qualifier to indicate that this was an estimated concentration on the Form 1 summaries; results below the QL were only detected for naphthalene in this sample set.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the MDL study and supported by the initial calibration, all results for the TO-15 SIM method (detects and non-detects) not qualified for other reasons are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

One zero blind PE samples (commonly known as a laboratory control sample, LCS) was prepared and analyzed by the laboratory in support of the TO-15 SIM sample analyses; this analysis was also reported as the CC standard analysis for this data set. All target analytes were spiked into the QC sample at 20 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form 3 summary in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes. No spiked duplicate analyses were performed for either method, so laboratory precision was not evaluated using spiked analyses.

No external single-blind PES sample for either method was required or submitted with the samples in this data set.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form 1 summaries. Results below the RL are not reported by the laboratory for this method. However, at the client's request, positive results for naphthalene, bromodichloromethane, and 1,2-dibromoethane (EDB) were evaluated down to one-half the RL, and reported with a "J" qualifier by the laboratory on the Form 1s.

One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.261 ug/m^3. No qualifications were deemed necessary on the basis of the RL slightly above that specified in the QAPP for total xylenes, since this concentration is still well below the risk screening level.

Samples SS-CP-1-06182011 and SS-CP-3-06182011 were analyzed at an initial two-fold dilution, sample SS-CP-2-06182011 was analyzed at an initial 10-fold dilution, and sample DUPSS-06182011 was analyzed at an initial dilution factor of 5.5 on the basis of laboratory judgment. Tetrachloroethene was detected above the linear range of the instrument in samples SS-CP-1-6182011, SS-CP-3-06182011 , and SS-CP-2-06182011; these samples were reanalyzed at an appropriate further dilution to bring tetrachloroethene within the upper half of the calibration range, and both sets of analyses were reported in the data package.

Results for tetrachloroethene initially outside the calibration range in the original analyses of samples SS-CP-1-6182011, SS-CP-3-06182011, and SS-CP-2-06182011 were rejected (R), and replaced with the acceptable concentrations from the corresponding diluted samples (SS-CP-1-6182011DL, SS-CP-3-06182011DL, and SS-CP-2-06182011DL.

The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers (results below the QL were only detected for naphthalene in this sample set).

The values that the validator has judged to be acceptable are presented on the electronic deliverable generated from the project database (Attachment A). Qualifiers applied by the validator during the validation effort have been listed on the electronic spreadsheet in an additional column labeled "Validator_Qualifier". The column labeled "Qualifier" contains both qualifiers applied by the laboratory and those applied by the validator; all qualifiers in this column have been accepted or changed during the validation effort. The column labeled "PreValidationFlag", which is generated by the database utility, also indicates which qualifiers were changed by the validator. Sample-specific quantitation limits may be found on the Form 1 for each sample or in the electronic deliverable (Attachment A, column "ReportingLimit").

The Form 1s submitted in the data package present results in units of ug/m^3 as well as in ppbv. Results are also presented almost entirely in units of ug/m^3 in the electronic data deliverable (EDD). Both the forms and the EDD were examined during the data validation process.

All positive results are listed on the electronic data deliverable, whether or not the value or qualifier was changed as a result of the validation. All non-detected results are listed on the electronic data deliverable with a Qualifier of "U" or "UJ"; these are also found as less-than (<) values in the "TextResult" column. If the reported result value was changed during the validation effort from a positive result to a value representing a concentration not detected at or below, the value representing the new reporting limit is reported as the Result with a Validator Qualifier of "U" or "UJ" and a "<" sign in the "TextResult" column.

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working acceptably, based on instrument printouts and spectral quality.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples were qualified as estimated (J, UJ).
- On the basis of the unacceptably low recovery in the associated ICV analysis, results for 1,3-butadiene in all samples were qualified as estimated (UJ).
- On the basis of the unacceptably high %D values in the associated CC standard, results for methyl tert-butyl ether (MTBE), toluene, ethylbenzene, and naphthalene in all samples were qualified as estimated (J, UJ).

- Results for tetrachloroethene initially outside the calibration range in the original analyses of samples SS-CP-1-6182011, SS-CP-3-06182011, and SS-CP-2-06182011 were rejected (R), and replaced with the acceptable concentrations from the corresponding diluted samples (SS-CP-1-6182011DL, SS-CP-3-06182011DL, and SS-CP-2-06182011DL.

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

XVII. Documentation

The required records for canister cleanliness were submitted as a separate data package, SDG No. L1108049, and all required records were properly included with this data package. Canister cleanliness and auxiliary equipment status was acceptable upon release from the laboratory, and appropriate checks and actions were performed as required upon sample and equipment receipt.

The chain of custody (COC) records were present and accurately completed for all reported samples.

Data presentation was acceptable, with the following observation:

- Raw data for the initial calibration used for the analysis of one of the canisters used in this sampling round was not submitted in the data package L11088435; the laboratory supplied the missing documentation at the validator's request. An incorrect version of the continuing calibration for this canister certification analysis was not supplied as requested, so the validator calculated the percent difference values for this analysis from the raw data. The laboratrory has been informed that this data is still missing and should be submitted.

- One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.261 ug/m^3.

This validation report should be considered part of the data package for all future distributions of the TO-15 SIM (volatiles in air) analysis data for SDG No. L1108885.

ATTACHMENT A

ELECTRONIC DELIVERABLE (EDD)
SDG No. L1108885
Selected Volatiles in Air Samples
(submitted electronically)

Phoenix Chemistry Services

Aug. 8, 2011

Nadine Weinberg
ARCADIS, U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Reference #s: 2011-0705-001 & -002, and 2011-0715-001 & -002

Dear Nadine,

Phoenix Chemistry Services has submitted four reports on August 4 - 5, 2011 presenting the results of the data validation of Sample Delivery Group (SD) Nos. L1108879, L1108880, L1108884, and L1108885 from the Indoor Air Quality/Vapor Intrusion (IAQ/VI) assessment work at several residential and/or commercial properties in Woburn, MA. The indoor and outdoor air and sub-slab vapor samples in these SDGs were collected June 16 - 18, 2011. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA.

The data packages and electronic deliverables were received on July 5 and 15, 2011. Two separate data packages for the canister certifications (SDG Nos. L1108049 and L1108435), and associated files L1108879.pdf, L1108880.pdf, L1108884.pdf, L1108885A.pdf, and L1108885B.pdf were received on June 16, 2011. The validation has been performed by Phoenix Chemistry Services according to the Tier III guidelines as defined by USEPA Region I, as presented in "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. The EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999), the IAQ/VI Quality Assurance Project Plan (QAPP), and the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate. Data qualifiers have been applied in the final validation report as necessary and appropriate, in accordance with these guidelines.

The samples in these four data packages were collected as a single sampling round, and utilized shared quality control (QC) samples, including two trip blanks, four outdoor air samples, four field duplicate pairs, and two laboratory replicates. The trip blanks and laboratory replicates were each logged in and reported in at least two data packages to avoid collecting redundant QC samples, as requested by the field engineer. Only one set of results for these QC samples was retained in the project database to avoid duplications; the earliest laboratory identifier was selected to be validated and reported. The laboratory is maintaining the original reporting packages.

A reporting error was noted in the clean canister certification package SDG No. L1108435; an incorrect copy of the initial calibration was included in the raw data section, and the continuing calibration presented incorrect percent difference values, as the compounds were evaluated against the incorrect initial calibration. The laboratory quickly responded to the validator's request for a copy of the missing initial calibration, however, a revision of the data package with the corrected continuing calibration has not yet been received (the validator performed the checks manually after receiving the correct initial calibration). The laboratory should be reminded that this is still outstanding.

Thank you for this opportunity to provide data validation services to ARCADIS. If there are any questions or concerns about the material in this report, please do not hesitate to contact me for help and clarification.

Sincerely,

Deborah H. Gaynor, Ph.D.
Principal, Phoenix Chemistry Services

Phoenix Chemistry Services | 126 Covered Bridge Road | North Ferrisburg | Vermont | 05473
Telephone: (802) 233-2473 | Website: www.phoenixchemistryservices.com | Email: dgaynor@phoenixchemistryservices.com

DATA VALIDATION

FOR

UniFirst-Woburn Vapor Intrusion Assessment
Woburn, MA

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
L1108884

Chemical Analyses Performed by:

Alpha Analytical Laboratories, Inc.
320 Forbes Blvd.
Mansfield, MA 02048

FOR

ARCADIS U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
Aug. 5, 2011

Reference #2011-0715-001
VOA Air Validation Report/L1108884/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the Method TO-15 Selected Ion Monitoring (SIM) volatiles in air analysis data prepared by Alpha Analytical Laboratories of Mansfield, MA, for 6 air samples and one (1) trip blank (TB) from a residential property in Woburn, MA. The laboratory reported the data under Sample Delivery Group (SDG) No. L1108884, which was submitted as a single data package received by Phoenix on July 15, 2011, and includes the following samples:

Sample ID	Laboratory ID
AA-10M-1-06162011	L1108884-01
IA-10M-2-06162011	L1108884-02
IA-10M-1-06162011	L1108884-03
DUPIA-06162011	L1108884-04
SS-10M-2-06172011	L1108884-05
SS-10M-1-06172011	L1108884-06
TB06182011	L1108884-07

A cross-reference table of sample IDs was provided in the data package. A separate data package, SDG No. L1108049, containing the supporting documentation (clean can certifications) for the preparation and analysis of the sampling canisters, and a file (L1108884.pdf) containing the raw data for the vacuum check upon receipt and the flow controller rate checks, were also submitted on June 16 and July 15, 2011, respectively.

The samples in this data set represent the indoor air and the sub-slab soil vapor samples (matched to the indoor sampling locations) collected from June 16 to 17, 2011 in Woburn, MA inside a residential building, and an ambient air sample collected outdoors at the sample location on June 16, 2011. All samples were kept in the engineer's custody after sampling until hand-delivered by laboratory courier to the laboratory on June 18, 2011.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for naphthalene and 1,3-butadiene in all samples were qualified as estimated (J, UJ).
- Results for methyl tert-butyl ether (MTBE), toluene, ethylbenzene, and naphthalene in all samples were qualified as estimated (J, UJ).
- Results for methylene chloride in IA-10M-1-06162011 and DUPIA06162011 were qualified as estimated (J).
- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation

findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered part of the data package for all future distributions of TO - 15 SIM (volatiles in air) analysis data for SDG No. L1108884.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, as modified for Selected Ion Monitoring (SIM) in the laboratory standard operating procedure (SOP) No. A-001, and in accordance with requirements in the Quality Assurance Project Plan (QAPP) for Indoor Air Quality and Vapor Intrusion Assessment, Rev. 2, March, 2010. The target compound list was limited to the compounds listed in Form K of the QAPP, and reporting limits are as specified there.

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) and the QAPP were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the USEPA Contract Laboratory Program (CLP) or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit.

In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded in the "Validator_Qualifier" column, and are also found with the validated laboratory-applied qualifiers in the "Qualifier" column in the electronic spreadsheet contained in Attachment A.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The outdoor and indoor air samples for volatiles analysis were collected over a 24-hour period from June 16 to 17, 2011, and the matching sub-slab (soil vapor) samples were collected at mid-day on June 17, 2011 for a 30-minute period. The property is located in Woburn, MA. All analyses were performed within eleven (11) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The canisters were delivered by laboratory courier to the field sampler's possession and after sampling the canisters were hand-delivered by laboratory courier to the laboratory three days after collection ended; the canisters were kept in the field engineer's office during the intervening days. A separate data package, SDG No. L1108049, was also submitted (on June 16, 2011), containing the supporting documentation (clean can certification) for the preparation and pre-sampling cleanliness check analysis of the canisters; the raw data for the vacuum and flow controller checks, as documented in the file L1108884.pdf was submitted on June 16, 2011.

The Chain of Custody (COC) and the Canister and Flow Controller Information records show that the sample canisters were collected and transported according to method specifications.

All canisters submitted to the field for use met all applicable method requirements. Based on acceptable sampling equipment conditions at receipt, sample integrity was deemed acceptable for all samples.

Field log books containing records of height of canister intake, barometric pressure, and ambient temperature at sampling locations were not submitted for review as part of this validation effort.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analyses from SDG No. L1108884 were analyzed on a single GC/MS system identified as instrument Airlab7. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or associated standards were analyzed. All three BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form 5 summaries in the data package.

III. Initial Calibration (IC)

One IC (6/25/11) was performed on instrument Airlab7 in support of the TO-15 SIM sample analyses. The IC was performed at ten concentration levels (0.02, 0.04, 0.1, 0.2, 0.5, 1.0, 2.5, 5.0, 10, and 50 part per billion by volume [ppbv]), except that the 0.02 ppbv standard was not used for calibration of naphthalene. It was noted that a standard at 20 ppbv was also analyzed and included in the data package, but was not used in the instrument calibration. Documentation of all individual IC standards was present in the data package and relative response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form 6 summary.

Manual integrations for some target analytes, internal standards, or surrogate standards were performed in some standards and samples in this data set. The before and after ion chromatograms, the reason for the manual integration, and the analyst's initials and date were printed for each manual integration.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I, with the exception that naphthalene exhibited a 37.3 %RSD.

An Independent Calibration Verification (ICV) sample analysis at 20 ppbv was analyzed on 6/27/11. All spiked analytes were recovered within 70 – 130 % recovery of expected values in the ICV analysis, with the exception of 1,3-butadiene, which was recovered at -41.7 % recovery.

Since the reporting limit for naphthalene is set above the lowest standard used in the calibration, no actions are necessary on the basis of the modification of the initial calibration range for this compound. On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples were qualified as estimated (J, UJ). On the basis of the unacceptably low recovery in the associated ICV analysis, results for 1,3-butadiene in all samples were qualified as estimated (J, UJ).

IV. Continuing Calibration (CC)

One continuing calibration (CC) standard performed on 6/29/11 was reported in support of the TO-15 SIM sample analyses reported in this data package; this analysis is also reported as the laboratory control sample analysis for this analytical window. Since this is an independent standard, this is acceptable, although redundant. Sample results were properly reported using the average RRF of the calibration curve for quantitation. Documentation of the standard analysis was present, and RRF as well as percent difference (%D) values were reported on the Form 7 summary within the data package. All RRF values were above the 0.05 minimum criterion, and all %D values were below the maximum limit (25%) specified by Region 1, with the following exceptions:

Table 1. Continuing Calibration (CC) Standard Exceedances

CC Date & Time	Analyte	%D	Associated Samples
6/29/11 14:07	methyl tert-butyl ether (MTBE)	+26.9	all samples
	toluene	+27.1	
	ethylbenzene	+25.8	
	naphthalene	-27.2	

It should be noted that a positive % D value (the CC response factor is less than the IC response factor) will result in a low bias for positive detects, and a negative % D will result in a high bias for positive detects.

On the basis of the unacceptably high %D values in the associated CC standard, results for methyl tert-butyl ether (MTBE), toluene, ethylbenzene, and naphthalene in all samples were qualified as estimated (J, UJ).

V. Blanks

Results for one air-matrix laboratory method blank (MB) were reported in association with the TO-15 SIM sample analyses. No target compounds were found in the MB.

One trip blank (TB), which was used as a field blank, was reported in this data package. The date of collection for the TB was set as 6/18/11, since it was used for sample canisters collected between 6/16/11 and 6/18/11 at two locations submitted to the lab at the same time. No target compounds were found in the TB.

Neither a trip blank nor a field blank is required for Method TO-15.

VI. Surrogate Compounds

No surrogate compounds are used in these methods.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

VIII. Laboratory Duplicates

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method. A laboratory duplicate analysis of a field sample (matrix duplicate) analysis is also not required but was performed per laboratory protocols. Sample SS-10M-1-06172011 was reported for laboratory duplicate analysis (WG476109-5). Relative percent difference (RPD) values were reported on a Form 3 summary within the data package.

Precision in the laboratory duplicate analyses (5.5 %RPD) was acceptable (less than 30 % RPD, for the single analyte greater than five times the reporting limit, on the basis of professional judgment).

IX. Field Duplicates

One field duplicate pair was collected in this sample set. Sample IA-10M-1-06162011 was identified as the field duplicate of DUPIA06162011.

Relative percent difference (RPD) values for compounds detected at greater than five times the quantitation limit in at least one member of a field duplicate pair must be less than 25 %RPD as per the QAPP. Precision in the field duplicate pair(range, 0 – 5.2 %RPD) was acceptable (less than 30 %RPD for all analytes greater than five times the reporting limit, on the basis of professional judgment), with the exception of methylene chloride (153 %RPD).

On the basis of unacceptable precision in the field duplicate pair, results for methylene chloride in IA-10M-1-06162011 and DUPIA06162011 were qualified as estimated (J).

X. Sensitivity Check

An MDL study for the TO-15 SIM method was analyzed by the laboratory on May 7, 2009, and the most recent verification study was performed between February 3 and 4, 2010. All target analytes in the statistical study had calculated MDLs below the method quantitation limits (QLs), and demonstrated acceptable ratios (at least 3:1) of the QL to the MDL. The QLs are also supported by the low concentration standard (at 0.020 ppbv) in the initial calibration.

Project objectives required a low reporting limit (RL) for naphthalene, and in order to achieve project objectives for detection limits, the analytes 1,2-dibromoethane (EDB), bromodichloromethane, and naphthalene were evaluated by the laboratory down to one-half the RL; concentrations between one-half the RL and the RL were reported with a "J" qualifier to indicate that this was an estimated concentration on the Form 1 summaries; results below the QL were only detected for naphthalene in this sample set.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the MDL study and supported by the initial calibration, all results for the TO-15 SIM method (detects and non-detects) not qualified for other reasons are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

One zero blind PE samples (commonly known as a laboratory control sample, LCS) was prepared and analyzed by the laboratory in support of the TO-15 SIM sample analyses; this analysis was also reported as the CC standard analysis for this data set. All target analytes were spiked into the QC sample at 20 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form 3 summary in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes. No spiked duplicate analyses were performed for either method, so laboratory precision was not evaluated using spiked analyses.

No external single-blind PES sample for either method was required or submitted with the samples in this data set.

Since all samples in this data set were previously qualiifed for the unacceptably low recovery of 1,3 – butadiene in this analysis (as an ICV), no further qualifications were applied.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form 1 summaries. Results below the RL are not reported by the laboratory for this method. However, at the client's request, positive results for naphthalene, bromodichloromethane, and 1,2-dibromoethane (EDB) were evaluated down to one-half the RL, and reported with a "J" qualifier by the laboratory on the Form 1s.

One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.261 ug/m^3. No qualifications were deemed necessary on the basis of the RL slightly above that specified in the QAPP for total xylenes, since this concentration is still well below the risk screening level.

The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers (results below the QL were only detected for naphthalene in this sample set).

The values that the validator has judged to be acceptable are presented on the electronic deliverable generated from the project database (Attachment A). Qualifiers applied by the validator during the validation effort have been listed on the electronic spreadsheet in an additional column labeled "Validator_Qualifier". The column labeled "Qualifier" contains both qualifiers applied by the laboratory and those applied by the validator; all qualifiers in this column have been accepted or changed during the validation effort. The column labeled "PreValidationFlag", which is generated by the database utility, also indicates which qualifiers were changed by the validator. Sample-specific quantitation limits may be found on the Form 1 for each sample or in the electronic deliverable (Attachment A, column "ReportingLimit").

The Form 1s submitted in the data package present results in units of ug/m^3 as well as in ppbv. Results are also presented almost entirely in units of ug/m^3 in the electronic data deliverable (EDD). Both the forms and the EDD were examined during the data validation process.

All positive results are listed on the electronic data deliverable, whether or not the value or qualifier was changed as a result of the validation. All non-detected results are listed on the electronic data deliverable with a Qualifier of "U" or "UJ"; these are also found as less-than (<) values in the "TextResult" column. If the reported result value was changed during the validation effort from a positive result to a value representing a concentration not detected at or below, the value representing the new reporting limit is reported as the Result with a Validator Qualifier of "U" or "UJ" and a "<" sign in the "TextResult" column.

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working acceptably, based on instrument printouts and spectral quality.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples were qualified as estimated (J, UJ).
- On the basis of the unacceptably low recovery in the associated ICV analysis, results for 1,3-butadiene in all samples were qualified as estimated (UJ).
- On the basis of the unacceptably high %D values in the associated CC standard, results for methyl tert-butyl ether (MTBE), toluene, ethylbenzene, and naphthalene in all samples were qualified as estimated (J, UJ).
- On the basis of unacceptable precision in the field duplicate pair, results for methylene chloride in IA-10M-1-06162011 and DUPIA06162011 were qualified as estimated (J).
- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

XVII. Documentation

The required records for canister cleanliness were submitted as a separate data package, SDG No. L1108049, and all required records were properly included with this data package. Canister cleanliness and auxiliary equipment status was acceptable upon release from the laboratory, and appropriate checks and actions were performed as required upon sample and equipment receipt.

The chain of custody (COC) records were present and accurately completed for all reported samples.

Data presentation was acceptable, with the following observation:

- One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.261 ug/m^3.

This validation report should be considered part of the data package for all future distributions of the TO-15 SIM (volatiles in air) analysis data for SDG No. L1108884.

ATTACHMENT A

ELECTRONIC DELIVERABLE (EDD)
SDG No. L1108884
Selected Volatiles in Air Samples
(submitted electronically)

Phoenix Chemistry Services

Aug. 8, 2011

Nadine Weinberg
ARCADIS, U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Reference #s: 2011-0705-001 & -002, and 2011-0715-001 & -002

Dear Nadine,

Phoenix Chemistry Services has submitted four reports on August 4 - 5, 2011 presenting the results of the data validation of Sample Delivery Group (SD) Nos. L1108879, L1108880, L1108884, and L1108885 from the Indoor Air Quality/Vapor Intrusion (IAQ/VI) assessment work at several residential and/or commercial properties in Woburn, MA. The indoor and outdoor air and sub-slab vapor samples in these SDGs were collected June 16 - 18, 2011. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA.

The data packages and electronic deliverables were received on July 5 and 15, 2011. Two separate data packages for the canister certifications (SDG Nos. L1108049 and L1108435), and associated files L1108879.pdf, L1108880.pdf, L1108884.pdf, L1108885A.pdf, and L1108885B.pdf were received on June 16, 2011. The validation has been performed by Phoenix Chemistry Services according to the Tier III guidelines as defined by USEPA Region I, as presented in "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. The EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999), the IAQ/VI Quality Assurance Project Plan (QAPP), and the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate. Data qualifiers have been applied in the final validation report as necessary and appropriate, in accordance with these guidelines.

The samples in these four data packages were collected as a single sampling round, and utilized shared quality control (QC) samples, including two trip blanks, four outdoor air samples, four field duplicate pairs, and two laboratory replicates. The trip blanks and laboratory replicates were each logged in and reported in at least two data packages to avoid collecting redundant QC samples, as requested by the field engineer. Only one set of results for these QC samples was retained in the project database to avoid duplications; the earliest laboratory identifier was selected to be validated and reported. The laboratory is maintaining the original reporting packages.

A reporting error was noted in the clean canister certification package SDG No. L1108435; an incorrect copy of the initial calibration was included in the raw data section, and the continuing calibration presented incorrect percent difference values, as the compounds were evaluated against the incorrect initial calibration. The laboratory quickly responded to the validator's request for a copy of the missing initial calibration, however, a revision of the data package with the corrected continuing calibration has not yet been received (the validator performed the checks manually after receiving the correct initial calibration). The laboratory should be reminded that this is still outstanding.

Thank you for this opportunity to provide data validation services to ARCADIS. If there are any questions or concerns about the material in this report, please do not hesitate to contact me for help and clarification.

Sincerely,

Deborah H. Gaynor, Ph.D.
Principal, Phoenix Chemistry Services

Phoenix Chemistry Services | 126 Covered Bridge Road | North Ferrisburg | Vermont | 05473
Telephone: (802) 233-2473 | Website: www.phoenixchemistryservices.com | Email: dgaynor@phoenixchemistryservices.com

DATA VALIDATION

FOR

UniFirst-Woburn Vapor Intrusion Assessment
Woburn, MA

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
L1108879

Chemical Analyses Performed by:

Alpha Analytical Laboratories, Inc.
320 Forbes Blvd.
Mansfield, MA 02048

FOR

ARCADIS U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
Aug. 4, 2011

Reference #2011-0704-001
VOA Air Validation Report/L1108879/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the Method TO-15 Selected Ion Monitoring (SIM) volatiles in air analysis data prepared by Alpha Analytical Laboratories of Mansfield, MA, for 6 air samples and one (1) trip blank (TB) from a residential property in Woburn, MA. The laboratory reported the data under Sample Delivery Group (SDG) No. L1108879, which was submitted as a single data package received by Phoenix on July 4, 2011, and includes the following samples:

Sample ID	Laboratory ID
AA-57O-1-06162011	L1108879-01
IA-7O-3-06162011	L1108879-02
IA-7O-2-06162011	L1108879-03
IA-7O-1-06162011	L1108879-04
SS-7O-1-06162011	L1108879-05
SS-7O-2-06162011	L1108879-06
TB06172011	L1108879-07

A cross-reference table of sample IDs was provided in the data package. A separate data package, SDG No. L1108049, containing the supporting documentation (clean can certifications) for the preparation and analysis of the sampling canisters, and a file (L1108879.pdf) containing the raw data for the vacuum check upon receipt and the flow controller rate checks, were also submitted on June 16 and July 4, 2011, respectively.

The samples in this data set represent the indoor air and the sub-slab soil vapor samples (matched to the indoor sampling locations) collected from June 16 to 17, 2011 in Woburn, MA inside a residential building, and an ambient air sample collected outdoors at the sample location on June 16, 2011. All samples were kept in the engineer's custody after sampling until hand-delivered by laboratory courier to the laboratory on June 18, 2011.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for naphthalene and 1,3-butadiene in all samples were qualified as estimated (J, UJ).
- Positive results greater than the sample-specific (adjusted) quantitation limit but less than the action limit (at twice the detected concentration) for methylene chloride in samples AA-570-1-06162011, IA-70-3-06162011, IA-70-2-06162011, IA-70-1-06162011, and SS-70-1-06172011, and for toluene in SS-70-1-06172011 were qualified as less than the reported value (U).
- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered part of the data package for all future distributions of TO - 15 SIM (volatiles in air) analysis data for SDG No. L1108879.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, as modified for Selected Ion Monitoring (SIM) in the laboratory standard operating procedure (SOP) No. A-001, and in accordance with requirements in the Quality Assurance Project Plan (QAPP) for Indoor Air Quality and Vapor Intrusion Assessment, Rev. 2, March, 2010. The target compound list was limited to the compounds listed in Form K of the QAPP, and reporting limits are as specified there.

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) and the QAPP were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the USEPA Contract Laboratory Program (CLP) or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit.

In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded in the "Validator_Qualifier" column, and are also found with the validated laboratory-applied qualifiers in the "Qualifier" column in the electronic spreadsheet contained in Attachment A.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The outdoor and indoor air samples for volatiles analysis were collected over a 24-hour period from June 16 to 17, 2011, and the matching sub-slab (soil vapor) samples were collected at mid-day on June 17, 2011 for a 30-minute period. The property is located in Woburn, MA. All analyses were performed within eleven (11) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The canisters were delivered by laboratory courier to the field sampler's possession and after sampling the canisters were hand-delivered by laboratory courier to the laboratory three days after collection ended; the canisters were kept in the field engineer's office during the intervening days. A separate data package, SDG No. L1108049, was also submitted (on June 16, 2011), containing the supporting documentation (clean can certification) for the preparation and pre-sampling cleanliness check analysis of the canisters; the raw data for the vacuum and flow controller checks, as documented in the file L1108879.pdf was submitted on June 16, 2011.

The Chain of Custody (COC) and the Canister and Flow Controller Information records show that the sample canisters were collected and transported according to method specifications.

All canisters submitted to the field for use met all applicable method requirements. Based on acceptable sampling equipment conditions at receipt, sample integrity was deemed acceptable for all samples.

Field log books containing records of height of canister intake, barometric pressure, and ambient temperature at sampling locations were not submitted for review as part of this validation effort.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analyses from SDG No. L1108879 were analyzed on a single GC/MS system identified as instrument Airlab7. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or associated standards were analyzed. Both BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form 5 summaries in the data package.

III. Initial Calibration (IC)

One IC (6/25/11) was performed on instrument Airlab7 in support of the TO-15 SIM sample analyses. The IC was performed at ten concentration levels (0.02, 0.04, 0.1, 0.2, 0.5, 1.0, 2.5, 5.0, 10, and 50 part per billion by volume [ppbv]), except that the 0.02 ppbv standard was not used for calibration of naphthalene. It was noted that a standard at 20 ppbv was also analyzed and included in the data package, but was not used in the instrument calibration. Documentation of all individual IC standards was present in the data package and relative response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form 6 summary.

Manual integrations for some target analytes, internal standards, or surrogate standards were performed in some standards and samples in this data set. The before and after ion chromatograms, the reason for the manual integration, and the analyst's initials and date were printed for each manual integration.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I, with the exception that naphthalene exhibited a 37.3 %RSD.

An Independent Calibration Verification (ICV) sample analysis at 20 ppbv was analyzed on 6/27/11. All spiked analytes were recovered within 70 – 130 % recovery of expected values in the ICV analysis, with the exception of 1,3-butadiene, which was recovered at -41.7 % recovery.

Since the reporting limit for naphthalene is set above the lowest standard used in the calibration, no actions are necessary on the basis of the modification of the initial calibration range for this compound. On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples were qualified as estimated (J, UJ). On the basis of the unacceptably low recovery in the associated ICV analysis, results for 1,3-butadiene in all samples were qualified as estimated (UJ).

IV. Continuing Calibration (CC)

One continuing calibration (CC) standard was reported in support of the TO-15 SIM sample analyses reported in this data package; this analysis is also reported as the ICV and as the laboratory control sample analysis for this analytical window. Since this is an independent standard, this is acceptable, although redundant. Sample results were properly reported using the average RRF of the calibration curve for quantitation. Documentation of the standard analysis was present, and RRF as well as percent difference (%D) values were reported on the Form 7 summary within the data package. All RRF values were above the 0.05 minimum criterion, and all %D values were below the maximum limit (25%) specified by Region 1, with the exception of 1,3-butadiene, which exhibited a -41.7 %D.

It should be noted that a positive % D value (the CC response factor is <u>less than</u> the IC response factor) will result in a low bias for positive detects, and a negative % D will result in a high bias for positive detects.

Since results for 1,3-butadiene in all samples were previously qualified for this analysis on the basis of ICV criteria, no further qualifications were applied.

V. Blanks

Results for one air-matrix laboratory method blank (MB) were reported in association with the TO-15 SIM sample analyses. No target compounds were found in the MB.

One trip blank (TB), which was used as a field blank, was reported in this data package. No target compounds were found in the TB, with the exceptions of methylene chloride (9.20 ppbv), and toluene (0.094 ppbv), which are both above their respective quantitation limits (0.50 and 0.050 ppbv).

Neither a trip blank nor a field blank is required for Method TO-15.

On the basis of field contamination and professional judgment, positive results greater than the sample-specific (adjusted) quantitation limit but less than the action limit (at twice the detected concentration) for methylene chloride in samples AA-570-1-06162011, IA-70-3-06162011, IA-70-2-06162011, IA-70-1-06162011, and SS-70-1-06172011, and for toluene in SS-70-1-06172011 were qualified as less than the reported value (U).

VI. Surrogate Compounds

No surrogate compounds are used in these methods.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

VIII. Laboratory Duplicates

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method. A laboratory duplicate analysis of a field sample (matrix duplicate) analysis is also not required but was performed per laboratory protocols. Sample IA-7O-3-06162011 was reported for laboratory duplicate analysis (WG475607-5). Relative percent difference (RPD) values were reported on a Form 3 summary within the data package.

Precision in the laboratory duplicate analyses (6.8 – 11.5 %RPD) was acceptable (less than 30 % RPD, for all analytes greater than five times the reporting limit) on the basis of professional judgment.

IX. Field Duplicates

One field duplicate pair was collected on 6/17/11 from a nearby location as part of this sample set, and reported separately in SDG No. L1108880.

Relative percent difference (RPD) values for compounds detected at greater than five times the quantitation limit in at least one member of a field duplicate pair must be less than 25 %RPD as per the QAPP. Precision in the field duplicate pair for naphthalene, the only detected analyte meeting threshold criteria, was acceptable (2.9 %RPD).

X. Sensitivity Check

An MDL study for the TO-15 SIM method was analyzed by the laboratory on May 7, 2009, and the most recent verification study was performed between February 3 and 4, 2010. All target analytes in the statistical study had calculated MDLs below the method quantitation limits (QLs), and demonstrated acceptable ratios (at least 3:1) of the QL to the MDL. The QLs are also supported by the low concentration

standard (at 0.020 ppbv) in the initial calibration.

Project objectives required a low reporting limit (RL) for naphthalene, and in order to achieve project objectives for detection limits, the analytes 1,2-dibromoethane (EDB), bromodichloromethane, and naphthalene were evaluated by the laboratory down to one-half the RL; concentrations between one-half the RL and the RL were reported with a "J" qualifier to indicate that this was an estimated concentration on the Form 1 summaries; results below the QL were only detected for naphthalene in this sample set.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the MDL study and supported by the initial calibration, all results for the TO-15 SIM method (detects and non-detects) not qualified for other reasons are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

One zero blind PE samples (commonly known as a laboratory control sample, LCS) was prepared and analyzed by the laboratory in support of the TO-15 SIM sample analyses; this analysis was also reported as the ICV and as the CC standard analysis for this data set. All target analytes were spiked into the QC samples at 20 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form 3 summary in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes, with the exception (previously noted) of 1,3-butadiene, which was recvored at -41.7 %. No spiked duplicate analyses were performed for either method, so laboratory precision was not evaluated using spiked analyses.

