

EarthTec Ionic Copper: A More Rational Use of Copper



Open Forum regarding Lake Skaneateles, NY
9/15/2021

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M.S., Energy & Resources Group, UC Berkeley

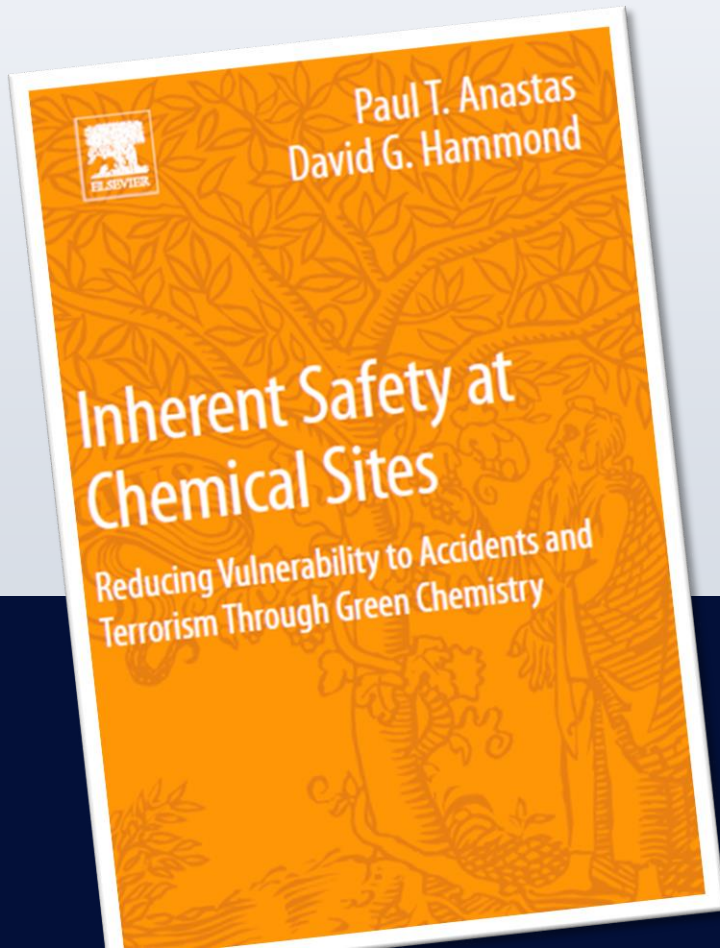
Ph.D., Agricultural & Environmental Chemistry Group, UC Berkeley

Applied Algae Research Group, UC Berkeley

Founder of a non-profit teaching sustainable ag in Guatemala

Two patents on naturally derived pesticides using plant-based ingredients

Co-author of a book about Green Chemistry



Harmful Algal Blooms (HABs) in the News (compiled 2015)



Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

CDC launches updated Harmful Algal Blooms (HABs) website and the One Health Harmful Algal Bloom System OHHABS as hot weather brings extensive HAB events

Environment, US News

Toxic Algae Rampant in California, Also Spreading Nationwide

Drought has helped create optimal conditions for algae's growth

By Tara Maclsaac, Epoch Times | September 21, 2016 AT 9:33 AM | Last Updated: September 21, 2016 11:44 am

SCIENTIFIC AMERICAN

English Cart

Harmful Algal Blooms Are on the Rise

Causes include increasing agricultural runoff and rising temperatures due to climate change

By Rob Herman on September 7, 2016

Harmful Algal Blooms (HABs) in the News (compiled 2021 – things are no better)

Toxic Algae Has Sent Hundreds of Americans to the ER Since 2017, CDC Study Finds

Dangerous algae blooms will only become more commonplace as temperatures increase.

