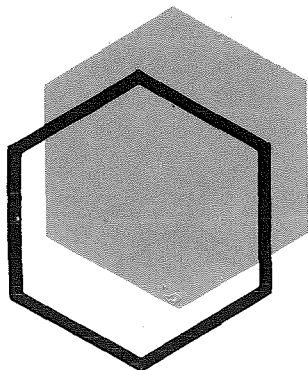




Toxics Information Series

October 1981



Dioxins--
Why are They
a Concern?

Dioxins

Since the late 1960's, scientific and public concern grew as more information became available regarding the toxicity of 2,3,7,8 tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD). This concern includes items from such events as:

Suspension of the use of Agent Orange herbicide (contaminated with 2,3,7,8-TCDD) in Vietnam;

Industrial accidents of the type that occurred in Seveso, Italy, which resulted in human exposure to 2,3,7,8-TCDD;

Suspension of certain uses of the herbicide 2,4,5-T (contaminated with 2,3,7,8-TCDD) in the U.S.;

Incineration of waste material, a process which may reportedly release TCDD into the environment;

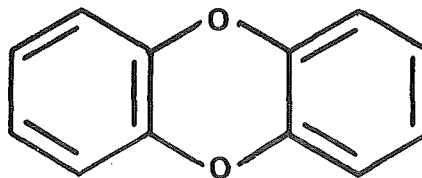
Leaching of 2,3,7,8-TCDD-contaminated waste material from abandoned dump sites;

Reports of low levels of 2,3,7,8-TCDD in gull eggs throughout the Great Lakes regions.

This Information Bulletin will outline what the U.S. Environmental Protection Agency (EPA) knows, and doesn't yet know, about the hazards of 2,3,7,8-TCDD, and also what steps are being taken to protect the public health and the environment from the dangers of this compound.

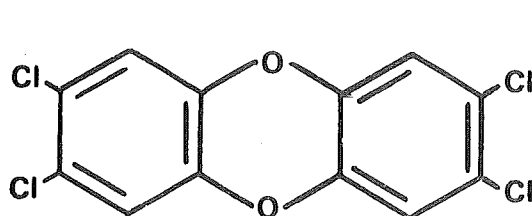
What are
dioxins?

The term dibenzo-para-dioxin refers to chemicals having the following basic structure:

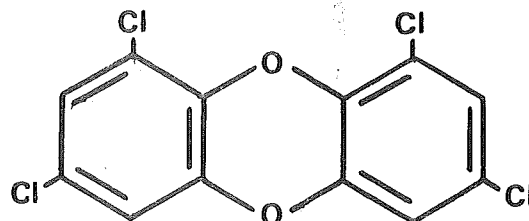


dibenzo-para-dioxin

Some of the substances contain chlorine atoms, an addition which may increase the toxicity of the compound. The term "dioxin" is loosely used to refer to these chlorinated dibenzo-para-dioxin compounds, of which there are seventy-five. The most toxic chlorinated dioxin studied thus far is tetrachlorodibenzo-para-dioxin (TCDD), a dioxin compound containing four chlorine atoms. There are 22 different isomers, or kinds of TCDD, differing in the locations at which the chlorine atoms are attached to the dibenzo-para-dioxin molecule. The most toxic of these 22 forms is designated as 2,3,7,8-TCDD.

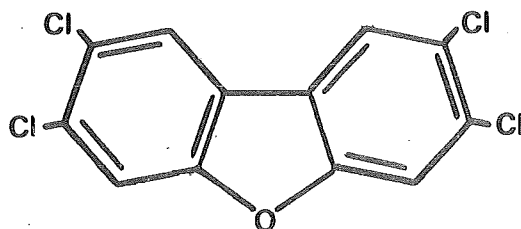


2,3,7,8-TCDD
most toxic TCDD



1,3,7,9-TCDD
one of 22 TCDDs

All of these chlorinated derivatives of dibenzo-para-dioxin differ in their toxicological properties and environmental significance; ranging from relatively non-toxic to highly toxic. A closely related set of compounds, tetrachlorodibenzodurans (TCDFs or "furans"), have appeared along with TCDDs in some cases, and are also under examination by EPA.



