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Stimulation of Dechlorination of Lightly Chlorinated Dibenzo-*p*-Dioxins in Aquatic Sediments

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Background/Objectives. A major goal in remediation of environmental media contaminated with chlorinated chemicals is removal of all chlorines from the organic molecule through reductive dechlorination. This may detoxify the compounds and ultimately allow further biodegradation to occur. Relatively little, however, is known about exactly how anaerobic organohalide respiring bacteria function and about how to most effectively cultivate and enrich these bacteria to perform reductive dechlorination on a large scale and on compounds such as polychlorinated dibenzo-*p*-dioxins (PCDDs).

Approach/Activities. We examined the dechlorination of PCDDs with four or fewer chlorines in aquatic sediments from several locations. In some sediments pre-enrichment with other organohalides was performed prior to assessing dioxin dechlorination. Sediment samples from sites in Maine and New Jersey that were originally contaminated with environmental polychlorinated dibenzo-p-dioxins (PCDDs) were placed in serum bottles with anaerobic minimal medium. Triplicate microcosms were amended with electron donor (organic acids), soluble alternate halogenated compounds intended to enhance organohalide respiring bacteria that dechlorinate dioxin, or a dioxin congener. Transfers from the New Jersey sediments are being further enriched in fill and draw bottles in order to cultivate larger communities of dehalogenating bacteria.

Results/Lessons Learned. After prolonged incubation (years) 2-monochlorodibenzo-*p*-dioixn was detected in most treatments from the ME site along with lesser amounts of non-chlorinated dibenzo-*p*-dioxin (up to 9.8 mol% of the original parent compound). For the NJ site the microcosms amended with more soluble organohalides exhibited rapid dechlorination. On-going work is assessing the ability of these enrichments to dechlorinate tetrachlorodibenzo-*p*-dioxin. Production of abundant mono-chloro and non-chlorinated dibenzo-*p*-dioxin from PCDDs after long incubation times raises the possibility that reductive dechlorination could result in complete removal of chlorines. Analysis of sediment microbial communities is being conducted to link this activity to presence of specific organohalide-respiring bacteria.