

**ATCO** Energy Systems™

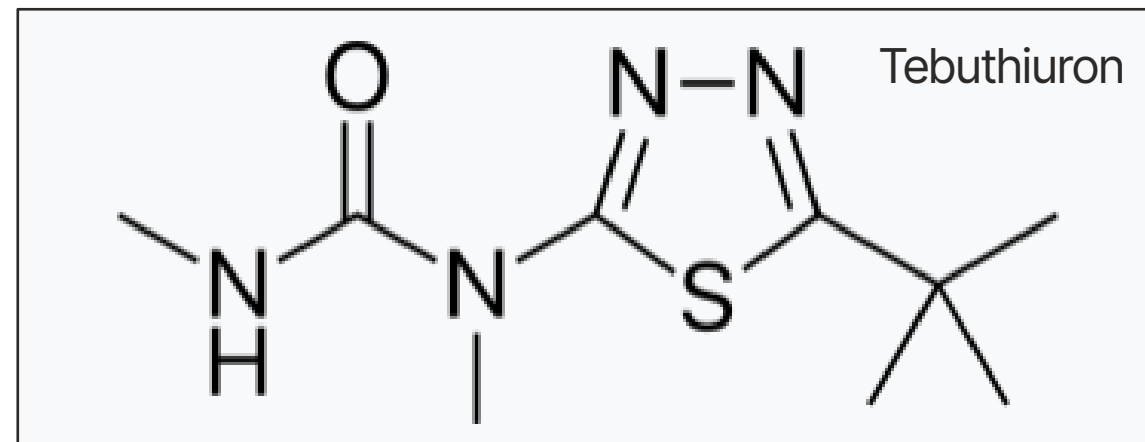
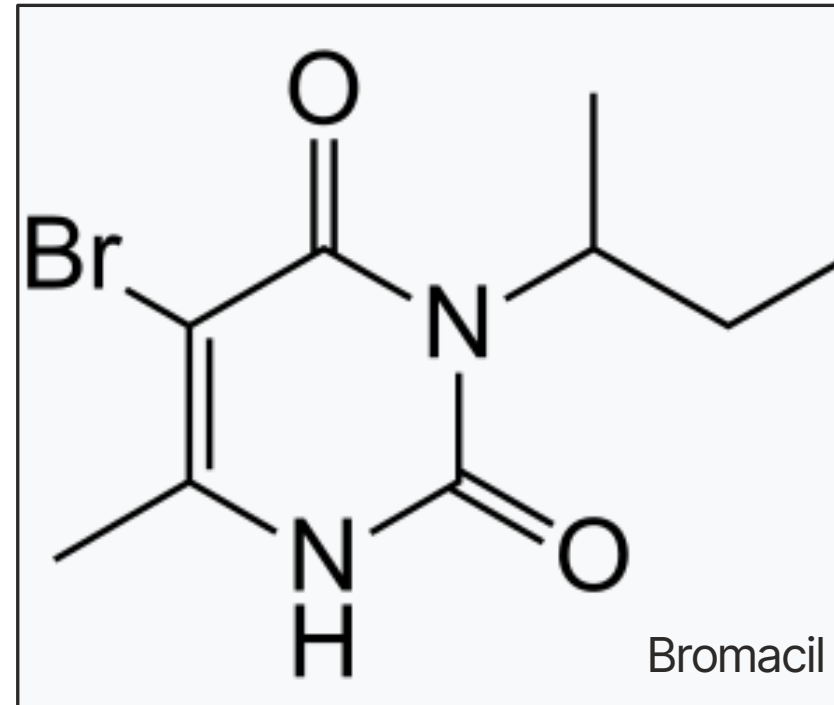
# Soil Sterilant Program: Industry Applications

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# Background





# Soil Sterilants – What is the Issue?

- Long lasting herbicides historically used for non-selective vegetation control to maintain bare-earth conditions at critical infrastructure locations (for fire protection)
- Includes the chemicals bromacil, tebuthiuron, atrazine, simazine, diuron and linuron
- Bromacil is most commonly encountered at ATCO sites, followed by tebuthiuron
- Used at ATCO sites (urban and rural) from the 1960s to mid-1990s. **No longer used**
- Soil and groundwater quality guidelines introduced in 2007 (tebuthiuron) and 2010 (bromacil)
- Concentrations commonly encountered more than 25 years later at sites above Tier 1 guidelines



