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Environmental Health

Coal Waste May Cause Carcinogen Spikes in Drinking Water

APRIL 7, 2014 by [EDITOR](#) in [ENVIRONMENTAL HEALTH](#), [FEATURED](#), [STATE HEALTH POLICY](#)

An investigation by North Carolina Health News finds water-quality issues from coal waste in municipalities near a Duke Energy coal plant outside of Eden.

By **Gabe Rivin**

Terry Shelton was on a hunt for clues.

Shelton is the director of environmental services for the city of Eden, in Rockingham County, which draws its drinking water from the Dan River. Up until 2011, the city had had few problems with the health of its drinking water.



Terry Shelton, director of environmental services for Eden, explains the treatment process at Eden's drinking-water plant.
Photo: Gabe Rivin

But early that year, Shelton and his colleagues noticed something troubling with the water that Eden distributes outside the city center. The treated water was showing [a spike in trihalomethanes](#), byproducts of the treatment process that, research has found, can be harmful to human health.

Shelton and others began to sample water from the Dan, moving incrementally upstream in hopes of finding the source of their problems.

"We were taking water samples upriver for as much as 30 miles at various bridges and bringing them back and looking for differences in the water," he said.

Eventually, the team pinpointed what appeared to be the source: a Duke Energy

coal-fired power plant. Duke's Belews Creek plant, upstream from Eden's drinking-water plant, was releasing bromides into the river. Those bromides contribute to the formation of potentially cancer-causing trihalomethanes in treated drinking water.

Eden has featured prominently in recent headlines, after a coal ash pond, [next to a different Duke Energy plant farther downstream](#), spilled tons of waste ash into the Dan in February. The spill initiated a fierce public debate about the safety of such coal ash reservoirs. Debate has also raged over whether such ponds have contaminated subsurface water.

But Shelton's findings raise another grim possibility: Waste from coal plants could also be polluting major rivers across North Carolina and putting people's health at risk.

Trading one problem for another

In a way, Eden's problems resulted from good intentions.

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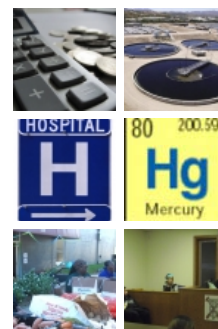


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At its Belews Creek coal plant, Duke Energy installed a “scrubber” system in the smokestacks in 2010 that helps to trap polluting gases before they’re released into the air.

To trap the gases, some coal plants pump those gases through a slurry that contains minerals like limestone. The process produces wastewater that can contain bromides.

This scrubbing process – technically known as flue gas desulfurization – takes place in a very large building, one that energy companies spend fortunes to construct, according to John Ward, a communications coordinator with the American Coal Ash Association.

According to Ward, some of the scrubber waste gets reused into products such as wallboard.

But other scrubber waste is often treated and then mixed with coal ash or coal ash wastewater, according to Susan Massengale, a public information officer at the N.C. Department of Environment and Natural Resources.

That coal ash wastewater, now containing bromides from the scrubber, is then released into rivers and other surface waters, as permitted by the state.

Duke acknowledges that its Belews Creek plant releases bromides into the Dan.

“The Belews Creek scrubber process that was installed to meet air quality standards produces a wastewater containing bromide,” said Lisa Hoffmann, a Duke Energy spokesman, in an email interview.

Hoffmann said that scrubber wastewater must meet state requirements before being released into rivers.

But, she said, “There is no federal or state surface water quality standard for bromide and, therefore, no limit in the plant’s permit for it.”

But bromides aren’t the problem per se; the problem takes place when those bromides go through the drinking-water treatment process.

The making of a trihalomethane

Drinking-water plants often draw water from rivers, which can be rife with bacteria. To kill those bacteria, these plants often treat their water with chlorine. This clears the water of countless pathogens. But chlorine also reacts with natural, decaying matter, such as plant leaves and riverbank grasses.

These [interactions](#) can produce trihalomethanes.

Researchers have studied [trihalomethanes](#) for about 40 years, according to Philip Singer, a professor emeritus of environmental engineering at the University of North Carolina-Chapel Hill. The U.S. Environmental Protection Agency requires drinking-water plants to minimize trihalomethanes and haloacetic acids, another of the so-called disinfection byproducts in water plants.

But not all trihalomethanes are created equal; not all of them have the potential to cause harm.



