CSAP
Society of Contaminated Sites Approved Professionals of British Columbia

Fall Professional Development Workshop
AGENDA
November 12, 2025
Vancouver Marriott Pinnacle Downtown Hotel

8:30am – 9:00am	Registration
9:00am – 9:05am	**Introduction** Erin Robson, P.Eng., SLR Consulting Chair, CSAP Professional Development Committee **Welcome** Tara Siemens Kennedy, MET, P.Chem., AtkinsRéalis CSAP President
9:05am – 9:35am	**Neurodiversity in the Workplace** Courtenay Edwardes, RTC ADHD Coaching & Counselling
9:35am – 10:15am	**Performance Assessment Committee Lessons Learned** Jason Christensen, P.Eng., Keystone Environmental Chair, CSAP Performance Assessment Committee
10:15am – 10:35am	Morning break
10:35am – 11:15am	**Environmental and Health Impacts of Wildfires in BC** Dr. John Clague, Emeritus Professor Department of Earth Sciences, Simon Fraser University
11:15am – 11:45am	**Climate Change Readiness in Risk Assessment** Mandeep Purewal, MET, R.P.Bio., P.Ag., CSAP, AtkinsRéalis
11:45am – 1:00pm	Lunch break
1:00pm – 1:05pm	**Welcome to the Ministry of Environment and Parks** Erin Robson
1:05pm – 1:25pm	**Director and Policy Update** Carrie Nugent, Director, Site Remediation Program Christa Zacharias-Homer, Director, Bonding & Site Remediation Policy Kelli Larsen, Senior Policy Analyst, Bonding & Site Remediation Policy Ministry of Environment and Parks (ENV)
1:25pm – 1:55pm	**Protocol 12 Clarifications** Evan Scheidt, Site Risk Classification Officer, Site Remediation Program, ENV

1:55pm – 2:30pm	**Nature-Based, Data-Backed: The Future of Sustainable Remediation** Parisa Jourabchi, Ph.D., P.Eng., Founder & Chief Science Officer ARIS Environmental Ltd
2:30pm – 2:50pm	Afternoon break
2:50pm – 3:55pm	**ENV FAQ Interactive Discussion** David Mitchell, P.Eng., CSAP, Active Earth Kerri Skelly, Manager Operations, Site Remediation Program, ENV
3:55pm – 4:00pm	**Closing Remarks** Tara Siemens Kennedy

Please join us after the event for a no-host happy hour in the foyer, outside Pinnacle I & II at the Vancouver Marriott Pinnacle Downtown Hotel.

CSAP members earn six (6) PD hours for attending the full day.

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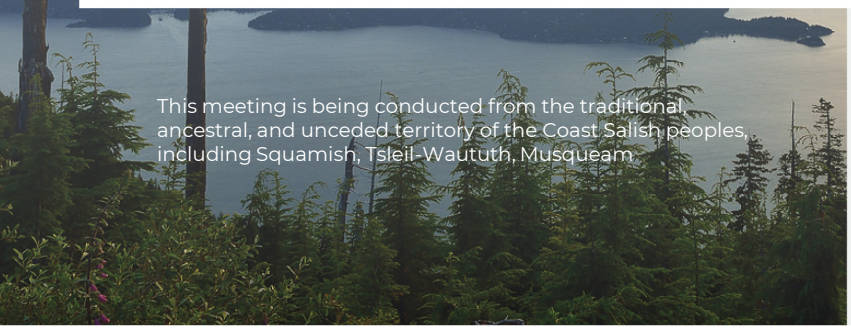

This meeting is being conducted from the traditional, ancestral, and unceded territory of the Coast Salish peoples, including Squamish, Tsleil-Waututh, Musqueam.

Introduction

- Erin Robson, P.Eng., SLR Consulting, Chair, CSAP Professional Development Committee

Welcome

- Tara Siemens Kennedy, MET, P.Chem., AtkinsRéalis
  CSAP President

NEURODIVERSITY
IN WORK & LIFE

Presented by Courtenay Edwardes
ADHD & Life Skills Coach
Registered Therapeutic Counsellor, RTC

OVERVIEW

- Introduction
- About Neurodiversity
- Different Conditions
- ADHD
- At Work
- In Life
- Human Behaviour
- Tools

About Courtenay

-ADHD & Life Skills Coach

-Registered Therapeutic Counsellor, RTC

-Diagnosed 2 years after teenaged son was diagnosed and learned it's highly genetic.

-Obvious Slugger

WHY IT MATTERS

Some Neurodivergent Symptoms are Invisible making them hard to see, understand and potentially believe.

OUTSIDE OF NEURODIVERSITY

Anxiety, Depression, Low Self-Worth, Head Trauma, Addiction, Grief, Chronic Pain Disorders, Body Injuries, Unsafe Living Conditions, Migraines, Hearing or Visual Impairments, Eating Disorders, Acute/Chronic Trauma, and more.....

Holding our judgements at bay and **being more curious** about what is actually happening with this person in front of us.

WHAT IS NEURODIVERSITY

A difference in Structure and Function compared to a Neurotypical Brain. How the brain thinks, learns and processes information.

Under the Neurodiversity Umbrella:

Autism Spectrum Disorder (ASD)
Tourette Syndrome (tics & impulse control)
ADHD (Attention-Deficit/Hyperactivity Disorder)
OCD (Obsessive-Compulsive Disorder)

Emotional Regulation
Sensory Processing
Learning Disorders Alongside (**dyslexia -** reading & language, **dysgraphia -** writing & expressing thought, **dyscalculia -** numbers & math)

AUTISM

Difficulties with **social communication/interaction**.

Difficulty understanding **social cues/sarcasm/body language.**

Trouble **initiating/maintaining conversations**.

Seemingly **blunt or rude** when being factual/honest.

Discomfort with **eye contact.**

An inflexible **way of thinking** at times.

Strong **preference for routines**, getting anxious if changed.

Finding it hard to **make or keep friends** or connect with others.

Executive Functioning/Emotional Regulation Challenges

2 in 100 Canadian Children have Autism

87% of autistic adults report a co-occurring disability.

Friend at work: noisy, too stimulation, allowed to have headphones, might be awkward in social settings.

TOURETTE'S SYNDROME

- **Vocal tics:** Grunting, throat clearing, sniffing, barking.
- **Motor tics:** Eye blinking, facial grimacing, nose twitching, shoulder shrugging, or head jerking.
- **Hopping, bending or twisting**, touching or smelling objects, stepping in a specific pattern, or repeating observed movements.
- **Repeating** one's own words or phrases (palilalia), repeating the words of others (echolalia), or uttering socially inappropriate words or phrases (coprolalia).
- **Tics can temporarily worsen** when a person is stressed, anxious, tired, or ill.

Approx 1 in 100 Canadians have Tourettes.

More common in boys.

Adults with TS have higher rates of Anxiety disorders and Mood disorders.

Brother at work: prefers when people already know about his TS, prefers small groups and less noise, can be impatient.

OCD

Presence of **obsessions**, **compulsions**, or both:

Obsessions: are defined as **recurrent, persistent, intrusive, and unwanted thoughts, urges, or images** that cause marked anxiety or distress. The individual attempts to ignore, suppress, or neutralize these with a compulsion.

Compulsions: are **repetitive behaviours** (e.g., hand washing, ordering) or **mental acts** (e.g., praying, counting) that the individual feels driven to perform in response to an obsession/rigid personal rules.

Roughly 1 in 100 Canadians

Most people with OCD also have another mental-health disorder: e.g., anxiety or mood disorders.

Perfectionism, Over Checking Work , Rigidity, Fear of Mistakes, Energy Drain from Obsessions & Compulsions.

ADHD

- **Pre-Frontal Cortex** (Executive Functioning/Emotional Regulation)
- Less **Dopamine** (motivation/reward), **Serotonin** (mood/emotions) and **Norepinephrine** (focus/concentration)
- **Motivated by** Interest, New/Novel, Urgency, Instant Reward (vs Importance, Future Self and Delayed Reward)
- Many **adults go undiagnosed**, especially women/girls, who often mask symptoms or internalize struggles (Masking, People Pleasing, Rejection Sensitivity Disorder).
- Symptoms known to get worse for women with **hormonal changes**. Ie. whatever your struggles...just worse.
- It's often **invisible** (inattentive), you can't "see" ADHD, so struggles are frequently misread as laziness or carelessness.

Common Human Challenges

Approx 1 in 20 Canadians

More common in boys. 2:1

Have before the age of 12

Me at work: easily distracted, paperwork least favourite, sensory overload with too many sounds/rising decibles in large groups. Put me in the best environment.

3 TYPES OF ADHD

Innattentive

1 - Difficulty with Focus
2 - Forgetfulness
3 - Procrastination
4 - Disorganization
5 - Daydreaming
6 - Poor Time Management
7 - Attention to Detail Difficulty
8 - Easily Overwhelmed

Combined

Hyperactive

1 - Impatient
2 - Restlessness
3 - Easily Frustrated
4 - Risk Taking Behaviour
5 - Interrupts Others
6 - Difficulty Relaxing
7 - Impulsivity
8 - Fidgety/Hard to Wind Down

EXECUTIVE FUNCTIONING

1) Task Initiation - Procrastinates on reports until deadline pressure hits

2) Time Blindness - Underestimates how long tasks take, misses meetings

3) Prioritization - Spends hours on minor details, misses big goals

4) Forgetfulness - Forgets to send follow-up emails or complete small steps

5) Transitioning Tasks - Struggles to shift from deep work to team meetings

6) Working memory - Loses track of what was discussed in meetings

7) Overwhelm - Shuts down when too many tasks compete for attention

8) Disorganization - Desk, inbox, or project list in constant chaos

9) Inconsistent Focus - Hyperfocus on one task, neglects others

10) Task Completion - Starts projects strong, but loses momentum mid-way

EMOTIONAL REGULATION

FIGHT, FLIGHT & FREEZE - NERVOUS SYSTEM

1.Quick to **frustration or irritability** when projects stall or systems fail.

2. **Overreacting to feedback** or perceived criticism.

3. Difficulty **letting go of small mistakes** or past conversations.

4. **Avoiding conflict** or uncomfortable discussions due to fear of emotional overwhelm

5. **Taking things personally**, even when feedback is neutral or factual.

6. Emotional exhaustion from **constant self-monitoring** and **masking.**

7. **Feeling shut down** or paralyzed during high-stress meetings or presentations.

8. **Difficulty recovering** after an emotional event, **ruminating** long after it’s over.

9. **Impulsive communication** (emails, texts, or comments sent in the heat of emotion).

10. **Emotions driving decision-making**, leading to inconsistency or regret later.

IMPACT ON WORK

1) **Missing deadlines** — not from lack of effort, but from underestimating how long a task will take.

2) **Procrastinating** on starting important projects until the last possible moment, acting on urgency

3) **Over-focusing** on one detail or section of a project and losing track of the bigger picture.

4) **Avoiding emails** or messages that feel overwhelming or require emotional energy to respond to.

5) **Forgetting** what was just discussed in a meeting or losing track of verbal instructions.

6) **Overcommitting** by saying yes to too many projects, then feeling overwhelmed or guilty.

7) **Difficulty prioritizing**, everything feels equally urgent or equally impossible to start.

8) **Interrupting** during meetings, not out of rudeness, but from excitement or fear of forgetting a thought.

9) **Intense emotions** while communicating that don't fit the scenario.

IMPACT ON LIVES

1) Relationships (with self & others)

2) School & Education

3) Job & Careers

4) Finances & Paying Bills on time

5) Self-Worth, Self-Esteem, Self-Confidence

6) Substance Abuse & Self Harm

7) Oppositional Defiance Disorder

8) Poor Social & Coping Skills

9) Criminal Activity (Impulsive/DUI)

10) Constant state of Nervous System Activation

IMPACT ON DAILY LIVES

1. **Looking for keys** 3 times a day.
2. **Start cleaning** one room, 3 organized drawers later...
3. **Buy 18 bottles** of hot sauce.
4. **Forget** why you walked into a room. Again.
5. **Hyper-focus** for 8 hours and feels like 10 mins.
6. **Leave laundry** in the washer for two days, and have to rewash it.
7. Write endless **to-do lists**, and then lose them.
8. **Missing Appointments**, and deadlines
9. Have **12 browser tabs** open (which also resembles inside of brain).
10. Do a **new hobby** for 3 weeks, then forget it exists.
11. **Looking for your phone**, while talking on it.
12. **Buy planners**, notebooks, and apps to "get organized" then never use them.

STRENGTHS

Natural ADHD skills, gifts and abilities to lean on

Common ADHD Strengths

Resiliant & Risk Taking

Outside the Box Thinking

Creativity & Innovation

Compasstionate & Empathetic

High Energy & Spontaneity

Performs well under pressure

Courageous & Curious

Able to Hyper Focus

Careers ADHD comes in handy

Athletes

Surgeons

First Responders

Sales Person

Creative Projects

Chef/Restaurants

Entrepreneurs - 2-3 x's

ADHD TOOLS

Pomodoro Tenchnique - egg timer

Body Doubling - working alongside someone else

Break Down Tasks - little baby steps (avoids overwhelm)

Gamify and make it fun/rewards (time yourself, play a song you love)

External Reminders – Use alarms, sticky notes, visual cues, or smart devices to prompt action and transitions.

Habit Stacking – Link new habits to existing routines (e.g., review your to-do list while drinking your morning coffee).

Environmental Design – Adjust your workspace (lighting, clutter, sounds) to minimize distractions and maximize focus.

Creating a Neuro-Inclusive Workplace

1) Pause Before Reacting – Space between stimulus and response**.**

2) Seek to Understand – Lead with curiosity, not judgment.

3) Ask About Preferences – Lighting, noise, workspace, communication.

4) Flexible Work Rhythms – Short focus blocks, frequent breaks**.**

5) Clear Communication – Written follow-ups, clear expectations**.**

6) Sensory-Friendly Spaces – Quiet zones, adjustable lighting, fewer distractions.

7) Normalize Support – Safe to ask for help or accommodations.

8) Educate Teams – Training on neurodiversity and emotional regulation

9) Play to Strengths – Match roles to natural skills and interests.

10) Check-Ins – Quick “how’s everyone doing?” moments.

What has helped me...

Stopped Judging Myself.
Which also helped not judging others or caring if they judged me.

An activated mind is trying to survive, not understand another person. Is the person across from you activated?

Play it forward, then work backwards

Awareness with Kindness - For Ourselves & Others

One Thing

COURTENAY EDWARDES COACHING

Helping people with (or without) ADHD get clear on their goals/challenges, create an actionable plan forward, get started and maintain momemtem, provide accountability/checkins to help keep you on track! I love seeing people SUCCEED!

COURTENAY EDWARDES COUNSELLING

Providing a safe and judgement free space to explore thoughts, feelings and emotions that are no longer serving you in a positive way. Modalities include CBT, DBT exercises and Parts Work (internal family systems).

*Potential Coverage with some Insurance Companies

Mobile Number: 604-790-9958
Website: courtenayedwardescoaching.com
Email Address: courtenayedwardes@gmail.com

SCAN THE QR CODE TO CONNECT FOR A FREE, RELAXED 20-MINUTE MEET & GREET.

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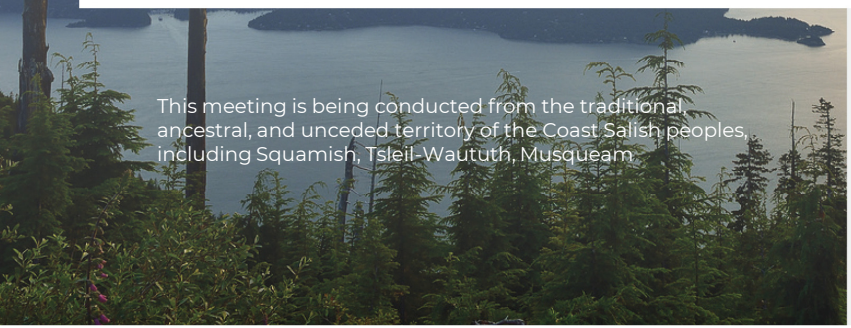
Performance Assessment Committee Lessons Learned

Jason Christensen, P.Eng., Keystone Environmental
Chair, CSAP Performance Assessment Committee



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Note: Correct answers are highlighted in yellow.

1. For a numerical CoC application following an AiP what does the AP need to review?
    a. Confirmation of Remediation Report
    b. DSI if additional delineation completed
    c. The original remediation plan
    d. Previous investigation reports

2. What are possible actual or perceived conflicts of interest for a PAP member?
    a. Provided a recent proposal for the site
    b. Worked on an adjacent site in the past 7 years
    c. Have a standing contract with the client of the submission
    d. Contractual arrangement with submitting AP in the last 2 years

Note: Correct answers are highlighted in yellow.

3. What documents can be modified following a certification submission to CSAP?
    a. Remediation Plan
    b. Summary of Site Condition
    c. Site Risk Classification Report
    d. Detailed Site Investigation

4. What details should be provided If a surface barrier is listed in Schedule B?
    a. Metes and bounds on Schedule A
    b. Sealed drawing by Land Surveyor
    c. Thickness of surface barrier provided in RA
    d. Location of deep rooting vegetation on the site

Note: Correct answers are highlighted in yellow.

5. In P13 question HS-1, what are the soil quality results compared to?
    a. All soil matrix standards
    b. Intake of contaminated soil
    c. P4 Background soil concentrations
    d. Groundwater used for drinking water

6. What documents are to be included with a site risk classification with upper cap concentrations?
    a. Cross section drawings
    b. Contour maps
    c. Exposure pathway questionnaire
    d. Rationale that groundwater will not migrate within 10 m of receptor

Note: Correct answers are highlighted in yellow.

7. Does a vapour probe within 30 m adequately investigate an APEC?
    a. True
    b. False

8. Which of the following are examples where Ministry preapproval is required?
    a. Access has been denied to an affected parcel
    b. Flow through site
    c. Not feasible to investigate a site due to geotechnical concerns
    d. Merging contaminant plumes

Note: Correct answers are highlighted in yellow.

9. When area wide contamination is identified, where should rationale be provided to not delineate?
    a. Section of applicable reports
    b. Site risk classification report
    c. Section 4.8 of SoSC
    d. TG11 Checklist

10. For a SRCR, can stats be used to show UC sample not high risk in shallow sediment for an area of 10 m^2?
    a. Yes, UCL95 can be used as it is a small area
    b. No, max concentrations must be used, but not HR
    c. Yes, if sample is shown to be non-representative and replaced
    d. No, max concentrations must be used, so HR

Note: Correct answers are highlighted in yellow.

11. Who is able to sign a SoSC Part 8 for an affected parcel?
    a. The owner of the affected parcel
    b. Lessee of the affected parcel
    c. Agent on behalf of the responsible party
    d. Consultant

12. How many APs can provide recommendation of a certification document?
    a. One Numerical AP
    b. Two Numerical APs for SLRA
    c. One Numerical and one Risk AP
    d. Multiple APs with clearly defined scope of review

Note: Correct answers are highlighted in yellow.

13. What are examples of when a SRCR is exempt?
    a. An accurate SRCR provided in the last 5 yrs, no new site info available
    b. Less than 5 m^3 remediated
    c. IR of a spill that is reported under the Spill Reporting Regulation
    d. Independent remediation of 3,000 L Heating oil tank

14. Which of the following areas does the spelling need to match CSR Schedules?
    a. Schedule C of certification document
    b. Section 4.5 of the SoSC
    c. Section 7 of the SoSC
    d. In the appended legend to the SoSC

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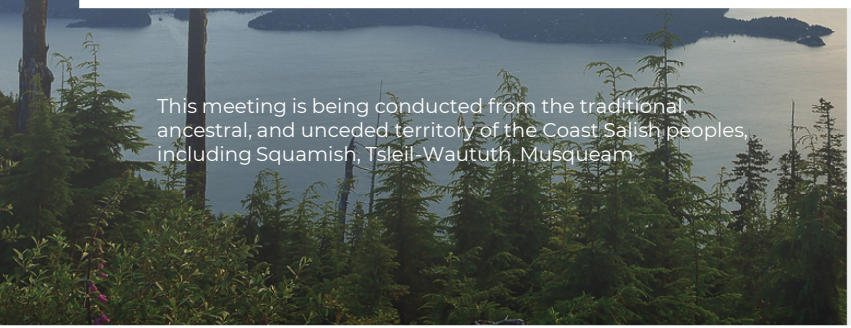
Environmental and Health Impacts of Wildfires in BC

Dr. John Clague, Emeritus Professor
Department of Earth Sciences, Simon Fraser University



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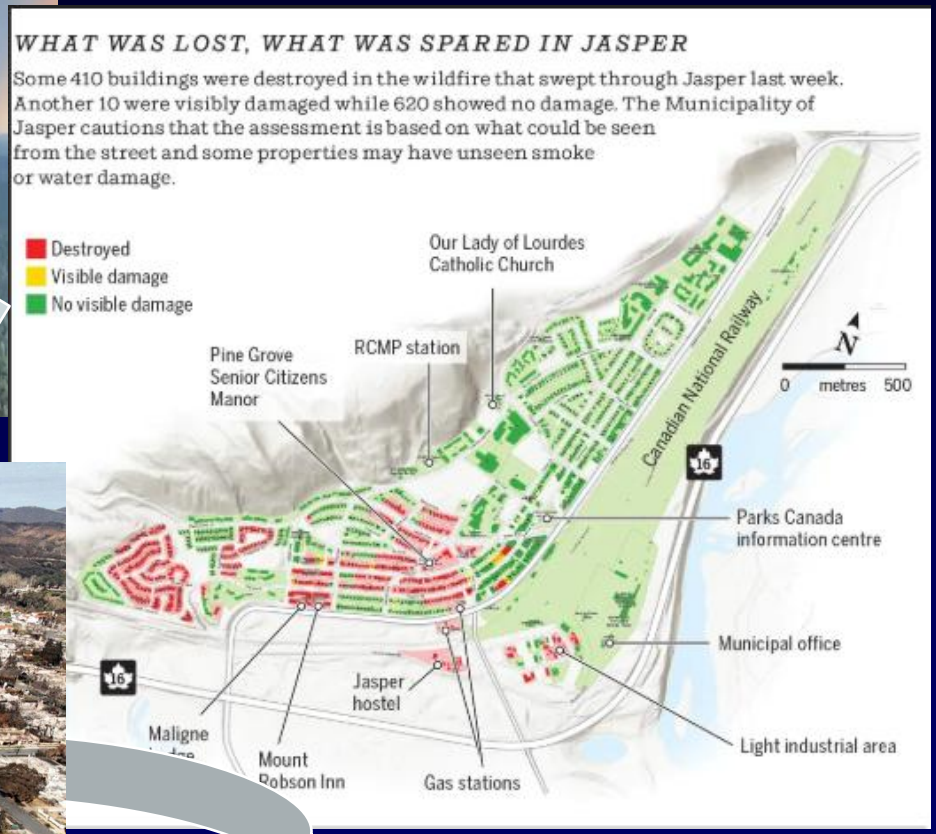
Environmental and Health Impacts of Wildfires in BC

