CSAP Society of Contaminated Sites Approved Professionals of British Columbia

CSAP WEBINAR SERIES

WEBINAR 2: TG4 and TW Attenuation Factors

SPEAKERS

David Williams, Principal, Millennium EMS Solutions Ltd.

Conducted review of trench worker exposure assessment methods under Meridian Environmental Inc. (now Millennium). Prepared CSAP Technical Review #18 (2012) in conjunction with CSAP and MOE, from which the TW Attenuation Factors were developed

SPEAKERS

Peter Kickham, Risk Assessment Officer, Land Remediation, MOE

Who will provide background as to why TW attenuation factors were added, and present an overview of draft TG-4 and the application of the new attenuation factors.

SPEAKERS

Tara Kennedy, Senior Risk Assessor,

SNC Lavalin

Who will be presenting a case study demonstrating the implications of this revision to TG-4 to vapour characterization.

SESSION INFORMATION

- The Webinar consists of a Adobe Connect website portal which was supplied to you as a link and where the presentations can be viewed.
- Should you wish, your computer speakers can be used to hear the presentation.
- Should you not be able to hear the presentation please also dial in to the conference call line supplied to you (please note your line will be muted)
- Questions should be typed in to the “chat” and will be answered by the presenters

VAPOUR ATTENUATION FACTORS FOR TRENCH WORKER EXPOSURE

David Williams
Millennium EMS Solutions Ltd.
(formerly Meridian Environmental Inc.)

CSAP Society Webinar
January 31, 2014

MILLENNIUM
EMS Solutions Ltd.

Background – Why Evaluate Trench Worker Exposure?

Site-specific risk assessment in BC

- MOE requires that risk assessments evaluate risks to all receptors likely to be present at a site (TG7)
- Includes occupation-related exposures (construction, maintenance etc.)
- Worker in trench may have higher degree of exposure to contaminants than worker at surface
- Vapour inhalation greatest contribution to exposure in most cases

Background – Why Evaluate Trench Worker Exposure?

MOE Technical Guidance 4

- Most recent version (2010) does not provide guidance for assessing this pathway
  - Need for standardized approach
- TG4 discussed in more detail in subsequent presentation

Other initiatives

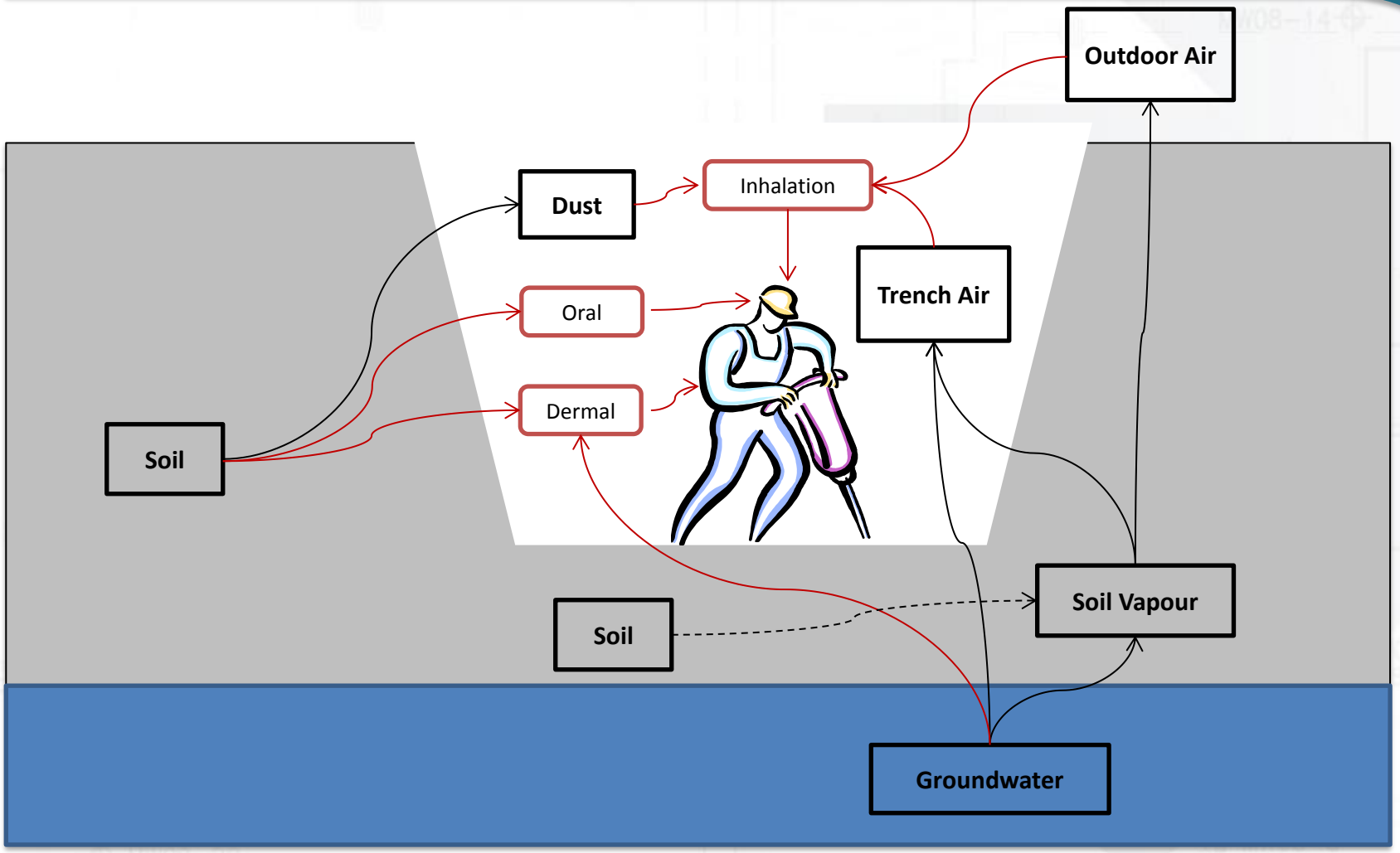
- CCME and some other jurisdictions consider trench worker exposure pathways in guidelines and guidance

Trench Vapour Attenuation Factors

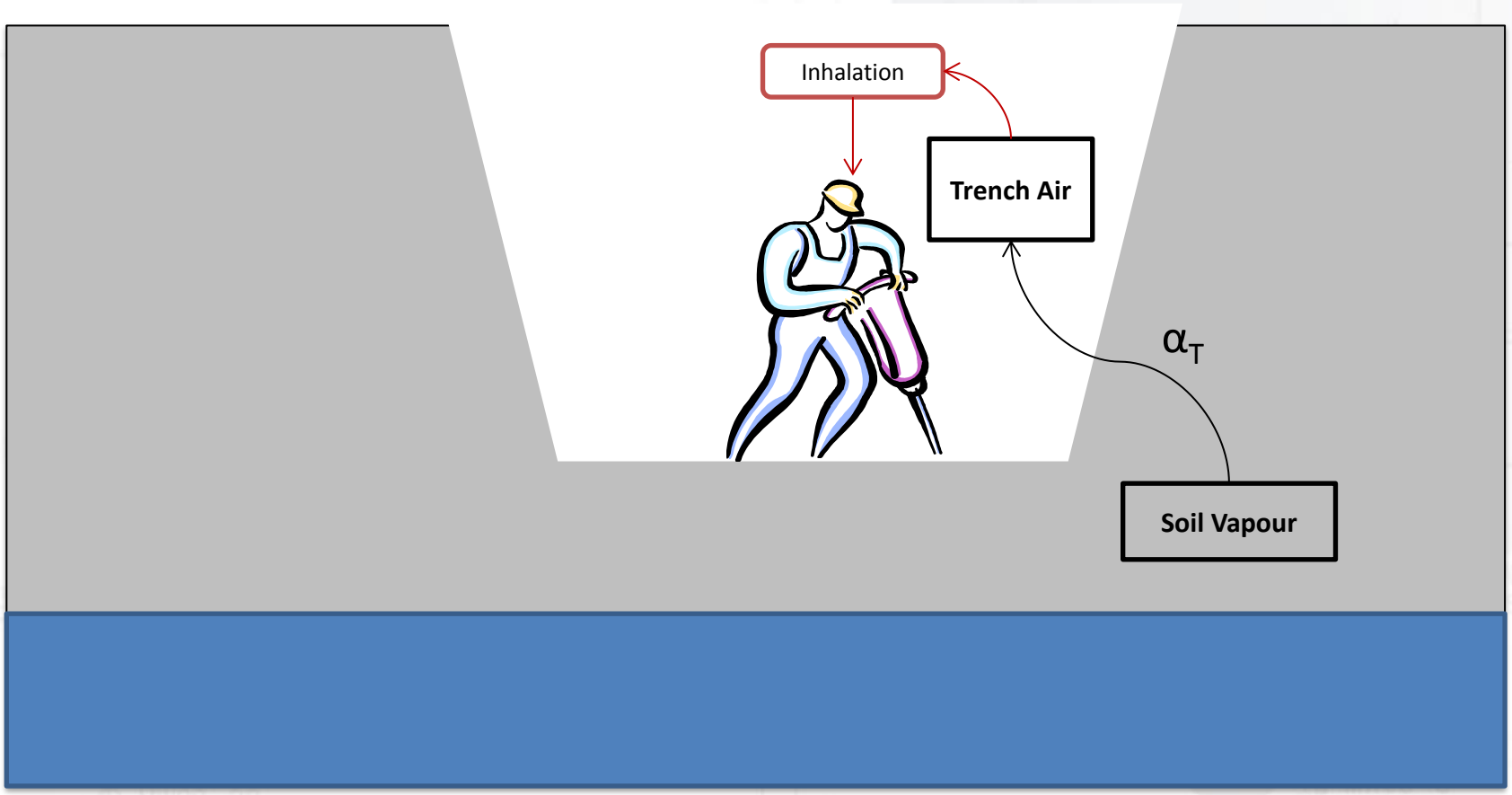
CSAP Technical Review #18 (2012)