By Ed Cara | 9/09/21

First HABs confirmed on Seneca Lake

Bill Roege, HABs Director, Seneca Lake Pure Waters Association

Published 11:36 a.m. ET Sep. 3, 2021

Something is causing more algal blooms in more places

Catherine Kozak Coastal Review Sep 9, 2021

Cayuga Lake leads state in toxic algae blooms

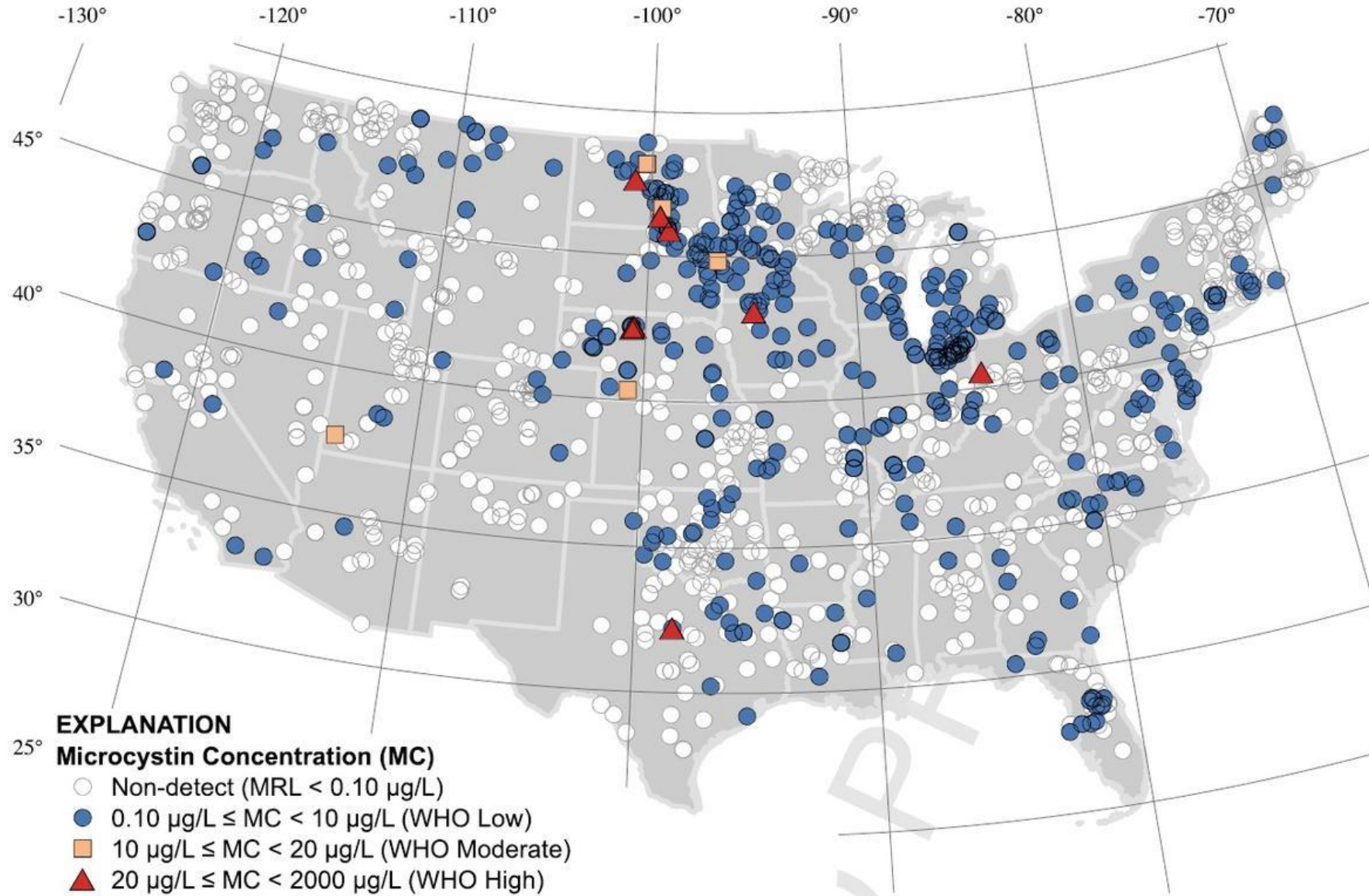
by Peter Mantius August 12, 2021

The Innovation

Volume 2, Issue 2, 28 May 2021, 100092

From unusual suspect to serial killer:
Cyanotoxins boosted by climate change
may jeopardize megafauna

