**1,4-DIOXANE: ISSUES AND POTENTIAL TREATMENT OPTIONS**

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1,4-Dioxane (14D) is frequently present at DNAPL sites due to its common use as a stabilizing agent for 1,1,1-trichloroethane (TCA) and other chlorinated solvents. 14D may also enter groundwater due to its use as a solvent, wetting/dispersing agent, and aerosol additive or as an inadvertent byproduct of polyester and surfactant production.

While not acutely toxic, 14D is classified as a Class B2 (probable) human carcinogen based on the increased incidence of nasal cavity and liver carcinomas in animal studies. USEPA has not established a maximum contaminant level (MCL) for 1,4-dioxane in drinking water but has issued a drinking water health advisory with an estimated lifetime cancer risk of 1 in 10,000 for a drinking water concentration of 0.3 mg/L. Several states have adopted more stringent water quality criteria with some standards as low as 0.003 mg/L in drinking water and/or groundwater.

14D (C₄H₈O₂) is a cyclic organic compound containing two symmetrically opposed ether linkages which results in low potential for sorption, volatilization, and abiotic hydrolysis. Consequently, 14D is very mobile in groundwater and can form large plumes. Most conventional above-ground water treatment processes (e.g., air stripping and carbon adsorption) are not effective for 14D. However, advanced oxidation processes (AOPs) using hydrogen peroxide, ozone and/or UV photooxidation can be effective. In situ chemical oxidation (ISCO) using ozone, catalyzed hydrogen peroxide, and persulfate can be effective for remediation of 14D in source areas. However, 14D plumes are often very large and ISCO may not be cost effective for treatment of large, dilute plumes.

Most early research indicated that 14D is resistant to aerobic and anaerobic biodegradation. However, recent studies have shown that high 14D concentrations can support growth of pure and mixed bacterial cultures under aerobic conditions. Unfortunately, growth rates on 14D are very slow and decline rapidly with decreasing concentration. 14D can be cometabolically biodegraded using a variety of co-substrates including methane. This suggests that cometabolism could be an important attenuation mechanism downgradient of anaerobic bioremediation systems where methane mixes with oxygen and possibly in engineered systems where methane or other co-substrates are injected to stimulate microbial growth.