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AECOM Environment

Prepared for:
Glenn Springs Holdings, Inc.
MID 006 0014 906
Dallas, TX

Prepared by:
AECOM
Grand Rapids, Michigan
60215783
July 7, 2011

Interim Update on First Round Soil Gas Sampling Results and Work Plan Addendum for Soil Gas Investigation South of Old Channel Trail near Montague, Michigan

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Acronyms

Accutest	Accutest Laboratories
AF	attenuation factor
ASTM	American Society for Testing and Materials
c-1,2-DCE	cis-1,2-dichloroethylene
C_{IA-VI}	indoor air concentration arising from vapor intrusion
C_{SV}	subsurface vapor concentration at a point of interest in the vapor intrusion pathway
CT	carbon tetrachloride
GSH	Glenn Springs Holdings, Inc.
HCA	Hexachloroethane
HI	hazard index
HQ	hazard quotient
IPA	isopropyl alcohol
OCC	Occidental Chemical Company
PCE	Tetrachloroethene
pcf	pounds per square foot
ppbv	parts per billion by volume
RSL	Regional Screening Level
SGMP	Soil Gas Monitoring Points
t-1,2-DCE	*trans*-1,2-dichloroethylene
TCE	trichloroethylene
ug/m^3	micrograms per cubic meter
U.S. EPA	United States Environmental Protection Agency

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1.0 Introduction

Occidental Chemical Corporation ("OCC") operated a chemical plant on Old Channel Trail in Montague Township, Michigan ("Site"). At this Site, OCC produced several products such as chlorine gas from 1954 through 1982 and produced hexachlorocyclopentadiene (C-56) from 1954 through 1977. Significant remedial activities were performed from 1979 through 1982 under a consent judgment with the State of Michigan when all of the manufacturing operations for C-56 were removed from the site or placed in an on-site secure landfill and waste materials and impacted soils were excavated and placed in the on-site secure landfill. A stable and well-defined groundwater plume is present at the Site.

Currently, Glenn Springs Holdings, Inc. ("GSH") operates the ongoing groundwater collection and treatment system, provides post-closure care for the landfill, and maintains the Site. GSH also complies with the requirements of the Resource Conservation and Recovery Act Corrective Action under an administrative order with the U.S. EPA. GSH is an affiliate of OCC.

Due to complex remedial challenges at the Site, a Post-Implementation Technical Impracticability Evaluation for Groundwater Restoration Report was prepared and submitted to the United States Environmental Protection Agency (U.S. EPA) Region 5 for the Former Occidental Chemical Company ("OCC") facility (U.S. EPA I.D. No. MID 006 014 906) (AECOM, 2009). The Technical Impracticability Evaluation was approved by the U.S. EPA on October 13, 2010 in an Amended Final Decision and Response to Comments for Selection of Updated Corrective Measures document (the Amended FD, U.S. EPA, 2010). The Amended FD from U.S. EPA required submitting a work plan to the U.S. EPA to "characterize the vertical concentration of volatile organic compounds and hexachloroethane in soil gas above the defined groundwater contaminant plume south of Old Channel Trail, including the locations of potential receptors at private residences along Old Channel Trail and McFall Drive, and estate buildings on OCC property." This update summarizes the soil gas monitoring point (SGMP) installation and analytical results from the initial soil gas sampling event completed in May 2011.

This update summarizes the May 2011 soil gas sampling results at the Site and focuses on the initial soil gas sampling results. The soil gas investigation was performed following the Work Plan dated February 7, 2010 (AECOM, 2011) and approved by the U.S. EPA on February 28, 2011.

A cumulative risk-based screening of soil gas data is presented for residential and worker exposure scenarios. The residential scenario applies to SGMP installed near residential receptors. The worker exposure scenario applies to SGMP installed within the Occidental Estate Area buildings (see **Figure 1**). The locations of SGMP relative to the Occidental Estate Area buildings and residences are discussed in Section 2.0. The update also includes short-term recommendations for further activities at the Site.

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2.0 Soil Gas Monitoring Point Installation

SGMPs were installed at the Site from May 16 to 18, 2011 using direct-push Geoprobe for intermediate and deep SGMPs and hand-auger methods in the shallow SGMPs. The SGMP locations are shown on Figure 1. All SGMPs are on Occidental property and not on property used for full-time residences.

- A total of 21 SGMPs were installed at seven locations overlying the groundwater plume.
- SGMPs were installed in separate boreholes at depths of 4.5 to 5-feet (S), 14.5 to 15 feet (I) and 29.5 to 30 feet (D) at all seven locations.
- Three SGMPs are located within the Occidental property, away from the property boundary and away from residential receptors. SGMP-01 (S, I and D) and SGMP-02 (S, I and D) were installed proximal to the Occidental Conference Building. SGMP-03 (S, I and D) was installed over the central portion of the groundwater plume near the purge well network.
- Four SGMPs are located on Occidental property at locations near off-site residential property located over the western portion of the plume south of Old Channel Trail. SGMP-04 (S, I and D) was installed approximately 500 feet east of McFall Circle. SGMP-06 (S, I and D) and SGMP-07 (S, I and D) were installed up gradient and north of residences on Blueberry Ridge Drive. SGMP-05 (S, I and D) was installed over the central portion of the groundwater plume close to the boundary of residential property.
- Soil encountered was predominately fine grain sand, with medium grain horizons.
- Originally, the work plan proposed installing the SGMP with formation backfill. However, the boreholes at all 21 SGMPs remained open up to terminal depth of 30 feet. Global #0 sand pack was poured around the SGMP, and the remaining borehole filled with native sand and bentonite from 5-feet to 1-foot. The depths, locations and construction of SGMP were followed as proposed in the work plan (AECOM, 2011).
- No volatile organic compounds were detected in soils during the installation of the SGMPs using photo-ionization detector.
- No odors were observed while installing the SGMPs.
- All SGMPs were completed with stick-up pro-style covers.

Soils were logged by certified professional geologist using the Unified Soil Classification System. Sand samples were collected from one SGMP location (SGMP-03) at approximately the 4- to 6-foot, 14- to 16-foot and 28- to 30-foot depths. Samples were submitted to Material Testing Consultants, Inc. for geotechnical analyses, including: moisture content (ASTM D2216), density (ASTM D7263), specific gravity (ASTM D854), fraction of organic carbon (ASTM D2974), and grain size (ASTM D6913).

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Porosity was derived from density, moisture and specific gravity calculations. Moisture ranged from 4.4% to 6.8%. Density ranged from 100.7 to 104.5 pounds per cubic foot (pcf). Specific gravity ranged from 2.65 to 2.74. Porosity ranged from 37% to 41%, and F_{OC} 0.1% to 0.3%. Using sieve analyses, all samples were classified as poorly-graded sand. Based on sieve analysis, the samples are predominantly fine grain sand with very little (3.5% or less) fine fractions (silt or clay). The samples collected from the 4- to 6-foot depth contained a higher medium grain fraction (38.2%), compared to the 14- to 16-foot and 28- to 30-foot depth samples (3.3% or less medium grain sand). These geotechnical results indicate there is little physical variation in the vadose zone sand from sampled depths. Geotechnical results are attached in **Appendix A**. Soil boring and SGMP construction logs are presented in **Appendix B**.

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3.0 Soil Gas Purging & Sampling

Soil gas purging and sampling were performed during the week of May 23, 2011. Samples SGMP-03D-1 and SGMP-03D-2 are duplicate samples collected concurrently from SGMP-03D using a T-connector. Soil gas sampling was performed at a rate of approximately 150 ml/min using 6-liter capacity Summa canisters from May 23 through 26, 2011. During sampling, iso-propyl alcohol (IPA) was present at the ground surface to evaluate leakage at all 21 sampling points. Oxygen and carbon dioxide measurements were collected at each SGMP during purging. The soil gas samples were shipped to Accutest, New Jersey, under chain-of-custody documentation and analyzed using TO-15 for target analytes, as proposed in the work plan. The samples arrived at Accutest on May 27, 2011. All samples were analyzed within the recommended method hold time. All method blanks for the samples met TO-15 method specific criteria.

Tabulated analytical results are attached in **Table 1**. Laboratory analytical results are presented in **Appendix C**. SGMP sampling forms are attached in **Appendix D**.

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4.0 Field Quality Assurance

IPA was detected in all SGMP samples, except SGMP-01S. Concentrations ranged up to 31.4 ppbv (SGMP-07I). The IPA concentrations are orders of magnitude below the concentration that would suggest a leak or compromised soil gas sample of 100 ug/m^3 IPA (approximately 40,000 ppbv of IPA at standard temperature and pressure) (see the letter from GSH to the U.S. EPA dated March 22, 2011).

During soil gas purging, carbon dioxide and oxygen were measured using a GEM™ landfill gas meter. Carbon dioxide concentrations in soil gas were higher than in ambient air conditions. Oxygen concentrations in soil gas were generally slightly lower or the same as in ambient air. Site soil gas falls within the range for naturally occurring concentrations for oxygen and carbon dioxide in soil gas of 15 to 21% and 0.5%, respectively (AFCEE, 2011). Carbon dioxide and oxygen concentrations are summarized in **Appendix E**.

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5.0 General Discussion of Analytical Results

Compounds reported above method detection limits in soil gas include carbon tetrachloride (CT), chloroform, cis-1,2-dichloroethylene (c-1,2-DCE), trichloroethylene (TCE) and tetrachloroethene (PCE). Hexachloroethane (HCA) and *trans*-1,2-dichloroethylene(t-1,2-DCE) were not reported above method detection limit at any SGMP. Cis-1,2-DCE was detected in two samples slightly above method detection limit.

- Chloroform was infrequently detected, and ranged from not detectable (< 0.54 ug/m3) to 15 ug/m3 (SGMP-04D).
- CT ranged from not detectable (<0.25 ug/m3) to 2,090 ug/m3 (SGMP-01D).
- c-1,2-DCE ranged from not detectable to 0.87 ug/m3 (SMGP-06S).
- TCE ranged from not detectable (<0.18 ug/m3) to 12 ug/m3 (SGMP-01D).
- PCE was detected at all 21 SGMPs with concentrations from 2.6 ug/m3 (SGMP-06I) to 5,050 ug/m3 (SGMP-01D).

In general, compound concentrations decreased from the deep SGMP to the shallow SGMP at a location, consistent with a diffusion-driven soil gas system in the sandy soil column. For example, PCE was reported at concentrations of 5,050 ug/m^3 (30 foot depth), 2,640 ug/m^3 (15 foot depth) and 1,800 ug/m^3 (5-foot depth) at SGMP-01.

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6.0 Applicable Attenuation Factors

In 2002, the U.S. EPA issued draft vapor intrusion guidance based on existing knowledge available to the U.S. EPA from a limited number of vapor intrusion sites at that time (U.S. EPA, 2002). In 2008, the U.S. EPA issued additional draft guidance that further evaluated attenuation factors, based on a larger site database. In general, vapor attenuation results from physical, biological and chemical processes that control vapor transport in soil coupled with dilution and other factors that occur when vapors enter a building. The attenuation factor (AF) is defined as "the ratio of the indoor air concentration arising from vapor intrusion (C_{IA-VI}) to the subsurface vapor concentration at a point of interest in the vapor intrusion pathway (C_{SV})," or expressed as equation $AF = C_{IA-VI} / C_{SV}$ (U.S. EPA, 2008).

The AF varies due to several factors including a site's physical setting (e.g., soil type, organic carbon content, depth of monitoring point – factors that control vapor transport through diffusion, advection, sorption, biodegradation and transformation reactions) and physical barriers or migration obstacles (e.g., soil heterogeneity and physical construction of a building foundation or slab)

The U.S. EPA's 2008 guidance provides an AF statistical analysis that considers "background indoor air concentrations" effects as potentially skewing AF (Section 5.5, U.S. EPA, 2008). The 2008 guidance provides a median soil-gas-to-indoor air AF to be about 0.01 (Section 6.2, U.S. EPA, 2008). In the soil gas work plan approval letter, Region 5 U.S. EPA noted in bullet number 3, "*The attenuation factor (AF) of 0.1 can be used for the five-foot depth and the AF of 0.01 used for the 15-foot and 30-foot sample depths*" (U.S. EPA, 2011a).

