

ESAA Environmental Summit 2023

Practical Considerations for Risk Assessment and Management

Panel 1

April 13, 2023

Moderator: Bruce Tunncliffe, M.A.Sc., P.Eng.



Practical Considerations for Risk Assessment and Management

- **Objective:** bring together experts in real estate, environmental law, consulting, risk assessment and remediation to....
- present practical considerations,
- real-world examples, and,
- lessons learned
- from a variety of perspectives with regard to environmental risk assessment and risk management of brownfield and other contaminated sites in Alberta and Canada.
- **Timing:**
 - 2:20 to 3:30 total
 - 3 speakers – about 10 minute presentations each
 - 30 minutes for question from the audience



Practical Considerations for Risk Assessment and Management

Panel 1 Moderator



Bruce Tunnicliffe,
M.A.Sc., P.Eng.
Vertex Environmental Inc.
Moderator



Practical Considerations for Risk Assessment and Management – Panel 1



Jacquie Stevens,
B.Sc., M.Sc., M.S.E.L., LL.B.
Willms & Shier
Lawyer



Albert Ho,
M.Eng., P.Eng, MBA
First Capital
Land Owner



Theresa Keenan
R.T.(Ag)
UFA Co-operative
Land Owner



Louise Burden,
M.Sc. P.Geol
Ashwell Consulting
Consultant



Let's Get Started!



ESAA Environmental Summit 2023

Practical Considerations for Risk Assessment and Management

Panel 2

April 13, 2023

Moderator: Bruce Tunncliffe, M.A.Sc., P.Eng.



Practical Considerations for Risk Assessment and Management

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- present practical considerations,
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- lessons learned
- from a variety of perspectives with regard to environmental risk assessment and risk management of brownfield and other contaminated sites in Alberta and Canada.
- **Timing:**
 - 3:30 to 4:40 total
 - 3 speakers – about 10 minute presentations each
 - 30 minutes for question from the audience



Practical Considerations for Risk Assessment and Management – Panel 2



Karl Bresee
M.Sc., P.Biol.
Intrinsic Corp
Risk Assessment



Sylvain Bordenave,
Ph.D., P.Biol.
Trace Associates
Consultant (RAs)



Kevin French,
B.A.Sc., P.Eng.,
Vertex Environmental
Contractor



Let's Get Started!





Mount Royal West,
Calgary, AB

Albert Ho
Senior Director Environmental Programs

Environmental Risk Management In Real Estate

Environmental Services Association of Alberta
ESAA Environmental Summit 2023

**Real Estate
Considerations**

&

Risk Management



Highest Best Use



Geography



Location



Tenant Mix



Asset Class

First Capital owns, operates and develops grocery-anchored, open-air centres in neighbourhoods with the strongest demographics in Canada.



FCR's Pillars of Environmental Risk Management

1. Integration of Risk Management into Functional Teams
2. Master Service Agreement with select Consultants
3. Management System and Proactive Work Programs
4. Environmental Insurance Program
5. Quarterly Reporting to Executive Management and the Board of Directors

Facing Questions From C-Suite!

1. Are there any concerns with *Fill in Business Driver* this property?
2. How can we address or overcome these concerns?



Edmonton Brewery District
Edmonton, AB

Business Drivers

1. Acquisitions and Disposition
2. Financing
3. Redevelopment
4. Operating a property
5. Meeting Tenant Needs
6. Public Perception



Seton Gateway
Calgary, AB

Questions I need to Ask to Assess Risk?

1. Are there legal claims or Ministry orders?
2. Is there environmental Impairment?
3. What do we need to do after we own the property?
4. What options do we have to manage risk?
5. What will stakeholders accept?



Mount Royal Village
Calgary, AB



Top 5 Intolerable Environmental Risks

Uncertainty = Risk

1. Inability to Investigate the Property
2. Known human/ ecological health Concerns
3. Off-site Migration
4. Uncharacterized or Not Fully Characterized Contamination
5. Practically Unresolvable and/or Ambiguous

Recommendations in Reports

Cranston Market
Calgary, AB



Albert Ho

Senior Director Environmental Programs

First Capital

Shops at King Liberty
85 Hanna Ave, Suite 400
Toronto, ON

Tel: 416-216-2390

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Royal Oak Centre
Calgary, AB

Practical Considerations for Risk Assessment and Management – Part 1: Alberta's Risk Assessment Legal Regime

Jacquelyn Stevens

Partner, Certified Specialist in Environmental Law by the Law Society of Ontario

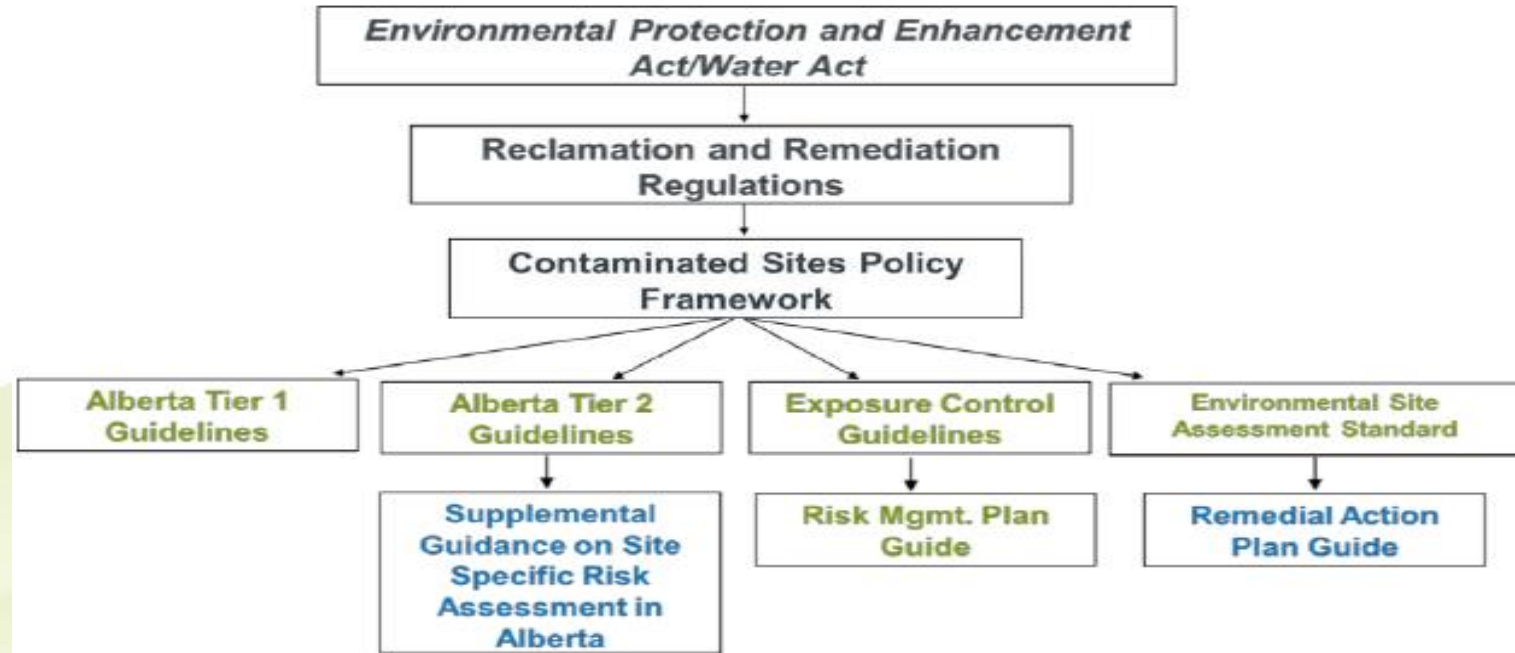
This presentation provides general information and is not intended to provide legal advice.
Audience members should seek legal advice for specific situations.

ESAA Environmental Summit
Jasper, Alberta
April 13, 2023

Contaminated Sites – Key Concepts

- **Promote Redevelopment of Brownfield/ Contaminated Sites**
- **Protect Human Health and Environment/Ecology**
- **Contaminant/Contamination Definition**
- **Standards/Guidelines**
- **Qualified/Responsible Person/Professional**
- **Risk Assessment/Risk Management**
- **Regulatory Approval/ Liability Allocation**

Alberta Legislation and Policy Documents



*Documents in **green** are incorporated into the Remediation Regulation by direct reference. Documents in **blue** are supplemental guidance to the primary reference.

Alberta Policy Framework

- **Environmental Protection and Enhancement Act**
 - Conservation and Reclamation Regulation, Release Reporting Regulation, and Remediation Regulation
- **Contaminated Site Policy Framework (October 31, 2014)**
- **3 policy outcomes**
 - pollution prevention – avoid impairment of or damage to the environment, human health or property
 - health protection – take action to respond to risk
 - productive use – remediate and return site to productive use
- **Traditionally preferred and promoted full remediation to Alberta Tier 1 and 2 Guidelines over Risk Management/ Exposure Control**

Alberta Policy Framework

- **Section 112 EPEA – take all reasonable measures to repair, remedy and confine effects of substances, and remediate, manage, remove or otherwise dispose of the substances in a way to prevent an adverse effect**
- **Remedial Measures for substance releases**
 - submission of Phase 2 ESA
 - complete remediation ASAP and submit report to Director
 - if remediation not complete within 2 years, submit remedial action plan
 - report “new information” to “affected” persons (not defined)
- **Professional Declaration – AIA, ASPB, APEGA, ACPA, CAPF, CAPFT, ASET – minimum 5 years experience and E & O insurance**

Alberta Tier 1 and Tier 2 Guidelines

- **Alberta Tier 1 Guidelines (January 2023)**
 - more protective of sensitive receptors
 - all generic exposure pathways and receptors present and may not be screened out
 - standard to determine contaminant “adverse effect” under EPEA
- **Alberta Tier 2 Guidelines (January 2023)**
 - site specific remediation standards
 - only available in limited cases
- **CCME 2016 Guidance Manual for Environmental Site Characterization adopted**

Alberta Tier 1 and Tier 2 Guidelines

- **Alberta Tier 1 Guidelines Preferred for Source Control**
 - not “pollute-up-to” levels
 - Tier 1 Remediation Certificate provides EPO protections
 - where complete source removal not feasible, must be removed to greatest extent + treatment, control, and management measures implemented
 - where remedial management of residual source, not eligible for Remediation Certificate
- **Alberta Tier 2 Guidelines may be used in limited cases**
 - Site Specific Risk Assessments
 - Director must determine that Tier 2 Guidelines offer “equivalent” environmental and health protections
 - eligible for Tier 2 Compliance Letter

Alberta Environmental Site Assessment

- **Provides minimum requirements for site characterization and reporting**
- **Delineation – both horizontal and vertical – to assess exposure pathways and receptors**
- **Delineation complete when measured concentrations consistently less than Alberta Tier 1 or Tier 2 Guidelines**

Alberta Exposure Control

- **Use of physical and/or chemical exposure barriers, administrative controls or other exposure management**
- **Long(er) term strategy where remediation cannot or will not be completed, with continued maintenance of exposure controls/RMP**
- **Consider requirements for**
 - present and future land use
 - source control
 - mitigation of off-site contaminant migration
 - regulatory and stakeholder input
- **Regulatory closure precluded - issuance of EPOs allowed**
- **Use of RMP and SSRA to manage**

