



Bench-Scale Testing of Remediation Technologies on Sterilant Impacted Soils in Alberta

Jean Pare, Chemco Inc.
Kevin French, VEI Contracting
Victor Bachmann, InnoTech Alberta

Soil sterilants are non-selective residual herbicides that render the treated soil unfit for plant growth for relatively long periods of time. Sterilants were commonly used in Alberta from the 1960s to late 1990s for non-selective vegetation control on oil and gas wells, gas processing plants, rights-of-way, railways, sawmills, pulp mills, and electrical utility sites; residues may also be found at agrochemical dealer sites. Sterilant treated areas can remain devoid of vegetation for many years, depending upon the type, rate and frequency of application of soil sterilant and the climatic conditions. Limited technologies have been proven to reduce the concentration of or impacts from bromacil and tebuthiuron. Immobilization, thermal desorption, and remedial excavation and off-site disposal are the current methods used in sterilant impacted site management and remediation.

A series of activities through the Soil Sterilants Program (SSP) sought to:

- Identify existing commercial- or near commercial-ready technologies for their suitability for the remediation of bromacil and tebuthiuron
- Test the identified remediation technologies at bench-scale for their ability to destructively remediate bromacil and tebuthiuron
- Evaluate the longevity of bromacil and tebuthiuron immobilization by activated carbon

Several remediation technologies were identified for potentially destructively remediating bromacil and/or tebuthiuron and selected for bench-scale testing. These technologies remediated sterilants through two main processes: In-situ chemical oxidation (ISCO) and In-situ chemical reduction (ISCR) coupled with enhanced anaerobic biodegradation. The remediation technologies tested were:

- Trap & Treat® BOS 200+®
- Trap & Treat® CAT 100
- Micro-scale Zero Valent Iron (ZVI)
- DARAMEND®
- Potassium persulfate (activated with hydrated lime)
- Sodium persulfate (activated with calcium peroxide)
- Sodium persulfate (activated with sodium hydroxide)
- Hydrogen peroxide (H₂O₂) (alone or utilising VTX catalyst)

Results from the bench-scale tests demonstrated that bromacil was effectively remediated by Trap & Treat® BOS 200+®, Trap & Treat® CAT 100, ZVI, DARAMEND, and H₂O₂ with VTX catalyst. Tebuthiuron was effectively remediated by Trap & Treat® BOS 200+®, Sodium persulfate activated with sodium hydroxide, and H₂O₂ with VTX catalyst.

Laboratory studies were conducted to assess the percentage of sterilant retained by activated carbon after synthetic leaching and the longevity of sterilant immobilization on activated carbon amended soil after synthetic weathering. Results from these studies showed that sterilant desorption ranged from 0% to 14% in activated carbon amended soil after synthetic leaching and from 1% to 3% after artificial weathering.

While further testing through a range of bromacil and tebuthiuron concentrations and soil characteristics are required, the findings from these studies have shown the potential to remediate bromacil and tebuthiuron impacted sites in Alberta. Some of these technologies were selected for further bench- and meso-scale trials to assess their real-world efficacy and to optimize their application.

This presentation will provide a summary of the soil sterilant issue in Alberta, the remedial technologies assessed, results of the bench-scale testing and lessons learned. It is hoped that the findings of this work will assist environmental practitioners and site owners in more effectively managing risks associated with sterilant impacted sites in Alberta.

continued on next page...



Soil Sterilants Program

...continued from previous page

Jean Paré

Mr. Paré has a degree in Chemical Engineering from Laval University. For the last eighteen years he has been involved in the evaluation, development, design, and promotion of both conventional and innovative environmental technologies, working with engineering firms and expert environmental consultants in industry and various levels of government. As Vice President with Chemco Inc., Mr. Paré's responsibilities include the development of remediation strategies, assistance in drafting certificates of authorization, technico-economical analysis, design and supply of storage equipment, pumps and the logistics of supply for projects. Last year he worked with over 350 sites, applying his expertise to various types of contaminants ranging from chlorinated compounds, pesticides, and petroleum hydrocarbons.

He is involved with many environmental organizations, including the Canadian Brownfield Network, ESAA, OCETA, CLRA, and Réseau-Environnement, where he is an active technical committee member and speaker.

Kevin French

Kevin French, B.A.Sc., P.Eng, is Vice President of Vertex Environmental and has over 30 years of experience and expertise in environmental engineering, specializing in site assessment and remediation. He has been involved in the design and implementation of remediation programs across Canada involving permeable reactive barriers, adsorptive technologies, in-situ chemical oxidation and reduction, aerobic and anaerobic biodegradation, etc. in soil, groundwater and bedrock for a variety of contaminants, including petroleum hydrocarbons, chlorinated solvents, heavy metals and other compounds. Kevin holds a bachelor's degree in Engineering from the University of Waterloo and is a Professional Engineer and a Qualified Person in Ontario.

Victor Bachmann

Victor Bachmann, B.Sc. is a research technologist with Innotech Alberta where he works on reclamation and remediation research projects that help improve the sustainability of industries in Alberta, including managing the remediation projects within the Soil Sterilants Program for the past 5 years. Victor has an undergraduate degree from the University of Alberta (BSc - Physics) and a technical diploma from NAIT (Environmental Sciences). He is currently pursuing his MSc in Soil Science at the University of Alberta where he is researching the use Daramend for the remediation of bromacil on soils in Alberta. Outside of work, Victor is also President of the Edmonton Nature Centre Foundation where he shares his passion for educating kids of all ages on the importance of nature.