John J. Clague
Centre for Natural Hazard Research
Simon Fraser University
Burnaby, BC, Canada
jclague@sfu.ca

Introduction

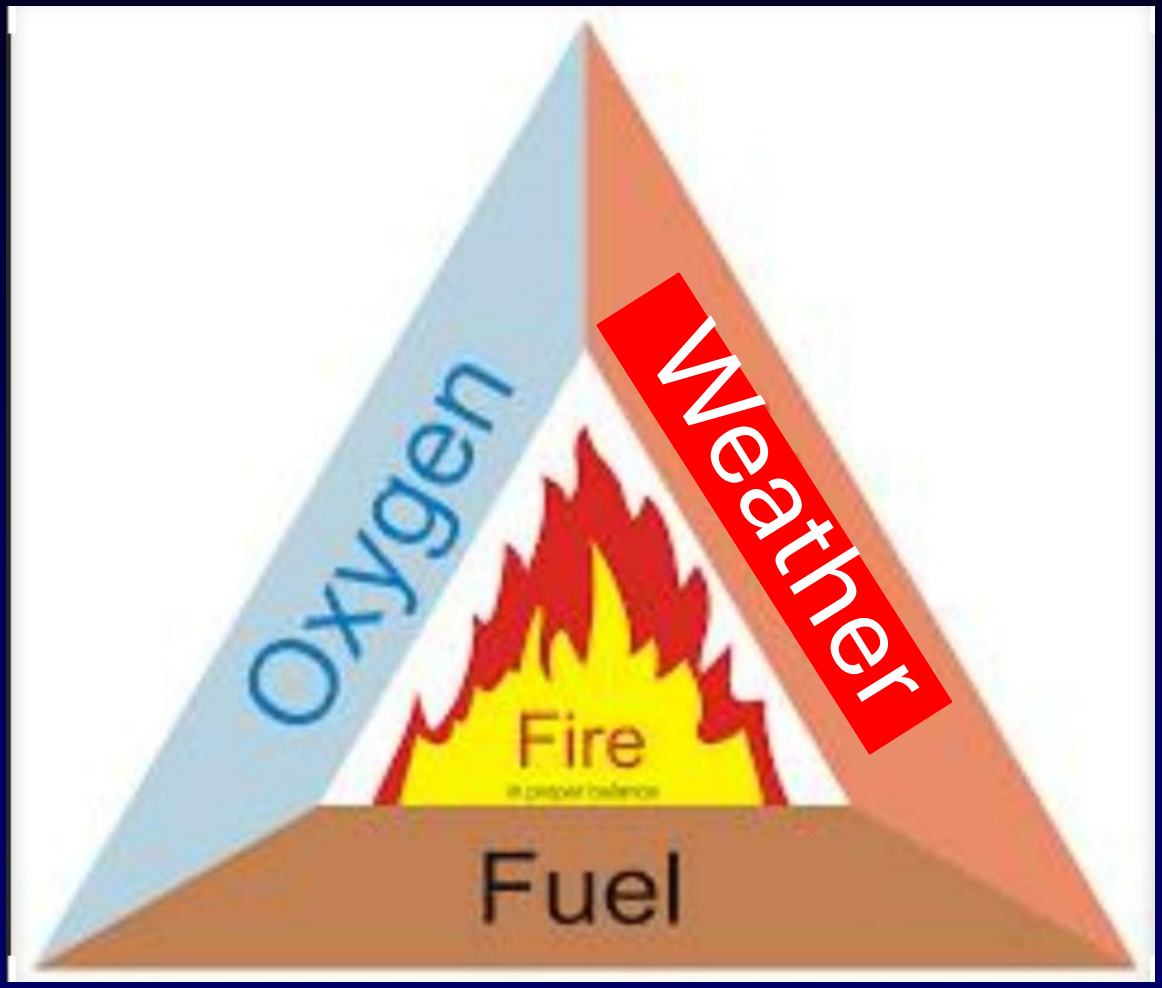
- *Wildfire types*



Interface

Introduction

- *Fire triangle*

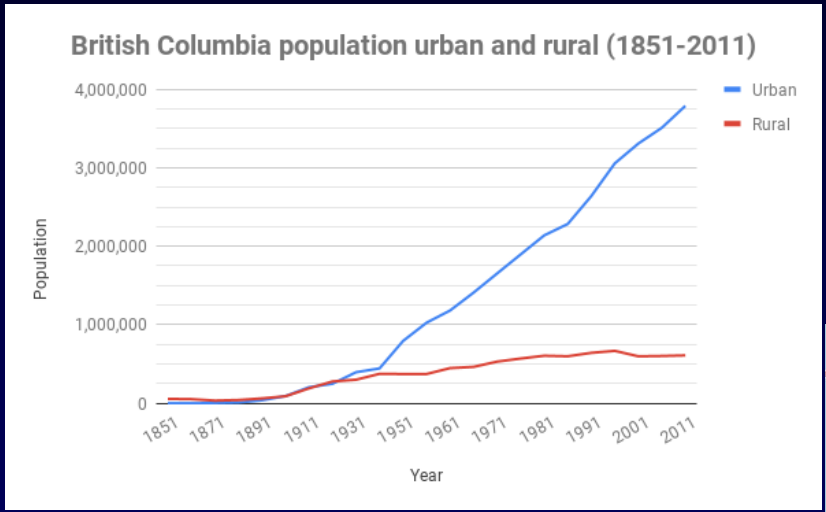


Fire triggers/causes

- *Arson*
- *Burning vegetation*
- *Campfires*
- *Cigarettes*
- *Controlled burning*
- ***Heat and drought***
- *Equipment*
- *Power lines*
- *Fireworks*
- ***Lightning and strong winds***
- *Vehicle crashes*
- ***Volcanic eruptions***

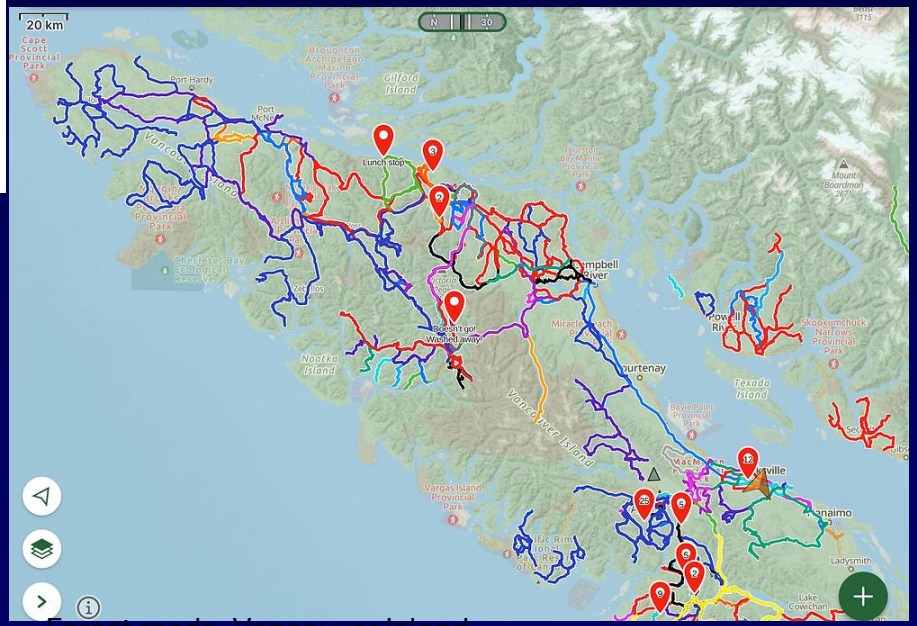
Recent increases in wildfire frequency and severity

A major factor driving an increase in wildfire frequency in BC is the emergence of ubiquitous and easy access to formerly remote areas in the province accompanying population growth and attendant resource extraction

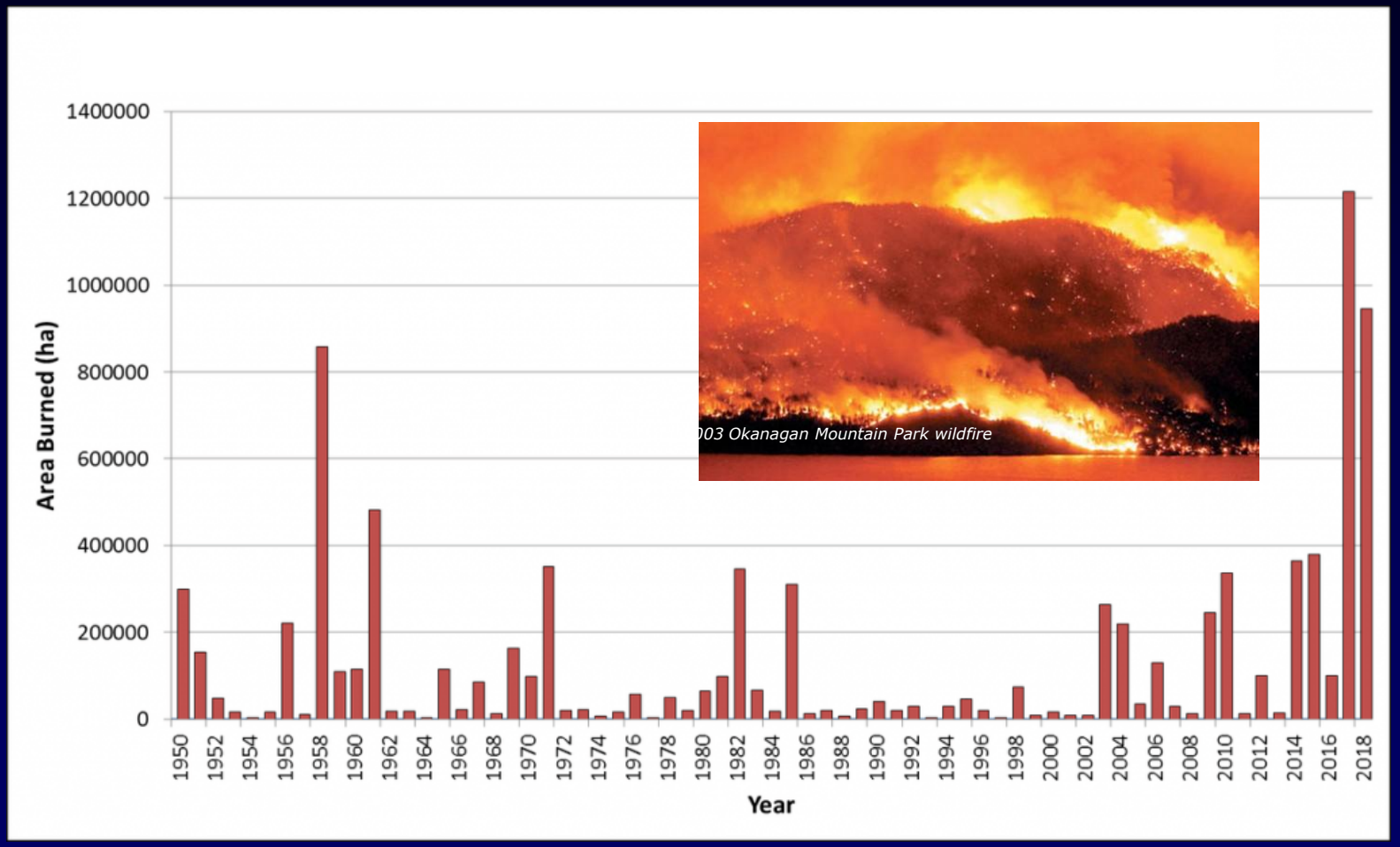


As BC's population has increased, the industrial and recreational 'footprint' on forest lands has increased everywher

There are nearly 620,000 km of forest roads in BC, providing access to nearly the entire province



Forest roads, Vancouver Island


1400000
1200000
1000000
800000
600000
400000
200000
0
Area Burned (ha)
1950
1952
1954
1956
1958
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
2008
2010
2012
2014
2016
2018
Year
003 Okanagan Mountain Park wildfire

British Columbia wildfire stats, 2021-2024

Year	Total Fires	Total Hectares	Total Cost (estimated)	Human-caused (%)	Lightning-caused (%)
2024	1,697	1,081,159	$769.4 million	511 (30%)	1,186 (70%)
2023	2,293	2,840,104	$1,094.8 million	609 (26%)	1,638 (71%)
2022	1,801	135,235	$411.9 million	578 (32%)	1,200 (66%)
2021	1,647	869,300	$718.8 million	633 (38%)	970 (59%)

British Columbia wildfire stats, 2021-2024

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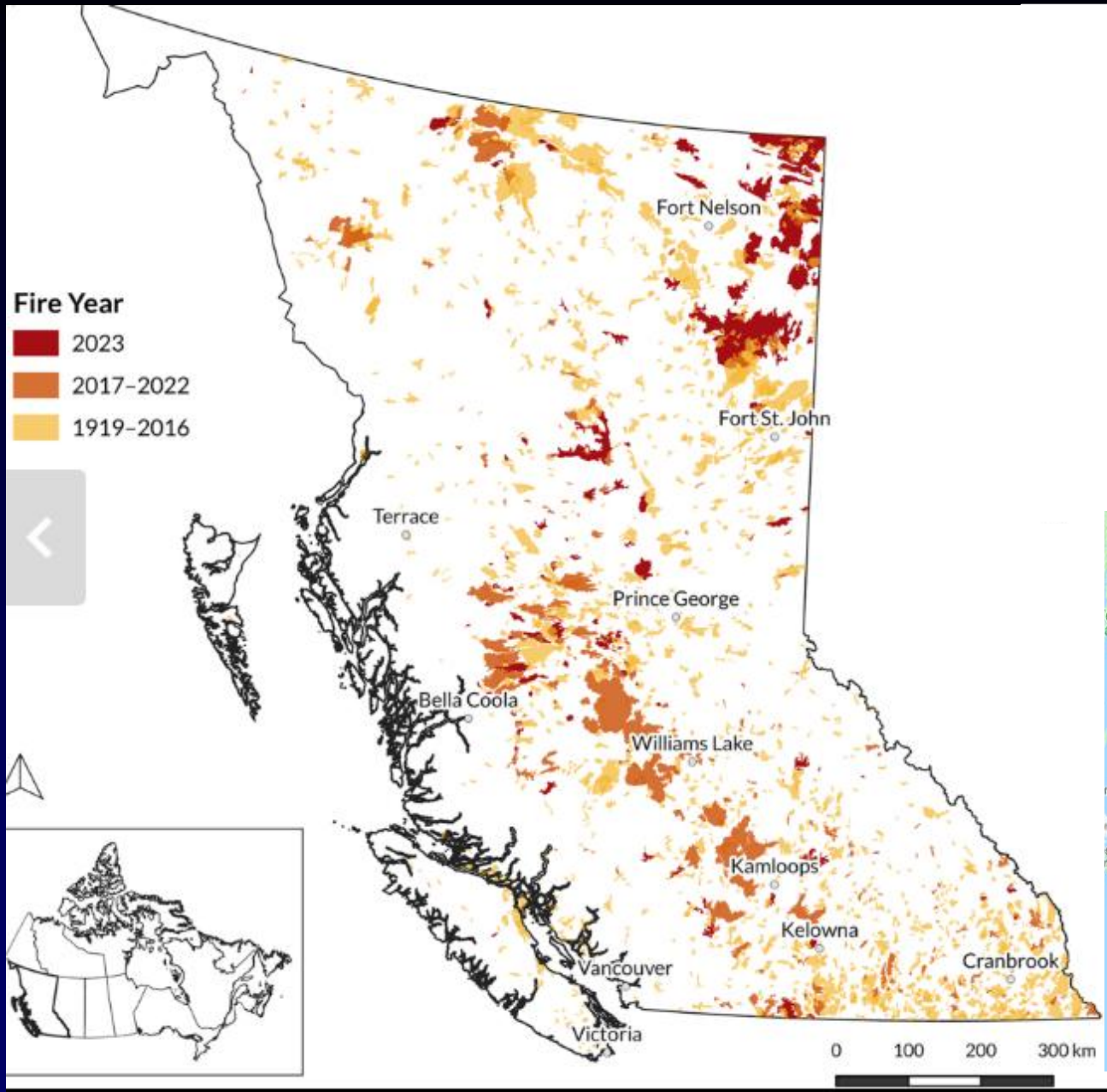
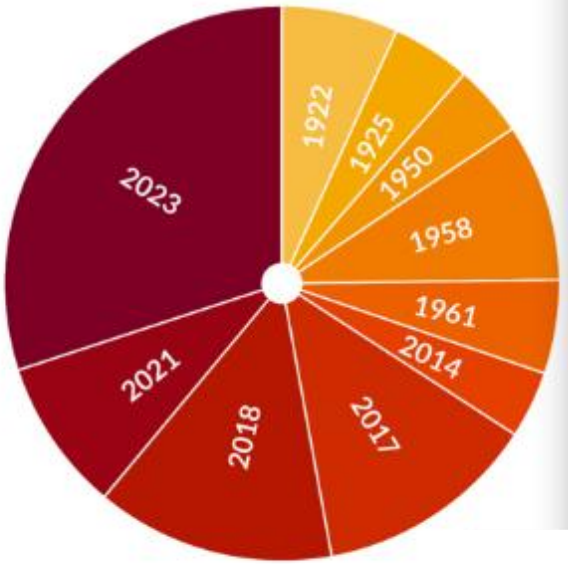
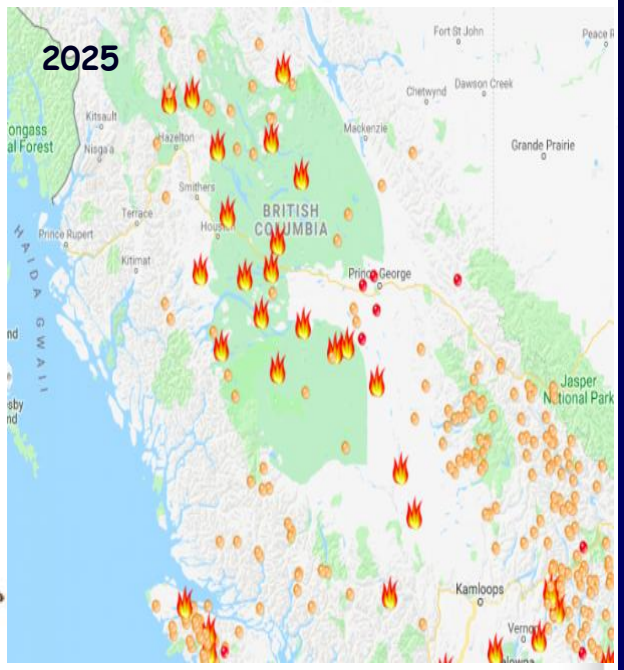
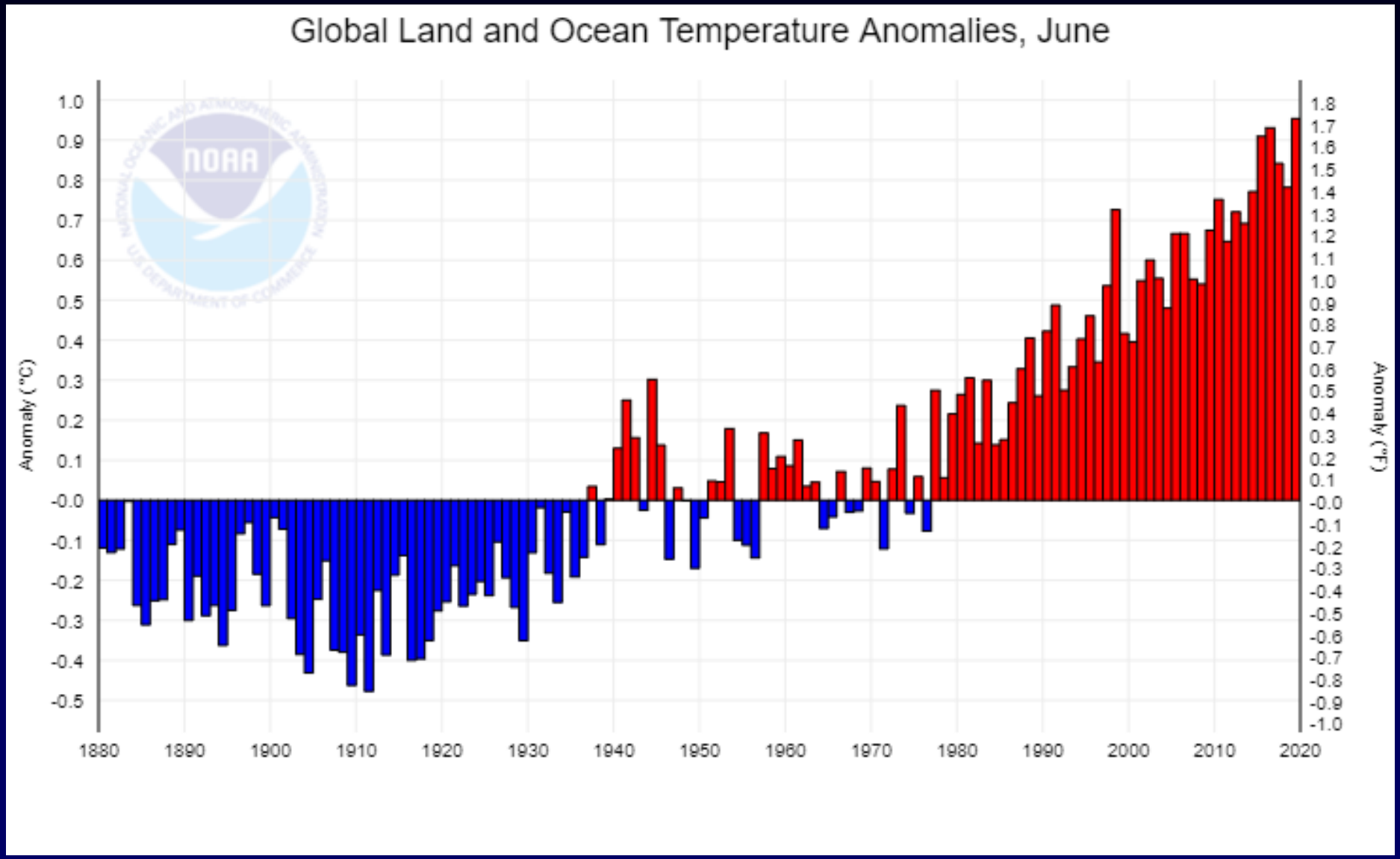
ca. $200 tax dollars for every adult and child in the province!