Alberta Risk Management Plan

- **Exposure control assessment as an option for managing contaminated land to ensure risks to human health and the environment managed**
- **RMMs will vary in complexity relative to issue at a site**
- **Exposure barriers** – soil cover, impermeable barriers, vapour control, fencing, binding chemicals in soil-cement matrix, groundwater pump and treat
- **Administrative controls** – security program, groundwater use restriction, employee safety program, design restrictions for building/construction/utility, restrictive covenants/caveats
- **Long term control, monitoring, contingency, communications, and timeline plans**

Alberta Tier 2 Site Specific Risk Assessment

- ***“Supplemental Guidance on Site-Specific Risk Assessments in Alberta”***
August 9, 2022
 - clarification on technical requirements and expectations for SSRAs for contaminated sites
- **2 components to be completed by qualified professionals**
 - human health risk assessment
 - ecological risk assessment
- **Develop Site-Specific Remedial Objectives (SSROs)**
- **Spectrum of complexity - screening level RA - detailed quantitative RA**
- **Regardless of complexity, defensible conclusions to be drawn about level of risk and SSROs**

Alberta Tier 2 SSRA

- **Factors required to be considered complete**
 - vertical and horizontal delineation in soil, groundwater and other relevant media for all COPCs prior to undertaking RA
 - development of a Conceptual Site Model
 - all COPCs, exposure pathways and receptors to be considered during problem formulation phase
- **Data required to conduct an SSRA must include**
 - complete on-site and off-site COPC characterization
 - site data
 - receptor characteristics and identification of exposure pathways
 - toxicity information

Alberta Tier 2 SSRA

- **Sample Conditions of when an SSRA may be declined**
 - failure to demonstrate source control and/or stable or decreasing plume size
 - use of inappropriate receptor characteristics
 - incorporation of risk management assumptions with an accepted Risk Management Plan
 - failure to identify and consider vulnerable populations or unique receptors
 - modeling without adequate sensitivity analysis

Alberta Limited Remediation Certificate

- **Where property is not a “site” and/or is a transmission line, pipeline, road right of way, railway**
- **Details of site, land use, delineation, substance releases, details of remediation to Alberta Tier 1 or Tier 2 Guidelines**
- **Risk Management Plan to monitor/mitigate adverse effects**
- **Protection from EPOs, with exceptions**
 - contamination exceeds remediation objective
 - change in condition causing adverse effect
 - change to the use of land

Alberta Site-Based Remediation Certificate

- **“sites” – land where substances were released, stored, produced, drilled, or used (Schedule of Activities)**
- **In addition to requirements for Limited Remediation Certificate, need**
 - Phase 1 ESA and Phase 2 ESA
 - detailed remediation report confirming contaminants addressed
- **Protection from EPOs, with exceptions**
 - contamination exceeds Guidelines onsite or offsite
 - Risk Management Plan not implemented
 - change in condition causing adverse effect
 - change to the use of land

Alberta Tier 2 Compliance Letter

- **Available when area of land or site meets Alberta Tier 2 Guidelines and no remediation required**
- **Applicant must submit**
 - completed Phase 1 ESA and Phase 2 ESA – no Tier 2 exceedances
 - CSM that supports SSRA
 - SSRA that justifies assumptions of RA
- **May be rescinded if**
 - Guidelines, site conditions or land use change
 - audit or complaint that site not compliant at time of issuance
 - Environment Professional provides false/misleading information

Willms & Shier Environmental Lawyers

- **Established nearly 50 years ago**
- **Environmental, Indigenous, and Energy law**
- **16 lawyers**
 - seven lawyers are certified by the Law Society of Ontario as Environmental Law Specialists and one in Indigenous Legal Issues
 - lawyers called to the Bars of Alberta, British Columbia, Ontario, New Brunswick, Northwest Territories, Nunavut and the Yukon
 - offices in Toronto, Ottawa, Calgary, and Yellowknife

Contact Information



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Environmental Law Specialist
Certified by the Law Society of Ontario

