Soil, Sediment, Bedrock and Sludge

Dehalogenation

Introduction:

Reagents are added to soils contaminated with halogenated organics. The dehalogenation process is accomplished by either the replacement of the halogen molecules or the decomposition and part volatilisation of the contaminants.

Description:

Contaminated soil is screened, processed with a crusher and mill, and blended with reagents. The mixture is warmed through in a reactor for dehalogenation to occur.

Base-catalysed Decomposition (BCD)

Base-catalysed decomposition (BCD) was developed by EPA's Risk Reduction Engineering Laboratory (RREL), in collaboration with the Naval Facilities Engineering Services Centre (NFESC) to treat soils and sediments contaminated with chlorinated organic compounds, particularly PCBs, and dioxins. The contaminated (screened and crushed) soil is heated to above 330 °C (630°F) in a reactor to partly decay and volatilise the contaminants. The volatilised contaminants are captured, condensed, and treated independently.

Glycolate/Alkaline Polyethylene Glycol (APEG)

Glycolate is a full-scale process where an alkaline polyethylene glycol (APEG) reagent is applied. Potassium polyethylene glycol (KPEG) is the most widespread APEG reagent. Contaminated soils and the reagent are blended and heated in a treatment vessel. In the APEG process, the reaction brings about the polyethylene glycol to substitute halogen molecules and leave the compound less toxic. The APEG dehalogenates the contaminant to form a glycol ether or a hydroxylated compound and an alkali metal salt, which are water-soluble by-products. Dehalogenation (APEG/KPEG) is commonly considered a stand-alone technology; nevertheless, it can be used in arrangement with other technologies. Treatment of the wastewater produced by the process can include chemical oxidation, biodegradation, carbon adsorption, or precipitation.

Dehalogenation is usually a short- to medium-term process, where the contaminant is moderately decomposed rather than being transferred to a different medium.

Applicability:

The target contaminant groups are halogenated SVOCs and pesticides. APEG dehalogenation is one of a few processes offered other than incineration that has been effectively field-tested for the treatment of PCBs. The technology can be made use of but may be less effective against selected halogenated VOCs and is agreeable to small-scale applications. The BCD can be additionally used to treat halogenated VOCs but in general will be more expensive than other options.

Limitations:

- High clay and moisture content can increase treatment costs.
- The APEG/KPEG technology is not cost-effective for large waste volumes.
- Concentrations of chlorinated organics greater than 5% need large volumes of reagent.
- With the BCD process, capture and treatment of residuals (volatilised contaminants captured, dust, and other condensates) may be hard, especially when the soil contains high levels of fines and moisture.

Data Needs:

Treatability tests should be undertaken to identify factors such as water, alkaline metals, and humus content in the soils; the existence of multiple phases; and total organic halides that may have the potential to affect the processing time and costs.

Performance Data:

Glycolate process has been used to effectively treat contaminant concentrations of PCBs from less than 2 mg/l to apparently as high as 45,000 mg/l. The technology has approval from the EPA's Office of Toxic Substances under the Toxic Substances Control Act for the treatment of PCBs.

Cost:

The approximate cost for full-scale operation is thought to be in the range of £ 150 to £ 320 per tonne and does not take into consideration the excavation, refilling, residue disposal, or analytical costs. Factors like high clay or moisture content could further raise the treatment costs.