Dichlorodifluoromethane and Drinking Water

Summary

Dichlorodifluoromethane (DCDFM) is a human-made chemical, commonly known as Freon-12, that has been phased out of common use because it damages the ozone layer in the atmosphere. DCDFM has been detected in some Minnesota groundwater and landfill leachate. Based on the levels detected in Minnesota water, MDH does not expect DCDFM in drinking water to harm the health of Minnesotans.

DCDFM

DCDFM was used in aerosol sprays and plastics and as a coolant gas in refrigerators and air conditioners.[1] In 1996, the Montreal Protocol banned the production of DCDFM in developed countries because the chemical contributes to the destruction of the ozone layer. As of 2010, all countries in the United Nations agreed to stop producing DCDFM, but it is still being sold and used for limited purposes.

U.S. Environmental Protection Agency data shows that between 1991 and 1998 somewhere between five and 385,800 pounds of DCDFM were released into the air by companies operating in Minnesota. There was a continual downward trend in releases until 1999, at which point there were no releases going forward. There were no reported releases to water.[2]

DCDFM in Minnesota Waters

Data from 2000 show that DCDFM was detected in landfill leachate at some Minnesota sites. Concentrations of DCDFM ranged from 0.8 to 1.2 micrograms per liter (µg/L)*.[3] Another Minnesota study, released in 2008, showed detections of DCDFM in groundwater and landfill leachate at levels of about 10 µg/L in Washington County.[4] DCDFM detections have not been reported to the Minnesota Pollution Control Environmental Quality Information System in the past ten years.[5]

DCDFM is rarely detected in public drinking water. It has been found in 48 public water systems since 1993 at levels between 0.5 µg/L and 46 µg/L. In the past 10 years, detections have been 18 µg/L or lower.[6]

*One microgram per liter (µg/L) is the same as one part per billion (ppb).

MDH Guidance Value

Based on available information, MDH developed risk assessment advice of 500 ppb for DCDFM in drinking water. A person drinking water at or below the guidance value would have little or no risk for health effects. MDH has a 2011 Health Risk Limit (HRL) for DCDFM of 700 ppb.

Potential Health Effects

There is limited information available about health effects in humans who ingest DCDFM. The only observed effect in limited laboratory studies with animals was decreased weight gain after exposure to high doses of DCDFM.[7] Very high intentional or occupational exposures in humans have led to more severe cardiac and neurological symptoms.[8]

Potential Exposure to DCDFM

You can be exposed to DCDFM through breathing in air or consuming water with DCDFM in it. Contact with contaminated water could cause low levels of skin exposure to DCDFM. Most people are not likely to be exposed to DCDFM at their workplace because DCDFM is no longer produced, but could be in

older machinery or in ambient air at some sites affected by past and ongoing contamination. Mechanics and heating, ventilation, and air conditioning (HVAC) workers might have some exposure from DCDFM's use in older machinery.[8]

DCDFM in the Environment

DCDFM no longer enters the environment through production processes. However, it is possible for DCDFM to be released from products that were made before the Montreal Protocol. DCDFM is very volatile and is likely to go into the air quickly. In soil, DCDFM is very mobile and can breakdown in about a month.[7] DCDFM is also very mobile in water and is soluble in water, making it possible to be in groundwater. DCDFM is most persistent in the upper atmosphere, where its half-life is over 100 years.[9]

Potential Environmental Impacts of DCDFM

The effects to the environment from DCDFM are most likely indirect, through the damage to the ozone layer. Ozone layer depletion increases ultraviolet (UV) radiation, which can inhibit growth processes in plants, including aquatic plants and algae.[10] Direct toxicity of DCDFM in water has not been studied, but estimates of toxicity do not indicate a risk to 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 drinking water. 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.

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