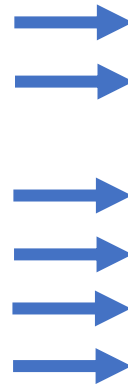
HABs are occurring nationwide



Risk-based Analysis of Cyanotoxins

Cyanotoxins:

- No good level to have
- WHO possible carcinogen list
- ALS, PDS, Alzheimer's link
- Has caused deaths of cows, elk, dogs, birds, fish, people, etc.
- EPA candidate contaminate list
- drinking water



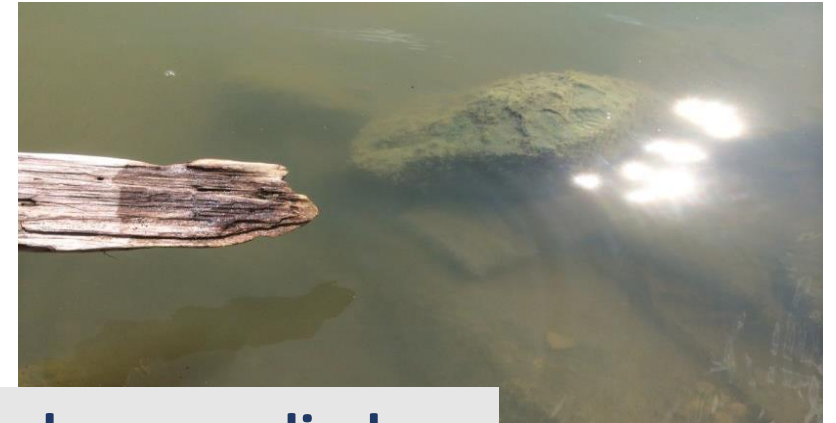
Copper:

- Essential nutrient
 - Hemocyanin respiratory protein
 - Suggested Daily Intake (1 mg/day)
- 26th most abundant element in earth's crust
- Transfers to less available forms through time
- No swimming/ drinking/irrigation restrictions on label

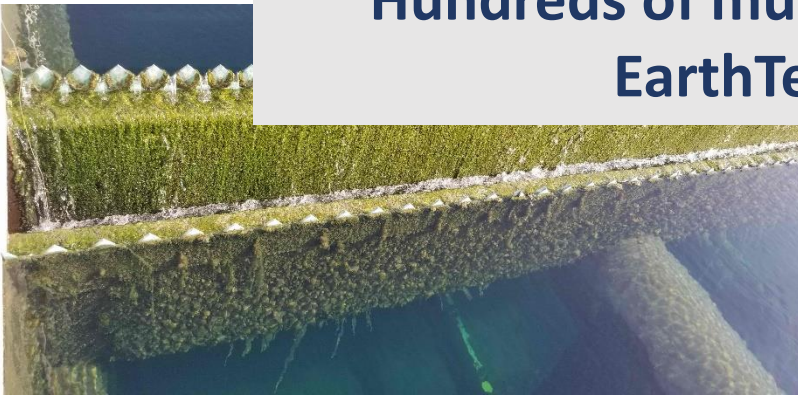
Scientists are still learning about cyanotoxins....