No external single-blind PES sample for either method was required or submitted with the samples in this data set.

Since all samples in this data set were previously qualiifed for the unacceptably low recovery of 1,3 – butadiene in this analysis (as an ICV), no further qualifications were applied.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form 1 summaries. Results below the RL are not reported by the laboratory for this method. However, at the client's request, positive results for naphthalene, bromodichloromethane, and 1,2-dibromoethane (EDB) were evaluated down to one-half the RL, and reported with a "J" qualifier by the laboratory on the Form 1s.

One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.261 ug/m^3. No qualifications were deemed necessary on the basis of the RL slightly above that specified in the QAPP for total xylenes, since this concentration is still well below the risk screening level.

The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers (results below the QL were only detected for naphthalene in this sample set).

The values that the validator has judged to be acceptable are presented on the electronic deliverable generated from the project database (Attachment A). Qualifiers applied by the validator during the validation effort have been listed on the electronic spreadsheet in an additional column labeled "Validator_Qualifier". The column labeled "Qualifier" contains both qualifiers applied by the laboratory and those applied by the validator; all qualifiers in this column have been accepted or changed during the validation effort. The column labeled "PreValidationFlag", which is generated by the database utility, also indicates which qualifiers were changed by the validator. Sample-specific quantitation limits may be found on the Form 1 for each sample or in the electronic deliverable (Attachment A, column "ReportingLimit").

The Form 1s submitted in the data package present results in units of ug/m^3 as well as in ppbv. Results are also presented almost entirely in units of ug/m^3 in the electronic data deliverable (EDD). Both the forms and the EDD were examined during the data validation process.

All positive results are listed on the electronic data deliverable, whether or not the value or qualifier was changed as a result of the validation. All non-detected results are listed on the electronic data deliverable with a Qualifier of "U" or "UJ"; these are also found as less-than (<) values in the "TextResult" column. If the reported result value was changed during the validation effort from a positive result to a value representing a concentration not detected at or below, the value representing the new reporting limit is reported as the Result with a Validator Qualifier of "U" or "UJ" and a "<" sign in the "TextResult" column.

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working acceptably, based on instrument printouts and spectral quality.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples were qualified as estimated (J, UJ).

- On the basis of the unacceptably low recovery in the associated ICV analysis, results for 1,3-

butadiene in all samples were qualified as estimated (UJ).

- On the basis of field contamination and professional judgment, positive results greater than the sample-specific (adjusted) quantitation limit but less than the action limit (at twice the detected concentration) for methylene chloride in samples AA-570-1-06162011, IA-70-3-06162011, IA-70-2-06162011, IA-70-1-06162011, and SS-70-1-06172011, and for toluene in SS-70-1-06172011 were qualified as less than the reported value (U).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers.

XVII. Documentation

The required records for canister cleanliness were submitted as a separate data package, SDG No. L1108049, and all required records were properly included with this data package. Canister cleanliness and auxiliary equipment status was acceptable upon release from the laboratory, and appropriate checks and actions were performed as required upon sample and equipment receipt.

The chain of custody (COC) records were present and accurately completed for all reported samples.

Data presentation was acceptable, with the following observation:

- One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.261 ug/m^3.

This validation report should be considered part of the data package for all future distributions of the TO-15 SIM (volatiles in air) analysis data for SDG No. L1108879.

ATTACHMENT A

ELECTRONIC DELIVERABLE (EDD)
SDG No. L1108879
Selected Volatiles in Air Samples
(submitted electronically)

Phoenix Chemistry Services

Aug. 8, 2011

Nadine Weinberg
ARCADIS, U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Reference #s: 2011-0705-001 & -002, and 2011-0715-001 & -002

Dear Nadine,

Phoenix Chemistry Services has submitted four reports on August 4 - 5, 2011 presenting the results of the data validation of Sample Delivery Group (SD) Nos. L1108879, L1108880, L1108884, and L1108885 from the Indoor Air Quality/Vapor Intrusion (IAQ/VI) assessment work at several residential and/or commercial properties in Woburn, MA. The indoor and outdoor air and sub-slab vapor samples in these SDGs were collected June 16 - 18, 2011. The laboratory analyses were performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA.

The data packages and electronic deliverables were received on July 5 and 15, 2011. Two separate data packages for the canister certifications (SDG Nos. L1108049 and L1108435), and associated files L1108879.pdf, L1108880.pdf, L1108884.pdf, L1108885A.pdf, and L1108885B.pdf were received on June 16, 2011. The validation has been performed by Phoenix Chemistry Services according to the Tier III guidelines as defined by USEPA Region I, as presented in "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. The EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-99/008, October, 1999), the IAQ/VI Quality Assurance Project Plan (QAPP), and the Field-Laboratory Coordination Memorandum (Phoenix Chemistry Services, March 25, 2010) were also considered during the evaluation, and professional judgment was applied as necessary and appropriate. Data qualifiers have been applied in the final validation report as necessary and appropriate, in accordance with these guidelines.

The samples in these four data packages were collected as a single sampling round, and utilized shared quality control (QC) samples, including two trip blanks, four outdoor air samples, four field duplicate pairs, and two laboratory replicates. The trip blanks and laboratory replicates were each logged in and reported in at least two data packages to avoid collecting redundant QC samples, as requested by the field engineer. Only one set of results for these QC samples was retained in the project database to avoid duplications; the earliest laboratory identifier was selected to be validated and reported. The laboratory is maintaining the original reporting packages.

A reporting error was noted in the clean canister certification package SDG No. L1108435; an incorrect copy of the initial calibration was included in the raw data section, and the continuing calibration presented incorrect percent difference values, as the compounds were evaluated against the incorrect initial calibration. The laboratory quickly responded to the validator's request for a copy of the missing initial calibration, however, a revision of the data package with the corrected continuing calibration has not yet been received (the validator performed the checks manually after receiving the correct initial calibration). The laboratory should be reminded that this is still outstanding.

Thank you for this opportunity to provide data validation services to ARCADIS. If there are any questions or concerns about the material in this report, please do not hesitate to contact me for help and clarification.

Sincerely,

Deborah H. Gaynor, Ph.D.
Principal, Phoenix Chemistry Services

Phoenix Chemistry Services | 126 Covered Bridge Road | North Ferrisburg | Vermont | 05473
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DATA VALIDATION

FOR

UniFirst-Woburn Vapor Intrusion Assessment
Woburn, MA

ORGANIC ANALYSIS DATA
Selected Volatiles in Air Samples

Sample Delivery Group (SDG) No.
L1108880

Chemical Analyses Performed by:

Alpha Analytical Laboratories, Inc.
320 Forbes Blvd.
Mansfield, MA 02048

FOR

ARCADIS U.S., Inc.
482 Congress Street, Suite 501
Portland, ME 04101

Data Validation Report by:

Phoenix Chemistry Services
126 Covered Bridge Rd.
N. Ferrisburg, VT 05473
(802) 233-2473
Aug. 4, 2011

Reference #2011-0704-002
VOA Air Validation Report/L1108880/dhg

EXECUTIVE SUMMARY

Phoenix Chemistry Services (Phoenix) has completed the validation of the Method TO-15 Selected Ion Monitoring (SIM) volatiles in air analysis data prepared by Alpha Analytical Laboratories of Mansfield, MA, for 5 air samples from a residential property in Woburn, MA. The laboratory reported the data under Sample Delivery Group (SDG*)* No. L1108880, which was submitted as a single data package received by Phoenix on July 4, 2011, and includes the following samples:

Sample ID	Laboratory ID
IA-5O-4-06162011	L1108880-02
IA-5O-5-06162011	L1108880-03
SS-5O-4-06162011	L1108880-04
DUPSS06172011	L1108880-05
SS-5O-5-06162011	L1108880-06

A cross-reference table of sample IDs was provided in the data package. A separate data package, SDG No. L1108049, containing the supporting documentation (clean can certifications) for the preparation and analysis of the sampling canisters, and a file (L1108880.pdf) containing the raw data for the vacuum check upon receipt and the flow controller rate checks, were also submitted on June 16 and July 4, 2011, respectively.

The samples in this data set represent the indoor air and the sub-slab soil vapor samples (matched to the indoor sampling locations) collected from June 16 to 17, 2011 in Woburn, MA inside a residential building; a trip blank and an ambient air sample collected outdoors at this sample location on June 16, 2011 were reported separately (SDG No. L1108879) but will be discussed in this report. All samples were kept in the engineer's custody after sampling until hand-delivered by laboratory courier to the laboratory on June 18, 2011.

Findings of the validation effort resulted in the following qualifications of sample results:

- Results for naphthalene and 1,3-butadiene in all samples were qualified as estimated (J, UJ).

- Positive results greater than the sample-specific (adjusted) quantitation limit but less than the action limit (at twice the detected concentration) for methylene chloride in samples in the outdoor air sample submitted separately in SDG No. L1108879, and for toluene in samples SS-50-4-06172011, DUPSS06172011, and SS-50-5-06172011 were qualified as less than the reported value (U).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers; however, no results below the QL were detected for any samples in this sample set.

The Overall Evaluation of Data (Section XVI) summarizes the validation results. The validation findings and conclusions for each analytical parameter are detailed in the remaining sections of this report.

Documentation problems observed in the data package are described in Section XVII.

This validation report shall be considered part of the data package for all future distributions of TO - 15 SIM (volatiles in air) analysis data for SDG No. L1108880.

INTRODUCTION

Analyses of selected volatiles in air samples were performed according to Method TO-15, as modified for Selected Ion Monitoring (SIM) in the laboratory standard operating procedure (SOP) No. A-001, and in accordance with requirements in the Quality Assurance Project Plan (QAPP) for Indoor Air Quality and Vapor Intrusion Assessment, Rev. 2, March, 2010. The target compound list was limited to the compounds listed in Form K of the QAPP, and reporting limits are as specified there.

Tentative identification of non-target analyte peaks (i.e., tentatively identified compounds, or TICs) was not requested for these analyses.

Phoenix's validation was performed in conformance with Tier III guidelines as defined by USEPA Region I. Data qualifiers are applied as necessary and appropriate. To the extent possible, the data were evaluated in accordance with the "Region I EPA-NE Data Validation Functional Guidelines for Evaluating Environmental Analyses", December, 1996. EPA's National Functional Guidelines for Organic Data Review (EPA 540/R-94/012, 2/94) and the QAPP were also considered during the evaluation, and professional judgment was applied as necessary and appropriate.

The data validation process evaluates data on a technical basis for chemical analyses conducted under the USEPA Contract Laboratory Program (CLP) or other well-defined methods. Contract compliance is evaluated only in specific situations. Issues pertaining to contractual compliance are noted where applicable. It is assumed that the data package is presented in accordance with the CLP requirements. It is also assumed that the data package represents the best efforts of the laboratory and has already been subjected to adequate and sufficient quality review prior to submission for validation.

Results of sample analyses are reported by the laboratory as either qualified or unqualified; various qualifier codes are used by the laboratory to denote specific information regarding the analytical results. During the validation process, laboratory data are verified against all available supporting documentation. Based on this evaluation, qualifier codes may be added, deleted or modified by the data validator. Raw data is examined in detail to check calculations, compound identification, and/or transcription errors. Validated results are either qualified or unqualified; if results are unqualified, this means that the reported values may be used without reservation. Final validated results are annotated with the following codes, as defined in the EPA Region I Functional Guidelines:

U - The analyte was analyzed for, but was not detected. The associated numerical value is the sample quantitation limit. The sample quantitation limit accounts for sample specific dilution factors and percent solids corrections or sample sizes that deviate from those required by the method.

J - The associated numerical value is an estimated quantity.

UJ - The analyte was analyzed for, but was not detected. The sample quantitation limit is an estimated quantity.

R - The data are unusable (analyte may or may not be present). Resampling and reanalysis is necessary for verification. The R replaces the numerical value or sample quantitation limit.

In some instances (e.g., a dilution) a result may be indicated as "rejected" to avoid confusion when a more quantitatively accurate result is available.

EB, TB, BB - An analyte that was identified in an aqueous equipment (field) blank, trip blank, or bottle blank that was used to assess field contamination associated with soil/sediment samples. These qualifiers are to be applied to soil/sediment sample results only.

These codes are assigned during the validation process and are based on the data review of the results. They are recorded in the "Validator_Qualifier" column, and are also found with the validated laboratory-applied qualifiers in the "Qualifier" column in the electronic spreadsheet contained in Attachment A.

All data users should note two facts. First, **the "R" qualifier means that the laboratory-reported value is completely unusable.** The analysis is invalid due to significant quality control problems, and provides no information as to whether the compound is present or not. Rejected values should not appear on data tables because they have no useful purpose under any circumstances. Second, **no analyte concentration is guaranteed to be accurate even if all associated quality control is acceptable.** While strict quality control conformance provides well-defined confidence in the reported results, any analytical result will always contain some error.

The user is also cautioned that the validation effort is based on the materials provided by the laboratory. Software manipulation, resulting in misleading raw data printouts, cannot be routinely detected during validation; unless otherwise stated in the report, these kinds of issues are outside the scope of this review.

Detailed Findings of Measurement Error Associated with the Analytical Analysis

I. Sample Integrity

The indoor air samples for volatiles analysis were collected over a 24-hour period from June 16 to 17, 2011, and the matching sub-slab (soil vapor) samples were collected at mid-day on June 17, 2011 for a 30-minute period. The property is located in Woburn, MA. All analyses were performed within eleven (11) days after sample collection, which is within the 30 day holding time defined in Method TO-15.

The canisters were delivered by laboratory courier to the field sampler's possession and after sampling the canisters were hand-delivered by laboratory courier to the laboratory three days after collection ended; the canisters were kept in the field engineer's office during the intervening days. A separate data package, SDG No. L1108049, was also submitted (on June 16, 2011), containing the supporting documentation (clean can certification) for the preparation and pre-sampling cleanliness check analysis of the canisters; the raw data for the vacuum and flow controller checks, as documented in the file L1108880.pdf was submitted on June 16, 2011.

The Chain of Custody (COC) and the Canister and Flow Controller Information records show that the sample canisters were collected and transported according to method specifications.

All canisters submitted to the field for use met all applicable method requirements. Based on acceptable sampling equipment conditions at receipt, sample integrity was deemed acceptable for all samples.

Field log books containing records of height of canister intake, barometric pressure, and ambient temperature at sampling locations were not submitted for review as part of this validation effort.

II. GC/MS Instrument Performance Check (Tuning)

The samples for volatiles in air analyses from SDG No. L1108880 were analyzed on a single GC/MS system identified as instrument Airlab7. The tuning of this instrument was demonstrated with analysis of 4-bromofluorobenzene (BFB); tunes were analyzed for each 24-hour period during which the samples or associated standards were analyzed. Both BFB tunes were correctly calculated, within acceptance limits, and are reported accurately on the Form 5 summaries in the data package.

III. Initial Calibration (IC)

One IC (6/25/11) was performed on instrument Airlab7 in support of the TO-15 SIM sample analyses. The IC was performed at ten concentration levels (0.02, 0.04, 0.1, 0.2, 0.5, 1.0, 2.5, 5.0, 10, and 50 part per billion by volume [ppbv]), except that the 0.02 ppbv standard was not used for calibration of naphthalene. It was noted that a standard at 20 ppbv was also analyzed and included in the data package, but was not used in the instrument calibration. Documentation of all individual IC standards was present in the data package and relative response factor (RRF) as well as percent relative standard deviation (%RSD) values were correctly calculated and accurately reported on the Form 6 summary.

Manual integrations for some target analytes, internal standards, or surrogate standards were performed in some standards and samples in this data set. The before and after ion chromatograms, the reason for the manual integration, and the analyst's initials and date were printed for each manual integration.

All average RRF values were above the 0.05 minimum criterion, and all %RSDs were below the maximum limit (30%) specified by Region I, with the exception that naphthalene exhibited a 37.3 %RSD.

An Independent Calibration Verification (ICV) sample analysis at 20 ppbv was analyzed on 6/27/11. All spiked analytes were recovered within 70 – 130 % recovery of expected values in the ICV analysis, with the exception of 1,3-butadiene, which was recovered at -41.7 % recovery.

Since the reporting limit for naphthalene is set above the lowest standard used in the calibration, no actions are necessary on the basis of the modification of the initial calibration range for this compound. On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples were qualified as estimated (J, UJ). On the basis of the unacceptably low recovery in the associated ICV analysis, results for 1,3-butadiene in all samples were qualified as estimated (UJ).

IV. Continuing Calibration (CC)

One continuing calibration (CC) standard was reported in support of the TO-15 SIM sample analyses reported in this data package; this analysis is also reported as the ICV and as the laboratory control sample analysis for this analytical window. Since this is an independent standard, this is acceptable, although redundant. Sample results were properly reported using the average RRF of the calibration curve for quantitation. Documentation of the standard analysis was present, and RRF as well as percent difference (%D) values were reported on the Form 7 summary within the data package. All RRF values were above the 0.05 minimum criterion, and all %D values were below the maximum limit (25%) specified by Region 1, with the exception of 1,3-butadiene, which exhibited a -41.7 %D.

It should be noted that a positive % D value (the CC response factor is less than the IC response factor) will result in a low bias for positive detects, and a negative % D will result in a high bias for positive detects.

Since results for 1,3-butadiene in all samples were previously qualified for this analysis on the basis of ICV criteria, no further qualifications were applied.

V. Blanks

Results for one air-matrix laboratory method blank (MB) were reported in association with the TO-15 SIM sample analyses. No target compounds were found in the MB.

One trip blank (TB) identified as TB06172011, which was used as a field blank, was reported in a separate data package (SDG No. L1108879). No target compounds were found in the TB, with the exceptions of methylene chloride (9.20 ppbv), and toluene (0.094 ppbv), which are both above their respective quantitation limits (0.50 and 0.050 ppbv).

Neither a trip blank nor a field blank is required for Method TO-15.

On the basis of field contamination and professional judgment, positive results greater than the sample-specific (adjusted) quantitation limit but less than the action limit (at twice the detected concentration) for methylene chloride in the outdoor air sample submitted separately in SDG No. L1108879, and for toluene in samples SS-50-4-06172011, DUPSS06172011, and SS-50-5-06172011 were qualified as less than the reported value (U).

VI. Surrogate Compounds

No surrogate compounds are used in these methods.

VII. Internal Standards (IS)

All IS areas and retention times (RT) were within the established QC limits for all reported sample analyses in this data package.

VIII. Laboratory Duplicates

A matrix spike/matrix spike duplicate (MS/MSD) analysis is not used in this method. A laboratory duplicate analysis of a field sample (matrix duplicate) analysis is also not required but was performed per laboratory protocols. A laboratory duplicate was selected from the samples collected during the same sampling set on June 16-17, 2011, and reported in SDG No. L1108879. Relative percent difference (RPD) values were reported on a Form 3 summary within that data package.

Precision in the laboratory duplicate analyses (6.8 – 11.5 %RPD) was acceptable (less than 30 % RPD, for all analytes greater than five times the reporting limit) on the basis of professional judgment.

IX. Field Duplicates

One field duplicate pair was reported in this sample set. Sample DUPSS06162011 was identified as the field duplicate of sample SS-5O-4-06162011.

Relative percent difference (RPD) values for compounds detected at greater than five times the quantitation limit in at least one member of a field duplicate pair must be less than 25 %RPD as per the QAPP. Precision in the field duplicate pair for naphthalene, the only detected analyte meeting threshold criteria, was acceptable (2.9 %RPD).

X. Sensitivity Check

An MDL study for the TO-15 SIM method was analyzed by the laboratory on May 7, 2009, and the most recent verification study was performed between February 3 and 4, 2010. All target analytes in the

statistical study had calculated MDLs below the method quantitation limits (QLs), and demonstrated acceptable ratios (at least 3:1) of the QL to the MDL. The QLs are also supported by the low concentration standard (at 0.020 ppbv) in the initial calibration.

Project objectives required a low reporting limit (RL) for naphthalene, and in order to achieve project objectives for detection limits, the analytes 1,2-dibromoethane (EDB), bromodichloromethane, and naphthalene were evaluated by the laboratory down to one-half the RL; concentrations between one-half the RL and the RL were reported with a "J" qualifier to indicate that this was an estimated concentration on the Form 1 summaries; results below the QL were only detected for naphthalene in this sample set.

On the basis of acceptable sensitivity and accuracy, as demonstrated by the MDL study and supported by the initial calibration, all results for the TO-15 SIM method (detects and non-detects) not qualified for other reasons are deemed acceptable as reported.

XI. Performance Evaluation Samples (PES)/Accuracy Check

One zero blind PE samples (commonly known as a laboratory control sample, LCS) was prepared and analyzed by the laboratory in support of the TO-15 SIM sample analyses; this analysis was also reported as the ICV and as the CC standard analysis for this data set. All target analytes were spiked into the QC samples at 20 ppbv. Percent recoveries (%R) were correctly calculated for the spiked compounds, accurately reported on the Form 3 summary in the data package, and were within the laboratory established QC limits (70 - 130 %R) for all target analytes, with the exception (previously noted) of 1,3-butadiene, which was recvored at -41.7 %. No spiked duplicate analyses were performed for either method, so laboratory precision was not evaluated using spiked analyses.

No external single-blind PES sample for either method was required or submitted with the samples in this data set.

Since all samples in this data set were previously qualiifed for the unacceptably low recovery of 1,3 – butadiene in this analysis (as an ICV), no further qualifications were applied.

XII. Target Compound Identification

Reported target compounds were correctly identified for all samples in this data set.

XIII. Compound Quantitation and Reported Quantitation Limits

Target compound quantitation and practical quantitation limits (PQLs) were accurately reported on the Form 1 summaries. Results below the RL are not reported by the laboratory for this method. However, at the client's request, positive results for naphthalene, bromodichloromethane, and 1,2-dibromoethane (EDB) were evaluated down to one-half the RL, and reported with a "J" qualifier by the laboratory on the Form 1s.

One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.261 ug/m^3. No qualifications were deemed necessary on

the basis of the RL slightly above that specified in the QAPP for total xylenes, since this concentration is still well below the risk screening level.

The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers (no results below the QL were detected for any samples in this sample set).

The values that the validator has judged to be acceptable are presented on the electronic deliverable generated from the project database (Attachment A). Qualifiers applied by the validator during the validation effort have been listed on the electronic spreadsheet in an additional column labeled "Validator_Qualifier". The column labeled "Qualifier" contains both qualifiers applied by the laboratory and those applied by the validator; all qualifiers in this column have been accepted or changed during the validation effort. The column labeled "PreValidationFlag", which is generated by the database utility, also indicates which qualifiers were changed by the validator. Sample-specific quantitation limits may be found on the Form 1 for each sample or in the electronic deliverable (Attachment A, column "ReportingLimit").

The Form 1s submitted in the data package present results in units of ug/m^3 as well as in ppbv. Results are also presented almost entirely in units of ug/m^3 in the electronic data deliverable (EDD). Both the forms and the EDD were examined during the data validation process.

All positive results are listed on the electronic data deliverable, whether or not the value or qualifier was changed as a result of the validation. All non-detected results are listed on the electronic data deliverable with a Qualifier of "U" or "UJ"; these are also found as less-than (<) values in the "TextResult" column. If the reported result value was changed during the validation effort from a positive result to a value representing a concentration not detected at or below, the value representing the new reporting limit is reported as the Result with a Validator Qualifier of "U" or "UJ" and a "<" sign in the "TextResult" column.

XIV. Tentatively Identified Compounds (TICs)

Evaluation of unidentified, non-target analyte peaks was not requested or performed for these samples.

XV. System Performance

The analytical system appears to have been working acceptably, based on instrument printouts and spectral quality.

XVI. Overall Evaluation of Data

Findings of the validation effort resulted in the following qualifications:

- On the basis of the unacceptably high %RSD value in the associated IC, results for naphthalene in all samples were qualified as estimated (J, UJ).

- On the basis of the unacceptably low recovery in the associated ICV analysis, results for 1,3-butadiene in all samples were qualified as estimated (UJ).

- On the basis of field contamination and professional judgment, positive results greater than the sample-specific (adjusted) quantitation limit but less than the action limit (at twice the detected concentration) for methylene chloride in the outdoor air sample submitted separately in SDG No. L1108879, and for toluene in samples SS-50-4-06172011, DUPSS06172011, and SS-50-5-06172011 were qualified as less than the reported value (U).

- The laboratory appropriately applied "J" qualifiers to the CLP-like sample Form 1s when the concentration of an analyte was less than the sample-specific QL for the analytes naphthalene, 1,2-dibromoethane, and bromodichloromethane in the TO-15 SIM analysis. The validator did not remove these qualifiers; however, no results below the QL were detected for any samples in this sample set.

XVII. Documentation

The required records for canister cleanliness were submitted as a separate data package, SDG No. L1108049, and all required records were properly included with this data package. Canister cleanliness and auxiliary equipment status was acceptable upon release from the laboratory, and appropriate checks and actions were performed as required upon sample and equipment receipt.

The chain of custody (COC) records were present and accurately completed for all reported samples.

Data presentation was acceptable, with the following observation:

- One compound was reported with reporting limits slightly higher than specified in the QAPP. Total xylenes were reported with a quantitation limit of 0.261 ug/m^3.

This validation report should be considered part of the data package for all future distributions of the TO-15 SIM (volatiles in air) analysis data for SDG No. L1108880.

ATTACHMENT A

ELECTRONIC DELIVERABLE (EDD)
SDG No. L1108880
Selected Volatiles in Air Samples
(submitted electronically)

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Memorandum

Date: 25 April 2011

To: Todd Creamer

From: Mary Tyler

Copies to: Julia Caprio

Subject: Tier IV Data Validation Alpha Analytical Lab Number L1103698
Wells G&H Superfund Site, Woburn, Massachusetts

1. INTRODUCTION AND SUMMARY

This report summarizes the findings of a Tier IV data validation for eleven air samples, two field duplicate samples, and one trip blank collected on 17 and 18 March 2011. These samples were collected as part of the Wells G&H Superfund Site Vapor Intrusion Assessment. Air samples were analyzed by Alpha Analytical (Mansfield, Massachusetts) using the following methods:

- EPA Modified Method TO-15 using Selected Ion Monitoring (SIM) - Volatile Organic Compounds (VOCs); and
- Massachusetts DEP Method APH – Air-Phase Petroleum Hydrocarbons (APH)

All samples collected on 17 and 18 March, once received by the lab, were handled, prepared, and measured in the same manner under similar prescribed conditions.

Data for organic compounds were reviewed based on guidance specified in the project-specific Quality Assurance Project Plan (QAPP) in Form F which lists the USEPA Region 2 Guidance document entitled USEPA Hazardous Water Support Branch: Validating Air Samples, Volatile Organic Analysis of Ambient Air in Canisters by Method TO-15 (SOP#HW-31, Revision #4, October 2006). Data for organic compounds were also reviewed based on the pertinent methods referenced by the data package and professional judgment.

The following samples were analyzed and validated at a Tier IV level in the data set:

Lab ID	Client ID
L1103698-01	260902-OA
L1103698-02	260902-IA1
L1103698-03	260902-IA2
L1103698-04	260902-IA3
L1103698-05	260903-OA
L1103698-06	260903-IA1
L1103698-07	260903-IA2
L1103698-08	BD01-03182011
L1103698-09	260902-SS1
L1103698-10	260902-SS2
L1103698-11	260903-SS1
L1103698-12	260903-SS2
L1103698-13	BD02-03182011
L1103698-14	TB01-03182011

The conclusion from the Tier IV data validation presented herein and covering the QC parameters listed below, is that the data, as qualified, are usable for meeting the project objectives documented in Form D of the QAPP.

2. VOLATILE ORGANIC COMPOUND ANALYSIS (VOCS)

Eleven air samples, two field duplicate samples and one trip blank sample were analyzed for VOCs per EPA modified Method TO-15, using SIM.

Components of the laboratory data package that were reviewed during this Tier IV data validation are listed below. A check mark (✓) indicates components of the data package that are acceptable. A crossed circle (⊗) signifies components of the data package where issues were raised during the course of the validation review and these issues should be considered to determine whether they have an impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Instrument Performance Check
- ✓ Initial Calibration
- ⊗ Continuing Calibration Verification
- ⊗ Method Blanks
- ✓ Laboratory Control Sample
- ✓ Laboratory Duplicate
- ✓ Trip Blank
- ⊗ Field Duplicate

- ✓ Internal Standards
- ✓ Target Compound Identifications
- ⊗ Target Compound Quantitations
- ✓ Electronic Data Deliverables Review

2.1 Overall Assessment

The VOC data reported in this package are considered to be usable for meeting the project objectives documented in Form D of the QAPP. The results are considered to be valid; the analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for analysis, for the project is 100%.

It was noted that for most analytes, reporting limit concentrations were the same as the method detection limit (MDL) concentrations. Review of the reporting limits and MDLs found that the proposed screening levels listed in the QAPP were met.

2.2 Holding Times

The holding time for an air sample collected in a Summa™ canister for TO-15 analysis is 30 days from sample collection. The holding times were met for the sample analyses.

2.3 Instrument Performance Check

An instrument performance check sample (tune standard) was analyzed by Alpha Analytical. All calibration standards, the air samples and QC samples were analyzed within 24-hours after analyzing the tune standard. All ion abundance criteria were met for the tune standard, bromofluorobenzene (BFB).

2.4 Initial Calibration

Appropriate initial calibrations were performed and documented for each analyte. The laboratory calculated percent relative standard deviations (%RSDs) of the relative response factors (RRFs). The %RSDs met the method criteria of less than or equal to 30%, and the minimum average RRFs were above the method criteria of 0.050.

An initial calibration verification (ICV) standard was analyzed after the initial calibration. The ICV RRFs met the method minimum RRF criteria of 0.050. The percent differences (%Ds) between the RRFs in the initial calibration and the ICV were within the method acceptance criteria of less than or equal to 30%.

2.5 Continuing Calibration Verification (CCV)

The CCV was performed after initial calibration on a daily basis after the BFB tune and prior to the analyses of samples. The CCV RRFs met the method minimum RRF criteria of 0.050. The percent differences (%Ds) between the RRFs in the initial calibration and CCV were within the method acceptance criteria of less than or equal to 30%, with the following exceptions:

- The %D for naphthalene was 35%, with a low bias.
- The only samples qualified due to the low %D in the CCV were 260902-OA, 260903-OA, 260902-SS1 and TB01-03182011.
- The other samples were qualified due to method blank contamination and no additional qualifications were applied to these samples due to the low %D in the CCV.
- The detected concentration of naphthalene in sample 260902-SS1 was J qualified as estimated.
- Naphthalene was not detected at concentrations greater than the MDL in samples 260902-OA, 260903-OA, and TB01-03182011 so these results were UJ qualified as estimated less than the MDL. These qualifications are summarized below.

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
260902-OA	Naphthalene	0.131 U	0.131 UJ	9
260903-OA	Naphthalene	0.131 U	0.131 UJ	9
260902-SS1	Naphthalene	2.38	2.38 J	9
TB01-03182011	Naphthalene	0.131 U	0.131 UJ	9

U-not detected at the reported MDL

2.6 Method Blanks

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (i.e., one per batch of 20 samples). One method blank was analyzed and reported for the 14 samples. VOCs were not detected in the method blank above the MDLs, with the exception of naphthalene. Naphthalene was detected in the method blank at an estimated concentration of 0.168 µg/m^3, which is greater than the MDL and less than the reporting limit. Therefore, the estimated concentrations greater than the MDL and less than the reporting limit in samples associated with this method blank were U qualified as not detected at the reporting limit. Concentrations less than five times the blank concentration were U qualified as not detected at the reported concentrations. The undetected concentrations of naphthalene in samples 260902-OA, 260903-OA, and TB01-03182011 were not qualified.

Samples qualified based on data for the method blank are summarized below:

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
260902-IA1	Naphthalene	0.723	0.723 U	3
260902-IA2	Naphthalene	0.608	0.608 U	3
260902-IA3	Naphthalene	0.267	0.267 U	3
260903-IA1	Naphthalene	0.173 J	0.262 U	3
260903-IA2	Naphthalene	0.194 J	0.262 U	3

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
BD01-03182011	Naphthalene	0.571	0.571 U	3
260902-SS2	Naphthalene	0.241 J	0.262 U	3
260903-SS1	Naphthalene	0.246 J	0.262 U	3
260903-SS2	Naphthalene	0.828	0.828 U	3
BD02-03182011	Naphthalene	0.361	0.361 U	3

J- estimated concentration greater than the MDL and less than the reporting limit

2.7 Laboratory Duplicate

Laboratory duplicates were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). One laboratory duplicate was analyzed, using sample 260903-SS1. The results for the laboratory duplicate were within the method-specified acceptance criteria for VOCs of 25% D.

2.8 Laboratory Control Sample

One laboratory control sample (LCS) was analyzed for the 14 samples submitted, which is the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). The results for the LCS were within the method-specified acceptance criteria for recovery of 70-130%, with the exception of naphthalene. The recovery of naphthalene was 64% which is below the minimum acceptance criteria of 70%. However, since the associated samples were qualified due to the method blank contamination (see above) and low CCV %D, no additional qualifications were applied to the data.

2.9 Trip Blank

A trip blank, TB01-03182011, accompanied the sample shipment. No VOCs were detected in the trip blank above the MDL.