- Conducted by Meridian Environmental Inc. (now Millennium) in conjunction with CSAP Society and MOE
- Review of existing guidance and models for estimating soil vapour concentrations in trenches
- Identification and definition of standard exposure scenarios (trench geometry, vapour source depth)
- Development of default vapour attenuation factors for each identified scenario

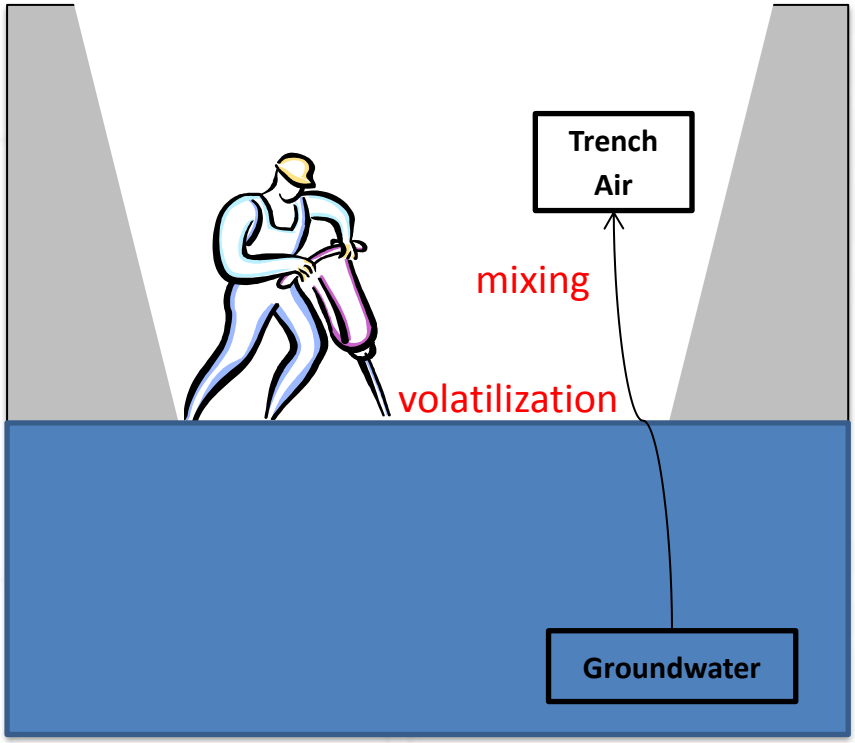
Trench Worker Exposure Pathways

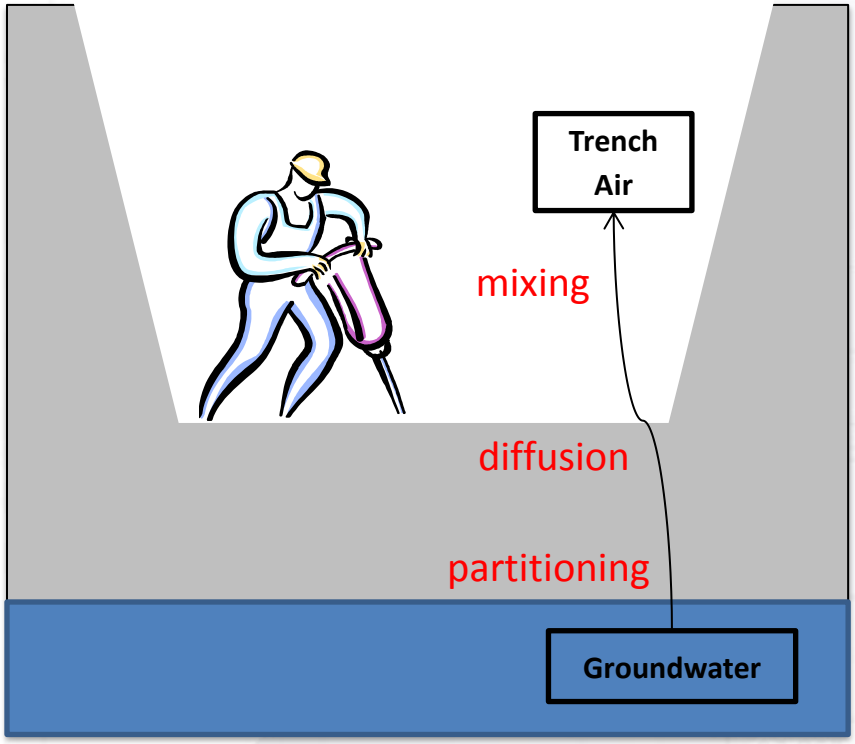


Trench Vapour Attenuation Factor



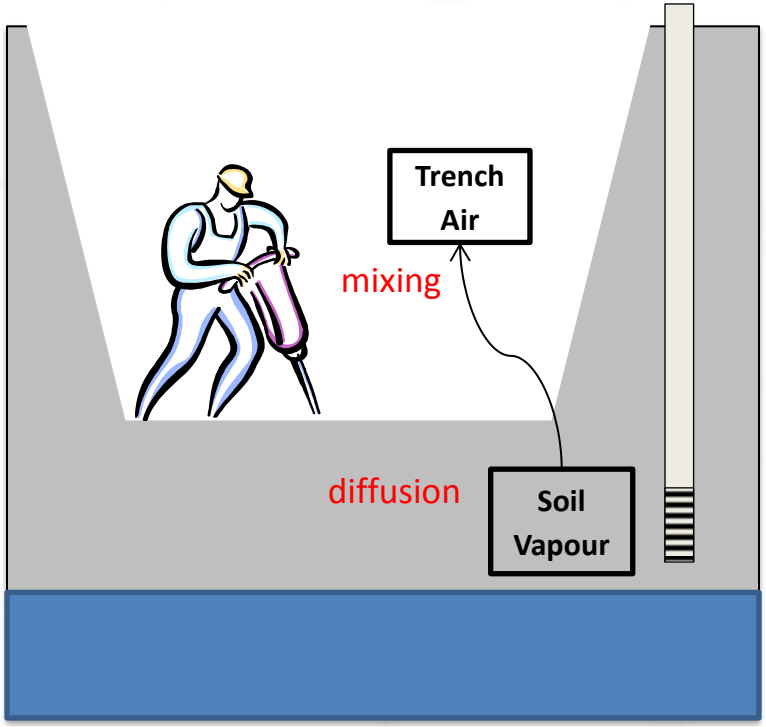
Virginia DEQ Model





http://www.deq.virginia.gov/Programs/LandProtectionRevitalization/RemediationProgram/VoluntaryRemediationProgram/VRPRiskAssessmentGuidance.aspx

Adapted Virginia DEQ Model



$$C_{trench} = C_{SV} * VF_{SV}$$

$$VF_{SV} = \frac{D_{air} * AC_{vad}{}^{3.33} * A * F * 10^4 * 3600}{L_d * ACH * V * Por_{vad}{}^2 * 10^6}$$

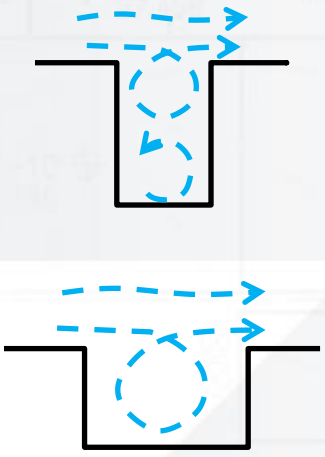
$$\alpha_T = VF_{SV}$$

CSAP (2012) Technical Review #18
Soil Vapour Attenuation Factors for Trench Worker Exposure
Prepared by Meridian Environmental Inc. (now Millennium)

Key Parameters

Air exchange rate (ACH) a function of trench geometry

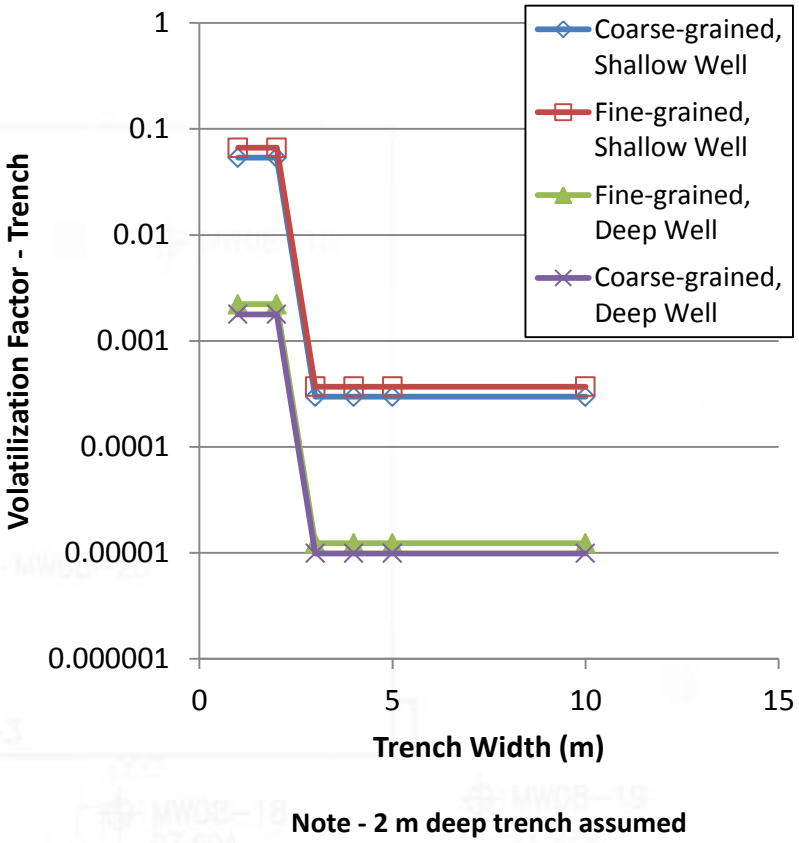
- Narrow trench
  - W/D <1: ACH = 2/h
- Wide trench
  - W/D >1: ACH = 360/h
- Based on studies of urban canyons (VDEQ, EPA)



