1. INTRODUCTION

Endocrine disrupting compounds (EDCs) are defined as “chemicals that either mimic endogenous hormones, interfere with pharmacokinetics, or act by other mechanisms” (1). Adverse effects such as compromised reproductive fitness, functional or morphological birth defects, cancer, and altered immune functions, among others have been reported in the scientific literature (1–3). The term “endocrine disruptors” is used to describe substances that are not produced in the body but act by mimicking or antagonizing natural hormones. It is thought that EDCs may be responsible for some reproductive problems in both women and men as well as for the increases in the frequency of certain types of cancer. EDCs have also been linked to developmental deficiencies and learning disabilities in children. Because hormone receptor systems are similar in humans and animals, effects observed in wildlife species raise concerns of potential human health effects. During fetal development and early childhood, low-dose exposure to EDCs may have profound effects not observed in adults, such as reduced mental capacity and genital malformations. Evaluating potential low-dose effects of environmental estrogenic compounds has been identified as a major research priority.

There is growing evidence that artificial chemicals in the environment can disrupt hormones by sending erroneous signals or blocking legitimate signals. Because the hormones are part of the endocrine system, the hormone disruptors are also called endocrine
disruptors. Because the concern originated with estrogen, the “female” hormone, they are sometimes called estrogen mimics.

The strongest evidence that endocrine disruptors are damaging human or animal health comes from the animal kingdom. In the 1980s and 1990s, fish and beluga whales with horrible malformations showed up in the Great Lakes region, with cancers, ulcers, and other deformations. In the 1990s, an epidemic of misshapen reproductive organs in Florida alligators was blamed on a pesticide spill into the lake. Other reproductive abnormalities in gulls, minks, eagles, and other animals have been blamed on chemicals that mimic hormones. Furthermore, in the laboratory, tiny concentrations of hormone mimics lock onto cell receptors, causing the cells to reproduce in a phenomenon suspiciously like cancer. The controversy about endocrine disrupters began with concern about chemicals that disrupt estrogen, but now it has expanded to cover chemicals that interfere with androgens (male hormones). Keeping in mind that males have female hormones, and vice versa, it is immediately realized that the endocrine story is much more complicated than once thought.

Several studies have found a worldwide lowering of sperm counts, and blamed it on the rising concentrations of estrogen mimics in the environment. Some scientists say estrogen mimics could also explain the growing incidence of breast cancer and perhaps prostate cancer as well (4–6). The putative endocrine disruptors have structures akin to real hormones, and seem to include: breakdown products of several pesticides that are now banned, such as DDT, polychlorinated biphenyls (PCBs), a persistent group of chemicals still found in electrical equipment that pollutes lake and stream sediments in many industrial regions, dioxins, a group of toxic chemical byproducts from paper production and incineration, and chemicals found in the epoxy lining of “tin” cans, plastics used for storing food, dental sealants, and vinclozolin, a fungicide used on fruit.

A growing body of scientific research indicates that man-made industrial chemicals and pesticides may interfere with the normal functioning of human and wildlife endocrine systems. A hormone is defined as any substance in the body that is produced by one organ and then carried by the bloodstream to have an effect on another organ. The primary function of hormones, or the endocrine system, is to maintain a stable environment within the body; this is often referred to as homeostasis. The endocrine system also controls reproduction and growth.

Recently, public concern has focused on the possible hormonal effects of some environmental pollutants on wildlife and humans. These chemicals, referred to collectively as endocrine disruptors, include a wide range of substances, such as pesticides (methoxychlor), surfactants (nonylphenol), plasticizers (diethylphthalate), and organohalogens (PCBs and dioxin). Many industrial chemicals and pesticides have undergone extensive toxicological testing; however, since the purpose of this testing was not to find some subtle endocrine effects, these potential effects may not have been revealed. The persistence of some pesticides in the aquatic environment may pose a threat to the human population, especially, if such substances occur in the nation’s drinking water sources. As a result of this growing concern, the 1996 Safe Drinking Water Act (SDWA) amendments and the Food Quality Protection Act require the United States Environmental Protection Agency (US EPA) to develop a screening and