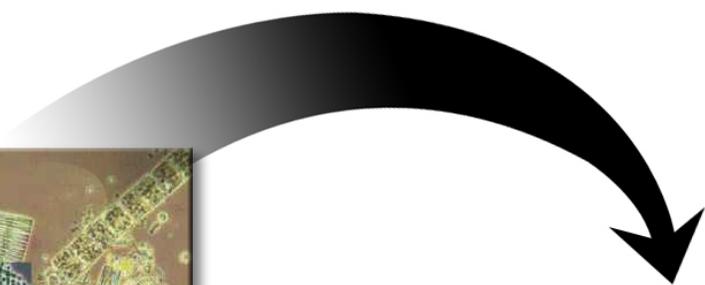


AquaSentinel: A Revolutionary Biosensor System for Primary-Source Water Protection

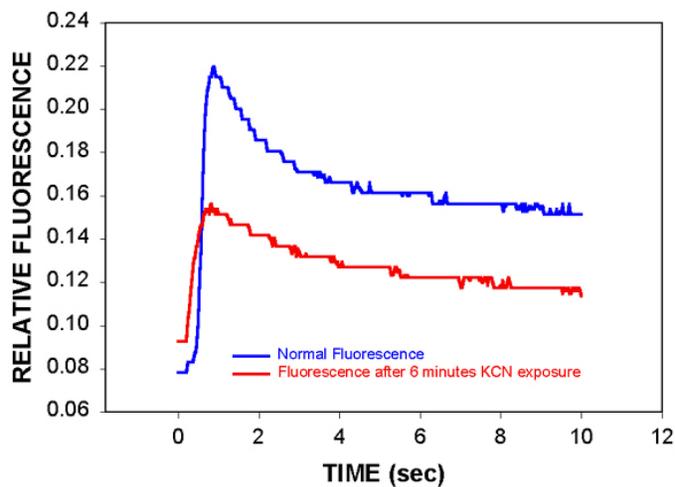
Elias Greenbaum and Miguel Rodriguez Jr.

**Chemical Sciences Division
Oak Ridge National Laboratory
Oak Ridge, Tennessee**

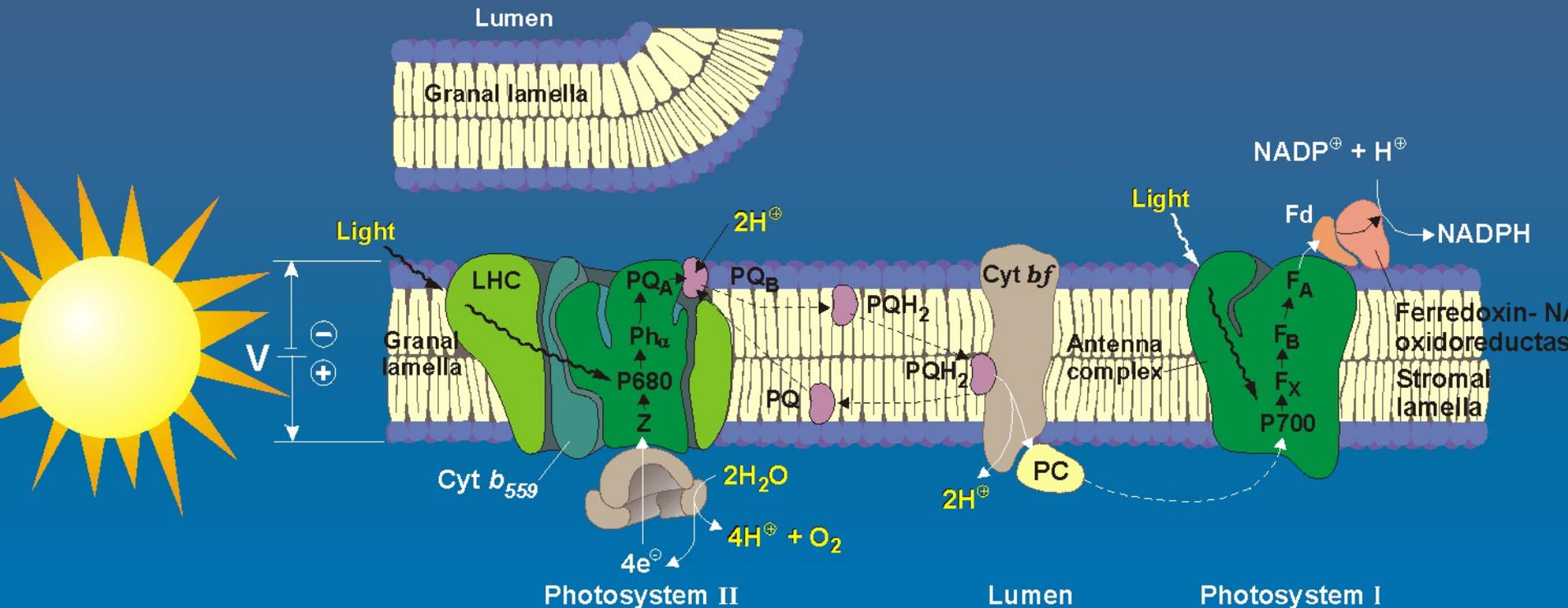




Effect of 2 mM Potassium Cyanide (KCN) on Naturally Occurring Algae from Freshwater Samples