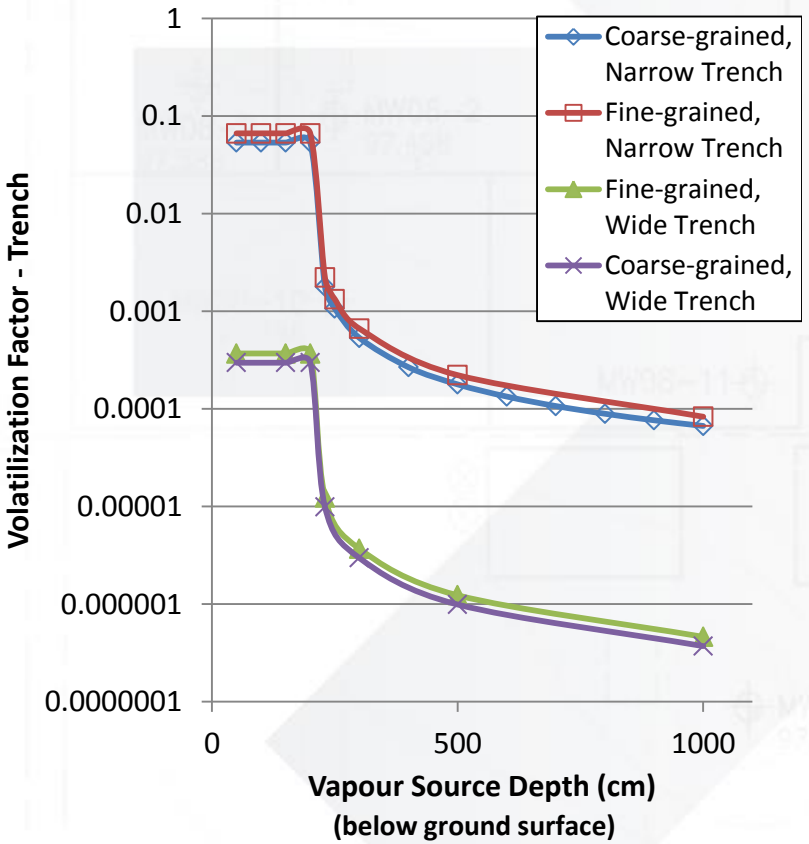
Distance between trench floor and vapour source (L_d)

- Depends on location of vapour sample

Model Sensitivity



Note - 2 m deep trench assumed



Generic Trench Scenarios

Four scenarios based on most influential parameters

- Narrow trench, deep vapour source (≥30 cm beneath base of trench)
- Narrow trench, shallow vapour source (intersected by trench)
- Wide trench, deep vapour source (≥30 cm beneath base of trench)
- Wide trench, shallow vapour source (intersected by trench)

Trench Vapour Attenuation Factors

Recommended default vapour attenuation factors (α_T)

Scenario	Narrow trench	Wide trench
Vapour source intersected by trench	0.09	0.0005
Vapour source below trench base	0.003	0.00002

Trench Vapour Attenuation Factors

Questions?

DRAFT UPDATE TO TECHNICAL GUIDANCE 4: CHARACTERIZING VAPOUR CONTAMINATION IN TRENCHES

Colm Condon / Peter Kickham

January 31, 2014

BRITISH COLUMBIA | Ministry of Environment

PRESENTATION OUTLINE

1. Background information
2. Overview of draft TG-4
3. Application of draft TG-4

STARTING POINT: 2010 TG-4

BRITISH COLUMBIA
The Best Place on Earth

Ministry of Environment

4

TECHNICAL GUIDANCE ON CONTAMINATED SITES

Version 1 September 2010

Vapour Investigation and Remediation

Introduction

Regulatory context

On January 1, 2009, the Stage 6 amendments to the Contaminated Sites Regulation (the Regulation) under the *Environmental Management Act* came into effect [1]. These amendments included the addition of vapour as a regulated environmental medium and a new schedule: Schedule 11 "Generic Numerical Vapour Standards". The ministry has written this document to clarify its expectations for the assessment of sites in the context of these amendments.

Document organization

This document is divided into sections involving the following four activities (Figure 1):

- identifying site use, areas of potential environmental concern (APECs), and potential contaminants of concern (PCOCs);
- refining the list of vapour PCOCs;
- characterizing vapour contamination; and
- remediating vapour contamination.

Supplementary notes and final comments complete the document. The terms used in this guidance listed in Appendix 1 are defined in the procedure "Definitions and Acronyms for Contaminated Sites."

Identifying site use, APECs, and PCOCs

To begin, identify APECs, PCOCs, and site use as per standard practice for Stage 1 preliminary site investigations (PSIs) [2]. Vapour PCOCs include all substances that are both of the following:

a) associated with activities listed in Schedule 2 of the Regulation (Schedule 2) carried out on or near the site, and

b) listed in Schedule 11 of the Regulation (Schedule 11).

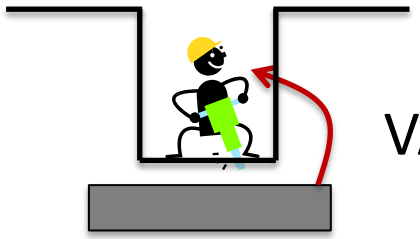
When selecting PCOCs for dry cleaning, waste oil, diesel, or gasoline APECs, the ministry recommends following the guidance "CSAP Soil Vapour Advice and Practical Guidelines" [3] developed by the Contaminated Sites Approved Professional (CSAP) Soil Vapour Advice and Practice Guidelines Development Panel. Site use is determined in accordance with Section 12 (2.2) of the Regulation and footnotes 5, 6, and 7 of Schedule 11.

Note
Regarding footnote 5 of Schedule 11, vapour that passes vertically from water through soil to the breathing zone is deemed to arise from soil. Thus, for example, where vapour arises from groundwater, passes through soil, and enters a commercial building at the surface of a commercial land use site, the site use is commercial and the vapour is deemed to arise from soil, not water.

A SHORTCOMING OF 2010 TG-4

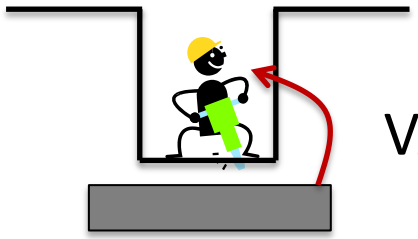
REASONS FOR THE SHORTCOMING IN 2010 TG-4

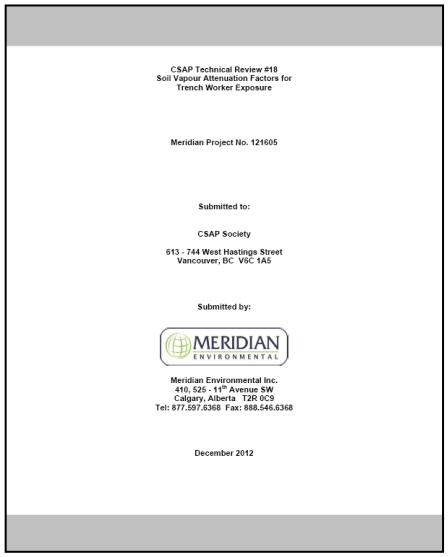
1. WorkSafeBC or British Columbia Ministry of Environment ?

2.  VAF?

WHAT DO WE KNOW NOW?

