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Study finds drugs, chemicals in Ohio River

By James Bruggers • The Courier-Journal • July 17, 2010

Dozens of chemicals and pharmaceuticals - antidepressants, veterinary hormones, even cocaine - have been detected in the Ohio River.

Researchers who conducted the study that found the substances, however, downplayed the potential effects for the 5 million people along the 981-mile river who use it for drinking water. The contaminants, they said, are in extremely low concentrations.

But outside scientists who reviewed the data noted that some of the pollutants have been tied to feminization of male fish, effects that should serve as a warning to people.

"When we see something this basic being altered in fish, we should be concerned about what it's doing to our own health," said biologist Peter DeFur, a research associate professor at Virginia Commonwealth University who specializes in chemical contaminants in the environment and was not involved in the study.

The drugs and chemicals were found in a survey by the eight-state Ohio River Valley Water Sanitation Commission even though sewage treatment efforts screen out a significant percentage of the contaminants.

The sampling at 22 locations from Pittsburgh to Paducah is the first to determine such a widespread presence in the Ohio of what are called "contaminants of emerging concern" and are a new focus of the U.S. Environmental Protection Agency.

The Cincinnati-based sanitation commission, which was established by Congress and Ohio River states in 1948, and its partner in the study, the EPA, say there's little information available regarding human health risks of what they found.

Outside scientists said there are legitimate concerns that the contaminants, including medications that pass through people and into the sewage system, may pose health risks to people.

Greater Cincinnati Water Works serves a million customers in Hamilton, Clermont, Butler, Warren and Boone counties. Deborah Metz, superintendent of water quality and treatment, said the water works also tests down to parts-per-trillion like the ORSANCO study.

She points out how small one part per trillion is: "It would be one second in 32,000 years; or 1 inch in 33 round-trips to the moon; one grain of sugar in an Olympic-sized swimming pool full of sugar; or one penny in \$10 billion. So we're talking very low."

Some home filter systems claim to remove many of the pharmaceuticals. But those claims have not yet been verified, said Tom Bruursema, who manages a water treatment certification program for NSF International, a nonprofit public health and safety agency that tests and sets standards for water treatment systems.

'The big unknown'

"Just because you find it doesn't mean it's a problem," said Erich Emery, a biologist and research manager working on the study for the commission, commonly known as ORSANCO. "We have the ability to detect (almost) anything we want now," with the ability to find substances that register only in parts per trillion.

ORSANCO's 279-page screening survey is almost entirely made up of raw data. ORSANCO staff and the EPA are working on a final report to be completed early next year.

The commission this spring gave the data to its member states. It also provided a copy to The Courier-Journal, which reviewed it with several outside environmental health experts, including Theo Colborn, who said some of the detected chemicals are considered endocrine disrupters. They can mimic or interfere with hormones in the body, possibly affecting tissues and organs.

The 1996 book Colborn co-authored, "Our Stolen Future," brought international attention to the issue, and she said research has suggested potential links between endocrine disrupters and such medical conditions as attention deficit hyperactivity disorder, obesity, early puberty and infertility.

"The big unknown is the mixture of these things being taken together," said DeFur. "We have no idea how to even think about what that means."

He and others spoke of the need for a precautionary approach.

"When you are faced with an unknown and you believe there is potential for harm, you err on the side of human health," said Dr. David Tollerud, chairman of the department of environmental and occupational health sciences at the University of Louisville's School of Public Health.

Nearly indestructible

The \$85,000 study was designed to look for 158 contaminants, including 118 pharmaceuticals, hormones and personal care products. It also looked for perfluorinated compounds, which have been widely used in nonstick coatings for pots and pans and in stain- and grease-proof coatings for food packaging and fabric.

All are essentially unregulated in the nation's waterways and drinking water supplies and are among thousands of chemicals made by humans that are of potential concern.

Terry Collins, who leads Carnegie Mellon University's Institute for Green Science in Pittsburgh and reviewed the ORSANCO data for the newspaper, called it "a very good study" that sheds light "on a large number of compounds."

"... Some of them are coming back in our drinking water," he said.

He said the perfluorinated compounds, or PFCs, are nearly indestructible, and they build up in humans and animals.

The federal Centers for Disease Control and Prevention, which has found as many as 12 PFCs in a national survey of human blood serum, says people are likely exposed by consuming them in food or water or by using products that contain them.

Some PFCs have been linked to liver toxicity in fish and liver cancer in rodents, Collins said.