2.10 Field Duplicate

Two field duplicate samples, BD01-03182011 and BD02-03182011, were collected with the samples. Acceptable precision (RPD $\leq$25%) was demonstrated between each field duplicate and the associated original samples, 260902-IA2 and 260903-SS1, respectively, with the following exceptions:

- 1,2-Dichloroethane and chloroform were detected above the reporting limits in sample 260903-SS1 and not detected above the reporting limit in duplicate BD02-03182011, resulting in a non-calculable and unacceptable RPD between the results.
- Naphthalene was detected at an estimated concentration greater than the MDL and less than the reporting limit in sample 260903-SS1, and detected above the reporting limit in duplicate BD02-03182011, resulting in a non-calculable and unacceptable RPD between the results.

Based on professional judgment, no qualifications were applied to the naphthalene concentrations due to the field duplicate results; the results were qualified as not detected due to the method blank contamination. However, the detected concentrations of 1,2-dichloroethane and chloroform were J qualified as estimated and the undetected concentrations of 1,2-dichloroethane and chloroform were UJ qualified as estimated less than the MDL in duplicate pair 260903-SS1/ BD02-03182011. The calculated RPD of the duplicate pairs and applicable qualifications are summarized below.

Sample ID	Compound	Laboratory Concentration (µg/m3)	RPD	Validation Concentration (µg/ m3)	EDD Reason Code
260902-IA2	1,2,4-Trimethylbenzene	12.6	1	NA	NA
BD01-03182011	1,2,4-Trimethylbenzene	12.7		NA	NA
260902-IA2	1,2-Dichloroethane	1.44	3	NA	NA
BD01-03182011	1,2-Dichloroethane	1.40		NA	NA
260902-IA2	1,3-Butadiene	0.102	9	NA	NA
BD01-03182011	1,3-Butadiene	0.093		NA	NA
260902-IA2	Benzene	8.78	3	NA	NA
BD01-03182011	Benzene	8.54		NA	NA
260902-IA2	Carbon tetrachloride	0.603	6	NA	NA
BD01-03182011	Carbon tetrachloride	0.566		NA	NA
260902-IA2	Chloroform	0.254	4	NA	NA
BD01-03182011	Chloroform	0.244		NA	NA
260902-IA2	Ethylbenzene	11.7	1	NA	NA
BD01-03182011	Ethylbenzene	11.8		NA	NA
260902-IA2	Naphthalene	0.608	6	NA	NA
BD01-03182011	Naphthalene	0.571		NA	NA
260902-IA2	Tetrachloroethene	0.183	0	NA	NA
BD01-03182011	Tetrachloroethene	0.183		NA	NA
260902-IA2	Toluene	50.7	2	NA	NA
BD01-03182011	Toluene	51.9		NA	NA
260902-IA2	Total Xylene	51.6	1	NA	NA
BD01-03182011	Total Xylene	51.9		NA	NA
260902-IA2	All other VOCs	ND	0	NA	NA
BD01-03182011	All other VOCs	ND		NA	NA
260903-SS1	1,2,4-Trimethylbenzene	0.113	14	NA	NA
BD02-03182011	1,2,4-Trimethylbenzene	0.098		NA	NA
260903-SS1	1,2-Dichloroethane	0.093	NC	0.093 J	7
BD02-03182011	1,2-Dichloroethane	0.081 U		0.081 UJ	7
260903-SS1	1,4-Dichlorobenzene	0.132	10	NA	NA
BD02-03182011	1,4-Dichlorobenzene	0.120		NA	NA
260903-SS1	Chloroform	0.102	NC	0.102 J	7

Sample ID	Compound	Laboratory Concentration (µg/m3)	RPD	Validation Concentration (µg/ m3)	EDD Reason Code
BD02-03182011	Chloroform	0.098 U		0.098 UJ	7
260903-SS1	Naphthalene	0.246 J	NC	NA*	NA
BD02-03182011	Naphthalene	0.361		NA*	NA
260903-SS1	Tetrachloroethene	0.380	3	NA	NA
BD02-03182011	Tetrachloroethene	0.393		NA	NA
260903-SS1	Toluene	0.644	4	NA	NA
BD02-03182011	Toluene	0.621		NA	NA
260903-SS1	Total Xylene	0.295	11	NA	NA
BD02-03182011	Total Xylene	0.265		NA	NA
260903-SS1	All other VOCs	ND	0	NA	NA
BD02-03182011	All other VOCs	ND		NA	NA

U-not detected at the reported MDL
ND-not detected at the MDL
J- estimated concentration greater than the MDL and less than the reporting limit
NC-not calculable
NA-not applicable
*- no additional qualifications applied to the data based on the field duplicate results; results qualified due to method blank contamination

2.11 Internal Standards

The internal standard areas and retention times (RTs) were within method limits of ±40% of the internal standard areas from the most recent calibration and within 0.33 minutes of the retention times for the internal standards from the most recent calibration.

2.12 Target Compound Identifications

The target compound identifications were within the validation criteria.

2.13 Compound Quantitation

The compound quantitations were within the validation criteria with the one sample exception noted below which is a result of field sample collection conditions and not the laboratory analytical system.

Based on measurements collected in the field, there was a helium leak in the probe during collection of sample 260902-SS1 potentially diluting the sub-slab sample with indoor air. The helium concentration in screening samples of sub-slab soil gas collected immediately prior to sample collection was approximately 6% of the average helium in the shroud covering the probe. The sample collection work plan and project specific QAPP specified a maximum helium concentration in the sample equal to 1% of the shroud concentration. Therefore, based on professional judgment, the concentrations of VOCs detected in sample 260902-SS1 were J qualified as estimated. Similarly, analytes that were undetected were UJ qualified as estimated less than the MDLs. These qualifications are summarized below.

Sample ID	Compound	Laboratory Concentration (µg/m3)	Validation Concentration (µg/ m3)	EDD Reason Code
260902-SS1	1,1,1-Trichloroethane	0.109 U	0.109 UJ	13
260902-SS1	1,1,2-Trichloroethane	0.109 U	0.109 UJ	13
260902-SS1	1,1-Dichloroethane	0.081 U	0.081 UJ	13
260902-SS1	1,1-Dichloroethene	0.079 U	0.079 UJ	13
260902-SS1	1,2,4-Trimethylbenzene	1.60	1.60 J	13
260902-SS1	1,2-Dibromoethane	0.154 U	0.154 UJ	13
260902-SS1	1,2-Dichloroethane	0.101	0.101 J	13
260902-SS1	1,2-Dichloropropane	0.092 U	0.092 UJ	13
260902-SS1	1,3-Butadiene	0.044 U	0.044 UJ	13
260902-SS1	1,3-Dichlorobenzene	0.18	0.18 J	13
260902-SS1	1,4-Dichlorobenzene	0.198	0.198 J	13
260902-SS1	Benzene	0.744	0.744 J	13
260902-SS1	Bromodichloromethane	0.067 U	0.067 UJ	13
260902-SS1	Bromoform	0.206 U	0.206 UJ	13
260902-SS1	Carbon tetrachloride	0.170	0.170 J	13
260902-SS1	Chlorobenzene	0.092 U	0.092 UJ	13
260902-SS1	Chloroform	0.298	0.298 J	13
260902-SS1	Ethylbenzene	1.42	1.42 J	13
260902-SS1	Isopropylbenzene	2.46 U	2.46 UJ	13
260902-SS1	Methyl tert butyl ether	0.072 U	0.072 UJ	13
260902-SS1	Methylene chloride	1.74 U	1.74 UJ	13
260902-SS1	Naphthalene	2.38	2.38 J	13
260902-SS1	Tetrachloroethene	0.258	0.258 J	13
260902-SS1	Toluene	4.48	4.48 J	13
260902-SS1	Trichloroethene	0.107 U	0.107 UJ	13
260902-SS1	Vinyl chloride	0.051 U	0.051 UJ	13
260902-SS1	Total Xylenes	8.38	8.38	13
260902-SS1	cis-1,2-Dichloroethene	0.079 U	0.079 UJ	13
260902-SS1	trans-1,2-Dichloroethene	0.079 U	0.079 UJ	13
260902-SS1	trans-1,3-Dichloropropene	0.091 U	0.091 UJ	13

U-not detected at the reported MDL

2.14 Electronic Data Deliverables Review

A minimum of 20% of the results and all sample IDs provided in the electronic data deliverable (EDD) were reviewed against information provided in the Level IV report. No discrepancies were identified between the EDD and the Level IV report.

3. AIR PHASE PETROLEUM HYDROCARBONS (APH)

Eleven air samples, two field duplicate samples and one trip blank sample were analyzed for petroleum hydrocarbons per EPA Massachusetts DEP Method APH.

Components of the laboratory data package that were reviewed during this Tier IV data validation are listed below. A check mark (✓) indicates components of the data package that are acceptable. A crossed circle (⊗) signifies components of the data package where issues were raised during the course of the validation review, and these issues should be considered to determine whether they have an impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Instrument Performance Check
- ✓ Initial Calibration
- ✓ Continuing Calibration Verification
- ✓ Method Blanks
- ✓ Laboratory Control Sample
- ⊗ Laboratory Duplicate
- ✓ Trip Blank
- ⊗ Field Duplicate
- ✓ Internal Standards
- ✓ Target Compound Identifications
- ⊗ Target Compound Quantitations
- ✓ Electronic Data Deliverables Review

3.1 Overall Assessment

The APH data reported in this package are considered to be usable for meeting the project objectives documented in Form D of the QAPP. The results are considered to be valid; the analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for analysis, for the project is 100%.

3.2 Holding Times

The holding time for an air sample collected in a Summa™ canister for APH analysis is 30 days from sample collection. The holding times were met for the sample analyses.

3.3 Instrument Performance Check

An instrument performance check sample (tune standard) was analyzed by Alpha Analytical. All calibration standards, the air samples and QC samples were analyzed within 24-hours after analyzing the tune standard. All ion abundance criteria were met for bromofluorobenzene (BFB).

3.4 Initial Calibration

Appropriate initial calibrations were performed and documented for each analyte. The laboratory calculated %RSDs of the RRFs. The %RSDs met the method criteria of less than or equal to 30% for all compounds except naphthalene, which has a %RSD criteria of less than or equal to 40%.

3.5 Continuing Calibration Verification (CCV)

The CCV was performed after initial calibration on a daily basis after the BFB tune and prior to the analysis of samples. The CCV RRFs met the method minimum RRF criteria of 0.050. The %Ds between the RRFs in the initial and CCVs were within the method acceptance criteria of less than or equal to 30%.

3.6 Method Blanks

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (i.e., one per batch of 20 samples). Two method blanks were analyzed and reported for the 14 samples. APH were not detected in the method blanks above the reporting limits.

3.7 Laboratory Duplicate

Laboratory duplicates were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Two laboratory duplicates were analyzed, using samples 260902-OA and 260903-SS1. The results for the laboratory duplicates were within the method-specified acceptance criteria for APH analytes of 25%D, with the following exception:

- C9-C12 Aliphatics was detected in sample 260903-SS1 above the reporting limit and not detected in the laboratory duplicate, resulting in a non-calculable and unacceptable RPD between the results. Therefore, the detected concentration C9-C12 Aliphatics in sample 260903-SS1 was J qualified as estimated. This qualification is summarized below:

Sample ID	Compound	Laboratory Concentration ($\mu g/m^3$)	Validation Concentration ($\mu g/ m^3$)	EDD Reason Code
260903-SS1	C9-C12 Aliphatics	14	14 J	12

3.8 Laboratory Control Sample

Two LCSs were analyzed for the 14 samples submitted to the laboratory, which is the proper frequency for the number and types of samples analyzed (i.e., one per batch of 20 samples). The results for the LCSs were within the method-specified acceptance criteria for recovery of 70-130%, with the following exception:

- The recovery of o-xylene in the LCS for batch WG460890-3 was 131%, which is above the method-specified acceptance criteria of 130%.

Since o-xylene was not detected above the reporting limit in any of the samples associated with the LCS in batch WG460890-3, no qualifications were applied to the data.

3.9 Trip Blank

A trip blank, TB01-03182011, accompanied the sample shipment. No APH were detected in the trip blank above the reporting limits.

3.10 Field Duplicate

Two field duplicate samples, BD01-03182011 and BD02-03182011, were collected with the samples. Acceptable precision (i.e., RPD ≤25%) was demonstrated between the field duplicates and the original samples, 260902-IA2 and 260903-SS1, respectively, with the following exception:

- C9-C12 aliphatics were detected in sample 260903-SS1 above the reporting limit but not detected in the duplicate sample, BD02-03182011. This results in a non-calculable and unacceptable RPD between the original and duplicate samples.

Therefore, the detected concentrations of C9-C12 aliphatics in sample 260903-SS1 were J qualified as estimated and the undetected concentration of C9-C12 aliphatics were UJ qualified as estimated less than the reporting limits in duplicate BD02-03182011. The calculated RPDs of the duplicate pair and applicable qualifications are summarized below:

Sample ID	Compound	Laboratory Concentration (µg/m^3)	RPD	Validation Concentration (µg/ m^3)	EDD Reason Code
260902-IA2	Benzene	9.5	3	NA	NA
BD01-03182011	Benzene	9.8		NA	NA
260902-IA2	C5-C8 Aliphatics, Adjusted	500	2	NA	NA
BD01-03182011	C5-C8 Aliphatics, Adjusted	510		NA	NA
260902-IA2	C9-C10 Aromatics Total	52	10	NA	NA
BD01-03182011	C9-C10 Aromatics Total	47		NA	NA
260902-IA2	C9-C12 Aliphatics, Adjusted	72	4	NA	NA
BD01-03182011	C9-C12 Aliphatics, Adjusted	75		NA	NA
260902-IA2	Ethylbenzene	12	0	NA	NA
BD01-03182011	Ethylbenzene	12		NA	NA
260902-IA2	Toluene	55	5	NA	NA

Sample ID	Compound	Laboratory Concentration (µg/m^3)	RPD	Validation Concentration (µg/ m^3)	EDD Reason Code
BD01-03182011	Toluene	58		NA	NA
260902-IA2	o-Xylene	14	0	NA	NA
BD01-03182011	o-Xylene	14		NA	NA
260902-IA2	p/m-Xylene	38	0	NA	NA
BD01-03182011	p/m-Xylene	38		NA	NA
260902-IA2	All other APH	ND	0	NA	NA
BD01-03182011	All other APH	ND		NA	NA
260903-SS1	C5-C8 Aliphatics, Adjusted	25	15	NA	NA
BD02-03182011	C5-C8 Aliphatics, Adjusted	29		NA	NA
260903-SS1	C9-C12 Aliphatics, Adjusted	14	NC	14 J	7
BD02-03182011	C9-C12 Aliphatics, Adjusted	14 U		14 UJ	7
260903-SS1	All other APH	ND	0	NA	NA
BD02-03182011	All other APH	ND		NA	NA

U - not detected at the indicated reporting limit
ND - not detected at the reporting limit

3.11 Internal Standards

The internal standard areas and retention times (RTs) were within method limits of ±40% of the internal standard areas from the most recent calibration and within 0.33 minutes of the retention times for the internal standards from the most recent calibration.

3.12 Target Compound Identifications

The target compound identifications were within the validation criteria.

3.13 Compound Quantitation

The compound quantitations were within the validation criteria except for the condition noted below which is a result of field sample collection conditions and not the laboratory analytical system.

Based on measurements collected in the field, there was a helium leak in the probe during collection of sample 260902-SS1 potentially diluting the sub-slab sample with indoor air. The

helium concentration in sub-slab soil gas screening samples collected immediately prior to sample collection was approximately 6% of the average helium in the shroud covering the probe. The sample collection work plan and project specific QAPP specify a maximum helium concentration in the sample equal to 1% of the shroud concentration. Therefore, based on professional judgment, the concentrations of APH detected in sample 260902-SS1 were J qualified as estimated. Undetected concentrations were UJ qualified as estimated less than the reporting limits. A summary of the qualified data are below:

Sample ID	Compound	Laboratory Concentration (µg/m3)	Validation Concentration (µg/ m3)	EDD Reason Code
260902-SS1	1,3-Butadiene	2.0 U	2.0 UJ	13
260902-SS1	Benzene	2.0 U	2.0 UJ	13
260902-SS1	C5-C8 Aliphatics, Adjusted	67	67 J	13
260902-SS1	C9-C10 Aromatics Total	10 U	10 UJ	13
260902-SS1	C9-C12 Aliphatics, Adjusted	130	130 J	13
260902-SS1	Ethylbenzene	2.0 U	2.0 UJ	13
260902-SS1	Methyl tert butyl ether	2.0 U	2.0 UJ	13
260902-SS1	Naphthalene	2.3	2.3 J	13
260902-SS1	Toluene	5.5	5.5 J	13
260902-SS1	o-Xylene	3.0	3.0 J	13
260902-SS1	p/m-Xylene	7.0	7.0 J	13

U-not detected at the stated reporting limit

3.14 Electronic Data Deliverables Review

A minimum of 20% of the results and all sample IDs provided in the EDD were reviewed against the information provided in the Level IV report. No discrepancies were identified between the EDD and the Level IV report.

* * * * *

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Memorandum

Date: 25 July 2011

To: Todd Creamer

From: Mary Tyler

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Subject: Tier IV Data Validation Alpha Analytical Lab Number L1108139
Wells G&H Superfund Site, Woburn, Massachusetts

1. INTRODUCTION AND SUMMARY

This report summarizes the findings of a Tier IV data validation for twenty two air samples, four field duplicate samples, and one trip blank collected from 06 June 2011 through 08 June 2011. These samples were collected as part of the Wells G&H Superfund Site Vapor Intrusion Assessment. Air samples were analyzed by Alpha Analytical (Mansfield, Massachusetts) using the following methods:

- EPA Modified Method TO-15 using Selected Ion Monitoring (SIM) - Volatile Organic Compounds (VOCs)
- EPA Modified Method TO-15 – Acetone and Ethyl Acetate Only
- Massachusetts DEP Method APH – Air-Phase Petroleum Hydrocarbons (APH)

All samples collected from 06 June 2011 through 08 June 2011, once received by the lab, were handled, prepared, and measured in the same manner under similar prescribed conditions.

Data for the organic compounds were reviewed based on guidance specified in the project-specific Quality Assurance Project Plan (QAPP) in Form F which lists the USEPA Region 2 Guidance document entitled USEPA Hazardous Water Support Branch: Validating Air Samples, Volatile Organic Analysis of Ambient Air in Canisters by Method TO-15 (SOP#HW-31, Revision #4, October 2006). Data for the organic compounds were also reviewed based on the pertinent methods referenced by the data package and professional judgment.

The following samples were analyzed and validated at a Tier IV level in the data set:

Lab ID	Client ID
L1108139-01	260902-IA1-20110607
L1108139-02	260902-IA2-20110607
L1108139-03	260902-OA-20110607
L1108139-04	260902-SS1-20110607
L1108139-05	260902-SS2-20110607
L1108139-06	260903-IA1-20110607
L1108139-07	260903-IA2-20110607
L1108139-08	260903-OA-20110607
L1108139-09	260903-SS1-20110607
L1108139-10	260903-SS2-20110607
L1108139-11	260407-17-IA1-20110607
L1108139-12	260407-17-SS1-20110607
L1108139-13	260407-19-SS1-20110608
L1108139-14	260407-20-IA1-20110607
L1108139-15	260407-20-SS1-20110608
L1108139-16	260407-22-IA1-20110607
L1108139-17	260407-22-IA2-20110607
L1108139-18	260407-22-SS1-20110608
L1108139-19	260407-22-SS2-20110608
L1108139-20	260407-OA1-20110607
L1108139-21	260407-OA2-20110607
L1108139-22	BD01-20110607
L1108139-23	BD02-20110607
L1108139-24	BD03-20110607
L1108139-25	BD04-20110608
L1108139-26	TB-20110608
L1108139-27	260407-19-IA1-20110607

The laboratory report was revised twice. The first revision, issued on 23 June 2011, corrected the sample type for several APH samples. The APH result forms in the hardcopy laboratory report for samples 260407-17-IA1-20110607, 260407-20-IA1-20110607, 260407-22-IA1-20110607, 260407-22-IA2-20110607, 260407-OA1-20110607, and 260407-OA2-20110607 listed the sample types incorrectly as 24 hour composite samples; the information for these samples was corrected on the APH result forms to indicate 8 hour composite samples.

The second revision, issued on 19 July 2011, was requested because the electronic data deliverable (EDD) for APH did not match the hardcopy laboratory report. The laboratory data flag M, which indicates that the reporting limit exceeds the MCP CAM reporting limit, was not listed on the hardcopy report for any of the APH results, yet some of the results in the EDD had the M flag. In addition, the MADEP MCP Response Action Analytical Report Certification form did not indicate that the CAM reporting limits were not met for C5-C8 aliphatics. The second revision corrected the MADEP MCP Response Action Analytical Report Certification form, revised the laboratory narrative for petroleum hydrocarbons in air (APH) and revised the EDD

for APH. The form was changed to indicate that the reporting limits were not at or below the CAM reporting limits specified in the selected CAM protocol for APH analysis. The narrative was amended to indicate that one or more of the APH target analytes did not achieve the requested CAM reporting limits. In addition, the laboratory data flag M was removed from the EDD for APH analyses, as the laboratory is not currently flagging any data with the M qualifier.

Review of the canister cleaning certification documentation, included in the data package, indicated the following:

- Acetone was detected at estimated concentrations greater than the method detection limit (MDL) and less than the reporting limit (RL) in the canisters used to collect samples 260407-17-IA1-20110607, 260407-17-SS1-20110607, 260407-22-IA1-20110607, 260407-22-IA2-20110607, 260407-22-SS1-20110608, 260407-OA1-20110607, BD03-20110607 and 260407-19-IA1-20110607. Since acetone was detected in these samples at concentrations above the RL, no qualifications were applied to the data based on professional judgment.
- Acetone was also detected at an estimated concentration greater than the MDL and less than the reporting limit in the canister used to collect the trip blank, TB-20110608. Therefore, the acetone concentration in the trip blank was qualified as not detected at the reporting limit; see section 2.9 below.
- The flow controller used to collect sample 260407-22-IA2-20110607 did not have certification documentation for acetone and ethyl acetate. No qualifications were applied to the data based on professional judgment since the concentration of acetone detected in the sample was greater than the RL and ethyl acetate was not detected in the sample.

The conclusion from the Tier IV data validation presented herein and covering the QC parameters listed below, is that the data, as qualified, are usable for meeting the project objectives documented in Form D of the QAPP.

It was noted that the samples were analyzed for 1,3-butadiene, methyl tert-butyl ether (MTBE), benzene, toluene, ethylbenzene and naphthalene by both EPA Method TO-15 SIM and Massachusetts DEP Method APH. Comparable results were reported by both methods.

2. VOLATILE ORGANIC COMPOUND ANALYSIS (VOCs)

Twenty two air samples, four field duplicate samples and one trip blank sample were analyzed for VOCs per EPA modified Method TO-15, using SIM and for acetone and ethyl acetate, using EPA modified Method TO-15.

Components of the laboratory data package that were reviewed during this Tier IV data validation are listed below. A check mark (✓) indicates components of the data package that are acceptable. A crossed circle (⊗) signifies components of the data package where issues were raised during the course of the validation review and these issues should be considered to determine whether they have an impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Instrument Performance Check
- ✓ Initial Calibration
- ⊗ Continuing Calibration Verification
- ✓ Method Blanks
- ✓ Laboratory Control Sample
- ⊗ Laboratory Duplicate
- ⊗ Trip Blank
- ⊗ Field Duplicate
- ✓ Internal Standards
- ✓ Target Compound Identifications
- ⊗ Target Compound Quantitations
- ⊗ Electronic Data Deliverables Review

2.1 Overall Assessment

The VOC data reported in this package are considered to be usable for meeting the project objectives documented in Form D of the QAPP. The results are considered to be valid; the analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for analysis, for the project is 100%.

Review of the RLs for TO-15 SIM and MDLs for TO-15 (acetone and ethyl acetate only) found that the proposed screening levels listed in the QAPP were met for all compounds except 1,2-dibromoethane, naphthalene and bromodichloromethane. Based on the QAPP requirements, the laboratory reported these three compounds to ½ the RL by TO-15 SIM. However, the value for ½ the RL is listed as the MDL in the hardcopy report. Additionally, these three compounds were reported as non-detect to the RL in the electronic data deliverable (EDD) rather than to ½ the RL. Based on information from Alpha Analytical, the misreported values are due to a limitation of the laboratory information system (LIMS). For the purposes of this report, the term "respective reporting limit" will be used to indicate the compound RLs for Method TO-15 SIM. Data users are advised to note that the concentrations listed for TO-15 SIM analyses in the hardcopy report as the MDLs are not in fact the MDLs.

2.2 Holding Times

The holding time for an air sample collected in a Summa™ canister for TO-15 analysis is 30 days from sample collection. The holding times were met for the sample analyses.

2.3 Instrument Performance Check

Instrument performance check samples (tune standards) were analyzed by Alpha Analytical. All calibration standards, the air samples and QC samples were analyzed within 24-hours after analyzing the tune standards. All ion abundance criteria were met for the tune standard, bromofluorobenzene (BFB).

2.4 Initial Calibration

Appropriate initial calibrations were performed and documented for each analyte. The laboratory calculated percent relative standard deviations (%RSDs) of the relative response factors (RRFs). The %RSDs met the method criteria of less than or equal to 30%, and the minimum average RRFs were above the method criteria of 0.050.

Initial calibration verification (ICV) standards were analyzed after the initial calibrations. The ICVs RRFs met the method minimum RRF criteria of 0.050. The percent differences (%Ds) between the RRFs in the initial calibration and the ICV were within the method acceptance criteria of less than or equal to 30%.

2.5 Continuing Calibration Verification (CCV)

CCVs were performed after the initial calibration on a daily basis after the BFB tune and prior to the analyses of samples. The CCVs RRFs met the method minimum RRF criteria of 0.050. The %Ds between the RRFs in the initial calibration and CCVs were within the method acceptance criteria of less than or equal to 30%, with the following exceptions. The %D for naphthalene on instrument Airlab8, analyzed on 21 June 2011, was 34.3%. Therefore, the detected concentrations of naphthalene were J qualified as estimated. In addition, the %Ds for MTBE and toluene on instrument Airpiano2, analyzed on 20 June 2011, were 35.2% and 30.5%, respectively. Therefore, the non-detected results of MTBE and toluene in the associated samples were UJ qualified as estimated less than the reporting limits and the detected concentrations were J qualified as estimated. These qualifications are summarized below:

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)*	EDD Reason Code**
260903-IA1-20110607	Naphthalene	0.367	0.367 J	9
260903-IA2-20110607	Naphthalene	0.288	0.288 J	9
260407-17-IA1-20110607	Naphthalene	0.273	0.273 J	9
260407-20-IA1-20110607	Naphthalene	0.351	0.351 J	9
260407-22-IA1-20110607	Naphthalene	0.257 J	0.257 J	9
260407-22-IA2-20110607	Naphthalene	0.168 J	0.168 J	9
BD01-20110607	Naphthalene	0.246 J	0.246 J	9
BD03-20110607	Naphthalene	0.744	0.744 J	9
260407-19-IA1-20110607	Naphthalene	0.493	0.493 J	9
260902-IA1-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	9
260902-IA1-20110607	Toluene	3.24	3.24 J	9
260902-IA2-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	9
260902-IA2-20110607	Toluene	3.29	3.29 J	9
260902-OA-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	9

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)*	EDD Reason Code**
260902-OA-20110607	Toluene	1.37	1.37 J	9
260903-OA-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	9
260903-OA-20110607	Toluene	1.47	1.47 J	9
260407-OA1-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	9
260407-OA1-20110607	Toluene	1.22	1.22 J	9
260407-OA2-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	9
260407-OA2-20110607	Toluene	1.29	1.29 J	9
TB-20110608	Methyl tert butyl ether	0.072 U	0.072 UJ	9
TB-20110608	Toluene	0.188 U	0.188 UJ	9

U-not detected
J-estimated concentration
µg/m^3 – micrograms per cubic meter
*Validation qualifiers are defined in Attachment 1 at the end of this report
**EDD reason codes are defined in Attachment 2 at the end of this report

2.6 Method Blanks

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (i.e., one per batch of 20 samples). Six method blanks were analyzed and reported for the 27 samples. VOCs were not detected in the method blanks above their respective reporting limits (TO-15 SIM) or the MDLs (TO-15), with the following exceptions. Acetone was detected in the method blanks in batches WG474469, WG474612 and WG474612 at concentrations greater than the MDL and less than the reporting limit. Since the concentrations of acetone in the associated samples were either greater than the reporting limit or in the case of the trip blank, qualified due to the concentration in the empty canister, no qualifications were applied to the data due to the method blanks' acetone concentrations.

2.7 Laboratory Duplicate

Laboratory duplicates were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Five laboratory duplicates were analyzed, using samples 260407-19-SS1-20110608 (both TO-15 SIM and TO-15 analyses), 260902-IA2-20110607, 260903-IA1-20110607 and 260407-20-IA1-20110607. The results for the laboratory duplicates were within the method-specified acceptance criteria for VOCs of 25% D.

2.8 Laboratory Control Sample

Six laboratory control samples (LCSs) were analyzed for the 27 samples submitted, which satisfies the minimum frequency for the number and types of samples analyzed (one per batch of 20 samples). The results for the LCSs were within the method-specified acceptance criteria for recovery of 70-130%, with the following exceptions. The recovery of naphthalene in batch WG474558 was low (66%) and outside the method-specified acceptance criteria for recovery.

Therefore, the detected concentrations of naphthalene in the associated samples were J qualified as estimated. In addition, the recovery of MTBE in batch WG474617 was low (65%) and outside the method-specified acceptance criteria for recovery. MTBE was not detected in the associated samples and therefore, the MTBE results are UJ qualified as estimated less than the reporting limit. These qualifications are summarized below.

	Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
6	260903-IA1-20110607	Naphthalene	0.367	0.367 J	5
7	260903-IA2-20110607	Naphthalene	0.288	0.288 J	5
11	260407-17-IA1-20110607	Naphthalene	0.273	0.273 J	5
14	260407-20-IA1-20110607	Naphthalene	0.351	0.351 J	5
16	260407-22-IA1-20110607	Naphthalene	0.257 J	0.257 J	5
17	260407-22-IA2-20110607	Naphthalene	0.168 J	0.168 J	5
22	BD01-20110607	Naphthalene	0.246 J	0.246 J	5
24	BD03-20110607	Naphthalene	0.744	0.744 J	5
27	260407-19-IA1-20110607	Naphthalene	0.493	0.493 J	5
1	260902-IA1-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	5
2	260902-IA2-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	5
3	260902-OA-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	5
8	260903-OA-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	5
20	260407-OA1-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	5
21	260407-OA2-20110607	Methyl tert butyl ether	0.072 U	0.072 UJ	5
26	TB-20110608	Methyl tert butyl ether	0.072 U	0.072 UJ	5

U-not detected
J-estimated concentration

2.9 Trip Blank

A trip blank, TB-20110608, accompanied the sample shipment. VOCs were not detected in the trip blank above their respective reporting limits (TO-15 SIM) or the MDLs (TO-15), with the following exception. Acetone was detected in the trip blank at an estimated concentration greater than the MDL and less than the reporting limit, at a concentration of 0.354 µg/m^3. According to the canister cleaning documentation, acetone was detected in the canister used as the trip blank at an estimated concentration greater than the MDL and less than the reporting limit, at a concentration of 0.290 µg/m^3. Therefore, the concentration of acetone in the trip blank was U qualified as not detected at the reporting limit. This qualification is summarized below:

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
TB-20110608	Acetone	0.354 J	2.38 U	13

J-estimated concentration

2.10 Field Duplicate

Four field duplicate samples, BD01-20110607, BD02-20110607, BD03-20110607 and BD04-20110608, were collected with the samples. Acceptable precision (RPD ≤25%) was demonstrated between each field duplicate and the associated original samples, 260902-IA2-20110607, 260903-SS1-20110607, 260407-19-IA1-20110607 and 260407-22-SS1-20110608, respectively, with the following exceptions.

- 1,2,4-Trimethylbenzene, 1,2-dichloroethane, benzene, chloroform, ethylbenzene and total xylenes were detected above the reporting limits in one sample and not detected above their respective reporting limits in the other sample for the duplicate pair 260407-22-SS1-20110608/BD04-20110608, resulting in non-calculable and unacceptable RPDs between the results. Therefore, the detected concentrations of these compounds were J qualified as estimated and the non-detected results were UJ qualified as estimated less than their respective reporting limits in the duplicate pair.
- Ethyl acetate was detected above the reporting limit in the field duplicate and not detected above MDL in the parent sample for the duplicate pair 260407-22-SS1-20110608/BD04-20110608, resulting in a non-calculable and unacceptable RPD between the results. Therefore, the detected concentrations of ethyl acetate was J qualified as estimated and the non-detected result was UJ qualified as estimated less than the MDL in the duplicate pair.
- The RPDs were greater than 25% for 1,1,1-trichloroethane, acetone, carbon tetrachloride, tetrachloroethene, toluene and trichloroethene in the duplicate pair 260407-22-SS1-20110608/BD04-20110608; therefore, the detected concentrations of these compounds were J qualified as estimated in the duplicate pair.

