



Miller Environmental Corporation

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Committed to Leadership in Our Industry



September 27, 2013

Manitoba Conservation and Water Stewardship
Environmental Approvals Branch
123 Main Street, Suite 160
Winnipeg MB R3C 1A5

Attention: Tracey Braun, M.Sc. – Director Environmental Assessment & Licensing Branch

Dear Ms. Braun:

RE: Dangerous Goods Handling & Transportation Act License No. 58 HW S2 RRR

As per Miller Environmental Corporation's (Miller) requirements regarding the issuance of Dangerous Goods Handling & Transportation Act licence No. 58 HW S2 RRR (licence), please accept this letter as clarification to clauses 29, 30 and 62 as per the letter sent by Tracey Braun dated July 30, 2013.

Clause 29 (page 8) - "The Licencee shall provide to the Director for approval and prior to storage of out bound waste in trailers, a written plan for the secure parking of the trailers within 60 days from the date of this revised Licence."

- Miller's internal standard operating procedure 20.70.1 has been updated to respond to the comments in the letter sent by Tracey Braun dated July 30, 2013 (refer to the attached "20.70.1 - Trailer Parking Procedure at MEC").

Clause 30 (page 8) - "The Licencee shall provide for the approval of the Director within 60 days of the issuance of this Licence, a written plan for storage of all types of waste at the facility such that storage in trailers will not be necessary."

- Miller primarily transports waste on 53' trailers. The floor capacity on a 53' trailer is 26 single stacked pallet spaces (104 drums). If Miller was to stage a trailer load inside one of our processing buildings, we would require 13 double stacked pallet spaces (104 drums). As per Clause 28 in Miller's licence, we have up to a maximum of four trailers at any time to store outbound waste. To stage waste for four outbound trailers, this would require building storage of 52 double stacked pallet spaces (416 drums).

Currently, Miller has the following storage available containing fire suppression systems for waste storage:

- Process Building 5 (PB5) Transfer Facility – 59 double stacked pallet spaces (472 drums)

- Process Building 1 (PB1) Transfer Station – 136 double stacked pallet spaces (544 drums)
- PB1 – 96 double stacked pallet spaces (384 drums)

Storage of waste on trailers for outbound disposal is dependent on many factors. Approximate outbound trailer fill time can vary anywhere from a few days to two weeks. This is dependent on received waste variations and volumes from our customers. It is also dependent on load-out scheduling and receiving at various disposal facilities used by Miller.

In addition, building storage becomes limited during winter periods when Miller receives high volumes of waste. During winter months, building storage is utilized to thaw frozen containers. Thawing can take up to a week at times before Miller can begin processing this waste.

Based on Miller's August month end of our fiscal year (March 1, 2014), Miller is forecasting the management of approximately 67,000 drum space equivalents. Available storage containing fire suppression systems are 1,400 drum space equivalents. The requirement of 416 drum space equivalents for four outbound trailers is 29.71% of Miller's available storage space. Staging outbound waste in the available buildings is performed as the initial preparatory step. However, there are times when floor space is necessary for receiving waste and this staged waste is the first to be utilized. At this point, the staged drums are transferred onto outgoing trailers.

Miller will continue to stage outbound trailer waste in process buildings containing fire suppression whenever possible. When floor space is required to receive waste from inbound trailers, Miller will begin to prepare outbound trailers. It is important to understand Miller's trailer staging cycle does not reflect having 4 full trailers on site at all times. Although 4 trailers have 416 drum equivalents, Miller usually will have 2 trailers being constructed at one time with the fully constructed trailer(s) leaving shortly after approval to be received by an external disposal facility. Miller has the flexibility to have 4 full outbound trailers on site at one time but is a rare occurrence.

The addition of process building 5 (PB5) has given Miller the capability of separating inorganic and organic processing providing a higher level of safety to the facility. With PB5 being the initial transfer facility of inbound waste into the facility, Miller now separates all inbound inorganic and organic waste upon receipt. All inorganic waste is stored in the PB5 transfer facility and all organic waste is put into a trailer and moved to the PB1 transfer station when full. Documentation of complete trailer inventory is available at all times, including these organic trailers. There are times when these organic waste trailers cannot be immediately received at the PB1 transfer station due to unloading of other trailers. In this situation, these trailers are parked in the trailer staging area south of PB4 (refer to Appendix A - Facility Map in the licence revision package submitted on March 22, 2013) and received at the next available opportunity. If organic trailers cannot be received the day they were moved to the PB1 transfer station, they will fall under Miller's daily inspection to ensure mitigation of potential leaks or environmental concern.

Clause 62 (page 12) - ***“The Licencee shall provide to the Director, within 60 days of the issuance of this Licence, protocols for all sampling that will be carried out at the facility.”***

- Miller's has updated our internal sampling protocol manual to respond to the comments in the letter sent by Tracey Braun dated July 30, 2013 (refer to the attached "MEC Monitoring Protocols").

If you have any questions or comments, please contact me at 204-925-9604, or by email at daveh@millerenvironmental.mb.ca.

Sincerely yours,
Miller Environmental Corporation



Dave Howes
Technical Services Coordinator

CC: Randy Webber – Manitoba Conservation and Water Stewardship
Vaughn Bullough – Miller Environmental Corporation
Gaetan Fontaine – Community Liaison Committee
Ian Forrester – Manitoba Hazardous Waste Management Corporation



Miller Environmental Corporation

Section:
20.70.1

Subject:
**Van and Tanker Trailer
Parking Procedure at MEC**

**STANDARD OPERATING POLICY &
PROCEDURES MANUAL**

Revision:
3

Page: 1 of 3
Date: September 2013

Trailer Parking Procedure at MEC

1.0 PURPOSE

As part of our ongoing commitment to our IMS program, all policies and procedures comply with ISO Standards 9001:2008, 14001:2004 and OHSAS 18001:2007.

There are circumstances when the company may require van and tanker trailers containing regulated and non-regulated waste to be parked at the Miller Environmental Corporation (Miller) facility (MEC): e.g. inbound and outbound waste, storage of non-regulated waste. This procedure outlines location, inspection, and security guidelines that will be enforced by the operations department.

2.0 SCOPE

This procedure applies to all trailers that are to be spotted at the MEC.

3.0 DEFINITIONS

Trailers – A transport unit with either a van type container usually used to transport drums, totes and pallets or a bulk tanker type used for liquids.

Spotted – Trailer that has been moved into place, parked and then the tractor unit has been decoupled and departed.

4.0 RESPONSIBILITIES


It is the responsibility of MEC operations staff receiving trailers and tankers to follow this procedure.

5.0 PROCEDURE

5.1 Location

Trailers containing regulated waste on van trailers will be parked in one of six possible locations: (see Attachment 7.1).

1. PB4 shipping and receiving ramp
2. PB5 shipping and receiving ramp
3. PB2 shipping and receiving ramp
4. Trailer staging area east of PB5
5. Trailer staging area south of PB4
6. Trailer staging area northwest of PB3

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Tanker trailers containing regulated waste will be parked in one of two possible locations: (see Attachment 7.1).

1. PB1 bulk unloading & loading pad
2. PB5 bulk unloading & loading pad

Trailers containing non-regulated wastes may be parked at any trailer staging area on the facility property.

5.2 Inspection

Trailers will be inspected and the results of inspection documented at the start of each operating day by the operations manager, operations supervisor, or designate. Trailers will be inspected for leaking containers or spills. Van and tanker trailer inspections are included in the weekend facility checks.

5.3 Security


During non-operating hours, all van trailers containing regulated waste will be locked with a padlock on the rear doors, and side door (if applicable). Load seals are applied to tanker ports prior to shipment by external transport subcontractors. The active area of the facility is fenced and gates at both entrances are locked at the end of each day.

