Lake Greenwood Fish Toxicity Analysis
SCDES Aquatic Science Division

SCDES Sample Collection and Analysis Overview

As part of the investigation into the April 13-20 fish kill that occurred at Lake Greenwood, the South Carolina Department of Environmental Services (SCDES) Aquatic Science Division (ASD) collected live fish from two areas of the lake on May 5-6, in areas where reports of the April fish kill occurred. The sites are indicated on the map below.

- Site 1: 34.230408, -81.964113
- Site 2: 34.239297, -82.016536

Figure 1. Fish collection sites in Lake Greenwood. Samples were collected on May 5-6, 2026.

ASD conducted comprehensive toxin analysis on both fillet and whole-body composite samples of recreationally important fish species from Lake Greenwood:

- Largemouth bass
- Bluegill
- Redear sunfish
- Channel catfish
- Flathead catfish

In addition to the live fish tissue samples, dead fish were collected from Lake Greenwood on May 1. These specimens were combined and analyzed as a whole-tissue composite.

Contaminant categories included in the Lake Greenwood fish toxin analysis were:

- Trace metals (arsenic, cadmium, lead, selenium, tin)
- Mercury
- Organochlorine pesticides
- Organophosphorus pesticides
- Polycyclic aromatic hydrocarbons (PAHs)
- Polychlorinated biphenyls (PCBs)
- Dioxins and Furans

Table 1. Lake Greenwood fish tissue toxin analysis matrix.

Species	Sample Type	Trace Metals	Mercury	Organochlorine Pesticides	Organophosphorus Pesticides	PCBs	PAHs	Dioxins/Furans
Collected Dead Fish Composite	Whole Tissue Composite	•	•	•		•	•	•
Flathead Catfish	Fillet	•	•		•		•	
Flathead Catfish	Whole Tissue Composite	•	•		•		•	
Largemouth Bass	Fillet	•	•		•		•	
Largemouth Bass	Fillet	•	•				•	
Largemouth Bass	Whole Tissue Composite	•	•	•	•		•	
Bluegill	Fillet	•	•		•		•	
Bluegill	Fillet	•	•		•		•	
Bluegill	Whole Tissue Composite	•	•	•	•		•	
Redear Sunfish	Fillet	•	•	•	•		•	
Redear Sunfish	Fillet	•	•				•	
Channel Catfish	Fillet	•	•	•	•		•	
Channel Catfish	Fillet	•	•				•	

Toxin Analysis and Study Results

Fillet and Whole-Tissue Composite

For this investigation, SCDES tested both fillet and whole-body tissue components of recreationally important fish species.

- Fillet testing determines the health risks to human consumers
- Whole-body tissue testing identifies risks to wildlife predators and ecosystem health. Whole-body tissue testing includes organs such as the liver and kidneys which serve primary detoxification functions for the animal and tend to accumulate certain toxins at higher rates than the fillet.

The US Environmental Protection Agency (EPA) provides a detailed summary of exposure assessment by media: https://www.epa.gov/expobox/exposure-assessment-tools-media-aquatic-biota#concentration.

Toxin Classes

Mercury and Trace Metals

Mercury and toxic trace metals such as arsenic, cadmium, lead, and selenium bioaccumulate in humans and wildlife over time due to exposure and ingestion. According to the World Health Organization (WHO) and US Food and Drug Administration (FDA), exposure to these metals can lead to nervous system impairments, increased risk from certain cancers, decreased kidney function, and reduced cardiovascular health.

All samples (dead fish composite, individual fish fillet, and whole-tissue composite) were below laboratory reporting limit for arsenic, cadmium, lead, selenium, and tin.

Mercury was above laboratory reporting limit in three species:

- Channel catfish fillet: 0.37 mg/kg
- Largemouth bass fillet sample 1: 0.34 mg/kg
- Largemouth bass fillet sample 2: 0.59 mg/kg
- Largemouth bass whole-tissue composite: 0.49 mg/kg
- Flathead catfish fillet: 2.2 mg/kg
- Flathead catfish whole-tissue composite: 1.6 mg/kg

SCDES's Fish Consumption Advisory Program routinely tests for mercury in fish fillets statewide and lists mercury-based fish consumption advisories for many waterbodies across the state (https://gis.des.sc.gov/fishadvisories/). Due to worldwide air deposition of mercury from activities such as mining and fossil fuel combustion, detectable mercury is expected in fish fillets in South Carolina. The mercury fillet concentrations determined in this investigation are consistent with historic Fish Consumption Advisory Program data for Lake Greenwood and the program's statewide dataset.

Table 2. Trace metals and mercury analyte panel and laboratory analytical method.

Compound Class	Contaminant Name	Analytical Method
Trace Metals and Mercury	Arsenic	SW6010D
	Cadmium	
	Lead	
	Selenium	
	Tin	
	Mercury	SW7471B

Organochlorine Pesticides and Organophosphorus Pesticides

Organochlorine pesticides and organophosphorus pesticides are two major classes of synthetic insect-control chemicals. These pesticides have been historically used in agriculture and disease vector control. Due to their persistence and toxicity, organochlorine pesticides have been largely banned in the US since the 1970s. Organophosphorus pesticides are less persistent and tend to breakdown more quickly in the environment. Both classes of compounds are toxic to humans and exposure can lead to neurological and endocrine disruption.

Organochlorine pesticide results are pending.

