Ozone

when it comes to Drinking Water

Ignorance is Not Bliss

Many Americans were shocked by the recent* Associated Press (AP) *report stating at least 41 million Americans receive drinking water tainted by an array of pharmaceuticals including antibiotics, anticonvulsants, caffeine, mood stabilizers and sex hormones. International Ozone Association (IOA) members, however, were not surprised.

By Paul Overbeck

Report on pharmaceutical-tainted drinking water drives interest in ozone treatment

The *AP* report, stemming from a five-month inquiry, revealed to the public that various drugs have been detected in the drinking water supplies of 24 major metropolitan areas from Southern California to northern New Jersey. In January, a similar finding was featured in a 100-page report commissioned by Britain's Drinking Water Inspectorate.

These findings are neither a surprise to associations like the IOA, American Water Works Association (AWWA), Water Environment Federation and International Ultraviolet Association, nor to the U.S. Environmental Protection Agency (EPA), who has been looking for and evaluating treatment options for a long list of emerging contaminants including endocrine-disrupting compounds that scientists believe interfere with the body's endocrine system and produce negative effects on developmental, reproductive, neurological and immune processes in humans, fish and animals.

Relative Strength of Ozone

Oxidizing Agent	EOP (mV)	EOP vs Cl_2
Fluorine	3.06	2.25
Hydroxyl radical	2.80	2.05
Oxygen (atomic)	2.42	1.78
OZONE	**2.08**	**1.52**
Hydrogen peroxide	1.78	1.30
Hypochlorite	1.49	1.10
Chlorine	1.36	1.00
Chlorine dioxide	1.27	0.93
Oxygen (molecular)	1.23	0.90

Background

Over the past 10 years, research has been funded by various sources to identify low levels of currently unregulated contaminants and potential reduction methods. Improvements in instrumentation and sampling techniques have led to refined measurement of specific organic compounds at parts per billion and trillion levels.

The source water for drinking water systems receives both naturally occurring and synthetic contaminants from numerous sources. Surface water supplies change seasonally with severity and increases or decreases in storm events or snow melt, affecting turbidity, total dissolved solids and total organic matter.

Well water supplies can be impacted as well as surface water supplies. Examples of industrial pollution are in the news regularly, including the following March 18 report that the city of Bakersfield, Calif., and California Water Service Co. (Cal Water), a San Jose-based company that delivers water to 460,000 customers, filed a lawsuit against two chemical company giants for allegedly knowingly polluting drinking water wells. Trace amounts of the chemical 1,2,3-trichloropropane (1,2,3-TCP) have been detected in about 15% of the city's wells and in about 25% of the Cal Water wells. A known carcinogen, 1,2,3-TCP was banned 30 years ago.

Wastewater from industrial and domestic sources goes to wastewater treatment plants for conventional biological digestion and disinfection before discharge to surface water streams or groundwater recharge. The chemical makeup of the wastewater stream can be highly variable, especially from combined industrial and domestic sources.

Chemicals entering the wastewater system can include solvents, gasoline additives, detergents, sanitizers, insecticides, cleaners, and prescription and over-the-counter drugs that are not completely absorbed by those taking the medication. With medications, what is not absorbed is flushed down the toilet.

Conventional physical-chemical wastewater treatment systems remove solids and most dissolved organic compounds that are biologically digestible. The water is then typically disinfected using chlorination before it is discharged into reservoirs, rivers or lakes. The level of gross contaminants and pathogens allowed in this discharge is regulated by federal, state and local governments as are testing and reporting requirements.

Low levels of chemicals remain in the treated effluent from these wastewater plants. Dilution occurs when discharged into reservoirs, rivers, lakes or the ocean. These source waters for drinking water treatment undergo additional treatment before used by the public.

Even with all this conventional treatment, however, the drinking water that meets current governmental standards still frequently has low residual levels of unregulated chemical compounds.

Armed with details on what low-level contaminants are in their systems, many water utilities have evaluated treatment options to provide reduction of many currently unregulated contaminates.

Oxidation and advanced oxidation processes (AOP), designed to generate hydroxyl radicals, have shown significant benefits in both water and wastewater treatment and reuse applications.

One Community's Story

Research by Dr. Shane Snyder, Southern Nevada Water Authority (SNWA), under an AWWA Research

Foundation grant showed excellent reduction of endocrine disruptors and pharmaceutical and personal care products (PPCP) using ozone and AOPs, including ozone plus hydrogen peroxide (H_2O_2) and ultraviolet plus H_2O_2.

This research is important to SNWA because their source water, Colorado River water from the Lake Mead reservoir, is also the discharge-receiving stream for the Clark County wastewater treatment plant. This is a common global practice.

Further pilot testing on Clark County wastewater effluent determined that desired contaminant reduction goals could be achieved by final treatment with ozone oxidation and disinfection treatment without the addition of H_2O_2. Clark County will be adding ozone to their wastewater treatment plant expansion and the people living in or visiting Las Vegas and southern Nevada will be doubly protected with ozone treatment in both their wastewater and drinking water treatment plants.

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Southern Nevada is not the first to look to ozone as part of their improved wastewater treatment and reuse process, nor will they be the last.

The Gwinnett County Department of Utilities (GCDU) provides water and wastewater treatment to public and industrial users in and around Atlanta. This area has been experiencing drought conditions and has been fighting with surrounding states for diminishing water resources flowing through the Lake Lanier reservoir.

In 2005, the IOA held its regional conference at Lake Lanier, Ga., in part to learn about the benefits GCDU was receiving by adding ozone to both the drinking water and wastewater treatment plants that pull from and discharge into Lake Lanier.

In Montreal, Canada, Mayor Gérald Tremblay recently announced plans to add a $200 million ozonation facility to its wastewater treatment plant, following 10 years of laboratory study and pilot projects. The addition of ozone treatment to its wastewater process will make this 7,400 gal-per-second (640-mgd) plant the world leader in the use of ozone for wastewater disinfection. Montreal currently uses ozone at its many drinking water plants.

What Can We Learn

The work of proactive utilities has given great confidence to their local communities and valuable information to the global community on treatment options. Other utilities facing newly raised concerns of emerging and currently unregulated contaminant treatment can follow in their footsteps.

While government regulators determine if these concerns are valid, viable solutions are being evaluated, installed and performance validated.

Ozone and AOPs can reduce endocrine disrupters and PPCP's in drinking water and wastewater and will be used to a greater extent to meet treatment needs and protect public health in the long term. *wqp*

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