5.4 Regulatory Considerations

1. As the majority of waste movement occurs in trailers, elimination of storage on trailers is not always possible, however, Miller is committed to off-loading trailers as soon as possible from the date of receipt. If for any reason off-loading has to be delayed the trailers will be inspected daily to mitigate the possibility of leaks or reactions on those units.
2. The documentation (manifests, bill of ladings, etc.) for all trailers containing non-regulated and regulated waste is to be kept in the MEC lab and available to Conservation and Water Stewardship personnel.
3. A maximum of 4 outgoing trailers plus 4 tankers are allowed to contain hazardous waste on the MEC site. Non-hazardous waste trailers do not apply to the outgoing trailer limit.

6.0 REFERENCES

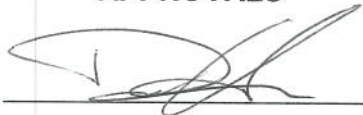
- 6.1 ISO Standards 9001:2008, 14001:2004 & OHSAS 14001:2007
- 6.2 License No. 58 HW S2 RRR

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7.0 ATTACHMENTS

7.1 Facility Map

8.0 APPROVALS



Department Manager



IMS Coordinator

MILLER SOPP MANUAL

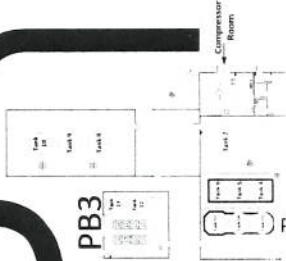
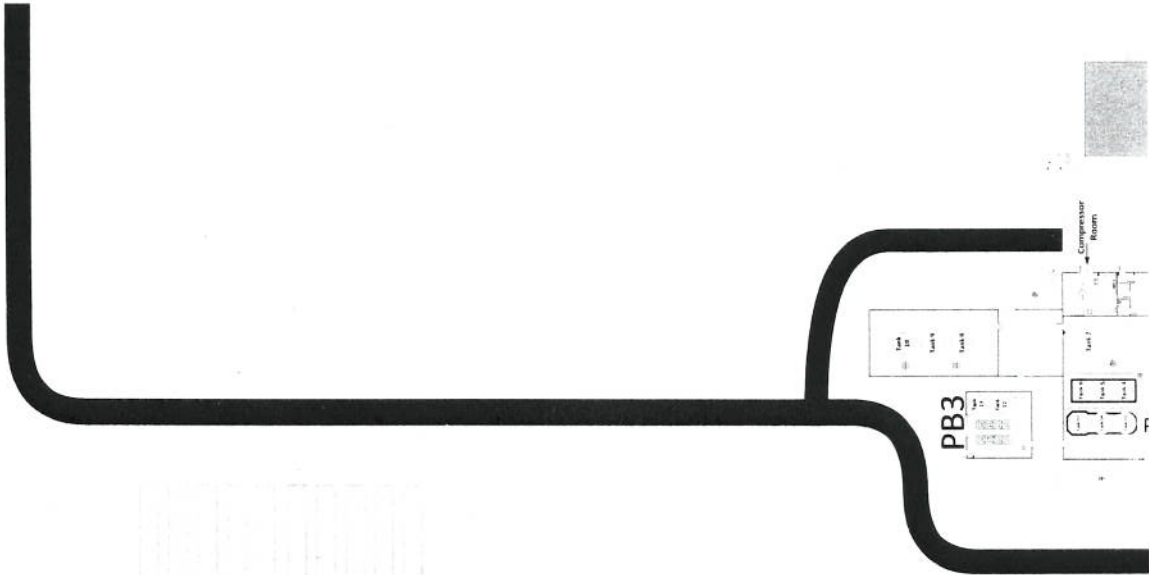
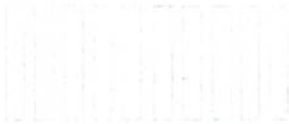


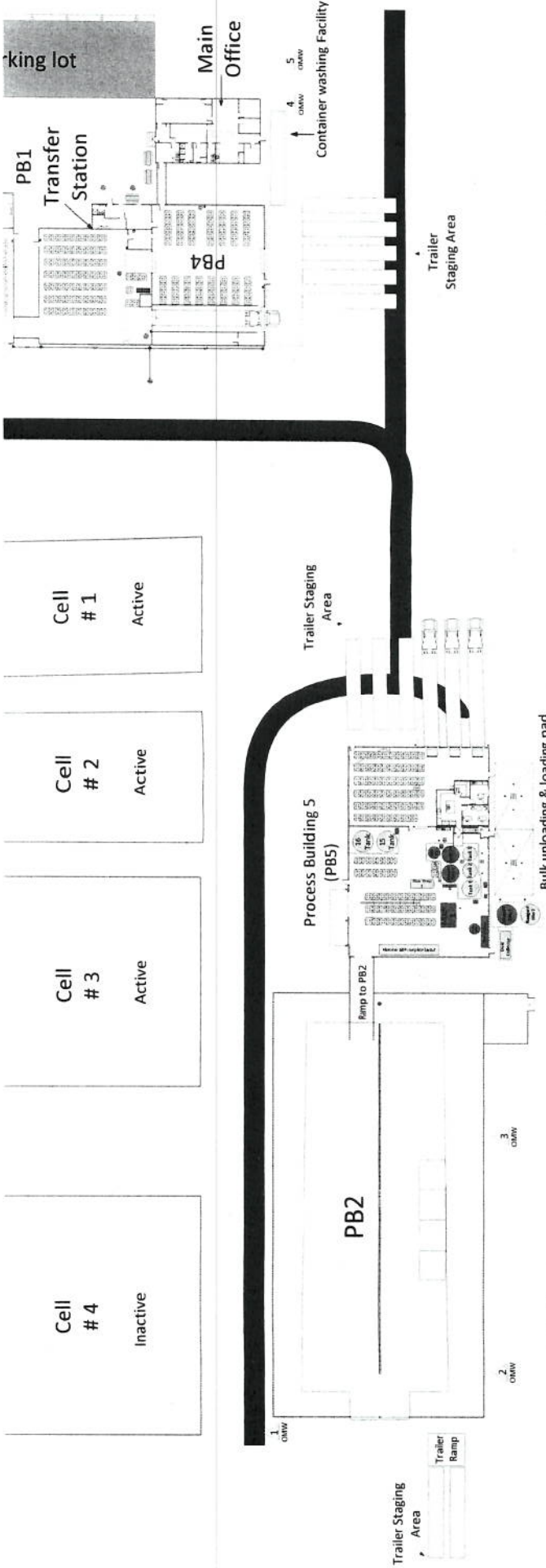
Attachment 7.1



Miller Environmental Corporation Facility Map (Active Area)

Trailer
Staging Area





Monitoring Wells 1 - 5



OPERATIONS ENVIRONMENTAL MONITORING PROGRAM

Air, Soil, Surface Water and Groundwater Sampling and Monitoring Protocols

The Operations Environmental Monitoring Program was designed to identify and quantify any localized impact resulting from facility operation. The external monitoring program (air, soil and groundwater) concentrates on the operational areas of the site and includes six air monitoring events for volatile organic compounds, three air monitoring events for total particulate and metals, surface water (if in the event a discharge from the retention ponds is required), soil monitoring (every three years) and an annual ground water monitoring event. The sample sites are all on location at the MEC (see Appendix I – Sampling Locations Map). Groundwater monitoring is represented by the five operations monitoring wells immediately downstream of the facility.

AIR SAMPLING

Introduction

Routine operations monitoring comprises only volatile organic compounds (VOCs) and inorganic metals and particulates. Parameters are listed in clause 59 of operating license 58 HW S2 RRR.

