Fact Sheet
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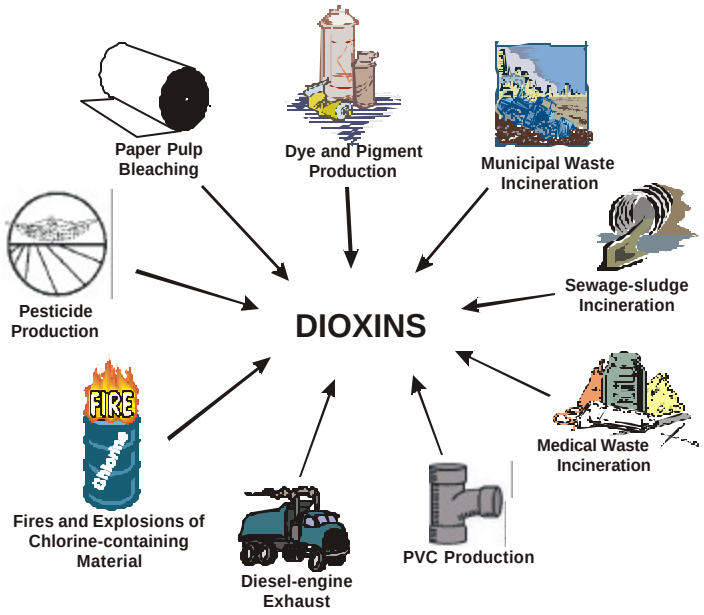
Alaska Department of Environmental Conservation
Division of Spill Prevention and Response

Dioxins and the Haines-Fairbanks Pipeline

What are dioxins?
Dioxins are a group of chemical compounds that share certain similar chemical structures and properties. Sometimes the term dioxin is also used to refer to the most well studied and the most toxic dioxin, 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TCDD). 2,3,7,8-TCDD was the contaminant of potential concern driving the recent investigation of the Haines-Fairbanks Pipeline.

What are sources of dioxin?
There are multiple sources of dioxins in the environment. Dioxin is not intentionally manufactured; it is a by-product of combustion and production processes involving chlorine. Dioxins are released into the air from commercial, municipal, and residential waste incineration and from burning fuels like wood, coal or oil. Dioxins can also be formed when household trash is burned and during forest fires. Chlorine bleaching of pulp and paper, certain types of chemical manufacturing and processing, and other industrial processes all can create small quantities of dioxins. The levels of dioxins in the environment that may come from any of these sources but can not be linked to one specific source are called background levels.

Dioxins can be made in the manufacturing of herbicides. The Haines-Fairbanks Pipeline investigation concerned possible aerial spraying of herbicides that may have contained dioxin. The dioxin 2,3,7,8-TCDD is a contaminant which was at times unintentionally generated during the manufacture and storage of the herbicide 2,4,5-trichlorophenoxy acetic acid (2,4,5-T). Unlike other sources of dioxin, the manufacture of that herbicide almost exclusively yielded 2,3,7,8-TCDD. This fact allows the most toxic form of dioxin, the one associated with herbicides, to be distinguished from the much more common types of dioxin associated with incineration. The herbicides known as "Agent Orange" and "Esteron," if applied to the pipeline, would have contained 50% 2,4,5-T and thus may have contained the dioxin 2,3,7,8-TCDD.



What are the health effects of dioxin exposure?
The health effects of exposure to any chemical are determined by many factors. Probably most important are the amount of the chemical people take into their body, called their exposure, and the length of time they are exposed. The body can sometimes eliminate small amounts of toxic chemicals without harmful effects. Also, some people are more sensitive to the effects of certain chemicals than other people. All these factors mean there is uncertainty about the health effects of dioxin contamination in the environment. Since scientists can not always eliminate all this uncertainty, they often talk about the probability, or the risk, of a negative health effect.

The most noted health effect in people exposed to large amounts of 2,3,7,8-TCDD is chloracne.

Chloracne is a severe skin disease with acne-like lesions that occur mainly on the face and upper body. Other effects of exposure to large amounts of dioxin include skin rashes, skin discoloration, excessive body hair, and possibly mild liver damage. The levels of dioxins found to date along the Haines-Fairbanks Pipeline are just at background levels and are not high enough to cause chloracne or these other effects.

One of the main health effects of concern for dioxins is cancer in adults. Cancer is a common disease and is related to genetic, environmental and behavioral factors. Several studies suggest that workers who were exposed to high levels of dioxins at their workplace over many years have an increased rate of cancer. Animal studies have also shown an increased rate of cancer from long-term exposure to dioxins.

Animal studies show that exposure to low levels of dioxins over long periods might result in reproductive or developmental effects. These could include weakened immune responses and behavior changes in offspring. Human studies have *not* shown these effects.

What happens to dioxins when they enter the environment?