Coal plant scrubbers also produce gypsum, which is reused in wallboards and concrete. Photo courtesy American Coal Ash Association

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"The regulations are for total trihalomethanes, which is the sum of four different species," Singer said. "One of them is chloroform. The others all have the same structure as chloroform, but they have bromine instead of chlorine attached to the carbon."



When bromides react with the chlorine and decaying matter, they tend to increase the level of trihalomethanes. Bromides also shift trihalomethanes, turning them into their brominated forms, the form of trihalomethanes that worries health researchers the most, according to Singer.

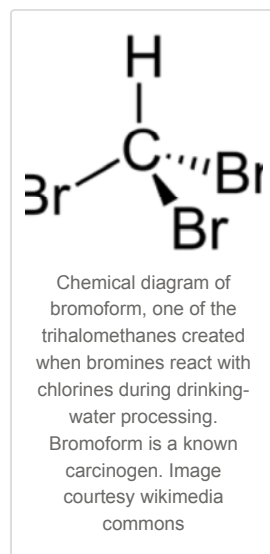
Exposure to brominated-forms of trihalomethane has been linked to a number of health issues, including bladder cancer, according to Singer. He said scientists consider chloroform, the trihalomethane that lacks bromine, to not be a major health risk.

Bromoform, one of the three brominated trihalomethanes that EPA regulates, can cause eye and skin irritation, central nervous system problems and damage to livers and kidneys, according to the [Centers for Disease Control and Prevention](#).

In contrast, chloroform, the trihalomethane that lacks bromine, is not a significant risk to human health, Singer said.

A 'non-regulated chemical'

The lack of regulations for bromides can be a problem, said Tom Boyd, a senior environmental specialist at the Department of Environment and Natural Resources. Boyd, who works with drinking-water plants in northwest North Carolina, said coal plants send their scrubber waste to wastewater treatment systems, but that those systems often fail to remove the bromide.



"Sadly, it's passing through into the waters of the state," he said.

Boyd, like Hoffmann, noted that North Carolina does not control bromide releases into streams or rivers. "It's a non-regulated chemical," he said.

DENR has, however, [required Duke to monitor bromides at its Belews Creek plant](#) and to report its data on bromide releases to the city of Eden and the nearby town of Madison if their levels of trihalomethanes increase.

But that's not the case at Duke's other active coal plants, all but one of which use scrubber technology. (Click [here](#) for a list of Duke's permits to discharge wastewater into state waters.)

DENR's Massengale said the department required Duke to monitor bromides at Belews Creek because "it seemed to be causing a problem" for

Eden's and Madison's water plants. But DENR wouldn't require monitoring at other coal plants unless downstream drinking-water users reported problems.

Uncertain effects across the state

Assessing those problems statewide can be difficult.

Many drinking-water plants in North Carolina have reported violations of trihalomethanes and haloacetic acids. Some of these plants are downstream from active coal plants with scrubbers.

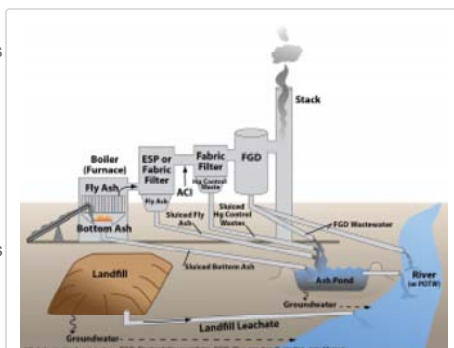
But with little monitoring of bromides, it can be difficult to draw a link between coal plants' scrubber waste and trihalomethanes in drinking water.

"We're trying to figure out exactly where the bromide is coming from," said Detlef Knappe, a professor of environmental engineering at North Carolina State University.

Since 2013, Knappe has surveyed surface waters across the state, measuring bromide levels. The large majority of surface waters, he said, had normal levels of bromides.

Some rivers, such as the Cape Fear, had highly elevated levels of bromides. But he warned that the bromide-saturated water in the Cape Fear did not appear to be tied to upstream coal plants.

He also noted that several industries may release bromides into surface waters.



A diagram showing the disposal of waste from scrubbing, or flue gas desulfurization (FGD). In North Carolina, scrubbed coal plants do not release FGD waste directly into rivers, according to the N.C. Department of Environment and Natural Resources. Graphic courtesy U.S. EPA

"The main point here is, it's not only coal-fired power plants or power plants in general that could be a source of bromide," Knappe said. "There could be also industries that use bromine-containing substances."