Fire Year
2023
2017–2022
1919–2016
Fort Nelson
Fort St. John
Terrace
Prince George
Bella Coola
Williams Lake
Kamloops
Kelowna
Vancouver
Cranbrook
Victoria
0
100
200
300 km


2023
1922
1925
1950
1958
1961
2014
2017
2018
2021


2025
BRITISH COLUMBIA
Fort St John
Dawson Creek
Chetwynd
Grande Prairie
Mackenzie
Smithers
Terrace
Prince Rupert
Kitimat
Prince George
Jasper National Park
Kamloops

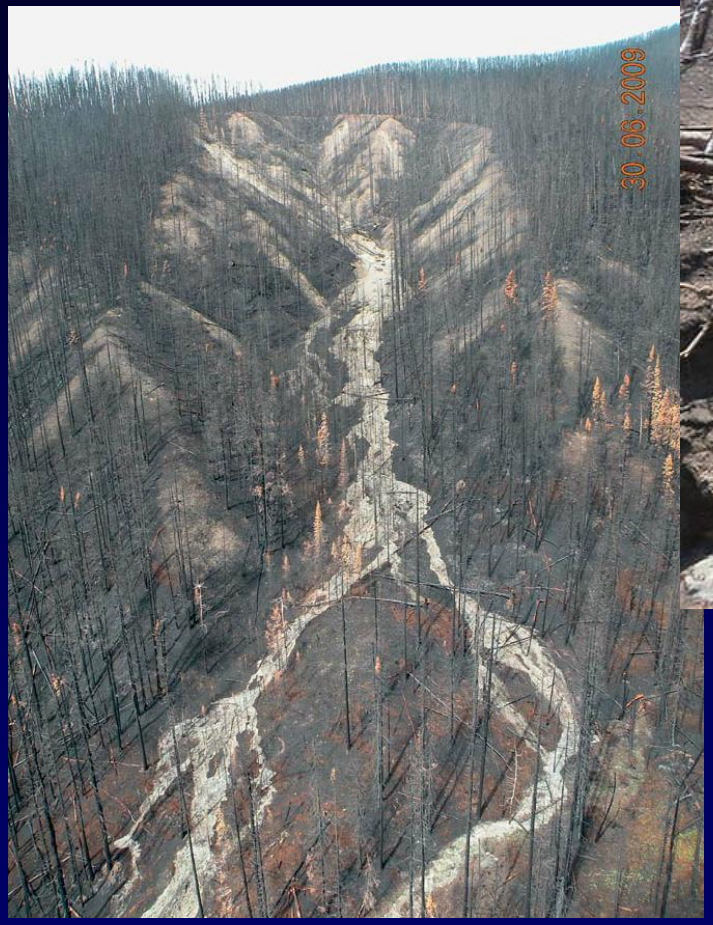
Our warming climate is ‘amping up’ the hazard



Impacts of wildfires

- *Storm runoff (hydrophobic soils)*
- *Debris flows*
- *Stream channel aggradation*
- *Human health (ash particles, aerosols, heavy metals)*

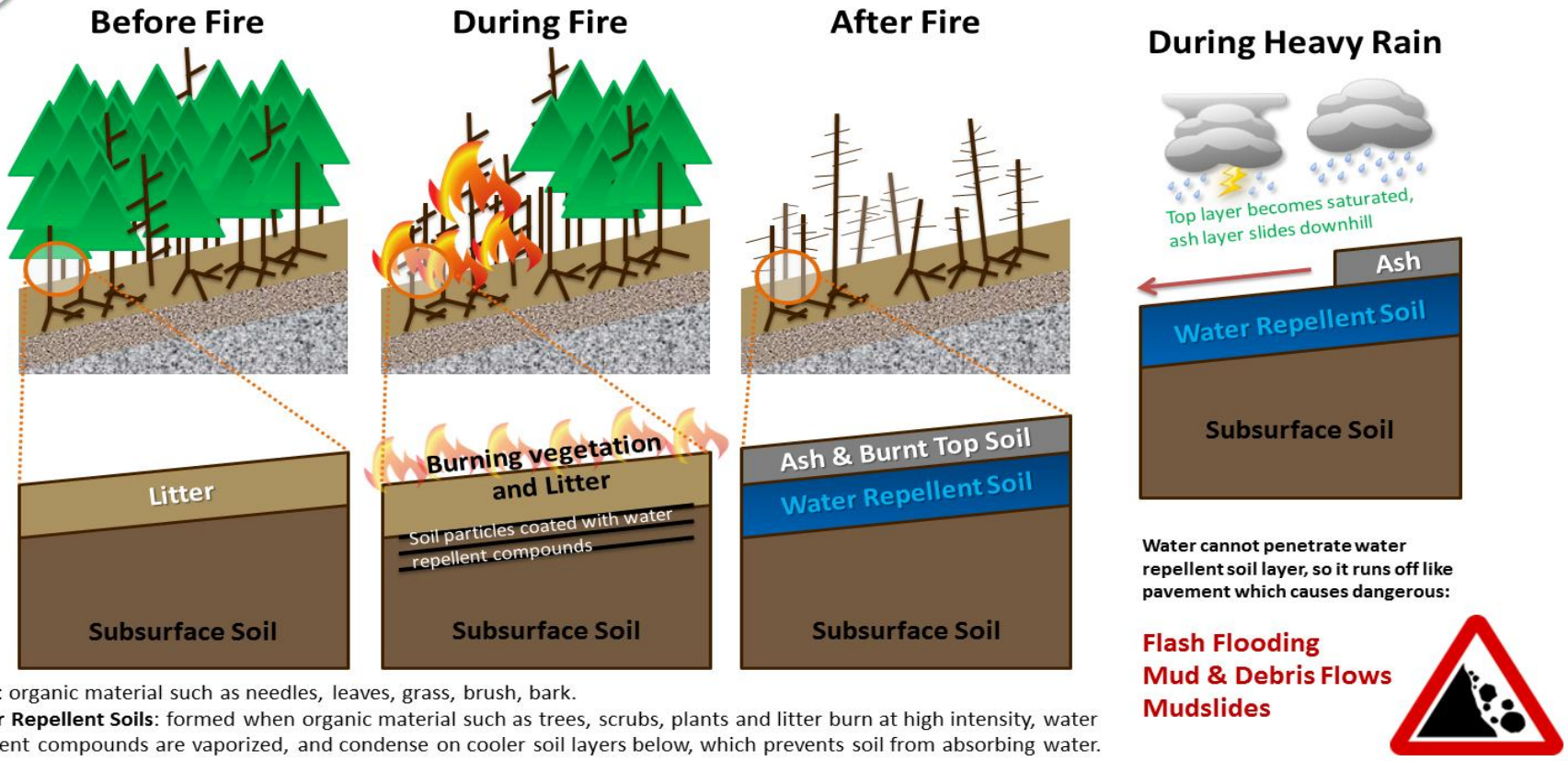
Wildfires and clear-cut logging exacerbate flooding



Wildfires and hydrophobic soils

*The **hydrophobic effect** is the observed tendency of nonpolar substances substances to aggregate in an aqueous solution and exclude water molecules*

Wildfire Burn Scars are a Flood Risk



Litter: organic material such as needles, leaves, grass, brush, bark.
Water Repellent Soils: formed when organic material such as trees, scrubs, plants and litter burn at high intensity, water repellent compounds are vaporized, and condense on cooler soil layers below, which prevents soil from absorbing water.

Gases penetrate the soil

They create a waxy coating that repels water

- *Increase in water run-off*
- *Seeds cannot germinate*
- *Roots of surviving plants cannot get water*

A hazard cascade

Atmospheric rivers – Post-wildfire autumn/winter rains

Canada's most costly natural disaster
November 2021

(Damages up to US$ 7.5 billion)

Highway 7 was closed due to multiple mudslides and washouts. 300 people were trapped on the highway and spent more than two days inside vehicles before being airlifted to safety by three search and rescue helicopters from CFB Comox

BC Ministry of Transportation

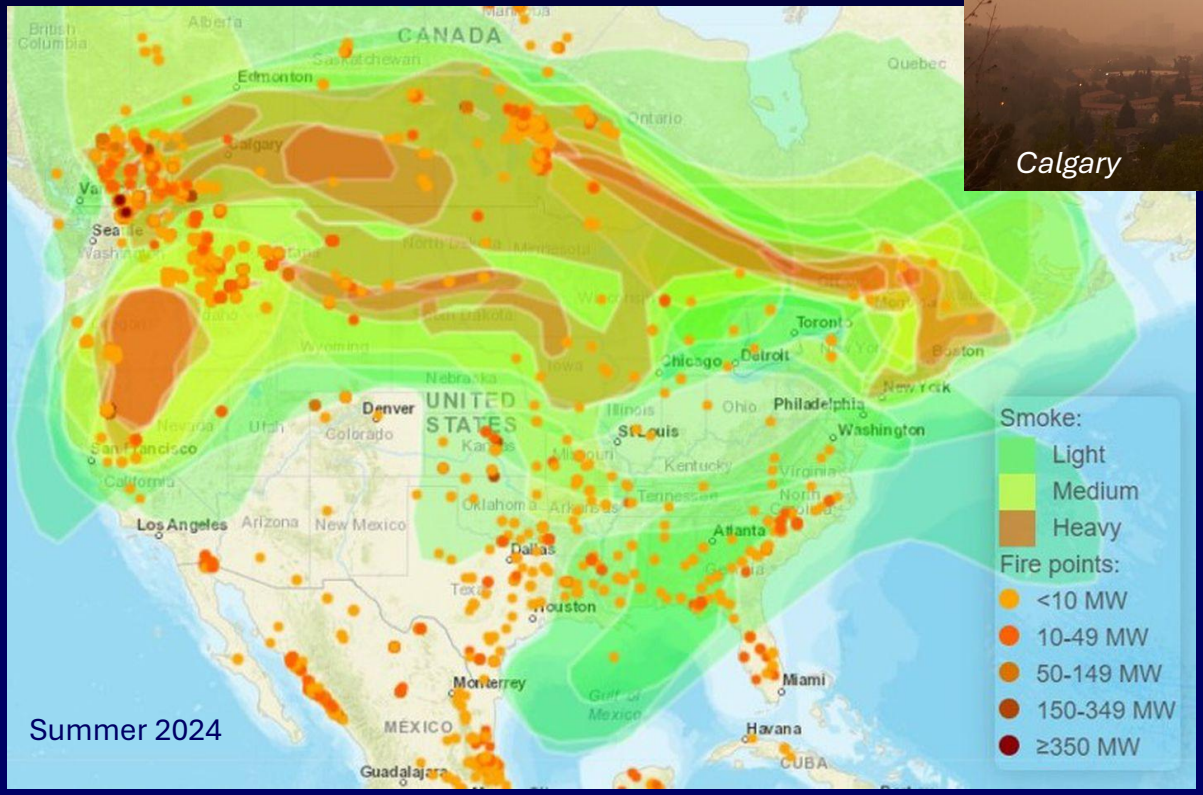
Flooding in Merritt

Merritt

Runoff is also more rapid in cut blocks than in forested areas

Stream channel aggradation

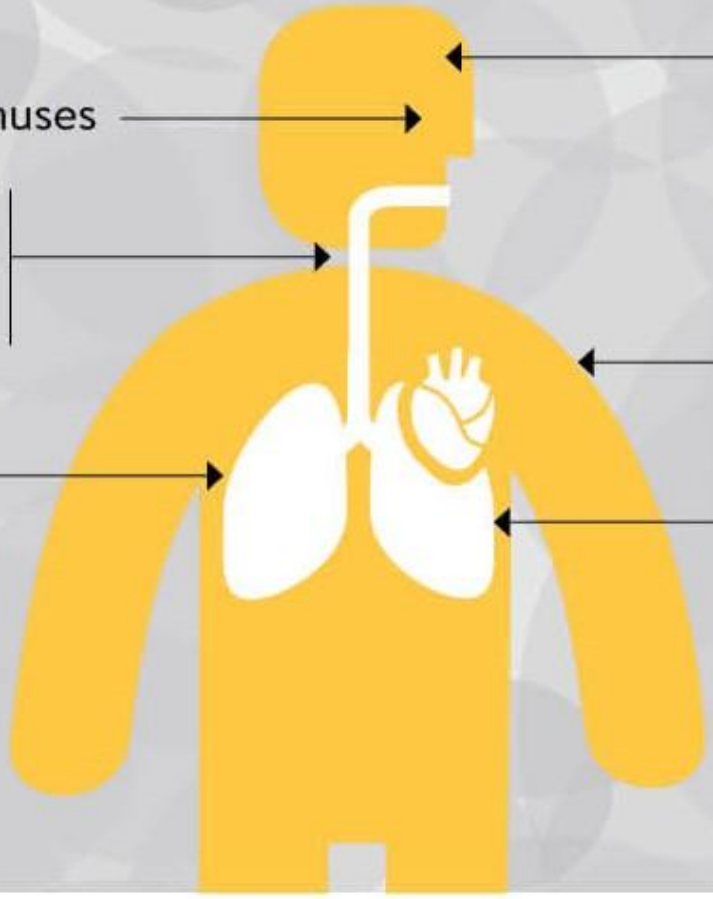
Human health - particles, aerosols, heavy metals



Summer 2024

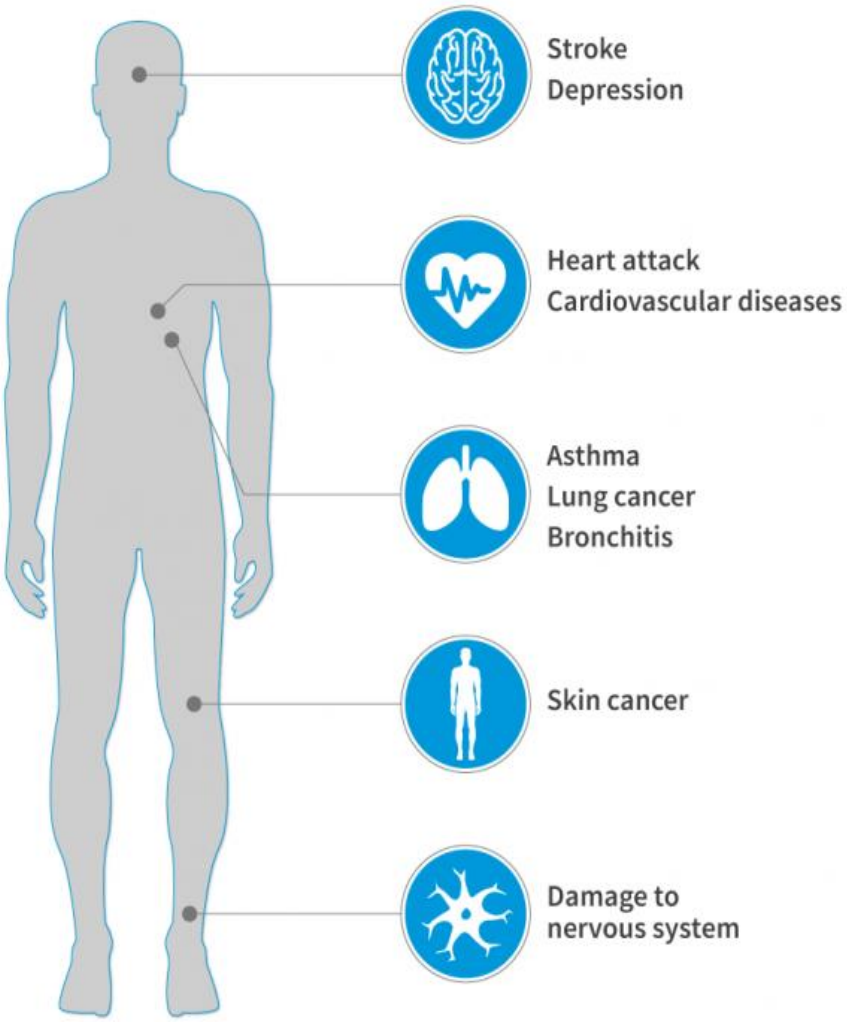
Short-term effects

Fine particles (PM 2.5) pollution from wildfire smoke can cause:



- Irritated eyes and sinuses
- Irritated throat
- Increased coughing
- Difficulty breathing
- Headache
- Increased fatigue
- Asthma attacks
- Chest pain

Long-term health effects



Long-term, multi-institutional study on health impacts of Los Angeles wildfires launched

By Todd Datz · January 30, 2025

Wildfires in urban areas present unique hazards as buildings, cars, and products are incinerated, exposing people to particulate matter, gases, chemicals, heavy metals, asbestos, PFAS, microplastics, and other toxic pollutants. They settle out of the air into soil and dust and can become resuspended during recovery and rebuilding efforts. Water quality can also be affected.

Lahaina, Maui, August 2023

Refinery fire
Roseland, Louisiana, August 2025

.....Communities impacted by a fire can be exposed to chemicals through combustion of buildings, plastics, electronics and appliances, vehicles, and artificial structures. Such chemicals can include heavy metals (e.g., lead), polybrominated diphenyl ethers (PBDEs), per- and polyfluoroalkyl substances (PFAS), and other known carcinogens such as polycyclic aromatic hydrocarbons (PAHs) and asbestos.

In the case of the LA Fires, nearby residents were also exposed to a flame retardant, which may be enriched with heavy metals. Further, smoke from wildfires that burned structures appears enriched in heavy metals compared with wildfires that burned vegetation alone.

The risk may increase for particles much small than PM 2.5...

Research from the National Institue for Occupational Safety and Health has shown that urban fire fighters have a 9% higher risk of being diagnosed with cancer and a 14% higher risk of dying from cancer that the general U.S. population.

Research from the National Institute for Occupational Safety and Health has shown that urban fire fighters have a 9% higher risk of being diagnosed with cancer and a 14% higher risk of dying from cancer that the general U.S. population.

Long-term contaminant issues

- Contamination of soil and surface water
- Emergent diseases long after exposure
- Impacts on human health care system
- Unknown impacts on ecosystems

Path forward?

- Transition to an economy based on renewable energy
- Limit access to forest lands during periods of extreme wildfire weather
- Employ existing and emerging remote sensing technologies to detect new fires BEFORE they spread
- Better manage forests to minimize wildfire damage
- Thin forest cover around interface between towns and cities, and forest lands
- Increase support for biomedical research on health impacts of fires, especially urban wildfires

Thanks for your attention

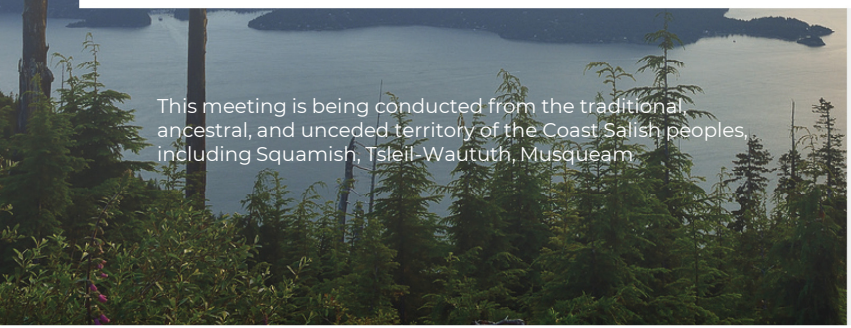
Altadena, California, January 2025

CSAP

SOCIETY OF CONTAMINATED SITES
APPROVED PROFESSIONALS
OF BRITISH COLUMBIA

Climate Change Readiness in Risk Assessment

Mandeep Purewal, MET, R.P.Bio., P.Ag., CSAP, AtkinsRéalis



This meeting is being conducted from the traditional, ancestral, and unceded territory of the Coast Salish peoples, including Squamish, Tsleil-Waututh, Musqueam

Climate Change Readiness in Risk Assessment

Mandeep Purewal, MET, RPBio, PAg, CSAP

Senior Risk Assessor & Toxicologist / Technical Lead Risk Assessment, AtkinsRéalis

November 12, 2025: CSAP Fall PD Workshop

AtkinsRéalis

How do we Define Climate Change?

Climate Change

Long term shift in weather conditions

Different emissions scenarios based on predicted greenhouse gas emissions

Climate Change Impact

Effect of climate change on systems

How Can Climate Change Impact Contaminated Sites?