Two sampling stations are used for air quality monitoring (see Appendix I – Sampling Locations Map).

- Southeast side of MEC property (A1)
- North side of MEC property, near highway (A2)

Station A1 is a site near the facility that will experience northwest winds coming from the facility. Station A2 is selected as another site close to the facility, which will allow southerly winds coming from the facility to be sampled.

Stations A1 and A2 are sampled six times during the year for volatile organic compounds (VOC's) and 3 times per year for inorganic particulates (metals). The sampling is partly weather dependent and periods of precipitation are to be avoided, if possible.

Methodology

The air quality methods depend on the compounds of interest and are most easily divided into methods to sample:

- Inorganic particulate matter for analysis of metals;
- Volatile organic compounds;

Two separate sampling systems are used to measure the wide range of compounds. Inorganic particulate matter and metals are sampled with a high volume sampler. Volatile organic compounds are sampled with a low volume sampling system.

Inorganic Particulate Matter and Metals

The sampling methodology involves drawing a sample of air through a filter, which collects particulate matter. It is then analyzed for several different parameters. The air sample is collected using a calibrated high volume sampler for a 24 hour period.

Equipment

A high volume sampler is used (General Metal Works Model GMWS 2310 Accuvol). The sampler has a constant flow controller to ensure that the flow rate remains constant. The sampler required 120V AC power and is sheltered inside housing. Air is drawn through a cellulose, glass fibre or Teflon filter, which is mounted at the air intake of the sampler. Separate samplers are operated at Station A1 and A2 and labelled as Units HV1 and HV2 respectively.

Sample Collection, Preservation, Handling and Transport

The calibrated high volume sampler is placed in the field. Calibration procedures are outlined in the operations manual. The filters are handled while wearing nitrile or latex gloves. Make sure hands and clothes are clean to avoid sampled contamination. Field procedures are as follows:

1. The filter holder on the sampler is wiped with a clean cellulose tissue to remove surface deposits of particulate matter.
2. A pre-weighed filter is removed from the lab supplied container envelope, placed on the filter screen and secured while the sampler is turned off. This filter is left on the sampler for about 10 seconds, then removed and returned to the envelope. The

envelope is labelled as a "field blank". This envelope is placed inside the sampler housing and kept there until completion of the sampling event. This is done at Station A1 only.

3. A second pre-weighed filter is removed from the lab supplied envelope, placed on the filter screen and secured while the sampler is turned off. The sampler is turned on and the time of start-up is noted. The flow controller is preset during calibration and there is no need for a flow reading. The sampler is left running for 24 hours nominally, after which time it is turned off and the time noted. The filter is removed from the filter holder and placed in the envelope and labelled with a unique identifying label.

The filters are transported to and from the site inside a clean cooler. They may be kept at room temperature until analyzed.

Data Management

To calculate the concentration of metals per m³ of air use:

$$Ca = Mc / (FTs)$$

where:

- Ca = concentration per m³
- Mc = mass of collected metal (ug)
- F = flow rate (calibrated at 40 cfm)
(note 1 cf = .02831685 m³)
- Ts = time (minutes)

Volatile Organic Compounds

The sampling methodology involves drawing a sample of air through a Thermal Desorption Tube, which collects volatile organic compounds. It is then analyzed for several different parameters. The air sample is collected using a calibrated low volume sampler for a 24 hour period.

The U.S. Environmental Protection Agency (EPA) has identified several methods for determination of organic compounds in ambient air. These methods have been matched to the potential contaminants that could be released from the MEC. Alternative and approved equivalent methods are acceptable, providing they are comparable to those developed during the baseline and operational monitoring programs.

The EPA methods are listed and described in the "Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air" (U.S. EPA, Washington, D.C., PB90-127374, June 1988).

A slight modification of the EPA TO-17 method is used (see Appendix II – VOCs In Air Using TD Tubes with Analysis by GC/MS). This method involves drawing air through a Thermal Desorption Tube with subsequent analysis using GC/MS (gas chromatography/mass spectrometry).

Equipment

An air pump draws an air sample continuously through a sampling tube, with the air flow regulated by a flowmeter. A Metal Bellows Pump (Cole Parmer Model L-07065-20) is used to draw the air sample.

The sampling tubes for volatile organic compounds are Stainless Steel ATD Prepacked Sample Tubes – Sorbent - Perkin Elmer Air Toxics Tubes.

The sampling tubes are housed in a shelter that allows unobstructed air flow with no tubing in the air stream ahead of the sampling tubes. Connectors between the Supelco tubes and the flowmeters is Swagelok. All other tubing is made of either plastic or copper.

The mass flowmeters (Matheson Model 8112-0422) allow low flows, up to 200 mL/min, A complete sampling system is provided at each of Stations A1 and A2. These are mounted on the inorganic particulate high volume shelters, labelled as Units HV1 and HV2 respectively.

Sample Collection, Preservation, Handling and Transport

The methods follow similar procedures because they are used with the same sampling system. All operations which include handling the sampling tubes are completed while wearing nitrile or latex gloves. It is important to be sure to wash your hands carefully with soap and water prior to initiating the sampling. Make sure clothes have not come into contact with any organic compounds which might contaminate the samples. Basic procedures are outlined below.

1. At Station A1, attach the tube to the sampling inlet, leave for about 10 seconds, disconnect and recap the ends. Label the tube as a "field blank". Leave this tube at the sampling station for the remainder of the sampling event. Do this at Station A1 only.
2. Turn the pump on and set the flowmeters to 50 mL/min then turn it off.
3. Uncap another tube and attach to the system.
4. When sampling tube is connected, turn the pump on, noting the date and time. Read just the flow rates to those given in step 2. Note the flowmeter readings at least one more time within an hour of initiation to ensure correct flow rates are maintained.

5. After running for 24 hours, note the flowmeter flow rates again and turn pump off, noting the time.
6. Remove the tube and recap and label it. Place all tubes in a cooler at 4^o C or colder.
7. Steps 2 to 7 are repeated for the sampling system located at Station A2.

Data Management

To calculate the concentration of VOC per m³ of air use:

$$Ca = Mc/(FTs)$$

where:

- Ca = concentration per m³
- Mc = mass of collected compound (ng)
- F = measured flow rate (m³)
- Ts – time (minutes)

SOIL SAMPLING

Introduction

Soil sampling sites are located at locations A1, A2 and A3 (see Appendix I – Sampling Locations Map). Parameters are listed in clause 60 of operating license 58 HW S2 RRR.

The following equipment is required to collect the soil samples:

- Tarpaulin (optional)
- Latex gloves
- Distilled water
- Hand sugar
- Putty knife or spatula
- Glass containers
- Shovel
- Cooler
- Decontamination equipment (pail, lab detergent, scrub brush)

Sample Collection, Preservation, Handling and Transport

If necessary, place a tarpaulin beside the sampling location to provide a clean working area. A clean small diameter hand auger is used to collect the soil samples. Soil samples are collected immediately below the ground surface. Twist the auger down and remove the sample. Using a clean putty knife, pare the soil on the outside of the auger and discard that soil. Transfer the

remaining soil from the auger with a clean pair of latex gloves into appropriate sample container. Decontaminate the auger with a laboratory detergent waterwash and distilled water rinse before collection at the next sampling site.

Each sample is labelled with the identification number, name of collector, date and time of sampling, preservation methods and analyses required. Place clear wide tape over all labels. Check that the sample container is capped securely. Place sample container in protective plastic bag in a cooler and maintain at 4^o C throughout transport. The Table summarizes the typical volume of sample required, container type preservation method and holding time for various chemical parameters. Inform the laboratory of the anticipated arrival of the samples so that analyses can be performed within recommended holding periods.

