

ENVIRONMENT

Florida's algae-tainted waters also pump toxins into the air. Scientists study health risks

BY SARAH LOFTUS *MIAMI HERALD WRITER*
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Fear grows as Lake Okeechobee faces toxic algae bloom

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A deepening algae bloom across Lake Okeechobee in 2018 raised fears along the Treasure Coast and Calooshattee River that another toxic summer was forming. BY [PEDRO PORTAL](#)



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Last month, the scientists and health experts trying to figure out how to combat Florida's persistent blue-green algae bloom problems discussed how to do a better job of informing the public when toxins are detected in waterways.

One recommendation included posting signs in multiple languages advising against swimming or drinking the water — though green slime on a lake, canal or river is also its own warning sign.

But keeping people and pets out of the water is only part of the concern about blue-green algae — particles can also waft invisibly into the air, carrying toxins with them. Scientists across the state are now studying the potential long-term health risks from blue-green algae toxins inhaled into the lungs, where they might enter the bloodstream. Some initial findings suggest the impact could extend far beyond the waterfront.

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The research is in its early stages and there are no answers yet, but so far scientists have found that many Floridians may already be well-equipped to protect themselves if the airborne toxins are dangerous. They've found that N95 face masks and disposable surgical masks, familiar headwear during the ongoing COVID-19 pandemic, can filter most algae toxins from the air.

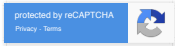
“We know it’s getting in the air, we know people are breathing it in, but we don’t know what risk that represents,” said Mike Parsons, a harmful algae bloom expert with The Water School at Florida Gulf Coast University.

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Beachgoers on the Gulf Coast are well aware that ocean waves can launch toxic aerosols from red tide blooms. Toxins in the water can kill marine life, and toxins in the air can cause coughing, throat irritation and assorted respiratory irritations for humans, especially those with diseases like asthma. Much less is known about the effects of aerosols from blue-green algae, which are a different type of algae that grow in freshwater and in estuaries near the coast.

There are anecdotal reports of health problems from blue-green slime as well.

In the summer of 2016, residents living along the Atlantic coast's St. Lucie estuary near Stuart became sick during a serious blue-green bloom, even though they weren't entering the water or eating its fish, said Larry Brand, a harmful algae bloom expert at the University of Miami Rosenstiel School of Marine and Atmospheric Science. The same happened along the Gulf coast's Caloosahatchee estuary around Cape Coral in 2018. Some people even left their homes along the canals and estuaries for a week or two during the blooms, he said.

"It smelled like raw sewage, and people were reporting flu-like symptoms and headaches," said Parsons, the Florida Gulf Coast University algae expert.

Parsons started monitoring airborne toxins in 2018, after a pregnant woman living on a boat on the Caloosahatchee estuary asked him if the surrounding algae would harm her developing baby. At that point not much research had been devoted to inhalation of blue-green algae toxins.

Parsons is also a member of Florida's [Blue-Green Algae Task Force](#) along with four other scientists. Gov. Ron DeSantis initiated the task force last year after the particularly severe blooms in 2018. Along with many other [recommendations](#) to prevent and monitor blooms, last fall the task force [recommended research studies](#) on both the short- and long-term health effects of blue-green algae toxins. This year the Florida Department of Health also funded pilot research projects at four universities, providing \$650,000 total.

FLORIDA'S BLOOM PROBLEM

Blue-green algae, also known as cyanobacteria, are like microscopic aquatic plants. Algae overgrowth is called a bloom, which tends to appear in the wet season during late summer and early fall. Hot temperatures and nutrient-polluted water containing phosphorus and nitrogen, primarily from agriculture but also from leaky septic and sewer systems, provide optimal bloom conditions.

Decades of manipulating waterways and applying fertilizers to the land have led to serious blooms statewide. The Caloosahatchee River on Florida's west coast and the St. Lucie River on the east coast connect to Lake Okeechobee through constructed canals. The lake collects nutrients from stormwater runoff, and nutrients are also stored in its sediments that can get mixed around during storms. If the U.S. Army Corps of Engineers releases freshwater from the lake into the rivers, or if enough nutrient-polluted freshwater runoff enters waterways and estuaries, [blue-green blooms can form](#).

