Reproductive Health Technologies Project

"Is there estrogen from birth control in my water?!?"

Introduction

In this fact sheet, we answer some of the basic questions that advocates and policymakers ask when confronted with reports about estrogen from birth control in drinking water or waterways and its effects on human health or fish populations. It is important to note that the science in this area is complex and incomplete, and that simple "yes" or "no" answers are difficult to provide. This document is based on a review of the existing research on estrogenic compounds in water by scientists at the University of California San Francisco Program on Reproductive Health and the Environment.[1]

1. Is EE2, the estrogen in hormonal contraceptives (including the pill, patch, Depo shot, and Nuvaring) present in drinking water?

Very low levels of EE2 have been detected in some drinking water samples and not detected in others. The presence of EE2 or any other contaminant in a particular water supply will vary depending on location, source of the drinking water, and the quality of drinking water treatment facilities.

2. Is EE2 in drinking water harming human health?

There is no evidence that, by itself, EE2 in drinking water is harming human health. However, the *total* presence of *all* estrogenic compounds in our waterways and environment *is* a threat to human health and aquatic life.

3. Is EE2 present in waterways?

EE2 has been detected in some rivers and streams. However, research tells us that the contribution of EE2 to the *total* presence of estrogenic compounds in waterways appears to be small – especially compared to *other* estrogenic compounds produced by industrial processes, chemicals used in consumer products, and estrogenic pesticides and fertilizers used in agriculture.

Key Terms: Selected Estrogenic Compounds

Estrogenicity: *the extent to which a medium (for example, a water source) contains estrogenic compounds; high estrogenicity = high presence of estrogenic compounds*

Estrogenic compounds: includes naturally produced estrogen hormones *and* synthetic chemicals that mimic estrogens in the body of a human or animal exposed to the chemicals

Natural estrogens: estrogenic compounds secreted by male and female humans and animals and found in plants and fungi

Synthetic estrogens: estrogen-mimicking chemicals manufactured for pharmaceutical, industrial, or agricultural/veterinary use

Human/animal estrogens: Naturally occurring steroid hormones E1, E2, E3, secreted by male and female humans and animals (including livestock)

Xenoestrogens: chemicals used in manufacturing processes and products; includes alkylphenol, Bisphenol-A (BPA), surfactants, and phthalates

EE2: the primary active ingredient in birth control pills, Nuvaring, OrthoEvra (the patch) and the Depo shot

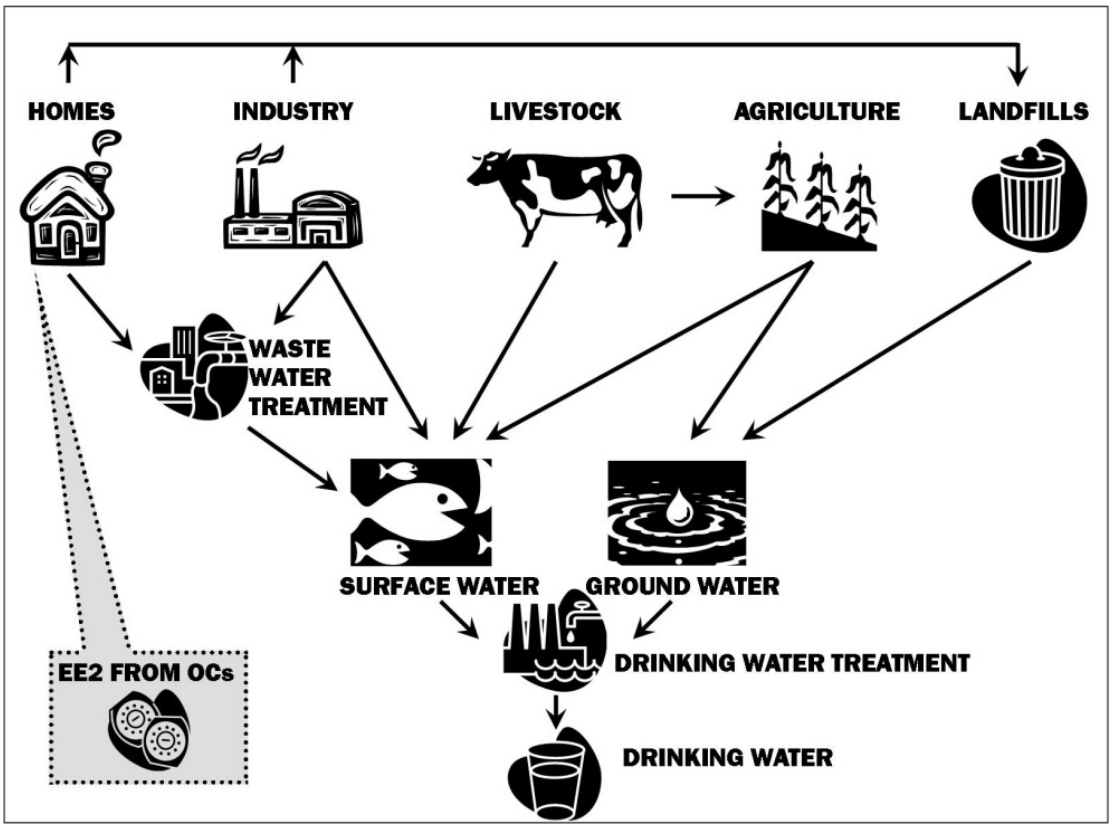
[1] **Are Oral Contraceptives a Significant Contributor to the Estrogenicity of Drinking Water?** Amber Wise, Kacie O'Brien, Tracey Woodruff, *Environmental Science & Technology*, **Article ASAP**.

