dioxins and furans:

Reducing Exposure from Agricultural Activities

About this Brochure

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 reducing exposure to dioxins and furans from agricultural activities 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?

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 2005 and 2006.

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

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 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
- 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

Dioxins and Agriculture in the Floodplain

There are currently an estimated 3,500 acres of agricultural land being farmed in the Tittabawassee River floodplain. As farmers actively work in their fields and with livestock, many have asked about reducing their risk of exposure to dioxins; about limiting exposure of livestock; and for assistance in identifying planting alternatives.

This brochure provides background information on dioxin and describes some recommended methods of reducing exposure during agricultural activities.

Exposure

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. Fruits and vegetables do not appreciably take up dioxins through their roots. However, dioxin contaminated soil particles may adhere to fruits and vegetables and therefore they should be carefully washed and/or peeled. 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.


FARMING
Outdoor Activity
Harvest
Contaminated Soil
Combining
Dirty Hands, Dust
Contaminated Dust Cloud
Contaminated Dust Cloud
Working Field
House Dust
Planting
Track-in
Contaminated Soil
Outdoor Activity
HEALTH
EXPOSURE
PATHWAYS

POTENTIAL EXPOSURES FROM EATING LIVESTOCK

Livestock

Contaminated Soil

Plants

Cows-Pigs

Meat

Livestock

Contaminated Soil

Plants

Cows

Milk

Food Consumption

Meat

Chicken

Contaminated Soil

Poultry

Eggs

Chicken

Contaminated Soil

Poultry

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.

Does amount of exposure make a difference?

The EPA, WHO, MDEQ, Michigan Department of Community Health (MDCH) and others all 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 most sensitive groups of people, such as children and women of childbearing age.

Recommendations to Reduce Exposure for Farmers

Dioxins found in the repeatedly flooded areas along the Tittabawassee River from Midland to the Saginaw River are mainly attached to soils and sediment. Important exposure pathways for farmers are diet (especially through consumption of locally grown livestock, eggs, and dairy products, fish from the Saginaw Bay watershed and wild game from the Tittabawassee River floodplain) and through incidentally consuming small amounts of contaminated soil, and dust that result from typical farming practices.

Minimizing potential dioxin exposure from diet

The following are recommendations for reducing potential exposure to dioxins from diet:

MDCH recommends following the state's fish advisory and wild game consumption advisory for dioxins in effect for this area of mid-Michigan.

The Michigan Department of Agriculture (MDA) 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.

Copies of these advisories and recommendations are available at www.michigan.gov/deqdioxin.

In addition, because dioxins build up in the food chain, MDA and MDCH recommend the following general guidelines for reducing potential dioxin exposures via food:

- Consume a balanced diet low in fats of animal origin
- Trim fat from foods
- Cook foods in ways that reduce animal fat content
- Thoroughly wash, pare or peel any garden produce grown in contaminated soils.

Consuming a "Heart Healthy Diet" is recommended. Information on a "Heart Healthy Diet" can be found at: http://nhlbisupport.com/cgi-bin/chd1/step1intro.cgi

Reducing Exposure for Livestock

Cows, sheep, pigs and chickens on the Tittabawassee River floodplain can be exposed by eating contaminated soil – both during grazing and by eating the soil that may have accumulated on the surfaces or these forages. For most plants, root uptake of dioxins from soil has been shown to be minimal.

Farmers can reduce the amount of dioxins to which their livestock are exposed by not raising livestock or forage crops on contaminated soil. Dioxin contaminated soils are likely to be present in areas that have been repeatedly flooded by the Tittabawassee River.

One way to reduce soil consumption is to alter an animal's living conditions.

For example, animals that live in unpaved feed lots with ponds, surface water and forage grasses have direct access to contaminated soils and sediments. These animals could be moved to a location with uncontaminated soils and the farmer could ensure that the animal is not exposed to contaminated roughage, forage and surface water.

Minimizing Potential Dioxin Exposure from Soils

Since dioxins can attach to soil particles and remain for long periods of time, the following recommendations are for people who work with land or soil in areas that are suspected of being contaminated with dioxins.