Called to the Bars of Ontario and Alberta

Willms & Shier Environmental Lawyers LLP

www.willmsshier.com

ESAA Summit 2023: Risk Assessment /Risk Management Panel: April 13th

GUIDELINES AS RISK ASSESSMENTS

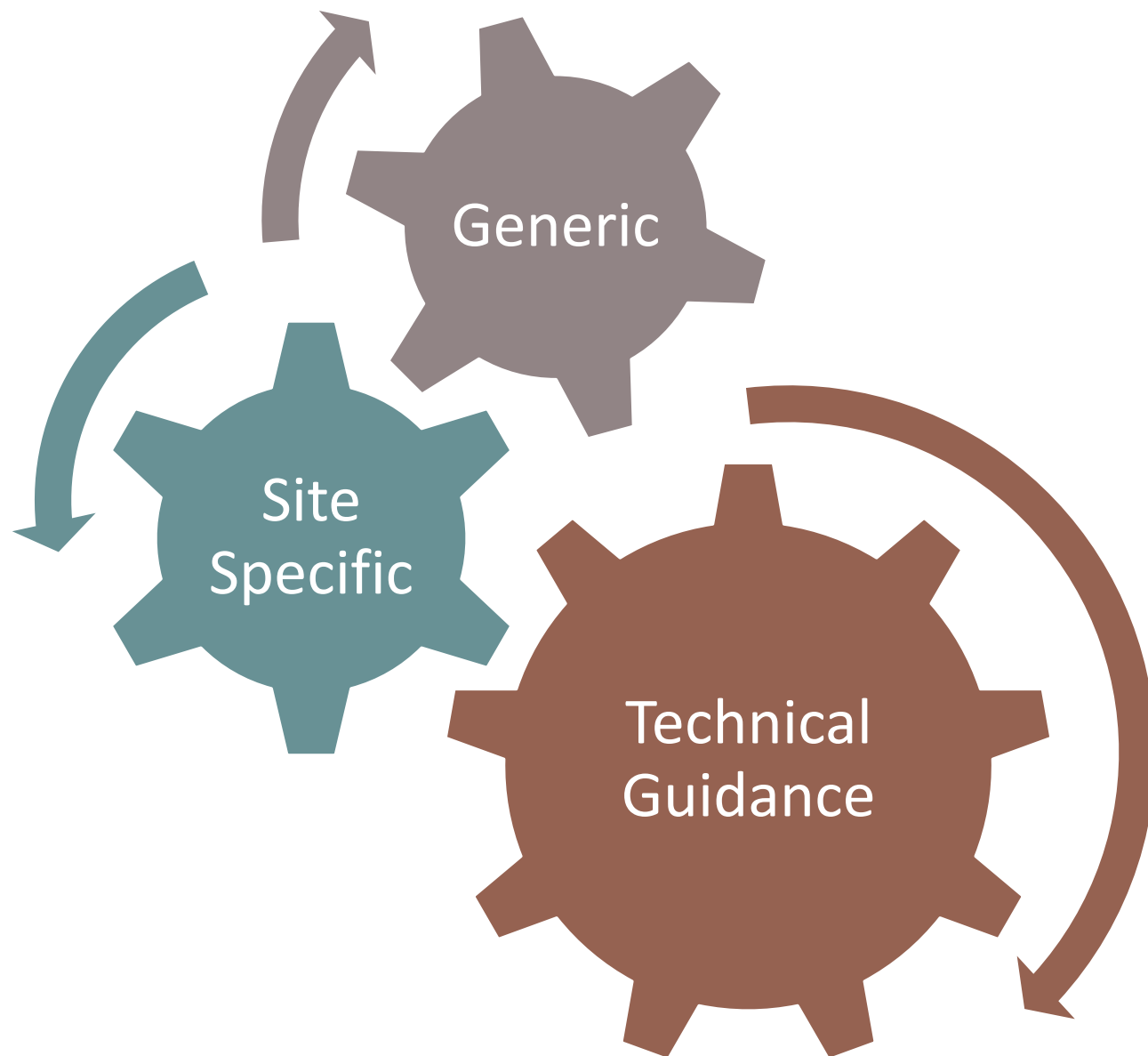
Louise Burden M.Sc P.Geol, QPTIER3



Guidelines as Risk Assessments

Different Perspective





—
**Alberta tier 1
soil and groundwater
remediation guidelines**

Alberta

Classification: Public

—
**Alberta tier 2
soil and groundwater
remediation guidelines**

Alberta

Public

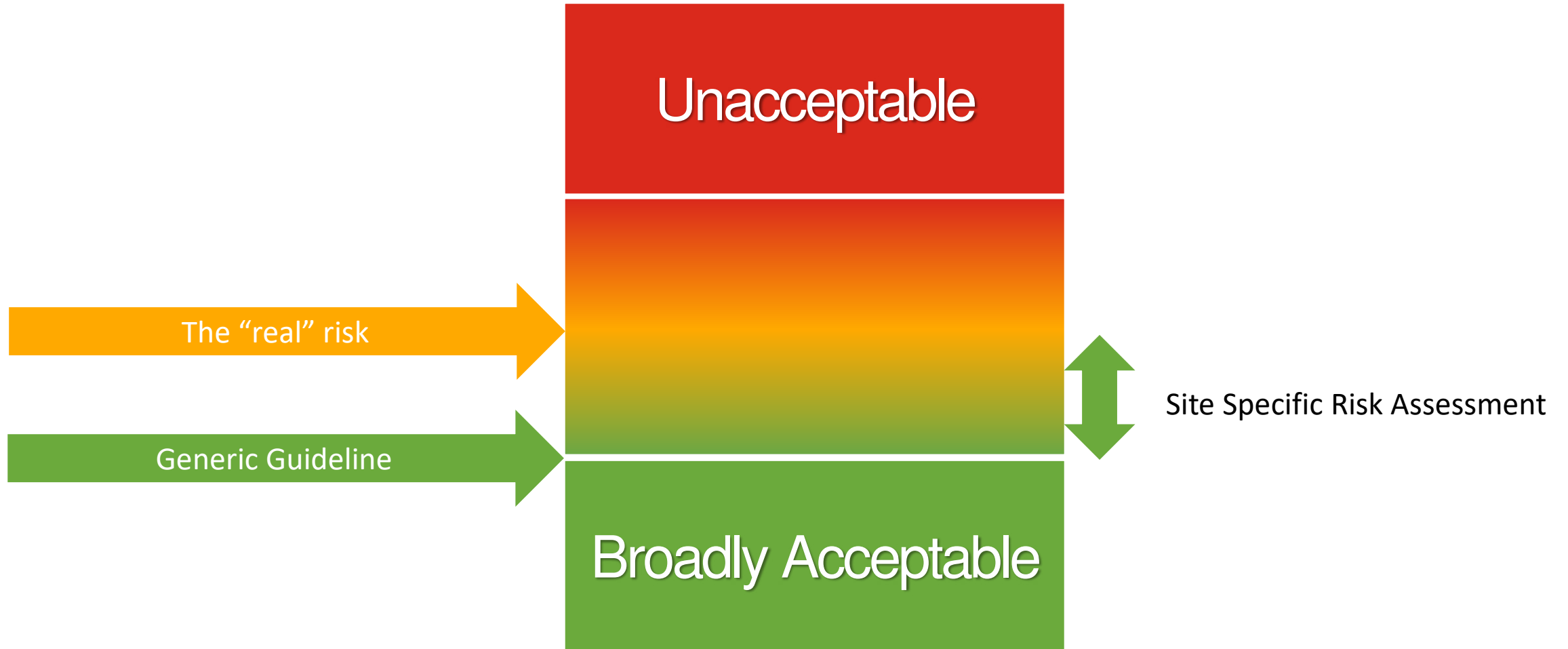


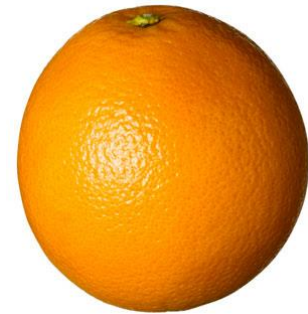
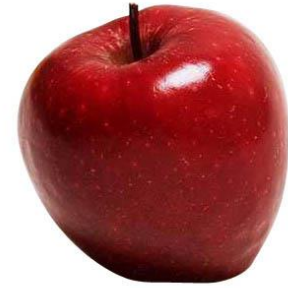
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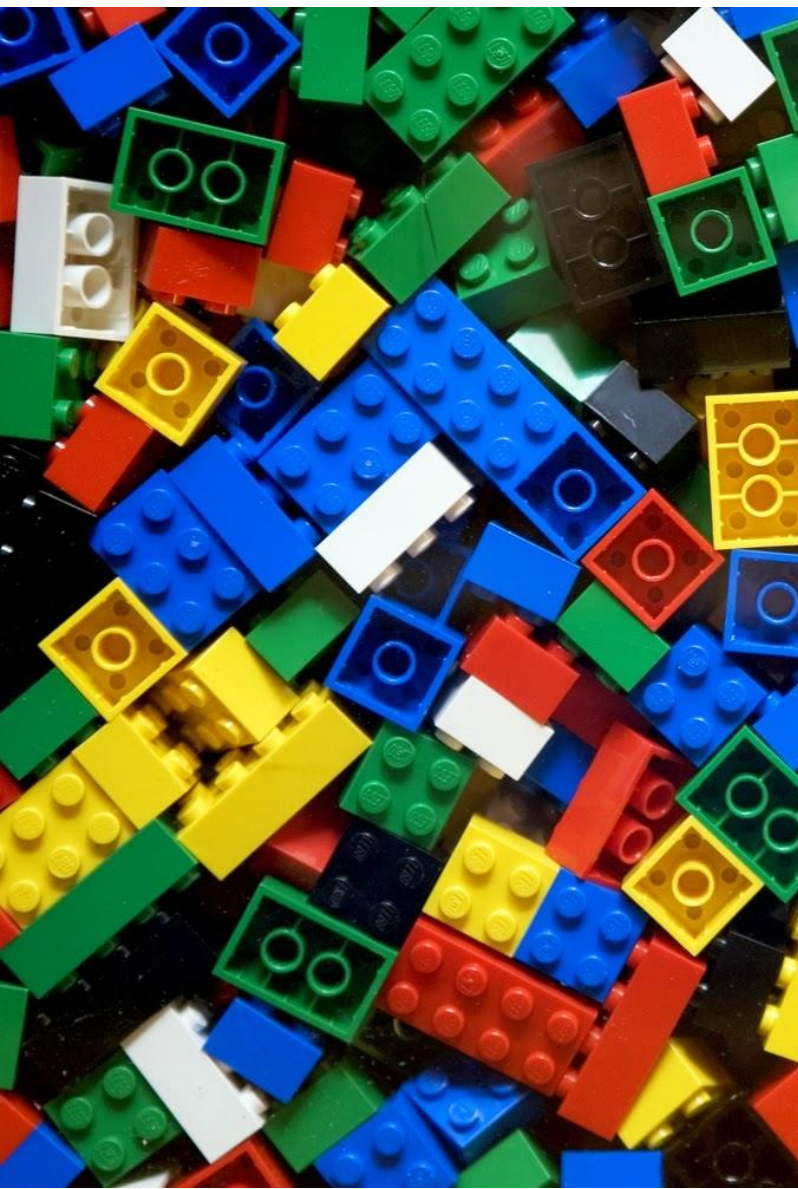
Right tool for the job



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Practical Considerations for Risk Assessment and Management:

Risk Assessment

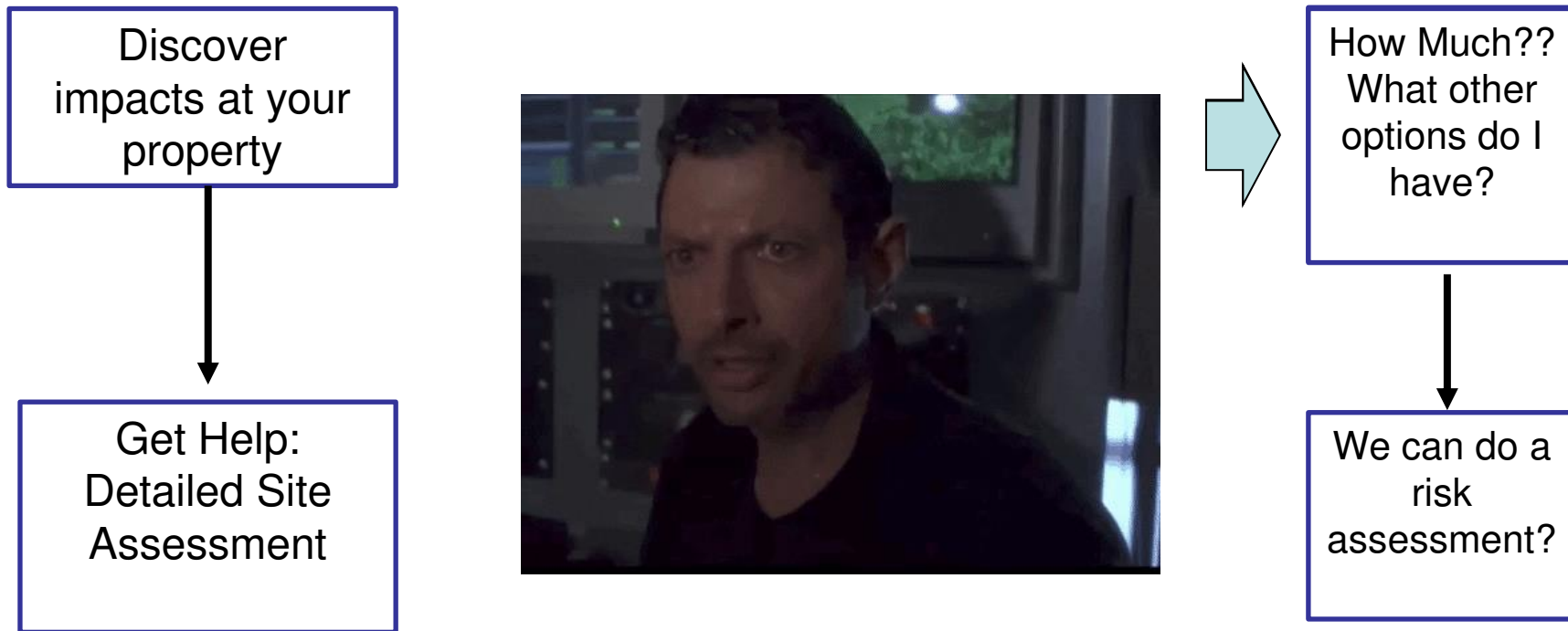
By: Karl Bresee, B.Sc., PBD, P.Biol.
Intrinsik Corp.,

April 13th 2023
ESAA Environmental Summit, Jasper, Alberta

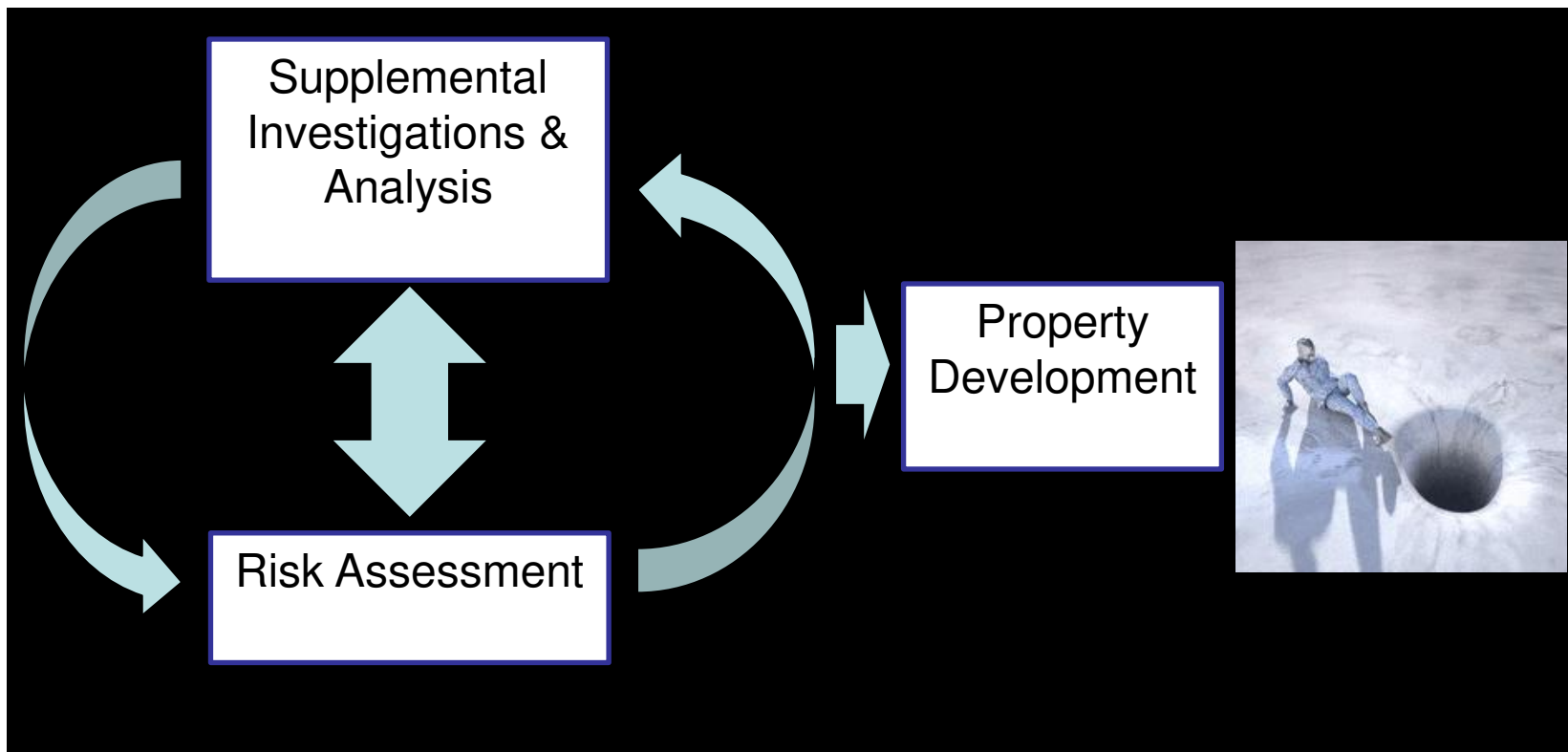
Outline

- What I do as a risk assessor.
- Risk assessment options / strategies.
- Outcomes of risk assessment.