These qualifications are summarized below:

Sample ID	Compound	Laboratory Result (µg/m^3)	RPD (%)	Validation Result (µg/m^3)	Reason Code
260407-22-SS1-20110608	1,1,1-Trichloroethane	5.89	29	5.89 J	7
BD04-20110608	1,1,1-Trichloroethane	4.40		4.40 J	7
260407-22-SS1-20110608	1,2,4-Trimethylbenzene	0.098 U	NC	0.098 UJ	7
BD04-20110608	1,2,4-Trimethylbenzene	0.202		0.202 J	7
260407-22-SS1-20110608	1,2-Dichloroethane	0.081 U	NC	0.081 UJ	7
BD04-20110608	1,2-Dichloroethane	0.304		0.304 J	7
260407-22-SS1-20110608	Acetone	17.6	137	17.6 J	7
BD04-20110608	Acetone	94.5		94.5 J	7
260407-22-SS1-20110608	Benzene	0.224 U	NC	0.224 UJ	7
BD04-20110608	Benzene	0.268		0.268 J	7
260407-22-SS1-20110608	Carbon tetrachloride	0.176	36	0.176 J	7

Sample ID	Compound	Laboratory Result (µg/m^3)	RPD (%)	Validation Result (µg/m^3)	Reason Code
BD04-20110608	Carbon tetrachloride	0.252		0.252 J	7
260407-22-SS1-20110608	Chloroform	0.098 U	NC	0.098 UJ	7
BD04-20110608	Chloroform	0.317		0.317 J	7
260407-22-SS1-20110608	Ethyl Acetate	0.544 U	NC	0.544 UJ	7
BD04-20110608	Ethyl Acetate	4.25		4.25 J	7
260407-22-SS1-20110608	Ethylbenzene	0.087 U	NC	0.087 UJ	7
BD04-20110608	Ethylbenzene	0.282		0.282 J	7
260407-22-SS1-20110608	Tetrachloroethene	102	28	102 J	7
BD04-20110608	Tetrachloroethene	77.3		77.3 J	7
260407-22-SS1-20110608	Toluene	0.320	161	0.320 J	7
BD04-20110608	Toluene	3.01		3.01 J	7
260407-22-SS1-20110608	Trichloroethene	0.193	44	0.193 J	7
BD04-20110608	Trichloroethene	0.301		0.301 J	7
260407-22-SS1-20110608	Total Xylenes	0.261 U	NC	0.261 UJ	7
BD04-20110608	Total Xylenes	1.16		1.16 J	7
260407-22-SS1-20110608	All other VOCs	ND	0	NA	NA
BD04-20110608	All other VOCs	ND		NA	NA

U - not detected
ND - not detected
NC - not calculable
NA - not applicable

- Chloroform was detected above the reporting limit in the field duplicate sample and not detected above the reporting limit in the parent sample for the duplicate pair 260903-SS1-20110607/BD02-20110607, resulting in a non-calculable and unacceptable RPD between the results. Therefore, the detected concentration of chloroform was J qualified as estimated in the field duplicate sample and the non-detected result was UJ qualified as estimated less than the reporting limit in the parent sample. These qualifications are summarized below:

Sample ID	Compound	Laboratory Result (µg/m^3)	RPD (%)	Validation Result (µg/m^3)	Reason Code
260903-SS1-20110607	Chloroform	0.098 U	NC	0.098 UJ	7
BD02-20110607	Chloroform	0.190		0.190 J	7
260903-SS1-20110607	Methylene chloride	24.1	3	NA	NA
BD02-20110607	Methylene chloride	23.3		NA	NA
260903-SS1-20110607	Tetrachloroethene	0.271	24	NA	NA
BD02-20110607	Tetrachloroethene	0.346		NA	NA
260903-SS1-20110607	Toluene	0.241	19	NA	NA

Sample ID	Compound	Laboratory Result (µg/m^3)	RPD (%)	Validation Result (µg/m^3)	Reason Code
BD02-20110607	Toluene	0.200		NA	NA
260903-SS1-20110607	All other VOCs	ND	0	NA	NA
BD02-20110607	All other VOCs	ND		NA	NA

U - not detected
ND - not detected
NC - not calculable
NA - not applicable

- Tetrachloroethene was detected above the reporting limit in the field duplicate sample and not detected above the reporting limit in the parent sample for the duplicate pair 260902-IA2-20110607/BD01-20110607, resulting in non-calculable and unacceptable RPD between the results. Therefore, the detected concentration of tetrachloroethene was J qualified as estimated in the field duplicate and the non-detected result was UJ qualified as estimated less than the reporting limit in the parent sample.
- The RPDs were greater than 25% for 1,3-butadiene, chloroform, ethyl benzene, methylene chloride and total xylenes in the duplicate pair 260902-IA2-20110607/BD01-20110607; therefore, the detected concentrations of these compounds were J qualified as estimated in the duplicate pair.

These qualifications are summarized below:

Sample ID	Compound	Laboratory Result (µg/m^3)	RPD (%)	Validation Result (µg/m^3)	Reason Code
260902-IA2-20110607	1,2,4-Trimethylbenzene	0.836	21	NA	NA
BD01-20110607	1,2,4-Trimethylbenzene	1.03		NA	NA
260902-IA2-20110607	1,2-Dichloroethane	2.74	25	NA	NA
BD01-20110607	1,2-Dichloroethane	2.13		NA	NA
260902-IA2-20110607	1,3-Butadiene	0.106	59	0.106 J	7
BD01-20110607	1,3-Butadiene	0.058		0.058 J	7
260902-IA2-20110607	Benzene	0.837	21	NA	NA
BD01-20110607	Benzene	0.680		NA	NA
260902-IA2-20110607	Bromodichloromethane	0.120 J	NC	NA	NA
BD01-20110607	Bromodichloromethane	0.094 J		NA	NA
260902-IA2-20110607	Carbon tetrachloride	0.484	19	NA	NA
BD01-20110607	Carbon tetrachloride	0.402		NA	NA
260902-IA2-20110607	Chloroform	0.293	26	0.293 J	7
BD01-20110607	Chloroform	0.381		0.381 J	7
260902-IA2-20110607	Ethylbenzene	0.586	26	0.586 J	7
BD01-20110607	Ethylbenzene	0.760		0.760 J	7

Sample ID	Compound	Laboratory Result (µg/m^3)	RPD (%)	Validation Result (µg/m^3)	Reason Code
260902-IA2-20110607	Methylene chloride	11.1	109	11.1 J	7
BD01-20110607	Methylene chloride	3.27		3.27 J	7
260902-IA2-20110607	Naphthalene	0.435	NC	0.435 J	7
BD01-20110607	Naphthalene	0.246 J		0.246 J	7
260902-IA2-20110607	Tetrachloroethene	0.136 U	NC	0.136 UJ	7
BD01-20110607	Tetrachloroethene	0.156		0.156 J	7
260902-IA2-20110607	Toluene	3.29	25	NA	NA
BD01-20110607	Toluene	4.22		NA	NA
260902-IA2-20110607	Total Xylenes	2.44	30	2.44 J	7
BD01-20110607	Total Xylenes	3.31		3.31 J	7
260902-IA2-20110607	All other VOCs	ND	0	NA	NA
BD01-20110607	All other VOCs	ND		NA	NA

U-not detected
J-estimated concentration
ND - not detected
NC - not calculable
NA - not applicable

- 1,3-Butadiene was detected above the reporting limit in the parent sample and not detected above the reporting limit in the field duplicate sample for the duplicate pair 260407-19-IA1-20110607/BD03-20110607, resulting in a non-calculable and unacceptable RPD between the results. Therefore, the detected concentration of 1,3-butadiene was J qualified as estimated in the parent sample and the non-detected result was UJ qualified as estimated less than the reporting limit in the field duplicate sample.
- The RPDs were greater than 25% for chloroform, methylene chloride and naphthalene in the duplicate pair 260407-19-IA1-20110607/BD03-20110607; therefore, the detected concentrations of these compounds were J qualified as estimated in the duplicate pair.

These qualifications are summarized below:

Sample ID	Compound	Laboratory Result (µg/m^3)	RPD (%)	Validation Result (µg/m^3)	Reason Code
BD03-20110607	1,1,1-Trichloroethane	1.30	11	NA	NA
260407-19-IA1-20110607	1,1,1-Trichloroethane	1.17		NA	NA
BD03-20110607	1,2,4-Trimethylbenzene	2.47	5	NA	NA
260407-19-IA1-20110607	1,2,4-Trimethylbenzene	2.34		NA	NA
BD03-20110607	1,2-Dichloroethane	0.470	10	NA	NA
260407-19-IA1-20110607	1,2-Dichloroethane	0.425		NA	NA
BD03-20110607	1,3-Butadiene	0.055	NC	0.055 J	7
260407-19-IA1-20110607	1,3-Butadiene	0.044 U		0.044 UJ	7

Sample ID	Compound	Laboratory Result (µg/m^3)	RPD (%)	Validation Result (µg/m^3)	Reason Code
BD03-20110607	1,4-Dichlorobenzene	3.35	8	NA	NA
260407-19-IA1-20110607	1,4-Dichlorobenzene	3.08		NA	NA
BD03-20110607	Acetone	261	22	NA	NA
260407-19-IA1-20110607	Acetone	209		NA	NA
BD03-20110607	Benzene	0.655	7	NA	NA
260407-19-IA1-20110607	Benzene	0.613		NA	NA
BD03-20110607	Carbon tetrachloride	0.390	2	NA	NA
260407-19-IA1-20110607	Carbon tetrachloride	0.384		NA	NA
BD03-20110607	Chloroform	0.327	96	0.327 J	7
260407-19-IA1-20110607	Chloroform	0.928		0.928 J	7
BD03-20110607	Ethyl Acetate	12.2	13	NA	NA
260407-19-IA1-20110607	Ethyl Acetate	10.7		NA	NA
BD03-20110607	Ethylbenzene	1.28	5	NA	NA
260407-19-IA1-20110607	Ethylbenzene	1.22		NA	NA
BD03-20110607	Methylene chloride	1.94	89	1.94 J	7
260407-19-IA1-20110607	Methylene chloride	5.07		5.07 J	7
BD03-20110607	Naphthalene	0.744	41	0.744 J	7
260407-19-IA1-20110607	Naphthalene	0.493		0.493 J	7
BD03-20110607	Tetrachloroethene	0.312	7	NA	NA
260407-19-IA1-20110607	Tetrachloroethene	0.292		NA	NA
BD03-20110607	Toluene	16.0	4	NA	NA
260407-19-IA1-20110607	Toluene	15.3		NA	NA
BD03-20110607	Total Xylenes	4.78	5	NA	NA
260407-19-IA1-20110607	Total Xylenes	4.56		NA	NA
BD03-20110607	All other VOCs	ND	0	NA	NA
260407-19-IA1-20110607	All other VOCs	ND		NA	NA

U - not detected
ND - not detected
NC - not calculable
NA - not applicable

2.11 Internal Standards

The internal standard areas and retention times were within method limits of ±40% of the internal standard areas from the most recent calibration and within 0.33 minutes of the retention times for the internal standards from the most recent calibration.

2.12 Target Compound Identifications

The target compound identifications were within the validation criteria.

2.13 Target Compound Quantitations

The compound quantitations were within the validation criteria with the exceptions noted below.

Acetone was detected above the calibration range in the original analyses of samples 260407-17-IA1-20110607, 260407-22-IA2-20110607, BD03-20110607, 260407-19-IA1-20110607. The samples were analyzed at dilution, bringing the concentrations of acetone within the calibration range; both sets of data were reported. Only the acetone results within the calibration range should be used; the E flagged results should not be used.

Tetrachloroethene was detected above the calibration range in the original analysis of sample 260407-22-SS2-20110608. The sample was analyzed at dilution, bringing the concentrations of tetrachlorethene within the calibration range; both sets of data were reported. Only the tetrachlorethene result within the calibration range should be used; the E flagged result should not be used.

2.14 Electronic Data Deliverables Review

A minimum of 20% of the results and all sample IDs provided in the electronic data deliverable (EDD) were reviewed against information provided in the Level IV report. It was noted that sample results for 1,2-dibromoethane, naphthalene and bromodichloromethane were not reported to ½ the RL in the EDD.

3. AIR PHASE PETROLEUM HYDROCARBONS (APH)

Twenty two air samples, four field duplicate samples and one trip blank sample were analyzed for petroleum hydrocarbons per EPA Massachusetts DEP Method APH.

Components of the laboratory data package that were reviewed during this Tier IV data validation are listed below. A check mark (✓) indicates components of the data package that are acceptable. A crossed circle (⊗) signifies components of the data package where issues were raised during the course of the validation review, and these issues should be considered to determine whether they have an impact on data quality and usability.

- ✓ Overall Assessment
- ✓ Holding Times
- ✓ Instrument Performance Check
- ✓ Initial Calibration
- ⊗ Continuing Calibration Verification
- ✓ Method Blanks
- ✓ Laboratory Control Sample
- ⊗ Laboratory Duplicate
- ⊗ Trip Blank
- ⊗ Field Duplicate
- ✓ Internal Standards
- ✓ Target Compound Identifications
- ✓ Target Compound Quantitations

⊗ Electronic Data Deliverables Review

3.1 Overall Assessment

The APH data reported in this package are considered to be usable for meeting the project objectives documented in Form D of the QAPP. The results are considered to be valid; the analytical completeness, defined as the ratio of the number of valid analytical results (valid analytical results include values qualified as estimated) to the total number of analytical results requested on samples submitted for analysis, for the project is 100%.

Review of the reporting limits found that the proposed screening levels listed in the QAPP were met for all compounds except C9-C12 aliphatic hydrocarbons. During this assessment, it was noted that the laboratory hardcopy report lists the same value for the reporting limit and the MDL for each analyte. Based on information from Alpha Analytical, this is due to a limitation of the LIMS and none of the data have been reported to the MDLs, but to the RLs.

3.2 Holding Times

The holding time for an air sample collected in a Summa™ canister for APH analysis is 30 days from sample collection. The holding times were met for the sample analyses.

3.3 Instrument Performance Check

Instrument performance check samples (tune standards) were analyzed by Alpha Analytical. All calibration standards, the air samples and QC samples were analyzed within 24-hours after analyzing the tune standards. All ion abundance criteria were met for BFB.

3.4 Initial Calibration

Appropriate initial calibrations were performed and documented for each analyte. The laboratory calculated %RSDs of the RRFs. The %RSDs met the method criteria of less than or equal to 30% for all compounds except naphthalene. The %RSD for naphthalene was 38% in the initial calibration performed on instrument AirLab8. Therefore, based on professional judgment, the non-detected results of naphthalene in the associated samples were UJ qualified as estimated less than the reporting limit; naphthalene was not detected in the associated samples. These qualifications are summarized below:

Sample ID	Compound	Laboratory Concentration ($\mu g/m^3$)	Validation Concentration ($\mu g/ m^3$)	EDD Reason Code
260902-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260902-IA2-20110607	Naphthalene	2.0 U	2.0 UJ	9
260902-OA-20110607	Naphthalene	2.0 U	2.0 UJ	9
260903-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260903-IA2-20110607	Naphthalene	2.0 U	2.0 UJ	9
260903-OA-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-17-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
260407-20-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-22-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-22-IA2-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-OA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-OA2-20110607	Naphthalene	2.0 U	2.0 UJ	9
BD01-20110607	Naphthalene	2.0 U	2.0 UJ	9
BD03-20110607	Naphthalene	2.0 U	2.0 UJ	9
TB-20110608	Naphthalene	2.0 U	2.0 UJ	9
260407-19-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9

U - not detected at the reporting limit

ICV standards were analyzed after the initial calibrations. The %Ds between the RRFs in the initial calibrations and the ICVs were within the method acceptance criteria of less than or equal to 30%, with the following exception. The %D for naphthalene was 47% for the ICV analyzed on instrument AirLab8 on 6/10/11. Based on professional judgment, no qualifications were applied to the data due to the ICV %D result for naphthalene since the CCV standard %D and the LCS recovery for naphthalene, analyzed on the same day as the samples, were within the method acceptance limits.

3.5 Continuing Calibration Verification

CCVs were performed after the initial calibration on a daily basis after the BFB tune and prior to the analysis of samples. The CCVs RRFs met the method minimum RRF criteria of 0.050. The %Ds between the RRFs in the initial and CCVs were within the method acceptance criteria of less than or equal to 30%, with the following exception. The CCV analyzed on instrument Air2 on 18 June 2011 had 35%D for naphthalene; naphthalene was not detected in the associated samples and therefore, the non-detected results of naphthalene in the associated samples were UJ qualified as estimated less than the reporting limit. These qualifications are summarized below:

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
260902-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260902-IA2-20110607	Naphthalene	2.0 U	2.0 UJ	9
260902-OA-20110607	Naphthalene	2.0 U	2.0 UJ	9
260903-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260903-IA2-20110607	Naphthalene	2.0 U	2.0 UJ	9
260903-OA-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-17-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-20-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-22-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
260407-22-IA2-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-OA1-20110607	Naphthalene	2.0 U	2.0 UJ	9
260407-OA2-20110607	Naphthalene	2.0 U	2.0 UJ	9
BD01-20110607	Naphthalene	2.0 U	2.0 UJ	9
BD03-20110607	Naphthalene	2.0 U	2.0 UJ	9
TB-20110608	Naphthalene	2.0 U	2.0 UJ	9
260407-19-IA1-20110607	Naphthalene	2.0 U	2.0 UJ	9

U - not detected at the reporting limit

3.6 Method Blanks

Method blanks were analyzed at the proper frequency for the number and types of samples analyzed (i.e., one per batch of 20 samples). Two method blanks were analyzed and reported for the 27 samples. APH were not detected in the method blanks above the reporting limits.

3.7 Laboratory Duplicate

Laboratory duplicates were analyzed at the proper frequency for the number and types of samples analyzed (one per batch of 20 samples). Two laboratory duplicates were analyzed, using samples 260407-19-SS1-20110608 and 260407-20-IA1-20110607. The results for the laboratory duplicate were within the method-specified acceptance criteria for APH analytes of 25%D, with the following exception. o-Xylene was detected in sample 260407-20-IA1-20110607 above the reporting limit and not detected in the laboratory duplicate, resulting in a non-calculable and unacceptable RPD between the results. Therefore, the detected concentration of o-xylene in sample 260407-20-IA1-20110607 was J qualified as estimated. This qualification is summarized below:

Sample ID	Compound	Laboratory Concentration (µg/m^3)	Validation Concentration (µg/ m^3)	EDD Reason Code
260407-20-IA1-20110607	o-Xylene	2.0	2.0 J	12

3.8 Laboratory Control Sample

Two LCSs were analyzed for the 27 samples submitted to the laboratory, which is the proper frequency for the number and types of samples analyzed (i.e., one per batch of 20 samples). The results for the LCSs were within the method-specified acceptance criteria for recovery of 70-130%.

3.9 Trip Blank

A trip blank, TB01-03182011, accompanied the sample shipment. No APH were detected in the trip blank above the reporting limits, with the exception of C5-C8 Aliphatics, which was detected

at a concentration of 13.0 µg/m^3. Since the samples were analyzed from Summa™ canisters, no qualifications were applied to the data, based on professional judgment.

3.10 Field Duplicate

Four field duplicate samples, BD01-20110607, BD02-20110607, BD03-20110607 and BD04-20110608, were collected with the samples. Acceptable precision (RPD ≤25%) was demonstrated between each field duplicate and the associated original samples, 260902-IA2-20110607, 260903-SS1-20110607, 260407-19-IA1-20110607 and 260407-22-SS1-20110608, respectively, with the following exceptions. C9-C12 aliphatics and toluene were detected in the field duplicate and not detected in the parent sample for the duplicate pair 260407-22-SS1-20110608/BD04-20110608. Therefore, the detected concentrations of C9-C12 aliphatics and toluene in field duplicate BD04-20110608 were J qualified as estimated and the non-detected results in sample 260407-22-SS1-20110608 were UJ qualified as estimated less than the MDLs.

The calculated RPDs for the duplicate pairs and applicable qualifications are summarized below:

Sample ID	Compound	Laboratory Concentration (µg/m^3)	RPD	Validation Concentration (µg/ m^3)	EDD Reason Code
260902-IA2-20110607	C5-C8 Aliphatics	85	2	NA	NA
BD01-20110607	C5-C8 Aliphatics	83		NA	NA
260902-IA2-20110607	C9-C12 Aliphatics	52	0	NA	NA
BD01-20110607	C9-C12 Aliphatics	52		NA	NA
260902-IA2-20110607	Toluene	4.3	10	NA	NA
BD01-20110607	Toluene	3.9		NA	NA
260902-IA2-20110607	All other APH	ND	0	NA	NA
BD01-20110607	All other APH	ND		NA	NA

ND - not detected at the reporting limit
NA - not applicable

Sample ID	Compound	Laboratory Concentration (µg/m^3)	RPD	Validation Concentration (µg/ m^3)	EDD Reason Code
260903-SS1-20110607	C5-C8 Aliphatics	20	11	NA	NA
BD02-20110607	C5-C8 Aliphatics	18		NA	NA
260903-SS1-20110607	All other APH	ND	0	NA	NA
BD02-20110607	All other APH	ND		NA	NA

ND - not detected at the reporting limit
NA - not applicable

Sample ID	Compound	Laboratory Concentration (µg/m^3)	RPD	Validation Concentration (µg/ m^3)	EDD Reason Code
BD03-20110607	C5-C8 Aliphatics	360	9	NA	NA

260407-19-IA1-20110607	C5-C8 Aliphatics	330		NA	NA
BD03-20110607	C9-C10 Aromatics Total	12	15	NA	NA
260407-19-IA1-20110607	C9-C10 Aromatics Total	14		NA	NA
BD03-20110607	C9-C12 Aliphatics	180	0	NA	NA
260407-19-IA1-20110607	C9-C12 Aliphatics	180		NA	NA
BD03-20110607	Toluene	16	0	NA	NA
260407-19-IA1-20110607	Toluene	16		NA	NA
BD03-20110607	All other APH	ND	0	NA	NA
260407-19-IA1-20110607	All other APH	ND		NA	NA

ND - not detected at the reporting limit
NA - not applicable

Sample ID	**Compound**	**Laboratory Concentration ($\mu g/m^3$)**	**RPD**	**Validation Concentration ($\mu g/ m^3$)**	**EDD Reason Code**
260407-22-SS1-20110608	C5-C8 Aliphatics	33	8	NA	NA
BD04-20110608	C5-C8 Aliphatics	39		NA	NA
260407-22-SS1-20110608	C9-C12 Aliphatics	14 U	NC	14 UJ	7
BD04-20110608	C9-C12 Aliphatics	14		14 J	7
260407-22-SS1-20110608	Toluene	2.0 U	NC	2.0 UJ	7
BD04-20110608	Toluene	3.3		3.3 J	7
260407-22-SS1-20110608	All other APH	ND	0	NA	NA
BD04-20110608	All other APH	ND		NA	NA

U - not detected at the indicated reporting limit
NC - not calculable
NA - not applicable
ND - not detected at the reporting limit

3.11 Internal Standards

The internal standard areas and retention times were within method limits of ±40% of the internal standard areas from the most recent calibration and within 0.33 minutes of the retention times for the internal standards from the most recent calibration.

3.12 Target Compound Identifications

The target compound identifications were within the validation criteria.

3.13 Target Compound Quantitations

The compound quantitations were within the validation.

3.14 Electronic Data Deliverables Review

A minimum of 20% of the results and all sample IDs provided in the EDD were reviewed against the information provided in the Level IV report. Discrepancies were identified between the EDD

and the Level IV report; there were M flagged results in EDD that were not M flagged in hardcopy. The laboratory was contacted and the EDD was revised to remove the M flags from the sample results.

* * * * *

APPENDIX B

ANALYTICAL RESULTS

Subslab Soil Gas, Indoor Air and Ambient Outdoor Air

Table B-1. Summary of Analytical Results for Air Samples -- March and June 2011
Wells G & H (Parcel 260206)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/02/06		26/02/06		26/02/06			26/02/06			26/02/06	
		Sample Type:	Ambient Air		Ambient Air		Indoor Air			Indoor Air			Indoor Air	
		Sample Location:	AA-CP-1		AA-CP-2		IA-CP-1			IA-CP-2			IA-CP-3	
		Sample ID:	AA-1	AA-CP-1	AA-2	AA-CP-2	IA-1	DUP IA-3-12-11	IA-CP-1	IA-2	IA-CP-2	DUPIA	IA-3	IA-CP-3
		Sample Date:	3/12/2011	6/17/2011	3/12/2011	6/17/2011	3/12/2011	3/12/2011 Field Dup	6/17/2011	3/12/2011	6/17/2011	6/17/2011 Field Dup	3/12/2011	6/17/2011
TO-15														
(ug/m3)	1,1,1-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	**0.109**	0.109 U	**0.109**	0.109 U	0.109 U	0.109 U
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	1,2,4-Trimethylbenzene		0.098 U	**0.241**	0.098 U	**0.142**	**0.339**	**0.295**	**2.13**	**0.314**	**2.30**	**2.67**	**0.236**	**2.69**
	1,2-Dibromoethane		0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U
	1,2-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	**0.125**	**0.125**	**0.308**	**0.125**	0.081 U	0.081 U	**0.162**	**0.368**
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	1,3-Butadiene		0.044 U	0.044 UJ	0.044 U	0.044 UJ	**0.058**	**0.060**	**0.077 J**	**0.058**	**0.10 J**	**0.10 J**	**0.073**	**0.077 J**
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	1,4-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	**0.180**	0.120 U	**0.168**	**0.186**	0.120 U	**0.168**
	Benzene		**0.424**	0.224 U	**0.373**	0.224 U	**0.721**	**0.661**	**3.18**	**0.753**	**3.19**	**3.14**	**0.747**	**3.07**
	Bromodichloromethane		0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	**0.315**	0.134 U	**0.328**	**0.315**	**0.074 J**	**0.315**
	Bromoform		0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.206 U	0.207 U	0.206 U	0.207 U	0.207 U	0.206 U	0.207 U
	Carbon tetrachloride		**0.578**	**0.447**	**0.553**	**0.459**	**1.36**	**1.29**	**0.704**	**1.22**	**0.679**	**0.660**	**1.54**	**0.679**
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	Chloroform		0.098 U	0.098 U	0.098 U	0.098 U	**3.22**	**3.20**	**5.27**	**3.36**	**5.13**	**4.79**	**4.07**	**5.57**
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	Ethylbenzene		0.087 U	**0.091 J**	0.087 U	0.087 UJ	**0.521**	**0.464**	**3.47 J**	**0.538**	**3.56 J**	**3.68 J**	**0.486**	**3.57 J**
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U
	Methyl tert butyl ether		0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 U	0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 UJ	0.072 U	0.072 UJ
	Methylene chloride		**2.10**	**3.29**	**1.99**	**3.96**	1.74 U	1.74 U	**6.81**	1.74 U	**3.26**	**3.00**	**2.01**	**2.89**
	Naphthalene		0.262 UJ	**2.86 J**	0.262 UJ	**0.157 J**	0.262 UJ	0.262 UJ	**0.603 J**	0.262 UJ	**0.587 J**	**0.514 J**	0.262 UJ	**0.603 J**
	Tetrachloroethene		0.136 U	0.136 U	0.136 U	0.136 U	**1.02**	**0.942**	**1.09**	**1.19**	**1.13**	**1.23**	**1.17**	**1.19**
	Toluene		0.407 U	**0.637 J**	0.339 U	**0.724 J**	**3.82**	**3.43**	**27.9 J**	**5.64**	**29.0 J**	**27.2 J**	**4.03**	**27.0 J**
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U
	Xylenes (total)		0.260 U	**0.330**	0.260 U	**0.304**	**2.68**	**2.37**	**18.8**	**2.67**	**19.0**	**19.9**	**2.46**	**19.3**

Notes:

ug/m3 - micrograms per cubic meter.

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

UJ - Estimated non-detect.

Values in **Bold** indicate the compound was detected.

TO - Toxic organics.

(+) - Field duplicate collected at this location; sample volume extrmely low at end of collection period; result not used.

Table B-1. Summary of Analytical Results for Air Samples -- March and June 2011
Wells G & H (Parcel 260206)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/02/06			26/02/06		26/02/06	
		Sample Type:	Sub-Slab Soil Gas			Sub-Slab Soil Gas		Sub-Slab Soil Gas	
		Sample Location:	SS-CP-1			SS-CP-2		SS-CP-3	
		Sample ID:	SS-1	DUPSS-3-12-11	SS-CP-1	SS-2	SS-CP-2	SS-3	SS-CP-3
		Sample Date:	3/12/2011	3/12/2011 Field Dup	6/17/2011 (+)	3/12/2011	6/17/2011	3/12/2011	6/17/2011
TO-15 (ug/m3)	1,1,1-Trichloroethane		**10.8**	**10.5**	**8.40**	**50**	**38.2**	**15.9**	**12.1**
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.218 U	0.218 U	1.09 U	0.109 U	0.218 U
	1,1-Dichloroethane		**0.497**	**0.481**	**0.518**	**0.178**	0.809 U	0.081 U	0.162 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.158 U	0.158 U	0.793 U	0.079 U	0.158 U
	1,2,4-Trimethylbenzene		0.098 U	0.098 U	0.197 U	0.196 U	0.983 U	**0.138**	0.197 U
	1,2-Dibromoethane		0.154 U	0.154 U	0.307 U	0.307 U	1.54 U	0.154 U	0.307 U
	1,2-Dichloroethane		0.081 U	0.081 U	0.162 U	0.162 U	0.809 U	0.081 U	0.162 U
	1,2-Dichloropropane		0.092 U	0.092 U	0.185 U	0.185 U	0.924 U	0.092 U	0.185 U
	1,3-Butadiene		0.044 U	0.044 U	0.089 UJ	0.088 U	0.442 UJ	0.044 U	0.089 UJ
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.240 U	0.240 U	1.20 U	0.120 U	0.240 U
	1,4-Dichlorobenzene		0.120 U	0.120 U	0.240 U	0.240 U	1.20 U	0.120 U	0.240 U
	Benzene		0.223 U	0.223 U	0.447 U	0.447 U	2.24 U	0.223 U	0.447 U
	Bromodichloromethane		**3.61**	**3.46**	**2.57**	**0.589**	1.34 U	**0.623**	**0.482**
	Bromoform		0.206 U	0.206 U	0.414 U	0.413 U	2.07 U	0.206 U	0.414 U
	Carbon tetrachloride		0.126 U	0.126 U	0.252 U	0.251 U	1.26 U	**0.283**	**0.302**
	Chlorobenzene		0.092 U	0.092 U	0.184 U	0.184 U	0.921 U	0.092 U	0.184 U
	Chloroform		**57.9**	**55.3**	**58.6**	**29.5**	**28.9**	**31.3**	**32.7**
	cis-1,2-Dichloroethene		**0.242**	**0.258**	**0.285**	0.158 U	0.793 U	0.079 U	0.158 U
	Ethylbenzene		0.087 U	0.087 U	0.174 UJ	0.174 U	0.869 UJ	**0.269**	0.174 UJ
	Isopropylbenzene		2.46 U	2.46 U	4.92 U	4.91 U	24.6 U	2.46 U	4.92 U
	Methyl tert butyl ether		0.072 U	0.072 U	0.144 UJ	0.144 U	0.721 UJ	0.072 U	0.144 UJ
	Methylene chloride		1.74 U	1.74 U	3.47 U	3.47 U	17.4 U	1.74 U	3.47 U
	Naphthalene		0.262 UJ	0.262 UJ	0.524 UJ	0.524 UJ	2.62 UJ	0.262 UJ	0.524 UJ
	Tetrachloroethene		**1,340**	**1,270**	**1,100**	**3,080**	**5,730**	**1,380**	**1,120**
	Toluene		0.188 U	0.188 U	0.377 UJ	0.376 U	1.88 UJ	0.192 U	0.377 UJ
	trans-1,2-Dichloroethene		**0.273**	**0.261**	**0.285**	0.158 U	0.793 U	0.079 U	0.158 U
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.182 U	0.181 U	0.908 U	0.091 U	0.182 U
	Trichloroethene		**27.6**	**26.0**	**25.7**	**4.28**	**4.46**	**0.644**	**0.709**
	Vinyl chloride		0.051 U	0.051 U	0.102 U	0.102 U	0.511 U	0.051 U	0.102 U
	Xylenes (total)		0.26 U	0.26 U	0.521 U	0.521 U	2.61 U	**11.6**	0.521 U

Notes:

ug/m3 - micrograms per cubic meter.

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

UJ - Estimated non-detect.

Values in **Bold** indicate the compound was detected.

TO - Toxic organics.