AECOM evaluated what an appropriate site-specific soil gas AF is likely to be using the U.S. EPA's on-line vapor intrusion database spreadsheet macro tool (U.S. EPA, 2011b). The spreadsheet allows the user to filter available sites and conditions to better represent site-specific conditions. AECOM filtered conditions to represent the Montague Site (see **Appendix F**).

Using assumptions and input parameters presented in **Appendix F**, the 25th percentile AF of 4.2E-04 (0.0004), 75th percentile of 2.8E-02 (0.028) and a median AF of 8.6E-03 (0.009) were calculated (the 75th percentile is close to the U.S. EPA conservative default value of 0.01 for soil gas to indoor air AF). These AFs are based on 18 paired soil gas and indoor air samples from six sites. Soil gas sampling depth was not distinguished (i.e., the same AFs were calculated for soil gas and sub-slab samples).

To evaluate the potential risk associated with soil gas concentrations collected from 5-, 15-, and 30-foot depths at the Site, a cumulative risk screening assessment was conducted, as described below and presented on **Table 2**. The cumulative risk screening in **Table 2** uses U.S. EPA's suggested and conservative values of 0.1 and 0.01 for shallow and deep samples, respectively.

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7.0 Cumulative Risk-based Screening for Residential Scenario

Table 2 uses U.S. EPA's conservative default AFs of 0.1 for shallow samples and 0.01 for intermediate and deep samples, respectively, to calculate soil gas screening levels. Soil gas screening levels were calculated by dividing the U.S. EPA Regional Screening Levels (RSLs) for a residential or estate worker exposure scenario by the soil gas to indoor air attenuation factors. The concentrations of each compound detected in shallow (5 feet) and intermediate and deep (15 and 30 feet) soil gas samples were compared to the soil gas screening levels.

For sample locations SGMP-01, SGMP-02, SGMP-03, located near the on-site estate facilities, risk-based indoor air screening levels were derived to be protective of the estate workers and guest who occupy the buildings while guests are present. These workers are assumed to be present up to 20 days per year, 24 hours per day, for a 25-year period based on reported property use. The assumed 25-year exposure duration is the U.S. EPA's recommended default for a worker exposure scenario. The risk-based indoor air screening levels protective of estate workers were derived using the U.S. EPA's RSL on-line calculator (http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) for a site-specific exposure scenario for a worker in the estate area buildings using the exposure assumptions discussed above and a target risk level of $1x10^{-6}$ and target hazard quotient (HQ) of 1. The RSL calculator output showing the derived screening levels specific to an estate worker scenario is presented in **Table 3**.

For sample locations SGMP-04, SGMP-05, SGMP-06 and SGMP-07, located in the residential area southwest of the Site, indoor air screening levels are equal to the published U.S. EPA RSLs for residential air, based on an exposure frequency of 350 days-per-year, an exposure time of 24-hours-per-day, an exposure duration of 30 years, and a target risk level of $1x10^{-6}$ and target HQ of 1.

The potential risk and HQ associated with the soil gas concentration within each sample was estimated by multiplying the ratio of the soil gas concentration to the soil gas screening level by the target risk level or HQ that the screening level was based on. Therefore, the ratio was multiplied by a factor of $1x10^{-6}$ for potential carcinogenic effects, and a factor of 1 for non-carcinogenic effects. This approach was selected by rearranging the following equation (1) and solving for the Risk or HQ term in Equation 2:

Equation 1:

$$\frac{\text{SOIL GAS SCREENING LEVEL (ug/m}^3\text{)}}{\text{TARGET RISK OF 1X10-6 OR TARGET HQ OF 1}} = \frac{\text{SOIL GAS CONCENTRATION (ug/m}^3\text{)}}{\text{POTENTIAL RISK OR HQ ASSOCIATED WITH THE SOIL GAS CONCENTRATION}}$$

Equation 2:

$$\text{POTENTIAL RISK OR HQ ASSOCIATED WITH THE SOIL GAS CONCENTRATION} = \frac{\text{SOIL GAS CONCENTRATION (ug/m}^3\text{) x TARGET RISK OF 1X10-6 OR TARGET HQ OF 1}}{\text{SOIL GAS SCREENING LEVEL (ug/m}^3\text{)}}$$

The ratios were then summed separately for compounds with screening levels based on carcinogenic effects and for those based on non carcinogenic effects to calculate the potential cumulative risk and hazard index (HI), respectively.

The cumulative risk screening using the U.S. EPA's conservative default AFs (0.1 for 5 ft samples and 0.01 for 15 ft and 30 ft samples) is presented in **Table 2**. The potential risk and HI results were compared to the U.S. EPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$ and target HI of one, respectively. As shown on **Table 2**, the cumulative potential risk and HI results for all soil gas samples are within or below the U.S. EPA's $1x10^{-6}$ to $1x10^{-4}$ target risk range, and below the U.S. EPA's target HI of 1. The estimated potential risks and HIs presented are conservative, as they are based on a conservative estimate of the soil gas to indoor air attenuation factor (in addition to conservative assumptions used by the U.S.EPA to develop the risk screening levels).

The cumulative risk screening results using the median AF of 0.009, identified as being more representative of site-specific conditions at the Site based on the U.S. EPA's attenuation factor database (U.S. EPA, 2008), estimate lower potential risks and HIs than the screening results using the U.S. EPA defaults of 0.1 and 0.01. Because the screening results using the more conservative (i.e., health protective) AFs do not show U.S. EPA target risk or HI levels were exceeded, the screening using the AF of 0.009 is not presented.

In conclusion, the cumulative risk screening assessment for the soil gas concentrations detected in May 2011 indicate there are no potential risks or hazards above acceptable U.S. EPA levels posed to building occupants in the Site's vicinity.

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8.0 Addendum to Work Plan

GSH has completed the first of two rounds of soil gas samples as described in the approved Work Plan (AECOM, 2011), and GSH will complete the second round of soil gas samples as scheduled in November 2011. The review of the concentrations in the first round of soil gas samples presented in this interim report documents that no unacceptable risk is projected for exposure to indoor air at the site or in residential properties adjacent to the site. The concentrations of soil gas detected are greater than U.S EPA's conservative screening levels for residential use based on a $1x10^{-6}$ level of risk, so additional evaluation has been performed that shows that the expected cumulative risk from all of the compounds is within the U.S. EPA's target risk range of $1x10^{-6}$ to $1x10^{-4}$. This evaluation of the soil gas data incorporates an evaluation of actual usage of the property and also an evaluation of the cumulative risk from all of the compounds detected. Since a more detailed evaluation of potential risk is being performed, GSH is proposing supplemental soil gas sampling beyond that required in the approved Work Plan to accomplish the following two objectives:

- Document the soil gas concentrations on the east side of the groundwater plume near residential properties that are east of the site, and
- Provide additional data on the variations of soil gas concentrations with time.

To meet these objectives, GSH is proposing the following addendum to the Work Plan (AECOM, 2011):

- Continue to implement the second round of air sampling from the approved Work Plan in November 2011.
- Install two additional SGMP locations near the Site's east side to further document soil gas concentrations on the Site's eastern portion. Both new SGMP locations would have nested SGMPs at 5-foot, 15-foot and 30-foot depths. Installation would be completed in late July 2011, with sampling in mid-August of 2011. The Proposed Soil Gas Sampling locations are presented on **Figure 2**.
  - SGMP-08 S, I and D would be located on the Site just south of Old Channel Trail near the groundwater plume's eastern edge.
  - SGMP-09 S, I and D would be located on the Site southeast of purge well Pf near the groundwater plume's eastern edge.
- Collect one additional round of soil gas samples during this study period in August 2011, using methods and laboratory methods previously approved by the U.S. EPA. It is appropriate to collect an additional (third) set of air samples from the SGMPs as specified in the work plan to make sound conclusions on the soil gas concentrations in the subsurface south of Old Channel Trail.
- Upon completion of the third round of sampling, GSH will prepare a Final Report of Findings as proposed in the approved work plan.

This additional work will be accomplished within the original schedule presented in the Work Plan, so this work will not affect the schedule for submittal of the Final Report of Findings.

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9.0 References

AECOM, 2009. Post-Implementation Technical Impracticability Evaluation for Groundwater Restoration at the Occidental Chemical Corporation Site in Montague, Michigan.

AECOM, 2011. Work Plan for Soil Gas Investigation South of Old Channel Trail near Montague, Michigan, Version 1.0.

AFCEE, 2011. On-line Access June 23, 2011: http://www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/bioventing/sitescreening/index.asp

GSH, March 22, 2011. Response to EPA Comments, dated March 7, 2011.

U.S. EPA, 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils.

U.S. EPA, 2008. Draft U.S. EPA's Vapor Intrusion Database: Preliminary Evaluation of Attenuation factors, Office of Solid Waste, U.S. EPA, Washington, DC.

U.S. EPA, 2010. Amended Final Decision and Response Comments for Occidental Chemical Corporation, Montague Township, Michigan.

U.S. EPA, 2011a. Approval of Soil Gas Investigation Work Plan, letter to GSH, dated March 7, 2011.

U.S. EPA, 2011b. On-line VI Database Tool https://iavi.rti.org/OtherDocuments.cfm?PageID=documentDetails&AttachID=369

U.S. EPA's RSL on-line calculator (http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search)

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Figures

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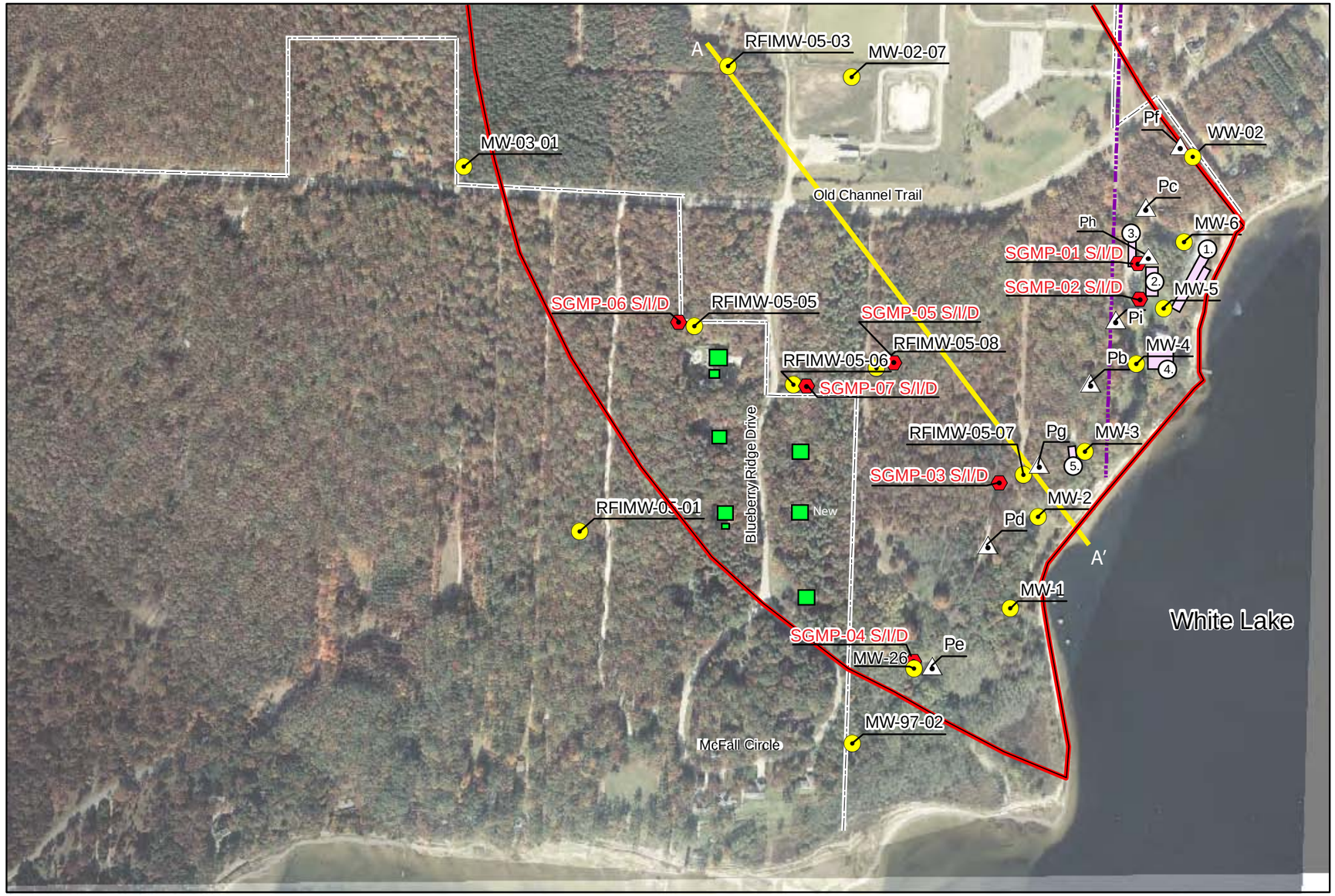

