

Sulfonamide Antibiotics and Drinking Water

Sulfamethoxazole (SMX) and sulfamethazine (SMZ), two sulfonamide antibiotics, are contaminants that have been found in surface water and groundwater in Minnesota. The Minnesota Department of Health (MDH) developed health-based guidance values for SMX and SMZ in drinking water and, based on these values, does not expect levels in drinking water to harm Minnesotans.

What are SMX and SMZ?

SMX and SMZ are sulfonamide antibiotic drugs. SMX is used for both human and veterinary applications, and SMZ is used for veterinary purposes only. Prescription rates of SMX for human applications have increased in the last decade.

People are primarily exposed to SMX is through taking it as a prescription medication. Because of the use of SMX and SMZ in animal agriculture, they have the potential to be found in food. The U.S. Department of Agriculture regularly monitors for drug residues in meat, poultry, and eggs, and has occasionally detected SMX and SMZ in these products (detected in about one in every ten thousand samples.) Even at the levels found, they are not expected to impact your health.

Have SMX and SMZ been found in Minnesota waters?

SMX has been found in rivers and lakes in Minnesota,^{1,2} and is more likely to be found in those waters that receive treated wastewater. It has been found once in groundwater, in an urban monitoring well. To date, SMX has not been detected in finished drinking water in Minnesota.²

In a 2013 study by the Minnesota Pollution Control Agency, SMZ was detected at low levels in two out of 50 lakes tested.¹ SMZ has only been detected once in Minnesota groundwater, in a monitoring well near a feedlot. In a national reconnaissance study of rivers and streams, SMZ was detected in about 5 percent of samples. To date, SMZ has not been detected in finished drinking water in Minnesota.²

What are the MDH guidance values for SMX and SMZ in drinking water?

Based on available information, MDH derived a guidance value of 100 ppb for both SMX and SMZ in drinking water.³ A person drinking water at or below this level, whether briefly, occasionally, or daily for a lifetime, would have little or no risk of any health effects from SMX and SMZ.

At a Glance

SMX and SMZ ...

- are antibiotics used to fight infections in humans and other animals.
- have been found in water and food at low levels that are not expected to impact health.

SMX and SMZ enter your body...

- primarily from taking SMX as a prescription medication, and
- possibly (but rarely) from drinking contaminated water or eating contaminated animal products.



SMX and SMZ in drinking water are safe if...

Levels are lower than the MDH guidance value of 100 ppb.

Can SMX and SMZ in drinking water affect my health?

In toxicological studies, SMX and SMZ were shown to alter thyroid hormone levels and cause hyperplasia in the thyroid gland. However, levels of SMX and SMZ found in drinking water are not high enough to affect health. Use of antibiotics like these may contribute to the development of bacteria that are resistant to antibiotics. Over time, this could cause antibiotics to become less effective in treating infections in humans and other animals.

How do SMX and SMZ get into the environment?

These antibiotics get into the environment when they pass through the bodies of the animals or people who are taking them. They can also be released to the environment when animal manure or wastewater sludge containing traces of SMX and SMZ are land applied. Wastewater treatment removes some SMX and SMZ, but some passes through and is released to the environment. Unused prescription SMX and SMZ may also be disposed of improperly (e.g., flushing down the drain or toilet).

How long do SMX and SMZ stay in the environment?

SMZ biodegrades easily in sludge but does not break down easily in soil or groundwater. SMX is not easily biodegradable. In surface water, SMX may break down over a period of weeks when exposed to sunlight. However, SMX in surface water may be continuously replenished by additions of new treated wastewater.

What are the potential environmental impacts of SMX and SMZ?

Based on available laboratory studies, it appears unlikely that SMX or SMZ will cause widespread impacts to fish or other wildlife living in Minnesota lakes and streams. Limited studies show that SMX may interfere with normal reproduction and endocrine system function in fish. However, these studies were done with higher levels of SMX than have been found in Minnesota waters. Additional studies would be needed to determine the importance of these effects.

What Minnesotans Need to Know . . .

SMX and SMZ are antibiotic drugs used for human and veterinary applications. Levels found in water and food are not expected to impact health.

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The Contaminants of Emerging Concern (CEC) Program...

Evaluates health risks from contaminants in drinking water and develops drinking water guidance. MDH works in collaboration with the Minnesota Pollution Control Agency and the Minnesota Department of Agriculture to understand the occurrence and environmental effects of contaminants.

References

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2. Lee, K., et al. Presence and Distribution of Organic Wastewater Compounds in Wastewater, Surface, Ground, and Drinking Waters, Minnesota, 2000–02. USGS Scientific Investigations Report 2004-5138. <http://pubs.usgs.gov/sir/2004/5138/>
3. www.health.state.mn.us/divs/eh/risk/guidance/gw/sulfamethsum.pdf