1. WorkSafeBC or British Columbia Ministry of Environment ?

2. 
VAF? →


CSAP Technical Review #18
Soil Vapour Attenuation Factors for Trench Worker Exposure

Meridian Project No. 121605

Submitted to:

CSAP Society

613 - 744 West Hastings Street
Vancouver, BC V6C 1A5

Submitted by:

MERIDIAN ENVIRONMENTAL

Meridian Environmental Inc.
410, 525 - 11th Avenue SW
Calgary, Alberta T2R 0C9
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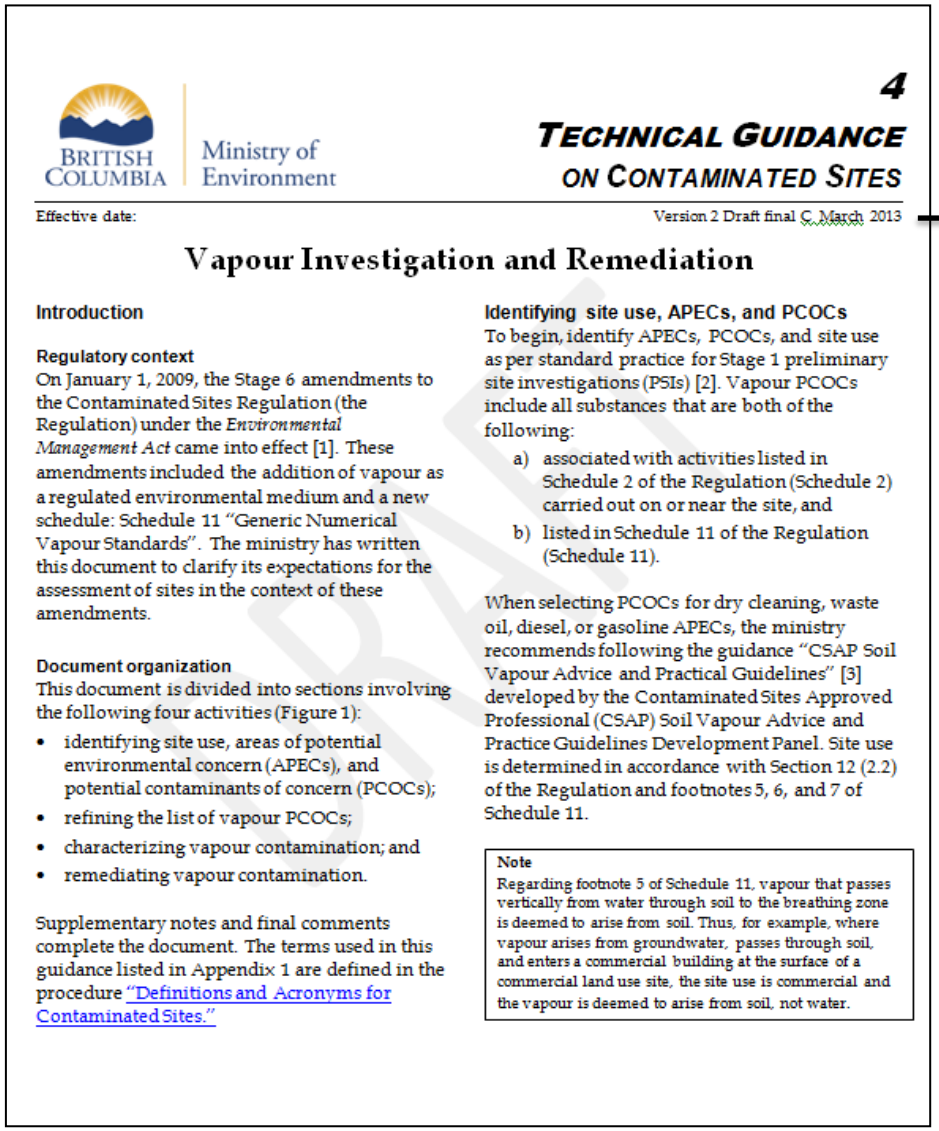
December 2012

DRAFT TG-4 2013



BRITISH COLUMBIA Ministry of Environment

4

TECHNICAL GUIDANCE ON CONTAMINATED SITES

Effective date: Version 2 Draft final C March 2013

Vapour Investigation and Remediation

Introduction

Regulatory context

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Version 2
Draft final C
March 2013

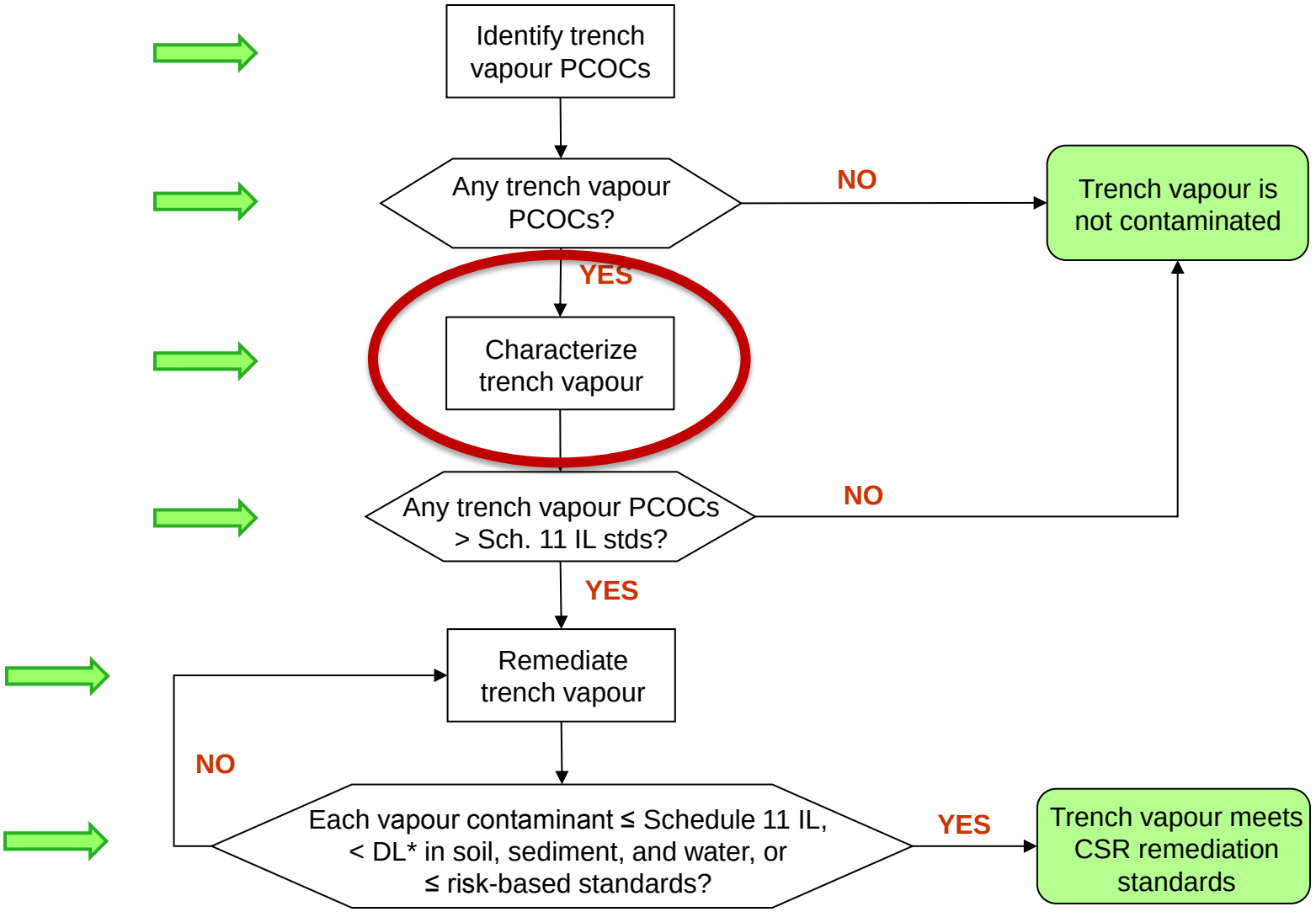
CSAP Society of Contaminated Sites Approved Professionals of British Columbia

With MOE for finalization

KEY NOTES ABOUT DRAFT TG-4 2013

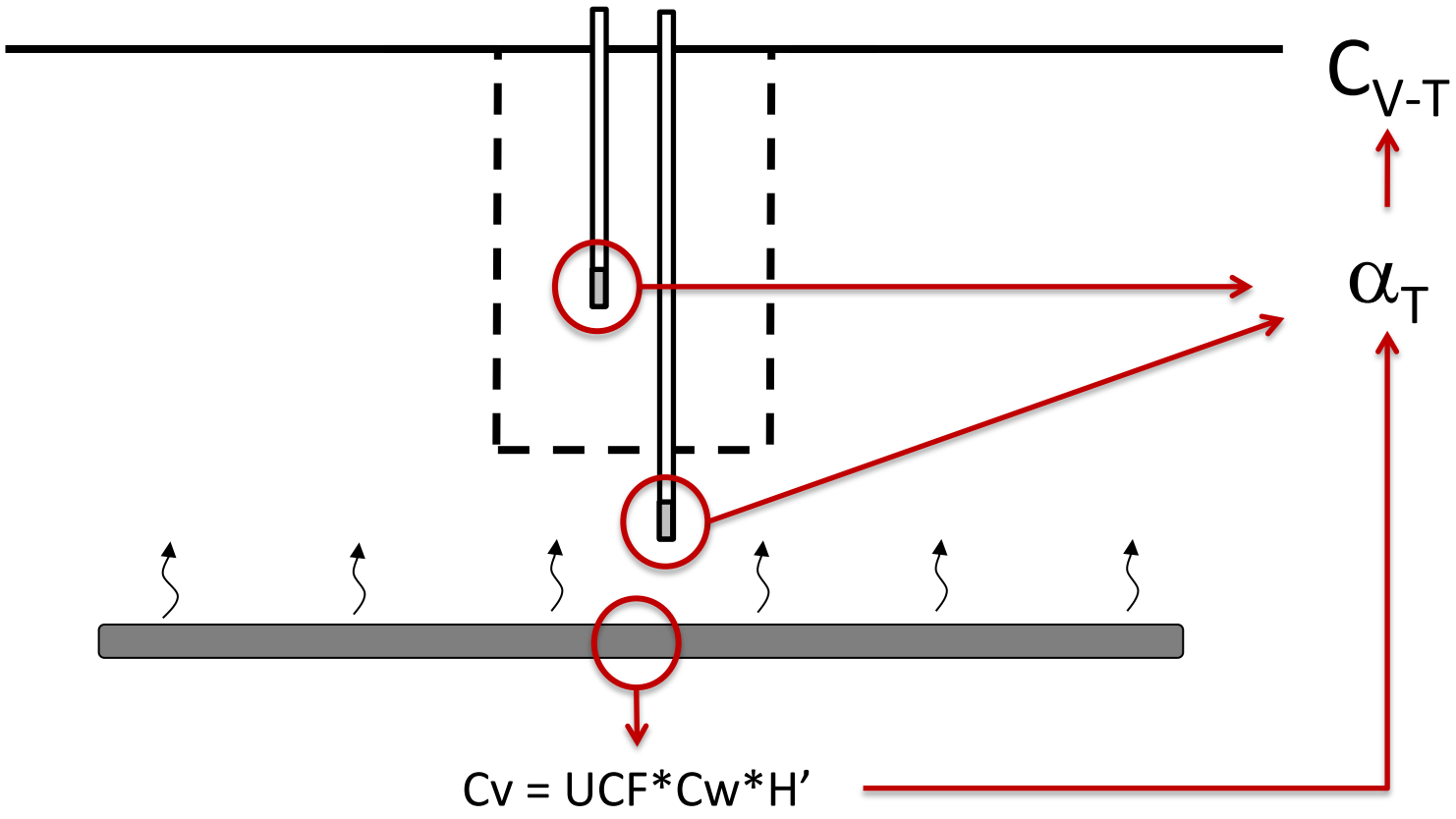
- **Draft** document; could change
- Generally consistent with Meridian's document
- Trench attenuation factors are currently applied for site characterization

