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Teams study pollutants in Arizona rivers

Annalyn Censky
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Three teams of Arizona scientists are focusing research on a class of chemicals in the state water supply that could lead to cancer, infertility, birth defects or other health problems.

The chemicals, known as endocrine disruptors, mimic certain hormones and then interrupt or exaggerate chemical reactions, leading to potential health threats.

Endocrine disruptors are found in pharmaceuticals, soaps, plastics, fabrics, cosmetics, soft drinks and other common household and industrial products. They enter the water supply through drains, sewers and agricultural runoff.

One team of scientists has recently identified higher-than-expected concentrations of endocrine disruptors in Arizona rivers. The other two teams are trying to determine how damaging the disruptors can be to people by studying their effect on wildlife along the rivers.

"Endocrine disruptors are everywhere," said David Walker, a University of Arizona researcher who studies the effect of the chemicals on native fish. "These are things that have made it easier for us to survive as a species, but at the same time, the long-term effect of being exposed to low doses of these compounds, nobody knows about."

At present, very little is known about the threat to human health, but researchers at all three Arizona public universities hope to change that soon.

ASU studies rivers

Morteza Abbaszadegan has been looking for endocrine disruptors in the Gila, Verde and Salt rivers for four years.

Not much was known about the chemicals prior to 1996. But then-President Bill Clinton signed laws requiring the EPA to investigate their long-term effects, and research increased. Since then, scientific studies have linked the chemicals to infertility, breast and testicular cancer and early-onset puberty.

Abbaszadegan is the director of the National Science Foundation's Water Quality Center at Arizona State University, a research group that investigates physical, chemical and biological processes affecting water quality. He wanted to determine if the chemicals were present in Arizona rivers and to what degree.

Abbaszadegan and his graduate students take water samples, concentrate the pollutants found in the water and expose human breast-cancer cells to them to gauge their potency.

If the cancer cells grow significantly faster than usual, endocrine disruptors are present.

Salt River water samples made the cells grow faster by 60 percent. Concentrated water from the Central Arizona Project canal and Verde River made cells grow faster by 69 and 68 percent, respectively. After water treatment, those numbers dropped to the low 20s.

While those lower numbers are probably safe for tap water, Abbaszadegan said, the higher percentages in the rivers might imply that the pollutants are present at levels that could cause

cancer and other health problems.

It's difficult, however, Abbaszadegan said, for scientists to attribute cancer or other diseases to any one of the more than 15,000 endocrine disrupting compounds people are exposed to in their daily lives.

Chemical companies still manufacture billions of pounds of these chemicals each year for use in building materials, cosmetics and lotions, plastics and common pharmaceuticals. Birth-control pills, shower curtains, baby bottles, dental fillings and egg cartons contain these chemicals. Endocrine disruptors also are found in runoff from pesticides and excrement from farm animals.

The technology doesn't exist to separate and track all those chemicals and their effects, Abbaszadegan said.

That's perhaps one reason the EPA has not passed any regulations on the chemicals, although the agency set out a decade ago to determine potential dangers.

In addition, scientists say there is still much to learn about the chemicals before testing on humans.

UA studies fish

At UA, Walker studies the environmental impact of endocrine disruptors in wastewater that flows into the Santa Cruz River in Tucson.

He exposes a native fish, the bony-tailed chub, to different concentrations of the water over a year, documenting the response.

The treated wastewater contained 15 compounds known to cause endocrine disruption, mainly stemming from byproducts of soaps and detergents, flame retardants and plasticizers. None of the compounds was found at levels higher than 1 microgram per liter of water, or one part per billion.

Nevertheless, the presence of those compounds in small concentrations was enough to have a significant effect.

In Walker's study, the Santa Cruz River wastewater feminized male fish.

After a year of living in the wastewater, male fish had the same amount or more female hormones than healthy female fish.

Meanwhile, the female fish living in the wastewater showed much lower levels of estrogen compared with females living in clean water.

If the study were extended to include several generations, Walker said he would expect to see changes in sex organs and mating behavior. He bases that hypothesis on research elsewhere in the country.

Scientists often blame estrogenic chemicals, which mimic and interfere with natural estrogen, for causing those reproductive changes. Artificial estrogen from birth-control pills, some scientists say, may account for a major portion of estrogenic chemicals in wastewater runoff.

Others, like Walker, disagree, saying there are numerous sources.

NAU studies frogs

In Flagstaff, biologist Catherine Propper of Northern Arizona University studies the effects of estrogenic chemicals called non-ionic surfactants on frogs.

The chemicals improve cleaning power in detergents and make pesticides stick to plants.

One often found in sunscreens, octylphenol, interfered with gene expression and sexual development in frogs, even at a low-parts-per-billion level found in local rivers, Propper said.

"A lot of groups will say the levels in the environment are too low to have an environmental impact," she said. "Looking at the effect on aquatic vertebrates and mammals as surrogates for humans, we are very concerned. We do know environmental levels to have an impact."

The EPA does not require municipalities to filter endocrine disruptors from tap water. Even if it did, Phoenix water-treatment officials say concentrations of endocrine disruptors in local rivers are so low, they are nearly impossible to measure.

Consider the concentration of Tagamet, a common heartburn medication with estrogen-like chemistry, said John Watson, superintendent of the city's pollution-control division. A person would have to drink two liters of Phoenix wastewater every day for 1,000 years to consume enough Tagamet to equal that of one 400-milligram pill, he said.

And that's just one chemical. Measuring for thousands of endocrine disruptors at levels that low would take state-of-the-art equipment and hundreds of thousands of dollars to implement, Watson said.

Meanwhile, hundreds of products, including baby toys and teething rings, have been banned in countries around the world for containing endocrine disruptors. Because of a lack of regulations, these products are still available in the U.S.

That's worrisome to scientists like NAU's Propper, who said the data show human health is at risk, even though the risk has not been quantified or well defined.

"It is a very complicated problem, and people need to understand there won't be simple solutions," she said.

But there are some things people can do to cut down on their use of endocrine disrupting chemicals.

Propper said she eats more organic food and does not use pesticides, antimicrobial soaps or shampoos containing chemicals called phthalates.

Flushing pills down the toilet is also a no-no, Watson said.

Meanwhile, further studies are planned at all three state universities as scientists work to determine the dangers these chemicals pose to people.