

Integrated Risk Assessment of Dioxin in Bleached Pulp and Paper
An Interagency Work Group Process

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ABSTRACT: Under a July 1988 agreement with United States environmental groups, the U.S. Environmental Protection Agency (EPA) agreed to commence a multiple pathway risk assessment considering sludges, water effluent, and products made from pulp produced at bleached kraft pulp and paper mills. Under this consent decree, EPA considered both occupational and nonoccupational risks, including but not limited to risks to aquatic organisms and from consumption by wildlife and humans. The integrated risk assessment is a multimedia multiexposure pathway exercise conducted cooperatively by the EPA's Office of Toxic Substances, Office of Water, Office of Solid Waste, and Office of Air Quality Planning and Standards and by the U.S. Consumer Product Safety Commission and the Food and Drug Administration. The risk assessment was organized and assembled by an interagency technical work group with representation from each of these offices.

INTRODUCTION: In 1985, the U.S. Environmental Protection Agency National Dioxin Study revealed the presence of 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) in native fish collected downstream from pulp and paper facilities and in bleached kraft pulp and paper facility wastewater sludges. The results of this study prompted the EPA and the paper industry to enter into a cooperative screening study of five bleached kraft pulp facilities. This 1986 study indicated the presence of 2,3,7,8-TCDD and 2,3,7,8-tetrachlorodibenzofuran (TCDF) in the effluents, sludges, and pulps from these facilities. The probable source is the bleaching of kraft pulp with chlorine and chlorine derivatives. In 1988, the EPA and the U.S. Paper Industry cooperated in a study of 104 mills that bleach chemical pulp with chlorine or chlorine derivatives. This study confirmed measurable concentrations of 2,3,7,8-TCDD and 2,3,7,8-TCDF. These findings led to the development of a consent agreement involving the EPA, the Environmental Defense Fund, and the National Wildlife Federation concerning the regulation of polychlorinated dibenzo-p-dioxins and dibenzofurans formed in pulp and paper processing based on an integrated risk assessment. This paper is one in a series of papers, that when presented sequentially, describes this integrated risk assessment in full.

EXPERIMENTAL PART: The integrated risk assessment was developed by an interagency technical work group, chaired by the EPA Office of Toxic Substances. This technical work group orchestrated the development of individual risk assessments by the work group constituents and by program area and then integrated these assessment to produce a cohesive study. The approach to assessing risk followed by each program area was generally the same. Where differences occurred, they were documented. All focused on 2,3,7,8-TCDD and 2,3,7,8-TCDF as the congeners of reference because these have been the most studied and are thought to represent the greatest risk. However, the basis for toxicity concerns for these congeners did vary among the three principal federal agencies involved in the study. Each, therefore, employed a different slope factor in calculating risk. EPA and FDA employed toxicity equivalency factors (TEF); the TEF for 2,3,7,8-TCDF was considered to be one tenth that of 2,3,7,8-TCDD. The implications of these differences in approach will be discussed in the risk characterization paper, presented later in this series.

RESULTS AND DISCUSSION: The work group process worked well in producing an integrated risk assessment. This paper provides a brief background to the establishment of the technical work group and the areas of responsibility assigned to each work group representative. This paper will be followed by a series of papers describing the risks calculated by assigned area and the general approach used by these representatives, including assumptions made.

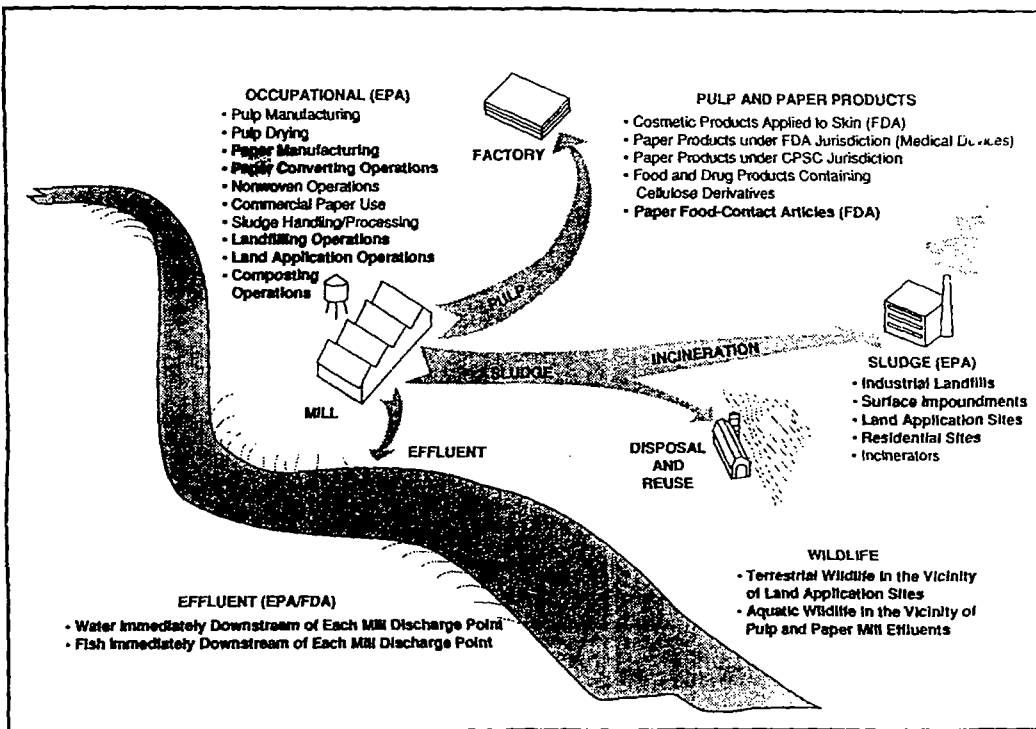
Each representative office was assigned the task of preparing a risk assessment for its individual area of responsibility. Collectively, these representatives evaluated over 120 exposure pathways. These exposure pathways, categorized in the figure, include those associated with sludge, wastewater, and pulp and paper products and work place or occupational activities. Ingestion, inhalation, and dermal exposure pathways were evaluated.

The occupational risks were calculated by the Office of Toxic Substances. Workers may be exposed to 2,3,7,8-TCDD and 2,3,7,8-TCDF at various stages of the paper production process. Exposure may occur during the bleaching of wood pulp and through contact with raw paper products, finished commercial paper products, and wastewater and sludge generated during the manufacture of paper products. Additional exposure may occur from the commercial use of pulp and paper mill sludge.

The risks associated with pulp and paper products were calculated in part by the U.S. Food and Drug Administration (FDA), the Consumer Product Safety Commission (CPSC), and the EPA. The FDA calculated risks for cosmetic products applied to the skin, food products containing cellulose derivatives, drug products containing cellulose derivatives, and paper food contact articles. EPA collaborated with the FDA on calculating risks for a collection of paper products described as medical devices. These include health and hygiene products and products typically employed in medical practice. The CPSC calculated risks for paper products typically used by consumers.

The risks associated with the use and disposal of sludge, the disposal of paper wastes, and the incineration of sludge were calculated by the EPA. Exposure scenarios included landfilling, discharge to surface impoundments, land application, use at residential sites, and incineration. Risks to terrestrial and avian wildlife were also calculated.

Risks associated with the wastewater discharge from pulp and paper mills were calculated by EPA on an individual plant basis. Risks to both human health and aquatic wildlife were estimated. EPA and the FDA each provided estimates of risk associated with the ingestion of contaminated fish.



SOURCE CHARACTERIZATION