Aerial Photo Source: Abrams Aerial Survey Corporation

0 250 500 1,000 1,500 2,000 Feet

N W E S

MW-05-02 Monitoring Well
Ph Purge Well
Glenn Springs Holdings Property
Soil Gas Monitoring Points
S = 5’
I = 15’
D = 30’
Montague Township Boundary
Impacted Groundwater
Cross section Location
Residential Building
Occidental Buildings (Part-Time Occupancy)
1. Recreation Hall
2. Conference Building
3. 3 Bedroom Laundry Building
4. White House
5. Caretaker’s House

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FILE NAME:	

FIGURE 1

Soil Gas Monitoring Point Location Map, June 2011

Former Occidental Chemical Site
Montague, MI

PROJECT NUMBER	60143500	SCALE:	As shown

L:\work\60143500\misc\VI\Ai\SGMP Locations.pdf

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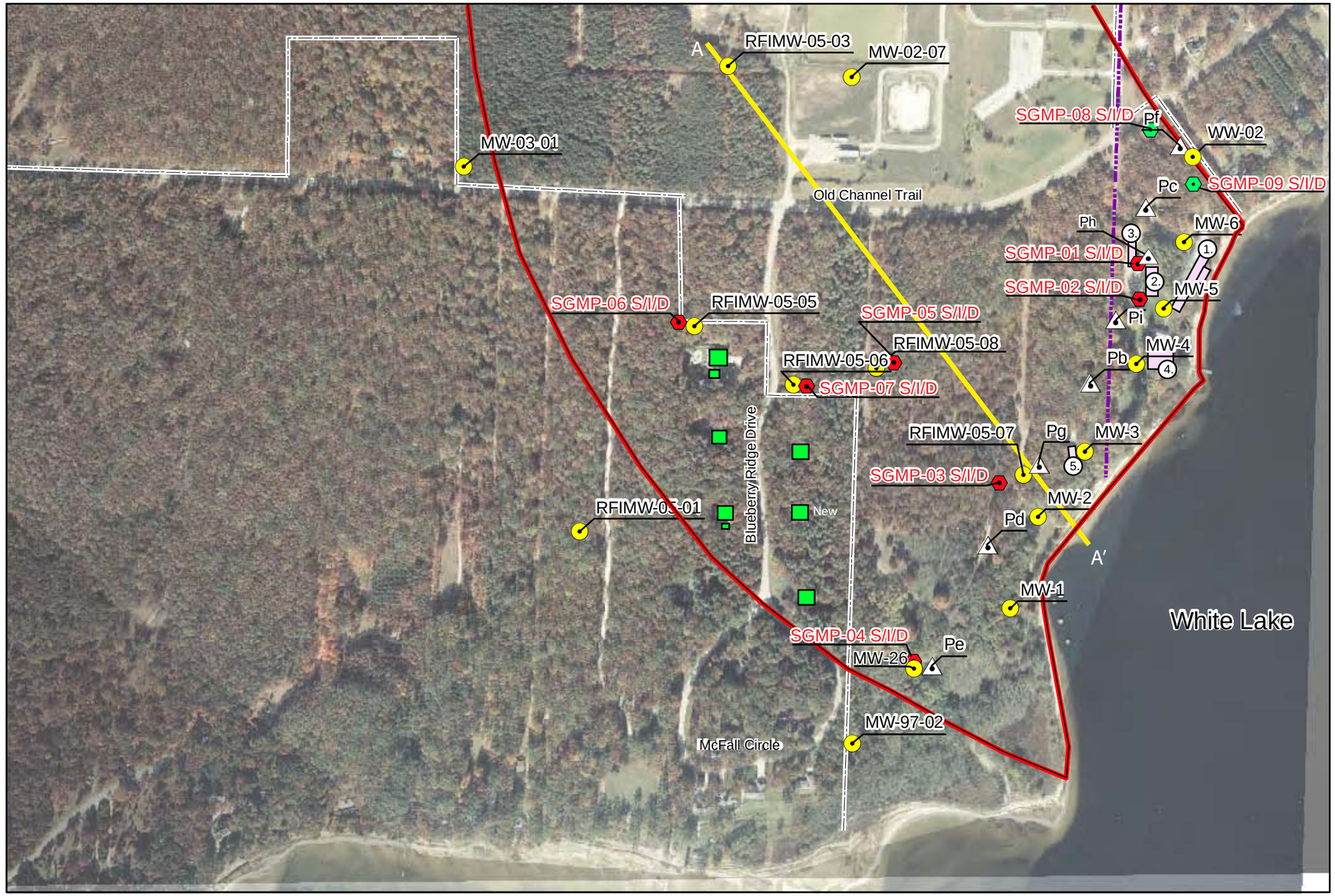

Aerial Photo Source: Abrams Aerial Survey Corporation

0 250 500 1,000 1,500 2,000 Feet

N W E S

MW-05-02 Monitoring Well

Ph Purge Well

Glenn Springs Holdings Property

Soil Gas Monitoring Points

S = 5’
I = 15’
D = 30’

Proposed Soil Gas Monitoring Points

Montague Township Boundary

Impacted Groundwater

Cross section Location

Residential Building

Occidental Buildings (Part-Time Occupancy)

1. Recreation Hall
2. Conference Building
3. 3 Bedroom Laundry Building
4. White House
5. Caretaker’s House

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FILE NAME:	

FIGURE 2

Proposed Soil Gas Monitoring Points Location Map, June 2011

Former Occidental Chemical Site
Montague, MI

PROJECT NUMBER	60143500	SCALE:	As shown

L:work\60143500\misc\VI\Ai\Proposed SGMP Locations.pdf

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Tables

Table 1
Summary of Soil Gas Results Collected in May 2011
Former Occidental Chemical Facility
Montague, Michigan

Client Sample ID:	UNITS	SGMP-01D	SGMP-01I	SGMP-01S	SGMP-02D	SGMP-02I	SGMP-02S	SGMP-03D-1	SGMP-03D-2	SGMP-03I	SGMP-03S
Lab Sample ID:		JA76953-3	JA76953-2	JA76953-1	JA76953-6	JA76953-5	JA76953-4	JA76953-9	JA76953-10	JA76953-8	JA76953-7
Date Sampled:		5/23/2011	5/23/2011	5/23/2011	5/23/2011	5/23/2011	5/23/2011	5/24/2011	5/24/2011	5/24/2011	5/24/2011
Matrix:		Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor
		Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.
		AT NORTH END OF CONF BLDG			AT SOUTH END OF CONF BLDG			RFI-MW-05-07 PLUME CENTERLINE OXY RESORT			
GC/MS Volatiles (TO-15)								SPLIT	SPLIT		
Chloroform	ug/m3	ND (0.54)	ND (0.54)	2.3 J	ND (0.54)	ND (0.14)	4.5	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)
Carbon tetrachloride	ug/m3	2090	975	432	686	251	138	5.9	6	2.8	1.2 J
trans-1,2-Dichloroethylene	ug/m3	ND (0.52)	ND (0.52)	ND (0.52)	ND (0.52)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)
cis-1,2-Dichloroethylene	ug/m3	ND (0.59)	ND (0.59)	ND (0.59)	ND (0.59)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)
Hexachloroethane	ug/m3	ND (0.96)	ND (0.96)	ND (0.96)	ND (0.96)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)
Tetrachloroethylene	ug/m3	5050	2640	1800	3610	1700	1110	199	203	37	37
Trichloroethylene	ug/m3	12	1.1	0.97	4.6	0.54	0.39	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)
TRACER											
Isopropyl Alcohol	ppbv	3.7	0.95	ND	0.89	2.1	1.2	2.6	2.9	5.1	7.7

Client Sample ID:	UNITS	SGMP-04D	SGMP-04I	SGMP-04S	SGMP-05D	SGMP-05I	SGMP-05S	SGMP-06D	SGMP-06I	SGMP-06S	SGMP-07D	SGMP-07I	SGMP-07S
Lab Sample ID:		JA76953-12	JA76953-11	JA76953-22	JA76953-15	JA76953-14	JA76953-13	JA76953-18	JA76953-17	JA76953-16	JA76953-21	JA76953-20	JA76953-19
Date Sampled:		5/24/2011	5/24/2011	5/26/2011	5/24/2011	5/24/2011	5/24/2011	5/24/2011	5/24/2011	5/24/2011	5/25/2011	5/25/2011	5/25/2011
Matrix:		Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor	Soil Vapor
		Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.	Comp.
		MW-26 / Pe			RFI-MW-05-08 PLUME CENTERLINE			RFI-MW-05-05 BLUEBERRY RIDGE			RFI-MW-05-06 BLUEBERRY RIDGE		
GC/MS Volatiles (TO-15)													
Chloroform	ug/m3	15	1	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)
Carbon tetrachloride	ug/m3	16	9.4	3.7	13	7.5	4.5	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	0.94 J
trans-1,2-Dichloroethylene	ug/m3	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)
cis-1,2-Dichloroethylene	ug/m3	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	0.87	ND (0.15)	ND (0.15)	0.44 J
Hexachloroethane	ug/m3	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)
Tetrachloroethylene	ug/m3	166	98.3	29	669	57	141	3.6	2.6	2.9	7.5	3.1	24
Trichloroethylene	ug/m3	1	0.22	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	0.86	ND (0.18)	ND (0.18)	ND (0.18)
TRACER													
Isopropyl Alcohol	ppbv	27.1	9.5	11	3.8	2.8	5.6	2.7	4.3	2.1	17.5	31.4	24.1

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Table 2
Cumulative Risk Screening Evaluation
Former Occidental Chemical Facility
Montague, Michigan

