

## **Consider the Source**

### **Chlorination Byproducts in Ohio Tap Water**

#### **Summary**

Chlorinating tap water is a critical public health measure that saves thousands of lives each year by reducing the incidence of waterborne disease. But chlorination is no substitute for cleaning up America's waters.

By failing to clean up rivers and reservoirs that provide drinking water for hundreds of millions of Americans, EPA and the Congress have forced water utilities to chlorinate water that is contaminated with animal waste, sewage, fertilizer, algae, and sediment, in order to provide water free of disease-causing microorganisms. Chlorine, when combined with the organic matter in this pollution, produces harmful byproducts collectively referred to as chlorination byproducts (CBPs). In spite of the diligent efforts of the water utilities to filter and clean the water before they chlorinate, CBP levels remain high in the water consumed by millions of people each day. Approximately 240 million Americans drink tap water contaminated with some level of CBPs.

Industrial water pollution is not a major contributor to CBPs in tap water. Instead the main causes are sediments, nutrients, and pollution from agricultural and urban runoff, and in some small systems, inappropriate overuse of chlorine. Until Congress and the EPA act to limit pollution from farms and urban runoff so that water entering drinking water treatment plants is much cleaner than it is today, CBP levels will remain at unacceptably high levels.

This first ever national analysis of chlorination byproducts in tap water from both large and small cities, the Environmental Working Group (EWG) found that, although most water suppliers are in compliance with current and future drinking water standards:

- 137,000 pregnancies nationally and 6,777 pregnancies in Ohio are at increased risk of miscarriage and birth defects each year from exposure to CBPs in tap water. (See Table 1, Page 3)
- Since 1995, more than 16 million people in 1,200 communities across the nation have been served water contaminated with chlorination byproducts for 12 months in a row at levels above the legal limit going into effect in January 2002. (See Table 2, Page 4)

#### **Tap Water in Ohio**

Data on tap water contamination with trihalomethanes (THMs), one of the principle byproducts of chlorination, were obtained from Ohio Environmental Protection Agency, Division of Groundwater and Drinking Water. The data represent THM levels in tap water from 1,170 systems serving 8,792,614 people from the years 1995 through 2001. Not all systems provided data for all years. The data analyzed here represent 81.30% of all small systems and 86.30% of large systems in Ohio.

The maps on the next page illustrate counties with potentially elevated risk of birth defects, miscarriages, and cancers from chlorinated tap water in Ohio. (See page 6 for a description of health risks associated with chlorination byproducts.)

# Ohio

Sanitizing tap water with chlorine forms hundreds of byproducts, including trihalomethanes (THMs) - a family of chemicals linked to cancers, birth defects, and miscarriages. People are exposed to THMs in contaminated water through drinking, bathing and showering.

Environmental Working Group has analyzed data from water utilities to highlight counties with increased risks to these health problems due to chlorination of drinking water supplies.

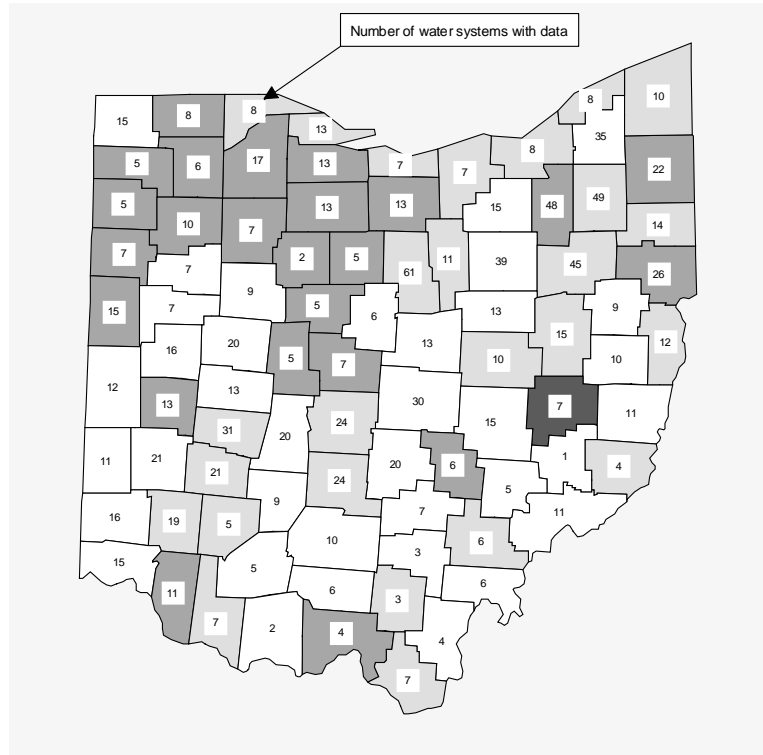
## Elevated Birth Defect and Miscarriages Risk from Chlorination of Tap Water

