

**Annual Groundwater Monitoring  
and 3-Year Vapor Intrusion Evaluation Work Plan  
Bentley Mall East Satellite  
Fairbanks, Alaska  
ADEC File No. 102.38.022**

October 2018



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Submitted To:  
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**ANNUAL GROUNDWATER MONITORING AND  
3-YEAR VAPOR INTRUSION EVALUATION WORK PLAN  
BENTLEY MALL EAST SATELLITE  
FAIRBANKS, ALASKA  
ADEC FILE NO. 102.38.122**

October 29, 2018

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## ACRONYMS AND ABBREVIATIONS

AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
BMES	Bentley Mall East Satellite
°C	degrees Celsius
CFR	Code of Federal Regulations
COC	chain of custody
COPC	contaminants of potential concern
CSM	conceptual site model
CUL	cleanup level
DO	dissolved oxygen
1,2-DCE	1,2-dichloroethene (includes both <i>cis</i> and <i>trans</i> )
EPA	Environmental Protection Agency
ERG	Environmental Resource Group
Eurofins	Eurofins Air Toxics, Ltd.
HCl	hydrochloric acid
IDW	investigation-derived waste
inHg	inches mercury
µg/L	microgram per liter
µg/m <sup>3</sup>	microgram per cubic meter
µS	micro Siemens
mg/L	milligram per liter
mV	millivolts
PAN	parcel account number
PCE	tetrachloroethene
QA	quality assurance
QAOs	QA objectives
QC	quality control
SDS	Safety Data Sheet
SGS	SGS North America, Inc.
SIM	Selective Ion Monitoring
SSHP	site safety and health plan
SVE	soil vapor extraction
TCE	trichloroethene
VOA	volatile organic analysis
VI	vapor intrusion
VOC	volatile organic compound
WP	work plan
YSI	YSI Pro Plus or YSI 556 MPS multi-probe analyzer

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**1.0 INTRODUCTION**

This work plan (WP) describes our proposed approach for additional assessment of the chlorinated-solvent plume and potential vapor intrusion (VI) reportedly associated with the Bentley Mall East Satellite (BMES) building, located at 20 College Road in Fairbanks, Alaska (Figure 1). The BMES building is located in the southeast corner of the Bentley Mall property (parcel account number [PAN] 93181); it is listed by the Alaska Department of Environmental Conservation (ADEC) as a contaminated site (ADEC File 102.38.122), as a result of chlorinated-solvent contamination having been detected in soil and groundwater at the site.

Shannon & Wilson prepared this WP in compliance with ADEC regulations Title 18 Chapter 75 of the Alaska Administrative Code (18 AAC 75.335) and applicable ADEC guidance. Our services are performed in accordance with our proposal dated October 3, 2018. The work was authorized under the Task Order issued October 9, 2018 and subject to the Terms and Conditions contained in Master Service Agreement KCI-2016.

**1.1 Project Purpose and Objectives**

The project purpose is to evaluate groundwater quality in the area downgradient (west) of the BMES building and assess the potential for VI into homes and buildings within the affected area. The project objectives and overall study goals are to collect and analyze groundwater, soil-gas, and indoor-air samples. We will use the collected information to evaluate contaminant concentrations and trends, with the goal of providing recommendations for continued monitoring, corrective action, or site closure, as appropriate.

**1.2 Field-Investigation Tasks**

To meet these objectives, we will perform the following field tasks, which we describe in this work plan:

- Collect analytical water samples on an annual basis, from 13 existing monitoring wells.
- Collect soil-gas samples once every three years from ten private properties in Charles Slater subdivision.

- Collect indoor-air samples once every three years from nine commercial and four private properties downgradient of the BMES building.
- Collect follow-up indoor air samples in 2018 from two private properties where chloroform was detected above ADEC target levels during the October 2017 sampling event.

### **1.3 Project Submittals and Schedule**

The primary project submittals will be this WP and post-field work summary reports describing field work activities. Following completion of field work, we will submit a summary report 60 days after our receipt of final laboratory results.

The tentative project schedule for annual groundwater monitoring is:

- October 29, 2018 – submit final WP to ADEC
- End of October-November 2018 – perform annual groundwater sampling
- September-October 2019, 2020 – perform annual groundwater sampling
- Mid-January 2019, 2020, 2021 – submit groundwater summary report to ADEC

The tentative project schedule for VI evaluation, assuming a modification to the ADEC approved 3-year VI sampling frequency is not required:

- November 2018– collect follow-up indoor air samples at two locations where chloroform was detected above ADEC target levels
- September 2020 – perform VI sampling at commercial and residential properties
- December 2020– submit VI summary report to ADEC along with the 2020 annual groundwater summary report

### **1.4 Project Team**

The project team will be composed of the following members; their associated responsibilities are summarized below in Table 1:

**TABLE 1  
PROJECT TEAM**

<b>Team Member</b>	<b>Responsibilities</b>
KE Bentley One, LLC. and KGC Bentley Two, LLC. David Pyle (415-732-5600)	Client, contract administrator
Alaska Department of Environmental Conservation Jim Fish (907-451-2117)	Regulatory oversight, work plan approval
Shannon & Wilson, Inc. Project Manager: Sheila Hinckley (907-458-3151) Principal in Charge: Christopher Darrah (907-458-3143)	Environmental consultant, work plan implementation and reporting
SGS Environmental Services, Inc. Jennifer Dawkins (907-474-8656)	Analytical sample analysis and data reporting – groundwater samples
Eurofins Air Toxics, Inc. Kelly Buettner (916-985-1000)	Analytical sample analysis and data reporting – air samples

Sheila Hinckley will be the Shannon & Wilson Project Manager, responsible for overseeing day-to-day activities and coordinating with other team members. Shannon & Wilson field personnel will implement the work plan activities; Shannon & Wilson environmental staff assigned to this project are ADEC Qualified Samplers. Shannon & Wilson personnel will read and comply with the Site Safety and Health Plan (SSHP) for field activities presented in Appendix A.

## 2.0 SITE DESCRIPTION AND BACKGROUND

### 2.1 Site Description

The BMES building is located at 20 College Road in Fairbanks, Alaska, situated on the southeast corner of the Bentley Mall property (PAN 93181). Tetrachloroethene (PCE) and trichloroethene (TCE) have been detected in groundwater at and downgradient of the BMES property. The ADEC considers the BMES site to be a source of this contamination, although an additional suspected source has been identified. The groundwater-contaminant plume extends west of the site into the Charles Slater residential subdivision. The area is served by public water and sewer service. Based on previous site-specific groundwater investigations conducted by Environmental Resource Group (ERG) and Shannon & Wilson, we anticipate groundwater flow direction to be to the west and northwest.

Our study boundaries comprise the suspected source area in the vicinity of the BMES structure, and the groundwater-contaminant plume extending west of the site into the Charles Slater residential subdivision.



## 2.2 Background

The BMES site was added to the ADEC's Contaminated Sites Database in April 2003 following detections of PCE and TCE in soil and groundwater. In April 2005, indoor-air samples were collected from the BMES building (Figure 1) and Wells Fargo Bank; PCE and TCE were detected above target levels at that time. Thirteen monitoring wells (MW-1 to MW-13) were installed and sampled in fall 2005; sample results suggested a PCE and TCE plume extending off-site in a westerly direction.

Soil vapor extraction (SVE) systems were installed in the BMES and Wells Fargo Bank buildings in September 2006 and remained active for five years. PCE and TCE concentrations in the source area decreased during this time and in August 2011, ADEC approved ERG's request to shut down the SVE systems citing approval of a groundwater-monitoring schedule. Groundwater PCE and TCE concentrations at the time were not below ADEC cleanup levels (CULs).

ERG collected 30 passive soil gas samples along the Noyes Street sewer line in October 2010. Sample results indicated relatively low levels of PCE were detected and appeared to be in a clustered formation near 620 and 640 Noyes Street. They concluded it may be indicative of a leaking sewer or storm drain.

Fall 2012 groundwater results showed increasing concentrations of PCE in MW-1. ADEC subsequently followed up with letters to the owners of VIP Cleaners, Inc. and the BMES. In a letter dated April 22, 2013, ADEC reopened BMES as a contaminated site and required further evaluation of VI risks associated with the groundwater plume.

ERG collected soil-gas samples in September 2015 from the Charles Slater subdivision to assess whether further investigation at the residences was necessary. Soil-gas samples were collected from seven private properties in the Charles Slater subdivision in March 2016. Soil-gas sample results for four of the private property exceeded or nearly exceeded ADEC target levels for PCE, TCE or 1,2-dichloroethene (1,2-DCE). ERG also collected indoor-air samples from 120 Ina Street in November 2015 and January 2016; chlorinated solvents were not detected above ADEC target levels in these samples.

Shannon & Wilson conducted a winter 2016 sampling event (December 2016 and January 2017) collecting indoor-air samples from seven commercial business' and soil-gas samples from the Charles Slater subdivision, using the sampling ports installed by ERG. ADEC target levels for PCE and TCE were not exceeded with the exception of PCE from the AutoZone sample. In June

2017, ADEC requested additional samples be collected from the sampling ports to verify the lower concentrations noted between the March 2016 and winter 2016 sampling event.

In October and November 2017, we collected soil-gas, sub-slab, and indoor-air samples from residential properties and indoor-air from the AutoZone and Wild Wings. PCE and TCE results from our October/November 2017 VI sampling event were comparable to the winter 2016 sampling event. Contaminants of potential concern (COPC) were below ADEC target levels with following the exceptions at private locations:

- chloroform, from soil-gas sample SV-13 and sub-slab sample SS1A, and
- PCE and TCE in soil-gas field duplicate sample pair SVR4B / SVR40B.

Groundwater sampling conducted in October 2017 resulted in COPC analytical detections greater than ADEC regulatory limits in nine of the 13 monitoring wells.

In the May 2018 comments to our *Bentley Mall East Satellite 2017 Soil Gas and Groundwater Assessment Report*, ADEC requested a work plan to cover a three-year time frame for continued annual groundwater monitoring and once every three years for VI monitoring.

### **3.0 CONCEPTUAL SITE MODEL**

A conceptual site model (CSM) describes potential pathways between a contaminant source and possible receptors (i.e., people, animals, and plants) and is used to determine who may be at risk of exposure to those contaminants. We describe the suspected contaminant sources, migration and exposure pathways, and potential receptors. This information is summarized on the *Human Health Conceptual Site Model Graphic Form* in Appendix B.

Based on our understanding of site conditions and historical information from the former dry-cleaning business located in the BMES building, potentially contaminated media include surface and subsurface soil, groundwater, and air. Contaminants that reach the groundwater table are presumed to be subject to transport with groundwater flow away from the source areas. Potential receptors include construction workers, residents, commercial or industrial workers, and other site visitors. Potential exposure routes include dermal contact with, and incidental ingestion of, contaminated soils and groundwater, and exposure to vapors in outdoor and indoor air.

### **4.0 SAMPLING PLAN AND ADDITIONAL FIELD ACTIVITIES**

The ADEC has requested a three-year offsite VI sampling regime with the option for annual amendments should conditions warrant modifications, and annual groundwater monitoring of the current monitoring well network. Section 5.0 presents information on the COPC and regulatory

levels. In this section, we describe our proposed investigative approach to provide ADEC with the requested information inputs.

Groundwater samples will be collected from 13 monitoring wells previously installed within the project area. The analytical results for groundwater samples will be compared to ADEC Groundwater CULs listed in 18 AAC 75 – Table C (July 2017).

Soil-gas and indoor-air samples will be collected from private properties in the Charles Slater subdivision downgradient of the BMES site. Indoor-air samples will be collected from commercial properties within and downgradient to the BMES site. Air sample analytical results will be compared to target levels described in ADEC's *Vapor Intrusion Guidance* (November 2017).

#### **4.1 Monitoring-Well Samples**

We will collect groundwater samples annually from the 13 monitoring wells MW-1R through MW-13 using methods described in Section 6.1. During 2018 construction activities near the BMES building, monitoring wells MW-1, MW-2, MW-3, and MW-4 were decommissioned, with replacement wells installed in similar locations as the original wells.

The top-of-casing elevation for each of the 13 monitoring wells will be surveyed every two years (within one week of a sampling event) starting in 2018. Surveys will be conducted by a registered professional surveyor or a registered professional engineer with a horizontal accuracy of 0.1 foot and a vertical accuracy of 0.01 foot, as recommended in the ADEC Monitoring Well Guidance, dated September 2013. The most recent survey data will be used to assess the groundwater gradient and will be reported in the annual summary reports.

#### **4.2 Soil-gas from Private Properties**

Subsurface soil-gas samples were collected from private properties in the Charles Slater subdivision in March 2016, winter 2016, and October/November 2017. We installed three sub-slab ports at two residential locations and one replacement soil-gas port at the Monroe Catholic School in 2017.

We will attempt to collect soil-gas samples from each of the locations sampled during the previous sampling events. We will notify BMES and ADEC in the case where an owner refuses access to their property. We will attempt VI sampling once every three years until groundwater-sample results for monitoring wells in the Charles Slater subdivision decline below ADEC groundwater CULs.

The next sampling event will be conducted in 2020. Should conditions warrant an increase to the three-year VI sampling frequency, we will notify you in the annual report and submit a work plan addendum. We will collect samples from the original sampling ports, where possible. Locations where soil-gas samples will be collected are shown in Table 2 below.

