

N-Nitrosodimethylamine and Water

N-Nitrosodimethylamine (NDMA)

N-Nitrosodimethylamine (NDMA) is found in the environment as a byproduct of industrial processes and water disinfection. Water disinfection destroys or inactivates bacteria and other harmful microorganisms that can make people sick. Water disinfection is essential to keeping our waters safe for recreation and drinking. Disinfection has prevented thousands of deaths in Minnesota from waterborne diseases.

NDMA can also be found in many processed foods and beverages such as whiskey, beer, cured meats, bacon, and cheeses. Levels of NDMA in these foods are typically much higher than levels of NDMA found in treated drinking water.

In the past, NDMA was used as an ingredient in rocket fuel, as a solvent, and as a pesticide.¹

NDMA in Minnesota Waters

Minnesota does not regularly monitor for NDMA in water. NDMA can form as a byproduct of water disinfection, so it can be found in drinking water even if it is not found in the source water or the local environment. Between 2008 and 2010 NDMA was included in the Second Unregulated Contaminant Monitoring Rule (UCMR2), a one-time monitoring effort of public drinking water. During this monitoring, NDMA was detected in drinking water at levels up to 0.08 micrograms per liter ($\mu\text{g/L}$)*.²

*One microgram per liter ($\mu\text{g/L}$) is the same as one part per billion (ppb).

MDH Guidance Value

Based on available information, MDH developed a guidance value of 0.005 ppb for NDMA in water. MDH does not use guidance values to regulate water quality, but they may be useful in situations for which no regulations exist. MDH guidance values are developed to protect people who are most vulnerable to the potentially harmful effects of a contaminant. A person drinking water at or below the guidance value would be at little or no risk for harmful health effects.

Potential Health Effects

A few people have directly ingested NDMA, which at very high doses is fatal after extensive liver toxicity. Studies in animals at lower doses have shown developmental, immune, liver, and other non-cancer health effects. NDMA is also a well-studied carcinogen in rodents, causing tumors in the liver and other organs. While the potential for developmental and other effects from shorter-term exposures to NDMA is a concern, the guidance developed by MDH is based on life time exposures that lead to increased risk of cancer.

Potential Exposure to NDMA

Most NDMA exposure occurs when you eat foods that contain nitrosamines, such as smoked or cured meats, bacon, some fish, canned fruit, soybean oil, and cheeses; or when you drink malt beverages, such as beer and whiskey.^{3,4} Drinking water is estimated to be a minor source of exposure compared to other dietary sources.^{5,6} We also produce some NDMA in our stomachs after eating foods with nitrates or nitrites.⁴

You can be exposed to NDMA when you use toiletry and cosmetic products such as shampoos and cleansers that contain NDMA. Breathing in cigarette smoke will also expose you to NDMA. Workplace exposure can occur at tanneries, pesticide manufacturing plants, and rubber and tire plants.³

NDMA in the Environment

NDMA can form when water is disinfected with chloramines to reduce bacteria and other potentially harmful microorganisms in the water.³ Some polymers used in water treatment can also lead to NDMA formation during disinfection. These treatment processes may result in releases of NDMA to the environment. NDMA can also enter the environment when it is used for industrial purposes, or when consumer products containing NDMA are disposed. NDMA moves easily through soil and breaks down over several weeks, but can break down at a faster rate in the presence of sunlight.¹

Potential Environmental Impacts of NDMA

NDMA is not frequently monitored for or detected in surface water. When it has been detected, even the highest levels from industrial releases are much lower than levels that would affect aquatic life.

Health Risk Assessment Unit

The MDH Health Risk Assessment Unit evaluates the health risks from contaminants in drinking water sources and develops health-based guidance values for groundwater. 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 in water.

References

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