[Right] EWG has highlighted the counties with elevated risk of birth defects and miscarriages based on the chance that a woman would be exposed to high total THM levels (>80 parts per billion) for a full trimester. See the text or [www.ewg.org](http://www.ewg.org) for the worst systems in your state in violation of this measure.

## Elevated Cancer Risk from Chlorination of Tap Water

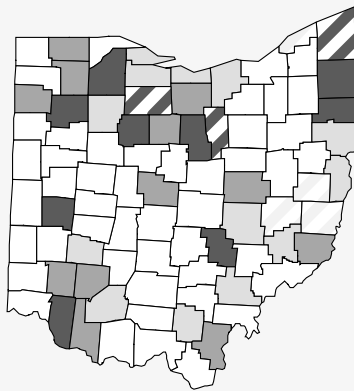
[Below] Small, currently unregulated systems that obtain water from rivers and reservoirs often provide water with high total THM levels. See the text or [www.ewg.org](http://www.ewg.org) for the worst systems across the state.

## Ohio Counties with Potentially Elevated Birth Defect and Miscarriage Risks from Chlorination Byproducts in Tap Water

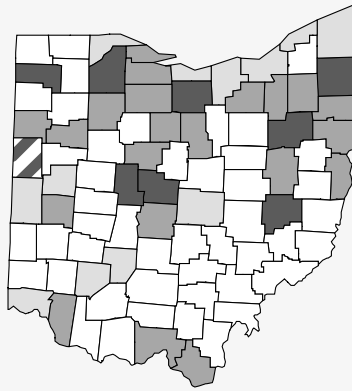


Percent of pregnancies exposed to high THMs for a full trimester  
 Nearly all (diagonal lines) Up to 80% (dark grey) Up to 50% (medium grey) Up to 10% (light grey) Almost none (white)

## Ohio Counties with Elevated Cancer Risk from Chlorination Byproducts in Tap Water



Small Communities (<10,000 people) Drinking Water from Surface Water Public Supplies (Rivers, Lakes, and Reservoirs)



Large Communities (>10,000 people) Drinking Water from Surface Water Public Supplies (Rivers, Lakes, and Reservoirs)



Communities Drinking Water from Ground Water Public Supplies

Cancer Risk from Chlorination Byproducts  
 Very Serious Risk (Exceeds Federal Health Standard) (diagonal lines)  
 Serious Risk (60-80 ppb) (dark grey)  
 Elevated Risk (40-60 ppb) (medium grey)  
 Moderate Risk (20-40 ppb) (light grey)  
 Low Risk (0-20 ppb) (white)  
 No Data (white)  
 ppb = parts per billion

Notes:

- Large surface water systems use results from quarterly sampling to prove compliance with health standards. Small systems may test less frequently. These maps are based on this compliance testing data.
- The number of water suppliers in each county with available data is indicated on this map. In cases for which data for only one water supplier are presented, the county composite is based on data from only that single water supplier.

Source: Environmental Working Group analysis of US EPA tap water testing results and Ohio Environmental Protection Agency, Division of Groundwater and Drinking Water.

In Ohio, 6,777 pregnancies face an elevated risk for birth defects and miscarriage from high levels of THMs\*. Columbus, Akron, and Warren water systems top the list of communities most at risk (Table 1).

**Table 1: An estimated 6,777 Ohio pregnancies face an elevated risk of birth defects and miscarriages from high levels of chlorination byproducts in tap water.**

Communities listed below are ordered based on the number of pregnancies each year exposed to at least 80 ppb THMs\* for at least a trimester. These pregnancies are at an increased risk for birth defects and miscarriages.