Contaminated Site

- Soil
- Sediment
- Surface Water
- Groundwater
- Vapour

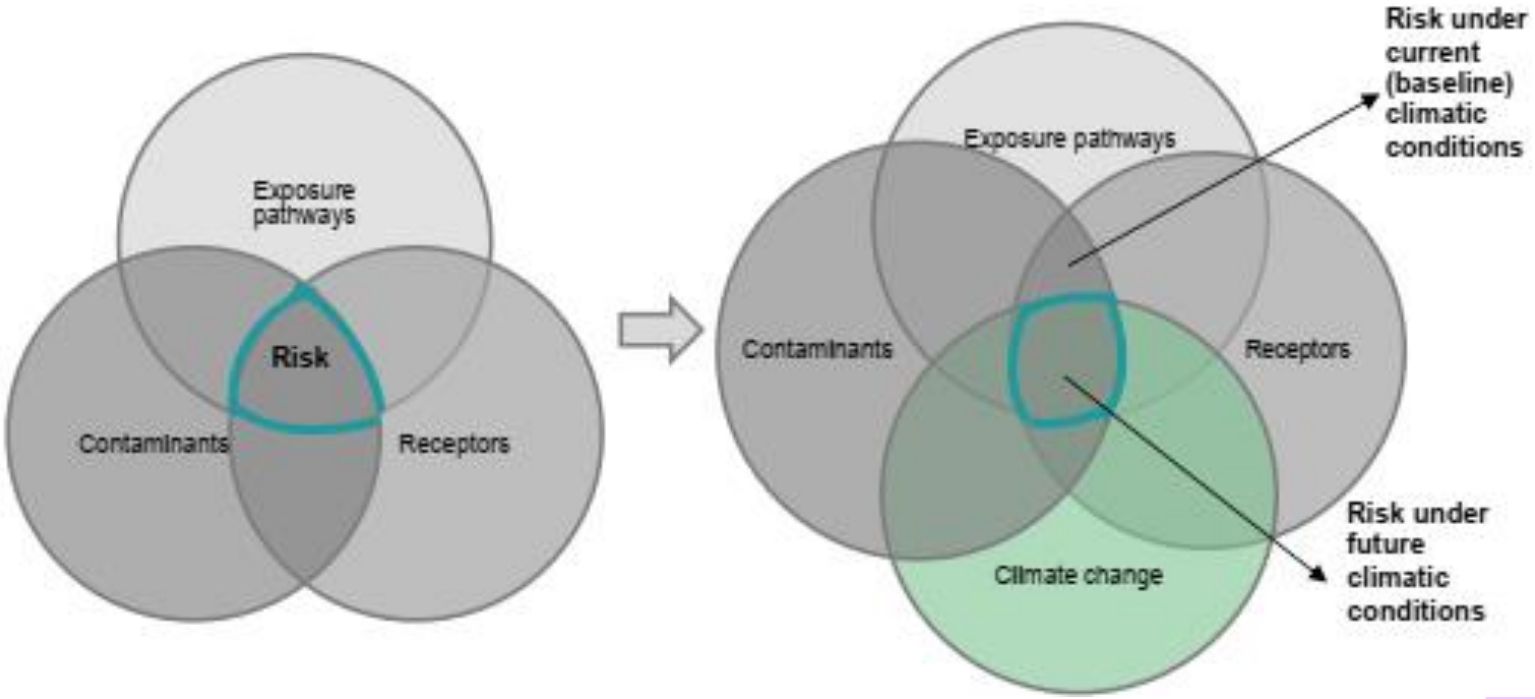
Some Potential Changes

- Contaminant Distribution
  - Changes in groundwater levels, flooding, transport of contamination
- Concentration Changes
  - Increased or decreased
- Changes in Media
  - Submerged soil

How Can Climate Change Impact Risk Assessment?

Baseline/Typical Risk Assessment

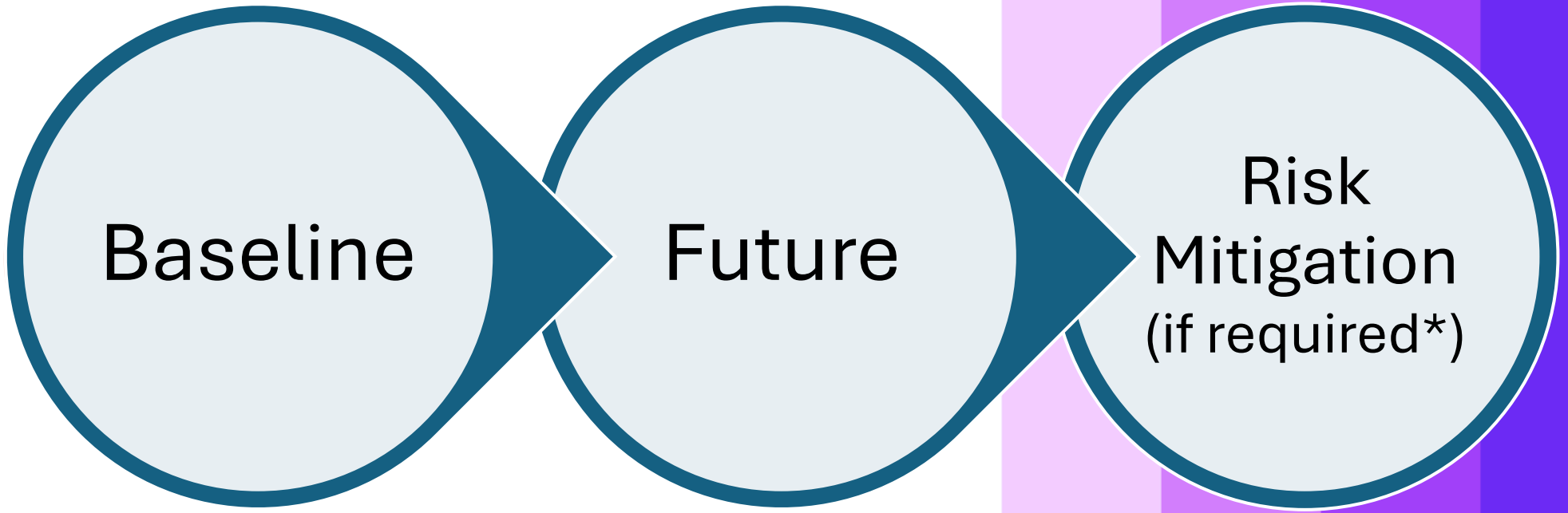
Climate Change Risk Assessment



Source: FCSAP, 2022 Figure 3: Update of Risk Components Relationship Considering Climate Change (modified from CSMWG, 1999)

People. Data. Technology.

Essential Steps for Evaluating Climate Change Readiness in Risk Assessments



ESTABLISH BASELINE CONDITIONS AND RISKS.

DETERMINE FUTURE CONDITIONS AND ASSOCIATED RISKS.

IDENTIFY WHAT AREAS NEED RISK MITIGATION/FURTHER WORK TO MAKE SITE CLIMATE CHANGE RESILIENT.

Essential Steps for Climate Change Risk Assessment Evaluations

- ❑ Establish baseline conditions and risks
  - ❑ How is our Site currently used?
  - ❑ What is the key habitat?
    - ❑ Known vulnerabilities?
  - ❑ What are the current risks at the Site?
  - ❑ Is risk mitigation required?
    - ❑ **How will it hold up to climate change?**
  - ❑ What does our CSM look like and are we confident in it or do we need more data?

Essential Steps for Climate Change Risk Assessment Evaluations

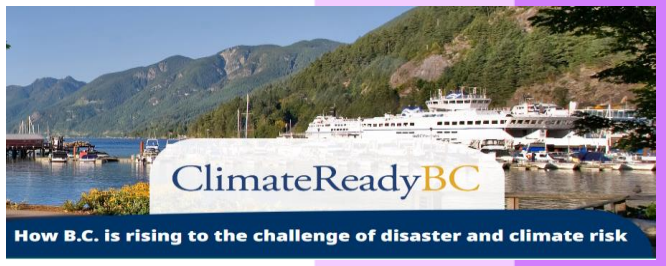
- ❑ Determine future conditions and associated risks
  - ❑ What do we know about the Site?
  - ❑ What are the key considerations?
    - ❑ How will exposure be altered?
    - ❑ How will concentrations differ?
  - ❑ What are the key climate hazards that could impact the Site?
  - ❑ How will our CSM differ?

Essential Steps for Climate Change Risk Assessment Evaluations

- ❑ Identify what areas need risk mitigation/further work to make site climate change resilient
- ❑ Compare the current baseline risks (known) to those predicted?
- ❑ Where are the vulnerabilities?
- ❑ Is action needed to protect the Site?
- ❑ Is natural recovery anticipated?
- ❑ What are the priorities?
- ❑ Based on contaminant? Receptor? Feasibility of effectiveness?

Resources for Assessing Climate Change at Contaminated Sites: BC Perspective

- ❑ Considering Climate Change in Remediation
- ❑ ClimateReadyBC
- ❑ Pacific Climate Impact Consortium
- ❑ ClimateData.ca
- ❑ CCME Guidance on Climate Risk Assessment



PACIFIC CLIMATE IMPACTS CONSORTIUM

People. Data. Technology.

What are Contaminated Sites Related Climate Hazards: BC Perspective?

- Which ones do you look at?
  - What are the vulnerabilities of your site?
  - What will result in the biggest changes to your CSM?
  - Who needs to be involved/consulted?

BC Specific Climate Hazards

- Increased temperatures
- Extreme storms and precipitation
- Drought
- Sea level rise
- Flooding
- Erosion and landslides
- Severe wildfires
  - Source: Preliminary Strategic Climate Risk Assessment for B.C.

How do Climate Hazards Relate to Impacts: BC Perspective?

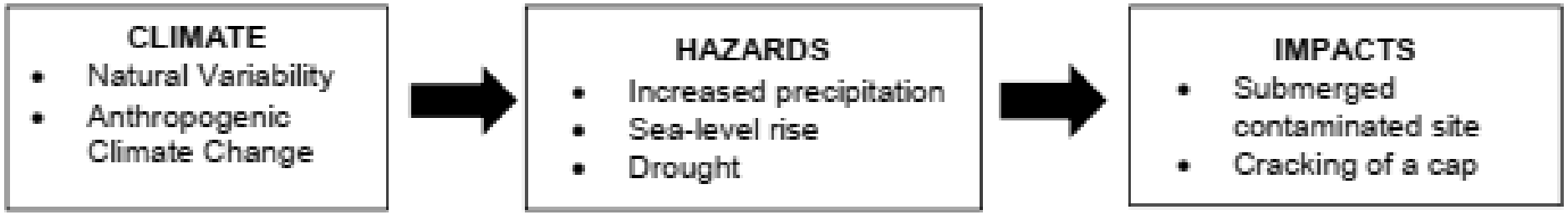
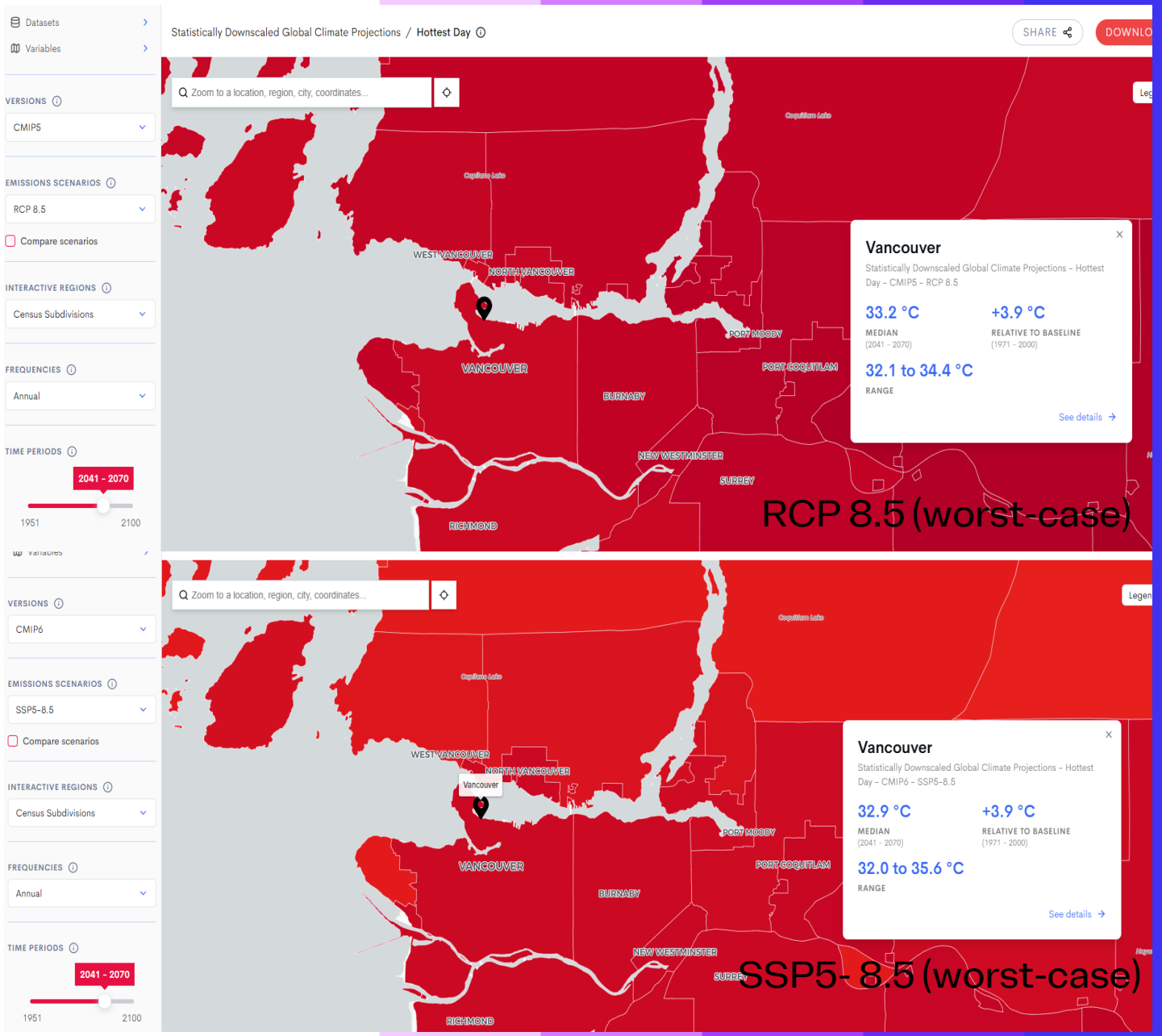


Figure 1: Illustration of Climate Change Hazards versus Climate Change Impacts

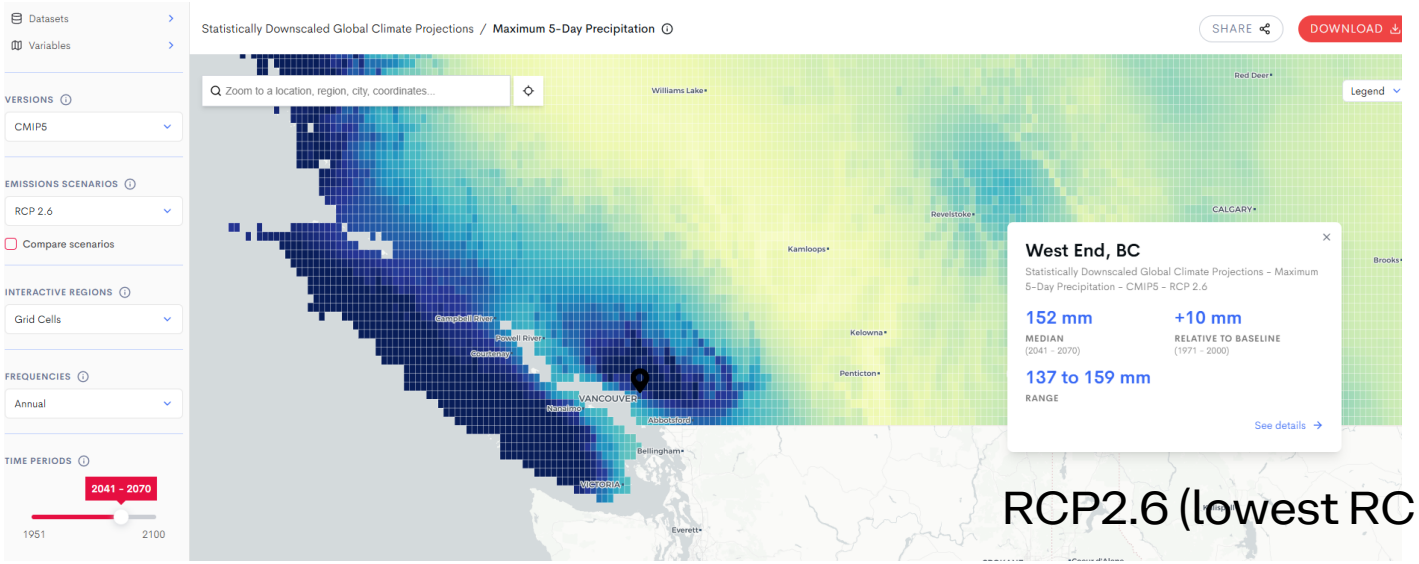
Source: FSCAP, 2022

Climate Risk and Vulnerability: BC Perspective

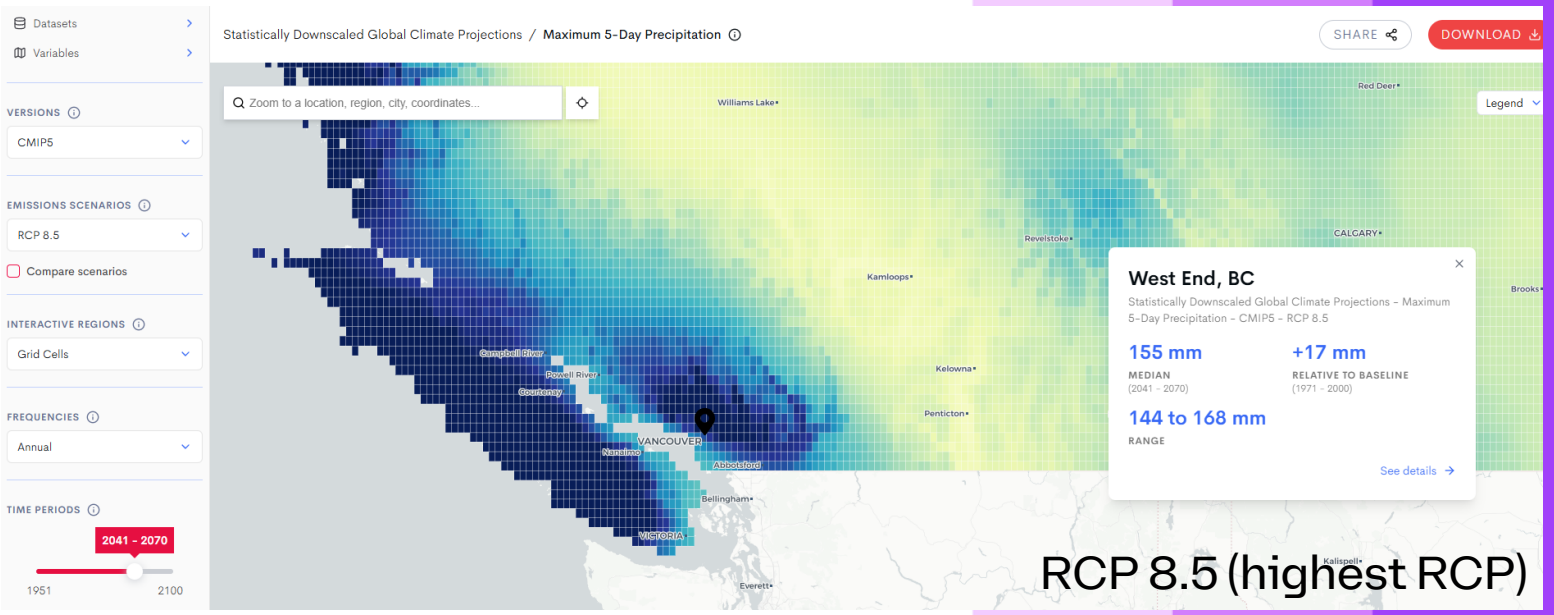
- RCPs/SSPs
- Adaptive capacity of the site
- Considering Climate Change in Remediation



Climate Risk and Vulnerability: BC Perspective



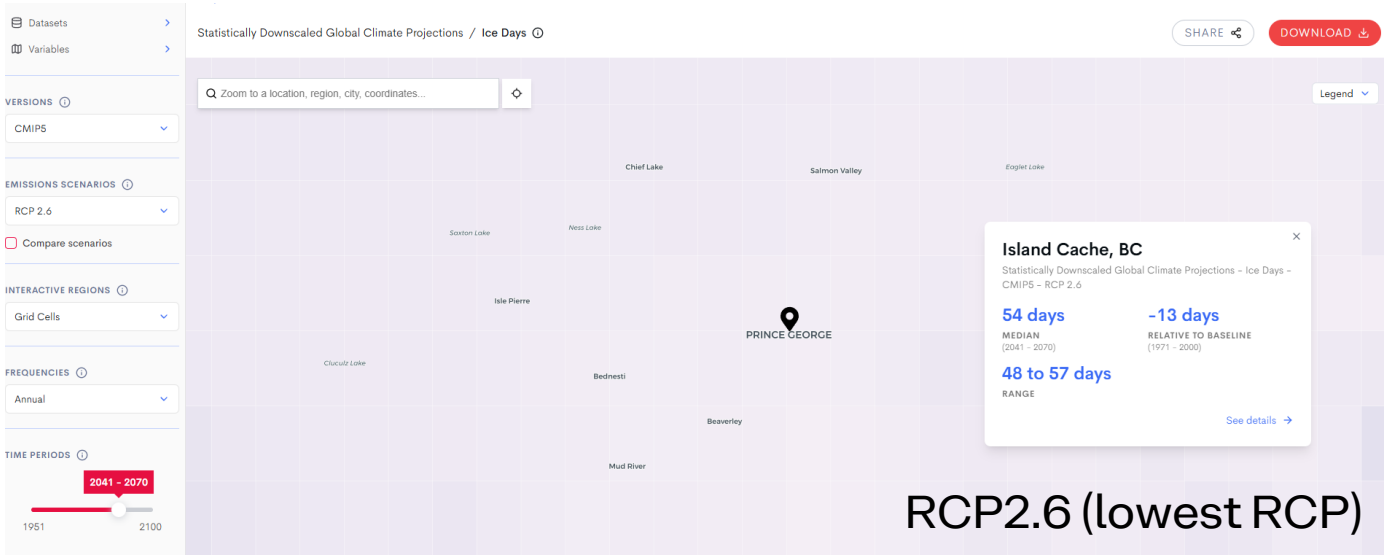
RCP2.6 (lowest RCP)



RCP 8.5 (highest RCP)

People. Data. Technology.