2013 TG-4 STEPS FOR TRENCHES



* TG-4 Table 1 substances only

CHARACTERIZING TRENCH VAPOUR CONTAMINATION



VAPOUR ATTENUATION FACTORS FOR TRENCHES

Sampling Depth	Vapour Attenuation Factor (α_T)	
	Narrow Trench (Width < Depth)	**Wide Trench** (Width > Depth)
Shallow (< 30 cm below trench base)	9.0×10^{-2}	5.0×10^{-4}
Deep (> 30 cm below trench base)	3.0×10^{-3}	2.0×10^{-5}

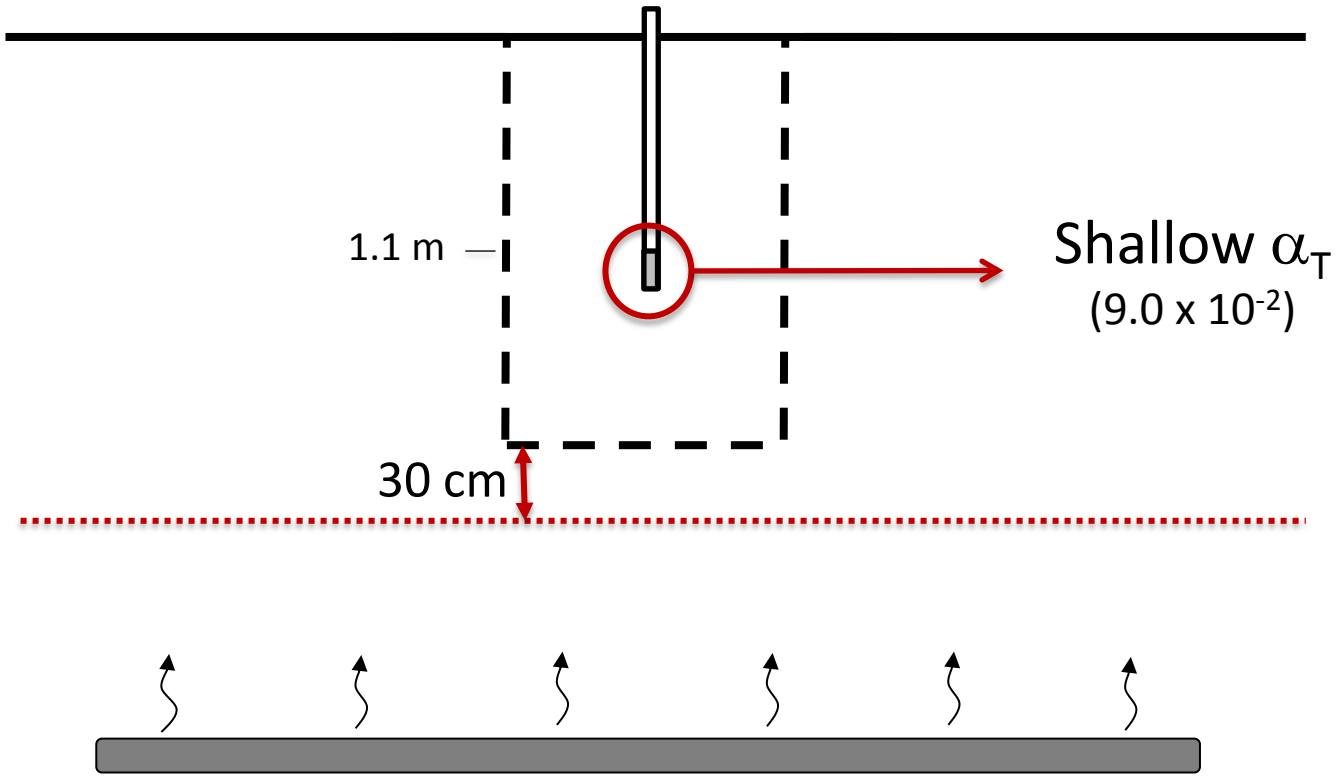
*5 guiding footnotes.

APPLYING α_T — 7 SCENARIOS

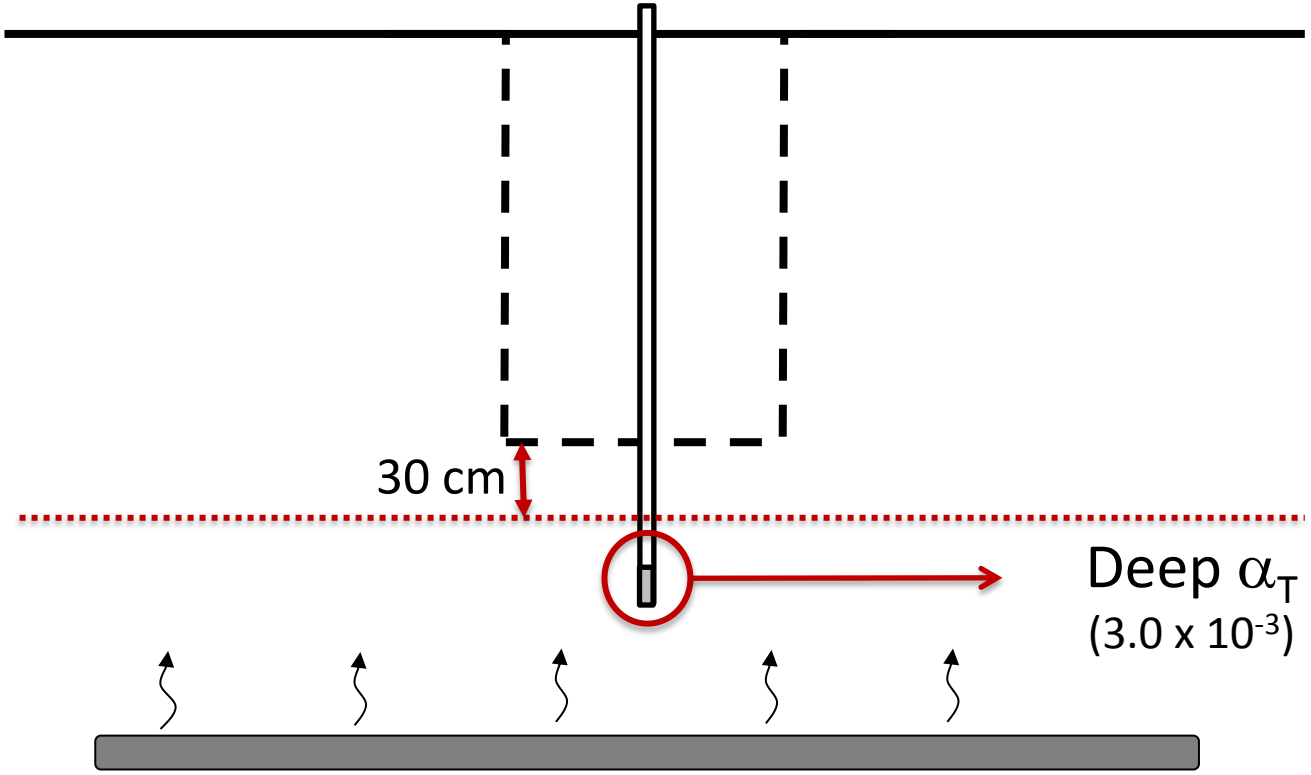
Key TG-4 principle:

"Characterization of vapour contamination must capture worst-case vapour concentrations expected in the breathing zone"

