EPA's Reassessment of Dioxin Health Effects and Approaches to Estimating Exposure

William H. Farland and John L. Schaum
Office of Research and Development , USEPA

EPA prepared assessments of the human health risks associated with environmental exposures to dioxin in 1985 and 1988. The 1985 assessment reported insufficient evidence of carcinogenicity in humans, but found sufficient evidence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) carcinogenicity in animals to classify dioxin as probably carcinogenic to humans (B2), using EPA's Cancer Risk Assessment Guidelines. The 1985 document also suggested the need to continue to evaluate other non-cancer effects of TCDD. The 1988 draft assessment suggested that new scientific information on dioxin and related compounds may lead to a revised cancer potency estimate and both the EPA and the Agency's Science Advisory Board (SAB) panel, which reviewed the document, agreed that a biologically based dose-response model should be explored.

Using these two assessments as a base, EPA is updating the health assessment document for dioxin to include later epidemiologic studies and studies on the mechanisms of action. The expanded health assessment is examining dioxin and other compounds exhibiting "dioxin-like" attributes in their biologic processes and toxic effects, as well as all health effects related to exposure to these substances.

The updated and revised health risk assessment will be co-authored by leading international experts and EPA scientists. The assessment document will include a chapter on risk characterization and will incorporate the application of the dose-response model which is under development. Seven state-of-the-science chapters relating to the assessment of dioxin health effects have been identified and are under development. They include: mechanism(s) of toxic actions; disposition and pharmacokinetics; toxicology - acute, subchronic, chronic; toxicology - immunotoxic effects; toxicology - reproductive/developmental effects; carcinogenicity; and epidemiology/human data. The internal and limited external peer review of the draft chapters began in mid-1992. Next steps include the integration of the chapters, connections to other assessment activities, and the development of a comprehensive risk characterization for dioxin and related compounds.

The update and revision of the dioxin exposure assessment, which is currently underway by EPA's Exposure Assessment Group, will be based on the final draft of the 1988 dioxin exposure document and will include comments made by the SAB in their review of that document. The scope of the assessment will be expanded to include dioxin and related dioxin-like compounds and will address such potential exposure pathways as dust inhalation, vapor inhalation, dermal soil contact, soil ingestion, ingestion of beef and dairy products, fish ingestion,

water ingestion, and fruit and vegetable ingestion. The document will also include new information on persistence, volatility, and bioaccumulation and expanded exposure scenarios involving environmental fate and potential exposure pathways.

The primary purpose of the document is to present procedures for conducting site-specific exposure assessments of dioxin-like compounds. In addition information will be included on the levels of these compounds found in various media, identification of possible associated sources and estimation of the resulting exposure levels. The types of sites covered in the document include incinerators, landfills and other areas involving contaminated soils. The procedures identify possible exposure pathways, associated with these sites, present fate models to estimate media concentrations at the point of exposure and identify ways to estimate contact rates and resulting exposure levels. A discussion is also presented on procedures specific to effluent discharges to water bodies.

The end products of the exposure assessment procedures presented are estimates of potential dose expressed in milligrams of dioxin toxicity equivalents per kilogram-day. Pharmacokinetic models are explored to predict dioxin levels in blood, adipose tissue and other body compartments. The draft document has undergone internal and external review and next steps will parallel those of the health effects efforts.