SURFACE WATER SAMPLING

Introduction

Surface water sampling locations are intended to monitor site drainage. They are the east and west landscaped ponds and the drainage ditch south of PTH 14. Baseline monitoring has been completed in the Letellier and St. Joseph reservoirs and at Buffalo Creek and PTH 14. Surface water sampling is completed prior to discharge only. Parameters are listed in clause 64 of operating license 58 HW S2 RRR.

Sample Collection, Preservation, Handling and Transport

Surface water samples are collected by dipping the water samples out with the appropriate sample bottles. Any significant amount of suspended matter in the sample should be separated by decantation. Use of nitrile or latex gloves is required.

Label each sample with the identification number, name of collector, date and time of sampling, preservation methods and analyses required. Place clear wide tape over all labels. Check that the sample container is capped securely. Place sample container in protective plastic bag and put in cooler with sufficient ice or ice packs to maintain samples at 4^o C throughout transport.

GROUNDWATER SAMPLING

Introduction

The operations monitoring program is not directed at the collection of groundwater samples from the perimeter monitoring wells installed in the clay deposits of at the clay-till interface. Because of the very low permeability in the soil and the distance of the wells from MEC operations, any potential contamination should be detected and acted up on using other environmental media before it could reach the perimeter wells.

Groundwater monitoring wells have been installed proximate to operational buildings (soil and transfer facilities). These wells are named OMW01 – 05 (see Appendix I – Sampling Locations Map) and need to be monitored for parameters of interest. Parameters are listed in clause 61 of operating license 58 HW S2 RRR.

The monitoring wells installed at the facility site consist of 316 stainless steel and rigid polyvinyl chloride (PVC). Stainless steel is highly inert in most situations but can degrade under low pH or high chloride conditions and may contribute to contamination by chromium and other metals. PVC is also highly inert, but is subject to chemical attack by some pure-phase solvents such as toluene, trichloroethylene and others.

Water Level Measurement

Lower the probe attached to the electric wire down the well until the busser or light is activated. The depth to water is measured from the top of the well casing. The top of casing is used as a constant measuring reference and its geodetic elevation has been established. The date, time and depth to water is recorded for each well. Rinse the probe with distilled water before measuring the water level in the next well.

To obtain the depth to static water level from the ground surface, two calculations must be made. The first is to determine the static water elevation by subtracting the measured value from the tape from the elevation at the top of the piezometer. To obtain the static water level from the surface, subtract the static elevation from the ground level.

Equipment

Groundwater samples are collected utilizing an inertial lift system. This consists of a delrin foot valve connected to a length of 15 mm O.D. LDPE tubing. The system is removed after sample collection; tubing is discarded and the foot valves decontaminated, packaged and stored for future use. The concern of the influence of sampler materials on water chemistry is reduced by discarding the tubing and cleaning the foot valve before sampling the next monitoring well.

Sample Collection, Preservation, Handling and Transport

Unlock the protective casing on the monitoring well to be sampled. If necessary, place a tarpaulin beside the well to provide a clean working area. Measure the water level using the procedures outlined above. Wear nitrile or latex gloves at all times during sampling. Install the Waterra inertial lift pump. Raise tubing such that the foot valve is above the well screen. Lift and drop the tubing until groundwater begins to flow from the tubing.

Insert the end of the tubing into the appropriate container and continue to lift and drop the tubing until the sample container is full. Once all samples have been collected, remove sampling system as discussed above.

Label each sample with the identification number, name of collector, date and time of sampling, preservation methods and analyses required. Parameters are listed in clause 61 of operating license 58 HW S2 RRR. Check that the sample container is capped securely. Place sample container in a protective plastic bag and put in cooler to maintain samples at 4^o C throughout transport.

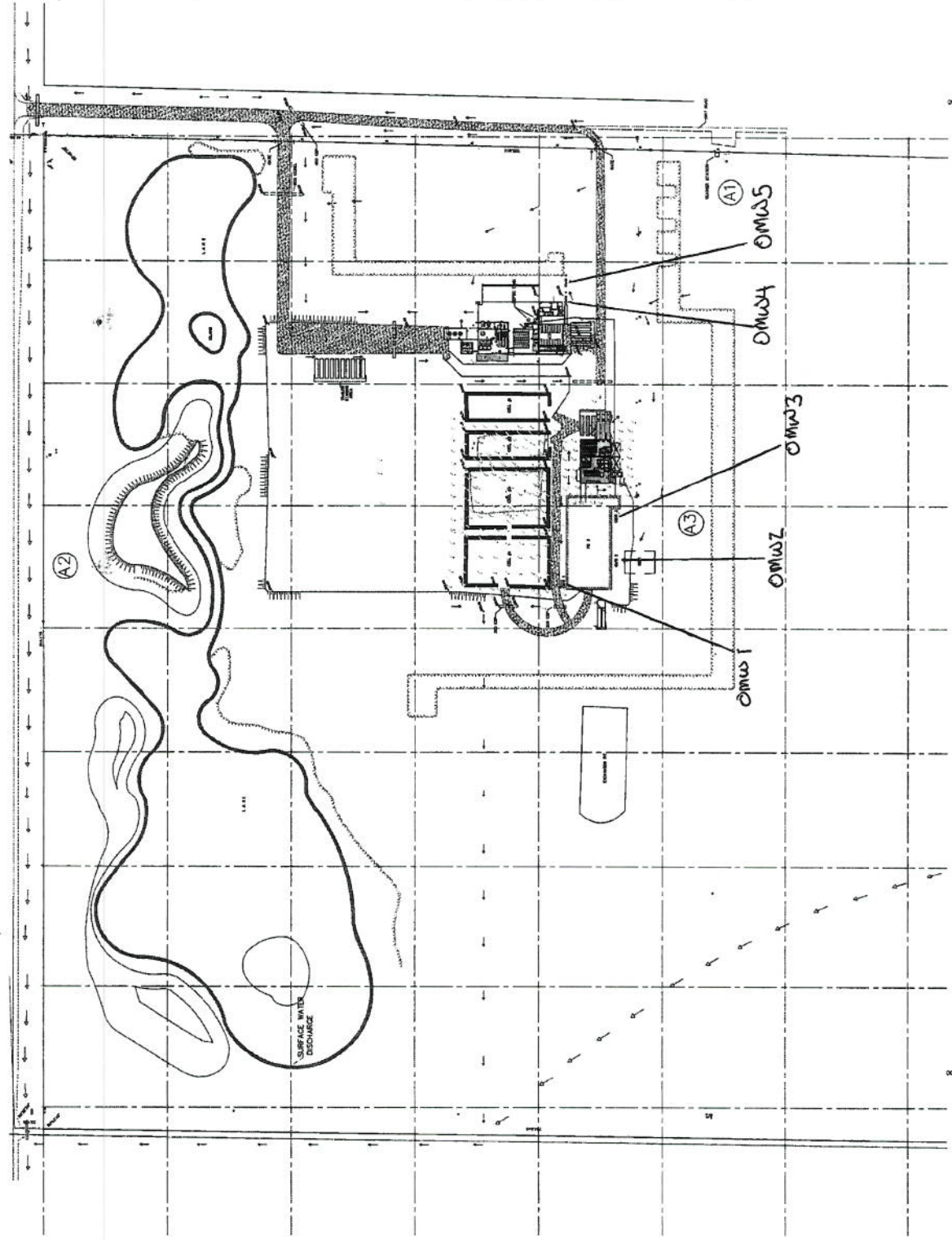
Appendix I
Sampling Locations Map



MONITORING LOCATIONS	
A1 + A2	AIR
A1, A2 + A3	SOIL
OMW1-5	GROUND WATER

EXISTING FEATURES LEGEND	
	BUILDING
	TOP OF BERM
	TOP OF DYKE
	GRAVEL ROAD
	DITCH
	HYDRO POLE
	CONTROL MONUMENT
	MONITORING WELL
	WEATHER TOTEM
	GRID LINE
	GULVERT
	FENCE
	ANCHOR
	BURIED CABLE
	PROPERTY LINE
	EXISTING ELEVATION
	PROPOSED LANDSCAPING

- NOTES
- 1) SEE THE CONTRACTS MADE BY SURVEYOR FOR THE LOCATION OF MONITORING POINTS AND THE LOCATION OF MONITORING POINTS.
 - 2) EXISTING MONITORING POINTS ARE IDENTIFIED BY THE SURVEYOR'S MONITORING POINT SYMBOLS.
 - 3) LOCAL GRID NO. 7 2001 2001.
 - 4) SEE SURVEY CONDUCTED ON MAY 16, 1994.
 - 5) HANCO & ASSOCIATES DRAWING UNIT CHERRY LANE FEBRUARY 1994.



