

Accepted Manuscript

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PII: S0165-232X(16)30284-1
DOI: doi: [10.1016/j.coldregions.2016.10.008](https://doi.org/10.1016/j.coldregions.2016.10.008)
Reference: COLTEC 2327

To appear in: *Cold Regions Science and Technology*

Received date: 18 June 2016
Revised date: 21 September 2016
Accepted date: 19 October 2016



Please cite this article as: Camenzuli, Danielle, Wise, Lauren E., Stokes, Alex J., Gore, Damian B., Treatment of soil co-contaminated with inorganics and petroleum hydrocarbons using silica: Implications for remediation in cold regions, *Cold Regions Science and Technology* (2016), doi: [10.1016/j.coldregions.2016.10.008](https://doi.org/10.1016/j.coldregions.2016.10.008)

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Treatment of soil co-contaminated with inorganics and petroleum hydrocarbons using silica: Implications for remediation in cold regions.

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Abstract

Successful remediation of contaminated land in cold regions is challenged by freeze-thaw cycling, slow rates of natural hydrocarbon attenuation, extreme weather and financial and logistical constraints. At sites co-contaminated with metals and petroleum hydrocarbons, microbial activity is suppressed and biodegradation of petroleum hydrocarbons is also slowed. This study assesses the performance of eight silica treatments for immobilising inorganics (Al, Cr, Fe, Ni, Cu, Zn, As, Cd and Pb) and encapsulating petroleum hydrocarbons (a winterised diesel) in co-contaminated soil at 2 °C. Treatments containing orthophosphoric acid immobilised Cu, Zn, Cd and Pb, but mobilised As. The formation of hydroxypyromorphite, sodium aluminosilicates and calcium bearing minerals were observed following treatment, demonstrating the potential for successful immobilisation of inorganics using silica treatments. Silica treatments were less effective at reducing total extractable concentrations of petroleum hydrocarbons in soil, indicating that further research is required to optimise treatment performance in soil co-contaminated with inorganics and petroleum hydrocarbons.

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