



17 α -Ethinylestradiol and Mestranol and Drinking Water

Summary

17 α -Ethinylestradiol (EE2) and mestranol (MeEE2) are synthetic estrogens widely used in contraceptives. During normal use, medications containing EE2 and MeEE2 are eliminated from the body. Wastewater treatment does not remove all EE2 and MeEE2 from water. When treated wastewater is released into the environment, EE2 and MeEE2 can enter surface water sources that may be used for drinking water. EE2 and MeEE2 have been detected in Minnesota waters.

EE2 and MeEE2

EE2 and MeEE2 are synthetic estrogens, most often used as contraceptives in combination with another hormone, progesterone. MeEE2 is an inactive version of EE2 and is demethylated in the liver to form the active EE2. Commonly prescribed brand names include Norinyl, Lo Loestrin[®] FE, Seasonique[®], and NuvaRing[®]. Synthetic estrogen medications can also be used to treat acne, endometriosis, ovarian cysts, and symptoms of menopause.

EE2 and MeEE2 in Minnesota Waters

EE2 has been detected in Minnesota surface water at a maximum concentration of 0.0015 parts per billion (ppb).¹ EE2 was found in 40% of wastewater treatment plant samples.¹ EE2 also was detected in three monitoring wells at concentrations ranging from 0.00065 to 0.00136 ppb.² To date, MeEE2 has been detected three times in Minnesota surface water, with a maximum concentration of 0.071 ppb.³ MeEE2 was detected in one shallow, private well in Minnesota at a concentration of 0.0007 ppb.⁴

MDH Guidance Value

Based on the available information, MDH developed a guidance value of 0.0002 ppb for EE2 in drinking water.⁵ MDH developed a guidance value of 0.0002 ppb for MeEE2 in drinking water.⁶ A person drinking water at or below the guidance values would have little or no risk for health effects.

It can be difficult to analyze water samples for these chemicals at the very low guidance value MDH has calculated. MDH continues to develop improved analytical methods for detecting estrogens in water in order to ensure that source waters do not exceed guidance values.⁷

Potential Health Effects

EE2 exposure may affect the reproductive system and infant development. It is a potent endocrine disruptor affecting both male and female sex hormones and sex organs. EE2 caused enlarged male mammary glands in laboratory animal studies. In humans, reports of gynecomastia (enlarged breasts) have been reported in both male and female infants whose mothers took EE2 while nursing. EE2 and MeEE2 are also known human carcinogens linked to endometrial, ovarian, and breast cancers.⁸

Potential Exposure to EE2 and MeEE2

The most common exposure to EE2 and MeEE2 is the use of contraceptives and hormone replacement therapy. Because EE2 and MeEE2 are present in treated wastewater that is often discharged into the environment, it is possible for EE2 and MeEE2 to be present in drinking water sources. However, EE2 and MeEE2 are not commonly detected in drinking water and drinking water is not expected to be a major source of exposure for most people.

EE2 and MeEE2 can be excreted in breastmilk; nursing while on EE2 and MeEE2 medications is not recommended.⁸ Oral contraceptives containing EE2 or MeEE2 can also reduce milk production.⁹

EE2 and MeEE2 in the Environment

EE2 and MeEE2 enter the environment through human excretion and through the disposal of unused medications into toilets, sink, and landfills. EE2 and MeEE2 pass through the body and are excreted in urine and feces. Wastewater treatment removes some of the EE2, but some passes through into the environment. Although EE2 can degrade in the environment, there is a constant replenishment from wastewater treatment plants. One way to reduce EE2 and MeEE2 in the environment is to dispose of unused medication properly. Follow the recommendations from the Minnesota Pollution Control Agency (MPCA) for disposing of unwanted medications.¹⁰ Once in the environment, EE2 can remain for months or years, depending on the conditions. MeEE2 does not biodegrade easily and can remain in the soil or sediment for years. MeEE2 can be converted to EE2 in the environment or during wastewater treatment. EE2 and MeEE2 can accumulate in fish and plants.

Potential Environmental Impacts of EE2 and MeEE2

In the environment, EE2 and MeEE2 are referred to as endocrine active compounds (EACs), because they interact with the endocrine (hormone) systems of fish and other aquatic organisms. EACs have been shown to cause physical changes in fish called intersex characteristics. The extent to which EACs affect the reproduction and development of fish is a current area of research. EE2 and MeEE2 have been measured in some Minnesota surface waters at or above concentrations that may be harmful to aquatic life based on the scientific literature.

CEC Program

The MDH Contaminants of Emerging Concern Program (CEC) 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.

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