 Reid Crowther Environmental & Earthworks Ltd. 10000 Highway 104, Suite 100, Edmonton, Alberta Telephone: (403) 462-1111	Project: MANITIBA HAZARDOUS WASTE MANAGEMENT CORPORATION Site Topography - 1994 Existing Features	Scale: 1" = 100' Project No.: 61504-S1 Drawing No.: Date: 06-94
	Revision: _____ by: _____ on: _____ Revision: _____ by: _____ on: _____ Revision: _____ by: _____ on: _____	Checked: _____ Drawn: _____ Design: _____ Approved: _____

Appendix II
VOCs In Air Using TD Tubes with Analysis by GC/MS



METHOD SUMMARY

VOCs In Air Using TD Tubes with Analysis by GC/MS

Document #: BBY5SOP-00031/3

Reference Methods:

Volatile Organic Compounds in Air-Vapour by Thermal Desorption Tube / GCMS
– PBM, BC Environmental Lab Manual, June 19, 2009

Volatile Hydrocarbons in Air-Vapour by GC-FID / GC-MS, BC Environmental Lab
Manual, June 26, 2009

SECTION 1: Purpose/Principle of Method

A measured volume of air is collected into a dual sorbent-bed TD tube, consisting of graphitized carbon black and a proprietary carbon molecular sieve. Using a calibrated sampling pump, samples are collected at a fixed pump flow rate (i.e. 50 to 200mL/min) for a pre-determined duration. The captured VOCs are extracted from the TD tube by applying heat, and a reverse flow (relative to the air flow during sampling collection) of helium, to the tube. A focusing trap then adsorbs the VOCs, and in turn is rapidly heated, and the analytes are desorbed, as a narrow band, and transferred to the GC column in the helium steam. This process is known as two-stage thermal desorption. No solvent is required. The amount of contaminant is determined by comparison with standards analyzed at the same time, in full scan mode. Samples can be re-collected, allowing for re-analysis.



SECTION 2: Scope

TD tubes can sample a wide range of VOC's currently performed by the U.S. EPA Method TO-17, NIOSH methodology, BC Ministry of Environment BC Environmental Lab Manual (Section H), and are regulated by the BC Environmental Management Act Contaminated Sites Regulation (Schedule 11) and the WorkSafe BC Occupational Health and Safety Regulations.

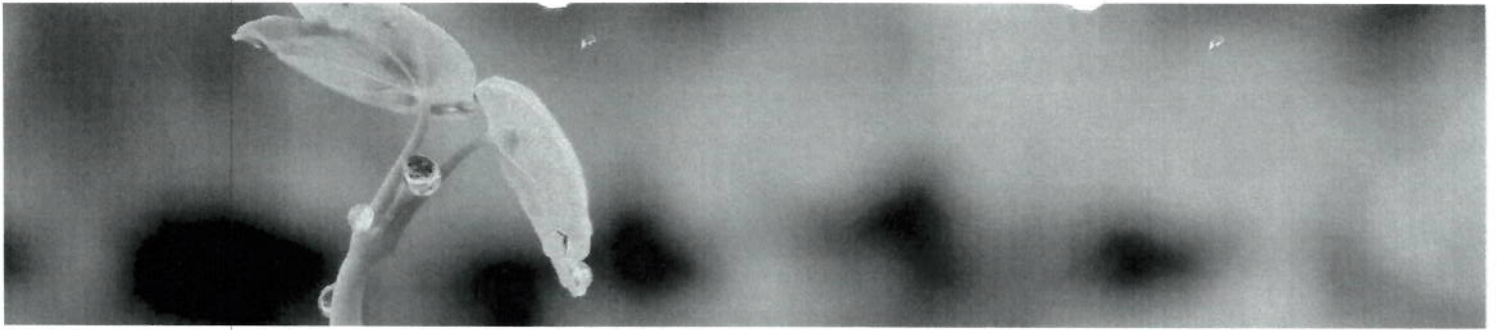
This procedure applies to the determination of VOC's that can be recovered from TD tubes, are thermally stable, and can be analyzed by GC/MS.

With this method, VOC's can be determined in outdoor and indoor ambient air, soil vapour gases, compressed gases and Tedlar bags. The target VOC's compounds are from the following classes: Petroleum Hydrocarbons, Aromatic and Halogenated Hydrocarbons, Ketones, Alcohols, Ethers, Glycol Ethers, Glycols, Halogenated Ethers, Esters, Chlorinated and Non-chlorinated Phenols, Aldehydes, Fatty Acids, Terpenes, Nitrogenous compounds and Anaesthetics gases.

VHv6-13 measures hydrocarbons and other VOCs with a vapour pressure range of approximately 0.05 to 150 Torr (at 25°C), or a boiling point range of approximately 69°C to 234°C.

This method is NOT suitable for the determination of the following classes of compounds:

Ammonia, Chlorine
Hydrogen Cyanide, Phospine
Formaldehyde, Isocyanates,

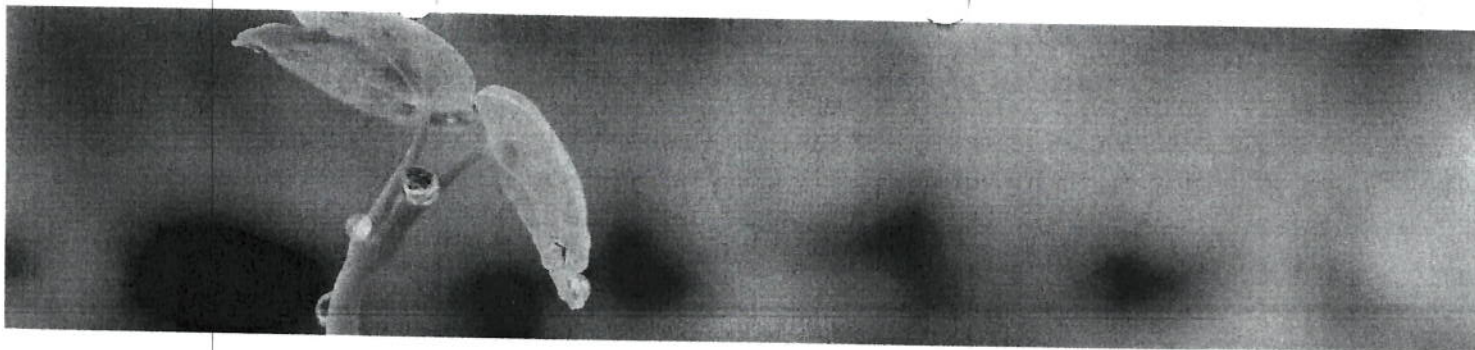


Methanol
2-Butanone Peroxide, Acetone Cyanohydrin
Sulphur Dioxide, Hydrogen Sulphide
Strong Acids or Bases
CO ₂ , CO, O ₂ , N ₂ , Radon
Methane, Ethane, Ethene
VOC's MW less than 35 amu
Compounds with a bp greater than that of n-C ₁₆
PAH's with a bp greater than that of fluorene
PCB's
Thermally labile compounds

