Soil Vapour…..

Which Regulation?
What Sampling Technique?
What Equipment ?



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What is PASSIVE vs Active air sampling?

Active Sampling : Air Sampling that requires a pump of some sort
Passive Sampling: Air Sampling device operates on the principal of passive diffusion or sampling into an evacuated cylinder (canister)

1. What kind of air is being sampled & applicable **regulation**?

2. Do you have an analyte **target list & required reporting limits**?

3. Do you have a required **sampling time**, or does it matter?



Outline

- **US**- EPA → Methods TO-15, TO-17
- **Federal** – Health Canada & CCME
- **Maritimes** – RBCA
- **Ontario** – Regulation 153/04
- **Alberta** – AEP
- **British Columbia** – BCMOE – Sch.11 & BC CSAP

Federal Documents :

Health Canada & Canadian Council for Ministers of the Environment (CCME)

CCME

- CCME's primary guidance for soil vapour is the **2014 Protocol for the Derivation of Soil Vapour Quality Guidelines for Protection of Human Exposures via Inhalation of Vapours – update 2016**
- Canister / Sorbent Tube
- BTEX F1/F2 with or without subfractionation

Health Canada

- Federal Contaminated Sites Risk Assessment in Canada, Part VII: Guidance for Soil Vapour Intrusion Assessment at Contaminated Sites – 2023
- Canister / Sorbent Tube
- Health Based Indoor Air / Chlorine degradation



Maritimes – Atlantic Risk-Based Corrective Action (RBCA), 2024

Which document ?

V4 User Guidance, August 2022
(note : that screening level tables are in: Atlantic Canada Tier II, July 2021)





What technique, target analysis ?

Passivated Canister , BTEX , F1/F2 & aliphatic /aromatics

Sometimes additional chlorinated VOCs :tetrachloroethene, trichloroethene, cis-1,2-dichloroethene, trans-1,2-dichloroethane, 1,1-dichloroethane, vinyl chloride



What equipment ?

Canister, flow controller, duplicate sampler, travel blank, teflon tubing , nut/ferrule fittings



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Ontario Regulation 153/04

Which document ?

Technical Guidance for Soil Vapour Intrusion Assessment, MECP 2021

What target analysis ?

BTEX , F1/F2 with or without aliphatic /aromatics ,
Sometimes additional chlorinated VOCs only, Reg 153/04 Health Based Indoor Air
Utilize conceptual site model, see also section 5.3
Monitoring Well , Vapour Pins, Sub-Slab

What equipment ?

Canisters , TD tubes (thermal desorption- NO F1F2)
If sampling from vapour pins – nut /ferrules?
Purging !

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Alberta Tier One (AEP- Alberta Environment Protection)

Which document?

Alberta Tier One Soil and Groundwater Remediation Guidelines, June 2024
Soil Vapour reference : CCME (2014) *some projects defer to BC MOE CSR Protocol 11, April 2026 “

What target analysis?

BTEX F1/F2 + aliphatic / aromatic subfractionation
BE AWARE of Trichloroethylene RL required if chlorinated VOCs are needed!

What equipment?

Canister if F1/F2 (with or without aliphatic aromatic subfractionation) are needed

Thermal Desorption Tube (only if VHV volatile hydrocarbons/volatile petroleum hydrocarbons in the vapour phase is acceptable)

Other considerations : blank , duplicate , background, Teflon tubing , nut/ferrules

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British Columbia – BC guidance doc & BC Contaminated Sites Approved Professionals (CSAP)

BC – Guidance on Site Characterization for Evaluation of Soil Vapour Intrusion into Buildings, May 2011 (Golder Associates)

- Canisters, **TD Tubes –preferred in BC**, Tedlar bags
- Outlines sampling techniques with insights

BC CSAP –Guidance on the Assessment of Soil Vapour to Air Pathway- 2020,2022, 2024

- Complements BC Ministry of the Environment's requirements, eg Protocol 22 & Technical Guidance 4
- Sampling depends on approach and site conditions