**TABLE 2  
RESIDENTIAL SOIL-GAS SAMPLE LOCATIONS**

<b>Location</b>	<b>Sample Designation</b>
311 Noyes Street	SVR1
208 Charles Street †	SVR2
625 Noyes Street †	SVR3
120 Ina Street	SVR4
201 Ellingson Street	SVR5
236 Ina Street †	SVR6
106 Charles Street	SVR7
Monroe Catholic School	SV-12R, SV-13, SV-14, SV-15
518 Fulton Street	SS1
631 Noyes Street	SS2

Note: † – unable to collect samples during the October/November 2017 sampling event due to owner refusal.

SV – soil-vapor

SVR – soil-vapor residential

SS – sub slab

### **4.3 Indoor-Air from Private Properties**

Indoor-air samples provide information regarding the completeness of the VI pathway for a given structure. We will attempt to gain permission from the residents and collect indoor-air samples from four private residences, shown in Table 3 below. These locations were selected based on previous soil-gas results, where COPC results exceeded or nearly exceeded target levels.

We note that we were unable to collect samples from various residential locations during our winter 2016 and October/November 2017 sampling events due to refusals by property owners. Should a sample location not be possible in 2020, we will suggest alternative replacement options in writing.

**TABLE 3  
RESIDENTIAL INDOOR-AIR SAMPLE LOCATIONS**

Location	Sample Designation
631 Noyes Street	SS2
625 Noyes Street †	SVR3
120 Ina Street	SVR4
201 Ellingson Street	SVR5

Note: † – unable to collect sample during the October/November 2017 sampling event due to owner refusal

#### **4.4 Indoor-Air from Commercial Properties**

Indoor-air samples were collected from several properties from the BMES property and downgradient properties in December 2016 and November 2017. Results were below target levels with the exception of PCE detected in the sample from AutoZone during the 2016 event at a concentration of 96 microgram per cubic meter ( $\mu\text{g}/\text{m}^3$ ). The 2017 indoor air sample and sub-slab vent sample from AutoZone yielded PCE results below target levels. It is suspected the above-target level December 2016 PCE concentration detected inside the AutoZone building is due to the use and sale of PCE-containing materials within the facility.

Recent renovations at the BMES building included resealing the vapor barrier for the Wild Wings restaurant. To demonstrate the effectiveness of the patched vapor barrier, we collected a 2017 indoor-air sample from this location and results were below ADEC target levels. Similar renovations took place at the BMES building in 2018, at the current Starbucks location. We are in the process of collecting an indoor-air sample to determine the effectiveness of the recent vapor-barrier installation process, as part of a separate project.

We will attempt to collect indoor-air samples in 2020, from each commercial location previously sampled, as shown in Table 4 below.

**TABLE 4  
COMMERICAL INDOOR AIR SAMPLE LOCATIONS**

Location	Sample Description
Auto Zone	CIA01
Alaska Ammo †	CIA02
Wells Fargo	CIA03
Satellite Hubb	CIA04
Papa John's	CIA05
Key Bank	CIA06
REI	CIA07
Wild Wings †	CIA08
Starbucks †	CIA09

Note: † Businesses are located in the BMES building. One location from the BMES building will be selected for sampling in 2020.

## 5.0 CONTAMINANTS OF POTENTIAL CONCERN AND REGULATORY LEVELS

The COPCs at this project site include PCE, TCE, 1,2-DCE, and chloroform. These contaminants were last detected in the monitoring wells associated with the BMES site during the October 2017 sampling event. Chloroform was added to the COPCs for the site at the request of the ADEC starting in 2017.

Our analytical approach and performance criteria are in compliance with ADECs *Data Quality Objectives, Checklists, Quality Assurance requirements for Laboratory Data, and Sample Handling* Technical Memorandum dated March 2017. We will collect groundwater samples to be analyzed for select volatile organic compounds (VOCs) during the annual sampling events as described in Section 6.1. The COPCs and their degradation products are included in the modified VOC list. We will compare groundwater-sample results to the 18 AAC 75.341 Table C Groundwater CULs.

We will collect VI samples to be analyzed for PCE, TCE, and their breakdown products, and chloroform during the 2020 sampling event as described in Sections 6.2 and 6.3. We will compare soil-gas and air-sample results to the commercial and/or residential ADEC target levels, where appropriate. We will use Appendix E: DEC Soil Gas Target Levels from ADECs *Vapor Intrusion Guidance* (November 2017) for soil-gas samples and Appendix D: DEC Indoor Air Target Levels for indoor-air samples.

The COPCs and Regulatory Levels are summarized in Table 5 below.

**TABLE 5  
CONTAMINANTS OF POTENTIAL CONCERN  
AND REGULATORY LEVELS**

Contaminants of Concern	Analytical Method	Regulatory Level (Groundwater)	Target Level (Residential Soil-gas)	Target Level (Indoor Air)
Tetrachloroethene (PCE)	SW 8260B (groundwater) TO-15 (air samples)	41 µg/L	410 µg/m <sup>3</sup>	Residential 41 µg/m <sup>3</sup> Commercial 41 µg/m <sup>3</sup>
Trichloroethene (TCE)	SW 8260B (groundwater) TO-15 (air samples)	2.8 µg/L	20 µg/m <sup>3</sup>	Residential 2.0 µg/m <sup>3</sup> Commercial 2.2 µg/m <sup>3</sup>
1,2-Dichloroethene (1,2-DCE)	SW 8260B (groundwater) TO-15 (air samples)	<i>cis</i> - 36 µg/L <i>trans</i> - 360 µg/L	N/A	Residential † <i>cis</i> - 8.3 µg/m <sup>3</sup> <i>trans</i> - 83.4 µg/m <sup>3</sup> Commercial † <i>cis</i> - 35 µg/m <sup>3</sup> <i>trans</i> - 350 µg/m <sup>3</sup>
chloroform	SW 8260B (groundwater) TO-15 (air samples)	2.2 µg/L	12 µg/m <sup>3</sup>	Residential 1.2 µg/m <sup>3</sup> Commercial 5.3 µg/m <sup>3</sup>

Note: † – Site-specific regulatory level provided by ADEC in September 20, 2017 email.

N/A – not applicable

µg/L – micrograms per liter

µg/m<sup>3</sup> – micrograms per cubic meter

## 6.0 MONITORING-WELL AND SOIL-GAS SAMPLING PROCEDURES

We will collect the samples outlined below in accordance with the ADEC August 2017 *Field Sampling Guidance*. Examples of our field forms are presented in Appendix C.

### 6.1 Groundwater-Sampling Procedures

The following section describes sample-collection, analytical methods, and quality control (QC) procedures for groundwater samples collected from the thirteen monitoring wells associated with the BMES site.

### **6.1.1 Water-Level Measurement**

We will measure and record the static groundwater level (to the nearest 0.01 foot) in each well prior to purging water from the well, using an electronic water-level indicator (Heron Instruments or Solinst Model 101). We will measure the depth to water before the pump or tubing is lowered into the well. We will also measure and record a total well depth (to the nearest 0.01 foot) to determine the volume of water present in the well prior to sampling. The probe of the water-level indicator will be decontaminated prior to each use and between each well (Section 6.4) to prevent the addition of external contamination or artifacts into a well.

### **6.1.2 Monitoring-Well Purging**

Monitoring wells will be purged prior to sampling. We will purge and sample the monitoring wells using a portable stainless-steel submersible pump and new, disposable tubing for each monitoring well. We will operate the submersible pump at a maximum flow rate of 1 gallon per minute, in accordance with the ADEC Field Sampling Guidance (August 2017) for low flow, minimal drawdown sampling.

We will measure and record temperature in degrees Celsius ( $^{\circ}\text{C}$ ), pH in standard units, conductivity in micro Siemens per centimeter ( $\mu\text{S}/\text{cm}$ ), dissolved oxygen (DO) in milligrams per liter (mg/L), and redox potential in millivolts (mV) with a YSI Pro Plus or YSI 556 MPS multi-probe analyzer (YSI) to determine the point at which sampling can begin. We will measure field parameters using a “flow-through cell” attached to the pump-discharge line.

Each well will be purged until three consecutive readings (taken at least three minutes apart) are considered stabilized for water-quality parameters or after three well-casing volumes are purged. The following values will be used to indicate stability:  $\pm 1.0^{\circ}\text{C}$ ,  $\pm 0.1$  pH;  $\pm 3$  percent conductivity;  $\pm 10$  mV redox; and  $\pm 0.1$  mg/L DO. The stabilization criterion outlined here for DO deviates from the ADEC’s 2017 *Field Sampling Guidance*. In our experience, the aquifer in the Fairbanks area is largely anoxic. At such low DO concentrations (e.g., 0.1 mg/L), achieving 10 percent stabilization is beyond the accuracy and resolution of the YSI; we therefore amended the DO stabilization criterion to accommodate sampling in this anoxic environment. All measurements will be recorded on a Monitoring Well Sampling Log (Appendix C). We will also document odor, color, sheen, or other apparent physical characteristics of the groundwater on the form.

### **6.1.3 Monitoring-Well Sampling**

Immediately after purging the monitoring wells using the procedures described in Section 6.1.2, we will collect groundwater samples into laboratory-provided containers. We will fill sample containers directly from the discharge line, taking care to eliminate headspace from the volatile



organic analyses (VOA) vials without overfilling to prevent diluting the preservatives. Samples will be labeled with the monitoring well name (sample ID), sample-collection date and time, and requested analyses prior to being placed in a sample cooler. The sample cooler will be maintained at a temperature between 0 – 6 °C with artificial ice. Sample containers and preservatives are described in Section 7.1.2. We will collect field QC samples according to Section 9.4 and follow sample-handling, storage, and chain-of-custody (COC) procedures as described in Section 7.1.1. The groundwater analytical method is summarized in Table 6 below.

## **6.2 Soil-Gas Sampling Procedures**

We plan to collect soil-gas samples to further investigate the potential for VI downgradient of the BMES site (Figure 1). Samples will be collected from previously-installed soil-gas ports and sub-slab sampling ports in accordance with the ADEC November 2017 *Vapor Intrusion Guidance for Contaminated Sites*. We plan to sample soil-gas sampling points in September or October of 2020.

### **6.2.1 Soil-gas Probe Purging and Leak Detection**

We will place a leak-detection shroud over the sample point, connecting the sample-point tubing through the shroud using the built-in-fittings. The tubing connects to a sampling “T” outside the shroud, to which we connect a peristaltic pump, rotameter, and helium detector on one side, and the sampling canister on the other. Connections outside the shroud will be leak-tested using a shut-in test; a vacuum [approximately 30 inches mercury (inHg)] will be applied with the pump and shut-in using the valves on the sampling train. We will monitor the vacuum gauge on the sampling “T” to check that the vacuum is sustained for at least one minute. If a leak is detected, we will retighten the connections and perform a second shut-in test, repeating until we have a leak-free sampling train.

Once we complete the shut-in test, we will then purge the sample point at the same rate at which the sample will be collected (about 200 milliliters per minute) using a peristaltic pump; during purging, we will flood the shroud with 99.99-percent helium while monitoring the helium detector. We will continue purging until 2 liters have been purged (about 10 minutes). If at any point a helium reading on the detector exceeds 5-percent of the concentration flooding the shroud, the soil-gas sampling point will have failed the leak check. Leaks detected in this way are either in the connection from the sample-point tubing to the fitting on the inside of the shroud, or the seal around the sample point. If we determine there is a leak, we will check our connections and reseal the sample point with bentonite; if we are unable to eliminate the leak, we may need to reinstall the sample point. Appendix C

### **6.2.2 Soil-gas Probe Sampling**

We will collect the soil-gas sample immediately following purging and leak-detection tests. We will use 1-liter canisters equipped with 30-minute flow controllers, supplied by the analytical laboratory, to meet reporting-limit objectives. The flow controller is used to regulate sampling vacuum to prevent unrepresentative desorption of contaminants from soil.

We will use methods outlined in the Eurofins Air Toxics, Ltd. (Eurofins) of Folsom California Guide to Air Sampling and Analysis to collect the soil-gas samples. The valve on the sampling “T” to the purging pump will be closed, and the valve to the canister opened. The summa canister valve will then be opened to begin sampling soil-gas. The canister valve will be closed when the desired time interval is met, and the final vacuum measured and recorded; the target vacuum is 5-10 inHg. When sampling is complete, we will disconnect our sampling train and seal the sampling port with a removable threaded plug, allowing for future re-sampling at the port, if necessary.

### **6.3 Indoor-Air Sampling and Analysis Procedures**

We will collect indoor-air samples over a 24-hour period using 6-liter canisters with flow controllers, supplied by the analytical laboratory, from a single location determined during the initial site visit; these will generally be the most frequently inhabited rooms on the ground floor of the building. For locations where soil-gas and indoor-air sampling is slated (Figure 1), we will conduct indoor- air sampling on the same day as the soil-gas sampling, where possible.

The 24-hour flow controller will be connected to the summa canister and the canister valve will then be opened to begin sampling indoor-air. The indoor-air samples will be collected in the breathing zone, approximately 3 to 5 feet off the ground in high use areas or areas with sensitive receptors. The canister valve will be closed when the desired time interval is met, and the final vacuum measured and recorded; the target vacuum is 5-10 inHg.

### **6.4 Equipment Decontamination**

Equipment that comes in contact with potentially contaminated media will be decontaminated prior to use and reuse. Shannon & Wilson field staff will decontaminate all non-dedicated sampling equipment using the following method:

1. Non-phosphate detergent wash;
2. tap water rinse; and
3. distilled-water rinse.

We will collect rinse water in purge buckets and discharge to the ground surface after treatment by activated carbon adsorption. Care will be taken to prevent discharging water in areas where

accumulation of ice may present a safety hazard. Equipment that cannot readily be decontaminated, such as pump-discharge tubing, will be disposed of as investigation-derived waste (IDW).