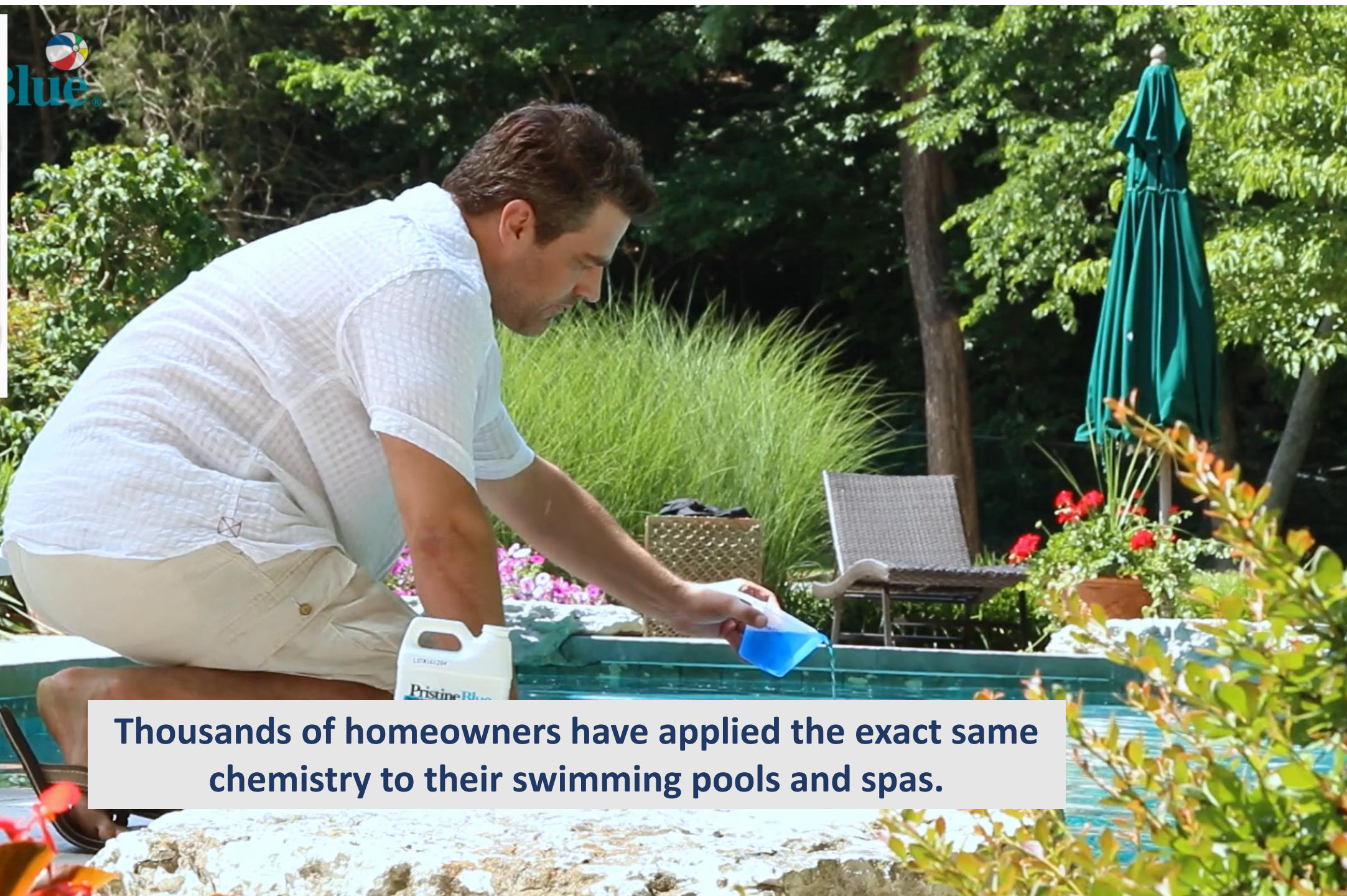
- Toxin production can be intermittent
- Instances where toxicity is present but no *known* toxin has been isolated yet
- New toxins still being discovered

EarthTec ionic copper approved for algae control in drinking water plants



Hundreds of municipal water utilities have applied EarthTec to their drinking water.





Thousands of homeowners have applied the exact same chemistry to their swimming pools and spas.

The exact same chemistry is OMRI-Listed for organic ag on food crops and is used in aquacultural fish farms.

Safe for fish when applied as recommended.

OMRI Listed®

The following product is OMRI Listed. It may be used in certified organic production or food processing and handling according to the USDA National Organic Program regulations.