(+) - Field duplicate collected at this location; sample volume extrmely low at end of collection perioc

Table B-2. Summary of Analytical Results for Air Samples -- April 2010 and February 2011
Wells G & H (Parcel 260207)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/02/07		26/02/07		26/02/07		26/02/07		26/02/07		26/02/07		26/02/07		26/02/07		26/02/07		26/02/07	
		Sample Type:	Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air	
		Sample Location:	IA-01		IA-02		IA-03		IA-04		IA-05		IA-06		IA-07		IA-08		IA-09			
		Sample ID:	IA-01	IA-1	IA-02	IA-2	IA-03	IA-03	IA-04	IA-04	IA-05	IA-05	IA-06	IA-06	IA-07	IA-7	IA-08	IA-8	IA-09	IA-09		
		Sample Date:	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011		
TO-15																						
(ug/m3)	1,1,1-Trichloroethane		**0.251**	0.109 U	**0.300**	0.109 U	**0.294**	0.109 U	**0.294**	**0.305**	**0.218**	**0.245**	**0.425**	**0.523**	**0.491**	**0.229**	**0.229**	**0.213**	**0.142**	0.109 U		
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U		
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U		
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U		
	1,2,4-Trimethylbenzene		**1.22**	**0.368**	**1.12**	**0.304**	**1.13**	**0.373**	**1.60**	**0.388**	**1.02**	**0.275**	**1.04**	**0.368**	**0.958**	**0.363**	**1.19**	**0.373**	**0.413**	**0.138**		
	1,2-Dibromoethane		0.077 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U		
	1,2-Dichloroethane		**0.554**	**0.222**	**0.607**	**0.210**	**0.651**	**0.230**	**0.833**	**0.283**	**0.356**	**0.206**	**0.562**	**0.267**	**0.663**	**0.243**	**0.481**	**0.202**	**0.243**	0.081 U		
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U		
	1,3-Butadiene		0.044 U	**0.046**	**0.053**	0.044 U	**0.044**	**0.044**	**0.046**	0.044 U	**0.097**	**0.046**	**0.066**	0.044 U	**0.062**	**0.046**	**0.055**	0.044 U	**0.110**	0.044 U		
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U		
	1,4-Dichlorobenzene		**36**	**1.98**	**40.1**	**1.83**	**15.8**	**2.11**	**11.6**	**1.30**	**1.43**	**0.661**	**2.35**	**0.739**	**3.75**	**1.51**	**4.11**	**0.589**	**0.378**	0.120 U		
	Benzene		**0.728**	**0.584**	**0.900**	**0.594**	**0.862**	**0.603**	**0.903**	**0.626**	**1.14**	**0.587**	**1.18**	**0.632**	**0.993**	**0.619**	**1.11**	**0.648**	**1.43**	**0.517**		
	Bromodichloromethane		0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U		
	Bromoform		0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U		
	Carbon tetrachloride		**0.459**	**0.471**	**0.484**	**0.490**	**0.408**	**0.490**	**0.421**	**0.484**	**0.402**	**0.471**	**0.453**	**0.478**	**0.421**	**0.497**	**0.490**	**0.478**	**0.415**	**0.478**		
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U		
	Chloroform		**0.215**	0.098 U	**0.263**	0.098 U	**0.176**	0.098 U	**0.161**	**0.098**	**0.151**	0.098 U	**0.161**	0.098 U	**0.151**	0.098 U	**0.220**	0.098 U	**0.195**	0.098 U		
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	**0.099**	0.079 U	0.079 U	0.079 U	**0.107**	**0.111**	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U		
	Ethylbenzene		**0.859**	**0.295**	**0.859**	**0.273**	**0.889**	**0.321**	**1.14**	**0.369**	**1.01**	**0.282**	**0.811**	**0.347**	**0.820**	**0.351**	**1.53**	**0.334**	**1.08**	**0.130**		
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U		
	Methyl tert butyl ether		**0.396**	0.072 U	**0.450**	0.072 U	**0.443**	0.072 U	**0.439**	0.072 U	**0.166**	0.072 U	**0.148**	0.072 U	**0.198**	0.072 U	**0.263**	0.072 U	**1.02**	0.072 U		
	Methylene chloride		**3.60**	**1.87**	**3.68**	**1.84**	**2.72**	**2.06**	**2.48**	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	**1.74**	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U		
	Naphthalene		**2.30**	**0.712 J**	**2.19**	**0.660 J**	**2.10**	**0.587 J**	**4.18**	**0.948 J**	**1.17**	0.262 UJ	**3.49**	**0.901 J**	**4.30**	**0.649 J**	**1.93**	**0.466 J**	0.260 U	0.262 UJ		
	Tetrachloroethene		**4.36**	**2.28**	**4.34**	**2.10**	**8.75**	**2.53**	**19.1**	**23.2**	**9.83**	**23.1**	**36.9**	**61**	**29.9**	**15.6**	**15.3**	**18.3**	**4.36**	**0.861**		
	Toluene		**5.86**	**1.85**	**6.18**	**1.72**	**8.77**	**2.15**	**19.6**	**2.08**	**7.56**	**1.41**	**9.02**	**1.88**	**10.7**	**1.99**	**9.75**	**1.76**	**8.46**	**0.618**		
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U		
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 UJ	0.091 U	0.091 UJ	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 UJ	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U		
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	**0.113**	0.107 U	**0.161**	**0.113**	**0.118**	0.107 U	**0.231**	**0.161**	**0.322**	0.107 U	**0.140**	0.107 U	**0.113**	0.107 U		
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U		
	Xylenes, Total		**2.99**	**1.09**	**2.97**	**0.942**	**3.22**	**1.12**	**4.32**	**1.27**	**4.02**	**0.985**	**3.09**	**1.14**	**3.06**	**1.20**	**5.37**	**1.18**	**3.64**	**0.421**		
APH																						
(ug/m3)	C5-C8 Aliphatics		**58**	22.0 U	**66**	21.0 U	**61**	27.0 U	**66**	**38**	**44**	32.0 U	**51**	**43**	**46**	30.0 U	**87**	**130**	**70**	12.0 U		
	C9-C12 Aliphatics		**87**	14.0 U	**83**	14.0 U	**61**	14.0 U	**73**	14.0 U	**28**	14.0 U	**29**	14.0 U	**32**	14.0 U	**69**	14.0 U	14.0 U	14.0 U		
	C9-C10 Aromatics		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U		
	1,3-Butadiene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U		
	Benzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U		
	Ethylbenzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U		
	Methyl tert butyl ether		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U		
	Naphthalene		**2.20**	2.00 U	**2.20**	2.00 U	**2.00**	2.00 U	**4.10**	2.00 U	2.00 U	2.00 U	**3.40**	2.00 U	**4.10**	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U		
	o-Xylene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U		
	p/m-Xylene		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	**4.50**	4.00 U	4.00 U	4.00 U		
	Xylenes, Total		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	**4.50**	4.00 U	4.00 U	4.00 U		
	Toluene		**6.80**	2.00 U	**7.70**	2.00 U	**10.0**	**2.30**	**21**	**2.30**	**8.30**	2.00 U	**10.0**	**2.00**	**12.0**	**2.20**	**12.0**	**2.00**	**9.80**	2.00 U		

Notes:

ug/m3 - micrograms per cubic meter.

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

UJ - Estimated non-detect.

Values in **Bold** indicate the compound was detected.

APH - Air-Phase Petroleum Hydrocarbons.

TO - Toxic organics.

Table B-2. Summary of Analytical Results for Air Samples -- April 2010 and February 2011
Wells G & H (Parcel 260207)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/02/07			26/02/07				26/02/07		26/02/07					26/02/07		26/02/07	
		Sample Type:	Indoor Air			Indoor Air				Indoor Air		Indoor Air					Indoor Air		Indoor Air	
		Sample Location:	IA-10			IA-11				IA-12		IA-13					IA-14		IA-15	
		Sample ID:	IA-10	IA-10A	IA-10	IA-11	IA-DUP02	IA-11	DUP-2-2-20-11	IA-12	IA-12	IA-13	IA-DUP01	IA-13A	IA-13	DUP-1-2-20-11	IA-14	IA-14	IA-15	IA-15
		Sample Date:	4/12/2010	4/12/2010	2/21/2011	4/12/2010	4/12/2010 Field Dup	2/21/2011	2/21/2011 Field Dup	4/12/2010	2/21/2011	4/12/2010	4/12/2010 Field Dup	4/12/2010	2/21/2011	2/21/2011 Field Dup	4/12/2010	2/21/2011	4/12/2010	2/21/2011
TO-15																				
(ug/m3)	1,1,1-Trichloroethane		**0.371**	**0.382**	**0.714**	**0.763**	**0.774**	**0.660**	**0.654**	**0.469**	**0.491**	**0.665**	**0.654**	**0.714**	**0.741**	**0.736**	**0.218**	**0.196**	**1.68**	**2.69**
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U
	1,1-Dichloroethane		0.081 U	0.081 U	**0.202**	0.081 U	0.081 U	**0.105**	**0.109**	0.081 U	0.081 U	**0.089**	**0.085**	**0.089**	**0.198**	**0.190**	0.081 U	0.081 U	**0.671**	**0.926**
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	**0.131**	**0.178**
	1,2,4-Trimethylbenzene		**1.10**	**1.33**	**0.393**	**0.452**	**0.334**	**0.182**	**0.211**	**1.22**	**0.383**	**0.727**	**0.211**	**0.791**	**0.427**	**0.427**	**1.41**	**0.432**	**0.211**	**0.246**
	1,2-Dibromoethane		0.077 U	0.077 U	0.154 U	0.077 U	0.077 U	0.154 U	0.154 U	0.077 U	0.154 U	0.077 U	0.077 U	0.077 U	0.154 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U
	1,2-Dichloroethane		**0.833**	**0.874**	**0.283**	**0.138**	**0.133**	**0.150**	**0.142**	**0.542**	**0.287**	**0.400**	**0.364**	**0.404**	**0.332**	**0.328**	**0.530**	**0.210**	**0.093**	**0.109**
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	1,3-Butadiene		0.044 U	0.044 U	**0.051**	**0.100**	**0.086**	0.044 U	0.044 U	**0.069**	**0.055**	**0.075**	**0.080**	**0.071**	0.044 U	**0.046**	0.044 U	**0.046**	**0.046**	**0.049**
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	1,4-Dichlorobenzene		**6.08**	**6.72**	**0.955**	**0.330**	**0.258**	**0.276**	**0.276**	**2.27**	**0.769**	**1.62**	**0.270**	**1.83**	**0.901**	**0.877**	**4.22**	**0.991**	**0.312**	**0.144**
	Benzene		**0.862**	**0.906**	**0.629**	**0.795**	**0.820**	**0.527**	**0.549**	**1.06**	**0.658**	**0.763**	**0.747**	**0.785**	**0.670**	**0.651**	**0.938**	**0.699**	**0.664**	**0.517**
	Bromodichloromethane		0.067 U	0.067 U	0.134 U	0.067 U	0.067 U	0.134 U	0.134 U	0.067 U	0.134 U	0.067 U	0.067 U	0.067 U	0.134 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U
	Bromoform		0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U
	Carbon tetrachloride		**0.440**	**0.415**	**0.490**	**0.415**	**0.465**	**0.484**	**0.484**	**0.434**	**0.478**	**0.415**	**0.408**	**0.408**	**0.484**	**0.490**	**0.440**	**0.509**	**0.421**	**0.478**
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	Chloroform		**0.141**	**0.146**	**0.127**	**0.141**	**0.146**	**0.098**	**0.098**	**0.156**	0.098 U	**0.136**	**0.122**	**0.132**	**0.132**	**0.127**	**0.405**	**0.190**	**0.229**	**0.293**
	cis-1,2-Dichloroethene		**0.095**	**0.103**	**0.313**	**0.170**	**0.146**	**0.515**	**0.507**	0.079 U	**0.103**	**0.194**	**0.178**	**0.198**	**0.321**	**0.309**	0.079 U	0.079 U	**0.570**	**1.35**
	Ethylbenzene		**0.803**	**0.950**	**0.390**	**0.482**	**0.395**	**0.200**	**0.208**	**0.833**	**0.356**	**0.581**	**0.395**	**0.590**	**0.495**	**0.464**	**1.43**	**0.364**	**0.968**	**0.390**
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U
	Methyl tert butyl ether		**0.248**	**0.266**	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	**0.130**	0.072 U	**0.083**	0.072 U	**0.072**	0.072 U	0.072 U	**0.252**	0.072 U	**0.072**	0.072 U
	Methylene chloride		**3.82**	**1.74**	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	**4.40**	1.74 U	1.74 U	1.74 U	1.74 U	**1.94**	1.74 U	1.74 U
	Naphthalene		**4.30**	**5.91**	**1.13 J**	**1.38**	**0.822**	**0.518 J**	**0.518 J**	**3.73**	**0.890 J**	**6.63**	**0.367 J**	**15.6**	**2.04 J**	**1.83 J**	**2.68**	**0.665 J**	**0.498 J**	0.267 UJ
	Tetrachloroethene		**28**	**33.5**	**31.3**	**19.8**	**17.2**	**83.8**	**78.6**	**45**	**53.3**	**48.2**	**43.6**	**60.2**	**61.1**	**59.5**	**17.9**	**16.5**	**12.0**	**39.9**
	Toluene		**11.9**	**12.9**	**1.92**	**2.96**	**2.52**	**0.994**	**0.975**	**7.98**	**1.98**	**4.87**	**4.26**	**4.80**	**2.36**	**2.28**	**9.58**	**1.98**	**4.74**	**2.15**
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U
	Trichloroethene		**0.220**	**0.231**	**0.188**	**0.521**	**0.505**	**1.06**	**1.02**	**0.220**	**0.156**	**0.483**	**0.451**	**0.510**	**0.274**	**0.274**	**0.118**	0.107 U	**0.226**	**0.489**
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U
	Xylenes, Total		**2.97**	**3.52**	**1.43**	**1.78**	**1.40**	**0.720**	**0.772**	**3.14**	**1.24**	**2.16 J**	**1.31 J**	**2.18**	**1.69**	**1.60**	**5.11**	**1.28**	**3.33**	**1.50**
APH																				
(ug/m3)	C5-C8 Aliphatics		**52**	**55**	**38**	**17.0**	**17.0**	20.0 U	23 U	**48**	**44**	**27**	**20**	**32**	**47**	**39**	**74**	**150**	**27**	20.0 U
	C9-C12 Aliphatics		**39**	**47**	14.0 U	14.0 U	14.0 U	14.0 U	14 U	**58**	**15.0**	21 U	14.0 U	18.0 U	14.0 U	14 U	**82**	**15.0**	14.0 U	14.0 U
	C9-C10 Aromatics		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10 U	10.0 U	10.0 U	10.0 U	10.0 U
	1,3-Butadiene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Benzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Ethylbenzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Methyl tert butyl ether		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Naphthalene		**4.20**	**5.70**	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**3.70**	2.00 U	**6.40**	2.00 U	**15.0**	**2.30**	2.00 U	**2.60**	2.00 U	2.00 U	2.00 U
	o-Xylene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	p/m-Xylene		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	**4.10**	4.00 U	4.00 U	4.00 U
	Xylenes, Total		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	**4.10**	4.00 U	4.00 U	4.00 U
	Toluene		**14.0**	**14.0**	**2.10**	**3.20**	**3.00**	2.00 U	2.00 U	**9.20**	**2.10**	**5.50**	**4.90**	**5.40**	**2.50**	**2.50**	**11.0**	**2.20**	**5.40**	**2.40**

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
APH - Air-Phase Petroleum Hydrocarbons.
TO - Toxic organics.

Table B-2. Summary of Analytical Results for Air Samples -- April 2010 and February 2011
Wells G & H (Parcel 260207)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/02/07	26/02/07	26/02/07		26/02/07	26/02/07	26/02/07	26/02/07		26/02/07		26/02/07		26/02/07		26/02/07		26/02/07		26/0
		Sample Type:	Outdoor Air	Outdoor Air	Outdoor Air		Outdoor Air	Outdoor Air	Outdoor Air	Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		Soil V
		Sample Location:	OA-01	OA-R2-1	OA-02		OA-R2-2	OA-03	OA-R2-3	SV-01		SV-02		SV-03		SV-04		SV-05		SV		
		Sample ID:	OA-01	OA-1	OA-02	OA-DUP1	OA-2	OA-03	OA-3	SV-01	SV-01	SV-02	SV-02	SV-03	SV-03	SV-04	SV-04	SV-05	SV-05	SV-06		
		Sample Date:	4/12/2010	2/20/2011	4/12/2010	4/12/2010 Field Dup	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010		
TO-15																						
(ug/m3)	1,1,1-Trichloroethane		**0.131**	0.109 U	**0.262**	**0.278**	0.109 U	**0.376**	0.109 U	**0.234**	**0.229**	**0.670**	**0.665**	**0.681**	**0.676**	**5.45**	**5.15**	**920**	**813**	**1,440**		
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.298 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	1.09 U	1.60 U	1.09 U		
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.221 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.809 U	1.18 U	**0.809**		
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.216 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.792 U	1.16 U	**0.872**		
	1,2,4-Trimethylbenzene		**0.344**	0.098 U	**0.270**	**0.236**	0.098 U	**0.265**	0.098 U	0.098 U	0.098 U	**0.832**	0.098 U	0.098 U	0.098 U	**0.108**	0.098 U	0.982 U	1.44 U	**1.67**		
	1,2-Dibromoethane		0.077 U	0.154 U	0.077 U	0.077 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U	0.210 U	0.154 U	0.077 U	0.154 U	0.077 U	0.154 U	0.768 U	2.25 U	0.768 U		
	1,2-Dichloroethane		**0.093**	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.221 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.809 U	1.18 U	0.809 U		
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.252 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.924 U	1.35 U	0.924 U		
	1,3-Butadiene		**0.124**	0.044 U	**0.097**	**0.073**	0.044 U	**0.066**	0.044 U	0.044 U	0.044 U	0.121 U	0.044 U	0.044 U	0.044 U	0.044 U	0.044 U	0.442 U	0.648 U	0.442 U		
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.328 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	1.20 U	1.76 U	1.20 U		
	1,4-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	**0.342**	0.120 U	**1.15**	0.120 U	**0.234**	0.120 U	**0.186**	0.120 U	1.20 U	1.76 U	1.20 U		
	Benzene		**0.852**	**0.508**	**0.808**	**0.801**	**0.504**	**0.820**	**0.479**	0.319 U	0.223 U	**0.872**	0.223 U	0.319 U	0.223 U	0.319 U	0.223 U	3.19 U	3.28 U	3.19 U		
	Bromodichloromethane		0.067 U	0.134 U	0.067 U	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.183 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.670 U	1.96 U	0.670 U		
	Bromoform		0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	0.564 U	0.206 U	0.206 U	0.206 U	0.206 U	0.206 U	2.06 U	3.03 U	2.06 U		
	Carbon tetrachloride		**0.421**	**0.484**	**0.408**	**0.434**	**0.484**	**0.421**	**0.478**	0.126 U	0.126 U	0.344 U	**0.151**	0.126 U	0.126 U	**0.214**	**0.201**	1.26 U	1.84 U	1.26 U		
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.251 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.920 U	1.35 U	**1.52**		
	Chloroform		**0.161**	0.098 U	**0.146**	**0.146**	0.098 U	**0.132**	0.098 U	**0.854**	**0.546**	**1.00**	**0.195**	0.098 U	0.098 U	0.098 U	0.098 U	**1.22**	1.43 U	**16.6**		
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.216 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.792 U	1.16 U	0.792 U		
	Ethylbenzene		**0.369**	0.087 U	**0.325**	**0.299**	0.087 U	**0.312**	0.087 U	0.087 U	0.087 U	**0.534**	0.087 U	0.087 U	**0.134**	0.087 U	**0.338**	0.868 U	1.27 U	0.868 U		
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	6.71 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	24.6 U	36 U	24.6 U		
	Methyl tert butyl ether		0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	**0.256**	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.720 U	1.06 U	0.720 U		
	Methylene chloride		**2.39**	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	4.74 U	1.74 U	1.74 U	1.74 U	1.74 U	**1.78**	17.4 U	25.4 U	17.4 U		
	Naphthalene		0.260 U	0.262 UJ	**0.555**	0.260 U	0.262 UJ	0.260 U	0.262 UJ	0.260 U	0.262 UJ	**1.06**	**0.571 J**	0.260 U	0.262 UJ	0.260 U	0.262 UJ	2.62 U	3.84 UJ	2.62 U		
	Tetrachloroethene		0.156 U	0.136 U	0.196 U	0.190 U	0.136 U	**0.217**	**0.163**	**68**	**38.6**	**923**	**689**	**255**	**143**	**201**	**104**	**203,000**	**168,000**	**420,000**		
	Toluene		**2.32**	**0.467**	**2.38**	**2.20**	**0.437**	**2.16**	**0.407**	**0.516**	0.188 U	**3.11**	0.188 U	**0.264**	**0.260**	**0.376**	**0.576**	1.88 U	2.76 U	1.88 U		
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.216 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.792 U	1.16 U	0.792 U		
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 UJ	0.091 U	0.248 UJ	0.091 U	0.091 U	0.091 UJ	0.091 UJ	0.091 U	0.907 UJ	1.33 U	0.907 UJ		
	Trichloroethene		**0.118**	0.107 U	**0.113**	**0.118**	0.107 U	**0.118**	0.107 U	0.107 U	0.107 U	0.293 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	**7.20**	**5.43**	**522**		
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.140 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.511 U	0.749 U	0.511 U		
	Xylenes, Total		**1.39**	0.260 U	**1.17**	**1.02**	0.260 U	**1.09**	0.260 U	**0.373**	0.260 U	**2.88**	0.260 U	0.260 U	**1.05**	0.260 U	**1.13**	2.60 U	3.82 U	2.60 U		
APH																						
(ug/m3)	C5-C8 Aliphatics		**16.0**	12.0 U	**15.0**	**14.0**	12.0 U	**12.0**	12.0 U	**22**	19.0 U	**120**	12.0 U	**13.0**	12.0 U	**20**	31.0 U	120 U	180 U	120 U		
	C9-C12 Aliphatics		14.0 U	14.0 U	14.0 U	14.0 U	14.0 U	14.0 U	14.0 U	**58**	**240**	**490**	**60**	20 U	**42**	**300**	**160**	140 U	210 U	140 U		
	C9-C10 Aromatics		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	27 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	100 U	150 U	100 U		
	1,3-Butadiene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5.40 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20 U	30 U	20 U		
	Benzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5.40 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20 U	30 U	20 U		
	Ethylbenzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5.40 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20 U	30 U	20 U		
	Methyl tert butyl ether		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5.40 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20 U	30 U	20 U		
	Naphthalene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5.40 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20 U	30 U	20 U		
	o-Xylene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	5.40 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20 U	30 U	20 U		
	p/m-Xylene		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	11.0 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	40 U	60 U	40 U		
	Xylenes, Total		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	11.0 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	40 U	60 U	40 U		
	Toluene		**2.50**	2.00 U	**2.70**	**2.60**	2.00 U	**2.30**	2.00 U	2.00 U	2.00 U	5.40 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	20 U	30 U	20 U		

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
APH - Air-Phase Petroleum Hydrocarbons.
TO - Toxic organics.

Table B-2. Summary of Analytical Results for Air Samples -- April 2010 and February 2011
Wells G & H (Parcel 260207)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	2/07	26/02/07		26/02/07		26/02/07		26/02/07		
		Sample Type:	Vapor	Soil Vapor		Soil Vapor		Soil Vapor		Soil Vapor		
		Sample Location:	-06	SV-07		SV-08		SV-09		SV-10		
		Sample ID:	SV-06	SV-07	SV-07	SV-08	SV-08	SV-09	SV-09	SV-10	SV-10	DUP-SS-2-2-21-11
		Sample Date:	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011	2/21/2011 Field Dup
TO-15												
(ug/m3)	1,1,1-Trichloroethane		**2,090**	**280**	**298**	**2.84**	**4.40**	**33.2**	**30.3**	**265**	**291**	**272**
	1,1,2-Trichloroethane		1.78 U	1.09 U	1.71 U	0.109 U	0.109 U	1.09 U	0.780 U	1.09 U	1.66 U	1.65 U
	1,1-Dichloroethane		1.32 U	**3.52**	**3.74**	0.081 U	0.081 U	0.809 U	0.579 U	**1.54**	1.23 U	1.22 U
	1,1-Dichloroethene		1.29 U	0.792 U	1.24 U	0.079 U	0.079 U	0.792 U	0.567 U	0.792 U	1.20 U	1.20 U
	1,2,4-Trimethylbenzene		1.60 U	0.982 U	1.54 U	0.098 U	0.098 U	0.982 U	0.703 U	0.982 U	1.49 U	1.48 U
	1,2-Dibromoethane		2.50 U	0.768 U	2.40 U	0.077 U	0.154 U	0.768 U	1.10 U	0.768 U	2.33 U	2.32 U
	1,2-Dichloroethane		1.32 U	0.809 U	1.27 U	0.081 U	0.081 U	0.809 U	0.579 U	0.809 U	1.23 U	1.22 U
	1,2-Dichloropropane		1.50 U	0.924 U	1.45 U	0.092 U	0.092 U	0.924 U	0.661 U	0.924 U	1.40 U	1.40 U
	1,3-Butadiene		0.720 U	0.442 U	0.692 U	0.044 U	0.044 U	0.442 U	0.316 U	0.442 U	0.671 U	0.668 U
	1,3-Dichlorobenzene		1.96 U	1.20 U	1.88 U	0.120 U	0.120 U	1.20 U	0.860 U	1.20 U	1.82 U	1.82 U
	1,4-Dichlorobenzene		1.96 U	1.20 U	1.88 U	0.120 U	0.120 U	1.20 U	0.860 U	1.20 U	1.82 U	1.82 U
	Benzene		3.64 U	3.19 U	3.50 U	0.319 U	0.223 U	3.19 U	1.60 U	3.19 U	3.39 U	3.38 U
	Bromodichloromethane		2.18 U	0.670 U	2.10 U	**0.074 J**	0.134 U	0.670 U	0.958 U	0.670 U	2.03 U	2.02 U
	Bromoform		3.36 U	2.06 U	3.23 U	0.206 U	0.206 U	2.06 U	1.48 U	2.06 U	3.14 U	3.12 U
	Carbon tetrachloride		2.05 U	1.26 U	1.97 U	**0.283**	**0.320**	1.26 U	0.900 U	1.26 U	1.91 U	1.90 U
	Chlorobenzene		1.50 U	0.920 U	1.44 U	0.092 U	0.092 U	0.920 U	0.658 U	0.920 U	1.40 U	1.39 U
	Chloroform		**18.0**	**2.58**	**2.75**	**7.74**	**8.88**	0.976 U	0.698 U	**9.02**	**9.03**	**8.84**
	cis-1,2-Dichloroethene		1.29 U	0.792 U	1.24 U	0.079 U	0.079 U	0.792 U	0.567 U	0.792 U	1.20 U	1.20 U
	Ethylbenzene		1.41 U	0.868 U	1.36 U	0.087 U	0.087 U	0.868 U	0.621 U	0.868 U	1.32 U	1.31 U
	Isopropylbenzene		40 U	24.6 U	38.4 U	2.46 U	2.46 U	24.6 U	17.6 U	24.6 U	37.3 U	37.1 U
	Methyl tert butyl ether		1.17 U	0.720 U	1.13 U	0.072 U	0.072 U	0.720 U	0.516 U	0.720 U	1.09 U	1.09 U
	Methylene chloride		28.3 U	17.4 U	27.2 U	1.74 U	1.74 U	17.4 U	12.4 U	17.4 U	26.3 U	26.2 U
	Naphthalene		4.27 UJ	2.62 U	4.10 UJ	0.260 U	0.262 UJ	2.62 U	1.87 UJ	2.62 U	3.98 UJ	3.96 UJ
	Tetrachloroethene		**452,000**	**169,000**	**134,000**	**3,920**	**4,640**	**25,100**	**15,200**	**214,000**	**171,000**	**176,000**
	Toluene		3.07 U	1.88 U	2.95 U	**0.320**	0.188 U	1.88 U	1.35 U	1.88 U	2.86 U	2.84 U
	trans-1,2-Dichloroethene		1.29 U	0.792 U	1.24 U	0.079 U	0.079 U	0.792 U	0.567 U	0.792 U	1.20 U	1.20 U
	trans-1,3-Dichloropropene		1.48 U	0.907 UJ	1.42 U	0.091 UJ	0.091 U	0.907 UJ	0.649 U	0.907 UJ	1.38 U	1.37 U
	Trichloroethene		**612**	**13.9**	**14.4**	**0.247**	**0.290**	**4.51**	**3.92**	**14.6**	**11.9**	**11.0**
	Vinyl chloride		0.832 U	0.511 U	0.800 U	0.051 U	0.051 U	0.511 U	0.366 U	0.511 U	0.775 U	0.772 U
	Xylenes, Total		4.24 U	2.60 U	4.08 U	0.260 U	0.260 U	2.60 U	1.86 U	2.60 U	3.95 U	3.93 U
APH												
(ug/m3)	C5-C8 Aliphatics		190 U	120 U	190 U	**46**	20.0 U	120 U	86 U	120 U	180 U	180 U
	C9-C12 Aliphatics		220 U	140 U	220 U	**86**	**49**	140 U	100 U	140 U	210 U	210 U
	C9-C10 Aromatics		160 U	100 U	160 U	10.0 U	10.0 U	100 U	72 U	100 U	150 U	150 U
	1,3-Butadiene		32 U	20 U	32 U	2.00 U	2.00 U	20 U	14.0 U	20 U	30 U	30 U
	Benzene		32 U	20 U	32 U	2.00 U	2.00 U	20 U	14.0 U	20 U	30 U	30 U
	Ethylbenzene		32 U	20 U	32 U	2.00 U	2.00 U	20 U	14.0 U	20 U	30 U	30 U
	Methyl tert butyl ether		32 U	20 U	32 U	2.00 U	2.00 U	20 U	14.0 U	20 U	30 U	30 U
	Naphthalene		32 U	20 U	32 U	2.00 U	2.00 U	20 U	14.0 U	20 U	30 U	30 U
	o-Xylene		32 U	20 U	32 U	2.00 U	2.00 U	20 U	14.0 U	20 U	30 U	30 U
	p/m-Xylene		64 U	40 U	64 U	4.00 U	4.00 U	40 U	29 U	40 U	60 U	60 U
	Xylenes, Total		64 U	40 U	64 U	4.00 U	4.00 U	40 U	29 U	40 U	60 U	60 U
	Toluene		32 U	20 U	32 U	2.00 U	2.00 U	20 U	14.0 U	20 U	30 U	30 U

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
APH - Air-Phase Petroleum Hydrocarbons.
TO - Toxic organics.

