

DIOXIN: What Every Person Should Know

A Factsheet by the Institute for Agriculture and Trade Policy

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Dioxins are probably the most studied chemical compound in the world today, yet there is still much about them that is not known. But what we do know is enough to have many people calling for action.

Although frequently referred to in the singular form, "dioxin," chlorinated dioxins are actually a group of chemicals that includes 75 dioxins, 135 furans and 209 polychlorinated biphenyls (PCBs). They are grouped together because their chemical structure is very similar, as are many of their suspected effects. The most potent form of dioxin, 2,3,7,8-tetrachlorodibenzo-p-dioxin, is often referred to as 2,3,7,8-TCDD.

Unlike many chemicals that have gained notoriety over the past twenty-five years of increasing environmental awareness, dioxin is not a "product," or an intentionally produced substance, like DDT, Agent Orange, Alar and the like. Dioxin is a *by-product* of many industrial processes such as the incineration of garbage, medical waste or toxic chemicals; bleaching of paper pulp with chlorinated compounds; production of polyvinyl chloride (PVC) plastics; manufacture of some chlorinated pesticides; secondary smelting of copper; and other activities. In order to produce dioxin, one needs organic matter (carbon), chlorine, and a chemically or thermally reactive environment, such as a pesticide production facility or an incinerator.

History of dioxin

Dioxin first gained widespread public attention in the U.S. when it was found as a contaminant of Agent Orange, a chlorophenoxy herbicide known for its use as a defoliant in Vietnam. Military use of Agent Orange was banned in 1970. One component of Agent Orange, 2,4,5-trichlorophenol (2,4,5-T) was cancelled in the U.S. in 1987 after it was found to be contaminated with several forms of dioxin.¹ The use of the other half of Agent Orange, 2,4-D, has been restricted but it remains a common ingredient in many lawn-care "weed and feed" preparations and is still used on some food crops.

Dioxin contamination also led to the evacuation of such communities as the neighborhood in Niagara Falls, New York which came to be known as "Love Canal," and Times Beach, Missouri. Accidents at pesticide plants in

Nitro, West Virginia in 1949, a BASF facility in Germany in 1953, and in Seveso, Italy in 1976² also exposed large groups of people to high doses of dioxin.

Health effects

Dioxin has gained so much attention because years of scientific research has shown it to be one of the most toxic substances known to humans. It has been linked to a wide variety of health effects in people and in animals:

- cancer of the soft or connective tissue; lung; liver and stomach; non-Hodgkin's lymphoma;
- male reproductive effects, including lower sperm counts, testicular deformities, decreased sex drive, alterations of male hormone levels, and feminization of hormonal and behavioral responses;
- female reproductive effects, including hormone changes, miscarriage, decreased fertility, changes in the menstrual cycle, and endometriosis;
- birth defects such as cleft palate, reproductive organ and genital deformities
- effects in offspring such as neurological and developmental problems, delayed puberty and reduced fertility
- damage to the central nervous system
- liver damage
- immune system damage, including increased susceptibility to infectious disease and to cancer

Recently, dioxin has gained attention as one of 51 chemicals known or suspected of disturbing the hormone system of humans or animals. These chemicals are commonly referred to as "endocrine [hormone] disrupting chemicals." Endocrine disrupting chemicals are of particular concern because the health effects show up not in the exposed parent, but in their offspring. Hormones regulate many processes in the body, including sexual development, reproduction and growth. Hormones are produced in exquisitely tiny amounts, yet exert monumental effects. Thus, scientists are concerned that even very, very small doses of dioxin or other endocrine disrupting chemicals could produce life-altering changes in animal offspring and human babies.

Dioxin in the environment

Dioxin is fat-soluble compound, so it concentrates in fat; it is not very water-soluble. It is also difficult to break down in the body, so it tends to persist in the environment and to build up in the food chain. Thus, when animals at the top of the food chain (including humans) eat other animals or animal products, such as fish or milk, they will take in some of that animal's body burden of dioxin along with the nutrients in the food. The U.S. Environmental Protection Agency (EPA) has estimated that 90 percent of our dioxin exposure comes from our food.⁴

Most dioxin enters the food chain in two ways. The Center for the Biology of Natural Systems has researched dioxin emissions from combustion sources like incinerators and cement kilns and found that dioxin can attach to dust particles or water vapor and travel up to 1000 miles from the facility.⁵ The dioxin then falls to the ground, where it often lands on hay or grazing pastures. The dioxin particles stick to the grass or hay and thus are eaten by dairy or beef cattle. Because of its fat solubility, the dioxin concentrates in the beef fat or milk fat and is thus passed on to the human consumer in beef, milk or dairy products.

