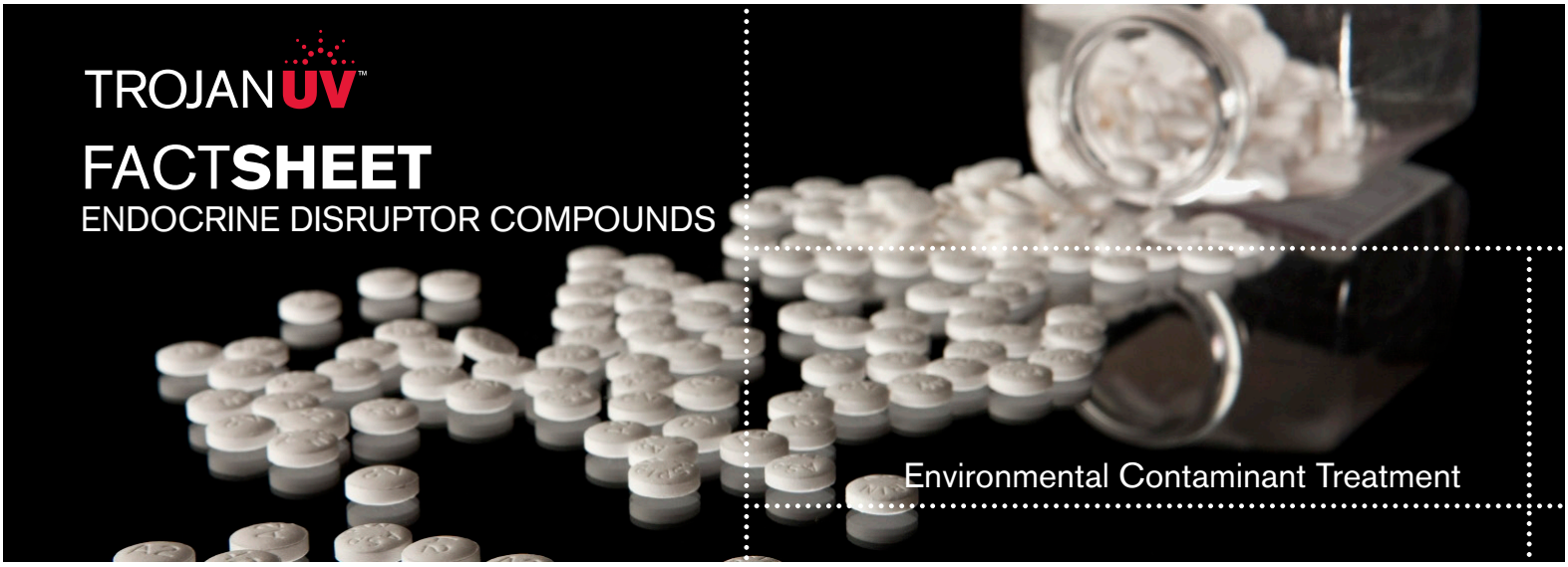
TROJAN UV™

FACTSHEET

ENDOCRINE DISRUPTOR COMPOUNDS



Environmental Contaminant Treatment

Update on Emerging Contaminants: Endocrine Disruptor Compounds

The public has become increasingly aware of the presence of chemicals in the water supply. In addition, research has provided growing evidence that many chemicals and mixtures of chemicals potentially present in our environment may act to inhibit, mimic, or accelerate the functions of the endocrine system in humans and animals. Disturbing statistics and news of intersex fish have generated concern in the general public. The sources of these contaminants are varied: wastewater treatment plant discharge, manufacturing plant wastewater, and chemical spills are a few examples. What course of action to take is one of the most difficult issues faced by regulators and scientists in the 21st century.

THE ENDOCRINE SYSTEM AND 'ENDOCRINE DISRUPTORS'

The endocrine system in humans is made up of the pituitary, thyroid, and adrenal glands, the male testes and female ovaries, and the hormones they produce. This complex chemical messaging system governs development, growth, reproduction, and behavior (USEPA 2000). These chemical messengers travel through the bloodstream and cause responses in other parts of the body. The term "endocrine disruptor" refers to a chemical that inhibits or artificially augments the function of these natural chemical messengers in the body.

HOW ENDOCRINE DISRUPTION WORKS – POTENTIAL HEALTH EFFECTS

Effects on the endocrine system occur in various ways. The USEPA report to the US Congress on endocrine disruption (2000) provides a description:

Some chemicals may mimic a natural hormone 'fooling' the body into over-responding to the stimulus or responding at inappropriate times. Other chemicals may block the effects of a hormone in parts of the body normally sensitive to it. Still others may directly stimulate or inhibit the endocrine system, causing overproduction or underproduction of hormones. Certain drugs, such as birth control pills, are used to intentionally cause some of these effects.