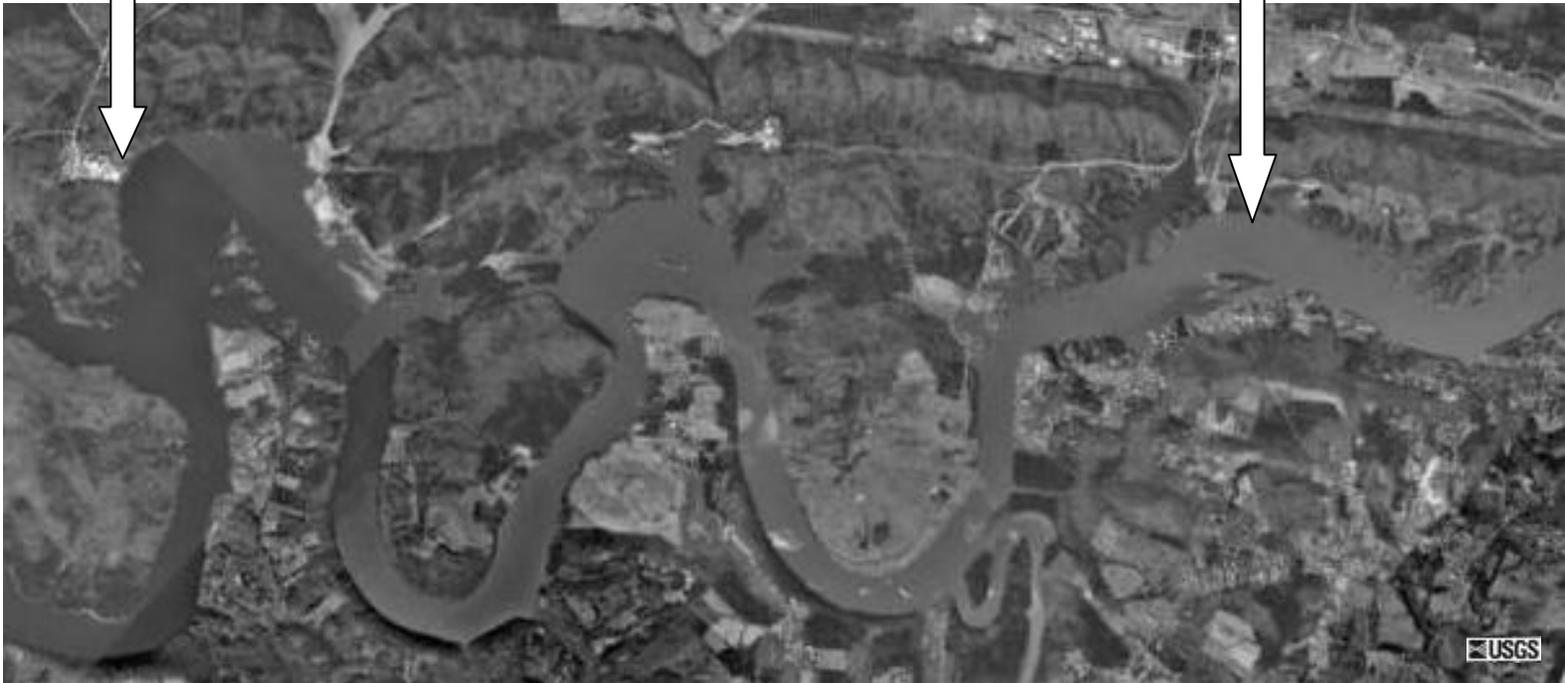
The Photosynthetic Membrane



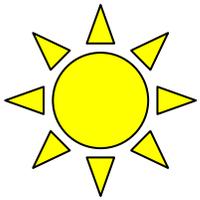
Real-World Conditions

AquaSentinel
Monitoring Station

Drinking Water Supply
for Oak Ridge, TN



CLINCH RIVER/MELTON HILL LAKE, OAK RIDGE, TN



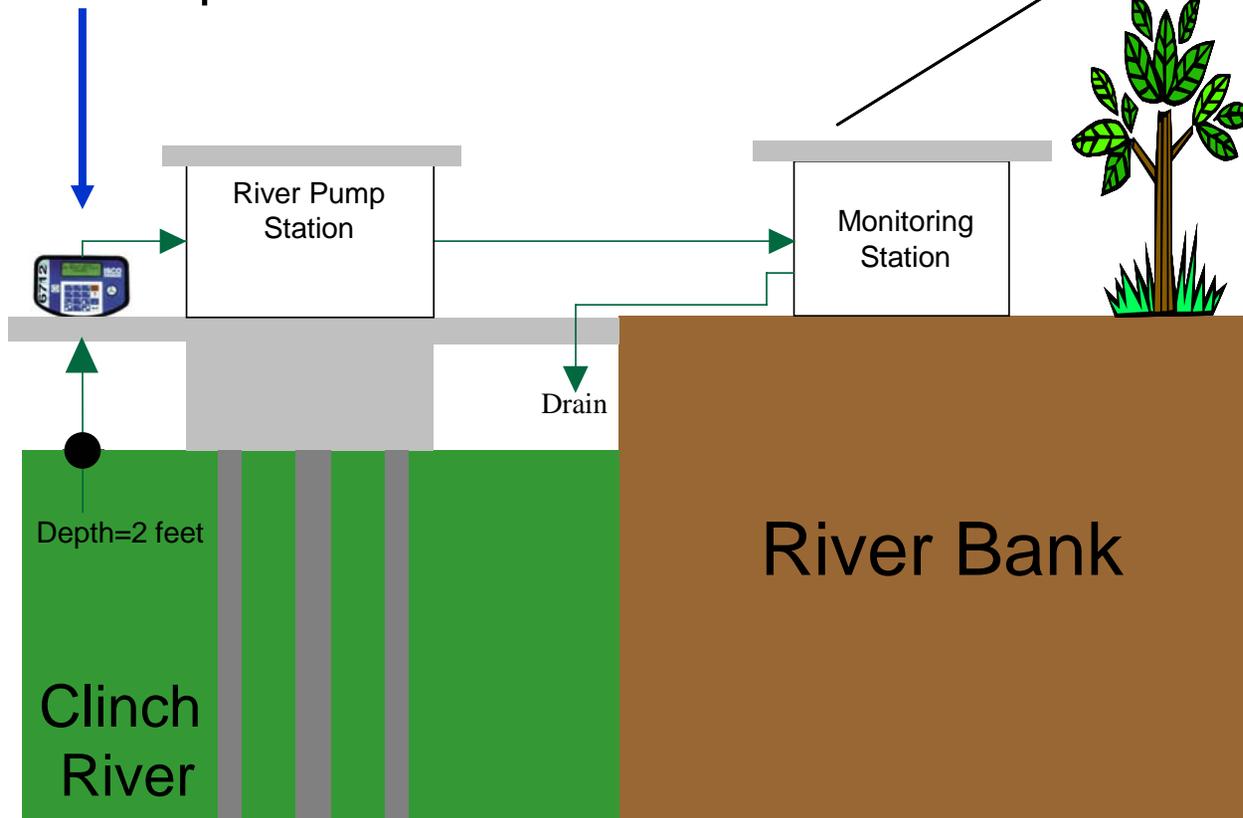
AquaSentinel

Schematic Illustration of
the Pump and Valve System
(COMPONENTS NOT TO SCALE)

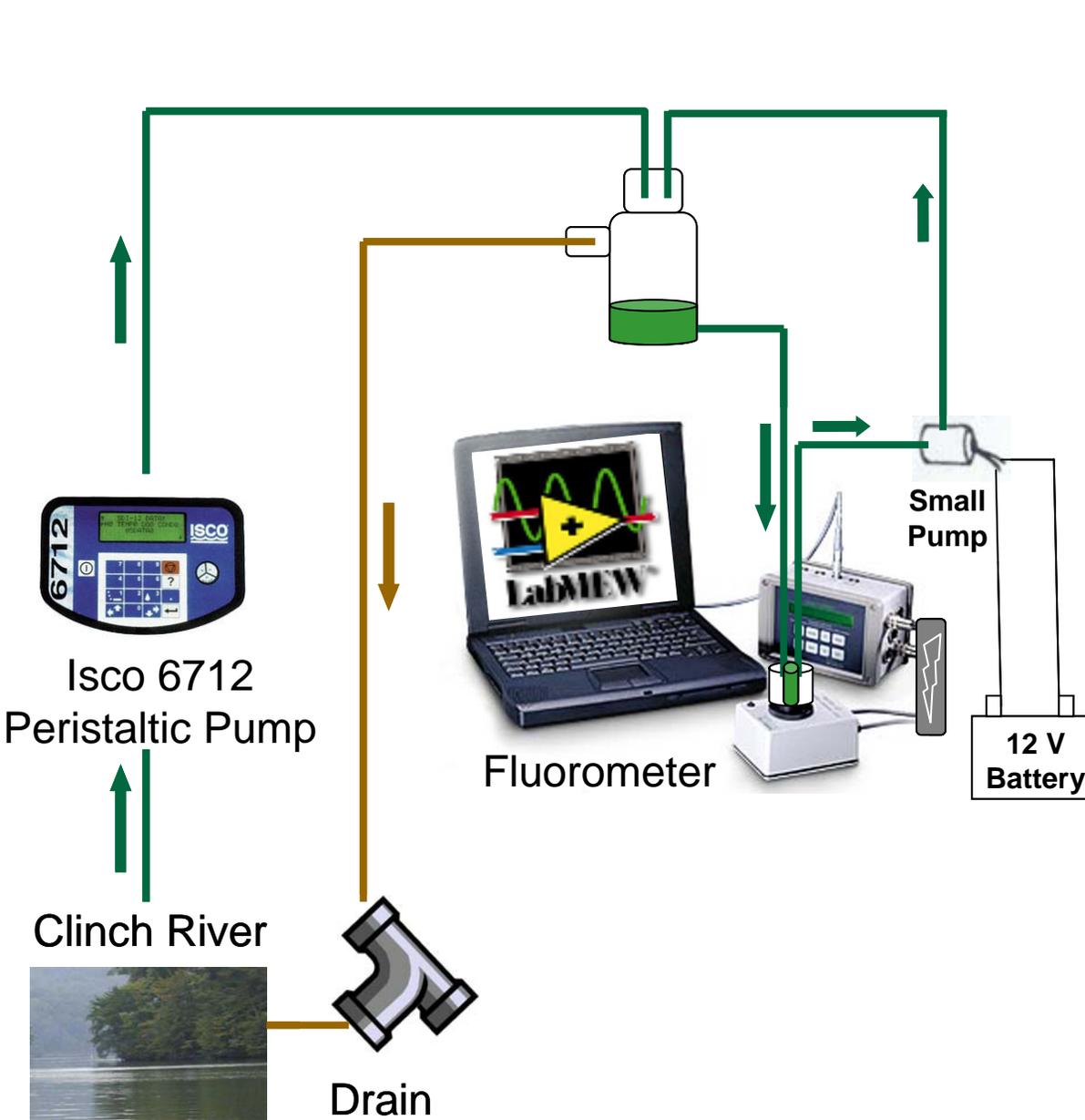


Walz
Chlorophyll
Fluorometer
(WATER-PAM)

Isco Pump



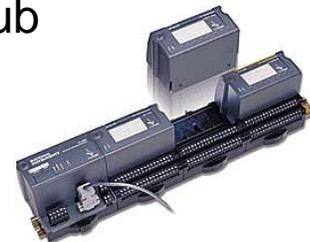
AquaSentinel Monitoring System



Web Cam
(password protected)

