Minnesota Pollution Control Agency

Endocrine Disrupting Compounds

March 2008

2008 Legislative fact sheet

At a glance

- Many chemicals can interfere with hormonal function in animals and humans.
- This process can harm both individuals and populations.
- A variety of management strategies is suggested.

Legislation in the 2007 session directed the Minnesota Pollution Control Agency to report to the 2008 Legislature on strategies to address endocrine disrupting compounds (EDCs) in waters of the state. A summary report was submitted to the Legislature on January 15, 2008. This fact sheet summarizes highlights.

What are EDCs?

EDCs are chemicals which, acting on human or animal endocrine systems, may have an adverse effect on reproduction or development. Most are man-made but there are a number of naturally occurring chemicals which may disrupt the endocrine system.

What is endocrine disruption?

The endocrine system is the system of glands, organs and tissues that secrete hormones into the bloodstream. Hormones are chemical messengers that are critical to many body processes, including growth and development, metabolism, and sexual differentiation.

Some chemicals can mimic or block normal hormonal function in animals and humans. This can trigger a wide variety of responses. This process is called endocrine disruption. Endocrine disruption in itself is not a toxic effect; rather it is a means by which a toxic effect may occur.

Exposure to even low doses of some EDCs may have adverse effects, particularly at critical stages of development. Individuals also are exposed to chemicals as mixtures, whose effects are unknown. EDCs can be found virtually everywhere in the environment, and exposure to them is widespread. A variety of adverse effects have been documented in laboratory studies as well as in the wild.

Potential effects on humans, fish and wildlife

In humans, exposure to EDCs has been associated with diminished intelligence, altered behavior and development, and decreased immunity. In animals, exposure to EDCs has been associated with reduced reproductive success, reduced survival, altered sex typing, and developmental abnormalities. Effects seen in individuals could result in population-level effects if reproduction is adversely affected. Population-level effects following exposure to EDCs have been documented in a variety of fish and wildlife populations.

Potential EDCs

EDCs are not a discrete class of chemicals. Known and potential EDCs are found in many classes of chemicals, including:

Pharmaceutical and personal care products. EDCs are found in synthetic hormones, over-the-counter and prescription drugs, and ingredients of cosmetics, toiletries, detergents, and cleaning products. Potential EDCs include parabens, siloxanes, phthalates, and musks.

General anthropogenic (man-made) compounds comprise a widely diverse group of industrial-use compounds. EDCs in this category include polychlorinated

leg-08sy1-02

biphenyls (PCBs), polybrominated diphenyl ethers (PBDEs), dioxins and furans, plasticizers, and alkylphenols. Many of these are banned in the U.S. and elsewhere, but they persist in the environment long after their use is discontinued.

Pesticides, including organochlorines, organophosphates, pyrethroids, herbicides, fungicides, and carbamates, are potential EDCs. Many organochlorine pesticides have been banned in the U.S. and elsewhere, but they are persistent and bioaccumulative. Organophosphates are the most widely used pesticides in the world.

Biogenic (naturally occurring) compounds include natural hormones secreted by humans, livestock and wildlife, as well as plant estrogens.

Inorganics and organometallic compounds are also potential EDCs. This group includes elemental metals such as aluminum, arsenic, chromium, lead and mercury, and organic metal complexes such as tributyltin.

Currently, there are more than 87,000 chemicals produced and used worldwide, many of which have benefited society. Their number and diversity make identifying potential EDCs very difficult. There is no scientific consensus on what makes a chemical an EDC, and chemicals may interact with the endocrine system in complex ways. More efficient, accurate and comprehensive screening tools are needed to properly identify and evaluate potential EDCs.

Sources of EDCs in the environment

There a many potential sources of EDCs in the environment. Effluent from wastewater treatment plants and paper mills are two major point sources of EDCs to surface water. Other potential sources include, landfill leachate, confined animal feeding operations, application of sewage sludge to fields, incineration of municipal waste, backyard burning of household trash, agricultural and household application of pesticides, biofuel operations, and aquaculture.

Strategies for managing EDCs

Effectively managing EDCs in the environment is difficult and complex. Their diversity as well as widespread, continual, and low-level release does not lend itself to remediation. Multiple strategies are needed to effectively reduce environmental contamination. Collaboration between state agencies, county governments, manufacturers, and academia would be needed to implement programs to reduce the release of EDCs in the environment.

Strategies that may be effective in reducing the initial release of EDCs include:

- Upgrading wastewater treatment plants to remove potential EDCs from effluent
- Instituting pharmaceutical collection programs to prevent their release to surface water
- Encouraging product stewardship by manufacturers, retailers, and consumers to reduce use of potential EDCs in consumer products
- Educating the public to reduce personal exposure to potential EDCs through informed product selection and use.

However, several confounding factors are likely to complicate taking more specific actions at this time:

- Lack of scientific consensus on what makes a chemical an EDC
- Lack of data regarding sources, possible exposure and effects, fate and transport, and environmental distribution to inform effective policy decisions
- Enormous diversity of compounds that may be EDCs requires multiple management strategies
- Widespread, low-level environmental contamination does not lend itself to remediation
- Many potential EDCs are in high demand by consumers and substitutes may not exist or have been poorly studied
- EDCs cannot be effectively addressed at the state level only. This is an international, trans-boundary issue that requires cooperation among multiple governments and academic institutions, as well as public acceptance and compliance.

As policy makers consider options to address EDCs, it is important to keep in mind that a variety of strategies is needed. While conventional “end of pipe” treatment may be feasible, a broad approach to preventing EDC release into the environment may ultimately have greater impact.

For more information

For more information about EDCs, contact Mike Sandusky, Director, Environmental Outcomes and Analysis Division, 651-296-7331 or mike.sandusky@pca.state.mn.us.