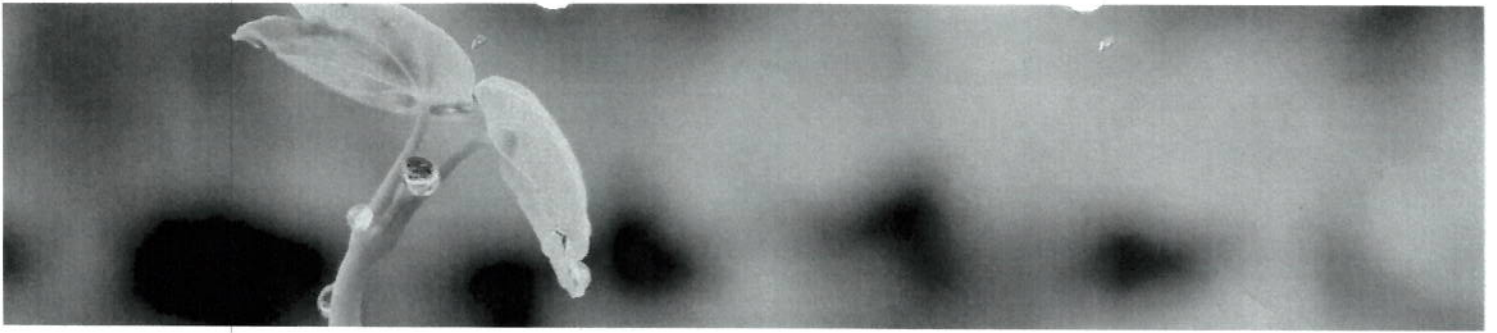
SECTION 3: Detection Limit

Routine VOC's

Compounds	RDL (µg)
dichlorodifluoromethane (freon 12)	0.06
chloromethane (methyl chloride)	0.04
vinyl chloride (chloroethene)	0.02
1,3-butadiene	0.01
bromomethane (methyl bromide)	0.08
chloroethane (ethyl chloride)	0.04
trichlorofluoromethane (freon 11)	0.03
1,1-dichloroethene (1,1-dichloroethylene)	0.01



methylene chloride (dichloromethane)	0.06
1,1,2-trichloro-1,2,2-trifluoroethane (freon 113)	0.01
1,2-dichloroethylene, trans (1,2-dichloroethene, trans)	0.01
methyl tertbutyl ether (MTBE)	0.10
1,1-dichloroethane	0.03
hexane (n-)	0.01
1,2-dichloroethylene, cis (1,2-dichloroethene, cis)	0.01
chloroform (trichloromethane)	0.004
1,2-dichloroethane	0.002
1,1,1-trichloroethane	0.04
carbon tetrachloride (tetrachloromethane)	0.005
benzene	0.01
dibromomethane (methylene bromide)	0.02
1,2-dichloropropane (propylene dichloride)	0.002
trichloroethylene (TCE)	0.002
bromodichloromethane (BDCM)	0.01
methylcyclohexane	0.02
1,3-dichloropropene, cis	0.01
1,3-dichloropropene, trans	0.01
1,1,2-trichloroethane	0.002
toluene	0.01
dibromochloromethane (DBCM)	0.01
1,2-dibromoethane (ethylene dibromide) (EDB)	0.005
tetrachloroethylene (PCE) (PERC)	0.01
octane(n-)	-
1,1,1,2-tetrachloroethane	0.002
chlorobenzene (monochlorobenzene)	0.01
ethylbenzene	0.01
xylenes (o-xylene + m,p-xylenes)	0.03
bromoform (tribromomethane)	0.02
styrene	0.01



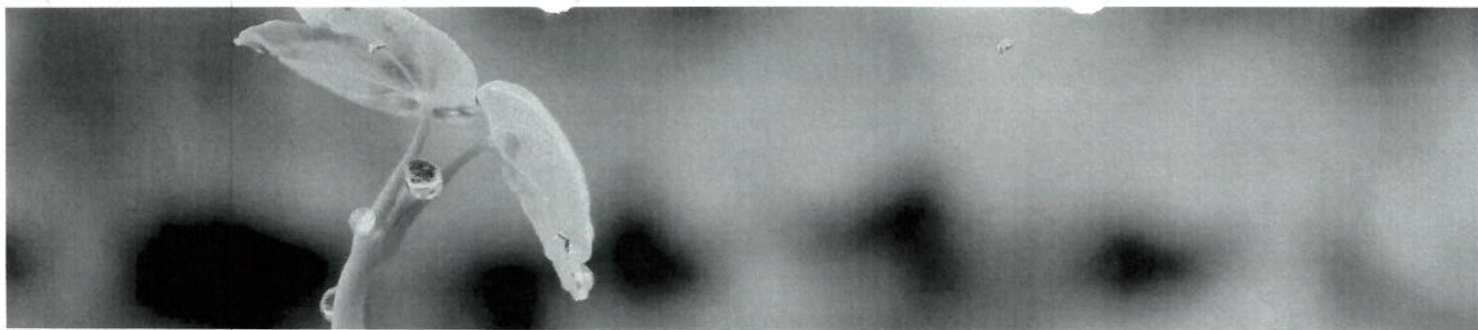
1,1,2,2-tetrachloroethane	0.002
1,2,3-trichloropropane	0.01
isopropylbenzene (cumene)	0.02
bromobenzene	0.02
1,3,5-trimethylbenzene	0.01
decane(n-)	0.02
1,2,4-trimethylbenzene	0.02
1,3-dichlorobenzene	0.02
1,4-dichlorobenzene	0.02
1,2-dichlorobenzene	0.02
1,2-dibromo-3-chloropropane (DBCP)	0.02
Dodecane(n-)	-
1,2,4-trichlorobenzene	0.01
naphthalene	0.01
1,3-hexachlorobutadiene	0.02
1,2,3-trichlorobenzene	0.02
Tridecane(n-)	-
VHv6-13 / VPHv	0.5

Non-Routine VOC's

Compounds	RDL µg
Freon 22	0.1
dimethylamine	1.0
vinyl bromide	0.01
Acrolein	0.1
Acetonitrile	0.1
Acetone	0.1
Furan	0.1
Propylene Oxide	0.01