The other main source of contamination comes from wastewater discharged by pulp mills that bleach paper pulp with chlorinated compounds. Chlorine combines with organic matter from the wood to form more than 1000 compounds referred to as "organochlorines." Dioxin is one of them. These organochlorines are released with wastewater into receiving waters such as lakes or rivers, where they can build up in fish and other aquatic wildlife.

How to get dioxins out of the environment?

It is important to remember that eliminating animal fat from one's diet will not make the dioxin problem go away; it would simply put farmers and fishers out of business. The only way to address the dioxin problem is to phase out the processes that *produce* dioxin.

Alternatives are readily available for many of the processes that generate dioxin. Indeed, dioxin expert Dr. Paul Connett has said, "If dioxin were a product [rather than an unwanted by-product], it would've been banned years ago."⁶

Clean production technologies, waste reduction, reuse and recycling can eliminate the need for garbage and hazardous waste incinerators and cement kilns.

Medical waste incineration, estimated by EPA to be the number-one estimated source of identified dioxin emissions, could be replaced with alternative technologies such as autoclaves or microwaves. Many of the PVC products in the medical wastestream as well as the household wastestream have readily available substitutes.

Nearly sixty percent of the PVC used in the U.S. goes into construction materials,⁷ and there, too, alternatives are available for windows, siding, plumbing pipes and fittings, and other fixtures.

The pulp and paper industry can convert to processes that are "totally chlorine-free" (TCF), meaning that no chlorinated agents are used in bleaching. The TCF process is in use at many pulp mills abroad, particularly in the Scandinavian countries, but only one U.S. mill -- Louisiana Pacific in Samoa, CA -- currently employs TCF technology. Also, many paper products do not actually require bleaching at all.

Resources for dioxin information

- Center for the Biology of Natural Systems, Queens College, Flushing, NY 11367. Phone: 718-670-4180; fax: 718-670-4189.
- "Stop Dioxin Exposure Campaign," Citizens Clearinghouse for Hazardous Waste, PO Box 6806, Falls Church, VA 22040. Phone: 703-237-2249; fax: 703-237-8389; e-mail: cchw@essential.org
- *Dying from Dioxin: A Citizens' Guide to Reclaiming Our Health and Rebuilding Democracy*, by Lois Gibbs and the Citizens Clearinghouse for Hazardous Waste, South End Press, 1995. (ISBN 0-89608-525-2) \$20.00. Available in bookstores.
- *RACHEL'S Health & Environment Weekly*. Produced by the Environmental Research Foundation, PO Box 5036, Annapolis, MD 21403-7036. Phone: 410-263-1584; fax: 410-263-8944; e-mail: erf@rachel.clark.net
- Institute for Agriculture and Trade Policy, 1313 5th St. SE, #303, Minneapolis, MN 55414. Phone: 612-379-5980; fax: 612-379-5982; e-mail: iatp@iatp.org
- *Waste Not*. Produced by Work on Waste USA, 82 Judson St., Canton, NY 13617. Phone: 315-379-9200; fax: 315-379-0448.

Sources:

¹ *Basic Guide to Pesticides: Their Characteristics and Hazards*, Shirley A. Briggs, Taylor & Francis: Washington, DC. 1992. p. 193

² *Dying from Dioxin: A Citizens' Guide to Reclaiming Our Health and Rebuilding Democracy*, by Lois Gibbs and the Citizens Clearinghouse for Hazardous Waste, South End Press: Boston. 1995. pp. xxix - xxx.

³ *Ibid.*, pp. 138-139.

⁴ *Estimating Exposure to Dioxin-Like Compounds*, Volume 1: Executive Summary review draft, USEPA Office of Research and Development, USEPA: Washington, DC. June 1994. p. 36.

⁵ "New Report Shows Dioxin Fallout Dusting Entire United States," Environmental Media Services press release, May 18, 1995.

⁶ Phone conversation with Dr. Paul Connett, November 29, 1995.

⁷ Presentation by Thomas A. Waltermire of The Geon Company to Goldman, Sachs & Company Fourth Annual Chemical Investors Forum, May 21, 1996.