Problem is Discovered – What I do



What I Do

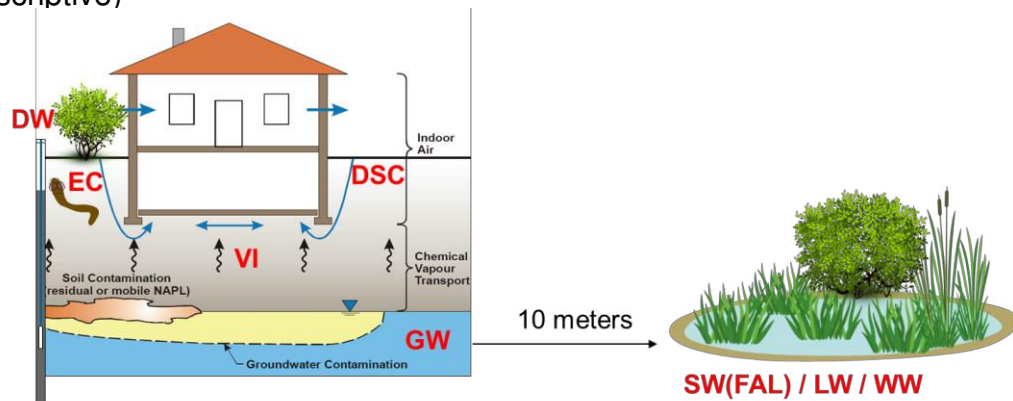


What I Do

- When Tier 1 is not enough.
- Remediation costs too high based on Tier 1/2.
- Economics of property not working (property value / remediation costs).
- Explore and advise if Tier 2 / Tier 3 will help.
- More in depth characterization of risks.
- Looking to manage risks (due diligence).
- Develop custom strategies.

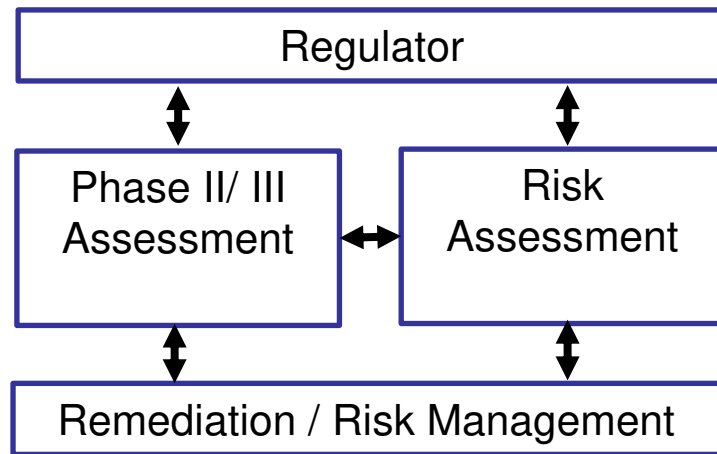
What Custom Strategies?

- Will Tier 2 work?
 - Pathway elimination
 - Calculate site-specific guidelines (very prescriptive)
- What does Tier 3 involve? (client)
 - More work and time
 - Balancing costs / benefits
- What does Tier 3 involve? (consultant team)
 - Collaboration with team
 - Soil bio-accessibility or ecotoxicity testing
 - More detailed modelling and testing (data intensive)
 - Monitoring to build evidence
 - Public / Government consultation
 - Bio-monitoring (blood lead testing)
 - Accessing the latest science and lessons learned
 - Use multiple lines of evidence (e.g., MNA)
- When to engage with the Government?




When to Engage the Government?

- Good question!
 - Depends on the information available – do we have enough to make informed decisions?
 - **Uncertainty with interpretation of risks and regulations:**
 - Complexity – Off-site risks, multiple parties involved, multiple impact areas.
 - Uncertainty – I want to use a novel or uncommon approach based on defensible science that isn't in policy.
- I don't want to waste regulator time.
- I need regulatory help or approval – “proof of concept” and agreement in principle.
- Sometimes early engagement can be very helpful.



Common Outcomes

- Most remediation certificates completed for Tier 1 & 2.
- Closure / remediation certificates for Tier 3 less common more commonly use a risk management plan.
- Characterize risks in a more detail manner which are used to provide comfort and/or develop a risk management strategy and mostly see a letter “agreement” from regulator:
 - Keep up the good work 
 - Risks have been characterized and not expected to change
 - Manage and monitor risks by corrective action plans, risk management plans, site management plans, exposure control (administrative, engineered)
 - Maintain ownership waiting for site to clean itself, economics to change, regulations to change (e.g., DUA)
- Mostly manage risks for clients so they can make an informed decision.

Common Outcomes

- Possible outcomes from a risk assessment and site assessments:
 - Remediation certificate or clear direction on what is required to get one.
 - Buy relief and/or time and avoid unwanted attention in the media and/or regulator.
 - Even though there is contamination impacts, everything is fine under current land use there are no unacceptable risks on or off your site.
 - Everything is fine, except you need to assess / manage these _____ risks.
 - Environmental triggers for risk management and monitoring plans.
 - The risk management plan is acceptable, and you can proceed as planned.
- Develop your site in the most cost effective and responsible manner.
- Avoid surprises (e.g. Ministerial orders for action).

Karl Bresee



- Intrinsik Corp.
- Karl Bresee, Senior Scientist (B.Sc., PBD, P.Biol, QPSASK)
- Mr. Bresee specializes in human and ecological risk assessment with extensive experience in exposure modelling and risk assessments associated with contaminated sites and environmental impact assessments.
- Mr. Bresee holds a Minor in Geology, a B.Sc. in Biology, a Post Bachelor's Diploma in Ecotoxicology, is a member of the Alberta Society of Professional Biologists and Qualified Professional in Saskatchewan for Risk Assessment.
- Email: kbresee@intrinsik.com

Questions

1. Information that describes the nature and magnitude of risks from exceedance of management limits is limiting and often hinders property development. What options do we have?
2. Financial lenders seems to have varying adversity to environmental risk (“lower risk tolerance”) and can be difficult as “gate keepers” to facilitating property development and title transfers – How can industry, regulations and financial institutions improve?
3. As a property developer – what is your biggest environmental obstacle or persistent annoyance to getting your property developed?

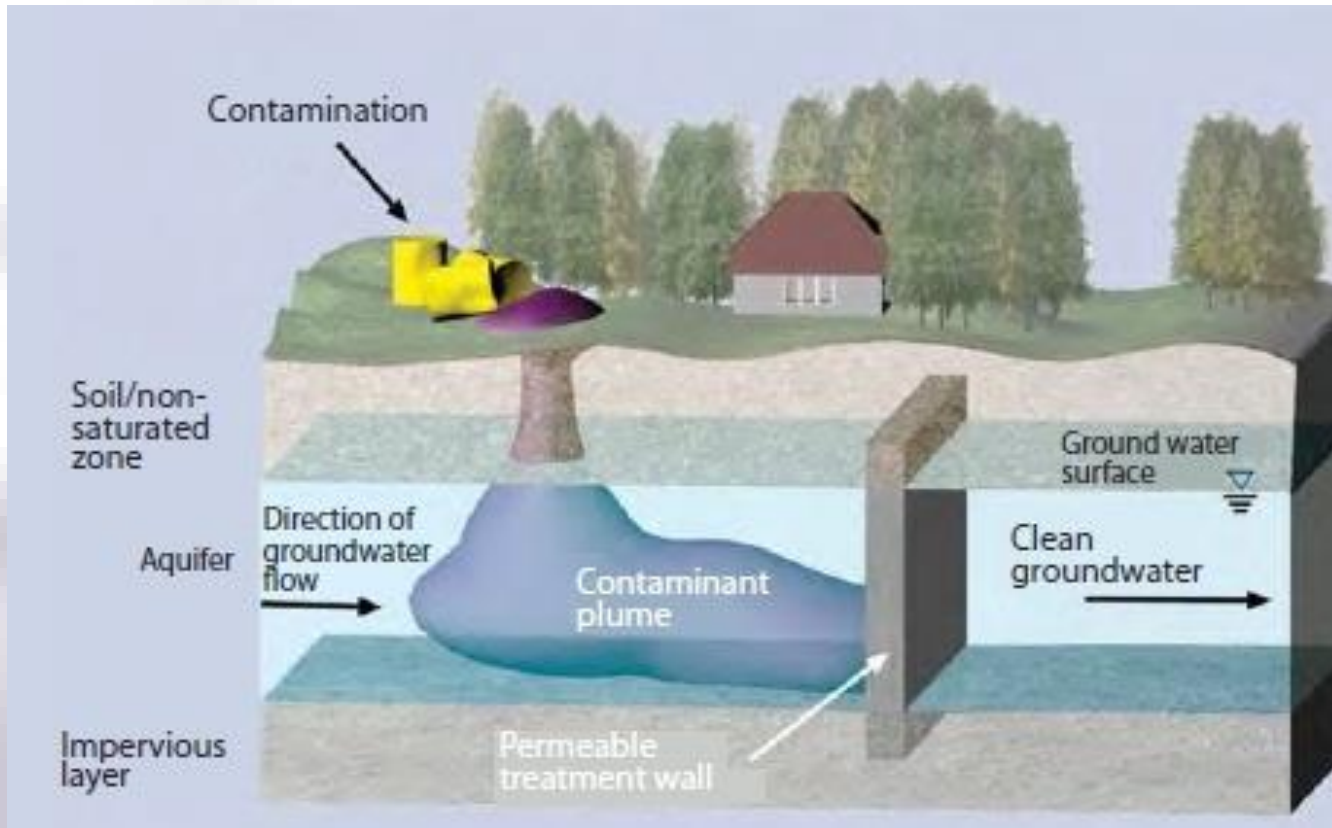
Practical Considerations for Risk Assessment and Management – Contractor's Perspective

Environmental Summit – Jasper, AB

April 13, 2023

Kevin E. French, P.Eng.

Presentation Overview



- Risk Management Measures
 - “Hot Spot” Remediation
 - Hard or Soft Capping
 - Soil Vapour Intrusion Mitigation
 - Permeable Reactive Barriers
 - LNAPL Immobilization
- Questions

Introduction – Presenter

Vertex Environmental Inc.