Rank	Water System	Population Served	Estimated Number of Pregnant Women per Year with Elevated Risk of Birth Defects and Miscarriages	Chance that a Pregnancy may be Served Water for an Entire Trimester with THM* Levels Above 80 ppb	Maximum 3-Month THM* Average**
1	Akron in Summit County	308,720	1,693	39 %	109.1 ppb
2	Warren in Trumbull County	70,000	476	49 %	139.4 ppb
3	BM Treatment Plant in Batavia of Clermont County	63,191	295	33 %	101.5 ppb
4	Bowling Green in Wood County	30,000	244	58 %	114.9 ppb
5	Barberton in Summit County	29,000	231	57 %	147.7 ppb
6	Del-Co Water Co.-Aluminum Chromium Plant in Delaware of Delaware County	27,500	231	60 %	105.8 ppb
7	Cambridge in Guernsey County	17,500	199	81 %	159.8 ppb
8	Portsmouth in Scioto County	43,962	193	31 %	124.6 ppb
9	Westerville in Franklin County	34,000	185	39 %	129.7 ppb
10	Alliance in Stark County	24,800	175	50 %	139.8 ppb
11	OH American Water Company-Tiffin District in Seneca County	21,000	160	54 %	128.5 ppb
12	Oregon in Lucas County	18,334	147	57 %	104.8 ppb
13	Delaware in Delaware County	28,000	147	38 %	97.5 ppb
14	Defiance in Defiance County	17,000	143	60 %	126.8 ppb
15	Del-Co Water Co.-Olentangy Plant in Delaware of Delaware County	27,500	137	36 %	105.5 ppb
16	Celina in Mercer County	10,889	136	89 %	355.5 ppb
17	Findlay in Hancock County	40,000	136	24 %	125.9 ppb
18	Berea in Cuyahoga County	19,000	127	48 %	124.6 ppb
19	East Liverpool in Columbiana County	14,200	122	61 %	116.8 ppb

Source: Environmental Working Group analysis of Ohio Environmental Protection Agency, Division of Groundwater and Drinking Water tap water testing data.

\*Trihalomethanes (THMs) are four individual chemicals that together are the most abundant byproducts of tap water chlorination.

\*\*ppb = parts per billion

Mcclure, Attica, and Sebring have the highest long-term average THM\* levels, at 133.8, 132.0, and 128.3 ppb, respectively, more than twice the federal safety standard that goes into effect beginning in January 2002 (Table 2).

**Table 2: Ohio communities with elevated cancer risk from high levels of THMs\* in tap water.**

Communities listed below are ordered on the long-term average THM level, an indicator for lifetime cancer risk.

Rank	Water System	Population Served	Tap Water Testing Data Availability	Long Term Average THM* Levels in Tap Water**
1	Mcclure in Henry County	850	5 tests from 12/27/96 to 11/21/00	133.8 ppb
2	Attica in Seneca County	1,200	5 tests from 10/25/95 to 09/06/00	132 ppb
3	Sebring in Mahoning County	8,100	8 tests from 03/15/95 to 08/15/00	128.3 ppb
4	Cinnamon Lake Utility Company in West Salem of Ashland County	600	4 tests from 08/07/96 to 09/29/00	127.7 ppb
5	Celina in Mercer County	10,889	27 tests from 07/17/95 to 06/27/01	121.1 ppb
6	Somerset in Perry County	1,500	6 tests from 08/21/95 to 09/11/00	97.5 ppb
7	Monroeville in Huron County	1,500	5 tests from 01/30/96 to 04/10/00	97.1 ppb
8	Williamsburg in Clermont County	2,466	5 tests from 04/02/96 to 01/16/01	89.8 ppb
9	Swanton in Fulton County	4,000	7 tests from 02/22/95 to 07/18/00	88.7 ppb
10	Village Administrator in Rock Creek of Ashtabula County	550	12 tests from 05/03/95 to 04/25/01	87.1 ppb
11	North Baltimore in Wood County	3,229	9 tests from 04/11/95 to 10/03/00	84.9 ppb
12	Ottawa in Putnam County	4,199	4 tests from 09/03/96 to 09/18/00	79.3 ppb
13	Cambridge in Guernsey County	17,500	25 tests from 02/22/95 to 01/10/01	78.7 ppb
14	New Lexington in Perry County	5,200	14 tests from 04/19/95 to 01/30/01	76.7 ppb
15	Shelby in Richland County	9,800	5 tests from 07/12/95 to 08/08/00	75.8 ppb
16	Galion in Crawford County	11,859	26 tests from 01/12/95 to 04/02/01	75.2 ppb
17	West Farmington in Trumbull County	1,100	5 tests from 07/19/95 to 08/19/00	73.7 ppb
18	Del-Co Water Co.-Aluminum Chromium Plant in Delaware of Delaware County	27,500	21 tests from 01/24/95 to 02/16/99	72.9 ppb
19	Warren in Trumbull County	70,000	28 tests from 01/19/95 to 04/17/01	70.7 ppb
20	Girard,city of in Trumbull County	15,000	4 tests from 12/21/99 to 01/30/01	69.7 ppb