Climate Risk and Vulnerability: BC Perspective



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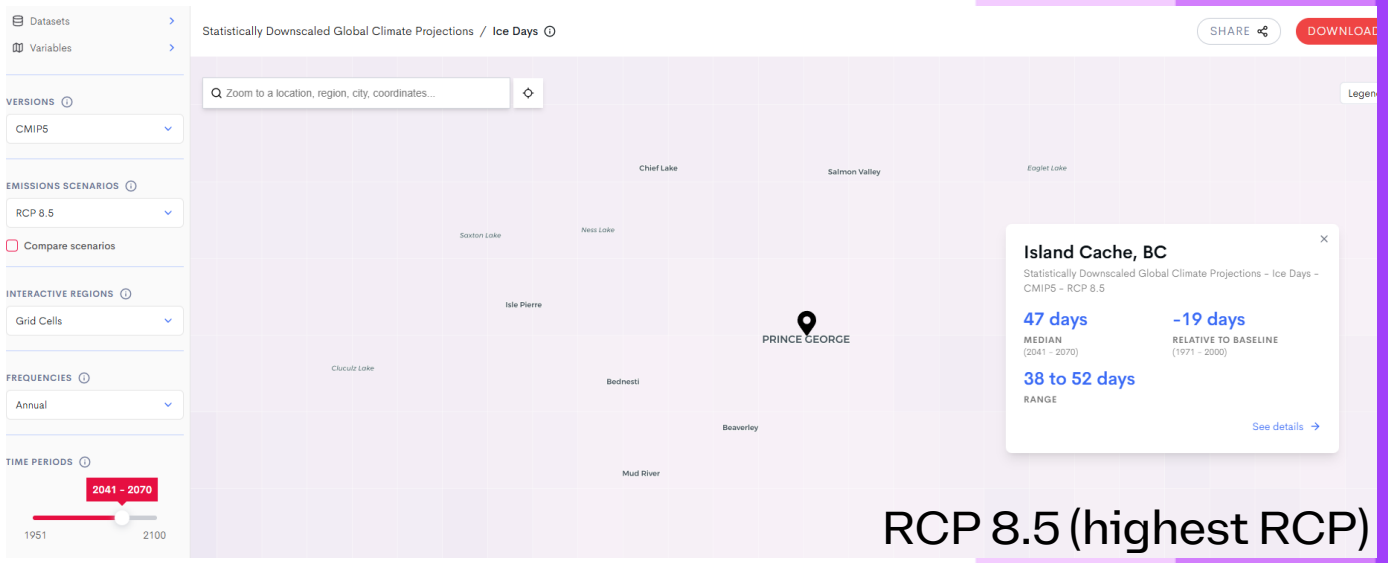
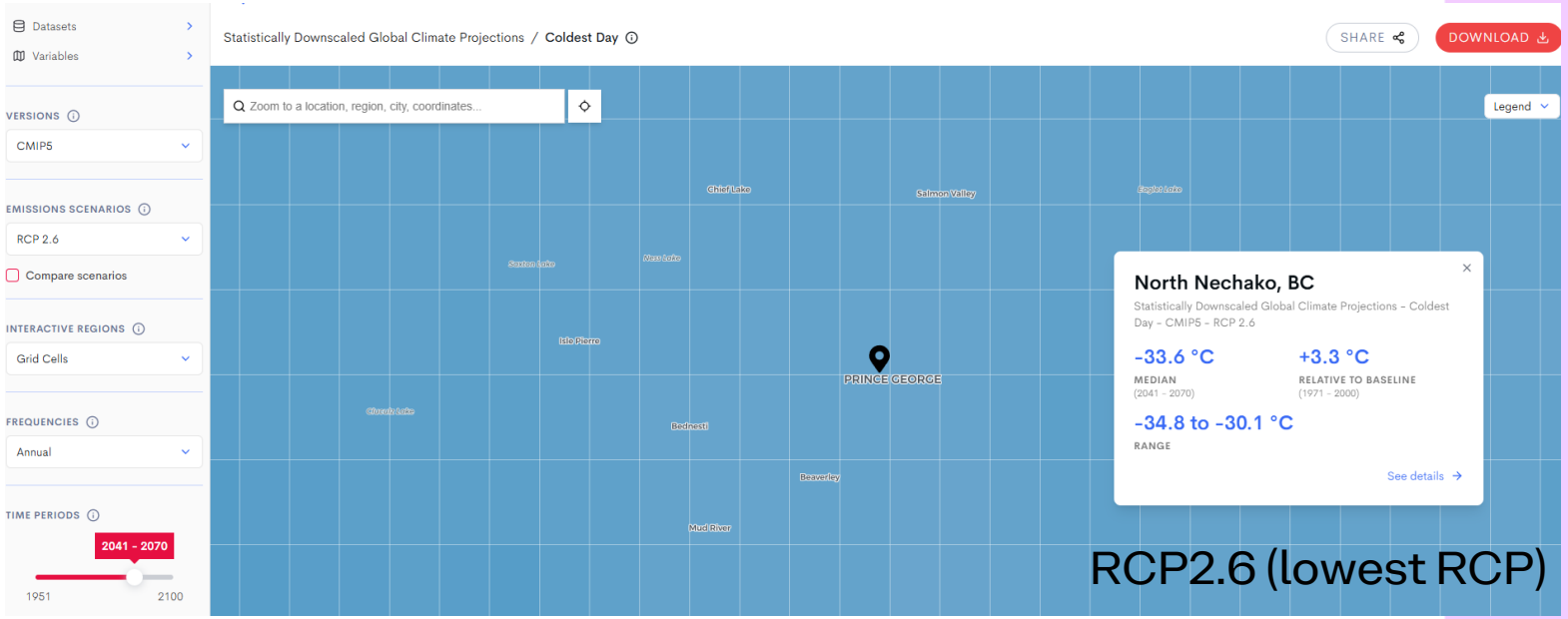
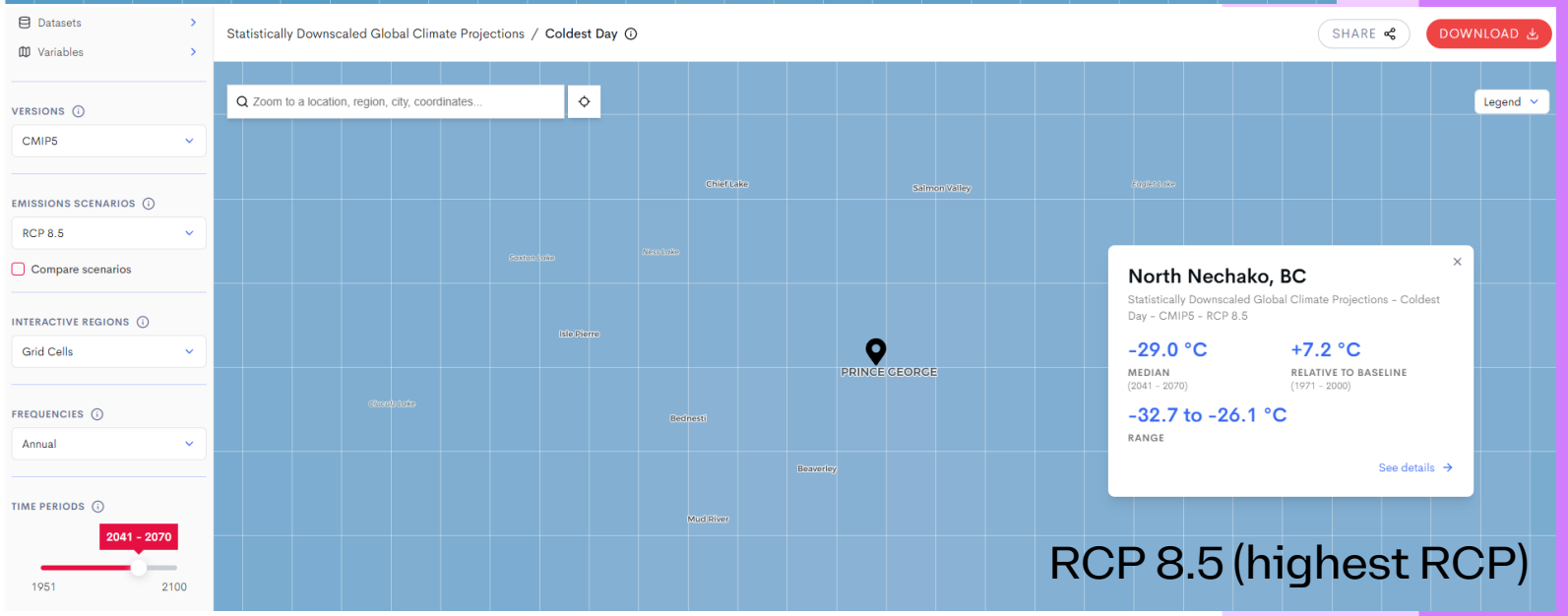


RCP 8.5 (highest RCP)

People. Data. Technology.

Climate Risk and Vulnerability: BC Perspective





People. Data. Technology.

What are the Options for Assessing Climate Change Resilience in Risk Assessment?

Qualitative

- ❑ Subjective assessment based on review of forecasted changes
- ❑ Challenge with degree of subjectivity and consistency in application
- ❑ Needs to meet key elements of climate change evaluation

Semi-Quantitative

- ❑ Risk-Ranking Approach
- ❑ Building on approach developed by United Nations Framework Convention of Climate Change and European Commission

Quantitative

- ❑ Fully quantifying the impact of projected changes
- ❑ Requirement for detailed fate and transport models

Qualitative Approach for Assessing Climate Change Resilience

Qualitative

- ❑ Subjective assessment based on review of forecasted changes
- ❑ Challenge with degree of subjectivity and consistency in application
- ❑ Needs to meet key elements of climate change evaluation.

- Things to Consider:
  - Have key elements of climate change evaluation been met?
  - Do you have the expertise in the site characterization and risk assessment to make conclusions?
  - What is the goal of your assessment?

Semi-Qualitative Approach for Assessing Climate Change Resilience.

Semi-Quantitative

- Risk-Ranking Approach
- Building on approach developed by United Nations Framework Convention of Climate Change and European Commission

Consequences of Climate Change Hazard on R/RM Component						
	Very High	Moderate Risk	High Risk	High Risk	Extreme Risk	Extreme Risk
	High	Low Risk	Moderate Risk	High Risk	High Risk	Extreme Risk
	Moderate	Low Risk	Low Risk	Moderate Risk	High Risk	High Risk
	Low	Negligible Risk	Low Risk	Low Risk	Moderate Risk	Moderate Risk
	Very Low	Negligible Risk	Negligible Risk	Low Risk	Low Risk	Low Risk
		Very Low	Low	Moderate	High	Very High
		Likelihood of Occurrence of Climate Change Hazard				

Source: FCSAP, 2022 Figure 4: Example of Risk Matrix to Determine Risk from Climate Change Hazards at a Site, adapted from Infrastructure Canada, 2019

Climate Change Risk Resilient Strategy

- Ensure that potential risks due to climate change have been considered
  - Consideration of differing contaminant distribution, exposure pathways and receptors
  - Adaption measures to make the site more climate resilient
- Things to consider
  - Science is evolving
  - Flexibility may be required to adjust as new scientific information or modelling/projection data becomes available.
  - Stakeholder consultation is vital

Considering Climate Change in Risk Assessment: Closing Remarks

Determine what is needed and appropriate for your site

Climate Change science is evolving

Requirements will evolve with the science

Thank you

AtkinsRéalis

AtkinsRéalis

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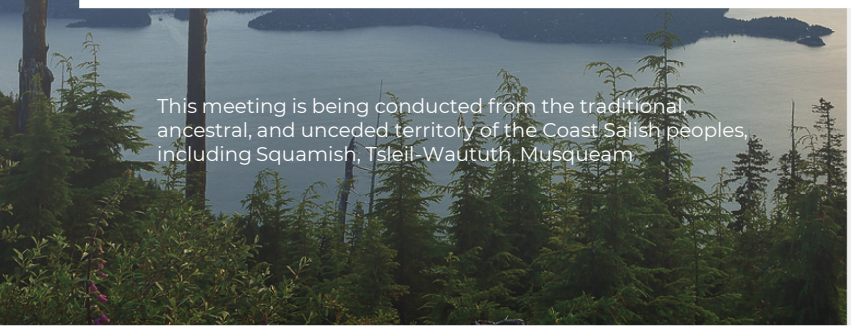
APPROVED PROFESSIONALS
OF BRITISH COLUMBIA

Nature-Based, Data-Based: The Future of Sustainable Remediation

Parisa Jourabchi, Ph.D., P.Eng.,
Founder & Chief Science Officer
ARIS Environmental Ltd.



This meeting is being conducted from the traditional, ancestral, and unceded territory of the Coast Salish peoples, including Squamish, Tsleil-Waututh, Musqueam.

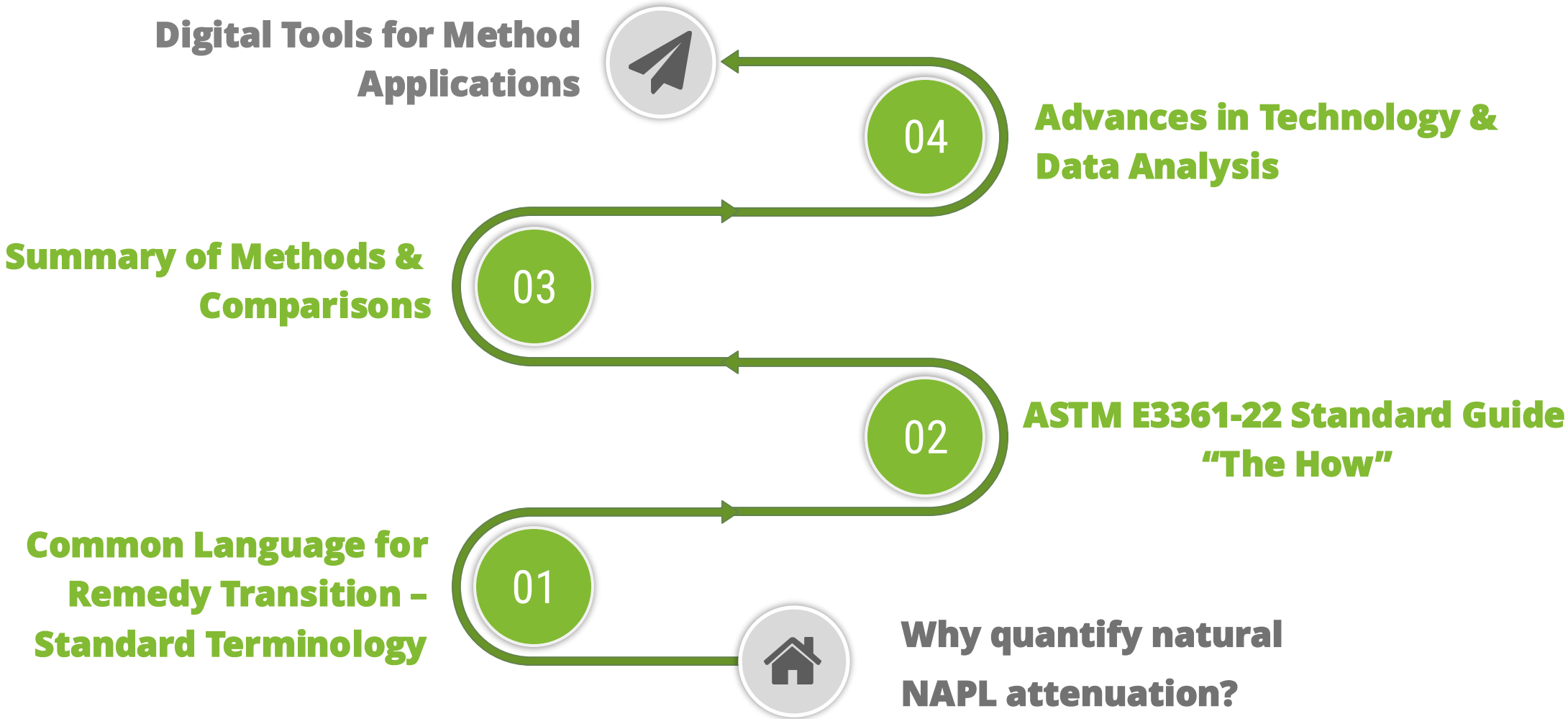
CSAP's 2025 Fall Professional Development Workshop
Vancouver, BC
12 November 2025

ARIS

Nature-Based, Data-Backed: The Future of Sustainable Remediation

Parisa Jourabchi, Ph.D., P.Eng.
Founder & Chief Science Officer, ARIS Environmental Ltd.

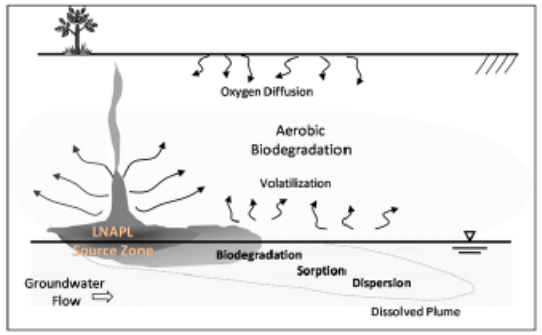
Roadmap

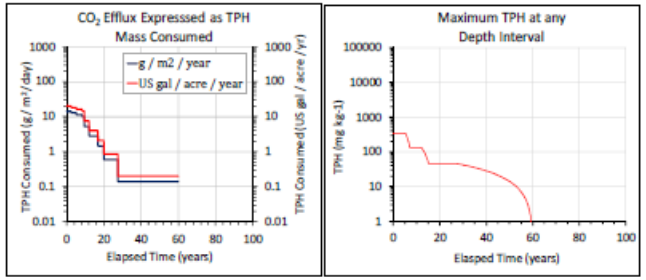

Digital Tools for Method Applications
04
Advances in Technology & Data Analysis
Summary of Methods & Comparisons
03
02
ASTM E3361-22 Standard Guide "The How"
Common Language for Remedy Transition – Standard Terminology
01
Why quantify natural NAPL attenuation?

Remediation Toolkits Project

REPORT

Toolkits for Evaluation of Monitored Natural Attenuation and Natural Source Zone Depletion





Submitted to:
Contaminated Sites Approved Professional Society
and Shell Global Solutions

Report Number: 1417511-001-R-Rev0

#1 CSM & Case Study Toolkit (2016)

#2 Monitoring and Prediction Toolkit (2016)

#3 Remediation Technology Toolkit (2021)

#4 Sustainability Toolkit (2021)

GOLDER

REPORT

TOOLKIT #3 – EVALUATION OF REMEDIATION TECHNOLOGIES FOR PETROLEUM HYDROCARBON SITES

REPORT

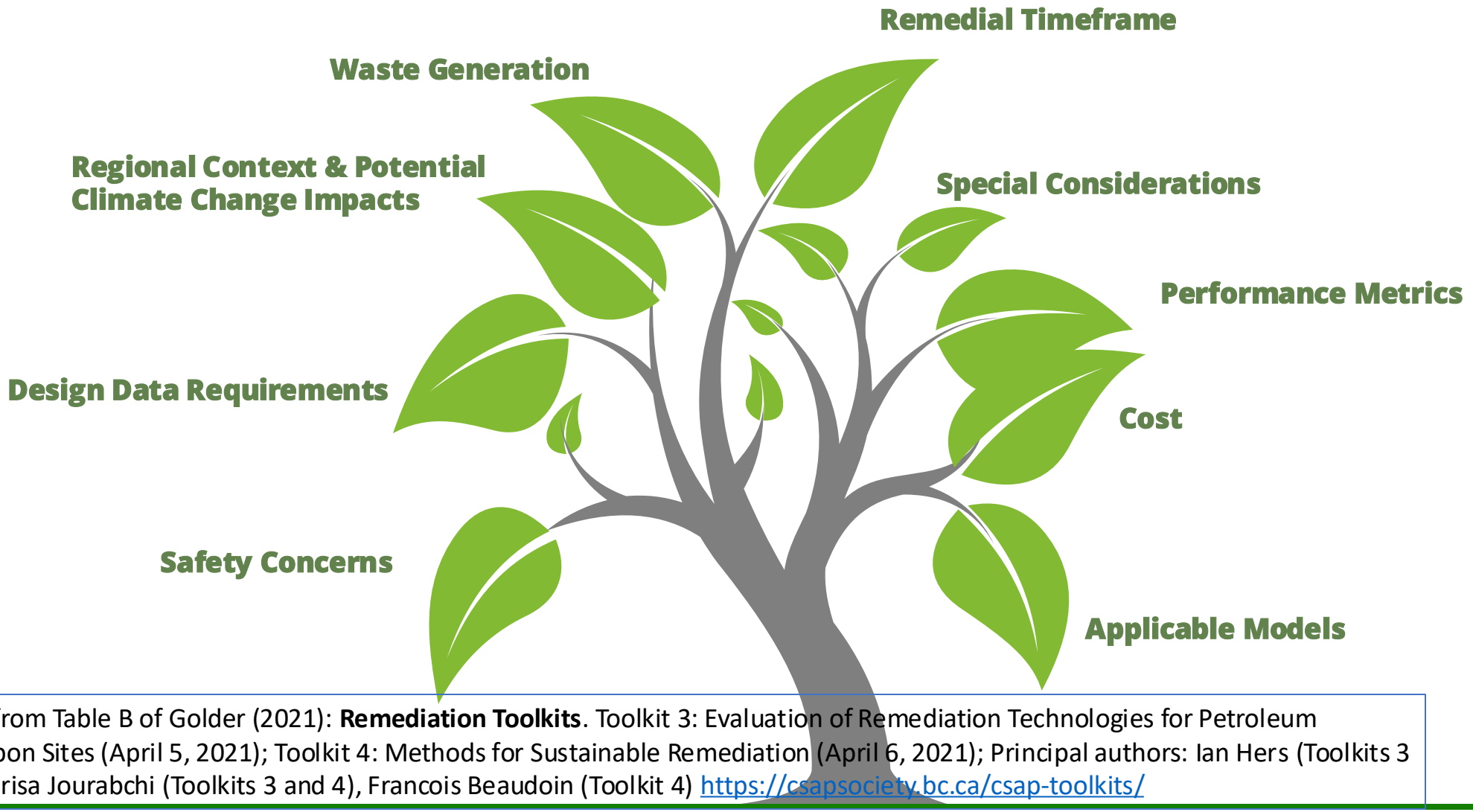
TOOLKIT#4 – METHODS FOR SUSTAINABLE REMEDIATION OF PETROLEUM HYDROCARBON SITES

Remediation Toolkits Project

Golder Associates

ARIS

Data Gathering for Remedial Technology Selection



Adapted from Table B of Golder (2021): **Remediation Toolkits**. Toolkit 3: Evaluation of Remediation Technologies for Petroleum Hydrocarbon Sites (April 5, 2021); Toolkit 4: Methods for Sustainable Remediation (April 6, 2021); Principal authors: Ian Hers (Toolkits 3 and 4), Parisa Jourabchi (Toolkits 3 and 4), Francois Beaudoin (Toolkit 4) https://csapsociety.bc.ca/csap-toolkits/

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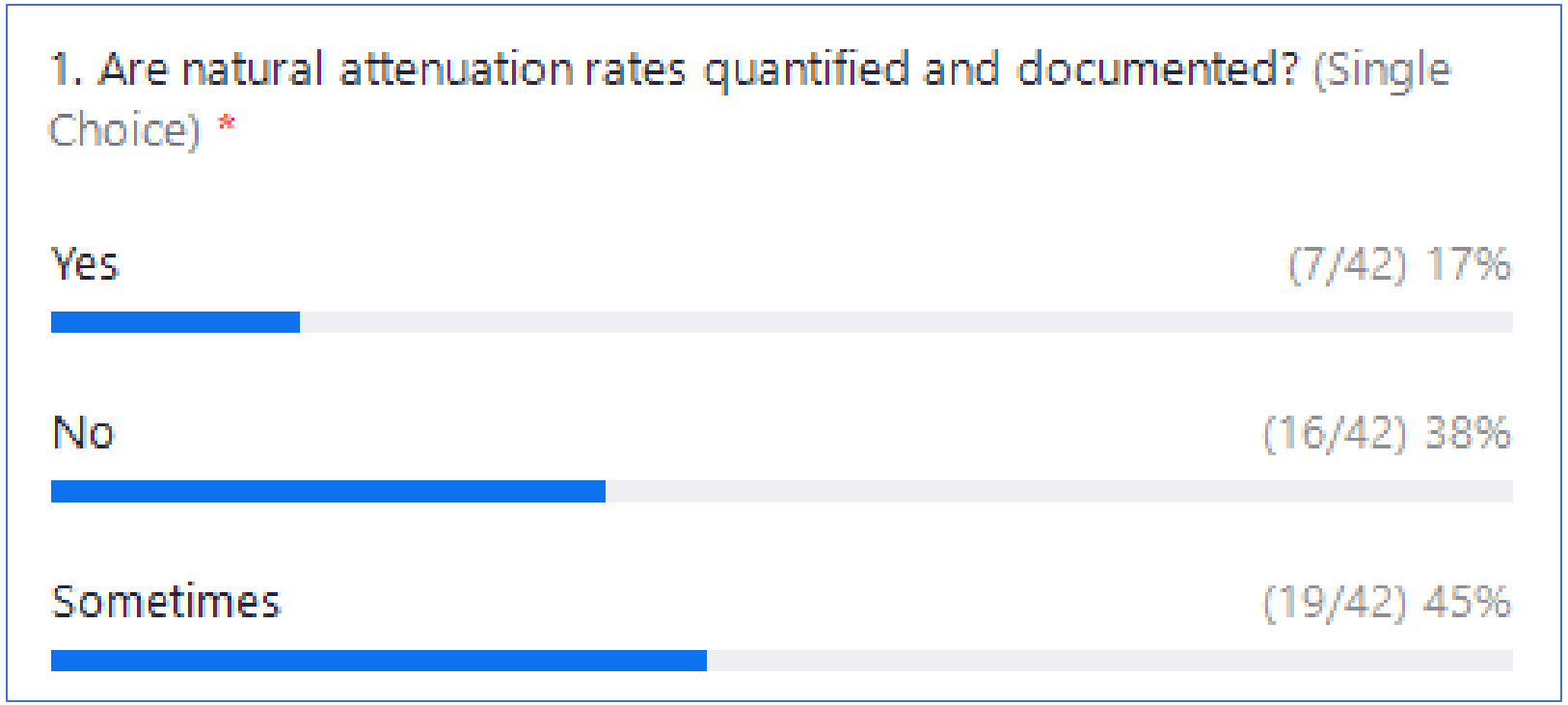
Survey Results – Rates Quantified & Documented?