BC MOE CSR Protocol 11, April 2026

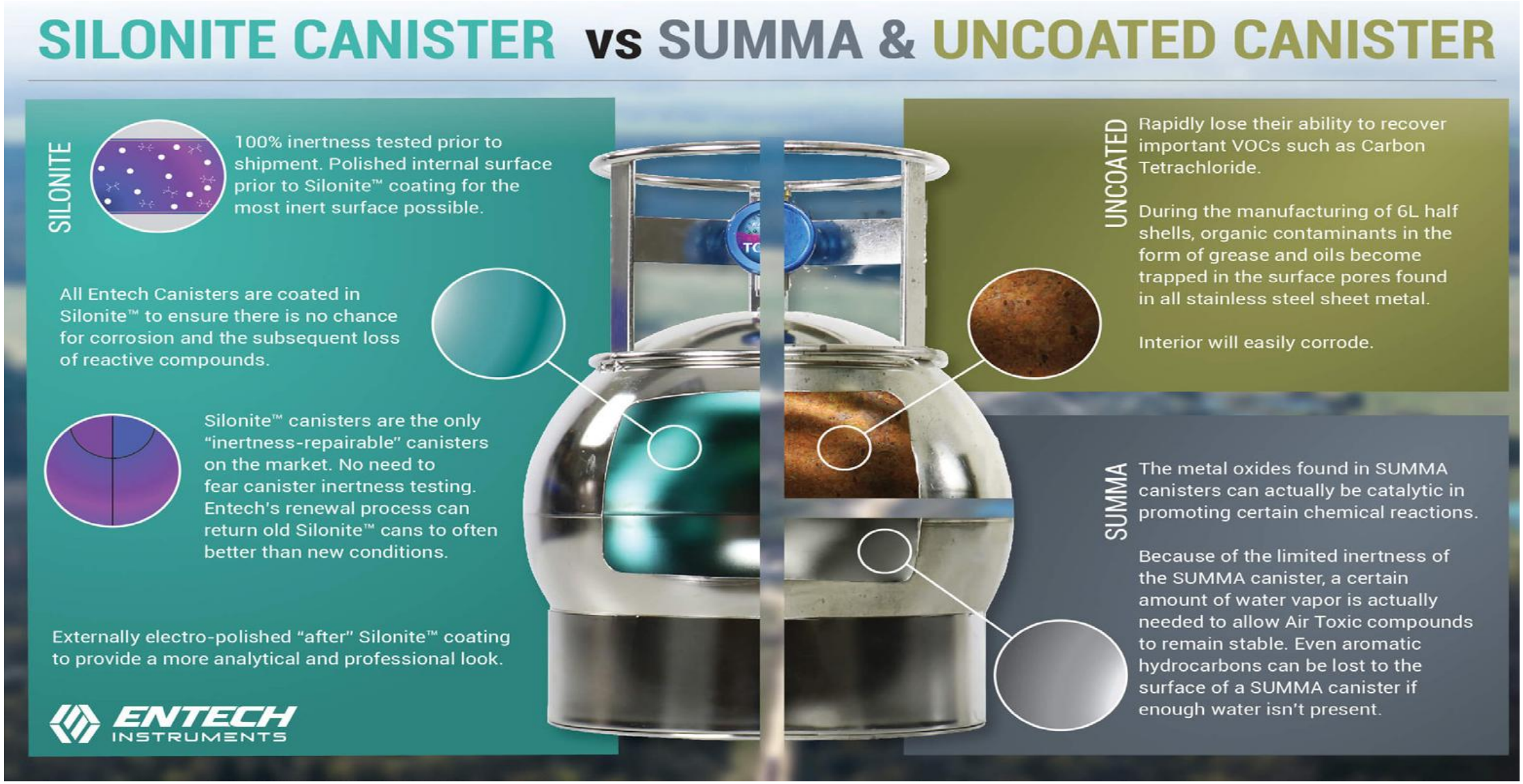
Soil Vapour Intrusion Guidance Documents

Ontario	Draft Technical Guidance: Soil Vapour Intrusion Assessment – MECP 2021
British Columbia	BC MOE CSR Protocol 11, April 2026 Guidance on Site Characterization for Evaluation of Soil Vapour Intrusion into Buildings – May 2011
BC CSAP	Guidance on the Assessment of the Soil Vapour to Air Pathway -2020,2022,2024
Health Canada	Federal Contaminated Sites Risk Assessment in Canada, Part VII: Guidance for Soil Vapour Intrusion Assessment at Contaminated Sites – 2023
AEP	Draft document to Alberta Tier 1 June 2024
CCME	Canadian Council for Ministers of the Environment – Contaminated Sites -2016
US EPA	OSWER Technical Guide For Assessing and Mitigating Vapour Intrusion Pathway from Subsurface Vapor Sources to Indoor Air – 2015, CA EPA 2023

Guidance documents may be available for other provinces – please let me know

Thank you to Ian Hers for updating this list

Silonite vs Summa (USEPA TO-15)



Thermal Desorption Tube Sampling (USEPA TO-17)

- Considerations
- Type of sample taken?
- Flowrate?
- Sampling Time / Volume?