Blue-green algae come in many different varieties. Only some types, like *Microcystis*, can produce toxins. If these freshwater blooms reach the ocean at the end of an estuary, the salty water can also make the algae split open, [leaking toxins](#) directly into the water.

Accidental exposure of humans and animals to blue-green algae toxins, along with experiments on rats, have led to some understanding of their damaging health effects. But long-term effects are much harder to discover and study, said Brand.

There are hundreds of [different forms](#) of blue-green algae toxins. The more common forms, called microcystins, target the liver, and other toxins can target the nervous system, digestive system and skin.

TOXINS IN THE AIR

Algae particles can escape into the air with water droplets and bursting air bubbles. Algae dust from dried up floating algae mats can also get picked up by the wind, said Parsons. Toxins inhaled from the air might have a more potent effect than swallowing them in water, because lungs have direct access to the bloodstream.

Parsons collects toxin-containing particles from the air using canisters that contain sequential filters with smaller and smaller openings. The filters represent different stages of the respiratory system, starting with the nose and reaching all the way to tiny sacs in the lungs where blood vessels pick up oxygen. Air whirls around the canisters, and particles settle on different filters

depending on their size.

After the peak of the 2018 bloom in the Caloosahatchee estuary, Parsons' research team [found low amounts](#) of microcystin toxins on all of the filter sizes, meaning the toxins could potentially enter someone's bloodstream.

"We also measured the same amount of toxins about ten miles away," said Parsons. "That was a head scratcher."

So they repeated the measurements during the dry season when there were no blooms. Even then they found toxins, though a smaller amount, indicating that some amount of toxin might always be in the air.

Researchers are now trying to determine the complex connection between airborne toxins and health.



In 2016, discharges from Lake Okeechobee led to widespread blooms along the St. Lucie River. Richard Graulich
THE PALM BEACH POST

Parsons credits the Florida Department of Health for funding the most cutting-edge research on

health impacts from blue-green algae toxins. The department plans to keep funding research in the coming fiscal year, providing \$1 million total.

With the state funding, Parsons' research team is comparing airborne toxins in the dry season and wet season in Cape Coral on the Caloosahatchee estuary, in Stuart on the St. Lucie estuary and in Clewiston near Lake Okeechobee. They're also planning to give out small portable air samplers that people can wear on their waist, so the measurements are more realistic to what someone is breathing in.

The scientists are collaborating with Florida Atlantic University researchers to ultimately measure toxins in people's blood, urine and noses so they can link any short-term health symptoms with toxin exposure. University of Miami researchers also planned to do a similar study with health department funding. The COVID-19 pandemic has interrupted much of the research on people, though.

Adam Schaefer, an epidemiologist at FAU's Harbor Branch Oceanographic Institute, previously found that people in Stuart near the blue-green algae bloom in 2018 had [microcystin toxin in their noses](#) even though none were swimming in the water. People who worked on the waterway, like marina managers, carried the highest amounts.

Residents who lived directly on the waterway didn't have higher amounts than people who lived elsewhere, though. Only six of the 121 people they tested didn't have detectable amounts of toxin. The toxin-free people were sampled towards the end of the bloom when toxin levels in the water were decreasing.

Schaefer's study is the first in Florida to measure blue-green algae toxins in people and connect it to what was happening in the water. Still, toxins in the nose don't reveal how much people actually absorb and whether it's enough to harm them.

FINDING HOT SPOTS

This year researchers started looking for disease hot spots that could potentially be long-term effects of blue-green algae toxins, like non-alcoholic liver disease and neurodegenerative diseases, such as Alzheimer's.

Yi Guo, a data scientist at University of Florida's College of Medicine, scanned a [medical database](#) containing anonymous records from 15 million Floridians, looking for diseases diagnosed between 2012 and 2018. The project is more of a demonstration to show how medical records can be used to pinpoint locations for further study.

His preliminary results show a few potential disease hot spots in Florida, but these findings haven't been compared to geographical data on blooms and toxins, so there's no evidence to suggest the diseases are linked to toxic algae. The medical records also don't account for where people may have lived before being diagnosed. Guo said he originally proposed to combine the health data with water quality data [collected around the state](#), but this more extensive analysis was cut from the health department grant.