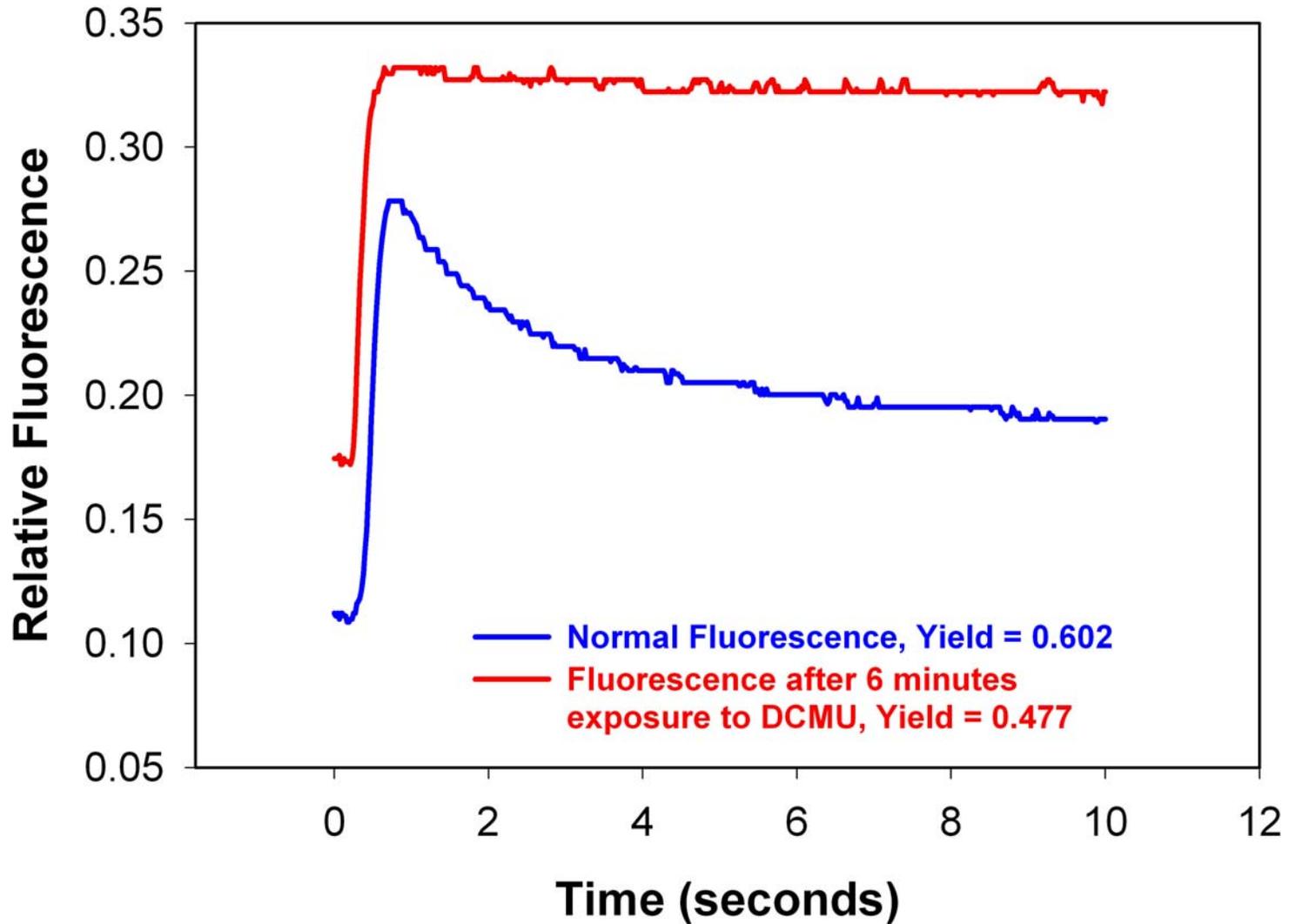


LAN Hub

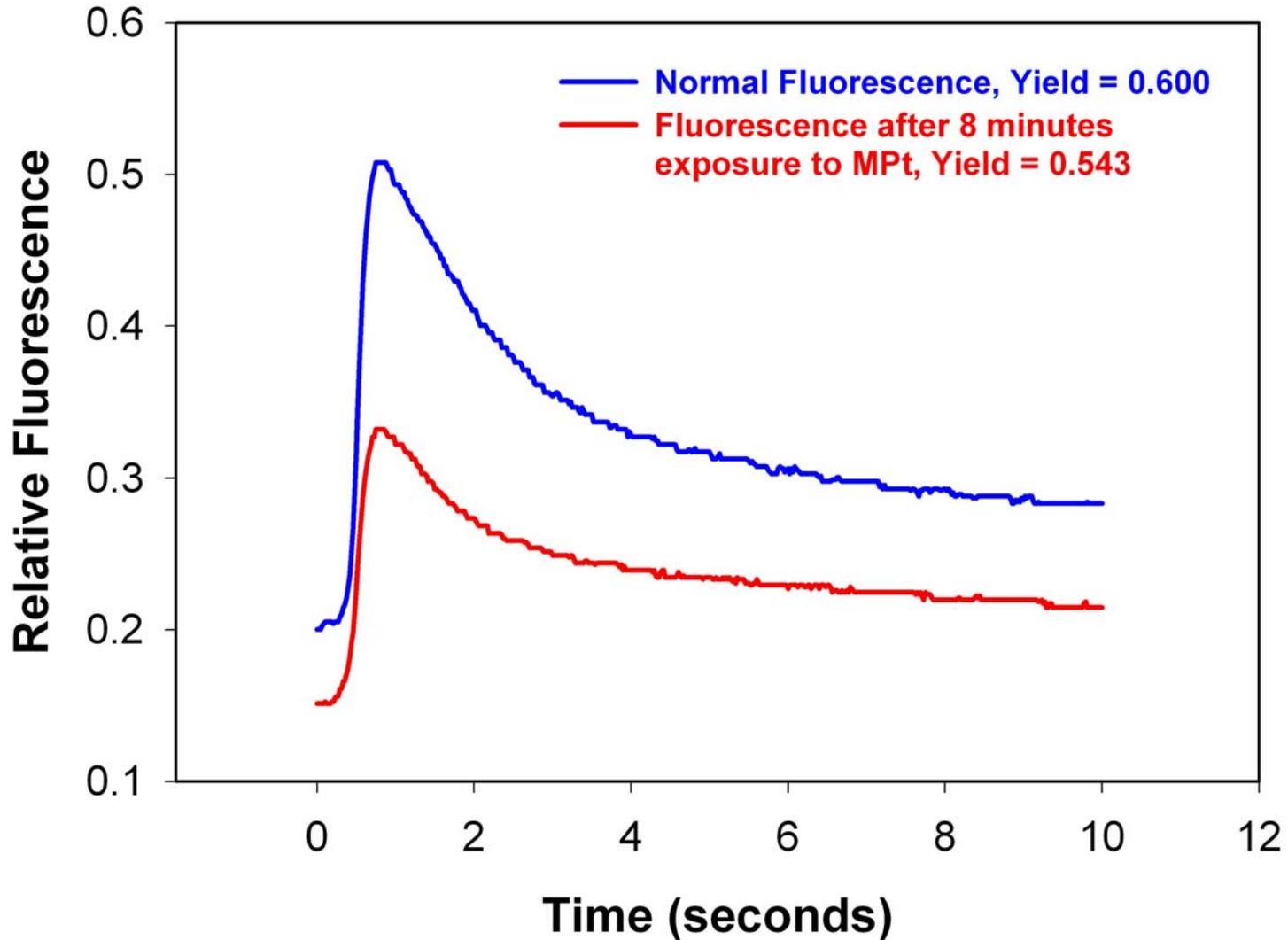


National Instruments
I/O Interface

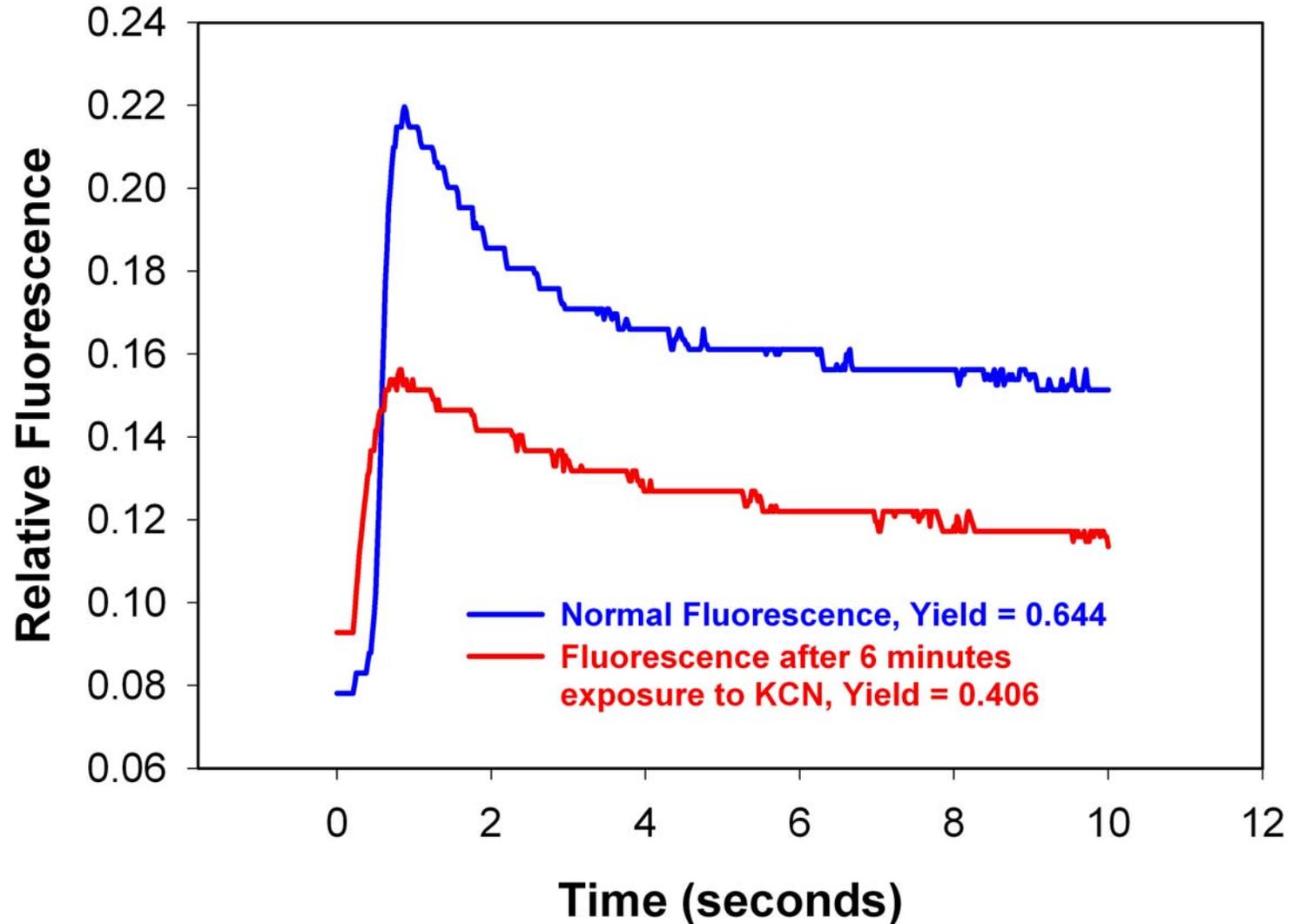
Effect of 10 μM DCMU (Diuron) on Clinch River's Naturally-Occurring Algae



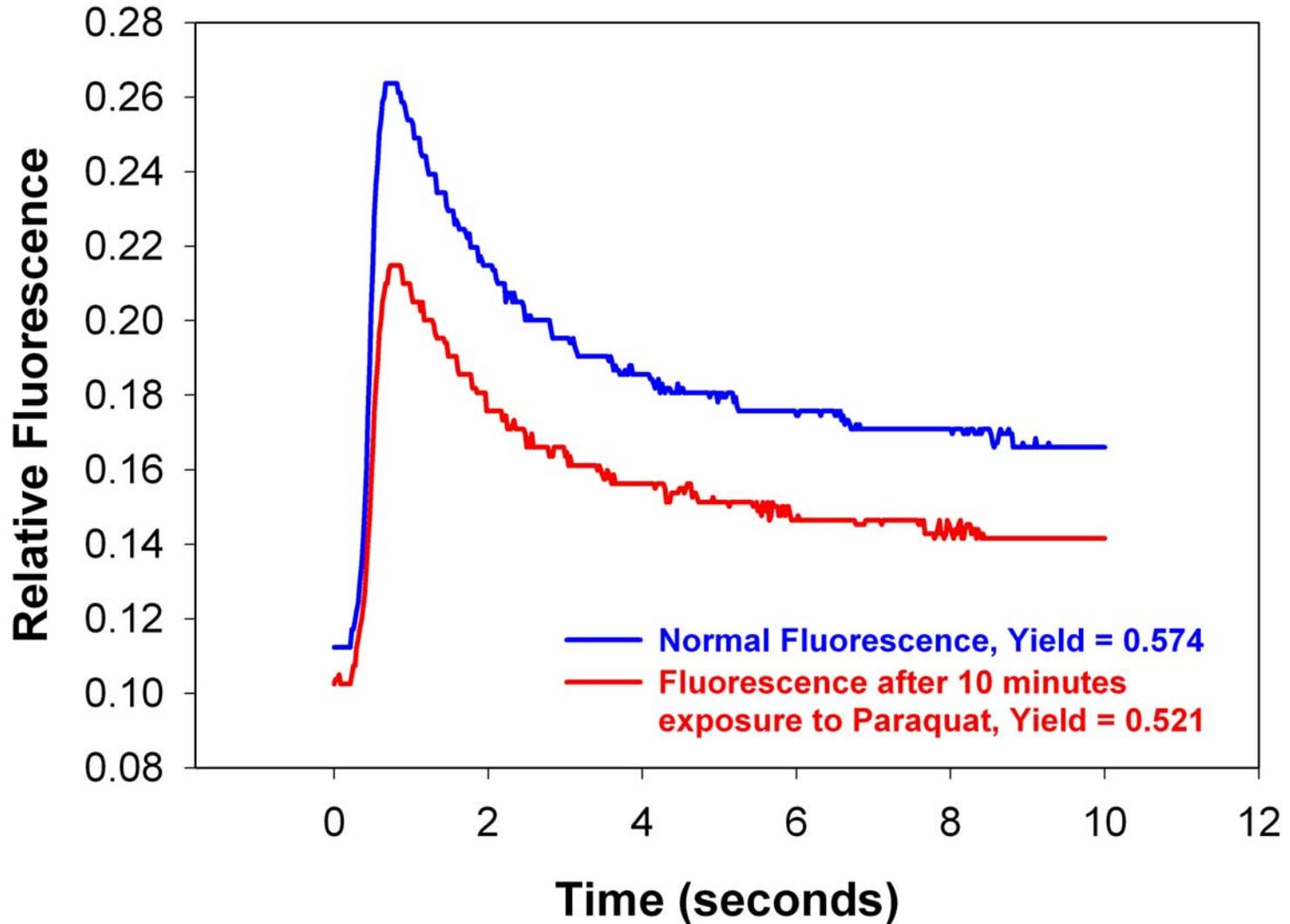
Effect of 20 μM Methyl Parathion (MPt) on Clinch River's Naturally-Occurring Algae



Effect of 2 mM Potassium Cyanide (KCN) on Clinch River's Naturally-Occurring Algae

