Exposure and Human Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-\textit{p}-Dioxin (TCDD) and Related Compounds

Part III: Integrated Summary and Risk Characterization for 2,3,7,8-Tetrachlorodibenzo-\textit{p}-Dioxin (TCDD) and Related Compounds

NOTICE

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National Center for Environmental Assessment
Research and Development
U.S. Environmental Protection Agency
Washington, DC
DISCLAIMER

This document is a draft for review purposes only and does not constitute U.S. Environmental Protection Agency policy. It has been provided for review to the National Academy of Sciences (NAS). While the NAS review is being conducted and until a final agency assessment has been released, the draft dioxin reassessment (2003 version or other draft versions) remains draft, does not represent a final position, and is not intended to serve as the basis or rationale for regulatory and other policy action. However, EPA will continue its work to reduce human exposure to dioxin.

While the NAS review is underway and no final reassessment has been issued, in meeting their regulatory responsibilities, the agency will continue its current practice of utilizing the best available data that meet the EPA Information Quality Guidelines and the government-wide Information Quality Guidelines issued by OMB. The Agency will consider all such data and associated uncertainty to determine the strength of the evidence in proposing regulatory actions related to dioxin and dioxin-like compounds.
Exposure and Human Health Reassessment
of 2,3,7,8-Tetrachlorodibenzo-\(p\)-Dioxin (TCDD)
and Related Compounds

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<th>Definition</th>
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<tr>
<td>Ah</td>
<td>aryl hydrocarbon</td>
</tr>
<tr>
<td>AHF</td>
<td>altered heptacellular foci</td>
</tr>
<tr>
<td>AhR</td>
<td>aryl hydrocarbon receptor</td>
</tr>
<tr>
<td>ALK</td>
<td>alkaline phosphatase</td>
</tr>
<tr>
<td>ALT</td>
<td>alanine aminotransferase</td>
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<tr>
<td>Arnt</td>
<td>aryl hydrocarbon receptor nuclear translocator</td>
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<td>AST</td>
<td>aspartate aminotransferase</td>
</tr>
<tr>
<td>ATSDR</td>
<td>Agency for Toxic Substances and Disease Registry</td>
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<tr>
<td>AUC</td>
<td>area under the curve</td>
</tr>
<tr>
<td>BaP</td>
<td>benzo[a]pyrene</td>
</tr>
<tr>
<td>BDD</td>
<td>brominated dibenzodioxin</td>
</tr>
<tr>
<td>BDF</td>
<td>polybrominated dibenzofuran</td>
</tr>
<tr>
<td>BMD</td>
<td>benchmark dose</td>
</tr>
<tr>
<td>BW</td>
<td>body weight</td>
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<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
</tr>
<tr>
<td>CDD</td>
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<tr>
<td>CFD</td>
<td>chlorinated dibenzofuran</td>
</tr>
<tr>
<td>CI</td>
<td>confidence interval</td>
</tr>
<tr>
<td>CTL</td>
<td>cytotoxic T lymphocyte</td>
</tr>
<tr>
<td>CYP1A1</td>
<td>cytochrome P4501A1 enzyme</td>
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<tr>
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<tr>
<td>CYP1B1</td>
<td>cytochrome P4501B1 enzyme</td>
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<tr>
<td>DFP</td>
<td>dioxins, furans, PCBs</td>
</tr>
<tr>
<td>DEN</td>
<td>diethylnitrosamine</td>
</tr>
<tr>
<td>DHT</td>
<td>5α-dihydrotestosterone</td>
</tr>
<tr>
<td>DNA</td>
<td>deoxyribonucleic acid</td>
</tr>
<tr>
<td>ED</td>
<td>effective dose</td>
</tr>
<tr>
<td>ED_{0.01}</td>
<td>effective dose at the 1% response level</td>
</tr>
<tr>
<td>EDC/VC</td>
<td>ethylene dichloride/vinyl chloride</td>
</tr>
<tr>
<td>EGF</td>
<td>epidermal growth factor</td>
</tr>
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<td>EGFR</td>
<td>epidermal growth factor receptor</td>
</tr>
<tr>
<td>EPA</td>
<td>U.S. Environmental Protection Agency</td>
</tr>
<tr>
<td>FSH</td>
<td>follicle-stimulating hormone</td>
</tr>
<tr>
<td>g</td>
<td>gram</td>
</tr>
<tr>
<td>GD</td>
<td>gestation day</td>
</tr>
<tr>
<td>GGT</td>
<td>gamma glutamyl transferase</td>
</tr>
<tr>
<td>HAH</td>
<td>halogenated aromatic hydrocarbons</td>
</tr>
<tr>
<td>HCDD</td>
<td>hexachlorodibenzo-p-dioxin</td>
</tr>
<tr>
<td>HIF</td>
<td>hypoxia-inducible factor</td>
</tr>
<tr>
<td>HpCDD</td>
<td>heptachlorodibenzo-p-dioxin</td>
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### LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (continued)