4. What other estrogenic compounds are present in our drinking water and waterways and how do they get there?

A vast array of chemicals, including pharmaceuticals, has been detected in our waterways, and estrogenic compounds are one subset of those chemicals.

Sources of estrogenic compounds include (see Figure 1 below):
- natural and synthetic estrogenic compounds excreted by male and female humans;
- synthetic xenoestrogens used in industrial processes and to manufacture everyday products;
- natural and veterinary estrogens excreted by livestock;
- estrogenic compounds found in fertilizer and pesticides; and
- the waste and runoff produced by each of these sources.

Figure 1: Estrogenic Compounds: Sources of Entry into Surface, Ground, and Drinking Water[2]



5. How is the *total* presence of *all* estrogenic compounds in the environment affecting human health or aquatic life?

Broadly, exposure to estrogenic compounds in the environment has been linked to reproductive and other health problems in human and aquatic life. For example, depending on the location of the waterway and amount of chemicals in the water, estrogenic compounds have been shown to contribute to egg production and decreased fertility in male fish (often referred to as intersex fish), which scientists believe is

[2] **Are Oral Contraceptives a Significant Contributor to the Estrogenicity of Drinking Water?** Amber Wise, Kacie O'Brien, Tracey Woodruff. *Environmental Science & Technology* **Article ASAP**.

leading to the collapse of certain fish populations.

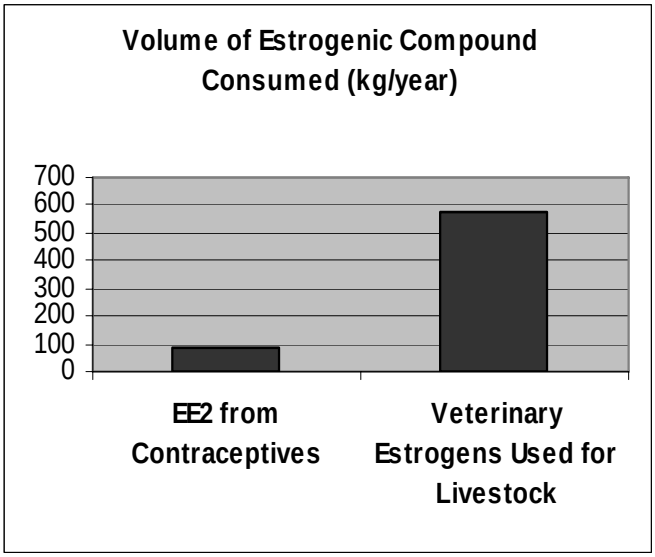
In humans, environmental exposure to estrogenic compounds has been linked to reproductive deformities, testicular cancer, breast cancer, endometriosis, and decreased sperm counts.