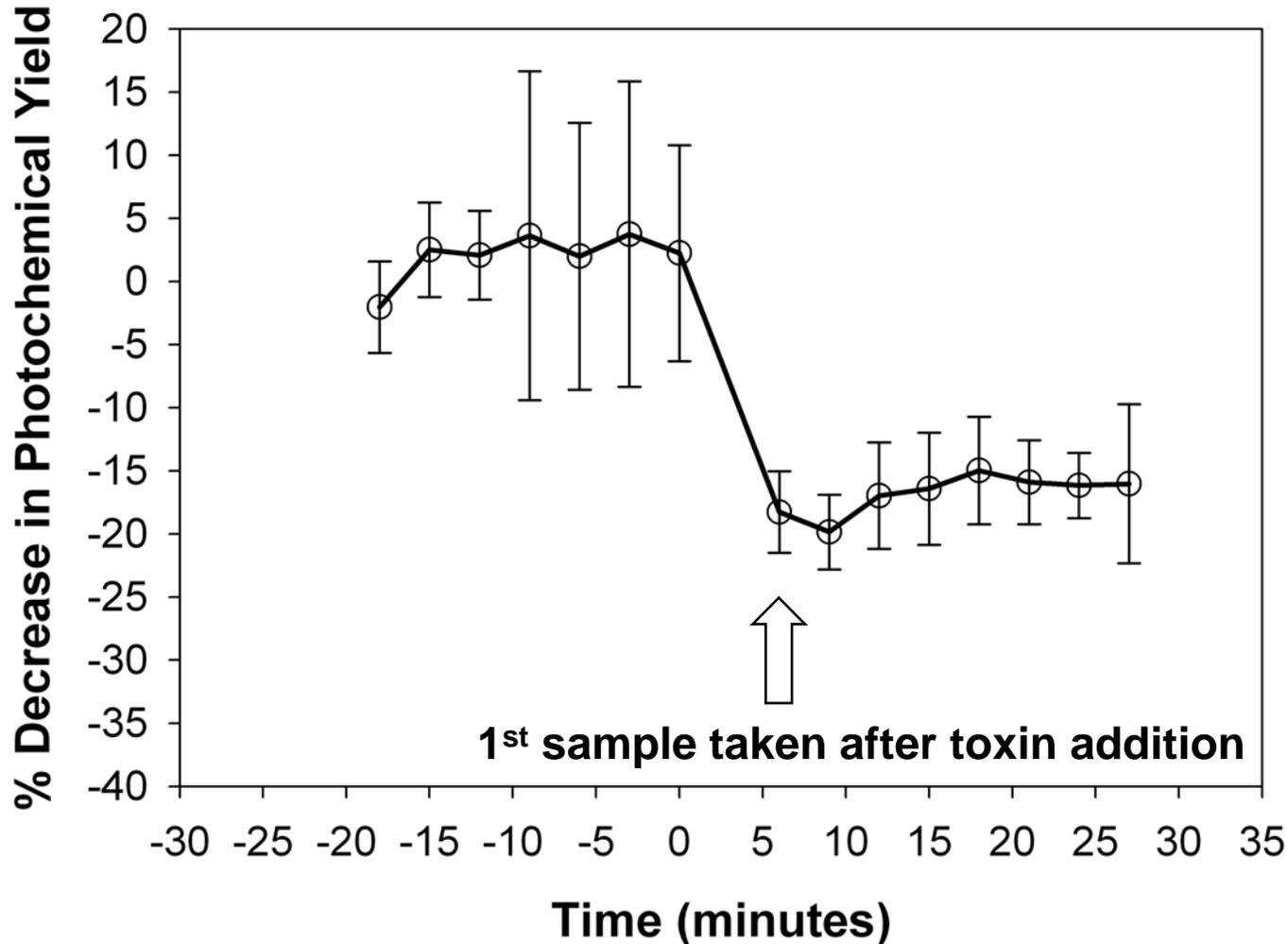


Effect of 30 μM Paraquat on Clinch River's Naturally-Occurring Algae

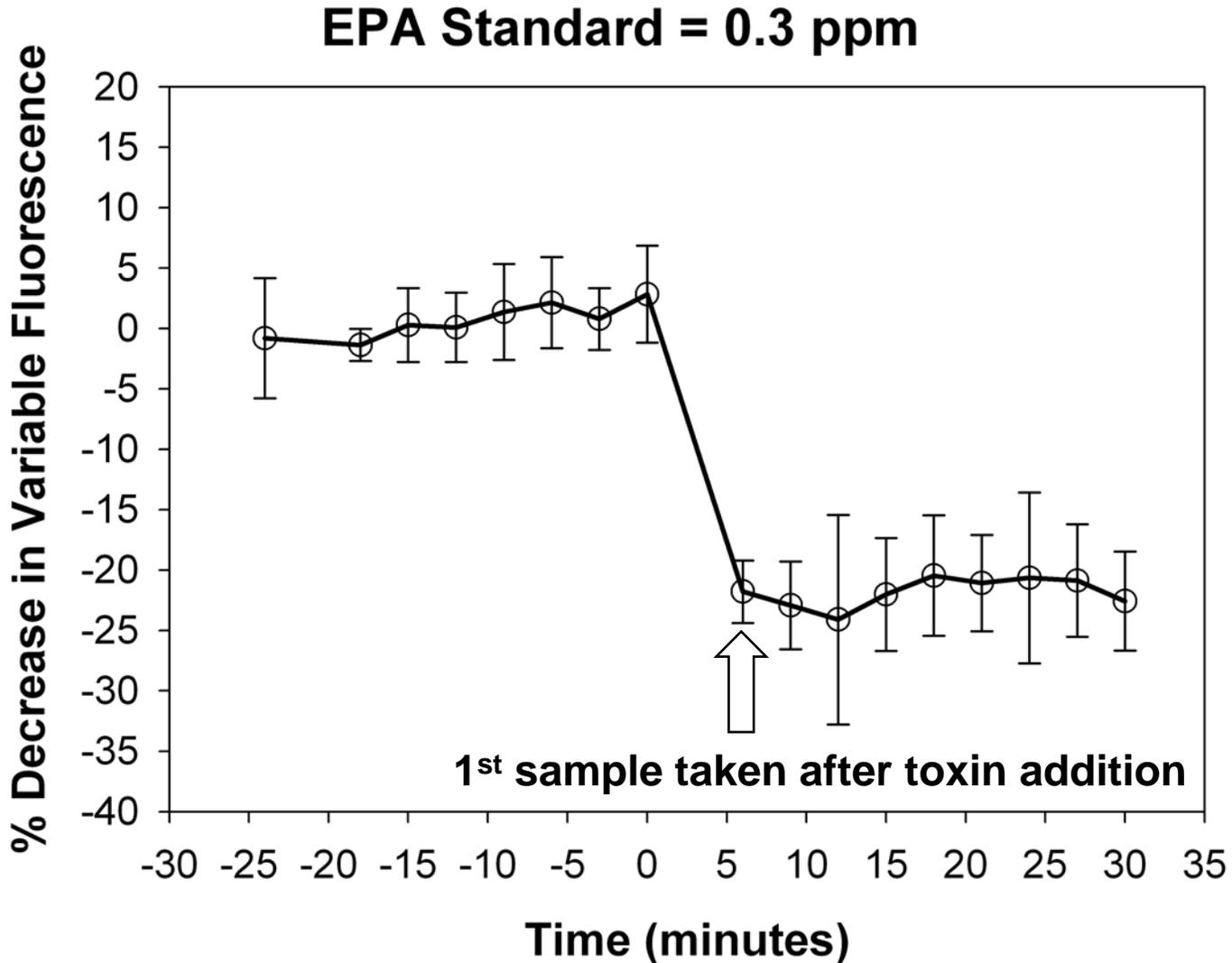


Effect of 1.0 ppm DCMU (Diuron) on Clinch River's Naturally-Occurring Algae (Error Bars Represent Triplicate Experiments)

EPA Standard = 1.0 ppm

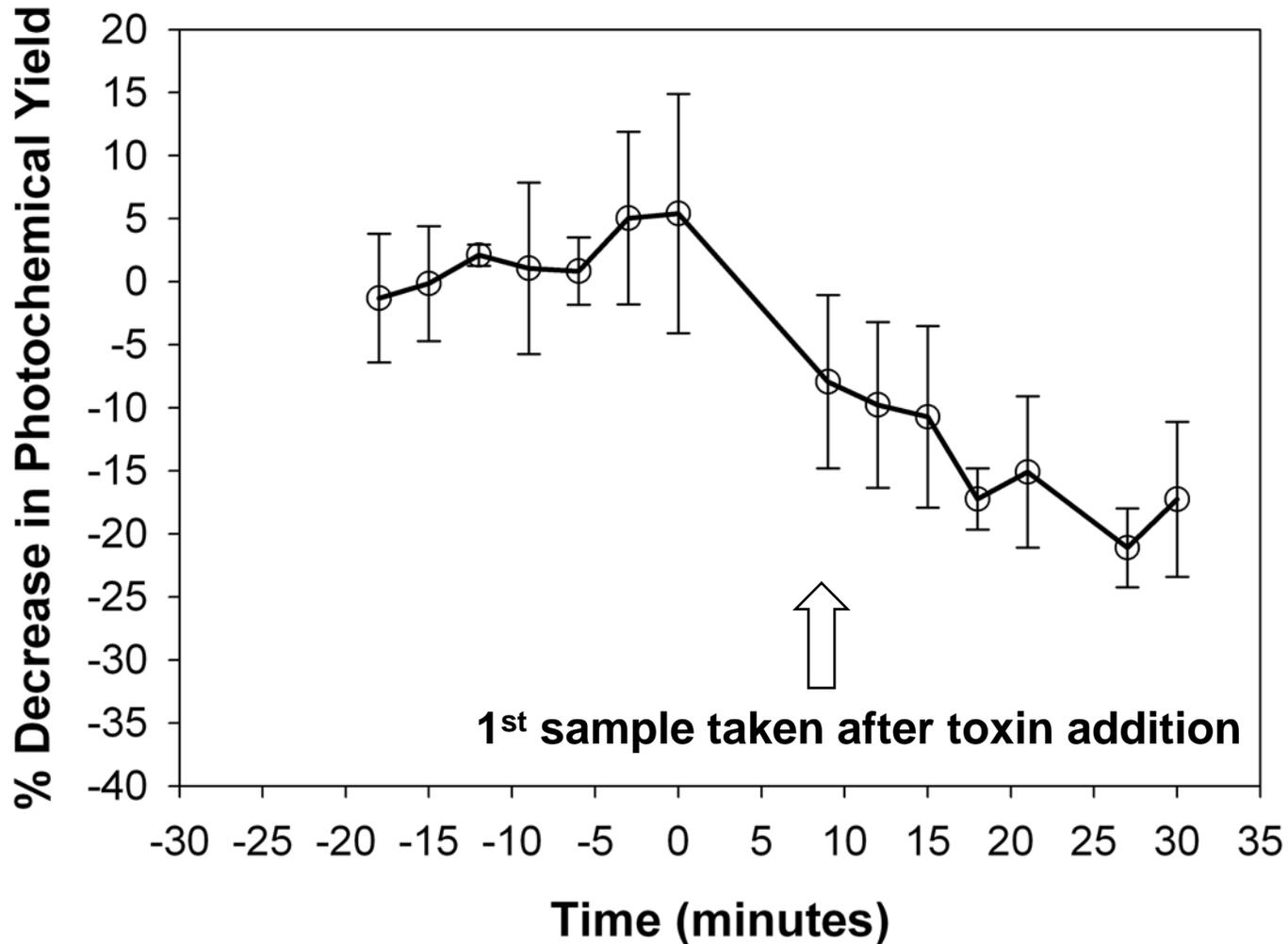


Effect of 4 ppm Methyl Parathion (MPt) on Clinch River's Naturally-Occurring Algae (Error Bars Represent Triplicate Experiments)