Research to date is inconclusive regarding the health effects of low-level endocrine disrupting chemicals (EDCs) in the water supply. However, downstream of wastewater plants, indicator species such fish and amphibians have shown direct effects from the various chemical contaminants emitted from wastewater discharge (e.g. feminization of fish, reproductive abnormalities, and physical deformities). Scientists' understanding of the effects of individual compounds is limited, and there is even less understanding of the effects of mixtures of potential endocrine disrupting compounds. Health effects research is the subject of many ongoing studies around the world.

WHERE EDCS MAY BE PRESENT

Potential EDCs and human usage needs intersect at a few key points in the water supply:

Municipal drinking water under the influence of an upstream wastewater discharge. Many waterways are under the influence of wastewater. This wastewater may carry *N*-nitrosodimethylamine (NDMA), pharmaceuticals, personal careproducts or other environmental contaminants. During dry seasons, wastewater effluent can comprise a majority of the volume of water present in a river

Endocrine-disruptor compounds enter our drinking water supplies through a variety of sources including municipal and industrial wastewater discharge and agricultural runoff.

or experiencing this condition has become known as "effluent dominated."

Reuse of municipal wastewater. Without sufficient treatment, reuse systems for irrigation and for indirect potable reuse may allow EDCs to pass into the environment.

Industrial Wastewater. Many industries including pharmaceutical manufacturing, marine vessel painting, and pulp and paper production are required to remove potential EDCs from wastewater.

REGULATORY OUTLOOK

Without conclusive scientific research, regulations regarding EDCs are unlikely for some time. However, some regulators have begun to take steps to collect the necessary data to build a case for regulation. For example, the California Department of Public Health has implemented a mandatory monitoring program for EDCs in wastewater and in wastewater reuse (CDPH 2008). In addition, some

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potential EDCs, such as atrazine and tributyltin, are already regulated and others are being examined for their potential for endocrine system effects.

TREATMENT WITH EXISTING FACILITIES

Conventional drinking water and wastewater treatment plants provide some level of treatment. For example, research has shown that conventional coagulation/sedimentation/filtration processes are capable of removing large percentages of some compounds. However, a number of compounds, such as NDMA, 1,4-dioxane, some pharmaceuticals such as carbemazepine (an anti-epileptic drug) and others, are not well removed by conventional plants (Snyder, 2004; Adams et al 2002).

ADVANCED TREATMENT WITH UV

Several advanced treatment technologies have been recognized for their ability to remove EDCs and other wastewater-derived contaminants. Examples are reverse osmosis (RO) membranes, biological systems, and ozone. However, such systems can be prohibitively expensive (especially for smaller water providers). They can also create by-products such as bromate, or generate a waste brine stream that is difficult to dispose of. However, Trojan's UV-oxidation systems are capable of providing effective treatment of many EDCs and other wastewater-derived contaminants at a fraction of the cost without these undesirable side effects. Further, Trojan's UV-oxidation systems provide a level of disinfection unmatched by other technologies.

Many potential EDCs are readily oxidized (Huber et al, 2003; Snyder, 2004) and can be cost-effectively treated by Trojan's UV-oxidation systems. UV-oxidation uses UV and hydrogen peroxide to generate hydroxyl radicals, that effectively break down a variety of EDCs. UV is especially effective in conjunction with other technologies, where it acts as an additional barrier to contaminants.

This TrojanUVPhox™ at the Orange County Water District removes NDMA and any other wastewater-derived contaminants that may be present in MF and RO-treated secondary effluent.

What Others Are Doing:
Several water supply projects currently take secondary treated wastewater and treat it to standards beyond those required for drinking water. These facilities use microfiltration (MF) and reverse osmosis (RO). However, because NDMA passes through MF and RO, Trojan UV-oxidation is used as a final polishing step. Selected indirect potable reuse projects include:

- The Orange County (CA) Water District's Groundwater Replenishment System (GWRS)
- Water Replenishment District's Leo J. Vander Lans Water Treatment Facility, and
- West Basin Municipal Water District's Edward C. Little Water Recycling Facility

In recent studies in North America, a variety of chemicals were found in streams, lakes and rivers. Examples of the types of compounds that have been found include antibiotics such as erythromycin, disinfectants such as triclosan, hormones such as 17ß-estradiol and 17ß-ethinylestradiol, steroids such as coprostanol and over-the-counter medications such as ibuprofen and acetaminophen.

TROJAN UV – TREATING MULTIPLE CONTAMINANTS WITH ONE SYSTEM

A further benefit of Trojan UV-oxidation systems for EDC treatment is simultaneous disinfection of the water. In addition, due to reactions initiated by the hydroxyl radical, many other dissolved organic contaminants potentially present in the water are treated, including taste and odor-causing compounds (MIB and geosmin), MTBE, and 1,4-dioxane.

For more information regarding the treatment of multiple contaminants using Trojan's UV solutions, including EDC treatment, please contact Trojan.

References:

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