2,3,7,8-TCDD is a very stable chemical, resisting breakdown by other chemicals or by bacteria, although under favorable circumstances sunlight may be able to destroy some of the chemical. In general, however, once released into the environment at least some of it can persist, tightly adsorbing onto solid surfaces, such as soil and particulate emissions from combustion sources.

Although 2,3,7,8-TCDD has a low solubility in water and does not appear to be absorbed from the soil by plants, it can be carried into water on particles suspended in landfill leachate, storm water runoff, or industrial discharge, thus becoming available for ingestion by animals. In animals, it tends to accumulate in various tissues and organs, as a process known as bioaccumulation.

What are the health effects?

Chlorinated dioxins are of concern, in part, because some kinds can be highly toxic at very low levels. In fact, in animal tests, 2,3,7,8-TCDD is demonstrated to be the most acutely toxic compound made by man.

Chronic exposure to 2,3,7,8-TCDD has also been associated with a broad range of serious health effects. Extensive laboratory tests and some surveys of exposed workers indicate that 2,3,7,8-TCDD can pose a risk of cancer.

Reproductive function is also affected by 2,3,7,8-TCDD as shown in laboratory tests for teratogenicity and reproductive success in rats, mice, and hamsters. Additional experiments have demonstrated a relationship between exposure to 2,3,7,8-TCDD and infertility, abortion, and still birth in female monkeys.

Chloracne, a persistent acne-like condition, can be caused by exposure to certain chlorinated compounds, such as 2,3,7,8-TCDD.

Other health problems which are related to 2,3,7,8-TCDD exposure and have been observed in animals and/or humans include neurological effects, liver toxicity, anemia and other blood disorders, kidney dysfunction, thymus atrophy and other impairments of the immune system.

Where do dioxins come from?

2,3,7,8-TCDD forms as a hazardous by-product during the manufacture of 2,4,5-trichlorophenol (2,4,5-TCP), a major starting material in the manufacture of several pesticide and bacterial products, such as 2,4,5-T and silvex.

Abandoned dump sites which contain wastes from 2,4,5-TCP manufactures can become sources of 2,3,7,8-TCDD emissions, if waste material leaches from the site.

Trace levels of dioxins (including 2,3,7,8-TCDD) may be present in fly ash and flue gases from combustion sources since:

(a) These compounds may be trace components of the waste material being incinerated that are not effectively destroyed (e.g., 2,3,7,8-TCDD residues on grass clippings previously treated with contaminated herbicide).

(b) The compounds may be formed during combustion of chlorinated organic chemicals such as polychlorinated benzenes, polychlorinated phenols and polyvinyl chloride plastics.

(c) Fires in transformers containing chlorinated benzenes and polychlorinated biphenyls (PCBs) can result in the formation of chlorinated dioxins and furans.

How can exposure to dioxins occur?

Human exposure to 2,3,7,8-TCDD can potentially occur through the following routes:

- (a) direct exposure in certain industrial accidents;
- (b) inadvertent exposure during application of 2,3,7,8-TCDD contaminated herbicides on forests, rights-of-way, rangeland, etc.;
- (c) indirect exposure through ingestion of food materials which have been exposed to 2,3,7,8-TCDD;
- (d) direct exposure due to emissions from combustion processed and uncontrolled burning of some chlorinated organic chemicals; and
- (e) indirect exposure through leachates from certain abandoned sites.

The risks associated with any of these sources depend upon the level of exposure encountered in each case. These sources are currently being investigated with regard to potential toxicity and level of exposure so as to more adequately assess the risks involved.

What's the government doing about the hazards of dioxins?