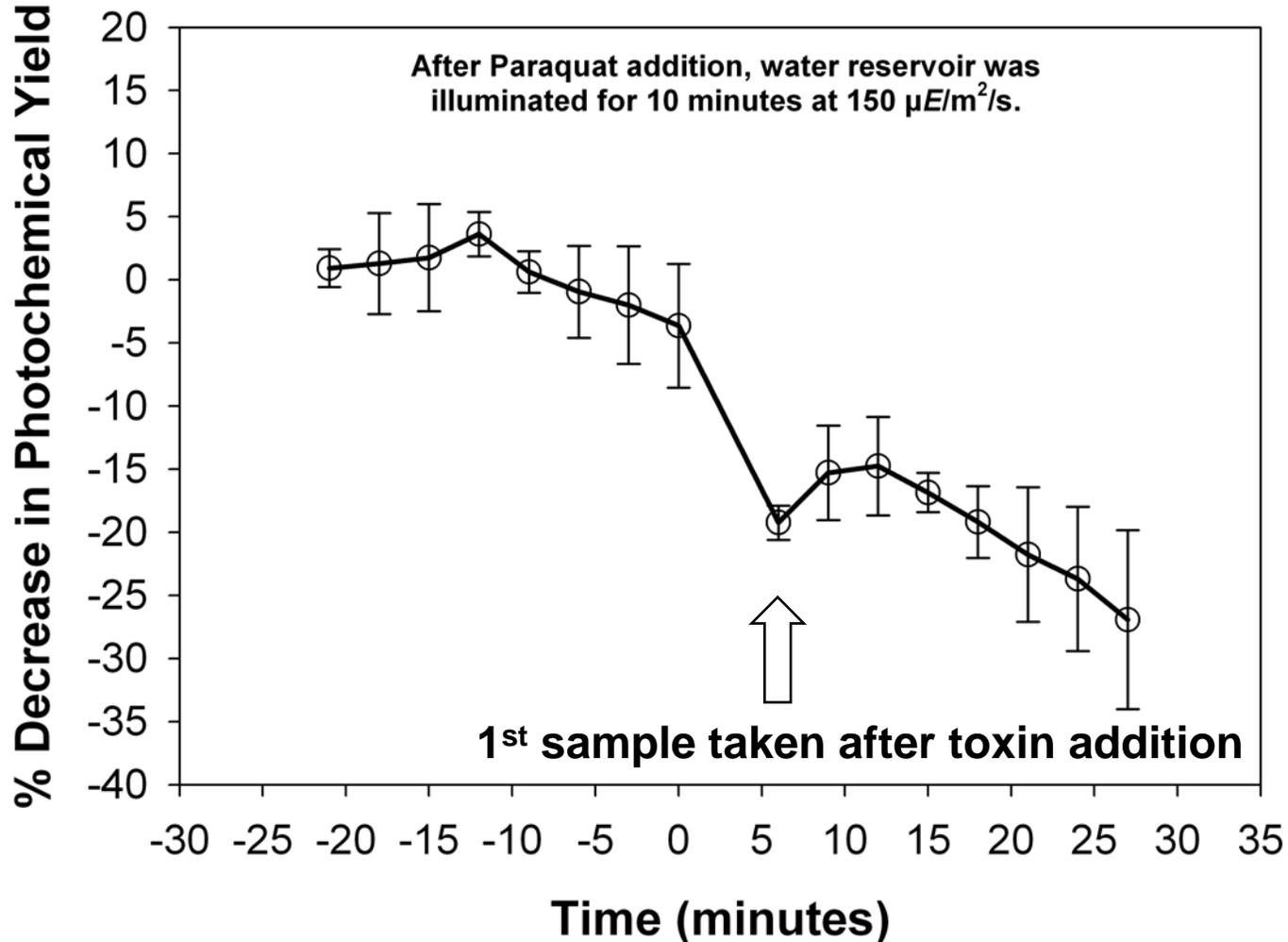
Effect of 10 ppm Potassium Cyanide (KCN) on Clinch River's Naturally-Occurring Algae (Error Bars Represent Triplicate Experiments)

EPA Standard = 0.2 ppm

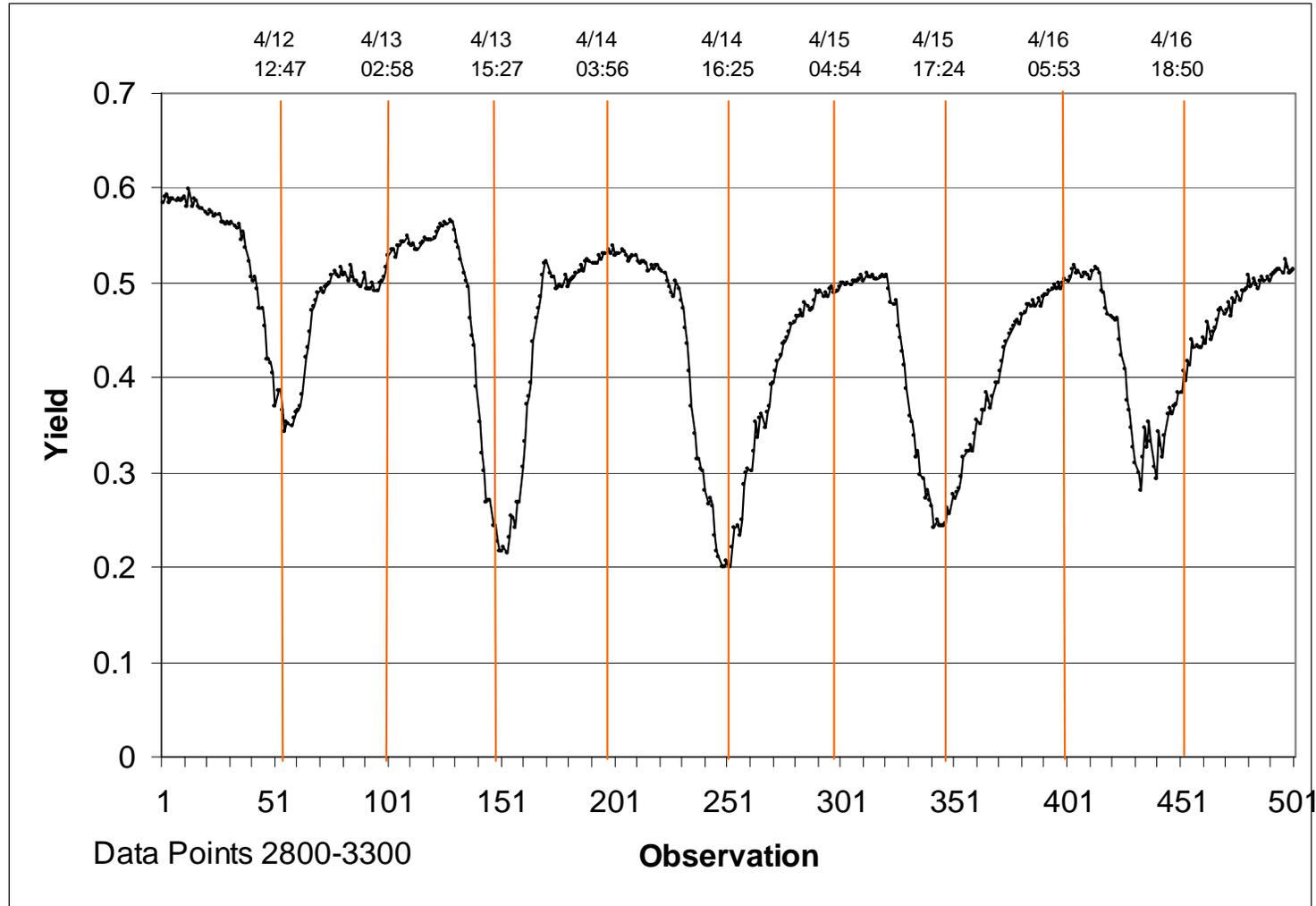


Effect of 0.1 ppm Paraquat on Clinch River's Naturally-Occurring Algae (Error Bars Represent Triplicate Experiments)