## **7.0 ANALYTICAL-TESTING PLAN**

### **7.1 Groundwater Analytical Laboratory and Methods**

We will submit groundwater samples to SGS North America, Inc. (SGS), an ADEC-approved laboratory with National Environmental Laboratory Accreditation Program certification for the method listed in Table 5. We will submit the samples with sufficient time to allow for the laboratory to analyze the samples within holding-time requirements. SGS has a sample-receiving office in Fairbanks; they ship samples via overnight ground transport to their laboratory in Anchorage, Alaska. Groundwater samples will be submitted for analysis of VOCs by Environmental Protection Agency (EPA) Method 8260B. We will request standard data-turnaround time (approximately two weeks) for SGS results. Analytical deliverables will be provided as described in Section 9.6.

#### **7.1.1 Sample Custody, Storage, and Transport**

We will maintain custody of the water samples at all times until submitting them to the laboratory for analysis. At the end of each field day, if not transported to the laboratory, field personnel will transfer the samples to the designated sample refrigerator in a secure area at Shannon & Wilson's Fairbanks office.

We will hand-deliver the samples directly to the SGS laboratory sample-receiving office in Fairbanks. The COC records document sample possession from the point of collection to the time of receipt by the laboratory sample-control center. We will keep a copy of the COC record to allow sample accountability between field and laboratory.

#### **7.1.2 Sample Containers, Preservation, and Holding Times**

We will deliver the water samples with sufficient time to allow for the laboratory to analyze the samples within holding-time requirements of the analytical method. Table 6 summarizes applicable analytical method, laboratory containers and preservative, and sample-holding times.

**TABLE 6  
GROUNDWATER SAMPLE CONTAINERS, PRESERVATION,  
AND HOLDING TIME REQUIREMENTS**

Analyte	Method	Sample Container	Preservation	Holding Time
VOCs	SW 8260B	(3) 40-mL amber glass VOA vials w/septa	HCl to pH<4, 0 °C to 6 °C	14 days to extraction, analyzed within 40 days of extraction

Notes: Groundwater samples will be submitted to SGS in Anchorage, Alaska.  
mL: milliliters  
HCl: hydrochloric acid

## 7.2 Soil-gas and Indoor-Air Analytical Laboratory and Methods

We will submit the summa canisters to Eurofins in Folsom, California. We will complete a COC form, placing it inside the box of canisters for shipment. We will maintain custody of the samples at all times until submitting them to Eurofins; we will use custody seals when shipping samples to the laboratory via FedEx. The air samples will be sent to Eurofins for determination of VOCs by a modified EPA Method TO-15 Selective Ion Monitoring (SIM) for the project COPCs and their decomposition products. The SIM method is being used to afford lower detection limits for this project. Samples will be delivered to the analytical laboratory with sufficient time to allow the laboratory to extract the sample within the holding-time requirements of the test methods listed in Table 7. We will request a standard data turnaround time for air samples, which is typically 10 business days.

**TABLE 7  
SOIL-GAS / INDOOR-AIR SAMPLE STORAGE, PRESERVATION, AND  
HOLDING TIME REQUIREMENTS**

Analyte	Method	Sample Container	Preservation	Holding Time
VOCs	EPA TO-15	1-Liter summa canister (soil-gas) 6-Liter summa canister (indoor-air)	Store at room temperature	30 days

Notes: Air samples will be submitted to: Eurofins in Folsom, California.

## 7.3 Analytical-testing Summary

Table 8 depicts a summary of samples and analyses proposed in this WP.

**TABLE 8  
SAMPLE-ANALYSIS MATRIX**

<b>Location Type</b>	<b>Matrix</b>	<b>Number of Samples</b>	<b>VOCs</b>	<b>Sampling Frequency *</b>	<b>Sample Description (Comments)</b>
<b>Private Property Locations</b>	Soil gas	19 + 2 QC	X	Every 3 Years	SVR1A, SVR1B, SVR2A, SVR2B, SVR3A, SVR3B, SVR4A, SVR4B, SVR5, SVR6A, SVR6B, SVR7, SV-12R, SV-13, SV-14, SV-15, SS1A, SS1B, SS2
	Indoor Air	4	X	Every 3 Years	SVR2, SVR3, SVR4, SVR5 Collected from the lower floor (see Table 3)
<b>Commercial Property Locations</b>	Indoor Air	9 + 1 QC	X	Every 3 Years	CIA01, CIA02, CIA03, CIA04, CIA05, CIA06, CIA07, CIA08, CIA09 Collected from the lower floor (see Table 4)
<b>Existing Monitoring Wells</b>	Ground water	13 + 2 QC	X	Annual	MW-1, MW-2, MW-3, MW-4, MW-5, MW-6, MW-7, MW-8, MW-9, MW-10, MW-11, MW-12, MW-13

Notes: Groundwater samples will be submitted to SGS in Anchorage, Alaska.

\* : Unless site conditions warrant modifications

## 8.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

We will collect monitoring-well purge water and decontamination water generated during groundwater sampling activities. Groundwater samples collected at BMES contained chlorinated solvents and are considered a F002 listed hazardous waste per 40 Code of Federal Regulations (CFR) 261.31, therefore waste generated from sampling activities will be disposed of in accordance with Federal, State, and Local Regulations. The water will be containerized into 55-gallon drums, labeled, and held onsite for disposal by NRC Alaska, LLC. We estimate up to 100 gallons of groundwater will be generated. We are not a treatment facility.

Other IDW will primarily consist of disposable sampling equipment (nitrile gloves, Teflon tubing, ½-inch diameter PVC, etc.) which will be disposed of at the Fairbanks North Star Borough landfill.

## 9.0 QUALITY ASSURANCE PROJECT PLAN

This section describes specific procedures to be followed during groundwater and air sampling to ensure sample collections and documentation are effective, laboratory data are usable, and the information acquired is of high quality and reliability.

## 9.1 Quality-Assurance Objectives

Our data quality assurance (QA) objective is to assure environmental-monitoring data are of known and acceptable quality. For analytical data, the objective is to meet acceptable QA standards of precision, accuracy, representativeness, comparability, and completeness.

Shannon & Wilson QA objectives (QAOs) for this project are presented in Table 9 below. Comparability among samples will be maintained by consistency in sampling procedures, sample-preservation methods, analytical methods, and data-reporting units. QAOs meet ADEC limits; reporting limit goals for this project will be less than ADEC CULs, specified in Table 5 in Section 5.0.

**TABLE 9**  
**QUALITY ASSURANCE OBJECTIVES FOR WATER AND AIR SAMPLES**

Analyte	Matrix	Method	Precision	Accuracy	Completeness
VOC	Water	SW 8260B	±30%	60-140%*	85%
VOC	Air	EPA TO-15	±50%	60-140%*	85%

\*= varies depending on analyte

## 9.2 Field Documentation

We will use field log sheets to record field documentation, including the following information:

- Sampling team member(s);
- weather and other salient observations;
- documentation of instrument calibration;
- location of activity and site conditions;
- field observations and comments;
- field measurements, including leak check results for air samples;
- changes to sampling protocol;
- sample identification;
- sample date and time;
- site photographs; and
- locations of sampling points.

## 9.3 Field-Instrument Calibration

Field equipment will be calibrated in accordance with manufacturer instructions. Shannon & Wilson field personnel are trained to calibrate and use the YSI multi-probe.

## **9.4 Field QC Samples**

The field QA/QC program includes collection of duplicate samples, equipment blank samples, and trip blanks. Descriptions of QA/QC samples are presented below.

### **9.4.1 Field-Duplicate Samples**

We will collect duplicate samples at a minimum rate of 10-percent of the samples submitted for analysis, i.e., a minimum of one per every 10 field samples for each matrix sampled and each target analyte, with a minimum of one duplicate. We understand the latest sampling guidance calls for one duplicate to be collected per day and we will adhere to this for the groundwater samples. However, due to scheduling and budget constraints that may not be possible for air samples.

If possible, we will collect duplicates from locations most likely to be contaminated based on historical results, as calculation of duplicate precision is not possible for samples with contaminants below detection limits. We will assign duplicates a unique sample number and submit them “blind” to the laboratory. We will use duplicate-sample results to test the comparability of field-sampling procedures.

We will collect monitoring-well and air-sample duplicates by filling two complete sets of sample bottles/canisters with groundwater/air from the selected well/location, entering the location of the duplicate sample(s) into the appropriate sampling log. These duplicates will be analyzed using the same analytical method used for the primary sample.

### **9.4.2 Trip-Blank Samples**

Trip blanks will be used to detect and quantify potential organic chemical cross-contamination between water samples and contamination originating from an outside source. Prior to field mobilization, the laboratory will prepare a water trip blank (filled with deionized water) for each cooler of water samples. These bottles will be transported to the sampling location and returned to the laboratory in the cooler(s) used to transport the water samples. The trip blanks will be analyzed for VOCs using the same analytical method as the project samples. The concentration of VOC artifacts found in the trip blanks will be noted and compared to the water-sample results. Trip blanks will be consecutively numbered. Trip blanks are not required for air samples.

### **9.4.3 Equipment-Blank Samples**

We will collect an equipment blank sample to determine the validity of the monitoring well sample results by establishing the effectiveness of our decontamination procedures. We will collect an equipment blank at a minimum rate of 5-percent of the samples submitted for analysis,

i.e., a minimum of one per every 20 field samples. We will not perform decontamination of disposable sampling equipment, such as pump tubing. Equipment blank samples are not required for air samples.

#### **9.4.4 Temperature Blanks**

Temperature blanks are provided for water samples by the laboratory and consist of jars filled with water and packed with the samples in each cooler. The water temperature in the blanks will be measured at the laboratory receiving office. The sample temperature should be within a range of 0 °C to 6 °C. The laboratory will document sample and cooler conditions, including temperature. Temperature blanks are not required for air samples.

#### **9.5 Laboratory QC Samples**

The analytical laboratory performs QC checks during sample analysis to determine precision and accuracy of the instrumentation at the time the project samples are analyzed. Laboratory QC includes initial and continuing calibration checks, analysis of method blanks, analysis of spiked samples, duplicate analyses, and evaluation of surrogate-analyte recoveries. Method blank results, spiked sample recoveries, duplicate analyses, and surrogate-recovery data will be presented in the laboratory report. The laboratory will apply their in-house procedures for QC reporting.

#### **9.6 Laboratory Data Deliverables**

Shannon & Wilson will request Level 2 Data Report Deliverables in .pdf format for transmittal with the groundwater and air samples reports. We will also request Electronic Data Deliverables from the analytical laboratories in a format that is compatible with our Environmental Data Manager database.

#### **9.7 Data Reduction, Evaluation, and Reporting**

The laboratory results will be validated by the laboratory supervisor or other responsible party and include evaluation for precision and accuracy of the data set. The laboratory QC officer or other responsible party will review and sign analytical data before release. Individual laboratory reports will be included with our final report. We will check analytical data generated by the laboratory for precision, accuracy, and completeness.

Qualified Shannon & Wilson personnel will review the field data, including sample descriptions and pertinent observations. Laboratory data-evaluation procedures will include QA checks to confirm holding times have been met, duplicate samples have been collected, and other QA parameters have been performed. We will also complete the ADEC QA/QC checklists as part of



our data-review process. The Shannon & Wilson project manager will check field data during preparation of the summary report.

We will prepare an annual summary report in which we document field activities and summarize groundwater sampling results and soil-gas sampling results. We will compare those results to the ADEC CULs (groundwater results) and target levels (soil-gas and indoor-air results). We will provide a discussion of analytical sample results and recommendations for additional investigation, corrective action, monitoring, or site closure, as appropriate. Our summary report will include laboratory data reports, ADEC data-review checklists, and copies of COC records with the report. We will also include:

- a narrative of work performed;
- analytical data tables summarizing current and historic results;
- figures showing sample locations;
- quality-control evaluation of analytical results;
- an updated CSM;
- conclusions and recommendations;
- laboratory analytical reports;
- copies of field notes; and
- ADEC QC checklists.



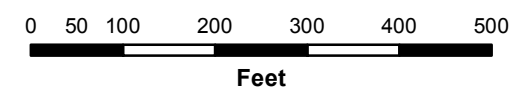


Notes: Monitoring wells MW-1, MW-2, MW-3, and MW-4 were removed and reinstalled in a similar areas in 2018.

Image provided courtesy of Pictometry International 2012

**LEGEND**

- Bentley Mall Properties
- Soil-Gas Property
- BMES Building
- Soil-Gas and Indoor-Air Property
- Monitoring Wells



Bentley Mall East Satellite (BMES)  
Fairbanks, Alaska

**Site Vicinity**

October 2018

101926-001

**SHANNON & WILSON, INC.**  
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

**Figure 1**



**APPENDIX A**  
**SITE SAFETY AND HEALTH PLAN**

## APPENDIX A

### SITE SAFETY AND HEALTH PLAN

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#### ATTACHMENTS

Site Safety and Health Plan Personal Acknowledgement Form

## **APPENDIX A**

### **SITE SAFETY AND HEALTH PLAN**

#### **A.1 APPLICABILITY AND PURPOSE**

Shannon & Wilson has prepared this SSHP for sampling activities associated with the BMES project in Fairbanks, Alaska. The purpose of this SSHP is to protect the health and safety of Shannon & Wilson field personnel involved in sampling activities from physical and chemical hazards associated with the work.