Area/Sample (a)	Detected Soil Gas Concentration (May 2011) (ug/m3)	Risk-Based Indoor Air Screening Level (b) (ug/m3)	Soil Gas Screening Level (ug/m3) (c)		Potential Risk/ Hazard Quotient (d)	
			Shallow 5' AF = 0.1	Deep 15' and 30' AF = 0.01	5' samples	15' and 30' samples
AT NORTH END OF CONF BLDG						
SGMP-01S (5 ft)						
Potential carcinogens:						
Chloroform	2.3	2.22	22.2	NA	1.0E-07	NA
Carbon tetrachloride	432	8.52	85.2	NA	5.1E-06	NA
Tetrachloroethylene	1800	8.66	86.6	NA	2.1E-05	NA
Trichloroethylene	0.97	25.6	256	NA	3.8E-09	NA
Total Risk:					**2.6E-05**	NA
Noncarcinogens:						
Chloroform	2.3	1780	17800	NA	0.0001	NA
Carbon tetrachloride	432	1830	18300	NA	0.02	NA
Tetrachloroethylene	1800	4950	49500	NA	0.04	NA
Trichloroethylene	0.97	183	1830	NA	0.0005	NA
Total HI:					**0.06**	NA
SGMP-01I (15 ft)						
Potential carcinogens:						
Carbon tetrachloride	975	8.52	NA	852	NA	1.1E-06
Tetrachloroethylene	2640	8.66	NA	866	NA	3.0E-06
Trichloroethylene	1.1	25.6	NA	2560	NA	4.3E-10
Total Risk:						**4.2E-06**
Noncarcinogens:						
Carbon tetrachloride	975	1830	NA	183000	NA	0.005
Tetrachloroethylene	2640	4950	NA	495000	NA	0.005
Trichloroethylene	1.1	183	NA	18300	NA	0.00006
Total HI:						**0.01**
SGMP-01D (30 ft)						
Potential carcinogens:						
Carbon tetrachloride	2090	8.52	NA	852	NA	2.5E-06
Tetrachloroethylene	5050	8.66	NA	866	NA	5.8E-06
Trichloroethylene	12	25.6	NA	2560	NA	4.7E-09
Total Risk:						**8.3E-06**
Noncarcinogens:						
Carbon tetrachloride	2090	1830	NA	183000	NA	0.01
Tetrachloroethylene	5050	4950	NA	495000	NA	0.01
Trichloroethylene	12	183	NA	18300	NA	0.0007
Total HI:						**0.02**
AT SOUTH END OF CONF BLDG						
SGMP-02S (5 ft)						
Potential carcinogens:						
Chloroform	4.5	2.22	22.2	NA	2.0E-07	NA
Carbon tetrachloride	138	8.52	85.2	NA	1.6E-06	NA
Tetrachloroethylene	1110	8.66	86.6	NA	1.3E-05	NA
Trichloroethylene	0.39	25.6	256	NA	1.5E-09	NA
Total Risk:					**1.5E-05**	
Noncarcinogens:						
Chloroform	4.5	1780	17800	NA	0.0003	NA
Carbon tetrachloride	138	1830	18300	NA	0.008	NA
Tetrachloroethylene	1110	4950	49500	NA	0.02	NA
Trichloroethylene	0.39	183	1830	NA	0.0002	NA
Total HI:					**0.03**	
SGMP-02I (15 ft)						
Potential carcinogens:						
Carbon tetrachloride	251	8.52	NA	852	NA	2.9E-07
Tetrachloroethylene	1700	8.66	NA	866	NA	2.0E-06
Trichloroethylene	0.54	25.6	NA	2560	NA	2.1E-10
Total Risk:						**2.3E-06**
Noncarcinogens:						
Carbon tetrachloride	251	1830	NA	183000	NA	0.001
Tetrachloroethylene	1700	4950	NA	495000	NA	0.003
Trichloroethylene	0.54	183	NA	18300	NA	0.00003
Total HI:						**0.005**

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Table 2
Cumulative Risk Screening Evaluation
Former Occidental Chemical Facility
Montague, Michigan

Area/Sample (a)	Detected Soil Gas Concentration (May 2011) (ug/m3)	Risk-Based Indoor Air Screening Level (b) (ug/m3)	Soil Gas Screening Level (ug/m3) (c)		Potential Risk/ Hazard Quotient (d)	
			Shallow 5' AF = 0.1	Deep 15' and 30' AF = 0.01	5' samples	15' and 30' samples
SGMP-02D (30 ft)						
Potential carcinogens:						
Carbon tetrachloride	686	8.52	NA	852	NA	8.1E-07
Tetrachloroethylene	3610	8.66	NA	866	NA	4.2E-06
Trichloroethylene	4.6	25.6	NA	2560	NA	1.8E-09
Total Risk:						**5.0E-06**
Noncarcinogens:						
Carbon tetrachloride	686	1830	NA	183000	NA	0.004
Tetrachloroethylene	3610	4950	NA	495000	NA	0.007
Trichloroethylene	4.6	183	NA	18300	NA	0.0003
Total HI:						**0.01**
RFI-MW-05-07 PLUME CENTERLINE OXY RESORT						
SGMP-03S (5 ft)						
Potential carcinogens:						
Carbon tetrachloride	1.2	8.52	85.2	NA	1.4E-08	NA
Tetrachloroethylene	37	8.66	86.6	NA	4.3E-07	NA
Total Risk:					**4.4E-07**	
Noncarcinogens:						
Carbon tetrachloride	1.2	1830	18300	NA	0.00007	NA
Tetrachloroethylene	37	4950	49500	NA	0.0007	NA
Total HI:					**0.0008**	
SGMP-03I (15 ft)						
Potential carcinogens:						
Carbon tetrachloride	2.8	8.52	NA	852	NA	3.3E-09
Tetrachloroethylene	37	8.66	NA	866	NA	4.3E-08
Total Risk:						**4.6E-08**
Noncarcinogens:						
Carbon tetrachloride	2.8	1830	NA	183000	NA	0.00002
Tetrachloroethylene	37	4950	NA	495000	NA	0.00007
Total HI:						**0.00009**
SGMP-03D-2 (30 ft)						
Potential carcinogens:						
Carbon tetrachloride	5.95	8.52	NA	852	NA	7.0E-09
Tetrachloroethylene	201	8.66	NA	866	NA	2.3E-07
Total Risk:						**2.4E-07**
Noncarcinogens:						
Carbon tetrachloride	5.95	1830	NA	183000	NA	0.00003
Tetrachloroethylene	201	4950	NA	495000	NA	0.0004
Total HI:						**0.0004**
MW-26 / Pe						
SGMP-04S (5 ft)						
Potential carcinogens:						
Carbon tetrachloride	3.7	0.41	4.1	NA	9.0E-07	NA
Tetrachloroethylene	29	0.41	4.1	NA	7.1E-06	NA
Total Risk:					**8.0E-06**	
Noncarcinogens:						
Carbon tetrachloride	3.7	100	1000	NA	0.004	NA
Tetrachloroethylene	29	280	2800	NA	0.01	NA
Total HI:					**0.01**	
SGMP-04I (15 ft)						
Potential carcinogens:						
Chloroform	1	0.11	NA	11	NA	9.1E-08
Carbon tetrachloride	9.4	0.41	NA	41	NA	2.3E-07
Tetrachloroethylene	98.3	0.41	NA	41	NA	2.4E-06
Trichloroethylene	0.22	1.2	NA	120	NA	1.8E-09
Total Risk:						**2.7E-06**
Noncarcinogens:						
Chloroform	1	100	NA	10000	NA	0.0001
Carbon tetrachloride	9.4	100	NA	10000	NA	0.0009

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Table 2
Cumulative Risk Screening Evaluation
Former Occidental Chemical Facility
Montague, Michigan

Area/Sample (a)	Detected Soil Gas Concentration (May 2011) (ug/m3)	Risk-Based Indoor Air Screening Level (b) (ug/m3)	Soil Gas Screening Level (ug/m3) (c)		Potential Risk/ Hazard Quotient (d)	
			Shallow 5' AF = 0.1	Deep 15' and 30' AF = 0.01	5' samples	15' and 30' samples
Tetrachloroethylene	98.3	280	NA	28000	NA	0.004
Trichloroethylene	0.22	10	NA	1000	NA	0.0002
Total HI:						**0.005**
SGMP-04D (30 ft)						
Potential carcinogens:						
Chloroform	15	0.11	NA	11	NA	1.4E-06
Carbon tetrachloride	16	0.41	NA	41	NA	3.9E-07
Tetrachloroethylene	166	0.41	NA	41	NA	4.0E-06
Trichloroethylene	1	1.2	NA	120	NA	8.3E-09
Total Risk:						**5.8E-06**
Noncarcinogens:						
Chloroform	15	100	NA	10000	NA	0.002
Carbon tetrachloride	16	100	NA	10000	NA	0.002
Tetrachloroethylene	166	280	NA	28000	NA	0.006
Trichloroethylene	1	10	NA	1000	NA	0.001
Total HI:						**0.01**
RFI-MW-05-08 PLUME CENTERLINE						
SGMP-05S (5 ft)						
Potential carcinogens:						
Carbon tetrachloride	4.5	0.41	4.1	NA	1.1E-06	NA
Tetrachloroethylene	141	0.41	4.1	NA	3.4E-05	NA
Total Risk:					**3.5E-05**	
Noncarcinogens:						
Carbon tetrachloride	4.5	100	1000	NA	0.005	NA
Tetrachloroethylene	141	280	2800	NA	0.05	NA
Total HI:					**0.05**	
SGMP-05I (15 ft)						
Potential carcinogens:						
Carbon tetrachloride	7.5	0.41	NA	41	NA	1.8E-07
Tetrachloroethylene	57	0.41	NA	41	NA	1.4E-06
Total Risk:						**1.6E-06**
Noncarcinogens:						
Carbon tetrachloride	7.5	100	NA	10000	NA	0.0008
Tetrachloroethylene	57	280	NA	28000	NA	0.002
Total HI:						**0.003**
SGMP-05D (30 ft)						
Potential carcinogens:						
Carbon tetrachloride	13	0.41	NA	41	NA	3.2E-07
Tetrachloroethylene	669	0.41	NA	41	NA	1.6E-05
Total Risk:						**1.7E-05**
Noncarcinogens:						
Carbon tetrachloride	13	100	NA	10000	NA	0.001
Tetrachloroethylene	669	280	NA	28000	NA	0.02
Total HI:						**0.03**
RFI-MW-05-05 BLUEBERRY RIDGE						
SGMP-06S (5 ft)						
Potential carcinogens:						
Tetrachloroethylene	2.9	0.41	4.1	NA	7.1E-07	NA
Trichloroethylene	0.86	1.2	12	NA	7.2E-08	NA
Total Risk:					**7.8E-07**	
Noncarcinogens:						
cis-1,2-Dichloroethylene	0.87	63 (e)	630	NA	0.001	NA
Tetrachloroethylene	2.9	280	2800	NA	0.001	NA
Trichloroethylene	0.86	10	100	NA	0.009	NA
Total HI:					**0.01**	
SGMP-06I (15 ft)						
Potential carcinogens:						
Tetrachloroethylene	2.6	0.41	NA	41	NA	6.3E-08
Total Risk:						**6.3E-08**

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Table 2
Cumulative Risk Screening Evaluation
Former Occidental Chemical Facility
Montague, Michigan

Area/Sample (a)	Detected Soil Gas Concentration (May 2011) (ug/m3)	Risk-Based Indoor Air Screening Level (b) (ug/m3)	Soil Gas Screening Level (ug/m3) (c)		Potential Risk/ Hazard Quotient (d)	
			Shallow 5' AF = 0.1	Deep 15' and 30' AF = 0.01	5' samples	15' and 30' samples
Noncarcinogens:						
Tetrachloroethylene	2.6	280	NA	28000	NA	0.00009
Total HI:						**0.00009**
SGMP-06D (30 ft)						
Potential carcinogens:						
Tetrachloroethylene	3.6	0.41	NA	41	NA	8.8E-08
Total Risk:						**8.8E-08**
Noncarcinogens:						
Tetrachloroethylene	3.6	280	NA	28000	NA	0.0001
Total HI:						**0.0001**
RFI-MW-05-06 BLUEBERRY RIDGE						
SGMP-07S (5 ft)						
Potential carcinogens:						
Carbon tetrachloride	0.94	0.41	4.1	NA	2.3E-07	NA
Tetrachloroethylene	24	0.41	4.1	NA	5.9E-06	NA
Total Risk:					**6.1E-06**	
Noncarcinogens:						
Carbon tetrachloride	0.94	100	1000	NA	0.0009	NA
cis-1,2-Dichloroethylene	0.44	63 (e)	630	NA	0.0007	NA
Tetrachloroethylene	24	280	2800	NA	0.009	NA
Total HI:					**0.01**	
SGMP-07I (15 ft)						
Potential carcinogens:						
Tetrachloroethylene	3.1	0.41	NA	41	NA	7.6E-08
Total Risk:						**7.6E-08**
Noncarcinogens:						
Tetrachloroethylene	3.1	280	NA	28000	NA	0.0001
Total HI:						**0.0001**
SGMP-07D (30 ft)						
Potential carcinogens:						
Tetrachloroethylene	7.5	0.41	NA	41	NA	1.8E-07
Total Risk:						**1.8E-07**
Noncarcinogens:						
Tetrachloroethylene	7.5	280	NA	28000	NA	0.0003
Total HI:						**0.0003**

