



dioxins and furans:

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# Health Questions

This brochure addresses the potential health effects associated with exposure to dioxins and furans

## About this Brochure

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The Michigan Department of Environmental Quality (MDEQ) has found higher than normal levels of dioxins and furans in soil and sediments of the Tittabawassee River and floodplain from Midland, Michigan into the Saginaw River and in certain parts of the City of Midland.

The Dow Chemical Company (Dow), which has manufacturing operations in this area, is thought to be responsible for these increased levels of dioxins and furans. Dow is required by its hazardous waste facility operating license to provide information about dioxins and furans to the general public so that people living in these areas can make informed decisions about limiting their potential exposure to these contaminants. This brochure covers potential health effects of dioxins and furans and is one of a series of publications that addresses the topic of dioxins and furans in mid-Michigan.

The information in this brochure has been reviewed and approved with modifications by the MDEQ. Dow does not necessarily agree with all of the information contained in this brochure. The sources for the information contained in this brochure are from the U.S. Environmental Protection Agency (EPA), the Agency for Toxic Substances and Disease Registry (ATSDR), the World Health Organization (WHO), the International Agency for Research on Cancer (IARC) and published peer-reviewed scientific literature.

## Where are the Priority Areas?

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The maps at the end of this brochure show the areas where higher levels of dioxins and furans are expected based on

concentrations that have been found in the City of Midland and along the Tittabawassee River downstream of Midland.

In the Tittabawassee floodplain, areas that have been repeatedly flooded have been shown to have higher levels of dioxins and furans. Higher levels have also been found outside of the floodplain in areas where contaminated soils have been moved and relocated. Residential properties where homes flooded or came close to flooding in March of 2004 and agricultural properties that flooded in 2004 have been identified as “Priority Areas” for initial response activities by Dow.

In Midland, higher than normal levels of dioxins and furans have also been found in surface soils located north and east of the Dow plant site. Levels appear to decrease in soils that are located further away from the plant. Several Priority 1 neighborhoods have been identified in this area based on location and historic sampling information.

## Background

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### What are dioxins and furans?

Dioxins and furans are a group of chemical compounds that have similar structures and chemical properties. These compounds usually are grouped together and referred to simply as “dioxins.” Because dioxins are usually found as mixtures, the total toxicity of the 17 most toxic dioxin and furan compounds is usually expressed as a single value, the toxic equivalent concentration, or TEQ.

Some polychlorinated biphenyls (PCBs) also have dioxin-like toxicity and may be included in reported TEQ values. In the Priority Areas covered by these brochures, dioxin-like PCBs have not been measured at elevated levels.

Most of the dioxins that are present in the environment today were formed as unintentional by-products of certain industrial manufacturing processes, waste incineration, and combustion

processes. Dioxins break down in the environment very slowly, usually over decades or centuries. Changes in manufacturing processes and increased environmental controls have resulted in a steady decline in releases of dioxin and typical levels in the environment.

In Michigan, the typical or “background” level of dioxins in soils is less than 10 parts per trillion (ppt) TEQ. In the Priority Areas, dioxin levels in soils and river sediments can range from this “background” concentration up into the hundreds of parts per trillion in certain parts of the City of Midland and into the thousands of parts per trillion in and along the Tittabawassee River.

Dioxin compounds do not readily dissolve in water, but tend to attach to soils and sediments. Dioxins build up in the bodies of fish, wildlife, domesticated animals and people, and tend to concentrate in the liver and fat.

#### What are the current sources of dioxins?

Current emissions of dioxins from Dow’s Midland facility are very low and are not thought to contribute significantly to the existing elevated levels of dioxins in Midland and in and along the Tittabawassee River. Today, the major sources of dioxin contamination in the Tittabawassee River and in the City of Midland are the contaminated soils and river sediments that remain from past releases. Elevated levels of dioxins are also found in some species of fish and animals living in the Tittabawassee River and floodplain.