EPA Standard = 0.1 ppm



Diurnal Variation in Photosynthetic Activity



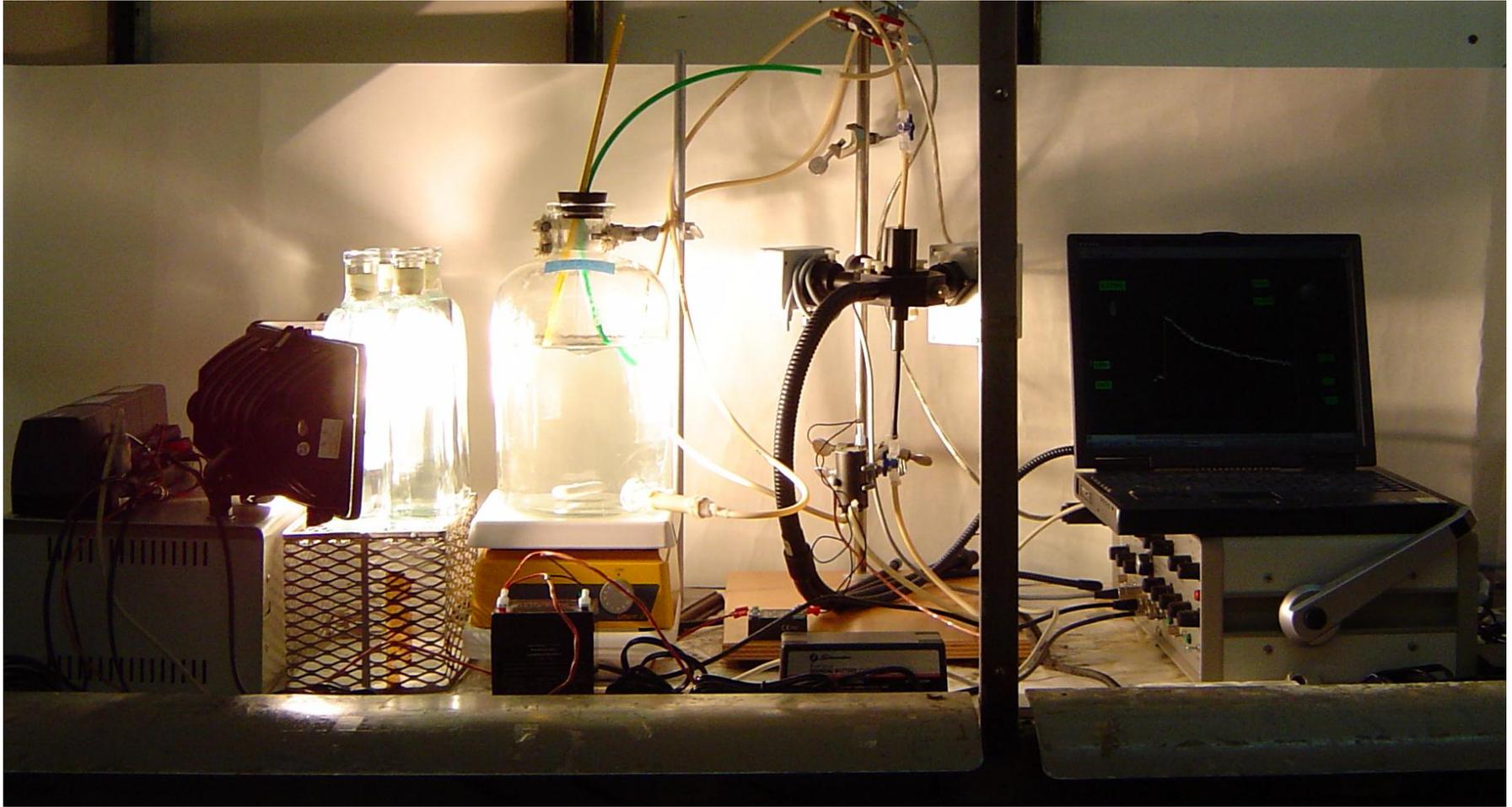
Induced Photoinhibition



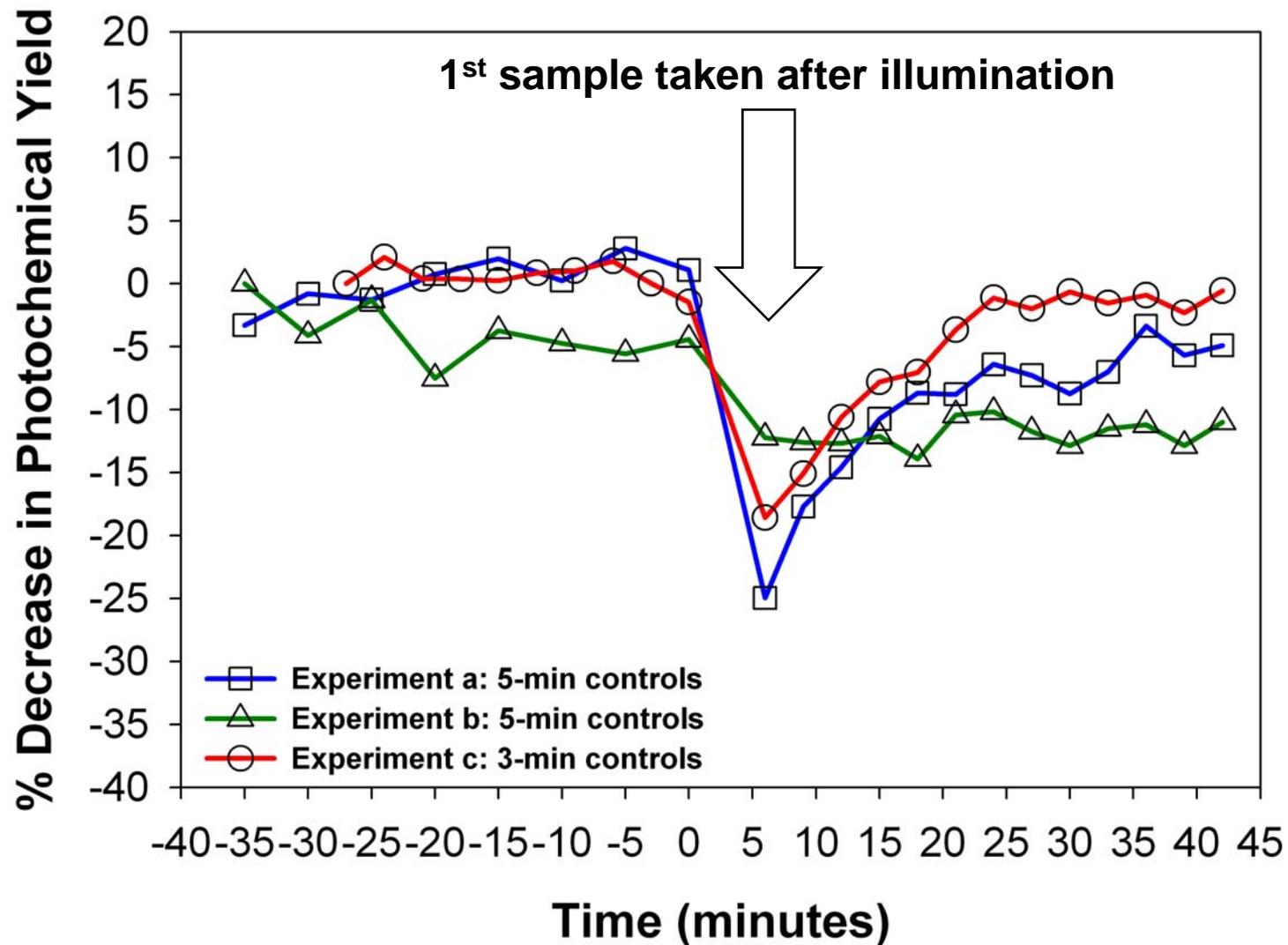
Solar Simulation Studies



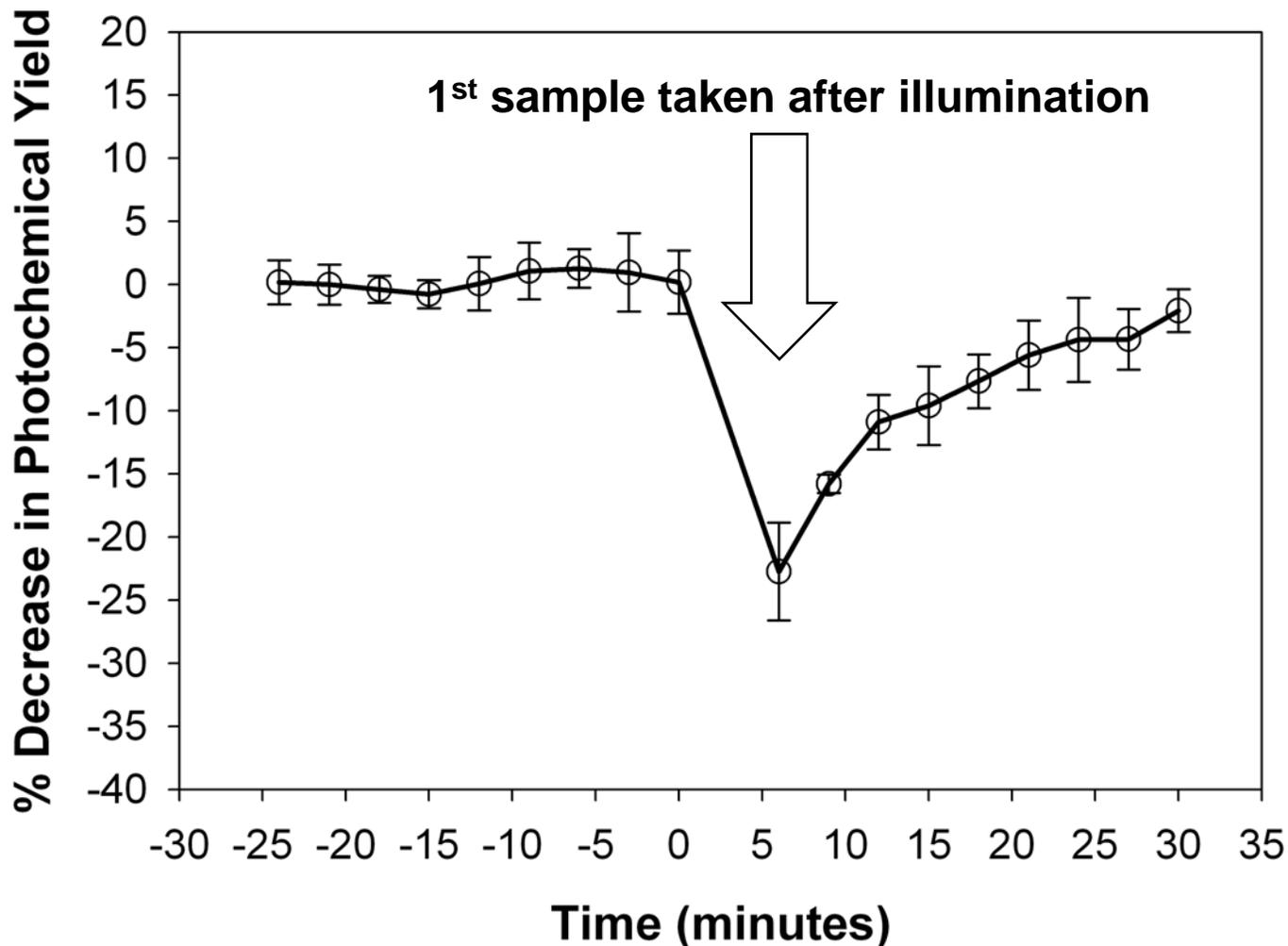
30-min Exposure: Average $1,500 \mu E/m^2/s$