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>hr</td>
<td>hairless</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agency for Research on Cancer</td>
</tr>
<tr>
<td>ID</td>
<td>immunosuppressive dose</td>
</tr>
<tr>
<td>IgA</td>
<td>immunoglobulin A</td>
</tr>
<tr>
<td>I-P</td>
<td>initiation-promotion</td>
</tr>
<tr>
<td>IPCS</td>
<td>International Programme on Chemical Safety (WHO)</td>
</tr>
<tr>
<td>I-TEQ</td>
<td>international TEF scheme adopted by EPA in 1989</td>
</tr>
<tr>
<td>kg</td>
<td>kilogram</td>
</tr>
<tr>
<td>L</td>
<td>liter</td>
</tr>
<tr>
<td>LABB</td>
<td>lifetime average body burden</td>
</tr>
<tr>
<td>LED&lt;sub&gt;0.1&lt;/sub&gt;</td>
<td>lower bound of the effective dose at the 1% response level</td>
</tr>
<tr>
<td>LH</td>
<td>luteinizing hormone</td>
</tr>
<tr>
<td>LMS</td>
<td>linearized multistage</td>
</tr>
<tr>
<td>LOAEL</td>
<td>lowest-observed-adverse-effect level</td>
</tr>
<tr>
<td>MOE</td>
<td>margin of exposure</td>
</tr>
<tr>
<td>mRNA</td>
<td>messenger ribonucleic acid</td>
</tr>
<tr>
<td>MRL</td>
<td>minimal risk level (ATSDR)</td>
</tr>
<tr>
<td>NHANES</td>
<td>National Health and Nutrition Examination Survey</td>
</tr>
<tr>
<td>NHATS</td>
<td>National Human Adipose Tissue Survey</td>
</tr>
<tr>
<td>ng</td>
<td>nanogram</td>
</tr>
<tr>
<td>NIOSH</td>
<td>National Institute for Occupational Safety and Health</td>
</tr>
<tr>
<td>NTP</td>
<td>National Toxicology Program</td>
</tr>
<tr>
<td>NOAEL</td>
<td>no-observed-adverse-effect level</td>
</tr>
<tr>
<td>NOEL</td>
<td>no-observed-effect level</td>
</tr>
<tr>
<td>OCDD</td>
<td>octachlorodibenzo-p-dioxin</td>
</tr>
<tr>
<td>pg</td>
<td>picogram</td>
</tr>
<tr>
<td>PAH</td>
<td>polycyclic aromatic hydrocarbon</td>
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<tr>
<td>PBPK</td>
<td>physiologically based pharmacokinetic</td>
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<tr>
<td>PBDD</td>
<td>polybrominated dibenzodioxin</td>
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<tr>
<td>PBDF</td>
<td>polybrominated dibenzofuran</td>
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<td>PCB</td>
<td>polychlorinated biphenyl</td>
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<td>PCP</td>
<td>pentachlorophenol</td>
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<tr>
<td>PCQ</td>
<td>polychlorinated quaterphenyl</td>
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<td>PeCDD</td>
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<td>PeCDF</td>
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<tr>
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<td>pharmacokinetic</td>
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<tr>
<td>POD</td>
<td>point of departure</td>
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<tr>
<td>POTW</td>
<td>publicly-owned treatment works</td>
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LIST OF ACRONYMS, ABBREVIATIONS, AND SYMBOLS (continued)

ppt part per trillion
PVC polyvinyl chloride
REP relative potency
RfD reference dose (EPA)
RR relative risk
SAB U.S. EPA’s Science Advisory Board
SMR standardized mortality ratio
SRBC sheep red blood cells
2,4,5-T 2,4,5-trichlorophenoxyacetic acid
TDG thyroid binding globulin
TCDD 2,3,7,8-tetrachlorodibenzo-p-dioxin
TCP trichlorophenol
TDI tolerable daily intake
TEF toxic equivalency factor
TEQ toxic equivalent
TEQ-WHO94 1994 WHO extension of the I-TEF scheme to include 13 dioxin-like PCBs
TEQ-WHO98 1998 WHO update to the previously established TEFs for dioxins, furans, and dioxin-like PCBs
TPA tetradecanoyl phorbol acetate
TNP-LPS trinitrophenyl-lipopolysaccharide
TSH thyroid stimulating hormone
URL unit risk level
WHO World Health Organization

~ approximately
> greater than
< less than
≥ greater than or equal to
≤ less than or equal to
µg microgram
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