Other UF and Florida Gulf Coast University researchers are currently sampling water around Florida for a blue-green algae toxin known as BMAA. BMAA is potentially linked to development of neurodegenerative diseases in people, though available evidence still [doesn't fully prove](#) there's a link.

"BMAA is not easy to measure," said UM's Brand. Since it doesn't have immediate health effects, the potential impacts are also harder to trace.

BMAA comes and goes, said Guo. Finding trends over time requires long-term monitoring.

MASKS AND OTHER PREVENTION

Preventing exposure to toxins is another research priority. A research team at the University of Miami that's been studying algae bloom aerosols recently showed that surgical face masks and home air conditioning filters, like those placed in air ducts and window units, can catch toxin-containing particles.

Preliminary, unpublished results confirmed that N95 face masks were true to their stated efficiency, blocking 95% or more of small particles emitted from a bubbling container of *Microcystis* algae, said Kim Pependorf, a chemical oceanographer at University of Miami's Rosenstiel School. Disposable surgical masks, which look like pleated squares, also blocked most of the microcystin toxins. These masks performed similarly to a HEPA filter, she said, which some people with allergies opt to have in their home.

The researchers haven't tested cloth face masks, but might be able to use results from other face mask studies to figure out filtering efficiency of toxic particles, said Pependorf.

Other home air filters were also true to their stated efficiency ratings, she said. Filters come with ratings, such as [MERVs](#), which indicate the percent of particles they can trap from the air.

"A more highly rated filter definitely traps more of the particles," said Pependorf. There's quite a wide range in what you can get on the shelf at the hardware store in terms of filter efficiency, she said.

The team is also starting to test the effects of airborne algae toxins on fruit flies.



In 2016, polluted discharges from Lake Okeechobee into the St. Lucie River prompted Gov. Rick Scott to declare a state of emergency. Greg Lovett *AP*

Elizabeth Kelly, water quality research manager with Miami Waterkeeper, remembers worrying about breathing around the blue-green bloom in Lake Okeechobee and the St. Lucie River in 2018 while sampling water for her Ph.D. research. She took a face mask just in case.

Kelly said the state needs to do more regular algae monitoring, especially in areas where blooms typically occur. She said the Florida Department of Environmental Protection now mainly relies on people seeing a bloom and [reporting](#) it. The DEP and other state agencies also do regular water monitoring, but it's been downsized over the years with [budget cuts](#).

"I think they're trying," she said about state monitoring. "We definitely want it to be stronger than it is."

When the DEP detects toxins they tell the health department, which issues a health advisory. But posting health alert signs basically becomes voluntary at the local level, said Parsons. The Blue-

Green Algae Task Force recommended regular toxin monitoring and mandatory health alert signs when any amount of toxins are detected, along with permanent caution signs.

Parsons said he understands the concern from residents who have been plagued by the repeated blooms over the last decade or more — particularly with so many questions about health impacts.

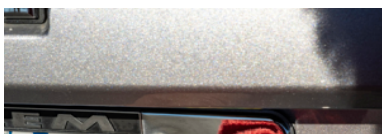
“A lot of people are very concerned,” he said. “They’re frustrated that they’re not getting answers.”

Sarah Loftus is a [Mass Media Fellow](#) with the American Association for the Advancement of Science, sponsored by the Heising-Simons Foundation.



Algae on Lake Okeechobee’s east shore surrounds boats in a harbor, July 11, 2018. Toxic algae blossoms on Lake Okeechobee helped convince Republican leaders to plan billions in state and federal projects tied to water storage and management in and around the Everglades. CHARLES TRAINOR JR CTRAINOR@MIAMIHERALD.COM

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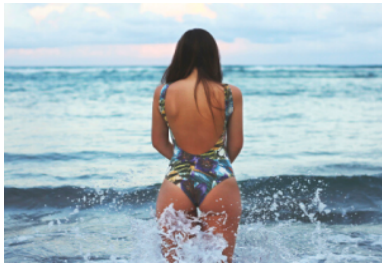


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