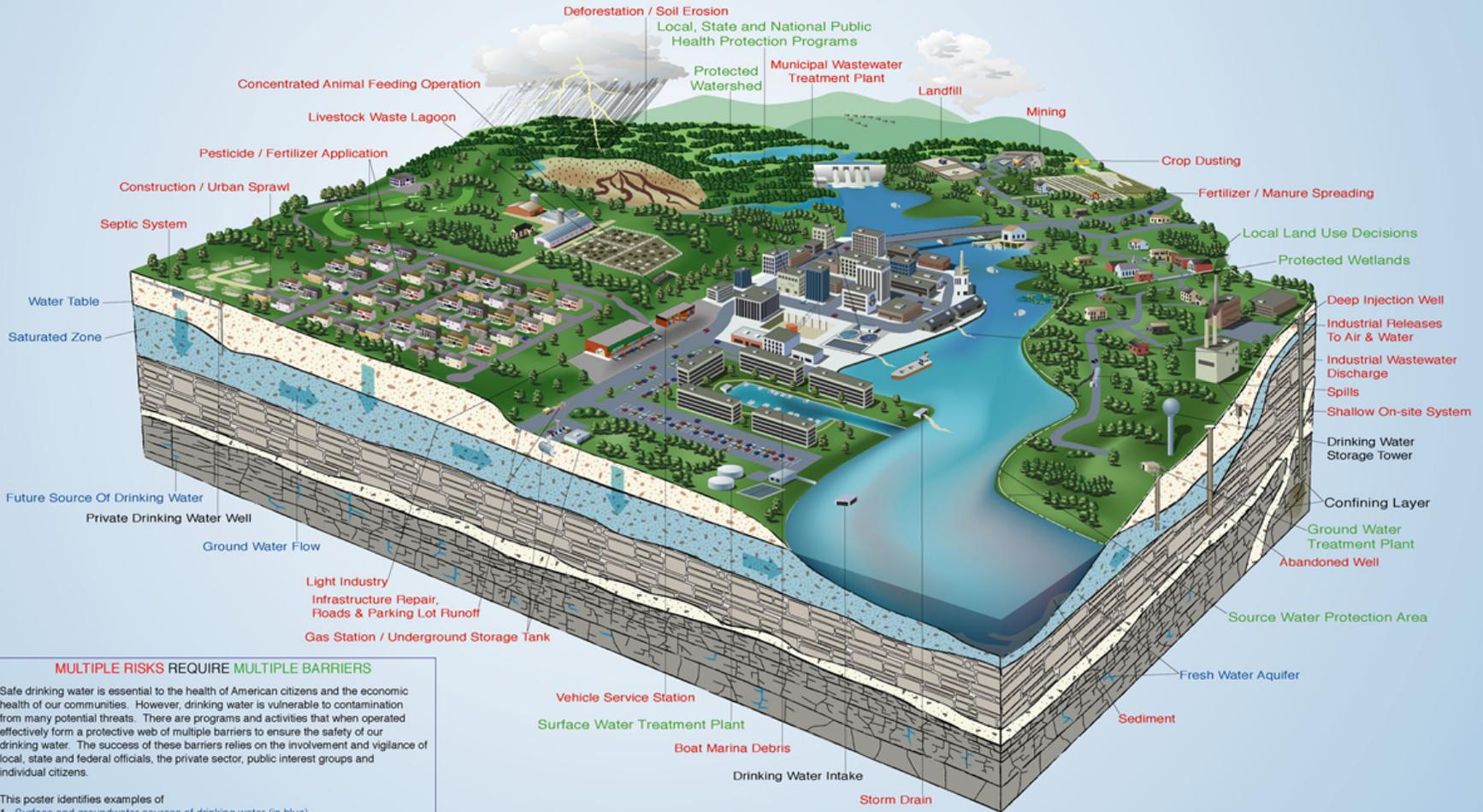
Recovery of Clinch River's Naturally-Occurring Algae from a 30-min Exposure to an Average $1,500 \mu E/m^2/s$



Recovery of Clinch River's Naturally-Occurring Algae from a 30-min Exposure to an Average $1,500 \mu E/m^2/s$ (Error Bars Represent Triplicate Experiments)



Safe Drinking Water Act - Protecting America's Public Health



MULTIPLE RISKS REQUIRE MULTIPLE BARRIERS

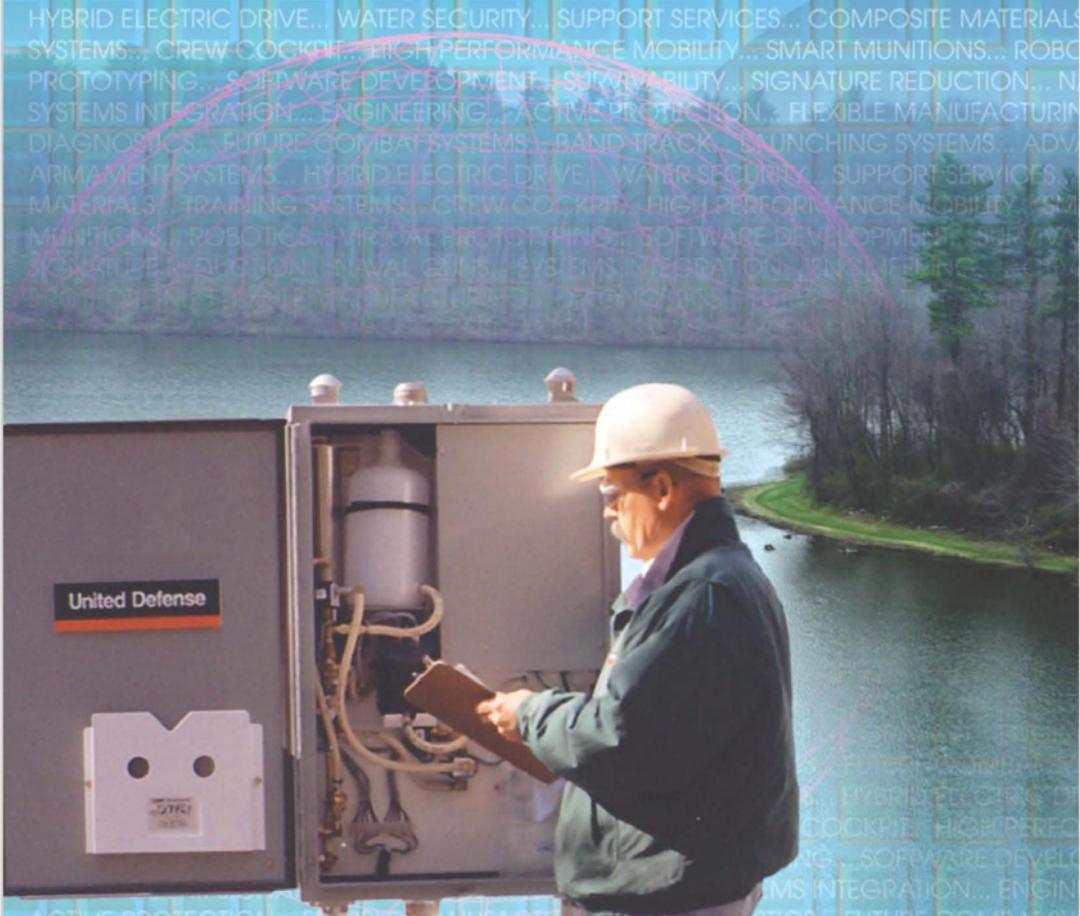
Safe drinking water is essential to the health of American citizens and the economic health of our communities. However, drinking water is vulnerable to contamination from many potential threats. There are programs and activities that when operated effectively form a protective web of multiple barriers to ensure the safety of our drinking water. The success of these barriers relies on the involvement and vigilance of local, state and federal officials, the private sector, public interest groups and individual citizens.

This poster identifies examples of

1. Surface and groundwater sources of drinking water (in blue),
2. Potential threats to those drinking water sources (in red), and
3. The multiple barriers that together protect our nation's public health (in green).
 - Risk Prevention Barrier
 - Risk Management Barrier
 - Risk Monitoring and Compliance Barrier
 - Individual Action Barrier

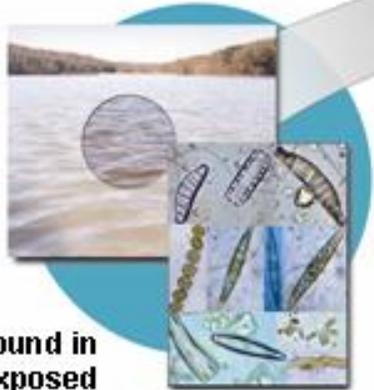
Safe Drinking Water Hotline – (800) 426-4791 Safewater Web Site – www.epa.gov/safewater

H O M E L A N D D E F E N S E



Defending Our Nation's Water Supplies. The United Defense WaterSentry™ system provides first alert toxin detection for homeland security, military and other civilian applications. The WaterSentry™ security alert system conducts automated around-the-clock testing for waterborne toxins, guarding our vital drinking water supplies.





Algae are found in all sun exposed bodies of water.

Water enters the test unit where a state of the art sensor measures the algal fluorescence.



Multiple variables are used to determine if a toxin is present in the water.