#### Elevated levels of dioxins have been found in:

- ☞ Sediments in the Tittabawassee River
- ☞ Soils in the Tittabawassee River floodplain
- ☞ Soils that have been relocated from the Priority Areas
- ☞ Eggs from chickens raised on the floodplain

## Exposure

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- ☞ Wild game and other animals from the flood plain and river
- ☞ Fish from the Tittabawassee River
- ☞ Surface soils in certain parts of the City of Midland

### How can my family and I be exposed to dioxins?

Researchers believe that for the general public, most dioxin exposure comes from food, especially foods high in animal fat.

In addition, people living in the Priority Areas may be exposed to higher levels of dioxins than the general public by eating locally harvested fish and wild game and locally grown foods (e.g., produce, meat, dairy products, eggs) that contain dioxins at levels greater than the national food supply. Exposure can also occur by incidentally consuming small amounts of contaminated soil, sediments, and blowing dust. To a lesser extent, exposure can also occur by skin contact with contaminated soils and sediments.

Depending on an individual's diet, occupation, and personal habits/behaviors the amount of dioxin entering the body from each exposure pathway can vary greatly.

Since dioxins build up in the body over time, the levels in your blood or other tissues are mostly from past exposures. It takes time for those levels to build up and once exposures are decreased, it will also take time for levels in your body to decline.

Although breast milk is a source of dioxin exposure for nursing infants, studies consistently show that breastfed infants are healthier than formula fed infants, in spite of the dioxin in breast milk. This statement is even truer now that typical or background levels have declined.