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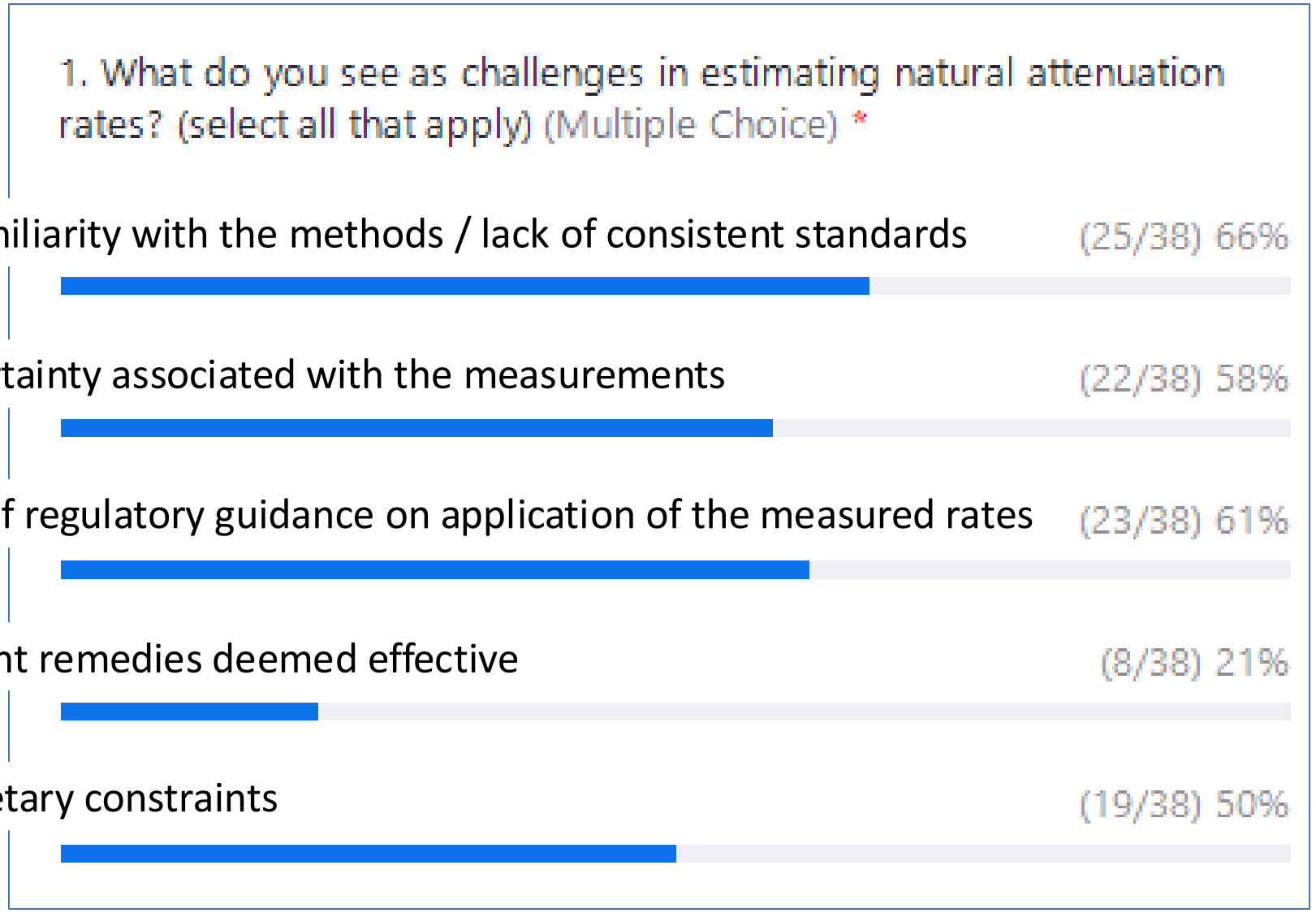
Survey Results – What are the challenges in estimating the rates?



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Natural Attenuation in BC CSR Context

BRITISH COLUMBIA | Ministry of Environment

22

TECHNICAL GUIDANCE ON CONTAMINATED SITES

Version 1.0 Draft 15 November 2014

Using Monitored Natural Attenuation and Enhanced Attenuation for Groundwater Remediation

PROTOCOL 22
FOR CONTAMINATED SITES

Application of Vapour Attenuation Factors to Characterize Vapour Contamination

PROTOCOL 13
FOR CONTAMINATED SITES

Screening Level Risk Assessment

Section 56, Environmental Management Act, S.B.C. 2003, c. 53: Selection of Remediation Options

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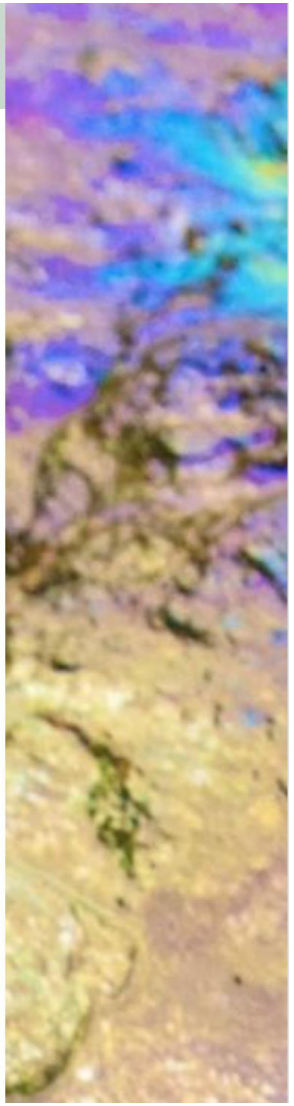
Toolkits

ANSR

- Tools
- Exit Strategy Toolkit Home
- Compendium
- Soil Vapor Extraction Factsheet
- Hydraulic Recovery Factsheet
- Bioventing Factsheet
- Air Sparging Factsheet
- Natural Attenuation Factsheet
- Glossary
- Acronyms
- References
- ANSR Homepage

Exit Strategy Toolkit

https://naplansr.com/tools



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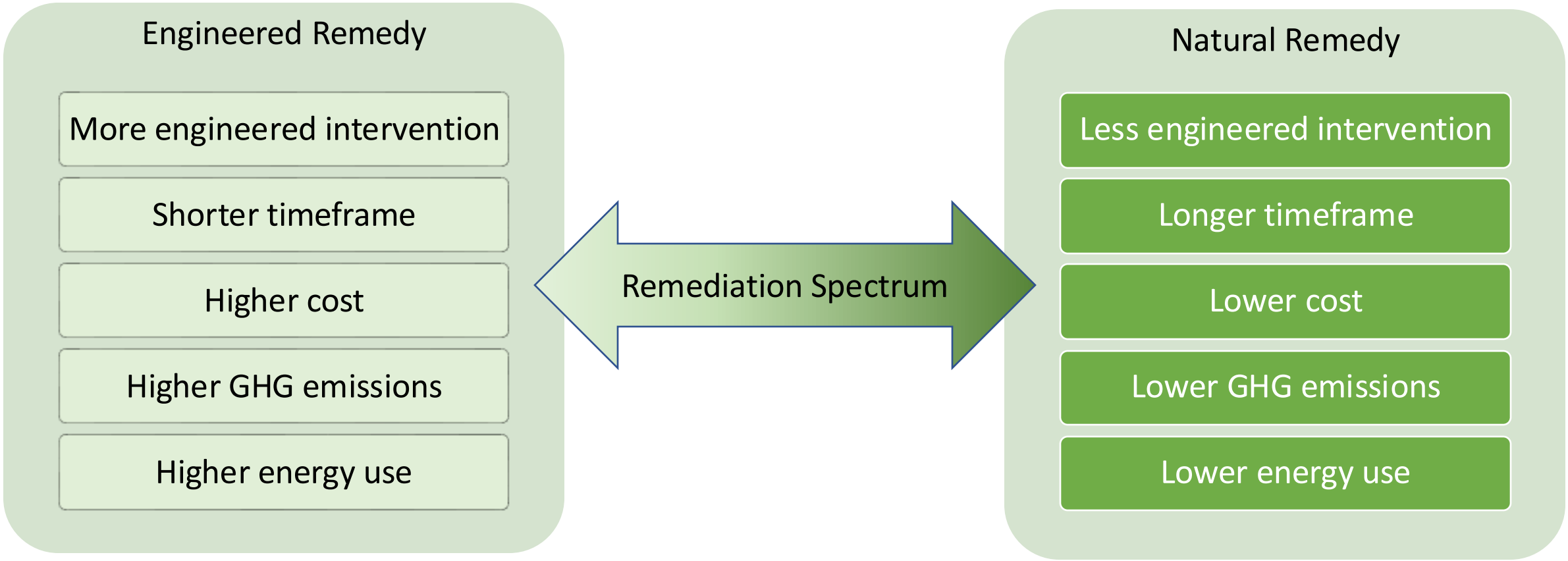
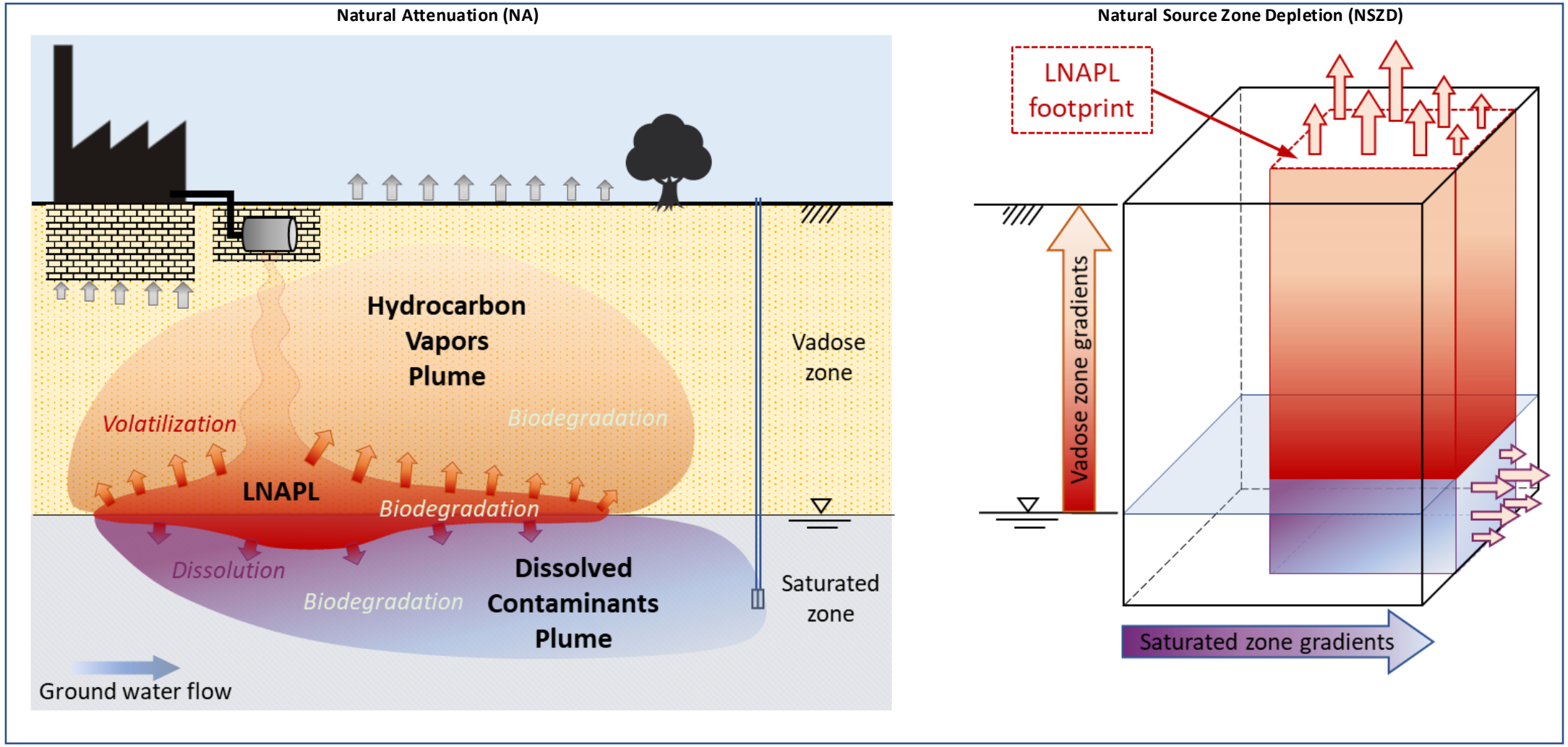
Remedy Transition



Natural Attenuation & Natural Source Zone Depletion (NSZD)



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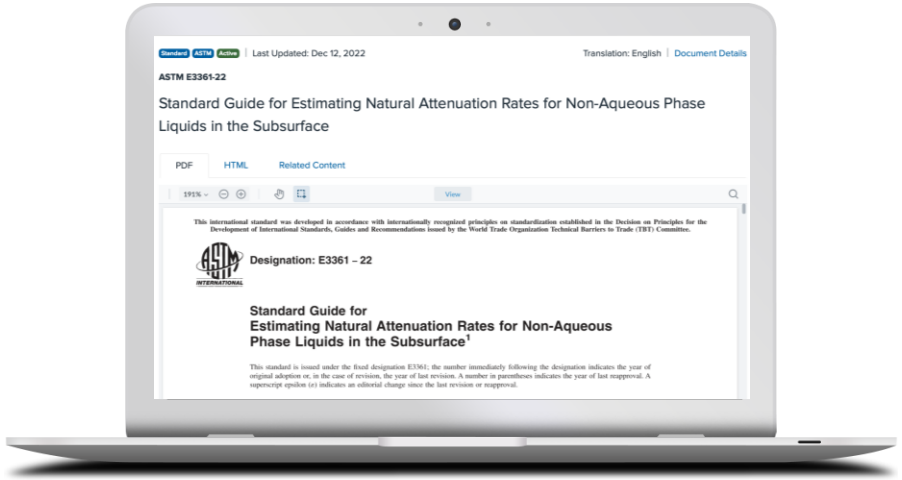
Natural Attenuation Estimation Methods

1. CO_2 Efflux Method
2. Temperature Gradient Method
3. Soil Gas Gradient Method
4. Groundwater Monitoring Method
5. NAPL Composition Method



ASTM E3361

Multiple technologies & approaches for data collection & interpretation for each method…

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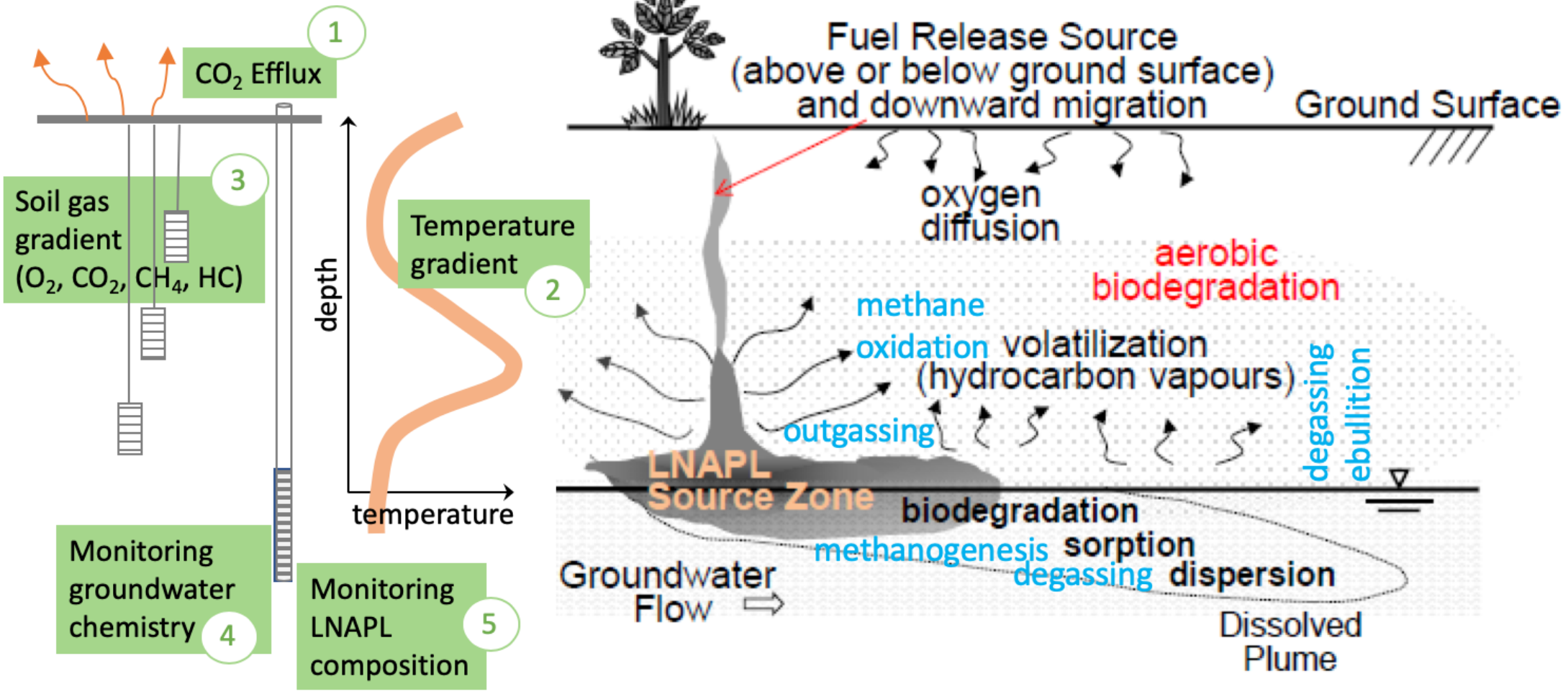
Natural Attenuation Processes & Pathways



CO_2 Efflux Method – Example Implementation

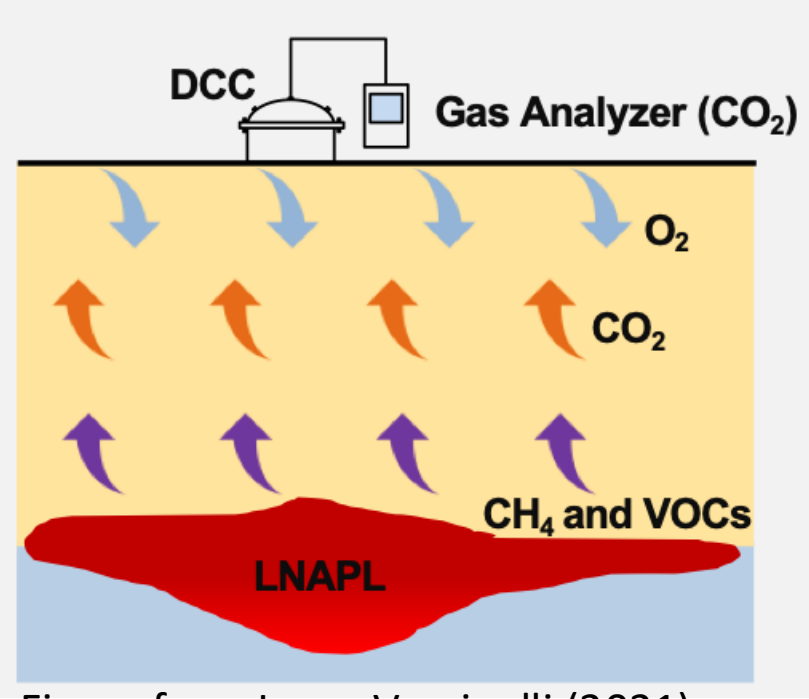


Figure from Iason Verginelli (2021)