Notes:
Highlighting indicates that the cumulative potential risk or total HI is above USEPA's cumulative target risk range of 1x10-6 to 1x10-4 or target HI of 1, respectively. Compounds that cause the cumulative risk or HI to be above target levels are also highlighted.
AF - Attenuation Factor.
ft - feet.
HI - Hazard index.
NA - not applicable.
RSL - USEPA Regional Screening Level for Residential Air based on 1x10-6 target risk and HI of 1. May 2011.
(a) Compounds detected above reporting limits are presented for inclusion in the cumulative risk screening evaluation.
(b) The following risk-based indoor air screening levels were used to derive soil gas screening levels. Both sets of screening levels are based on a target risk level of 1x10-6 and a target hazard quotient of 1.
- For sample locations SGMP-01, SGMP-02, SGMP-03, indoor air screening levels were derived using U.S. EPA's Regional Screening Level (RSL) on-line calculator (http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) for a site-specific exposure scenario for a worker of the resort area buildings (Exposure inputs include 20 days per year, 24 days per year, 25 years).
- For sample locations SGMP-04, SGMP-05, SGMP-06, and SGMP-07 indoor air screening levels are equal to the published U.S. EPA Regional Screening Level (RSL) for residential air. (Exposure inputs include 350 days per year, 24 hours per day, 30 years.
(c) Soil gas screening level calculated by dividing the risk-based indoor air concentration by the attenuation factor noted in the column heading. U.S. EPA's conservative default Afs were used (0.1 for 5 ft samples and 0.01 for 15 ft and 30 ft samples).
(d) Equal to the ratio of the maximum detected soil gas concentration to the soil gas screening level, multiplied by the risk/hazard level that the soil gas screening level is based on.
(e) No value available. Therefore, the value for trans-1,2-dichloroethylene is used as a surrogate.

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Table 3
U.S. EPA Regional Screening Level Calculator Output - Site-Specific Resort Worker Exposure Scenario
Site-specific Indoor Worker Risk-Based Screening Levels for Air
Former Occidental Chemical Facility
Montague, Michigan

a=Cancer, nc=Noncancer, ca* (Where nc SL < 100 x ca SL),
a** (Where nc SL < 10 x ca SL),
ax=SL exceeds ceiling limit (see User's Guide), sat=SL exceeds csat

Chemical	CAS Number	Inhalation Unit Risk ($ug/m^3)^{-1}$	IUR Ref	Chronic RfC (mg/m^3)	RfC Ref	Carcinogenic SL TR=1.0E-6 (ug/m^3)	Noncarcinogenic SL HI=1 (ug/m^3)	Screening Level (ug/m^3)	
arbon Tetrachloride	56-23-5	6.00E-06	I	1.00E-01	I	8.52E+00	1.83E+03	8.52E+00 ca	
hloroform	67-66-3	2.30E-05	I	9.77E-02	A	2.22E+00	1.78E+03	2.22E+00 ca	
ichloroethylene, 1,2-cis-	156-59-2	-		-		-	-	1.10E+03 nc	(a)
ichloroethylene, 1,2-trans-	156-60-5	-		6.00E-02	P	-	1.10E+03	1.10E+03 nc	
exachloroethane	67-72-1	4.00E-06	I	-		1.28E+01	-	1.28E+01 ca**	
etrachloroethylene	127-18-4	5.90E-06	C	2.71E-01	A	8.66E+00	4.95E+03	8.66E+00 ca	
richloroethylene	79-01-6	2.00E-06	C	1.00E-02	Y	2.56E+01	1.83E+02	2.56E+01 ca**	

ite-specific Indoor Worker Equation Inputs for Ai

ariable	Value
HQ (target hazard quotient) unitless	1
Tw (averaging time)	365
Fw (exposure frequency) d/yr	20
Dw (exposure duration) years	25
T (lifetime) yr	70
Tw (exposure time) hours	24

utput generated 20JUN2011:13:58:14

otes:
he above screening levels were calculated using USEPA's Regional Screening Level (RSL) Calculator (http://epa-prgs.ornl.gov/cgi-bin/chemicals/csl_search) and the
emi-site-specific inputs located above.
) The value calculated for trans-1,2-dichloroethylene was used as a surrogate for cis-1,2-dichloroethylene.

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Appendix A

Geotechnical Results

Materials Testing Consultants, Inc.
693 Plymouth NE • Grand Rapids, MI 49505
(616) 456-5469 • FAX (616) 456-5784

http://mtc.mateco.com

MATERIALS Engineers, Independent TESTING Laboratories, Geotechnical & Environmental CONSULTANTS — Since 1968

June 2, 2011
Project No. 111121

Barry Harding
AECOM
5555 Glenwood Hills Pkwy, SE Suite 200
Grand Rapids, MI 49512

Reference: GSH - Montague

Dear Mr. Harding:

Materials Testing Consultants, Inc. performed geotechnical testing on three samples retrieved from the referenced project. The following tests were performed:

Moisture Content: ASTM D2216
Determination of Density: ASTM D7263
Specific Gravity: ASTM D854
FOC (Organic Carbon): ASTM D2974
Grain Size Analysis: ASTM D6913

The Grain Size Analysis test report is attached. All other laboratory test results are reported in the following table, Table 1, Laboratory Test Results.

Table 1, Laboratory Test Results

Laboratory No.	Location	Depth	Moisture	Density	Specific Gravity	Porosity	FOC	USCS Classification
52593	SGMP-03	4-6 ft	5.3%	104.5 pcf	2.65	0.37	0.3%	SP
52594	SGMP-03	14-16 ft	4.4%	100.7 pcf	2.74	0.41	0.0%	SP
52595	SGMP-03	28-30 ft	6.8%	102.0 pcf	2.67	0.39	0.1%	SP

Should you have any questions or require additional assistance, please contact me at your earliest convenience.

Sincerely,

MATERIALS TESTING CONSULTANTS, INC.

Timothy J. Lautenbach, E.I.T.
Laboratory Manager

Att: Grain Size Analysis Reports

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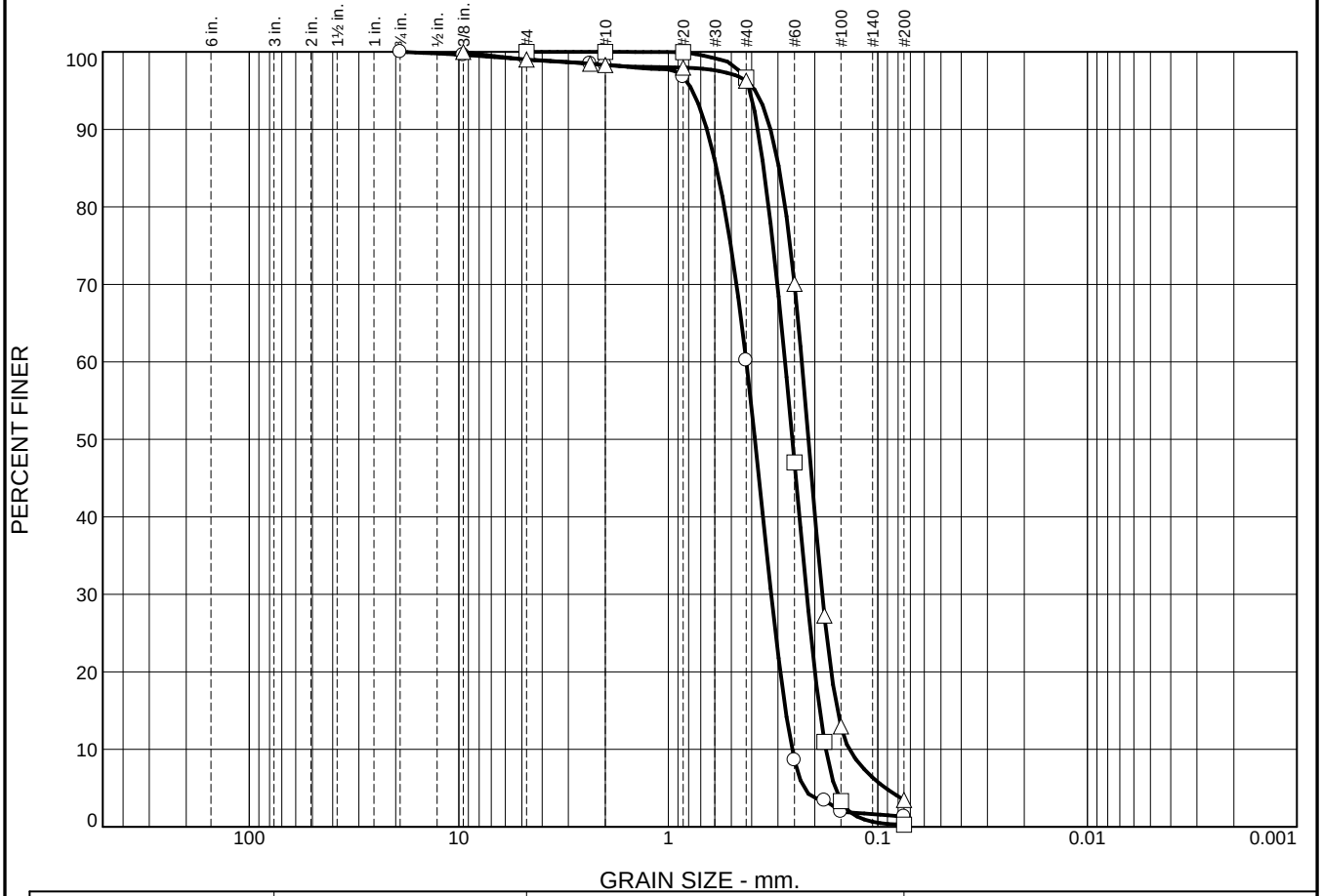
Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	1.0	0.6	38.2	58.9	1.3	
□	0.0	0.0	0.0	0.0	3.3	96.4	0.3	
△	0.0	0.0	1.0	0.7	2.0	92.8	3.5	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_C	C_u
○			0.5885	0.4242	0.3861	0.3228	0.2757	0.2565	0.96	1.65
□			0.3507	0.2773	0.2559	0.2183	0.1894	0.1774	0.97	1.56
△			0.2964	0.2305	0.2143	0.1844	0.1559	0.1368	1.08	1.68

Material Description	USCS	AASHTO
○ Poorly Graded Sand	SP	
□ Poorly Graded Sand	SP	
△ Poorly Graded Sand	SP	

Project No. 111121 **Client:** AECOM

Project: GSH - Montague

○ **Location:** SGMP-03 **Depth:** 4-6 ft **Sample Number:** 52593

□ **Location:** SGMP-03 **Depth:** 14-16 ft **Sample Number:** 52594

△ **Location:** SGMP-03 **Depth:** 28-30 ft **Sample Number:** 52595

MATERIALS TESTING CONSULTANTS, INC.