# EXAMPLES OF POTENTIAL EXPOSURES FROM

Outdoor Activity

Swimming

Contaminated Soil

Contaminated Sediment

Dirty Hands, Dust

Water

Incidental

Ingestion

House Dust

Contaminated Dust Cloud

Working Field

Near by Farming

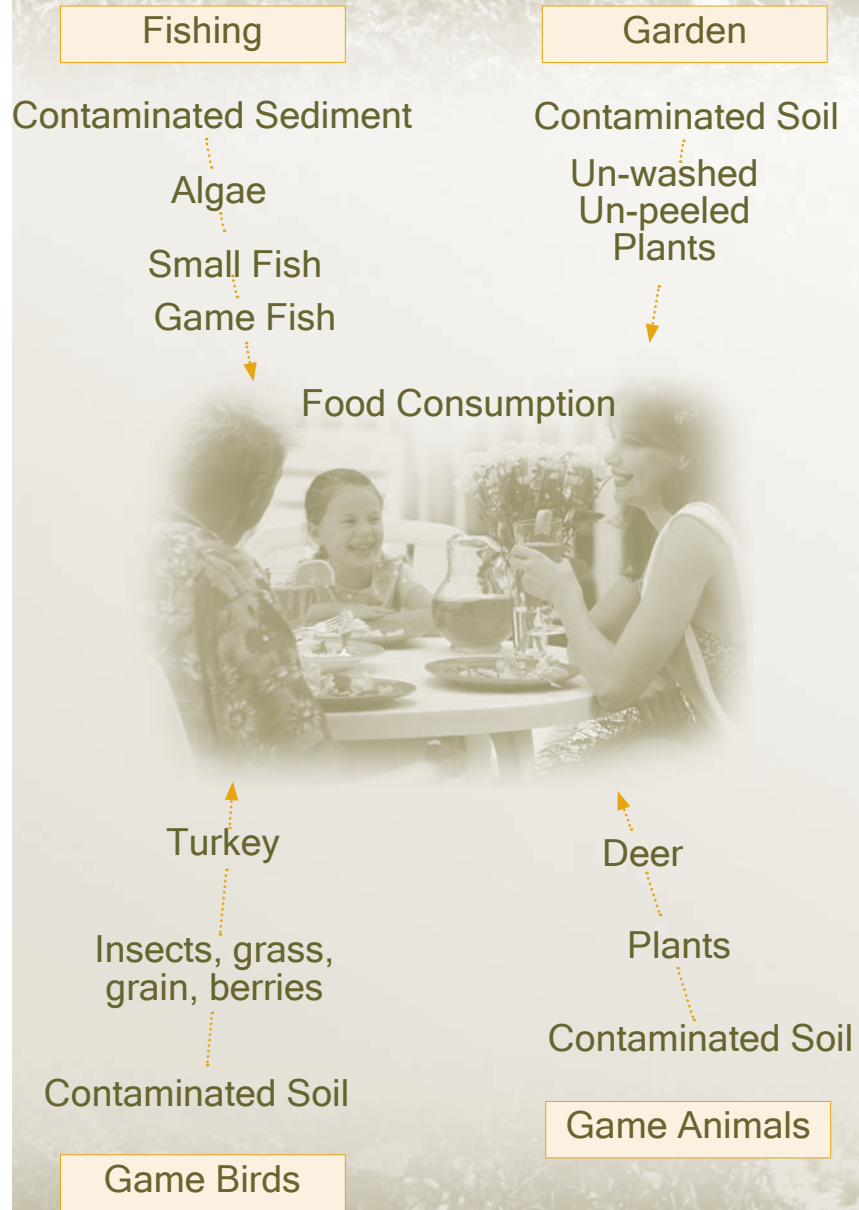
Track-in

Contaminated Soil

Outdoor Activity

HEALTH EXPOSURE PATHWAYS

## EXAMPLES OF POTENTIAL EXPOSURES





There are overwhelming benefits of breastfeeding both for the mother and her infant. The American Academy of Pediatrics and many other professional organizations have concluded that the benefits of breastfeeding far outweigh the potential effects of dioxin in breast milk. Breast milk is known to be the most complete form of nutrition for infants, with benefits for infant health, growth, immunity, and development. If you are concerned about this issue, you should consult your doctor.

#### Does amount of exposure make a difference?

The EPA, WHO, MDEQ, Michigan Department of Community Health (MDCH) and others agree that lower levels of exposure result in a lower risk for adverse health effects. Higher exposure leads to a greater risk for health effects.

#### Is there a safe level of exposure?

There is disagreement in the scientific community on the question of whether there is a safe level or frequency of exposure to dioxins. Until scientists understand more about these compounds, public policy will focus on protecting the more sensitive groups of people, such as children and women of childbearing age.

## Health Effects

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#### How do we know that dioxins cause health effects in people?

There are studies of people who were exposed to high levels of dioxins at their work place that manufactured chemicals contaminated with dioxins, through industrial accidents, and in contamination incidents.

Many of these studies have demonstrated adverse effects, but there are not always consistent results among these studies. It is easy to determine if an effect is associated with dioxin exposure for some effects that are obvious and/or occur soon after exposure, such as a severe acne-like skin condition called



chloracne. For other effects (e.g., cancer, chronic diseases like heart problems and diabetes), it may take many years before health effects, if any, are seen. For these types of effects it is not as easy to determine if the effect is from exposure to dioxins.

Human studies are often difficult to interpret because every person lives differently. In addition, the people in many of these studies were exposed to a number of chemicals at the same time and scientists cannot control those differences. It takes a lot of exposed people in a well designed study to see increases in common conditions such as heart disease, diabetes and some types of cancer.

People and other mammals tend to respond to dioxin in similar ways at the cellular level. Therefore, many scientists believe that it is reasonable to assume that people may experience the same health effects as those seen in mammal studies. However, it is not known whether people exposed to dioxins experience all of the same health effects as those seen in the animal studies.

In studies conducted on mammals, lower level exposures have shown effects on the immune system, hormone levels, and the development of the brain, reproductive system and tooth enamel. Increased incidence of some of these effects has also been observed in people and children exposed prenatally to elevated levels of dioxins in combination with other chemicals. However, not all health effects observed in studies of animals exposed to dioxins have been looked for or observed in humans.

### Which dioxins are associated with or contribute to cancer in people?

The WHO's International Agency for Research on Cancer, the U.S. Department of Health and Human Services (DHHS), and the EPA have classified one dioxin compound, 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD), as a human carcinogen.

The WHO, the DHHS, and the EPA believe that the other dioxin-like compounds and mixtures of those compounds are likely to increase cancer incidence through action similar to TCDD.

The most consistent findings from human studies of TCDD exposure show a small increase in all cancers combined and lung cancers in workers with the highest exposures. Increases in other cancer types have also been seen in individual studies. Animal studies have shown increases in cancers of the liver, lung, skin, thyroid, and soft tissues. The weight of scientific evidence from animal and human studies shows that dioxins may increase the incidence of multiple types of cancer.