The provisions of this plan apply to all Shannon & Wilson personnel who will potentially be exposed to safety and/or health hazards related to sampling activities. This plan applies only to Shannon & Wilson personnel; contractors and subcontractors hired by Shannon & Wilson are responsible for their own health and safety. Shannon & Wilson employees are covered under our Corporate Health & Safety Plan; general safety and health requirements described in that program will be met. Each Shannon & Wilson employee on the site will sign the acknowledgement form, documenting they have read and understand this SSHP and agree to abide by its requirements. A copy of this SSHP will be kept in the possession of field personnel throughout the duration of field activities.

#### **A.2 SITE HAZARD ANALYSIS**

There are two categories of hazards that may occur during the field work; potential chemical exposure hazards and physical hazards associated with sampling activities. These hazards are discussed below.

##### **A.2.1 Chemical Exposure Hazards**

Contaminated soil, groundwater and air may be present on the project site and encountered during field activities. Health and safety information is provided in the following paragraphs.

##### **A.2.2 Chlorinated Solvents**

Chlorinated solvent contamination in this area is highly probable, but in small amounts. Some potential chronic exposure health effects for chlorinated solvents (specifically TCE and PCE) are liver, kidney, peripheral and central nervous system depression, respiratory tract, skin, intolerance to alcohol, and increased cardiac output. This particular type of material is linked to mutagenic effects in humans and is a suspect carcinogen. Shannon & Wilson personnel will

avoid exposure to PCE, TCE and other chlorinated solvents by implementing skin-contact protection (use of disposable nitrile gloves) as appropriate. The Safety Data Sheets (SDS) for TCE and PCE are presented at the end of this SSHP.

#### **A.2.4 Hydrochloric Acid**

A small volume (0.5 milliliter) of HCl is used as a preservative in water-sample vials. Adding the water sample to the vial will generate a small volume of chlorine gas, which will dissipate quickly. Chlorine gas can cause irritation of the eyes, skin, respiratory tract, and mucous membranes. Sampling personnel will avoid exposure by keeping the sample vial away from the face and avoid breathing the gas. The SDS for HCl is provided at the end of this SSHP.

#### **A.2.2 Physical Hazards**

Physical hazards associated with sampling include being struck by vehicular traffic; lifting, slipping, tripping, and falling; and risk of eye injuries from working with hand tools. The best means of protection against accidents related to physical hazards are careful control of equipment activities in the planned work area; and use of experienced and safety- and health-trained field personnel.

##### **A.2.2.1 Slips, Trips, and Falls**

The most common hazards on a project site are typically slips, trips, and falls. These hazards will be reduced through the following practices:

- Personnel will stay alert to their surroundings.
- Access ways will be kept free of materials, supplies, and obstructions at all times.
- Equipment and other materials will be located so as not to cause tripping or other hazards.
- Personnel will be aware of potential tripping hazards associated with vegetation, debris and uneven ground.
- Personnel will be aware of limitations imposed by work clothing and personal protective equipment (PPE).

The project site may be inherently hazardous due to the presence of rain, snow, and ice, which can alter the character of the ground surface. The risk for slips, trips, and falls by site workers is increased due to wet or icy surfaces; therefore, workers will use caution when moving about the site.

### **A.2.2.2 Insects and Animals**

During the summer months in Fairbanks, mosquitoes, “white socks,” and “no-see-ums” are common in areas predominantly covered with vegetation. Wearing appropriate PPE should be sufficient to protect site workers. Personnel who use insect repellent should be aware its constituents may be detected by volatile analysis. Since wild and domestic animals may approach the work site, all food products shall remain inside vehicles.

### **A.2.2.3 Temperature Stress**

Wearing PPE may put a worker at risk of developing heat stress; however, since the activities will generally be conducted in Level D PPE, the risk of heat stress is considered low. Cold stress/injury due to hypothermia will be guarded against by wearing appropriate clothing, having warm shelter available, scheduling rest periods, and self-monitoring physical and mental conditions.

### **A.2.2.4 Lifting Hazards**

Moving heavy objects, including sample coolers, presents a lifting hazard. Personnel will use proper lifting techniques and obtain assistance when lifting objects weighing more than 40 pounds.

## **A.2.3 Other Hazards**

The following hazards are not expected to be present on this project:

- confined spaces;
- fire;
- explosion;
- noise;
- biological hazards; and/or
- ionizing radiation.

## **A.3 RESPONSIBILITIES, TRAINING, AND MEDICAL SURVEILLANCE**

### **A.3.1 Assignment of Responsibilities**

Shannon & Wilson field personnel are responsible for understanding and complying with the requirements of this SSHP. Following is a list of responsibilities of all Shannon & Wilson personnel working on the site:

- Review and follow this SSHP.

- Attend and participate in safety meetings.
- Take appropriate action as described in this SSHP regarding accidents, fires, or other emergency situations.
- Take all reasonable precautions to prevent injury to themselves and their fellow workers.
- Perform only those tasks they believe they can do safely, and immediately report any accidents or unsafe conditions to the Field Superintendent.
- Halt work, by themselves or others, if they observe an unsafe act or potential unsafe working condition.
- Report accidents, illnesses, and near-misses to the Shannon & Wilson Office Health and Safety Manager.

### **A.3.2 Personnel Training**

Shannon & Wilson personnel performing activities on this project and under this plan have completed the appropriate training requirements specified in 29 CFR 1910.120(e). Each individual has completed an annual eight-hour refresher-training course and/or initial 40-hour training course within the last year.

A personal acknowledgement form will be completed for each person on the site, documenting they have read and understand this SSHP.

### **A.3.3 Medical Surveillance Program**

Field personnel performing activities on the site covered by this SSHP have undergone baseline and annual physical/medical examinations as part of Shannon & Wilson's Corporate Health & Safety Plan. All field personnel are active participants in Shannon & Wilson's Medical Monitoring Program or a similar one, which complies with 29 CFR 1910.120(f).

## **A.4 PERSONAL PROTECTIVE EQUIPMENT**

PPE will be required during the course of the field work. PPE selection will be based primarily on work-task requirements and potential exposure. Field personnel will use Level D protective equipment during normal work activities. Personnel are trained in the use of PPE that is, or may be, required.

All personnel shall wear as a minimum:

- safety-toed boots
- high-visibility safety vest;
- gloves;
- hard hat (unless no overhead hazard is present);



- standard work clothes or cotton overalls; and
- safety glasses.

Disposable nitrile gloves will be worn during collection of all samples, and ear protection worn during any drilling activities.

## **A.5 DECONTAMINATION PROCEDURES**

Decontamination procedures for personnel and equipment are necessary to control contamination and protect field personnel.

### **A.5.1 Equipment Decontamination**

Reusable sampling equipment will be decontaminated using procedures outlined in Section 6.4.

### **A.5.2 Personnel Decontamination**

Shannon & Wilson will conduct sampling activities in Level D PPE. For this reason, personnel will not be decontaminated when leaving the work site unless gross visual contamination of protective clothing is present.

## **A.6 ACCIDENTS AND EMERGENCIES**

Shannon & Wilson field personnel are current in first aid and cardiopulmonary resuscitation training. At a minimum, the following site-safety equipment and first-aid supplies shall be available in the field:

- PPE and clothing specialized for known site hazards;
- first-aid kit, including first-aid booklet;
- portable eye wash;
- clean water in portable containers;
- other decontamination supplies; and
- fire extinguisher.

Shannon & Wilson's Corporate Health & Safety Plan requires accident reporting when there is a site-related accident, near-miss incident, or medical emergency. If an employee is treated by medical personnel, the medical attendant will complete an Incident Medical Treatment Documentation form. Completion of an Alaska Department of Labor Report of Occupational Injury or Illness is also required within 10 days for any work-related injury or illness.

**SITE SAFETY & HEALTH PLAN  
PERSONAL ACKNOWLEDGEMENT FORM**

**Annual Groundwater Monitoring and  
3-Year Vapor Intrusion Evaluation  
Bentley East Satellite  
Fairbanks, Alaska**

I have reviewed this document and understand its contents and requirements. A copy of the above-referenced document has been made available to me. I agree to abide by the requirements of this Site Safety & Health Plan.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Name (printed)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Representing

## SECTION 1: Identification of the substance/mixture and of the company/undertaking

- **1.1 Product identifier**
- **Trade name:** Trichloroethylene pure
- **Article number:** A2724
- **CAS Number:**  
79-01-6
- **EC number:**  
201-167-4
- **Index number:**  
602-027-00-9
- **1.2 Relevant identified uses of the substance or mixture and uses advised against**  
No further relevant information available.
- **Application of the substance / the mixture**  
Chemical for various applications  
Laboratory chemical
- **1.3 Details of the supplier of the safety data sheet**
- **Manufacturer/Supplier:**  
AppliChem GmbH  
Ottoweg 4  
D-64291 Darmstadt  
Tel.: +49 (0)6151 93570  
msds@applichem.com
- **Further information obtainable from:** Abteilung Qualitätskontrolle / Dep. Quality Control
- **1.4 Emergency telephone number:**  
+49(0)6151 93570 (während der normalen Geschäftszeiten / Inside normal business hours)

## SECTION 2: Hazards identification

- **2.1 Classification of the substance or mixture**
- **Classification according to Regulation (EC) No 1272/2008**

Muta. 2	H341 Suspected of causing genetic defects.
Carc. 1B	H350 May cause cancer.
Skin Irrit. 2	H315 Causes skin irritation.
Eye Irrit. 2	H319 Causes serious eye irritation.
STOT SE 3	H336 May cause drowsiness or dizziness.
Aquatic Chronic 3	H412 Harmful to aquatic life with long lasting effects.
- **Classification according to Directive 67/548/EEC or Directive 1999/45/EC**

T; Toxic	
Carc. Cat. 2	
R45:	May cause cancer.
.....	
Xi; Irritant	
R36/38:	Irritating to eyes and skin.
R52/53-67:	Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Vapours may cause drowsiness and dizziness.
Muta. Cat. 3	
- **Information concerning particular hazards for human and environment:** Not applicable.

(Contd. on page 2)

**Trade name: Trichloroethylene pure**

(Contd. of page 1)

- **2.2 Label elements**
- **Labelling according to Regulation (EC) No 1272/2008**  
The substance is classified and labelled according to the CLP regulation.
- **Hazard pictograms**



GHS07 GHS08

- **Signal word** *Danger*
- **Hazard-determining components of labelling:**  
*trichloroethylene*
- **Hazard statements**  
*H315 Causes skin irritation.*  
*H319 Causes serious eye irritation.*  
*H341 Suspected of causing genetic defects.*  
*H350 May cause cancer.*  
*H336 May cause drowsiness or dizziness.*  
*H412 Harmful to aquatic life with long lasting effects.*
- **Precautionary statements**  
*P273 Avoid release to the environment.*  
*P201 Obtain special instructions before use.*  
*P305+P351+P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.*  
*P308+P313 IF exposed or concerned: Get medical advice/attention.*  
*P302+P352 IF ON SKIN: Wash with plenty of soap and water.*
- **2.3 Other hazards**
- **Results of PBT and vPvB assessment**
- **PBT:** *Not applicable.*
- **vPvB:** *Not applicable.*

### SECTION 3: Composition/information on ingredients

- **3.1 Chemical characterisation: Substances**
- **CAS No. Description**  
*79-01-6 trichloroethylene*
- **Identification number(s)**
- **EC number:** *201-167-4*
- **Index number:** *602-027-00-9*

· **SVHC**

79-01-6 trichloroethylene

### SECTION 4: First aid measures

- **4.1 Description of first aid measures**
- **After inhalation:** *Supply fresh air or oxygen; call for doctor.*
- **After skin contact:**  
*Wash off with plenty of water.*  
*Immediately remove any clothing soiled by the product.*  
*Seek medical treatment.*
- **After eye contact:**  
*Rinse opened eye for several minutes under running water.*  
*Call a doctor immediately.*
- **After swallowing:**  
*Laxative: Sodium sulfate (1 tablespoon/ 1/4 L water)*

(Contd. on page 3)

**Trade name: Trichloroethylene pure**

(Contd. of page 2)

Subsequently administer:  
activated charcoal (20 - 40 g in 10 % slurry)  
Call a doctor immediately.

- **4.2 Most important symptoms and effects, both acute and delayed** No further relevant information available.
- **4.3 Indication of any immediate medical attention and special treatment needed**  
No further relevant information available.

## SECTION 5: Firefighting measures

- **5.1 Extinguishing media**
- **Suitable extinguishing agents:** Use fire extinguishing methods suitable to surrounding conditions.
- **5.2 Special hazards arising from the substance or mixture**  
Non-combustible.  
In case of fire, the following can be released:  
Hydrogen chloride (HCl)  
Ambient fire may liberate hazardous vapours.
- **5.3 Advice for firefighters**
- **Protective equipment:** Wear self-contained respiratory protective device.
- **Additional information**  
Dispose of fire debris and contaminated fire fighting water in accordance with official regulations.  
Contain escaping vapours with water.

## SECTION 6: Accidental release measures

- **6.1 Personal precautions, protective equipment and emergency procedures**  
Do not inhale steams/aerosols.  
Avoid substance contact.  
Ensure adequate ventilation
- **6.2 Environmental precautions:**  
Inform respective authorities in case of seepage into water course or sewage system.  
Do not allow to enter sewers/ surface or ground water.
- **6.3 Methods and material for containment and cleaning up:**  
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).  
Dispose contaminated material as waste according to item 13.  
Clean up affected area.
- **6.4 Reference to other sections**  
See Section 7 for information on safe handling.  
See Section 8 for information on personal protection equipment.  
See Section 13 for disposal information.