Table B-2. Summary of Analytical Results for Air Samples -- April 2010 and February 2011
Wells G & H (Parcel 260207)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/02/07				26/02/07		26/02/07			26/02/07		26/02/07	
		Sample Type:	Soil Vapor				Soil Vapor		Soil Vapor			Soil Vapor		Soil Vapor	
		Sample Location:	SV-11				SV-12		SV-13			SV-14		SV-15	
		Sample ID:	SV-11	SV-DUP02	SV-11	DUP-SS-1-2-21-11	SV-12	SV-12	SV-13	SV-DUP01	SV-13	SV-14	SV-14	SV-15	SV-15
		Sample Date:	4/12/2010	4/12/2010 Field Dup	2/21/2011	2/21/2011 Field Dup	4/12/2010	2/21/2011	4/12/2010	4/12/2010 Field Dup	2/21/2011	4/12/2010	2/21/2011	4/12/2010	2/21/2011
TO-15															
(ug/m3)	1,1,1-Trichloroethane		**85.8**	**67.8**	**164**	**150**	**1,050**	**251**	**313**	**373**	**384**	**0.812**	**1.55**	**48.1**	**130**
	1,1,2-Trichloroethane		1.09 U	1.02 U	0.856 U	0.849 U	1.09 U	0.803 U	1.09 U	1.09 U	1.71 U	0.109 U	0.109 U	1.09 U	0.109 U
	1,1-Dichloroethane		**1.38**	**1.06**	**1.68**	**1.67**	**3.64**	**1.31**	**7.84**	**9.22**	**6.02**	0.081 U	0.081 U	**15.8**	**41.8**
	1,1-Dichloroethene		0.792 U	0.745 U	0.622 U	0.617 U	**6.02**	**1.11**	**2.02**	**2.10**	**3.54**	0.079 U	0.079 U	0.792 U	**1.76**
	1,2,4-Trimethylbenzene		0.982 U	0.924 U	0.771 U	0.765 U	0.982 U	0.724 U	0.982 U	0.982 U	1.54 U	0.098 U	0.098 U	0.982 U	**0.236**
	1,2-Dibromoethane		0.768 U	0.722 U	1.20 U	1.20 U	0.768 U	1.13 U	0.768 U	0.768 U	2.40 U	0.077 U	0.154 U	0.768 U	0.154 U
	1,2-Dichloroethane		0.809 U	0.761 U	0.635 U	0.630 U	0.809 U	0.596 U	0.809 U	0.809 U	1.27 U	0.081 U	0.081 U	0.809 U	0.081 U
	1,2-Dichloropropane		0.924 U	0.868 U	0.725 U	0.719 U	0.924 U	0.680 U	0.924 U	0.924 U	1.45 U	0.092 U	0.092 U	0.924 U	0.092 U
	1,3-Butadiene		0.442 U	0.416 U	0.347 U	0.344 U	0.442 U	0.326 U	0.442 U	0.442 U	0.692 U	0.044 U	0.044 U	0.442 U	0.044 U
	1,3-Dichlorobenzene		1.20 U	1.13 U	0.943 U	0.936 U	1.20 U	0.885 U	1.20 U	1.20 U	1.88 U	0.120 U	0.120 U	1.20 U	0.120 U
	1,4-Dichlorobenzene		1.20 U	1.13 U	0.943 U	0.936 U	1.20 U	0.885 U	1.20 U	1.20 U	1.88 U	0.120 U	0.120 U	1.20 U	0.120 U
	Benzene		3.19 U	3.00 U	1.75 U	1.74 U	3.19 U	1.65 U	3.19 U	3.19 U	3.50 U	0.319 U	0.223 U	3.19 U	0.223 U
	Bromodichloromethane		0.670 U	0.630 U	1.05 U	1.04 U	0.670 U	0.987 U	0.670 U	0.670 U	2.10 U	0.067 U	0.134 U	0.670 U	0.134 U
	Bromoform		2.06 U	1.94 U	1.62 U	1.61 U	2.06 U	1.52 U	2.06 U	2.06 U	3.23 U	0.206 U	0.206 U	2.06 U	0.206 U
	Carbon tetrachloride		1.26 U	1.18 U	0.987 U	0.979 U	1.26 U	0.926 U	1.26 U	1.26 U	1.97 U	**0.314**	**0.295**	1.26 U	**0.176**
	Chlorobenzene		0.920 U	0.865 U	0.722 U	0.716 U	0.920 U	0.678 U	**1.38**	**1.93**	1.44 U	0.092 U	0.092 U	0.920 U	0.092 U
	Chloroform		**1.46**	**1.79**	**1.11**	**1.10**	0.976 U	0.719 U	**13.3**	**16.0**	**11.1**	0.098 U	0.098 U	**3.80**	**7.46**
	cis-1,2-Dichloroethene		**248**	**194**	**297**	**285**	**1.19**	0.584 U	**5.66**	**6.70**	**2.30**	0.079 U	0.079 U	**45.5**	**16.7**
	Ethylbenzene		0.868 U	0.816 U	0.681 U	0.676 U	0.868 U	0.639 U	0.868 U	0.868 U	1.36 U	0.087 U	0.087 U	0.868 U	0.087 U
	Isopropylbenzene		24.6 U	23.1 U	19.3 U	19.1 U	24.6 U	18.1 U	24.6 U	24.6 U	38.4 U	2.46 U	2.46 U	24.6 U	2.46 U
	Methyl tert butyl ether		0.720 U	0.678 U	0.566 U	0.561 U	0.720 U	0.531 U	0.720 U	0.720 U	1.13 U	0.072 U	0.072 U	0.720 U	**0.281**
	Methylene chloride		17.4 U	16.3 U	13.6 U	13.5 U	17.4 U	12.8 U	17.4 U	17.4 U	27.2 U	1.74 U	1.74 U	17.4 U	1.74 U
	Naphthalene		2.62 U	2.46 U	2.06 UJ	2.04 UJ	2.62 U	1.93 UJ	2.62 U	2.62 U	4.10 UJ	0.260 U	0.262 UJ	2.62 U	0.262 UJ
	Tetrachloroethene		**25,500**	**22,600**	**47,400**	**47,700**	**16,000**	**12,300**	**196,000**	**156,000**	**133,000**	**735**	**1,060**	**9,160**	**3,160**
	Toluene		1.88 U	1.77 U	1.48 U	1.47 U	1.88 U	1.39 U	1.88 U	1.88 U	2.95 U	**0.290**	0.188 U	1.88 U	**0.222**
	trans-1,2-Dichloroethene		**1.82**	**1.38**	**2.02**	**1.91**	0.792 U	0.584 U	**0.951**	**1.03**	1.24 U	0.079 U	0.079 U	**1.19**	**0.376**
	trans-1,3-Dichloropropene		0.907 UJ	0.853 UJ	0.712 U	0.706 U	0.907 UJ	0.668 U	0.907 UJ	0.907 UJ	1.42 U	0.091 U	0.091 UJ	0.907 UJ	0.091 U
	Trichloroethene		**569**	**449**	**765**	**719**	**26.2**	**18.2**	**118**	**148**	**107**	0.107 U	0.107 U	**168**	**13.8**
	Vinyl chloride		0.511 U	0.480 U	0.401 U	0.398 U	0.511 U	0.376 U	0.511 U	0.511 U	0.800 U	0.051 U	0.051 U	0.511 U	0.051 U
	Xylenes, Total		2.60 U	2.45 U	2.04 U	2.03 U	2.60 U	1.92 U	2.60 U	2.60 U	4.08 U	0.260 U	0.260 U	2.60 U	**0.438**
APH															
(ug/m3)	C5-C8 Aliphatics		120 U	110 U	94 U	94 U	120 U	89 U	120 U	120 U	190 U	**13.0**	13.0 U	120 U	25.0 U
	C9-C12 Aliphatics		140 U	130 U	110 U	110 U	140 U	**110**	140 U	140 U	220 U	18.0 U	**45**	140 U	**68**
	C9-C10 Aromatics		100 U	94 U	78 U	78 U	100 U	74 U	100 U	100 U	160 U	10.0 U	10.0 U	100 U	10.0 U
	1,3-Butadiene		20 U	19.0 U	16.0 U	16 U	20 U	15.0 U	20 U	20 U	32 U	2.00 U	2.00 U	20 U	2.00 U
	Benzene		20 U	19.0 U	16.0 U	16 U	20 U	15.0 U	20 U	20 U	32 U	2.00 U	2.00 U	20 U	2.00 U
	Ethylbenzene		20 U	19.0 U	16.0 U	16 U	20 U	15.0 U	20 U	20 U	32 U	2.00 U	2.00 U	20 U	2.00 U
	Methyl tert butyl ether		20 U	19.0 U	16.0 U	16 U	20 U	15.0 U	20 U	20 U	32 U	2.00 U	2.00 U	20 U	2.00 U
	Naphthalene		20 U	19.0 U	16.0 U	16 U	20 U	15.0 U	20 U	20 U	32 U	2.00 U	2.00 U	20 U	2.00 U
	o-Xylene		20 U	19.0 U	16.0 U	16 U	20 U	15.0 U	20 U	20 U	32 U	2.00 U	2.00 U	20 U	2.00 U
	p/m-Xylene		40 U	38 U	31 U	31 U	40 U	30 U	40 U	40 U	64 U	4.00 U	4.00 U	40 U	4.00 U
	Xylenes, Total		40 U	38 U	31 U	31 U	40 U	30 U	40 U	40 U	64 U	4.00 U	4.00 U	40 U	4.00 U
	Toluene		20 U	19.0 U	16.0 U	16 U	20 U	15.0 U	20 U	20 U	32 U	2.00 U	2.00 U	20 U	2.00 U

Notes:

ug/m3 - micrograms per cubic meter.

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

UJ - Estimated non-detect.

Values in **Bold** indicate the compound was detected.

APH - Air-Phase Petroleum Hydrocarbons.

TO - Toxic organics.

Table B-3. Summary of Analytical Results for Air Samples -- March, April, and June 2011
Wells G & H (Parcel 260407)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/04/07		26/04/07			26/04/07		26/04/07		26/04/07		26/04/07	
		Sample Type:	Indoor Air		Indoor Air			Indoor Air		Indoor Air		Indoor Air		Outdoor Air	
		Sample Location:	17-IA1		19-IA1			20-IA1		22-IA1		22-IA2		OA1	
		Sample ID:	260407-17-IA1	260407-17-IA1-20110607	260407-19-IA1	260407-19-IA1-20110607	BD03-20110607	260407-20-IA1	260407-20-IA1-20110607	260407-22-IA1	260407-22-IA1-20110607	260407-22-IA2	260407-22-IA2-20110607	260407-OA1	260407-OA1-20110607
		Sample Date:	3/31/2011	6/7/2011	3/31/2011	6/7/2011	6/7/2011 Field Dup	3/31/2011	6/7/2011	3/31/2011	6/7/2011	3/31/2011	6/7/2011	3/31/2011	6/7/2011
TO-15															
(ug/m3)	1,1,1-Trichloroethane		**0.153**	**0.202**	0.109 U	**1.17**	**1.30**	**0.174**	**3.10**	0.109 U	**0.655**	0.109 U	**0.507**	0.109 U	0.109 U
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	1,2,4-Trimethylbenzene		**0.668**	**0.418**	**1.94**	**2.34**	**2.47**	**1.00**	**0.757**	**1.16**	**0.752**	**1.10**	**0.590**	**0.138**	**0.172**
	1,2-Dibromoethane		0.154 U	0.0770 U	0.154 U	0.0770 U	0.0770 U	0.154 U	0.0770 U	0.154 U	0.0770 U	0.154 U	0.0770 U	0.154 U	0.0770 U
	1,2-Dichloroethane		**0.408**	**0.158**	**0.214**	**0.425**	**0.470**	**9.52**	**20.2**	**0.489**	**0.894**	**0.437**	**0.850**	0.081 U	0.081 U
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	1,3-Butadiene		**0.115**	**0.133**	**0.210**	0.044 UJ	**0.055 J**	**0.128**	**0.100**	0.044 U	**0.104**	0.044 U	**0.124**	**0.077**	0.044 U
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	1,4-Dichlorobenzene		0.120 U	0.120 U	**1.15**	**3.08**	**3.35**	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	Acetone		**3,480**	**8,690**	**55.6 J**	**209**	**261**	**89.8**	**214**	**128**	**234**	**1,050**	**294**	**6.00**	**11.8**
	Benzene		**0.769**	**0.629**	**0.935**	**0.613**	**0.655**	**0.938**	**0.764**	**0.718**	**0.846**	**0.766**	**0.898**	**0.562**	**0.450**
	Bromodichloromethane		0.134 U	0.067 U	0.134 U	0.067 U	0.067 U	0.134 U	**0.080 J**	0.134	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U
	Bromoform		0.206 U	0.207 U	0.206 U	0.207 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U
	Carbon tetrachloride		**0.647**	**0.598**	**0.478**	**0.384**	**0.390**	**0.515**	**0.402**	**0.484**	**0.440**	**0.471**	**0.390**	**0.497**	**0.428**
	Chlorobenzene		0.092 U	0.092 U	**0.202**	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	**0.097**	0.092 U	0.092 U	0.092 U
	Chloroform		**0.337**	**0.454**	**0.185**	**0.928 J**	**0.327 J**	**0.629**	**0.825**	**1.10**	**1.24**	**63.2**	**7.42**	0.098 U	0.098 U
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	Ethyl Acetate		**367**	**347**	**4.84**	**10.7**	**12.2**	**22.2**	**19.9**	**10.5**	**14.2**	**9.24**	**13.7**	1.80 U	0.54 U
	Ethylbenzene		**0.928**	**0.426**	**1.23**	**1.22**	**1.28**	**1.46**	**1.31**	**1.34**	**0.838**	**1.24**	**0.93**	**0.130**	**0.148**
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U
	Methyl tert butyl ether		0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 UJ
	Methylene chloride		1.74 U	**3.86**	1.74 U	**5.07 J**	**1.94 J**	1.74 U	**5.00**	1.74 U	**4.17**	1.74 U	**3.22**	**1.96**	1.74 U
	Naphthalene		0.320 U	**0.273 J**	0.581 U	**0.493 J**	**0.744 J**	0.445 U	**0.351 J**	0.382 U	**0.257 J**	0.393 U	**0.168 J**	0.262 UJ	0.131 U
	Tetrachloroethene		**0.352**	**0.183**	**0.149**	**0.292**	**0.312**	**0.488**	**0.373**	**0.454**	**0.339**	**0.63**	**0.353**	0.136 U	0.136 U
	Toluene		**64.5**	**22.0**	**10.0**	**15.3**	**16.0**	**53.6**	**8.86**	**21.5**	**9.12**	**21.7**	**8.55**	**0.757**	**1.22 J**
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	**0.107**	0.107 U	**0.113**	0.107 U	**0.107**	0.107 U	0.107 U
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U
	Xylenes (total)		**4.24**	**1.54**	**4.95**	**4.56**	**4.78**	**6.94**	**6.17**	**6.76**	**3.30**	**6.17**	**3.82**	**0.499**	**0.452**
APH															
(ug/m3)	C5-C8 Aliphatics		**2,200**	**1,900**	**130**	**330**	**360**	**1,000**	**860**	**160**	**160**	**180**	**180**	12.0 U	**20.0**
	C9-C12 Aliphatics		**460**	**28.0**	**120**	**180**	**180**	**99**	**100**	**140**	**60.0**	**200**	**46.0**	14.0 U	14.0 U
	C9-C10 Aromatics		**14.0**	10.0 U	**14.0**	**14.0**	**12.0**	**15**	10.0 U	**10.0 J**	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
	1,3-Butadiene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Benzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Ethylbenzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Methyl tert butyl ether		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Naphthalene		2.00 U	2.00 UJ	2.00 U	2.00 UJ	2.00 UJ	2.00 U	2.00 UJ	2.00 U	2.00 UJ	2.00 U	2.00 UJ	2.00 U	2.00 UJ
	o-Xylene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**2.00 J**	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	p/m-Xylene		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	**5.20**	4.00 U	**5.10**	4.00 U	**4.60**	4.00 U	4.00 U	4.00 U
	Xylenes, Total		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	**5.20**	**2.00 J**	**5.10**	4.00 U	**4.60**	4.00 U	4.00 U	4.00 U
	Toluene		**71**	**21.0**	**11.0**	**16.0**	**16.0**	**58**	**9.00**	**23**	**8.90**	**23**	**7.60**	2.00 U	2.00 U

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
APH - Air-Phase Petroleum Hydrocarbons.
TO - Toxic organics.

Table B-3. Summary of Analytical Results for Air Samples -- March, April, and June 2011
Wells G & H (Parcel 260407)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/04/07		26/04/07			26/04/07			26/04/07		26/04/07			26/04/07	
		Sample Type:	Outdoor Air		Sub-Slab Soil Gas			Sub-Slab Soil Gas			Sub-Slab Soil Gas		Sub-Slab Soil Gas			Sub-Slab Soil Gas	
		Sample Location:	OA2		17-SS1			19-SS1			20-SS1		22-SS1			22-SS2	
		Sample ID:	260407-OA2	260407-OA2-20110607	260407-17-SS1	BD03-03312011	260407-17-SS1-20110607	260407-19-SS1	BD04-04012011	260407-19-SS1-20110608	260407-20-SS1	260407-20-SS1-20110608	260407-22-SS1	260407-22-SS1-20110608	BD04-20110608	260407-22-SS2	260407-22-SS2-20110608
		Sample Date:	3/31/2011	6/7/2011	3/31/2011	3/31/2011 Field Dup	6/7/2011	4/1/2011	4/1/2011 Field Dup	6/8/2011	3/31/2011	6/8/2011	4/1/2011	6/8/2011	6/8/2011 Field Dup	4/1/2011	6/8/2011
TO-15																	
(ug/m3)	1,1,1-Trichloroethane		0.109 U	0.109 U	**0.365**	**0.365**	**0.524**	**3.97**	**5.08**	**4.00**	**4.18**	**5.10**	**0.469**	**5.89 J**	**4.40 J**	**1.48**	**0.513**
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.218 U
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.162 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.158 U
	1,2,4-Trimethylbenzene		**0.113**	**0.118**	**0.246**	**0.255**	0.098 U	**1.53 J**	**1.98 J**	**0.334**	**3.46**	0.098 U	**0.550**	0.098 UJ	**0.202 J**	**0.265**	0.197 U
	1,2-Dibromoethane		0.154 U	0.0770 U	0.154 U	0.154 U	0.0770 U	0.154 U	0.154 U	0.0770 U	0.154 U	0.0770 U	0.154 U	0.0770 U	0.0770 U	0.154 U	0.154 U
	1,2-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	**0.271**	**0.146**	0.081 U	0.081 UJ	**0.304 J**	0.081 U	0.162 U
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.185 U
	1,3-Butadiene		**0.044**	**0.049**	0.044 U	0.044 U	0.044 U	**0.046**	**0.049**	0.044 U	**0.214**	0.044 U	0.044 U	0.044 U	0.044 U	0.044 U	0.089 U
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.240 U
	1,4-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	**0.450**	**0.559**	0.120 U	**0.222**	0.120 U	**0.120**	0.120 U	0.120 U	0.120 U	0.240 U
	Acetone		**4.95**	**13.8**	**1,070**	**1,380**	**230**	**76**	**90.4**	**22.2**	**167**	**11.4**	**95.6**	**17.6 J**	**94.5 J**	**140**	**25.2**
	Benzene		**0.460**	**0.508**	0.223 U	0.223 U	0.224 U	**0.421**	**0.453**	0.224 U	**0.677**	0.224 U	**0.348**	0.224 UJ	**0.268 J**	0.223 U	0.447 U
	Bromodichloromethane		0.134 U	0.067 U	0.134 U	0.134 U	0.067 U	0.134 U	0.134 U	0.067 U	0.134 U	0.067 U	0.134 U	0.067 U	0.067 U	0.134 U	0.134 U
	Bromoform		0.206 U	0.207 U	0.206 UJ	**0.320 J**	0.207 U	0.206 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U	0.207 U	0.206 U	0.414 U
	Carbon tetrachloride		**0.471**	**0.409**	**0.408**	**0.415**	**0.503**	**0.176 J**	0.126 UJ	**0.126**	**0.163**	**0.132**	**0.295**	**0.176 J**	**0.252 J**	**0.308**	**0.352**
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.184 U
	Chloroform		0.098 U	0.098 U	**0.220**	**0.220**	**0.278**	**1.46**	**1.86**	**1.68**	**1.91**	**1.58**	0.098 U	0.098 UJ	**0.317 J**	**0.161**	**0.244**
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.158 U
	Ethyl Acetate		1.80 U	0.54 U	1.80 UJ	**2.31 J**	**0.721 J**	1.80 U	1.80 U	0.54 U	1.80 U	0.54 U	1.80 U	0.54 UJ	**4.25 J**	1.80 U	0.54 U
	Ethylbenzene		**0.100**	**0.174**	**0.104**	**0.126**	0.087 U	**2.38**	**2.98**	**0.430**	**35**	**0.365**	**0.178**	0.087 UJ	**0.282 J**	**2.70**	**0.295**
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	**4.33**	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	4.92 U
	Methyl tert butyl ether		0.072 U	0.072 UJ	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	**0.094**	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.144 U
	Methylene chloride		1.74 U	**3.13**	1.74 U	1.74 U	**23.1**	**14.4 J**	1.74 UJ	**20.6**	**4.46**	**17.0**	**17**	1.74 U	1.74 U	**10.3**	3.47 U
	Naphthalene		0.262 UJ	0.131 U	0.498 U	0.592 U	0.131 U	**2.03 J**	**2.70 J**	0.131 U	**1.20 J**	0.131 U	0.733 U	0.131 U	0.131 U	0.262 U	0.262 U
	Tetrachloroethene		0.136 U	0.136 U	**4.45**	**5.54**	**8.07**	**12.9 J**	**16.7 J**	**17.4**	**19.2**	**23.2**	**80**	**102 J**	**77.3 J**	**2,310**	**1,070**
	Toluene		**0.621**	**1.29 J**	**2.59**	**2.75**	**0.618**	**1.16**	**1.46**	**0.716**	**2.68**	**0.407**	**0.493**	**0.320 J**	**3.01 J**	**0.554**	**0.399**
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.158 U
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.182 U
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	**0.150**	**0.177**	**0.140**	**0.113**	0.107 U	**0.177**	**0.193 J**	**0.301 J**	**3.83**	**1.32**
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.102 U
	Xylenes (total)		**0.369**	**0.543**	**0.547**	**0.564**	0.261 U	**17**	**21.2**	**2.72**	**321**	**2.87**	**1.08**	0.261 UJ	**1.16 J**	**27.8**	**2.12**
APH																	
(ug/m3)	C5-C8 Aliphatics		12.0 U	12.0 U	**200**	**190**	**16.0**	**230**	**300 J**	**53.0**	**90**	**24.0**	**140**	**33.0**	**39.0**	58 U	**29.0**
	C9-C12 Aliphatics		14.0 U	14.0 U	**18**	**20**	14.0 U	**310 J**	**420 J**	**73.0**	**120**	14.0 U	**1,300**	14.0 UJ	**14.0 J**	14.0 U	28.0 U
	C9-C10 Aromatics		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	**13.0 J**	**18.0 J**	10.0 U	**19**	10.0 U	**14.0**	10.0 U	10.0 U	10.0 U	20.0 U
	1,3-Butadiene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	4.00 U
	Benzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	4.00 U
	Ethylbenzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**2.60**	**3.00**	2.00 U	**36**	2.00 U	2.00 U	2.00 U	2.00 U	**2.80**	4.00 U
	Methyl tert butyl ether		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	4.00 U
	Naphthalene		2.00 U	2.00 UJ	2.00 U	2.00 U	2.00 U	**2.50 J**	**3.30 J**	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	4.00 U
	o-Xylene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	**4.60**	**5.80**	2.00 U	**140**	2.00 U	2.00 U	2.00 U	2.00 U	**14.0**	4.00 U
	p/m-Xylene		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	**13.0**	**15.0**	4.00 U	**180**	4.00 U	4.00 U	4.00 U	4.00 U	**14.0**	8.00 U
	Xylenes, Total		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	**17.6**	**20.8**	4.00 U	**320**	4.00 U	4.00 U	4.00 U	4.00 U	**28.0**	8.00 U
	Toluene		2.00 U	2.00 U	**3.10**	**3.40**	2.00 U	2.00 U	2.00 U	2.00 U	**3.00**	2.00 U	2.00 U	2.00 UJ	**3.30 J**	2.00 U	4.00 U

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
APH - Air-Phase Petroleum Hydrocarbons.
TO - Toxic organics.

Table B-4. Summary of Analytical Results for Air Samples -- March and June 2011
Wells G & H (Parcel 260504)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/05/04		26/05/04			26/05/04		26/05/04		26/05/04	
		Sample Type:	Ambient Air		Indoor Air			Indoor Air		Sub-Slab Soil Gas		Sub-Slab Soil Gas	
		Sample Location:	AA-10M-1		IA-10M-1			IA-10M-2		SS-10M-1		SS-10M-2	
		Sample ID:	AA-1	AA-10M-1	IA-1	IA-10M-1	DUPIA	IA-10M-2	IA-2	SS-1	SS-10M-1	SS-2	SS-10M-2
		Sample Date:	3/11/2011	6/16/2011	3/11/2011	6/16/2011	6/16/2011 Field Dup	3/11/2011	6/16/2011	3/11/2011	6/16/2011	3/11/2011	6/16/2011
TO-15													
(ug/m3)	1,1,1-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	**0.801**	**0.153**	**0.491**	**0.147**
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	1,2,4-Trimethylbenzene		0.098 U	**0.270**	**3.88**	**1.48**	**1.56**	**3.32**	**1.26**	0.098 U	**0.118**	**0.319**	**0.192**
	1,2-Dibromoethane		0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U
	1,2-Dichloroethane		0.081 U	0.081 U	0.081 U	**0.138**	**0.138**	0.081 U	**0.130**	0.081 U	0.081 U	0.081 U	0.081 U
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	1,3-Butadiene		**0.044**	0.044 UJ	**0.351**	**0.106 J**	**0.108 J**	**0.292**	**0.150 J**	0.044 U	0.044 UJ	**0.069**	0.044 UJ
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	1,4-Dichlorobenzene		0.120 U	0.120 U	0.120 U	**0.168**	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	Benzene		**0.405**	**0.316**	**5.93**	**0.732**	**0.767**	**5.31**	**0.728**	0.223 U	0.224 U	**1.34**	0.224 U
	Bromodichloromethane		0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U
	Bromoform		0.206 U	0.207 U	0.206 U	0.207 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U
	Carbon tetrachloride		**0.591**	**0.453**	**0.534**	**0.447**	**0.472**	**0.490**	**0.459**	**0.490**	**0.377**	**0.553**	**0.409**
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	Chloroform		0.098 U	**0.137**	**0.507**	**0.591**	**0.571**	**0.346**	**0.493**	0.098 U	**0.195**	**0.322**	0.098 U
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	Ethylbenzene		0.087 U	**0.200 J**	**2.50**	**0.738 J**	**0.747 J**	**2.40**	**0.734 J**	0.087 U	0.087 UJ	**0.568**	0.087 UJ
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U
	Methyl tert butyl ether		0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 UJ	0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 U	0.072 UJ
	Methylene chloride		1.74 U	1.74 U	1.74 U	**21.1 J**	**2.78 J**	**2.50**	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U
	Naphthalene		0.262 UJ	**0.142 J**	**0.890 J**	**1.80 J**	**1.80 J**	**0.498 J**	**1.45 J**	**0.539 J**	0.262 UJ	0.262 UJ	0.262 UJ
	Tetrachloroethene		0.136 U	0.136 U	**0.542**	**0.746**	**0.841**	**0.603**	**0.739**	**318**	**127**	**178**	**84.8**
	Toluene		**0.618**	**1.22 J**	**24.8**	**5.28 J**	**5.54 J**	**22.4**	**4.22 J**	0.188 U	0.188 UJ	**3.95**	**0.241 J**
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	**0.140**	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U
	Xylenes (total)		0.260 U	**0.908**	**14.4**	**3.09**	**3.25**	**13.4**	**3.10**	**0.273**	0.261 U	**1.81**	**0.360**

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
TO - Toxic organics.

Table B-5. Summary of Analytical Results for Air Samples -- April and June 2011
Wells G & H (Parcel 260505)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/05/05 - North		26/05/05 - North		26/05/05 - North		26/05/05 - South		26/05/05 - South			26/05/05 - South		26/05/05 - North		26/05/05 - North	
		Sample Type:	Indoor Air		Indoor Air		Indoor Air		Indoor Air		Indoor Air			Outdoor Air		Sub-Slab Soil Gas		Sub-Slab Soil Gas	
		Sample Location:	IA-1		IA-2		IA-3		IA-4		IA-5			AA-1		SS-1		SS-2	
		Sample ID:	IA-01	IA-7O-1	IA-02	IA-7O-2	IA-03	IA-7O-3	IA-04	IA-5O-4	IA-05	DUPIA042111	IA-5O-5	OA-01	AA-57O-1	SS-1	SS-7O-1	SS-2	SS-7O-2
		Sample Date:	4/22/2011	6/16/2011	4/22/2011	6/16/2011	4/22/2011	6/16/2011	4/22/2011	6/16/2011	4/22/2011	4/22/2011 Field Dup	6/16/2011	4/22/2011	6/16/2011	4/22/2011	6/16/2011	4/22/2011	6/16/2011
TO-15																			
(ug/m3)	1,1,1-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	**0.245**	**0.273**	**0.213**	**0.153**
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	1,2,4-Trimethylbenzene		**0.314**	**0.256**	**0.344**	**0.256**	**0.403**	**0.177**	**0.201**	**0.565**	**0.167**	**0.157**	**0.575**	0.098 U	**0.226**	0.098 U	**0.221**	0.098 U	0.098 U
	1,2-Dibromoethane		0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U
	1,2-Dichloroethane		**0.234**	**0.202**	**0.267**	**0.162**	**0.376**	**0.461**	**0.125**	**0.716**	**0.113**	**0.125**	**0.712**	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	**0.097**	0.092 U	0.092 U	**0.102**	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	1,3-Butadiene		**0.186**	0.044 UJ	**0.225**	0.044 UJ	**0.228**	0.044 UJ	**0.148**	**0.124 J**	**0.115**	**0.124**	**0.137 J**	0.044 U	0.044 UJ	0.044 U	0.044 UJ	0.044 U	0.044 UJ
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	1,4-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	Benzene		**0.881**	**0.316**	**0.964**	**0.345**	**0.99**	**0.278**	**0.485**	**0.585**	**0.460**	**0.469**	**0.543**	**0.326**	**0.249**	**1.32**	0.224 U	0.223 U	0.224 U
	Bromodichloromethane		0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	**0.161**	0.134 U	0.134 U	**0.154**	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U
	Bromoform		0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U
	Carbon tetrachloride		**0.333**	**0.421**	**0.333**	**0.465**	**0.346**	**0.459**	**0.358**	**0.491**	**0.339**	**0.339**	**0.484**	**0.352**	**0.472**	0.126 U	**0.145**	0.126 U	0.126 U
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	Chloroform		**0.244**	**0.234**	**0.254**	**0.200**	**0.254**	**0.137**	**1.18**	**1.97**	**0.629**	**0.663**	**2.00**	0.098 U	**0.107**	**0.205**	**0.220**	**0.693**	**0.166**
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	Ethylbenzene		**0.555**	**0.478**	**0.612**	**0.456**	**0.625**	**0.195**	**0.317**	**1.80**	**0.295**	**0.304**	**1.84**	**0.087**	**0.130**	**0.590**	0.087 U	0.087 U	0.087 U
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U
	Methyl tert butyl ether		0.072 UJ	0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 UJ	0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 U	0.072 UJ	0.072 U
	Methylene chloride		1.74 U	2.17 U	1.74 U	1.78 U	1.74 U	3.35 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	2.76 U	1.74 U	3.02 U	1.74 U	1.74 U
	Naphthalene		0.262 UJ	**0.162 J**	0.262 UJ	**0.189 J**	0.262 U	**0.136 J**	0.183 UJ	**0.351 J**	0.262 U	0.131 UJ	**0.383 J**	0.262 U	**0.304 J**	0.262 U	0.262 UJ	0.262 U	0.262 UJ
	Tetrachloroethene		**0.366**	0.136 U	**0.366**	0.136 U	**0.291**	0.136 U	**1.90**	**1.82**	**1.96**	**2.09**	**2.34**	0.136 U	0.136 U	**53.2**	**73.9**	**154**	**145**
	Toluene		**2.65**	**2.32**	**2.80**	**1.86**	**2.95**	**1.20**	**3.10**	**15.5**	**2.96**	**2.97**	**16.7**	**0.561**	**1.27**	**6.40**	0.686 U	0.188 U	0.188 U
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	trans-1,3-Dichloropropene		0.091 UJ	0.091 U	0.091 UJ	0.091 U	0.091 UJ	0.091 U	0.091 UJ	0.091 U	0.091 UJ	0.091 UJ	0.091 U	0.091 UJ	0.091 U	0.091 UJ	0.091 U	0.091 UJ	0.091 U
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	**0.161**	0.107 U	0.107 U	0.107 U
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U
	Xylenes (total)		**1.58**	**0.960**	**1.81**	**0.947**	**1.94**	**0.617**	**0.698**	**3.70**	**0.681**	**0.672**	**3.71**	0.260 U	**0.491**	**1.80 J**	**0.386**	0.260 U	0.261 U
APH																			
(ug/m3)	C5-C8 Aliphatics		89 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	C9-C12 Aliphatics		**110**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	C9-C10 Aromatics		74 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	1,3-Butadiene		15.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Benzene		15.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Ethylbenzene		15.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		15.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Naphthalene		15.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	o-Xylene		15.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	p/m-Xylene		30 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Xylenes, Total		30 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	Toluene		15.0 U	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Notes:

ug/m3 - micrograms per cubic meter.

J - Estimated value.

NA - Sample not analyzed for the listed analyte.

U - Compound was not detected at specified quantitation limit.

UJ - Estimated non-detect.

Values in **Bold** indicate the compound was detected.

APH - Air-Phase Petroleum Hydrocarbons.

TO - Toxic organics.

Table B-5. Summary of Analytical Results for Air Samples -- April and June 2011
Wells G & H (Parcel 260505)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/05/05 - South				26/05/05 - South	
		Sample Type:	Sub-Slab Soil Gas				Sub-Slab Soil Gas	
		Sample Location:	SS-4				SS-5	
		Sample ID:	SS-4	DUPSS42211	SS-5O-4	DUPSS	SS-5	SS-5
		Sample Date:	4/22/2011	4/22/2011 Field Dup	6/16/2011	6/16/2011 Field Dup	4/22/2011	6/16/2011
TO-15								
(ug/m3)	1,1,1-Trichloroethane		0.109 U	0.109 U	**0.153**	**0.147**	0.109 U	0.109 U
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	1,2,4-Trimethylbenzene		0.098 U	0.098 U	**0.359**	**0.128**	0.098 U	**0.162**
	1,2-Dibromoethane		0.154 U	0.154 U	0.154 U	0.154 U	0.154 U	0.154 U
	1,2-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	1,3-Butadiene		0.044 U	0.044 U	0.044 UJ	0.044 UJ	0.044 U	0.044 UJ
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	1,4-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	Benzene		0.223 U	0.223 U	0.224 U	0.224 U	0.223 U	0.224 U
	Bromodichloromethane		0.134 U	0.134 U	0.134 U	0.134 U	0.134 U	0.134 U
	Bromoform		0.206 U	0.206 U	0.207 U	0.207 U	0.206 U	0.207 U
	Carbon tetrachloride		**0.170**	**0.163**	**0.157**	**0.151**	**0.327**	**0.327**
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	Chloroform		**0.122**	**0.112**	**0.469**	**0.171**	**0.180**	**0.298**
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	Ethylbenzene		0.087 U	0.087 U	0.087 U	0.087 U	0.087 U	0.087 U
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U
	Methyl tert butyl ether		0.072 UJ	0.072 UJ	0.072 U	0.072 U	0.072 UJ	0.072 U
	Methylene chloride		1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	1.74 U
	Naphthalene		0.262 U	0.262 U	**0.419 J**	0.262 UJ	0.262 U	0.262 UJ
	Tetrachloroethene		**12.0**	**11.3**	**13.6**	**14.0**	**0.352**	**1.71**
	Toluene		0.188 U	**0.233**	0.584 U	0.316 U	0.188 U	0.441 U
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	trans-1,3-Dichloropropene		0.091 UJ	0.091 UJ	0.091 U	0.091 U	0.091 UJ	0.091 U
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U
	Xylenes (total)		0.260 U	0.260 U	0.261 U	0.261 U	0.260 U	0.261 U
APH								
(ug/m3)	C5-C8 Aliphatics		NA	NA	NA	NA	NA	NA
	C9-C12 Aliphatics		NA	NA	NA	NA	NA	NA
	C9-C10 Aromatics		NA	NA	NA	NA	NA	NA
	1,3-Butadiene		NA	NA	NA	NA	NA	NA
	Benzene		NA	NA	NA	NA	NA	NA
	Ethylbenzene		NA	NA	NA	NA	NA	NA
	Methyl tert butyl ether		NA	NA	NA	NA	NA	NA
	Naphthalene		NA	NA	NA	NA	NA	NA
	o-Xylene		NA	NA	NA	NA	NA	NA
	p/m-Xylene		NA	NA	NA	NA	NA	NA
	Xylenes, Total		NA	NA	NA	NA	NA	NA
	Toluene		NA	NA	NA	NA	NA	NA

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
APH - Air-Phase Petroleum Hydrocarbons.
TO - Toxic organics.