Source: Environmental Working Group analysis of Ohio Environmental Protection Agency, Division of Groundwater and Drinking Water tap water testing data.

\*Trihalomethanes (THMs) are four individual chemicals that together are the most abundant byproducts of tap water chlorination.

\*\*ppb = parts per billion

Village Administrator, Celina, and Norwalk had the highest one-time peak measurements, at 492.1, 376.7, and 318.4 ppb, respectively, more than four times the average level allowed by the U.S. EPA over any consecutive 12 month period – 80 ppb beginning January 2002 (Table 3).

**Table 3: Highest recorded single sample spikes in THMs\* in Ohio**

Communities listed below are ordered on the highest recorded single THM level measured for that community’s water supplier.

Rank	Water System	Population Served	Maximum Spike in THMs**
1	Village Administrator in Rock Creek of Ashtabula County	550	492.1 ppb on 06/28/00
2	Celina in Mercer County	10,889	376.7 ppb on 09/11/96
3	Norwalk in Huron County	14,800	318.4 ppb on 08/22/00
4	Wright-Patterson Air Force Base in Greene County	15,160	298.9 ppb on 09/18/98
5	Sebring in Mahoning County	8,100	272.7 ppb on 08/03/95
6	Mcclure in Henry County	850	238.3 ppb on 10/05/98
7	Attica in Seneca County	1,200	234.1 ppb on 08/06/97
8	Waverly in Pike County	5,000	195.0 ppb on 12/06/99
9	Cinnamon Lake Utility Company in West Salem of Ashland County	600	192.8 ppb on 08/07/96
10	Berea in Cuyahoga County	19,000	183.1 ppb on 09/26/96
11	West Farmington in Trumbull County	1,100	182.7 ppb on 07/19/95
12	Galion in Crawford County	11,859	179.0 ppb on 07/24/00
13	Piqua in Miami County	20,500	178.1 ppb on 07/17/00
14	Warren in Trumbull County	70,000	177.5 ppb on 07/08/98
15	Cambridge in Guernsey County	17,500	173.3 ppb on 08/12/98
16	Williamsburg in Clermont County	2,466	172.5 ppb on 04/02/96
17	Athens in Athens County	22,335	171.7 ppb on 06/18/01
18	Shelby in Richland County	9,800	166.3 ppb on 07/12/95
19	Akron in Summit County	308,720	163.6 ppb on 08/09/00
20	Swanton in Fulton County	4,000	160.4 ppb on 07/18/00

Source: Environmental Working Group analysis of Ohio Environmental Protection Agency, Division of Groundwater and Drinking Water tap water testing data.

\*Trihalomethanes (THMs) are four individual chemicals that together are the most abundant byproducts of tap water chlorination.

\*\*ppb = parts per billion

## Health Risk from Chlorination Byproducts

Chlorination byproducts are a complex mixture of more than 100 potentially toxic compounds. EPA estimates that 240 million people are exposed to these compounds in tap water in the United States. Only trihalomethanes (THMs), five haloacetic acids, bromate, and chlorite are currently monitored and regulated, or proposed for regulation. Several chlorination byproducts are classified by the agency as "likely" human carcinogens (bromodichloromethane, bromoform, and dichloroacetic acid), and CBPs as a whole have the clear potential to cause birth defects or reproductive damage.

