



Management of Soil Sterilant Impacted Sites

RemTech 2020
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October 15, 2020

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1

“DO I KNOW YOU?”

(You’ve probably heard of us...)



Organization	Year	Description
Science and Industrial Research Council of Alberta (SIRCA)	1921	The first provincial research organization in Canada
Research Council of Alberta (RCA)	1930	Dr. Karl A. Clark lays the foundation for investment in oil sands development.
Alberta Research Council (ARC)	1981	Canada’s leading technology development and innovation organization.
Alberta Innovates-Technology Futures (AITF)	2010	Enhancing capacity within Alberta’s high-tech companies
InnoTech Alberta	2016	A wholly owned subsidiary of Alberta Innovates







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2

2

Sterilants – What is the Problem?

- **Non-selective, persistent, and residual**
- Typically applied at **high application** rates over **several years**
- Generally **older sites** - farms, transmission lines, oil and gas distribution and industrial facilities, pipelines and electric metering stations, railways
- Often become **contamination source** through leaching, runoff or wind dispersion
- Best estimate - **>60,000** sites just in Alberta



Photo Credit:
MEMS EMS Solutions

3

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3

Sterilants – What is the Problem?



Photo Credit: Advisian

- Remediation **stalled** due to **challenging nature** of contaminants and **cost** associated with conventional remediation approaches
 - Difficult to treat to guideline level
 - Widespread given length of migration time
 - No single, standardized solution due to differences in chemical structure and environmental behavior of products
 - Often confounding contaminant issues

*Considerable effort over past 20 years, however
knowledge gaps remain*

4

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4

Sterilants – Opportunity?

Increased emphasis on reducing liabilities

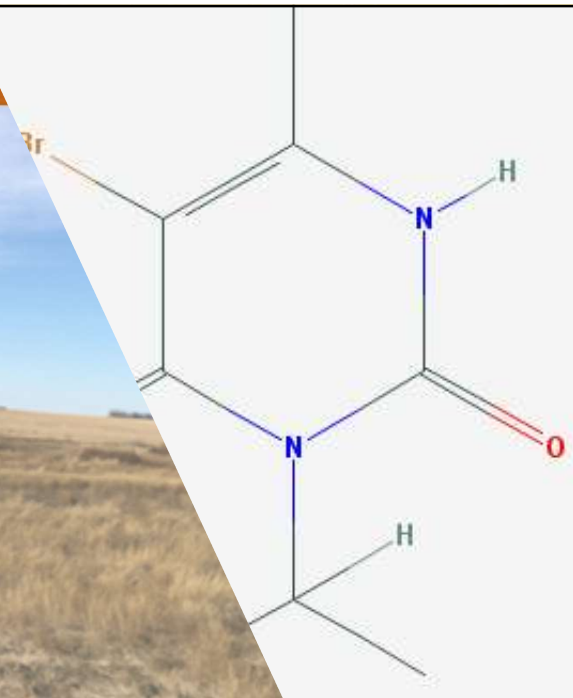
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Ageing sites nearing their end of life

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Opportunity to:

- Synthesize past learnings, and
- Partner to develop strategies and methods to effectively manage sterilant impacted sites




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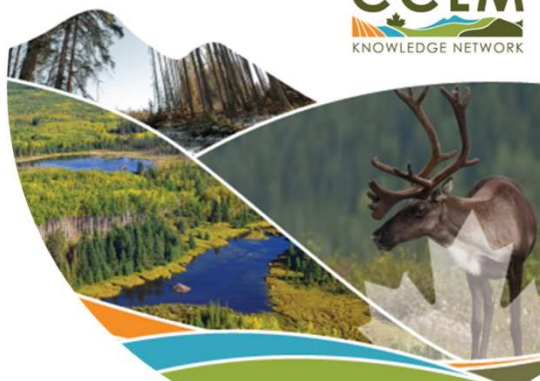
What did we learn?

- Majority of sterilant impacts in Alberta are associated with **bromacil** and **tebuthiuron**
- Sites are **primarily** located in **central** and **southern Alberta**
- Alberta **Tier 1** Soil and Groundwater Remediation Guidelines (AEP 2016) are **conservative** and based on data generated outside Alberta
- Lack of available information for use in **risk assessment models**
- Remediation technologies** have been **successfully** utilized to reduce or eliminate sterilant impacts – **more research required** for Alberta conditions and at larger scale

WWW.CCLMPORTAL.CA

What can we help you find?





Drozdowski, B., C.B. Powter, S. Levy, 2018. *Management of Sterilant Impacted Sites: Literature Synthesis*. InnoTech Alberta, Edmonton, Alberta. 49 pp.

Drozdowski, B., S. Levy and C.B. Powter, 2018. *Remediating Soil Sterilant-Affected Lands: Summary of Stakeholder Discussions*. InnoTech Alberta, Edmonton, Alberta. 42 pp.

6

Sterilants – What is the Solution?












