Little Miami River Biomonitoring Station

National Risk Management Research Laboratory
Water Supply and Water Resources Division

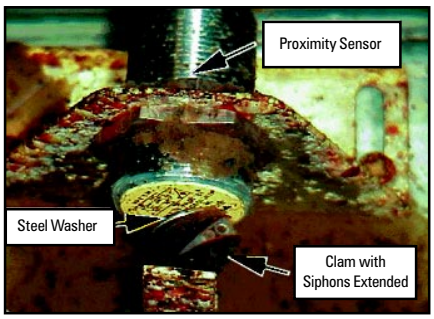
USEPA has installed a remote biomonitoring station on the Little Miami River, located near Cincinnati, Ohio. Collaboration partners on this effort include the University of North Texas, and Little Miami, Inc.

Purpose

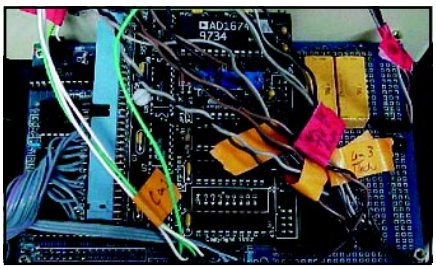
The purpose of the research is to demonstrate the ability to reliably monitor water quality using biological sensors. EPA also proposes to demonstrate the utility of multi-species biosensors (fish and bivalves) as an advanced measuring tool for real-time monitoring of water quality. Measurable water quality parameters were identified, and a customized biomonitoring system was developed for this purpose

Little Miami River, Cincinnati, Ohio Biosensor Sampling Point.

Multiple Sensor - Sonde.



Clam - Gape Biosensor.



Remote Monitoring Unit.

Biomonitoring System Components

The Biomonitoring system consists of three major components: water quality (or parameter) measuring devices, data collection/processing devices, and a power source to run these devices.

Parameter Measuring Devices

This component includes various sensors that measure the physical, chemical, and/or biological parameters. The physical and chemical parameters (e.g., temperature, pH, conductivity, dissolved oxygen) are measured using a commercially available multiprobe (sonde).

The biological parameters measured at this location include devices for measuring the bioelectric action potential (BAP) responses and gape behavior. Certain aquatic animals generate measurable bioelectric signal(s) or BAP responses that propagate into the surrounding water. These signals can be recorded as rhythmic analog signals representative of specific movement activities (e.g., gill beats, heart rates, etc.). In addition, gape measurements (the degree to which a bivalve is opened or closed) have been used with bivalve mollusks as a means to measure the response of the organisms to water quality change. Gape behavior is measured using proximity sensors which detect a stainless steel proxy attached to a shell of a clam.

Data Collection/Processing Devices

The measured information is collected and processed using a remote monitoring unit. A digital cellular modem is used to transmit the collected data for further analysis, display, and archiving.

Power Source

The Biomonitoring system is powered by four batteries with 90 amp-hour rated capacity. A solar array maintains the charge by charging the batteries during the daylight hours.

The individual components of the Little Miami Monitoring System can be modified to include other measurable water quality parameters.

Data Collection System with Solar Panels.

Project Summary

The study results indicate that changes in BAP responses and gape behavior can be continuously detected, recorded, and processed by utilizing appropriate electronics. The measured physical, chemical and biological data can be analyzed using various statistical techniques to quantify the changes in water quality. The collected data will be used to further study sensitivities and dose/response relationships of aquatic organisms.

Buoy - Monitoring Station.

Upcoming Research

USEPA will continue to develop and evaluate biomonitoring systems that can be used to collect and analyze water quality data onsite in real-time. USEPA is currently in the process of implementing a river-monitoring program along the Ohio River. The river-monitoring program uses early warning buoys that include a variety of sensors to monitor the water quality along the Ohio River. USEPA will continue to develop and evaluate biomonitoring systems at the Little Miami Station, the Ohio River Monitoring Program (Buoy Stations), and the USEPA Test and Evaluation (T&E) Facility in Cincinnati, Ohio. USEPA continues to evaluate innovative technologies and analysis techniques that can provide real-time water quality data from remote locations.

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