## SECTION 7: Handling and storage

- **7.1 Precautions for safe handling** Open and handle receptacle with care.
- **Information about fire - and explosion protection:** Keep respiratory protective device available.
- **7.2 Conditions for safe storage, including any incompatibilities**
- **Storage:**
- **Requirements to be met by storerooms and receptacles:** Prevent any seepage into the ground.
- **Information about storage in one common storage facility:** Not required.
- **Further information about storage conditions:**  
Keep container tightly sealed.  
Store under lock and key and with access restricted to technical experts or their assistants only.
- **Recommended storage temperature:** 15-25 °C
- **Storage class:** 6.1 D

(Contd. on page 4)

**Trade name: Trichloroethylene pure**

(Contd. of page 3)

· **7.3 Specific end use(s)** No further relevant information available.

## SECTION 8: Exposure controls/personal protection

· **Additional information about design of technical facilities:** No further data; see item 7.

· **8.1 Control parameters**

· **Ingredients with limit values that require monitoring at the workplace:**

**79-01-6 trichloroethylene**

WEL	Short-term value: 820 mg/m <sup>3</sup> , 150 ppm Long-term value: 550 mg/m <sup>3</sup> , 100 ppm Carc.; Sk
-----	--

· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**

· **Personal protective equipment:**

· **General protective and hygienic measures:**

Keep away from foodstuffs, beverages and feed.

Immediately remove all soiled and contaminated clothing

Wash hands before breaks and at the end of work.

Store protective clothing separately.

Avoid contact with the eyes and skin.

· **Respiratory protection:**

Respiratory protection required when vapours/aerosols are generated.

Filter A

· **Protection of hands:**



Protective gloves

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.

Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**

The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.

· **Penetration time of glove material**

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **For the permanent contact gloves made of the following materials are suitable:**

Recommended thickness of the material:  $\geq 0.70$  mm

Fluorocarbon rubber (Viton)

Value for the permeation: Level  $\geq 480$  min

· **As protection from splashes gloves made of the following materials are suitable:**

Nitrile rubber, NBR

Recommended thickness of the material:  $\geq 0.40$  mm

Value for the permeation: Level  $\geq 10$  min

· **Eye protection:**



Tightly sealed goggles

(Contd. on page 5)

**Trade name:** Trichloroethylene pure

(Contd. of page 4)

- **Body protection:**  
Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled.

## SECTION 9: Physical and chemical properties

### · 9.1 Information on basic physical and chemical properties

#### · General Information

#### · Appearance:

· <b>Form:</b>	Fluid
· <b>Colour:</b>	Colourless
· <b>Odour:</b>	Sweetish
· <b>Odour threshold:</b>	Not determined.

· **pH-value:** Not determined.

#### · Change in condition

· <b>Melting point/Melting range:</b>	-87 °C
· <b>Boiling point/Boiling range:</b>	87 °C

· **Flash point:** Not applicable.

· **Flammability (solid, gaseous):** Not applicable.

· **Ignition temperature:** 410 °C

· **Decomposition temperature:** Not determined.

· **Self-igniting:** Not determined.

· **Danger of explosion:** Product does not present an explosion hazard.

#### · Explosion limits:

· <b>Lower:</b>	7.9 Vol %
· <b>Upper:</b>	99 Vol %

· **Vapour pressure at 20 °C:** 60 hPa

· <b>Density at 20 °C:</b>	1.46 g/cm <sup>3</sup>
· <b>Relative density</b>	Not determined.
· <b>Vapour density</b>	Not determined.
· <b>Evaporation rate</b>	Not determined.

· **Solubility in / Miscibility with water at 20 °C:** 1 g/l

· **Partition coefficient (n-octanol/water):** Not determined.

#### · Viscosity:

· <b>Dynamic:</b>	Not determined.
· <b>Kinematic:</b>	Not determined.

#### · Solvent content:

· <b>Organic solvents:</b>	100.0 %
· <b>VOC (EC)</b>	100.00 %

· **9.2 Other information** No further relevant information available.

## SECTION 10: Stability and reactivity

- **10.1 Reactivity**
- **10.2 Chemical stability**
- **Thermal decomposition / conditions to be avoided:** Strong heating

(Contd. on page 6)

Trade name: Trichloroethylene pure

(Contd. of page 5)

· **10.3 Possibility of hazardous reactions**

Violent reactions possible with:  
metals

- **10.4 Conditions to avoid** No further relevant information available.
- **10.5 Incompatible materials:** No further relevant information available.
- **10.6 Hazardous decomposition products:** In the event of fire: See chapter 5

· **Additional information:**

Incompatible with:  
varous plastics

### SECTION 11: Toxicological information

· **11.1 Information on toxicological effects**

- **Acute toxicity:**
- **LD/LC50 values relevant for classification:**

· Components	Type	Value	Species
<b>79-01-6 trichloroethylene</b>			
Oral	LD50	4920 mg/kg (rat)	
Dermal	LD50	29000 mg/kg (rabbit)	

· **Primary irritant effect:**

- **on the skin:** Irritant to skin and mucous membranes.
- **on the eye:** Severe irritations.
- **After inhalation:** Irritant to skin and mucous membranes.
- **Sensitisation:** No sensitising effects known.
- **CMR effects (carcinogenity, mutagenicity and toxicity for reproduction)**  
Muta. 2, Carc. 1B

### SECTION 12: Ecological information

- **12.2 Persistence and degradability** Not easily biodegradable
- **12.3 Bioaccumulative potential** No further relevant information available.
- **12.4 Mobility in soil** No further relevant information available.
- **Ecotoxicological effects:**
- **Remark:** Harmful to fish
- **Additional ecological information:**
- **General notes:**  
Do not allow product to reach ground water, water course or sewage system, even in small quantities.  
Harmful to aquatic organisms  
Water hazard class 3 (German Regulation) (Assessment by list): extremely hazardous for water  
Danger to drinking water if even extremely small quantities leak into the ground.
- **12.5 Results of PBT and vPvB assessment**
- **PBT:** Not applicable.
- **vPvB:** Not applicable.
- **12.6 Other adverse effects** No further relevant information available.

### SECTION 13: Disposal considerations

- **13.1 Waste treatment methods**
- **Recommendation**  
Chemicals must be disposed of in compliance with the respective national regulations.  
Must not be disposed together with household garbage. Do not allow product to reach sewage system.

(Contd. on page 7)





**Trade name: Trichloroethylene pure**

(Contd. of page 6)

- **Uncleaned packaging:**
- **Recommendation:**  
 Disposal must be made according to official regulations.  
 Packagings that may not be cleansed are to be disposed of in the same manner as the product.

**SECTION 14: Transport information**

· <b>14.1 UN-Number</b> · <b>ADR, IMDG, IATA</b>	UN1710
· <b>14.2 UN proper shipping name</b> · <b>ADR, IMDG, IATA</b>	TRICHLOROETHYLENE
· <b>14.3 Transport hazard class(es)</b> · <b>ADR</b>	
	
· <b>Class</b> · <b>Label</b>	6.1 (T1) Toxic substances. 6.1
· <b>IMDG, IATA</b>	
	
· <b>Class</b> · <b>Label</b>	6.1 Toxic substances. 6.1
· <b>14.4 Packing group</b> · <b>ADR, IMDG, IATA</b>	III
· <b>14.5 Environmental hazards:</b> · <b>Marine pollutant:</b>	No
· <b>14.6 Special precautions for user</b> · <b>Danger code (Kemler):</b> · <b>EMS Number:</b> · <b>Segregation groups</b>	Warning: Toxic substances. 60 F-A,S-A Liquid halogenated hydrocarbons
· <b>14.7 Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code</b>	Not applicable.
· <b>Transport/Additional information:</b>	
· <b>ADR</b> · <b>Limited quantities (LQ)</b> · <b>Excepted quantities (EQ)</b>	5L Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml
· <b>Transport category</b> · <b>Tunnel restriction code</b>	2 E
· <b>IMDG</b> · <b>Limited quantities (LQ)</b> · <b>Excepted quantities (EQ)</b>	5L Code: E1 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 1000 ml

(Contd. on page 8)

**Trade name: Trichloroethylene pure**

(Contd. of page 7)

· **UN "Model Regulation":** UN1710, TRICHLOROETHYLENE, 6.1, III

### **SECTION 15: Regulatory information**

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**

· **National regulations:**

· **Information about limitation of use:**

Workers are not allowed to be exposed to this hazardous material. Exceptions can be made by the authorities in certain cases.

· **Other regulations, limitations and prohibitive regulations**

· **Substances of very high concern (SVHC) according to REACH, Article 57**

79-01-6 trichloroethylene

· **15.2 Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

### **SECTION 16: Other information**

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing MSDS:** Abteilung Qualitätskontrolle / Dept. Quality Control

· **Contact:** Hr. / Mr. Th. Stöckle

· **Abbreviations and acronyms:**

RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)

ICAO: International Civil Aviation Organisation

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)

IMDG: International Maritime Code for Dangerous Goods

IATA: International Air Transport Association

GHS: Globally Harmonised System of Classification and Labelling of Chemicals

EINECS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

VOC: Volatile Organic Compounds (USA, EU)

LC50: Lethal concentration, 50 percent

LD50: Lethal dose, 50 percent

Skin Irrit. 2: Skin corrosion/irritation, Hazard Category 2

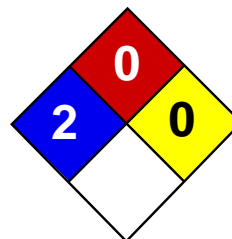
Eye Irrit. 2: Serious eye damage/eye irritation, Hazard Category 2

Muta. 2: Germ cell mutagenicity, Hazard Category 2

Carc. 1B: Carcinogenicity, Hazard Category 1B

STOT SE 3: Specific target organ toxicity - Single exposure, Hazard Category 3

Aquatic Chronic 3: Hazardous to the aquatic environment - Chronic Hazard, Category 3



Health	2
Fire	0
Reactivity	0
Personal Protection	G

## Material Safety Data Sheet Tetrachloroethylene MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** Tetrachloroethylene

**Catalog Codes:** SLT3220

**CAS#:** 127-18-4

**RTECS:** KX3850000

**TSCA:** TSCA 8(b) inventory: Tetrachloroethylene

**CI#:** Not available.

**Synonym:** Perchloroethylene; 1,1,2,2-Tetrachloroethylene; Carbon bichloride; Carbon dichloride; Ankilostin; Didakene; Dilatin PT; Ethene, tetrachloro-; Ethylene tetrachloride; Perawin; Perchlor; Perclene; Perclene D; Percosolve; Tetrachloroethene; Tetraleno; Tetralex; Tetravec; Tetroguer; Tetropil

**Chemical Name:** Ethylene, tetrachloro-

**Chemical Formula:** C<sub>2</sub>-Cl<sub>4</sub>

**Contact Information:**

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**  
1-800-424-9300

**International CHEMTREC, call:** 1-703-527-3887

**For non-emergency assistance, call:** 1-281-441-4400

### Section 2: Composition and Information on Ingredients

**Composition:**

Name	CAS #	% by Weight
Tetrachloroethylene	127-18-4	100

**Toxicological Data on Ingredients:** Tetrachloroethylene: ORAL (LD50): Acute: 2629 mg/kg [Rat]. DERMAL (LD): Acute: >3228 mg/kg [Rabbit]. MIST(LC50): Acute: 34200 mg/m 8 hours [Rat]. VAPOR (LC50 ): Acute: 5200 ppm 4 hours [Mouse].

### Section 3: Hazards Identification

**Potential Acute Health Effects:**

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of eye contact (irritant), of ingestion.

**Potential Chronic Health Effects:**

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (anticipated carcinogen) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, peripheral nervous system, respiratory tract, skin, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

## Section 4: First Aid Measures

### Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

### Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

### Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

### Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

### Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

### Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

**Serious Ingestion:** Not available.

## Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** Not applicable.

**Explosion Hazards in Presence of Various Substances:**

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

**Fire Fighting Media and Instructions:** Not applicable.

**Special Remarks on Fire Hazards:** Not available.

**Special Remarks on Explosion Hazards:** Not available.

## Section 6: Accidental Release Measures

**Small Spill:** Absorb with an inert material and put the spilled material in an appropriate waste disposal.

### Large Spill:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

**Precautions:**

Do not ingest. Do not breathe gas/fumes/ vapor/spray. Avoid contact with skin. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, metals, acids, alkalis.

**Storage:** Keep container tightly closed. Keep container in a cool, well-ventilated area.

## Section 8: Exposure Controls/Personal Protection

**Engineering Controls:**

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value.

**Personal Protection:**

Safety glasses. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

**Personal Protection in Case of a Large Spill:**

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

**Exposure Limits:**

TWA: 25 (ppm) from OSHA (PEL) [United States] TWA: 25 STEL: 100 (ppm) from ACGIH (TLV) [United States] TWA: 170 (mg/m3) from OSHA (PEL) [United States] Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Ethereal.