To minimize exposure through soils:

- ☞ Try to minimize inhaling and swallowing airborne soil particles and dust.
- ☞ Control dust by farming when soil is moist and under favorable wind conditions.
- ☞ Wash dirt and mud from items like outerwear, gardening tools and supplies outside after each use and store them outside.
- ☞ Designate certain clothing, including footwear and tight-fitting disposable gloves for farming use only. Remove footwear before entering the house and manage work clothes in a way that limits the amount of contaminated soil that may be carried into the house.

- ☞ After farming, wash all exposed areas of skin, preferably by showering, as soon as possible.
- ☞ Do not eat unwashed produce or other foods.
- ☞ Do not drink, smoke or engage in other activities while farming that may introduce soil into the mouth.
- ☞ Use minimum tillage, no-till and dust reduction practices in any production cycle.

Additional information and recommendations are also found in the brochure from this series entitled “Dioxins and Furans: Reducing Exposure at Home.”

Conservation Reserve Enhancement Program

Farmers who have agricultural land next to the Tittabawassee River may be eligible to enroll in the state’s Conservation Reserve Enhancement Program (CREP).

Through CREP, farmers have the option to enroll qualified cropland into prescribed conservation practices for 15 years or in some cases, permanent “conservation easements” may be available. Landowners will receive financial incentives for lands they have enrolled in the program.

In return, the landowner agrees to maintain specific conservation practices on their land. The conservation practices eligible for CREP include filter strips, wetland restorations, whole field grass planting, and windbreaks. CREP takes sensitive cropland out of production, reducing agricultural impact on the water resources. These conservation practices will reduce sediment runoff, water erosion and wind erosion, and enhance wildlife habitat and diversity.

Food and Agricultural Recommendations

Persons consuming or selling animals or animal products (eggs, milk, chicken, etc.) raised, foraged or fed forages grown on the Tittabawassee River floodplain Priority Areas should contact the MDA for help in determining whether these products are safe for consumption.

The MDEQ has detected elevated concentrations of dioxin in some floodplain soil samples. Further study has identified residents who are raising livestock for personal consumption or local distribution.

While location analysis has not identified any commercial livestock production in the affected area, analysis of eggs obtained from chicken for personal consumption at one residence showed elevated levels of dioxins. In addition, game species and other wildlife from the floodplain have been shown to contain elevated levels of dioxins.

About the Brochures in this Series

The brochures in this series are intended to provide straightforward 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

– Overview of Dioxins and Furans
– Overview of the Corrective Action Process
– Dioxins and Furans Health Questions
– Reducing Exposure at Homes
– Reducing Exposure during Recreational 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:

– 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

– Michigan Department of Agriculture (MDA) http://www.michigan.gov/mda

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

For More Information

Contact the following for additional information on dioxins and agriculture:

Dr. Brian Hughes, MDA toxicologist, 517-241-3267 or via e-mail at hughesb9@michigan.gov.

Steve Shine, MDA CREP Program Manager, 517-373-9798 or via e-mail at shines@michigan.gov.

More information about dioxins also can be found at:

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

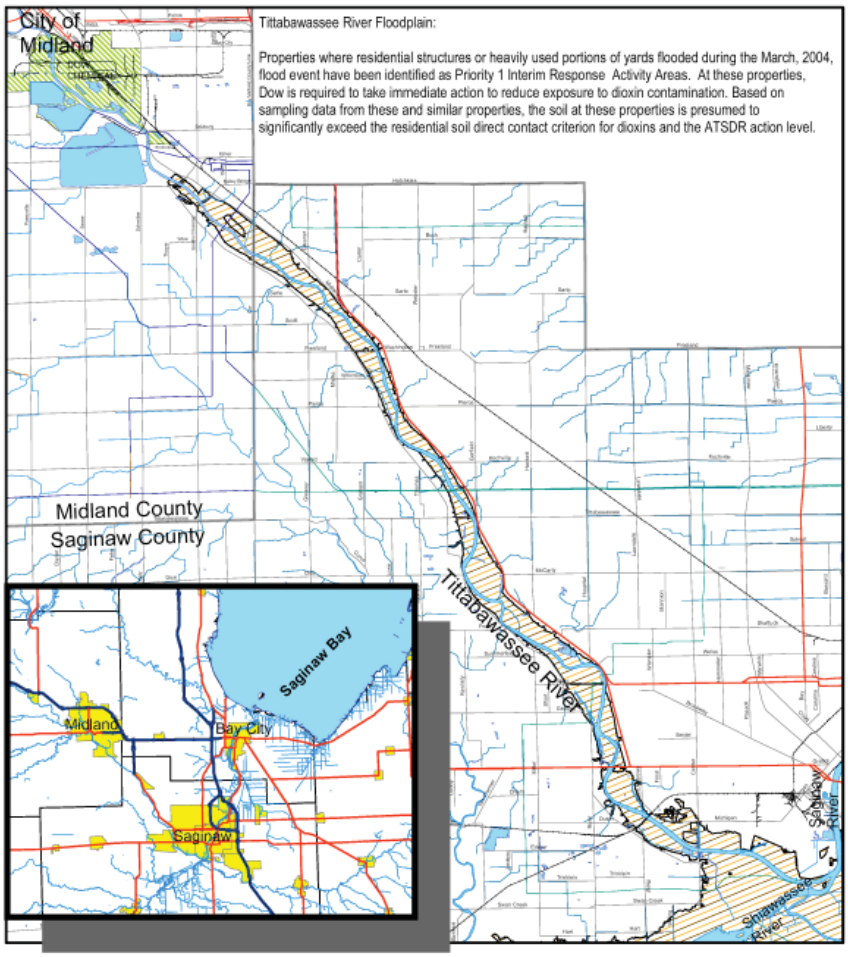
– Michigan Department of Agriculture: http://www.michigan.gov/mda

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

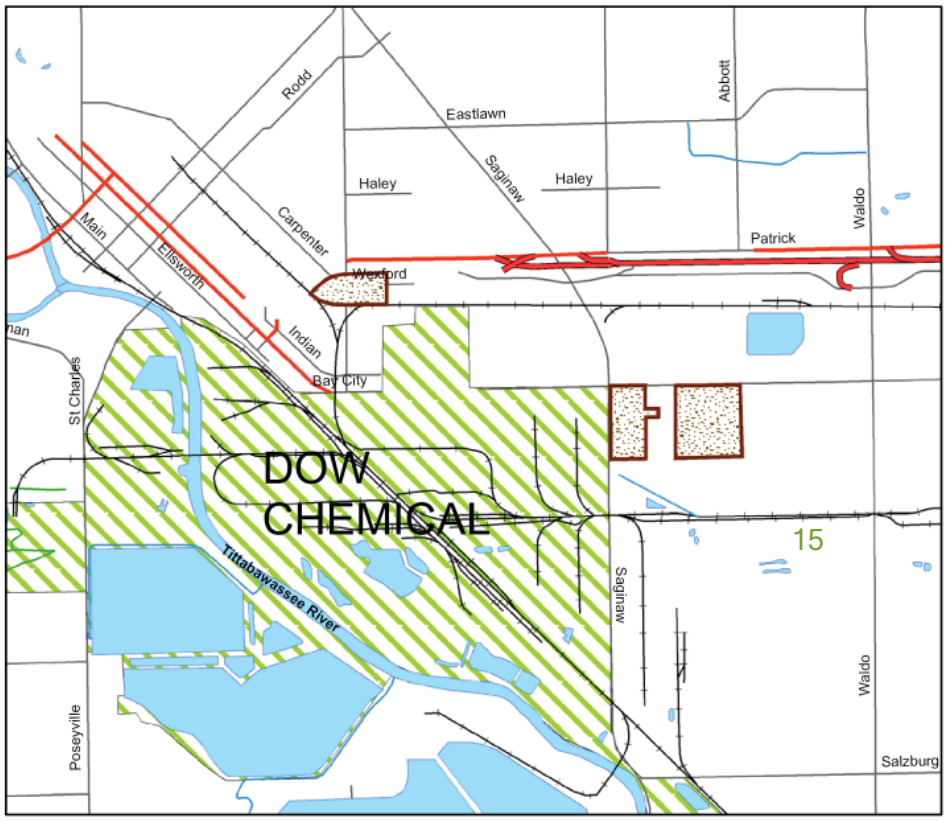
–United States Environmental Protection Agency: http://cfpub.epa.gov/ncea

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

Tittabawassee River Floodplain



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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