A compelling body of scientific evidence – nearly 30 peer-reviewed epidemiological studies - links chlorination byproducts to increased risks of cancer. A growing body of science links CBPs to miscarriages and birth defects, including neural tube defects, low birth weight, and cleft palate. Epidemiological studies often find adverse effects at levels considered legal under federal drinking water law. The specifics of which byproduct causes which effect remains unknown, and indeed may never be known.

### *Cancer*

EPA estimates the maximum health benefit of the new THM standard (80 ppb, reduced from the current standard of 100 ppb) as a potential reduction of 2,332 cases of bladder cancer per year, out of their upper estimate of 9,300 annual cases currently caused by THMs. The Agency then notes that the bladder cancer risk "captures only a portion of the potential risk associated with CBPs in drinking water" (63 FR 69390-69476, Dec. 1998, vol. 63 no 241). In the exposure assessment presented in this report, estimates of the number of water systems and people at increased risk for cancer are based on systems for which the average THM level over any consecutive 12-month period was at least 80 parts per billion (ppb).

### *Miscarriages and Birth Defects*

At least ten major epidemiological studies of more than 287,000 pregnant women show elevated risks for neural tube defects, reduced growth rates in the womb, miscarriages, and other adverse effects for women drinking chlorinated tap water. Scientists have found elevated risks associated with THM levels as low as 10 ppb (Kramer et al 1992), and for exposures to high but legal levels of THMs (75 ppb) over a single trimester of pregnancy (Waller et al 1998). In the exposure assessment presented in this report, estimates of the number of pregnant women facing an elevated risk for birth defects and miscarriage are based on systems for which the average THM level over at least one consecutive three-month period was at least 80 ppb (see Methodology appendix in the national report for more detail).

## Recommendations

The public and policy makers have been led to believe that they must accept either water polluted with pathogens or water contaminated with high levels of chlorination byproducts. This is simply not true. Tap water in the United States can meet pathogen standards and be low in CBPs as well.

To achieve this goal and protect the public from potential hazards of chlorination byproducts, we recommend:

*The creation of a nationwide health-tracking network to track Americans' exposure to chlorination byproducts and also the occurrence of birth defects, miscarriages, and other potential health effects of drinking tap water contaminated with THMs and other chlorination byproducts.*

- A growing coalition of public health and environmental groups has requested that Congress appropriate money to the Centers for Disease Control and Prevention (CDC) to create a nationwide health tracking network (Trust for America's Health, 2001). A fully functioning network is estimated to cost \$275 million; at the time of printing, Congress appeared poised to appropriate \$20 million as an initial down payment to start planning and creating the network. Lawmakers in the U.S. Senate and House of Representatives expect to introduce legislation in 2002, and to request significantly increased appropriations for the health tracking network. Through these processes, members of Congress will have an opportunity to support a proposal that would begin to close gaps in scientists' and policymakers' knowledge of environmentally-linked diseases, and provide health officials and health care providers with tools to act proactively to prevent chronic disease.

*Adequate funding for water utilities to treatment system upgrades and programs to train plant operators in better disinfection (chlorination) techniques, particularly for small drinking water systems.*

- Operator education has the potential to reduce the highest CBP levels in smaller drinking water systems and should be aggressively pursued. By itself it will not bring all of these small systems into compliance with the law, and it will not guarantee safe water for the most contaminated systems, but it has the potential to reduce the very highest levels of CBPs.

*A major national effort to clean up source water for all surface-supplied drinking water systems in the country.*

- Cleaner source water is the critical step to reliably reducing CBP levels while at the same time guaranteeing water as free of pathogens as possible. By failing to clean up drinking water source water, the Congress, EPA, and polluters are forcing water with high levels of CBPs on millions of people. For the majority of the systems with elevated CBP levels (small rural systems), cleaner source water will require definitive action to reduce soil erosion, and nutrient and animal waste runoff from farms and feedlots. For large systems, runoff from suburban sprawl and upstream sewage discharges must also be controlled.