

2007 Blue-Green Algae Information and Geist Reservoir

CIWRP research into blue-green algae took on a new level of urgency this summer as drought conditions created very favorable conditions for the proliferation of blue-green algae in area streams and reservoirs. Blue-green algae concentrations in both Eagle Creek and Geist Reservoirs, and the detection of an algal toxin in Geist Reservoir resulted in recreational usage advisories being posted by the Indiana State Department of Health for both reservoirs. CIWRP research and the expertise of CEES researchers (Tedesco, Pascual, and Hack) helped provide information and analyses to state agencies, state legislators, Veolia Water, and area residents.



Possible toxin producing blue-green algae from Geist Reservoir *Cylindrospermopsis raciborskii* (left) and *Planktothrix agardhii* (bottom) on a photo graphed through a microscope

First a little background on blue-green algae. Blue-green algae (also known as cyanobacteria) occur throughout area reservoirs and streams and have for many years. In general, there are numerous different species present but recent years have seen both an increase in the dominance of some species and the appearance of other species. There remains significant debate in the scientific community about the cause for these increases but several factors are commonly cited including climate warming (some of the species are tropical species), invasive species that are spreading (many were formerly unknown in temperate North America but can be traced to Africa, South America, and Australia), and increasing nutrient enrichment in area reservoirs favoring blue-green algae over other species. Some blue-green algae are capable of producing toxins that have potentially serious human and animal health effects. Toxin production however is quite variable and species known to produce toxins in some areas don't seem to produce it in other areas; and those that do produce toxins, don't produce it all the time. This makes understanding the risk associated with blue-green algae, especially in recreational waters, particularly difficult. Algal toxin exposure is most dangerous through ingestion but skin rashes can also occur. Thus, there are potential risks associated with swimming and other water sports especially when water is accidentally swallowed. There are different risks associated with finished drinking water, but luckily the water treatment process effectively removes the toxins that were found in Geist Reservoir. For this reason, the advisories and concerns for public health have been focused on recreational uses of the reservoirs.

A few other confounding factors to consider. 1) The US government has not adopted any standards for measurement of algal toxins or any guidelines for public health related to exposure to algal toxins in either recreational waters or drinking water; 2) there is no statewide program for routine monitoring of recreational waters and there are no state guidelines in place; 3) analyses for algal toxins are very slow – typically taking up to a week for results – and very costly; and 4) the problems associated with blue-green algae in Indiana waters is relatively new and an emerging problem so that responsibilities, communication lines, and specific actions remain uncoordinated and extremely confusing. The World Health Organization has posted guidelines that can be helpful to decision makers and these have been referenced for Indiana concerns. Europe, Australia, and several other countries have guidelines and standards in place.

This summer's hot, dry weather created warm water and high evaporation rates concentrating nutrients and allowing for accelerated growth of blue-green algae. As a result, blue-green algae abundances reached high levels in all the reservoirs but varied in species composition and increased and decreased in abundance over the season in similar patterns to other years. Veolia Water routinely monitors the reservoirs for the presence of blue-green algae especially as it relates to taste and odor compounds in drinking water that are the result of algae growth. CIWRP remote sensing research helps Veolia Water manage algal blooms when they are beginning to create taste and odor problems in finished drinking water. Taste and odor compounds are most frequently managed in the treatment plant through the use of powder-activated carbon. However, if taste and odor compounds appear to be increasing, and reservoir conditions favorable for continued algal growth, Veolia may use algaecides to control algae. Reservoir



algaeicide treatment requires a permit from IDNR and IDEM and also involves additional reservoir monitoring to protect fish and aquatic life. It was during this permit-induced monitoring prior to a treatment at Geist Reservoir that led to the detection of high cell counts of the potential toxin-producing blue-green algae called *Cylindrospermopsis*. This alga is interesting in that its first reported occurrence in Indiana was in 2001 in Ball Lake, Steuben County. This was alarming as this alga has caused toxin problems in other tropical countries and in Florida and it was these concerns that led IDNR to include documentation and reporting of its presence in the permit conditions.

Interestingly, CIWRP research has been working with international researchers looking at blue-green algae and algal toxins globally. Many of the researchers are affiliated with Veolia Water's international research program. Information coming from this research network is showing that *Cylindrospermopsis* in Europe is not a toxin producer – but in fact other algae are. Yet, there are no provisions for monitoring or reporting those others in Indiana

CIWRP researchers, especially Lani Pascual, have been doing detailed algal identifications in area reservoirs for several years in an effort to try to predict algal blooms. Her work has shown that there are at least five potential toxin producers in area reservoirs, but our work has never focused on determining if there are any toxins. The toxin detected in Geist Reservoir was Microcystin and was found at low levels. This toxin is not related to *Cylindrospermopsis*, but rather, we believe, to *Planktothrix*, a blue-green algae belonging to a different genera. CIWRP researchers have been conducting algal counts and even sending samples to outside laboratories for toxin analyses in an effort to determine which organism(s) is responsible for the toxin and how levels might related to reservoir conditions. Additionally, we have been compiling research and monitoring data from surrounding states and doing analyses to determine what area states are finding in their reservoirs and if they have better information regarding toxin occurrence and potential producing organisms.

Our work has been important in that we have been able to provide information to state agencies, the Indiana legislature, and the general public. We expect to continue our work in the future and hope to be able to provide solid science data to the public policy arena as Indiana works to set standards and address monitoring needs. We have posted some background information about blue-green algae on our website as well as recordings of comments made at a public meeting for Geist residents. We'll share more information as it is developed.