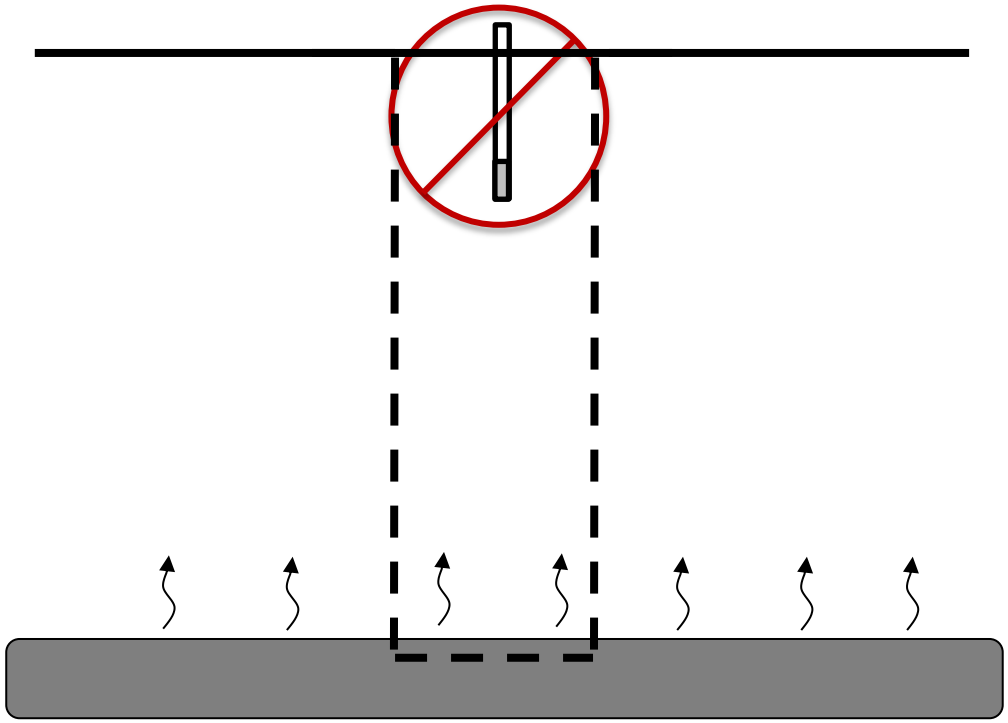
SCENARIO 1: DEEP SOURCE, SHALLOW SAMPLE



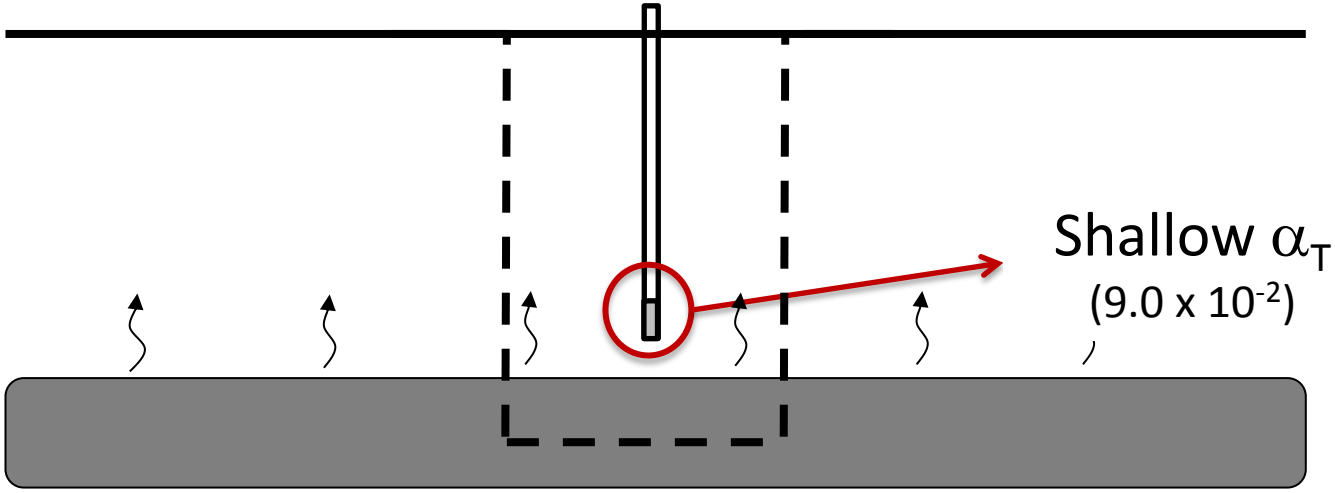
SCENARIO 2: DEEP SOURCE, DEEP SAMPLE



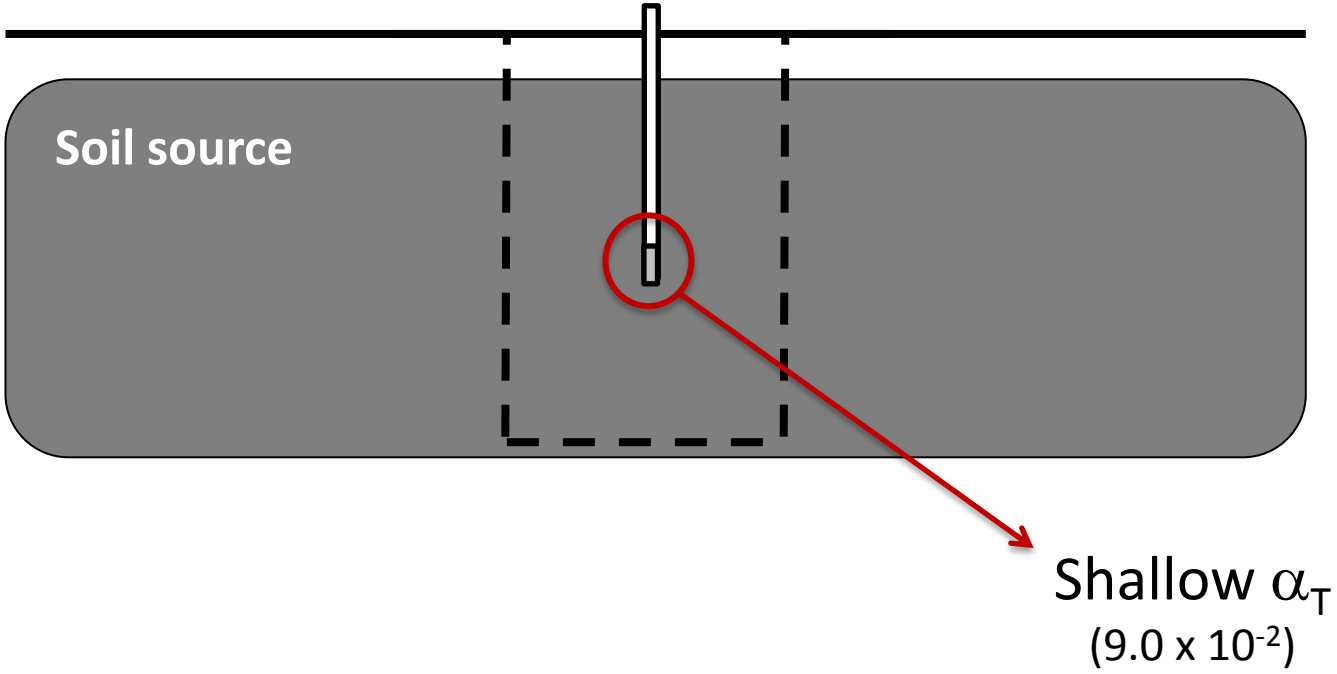
SCENARIO 3: DEEP TRENCH, SHALLOW SAMPLE



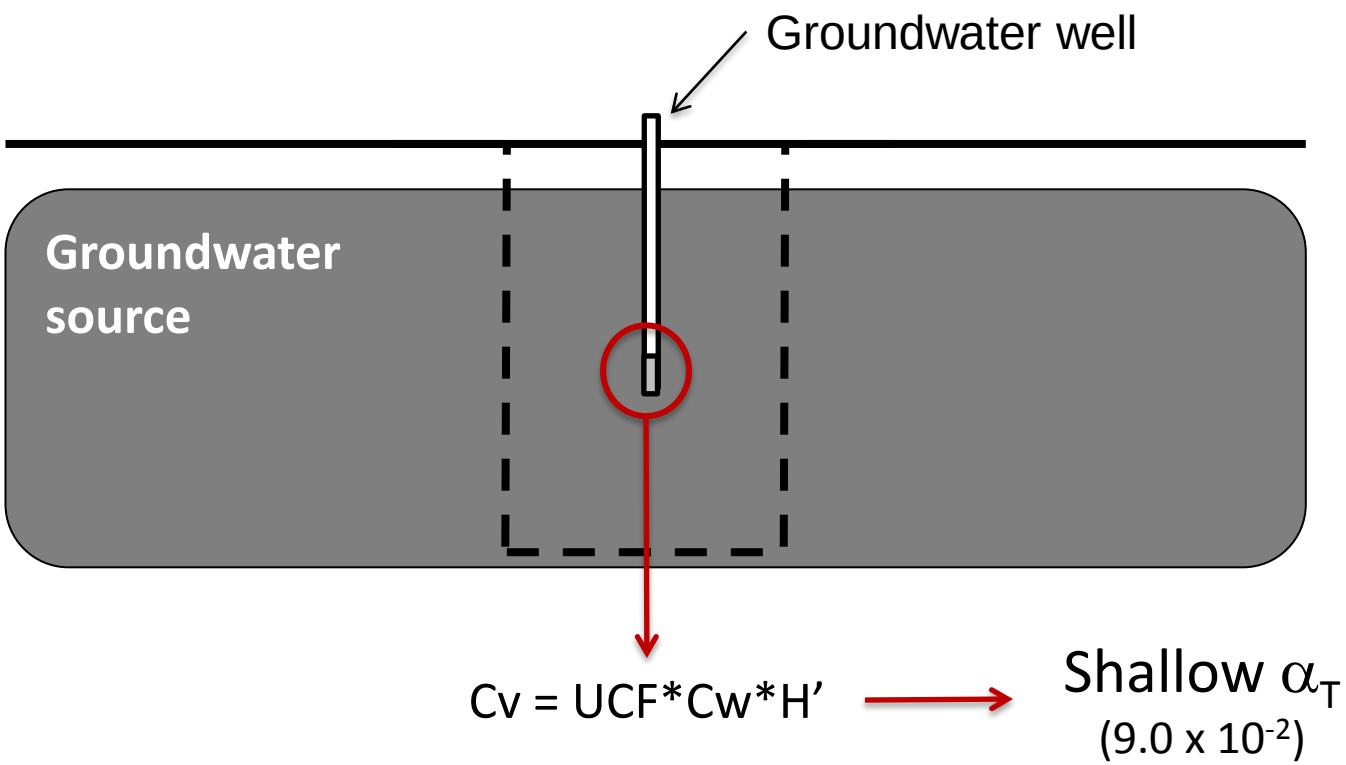
SCENARIO 4: SHALLOW SOURCE, SHALLOW SAMPLE