Table B-6. Summary of Analytical Results for Air Samples -- March and June 2011
Wells G & H (Parcel 260902)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/09/02		26/09/02				26/09/02	26/09/02		26/09/02		26/09/02	
		Sample Type:	Indoor Air		Indoor Air				Indoor Air	Outdoor Air		Sub-Slab Soil Gas		Sub-Slab Soil Gas	
		Sample Location:	IA1		IA2				IA3	OA		SS1		SS2	
		Sample ID:	260902-IA1	260902-IA1-20110607	260902-IA2	BD01-03182011	260902-IA2-20110607	BD01-20110607	260902-IA3	260902-OA	260902-OA-20110607	260902-SS1	260902-SS1-20110607	260902-SS2	260902-SS2-20110607
		Sample Date:	3/18/2011	6/7/2011	3/18/2011	3/18/2011 Field Dup	6/7/2011	6/7/2011 Field Dup	3/18/2011	3/18/2011	6/7/2011	3/18/2011	6/7/2011	3/18/2011	6/7/2011
TO-15 (ug/m3)	1,1,1-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 UJ	0.109 U	0.109 U	0.109 U
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 UJ	0.109 U	0.109 U	0.109 U
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 UJ	0.081 U	0.081 U	0.081 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 UJ	0.079 U	0.079 U	0.079 U
	1,2,4-Trimethylbenzene		**13.3**	**0.732**	**12.6**	**12.7**	**0.836**	**1.03**	**3.31**	**0.147**	**0.216**	**1.60 J**	0.098 U	**1.37**	**0.103**
	1,2-Dibromoethane		0.154 U	0.0770 U	0.154 U	0.154 U	0.0770 U	0.0770 U	0.154 U	0.154 U	0.0770 U	0.154 UJ	0.0770 U	0.154 U	0.0770 U
	1,2-Dichloroethane		**1.30**	**2.33**	**1.44**	**1.40**	**2.74**	**2.13**	**4.74**	0.081 U	0.081 U	**0.101 J**	0.081 U	0.081 U	0.081 U
	1,2-Dichloropropane		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 UJ	0.092 U	0.092 U	0.092 U
	1,3-Butadiene		**0.102**	**0.086**	**0.102**	**0.093**	**0.106 J**	**0.058 J**	**0.124**	0.044 U	**0.044**	0.044 UJ	0.044 U	**0.044**	0.044 U
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	**0.180 J**	0.120 U	0.120 U	0.120 U
	1,4-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	**0.198 J**	0.120 U	0.120 U	0.120 U
	Benzene		**9.35**	**0.735**	**8.78**	**8.54**	**0.837**	**0.680**	**2.79**	**0.501**	**0.463**	**0.744 J**	0.224 U	**0.574**	0.224 U
	Bromodichloromethane		0.134 U	**0.107 J**	0.134 U	0.134 U	**0.120 J**	**0.094 J**	0.134 U	0.134 U	0.0670 U	0.134 UJ	0.0670 U	0.134 U	0.0670 U
	Bromoform		0.206 U	0.207 U	0.206 U	0.206 U	0.207 U	0.207 U	0.206 U	0.206 U	0.207 U	0.206 UJ	0.207 U	0.206 U	0.207 U
	Carbon tetrachloride		**0.534**	**0.402**	**0.603**	**0.566**	**0.484**	**0.402**	**0.578**	**0.509**	**0.396**	**0.170 J**	**0.170**	0.126 U	0.126 U
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 UJ	0.092 U	0.092 U	0.092 U
	Chloroform		**0.185**	**0.249**	**0.254**	**0.244**	**0.293 J**	**0.381 J**	**0.229**	**0.102**	**0.107**	**0.298 J**	**0.303**	**1.58**	**1.66**
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 UJ	0.079 U	0.079 U	0.079 U
	Ethylbenzene		**12.3**	**0.530**	**11.7**	**11.8**	**0.586 J**	**0.760 J**	**3.33**	**0.152**	**0.213**	**1.42 J**	0.087 U	**1.06**	0.087 U
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 UJ	2.46 U	2.46 U	2.46 U
	Methyl tert butyl ether		0.072 U	0.072 UJ	0.072 U	0.072 U	0.072 UJ	0.072 U	0.072 U	0.072 U	0.072 UJ	0.072 UJ	0.072 U	**0.400**	0.072 U
	Methylene chloride		1.74 U	1.74 U	1.74 U	1.74 U	**11.1 J**	**3.27 J**	1.74 U	1.74 U	1.74 U	1.74 UJ	**20.1**	1.74 U	1.74 U
	Naphthalene		0.723 U	0.131 U	0.608 U	0.571 U	**0.435 J**	**0.246 J**	0.267 U	0.262 UJ	**0.215 J**	**2.38 J**	0.131 U	0.262 U	0.131 U
	Tetrachloroethene		**0.176**	0.136 U	**0.183**	**0.183**	0.136 UJ	**0.156 J**	**0.264**	**0.149**	0.136 U	**0.258 J**	**0.325**	**0.230**	**0.305**
	Toluene		**52.5**	**3.24 J**	**50.7**	**51.9**	**3.29 J**	**4.22**	**14.3**	**0.885**	**1.37 J**	**4.48 J**	**0.305**	**2.06**	0.188 U
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 UJ	0.079 U	0.079 U	0.079 U
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 UJ	0.091 U	0.091 U	0.091 U
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 UJ	0.107 U	0.107 U	0.107 U
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 UJ	0.051 U	0.051 U	0.051 U
	Xylenes (total)		**54.8**	**2.22**	**51.6**	**51.9**	**2.44 J**	**3.31 J**	**14.5**	**0.512**	**0.808**	**8.38 J**	0.261 U	**8.40**	0.261 U

Table B-6. Summary of Analytical Results for Air Samples -- March and June 2011
Wells G & H (Parcel 260902)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/09/02		26/09/02				26/09/02	26/09/02		26/09/02		26/09/02	
		Sample Type:	Indoor Air		Indoor Air				Indoor Air	Outdoor Air		Sub-Slab Soil Gas		Sub-Slab Soil Gas	
		Sample Location:	IA1		IA2				IA3	OA		SS1		SS2	
		Sample ID:	260902-IA1	260902-IA1-20110607	260902-IA2	BD01-03182011	260902-IA2-20110607	BD01-20110607	260902-IA3	260902-OA	260902-OA-20110607	260902-SS1	260902-SS1-20110607	260902-SS2	260902-SS2-20110607
		Sample Date:	3/18/2011	6/7/2011	3/18/2011	3/18/2011 Field Dup	6/7/2011	6/7/2011 Field Dup	3/18/2011	3/18/2011	6/7/2011	3/18/2011	6/7/2011	3/18/2011	6/7/2011
APH															
(ug/m3)	C5-C8 Aliphatics		**590**	**89.0**	**500**	**510**	**85.0**	**83.0**	**190**	12.0 U	**22.0**	**67 J**	**37.0**	**46**	**30.0**
	C9-C12 Aliphatics		**89**	**54.0**	**72**	**75**	**52.0**	**52.0**	**170**	**26**	14.0 U	**130 J**	14.0 U	**31**	**72.0**
	C9-C10 Aromatics		**67**	10.0 U	**52**	**47**	10.0 U	10.0 U	**14.0**	10.0 U	10.0 U	10.0 UJ	10.0 U	10.0 U	10.0 U
	1,3-Butadiene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 UJ	2.00 U	2.00 U	2.00 U
	Benzene		**11**	2.00 U	**9.50**	**9.80**	2.00 U	2.00 U	**3.20**	2.00 U	2.00 U	2.00 UJ	2.00 U	2.00 U	2.00 U
	Ethylbenzene		**15**	2.00 U	**12.0**	**12.0**	2.00 U	2.00 U	**3.40**	2.00 U	2.00 U	2.00 UJ	2.00 U	2.00 U	2.00 U
	Methyl tert butyl ether		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 UJ	2.00 U	2.00 U	2.00 U
	Naphthalene		2.00 U	2.00 UJ	2.00 U	2.00 U	2.00 UJ	2.00 UJ	2.00 U	2.00 U	2.00 UJ	**2.30 J**	2.00 U	2.00 U	2.00 U
	o-Xylene		**18**	2.00 U	**14**	**14**	2.00 U	2.00 U	**3.90**	2.00 U	2.00 U	**3.00 J**	2.00 U	**3.50**	2.00 U
	p/m-Xylene		**49**	4.00 U	**38**	**38**	4.00 U	4.00 U	**11.0**	4.00 U	4.00 U	**7.00 J**	4.00 U	**5.70**	4.00 U
	Xylenes, Total		**67**	4.00 U	**52**	**52**	4.00 U	4.00 U	**14.9**	4.00 U	4.00 U	**10.0 J**	4.00 U	**9.20**	4.00 U
	Toluene		**66**	**4.40**	**55**	**58**	**4.30**	**3.90**	**16**	2.00 U	2.00 U	**5.50 J**	2.00 U	**2.40**	2.00 U

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
APH - Air-Phase Petroleum Hydrocarbons.
TO - Toxic organics.

Table B-7. Summary of Analytical Results for Air Samples --March and June 2011
Wells G & H (Parcel 260903)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/09/03		26/09/03		26/09/03		26/09/03				26/09/03	
		Sample Type:	Indoor Air		Indoor Air		Outdoor Air		Sub-Slab Soil Gas				Sub-Slab Soil Gas	
		Sample Location:	IA1		IA2		OA		SS1				SS2	
		Sample ID:	260903-IA1	260903-IA1-20110607	260903-IA2	260903-IA2-20110607	260903-OA	260903-OA-20110607	260903-SS1	BD02-03182011	260903-SS1-20110607	BD02-20110607	260903-SS2	260903-SS2-20110607
		Sample Date:	3/18/2011	6/7/2011	3/18/2011	6/7/2011	3/18/2011	6/7/2011	3/18/2011	3/18/2011 Field Dup	6/7/2011	6/7/2011 Field Dup	3/18/2011	6/7/2011
TO-15														
(ug/m3)	1,1,1-Trichloroethane		**0.114**	**0.158**	**0.120**	**0.158**	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U
	1,1,2-Trichloroethane		0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U	0.109 U
	1,1-Dichloroethane		0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U	0.081 U
	1,1-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	1,2,4-Trimethylbenzene		**0.624**	**0.885**	**0.673**	**0.890**	**0.157**	**0.246**	**0.113**	**0.098**	0.098 U	0.098 U	**0.182**	0.098 U
	1,2-Dibromoethane		0.154 U	0.0770 U	0.154 U	0.0770 U	0.154 U	0.0770 U	0.154 U	0.154 U	0.0770 U	0.0770 U	0.154 U	0.0770 U
	1,2-Dichloroethane		**8.03**	**1.26**	**7.61**	**1.18**	0.081 U	**0.121**	**0.093 J**	0.081 UJ	0.081 U	0.081 U	**0.348**	0.081 U
	1,2-Dichloropropane		**0.508**	0.092 U	**0.489**	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	1,3-Butadiene		**0.044**	**0.053**	**0.046**	**0.053**	0.044 U	**0.082**	0.044 U	0.044 U	0.044 U	0.044 U	0.044 U	0.044 U
	1,3-Dichlorobenzene		0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U	0.120 U
	1,4-Dichlorobenzene		**0.985**	**3.22**	**1.15**	**3.20**	0.120 U	0.120 U	**0.132**	**0.120**	0.120 U	0.120 U	**0.312**	0.120 U
	Benzene		**0.658**	**0.498**	**0.677**	**0.524**	**0.485**	**0.530**	0.223 U	0.223 U	0.224 U	0.224 U	0.223 U	0.224 U
	Bromodichloromethane		0.134 U	**0.141**	0.134 U	**0.141**	0.134 U	0.067 U	0.134 U	0.134 U	0.067 U	0.067 U	0.134 U	0.067 U
	Bromoform		0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.207 U	0.206 U	0.206 U	0.207 U	0.207 U	0.206 U	0.207 U
	Carbon tetrachloride		**0.673**	**0.616**	**0.723**	**0.642**	**0.515**	**0.428**	0.126 U	0.126 U	0.126 U	0.126 U	**0.157**	0.126 U
	Chlorobenzene		0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U	0.092 U
	Chloroform		**0.634**	**1.24**	**0.590**	**1.35**	**0.107**	**0.117**	**0.102 J**	0.098 UJ	0.098 UJ	**0.190 J**	**7.17**	**3.88**
	cis-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	Ethylbenzene		**0.577**	**0.825**	**0.564**	**0.877**	**0.134**	**0.239**	0.087 U	0.087 U	0.087 U	0.087 U	**0.121**	0.087 U
	Isopropylbenzene		2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U	2.46 U
	Methyl tert butyl ether		0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 UJ	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U	0.072 U
	Methylene chloride		1.74 U	1.74 U	1.74 U	1.74 U	1.74 U	**1.85**	1.74 U	1.74 U	**24.1**	**23.3**	1.74 U	**27.3**
	Naphthalene		0.262 U	**0.367 J**	0.262 U	**0.288 J**	0.262 UJ	**0.173 J**	0.262 U	0.361 U	0.131 U	0.131 U	0.828 U	0.131 U
	Tetrachloroethene		**0.549**	**1.03**	**0.562**	**1.12**	**0.156**	0.136 U	**0.380**	**0.393**	**0.271**	**0.346**	**0.373**	**0.441**
	Toluene		**4.49**	**4.26**	**4.34**	**4.37**	**0.919**	**1.47 J**	**0.644**	**0.621**	**0.241**	**0.20**	**0.802**	**0.275**
	trans-1,2-Dichloroethene		0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U	0.079 U
	trans-1,3-Dichloropropene		0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U	0.091 U
	Trichloroethene		0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	0.107 U	**0.145**	**0.124**
	Vinyl chloride		0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U	0.051 U
	Xylenes (total)		**1.93**	**2.80**	**1.89**	**2.95**	**0.482**	**0.903**	**0.295**	**0.265**	0.261 U	0.261 U	**0.490**	0.261 U

Table B-7. Summary of Analytical Results for Air Samples --March and June 2011
Wells G & H (Parcel 260903)
Woburn, Massachusetts

Analysis	Analyte	Property Parcel #:	26/09/03		26/09/03		26/09/03		26/09/03				26/09/03	
		Sample Type:	Indoor Air		Indoor Air		Outdoor Air		Sub-Slab Soil Gas				Sub-Slab Soil Gas	
		Sample Location:	IA1		IA2		OA		SS1				SS2	
		Sample ID:	260903-IA1	260903-IA1-20110607	260903-IA2	260903-IA2-20110607	260903-OA	260903-OA-20110607	260903-SS1	BD02-03182011	260903-SS1-20110607	BD02-20110607	260903-SS2	260903-SS2-20110607
		Sample Date:	3/18/2011	6/7/2011	3/18/2011	6/7/2011	3/18/2011	6/7/2011	3/18/2011	3/18/2011 Field Dup	6/7/2011	6/7/2011 Field Dup	3/18/2011	6/7/2011
APH														
(ug/m3)	C5-C8 Aliphatics		**110**	**140**	**110**	**150**	12.0 U	**31.0**	**25**	**29.0**	**20.0**	**18.0**	**68**	12.0 U
	C9-C12 Aliphatics		**83**	**56.0**	**80**	**60.0**	14.0 U	14.0 U	**14.0 J**	14.0 UJ	14.0 U	14.0 U	**190**	14.0 U
	C9-C10 Aromatics		10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U	10.0 U
	1,3-Butadiene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Benzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Ethylbenzene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Methyl tert butyl ether		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	Naphthalene		2.00 U	2.00 UJ	2.00 U	2.00 UJ	2.00 U	2.00 UJ	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	o-Xylene		2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U
	p/m-Xylene		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
	Xylenes, Total		4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U	4.00 U
	Toluene		**5.20**	**4.40**	**5.10**	**4.10**	2.00 U	**2.10**	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U	2.00 U

Notes:
ug/m3 - micrograms per cubic meter.
J - Estimated value.
NA - Sample not analyzed for the listed analyte.
U - Compound was not detected at specified quantitation limit.
UJ - Estimated non-detect.
Values in **Bold** indicate the compound was detected.
APH - Air-Phase Petroleum Hydrocarbons.
TO - Toxic organics.

APPENDIX C

95-PERCENT UCL SUPPORTING DOCUMENTATION

APPENDIX C

95 PERCENT UCL SUPPORTING

DOCUMENTATION

260207 SPACE 1

General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	WorkSheet_a.wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,2,4-Trimethylbenzene

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	8

Raw Statistics		Log-transformed Statistics	
Minimum	0.138	Minimum of Log Data	-1.981
Maximum	1.22	Maximum of Log Data	0.199
Mean	0.633	Mean of log Data	-0.701
Median	0.393	SD of log Data	0.778
SD	0.442		
Std. Error of Mean	0.156		
Coefficient of Variation	0.698		
Skewness	0.52		

Warning: There are only 8 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.805	Shapiro Wilk Test Statistic	0.884
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.929	95% H-UCL	1.575
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.424
95% Adjusted-CLT UCL (Chen-1995)	0.921	97.5% Chebyshev (MVUE) UCL	1.763
95% Modified-t UCL (Johnson-1978)	0.934	99% Chebyshev (MVUE) UCL	2.429

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.459	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	0.434		
MLE of Mean	0.633		
MLE of Standard Deviation	0.524		
nu star	23.35		
Approximate Chi Square Value (.05)	13.35	**Nonparametric Statistics**	

Adjusted Level of Significance	0.0195	95% CLT UCL	0.89
Adjusted Chi Square Value	11.49	95% Jackknife UCL	0.929
		95% Standard Bootstrap UCL	0.87
Anderson-Darling Test Statistic	0.631	95% Bootstrap-t UCL	0.958
Anderson-Darling 5% Critical Value	0.723	95% Hall's Bootstrap UCL	0.813
Kolmogorov-Smirnov Test Statistic	0.265	95% Percentile Bootstrap UCL	0.865
Kolmogorov-Smirnov 5% Critical Value	0.297	95% BCA Bootstrap UCL	0.881
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.315
		97.5% Chebyshev(Mean, Sd) UCL	1.609
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	2.189
95% Approximate Gamma UCL	1.107		
95% Adjusted Gamma UCL	1.287		
Potential UCL to Use		Use 95% Approximate Gamma UCL	1.107

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

1,4-Dichlorobenzene

General Statistics

Number of Valid Data	8	Number of Detected Data	7
Number of Distinct Detected Data	7	Number of Non-Detect Data	1
		Percent Non-Detects	12.50%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.378	Minimum Detected	-0.973
Maximum Detected	40.1	Maximum Detected	3.691
Mean of Detected	14.03	Mean of Detected	1.585
SD of Detected	17.26	SD of Detected	1.772
Minimum Non-Detect	0.12	Minimum Non-Detect	-2.12
Maximum Non-Detect	0.12	Maximum Non-Detect	-2.12

Warning: There are only 7 Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.768	Shapiro Wilk Test Statistic	0.893
5% Shapiro Wilk Critical Value	0.803	5% Shapiro Wilk Critical Value	0.803
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	12.28
SD	16.73
95% DL/2 (t) UCL	23.49
Maximum Likelihood Estimate(MLE) Method	
Mean	10.98
SD	17.26
95% MLE (t) UCL	22.54
95% MLE (Tiku) UCL	22.13

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	1.035
SD	2.26
95% H-Stat (DL/2) UCL	12870
Log ROS Method	
Mean in Log Scale	1.048
SD in Log Scale	2.235
Mean in Original Scale	12.28
SD in Original Scale	16.73
95% t UCL	23.49
95% Percentile Bootstrap UCL	21.78
95% BCA Bootstrap UCL	23.76
95% H UCL	10857

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	0.431
Theta Star	32.57
nu star	6.03
A-D Test Statistic	0.55
5% A-D Critical Value	0.746
K-S Test Statistic	0.746
5% K-S Critical Value	0.326

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	40.1
Mean	12.27
Median	2.045
SD	16.73
k star	0.239
Theta star	51.3
Nu star	3.829
AppChi2	0.655
95% Gamma Approximate UCL	71.73
95% Adjusted Gamma UCL	118.6

Data Distribution Test with Detected Values Only

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	12.32
SD	15.62
SE of Mean	5.964
95% KM (t) UCL	23.62
95% KM (z) UCL	22.13
95% KM (jackknife) UCL	23.43
95% KM (bootstrap t) UCL	41.55
95% KM (BCA) UCL	22.27
95% KM (Percentile Bootstrap) UCL	21.74
95% KM (Chebyshev) UCL	38.32
97.5% KM (Chebyshev) UCL	49.57
99% KM (Chebyshev) UCL	71.66

Potential UCLs to Use

95% KM (Chebyshev) UCL	38.32

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Benzene

General Statistics

Number of Valid Observations 8

Number of Distinct Observations 8

Raw Statistics

Minimum	0.517
Maximum	1.43
Mean	0.777
Median	0.666
SD	0.298
Std. Error of Mean	0.105
Coefficient of Variation	0.383
Skewness	1.765

Log-transformed Statistics

Minimum of Log Data	-0.66
Maximum of Log Data	0.358
Mean of log Data	-0.305
SD of log Data	0.332

Warning: There are only 8 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.805
Shapiro Wilk Critical Value	0.818

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.89
Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.977

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	1.02
95% Modified-t UCL (Johnson-1978)	0.988

Assuming Lognormal Distribution

95% H-UCL	1.014
95% Chebyshev (MVUE) UCL	1.171
97.5% Chebyshev (MVUE) UCL	1.343
99% Chebyshev (MVUE) UCL	1.681

Gamma Distribution Test

k star (bias corrected)	6.11
Theta Star	0.127
MLE of Mean	0.777
MLE of Standard Deviation	0.314
nu star	97.76
Approximate Chi Square Value (.05)	75.95
Adjusted Level of Significance	0.0195
Adjusted Chi Square Value	71.1
Anderson-Darling Test Statistic	0.522
Anderson-Darling 5% Critical Value	0.715
Kolmogorov-Smirnov Test Statistic	0.241
Kolmogorov-Smirnov 5% Critical Value	0.294

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.95
95% Jackknife UCL	0.977
95% Standard Bootstrap UCL	0.934
95% Bootstrap-t UCL	1.174
95% Hall's Bootstrap UCL	1.578
95% Percentile Bootstrap UCL	0.954
95% BCA Bootstrap UCL	1.025
95% Chebyshev(Mean, Sd) UCL	1.236
97.5% Chebyshev(Mean, Sd) UCL	1.434
99% Chebyshev(Mean, Sd) UCL	1.824

95% Approximate Gamma UCL	1
95% Adjusted Gamma UCL	1.069

Potential UCL to Use Use 95% Approximate Gamma UCL 1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Carbon tetrachloride

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	7

Raw Statistics		**Log-transformed Statistics**	
Minimum	0.408	Minimum of Log Data	-0.896
Maximum	0.49	Maximum of Log Data	-0.713
Mean	0.462	Mean of log Data	-0.775
Median	0.475	SD of log Data	0.0733
SD	0.0328		
Std. Error of Mean	0.0116		
Coefficient of Variation	0.071		
Skewness	-1.077		

Warning: There are only 8 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		**Lognormal Distribution Test**	
Shapiro Wilk Test Statistic	0.811	Shapiro Wilk Test Statistic	0.801
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
95% Student's-t UCL	0.484	95% H-UCL	N/A
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.514
95% Adjusted-CLT UCL (Chen-1995)	0.476	97.5% Chebyshev (MVUE) UCL	0.537
95% Modified-t UCL (Johnson-1978)	0.483	99% Chebyshev (MVUE) UCL	0.581

Gamma Distribution Test		**Data Distribution**
k star (bias corrected)	136.1	**Data Follow Appr. Gamma Distribution at 5% Significance Level**
Theta Star	0.00339	
MLE of Mean	0.462	
MLE of Standard Deviation	0.0396	

nu star	2178
Approximate Chi Square Value (.05)	2070
Adjusted Level of Significance	0.0195
Adjusted Chi Square Value	2044
Anderson-Darling Test Statistic	0.768
Anderson-Darling 5% Critical Value	0.715
Kolmogorov-Smirnov Test Statistic	0.248
Kolmogorov-Smirnov 5% Critical Value	0.294

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.486
95% Adjusted Gamma UCL	0.492

Nonparametric Statistics

95% CLT UCL	0.481
95% Jackknife UCL	0.484
95% Standard Bootstrap UCL	0.479
95% Bootstrap-t UCL	0.48
95% Hall's Bootstrap UCL	0.476
95% Percentile Bootstrap UCL	0.478
95% BCA Bootstrap UCL	0.476
95% Chebyshev(Mean, Sd) UCL	0.512
97.5% Chebyshev(Mean, Sd) UCL	0.534
99% Chebyshev(Mean, Sd) UCL	0.577

Potential UCL to Use

Use 95% Approximate Gamma UCL 0.486

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Chloroform

General Statistics

Number of Valid Data	8	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	50.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.176	Minimum Detected	-1.737
Maximum Detected	0.263	Maximum Detected	-1.336
Mean of Detected	0.212	Mean of Detected	-1.561
SD of Detected	0.0374	SD of Detected	0.171
Minimum Non-Detect	0.098	Minimum Non-Detect	-2.323
Maximum Non-Detect	0.098	Maximum Non-Detect	-2.323

Warning: There are only 4 Distinct Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.95
5% Shapiro Wilk Critical Value	0.748

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.131
SD	0.0906
95% DL/2 (t) UCL	0.191
Maximum Likelihood Estimate(MLE) Method	
Mean	0.114
SD	0.111
95% MLE (t) UCL	0.188
95% MLE (Tiku) UCL	0.205

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.973
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.289
SD	0.786
95% H-Stat (DL/2) UCL	0.329
Log ROS Method	
Mean in Log Scale	-1.841
SD in Log Scale	0.338
Mean in Original Scale	0.167
SD in Original Scale	0.0561
95% t UCL	0.204
95% Percentile Bootstrap UCL	0.198
95% BCA Bootstrap UCL	0.201
95% H UCL	0.22

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	11.37
Theta Star	0.0187
nu star	90.98
A-D Test Statistic	0.25
5% A-D Critical Value	0.656
K-S Test Statistic	0.656
5% K-S Critical Value	0.394

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	0.263
Mean	0.125
Median	0.137
SD	0.101
k star	0.241
Theta star	0.518
Nu star	3.854
AppChi2	0.665
95% Gamma Approximate UCL	0.723
95% Adjusted Gamma UCL	N/A

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.194
SD	0.0292
SE of Mean	0.0119
95% KM (t) UCL	0.217
95% KM (z) UCL	0.214
95% KM (jackknife) UCL	0.215
95% KM (bootstrap t) UCL	0.218
95% KM (BCA) UCL	0.263
95% KM (Percentile Bootstrap) UCL	0.226
95% KM (Chebyshev) UCL	0.246
97.5% KM (Chebyshev) UCL	0.269
99% KM (Chebyshev) UCL	0.313

Potential UCLs to Use

95% KM (t) UCL	0.217
95% KM (Percentile Bootstrap) UCL	0.226

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Ethylbenzene

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	7

Raw Statistics		Log-transformed Statistics	
Minimum	0.13	Minimum of Log Data	-2.04
Maximum	1.08	Maximum of Log Data	0.077
Mean	0.588	Mean of log Data	-0.755
Median	0.59	SD of log Data	0.769
SD	0.368		
Std. Error of Mean	0.13		
Coefficient of Variation	0.625		
Skewness	0.0535		

Warning: There are only 8 Values in this data
Note: It should be noted that even though bootstrap methods may be performed on this data set,
the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.853	Shapiro Wilk Test Statistic	0.87
Shapiro Wilk Critical Value	0.818	Shapiro Wilk Critical Value	0.818
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.834	95% H-UCL	1.459
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	1.333
95% Adjusted-CLT UCL (Chen-1995)	0.805	97.5% Chebyshev (MVUE) UCL	1.648
95% Modified-t UCL (Johnson-1978)	0.835	99% Chebyshev (MVUE) UCL	2.268

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	1.572	Data appear Normal at 5% Significance Level	
Theta Star	0.374		
MLE of Mean	0.588		
MLE of Standard Deviation	0.469		
nu star	25.15		
Approximate Chi Square Value (.05)	14.72	Nonparametric Statistics	
Adjusted Level of Significance	0.0195	95% CLT UCL	0.802
Adjusted Chi Square Value	12.75	95% Jackknife UCL	0.834
		95% Standard Bootstrap UCL	0.787

Anderson-Darling Test Statistic	0.636	95% Bootstrap-t UCL	0.825
Anderson-Darling 5% Critical Value	0.723	95% Hall's Bootstrap UCL	0.746
Kolmogorov-Smirnov Test Statistic	0.298	95% Percentile Bootstrap UCL	0.787
Kolmogorov-Smirnov 5% Critical Value	0.297	95% BCA Bootstrap UCL	0.784
Data follow Appr. Gamma Distribution at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	1.155
		97.5% Chebyshev(Mean, Sd) UCL	1.4
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.881
95% Approximate Gamma UCL	1.005		
95% Adjusted Gamma UCL	1.16		
Potential UCL to Use		Use 95% Student's-t UCL	0.834

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Naphthalene

General Statistics

Number of Valid Data	8	Number of Detected Data	6
Number of Distinct Detected Data	6	Number of Non-Detect Data	2
		Percent Non-Detects	25.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.587	Minimum Detected	-0.533
Maximum Detected	2.3	Maximum Detected	0.833
Mean of Detected	1.427	Mean of Detected	0.179
SD of Detected	0.851	SD of Detected	0.67
Minimum Non-Detect	0.26	Minimum Non-Detect	-1.347
Maximum Non-Detect	0.262	Maximum Non-Detect	-1.339

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	2
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	6
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	25.00%

Warning: There are only 6 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.757	Shapiro Wilk Test Statistic	0.765
5% Shapiro Wilk Critical Value	0.788	5% Shapiro Wilk Critical Value	0.788
Data not Normal at 5% Significance Level		**Data not Lognormal at 5% Significance Level**	

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	1.103
SD	0.936
95% DL/2 (t) UCL	1.73
Maximum Likelihood Estimate(MLE) Method	
Mean	0.977
SD	1.061
95% MLE (t) UCL	1.688
95% MLE (Tiku) UCL	1.721

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-0.375
SD	1.172
95% H-Stat (DL/2) UCL	7.549
Log ROS Method	
Mean in Log Scale	-0.21
SD in Log Scale	0.916
Mean in Original Scale	1.133
SD in Original Scale	0.901
95% t UCL	1.737
95% Percentile Bootstrap UCL	1.607
95% BCA Bootstrap UCL	1.676
95% H UCL	3.764

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.61
Theta Star	0.886
nu star	19.32
A-D Test Statistic	0.826
5% A-D Critical Value	0.701
K-S Test Statistic	0.701
5% K-S Critical Value	0.335

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	2.3
Mean	1.07
Median	0.686
SD	0.976
k star	0.218
Theta star	4.916
Nu star	3.482
AppChi2	0.528
95% Gamma Approximate UCL	7.05
95% Adjusted Gamma UCL	11.96

Data Distribution Test with Detected Values Only

Data Follow Appr. Gamma Distribution at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	1.217
SD	0.764
SE of Mean	0.296
95% KM (t) UCL	1.778
95% KM (z) UCL	1.704
95% KM (jackknife) UCL	1.758
95% KM (bootstrap t) UCL	1.821
95% KM (BCA) UCL	1.841
95% KM (Percentile Bootstrap) UCL	1.667
95% KM (Chebyshev) UCL	2.507
97.5% KM (Chebyshev) UCL	3.066
99% KM (Chebyshev) UCL	4.162

Potential UCLs to Use

95% KM (Percentile Bootstrap) UCL	1.667

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Tetrachloroethene

General Statistics

Number of Valid Observations	8	Number of Distinct Observations	7

Raw Statistics

Minimum	0.861
Maximum	8.75
Mean	3.698
Median	3.435
SD	2.414
Std. Error of Mean	0.853
Coefficient of Variation	0.653
Skewness	1.334

Log-transformed Statistics

Minimum of Log Data	-0.15
Maximum of Log Data	2.169
Mean of log Data	1.116
SD of log Data	0.692

Warning: There are only 8 Values in this data

Note: It should be noted that even though bootstrap methods may be performed on this data set, the resulting calculations may not be reliable enough to draw conclusions

The literature suggests to use bootstrap methods on data sets having more than 10-15 observations.

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.869
Shapiro Wilk Critical Value	0.818

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	5.315

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	5.531
95% Modified-t UCL (Johnson-1978)	5.382

Gamma Distribution Test

k star (bias corrected)	1.809
Theta Star	2.044
MLE of Mean	3.698
MLE of Standard Deviation	2.749
nu star	28.95
Approximate Chi Square Value (.05)	17.67
Adjusted Level of Significance	0.0195
Adjusted Chi Square Value	15.48
Anderson-Darling Test Statistic	0.332
Anderson-Darling 5% Critical Value	0.722
Kolmogorov-Smirnov Test Statistic	0.19
Kolmogorov-Smirnov 5% Critical Value	0.297

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.818

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	7.889
95% Chebyshev (MVUE) UCL	7.801
97.5% Chebyshev (MVUE) UCL	9.556
99% Chebyshev (MVUE) UCL	13

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	5.101
95% Jackknife UCL	5.315
95% Standard Bootstrap UCL	4.969
95% Bootstrap-t UCL	5.941
95% Hall's Bootstrap UCL	11.41
95% Percentile Bootstrap UCL	5.055
95% BCA Bootstrap UCL	5.484
95% Chebyshev(Mean, Sd) UCL	7.418
97.5% Chebyshev(Mean, Sd) UCL	9.027
99% Chebyshev(Mean, Sd) UCL	12.19

95% Approximate Gamma UCL	6.059
95% Adjusted Gamma UCL	6.915

Potential UCL to Use Use 95% Student's-t UCL 5.315

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Trichloroethene

General Statistics

Number of Valid Data	8	Number of Detected Data	2
Number of Distinct Detected Data	1	Number of Non-Detect Data	6
		Percent Non-Detects	75.00%

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Trichloroethene was not processed!