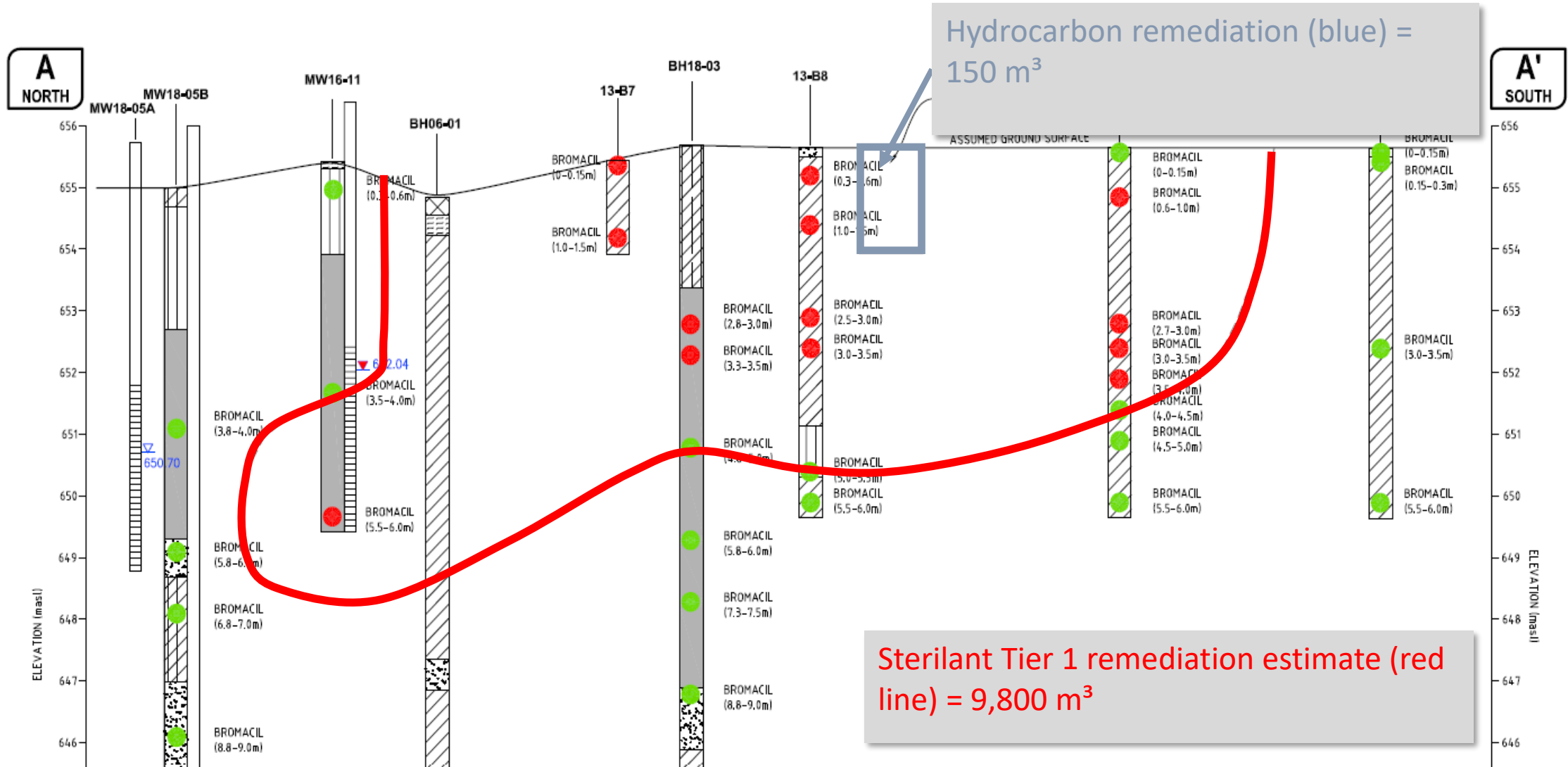
# Soil Sterilants at ATCO Sites

- Environmental concern is vegetation damage or growth impairment in soil directly impacted with sterilants or offsite migration to impact vegetation on adjacent properties
- Has not degraded as expected (examples below from application 25+ years ago)