Product

AgriTec Algaecide/Bactericide

Issue date

23-Jan-2018

Class

Crop Pest, Weed, and
Disease Control

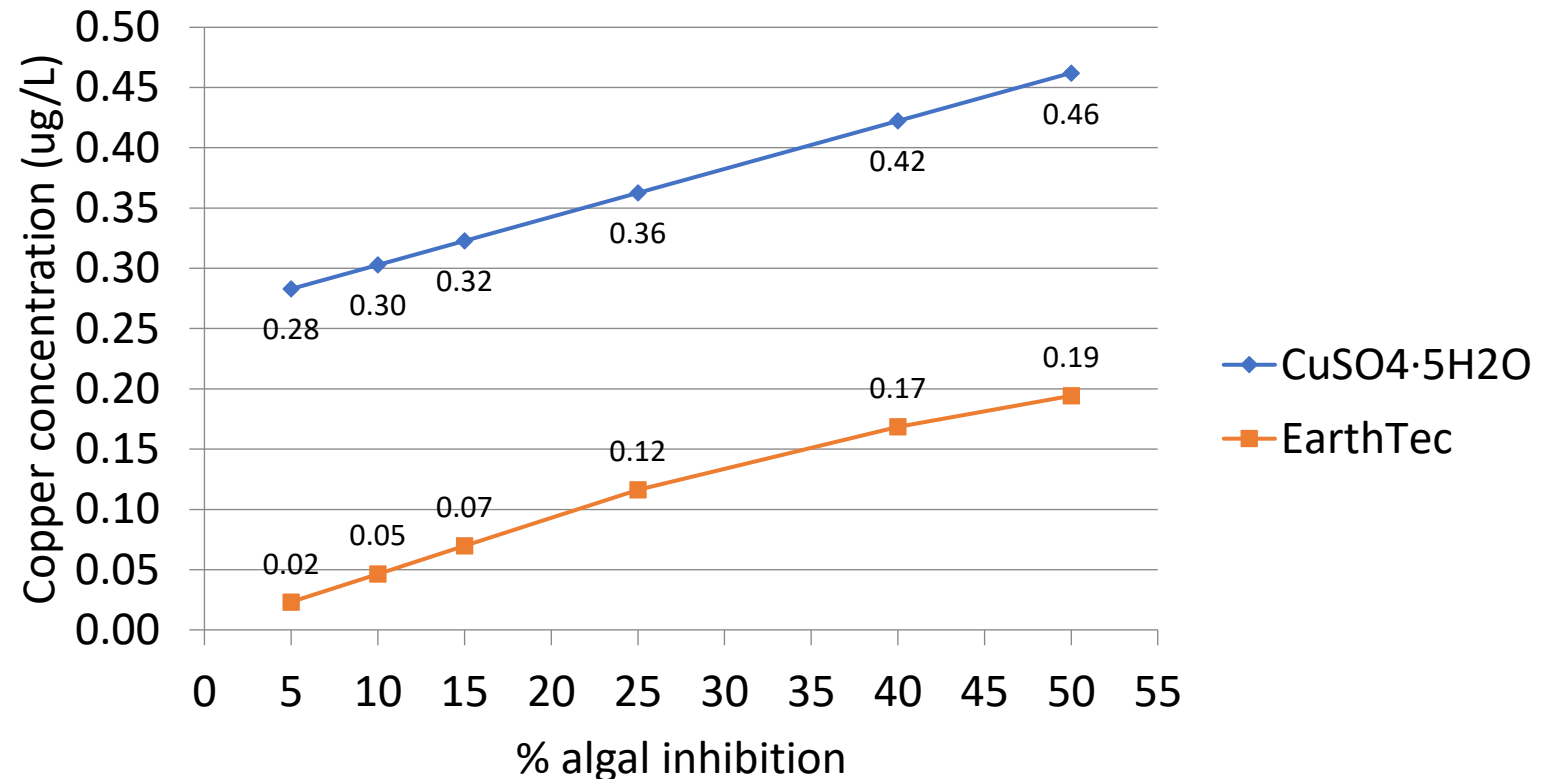


Copper Sulfate vs Ionic Copper

% Inhibition of Algal Growth after 96h of exposure to copper delivered as conventional copper sulfate vs EarthTec

Green Chemistry:

The copper dose required to achieve a given % inhibition of algae is much lower if applied as EarthTec than if applied as copper sulfate



Product Comparison

Copper Sulfate vs EarthTec

Norwalk, OH (2012 vs 2013)