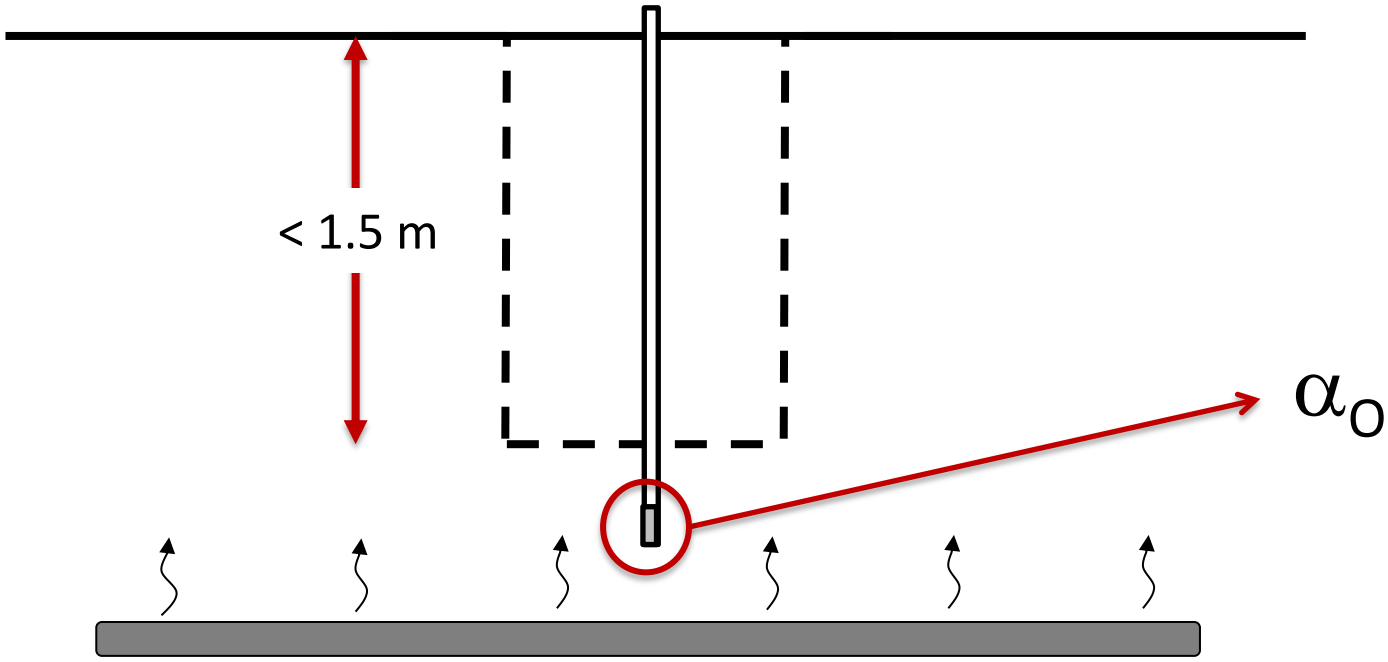
SCENARIO 5: VERY SHALLOW SOIL SOURCE



SCENARIO 6: VERY SHALLOW GROUNDWATER SOURCE



SCENARIO 7: SHALLOW TRENCH



SCENARIO 7: SHALLOW TRENCH

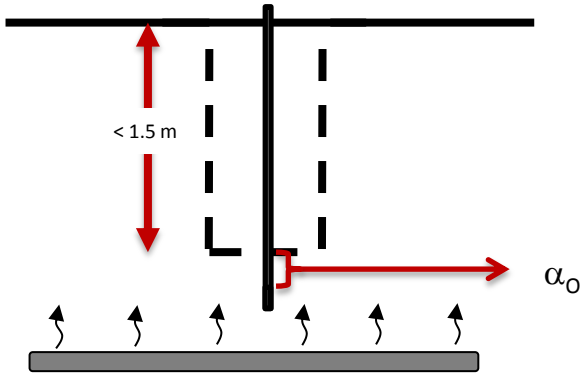


Table 2. Default vapour attenuation factors

Sample Location	Sample Depth[2,3]	Vapour Attenuation Factor (α_I, α_O)[1]		
		Outdoor Exposure (α_O)	Indoor Exposure (α_I)	
			Agricultural, Urban Park, Residential Use	Commercial/ Industrial Use
Below unlined crawlspace, earthen basement, or wooden basement[5]	0.45 to 5 m	-	1.0×10^{-1}	
Subslab[6]	-		2.0×10^{-2}	
In preferential flow pathway[7]	-	1.0×10^{-4}	2.0×10^{-2}	
Subsurface[4]	< 1.0 m	1.0×10^{-4}	2.0×10^{-2} [8]	
	1.0 m	1.5×10^{-6}	2.8×10^{-3}	3.7×10^{-4}
	1.5 m	1.2×10^{-6}	2.3×10^{-3}	3.4×10^{-4}
	2.0 m	9.2×10^{-7}	2.0×10^{-3}	3.1×10^{-4}
	3.0 m	6.1×10^{-7}	1.6×10^{-3}	2.7×10^{-4}
	5.0 m	3.7×10^{-7}	1.1×10^{-3}	2.1×10^{-4}
	7.0 m	2.6×10^{-7}	8.3×10^{-4}	1.7×10^{-4}
	10.0 m	1.8×10^{-7}	6.2×10^{-4}	1.3×10^{-4}
	15.0 m	1.2×10^{-7}	4.3×10^{-4}	9.9×10^{-5}
	20.0 m	9.2×10^{-8}	3.3×10^{-4}	7.8×10^{-5}
	30.0 m	6.1×10^{-8}	2.3×10^{-4}	5.5×10^{-5}

KEY MESSAGES

- **Draft** document; could change.
- Draft TG-4 requires trench vapour characterization
- HHRA for trench vapour: derive new TRV or risk management
- CSM: know where trenches are / will be
- Careful where you sample
- Comments welcome: peter.kickham@gov.bc.ca

QUESTIONS?

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Potential Implications of Proposed Changes to TG 4

Tara Siemens Kennedy, M.E.T., PChem, CSAP

Potential Implications of Changes to TG 4

- Current requirements for trench worker evaluation
- Potential implications of Proposed Changes to TG 4
- A Case Study: Former Service Station
- Considerations going forward

Trench/Trench Worker Def'n

- **Trench: excavation that is deeper than 1 (1.5?) m bgs and deeper than it is wide**
- **Trench Worker: worker that enters a trench that is deeper than 1 m bgs, and deeper than it is wide**

Current Requirements for Trench Worker Evaluation

- MoE (TG 7) requires that all potential receptors be evaluated in a Risk Assessment
  - Trench Workers are considered a uniquely exposed receptor
- In HHRA, DSI vapour data is reviewed using the trench VAFs → predicted trench concentrations > CSR IL = trench air COPCs

Table A: Predicted Trench Vapour Concentrations

Parameter	Maximum Un-attenuated Concentration[1] (µg/m^3) (location of maximum concentration)	Predicted Trench Vapour Concentration (µg/m^3) using an attenuation of 0.09	Applicable CSR IL Standard (µg/m^3)
Site			
Benzene	4,600	**414**	10

Current Requirements for Trench Worker Evaluation

- HHRA typically assumes that there is the potential for trenches anywhere at a Site or MA
  - To avoid unnecessary/difficult to manage risk controls on Schedule B, typical to assume that the trench will intersect the source (i.e., VAF of 0.09 applies)
- Exposures and associated risks to trench workers are predicted
  - Where unacceptable risks are identified, risk control in the form of an H&S plan is recommended

Potential Implications of Proposed Changes to TG4

1. **Vapour delineation has the potential to be driven by trench vapour exceedances**
    - unclear if delineation for trench vapours will be required
    - MoE currently considering how to address