#### What other health effects may be associated with dioxin exposure in people?

Chloracne, a severe acne-like disease, is known to be associated with high levels of exposure to dioxin. Some studies in highly exposed humans have also found association between dioxin exposure and heart disease, diabetes, and altered liver function. In addition, animal studies with lower level exposures have shown effects on the immune system, hormone levels, and the development of the brain, reproductive system and tooth enamel. Some studies on humans exposed to mixtures of dioxins and other chemicals have shown similar effects on the developing immune system, brain and tooth enamel.

#### Are some people more sensitive to the effects of dioxins than others?

Limited human studies and many animal studies suggest that fetuses, infants and children may be more sensitive to adverse effects of dioxins because they are growing and developing rapidly. The human studies have shown that children exposed in the womb have experienced some adverse health effects that are associated with increased exposure to dioxins.

### Has the health of people living in the floodplain been affected by dioxins?

It is not known if any health effects or illnesses have occurred in people as a result of exposure to dioxins in the Tittabawassee River floodplain or in the City of Midland.

### What can I do to limit my exposure?

Since the major way dioxins enter our bodies is through the food we eat, this gives us an important opportunity to prevent exposure. Pay careful attention to fish and wild game consumption advisories before eating fish or animals from the Tittabawassee River or floodplain. Fish and wild game consumption advisories are available free from the MDCH at 800-648-6942 or <http://www.michigan.gov/mdch>. The Michigan Department of Agriculture highly recommends not purchasing, eating, or selling home raised livestock from the Tittabawassee floodplain until the dioxin status of the property on which the animals were raised can be assessed. This recommendation includes livestock, eggs, and dairy products from animals that were raised, foraged, or fed forage grown on contaminated soils. Also, trim fat from meat, consume low-fat dairy products, and cook foods in ways that decrease the fat content to help reduce your level of dioxin exposure.

Avoid contact with soils and sediments that are known or suspected of being contaminated with dioxins. Children should not play in soil or sediment where there is known or suspected dioxin contamination. If you come into contact with soils suspected of containing dioxins, be sure to wash your hands and avoid tracking soil into living areas. Soil in gardens and lawns can be replaced or covered if dioxin contamination is known or suspected. Care should be taken not to disturb the layer of clean soil covering the contaminated soil. Care should be taken to avoid creating dust from soils believed to be contaminated with dioxins.

For more information on limiting exposure, see the brochure titled “Dioxins and Furans – Reducing Exposure at Home.”

## About the Brochures in this Series

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The brochures in this series are intended to provide straight-forward information so the public can make informed personal decisions about limiting potential exposure to dioxins or about other issues related to dioxin contamination. The brochures are part of an “interim response activity” for the Priority Areas.

Interim response activities are actions that are taken to control risk of exposure to dioxins or other contaminants, while longer-term plans for permanent corrective action are developed and implemented.

The brochures are being produced at the direction of MDEQ, with funding from Dow.

For questions about the Dow hazardous waste facility operating license or about the corrective action process, please contact the MDEQ at 517-373-9881.

The MDEQ, MDCH, and MDA are largely responsible for the content of this brochure.

## Other Brochures in This Series

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- Overview of Dioxins and Furans
- Overview of the Corrective Action Process
- Reducing Exposure at Homes
- Reducing Exposure during Recreational Activities
- Reducing Exposure from Agricultural Activities
- Reducing Exposure for Workers Who Have Contact with Contaminated Media
- Management of Disturbed Soils and Dredged Sediments
- How Regulations Affect Impacted Property Owners
- Fish Advisory for the Saginaw Bay Watershed
- Wild Game Advisory for the Tittabawassee River Watershed

## These brochures can be found at several public locations:

These brochures, as well as other educational materials that have been produced by public health organizations have been placed at several public locations:

### – Bay County:

- Sage Branch Library; 100 E. Midland Street; Bay City MI 48706
- Bay City Branch Library; 708 Center Avenue; Bay City, MI 48708