Substance	Max. Soil Concentration (mg/kg)	Tier 1 Guideline - AG (mg/kg)	Max. Groundwater Concentration (mg/L)	Tier 1 Guideline - AG (mg/L)
Bromacil	8.5	0.009	0.17	0.0002
Tebuthiuron	1.9	0.046	0.044	0.00043

- Main driver of remediation at ATCO Electric
- Often only driver of remediation at ATCO Gas sites
- Also were used at other utility, oil and gas and industrial sites in Alberta

# Substation Example



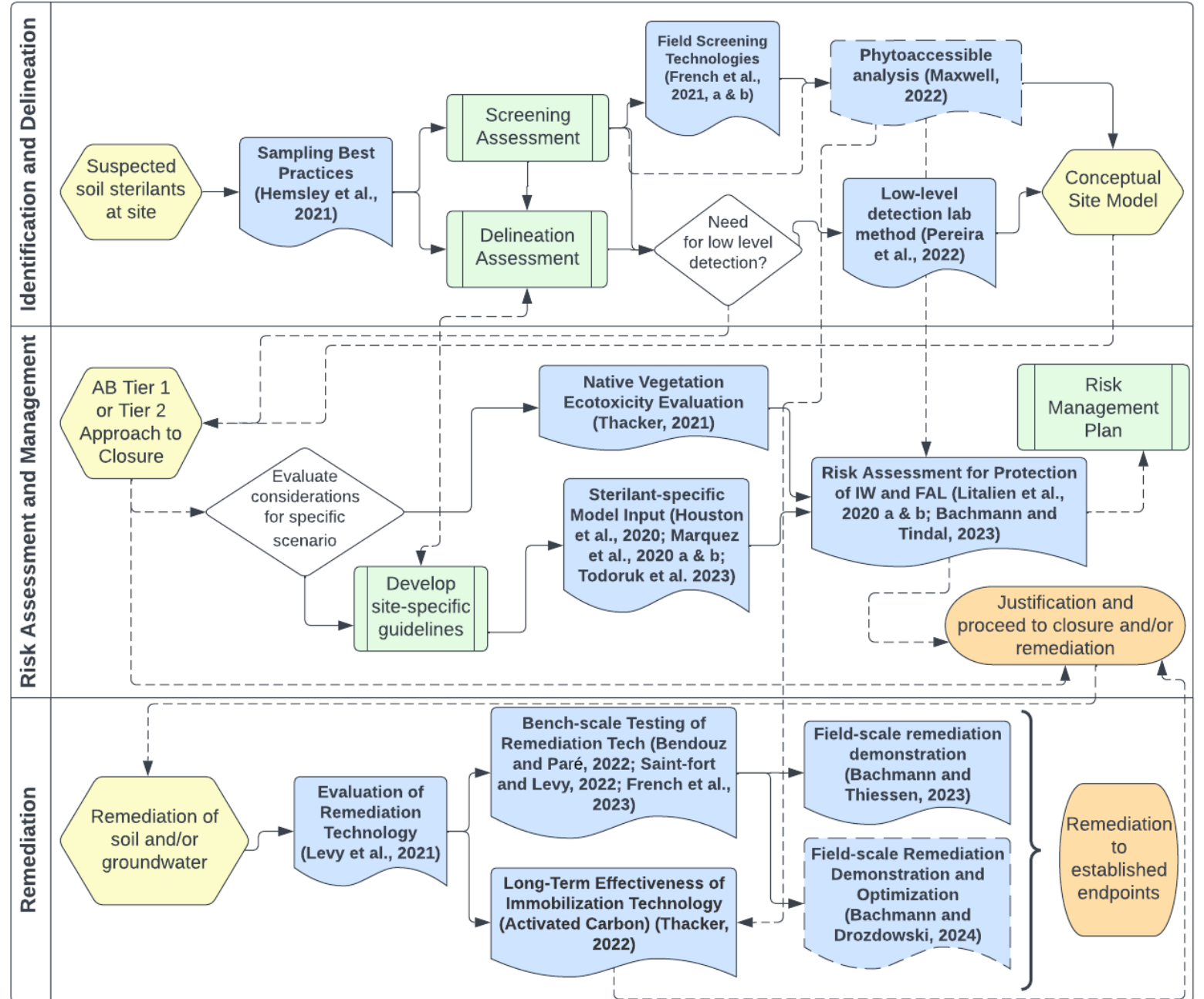


# Remediation Example





# InnoTech Soil Sterilants Program



# Overview of Program

- 5-year program initiated in April 2019 with 6-month extension for completion in September 2024
- Funding provided by Alberta Innovates, ATCO Electric, ATCO Gas and Pipelines and TC Energy
- Representatives from each of the funders acted as the program steering committee providing overall guidance and approval for all projects undertaken
- Goal of the program was to find ways to improve the likelihood of achieving regulatory closure of sites.





# Identification and Delineation Goals

- Streamline site assessments to reduce costs and need for multiple mobilizations to achieve delineation through:
  - Developing understanding of which sites sterilants should be considered a contaminant of concern (COC)
  - Assessing feasibility of field screening techniques to speed assessment and remediation efforts
