

Chromium carcinogenic in water; new standard in the works

Hexavalent chromium, the controversial 'Erin Brockovich' chemical, is carcinogenic in drinking water, scientists have concluded. California will soon propose a new health guideline for water supplies.

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A controversial water contaminant made famous by Erin Brockovich and a small California desert town is carcinogenic.

That conclusion by federal scientists, culminating more than a decade of debate, is likely to trigger new, more stringent standards limiting the amount of hexavalent chromium allowable in water supplies.

It's been known for about 20 years that people can contract lung cancer when inhaling hexavalent chromium, also known as Chromium 6. But until now, toxicologists have been uncertain whether it causes cancer when swallowed.

National Toxicology Program scientists reported that their two-year animal [study](#) "clearly demonstrates" that the compound is carcinogenic in drinking water. Mice and rats contracted malignant tumors in their small intestines and mouths when they drank water containing several different doses of hexavalent chromium.

"I think it's resolved, as much as it can be resolved," said George Alexeeff, deputy director of scientific affairs at California's Office of Environmental Health Hazard Assessment.

Based largely on the new cancer findings, California and U.S. Environmental Protection Agency officials are re-evaluating what concentration is safe in water supplies. Within a few weeks, California is expected to announce a proposal to set a new health guideline.

The Mojave Desert town of Hinkley, population of around 1,900, has the highest levels of hexavalent chromium reported in U.S. ground water. The compound seeped into water there from a Pacific Gas and Electric facility that used it to inhibit rust in cooling towers and discharged it into holding ponds in the 1950s and 1960s.

In 1996, PG&E paid a \$333 million settlement to about 600 residents of Hinkley after Brockovich, a law clerk, investigated the contamination and found high rates of cancer and other diseases. The town's plight drew national attention in 2000 from a film based on Brockovich's legal crusade. The payment was the largest tort injury settlement in U.S. history.

The animal study does not prove that people in Hinkley contracted cancer from drinking the tainted water. But it does resolve the debate over whether the contaminant is capable of causing some types of cancer.

Roberto Gwiazda, an assistant researcher at University of California at Santa Cruz's Department of Environmental Toxicology, called the new study a "milestone," saying it "settles the issue."

However, Gwiazda said, using the new research "to support a drinking water standard is a different matter" because extrapolating it to humans remains controversial.

Hinkley's ground water contained concentrations as high as 580 parts per billion, more than 10 times California's current drinking water standard of 50 ppb for total chromium compounds. The national standard is 100 ppb.

Because of the cancer uncertainty, California has had a tumultuous history of setting water standards to protect people from chromium.

In 1999, after the Hinkley case, California set a water guideline, called a Public Health Goal, of 2.5 ppb. It was based on a 1968 study in Germany that found stomach tumors in animals that drank the substance. However, the U.S. EPA rejected that study as flawed and determined there was no evidence it was carcinogenic in water. California's scientific advisors agreed, so the state rescinded its goal in 2001 and reverted to the 50 ppb standard, which was adopted in 1977 and based on the risks of skin irritation, not cancer.

The debate focused on whether hexavalent chromium is neutralized in the stomach by gastric acids that turn it into Chromium 3, an essential nutrient.

California officials, seeking to resolve the controversy, asked the National Toxicology Program to conduct animal tests.

The study, published online in Environmental Health Perspectives in December, shows that although some of the substance is reduced in the stomach to Chromium 3, it's not enough to avoid toxic effects.

"Since they found tumors in the small intestine, that shows it was not eliminated in the stomach," Alexeeff said.

Cancer in the small intestine is "relatively rare" in animals, even those exposed to other chemicals, the scientists reported. In addition, chromium caused mouth cancers, and infiltrated the cells of many organs, including livers and pancreatic lymph nodes.

Mice and rats were exposed to four different doses, and they contracted cancer at lower levels than in the 1968 study, according to Michelle Hooth, a toxicologist at the National Institute of Environmental Health Sciences who was the study's lead scientist.

That suggests California's new goal could be as stringent as the rescinded 2.5 ppb one.

Chromium is widely used in metal plating, stainless steel production, wood preservation and textile manufacturing. It has been detected in 30% of drinking water sources in California, at levels mostly under the existing 50 ppb state standard, according to the state health department.

Some of the rats and mice developed malignant intestinal tumors when fed doses as low as 57,000 ppb—100 times higher than the Hinkley water levels--for up to two years, Hooth said. The higher the dose, the more cancers found among the animals.

When setting a standard, scientists use high animal doses to extrapolate to a lower dose designed to protect people from a 70-year lifetime of exposure. Water standards are usually designed to keep the cancer risk to one case in every million or 100,000 people.

Gwiazda, who has served on EPA and California scientific advisory panels, said extrapolating the animal findings for humans creates uncertainty because the rodents had to be fed higher doses.

He said applying the data to humans assumes that the rodents' stomach eliminated the same fraction of chromium 6 at high doses that the human stomach would at lower doses.

"This assumption is flawed in my view because the stomach has a very high reducing capacity," Gwiazda said.

As a result, such extrapolations could lead to an overly restrictive water standard, he said. "On the other hand," he added, "there is probably a subpopulation of sensitive individuals with diminished stomach

reducing capacity due to illness." For those people, a standard based on the animal data "may not be protective enough," he said.

There also is human evidence that drinking hexavalent chromium can cause cancer. A study in China found high rates of stomach cancers in people whose water was contaminated with so much chromium from a smelter that it had turned yellow.

California state scientists will release their draft Public Health Goal for public comment "within the next couple of weeks," said Sam Delson, the Office of Environmental Health Hazard Assessment's deputy director of external and legislative affairs.

The new study, Alexeeff said, "is a large foundation of our results." The National Toxicology Program released some of its initial data last year, but the full report came out in December.

The number that Alexeeff's staff recommends will then be used by the state's health department to formulate a maximum allowable amount for water supplies. The health department factors in the cost and technical feasibility when it sets that standard.

"We come up with a goal, and it's up to the health department to propose a maximum contaminant level," Alexeeff said.

U.S. EPA officials also are evaluating the national 100 ppb standard and plan to release their results this fall. The agency is required by federal law to review water standards every six years. The EPA had adopted a more stringent chromium standard in 1977 but raised the allowable amount in 1991 in response to the lack of cancer evidence.

EPA spokeswoman Enesta Jones said Thursday that hexavalent chromium is among 20 compounds selected in 2008 for review by the agency's Office of Research and Development. When officials there analyze all scientific literature, including the new study, they then will decide whether to change the old toxicity levels used to set standards for water and soil cleanup, she said.

Cleanup of Hinkley's contaminated water--an underground plume that is two miles long and one mile wide--began in the late 1980s and is continuing, according to California Water Resources Control Board documents. The contamination is still spreading, so the state issued its latest cleanup order to PG&E in August.

Brockovich, now president of a consulting firm, has since fought other legal battles related to chromium and other pollutants.