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Dioxin Testing in Otsego, Michigan Public and Residential Well Supplies

City of Otsego Results

The City of Otsego'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 Otsego water.

Residential Well Results

The full set of laboratory results for residential wells have not been received from the laboratory. Complete results are needed for each well to calculate the TEQ. Full residential well results are expected by mid-October. Once received, the Michigan Department of Health and Human Services will calculate the TEQ and provide individual results to the residents whose wells were tested.

Background Information

City of Otsego municipal water and some residential wells were recently tested for a group of 29 chemicals referred to as dioxin-like chemicals. This is an explanation of these chemicals and what the results mean.

Dioxin-like chemicals include dioxins, furans, and PCBs. There are 29 dioxin-like chemicals, 7 dioxins, 10 furans, and 12 PCBs. Dioxin-like chemicals were selected for testing in Otsego municipal water supply wells because these chemicals have typically been found in waste from paper mills. Since dioxin-like chemicals are the most toxic, or harmful to health, of these paper mill waste chemicals, it is important to know if they are present in the wells. Recent test results found 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 has been evaluated 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-tetrachorodibenzo-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 Otsego 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 as 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 Otsego Municipal Water Results

There are three wells that supply water to the City of Otsego water distribution system. Test results for two of the City of Otsego wells did not find any of the 29 dioxin-like chemicals.

One of the wells (Well 3) had four dioxin-like chemicals detected at very low concentrations. Water from this well is combined with water from the other two wells to provide enough drinking water supply for the community. Three of the detected chemicals (HxCDF, HpCDF, and OCDF) were quantified below the reporting limit, the lowest amount that laboratory equipment can reliably measure. Therefore, the laboratory can say the chemical is present below the reporting limit, but the amount is estimated. Two of the furans had estimated maximum possible concentrations of 0.79 picograms per liter (pg/L) of 1,2,3,4,7,8-HxCDF and 0.64 pg/L for 1,2,3,4,6,7,8-HpCDF. The other furan (OCDF) had an estimated maximum concentration of 18 pg/L. There was only one dioxin-like PCB, PCB 118, that was found above the reporting limit, and was detected at 0.034 nanograms per liter (ng/L) or 34 pg/l for PCB 118.

The calculation of the TEQ for the City of Otsego Well 3 is:

1,2,3,4,7,8-HxCDF TEC = 0.79 pg/L x 0.1 = 0.079 pg/L

1,2,3,4,6,7,8-HpCDF TEC = 0.64 pg/L x 0.01 = 0.0064 pg/L

OCDF TEC = 18 pg/L x 0.0003 = 0.0054 pg/L

PCB 118 TEC = 34 pg/L x 0.00003 = 0.00102 pg/L

TEQ = 0.079 + 0.0064 + 0.0054 + 0.00102 = 0.09182 or 0.092 (rounded up two significant digits) pg/L or parts per quadrillion (ppq).

The TEQ for Otsego Municipal water well 3 was 0.092 ppq.

Otsego Municipal Water Evaluation

The TEQ for City of Otsego water well 3 was 0.092 parts per quadrillion-TEQ (ppq-TEQ). The test result of 0.092 ppq-TEQ is more than 100 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 0.092 ppq-TEQ does not represent a public health hazard. No public health recommendations are needed at this time.