Step 1. Install DCC

Step 2. Estimate the CO_2 Efflux, J_{CO2}

Step 3. Correct for background sources

$$J_{CSR} = J_{CO_2} - J_{NSR}$$

J_{CSR} = attributed to NAPL soil respiration (μmol CO_2/m^2/s)
J_{CO2} = total measured (μmol CO_2/m^2/s)
J_{NSR} = attributed to natural soil respiration (μmol CO_2/m^2/s)

Step 4. Estimate the NSZD Flux

$$J_{NSZD} = J_{CSR}\frac{M_w S_{HC:CO2} U}{\rho_o}$$

J_{NSZD} in gallons/acre/year.
M_w = Molar weight of hydrocarbon (g/mol)
$S_{HC:CO2}$ = Stoichiometric ratio of a mole of hydrocarbon degraded per mole of CO_2 produced
ρ_o = Density of hydrocarbon (kg/L)
U = Unit conversion factor = $33.7\frac{s}{year}\times\frac{kg}{\mu g}\times\frac{m^2}{acre}\times\frac{gallon}{L}$

ARIS

Example: CO_2 Efflux Method

Tools	Products / Instruments
Dynamic closed chamber Active air flow connected to infrared detector Measurement time scale: snapshot (minutes) Continuous monitoring	LI-COR Biosciences Automated Soil Gas Flux System
Static trap Sorbent material to passively capture CO_2 Measurement time scale: weeks (~1 to 4 weeks)	E-Flux Fossil-Fuel Trap
Forced diffusion dynamic chamber Flow regulated by gas permeable membrane Measurement time scale: snapshot (minutes) continuous monitoring	Eosense eosFD soil CO_2 flux sensor

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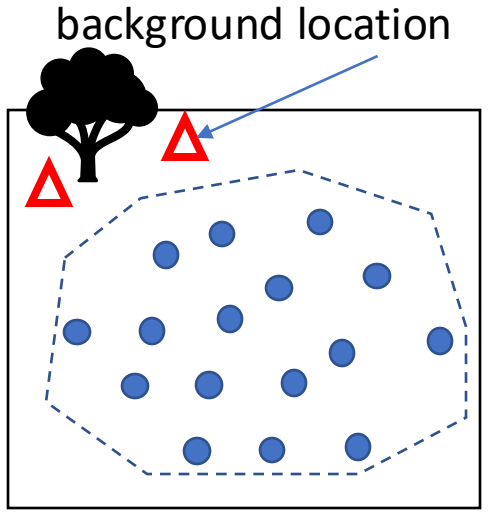
Background Sources of CO_2

- CO_2 produced from natural soil respiration

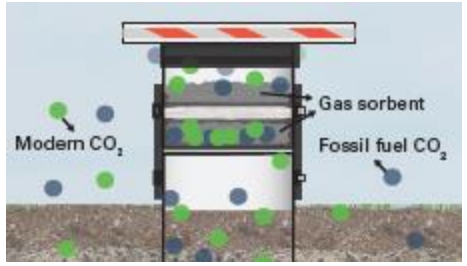
CO_2 Efflux = Contaminant Soil Respiration + Natural Soil Respiration

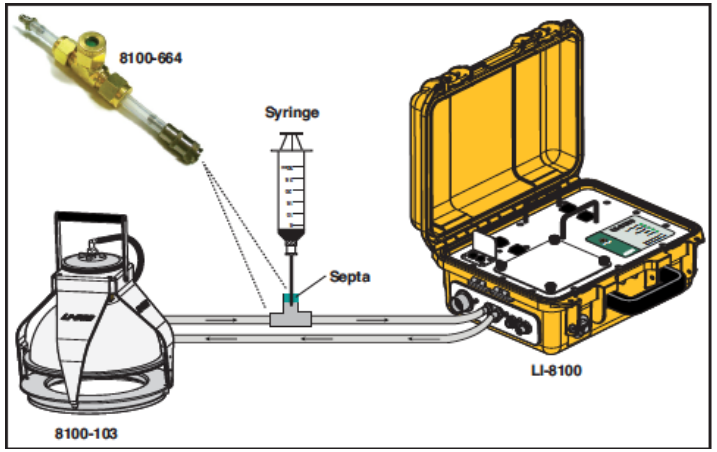
- Two general approaches:
  - Sampling background locations
  - Sampling & analysis of radiocarbon (^{14}C)
- Design of program for background correction is site specific:
  - Heterogeneity in surface cover & vegetation
  - Heterogeneity in hydrogeologic conditions



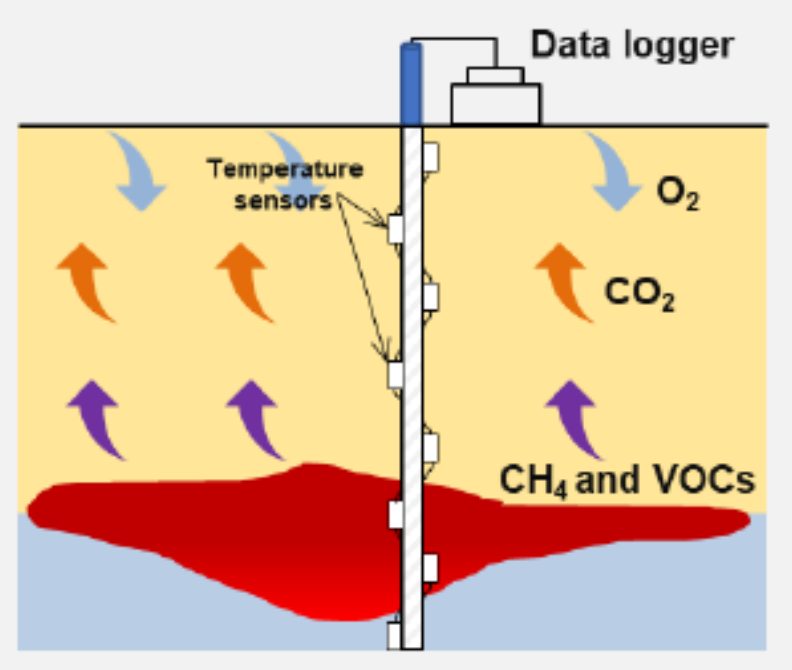
Sampling for ^{14}C Analysis

Contemporary (modern) organic carbon is ^{14}C-rich, while fossil fuel carbon is ^{14}C-depleted





Temperature Gradient Method – Example Implementation



Step 1. Identify the temperature profile

Step 2. Correct for background sources (select from three approaches)

Thermal correction approach	Measurement at background location
Background correction	yes
Thermal correction from surface heating and cooling – "single-stick" method	no
Thermal correction from surface heating and cooling - modeling	no

Step 3. Estimate the NSZD Flux, J_{NSZD}

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Temperature Gradient Method – New Guidance Content

Advances in the in-situ estimation of soil thermal conductivity

1. Active heat source is supplied and changes in temperature are monitored (Karimi Askarani et al. 2021)
2. Long-term temperature monitoring to estimate thermal diffusivity (Sweeney, unpublished and Kulkarni et al. 2021)

– requires estimate of volumetric heat capacity based on soil type and moisture content.

Advances in correcting for background sources

- Solution to heat conduction in 1-D at steady state
- Solving for three unknown variables:
  1. boundary condition of heat source/sink at the ground surface
  2. NSZD related heat source
  3. depth of the heat source
- Iterative algorithm & optimized fit between the observed and predicted temperature profiles

"Single-Stick" Method

Thermal estimation of natural source zone depletion rates without background correction

Water Research 169 (2020) 115245

Kayvan Karimi Askarani, Thomas Clay Sale*

Civil and Environmental Engineering Department, Colorado State University, 1320 Campus Delivery, B01, Fort Collins, CO. 80523-1320, USA

Soil Gas Gradient Method – Example Implementation

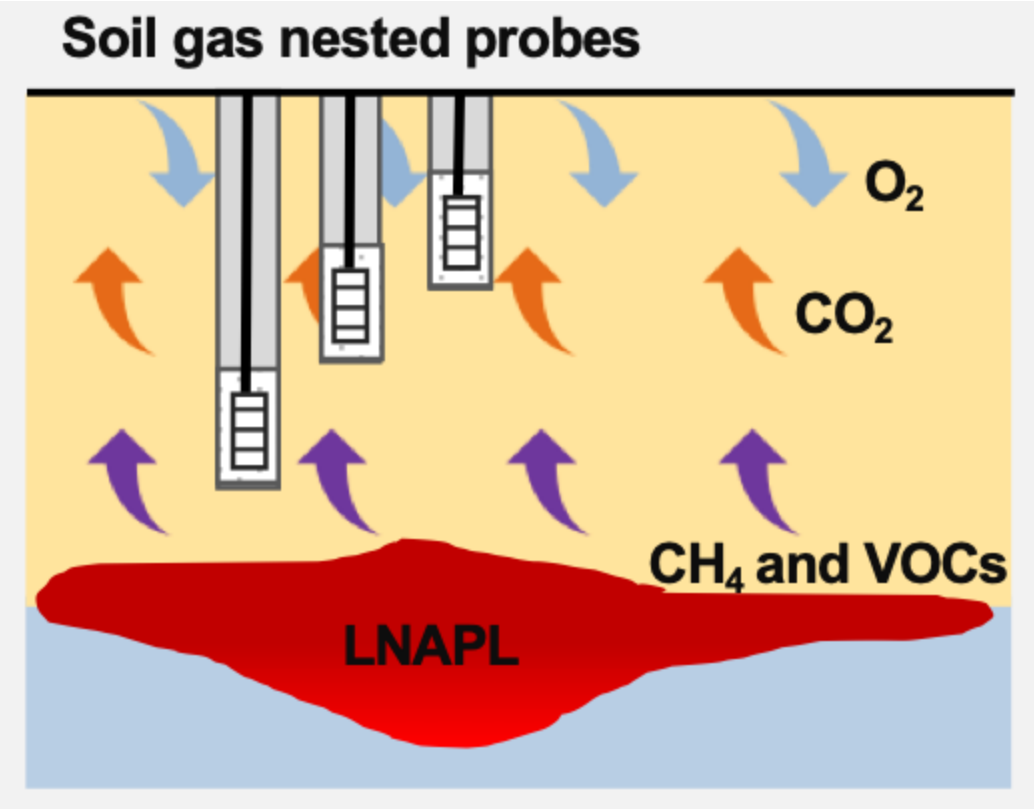


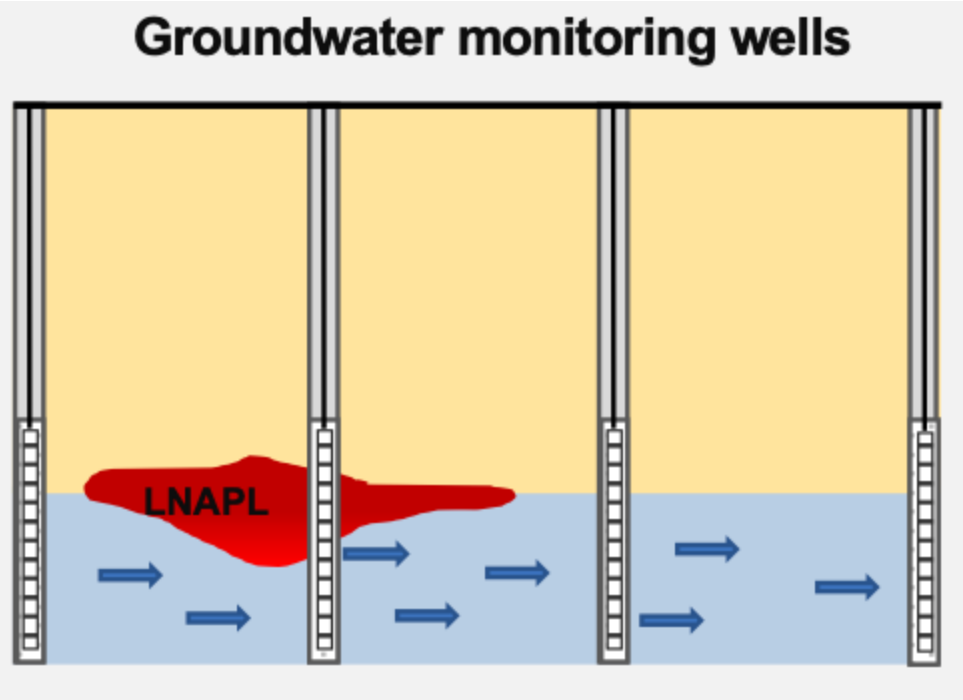
Figure from Dr. Iason Verginelli (2021)

Step 1. Identify the O_2 concentration profile in soil gas
Step 2. Estimate the concentration gradient of O_2 in soil gas
Step 3. Estimate the reaction length
Step 4. Estimate the diffusion coefficient
Step 5. Estimate the mass flux
Step 6. Correct for background O_2 demand (two approaches)
Step 7. Estimate the NSZD Flux, J_{NSZD}

$$J_{NSZD} = J_{CSR} S_{HC:O2}$$

J_{NSZD} in gallons/acre/year
$S_{HC:O2}$ = Stoichiometric mass ratio of g of hydrocarbon degraded per g of O_2 consumed

Groundwater Monitoring Method – Example Implementation



Step 1. Estimate source mass depletion due to dissolution & flow

Step 2. Estimate the assimilative capacity, A_c, based on groundwater monitoring data

Step 3. Assess conditions for **degassing & calculate A_c accordingly**

Step 4. Estimate the rate of biodegradation in the saturated zone

Step 5. Estimate the total rate in the saturated zone, R_{sat} (kg/day)

$$R_{sat} = R_{sat-dis} + R_{sat-bio}$$

R_{sat} = total mass loss of hydrocarbons in the saturated source zone combination of dissolution and flow of the hydrocarbons ($R_{sat-dis}$) and the rate of hydrocarbons biodegraded ($R_{sat-bio}$).

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Groundwater Monitoring Method – Confined NAPL Conditions

Modified Control Volume Method

Estimate methene generation based on:

1. Sampling & analysis of dissolved N_2, Ar, CO_2 and CH_4 data
2. Degassing batch model of Amos et al. (2005)
3. Model calibration
4. Include degassing into the assimilative capacity, A_C

$$R_{sat} = R_{sat-dis} + R_{sat-bio} \propto A_C$$

Using a Batch Model to Estimate Methane Production

Degassing Method Natural Source Zone Depletion Case Study
Reyenga (2020)
Applied NAPL Science Review (ANSR)

Degassing can be significant for confined NAPL/low permeability conditions

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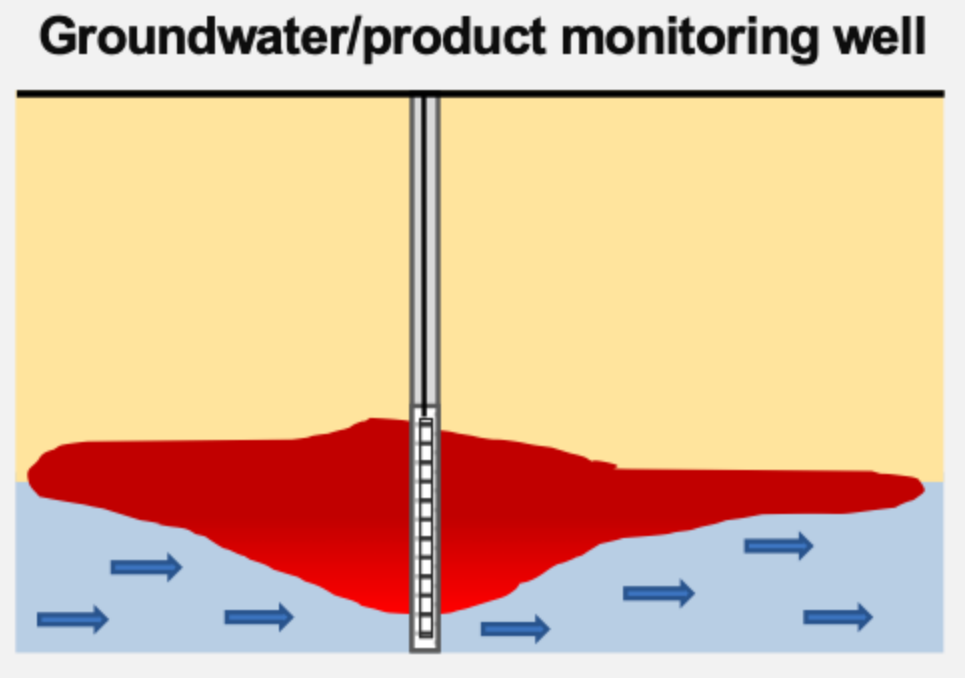
NAPL Composition Method – Example Implementation



- Conservative compound(s) increase in concentration due to weathering NAPL
- Mass loss of other compounds due to biodegradation, volatilization and dissolution
- Absolute mass loss rate estimated relative to the increase in conservative compound(s)
- Mass loss from single conservative compound

  Douglas et al. (1996)

  Environmental Stability of Selected Petroleum Hydrocarbon Source and Weathering Ratios - ES&T

  Baedecker at al. (2018)

  Weathering of Oil in a Surficial Aquifer - Groundwater

Method Strengths & Limitations

Considerations & Limitations

- Long-term monitoring data representative of site-conditions
- Method assumes no additional releases during monitoring period
- Consistent analytical method and normalization over the monitoring period
- Variations in marker selections
- Constituents with non-detects
- If best available markers are not conserved -> rates are underestimated

Key Advantages

- Application of the method is not limited by location of the NAPL source zone, soil type or ground surface conditions
- Marker selection method expands applicability of method to NAPL types, such as petroleum products, that don't typically contain "presumed" markers (less soluble, volatile, higher molecular weight chemicals)
- Though computationally more complex, online tools are available for efficient data analysis

Constituent-specific depletion rates for any constituent that can be measured in the NAPL

Groundwater Monitoring Tools

- Guidance documents on LNAPL assessment, characterization and remediation

(FCSAP, US EPA, ITRC, API, …)

- Mass flux estimates

(iFlux Technology, GSI Mass Flux Toolkit, ITRC guidance)

- Groundwater monitoring of natural attenuation & geochemical parameters

(FCSAP, ITRC Control Volume Approach)

- Modeling of contaminant fate and transport in groundwater

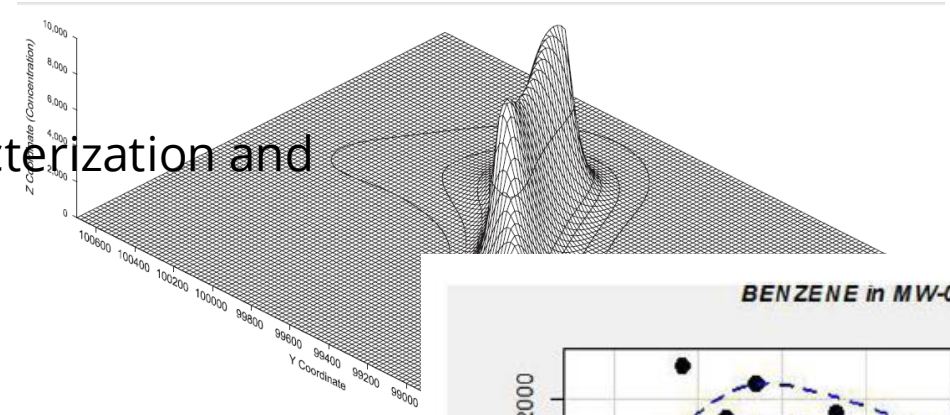
(BC GPM for P2 SSS 2023, US EPA BIOSCREEN, REMFuel, API LNAST, …)

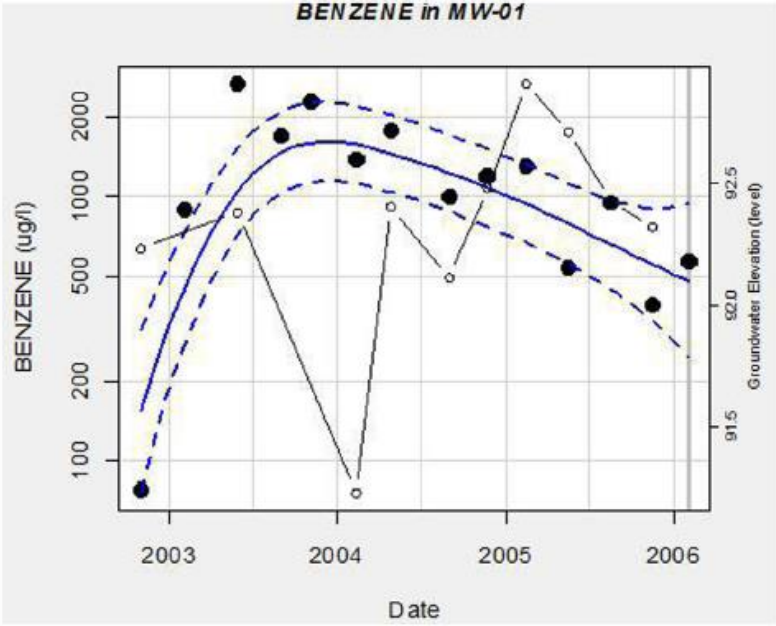
- Groundwater plume stability, LNAPL footprint, & data visualization

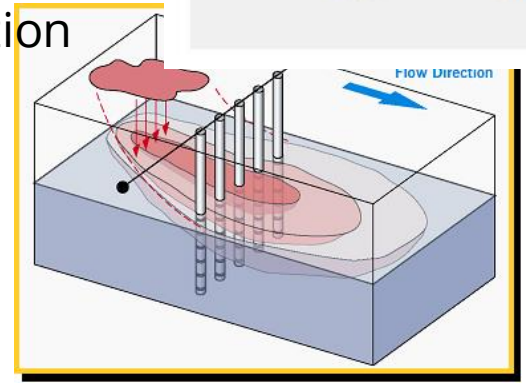
(CSAP 2024, GWSDAT, Ricker Method, …)

- Trend analysis and plume stability

(CSAP 2024, US EPA ProUCL, AFCEE MAROS, …)

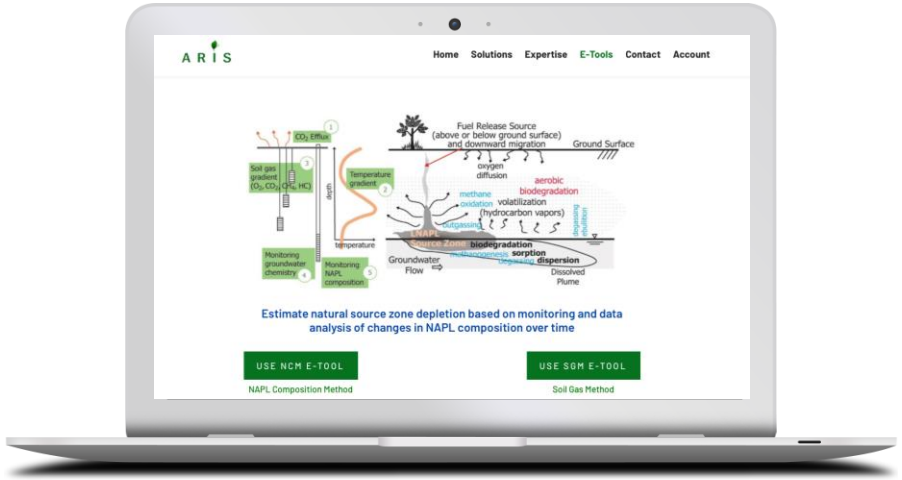






NAPL Composition Method (NCM) E-Tool

Streamlining the calculations!