OBJECTIVE:
 To establish **proven, technical, and cost-effective** strategies and best management practices for **effective management** of sites impacted by **residual soil sterilants**, with the goal of achieving regulatory site closure.



7


Sterilants Program

- 5 year Program
 - Initiated in 2019
- Scope
 - Address challenges specific to AB
 - Bromacil and tebuthiuron
- Structure
 - Program management and delivery agent – InnoTech
 - Steering Committee
 - Expert Advisory Committee
- Budget
 - \$1.4M



Governance and Management

Steering Committee (Funders)
 Strategic direction, guidelines and policies, project approval



Program Director

Expert Advisory Committee
 Volunteer; Program Recommendations


Project Execution

Identification and Delineation

Risk Assessment and Management

Remediation

Data Synthesis and Knowledge Transfer



8

Intended Outcomes

Program Area	Intended Outcome of the Program
Identification and Delineation	<ul style="list-style-type: none"> The uncertainty associated with the methods used to identify when/where sterilant impacts occur is reduced
Risk Assessment and Management	<ul style="list-style-type: none"> Reduction of risk associated with empirical data inputs to risk assessment models for protection of ecological pathways Reduction of risk associated with sterilant re-activation after the use of immobilization technologies by demonstrating and quantifying their effectiveness with empirical data
Remediation	<ul style="list-style-type: none"> Optimal, state-of-the-art technologies and/or processes are demonstrated under Alberta conditions
Knowledge Transfer	<ul style="list-style-type: none"> Development and retention of a community of practice Annual workshops and technical information dissemination

9

9






Series of Projects

Program Component	Project # and Title
Identification and Delineation	1. Decision Support Tool
	2. Sampling Best Management Practices
	3. Laboratory Method Investigation
	4. Detection of Bioavailable Sterilants
	5. Field Screening Technologies
Risk Assessment and Management	6. Sterilant-Specific Model Input Data
	7. Risk Assessment for Protection of Irrigation Water and Freshwater Aquatic Life
	8. Investigating Sterilant Mobility in Alberta
	9. Native Species Toxicity Evaluation
Remediation	10. Investigation of Long-term Effects of Activated Carbon
	11. Remediation Technology Screening and Testing
	12. Field-scale Remediation Demonstration(s)

10

10

Risk Assessment and Management Projects





Program Component	Project # and Title		Project Initiation	Project Service Provider	Principle Investigator/Team
Risk Assessment and Management	6./8.	Sterilant-Specific Model Input and Mobility in AB	October 2019	  	Aaron Tangedal Amy Gainer Barry Loescher Ryan Prosser
	7.	Risk Assessment for IW and FAL	October 2019		Cory Kartz Ian Mitchell
	9.	Phytotoxicity Evaluation	October 2019		Sarah Thacker

11



11



Identification and Delineation Projects

Program Component	Project # and Title		Project Initiation	Project Service Provider	Principle Investigator/Team
Identification and Delineation	1.	Decision Support Tool	March 2022	TBD	TBD
	2.	Sampling Best Practices	August/Sept 2020		Kathryn Bessie Tyrel Hemsley
	3.	Lab Methods	March 2020		Alberto Pereira Julius Pretorius
	4.	Bioaccessibility vs Total Concentrations	April 1, 2020		Jackie Maxwell, M.Sc. Candidate Sylvie Quideau
	5.	Field Screening Technologies	TBD (Soon)		Kevin French



12

Remediation Projects

Program Component	Project # and Title	Project Initiation	Project Service Provider	Principle Investigator/Team
Remediation	10. Investigation of Long-term Effects of Activated Carbon	April 2020	 UNIVERSITY OF ALBERTA  InnoTech ALBERTA A SUBSIDIARY OF ALBERTA INNOVATES	Jackie Maxwell, M.Sc. Candidate Sylvie Quideau Sarah Thacker
	11. Remediation Technology Screening and Testing	Q2/Q3 2020/21	TBD	TBD
	12. Remediation Demonstration(s)	Q1 2021/22	TBD	TBD

13

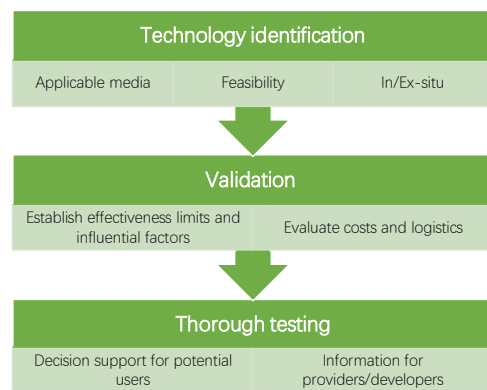
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13

Screening of Remediation Technologies

Candidate technologies:

- Remediation of bromacil and/or tebuthiuron in soil, groundwater and surface water
- Chemical, physical, biological mechanisms
- Further refinement of technologies already proven for sterilant remediation
AND
- Technologies with potential application based on treatment of similar chemicals