**Taste:** Not available.

**Molecular Weight:** 165.83 g/mole

**Color:** Clear Colorless.

**pH (1% soln/water):** Not available.

**Boiling Point:** 121.3°C (250.3°F)

**Melting Point:** -22.3°C (-8.1°F)

**Critical Temperature:** 347.1°C (656.8°F)

**Specific Gravity:** 1.6227 (Water = 1)

**Vapor Pressure:** 1.7 kPa (@ 20°C)

**Vapor Density:** 5.7 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 5 - 50 ppm

**Water/Oil Dist. Coeff.:** The product is more soluble in oil; log(oil/water) = 3.4

**Ionicity (in Water):** Not available.

**Dispersion Properties:** Not available.

**Solubility:**

Miscible with alcohol, ether, chloroform, benzene, hexane. It dissolves in most of the fixed and volatile oils. Solubility in water: 0.015 g/100 ml @ 25 deg. C It slowly decomposes in water to yield Trichloroacetic and Hydrochloric acids.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials

**Incompatibility with various substances:** Reactive with oxidizing agents, metals, acids, alkalis.

**Corrosivity:** Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

Oxidized by strong oxidizing agents. Incompatible with sodium hydroxide, finely divided or powdered metals such as zinc, aluminum, magnesium, potassium, chemically active metals such as lithium, beryllium, barium. Protect from light.

**Special Remarks on Corrosivity:** Slowly corrodes aluminum, iron, and zinc.

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Eye contact. Inhalation. Ingestion.

**Toxicity to Animals:**

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 2629 mg/kg [Rat]. Acute dermal toxicity (LD50): >3228 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 5200 4 hours [Mouse].

**Chronic Effects on Humans:**

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH. Classified 2A (Probable for human.) by IARC, 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, peripheral nervous system, upper respiratory tract, skin, central nervous system (CNS).

**Other Toxic Effects on Humans:**

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of skin contact (permeator), of ingestion.

**Special Remarks on Toxicity to Animals:**

Lowest Published Lethal Dose/Conc: LDL [Rabbit] - Route: Oral; Dose: 5000 mg/kg LDL [Dog] - Route: Oral; Dose: 4000 mg/kg LDL [Cat] - Route: Oral; Dose: 4000 mg/kg

**Special Remarks on Chronic Effects on Humans:**

May cause adverse reproductive effects and birth defects (teratogenic). May affect genetic material (mutagenic). May cause cancer.

**Special Remarks on other Toxic Effects on Humans:**

Acute Potential Health Effects: Skin: Causes skin irritation with possible dermal blistering or burns. Symptoms may include redness, itching, pain, and possible dermal blistering or burns. It may be absorbed through the skin with possible systemic effects. A single prolonged skin exposure is not likely to result in the material being absorbed in harmful amounts. Eyes: Contact causes transient eye irritation, lacrimation. Vapors cause eye/conjunctival irritation. Symptoms may include redness and pain. Inhalation: The main route to occupational exposure is by inhalation since it is readily absorbed through the lungs. It causes respiratory tract irritation, . It can affect behavior/central nervous system (CNS depressant and anesthesia ranging from slight inebriation to death, vertigo, somnolence, anxiety, headache, excitement, hallucinations, muscle incoordination, dizziness, lightheadness, disorientation, seizures, emotional instability, stupor, coma). It may cause pulmonary edema Ingestion: It can cause nausea, vomiting, anorexia, diarrhea, bloody stool. It may affect the liver, urinary system (proteinuria, hematuria, renal failure, renal tubular disorder), heart (arrhythmias). It may affect behavior/central nervous system with symptoms similar to that of inhalation. Chronic Potential Health Effects: Skin: Prolonged or repeated skin contact may result in excessive drying of the skin, and irritation. Ingestion/Inhalation: Chronic exposure can affect the liver (hepatitis, fatty liver degeneration), kidneys, spleen, and heart (irregular heartbeat/arrhythmias, cardiomyopathy, abnormal EEG), brain, behavior/central nervous system/peripheral nervous system (impaired memory, numbness of extremities, peripheral neuropathy and other

## Section 12: Ecological Information

### Ecotoxicity:

Ecotoxicity in water (LC50): 18.4 mg/l 96 hours [Fish (Fathead Minnow)]. 18 mg/l 48 hours [Daphnia (daphnia)]. 5 mg/l 96 hours [Fish (Rainbow Trout)]. 13 mg/l 96 hours [Fish (Bluegill sunfish)].

**BOD5 and COD:** Not available.

### Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The product itself and its products of degradation are not toxic.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

### Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

## Section 14: Transport Information

**DOT Classification:** CLASS 6.1: Poisonous material.

**Identification:** : Tetrachloroethylene UNNA: 1897 PG: III

**Special Provisions for Transport:** Marine Pollutant

## Section 15: Other Regulatory Information

### Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Tetrachloroethylene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Tetrachloroethylene Connecticut hazardous material survey.: Tetrachloroethylene Illinois toxic substances disclosure to employee act: Tetrachloroethylene Illinois chemical safety act: Tetrachloroethylene New York release reporting list: Tetrachloroethylene Rhode Island RTK hazardous substances: Tetrachloroethylene Pennsylvania RTK: Tetrachloroethylene Minnesota: Tetrachloroethylene Michigan critical material: Tetrachloroethylene Massachusetts RTK: Tetrachloroethylene Massachusetts spill list: Tetrachloroethylene New Jersey: Tetrachloroethylene New Jersey spill list: Tetrachloroethylene Louisiana spill reporting: Tetrachloroethylene California Director's List of Hazardous Substances: Tetrachloroethylene TSCA 8(b) inventory: Tetrachloroethylene TSCA 8(d) H and S data reporting: Tetrachloroethylene Effective date: 6/1/87; Sunset date: 6/1/97 SARA 313 toxic chemical notification and release reporting: Tetrachloroethylene CERCLA: Hazardous substances.: Tetrachloroethylene: 100 lbs. (45.36 kg)

### Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

### Other Classifications:

#### WHMIS (Canada):

CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

#### DSCL (EEC):

R40- Possible risks of irreversible effects. R51/53- Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. S23- Do not breathe gas/fumes/vapour/spray S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37- Wear suitable gloves. S61- Avoid release to the environment. Refer to special instructions/Safety data sheets.

**HMIS (U.S.A.):**

**Health Hazard:** 2

**Fire Hazard:** 0

**Reactivity:** 0

**Personal Protection:** g

**National Fire Protection Association (U.S.A.):**

**Health:** 2

**Flammability:** 0

**Reactivity:** 0

**Specific hazard:**

**Protective Equipment:**

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

**Section 16: Other Information**

**References:** Not available.

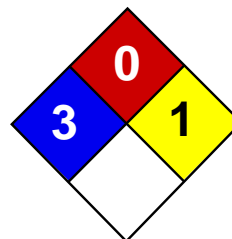
**Other Special Considerations:** Not available.

**Created:** 10/10/2005 08:29 PM

**Last Updated:** 05/21/2013 12:00 PM

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Health	3
Fire	0
Reactivity	1
Personal Protection	

## Material Safety Data Sheet Hydrochloric acid MSDS

### Section 1: Chemical Product and Company Identification

**Product Name:** Hydrochloric acid

**Catalog Codes:** SLH1462, SLH3154

**CAS#:** Mixture.

**RTECS:** MW4025000

**TSCA:** TSCA 8(b) inventory: Hydrochloric acid

**CI#:** Not applicable.

**Synonym:** Hydrochloric Acid; Muriatic Acid

**Chemical Name:** Not applicable.

**Chemical Formula:** Not applicable.

**Contact Information:**

**Sciencelab.com, Inc.**

14025 Smith Rd.

Houston, Texas 77396

US Sales: **1-800-901-7247**

International Sales: **1-281-441-4400**

Order Online: [ScienceLab.com](http://ScienceLab.com)

**CHEMTREC (24HR Emergency Telephone), call:**

1-800-424-9300

**International CHEMTREC, call:** 1-703-527-3887

**For non-emergency assistance, call:** 1-281-441-4400

### Section 2: Composition and Information on Ingredients

**Composition:**

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

**Toxicological Data on Ingredients:** Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

### Section 3: Hazards Identification

**Potential Acute Health Effects:**

Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

**Potential Chronic Health Effects:**

Slightly hazardous in case of skin contact (sensitizer). **CARCINOGENIC EFFECTS:** Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. **MUTAGENIC EFFECTS:** Not available. **TERATOGENIC EFFECTS:** Not available. **DEVELOPMENTAL TOXICITY:** Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

#### Section 4: First Aid Measures

**Eye Contact:**

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

**Skin Contact:**

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

**Serious Skin Contact:**

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

**Inhalation:**

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

**Serious Inhalation:**

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. **WARNING:** It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

**Ingestion:**

If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

**Serious Ingestion:** Not available.

#### Section 5: Fire and Explosion Data

**Flammability of the Product:** Non-flammable.

**Auto-Ignition Temperature:** Not applicable.

**Flash Points:** Not applicable.

**Flammable Limits:** Not applicable.

**Products of Combustion:** Not available.

**Fire Hazards in Presence of Various Substances:** of metals

**Explosion Hazards in Presence of Various Substances:** Non-explosive in presence of open flames and sparks, of shocks.

**Fire Fighting Media and Instructions:** Not applicable.

**Special Remarks on Fire Hazards:**

Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammable gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrogen gas.

**Special Remarks on Explosion Hazards:**

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

## Section 6: Accidental Release Measures

### Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

### Large Spill:

Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

## Section 7: Handling and Storage

### Precautions:

Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

**Storage:** Keep container tightly closed. Keep container in a cool, well-ventilated area.

## Section 8: Exposure Controls/Personal Protection

### Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

### Personal Protection:

Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

### Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

### Exposure Limits:

CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)] Consult local authorities for acceptable exposure limits.

## Section 9: Physical and Chemical Properties

**Physical state and appearance:** Liquid.

**Odor:** Pungent. Irritating (Strong.)

**Taste:** Not available.

**Molecular Weight:** Not applicable.

**Color:** Colorless to light yellow.

**pH (1% soln/water):** Acidic.

**Boiling Point:**

108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

**Melting Point:**

-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

**Critical Temperature:** Not available.

**Specific Gravity:**

1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

**Vapor Pressure:** 16 kPa (@ 20°C) average

**Vapor Density:** 1.267 (Air = 1)

**Volatility:** Not available.

**Odor Threshold:** 0.25 to 10 ppm

**Water/Oil Dist. Coeff.:** Not available.

**Ionicity (in Water):** Not available.

**Dispersion Properties:** See solubility in water, diethyl ether.

**Solubility:** Soluble in cold water, hot water, diethyl ether.

## Section 10: Stability and Reactivity Data

**Stability:** The product is stable.

**Instability Temperature:** Not available.

**Conditions of Instability:** Incompatible materials, water

**Incompatibility with various substances:**

Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

**Corrosivity:**

Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

**Special Remarks on Reactivity:**

Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalis (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothermic reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the following can cause explosion or ignition on contact or

**Special Remarks on Corrosivity:**

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinum, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

**Polymerization:** Will not occur.

## Section 11: Toxicological Information

**Routes of Entry:** Absorbed through skin. Dermal contact. Eye contact. Inhalation.

**Toxicity to Animals:**

Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

**Chronic Effects on Humans:**

CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

**Other Toxic Effects on Humans:**

Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

**Special Remarks on Toxicity to Animals:**

Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

**Special Remarks on Chronic Effects on Humans:**

May cause adverse reproductive effects (fetotoxicity). May affect genetic material.

**Special Remarks on other Toxic Effects on Humans:**

Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjunctivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and laryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well as headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomiting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophageal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

## Section 12: Ecological Information

**Ecotoxicity:** Not available.

**BOD5 and COD:** Not available.

**Products of Biodegradation:**

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

**Toxicity of the Products of Biodegradation:** The products of degradation are less toxic than the product itself.

**Special Remarks on the Products of Biodegradation:** Not available.

## Section 13: Disposal Considerations

**Waste Disposal:**

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

## Section 14: Transport Information

**DOT Classification:** Class 8: Corrosive material

**Identification:** : Hydrochloric acid, solution UNNA: 1789 PG: II

**Special Provisions for Transport:** Not available.

## Section 15: Other Regulatory Information

### Federal and State Regulations:

Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

### Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

### Other Classifications:

#### WHMIS (Canada):

CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

#### DSCL (EEC):

R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

#### HMIS (U.S.A.):

**Health Hazard:** 3

**Fire Hazard:** 0

**Reactivity:** 1

**Personal Protection:**

#### National Fire Protection Association (U.S.A.):

**Health:** 3

**Flammability:** 0

**Reactivity:** 1

**Specific hazard:**

#### Protective Equipment:

Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

## Section 16: Other Information

**References:**

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Industrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangereuses au Canada. Centre de conformité international Ltée. 1986.