  - Improving laboratory methods accuracy and precision around the guideline values to help reduce the risk of false positives driving delineation and remediation



# Identification & Delineation Learnings



Assume sterilants could be present if the site was operational pre ~2000 (review company records for alternate date)



Re-visit site assessments completed prior to Alberta Tier 1 guidelines being adopted – historic assessments may not have included sterilants



Include groundwater monitoring wells in initial Phase II ESA



Accelerate initial Phase II ESA delineation; collect and analyze deeper samples, delineate outside historic facility fence line



Do not rely on vegetation assessments as indicator of presence or absence – sterilants may have migrated below the rooting zone and vegetation may not be affected



# Identification & Delineation Learnings



Current reportable detection limits are close to guidelines - laboratory method improvements may be achievable with minimal changes to methodologies



InnoTech's lab methods show that improvements are possible in detection limits



Regulatory framework does not address phyto-accessible versus total sterlant concentrations



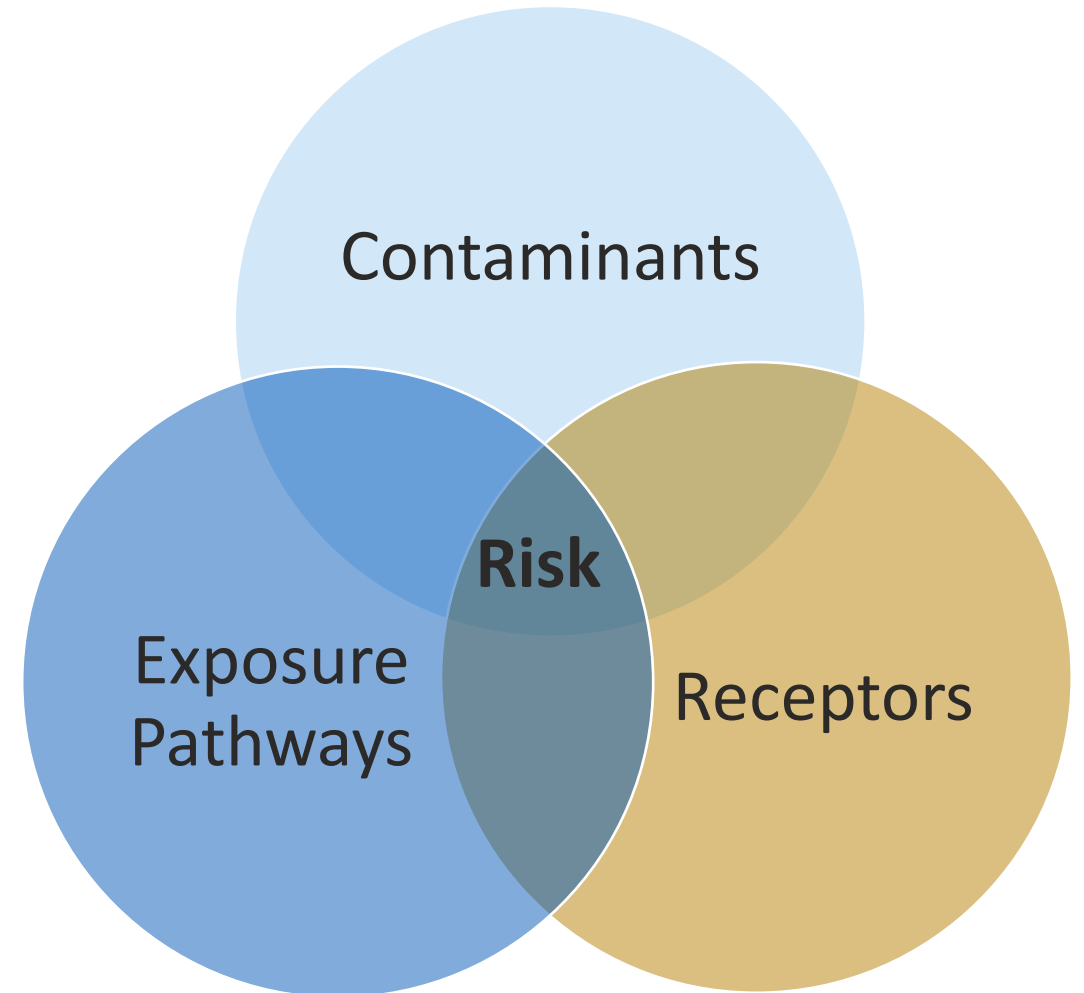
Field screening is not practical with current technology - reinforces need for better site characterization at the initial Phase II stage