- Founded in 2003
- Specialized Environmental Remediation Contracting (in-situ, ex-situ, treatment systems, vapour intrusion mitigation)
- High Resolution Site Characterization (HRSC) and Remedial Design Characterization (RDC)



Kevin French, P.Eng

- Vice President, Vertex Environmental Inc.
- B.A.Sc., Civil/Env. Eng., U. Waterloo
- Environmental engineering
 - Consulting starting 1988
 - Remediation contracting since 2012



“Hot Spot” Remediation

“Hot Spot” Remediation

Address high concentration of contaminant mass that does not pass RA:

- Physical removal of source and accessible highly impacted soil / NAPL



“Hot Spot” Remediation



Address high concentration of contaminant mass that does not pass RA:

- In-situ treatment of inaccessible highly impacted soil / NAPL using injection technology

Hard or Soft Capping

Hard or Soft Capping



Protection against:

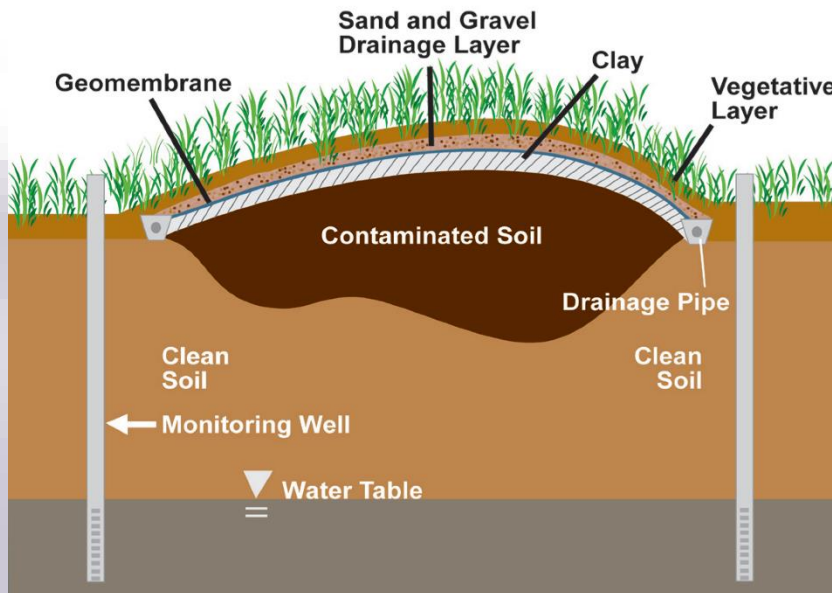
- Direct contact of impacted soils
- Windborne dust / surface water runoff
- Uptake by plants

Hard cap:

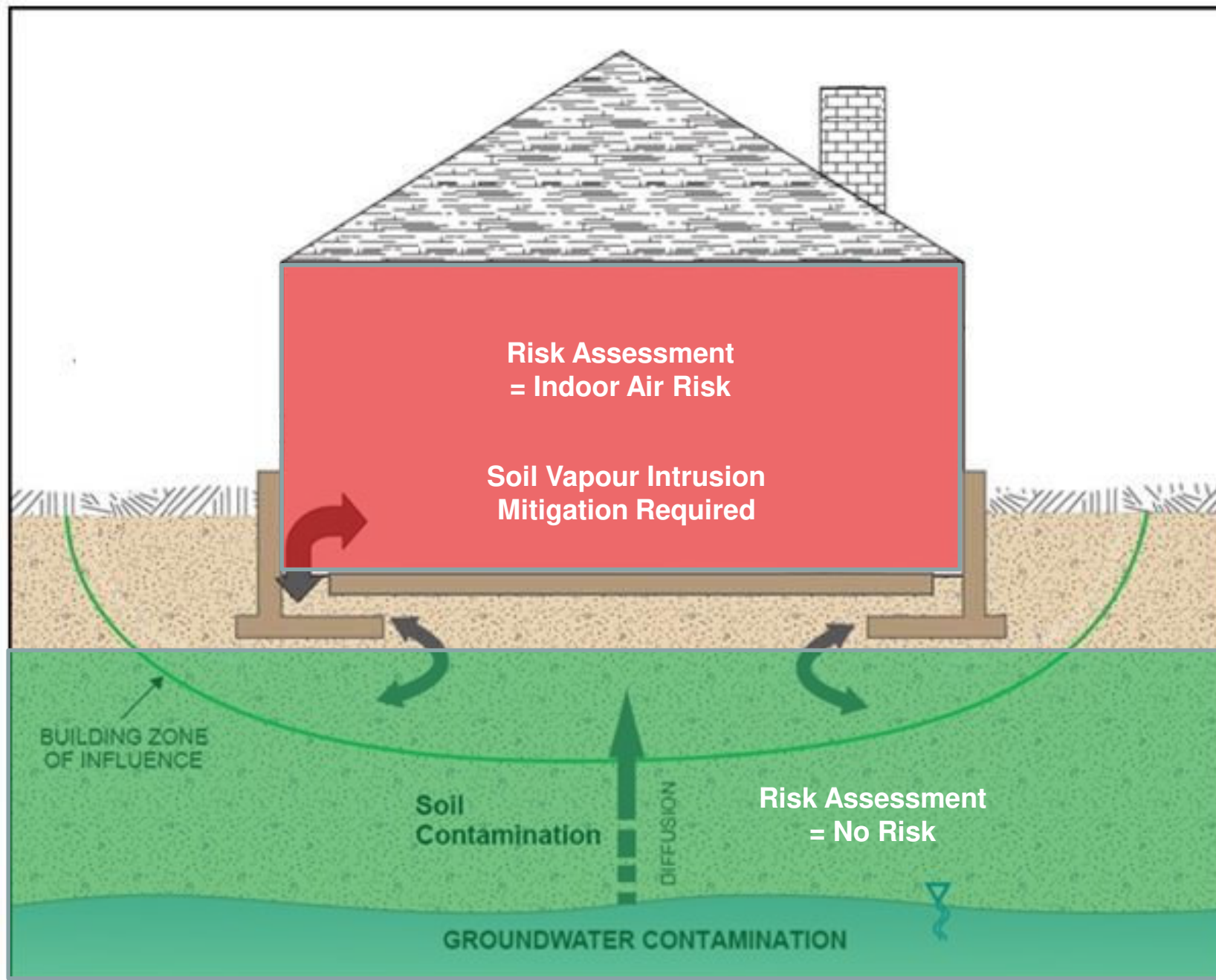
- Building footprint
- Concrete or asphalt paving

Soft cap:

- Clean soil cover buffer
- Low permeable clay cap



Soil Vapour Intrusion Mitigation



Soil Vapour Intrusion Mitigation – Barriers

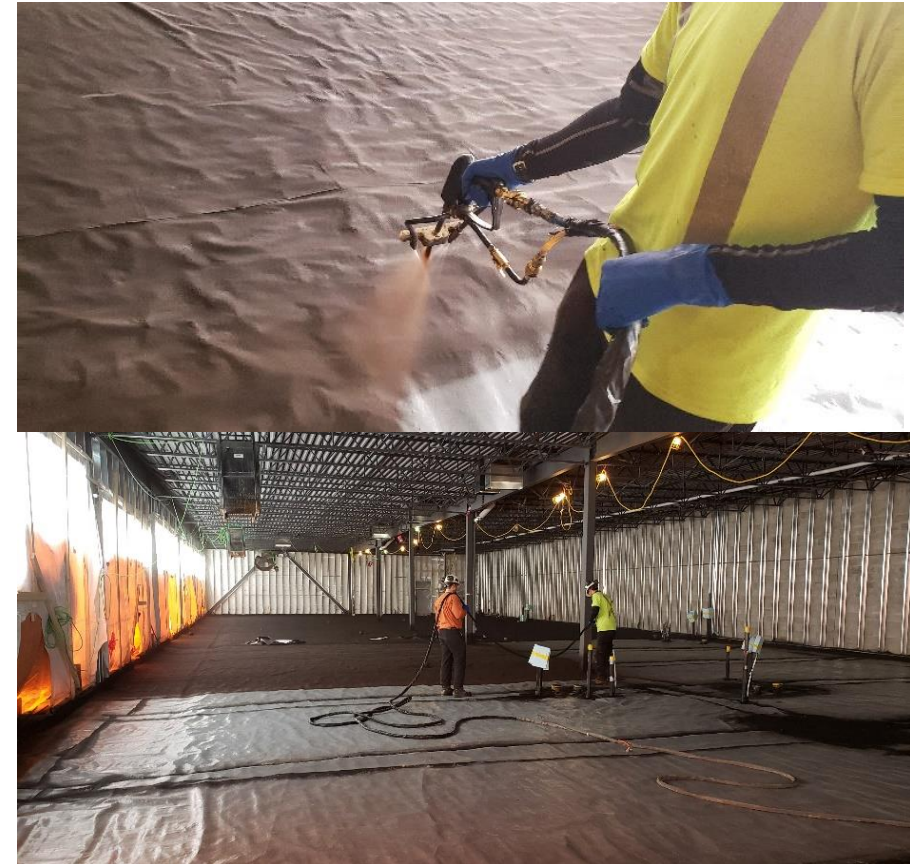
1) Sheet Membranes

- Ethylene Vinyl Alcohol (EVOH) or others
- Typically used in new construction and low-risk sites



2) Spray Applied (Polymer Modified Asphalt)

- Polymer Modified Asphalt based
- Sprayed on building foundation or sub-slab
- Typically used in higher-risk sites



Soil Vapour Intrusion Mitigation – Barriers



3) All penetrations must be sealed:

- Sumps
- Utilities
- Grease Traps
- Drains



4) Smoke testing to ensure integrity of finished barrier

Soil Vapour Intrusion Mitigation – Capture

1) Soil Vapour Collection (New Construction)

- Lay out low-profile vent pipe prior to slab being poured



Low-profile venting

2) Soil Vapour Extraction (Existing Retrofit)

- Cut trenches or suction pits in existing slab
- Install perforated piping, stone and refinish floor



Trenched perforated pipe



Suction pit installation

Soil Vapour Intrusion Mitigation – Capture

1) Passive Venting

- Non-energized
- Use on lower-risk sites
- Lower O&M



2) Active Extraction

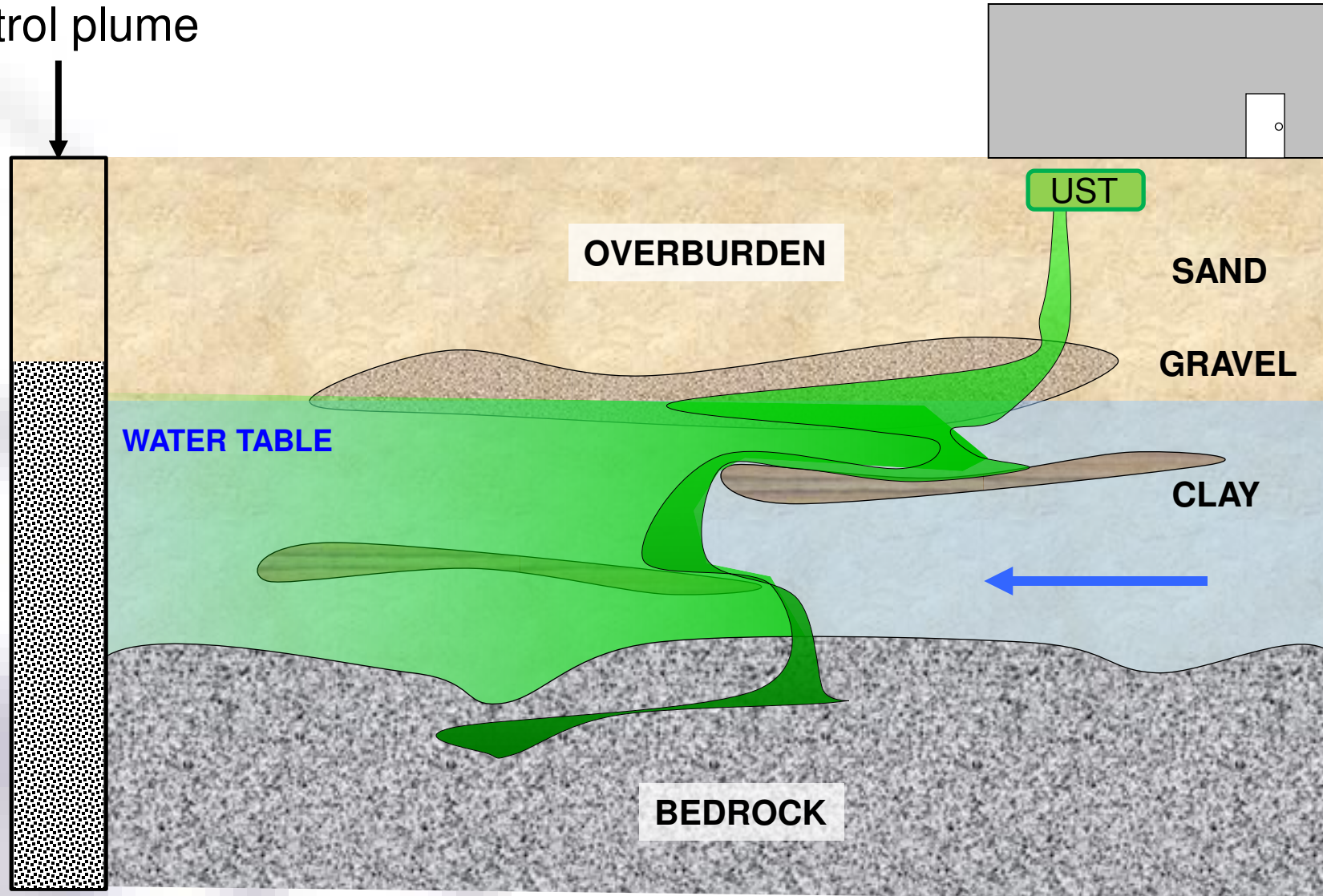
- Energized
- Use with tighter soils/higher concentrations
- Higher O&M
- Provides higher vacuum and flowrate