### – Saginaw County:

- Hoyt Library; 505 Janes Avenue; Saginaw, MI 48607
- James Township Hall; 6060 Swan Creek Road; Saginaw, MI 48609
- Zauel (Saginaw Township) Library; 3100 N. Center Road; Saginaw, MI 48603
- Thomas Township Library; 8207 Shields Drive; Saginaw, MI 48609
- Tittabawassee Township Hall; 145 S. Second Street; Freeland, MI 48623

### – Midland County:

- Grace A. Dow Memorial Library; 1710 W. St. Andrews Street; Midland, MI 48640

– Electronic versions of the brochures are housed on various web sites, including:

– Michigan Department of Environmental Quality (MDEQ):  
<http://www.michigan.gov/deqdioxin>

– Michigan Department of Community Health (MDCH):  
<http://www.michigan.gov/mdch>

– The Dow Chemical Company: <http://www.dow.com>

### More information about dioxins also can be found at:

– Agency for Toxic Substances and Disease Registry (ATSDR):  
<http://www.atsdr.cdc.gov>

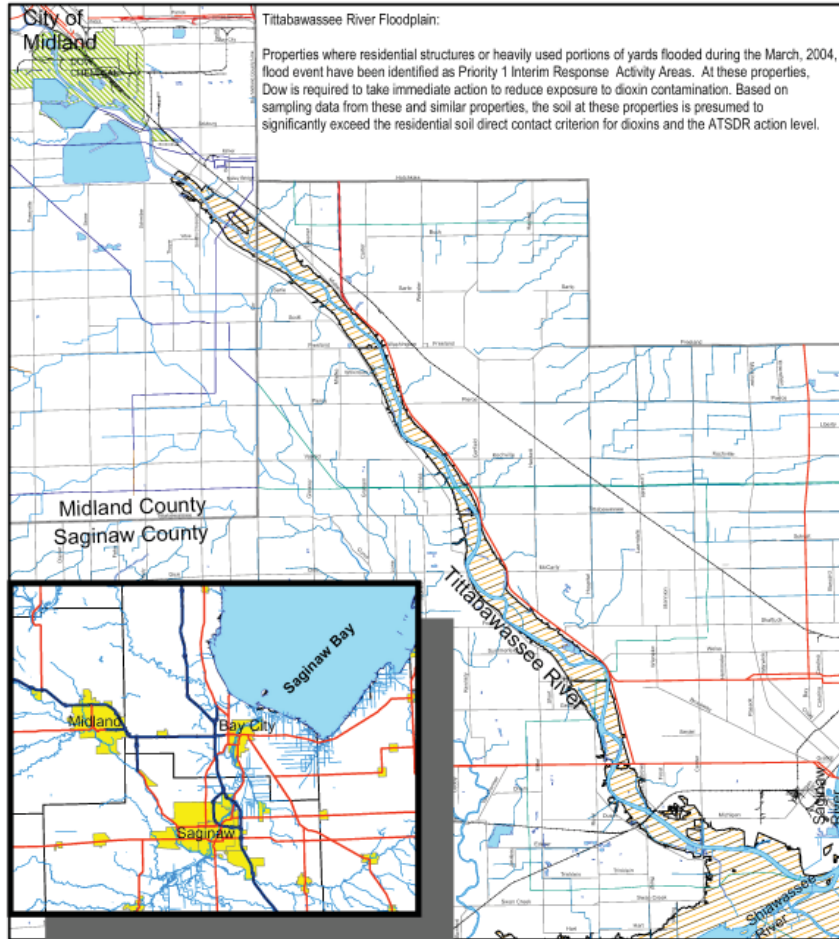
– Michigan Department of Agriculture:  
<http://www.michigan.gov/mda>

– National Toxicology Program:  
<http://ntp.niehs.nih.gov>

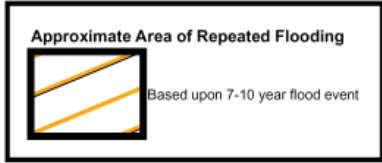
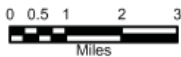
– United State Environmental Protection Agency:  
<http://cfpub.epa.gov/ncea>