The drugs that were detected in the river water include some of the most commonly prescribed medications, said Dr. George Bosse, medical director of the Kentucky Regional Poison Center in Louisville. The study found medications used to fight depression, anxiety, high blood pressure, diabetes, heart disease and infection.

Also frequently detected was caffeine, as well as evidence of cocaine and nicotine from tobacco products.

Our bodies don't use all the medication we take, and some gets excreted in human waste. Drugs also enter the environment when people flush unwanted medication down toilets. Of those two sources, the Food and Drug Administration says human excretion produces more drug contaminants.

Other sources of drugs in the environment include runoff from farms and water that passes through landfills.

The drugs found at two Cincinnati area test sites - near the I-275 bridge in the Anderson area and near Anderson Ferry, downriver of the Metropolitan Sewer District's wastewater treatment plant along the Mill Creek - included medications found in many area medicine cabinets.

Among the contaminants that increased while the river passed through Greater Cincinnati and Northern Kentucky were antidepressants, mood stabilizers, stimulants and a byproduct that's created when cocaine passes through the body.

Plant discharges

Many of the samples were taken above and below the wastewater treatment plants of cities along the river. In most cases, including Cincinnati, many concentrations were higher in the effluent.

For example, concentrations of the anti-convulsive and mood stabilizer carbamazepine, sold under brand names including Tegretol, increased almost 18 percent from Cincinnati's upriver and downriver test stations. The concentration of the PFC known as PFPeA was 92 percent higher, and the concentration of atenolol, a blood-pressure drug, was more than twice as high downriver.

The study also found the concentration of Benzoylcegonine, the urinary breakdown product of cocaine, was 170 percent higher downriver of MSD's treatment plant on the Mill Creek, while caffeine also was significantly higher. DEET, the insect repellent, was slightly lower downriver.

Here were other substances detected at the Cincinnati test sites: 10-Hydroxy-amitriptyline, an antidepressant; the stimulant Amphetamine; anticonvulsant and mood stabilizer Carbamazepine; Cotinine, a nicotine byproduct that increased 43 percent in this area; the antibiotic Erythromycin-H2O; anti-anxiety medication Meprobamate (a 61 percent increase); Diabetes medication Metformin (a 59 percent increase); and painkiller Oxycodone, which reached detectable levels past Cincinnati.

Wastewater treatment plants are not designed to remove all contaminants, said Collins, the Carnegie Mellon chemist.

"The fact that you are seeing spikes and you can trace them to a treatment plant is a promising thing," he said. "We can do better. We can lower those concentrations."

Future filtering

For their part, ORSANCO officials say they are not sure that the levels of what they found in the river need to come down.

"It would be nice if we had a better sense of which chemicals to worry about," said Peter Tennant, deputy director of the commission.

The regulatory system is not set up to deal with such a large inventory of potential threats, Tennant said, adding that the EPA typically issues just three or four new water quality standards per year.

"That kind of pace just isn't going to cut it for the thousands of chemicals that are of emerging concern," Tennant said.

EPA officials declined to be interviewed. But in a statement from EPA spokeswoman Enesta Jones, they said they are studying a list of 104 contaminants - including, for the first time, pharmaceuticals - for potential drinking water limits.

In August, the EPA said it will launch a survey looking for some 200 drugs and other chemicals in the source and tap waters of about 50 drinking water utilities across the United States, with the results anticipated by late 2011.

Greater Cincinnati Water Works, which gets 85 to 90 percent of its water from the Ohio River, uses 11½ feet of granular-activated carbon to filter such contaminants, Metz said. In that system, "the water stays in contact with the carbon 15-20 minutes," she said. "And plus we change it out a couple times a year."

"The positive news is that we and U.S. EPA have both looked at our removal through carbon and basically it's removed down to nothing - there's no problem with any of these compounds in our water," she said. "Now, once in a while we'll see something like a little bit of caffeine or something like that, but truthfully when EPA did the whole cadre ... the only thing they found was the caffeine coming through. But they found stuff in the river, though."

Estrogen-containing hormones "are very well removed with carbon," Metz said. The water works this year also will break ground on an ultraviolet disinfection system to its chlorine disinfectant system to remove problem microorganisms such as the protozoan parasite cryptosporidium.

As for the Metropolitan Sewer District of Greater Cincinnati, which cleans wastewater and releases the scrubbed effluent into the waterway, "Currently pharmaceuticals and personal products are not regulated by the EPA," said MSD spokeswoman Cassandra Hillary. "So they're not a part of our routine protocol. Currently we don't test for that because we're not required to test for that."

Enquirer reporter Mike Rutledge contributed to this report.