To make matters murkier, some drinking-water plants receive lab reports with limited information about trihalomethanes, according to DENR's Boyd.

Though there are four types of trihalomethanes – including brominated and non-brominated forms – some labs only list the total count of trihalomethanes, Boyd said. And some drinking-water operators, he added, don't know that they should ask for a species-by-species breakdown, even though DENR encourages it.

Massengale argued that other drinking-water plants have not faced the same problems as Eden and Madison.

"No other community in the state downstream of the power plant discharges [has] experienced [trihalomethane] issues," she said.

And though Duke admits its Belews Creek plant produces wastewater with bromides, the utility would not respond to questions about bromides at its other plants.

The cost of cleanup

Scrubber waste was almost certainly an issue for Eden, as well as Madison, which is also downstream from the Duke plant.

Recognizing its responsibility, Duke has offered to help both municipalities.

"In Eden, that involves helping to fund the city's conversion to another disinfection method," said Duke Energy's Hoffmann. "In Madison, that involved helping to install a new aeration technology."

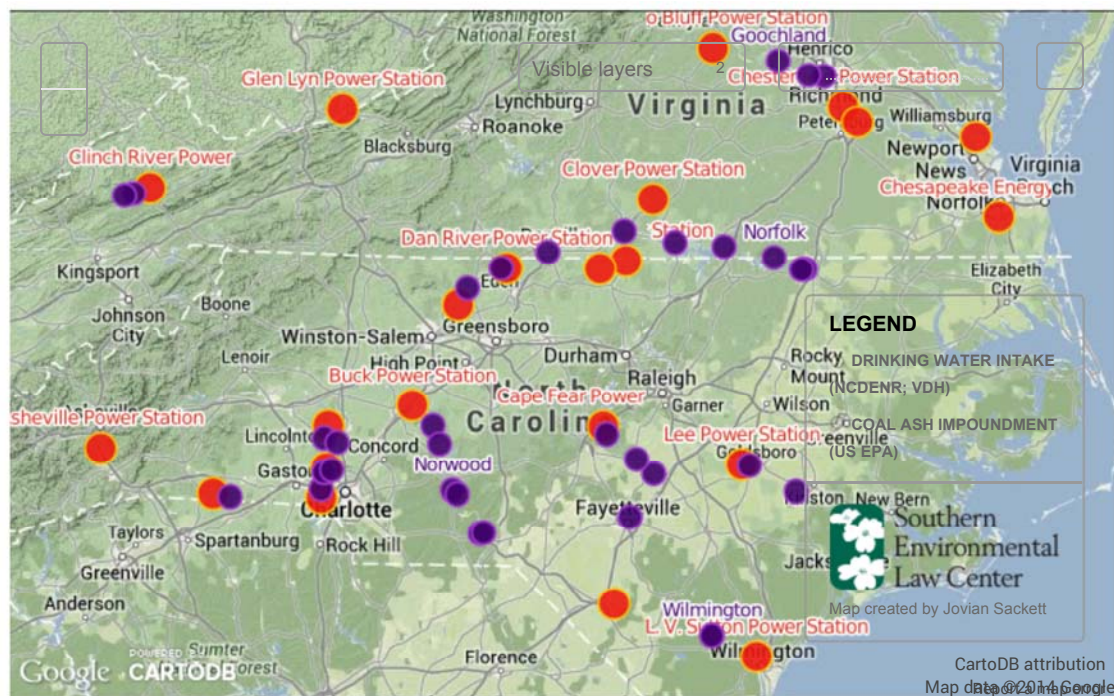
The conversion to a chloramine-based system will reduce trihalomethanes in water that Eden pumps outside the city, according to Shelton. But it will come at a cost. Duke has offered to pay \$1 million for the conversion, but the estimated remaining \$350,000 will come at Eden's expense.

UNC's Singer said that these sorts of water-plant upgrades are generally expensive.

"There are lots of ways of controlling trihalomethanes," he said. "But one of the best ways is to start with a better source of water, and not have your water degraded."

Coal Ash and Drinking Water Supplies

Click on the public drinking water intakes (purple dots) or the coal-fired power plants with coal ash impoundment sites (red dots) for additional information.



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Map courtesy the Southern Environmental Law Center

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