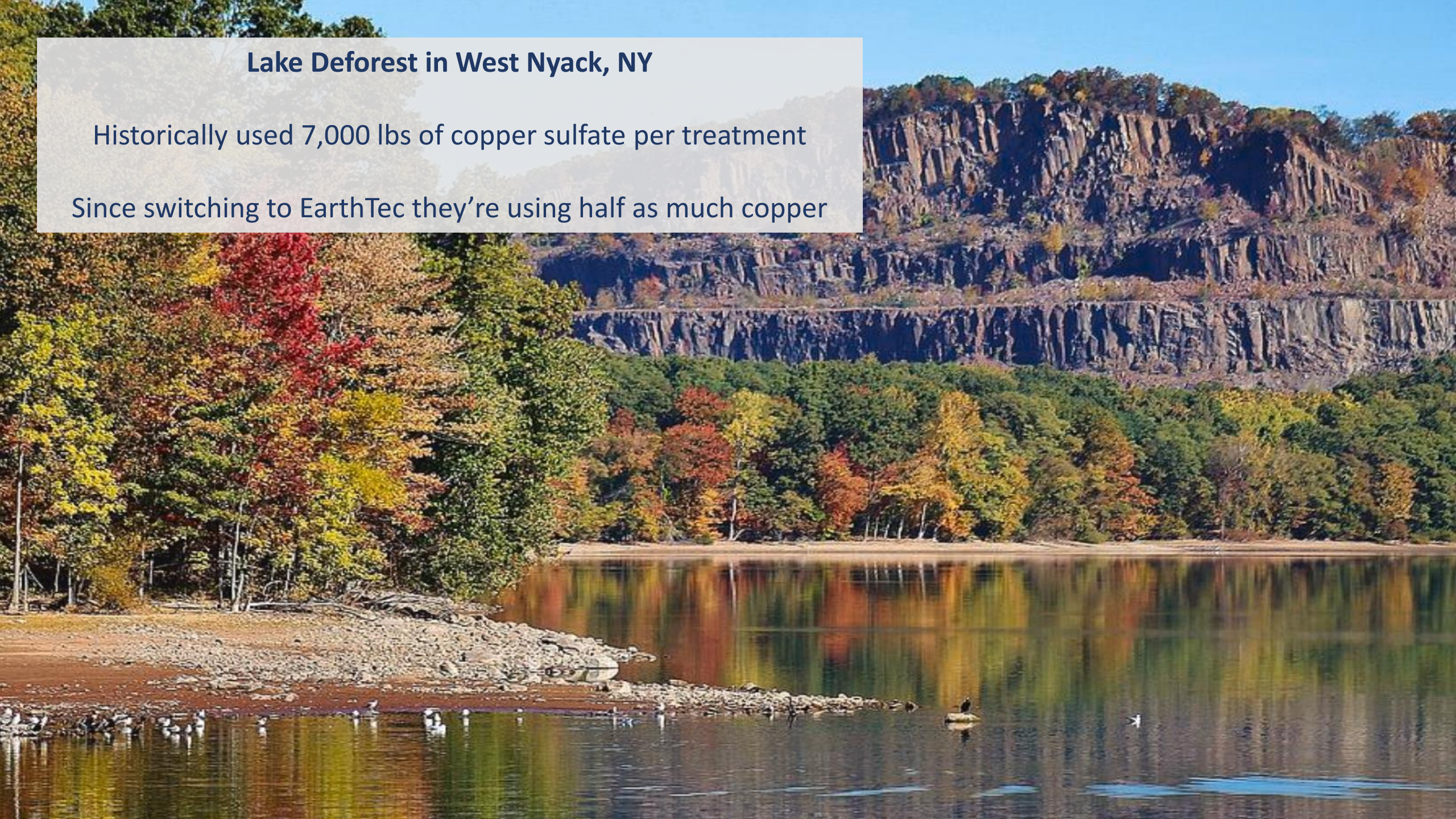
Copper sulfate 2012	Ionic Copper 2013	
10	8	treatments per year
500	60	lbs or gallons per treatment
	10	lbs, weight per gal of EarthTec
5,000	4,800	lbs per year
25%	5%	fraction that is elemental copper
1,250	240	elemental copper applied, lbs
100%	19.20%	total copper applied, %

When Norwalk switched from copper sulfate to EarthTec, they had fewer total applications per year and applied <20% of the elemental copper used in previous years, even though their treatment season spanned a longer portion of the year.