Grand Rapids, MI

Remarks:

Figure

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Appendix B

Soil Boring & SGMP Construction Logs

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SGMP-01-D

AECOM

Client: GSH, Inc. (Occidental)
Site: Montague, Michigan
Date: 5/16/2011
Weather: 60's. Clear
Geologist: Barry J. Harding, CPG
Driller: Stearns Drilling, Dutton, MI
Roger Christensen
Bryan Marshall
Rig: Direct-Push 6620 DT

Depth (feet bgs)	SGMP-S	SGMP-I	SGMP-D	Lithological Description	MiniRae PID (ppm)
1	BENTONITE	BENTONITE	BENTONITE		
2					
3					
4	SAND PACK	SAND	SAND	(3-8')Loose, medium grain SAND, trace coarse sand, trace gravel, well graded, brown 7.5 YR 4/4, moist	0.0
5	↓				
6					
7					
8					
9					
10		SAND PACK			
11					
12					
13					
14					
15		↓		(13-18') Loose, fine grain SAND, trace gravel, poorly graded, light brown 7.5 YR 6/4, moist	0.0
16					
17					
18					
19					
20					
21					
22					
23					
24					
25			SAND PACK		
26					
27					
28					
29				(25-30') Loose, fine to coarse grain SAND, trace gravel,	
30			↓	well graded, pinkish gray 7.5 YR 6/2, moist	0.0
31					
32					

SGMP-1 nest set north end of Conference Building.
Calibrate PID = 104 ppm (100 iso-butylene gas).

↓ Soil Gas Monitoring Point

US EPA ARCHIVE DOCUMENT

SGMP-02-D

AECOM

Client: GSH, Inc. (Occidental)
Site: Montague, Michigan
Date: 5/17/2011
Weather: 60's. Partly cloudy.
Geologist: Barry J. Harding, CPG
Driller: Stearns Drilling, Dutton, MI
Roger Christensen
Bryan Marshall
Rig: Direct-Push 6620 DT

Depth (feet bgs)	SGMP-S	SGMP-I	SGMP-D	Lithological Description	MiniRae PID (ppm)
1	BENTONITE	BENTONITE	BENTONITE		
2					
3					
4	SAND PACK				
5	↓			(3-8') Loose, very fine to fine SAND, trace gravel, poorly graded, brown 7.5YR 4/4, moist	0.0
6					
7		SAND			
8					
9					
10		SAND PACK			
11					
12					
13			SAND		
14					
15		↓		(13-18') Loose, very fine SAND, poorly graded, light brown 7.5YR 6/4, moist	0.0
16					
17					
18					
19					
20					
21					
22					
23					
24					
25			SAND PACK		
26					
27					
28					
29				(25-30') Loose, very fine to fine SAND, poorly graded,	
30			↓	pinkish gray 7.5YR 6/2, moist	0.0
31					
32					

SGMP-1 nest set south end of Conference Building.

↓ Soil Gas Monitoring Point

US EPA ARCHIVE DOCUMENT

SGMP-03-D

AECOM

Client: GSH, Inc. (Occidental)
Site: Montague, Michigan
Date: 5/17/2011
Weather: 60's. Partly cloudy.
Geologist: Barry J. Harding, CPG
Driller: Stearns Drilling, Dutton, MI
Roger Christensen
Bryan Marshall
Rig: Direct-Push 6620 DT

Depth (feet bgs)	SGMP-S	SGMP-I	SGMP-D	Lithological Description	MiniRae PID (ppm)
1					
2	BENTONITE	BENTONITE	BENTONITE	(0-3'). Top Soil. Leaf litter, loose medium SAND,	
3				poorly graded, roots, brown 7.5YR 4/4, moist	0.0
4	SAND PACK				
5	↓			(3-4') Hit Obstruction. Off-set 15'.	0.0
6				Loose, fine SAND, poorly graded, with thin 1/4 to 1/2	
7		SAND		inch silt laminae to 4' bgs. Brown 7.5YR 4/4. Silt is	
8				gray to light brown. (4-8'). Fine SAND, poorly graded,	
9				brown 7.5YR 4/4, moist	
10		SAND PACK			
11					
12					
13			SAND		
14					
15		↓		(13-18') Loose, very fine to fine SAND, poorly graded,	
16				light brown 7.5YR 6/4, moist	0.0
17					
18					
19					
20					
21					
22					
23					
24					
25			SAND PACK		
26					
27					
28				(25-30') Loose, very fine to fine SAND, poorly graded,	
29				pinkish gray 7.5YR 6/2, moist.	
30			↓		0.0
31				(30-32'). Hole was re-advanced due to collapse.	
32				31.5' a 1/2 inch clayey silt layer present. SAND	

SGMP-3 nest set in open wooded area near RFIMW-05-07

↓ Soil Gas Monitoring Point

US EPA ARCHIVE DOCUMENT

SGMP-04-D

AECOM

Client: GSH, Inc. (Occidental)
Site: Montague, Michigan
Date: 5/17/2011
Weather: 70F. Sunny.
Geologist: Barry J. Harding, CPG
Driller: Stearns Drilling, Dutton, MI
Roger Christensen
Bryan Marshall
Rig: Direct-Push 6620 DT

Depth (feet bgs)	SGMP-S	SGMP-I	SGMP-D	Lithological Description	MiniRae PID (ppm)
1	BENTONITE	BENTONITE	BENTONITE		
2					
3					
4	SAND PACK				
5	↓			(3-8') Loose, fine to medium SAND, trace coarse sand, poorly graded, brown 7.5YR 4/4, moist	0.1
6					
7		SAND			
8					
9					
10		SAND PACK			
11					
12					
13			SAND		
14					
15		↓		(13-18') Loose, very fine to fine SAND, poorly graded, 2-inch coarse sand seam at 15.5'. Dark grayish brown. Sand has 1/8-in thin laminae (silt?) approximately every 3 inches. Light rusty brown 5YR 4/3 within light brown 7.5 YR 6/4 matrix, moist	0.0
16					
17					
18					
19					
20					
21					
22					
23					
24					
25			SAND PACK		
26					
27					
28					
29				(25-32') Loose, very fine to fine SAND, poorly graded,	
30			↓	pinkish gray 7.5YR 6/2, moist. Hole advanced to 32'.	0.0
31					
32					

SGMP-04 nest set in wooded area near MW-26.

↓ Soil Gas Monitoring Point

US EPA ARCHIVE DOCUMENT

SGMP-05-D

AECOM

Client: GSH, Inc. (Occidental)
Site: Montague, Michigan
Date: 5/18/2011
Weather: Overcast, rain, low 60's.
Geologist: Barry J. Harding, CPG
Driller: Stearns Drilling, Dutton, MI
Roger Christensen
Bryan Marshall
Rig: Direct-Push 6620 DT

Depth (feet bgs)	SGMP-S	SGMP-I	SGMP-D	Lithological Description	MiniRae PID (ppm)
1					
2	BENTONITE	BENTONITE	BENTONITE		
3				(0-3') Leaf litter, sandy loam, with roots, dark brown 5YR	0.0
4	SAND PACK			3/3, reddish brown SAND at 3'. Moist.	
5	↓			(3-8') Loose, fine to medium SAND, trace coarse sand,	0.0
6				with gravel, well graded, light yellowish red 5YR 4/6	
7		SAND		oxidation zones, moist.	
8					
9					
10		SAND PACK			
11					
12					
13			SAND		
14					
15		↓		(13-15') Loose, fine to medium grain SAND, poorly graded,	0.0
16				trace coarse sand, light brown 7.5YR 6/4, moist.	
17					
18					
19					
20					
21					
22					
23					
24					
25			SAND PACK		
26					
27					
28					
29					
30			↓	(25-30') Loose, fine grain SAND, trace medium to coarse	0.0
31				sand, poorly graded, pinkish gray 7.5YR 6/2, moist.	
32					

SGMP-05 nest set in wooded area near RFIMW-05-08.
Calibrate PID = 103 ppm (100 iso-butylene gas).

↓ Soil Gas Monitoring Point

US EPA ARCHIVE DOCUMENT

SGMP-06-D

AECOM

Client: GSH, Inc. (Occidental)
Site: Montague, Michigan
Date: 5/18/2011
Weather: Overcast, rain, low 60's.
Geologist: Barry J. Harding, CPG
Driller: Stearns Drilling, Dutton, MI
Roger Christensen
Bryan Marshall
Rig: Direct-Push 6620 DT

Depth (feet bgs)	SGMP-S	SGMP-I	SGMP-D	Lithological Description	MiniRae PID (ppm)
1	BENTONITE	BENTONITE	BENTONITE		
2					
3					
4	SAND PACK				
5	↓			(3-8') Loose, very fine to fine SAND, poorly graded, brown 7.5YR 4/4, moist.	0.0
6					
7		SAND			
8					
9					
10		SAND PACK			
11					
12					
13			SAND		
14					
15		↓		(13-18') Loose, very fine to fine SAND, poorly graded, light brown 7.5YR 6/4, moist	0.0
16					
17					
18					
19					
20					
21					
22					
23					
24					
25			SAND PACK	(25-30') Loose, very fine to fine SAND, poorly graded, pinkish gray 7.5YR 6/2, moist.	0.0
26					
27					
28					
29					
30			↓		
31					
32					

SGMP-06 nest set in open lot north of residence, west of Blueberry Ridge Drive near RFIMW-05-05.

↓ Soil Gas Monitoring Point

US EPA ARCHIVE DOCUMENT

SGMP-07-D

AECOM

Client: GSH, Inc. (Occidental)
Site: Montague, Michigan
Date: 5/18/2011
Weather: Overcast, rain, low 60's.
Geologist: Barry J. Harding, CPG
Driller: Stearns Drilling, Dutton, MI
Roger Christensen
Bryan Marshall
Rig: Direct-Push 6620 DT

Depth (feet bgs)	SGMP-S	SGMP-I	SGMP-D	Lithological Description	MiniRae PID (ppm)
1	BENTONITE	BENTONITE	BENTONITE	(0-3') Leaf litter, sandy loam, dark brown to 1'. Loose reddish brown SAND to 3', moist.	
2					
3					
4	SAND PACK				
5	↓			(3-8') Loose, fine to medium grain SAND, trace coarse sand, trace gravel, poorly graded, brown 7.5YR 4/4, moist.	0.0
6					
7		SAND			
8					
9					
10		SAND PACK			
11					
12					
13			SAND		
14					
15		↓		(13-18') Loose, fine to medium grain SAND, 1-inch bedding planes, poorly graded, light brown 7.5YR 6/4, moist	0.0
16					
17					
18					
19					
20					
21					
22					
23					
24					
25			SAND PACK		
26					
27					
28				(25-30') Loose, very fine to fine SAND, trace medium grain sand, 1-inch bedding planes, poorly graded, pinkish gray 7.5YR 6/2, moist.	
29					
30			↓		0.0
31					
32					

SGMP-07 nest set in wooded area east of Blueberry Ridge Drive, near RFIMW-05--06.