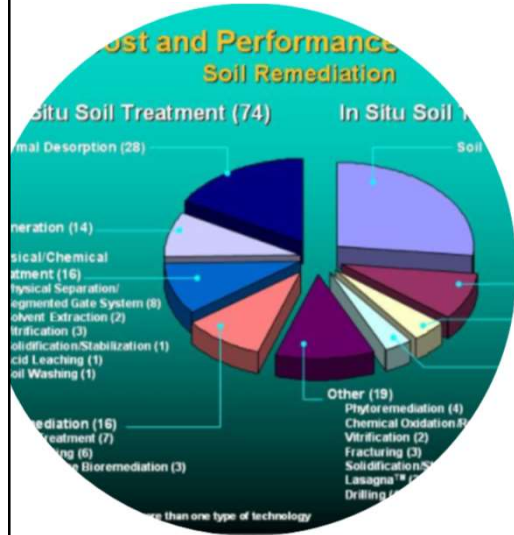


14

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14

Remediation Technologies Identified to Date



Treatment technologies investigated:

- Thermal desorption/conduction
- Oxidation
- Reduction
- Electrokinetic
- Sorption (in situ and ex situ)
- Chlorination
- Ultra-violet
- Biostimulation
- Bioaugmentation



15

Site Management Screening Matrix

Federal Remediation Technologies Roundtable

Resources ▾ Meetings and Other Materials

FRTR Home

Technology Screening Matrix

A user-friendly tool for screening potentially applicable technologies for a remediation project. The matrix allows you to screen 49 in situ and ex situ technologies for either soil or groundwater remediation. Variables used in screening include contaminants, development status, overall cost, and cleanup time. In-depth information on each technology is also available, including direct links to the database of cost and performance reports written by FRTR members.

<https://frtr.gov/matrix/default.cfm>

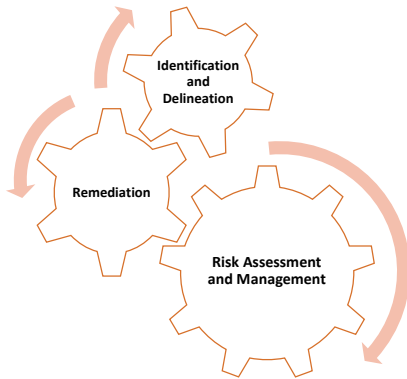
Leading the Federal Government's Efforts to Promote Interagency Cooperation to Advance the Use of Innovative Technologies to Cleanup Hazardous Waste Contamination



16

Knowledge Synthesis

The
KNOWLEDGE
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Holistic, comprehensive analysis of:

site characteristics +
COPC delineation +
risk assessment +
effective remediation technologies

= Decision support framework and tools
= Best practices for management of impacted sites

17

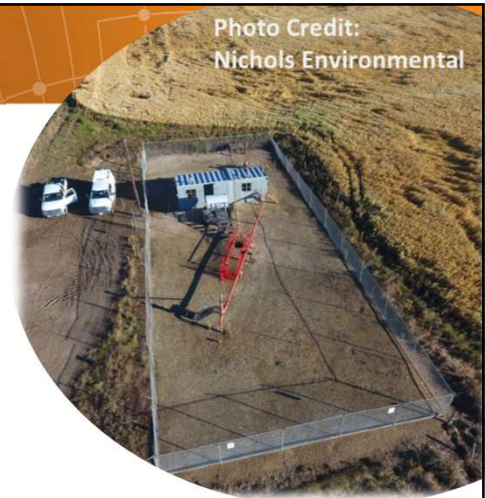
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17

How can you get involved?

- Reach out with awareness of viable remediation technologies
- Call for sites (and access) where **activated carbon** has been applied as a remediation technology
- Let us know if a tool like the FRTR for Alberta (western Canada) would be useful to you and if you would be willing to contribute

Photo Credit:
Nichols Environmental



18

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18

What's Next?

- Initiation of remaining projects
 - Bench scale testing of remediation technologies (if required)
 - Demonstration of comprehensive site management strategy for presentation to AEP/AER
 - Includes remediation and risk assessment
- Annual workshop (beginning in March 2021) for program participants and community of practice
- Knowledge synthesis and dissemination (www.cclmportal.ca)



Photo Credit:
Nichols Environmental



19

19

THANK YOU

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20

What are Soil Sterilants?

- **Non-selective, persistent, residual herbicides that render treated soil unfit for plant growth**
 - Selective vs non-selective
 - Selective herbicides control specific types of vegetation
 - Non-selective herbicides used for total vegetation control
 - Residual vs Non-Residual – can be selective or non-selective
 - Residual herbicides control vegetation long term
 - Non-residual herbicides generally only last one growing season
 - Persistent
 - Continued or prolonged existence of herbicide
 - Related to half life which depends on:
 - Application rate, soil moisture, pH, temperature, OM content, microbial content, etc.
 - Chemical and physical properties, composition, etc.



21