**Other Special Considerations:** Not available.

**Created:** 10/09/2005 05:45 PM

**Last Updated:** 05/21/2013 12:00 PM

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**APPENDIX B**  
**CONCEPTUAL SITE MODEL GRAPHIC**



# HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Bentley Mall East Satellite  
 ADEC File No. 102.38.122

Completed By: Sheila Hinckley/Shannon & Wilson, Inc.  
 Date Completed: October 2018

**Instructions:** Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.

(1) Check the media that could be directly affected by the release.	(2) For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.
Media	Transport Mechanisms
<input checked="" type="checkbox"/> Surface Soil (0-2 ft bgs)	<input checked="" type="checkbox"/> Direct release to surface soil <i>check soil</i> <input checked="" type="checkbox"/> Migration to subsurface <i>check soil</i> <input checked="" type="checkbox"/> Migration to groundwater <i>check groundwater</i> <input checked="" type="checkbox"/> Volatilization <i>check air</i> <input type="checkbox"/> Runoff or erosion <i>check surface water</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____
<input checked="" type="checkbox"/> Subsurface Soil (2-15 ft bgs)	<input checked="" type="checkbox"/> Direct release to subsurface soil <i>check soil</i> <input checked="" type="checkbox"/> Migration to groundwater <i>check groundwater</i> <input checked="" type="checkbox"/> Volatilization <i>check air</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____
<input checked="" type="checkbox"/> Ground-water	<input checked="" type="checkbox"/> Direct release to groundwater <i>check groundwater</i> <input checked="" type="checkbox"/> Volatilization <i>check air</i> <input type="checkbox"/> Flow to surface water body <i>check surface water</i> <input type="checkbox"/> Flow to sediment <i>check sediment</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____
<input type="checkbox"/> Surface Water	<input type="checkbox"/> Direct release to surface water <i>check surface water</i> <input type="checkbox"/> Volatilization <i>check air</i> <input type="checkbox"/> Sedimentation <i>check sediment</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____
<input type="checkbox"/> Sediment	<input type="checkbox"/> Direct release to sediment <i>check sediment</i> <input type="checkbox"/> Resuspension, runoff, or erosion <i>check surface water</i> <input type="checkbox"/> Uptake by plants or animals <i>check biota</i> <input type="checkbox"/> Other (list): _____

(3) Check all exposure media identified in (2).	(4) Check all pathways that could be complete. The pathways identified in this column must agree with Sections 2 and 3 of the Human Health CSM Scoping Form.	(5) Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.						
Exposure Media	Exposure Pathway/Route	Current & Future Receptors						
		Residents (adults or children)	Commercial or Industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
<input checked="" type="checkbox"/> soil	<input checked="" type="checkbox"/> Incidental Soil Ingestion <input type="checkbox"/> Dermal Absorption of Contaminants from Soil <input type="checkbox"/> Inhalation of Fugitive Dust				C/F			
<input checked="" type="checkbox"/> groundwater	<input checked="" type="checkbox"/> Ingestion of Groundwater <input checked="" type="checkbox"/> Dermal Absorption of Contaminants in Groundwater <input type="checkbox"/> Inhalation of Volatile Compounds in Tap Water	C/F	C/F		C/F			
<input checked="" type="checkbox"/> air	<input checked="" type="checkbox"/> Inhalation of Outdoor Air <input checked="" type="checkbox"/> Inhalation of Indoor Air <input type="checkbox"/> Inhalation of Fugitive Dust	C/F	C/F	C/F	C/F			
<input type="checkbox"/> surface water	<input type="checkbox"/> Ingestion of Surface Water <input type="checkbox"/> Dermal Absorption of Contaminants in Surface Water <input type="checkbox"/> Inhalation of Volatile Compounds in Tap Water							
<input type="checkbox"/> sediment	<input type="checkbox"/> Direct Contact with Sediment							
<input type="checkbox"/> biota	<input type="checkbox"/> Ingestion of Wild or Farmed Foods							

**APPENDIX C**  
**FIELD FORMS**



# MONITORING WELL SAMPLING LOG

Owner/Client \_\_\_\_\_ Project No. \_\_\_\_\_  
 Location \_\_\_\_\_ Date \_\_\_\_\_  
 Sampling Personnel \_\_\_\_\_ Well \_\_\_\_\_  
 Weather Conditions \_\_\_\_\_ Air Temp. (°F) \_\_\_\_\_ Time started \_\_\_\_\_  
 Time completed \_\_\_\_\_

Sample No. \_\_\_\_\_ Time \_\_\_\_\_  
 Duplicate \_\_\_\_\_ Analysis: \_\_\_\_\_ Time \_\_\_\_\_ Depth to Water (ft.) \_\_\_\_\_  
 Equipment Blank (EB) \_\_\_\_\_ Analysis: \_\_\_\_\_ Time \_\_\_\_\_ Depth to LNAPL (ft.) \_\_\_\_\_  
 NAPL Thickness (ft.) \_\_\_\_\_  
 Method of NAPL Measurement \_\_\_\_\_

Pump/Controller \_\_\_\_\_  
 Purging Method portable / dedicated pump Diameter and Type of Casing \_\_\_\_\_  
 Pumping Start \_\_\_\_\_ Approximate Total Depth of Well Below MP (ft.) \_\_\_\_\_  
 Purge Rate (gal./min.) \_\_\_\_\_ Measured Total Depth of Well Below MP (ft.) \_\_\_\_\_  
 Pumping End \_\_\_\_\_ Depth to Water Below MP (ft.) \_\_\_\_\_  
 Depth to Ice (if frozen) Below MP (ft.) \_\_\_\_\_  
 Pump Set Depth Below MP (ft.) \_\_\_\_\_ Feet of Water in Well \_\_\_\_\_  
 KuriTec Tubing (ft.) \_\_\_\_\_ Gallons per foot \_\_\_\_\_  
 TruPoly Tubing (ft.) \_\_\_\_\_ Gallons in Well \_\_\_\_\_  
 Silicone Tubing (ft.) \_\_\_\_\_ Gallons in Well x3 = \_\_\_\_\_  
 (also enter on back) Total Gallons Purged \_\_\_\_\_  
 Purge Water Disposal City of N. P. manhole near NPR Gate 1

Monument Condition \_\_\_\_\_  
 \_\_\_\_\_  
 Casing Condition \_\_\_\_\_  
 \_\_\_\_\_  
 Wiring Condition \_\_\_\_\_  
 (dedicated pumps) \_\_\_\_\_

Measuring Point (MP) Top of Casing (TOC) Monument type: Stickup / Flushmount  
 Measurement method: Tape measure

Top-of-casing to monument (ft.) \_\_\_\_\_ Datalogger Type (circle): RT-100 GW WL-16  
 Monument to ground surface (ft.) \_\_\_\_\_ AT-200 LT-700 LT-500  
Other: \_\_\_\_\_ HOBO  
 Datalogger serial #: \_\_\_\_\_  
 Measured cable length (ft) \_\_\_\_\_

- Frost-jacking? Y / N Temperature Logger Present (TidBit)? Y / N
- Lock present and operational
- Well name legible on outside of well (stickup) or inside of well (flushmount)

Notes \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

### WELL CASING VOLUMES

Diameter of Well [ID-inches]	CMT	1¼	2	3	4	6	8
Gallons per lineal foot	0.01057	0.08	0.17	0.38	0.66	1.5	2.6





**INDOOR-AIR SAMPLING FORM**

Address \_\_\_\_\_ Project Number \_\_\_\_\_  
Owner/Occupant \_\_\_\_\_ Project Name \_\_\_\_\_  
Mailing address \_\_\_\_\_ Date \_\_\_\_\_  
\_\_\_\_\_ Time \_\_\_\_\_  
Telephone \_\_\_\_\_ Geo/Eng \_\_\_\_\_  
Relative Humidity \_\_\_\_\_ Barometric Pressure \_\_\_\_\_

Sample Location \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Sample Number \_\_\_\_\_ Time \_\_\_\_\_  
Duplicate \_\_\_\_\_ Time \_\_\_\_\_  
Canister ID \_\_\_\_\_  
Flow Controller ID \_\_\_\_\_  
Purge Rate \_\_\_\_\_ Lab \_\_\_\_\_  
Analysis \_\_\_\_\_

Initial Vacuum \_\_\_\_\_  
Final Pressure \_\_\_\_\_  
Desired Flow Rate \_\_\_\_\_  
Actual Flow Rate \_\_\_\_\_

Notes: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION  
BUILDING INVENTORY AND INDOOR AIR SAMPLING QUESTIONNAIRE**

This form should be prepared by a person familiar with indoor air assessments with assistance from a person knowledgeable about the building. Complete this form for each building where interior samples (e.g., indoor air, crawl space, or subslab soil gas samples) will be collected. Section I of this form should be used to assist in choosing an investigative strategy during workplan development. Section II should be used to assist in identification of complicating factors during a presampling building walk-through.

Preparer's Name \_\_\_\_\_ Date/Time Prepared \_\_\_\_\_

Preparer's Affiliation \_\_\_\_\_ Phone No. \_\_\_\_\_

Purpose of Investigation \_\_\_\_\_

**SECTION I: BUILDING INVENTORY**

**1. OCCUPANT OR BUILDING PERSONNEL:**

**Interviewed: Y / N**

Last Name \_\_\_\_\_ First Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

Phone No. \_\_\_\_\_

Number of Occupants/people at this location \_\_\_\_\_ Age of Occupants \_\_\_\_\_

**2. OWNER or LANDLORD: (Check if same as occupant \_\_\_\_.)**

**Interviewed: Y / N**

Last Name \_\_\_\_\_ First Name \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

Phone No. \_\_\_\_\_

**3. BUILDING CHARACTERISTICS**

**Type of Building:** (Circle appropriate response.)

Residential  
Industrial

School  
Church

Commercial/Multi-use  
Other \_\_\_\_\_

**If the property is residential, what type?** (Circle appropriate response.)



Ranch  
Raised Ranch  
Cape Cod  
Duplex  
Modular

2-Family  
Split Level  
Contemporary  
Apartment House  
Log Home

3-Family  
Colonial  
Mobile Home  
Townhouse/Condo  
Other\_\_\_\_\_

**If multiple units, how many?**\_\_\_\_\_

**If the property is commercial, what type?**

Business types(s)\_\_\_\_\_

Does it include residences (i.e., multi-use)? Y / N

If yes, how many?\_\_\_\_\_

**Other characteristics:**

Number of floors\_\_\_\_\_

Building age\_\_\_\_\_

Is the building insulated? Y / N

How airtight? Tight / Average / Not Tight

**Have occupants noticed chemical odors in the building?**

Y / N

If yes, please describe:\_\_\_\_\_

\_\_\_\_\_

#### 4. AIRFLOW

**Use air current tubes, tracer smoke, or knowledge about the building to evaluate airflow patterns and qualitatively describe:**

Airflow between floors

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Airflow in building near suspected source

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Outdoor air infiltration

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Infiltration into air ducts

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

#### 5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply.)



**Describe the ventilation system in the building, its condition where visible, and the tightness of duct joints. Indicate the location of air supply and exhaust points on the floor plan.**

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**Is there a radon mitigation system for the building/structure? Y / N** Date of Installation\_\_\_\_\_

**Is the system active or passive?**      Active/Passive

**7. OCCUPANCY**

**Is basement/lowest level occupied?**    Full-time      Occasionally    Seldom      Almost never

**Level**      **General Use of Each Floor (e.g., family room, bedroom, laundry, workshop, or storage).**

Basement \_\_\_\_\_

1<sup>st</sup> Floor \_\_\_\_\_

2<sup>nd</sup> Floor \_\_\_\_\_

3<sup>rd</sup> Floor \_\_\_\_\_

**8. WATER AND SEWAGE**

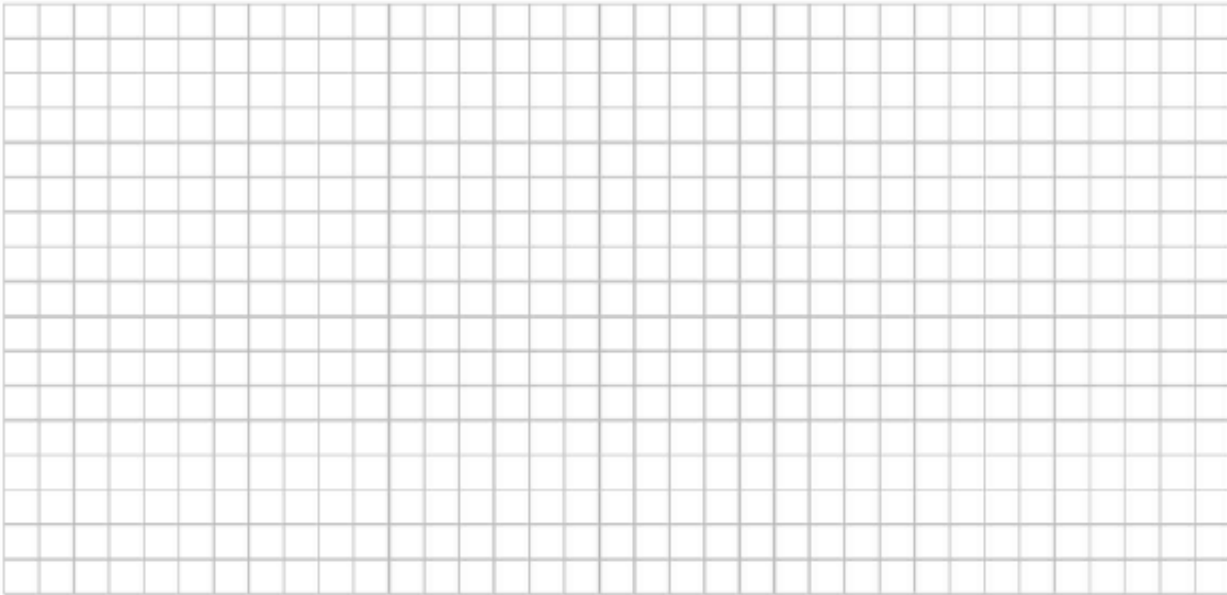
**Water supply:**    Public water    Drilled well    Driven well    Dug well    Other\_\_\_\_\_