↓ Soil Gas Monitoring Point

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Appendix C

Laboratory Analytical Report

Accutest New Jersey

6/21/2011 9:53

Job Number:	JA76953
Account:	Conestoga-Rovers & Associates
Project:	Montague, Montague, MI
Project Number:	60215783

Legend: Hit

Client Sample ID:		SGMP-01D	SGMP-01I	SGMP-01S	SGMP-02D	SGMP-02I	SGMP-02S	SGMP-03D-1	SGMP-03D-2	SGMP-03I	SGMP-03S
Lab Sample ID:		JA76953-3	JA76953-2	JA76953-1	JA76953-6	JA76953-5	JA76953-4	JA76953-9	JA76953-10	JA76953-8	JA76953-7
Date Sampled:		5/23/2011	5/23/2011	5/23/2011	5/23/2011	5/23/2011	5/23/2011	5/24/2011	5/24/2011	5/24/2011	5/24/2011
Matrix:		Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.
GC/MS Volatiles (TO-15)											
Chloroform	ppbv	ND (0.11)	ND (0.11)	0.47 J	ND (0.11)	ND (0.028)	0.92	ND (0.028)	ND (0.028)	ND (0.028)	ND (0.028)
Carbon tetrachloride	ppbv	333	155	68.6	109	39.9	22	0.94	0.95	0.44	0.19 J
trans-1,2-Dichloroethylene	ppbv	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)
cis-1,2-Dichloroethylene	ppbv	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)
Hexachloroethane	ppbv	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.10)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)
Isopropyl Alcohol	ppbv	3.7	0.95	ND (0.23)	0.89	2.1	1.2	2.6	2.9	5.1	7.7
Tetrachloroethylene	ppbv	744	389	265	532	251	163	29.3	29.9	5.5	5.4
Trichloroethylene	ppbv	2.2	0.2	0.18	0.85	0.1	0.073	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)
GC/MS Volatiles (TO-15) - ug/m3											
Chloroform	ug/m3	ND (0.54)	ND (0.54)	2.3 J	ND (0.54)	ND (0.14)	4.5	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)
Carbon tetrachloride	ug/m3	2090	975	432	686	251	138	5.9	6	2.8	1.2 J
trans-1,2-Dichloroethylene	ug/m3	ND (0.52)	ND (0.52)	ND (0.52)	ND (0.52)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)
cis-1,2-Dichloroethylene	ug/m3	ND (0.59)	ND (0.59)	ND (0.59)	ND (0.59)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)
Hexachloroethane	ug/m3	ND (0.96)	ND (0.96)	ND (0.96)	ND (0.96)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)
Isopropyl Alcohol	ug/m3	9.1	2.3	ND (0.57)	2.2	5.2	2.9	6.4	7.1	13	19
Tetrachloroethylene	ug/m3	5050	2640	1800	3610	1700	1110	199	203	37	37
Trichloroethylene	ug/m3	12	1.1	0.97	4.6	0.54	0.39	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)

Client Sample ID:		SGMP-04D	SGMP-04I	SGMP-04S	SGMP-05D	SGMP-05I	SGMP-05S	SGMP-06D	SGMP-06I	SGMP-06S	SGMP-07D
Lab Sample ID:		JA76953-12	JA76953-11	JA76953-22	JA76953-15	JA76953-14	JA76953-13	JA76953-18	JA76953-17	JA76953-16	JA76953-21
Date Sampled:		5/24/2011	5/24/2011	5/26/2011	5/24/2011	5/24/2011	5/24/2011	5/24/2011	5/24/2011	5/24/2011	5/25/2011
Matrix:		Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.	Soil Vapor Comp.
GC/MS Volatiles (TO-15)											
Chloroform	ppbv	3	0.21	ND (0.028)	ND (0.028)	ND (0.028)	ND (0.028)	ND (0.028)	ND (0.028)	ND (0.028)	ND (0.028)
Carbon tetrachloride	ppbv	2.6	1.5	0.59	2.1	1.2	0.71	ND (0.040)	ND (0.040)	ND (0.040)	ND (0.040)
trans-1,2-Dichloroethylene	ppbv	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)
cis-1,2-Dichloroethylene	ppbv	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)	ND (0.038)	0.22	ND (0.038)

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Hexachloroethane	ppbv	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)	ND (0.026)
Isopropyl Alcohol	ppbv	27.1	9.5	11	3.8	2.8	5.6	2.7	4.3	2.1	17.5
Tetrachloroethylene	ppbv	24.5	14.5	4.3	98.6	8.4	20.8	0.53	0.39	0.43	1.1
Trichloroethylene	ppbv	0.19	0.041	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	ND (0.033)	0.16	ND (0.033)
GC/MS Volatiles (TO-15) - ug/m3											
Chloroform	ug/m3	15	1	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)	ND (0.14)
Carbon tetrachloride	ug/m3	16	9.4	3.7	13	7.5	4.5	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)
trans-1,2-Dichloroethylene	ug/m3	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)	ND (0.13)
cis-1,2-Dichloroethylene	ug/m3	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	ND (0.15)	0.87	ND (0.15)
Hexachloroethane	ug/m3	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)	ND (0.25)
Isopropyl Alcohol	ug/m3	66.6	23	27	9.3	6.9	14	6.6	11	5.2	43
Tetrachloroethylene	ug/m3	166	98.3	29	669	57	141	3.6	2.6	2.9	7.5
Trichloroethylene	ug/m3	1	0.22	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	ND (0.18)	0.86	ND (0.18)
Client Sample ID:		**SGMP-07I**	**SGMP-07S**								
Lab Sample ID:		**JA76953-20**	**JA76953-19**								
Date Sampled:		**5/25/2011**	**5/25/2011**								
Matrix:		**Soil Vapor Comp.**	**Soil Vapor Comp.**								
GC/MS Volatiles (TO-15)											
Chloroform	ppbv	ND (0.028)	ND (0.028)								
Carbon tetrachloride	ppbv	ND (0.040)	0.15 J								
trans-1,2-Dichloroethylene	ppbv	ND (0.033)	ND (0.033)								
cis-1,2-Dichloroethylene	ppbv	ND (0.038)	0.11 J								
Hexachloroethane	ppbv	ND (0.026)	ND (0.026)								
Isopropyl Alcohol	ppbv	31.4	24.1								
Tetrachloroethylene	ppbv	0.46	3.5								
Trichloroethylene	ppbv	ND (0.033)	ND (0.033)								
GC/MS Volatiles (TO-15) - ug/m3											
Chloroform	ug/m3	ND (0.14)	ND (0.14)								
Carbon tetrachloride	ug/m3	ND (0.25)	0.94 J								
trans-1,2-Dichloroethylene	ug/m3	ND (0.13)	ND (0.13)								
cis-1,2-Dichloroethylene	ug/m3	ND (0.15)	0.44 J								
Hexachloroethane	ug/m3	ND (0.25)	ND (0.25)								
Isopropyl Alcohol	ug/m3	77.2	59.2								
Tetrachloroethylene	ug/m3	3.1	24								
Trichloroethylene	ug/m3	ND (0.18)	ND (0.18)								

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Appendix D

Soil Gas Sampling Field Forms

AECOM

Former Occidental Chemical Site
SG Sampling Field Form
Montague, MI

Location	Sample Name	Cannister	Controller	Sample Time Start	Sample Time End	Leak Check	Initial Vacuum ("Hg)	Initial Temp (F)	Initial Barometric Pressure ("Hg)	Final Vacuum ("Hg)	Final Temp (F)	Final Barometric Pressure ("Hg)	PID Readings
SGMP-01	SGMP-01S	A902	FC499	1325	1405	✓	28.0	83.4	28.80	4.0	82.6	28.79	N/A
5/23/11	SGMP-01I	A889	FC467	1430	1510	✓	28.0	76.2	28.79	4.5	71.6	28.79	N/A
	SGMP-01D	A769	FC530	1506	1546	✓	28.5	72.2	28.79	6.5	67.9	28.79	N/A
SGMP-02	SGMP-02S	A875	FC532	1548	1628	✓	27.0	65.5	28.80	4.0	67.8	28.81	N/A
5/23/11	SGMP-02I	A314	FC515	1620	1700	✓	26.0	62.3	28.81	3.5	78.2	28.81	N/A
	SGMP-02D	A298	FC456	1650	1730	✓	28.5	76.0	28.81	6.0	78.9	28.81	N/A
SGMP-03	SGMP-03S	A980	FC537	0850	0930	✓	30.0	52.7	29.17	8.0	54.1	29.16	N/A
5/24/11	SGMP-03I	A049	FC535	0909	0949	✓	29.0	53.1	29.16	6.0	55.1	29.16	N/A
	SGMP-03D-1	A667	FC531	1002	1042	✓	28.0	55.6	29.15	5.5	59.2	29.15	N/A
	SGMP-03D-2	A861	FC513	1002	1042	✓	29.0	55.6	29.15	5.0	59.2	29.15	N/A
SGMP-04	~~SGMP-04S~~	~~A091~~	~~FC522~~	~~1047~~	—	✓	~~30.0~~	~~55.2~~	~~29.07~~	Obstruction	down hole		N/A
5/25/11	SGMP-04I	A308	FC455	0936	1016	✓	28.0	57.7	29.11	5.0	58.5	29.08	N/A
	SGMP-04D	A467	FC466	1109	1149	✓	29.0	55.9	29.07	6.5	55.6	29.08	N/A
SGMP-05	SGMP-05S	A105	FC487	1228	1308	✓	28.0	69.2	29.16	4.5	69.0	29.15	N/A
5/24/11	SGMP-05I	A816	FC502	1308	1348	✓	29.0	69.0	29.15	6.0	65.4	29.15	N/A
	SGMP-05D	A309	FC504	1349	1429	✓	29.0	65.5	29.15	5.0	65.4	29.15	N/A
SGMP-06	SGMP-06S	A359	FC540	1503	1543	✓	29.0	63.6	29.15	4.0	65.2	29.15	N/A
5/24/11	SGMP-06I	A485	FC447	1543	1628	✓	28.0	65.2	29.15	10.0	65.8	29.15	N/A
	SGMP-06D	A757	FC508	1620	1700	✓	29.0	64.7	29.15	6.0	65.4	29.16	N/A
SGMP-07	SGMP-07S	A847	FC503	1404	1444	✓	29.0	57.2	29.01	6.5	54.7	29.00	N/A
5/25/11	SGMP-07I	A286	FC484	1439	1519	✓	27.5	54.8	29.01	5.0	56.2	28.98	N/A
	SGMP-07D	A576	FC493	1520	1600	✓	28.0	56.4	28.98	4.5	56.5	28.98	N/A

1/17/5/2011

Sampler Name: Michael Papp
Date: 5/23/11 - 5/25/11
Sample Methodolgy: 6L Summa / 40-min sample
Sample Analytical Meth: TO-15 (analyte list + IPA)
Project Number:

Comments: Leak Check; IPA (Reagent Grade) in small open container (soaked in paper towel) upwind.
SGMP-03D-2 = Duplicate. BP collected from rental GEM 2 CCC. *SGMP-04S sample cancelled. Obstruction!
See Page 2.

AECOM

Former Occidental Chemical Site
SG Sampling Field Form
Montague, MI

Location	Sample Name	Cannister	Controller	Sample Time Start	Sample Time End	Leak Check	Initial Vacuum ("Hg)	Initial Temp (F)	Initial Barometric Pressure ("Hg)	Final Vacuum ("Hg)	Final Temp (F)	Final Barometric Pressure ("Hg)	PID Readings
SGMP-04	SGMP-04S	A091	FC522	1207	1249	✓	30.0	53.7	29.12	7.5	55.3	29.13	N/A
5/26/11													

Sampler Name: Michael PAPP
Date: 5/26/11
Sample Methodolgy: 6L Summa / 40-min Sample
Sample Analytical Meth: TO-15 (analyte list + IBA)
Project Number:

Comments: SGMP-04S: Kink in MP tubing repaired. GEM 2000 used to collect BP.

ACCUTEST LABORATORIES

CHAIN OF CUSTODY

Air Sampling Field Data Sheet

2235 US Highway 130, Dayton, NJ 08810
Tel: 732.329.0200 Fax: 732.329.3499

FED-EX Tracking #

Bottle Order Control #

PAGE 1 OF 1

Client / Reporting Information			Project Information	Requested Analysis
Company Name		Project Name		
Address		Street		
City	State Zip	City	Date	
Project Contact	E-mail	Project #		
Phone #	Fax #	Client Purchase Order #		
Sampler(s) Name(s)				

Lab Sample #	Field ID / Point of Collection	Air Type: Indoor (I) Soil Vap (SV) Ambient (A)	Sampling Equipment Info: Canister Serial #	Canister Size 6L or 1L	Flow Controller Serial #	Start Sampling Information: Date	Time (24 hr clock)	Canister Pressure	Interval Time	Sampler	Stop Sampling Information: Date	Time (24 hr clock)	Canister Pressure	Interval Time	Sampler

Turnaround Time (Business Days)		Data Deliverable Information	Comments / Remarks
Standard - 15 Days			
10 Day			
5 Day			
3 Day			
2 Day			
1 Day			
Other			

Approved By: _____

Date: _____

ALL ORDERS are mandatory FAX

Comm'l

Diff'l

Results Only

FAX

Other

Sample Custody must be documented for each time samples change possession, including courier delivery.