Messages
[11/13/2003 09:04:40] Test cycle started

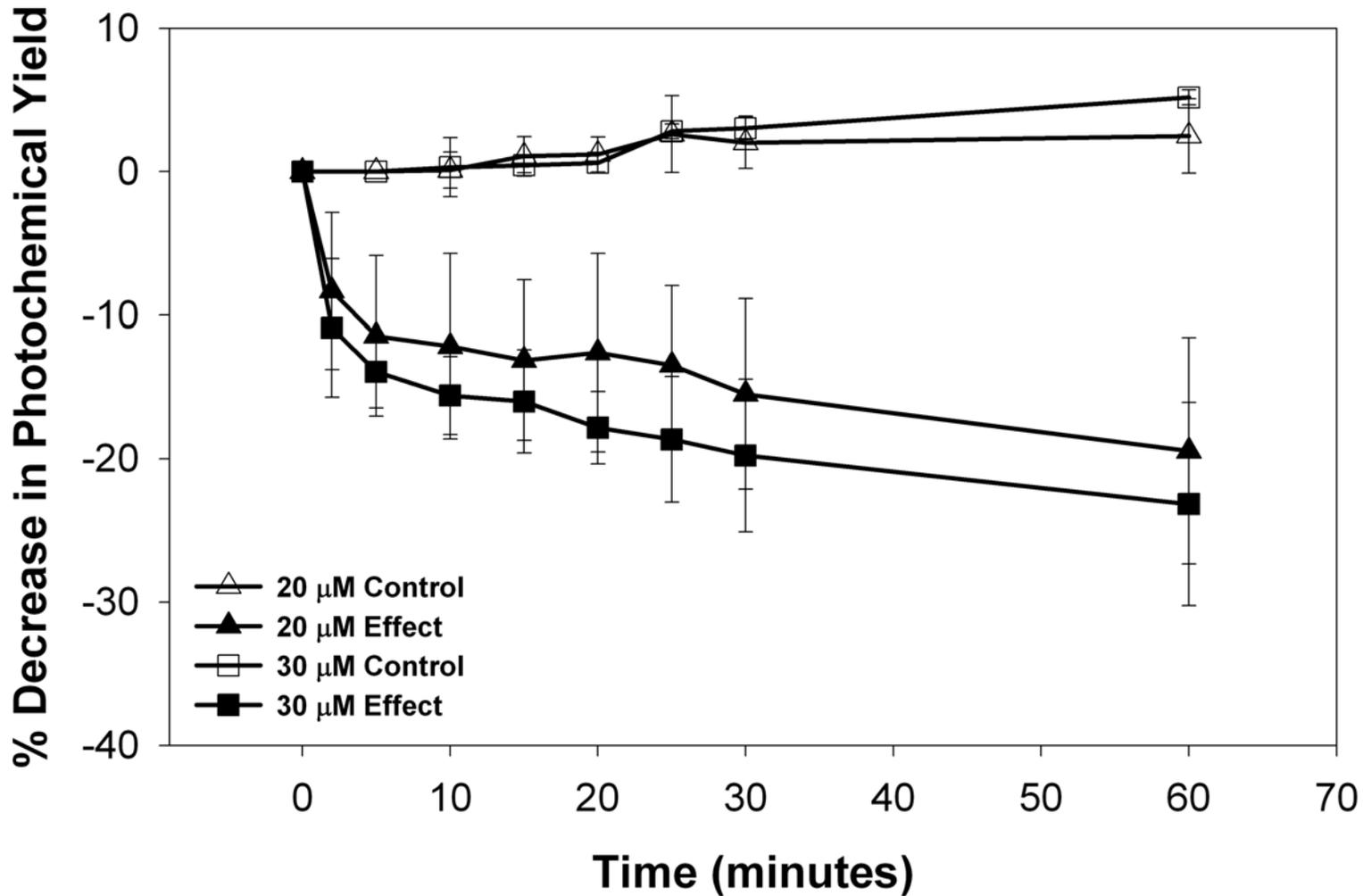
Test Unit Status

Test Unit	Alert Condition	Current Yield	Previous Yield	Bag #1	Bag #2
		0.3021	0.2995	<input type="checkbox"/> empty	<input type="checkbox"/> empty
	Ambiguous Alert	0.3000	0.3001	<input checked="" type="checkbox"/> full	<input type="checkbox"/> empty
		0.1762	0.1832	<input checked="" type="checkbox"/> full	<input checked="" type="checkbox"/> full
		0.3042	0.4753	<input type="checkbox"/> empty	<input type="checkbox"/> empty
		0.3042	0.4399	<input type="checkbox"/> empty	<input type="checkbox"/> empty
		0.4712	0.3253	<input checked="" type="checkbox"/> full	<input type="checkbox"/> empty
		0.2941	0.3051	<input checked="" type="checkbox"/> full	<input checked="" type="checkbox"/> full
#1				<input checked="" type="checkbox"/> full	<input type="checkbox"/> empty
#10				<input checked="" type="checkbox"/> full	<input type="checkbox"/> empty
#11		0.4212	0.4128	<input type="checkbox"/> empty	<input type="checkbox"/> empty
#12		0.2993	0.3231	<input type="checkbox"/> empty	<input type="checkbox"/> empty

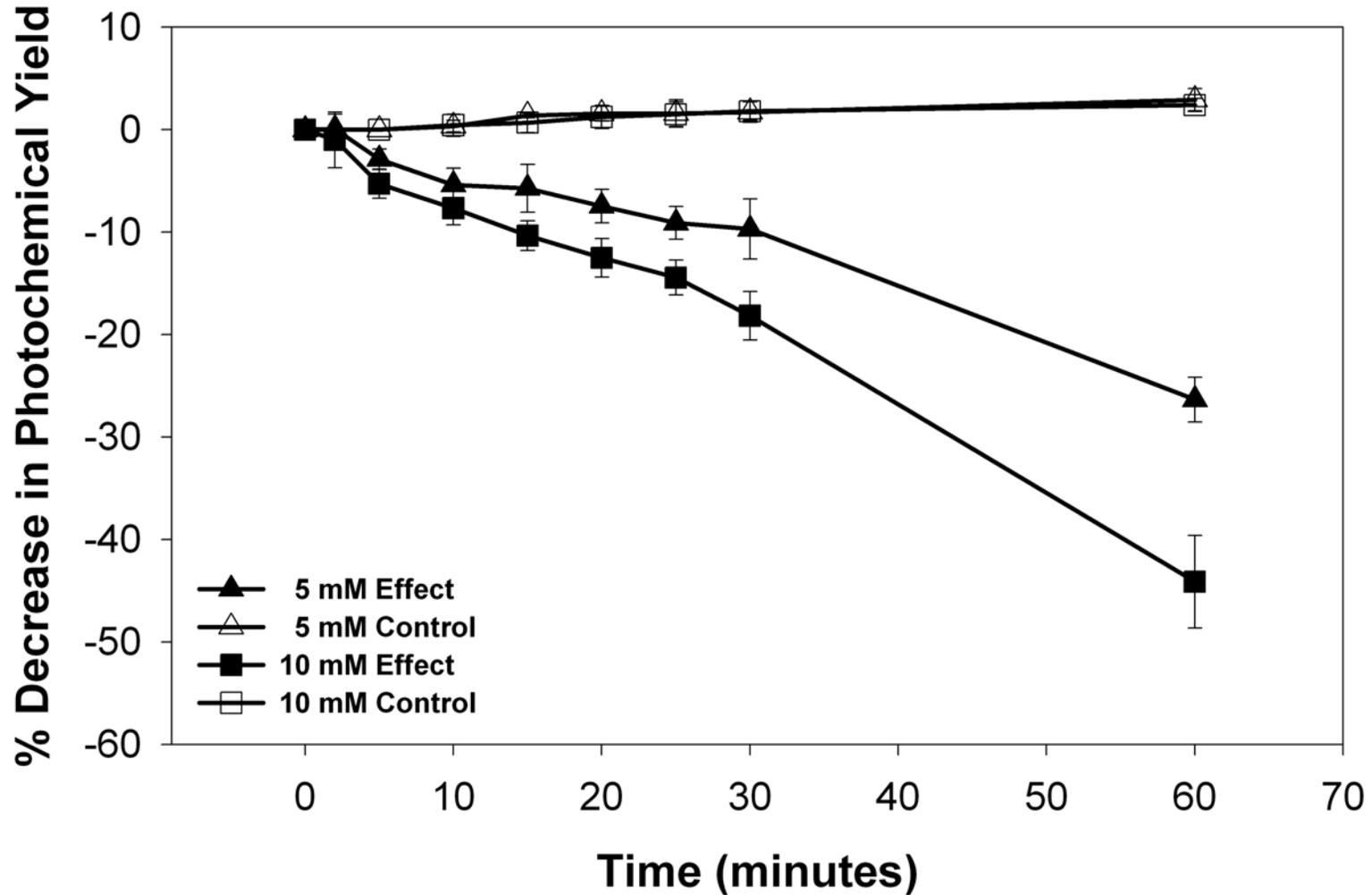
NEXT TEST CYCLE: 00:58

TEST NOW! SHUTDOWN

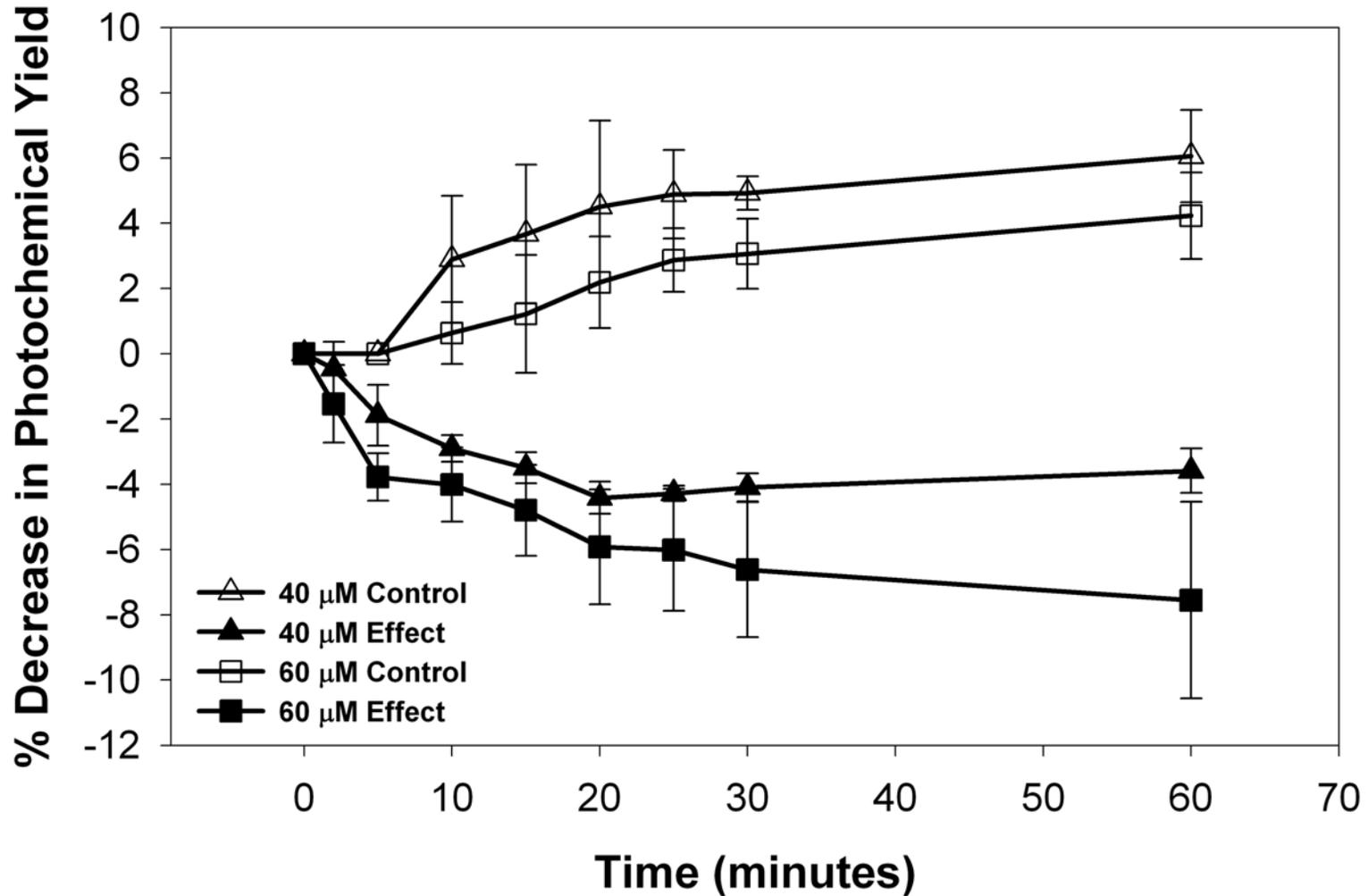
**Effect of DCMU (Diuron) on 0.14 μg chlorophyll/ml
Chlamydomonas reinhardtii suspensions
(Error Bars Represent Triplicate Experiments)**



Effect of Potassium Cyanide (KCN) on 0.14 μg chlorophyll/ml *Chlamydomonas reinhardtii* suspensions (Error Bars Represent Triplicate Experiments)



Effect of Methyl Parathion (MPt) on 0.14 μg chlorophyll/ml *Chlamydomonas reinhardtii* suspensions (Error Bars Represent Triplicate Experiments)



**Effect of Paraquat on 0.14 μg chlorophyll/ml
Chlamydomonas reinhardtii suspensions
(Error Bars Represent Triplicate Experiments)**