Questions?



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Quality Control Protocol – Blanks

- **Travel/trip blank**
  - As per the updated EPA TO15 requirements, a canister travel blank is filled with UHP Nitrogen
  - TD tube left unopened (normally field blank is done)
- **Field blank**
  - Canister filled in the field with UHP air or nitrogen in a similar manner to sample
  - TD tube opened & immediately closed at sampling location
- **Background blank**
  - Ambient air collected near building being sampled
- **Equipment blank**
  - Ambient air drawn through entire sampling train



Quality Control – Do's /Don'ts

Do's	Don'ts
• Use clean & dedicated sample train materials • Select Teflon or Nylaflow T tubing that doesn't off-gas VOCs which could exceed regulatory limits • Soil Gas Probes – Seal when not sampling • Stainless Steel is best, but rigid PVC (sufficiently old to have low levels of VOCs) is a practical alternative • Use small diameter probes & tubing to reduce purge volume	• No glue or tape except Teflon tape • Do not use: Tygon®, Low Density Polyethylene (LDPE), Silicone, Polyvinyl Chloride (PVC) or Nylon (Extra-Flex) • Do not use freshly cut or scratched rigid PVC

Quality Control – Duplicate Samples

Considerations

- Type of sample taken?
- Same or different flow?
- Same or different time?

Suggestions

- Co-located (side-by-side) for indoor air
- Simultaneous for sub-slab & soil gas using one flow controller
- Equalized pressure in joined canisters provides uniform filling

Potential contamination from different flow controllers can be an issue

Same sampling time requires flow controller set to double the flow rate

Canister Cleaning Procedure

- Canisters are cleaned by filling with nitrogen and evacuating to complete vacuum under heat
- 6L cans are cleaned for 2 days and go through 10 cycles mentioned above
- 1.4 L cans and bottle vacs are cleaned for 3 days and go through 15 cycles mentioned above
- Flow controllers are cleaned by flushing with nitrogen under heat for 24 hours before calibrating the flow rate on a digital flow meter
- All additional parts are continuously stored under heat to clean and maintain cleanliness
- All canisters are individually proofed; however, we only report 1 in a batch into our LIMS **(meets batch proofing requirements, but we actually proof all cans) .**

By individually proofing each canister, the client is able to request the individual proof certificate ($100) after analysis based on data received.

This saves cost for the client as they can pick and choose which canister proofs they want.

US- EPA TO-15 or TO-17 ?





EPA TO-15

- Canisters (passivated/under vacuum)
- VOC Compounds
- Whole Air
- RL is affected by underfilling canister

EPA TO-17

- Thermal Desorption Tubes (TD tubes)
- VOC compounds
- Safe Sampling Volumes (SSV)
- RL is affected by volume of sample taken

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SVI Sampling – Petroleum Hydrocarbons (PHC)

- **PHC Target Compounds**
  - Analysis based on EPA TO-15 method
  - BTEX or other PHCs target list

- **PHC F1 and F2**
  - Analysis based on CCME standard method (water & soil)
  - Total F1 & F2 and corrected for BTEX & naphthalene

- **PHC Sub-Fractions (aliphatic & aromatic)**
  - No standardized methodology, ALS Waterloo method based on Atlantic RBCA (water, soil) & BCMOE (air) methods
  - C6-C8, C>8-C10, C>10-C12 & C>12-C16 aliphatic & aromatic sub-fractions

Complementary Techniques – Why Use Canisters or TD Tubes?