Relinquished by Laboratory	Date Time	Received by	Relinquished by	Date Time	Received by
1		1	2		2
Relinquished by	Date Time	Received by	Relinquished by	Date Time	Received by
3		3			
Relinquished by	Date Time	Received by	Custody Seal #		
5		5			

CHAIN OF CUSTODY

Air Sampling Field Data Sheet

ACCUTEST LABORATORIES
2235 US Highway 130, Dayton, NJ 08810
Tel: 732.329.0200 Fax: 732.329.3499

PAGE ___ OF ___

Client / Reporting Information			Billing Parameters	Requested Analysis
Company Name	Project Name			
Address	Street			
City / State / Zip	City / State			
Project Contact / E-mail	Project #			
Phone # / Fax #	Client Purchase Order #			
Sampler(s) Name(s)				

Lab Sample #	Field ID / Point of Collection	Air Type: Indoor (I) Soil Vap (SV) Ambient (A)	Sampling Equipment Info: Canister Serial #	Canister Size 6L or 1L	Flow Controller Serial #	Start Sampling Information: Date	Time (24 hr clock)	Canister Pressure "Hg	Initial Temp F	Sampler Init	Stop Sampling Information: Date	Time (24 hr clock)	Canister Pressure "Hg	Final Temp F	Sampler Init
4738 5/20/14															

Turnaround Time (Business Days)		Data Deliverable Information	Comments / Remarks
Standard - 15 Days			
10 Day		Approved By:	
5 Day		Date:	
3 Day			
2 Day			
1 Day			
Other			

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Laboratory	Date Time	Received by	Relinquished by	Date Time	Received by
1		1	2		2
Relinquished by:	Date Time:	Received by:	Relinquished by:	Date Time	Received by:
3		3	4		4
Relinquished by	Date Time:	Received by	Custody Seal #		
5		5			

CHAIN OF CUSTODY

Air Sampling Field Data Sheet

ACCUTEST Laboratories
www.accutest.com
2235 US Highway 130, Dayton, NJ 08810
Tel: 732.329.0200 Fax: 732.329.3499

FED-EX Tracking #	Bottle Order Control #
Lab Quote #	Lab Job #

PAGE__ OF__

Client / Reporting Information

Company Name	Project Name
Address	Street
City State Zip	City State
Project Contact: E-mail	Project #
Phone # Fax #	Client Purchase Order #
Sample(s) Name(s):	

Weather Parameters

Temperature (Fahrenheit)
Start: Maximum:
Stop: Minimum:

Atmospheric Pressure (inches of Hg)
Start: Maximum:
Stop: Minimum:

Other weather comment:

Requested Analysis

Lab Sample #	Field ID / Point of Collection	Air Type: Indoor (I); Soil Vap (SV) Ambient(A)	Sampling Equipment Info: Canister Serial #	Canister Size 6L or 1L	Flow Controller Serial #	Start Sampling Information: Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp (F)	Sampler Init.	Stop Sampling Information: Date	Time (24 hr clock)	Canister Pressure ("Hg)	Interior Temp (F)	Sampler Init.		
	SG-MP-07S	SV															
	SG-MP-04S	SV															
	SGMP-04S	SV	A091	6L	FC522	5/26	1207	30.0	53.7	MJP	5/26	1249	7.5	55.3	MJP	X	X

Turnaround Time (Business Days)

Standard - 15 Days	
10 Day	
5 Day	
3 Day	
2 Day	
1 Day	
Other	

Approved By:_____

Date:_____

Data Deliverable Information

All NJDEP TO-15 's mandatory Full T1

Comm A	
Comm B	
Reduced T2	
Full T1	
Other:	

Comments / Remarks

Sample Custody must be documented below each time samples change possession, including courier delivery.

Relinquished by Laboratory: 1	Date Time:	Received by: 1	Relinquished by: 2	Date Time:	Received by: 2
Relinquished by: 3	Date Time:	Received by: 3	Relinquished by: 4	Date Time:	Received by: 4
Relinquished by: 5	Date Time:	Received by: 5	Custody Seal #		

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Appendix E

Oxygen and Carbon Dioxide Soil Gas Measurements

APPENDIX E

Oxygen and Carbon Dioxide Measurements
Collected During Soil Gas Purging
May 23 - May 26, 2011

Gas Measurements GEM Landfill Gas Meter	Units	SGMP-01			SGMP-02			SGMP-03			SGMP-04		
		5	15	30	5	15	30	5	15	30	5	15	30
Soil Gas O2	%	20.3	20.39	20.5	20.3	20.3	20.2	20.5	20.5	20.4	20.3	20.3	20.3
Soil Gas CO2	%	0.3	1.3	1.7	0.3	0.8	0.8	0.4	0.4	0.5	0.8	0.6	0.6

Gas Measurements GEM Landfill Gas Meter	Units	SGMP-05			SGMP-06			SGMP-07		
		5	15	30	5	15	30	5	15	30
Soil Gas O2	%	20.5	20.5	20.6	20.6	20.6	20.5	20.1	20.59	20.5
Soil Gas CO2	%	0.4	0.4	0.4	0.4	0.4	0.4	0.6	0.6	0.6

Ambient O2	20.60%
Ambient CO2	0.00%

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Appendix F

Attenuation Factor Calculations Using U.S. EPA 2008 AF Database Tool

APPENDIX F
SUMMARY OF AUTO FILTER CRITERIA USED FOR AF CALCULATION FOR MONTAGUE SITE
U.S. EPA VAPOR INTRUSION DATABASE: ATTENUATION FACTOR ANALYSIS

Subsurface Media: Soil Gas (ug/m^3)
Count: 18

SITE NAME
EAU CLAIRE
FRESHWATER LENS
HOPEWELL PRECISION SITE
MADEP1
MADEP2
UNCASVILLE
CHEM NAMES
CIS-1,2,-DCE
TCE
PCE
CHEM TYPE
CHC
SOIL TEXTURE
S
SOIL TYPE
COARSE
BUILDING USE
COMMERCIAL/RESIDENTIAL
FOUNDATION TYPE
ALL
GW COMMENTS
UNCHECK "NOT IN LINE WITH OTHER ALPHAS"
HYDROGEOLOGICAL SETTING
GLACIATED CENTRAL REGION
NORTHEAST AND SUPERIOR HIGHLANDS

All other tabs were not changed.
Calculated as "Autofilter"

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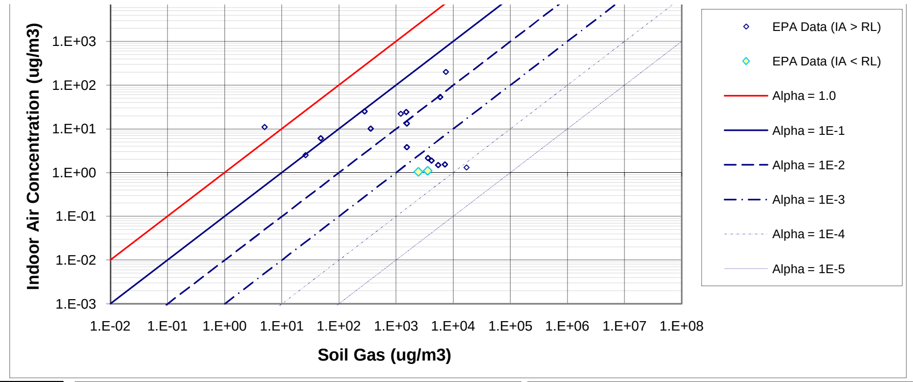
Site Name:	All Sites
ChemName:	All Chemicals
Chem Type:	All Chemical Types
Soil Texture Code:	All Soil Textures
Soil Type:	All Soil Types
Bldg Use:	All Building Uses
Foundation Type:	All Foundation Types

Subsurface Media: Soil Gas (ug/m3)



Select Subsurface Media

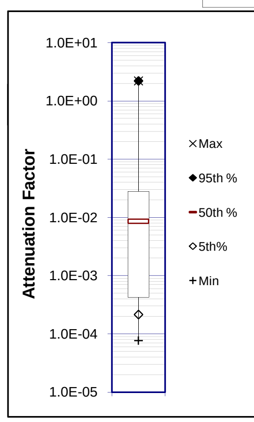
Apply Autofilter and Calculate Statistics

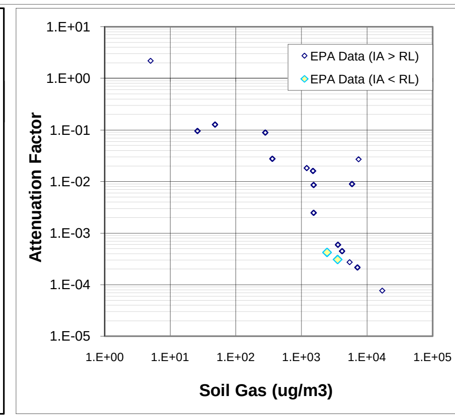
OR

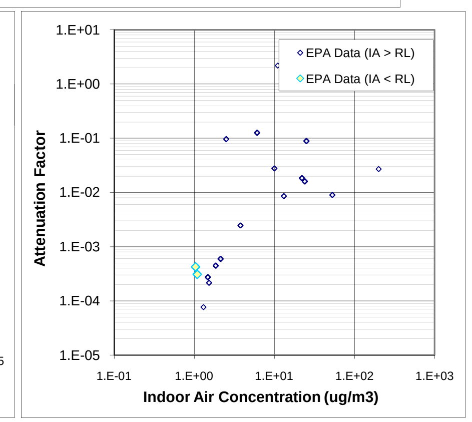
Apply Filter Criteria and Calculate Statistics

Reset Spreadsheet

Stats	EXCEL	KMStats
Min	7.6E-05	7.6E-05
5%	1.9E-04	2.2E-04
25%	4.3E-04	4.2E-04
50%	8.8E-03	8.6E-03
75%	2.8E-02	2.8E-02
95%	4.4E-01	2.2E+00
Max	2.2E+00	2.2E+00
Mean	1.5E-01	1.5E-01
StdDev	5.1E-01	5.1E-01
95UCL	2.4E-01	3.6E-01
Count All	18	18
Count D		18
Count ND		0







Filter Criteria — Counts Visible Data--> 18 (Selected Data), 49 (GW Data), 22 (SS Data), 18 (SG Data), 0 (CS Data), 54 (IA Data)

Site, Chemical, Soil, and Building Filters							
Site Name	ChemName	Chem Type	Soil Texture Code	Soil Type (VC, C or F)	Building Name	Bldg Use	Foundation Type

GW Filters				SS Filters			
[GW] > RL? (Y,N)	Use [GW] Source Strength Filter?	USE [GW] Alpha? (Y,N)	[GW] Comment	[SS] > RL? (Y,N)	Use [SS] Source Strength Filter??	USE [SS] Alpha? (Y,N)	[SS] Comment
	1000				50		

SG Filters				CS Filters				IA Filters			
[SG] > RL? (Y,N)	Use [SG] Source Strength Filter??	USE [SG] Alpha? (Y,N)	[SG] Comment	[CS] > RL? (Y,N)	Use [CS] Source Strength Filter??	USE [CS] Alpha? (Y,N)	[CS] Comment	[IA] > RL? (Y,N)	[IA] > Backgrnd Filter? (Y,N)	USE [IA] Data? (Y,N)	[IA] Comment
	100				100				1		

Enter Filter Factors -->

Selected Data				GW Data			SS Data	SG Data	CS Data	IA Data		Alphas			
Subsurface Concentration	Subsurface Alpha	Alpha Detect Flag (Y=1,N=0)	Alpha Nondetect Flag (Y=1,n+0)	copy of [gw] in ug/L	GW Temp (C); Default=15C	Predicted [gw_vapor] in ug/m3	copy of [ss] in ug/m3	copy of [sg] in ug/m3	copy of [cs] in ug/m3	copy of [ia] in ug/m3	90th % IA_Background	ia/gw alpha	ia/ss alpha	ia/sg alpha	ia/cs alpha

IA/GW Detect Flag (Y=1,N=0)	IA/GW Non-Detect Flag (Y=1,N=0)	IA/SS Detect Flag (Y=1,N=0)	IA/SS Non-Detect Flag (Y=1,N=0)

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