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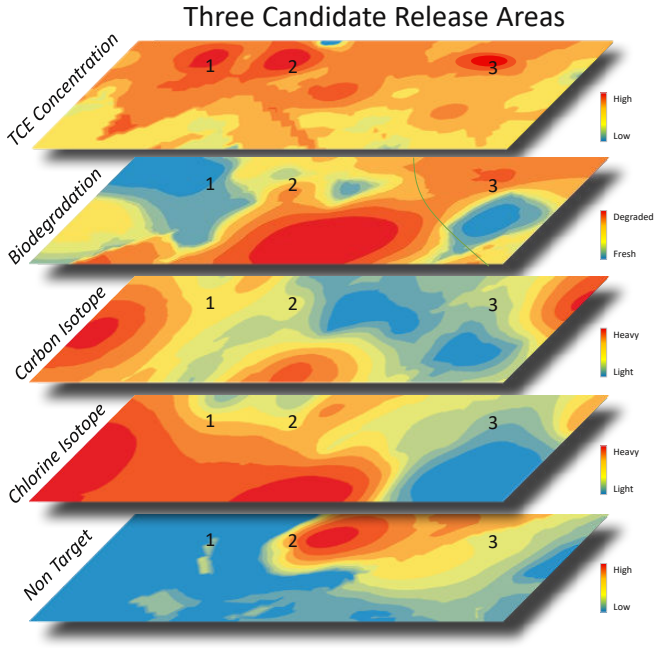
NewFields Note

Chlorinated Solvent Forensics

Source Identification Tools for Contaminated Groundwater, Soil and Air

NewFields Note: Technical information in a condensed, easily digestible format that is intended to promote environmental science education, knowledge transfer, and empowerment … *one note at a time.*

Chlorinated Solvents (aka, chlorinated volatile organic compounds or CVOCs) found widespread use over the past century in degreasing, dry-cleaning, chemical manufacturing, and other industrial, commercial and residential activities. Currently, CVOCs represent the most common groundwater contaminants in the US. Selected CVOCs, such as tetrachloroethylene (PCE) and trichloroethylene (TCE), as well as degradation products 1,1-dichloroethene (DCE11) and vinyl chloride (VC), are classified as carcinogens or probable carcinogens that result in very low regulatory limits. Some CVOC products are stabilized with compounds of concern, like 1,4-dioxane, that extend the legal liability for historical releases. Identifying the source of chlorinated solvent plumes and assessing the fate of chlorinated contaminants in the environment are common issues, especially when vapor intrusion is a concern or groundwater serves as a potential source of potable water.



Forensic complexity arises when impacted groundwater is surrounded by multiple candidate historical sources. Fortunately, CVOCs degrade chemically and isotopically in a predictable fashion as they migrate away from points of release. Differentiating impacts from numerous candidate sources benefits greatly from multiple lines of evidence with an emphasis on spatial concentration and degradation gradients augmented by co-occurring contaminants and solvent stabilizers. The synoptic use of standard regulatory methods and advanced forensic testing techniques helps differentiate independent source signatures. These diagnostic features enhance the development of conceptual site models, environmental remediation, and realistic cost allocations as described in the recent NewFields publication found here

Emsbo-Mattingly, Flanders, and Litman (2022) "Integrated differentiation of multiple trichloroethylene and tetrachloroethylene groundwater impacts using spatial concentration, biodegradation indices, chemical fingerprinting and carbon/chlorine isotope patterns." Environmental Forensics, DOI: 10.1080/15275922.2022.2047832.

Example CVOC Contaminants

Chloroethenes
- Perchloroethylene (PCE)
- Trichloroethene (TCE)
- Dichloroethene (DCE)

Chloroethanes
- Perchloroethane (PCA)
- Trichloroethane (TCA)
- Dichloroethane (DCA)

Chlorobenzenes
- Trichlorobenzene (TCB)
- Dichlorobenzene (DCB)
- Chlorobenzene (CB)
- Benzene (B)

For additional information, please contact your NewFields Technical Lead. Or send us an email at Science_Info@newfields.com!

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