Canisters:

- Quantitative recovery of low MW VOCs (C1-C3 range)
- Prior knowledge of VOCs air concentration is not a controlling factor in sampling (no saturation or safe sampling volume issues)
- Silica coated canisters provide best stability of VOCs, including sulphur & other reactive compounds
- Multiple (sample dilutions) & different (instruments) analyses are possible from the same canister

TD Tubes:

- Good recovery of higher MW VOCs (e.g. siloxanes, low MW PAHs, etc.)
- Good recovery of polar VOCs through adsorption on tube media
- Volume of air collected can be adjusted to meet low regulatory limits
- Small size – personal & area sampling; easy to ship
- Passive sampling – enables extended sampling times without a pump. Sampling applications include: fencelines (EPA 325), buildings (walls, ducts), confined spaces, pipelines, wells, etc.

Common occurrences in Canister Sampling

Canisters:

- Loosening or tightening of fittings
- Twisting off Dust Caps
- Improper filling of canisters
- Duplicate sampling with quick connects – sampling time
- Checking vacuum
- Using timers
- Paperwork

TD tubes:

- End caps left off
- End caps difficult to remove

Interpreting Results

Canister Data:

- ppbv vs ug/m^3
- Batch QC
- Individual proof vs batch proof
- Qualified data for canister at or above atmospheric pressure
- Impact of underfilled canisters

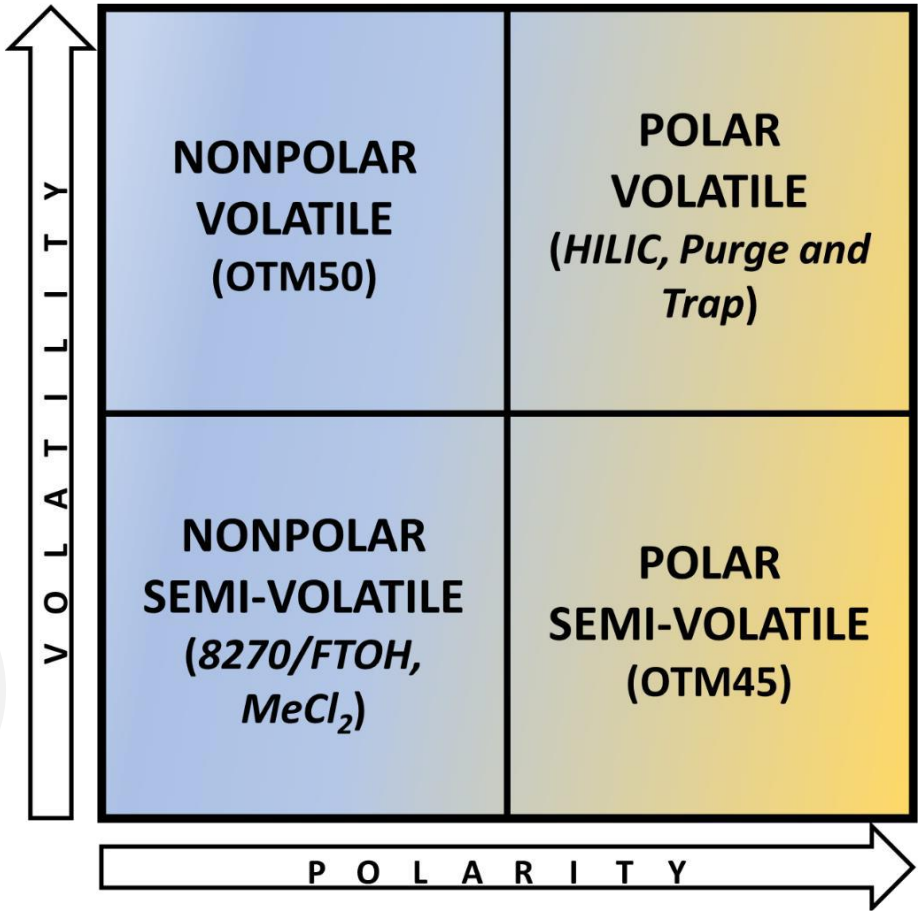
TD tubes:

- Sampling time vs Reporting limit
- Safe Sampling Volumes (SSV)

PFAS in Air-When: Air Monitoring for Survey or Control

- **Stack/source sampling**
- Canister collection
- GC-MS/MS
- 30 compounds (mostly PID)

- **Ambient sampling**
- ASTM D8591 - TD tubes
- OTM-55 - PUF/XAD traps solvent elution
- GC-MS/MS or LC-MS/MS
- FTOH, sulfonamides and others



Source: US EPA

Not many known compounds in this category

- **Stack/source sampling**
- Sampling train collection
- LC-MS/MS
- 49 compounds (typical water analytes)