Lake Deforest in West Nyack, NY

Historically used 7,000 lbs of copper sulfate per treatment

Since switching to EarthTec they're using half as much copper



Earth Science Laboratories, Inc.
113 S.E. 22nd St., Suite 1
Bentonville, Arkansas 72712Phone 800.257.9283
Fax 479.271.7693
www.earthscience labs.com**FIFRA Section 2(ee)
Recommendation****Product Bulletin
Technical Information****EarthTec – Use of Reduced Rates for Control
of Algae, Nonpublic Health Bacteria, and
Bacteria That Cause Odor Problems in the
State of New York****EPA Reg. Number: 64962-1**

This recommendation is made as permitted under FIFRA section 2(ee) and has not been submitted to or approved by the federal EPA.

Pesticide applicator certification and a permit from the New York State Department of Environmental Conservation may be required for sale, possession, or use. Contact the Pesticide Control Specialist at your NYSDEC regional office prior to the proposed application for specific conditions or exemptions.

All applicable directions, restrictions, precautions and Conditions of Sale and Warranty on the EPA registered label are to be followed. Refer to the container label for additional instructions. Always read and follow label directions. Information contained in this Technical Information Bulletin is not intended to replace or amend any product labeling. Always read and follow all label directions when using any pesticide alone or in tank mix combinations. For use in controlling algae and cyanobacteria at all aquatic application sites do not exceed a copper concentration in water of 1.0 ppm of metallic copper concentration (background + applied).

The user must have this recommendation in their possession at the time of use.

Directions for Use – Open Waters

Apply a dose no more than 3 parts per million EarthTec (i.e., 3 gallons of EarthTec per million gallons of water treated, equivalent to 1 gallon of EarthTec per acre-foot), yielding a concentration of 0.18 mg/L (ppm) as metallic copper. Supplemental applications are permissible as long as no more than a cumulative total of 0.18 mg/L as copper is applied in any given 14-day period.

Dose (ppm by volume)	gals/MG*	gals/ac-ft	Cu ²⁺ (mg/L)
0.5	0.5	0.15	0.030
1	1	0.3	0.060
2	2	0.7	0.120
3	3	1.0	0.180

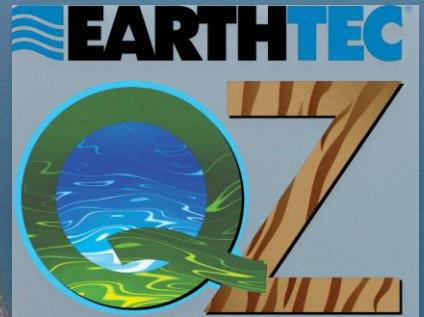
*MG = million gallons

EarthTec has the lowest
rates of copper in NY State

Low doses of EarthTec QZ ionic copper used in effort to eradicate quagga mussels from an entire Pennsylvania lake

David Hammond, PhD
Senior Scientist, Earth Science Laboratories

Gavin Ferris
Ecologist, SOLitude Lake Management



Abundance of non-target zooplankton at 1 year post-treatment

Individuals per 5-10 meter tow:

	Site 1	Site 2	Site 3	Site 4
Cladocerans	72,491	69,287	64,080	66,964
Copepods	9,612	9,212	9,612	11,214
Ostracods	8,330	10,894	12,816	15,059
Nauplei	6,408			

Eradication of quagga mussels from an entire lake was accomplished using EarthTec without major impacts on non-target zooplankton

Work performed Normandeau and Associates, Inc.

Where is the phosphorus coming from?

- 1 lb of phosphorus has the potential to generate up to 1,100 lbs of wet algae biomass
- **More phosphorus means more algae**