In February 1979 under authority of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), EPA ordered emergency suspension of the major uses of the herbicides 2,4,5-T and silvex. The suspended uses include spraying rights-of-way, forests, pastures, home and recreational areas, and aquatic weeds. This suspension remains in effect as EPA continues hearings begun in March 1980 which seek the cancellation of the registration of 2,4,5-T and silvex. The effect of cancellation would be to alter the conditions of use of these materials. This could take the form of banning some or all of the uses, including those which are not subject to the current suspension action (e.g., spraying of rangeland, rice, orchards, and certain non-crop areas). EPA initiated these hearings because the Agency has concluded that the risks of adverse effects to the public health and the environment are unreasonable when compared to the benefits associated with the use of these chemicals.

In 1976 the Toxic Substances Control Act (TSCA) became law. This legislation is designed to protect human health and the environment from unreasonable risk connected with the manufacture, distribution, use and disposal of commercial chemical substances. Acting under provisions of TSCA, the Office of Pesticides and Toxic Substances (OPTS) has issued a rule requiring any chemical manufacturer or processor wishing to dispose of TCDD-contaminated wastes to notify EPA at least 60 days in advance so that the disposal plans can be reviewed and approved. In addition, on behalf of the Hazardous Waste Enforcement Task Force at EPA, the Department of Justice has filed several court actions against companies for improper disposal of hazardous wastes, including TCDD. These actions seek safe clean-up of TCDD-contaminated materials through court orders.

Under authority of the Clean Water Act, EPA plans to publish effluent guidelines for industrial discharges of TCDD into waterways. The Agency has also proposed a water quality criterion for 2,3,7,8-TCDD which can be used as a basis for regulation by EPA or by individual States.

An Agency-wide Chlorinated Dioxins Work Group (CDWG) has been established within EPA to coordinate dioxin-related activities. This group oversees the sampling and analysis of emissions from combustion sources such as municipal waste incinerators, hazardous waste incinerators, and coal-fired power plants. The CDWG, in connection with the Agency's Office of Research and Development and the Department of Energy, is also developing a comprehensive research and development program to consider the risks and benefits of combustion versus landfill as methods of solid waste disposal. The group also reviews the plans for the clean-up of hazardous dumpsites at several locations around the nation (and assists in the identification of other potentially hazardous sites). As a part of its task, CDWG is working to maintain EPA's international leadership in the development and utilization of methods which can detect TCDD in concentrations as low as one part per trillion (1ppt).

Outside the EPA, the Veterans Administration is working with the Department of Defense in an attempt to locate veterans who might have been exposed to 2,3,7,8-TCDD through the use of Agent Orange in Vietnam. Through an out-reach program, these veterans are receiving thorough medical examinations to determine if their health has been affected and to institute corrective action as necessary. These efforts and related research are being reviewed by a White House-established Interagency Work Group on the Long Term Health Effects of Phenoxy Acids and their Contaminants, chaired by the Department of Health and Human Services. EPA actively contributes to the work of this group.

What
questions
remain
unanswered?

There are still unanswered questions concerning dioxins and furans. Recent events suggest that these materials may be more pervasive than originally anticipated. Programs are being initiated to address the following questions:

- (a) What are the ambient levels of dioxins in the environment?
- (b) What are the sources of dioxin releases and what are their relative contributions?
- (c) How can these releases be reduced?
- (d) What is the toxicological significance of these releases?

Want more
information?

More extensive information on dioxins can be found
in an EPA publication available from the National
Technical Information Service. Request number EPA-
600/2-80-197 when ordering.

Please write to:

U.S. Environmental Protection Agency
ORD Publications
26 West St. Clair Street
Cincinnati, Ohio 45268

Veterans can get additional information on Agent
Orange from the Veterans Administration, by writing to:

VA Central Office, Room 848
810 Vermont Avenue, N.W.
Washington, D.C. 20420

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