Permeable Reactive Barriers

Permeable Reactive Barrier - Concept

PRB needed to
control plume



Permeable Reactive Barrier – Installation via Excavation



Permeable Reactive Barrier – Installation via Injection



GeoTAPSM (Pre-Drill) Method



LNAPL Immobilization

LNAPL Immobilization



AB:

- Control (non-mobile) or **actively remediate** (remove) to the “**extent practicable**” (mobile)
- LNAPL source control: “stable” and “decreasing”
- Exposure controls and risk management may be needed

BC:

- Must assess **whether LNAPL is mobile** or stable (1 yr monitoring needed)
- LNAPL (>2 mm) in MWs and mobile LNAPL can trigger “**high-risk site**” classification
- Must assess VI considerations

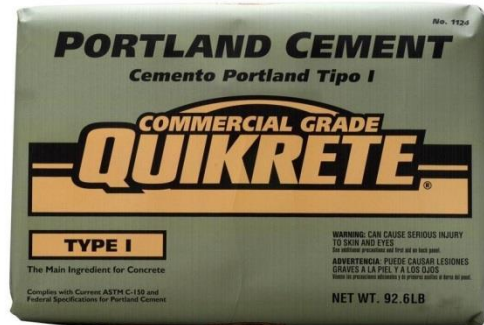


LNAPL Immobilization – Block & Adsorb Technology

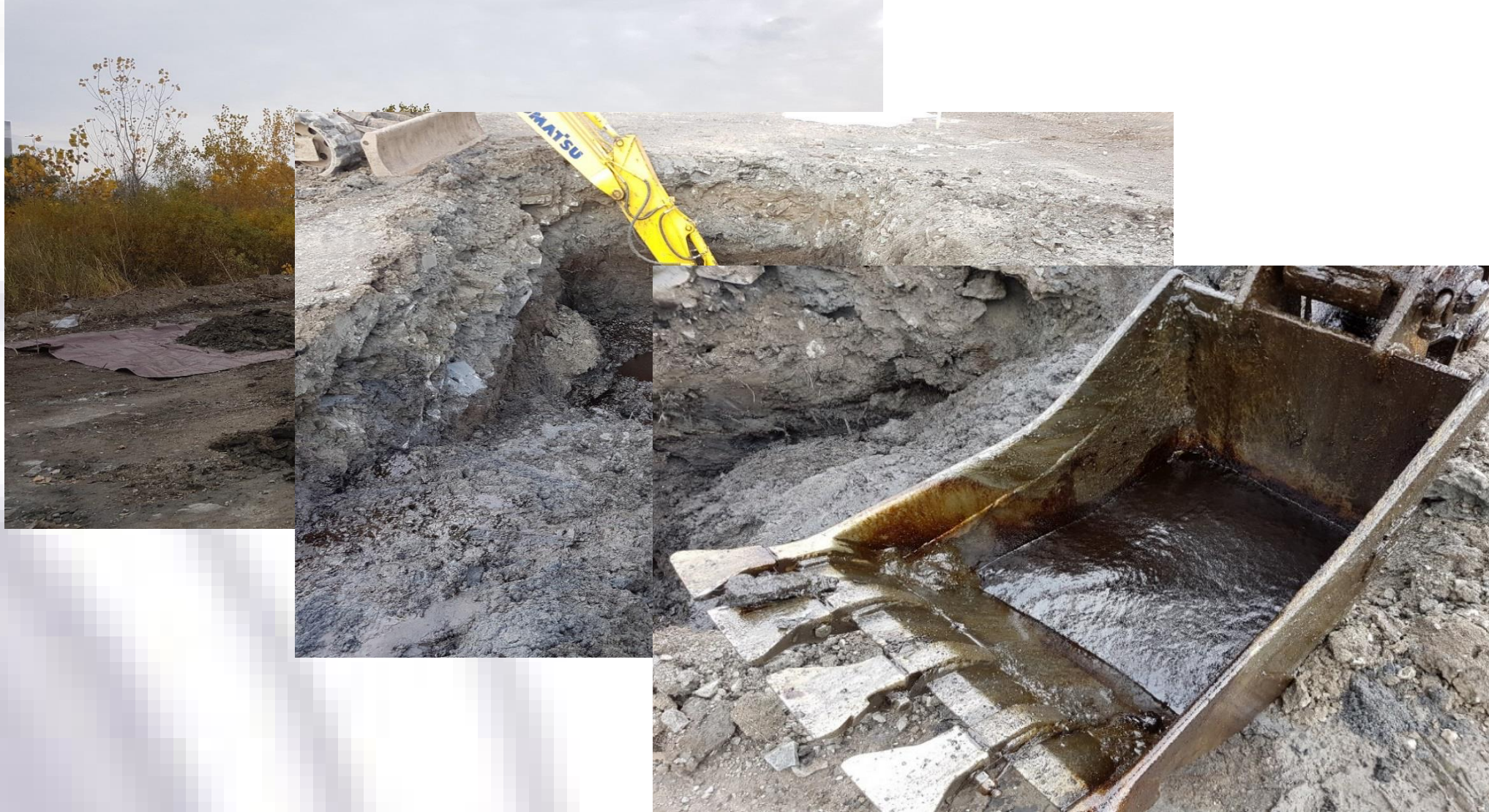
Concept:

- Bind mobile LNAPL & high concentrations of PHCs in soil and groundwater
- Lower formation permeability
- Enhance biodegradation potential

Block = Portland Cement (PC)
& **Adsorb** = Activated Carbon (GAC / PAC)



LNAPL Immobilization – Block & Adsorb Technology



LNAPL Immobilization – Block & Adsorb Technology

GAC addition and soil mixing



PC addition and soil mixing



LNAPL Immobilization – Block & Adsorb Technology

Groundwater Samples Collected:
Control Plot vs Test Plot



Test Pit Excavated:
Within vs Beyond Treated Soil Mass



LNAPL Immobilization – Block & Adsorb Technology

- **Effective immobilization of PHC LNAPL and sheens** in soils in-situ at up to (at least) 45,000 mg/kg total PHCs
- Low to moderate concentrations of PC **decreases permeability** by 80% to 95%
- Reduced levels of dissolved-phase PHCs
 - **Significant reduction** in leachability with low PC & GAC
 - **Essentially unleachable** at higher concentrations
- **Overcomes heterogeneities** in stratigraphy
- **No excavation / wastes** generated
- Relatively low cost and **sustainable** solution



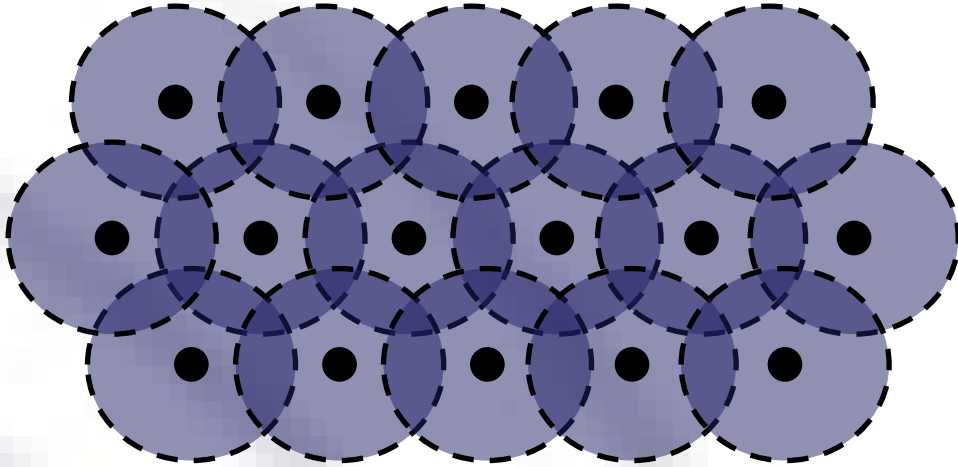
Take Aways / Lessons Learned



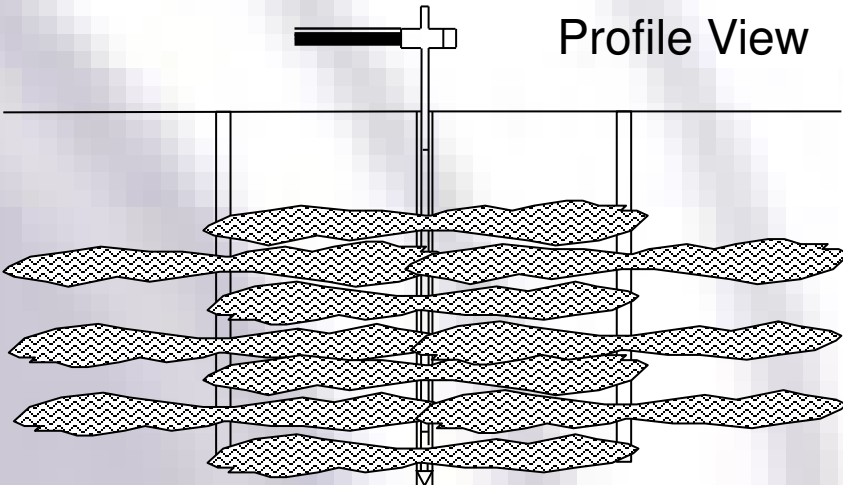
Take Aways / Lessons Learned

Remedial Injection Design:

Plan View

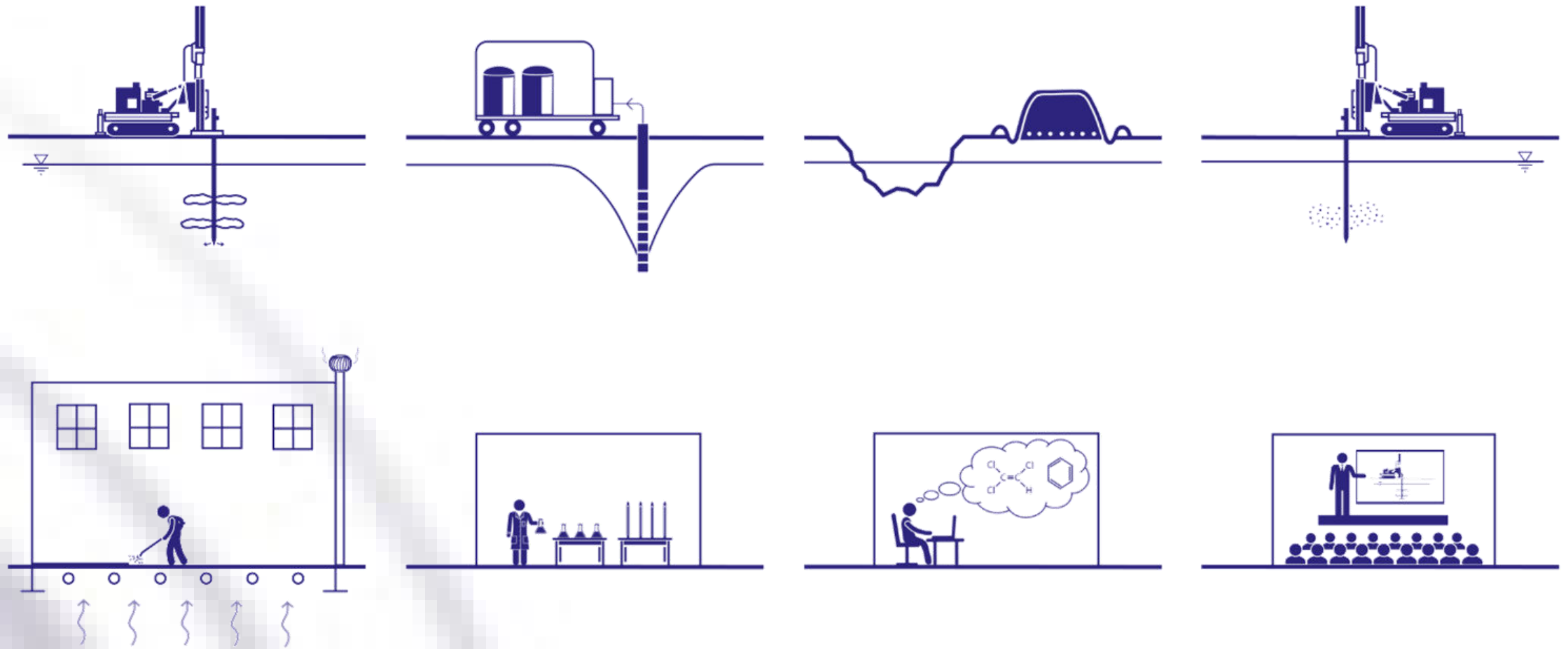


Profile View



Many types of Risk Management Measures that can be employed at a site:

- “Hot Spot” Remediation
 - Excavate or treat to address “outliers” or sources of excessive/mobile mass
- Hard or Soft Capping
 - Prevents direct exposure and plant uptake
- Soil Vapour Intrusion Mitigation
 - Passive and active barriers for indoor inhalation risks
- Permeable Reactive Barriers
 - Passive control of on- or off-site migration of plumes
- LNAPL Immobilization
 - Facilitates RA acceptance and reduces risks



Thank you!
Questions?

Kevin French, B.A.Sc., P.Eng.

Vertex Environmental Inc.

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Practical Considerations for Risk Assessment and Management – Risk Assessment Case Studies

Presented by: Sylvain Bordenave, Ph.D., P.Biol. (He/Him) – Trace Associates Inc.

Date: April 13, 2023

File: SBordenave_Enviro Summit_Risk Case Studies

Outline

1. Qualitative Risk Assessment –
Doing Risk Assessment Without
Calling it Risk Assessment
2. More Complex Site-Specific Risk
Assessment – Looking Behind
the Numbers



Case Study No. 1 –Conceptual Site Model

- Industrial area
- PHC F3-F4 management limit exceedances
- PAH Tier 1 exceedances (anthropogenic/industrial background?)
- Incomplete lateral and vertical delineation

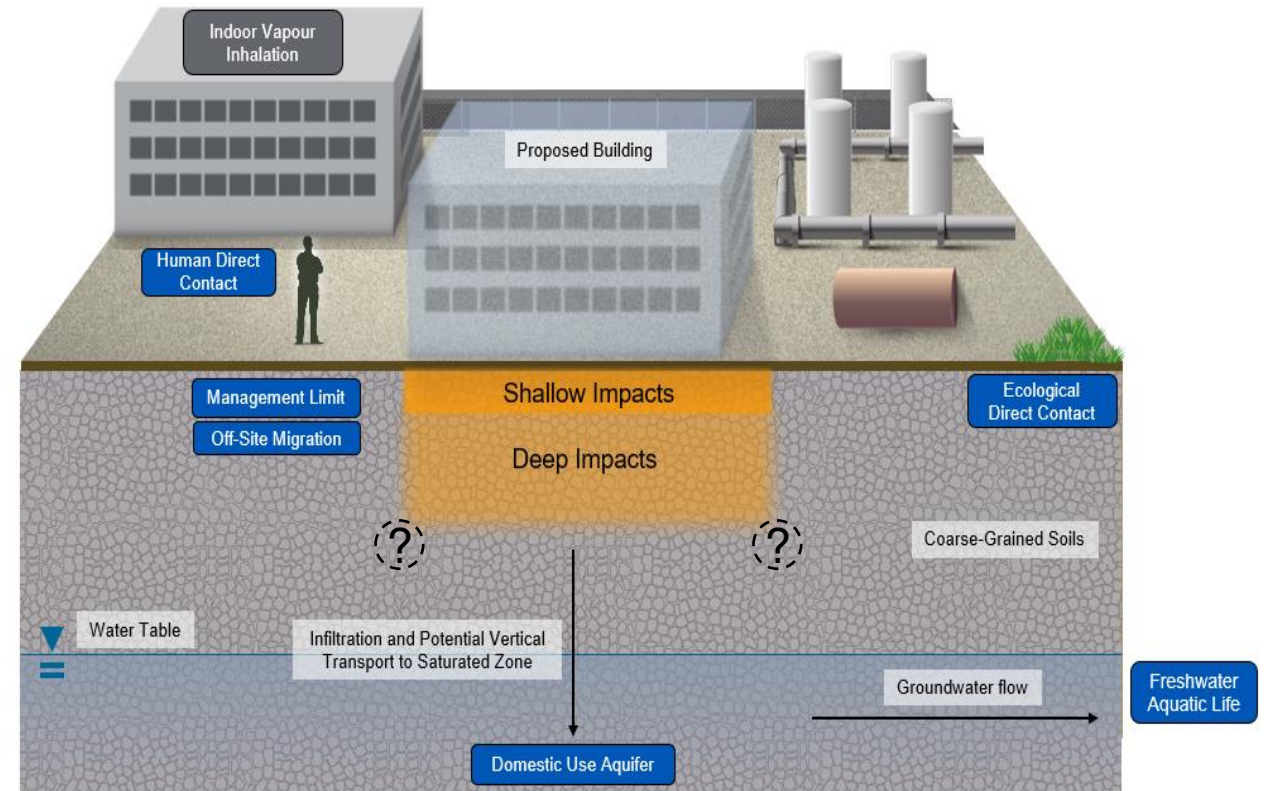


Figure prepared by Trace staff using Conceptual Site Model Builder Tool created by eSolutions Group Ltd., 2015, for the Contaminated Sites Division, Safe Environments Directorate, Health Canada, Ottawa

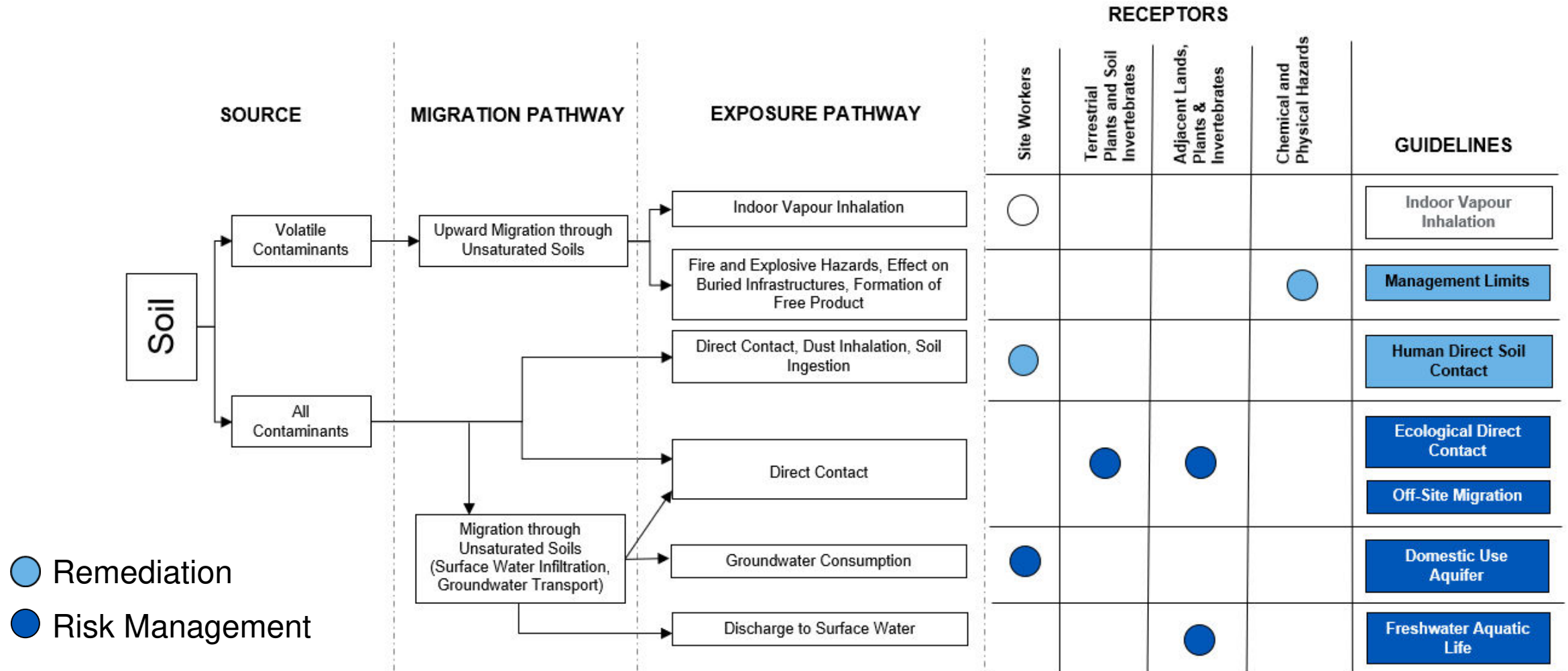
Case Study No. 1 – Screening-level Risk Assessment

Table D: Exposure Scenarios of Concern Summary - All Soils Data						
Contaminants of Potential Concern (COPC)	Human Exposure Pathways			Ecological Exposure Pathways		Other
	Direct Soil Contact	Protection of DUA	Off-Site Migration	Direct Soil Contact / Soil Structure	Protection of Freshwater Aquatic life	Management Limit
Toluene	-	-	-	-	X	-
PHC F3 and F4	-	-	-	X	-	X
Non-carcinogenic PAHs	-	-	-	X	X	-
Carcinogenic PAHs	X	X	X	X	-	-
Inorganic Parameters	-	-	-	X	-	-