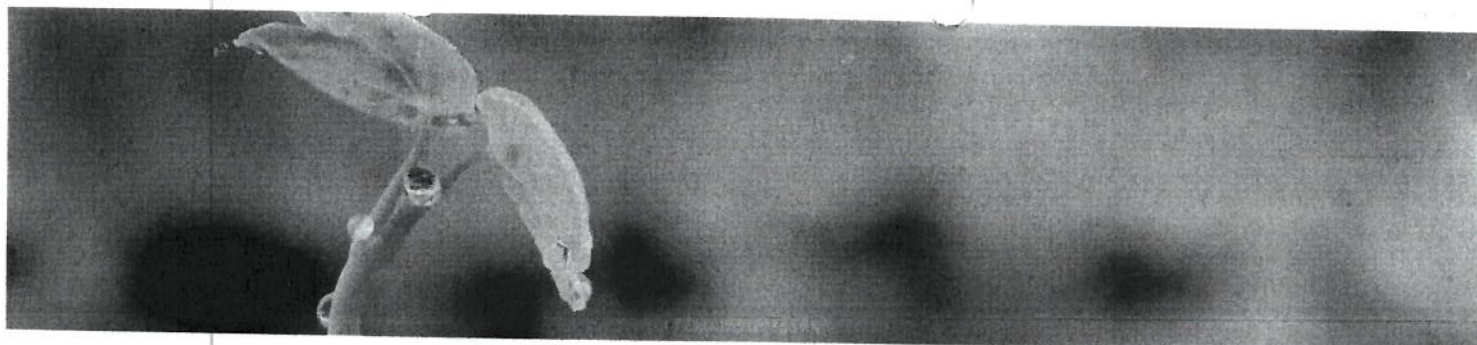
2-chloropropane	0.1
ethyl ether	0.1
Cyanogen Bromide	0.1
Acrylonitrile	0.1
methyl acetate	0.01
allyl chloride	0.01
carbon disulfide	0.01
Vinyl Acetate	0.01
Chloroprene	0.1
1,2-Epoxybutane	0.1
methyl ethyl ketone (2-butanone)	0.1
methylacrylonitrile	0.1
ethyl acetate	0.01
methyl acrylate	0.01
tetrahydrofuran	0.01
1-chlorobutane	0.01
Trans-Crotonaldehyde	0.1
Triethylamine	0.1
ethyl acrylate	0.01
methyl methacrylate	0.01
methyl cyclohexane	0.02
Epichlorohydrin	0.3
MIBK (4-methyl-2-pentanone)	0.1
pyridine	0.01
ethyl methacrylate	0.1
1,1,2-trichloropropane	0.01
4-chlorobenzotrifluoride	0.01
1,2,3-trichloropropene	0.01
bis(chloromethyl) ether	0.1
cis-1,4-dichloro-2-butene	0.1
cis-1,4-dichloro-2-butene	0.1
Bis(2-chloroethyl) ether	0.01



a-methylstyrene	0.1
2-chlorophenol	0.1
p-methylstyrene	0.01
m-vinytoluene(methylstyrene)	0.01
dicyclopentadiene	0.01
diisopropyl methylphosphanate	0.01
hexachloroethane	0.01
nitrobenzene	0.02
N,N-dimethylaniline	0.1
2-nitrotoluene	0.01
a,a,a-trichlorotoluene	0.01
1-chloro-4-nitrobenzene	0.1
hexachlorocyclopentadiene	0.01

SECTION 4: Interferences

1. Artifacts generated during sampling and sample storage are sometimes detected. Examples include toluene from tubing, dichloromethane for the ambient lab air, and phenol and N,N-dimethylacetamide from Tedlar bags. During thermal desorption, Tenax material will produce benzene and toluene, but AirToxics, Carbotrap, and Carbopack type sorbents do not produce this artifact. Once retained on a sorbent tube, chemically stable VOCs, loaded in laboratory conditions, have been shown to give good recoveries after storage of a year or more.
2. The presence of water should be kept to a minimum for this analysis. The use of hydrophobic sorbent media such as AirToxics is sufficient for this purpose. It is also essential to ensure that the temperature of the sorbent tube is the same and not lower than ambient temperature at the start of sampling or moisture



will be retained as condensation, however hydrophobic the sorbent. Dry purging during analysis is also ideal for removing water from the tubes.

3. Contaminants present in solvents, reagents, and sample processing hardware may cause interference or yield artifacts. All of these must be monitored and demonstrated to be free of interferences under the conditions of the analysis by the routine analysis of method blanks.

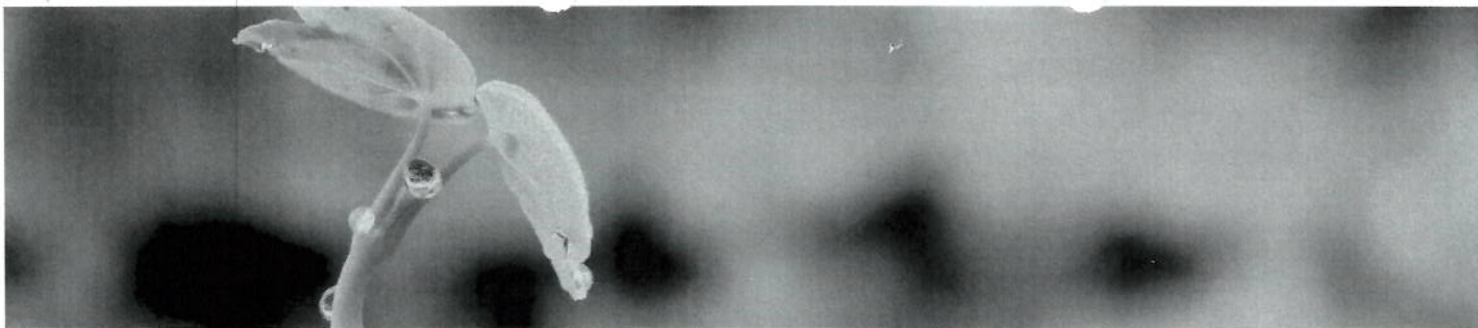
4. All lab method processes need to be taken to minimize Interferences which may affect accuracy and/or precision of the final result, including isolating the TD tubes from solvents found in the lab areas.

5. Exposure to organic solvents during sampling and analysis can contaminate sorbent tubes. It is recommended that a clean desorption tube, be sampled as a trip blank for each sampling period.

6. Potential Interferences that affect the accuracy and/or precision of the final result include contamination by carryover occurring whenever high-level and low-level samples are sequentially analyzed. When high levels of fuel vapour is sampled onto the TD tube, a portion remains on the cold trap and that portion contaminates the next sample (carryover cross contamination).

7. If possible, when an high level sample is analyzed, the instrument should be stopped and baked-out, followed by an Instrument Blank to check for system cleanliness.

8. Matrix interferences may be caused by contaminants that could be co-extracted from the sample. The extent of the matrix interferences will vary from source to source.



9. There are sometimes 3 to 5 peaks produced by silicone (siloxane compounds), encountered during the field sampling step. These peak are NOT included when integrating the VH peaks. i.e. they are subtracted from the total peaks.

Limits for background contamination are $< 2x$ RDL. Blank subtraction is NOT allowed.

SECTION 5: Sample Handling & Preservation:

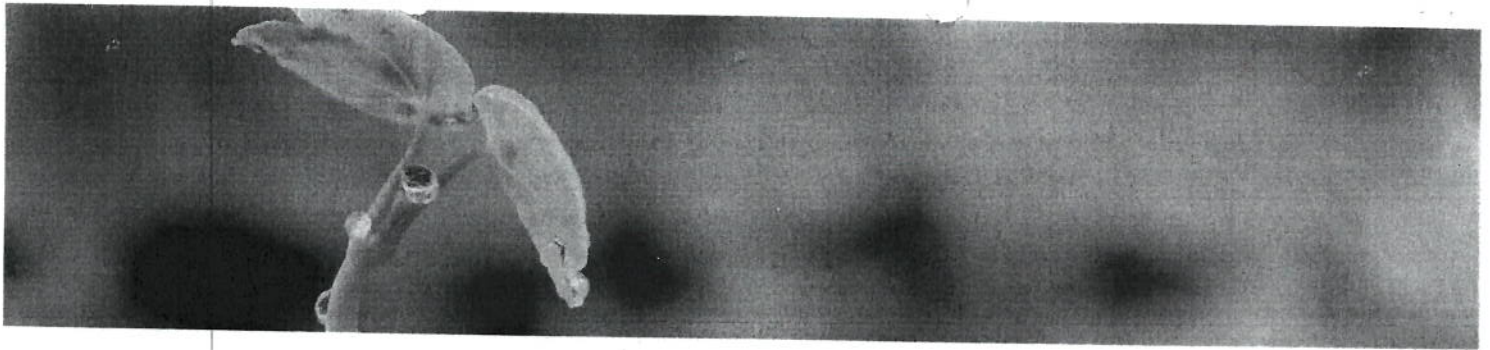
Preparation of tubes

Since the TD tubes are reusable, they are cleaned prior to being sent to clients. In a dedicated GC oven used for cleaning TD tubes, TD tubes are attached to a nitrogen source at a flow rate of 50 to 500 mL/min and baking at 350oC for a minimum of 3 hours. Once the cleaning cycle is completed they are immediately sealed with Swagelok™ fittings. They are stored, at < 6 oC in a container containing a small amount activated charcoal. 10% of the tubes are analyzed for batch-proofing.

