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Oral Bioaccessibility of Dioxins/Furans at Low Concentrations (50−350 ppt Toxicity Equivalent) in Soil

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Animal studies have indicated that the oral bioavailability of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD) in environmentally contaminated soil could range from 0.5 to 60%. To estimate the oral bioavailability of TCDD, and the 16 other 2,3,7,8-substituted dioxin/furan congeners, this study used a physiologically based extraction test, designed around the anatomic and physiologic characteristics of the human digestive tract. This test measures the fraction of dioxins/furans in soil that would be solubilized in the gastrointestinal tract (i.e., that would be bioaccessible) and therefore available for absorption. Eight soils from Midland, MI, were evaluated in this study and exhibited TCDD concentrations of 1.7−139 pg/g (ppt) and total TEQ concentrations of 6−340 ppt. Bioaccessibility of dioxins/furans from these soils ranged from 19 to 34% (averaged across the 17 2,3,7,8-substituted dioxin/furan congeners), with an average of 25%. The total organic carbon in these soils was low—ranging from 1 to 4%—particularly for the soil series from which they were collected. Bioaccessibility of individual congeners did not appear to be correlated with degree of chlorination. Even though these dioxin/furan concentrations are much less than studied previously, these results are consistent with those from animal studies at other sites, which have generally yielded values of 20−60% relative bioavailability for TCDD in soil.