Organophosphorus pesticides were tested on nine samples with at least one sample for each species and sample type (fillet and whole-tissue composite). All samples were below laboratory reporting limits for all 26 organophosphorus pesticides.

Table 3. Organophosphorus pesticide testing panel and laboratory analytical methods.

Compound Class	Contaminant Name	Analytical Method
Organophosphorus Pesticides	Azinphos-methyl	SWEPA 8141B
	Bolstar	
	Chlorpyrifos	
	Coumaphos	
	Demeton, Total	
	Diazinon	
	Dichlorvos	
	Dimethoate	
	Disulfoton	
	EPN	
	Mocap	
	Famphur	
	Fensulfothion	
	Fenthion	
	Malathion	
	Parathion	
	Methyl parathion	
	Mevinphos	
	Phorate	
	Ronnel	
	Stirophos	
	Sulfotepp	
	Thionazin	
	Tokuthion	
	Trichloronate	
	O,O,O-Triethyl phosphorothioate	

Polychlorinated Biphenyls

Polychlorinated biphenyls (PCBs) are synthetic organochlorine chemicals with wide industrial application because they are excellent insulators. Due to their persistence in the environment and tendency to bioaccumulate in wildlife and humans, PCBs were banned in the US in 1979. The EPA classifies PCBs as probable carcinogens and exposure can lead to developmental and neurological issues among children and disrupt endocrine and immune system functioning.

SCDES's Fish Consumption Advisory Program tests for PCBs from fish in waterbodies across the state and issues consumption advisories when concentration thresholds are exceeded. Lake Greenwood does not have a PCB fish consumption advisory. All seven analyzed polychlorinated biphenyls (PCBs) mixtures were below reporting limit for the dead fish composite sample. PCBs were not tested on additional samples since historically PCBs have not been present in Lake Greenwood fish tissue.

Table 4. Polychlorinated biphenyls testing panel and laboratory analytical method.

Compound Class	Contaminant Name	Analytical Method
Polychlorinated Biphenyls (PCBs)	PCB-1016	SW8082A
	PCB-1221	
	PCB-1232	
	PCB-1242	
	PCB-1248	
	PCB-1254	
	PCB-1260	

Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAHs) are a broad class of chemical compounds formed primarily through the incomplete combustion of organic materials like coal, wood, oil, and gas. Exposure to PAHs has been linked to increased risks of lung, skin, and bladder cancers, development and reproductive complications, and cardiovascular effects.

All 16 polycyclic aromatic hydrocarbons (PAHs) were below reporting limits for all 13 samples.

Table 5. Polycyclic aromatic hydrocarbon testing panel and laboratory analytical method.

Compound Class	Contaminant Name	Analytical Method
Polycyclic Aromatic Hydrocarbons (PAHs)	Acenaphthene	SW8270E
	Acenaphthylene	
	Anthracene	
	Benzo[a]anthracene	
	Benzo[a]pyrene	
	Benzo[b]fluoranthene	
	Benzo[g,h,i]perylene	
	Benzo[k]fluoranthene	
	Chrysene	
	Dibenz(a,h)anthracene	
	Fluoranthene	
	Fluorene	
	Indeno[1,2,3-cd]pyrene	
	Naphthalene	
	Phenanthrene	
	Pyrene	

Dioxins and Furans

Dioxins and furans are two families of toxic persistent chemicals created as byproducts in the production of products like herbicides, in the bleaching process in the pulp and paper industry, and combustion of man-made structures (e.g., during wildfires or trash burning). The EPA lists certain dioxins and furans as probable carcinogens. Exposure to these compounds can disrupt endocrine function and are known to cause skin disease.

A total of 25 individual or total dioxin and furan compounds were tested on the dead fish composite sample. One compound was above laboratory reporting limit:

- 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF): 19 ng/kg

Dioxins accumulate mainly in fatty tissues (belly flap, lateral line, subcutaneous and dorsal fat, dark muscle, gills, eye, brain, and internal organs). The whole body of a fish is expected to have higher dioxin concentration because organs tend to accumulate these toxins more so than fillet tissue. According to EPA, a national study showed that 2,3,7,8-TCDF was detected in 89% of sites sampled for fish tissue, with the maximum concentration of 404 ng/kg and an average concentration of 13.6 ng/kg (EPA-823-F-99-015).[1]

[1] US EPA. 1999. Polychlorinated Dibenzo-p-dioxins and Related Compounds Update Impact on Fish Advisories

Table 6. Dioxin and furan testing panel and laboratory analytical method.

Compound Class	Contaminant Name	Analytical Method
Dioxins and Furans	1,2,3,4,6,7,8-HpCDD	SW8290A
	1,2,3,4,6,7,8-HpCDF	
	1,2,3,4,7,8-HxCDD	
	1,2,3,4,7,8-HxCDF	
	1,2,3,4,7,8,9-HpCDF	
	1,2,3,6,7,8-HxCDD	
	1,2,3,6,7,8-HxCDF	
	1,2,3,7,8-PeCDD	
	1,2,3,7,8-PeCDF	
	1,2,3,7,8,9-HxCDD	
	1,2,3,7,8,9-HxCDF	
	2,3,4,6,7,8-HxCDF	
	2,3,4,7,8-PeCDF	
	2,3,7,8-TCDD	
	2,3,7,8-TCDF	
	OCDD	
	OCDF	
	Total HxCDD	
	Total HxCDF	
	Total HpCDD	
	Total HpCDF	
	Total PeCDD	
	Total PeCDF	
	Total TCDD	
	Total TCDF	