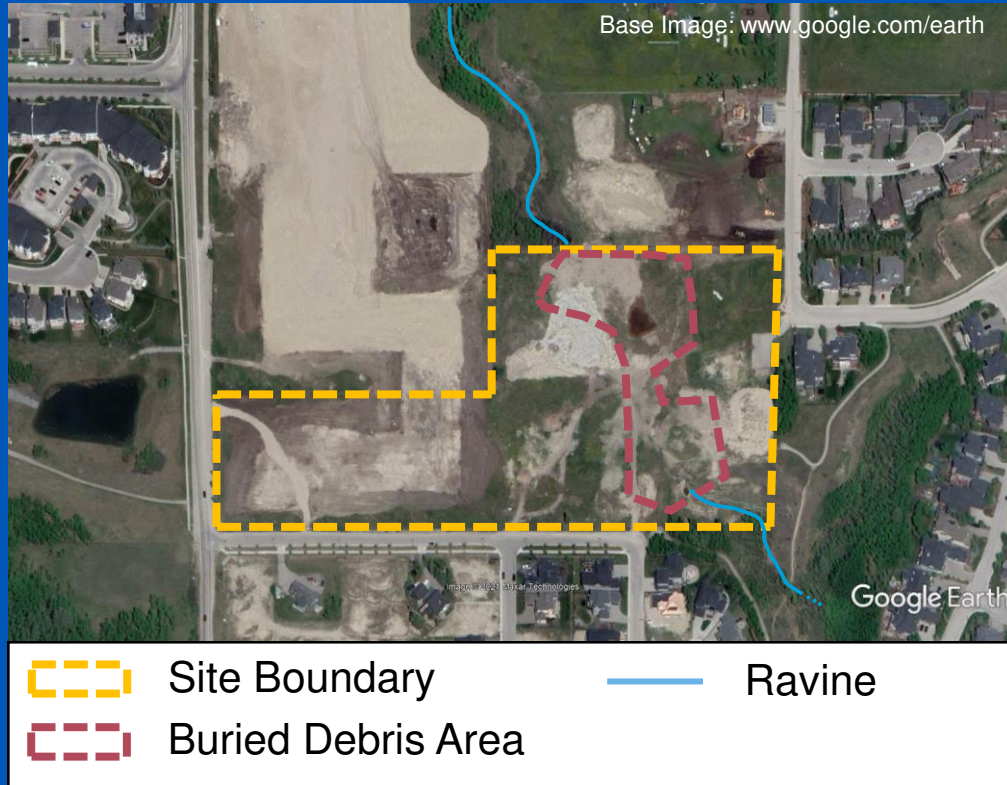
Case Study No. 1 – Qualitative Risk Assessment

		Likelihood / Probability			
		Extremely Remote	Remote	Reasonably Probable	Probable
Consequences / Severity	Extreme	Medium	High	Extreme	Extreme
	Serious/Major	Low	Medium	High	Extreme
	Minor	Low	Low	Medium	High
	Negligible	Low	Low	Low	Medium

Case Study No. 1 – Conceptual Exposure Model



Case Study No. 2 – Site Background

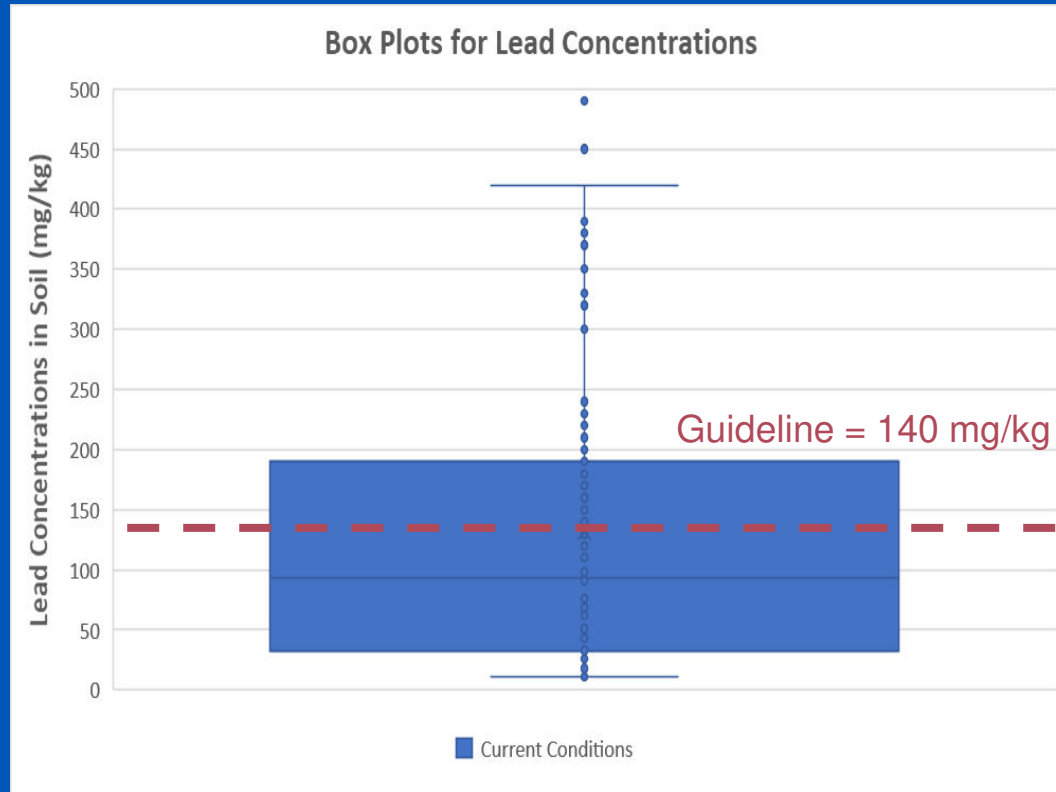


- Vacant land subject to residential development with proposed stormwater retention pond
- Suspected historical dumping of debris from flour mill demolition in a north-south ravine crossing the Site
- Estimated 23,000 m³ of soil with Tier 1 exceedances (metals, PHC F3-F4, and PAHs)

Case Study No. 2 – Guidelines as Screening Tools

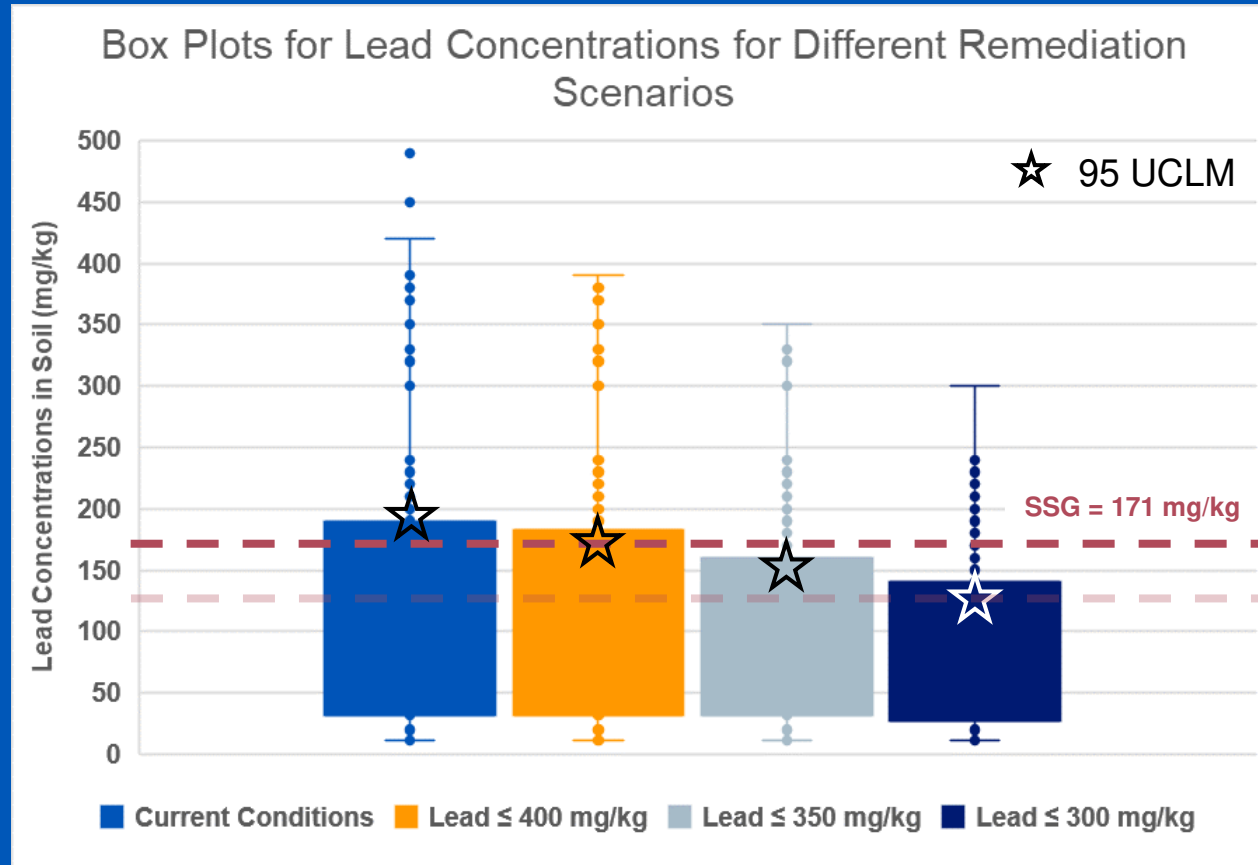
Table A: Chemical and Pathways of Concern Summary							
COC	Human Exposure Pathways			Ecological Exposure Pathways			Management Limit
	Soil Direct Contact	Indoor Vapour Inhalation	Domestic Use Aquifer	Soil Ecological Direct Contact	Nutrient/Energy Cycling Check	Freshwater Aquatic Life	
Metals	X	N/A	NA	X	X	N/A	N/A
PAHs	-	-	X	-	N/A	X	N/A
PHC Fractions F3 and F4	X	-	-	X	N/A	-	X

Case Study No. 2 – Risk Assessment Approach



- Adjust the guideline (toxicity assessment)
- Refine the exposure concentration of the receptor to the contaminant of potential concern (exposure assessment)

Case Study No. 2 – Site-specific Guideline and Lead Distribution



- Site-specific guideline (SSG) at 171 mg/kg
- Use of statistically representative concentration (95% upper confidence limit of the mean [95UCLM])
- Check different remediation scenarios
- Site-specific remediation objective of 350 mg/kg

Take Home Key Points

- Conceptual Site Model is the foundation of the risk assessment
- Screening allows to determine what is driving the risk and where to focus effort
- Critical to understand the guidelines
- Varying level of complexity and expertise needed (e.g., hydrogeology, geochemistry, toxicology, etc.)
- Risk assessment is not a magic bullet leading to no remediation, but it provides the same level of protection while reducing environmental impact



Project Technical Support (Case Study #2)



Karl Bresee, Intrinsic Corp.



Dr. Iris Koch, Royal Military College
(bio-availability testing)

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Thank you, we appreciate your attendance.

Questions? We're here to help

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