

ALLEGAN COUNTY HEALTH DEPARTMENT

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01/17

Office Administration

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Bioterrorism Preparedness

(269) 673-5411

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Communicable Disease

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Environmental Health

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Resource Recovery

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Dioxin Testing in City of Plainwell, Michigan Municipal Water

City of Plainwell Results

The City of Plainwell's municipal water was recently tested for a group of 29 chemicals referred to as dioxin-like chemicals. After reviewing the test results, the Michigan Department of Health and Human Services has determined there is no health concern regarding these chemicals in City of Plainwell water.

Background Information

Dioxin-like chemicals include dioxins, furans, and PCBs. There are 29 dioxin-like chemicals: 7 dioxins, 10 furans, and 12 PCBs. Dioxin-like chemicals are released through industrial processes. These chemicals are very toxic, or harmful to human-health.

Dioxin-like chemicals were selected for testing in City of Plainwell wells because they may have been in waste from paper mills, certain industrial processes, and other sources. It is important to determine if they are in the wells. Recent test results found low levels of two of the dioxin-like chemicals in residential wells. These results prompted testing of the local municipal water supplies.

Evaluating Health Risk from Dioxin-Like Chemicals

The most health protective approach for evaluating the health risk of these 29 chemicals is described by the United States Environmental Protection Agency (U.S. EPA) (https://rais.ornl.gov/documents/dioxin_tef.pdf). Each of these 29 chemicals can start causing cellular toxicity at the same way in the body. Because they have a similar toxicity mechanism, the U.S. EPA evaluates the mixture of the 29 chemicals together. The mixture toxicity is determined using the U.S. EPA recommended calculation that accounts for the fact that some of the 29 chemicals are more toxic than the others. This approach was developed by an international group of dioxin experts through the World Health Organization (WHO) and adopted by the U.S. EPA.

The US EPA calculation applies a Toxic Equivalent Factor (TEF) to each of the detected 29 chemicals. Each chemical has its own TEF that reflects its relative toxicity compared to 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD). TCDD is both the most toxic and well-studied of this group of 29 chemicals. To calculate the TEQ for the mixture of 29 dioxin-like chemicals detected in water sample, the detected amount of each dioxin-like chemical is multiplied by its TEF to create a Toxic Equivalent Concentration (TEC). The TEC for each of the 29 chemicals are added together to get a single number called the total Toxic

Equivalence (TEQ). The TEQ guides the health recommendations made by the agencies to the community.

Below are the TEFs for each of the 29 dioxin-like chemicals. These were all tested for in the City of Plainwell and the residential wells. Each chemical was assigned a TEF by the WHO. The TEF can range from 0.00003 to 1, reflecting the difference in the chemicals ability to cause toxicity.

Congener	TEF
2,3,7,8-TCDF	0.1
2,3,7,8-TCDD	1
1,2,3,7,8-PeCDF	0.03
2,3,4,7,8-PeCDF	0.3
1,2,3,7,8-PeCDF	1
1,2,3,4,7,8-HxCDF	0.1
1,2,3,6,7,8-HxCDF	0.1
2,3,4,6,7,8-HxCDF	0.1
1,2,3,7,8,9-HxCDF	0.1
1,2,3,4,7,8-HxCDD	0.1
1,2,3,6,7,8-HxCDD	0.1
1,2,3,7,8,9-HxCDD	0.1
1,2,3,4,6,7,8-HpCDF	0.01
1,2,3,4,7,8,9-HpCDF	0.01
1,2,3,4,6,7,8-HpCDD	0.01
OCDF	0.0003
OCDD	0.0003
PCB-77	0.0001
PCB-81	0.0003
PCB-105	0.00003
PCB-114	0.00003
PCB-118	0.00003
PCB-123	0.00003
PCB-126	0.1
PCB-156	0.00003
PCB-157	0.00003
PCB-167	0.00003
PCB-169	0.03
PCB-189	0.00003

Health Protective Drinking Water Level

The health protective value is the amount anyone - pregnant women, child, or adult - can drink daily over their lifetime and not be expected to experience harm. This health protective value has a 30-fold margin of safety built into the concentration, therefore, drinking water with more than 12 ppq-TEQ is not necessarily going to cause harm.