When released into the air, some dioxins may be transported long distances. Because of this, dioxins are found in most places in the world. When released into water, they tend to settle into sediments where they can be further transported or ingested by fish and other aquatic organisms.

Dioxins are broken down in the environment very slowly and can be deposited on plants and taken up by animals and aquatic organisms. Dioxins may be concentrated in the food chain, so that animals have higher concentrations than plants, water, soil or sediment. This is known as bioconcentration. Within animals, dioxins tend to accumulate in fat.

The sampling plan to detect dioxin along the pipeline corridor was based on several assumptions. If contaminated herbicides had been aerially applied along the pipeline, most of the impacts would be expected to be in the 50-foot wide pipeline corridor. A dioxin-containing herbicide, if used, would have likely been a broad leaf defoliant. This type forces the plant to drop its leaves to the ground. Over time the leaves would naturally decay and break down. The dioxin would enter the ground from either being sprayed directly on the ground or from the breakdown of the leaf litter. Dioxins, and in particular 2,3,7,8-TCDD, will bind strongly to organic material in soil: they have a very strong affinity for organic carbon due to their chemical structure. Also, dioxins are almost insoluble in water, so that once they bond to organic carbon, water will not leach the dioxin deeper into the soil. In the case of the Haines-Fairbanks Pipeline almost all of the sites sampled had very well developed peat or humic layers (high in organic carbon) found just above the mineral soil. Therefore, sampling was limited to less than two inches below the current leaf litter.

How much dioxin can be in the soil before it poses a risk to human health?

Neither the Alaska Department of Environmental Conservation (DEC) or the U.S. Environmental Protection Agency (EPA) has specific dioxin cleanup levels in regulation.

DEC sets cleanup levels for compounds that have the potential to cause cancer at a risk standard of one-in-one hundred thousand (1 in 100,000) to determine when cleanup is needed at a site. This risk standard means that people, including sensitive individuals (i.e., children or pregnant women), living on the site and having direct contact with the contaminated soil over thirty years will not increase their chance of developing cancer during their lifetime by more than 1 in 100,000 as a result of that exposure. Based on standard risk assessment assumptions, the default soil cleanup level for 2,3,7,8-TCDD in a residential setting in Alaska would be 39 nanograms per kilogram of soil (ng/kg). Alternative cleanup levels could be developed through an approved, site specific risk assessment.

Both EPA and DEC use a screening level to determine if contaminants at a site need to be looked at through further investigation. The Haines to Fairbanks pipeline investigation report refers to

an EPA Region 9 preliminary remediation goal (PRG) of 3.9 ng/kg for 2,3,7,8-TCDD. This screening level PRG was calculated to correspond to a risk level of 1 in 1,000,000 based on an assumption someone lives on the site as described above.

Four soil samples collected along the pipeline contained dioxins levels higher than the 3.9 ng/kg screening level but lower than the 39 ng/kg risk-based soil cleanup level. DEC evaluated the four samples that exceeded the screening level and found that the forms of dioxins in the samples were not any which would likely be from herbicide use, but were compounds that are products of burning or other industrial sources. All the other samples contained levels below the most stringent screening level (EPA PRG of 3.9 ng/kg). **No herbicide-related dioxin contamination was found along the pipeline.**

How common is dioxin in the environment?
Dioxins have been around in the environment for a very long time. They can be created in forest fires, and other natural combustion. The industrial revolution marked a time of significant increase in the production of dioxins, which continues today. Dioxins can be found in our food supply and our bodies. Eating food, primarily meat, dairy, and fish account for most of the intake of dioxins. Inhalation is another pathway for exposure but makes up a smaller portion of an exposure scenario.

Is there a medical test to show whether I've been exposed to dioxins?
Tests are available to measure dioxin levels in body fat, blood and breast milk but these tests are not routinely available. Most people have low levels of dioxins in their body fat and blood. Dioxin testing in humans is not recommended unless there is a definite reason to believe someone has been exposed to high levels. Although dioxins stay in body fat for a long time, tests cannot be used to determine when exposure occurred.

Other Resources on Dioxins and Risk Assessment

- Agency of Toxic Substances and Disease Registry *ToxFAQS – Chlorinated Dibenzo-p-dioxins (CDDs)* http://www.atsdr.cdc.gov/tfacts104.pdf
- EPA *Dioxin Frequently Asked Questions* http://cfpub.epa.gov/ncea/cfm/dioxin.cfm
- World Health Organization *Dioxins and Their Effects on Human Health* http://www.who.int/inf-fs/en/fact225.html
- EPA *Exposure and Health Reassessment of 2,3,7,8-Tetrachlorodibenzo-p-Dioxin (TCDD) and Related Compounds* (DRAFT) http://www.epa.gov/ncea/pdfs/dioxin/part2/dritoc.pdf

Additional Information
Information for this Fact Sheet was produced specially for the Haines-Fairbanks Pipeline.

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