C5-C8 Aliphatics

General Statistics

Number of Valid Data	8	Number of Detected Data	4
Number of Distinct Detected Data	4	Number of Non-Detect Data	4
		Percent Non-Detects	50.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	58	Minimum Detected	4.06
Maximum Detected	70	Maximum Detected	4.248
Mean of Detected	63.75	Mean of Detected	4.152
SD of Detected	5.315	SD of Detected	0.0833
Minimum Non-Detect	12	Minimum Non-Detect	2.485
Maximum Non-Detect	27	Maximum Non-Detect	3.296

Note: Data have multiple DLs - Use of KM Method is recommended	Number treated as Non-Detect	4
For all methods (except KM, DL/2, and ROS Methods),	Number treated as Detected	4
Observations < Largest ND are treated as NDs	Single DL Non-Detect Percentage	50.00%

Warning: There are only 4 Distinct Detected Values in this data
Note: It should be noted that even though bootstrap may be performed on this data set the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.974
5% Shapiro Wilk Critical Value	0.748

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	37
SD	28.88
95% DL/2 (t) UCL	56.35
Maximum Likelihood Estimate(MLE) Method	
Mean	32.8
SD	34.04
95% MLE (t) UCL	55.6
95% MLE (Tiku) UCL	60.88

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	48.24
Theta Star	1.322
nu star	385.9
A-D Test Statistic	0.236
5% A-D Critical Value	0.657
K-S Test Statistic	0.657
5% K-S Critical Value	0.394

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	35.27
Maximum	70
Mean	49.51
Median	46.63
SD	15.62
k star	7.212
Theta star	6.865
Nu star	115.4
AppChi2	91.58
95% Gamma Approximate UCL	62.38
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.975
5% Shapiro Wilk Critical Value	0.748

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	3.219
SD	1.025
95% H-Stat (DL/2) UCL	163.1
Log ROS Method	
Mean in Log Scale	4.022
SD in Log Scale	0.15
Mean in Original Scale	56.35
SD in Original Scale	8.643
95% t UCL	62.14
95% Percentile Bootstrap UCL	61.12
95% BCA Bootstrap UCL	61.36
95% H UCL	62.82

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	60.88
SD	4.343
SE of Mean	1.773
95% KM (t) UCL	64.23
95% KM (z) UCL	63.79
95% KM (jackknife) UCL	64.08
95% KM (bootstrap t) UCL	63.43
95% KM (BCA) UCL	70
95% KM (Percentile Bootstrap) UCL	66.5
95% KM (Chebyshev) UCL	68.6
97.5% KM (Chebyshev) UCL	71.95
99% KM (Chebyshev) UCL	78.52

Potential UCLs to Use

95% KM (t) UCL	64.23
95% KM (Percentile Bootstrap) UCL	66.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

C9-C12 Aliphatics

General Statistics

Number of Valid Data	8	Number of Detected Data	3
Number of Distinct Detected Data	3	Number of Non-Detect Data	5
		Percent Non-Detects	62.50%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	61	Minimum Detected	4.111
Maximum Detected	87	Maximum Detected	4.466
Mean of Detected	77	Mean of Detected	4.332
SD of Detected	14	SD of Detected	0.193
Minimum Non-Detect	14	Minimum Non-Detect	2.639
Maximum Non-Detect	14	Maximum Non-Detect	2.639

Warning: There are only 3 Distinct Detected Values in this data set
The number of detected data may not be adequate enough to perform GOF tests, bootstrap, and ROS methods.
Those methods will return a 'N/A' value on your output display!

It is necessary to have 4 or more Distinct Values for bootstrap methods.
However, results obtained using 4 to 9 distinct values may not be reliable.
It is recommended to have 10 to 15 or more observations for accurate and meaningful results and estimates.

UCL Statistics

Normal Distribution Test with Detected Values Only		Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.862	Shapiro Wilk Test Statistic	0.847
5% Shapiro Wilk Critical Value	0.767	5% Shapiro Wilk Critical Value	0.767
Data appear Normal at 5% Significance Level		Data appear Lognormal at 5% Significance Level	

Assuming Normal Distribution		Assuming Lognormal Distribution	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	33.25	Mean	2.841
SD	36.99	SD	1.239
95% DL/2 (t) UCL	58.03	95% H-Stat (DL/2) UCL	244.7
Maximum Likelihood Estimate(MLE) Method	N/A	Log ROS Method	
MLE yields a negative mean		Mean in Log Scale	3.912
		SD in Log Scale	0.404
		Mean in Original Scale	53.68
		SD in Original Scale	21.79
		95% t UCL	68.28
		95% Percentile Bootstrap UCL	65.73

95% BCA Bootstrap UCL	67.2
95% H-UCL	75.87

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	N/A
Theta Star	N/A
nu star	N/A
A-D Test Statistic	N/A
5% A-D Critical Value	N/A
K-S Test Statistic	N/A
5% K-S Critical Value	N/A

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	N/A
Maximum	N/A
Mean	N/A
Median	N/A
SD	N/A
k star	N/A
Theta star	N/A
Nu star	N/A
AppChi2	N/A
95% Gamma Approximate UCL	N/A
95% Adjusted Gamma UCL	N/A

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	67
SD	10.44
SE of Mean	4.521
95% KM (t) UCL	75.56
95% KM (z) UCL	74.44
95% KM (jackknife) UCL	81.87
95% KM (bootstrap t) UCL	71.95
95% KM (BCA) UCL	87
95% KM (Percentile Bootstrap) UCL	87
95% KM (Chebyshev) UCL	86.71
97.5% KM (Chebyshev) UCL	95.23
99% KM (Chebyshev) UCL	112

Potential UCLs to Use

95% KM (t) UCL	75.56
95% KM (Percentile Bootstrap) UCL	87

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

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General UCL Statistics for Data Sets with Non-Detects

User Selected Options

From File	26-02-07 (East Warehouse).wst
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,2,4-Trimethylbenzene

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	19

Raw Statistics

Minimum	0.197
Maximum	1.6
Mean	0.659
Median	0.41
SD	0.43
Std. Error of Mean	0.0962
Coefficient of Variation	0.653
Skewness	0.786

Log-transformed Statistics

Minimum of Log Data	-1.627
Maximum of Log Data	0.47
Mean of log Data	-0.622
SD of log Data	0.659

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.859
Shapiro Wilk Critical Value	0.905

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.915
Shapiro Wilk Critical Value	0.905

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.825

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.835
95% Modified-t UCL (Johnson-1978)	0.828

Assuming Lognormal Distribution

95% H-UCL	0.929
95% Chebyshev (MVUE) UCL	1.107
97.5% Chebyshev (MVUE) UCL	1.302
99% Chebyshev (MVUE) UCL	1.683

Gamma Distribution Test

k star (bias corrected)	2.244
Theta Star	0.293
MLE of Mean	0.659
MLE of Standard Deviation	0.44
nu star	89.77
Approximate Chi Square Value (.05)	68.93
Adjusted Level of Significance	0.038
Adjusted Chi Square Value	67.48
Anderson-Darling Test Statistic	0.94
Anderson-Darling 5% Critical Value	0.749
Kolmogorov-Smirnov Test Statistic	0.22
Kolmogorov-Smirnov 5% Critical Value	0.195

Data Distribution

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.817
95% Jackknife UCL	0.825
95% Standard Bootstrap UCL	0.812
95% Bootstrap-t UCL	0.854
95% Hall's Bootstrap UCL	0.833
95% Percentile Bootstrap UCL	0.81
95% BCA Bootstrap UCL	0.823

Data not Gamma Distributed at 5% Significance Level

95% Chebyshev(Mean, Sd) UCL	1.078
97.5% Chebyshev(Mean, Sd) UCL	1.259
99% Chebyshev(Mean, Sd) UCL	1.615

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.858
95% Adjusted Gamma UCL	0.876

Potential UCL to Use

Use 95% H-UCL	0.929

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

1,4-Dichlorobenzene

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	20

Raw Statistics

Minimum	0.144
Maximum	11.6
Mean	2.241
Median	1.128
SD	2.854
Std. Error of Mean	0.638
Coefficient of Variation	1.273
Skewness	2.312

Log-transformed Statistics

Minimum of Log Data	-1.938
Maximum of Log Data	2.451
Mean of log Data	0.199
SD of log Data	1.138

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.693
Shapiro Wilk Critical Value	0.905

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.98
Shapiro Wilk Critical Value	0.905

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	3.345

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	3.643
95% Modified-t UCL (Johnson-1978)	3.4

Assuming Lognormal Distribution

95% H-UCL	4.893
95% Chebyshev (MVUE) UCL	5.032
97.5% Chebyshev (MVUE) UCL	6.249
99% Chebyshev (MVUE) UCL	8.639

Gamma Distribution Test

k star (bias corrected)	0.845
Theta Star	2.653
MLE of Mean	2.241

Data Distribution

Data appear Gamma Distributed at 5% Significance Level

MLE of Standard Deviation	2.438
nu star	33.79
Approximate Chi Square Value (.05)	21.5
Adjusted Level of Significance	0.038
Adjusted Chi Square Value	20.72
Anderson-Darling Test Statistic	0.586
Anderson-Darling 5% Critical Value	0.77
Kolmogorov-Smirnov Test Statistic	0.153
Kolmogorov-Smirnov 5% Critical Value	0.2

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	3.523
95% Adjusted Gamma UCL	3.655

Nonparametric Statistics

95% CLT UCL	3.291
95% Jackknife UCL	3.345
95% Standard Bootstrap UCL	3.268
95% Bootstrap-t UCL	4.119
95% Hall's Bootstrap UCL	3.939
95% Percentile Bootstrap UCL	3.28
95% BCA Bootstrap UCL	3.668
95% Chebyshev(Mean, Sd) UCL	5.023
97.5% Chebyshev(Mean, Sd) UCL	6.227
99% Chebyshev(Mean, Sd) UCL	8.591

Potential UCL to Use

Use 95% Approximate Gamma UCL 3.523

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Benzene

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	20

Raw Statistics

Minimum	0.517
Maximum	1.18
Mean	0.776
Median	0.71
SD	0.199
Std. Error of Mean	0.0445
Coefficient of Variation	0.257
Skewness	0.713

Log-transformed Statistics

Minimum of Log Data	-0.66
Maximum of Log Data	0.166
Mean of log Data	-0.283
SD of log Data	0.247

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.915
Shapiro Wilk Critical Value	0.905

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	0.853

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	0.857
95% Modified-t UCL (Johnson-1978)	0.854

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.944
Shapiro Wilk Critical Value	0.905

Data appear Lognormal at 5% Significance Level

Assuming Lognormal Distribution

95% H-UCL	0.861
95% Chebyshev (MVUE) UCL	0.964
97.5% Chebyshev (MVUE) UCL	1.046
99% Chebyshev (MVUE) UCL	1.206

Gamma Distribution Test

k star (bias corrected)	14.47
Theta Star	0.0536
MLE of Mean	0.776
MLE of Standard Deviation	0.204
nu star	578.8
Approximate Chi Square Value (.05)	524
Adjusted Level of Significance	0.038
Adjusted Chi Square Value	519.9
Anderson-Darling Test Statistic	0.534
Anderson-Darling 5% Critical Value	0.741
Kolmogorov-Smirnov Test Statistic	0.207
Kolmogorov-Smirnov 5% Critical Value	0.194

Data follow Appr. Gamma Distribution at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	0.857
95% Adjusted Gamma UCL	0.864

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	0.849
95% Jackknife UCL	0.853
95% Standard Bootstrap UCL	0.848
95% Bootstrap-t UCL	0.864
95% Hall's Bootstrap UCL	0.85
95% Percentile Bootstrap UCL	0.851
95% BCA Bootstrap UCL	0.851
95% Chebyshev(Mean, Sd) UCL	0.97
97.5% Chebyshev(Mean, Sd) UCL	1.054
99% Chebyshev(Mean, Sd) UCL	1.219

Potential UCL to Use

Use 95% Student's-t UCL 0.853

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Carbon tetrachloride

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	14

Raw Statistics

Minimum	0.402
Maximum	0.497
Mean	0.451
Median	0.447
SD	0.0325
Std. Error of Mean	0.00726
Coefficient of Variation	0.0721
Skewness	-0.055

Log-transformed Statistics

Minimum of Log Data	-0.911
Maximum of Log Data	-0.699
Mean of log Data	-0.799
SD of log Data	0.0724

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.892
Shapiro Wilk Critical Value	0.905

Data not Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.892
Shapiro Wilk Critical Value	0.905

Data not Lognormal at 5% Significance Level

Assuming Normal Distribution	
95% Student's-t UCL	0.463
95% UCLs (Adjusted for Skewness)	
95% Adjusted-CLT UCL (Chen-1995)	0.463
95% Modified-t UCL (Johnson-1978)	0.463

Assuming Lognormal Distribution	
95% H-UCL	N/A
95% Chebyshev (MVUE) UCL	0.482
97.5% Chebyshev (MVUE) UCL	0.496
99% Chebyshev (MVUE) UCL	0.523

Gamma Distribution Test	
k star (bias corrected)	171.5
Theta Star	0.00263
MLE of Mean	0.451
MLE of Standard Deviation	0.0344
nu star	6859
Approximate Chi Square Value (.05)	6668
Adjusted Level of Significance	0.038
Adjusted Chi Square Value	6653
Anderson-Darling Test Statistic	0.934
Anderson-Darling 5% Critical Value	0.74
Kolmogorov-Smirnov Test Statistic	0.207
Kolmogorov-Smirnov 5% Critical Value	0.193
Data not Gamma Distributed at 5% Significance Level	
Assuming Gamma Distribution	
95% Approximate Gamma UCL	0.464
95% Adjusted Gamma UCL	0.465

Data Distribution
Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics	
95% CLT UCL	0.463
95% Jackknife UCL	0.463
95% Standard Bootstrap UCL	0.462
95% Bootstrap-t UCL	0.463
95% Hall's Bootstrap UCL	0.462
95% Percentile Bootstrap UCL	0.463
95% BCA Bootstrap UCL	0.462
95% Chebyshev(Mean, Sd) UCL	0.482
97.5% Chebyshev(Mean, Sd) UCL	0.496
99% Chebyshev(Mean, Sd) UCL	0.523

Potential UCL to Use	
Use 95% Student's-t UCL	0.463
or 95% Modified-t UCL	0.463

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Note: For highly negative-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Chloroform

General Statistics

Number of Valid Data	20	Number of Detected Data	16
Number of Distinct Detected Data	13	Number of Non-Detect Data	4
		Percent Non-Detects	20.00%

Raw Statistics		Log-transformed Statistics	
Minimum Detected	0.098	Minimum Detected	-2.323
Maximum Detected	0.293	Maximum Detected	-1.228

Mean of Detected	0.153
SD of Detected	0.0477
Minimum Non-Detect	0.098
Maximum Non-Detect	0.098

Mean of Detected	-1.915
SD of Detected	0.27
Minimum Non-Detect	-2.323
Maximum Non-Detect	-2.323

UCL Statistics

Normal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.778
5% Shapiro Wilk Critical Value	0.887

Data not Normal at 5% Significance Level

Assuming Normal Distribution

DL/2 Substitution Method	
Mean	0.132
SD	0.0601
95% DL/2 (t) UCL	0.155
Maximum Likelihood Estimate(MLE) Method	
Mean	0.135
SD	0.0557
95% MLE (t) UCL	0.157
95% MLE (Tiku) UCL	0.157

Lognormal Distribution Test with Detected Values Only

Shapiro Wilk Test Statistic	0.881
5% Shapiro Wilk Critical Value	0.887

Data not Lognormal at 5% Significance Level

Assuming Lognormal Distribution

DL/2 Substitution Method	
Mean	-2.135
SD	0.511
95% H-Stat (DL/2) UCL	0.171
Log ROS Method	
Mean in Log Scale	-2.037
SD in Log Scale	0.349
Mean in Original Scale	0.138
SD in Original Scale	0.0518
95% t UCL	0.158
95% Percentile Bootstrap UCL	0.159
95% BCA Bootstrap UCL	0.161
95% H UCL	0.161

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	11.12
Theta Star	0.0137
nu star	356
A-D Test Statistic	0.969
5% A-D Critical Value	0.738
K-S Test Statistic	0.738
5% K-S Critical Value	0.215

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	0.293
Mean	0.127
Median	0.137
SD	0.0684
k star	0.742
Theta star	0.171
Nu star	29.68

Data Distribution Test with Detected Values Only

Data do not follow a Discernable Distribution (0.05)

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	0.142
SD	0.0468
SE of Mean	0.0108
95% KM (t) UCL	0.161
95% KM (z) UCL	0.16
95% KM (jackknife) UCL	0.16
95% KM (bootstrap t) UCL	0.17
95% KM (BCA) UCL	0.163
95% KM (Percentile Bootstrap) UCL	0.164
95% KM (Chebyshev) UCL	0.189
97.5% KM (Chebyshev) UCL	0.209
99% KM (Chebyshev) UCL	0.249

Potential UCLs to Use

AppChi2	18.24	95% KM (BCA) UCL	0.163
95% Gamma Approximate UCL	0.207		
95% Adjusted Gamma UCL	0.215		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Ethylbenzene

General Statistics

Number of Valid Observations	20	Number of Distinct Observations	19

Raw Statistics		Log-transformed Statistics	
Minimum	0.204	Minimum of Log Data	-1.59
Maximum	1.14	Maximum of Log Data	0.131
Mean	0.601	Mean of log Data	-0.622
Median	0.484	SD of log Data	0.495
SD	0.285		
Std. Error of Mean	0.0637		
Coefficient of Variation	0.474		
Skewness	0.446		

Relevant UCL Statistics

Normal Distribution Test		Lognormal Distribution Test	
Shapiro Wilk Test Statistic	0.902	Shapiro Wilk Test Statistic	0.933
Shapiro Wilk Critical Value	0.905	Shapiro Wilk Critical Value	0.905
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		Assuming Lognormal Distribution	
95% Student's-t UCL	0.711	95% H-UCL	0.763
95% UCLs (Adjusted for Skewness)		95% Chebyshev (MVUE) UCL	0.904
95% Adjusted-CLT UCL (Chen-1995)	0.713	97.5% Chebyshev (MVUE) UCL	1.035
95% Modified-t UCL (Johnson-1978)	0.712	99% Chebyshev (MVUE) UCL	1.291

Gamma Distribution Test		Data Distribution	
k star (bias corrected)	3.95	**Data appear Gamma Distributed at 5% Significance Level**	
Theta Star	0.152		
MLE of Mean	0.601		
MLE of Standard Deviation	0.302		
nu star	158		
Approximate Chi Square Value (.05)	130	**Nonparametric Statistics**	
Adjusted Level of Significance	0.038	95% CLT UCL	0.706
Adjusted Chi Square Value	127.9	95% Jackknife UCL	0.711
		95% Standard Bootstrap UCL	0.702
Anderson-Darling Test Statistic	0.723	95% Bootstrap-t UCL	0.727
Anderson-Darling 5% Critical Value	0.745	95% Hall's Bootstrap UCL	0.706

Kolmogorov-Smirnov Test Statistic	0.19	95% Percentile Bootstrap UCL	0.703
Kolmogorov-Smirnov 5% Critical Value	0.195	95% BCA Bootstrap UCL	0.713
Data appear Gamma Distributed at 5% Significance Level		95% Chebyshev(Mean, Sd) UCL	0.879
		97.5% Chebyshev(Mean, Sd) UCL	0.999
Assuming Gamma Distribution		99% Chebyshev(Mean, Sd) UCL	1.235
95% Approximate Gamma UCL	0.731		
95% Adjusted Gamma UCL	0.742		
Potential UCL to Use		Use 95% Approximate Gamma UCL	0.731

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Naphthalene

General Statistics

Number of Valid Data	20	Number of Detected Data	18
Number of Distinct Detected Data	17	Number of Non-Detect Data	2
		Percent Non-Detects	10.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	0.498	Minimum Detected	-0.697
Maximum Detected	15.6	Maximum Detected	2.747
Mean of Detected	3.042	Mean of Detected	0.648
SD of Detected	3.561	SD of Detected	0.968
Minimum Non-Detect	0.262	Minimum Non-Detect	-1.339
Maximum Non-Detect	0.267	Maximum Non-Detect	-1.321

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	2
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	18
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	10.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.661	Shapiro Wilk Test Statistic	0.928
5% Shapiro Wilk Critical Value	0.897	5% Shapiro Wilk Critical Value	0.897
Data not Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	2.751	Mean	0.381
SD	3.486	SD	1.231
95% DL/2 (t) UCL	4.098	95% H-Stat (DL/2) UCL	7.245
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	2.541	Mean in Log Scale	0.424
SD	3.656	SD in Log Scale	1.145

95% MLE (t) UCL	3.955
95% MLE (Tiku) UCL	3.884

Mean in Original Scale	2.758
SD in Original Scale	3.48
95% t UCL	4.103
95% Percentile Bootstrap UCL	4.12
95% BCA Bootstrap UCL	4.595
95% H UCL	6.232

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	1.051
Theta Star	2.895
nu star	37.82
A-D Test Statistic	0.77
5% A-D Critical Value	0.762
K-S Test Statistic	0.762
5% K-S Critical Value	0.208

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	15.6
Mean	2.737
Median	1.15
SD	3.496
k star	0.347
Theta star	7.885
Nu star	13.89
AppChi2	6.494
95% Gamma Approximate UCL	5.854
95% Adjusted Gamma UCL	6.235

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Lognormal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	2.787
SD	3.371
SE of Mean	0.776
95% KM (t) UCL	4.128
95% KM (z) UCL	4.063
95% KM (jackknife) UCL	4.123
95% KM (bootstrap t) UCL	5.364
95% KM (BCA) UCL	4.194
95% KM (Percentile Bootstrap) UCL	4.199
95% KM (Chebyshev) UCL	6.168
97.5% KM (Chebyshev) UCL	7.631
99% KM (Chebyshev) UCL	10.5

Potential UCLs to Use

95% KM (Chebyshev) UCL	6.168

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

Tetrachloroethene

General Statistics

Number of Valid Observations	20
Number of Distinct Observations	20

Raw Statistics

Minimum	9.83
Maximum	81.2
Mean	36.39
Median	32.4
SD	19.28

Log-transformed Statistics

Minimum of Log Data	2.285
Maximum of Log Data	4.397
Mean of log Data	3.448
SD of log Data	0.577

Std. Error of Mean	4.312
Coefficient of Variation	0.53
Skewness	0.65

Relevant UCL Statistics

Normal Distribution Test

Shapiro Wilk Test Statistic	0.949
Shapiro Wilk Critical Value	0.905

Data appear Normal at 5% Significance Level

Lognormal Distribution Test

Shapiro Wilk Test Statistic	0.973
Shapiro Wilk Critical Value	0.905

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution

95% Student's-t UCL	43.84

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	44.15
95% Modified-t UCL (Johnson-1978)	43.95

Assuming Lognormal Distribution

95% H-UCL	49.02
95% Chebyshev (MVUE) UCL	58.46
97.5% Chebyshev (MVUE) UCL	67.84
99% Chebyshev (MVUE) UCL	86.26

Gamma Distribution Test

k star (bias corrected)	3.077
Theta Star	11.82
MLE of Mean	36.39
MLE of Standard Deviation	20.74
nu star	123.1
Approximate Chi Square Value (.05)	98.48
Adjusted Level of Significance	0.038
Adjusted Chi Square Value	96.74
Anderson-Darling Test Statistic	0.161
Anderson-Darling 5% Critical Value	0.746
Kolmogorov-Smirnov Test Statistic	0.0867
Kolmogorov-Smirnov 5% Critical Value	0.195

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

95% Approximate Gamma UCL	45.48
95% Adjusted Gamma UCL	46.3

Data Distribution

Data appear Normal at 5% Significance Level

Nonparametric Statistics

95% CLT UCL	43.48
95% Jackknife UCL	43.84
95% Standard Bootstrap UCL	43.28
95% Bootstrap-t UCL	44.76
95% Hall's Bootstrap UCL	44.06
95% Percentile Bootstrap UCL	43.52
95% BCA Bootstrap UCL	43.9
95% Chebyshev(Mean, Sd) UCL	55.18
97.5% Chebyshev(Mean, Sd) UCL	63.31
99% Chebyshev(Mean, Sd) UCL	79.29

Potential UCL to Use

Use 95% Student's-t UCL 43.84

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL. These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002) and Singh and Singh (2003). For additional insight, the user may want to consult a statistician.

Trichloroethene

General Statistics

Number of Valid Data	20	Number of Detected Data	18
Number of Distinct Detected Data	15	Number of Non-Detect Data	2
		Percent Non-Detects	10.00%

Raw Statistics	
Minimum Detected	0.113
Maximum Detected	1.04
Mean of Detected	0.313
SD of Detected	0.226
Minimum Non-Detect	0.107
Maximum Non-Detect	0.107

Log-transformed Statistics	
Minimum Detected	-2.18
Maximum Detected	0.0392
Mean of Detected	-1.342
SD of Detected	0.588
Minimum Non-Detect	-2.235
Maximum Non-Detect	-2.235

UCL Statistics

Normal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.754
5% Shapiro Wilk Critical Value	0.897

Data not Normal at 5% Significance Level

Lognormal Distribution Test with Detected Values Only	
Shapiro Wilk Test Statistic	0.936
5% Shapiro Wilk Critical Value	0.897

Data appear Lognormal at 5% Significance Level

Assuming Normal Distribution	
DL/2 Substitution Method	
Mean	0.287
SD	0.228
95% DL/2 (t) UCL	0.376
Maximum Likelihood Estimate(MLE) Method	
Mean	0.279
SD	0.235
95% MLE (t) UCL	0.37
95% MLE (Tiku) UCL	0.366

Assuming Lognormal Distribution	
DL/2 Substitution Method	
Mean	-1.5
SD	0.74
95% H-Stat (DL/2) UCL	0.432
Log ROS Method	
Mean in Log Scale	-1.479
SD in Log Scale	0.7
Mean in Original Scale	0.289
SD in Original Scale	0.227
95% t UCL	0.376
95% Percentile Bootstrap UCL	0.373
95% BCA Bootstrap UCL	0.393
95% H UCL	0.417

Gamma Distribution Test with Detected Values Only	
k star (bias corrected)	2.466
Theta Star	0.127
nu star	88.76
A-D Test Statistic	0.748
5% A-D Critical Value	0.746
K-S Test Statistic	0.746
5% K-S Critical Value	0.205

Data not Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution	
Gamma ROS Statistics using Extrapolated Data	
Minimum	0.000001
Maximum	1.04
Mean	0.282
Median	0.223

Data Distribution Test with Detected Values Only
Data appear Lognormal at 5% Significance Level

Nonparametric Statistics	
Kaplan-Meier (KM) Method	
Mean	0.293
SD	0.217
SE of Mean	0.0498
95% KM (t) UCL	0.379
95% KM (z) UCL	0.375
95% KM (jackknife) UCL	0.379
95% KM (bootstrap t) UCL	0.425
95% KM (BCA) UCL	0.391
95% KM (Percentile Bootstrap) UCL	0.383
95% KM (Chebyshev) UCL	0.511

SD	0.234	97.5% KM (Chebyshev) UCL	0.605
k star	0.444	99% KM (Chebyshev) UCL	0.789
Theta star	0.636		
Nu star	17.74	**Potential UCLs to Use**	
AppChi2	9.206	95% KM (Chebyshev) UCL	0.511
95% Gamma Approximate UCL	0.544		
95% Adjusted Gamma UCL	0.574		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

C5-C8 Aliphatics

General Statistics

Number of Valid Data	20	Number of Detected Data	16
Number of Distinct Detected Data	13	Number of Non-Detect Data	4
		Percent Non-Detects	20.00%

Raw Statistics		**Log-transformed Statistics**	
Minimum Detected	17	Minimum Detected	2.833
Maximum Detected	66	Maximum Detected	4.19
Mean of Detected	41.72	Mean of Detected	3.681
SD of Detected	12.41	SD of Detected	0.345
Minimum Non-Detect	20	Minimum Non-Detect	2.996
Maximum Non-Detect	32	Maximum Non-Detect	3.466

Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	7
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	13
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	35.00%

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.974	Shapiro Wilk Test Statistic	0.912
5% Shapiro Wilk Critical Value	0.887	5% Shapiro Wilk Critical Value	0.887
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	

Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	35.93	Mean	3.449
SD	16.27	SD	0.575
95% DL/2 (t) UCL	42.21	95% H-Stat (DL/2) UCL	48.96
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	38.1	Mean in Log Scale	3.562
SD	13.52	SD in Log Scale	0.394
95% MLE (t) UCL	43.33	Mean in Original Scale	37.77

95% MLE (Tiku) UCL	43.85

SD in Original Scale	13.71
95% t UCL	43.07
95% Percentile Bootstrap UCL	42.73
95% BCA Bootstrap UCL	42.83
95% H UCL	45.33

Gamma Distribution Test with Detected Values Only

k star (bias corrected)	8.325
Theta Star	5.012
nu star	266.4
A-D Test Statistic	0.487
5% A-D Critical Value	0.739
K-S Test Statistic	0.739
5% K-S Critical Value	0.215

Data appear Gamma Distributed at 5% Significance Level

Assuming Gamma Distribution

Gamma ROS Statistics using Extrapolated Data	
Minimum	5.586
Maximum	66
Mean	36.38
Median	40.5
SD	15.75
k star	3.47
Theta star	10.49
Nu star	138.8
AppChi2	112.6
95% Gamma Approximate UCL	44.86
95% Adjusted Gamma UCL	45.61

Note: DL/2 is not a recommended method.

Data Distribution Test with Detected Values Only

Data appear Normal at 5% Significance Level

Nonparametric Statistics

Kaplan-Meier (KM) Method	
Mean	37.11
SD	14.25
SE of Mean	3.31
95% KM (t) UCL	42.83
95% KM (z) UCL	42.55
95% KM (jackknife) UCL	42.61
95% KM (bootstrap t) UCL	42.23
95% KM (BCA) UCL	43.95
95% KM (Percentile Bootstrap) UCL	43.43
95% KM (Chebyshev) UCL	51.53
97.5% KM (Chebyshev) UCL	57.78
99% KM (Chebyshev) UCL	70.04

Potential UCLs to Use

95% KM (t) UCL	42.83
95% KM (Percentile Bootstrap) UCL	43.43

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.

C9-C12 Aliphatics

General Statistics

Number of Valid Data	20
Number of Distinct Detected Data	8

Number of Detected Data	8
Number of Non-Detect Data	12
Percent Non-Detects	60.00%

Raw Statistics

Minimum Detected	15
Maximum Detected	73
Mean of Detected	40.13
SD of Detected	18.58

Log-transformed Statistics

Minimum Detected	2.708
Maximum Detected	4.29
Mean of Detected	3.592
SD of Detected	0.492

Minimum Non-Detect	14	Minimum Non-Detect	2.639
Maximum Non-Detect	18	Maximum Non-Detect	2.89
Note: Data have multiple DLs - Use of KM Method is recommended		Number treated as Non-Detect	13
For all methods (except KM, DL/2, and ROS Methods),		Number treated as Detected	7
Observations < Largest ND are treated as NDs		Single DL Non-Detect Percentage	65.00%

Warning: There are only 8 Detected Values in this data

Note: It should be noted that even though bootstrap may be performed on this data set

the resulting calculations may not be reliable enough to draw conclusions

It is recommended to have 10-15 or more distinct observations for accurate and meaningful results.

UCL Statistics

Normal Distribution Test with Detected Values Only		**Lognormal Distribution Test with Detected Values Only**	
Shapiro Wilk Test Statistic	0.958	Shapiro Wilk Test Statistic	0.972
5% Shapiro Wilk Critical Value	0.818	5% Shapiro Wilk Critical Value	0.818
Data appear Normal at 5% Significance Level		**Data appear Lognormal at 5% Significance Level**	
Assuming Normal Distribution		**Assuming Lognormal Distribution**	
DL/2 Substitution Method		DL/2 Substitution Method	
Mean	20.35	Mean	2.617
SD	20.05	SD	0.872
95% DL/2 (t) UCL	28.1	95% H-Stat (DL/2) UCL	32.7
Maximum Likelihood Estimate(MLE) Method		Log ROS Method	
Mean	45.36	Mean in Log Scale	2.658
SD	15.56	SD in Log Scale	0.935
95% MLE (t) UCL	51.38	Mean in Original Scale	21.24
95% MLE (Tiku) UCL	55.36	SD in Original Scale	19.68
		95% t UCL	28.85
		95% Percentile Bootstrap UCL	28.7
		95% BCA Bootstrap UCL	30.23
		95% H UCL	38.07

Gamma Distribution Test with Detected Values Only		**Data Distribution Test with Detected Values Only**	
k star (bias corrected)	3.316	**Data appear Normal at 5% Significance Level**	
Theta Star	12.1		
nu star	53.06		
A-D Test Statistic	0.181	**Nonparametric Statistics**	
5% A-D Critical Value	0.719	Kaplan-Meier (KM) Method	
K-S Test Statistic	0.719	Mean	25.05
5% K-S Critical Value	0.295	SD	16.5
Data appear Gamma Distributed at 5% Significance Level		SE of Mean	3.945
		95% KM (t) UCL	31.87
Assuming Gamma Distribution		95% KM (z) UCL	31.54
Gamma ROS Statistics using Extrapolated Data		95% KM (jackknife) UCL	33.04

Minimum	0.000001	95% KM (bootstrap t) UCL	32.85
Maximum	73	95% KM (BCA) UCL	39.55
Mean	16.05	95% KM (Percentile Bootstrap) UCL	37.85
Median	0.000001	95% KM (Chebyshev) UCL	42.25
SD	23.11	97.5% KM (Chebyshev) UCL	49.69
k star	0.106	99% KM (Chebyshev) UCL	64.3
Theta star	150.9		
Nu star	4.255	**Potential UCLs to Use**	
AppChi2	0.825	95% KM (t) UCL	31.87
95% Gamma Approximate UCL	82.79	95% KM (Percentile Bootstrap) UCL	37.85
95% Adjusted Gamma UCL	95.35		

Note: DL/2 is not a recommended method.

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
For additional insight, the user may want to consult a statistician.