More work needed for additional species sensitivity - boreal species, updated agronomic species (Tier 1 guidelines are based on old studies)

# Risk Assessment & Management Goal

- Goal was to develop strategies to manage the ACTUAL risk of the sterilants in a sustainable manner by reducing soil sent to landfill, health and safety risks and greenhouse gas emissions
- Expectation was that risk assessment would have the most impact in the program due to:
  - Sterilants have not been detected at concentrations above human health guidelines
  - Majority of sites with sterilants impacts do not have vegetation impairment
  - Vertical migration out of surficial soils
  - No indication of off-site impacts at most sites
  - Sterilants are organic chemicals that do degrade with time (though slower than expected)





# Risk Assessment & Management Learnings



Alberta risk assessment framework limits the options for application of risk-based approaches for closure of sterilants sites



Data requirements for risk assessments do not scale for the size of the site and overall human health/ecological risk



Alberta risk assessment framework limits the ability to incorporate of site-specific conditions such as plant species distribution, local topography or features



Current Tier 1 guidelines assume sterilants are conservative contaminants. Introducing a half-life value would be beneficial to reduce remediation volumes



Risk management is feasible but not a preferred option for regulated utilities – risk of properties being deemed not used or useful; ongoing cost to ratepayers

# Remediation Goal

- Assess existing remediation solutions to see if there are technologies that will work to treat sterilants (in-situ or ex-situ) with the goal of:
  - Reducing volume of waste sent to landfill
  - Reducing greenhouse gas emissions
  - Reducing health and safety risk





# Remediation Learnings



Dig and dump is still the easiest, cheapest and most certain technique – likely only practical option for the near term at most sites



Treatment options look promising if ideal conditions present themselves and if pathway exclusion or modification is permitted



Regulatory buy in to novel solutions needed



Remediation program should have been initiated earlier in the 5-year period to have gotten further with field scale trials



# Overall Program Reflection





# Learnings

- **No silver bullet came out of the program, but...**
- Participant program fee was a fraction of the cost of the full remediation of a single site to Tier 1 Guidelines
- Although not every project met expectation, being able to know what is not going to be successful is a worthwhile outcome
- Encourage other industry participants to engage in collaborative research projects with InnoTech or other research organizations to leverage investments on novel contaminant issues
- Able to justify our current remediation approach knowing that we are managing sites in the best manner that we can within the constraints of the current Alberta regulatory framework



## For Next Time

- Re-evaluate program mid way to see if re-prioritization of projects is needed
- 5-years is a long time, and changes in personal (regulators, service providers, project managers) are bound to happen
- In-person forum to share ideas/experiences mid way through program may also have been beneficial (curtailed by pandemic restrictions)

## Next Steps

- Continue to evaluate sites to see if there are candidates for ex-situ treatment
- Field trials of Daramend®
- Assess options to have half life data incorporated into Tier 1 guidance
- Knowledge Synthesis Document and Program Summary Report public release



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**Thank you**

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