The basis of this health protective value is human studies from Italy where people were exposed for years to TCDD at much higher concentrations. Those exposures were found to increase the chance of harm to sperm production in young boys and thyroid function in newborns. The lowest amount of TCDD from those studies that might cause harm was adjusted lower by 30-fold to reach an amount where harm has not been observed and is unlikely to occur. That amount is used to calculate the 12 ppq-TEQ and represents an amount everyone can drink daily for a lifetime and not be expected to be harmed.

City of Plainwell Municipal Water Results

There are currently two that supply water to the City of Plainwell distribution system. Water from these wells is combined to provide enough drinking water supply for the community.

Test results for one of the City of Plainwell wells currently in use did not find any of the 29 dioxin-like chemicals. One of the wells (Well 7) had one dioxin-like chemical detected at a very low concentration. Water from this well is combined with water from the other well to provide enough drinking water supply for the community. The detected chemical, OCDD, was quantified at an estimated maximum possible concentration of 1.7 picograms per liter (pg/L) of OCDD.

The calculation of the TEQ for the City of Plainwell Well 7 is:

$$\text{OCDD TEC} = 1.7 \text{ pg/L} \times 0.0003 = 0.00051 \text{ pg/L}$$

TEQ = 0.00051 pg/L or parts per quadrillion (ppq) since OCDD was the only dioxin-like chemical detected.

The TEQ for City of Plainwell Municipal water well 7 was 0.00051 ppq-TEQ.

City of Plainwell Municipal Water Evaluation

The TEQ for the City of Plainwell Well 7 was 0.00051 parts per quadrillion-TEQ (ppq-TEQ). The test result of 0.00051 ppq-TEQ is more than 20,000 times below the health protective number of 12 ppq-TEQ used by the Michigan Department of Health and Human Services to determine health risk. The health protective number of 12 ppq-TEQ is the amount that anyone - pregnant women, child, or adult - can drink daily over their lifetime and not cause harm to their health.

MDHHS concludes that the dioxin-like chemical concentration for the City of Plainwell Well 7 of 0.00051 ppq-TEQ does not represent a public health hazard.

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Evaluating Health Risk from Dioxin-Like Chemicals

The best method of evaluating the health risk of these 29 chemicals is provided by the United States Environmental Protection Agency (U.S. EPA) (https://rais.ornl.gov/documents/dioxin_tef.pdf). This method was developed by an international group of dioxin experts through the World Health Organization and adopted by the U.S. EPA.

The U.S. EPA calculation provides the total toxicity of the dioxin-like chemicals that are present. The total toxicity of the dioxins is called the total toxicity equivalence or TEQ. The TEQ guides the health recommendations made by health agencies to the community. The toxicity numbers for each dioxin-like chemical are called toxic equivalence factors or TEFs. To calculate the total TEQ of dioxin-like chemicals, the amount of each dioxin-like chemical is multiplied by its TEF to get a toxic equivalent concentration or TEC. The TECs are calculated for each dioxin, furan, or PCB, then all of the TECs are added together to get the total TEQ. The TEQ is compared to numbers that are determined by health agencies to be protective of health.

City of Plainwell Municipal Water Results

There are currently two wells that supply water to the City of Plainwell distribution system. Water from these wells is combined to provide enough drinking water supply for the community.

Test results for one of the City of Plainwell wells did not find any 29 of the dioxin-like chemicals. One of the wells (Well 7) had one dioxin-like chemical detected at very low amounts.

City of Plainwell Municipal Water Evaluation

The TEQ for City of Plainwell Well 7 was 0.00051 parts per quadrillion-TEQ (ppq-TEQ). The test result of 0.00051 ppq-TEQ is more than 20,000 times below the health protective number of 12 ppq-TEQ used by the Michigan Department of Health and Human Services to determine health risk. The health protective number of 12 ppq-TEQ is well below the amount that anyone - pregnant women, child, or adult - can drink daily over their lifetime and not cause harm to their health.

MDHHS concludes that the dioxin-like chemical concentration for the City of Plainwell Well 7 of 0.00051 ppq-TEQ does not represent a public health hazard.