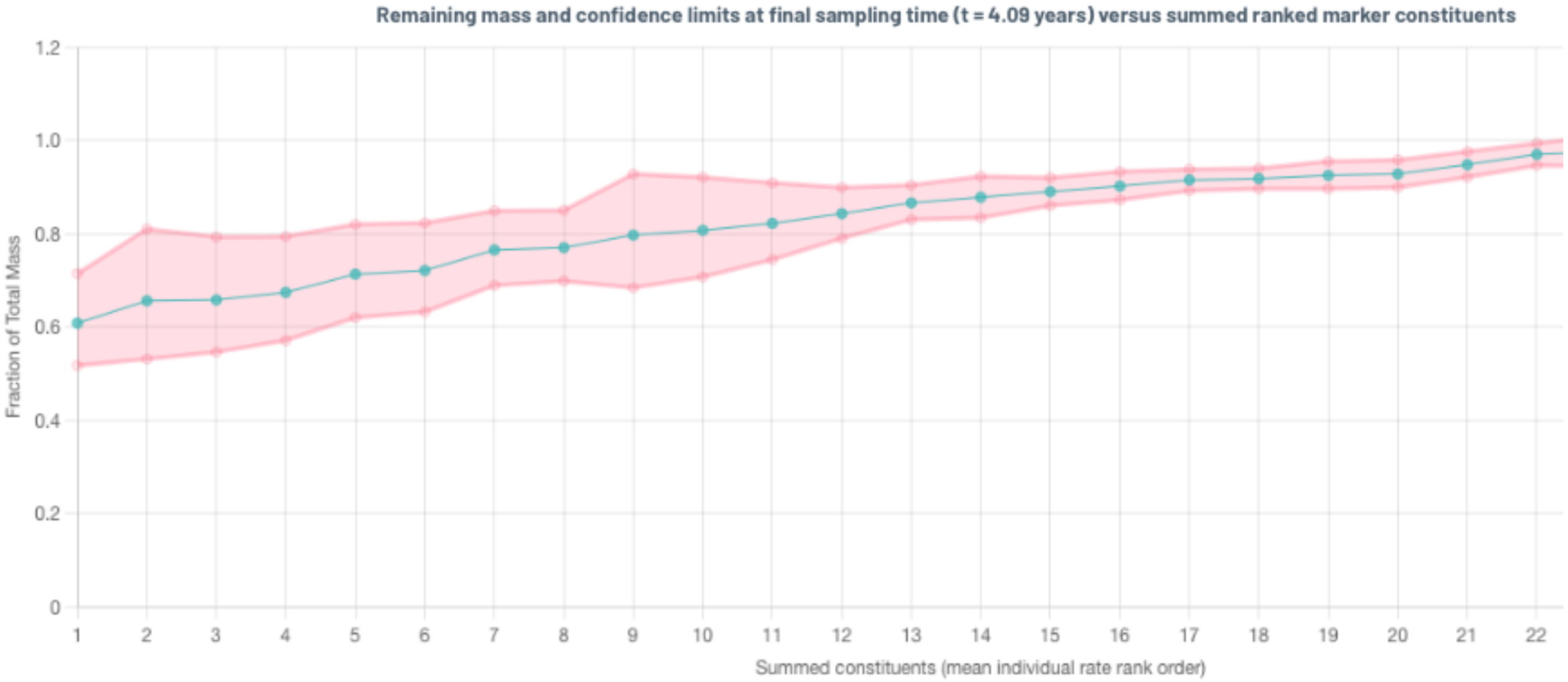
https://arisenv.ca/e-tools/

Input is a file containing mass fractions of each chemical

Example:

Elapsed years	0	0.025	0.5	...
benzene	0.00863	0.0095	0.00847	...
toluene	0.0653	0.0388	0.0366	...
...	...	...	...	...

Optimum q Selection: Analysis of Fraction of Total Mass



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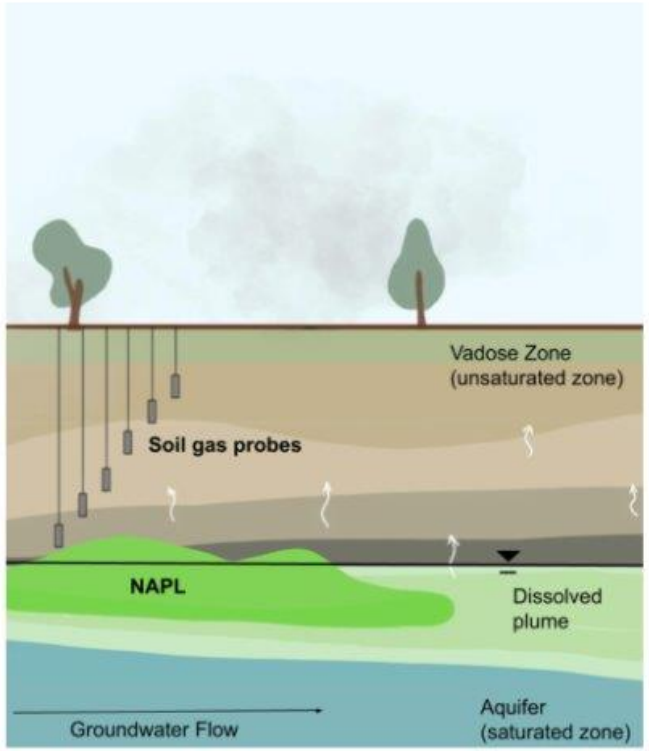
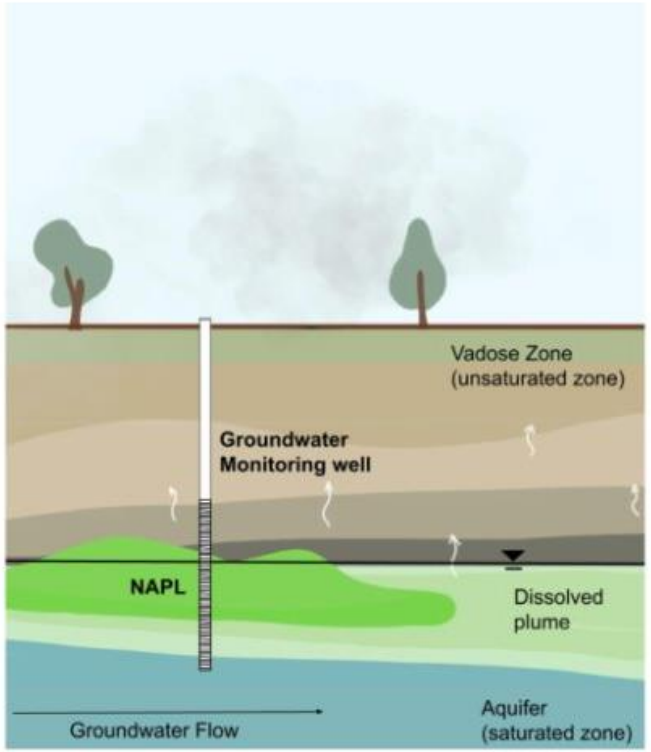
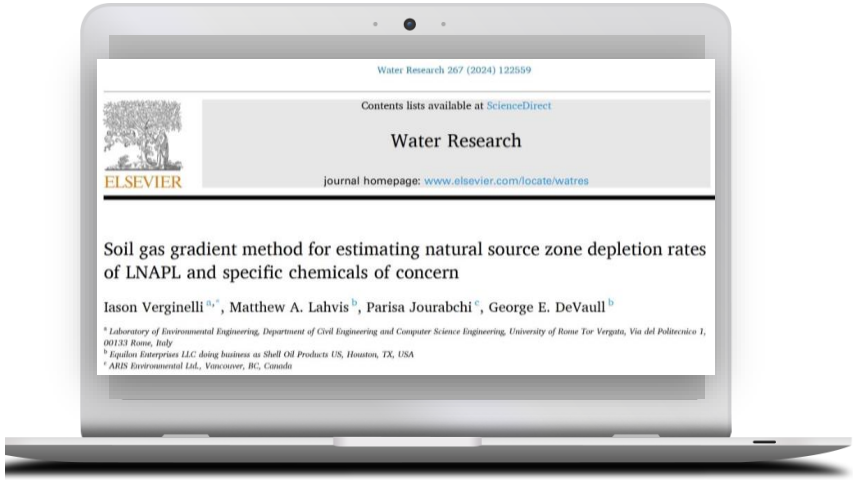
Advances in Soil Gas Method (SGM E-Tool)

Simplified Approach



Screening Approach





Verginelli et al (2024) Water Research

COC-specific rates directly linked to risk reduction

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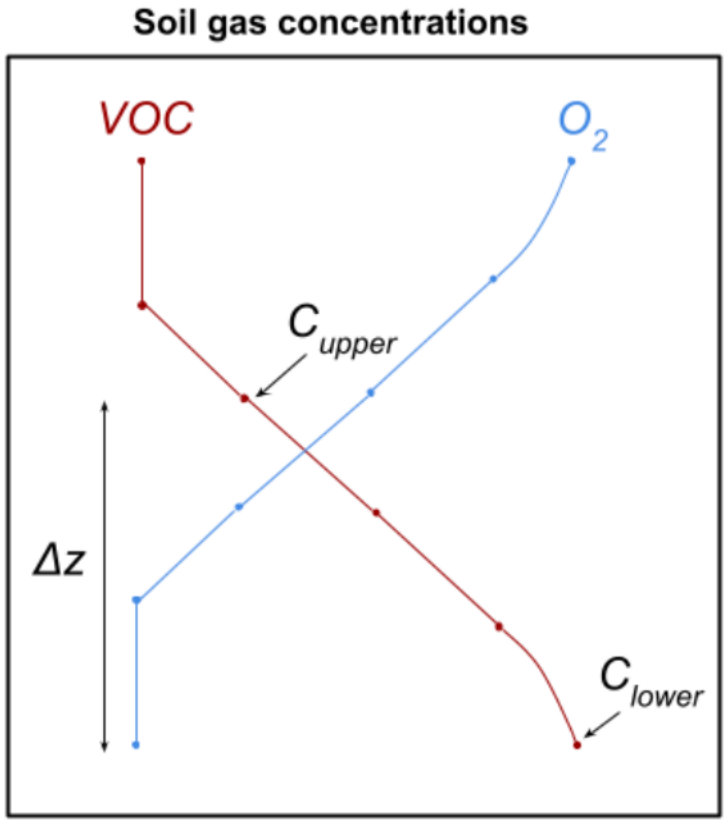
SGM Input



Full details and references
in the User Guide and FAQs of the SGM E-Tool

Vapour Substance (CAS Number)

benzene (71-43-2)

Soil Type

Sand

System Temperature °C

10

C_{upper} (µg/m^3)

100

Soil gas concentration at the upper control point

C_{lower} (µg/m^3)

100000

Soil gas concentration at the lower control point

Vertical distance, Δz (m)

2

Vertical distance between the upper and lower control points, where C_{upper} and C_{lower} are measured, respectively.

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SGM Output

SGM Output			
System Temperature Kelvin	T_s	2.83E+02	Kelvin
Diffusivity in air	D_{air}	7.73E-01	m^2/day
Diffusivity in water	D_{h2o}	8.90E-05	m^2/day
Henry's law constant at the system temperature	H_s	1.24E-01	-
Effective diffusion coefficient	D_{eff}	1.44E-06	m^2/s
Reactive diffusive length	L_R	2.90E-01	m
NSZD flux	J	4.300E-02	g/m^2/day

ARIS

Parisa Jourabchi (parisa@arisenv.ca)

ARIS

Key Points

- ASTM E3361 is the quantitative foundation for natural NAPL attenuation assessment.
- Framework documents (ASTM E3488, ANSR 2024) define the “why” and “when”.
- New digital tools make the methods faster, transparent, and scalable — moving quantification from research to practice.

CSAP

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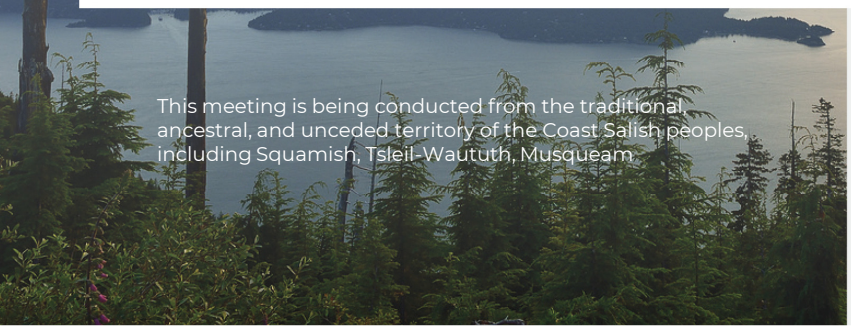
ENV FAQ Interactive Discussion

David Mitchell, P.Eng., CSAP, Active Earth
Kerri Skelly, Manager Operations, Site Remediation Program



This meeting is being conducted from the traditional, ancestral, and unceded territory of the Coast Salish peoples, including Squamish, Tsleil-Waututh, Musqueam.

Question 1: Answer

1. A commercial lot has a zoning that includes the potential for a caretaker residence. What is the appropriate land use?

- **It depends**
- **Rationale:** The appropriate land use depends on where the caretaker residence is with respect to the ground floor of a building and potential exposure to subsurface contamination. Although municipal zoning can influence the appropriate land use, it is independent from Provincial land uses. It also depends on whether the residence will actually be used as a residence, however if the potential is there for occupancy, then it should be considered when determining the appropriate land use.

Question 2: Answer

2. For a flow-through site, how and when is relief sought from the requirement to investigate and remediate off-Site contamination?

- **Provide your flow-through rationale in the detailed site investigation when applying for a certification document.**
- **Rationale:** Flow-through sites do not require preapproval, however rationale supporting a flow through site should be provided with an application.

Question 3: Answer

3. Soil vapour exceedances have been identified directly off-Site. Soil and groundwater concentrations within this area are below CSR standards for all PCOCs. Samples collected from sub-slab vapour probes and ambient air from within the basement of a nearby on-Site building contain detectable concentrations of VOCs. Do you submit a Notice of Offsite Migration?

- **It depends**
- **Rationale:** The observed 'off-site' vapour presence and concentration (within a highway ROW) may not constitute contamination. Protocol 22 describes the requirements for determining the presence and extent of vapour contamination at contaminated sites in BC using default vertical vapour attenuation factors (VAFs) for indoor and outdoor air. In addition, further investigation may be required to determine the source of contamination.

Question 4: Answer

4. Does the Environmental Management Act and BC Contaminated Sites Regulation apply to Federal lands?

- **Sometimes**
- **Rationale:** EMA (and its regulations) is a law of general application and is generally applicable to all land within the province of British Columbia that includes federal, provincial, municipal, fee simple, and Indigenous lands with limited exceptions. However, in some cases, EMA may not be applicable because its application would impair core areas of federal responsibility or may be inoperable because it conflicts with federal laws and Indigenous laws (made by First Nations under federal law), or may infringe constitutionally protected Aboriginal or treaty rights.

Question 5: Answer

5. Can the IW standards be excluded for a Site if there are no records of licensed irrigation wells or surface water licenses for irrigation within 500m of a Site?

- **Sometimes**
- **Rationale:** The absence of licenses can't be relied on alone to rule out IW applicability. This is because licensing records may be incomplete or not available in BC. In addition, consideration of preferential pathways and other instances that could allow for potential risk beyond the 500m mark need to be considered.

Question 6: Answer

6a: Generally, what land use designation is given to firehalls?

- **Commercial**

6b: Are there mitigating factors that would include them in another land use?

- **Yes**
- **Rationale:** Yes, depending how long firefighters remained onsite including dormitory facilities or other activities that would extend exposure time. Refer to P28 for exposure times.

Question 7: Answer

7. A site has historical contamination that migrated off-site to neighbouring properties. ENV issued a remediation order with an annual reporting requirement. The owners of the neighbouring properties are aware and allow access to sample monitoring wells on their properties every year. A Notice of Migration was not prepared in the past. What notification requirement is outstanding?

- **Depends**
- **Rationale:** This enquiry is about a legal interpretation of the regulation. The issuance of a NOM is a requirement of the CSR as mentioned in Section 60.1, so a review of this section is needed to determine if the requirement has been satisfied or not. A NIR isn't needed because the site is under order. There may be a need to provide updated NOMs if new contamination is discovered.

Question 8: Answer

8. In a Detailed Risk Assessment, if one of the data points is a statistical outlier, then does it mean it can be excluded from the dataset when calculating an “exposure point concentration”?

- **Sometimes**
- **Rationale:** There isn’t a quick and easy answer that would apply to all situations. Technical Guidance 12-8 goes into detail about this. In most cases, the default answer would generally be “no, do not remove a statistical outlier when calculating an exposure concentration”. Discarding an outlier from a data set is more about having a sound and logical argument that the data point is somehow “wrong”, e.g., an artifact of a sampling, analytical, or some other type of error. However, how you manage this outlier in your report can be up to the QP. Does the sample location represent a different area or activity from the other samples. Can a smaller area be managed independently. What are the implications of including it in the data set?

Question 9a: Answer

9a. Part A - When are you **not** required to submit a Summary of Site Condition (SOSC) for Site Remediation Services?

- **Scenario 2 Release**
- **Rationale:** Part A - EMA 39 (3), and CSR 7.1, states that an AP signed/prepared SoSC is required for the entire list of services outlined in section 7.1.
- CSR 7.1:

(1)A person applying for, requesting or seeking approval, consideration, review or a determination of any of the following in relation to a site must provide a summary of site condition, together with a recommendation by an approved professional in respect of the matter, to the director:

(a)a determination under section 44 of the Act *[determination of contaminated sites]*;

(b)a determination under section 50 of the Act *[minor contributors]*;

(c)a voluntary remediation agreement under section 51 of the Act;

(d)an approval in principle under section 53 (1.1) of the Act;

Question 9a: Answer Continue

(e)a certificate of compliance under section 53 (3) of the Act;

(f)Repealed. [B.C. Reg. 133/2022, App., s. 4.]

(g)if the site is one to which Part 5 of the Act applies, a transfer agreement referred to in section 67 (1) (a) *[advanced exploration sites]* or 68 (1) (a) *[producing or past producing mine sites]* of that Part;

(h)if the site is one to which Part 5 of the Act applies, indemnification for the site under the *Financial Administration Act*;

(i)a covenant to be registered under section 48 (1) of this regulation;

(j)a preliminary site investigation report;

(k)a human health risk assessment or environmental risk assessment report;

(l)a detailed site investigation report;

(m)a remediation plan;

(n)a confirmation of remediation report;

(o)a report respecting local background concentrations of substances.

- Protocol 12 required a SoSc for remediation of high-risk conditions

Question 9b: Answer

9b – When do you pay fees for SoSCs?

- **Certain submissions of a Summary of Site Condition**
- **Rationale**: CSAP Certification applications for related sites submitted together would require only one SOSC payment regardless of the number of SOSCs submitted. This is referenced in the footnote of the CSAP Submission Fee Schedule.

Question 10: Answer

10. As a risk assessor, if Protocol 1 is followed, does it mean everything that is required for risk assessment has been completed?

- **Maybe**
- **Rationale:** In most cases following Protocol 1 completes the requirements, SDMs have discretion when making decisions under EMA/CSR. The spirit/intent of the law is to "understand risk". SDMs have the obligation to ask for more information, not to issue a certification document, or to exercise other powers etc. if there are reasonable concerns about risk that haven't been addressed in comparison to the requirements of EMA and the CSR. ENV protocols are subordinate to EMA and CSR requirements.

Question 11: Answer

11. When relocating soil, under what circumstances can you conduct Protocol 19 sampling for only a portion of a single legal parcel of land?

- **All of the above**
- **Rationale:** In response to concerns received by the ministry with respect to Protocol 19 sampling requirements for larger sites, guidance has been posted on the ministry's web page that outlines when only a portion of a larger legal parcel of land is required to be sampled.

Question 12: Answer

12. A dyke is to be constructed in a location that includes a number of piles, and the construction plan involves cutting the top off the piles instead of full removal. What are some of the legal provisions that should be considered before moving forward with these construction plans?

- **All of the above**
- **Rationale:** Depending on the specific circumstances, permits or requirements under the CSR independent remediation requirements may apply.
- WDR – Is there:
    1. a prescribed activity such as landfilling or contaminated site contaminant management,
    2. a waste, and
    3. a discharge to the environment
- CSR IR provisions - is there handling, management or treatment of contamination?
- Heritage Conservation Act – Is this a possible archaeological site that would require a permit prior to commencement of the project?
- P13 – would not apply since the piles are not to be used for beneficial use once cut; however, one would still consider P13 beneficial use provisions in the evaluation process".

Question 13: Answer

13. How long do you have to submit a site disclosure statement once an owner ceases using the land for a Schedule 2 use?

- **18 months**
- **Rationale:** To meet the definition of ceasing operations, it requires the land not to be used for a Schedule 2 activity for 12 months. Then the owner/operator has up to 6 months after that to submit the SDS.

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