**Sewage disposal:**    Public sewer    Septic tank    Leach field    Dry well    Other\_\_\_\_\_

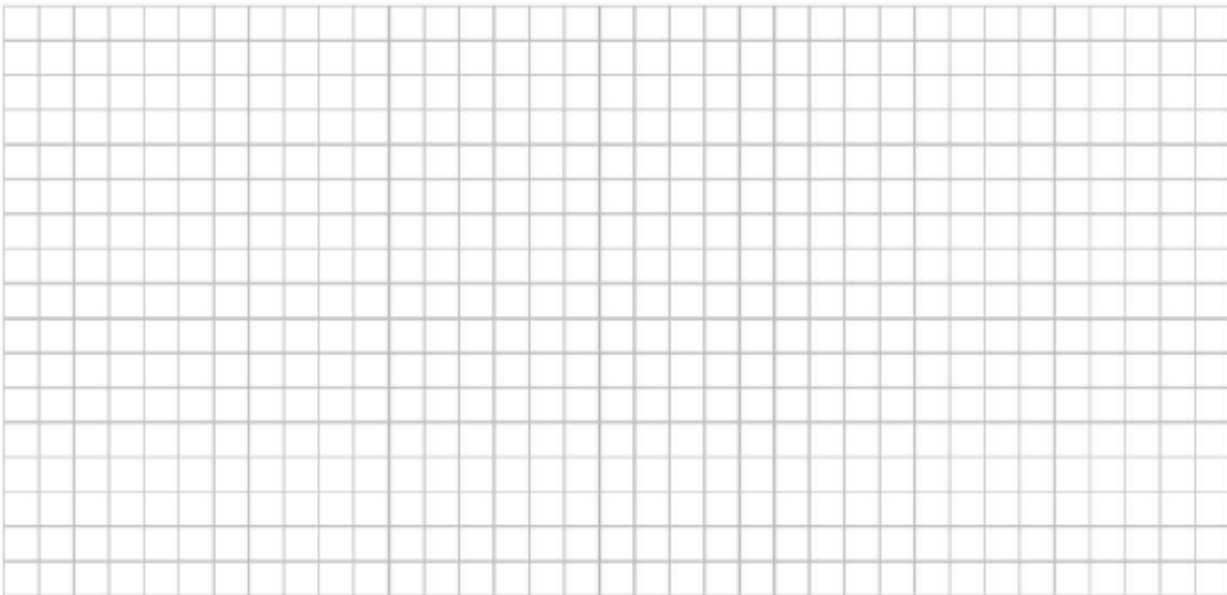
**9. FLOOR PLANS**

**Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note that.**

**Basement:**



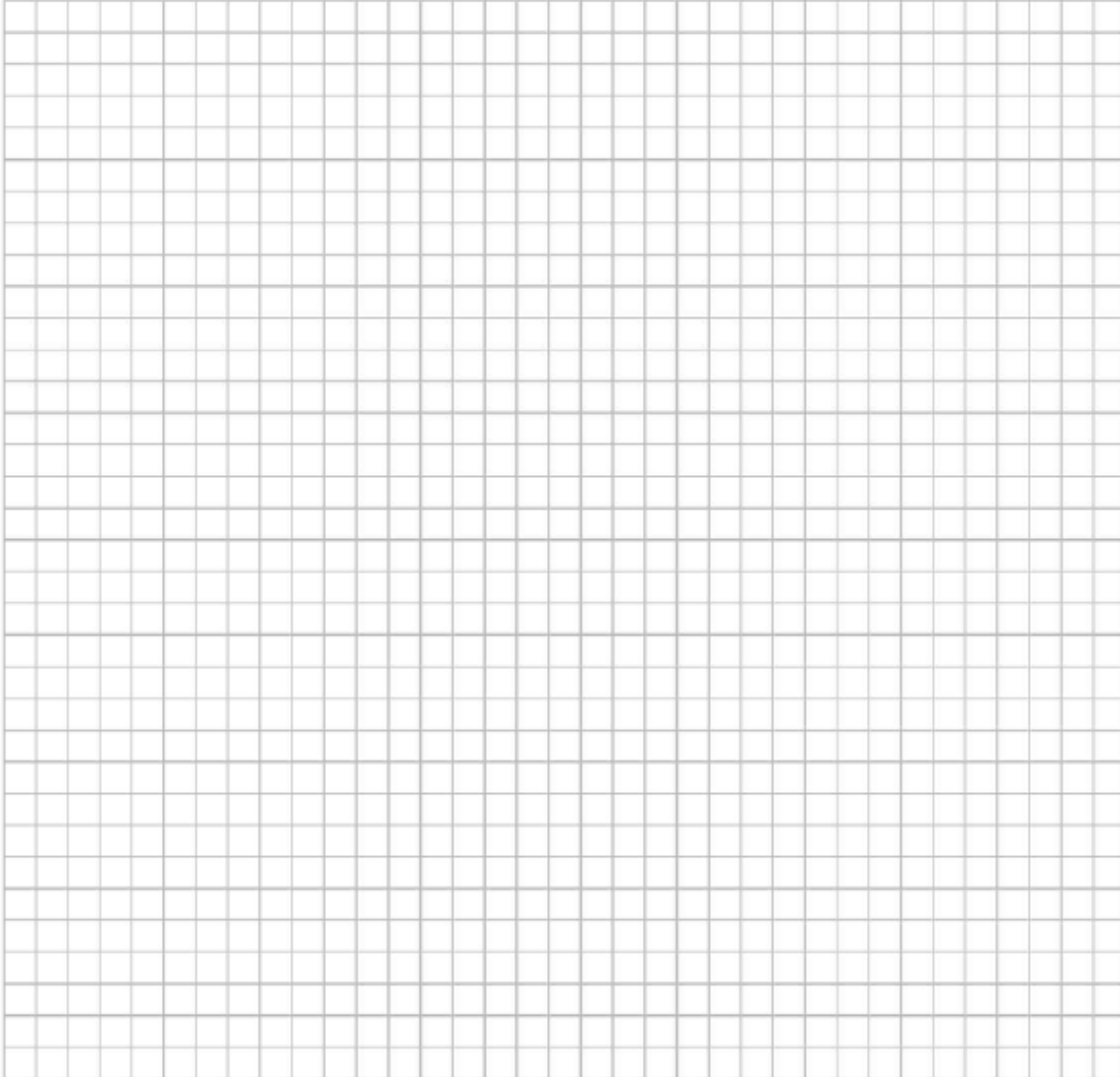
**First Floor:**



**10. OUTDOOR PLOT**

**Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (e.g., industries, gas stations, repair shops, landfills, etc.), outdoor air sampling locations and PID meter readings.**

**Also indicate compass direction, wind direction and speed during sampling, the location of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.**



**SECTION II: INDOOR AIR SAMPLING QUESTIONNAIRE**

This section should be completed during a presampling walk-through. If indoor air sources of COCs are identified and removed, consider ventilating the building prior to sampling. However, ventilation and heating systems should be operating normally for 24 hours prior to sampling.

**a) 1. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY**

- Is there an attached garage?** Y / N
- Does the garage have a separate heating unit?** Y / N / NA
- Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, ATV, or car)** Y / N /NA  
Please specify\_\_\_\_\_
- Has the building ever had a fire?** Y / N When?\_\_\_\_\_
- Is a kerosene or unvented gas space heater present?** Y / N Where?\_\_\_\_\_
- Is there a workshop or hobby/craft area?** Y / N Where and type\_\_\_\_\_
- Is there smoking in the building?** Y / N How frequently?\_\_\_\_\_
- Has painting/staining been done in the last six months?** Y / N Where and when?\_\_\_\_\_
- Is there new carpet, drapes or other textiles?** Y / N Where and when?\_\_\_\_\_
- Is there a kitchen exhaust fan?** Y / N If yes, where is it vented?\_\_\_\_\_
- Is there a bathroom exhaust fan?** Y / N If yes, where is it vented?\_\_\_\_\_
- Is there a clothes dryer?** Y / N If yes, is it vented outside? Y / N

**Are cleaning products, cosmetic products, or pesticides used that could interfere with indoor air sampling?** Y / N

If yes, please describe\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Do any of the building occupants use solvents at work?** Y / N

(For example, is the building used for chemical manufacturing or a laboratory, auto mechanic or auto body shop, painting shop, fuel oil delivery area, or do any of the occupants work as a boiler mechanic, pesticide applicator, or cosmetologist?)

If yes, what types of solvents are used?\_\_\_\_\_

If yes, are his/her/their clothes washed at work? Y / N

**Do any of the building occupants regularly use or work at a dry-cleaning service?** (Circle appropriate response)

- Yes, use dry cleaning regularly (weekly) No
- Yes, use dry cleaning infrequently (monthly or less) Unknown
- Yes, work at a dry cleaning services

**2. PRODUCT INVENTORY FORM** (For use during building walk-through.)

**Make and model of field instrument used:** \_\_\_\_\_

**List specific products found in the residence that have the potential to affect indoor air quality:**

Location	Product Description	Site (units)	Condition <sup>1</sup>	Chemical Ingredients	Field Instrument Reading (units)	Photo <sup>2</sup> <u>Y/N</u>

<sup>1</sup> Describe the condition of the product containers as **Unopened (UO)**, **Used (U)**, or **Deteriorated (D)**.  
<sup>2</sup> Photographs of the front and back of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.

This form was modified from:  
 ITRC (Interstate Technology and Regulatory Council). 2007. *Vapor Intrusion Pathway: A Practical Guideline*. VI-1. Washington, D.C.: Interstate Technology and Regulatory Council, Vapor Intrusion Team. Available at: [www.itrcweb.org](http://www.itrcweb.org).

The Alaska Department of Environmental Conservation's Contaminated Sites Program protects human health and the environment by managing the cleanup of contaminated soil and groundwater in Alaska. For more information, please contact our staff at the Contaminated Sites Program closest to you:  
 Juneau: 907-465-5390 / Anchorage: 907-269-7503  
 Fairbanks: 907-451-2153 / Kenai: 907-262-5210



**CHAIN-OF-CUSTODY RECORD**

**Sample Transportation Notice**

Relinquishing signature on this document indicates that sample is being shipped in compliance with all applicable local, State, Federal, national, and international laws, regulations and ordinances of any kind. Air Toxics Limited assumes no liability with respect to the collection, handling or shipping of these samples. Relinquishing signature also indicates agreement to hold harmless, defend, and indemnify Air Toxics Limited against any claim, demand, or action, of any kind, related to the collection, handling, or shipping of samples. D.O.T. Hotline (800) 467-4922

**180 BLUE RAVINE ROAD, SUITE B  
FOLSOM, CA 95630-4719  
(916) 985-1000 FAX (916) 985-1020**

Page \_\_\_\_ of \_\_\_\_

Project Manager \_\_\_\_\_

Collected by: (Print and Sign) \_\_\_\_\_

Company \_\_\_\_\_ Email \_\_\_\_\_

Address \_\_\_\_\_ City \_\_\_\_\_ State \_\_\_\_\_ Zip \_\_\_\_\_

Phone \_\_\_\_\_ Fax \_\_\_\_\_

<b>Project Info:</b> P.O. # _____ Project # _____ Project Name _____	<b>Turn Around Time:</b> <input type="checkbox"/> Normal <input type="checkbox"/> Rush <small>specify</small>	<small>Lab Use Only</small> Pressurized by: _____ Date: _____ Pressurization Gas: N <sub>2</sub> He
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Lab I.D.	Field Sample I.D. (Location)	Can #	Date of Collection	Time of Collection	Analyses Requested	Canister Pressure/Vacuum			
						Initial	Final	Receipt	Final (psi)

Relinquished by: (signature)    Date/Time	Received by: (signature)    Date/Time	<b>Notes:</b>
Relinquished by: (signature)    Date/Time	Received by: (signature)    Date/Time	
Relinquished by: (signature)    Date/Time	Received by: (signature)    Date/Time	

Lab Use Only	Shipper Name	Air Bill #	Temp (°C)	Condition	Custody Seals Intact?	Work Order #
					Yes   No   None	



# CHAIN-OF-CUSTODY RECORD

Laboratory \_\_\_\_\_

Attn: \_\_\_\_\_

400 N. 34th Street, Suite 100  
Seattle, WA 98103  
(206) 632-8020

2043 Westport Center Drive  
St. Louis, MO 63146-3564  
(314) 699-9660

303 Wellsian Way  
Richland, WA 99352  
(509) 946-6309

2355 Hill Road  
Fairbanks, AK 99709  
(907) 479-0600

5430 Fairbanks Street, Suite 3  
Anchorage, AK 99518  
(907) 561-2120

2255 S.W. Canyon Road  
Portland, OR 97201-2498  
(503) 223-6147

1200 17th Street, Suite 1024  
Denver, Co 80202  
(303) 825-3800

**Analysis Parameters/Sample Container Description**  
(include preservative if used)

Sample Identity	Lab No.	Time	Date Sampled	Analysis Parameters/Sample Container Description (include preservative if used)						Remarks/Matrix
				Comp.	Grab					

Project Information		Sample Receipt	
Project Number:		Total Number of Containers	
Project Name:		COC Seals/Intact? Y/N/NA	
Contact:		Received Good Cond./Cold	
Ongoing Project? Yes <input type="checkbox"/> No <input type="checkbox"/>		Delivery Method:	
Sampler:		(attach shipping bill, if any)	

Instructions	
Requested Turnaround Time:	
Special Instructions:	

Distribution: White - w/shipment - returned to Shannon & Wilson w/ laboratory report  
 Yellow - w/shipment - for consignee files  
 Pink - Shannon & Wilson - Job File

Relinquished By: 1.		Relinquished By: 2.		Relinquished By: 3.	
Signature:	Time: _____	Signature:	Time: _____	Signature:	Time: _____
Printed Name:	Date: _____	Printed Name:	Date: _____	Printed Name:	Date: _____
Company:		Company:		Company:	
Received By: 1.		Received By: 2.		Received By: 3.	
Signature:	Time: _____	Signature:	Time: _____	Signature:	Time: _____
Printed Name:	Date: _____	Printed Name:	Date: _____	Printed Name:	Date: _____
Company:		Company:		Company:	