6. How can we compare the relative impact of different estrogenic compounds?

It is difficult to compare the relative impacts of different estrogenic compounds because each compound has unique characteristics. For example, EE2 is highly potent, which means it produces a reaction at lower levels than less potent chemicals. On the other hand, industrial xenoestrogens have lower potency than EE2, but they are often present in much higher volume. Surfactants, one class of xenoestrogens used in detergent and other products, are among the most frequently detected compounds found in surface water.

As another example, veterinary estrogens consumed by livestock are also less potent than EE2, but the total yearly volume of veterinary estrogens alone is more than five times that of oral contraceptives (see Figure 2 right).

Figure 2: Comparing Total Volume of Oral Contraceptives versus Veterinary Estrogens used for Livestock



7**. How do all of these estrogenic chemicals interact with one another?**

In the real world, humans and animals are exposed to mixtures of chemicals, not single chemicals in isolation. An important factor in determining the relative contribution of various estrogenic compounds is the way these compounds interact with one another. Studies show that mixtures are "additive" when chemicals combine to cause an estrogenic effect equal to the sum of the constituent parts. A mixture is said to be "synergistic" when multiple chemicals combine to produce similar effects more intensely than would be suggested by merely adding them together. In other words, "the whole is greater than the sum of its parts."

A 2009 study suggests that complex mixtures of chemicals, including non-estrogenic compounds, may be contributing to the observed effects in fish that are sometimes attributed solely to estrogenic compounds or EE2 in particular.

8. How can we reduce the total presence of estrogenic compounds in our drinking water and waterways to protect our health and our environment?

Improved Water Treatment
Wastewater treatment and drinking water treatment systems vary in their abilities to remove estrogenic compounds from water, though some municipalities' systems have proven quite effective. Updating, standardizing, and better monitoring of water treatment plants could essentially eliminate the presence of these chemicals in drinking water.

Chemical Policy Reform
Unfortunately, laws to keep estrogenic chemicals of all kinds out of the environment are woefully inadequate. Federal law governing the use of toxic chemicals in everything from cosmetics, to electronics, to food containers, is outdated and does not give regulators the authority to protect the public. As a result, many of the chemicals used in everyday products have not been tested for safety, but continue to remain on the market. The toxic chemicals used in these products, including industrial xenoestrogens, are then released into the environment through either industrial runoff or when the products are discarded. In addition, laws governing the disposal of agricultural waste are almost non-existent. While a handful of states have begun to tackle these issues on their own, comprehensive federal legislation is needed to prevent the unchecked release of estrogenic chemicals into the environment, whether through agriculture, industrial processes, or waste disposal and landfills.

Safer Alternatives
In order to reduce the harms of estrogenic compounds, manufacturers should substitute safer chemicals and redesign products to reduce or eliminate estrogenic compounds. Pursuing safer alternatives will require the public and private sectors to invest in research and development for sustainable chemicals, products, materials, and processes.

Contraceptive Research and Development
Hormonal contraception has enabled women and families to decide when and how many children to have, and has improved the health of children, women, communities, and the environment. Nevertheless, the public and private sectors should continue to invest in research and development for safe, effective, and acceptable contraceptive options that have a minimal impact on the environment.

9. What questions are still unanswered by the science?

In order to better understand and assess the risks and harms of estrogenic compounds from all sources, further research is needed in several areas, including:
- cost effective methods of detection for very low levels of estrogenic compounds;
- threats posed by the combination of many types of chemicals found in surface and drinking water;
- location and transport of hormones from agricultural sources in soil and water; and
- the presence of industrial xenoestrogens in our waterways and their contribution to total estrogenicity.

10. What's the bottom line?

While more research is needed, current scientific information suggests that the contribution of EE2 to the total estrogenicity of our waterways is small. When other sources of estrogenic compounds are considered, it becomes clear that contraceptives are not the sole or primary cause of the threats to human and ecosystem health that have been documented.

As we continue to seek answers to these complex questions, it will be critical to address the many sources of estrogenic compounds through sound science and regulatory policy, including improving water treatment, chemical policy reform, the development of safer alternatives, and more research.

It will also be critical to correct unproven claims about contraceptives, which distract from the actual primary sources of estrogenic compounds in the environment, and serve to stigmatize birth control—which we know is good for women, their health, their communities, and the environment.

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