Sample Container

TD tubes are constructed from stainless steel and are sealed with Swagelok™ fittings and Teflon ferrules which protect the sorbent materials and analytes from light or contamination.

Note: Samples may become contaminated from other sources, including high contamination level soil and water samples, and solvents used or stored in the



laboratory. On delivery, store samples in the designated Industrial Hygiene bin in the Receiving Dept to minimize possible contamination.

Shipment and Transport

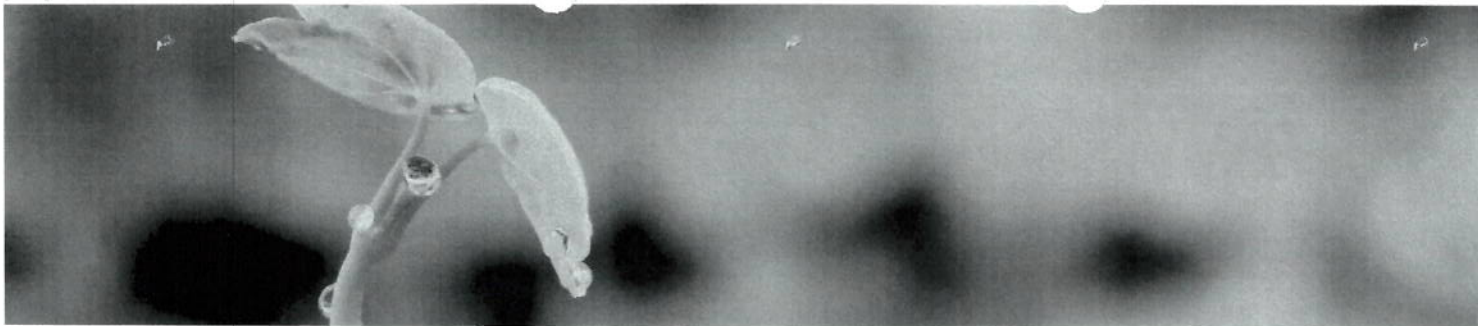
The TD tubes should be placed in Zip-Lock™ type bags, and stored at $< 10^{\circ}\text{C}$ during transport to the lab, and $\leq 6^{\circ}\text{C}$ at the laboratory.

Field Blanks

As a method to monitor possible contamination occurring during shipment and sampling, and subsequent storage at the laboratory, it is recommended by the primary reference method that field blanks are sent into the field to accompany the TD tubes through all stages of sampling and transportation. Field blanks are prepared in the same manner as the other TD tubes.

Holding Time

Analyze within 30 days.



Sample Matrix	Sample Container	Minimum Volume	Holding Time	Storage Conditions	Preservation	Comments
TD tube	Sealed Plastic Bag	N/A	30 days	≤ 6°C	None	According to HSE (UK gov.), BTEX demonstrate d stable for over 1 year, at room temp.

Sampling Apparatus

Pumps capable of rates from 10 to 200 mL/min are required. See BRNSOP-00319 for calibration procedures.

Sampling Rates and Times

Sampling rates should never exceed 200 mL/min. Sampling rates for routine analysis should be 200 mL/min for 60 minutes, resulting in 12 litres. e.g. 1,1-Dichloroethene has a Maxxam RDL of 0.01 µg, and a BCMOE Schedule 11 residential limit of 1 µg/m³:

- $\mu\text{g}/1 \mu\text{g}/\text{m}^3 \times 1000 = 10 \text{ L}$
- therefore 10 litres is required to meet the regulatory limit for this compound



Select sampling rates and times appropriate to collect the volume of air to meet the contaminant's regulatory requirement, but at the same time, try not to exceed the required volume.

Note: If a site is suspected to have high levels of VOC's/VH a 0.5 to 1 litre volume is recommended.

Sampling volumes have been determined to be safe up to 48 litres.

Alternate sampling rates may be applicable depending on the site and analytical requirements. See BRNSOP-00319 for complete information.

Sampling Data

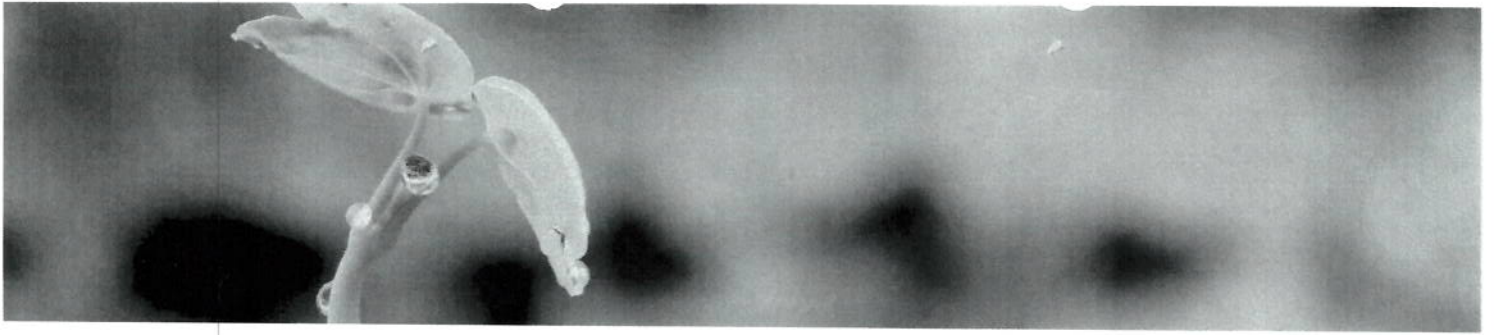
Clients should be advised to fill out Pump Sampling Data sheet completely prior to submission (preferably in the field). Information should include site location, sample ID, pump flow rates, dates, times, sampled volumes, ambient conditions, etc.

Suitable Atmospheric Conditions

Temperature range – The normal working range for sorbent packing is 0 to 40 oC. In general, an increase in temperature of 10 oC will reduce the breakthrough volume for sorbent packings by a factor of 2.

Humidity – Air Toxics sorbent is designed to minimize the effects of humidity.

Wind speeds. - Air movement is not a factor indoors or outdoors at wind speeds below 10 to 20 km per hour. Above this speed, tubes should be orientated



perpendicular to the prevailing wind direction and should be sheltered from the direct draft if wind speeds exceed 30 to 40 km per hour.

High concentrations of particulates - It may be necessary to connect a particulate filter (e.g., a 2 micron Teflon filter or short clean tube containing a loose plug of clean glass wool) to the sampling end of the tube in areas of high particulate concentrations. In extremely dusty sites frequent replacement of the particulate filter is therefore recommended, so as not to impede the sampling flow rate.

Note: Complete field sampling guidelines are beyond the scope of this method. For more information please refer to the BC Lab Manual: Volatile Organic Compounds in Air-Vapour by Thermal Desorption Tube / GCMS – PBM, BC Environmental Lab Manual, and to the BC Science Advisory Board document Guidance on Site Characterization for Evaluation of Soil Vapour Intrusion Into Buildings. The sampler must have a good understanding of the site conditions and required criteria level to keep the amount of air sampled to a minimum.