– World Health Organization (WHO):  
<http://www.who.int/mediacentre/factsheets/fs225/en>

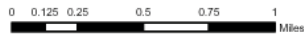
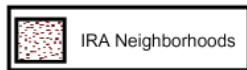
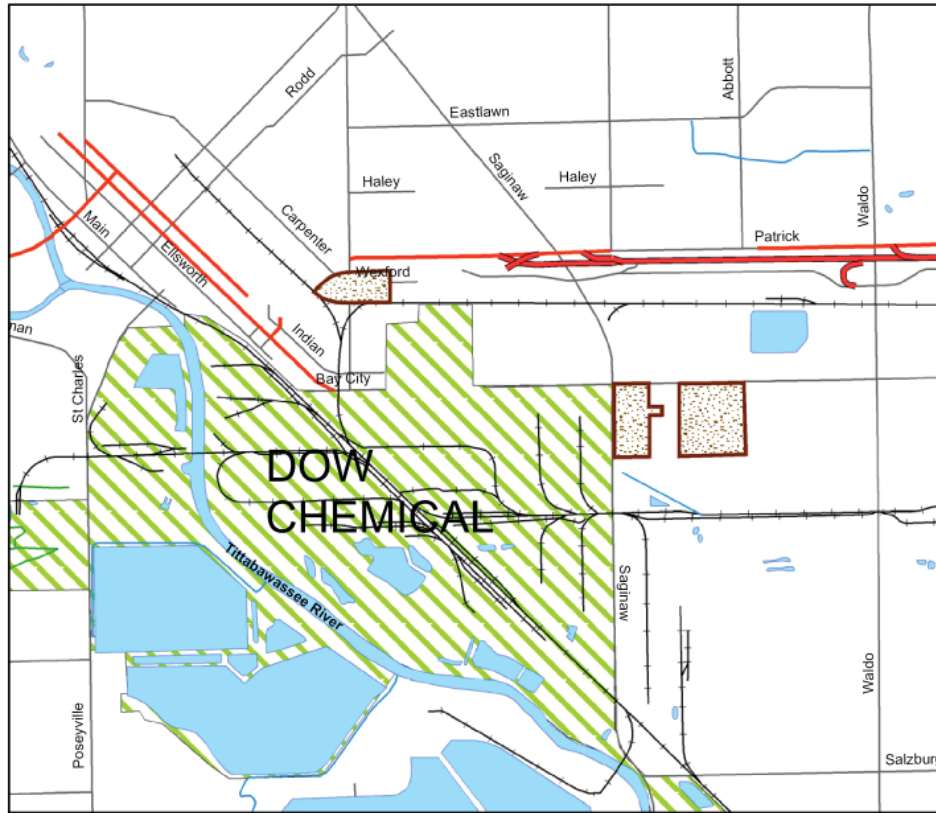
# Tittabawassee River Floodplain



Tittabawassee River Floodplain:  
Properties where residential structures or heavily used portions of yards flooded during the March, 2004, flood event have been identified as Priority 1 Interim Response Activity Areas. At these properties, Dow is required to take immediate action to reduce exposure to dioxin contamination. Based on sampling data from these and similar properties, the soil at these properties is presumed to significantly exceed the residential soil direct contact criterion for dioxins and the ATSDR action level.



## Midland Priority 1 Neighborhoods



City of Midland: The full extent of the Midland contamination has not yet been determined. Based on existing information, three neighborhoods that are close to and downwind of the Dow Midland Plant Site have been identified as Priority 1 Interim Response Activity Areas for immediate action by Dow to reduce exposure to dioxin contamination. These areas are presumed to significantly exceed the residential soil direct contact criterion for dioxins, based on soil sampling by the DEQ, Dow, and the U.S. Environmental Protection Agency. As part of the Corrective Action Process, Dow may develop site specific cleanup criteria and will further define the extent of contamination for remediation purposes.



For questions about the The Dow Chemical Company's operating license or about the Corrective Action Process, please contact the MDEQ at 517-373-9881.

The Michigan Departments of Environmental Quality, Community Health and Agriculture are largely responsible for the content of this brochure.

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