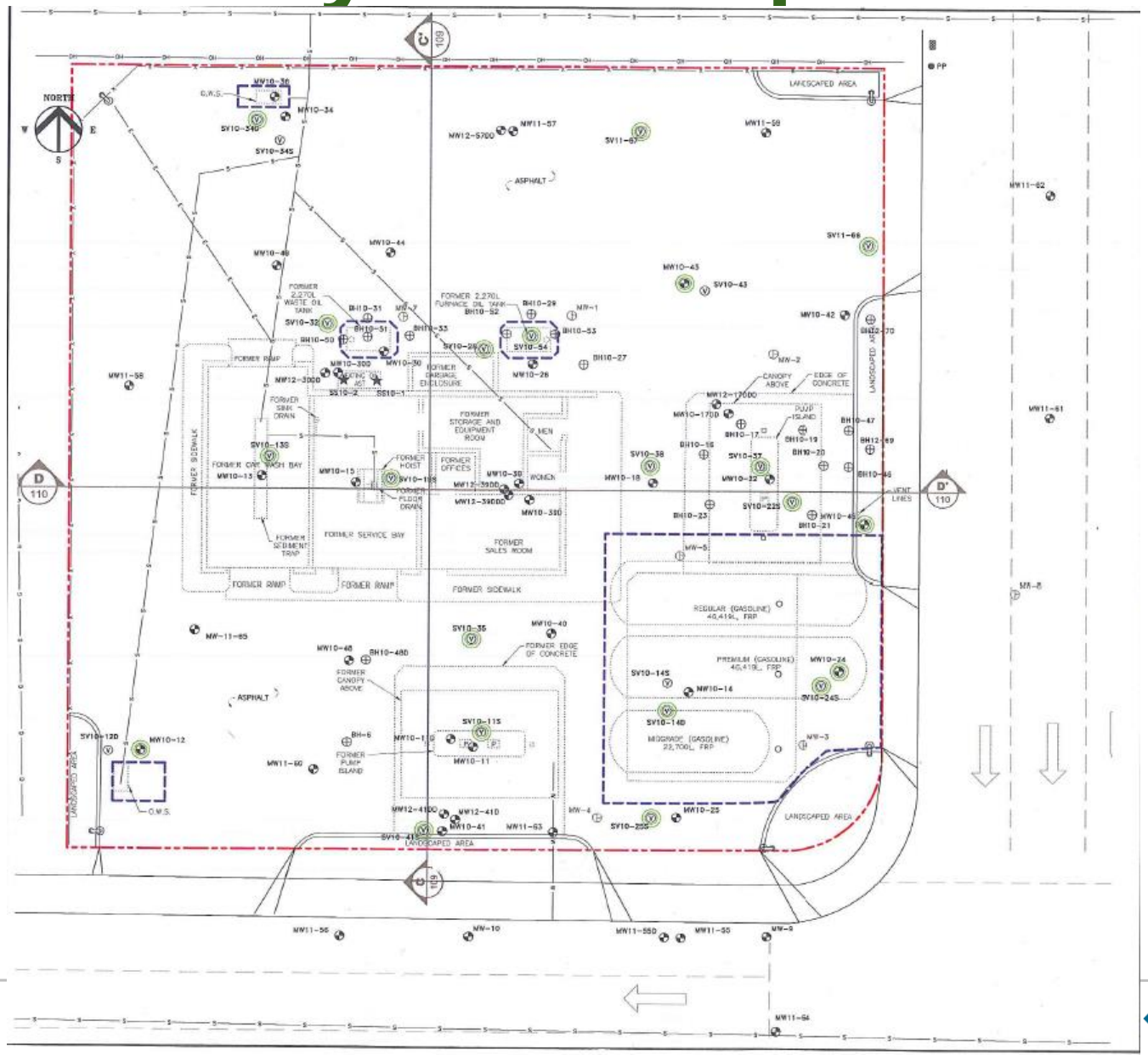
Potential Implications of Proposed Changes to TG4

2. **Management Areas defined solely due to trench vapours**
    - Risk-Based CofCs required for more sites
    - Performance Verification Plans required
    - AG 11 requirements for communication – more parties to communicate with

Case Study

- **Former Service Station Site; CofC obtained late 2012**
- **DSI Vapour CSM included:**
  - **Future slab on grade building at the CL Site**
  - **Nearby residences**
    - Characterized using on-Site data and depth specific VAFs

Case Study – DSI Vapour Results



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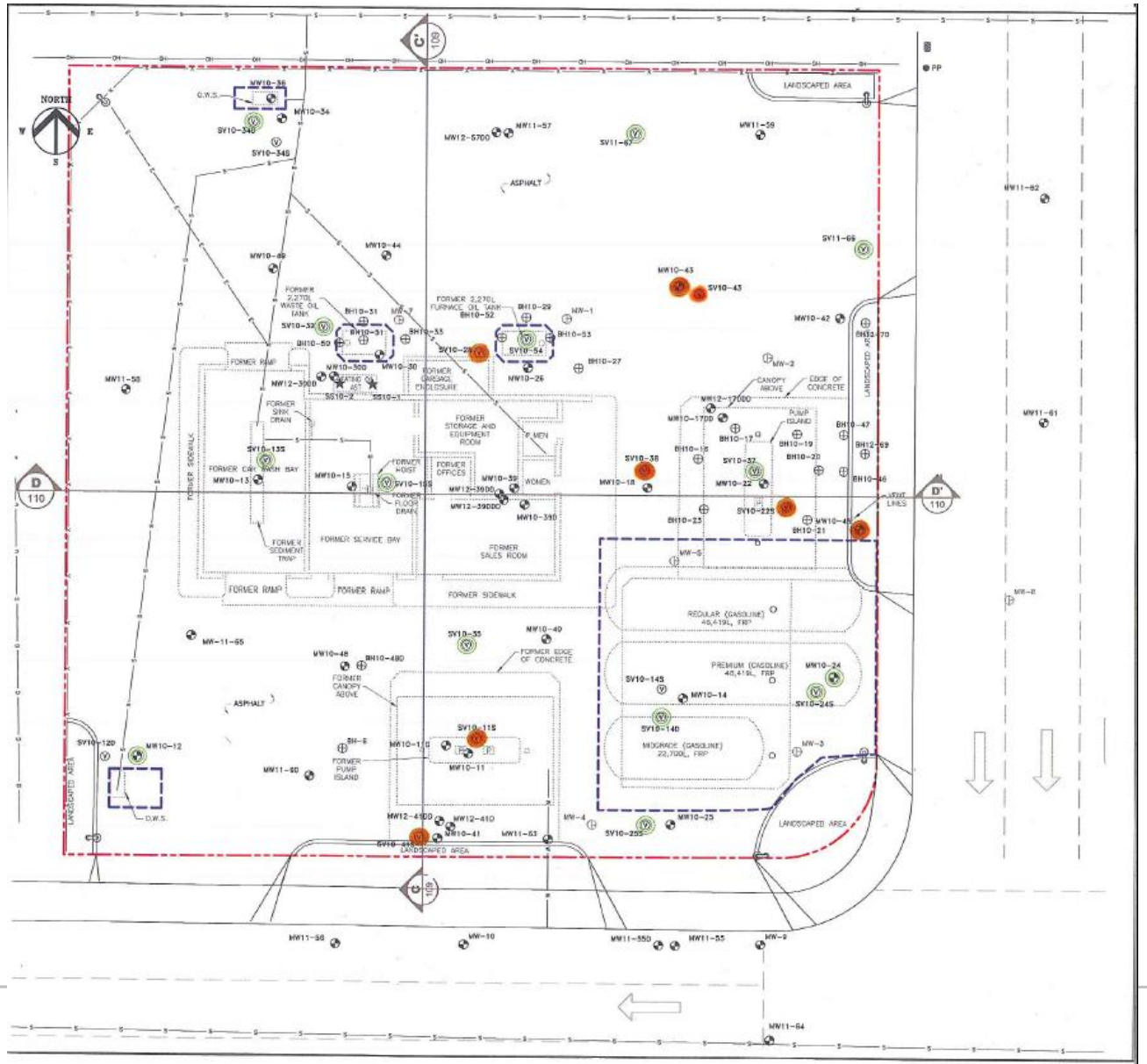
Case Study - DSI Results with Trench VAFs



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Going Forward

- **Considerations:**
  - **Does the MoE support the use of a 1.5 m trench depth?**
  - **Are there conditions that would preclude the potential for ‘problematic’ trenches?**
    - E.g. sites with utilities < 1.5 m bgs?
    - Sites where building occupies entire footprint?

Going Forward

- **MoE to consider how to address potential 'unintended' implications**
  - **Is delineation for trench vapour required?**
  - **If not, how will the exceedances be addressed?**

QUESTIONS?

WE CARE
NOUS VEILLONS

WE CARE embodies SNC-Lavalin's key corporate values and beliefs. It is the cornerstone of everything we do as a company. **Health and safety, employees,** the **environment, communities and quality:** these values all influence the decisions we make every day. And importantly, they guide us in how we serve our clients and therefore affect how we are perceived by our external partners. **WE CARE** is integral to the way we perform on a daily basis. It is both a responsibility and a source of satisfaction and pride by providing such important standards to all we do.

WE CARE about the health and safety of our employees, of those who work under our care, and of the people our projects serve.

WE CARE about our employees, their personal growth, career development and general well-being.

WE CARE about the communities where we live and work and their sustainable development, and we commit to fulfilling our responsibilities as a global citizen.

WE CARE about the environment and about conducting our business in an environmentally responsible manner.

WE CARE about the quality of our work.

Upcoming Webinars

Please mark you calendars for Webinar 3 in the Series

How to Complete AP Submissions

March 12th, 2014