

A Proposed Occupational Exposure Limit for 2,3,7,8-Tetrachlorodibenzo-p-dioxin

HON-WING LEUNG*, F. JAY MURRAY and DENNIS J. PAUSTENBACH†
Environmental Health and Safety, Syntex, Inc., 3401 Hillview Ave., Palo Alto, CA 94303

One contaminant produced unintentionally during the manufacture of chlorophenols and phenoxy herbicides is 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). The resulting TCDD-containing wastes have been detected at many hazardous waste sites which in recent years have been in the process of remediation. Concerns about worker exposure to TCDD-contaminated soil (dust) during remediation of hazardous waste sites have produced a need for an occupational exposure limit (OEL) for TCDD. The animal toxicology data and human experience with TCDD are reviewed, and an occupational exposure limit for TCDD is proposed. The animal data support risk estimations which are based on TCDD as a nongenotoxic carcinogen. Studies on human populations have failed to demonstrate clearly any significant long-term health effects at levels to which humans have been exposed. The data indicate that an 8-hr time-weighted average limit of 2 ng/m^3 is appropriate, and the associated risk would be consistent with other carcinogens at their corresponding OELs. A preliminary OEL of 0.2 ng/m^3 (200 pg/m^3) is recommended, however, in light of other sources of exposure because of TCDD's ubiquitousness in the environment, its unclear mechanism of action, and its rather long biological half-life in humans. This limit provides an ample margin of safety to prevent chloracne following repeated, acute exposure, and it addresses those chronic effects of TCDD observed in animal studies as well as those observed after accidental human exposure. The resulting body burden caused by chronic exposure to TCDD at the proposed OEL is examined. Its toxicological significance is compared with human tissue data and with other similarly persistent chemicals. Results indicate that the health risks associated with such tissue burden are insignificant.

Introduction

Polychlorinated dibenzodioxins (dioxins) are contaminants produced during the manufacture of chlorophenols, hexachlorophene and phenoxy herbicides. They also may be produced by the incineration of certain materials.⁽¹⁾ Most human exposure to dioxins is believed to be associated with the use of Agent Orange in Vietnam; with 2,4,5-trichlorophenoxyacetic acid (2,4,5-T) in agriculture; with the manufacture of these agents and pentachlorophenol; and with incineration of certain materials.

Because of restrictions on the use of hexachlorophene and 2,4,5-T in the United States and because of changes in manufacturing processes to limit dioxin contamination, occupational exposure to dioxin during the manufacture of these chemicals currently is not a concern in the United States. Dioxin, however, is present in the soil of numerous industrial sites, landfills and residential communities because of the past disposal of dioxin-containing waste.⁽²⁻³⁾ Many of these have been designated as Superfund hazardous waste sites under the Comprehensive Environmental Response, Compensation, and Liability Act. Remediation of these sites may involve soil excavation which may present potential exposure to airborne dust containing the dioxin.