Griffy, Annette

From: McGinn, Marty
Sent: Tuesday, May 25, 2004 5:25 PM
To: Griffy, Annette
Cc: Judd, David; Wierenga, Ron; Phillips, Randy
Subject: Cyanobacteria sampling plan

Attached is the final version of the Blue-green algae sampling plan for Vancouver Lake. I will be around to gather signatures from everyone on Thursday if that works. I'll give a call to verify. Thank You. Marty

blue green plan.doc
(85 KB)

Cyanobacteria (Blue-Green Algae) Monitoring Plan

For

Vancouver Lake

Prepared by

Marty McGinn

May 2004

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Approvals

Ron Wierenga, Water Resources Scientist, Clark County

Victor Erhlich, Engineer, City of Vancouver

Randy Phillips, Environmental Health Supervisor, Clark County

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Abstract

This project plan follows the guidance of the World Health Organization (WHO) Guidelines, Chorus and Bartram, 1999 for managing bathing waters which may produce cyanobacterial cells and/or toxins. Slight modifications were made to account for project specifics or constraints.

Currently there are no state regulations specifically written for swimming beach safety. However, Clark County Health Department is the local health jurisdiction assigned responsibility to protect public health and therefore necessitates that swimming areas be monitored to ensure the safety of the public.

Due to financial constraints, this sampling has been difficult to accomplish.

Specific objectives of the program include:

- Collect samples and have a laboratory determine the type and concentration of cyanobacteria in water samples from the swimming beach.
- Determine water temperature, turbidity, conductivity and dissolved oxygen of a sample taken from the beach.
- Compare the results with the WHO guidelines for swimming areas.
- Notify all interested parties of the results.

Organization and Schedule

The following are the roles of people involved in the study:

Marty McGinn, Clark County Health Department, 360-397-8428

- Responsible for project management, field sampling, data collection, data analysis.

Victor Erhlich, City Engineer, City of Vancouver, 360-696-8008

- Responsible for laboratory costs, billing procedures.

Dr. Yangdong Pan, Associate Professor, Portland State University, 503-725-4981

- Analyze samples for identification and enumeration.

Dr. Gene Foster, Oregon Department of Environmental Quality, 503-229-5983

- Analyze samples for toxins.

This project will start just before the swimming season (the typical swimming season at Vancouver Lake is from Memorial Day through Labor Day). The first sampling date will be Monday, May 24, 2004. The sampling will be bi-weekly throughout the summer and the last sample will be September 13, 2004. The collected data will be shared with the County parks staff and other interested parties each week.

Data Entry: Data will be submitted to Water Resources for entry into the County's centralized water quality database.

Background and Problem Statement

Vancouver Lake has a designated swimming beach on the west side of the lake. Since the public utilizes the lake for swimming and other activities, it is the responsibility of the Clark County Health Department to assure the users of the condition of the water.
Cyanobacteria (blue green algae) can produce toxins (including neurotoxins, hepatotoxins and cytotoxins causing skin irritations and other illnesses) that can impact wildlife, pets and humans. The likelihood that a bloom will produce toxins is thought to be 45% to 75% of the time (Crayton, 1993). Only laboratory testing can confirm the presence of toxin. Given the right conditions in a lake, the cyanobacteria can dominate the algal community, reaching tremendous population densities, which often results in negative ecological and recreational impacts on the lake.

Vancouver Lake has been determined to be in a eutrophic state meaning the lake is rich in nutrients. This fertile condition supports the rapid growth of blue-green algae. Enormous numbers of algae concentrate near the surface and form a rich, thick film that can resemble a bluish paint when it washes up on the shore. The blooms generally last from a few days to weeks. The ideal conditions for a bloom are hot, stagnant weather with abundant sunlight combined with relatively high water temperatures, high levels of phosphorus relative to nitrogen and a dysfunctional food web structure that limits the grazers that consume algae, like zooplankton. Typical bloom forming algae common to the region include Anabaena, Aphanizomenon and Microcystis.
The flow of water into Vancouver Lake, particularly in the summer months, has been on the decline due to recent drought. Furthermore, the flushing channel that was built in 1982 in an attempt to flush nutrients and algae from the lake, has never been dredged, thus limiting the flow from the Columbia River.
Last summer the lake was closed due to an algal bloom that had toxins present.
The Clark County Health Department does not have any recent data of cyanobacteria levels at the lake. This sampling program will provide us with the necessary information to advise the public on when it is safe to use the lake.

Project Description

Goal

The overall goal is to evaluate whether harmful algae or toxins are present at levels that may affect public health. This will be accomplished by determining the type and concentration of cyanobacteria in samples of water taken from the swimming beach of Vancouver Lake Park.

Objectives

1. Collect samples and have a laboratory determine the number of cells of cyanobacteria in each sample.
2. Compare the results with the WHO guidelines (if concentrations of cyanobacteria are greater than 100,000 cells, then restrict bathing, watch for scum and test for toxins).
3. Notify all interested parties of the results (Vancouver-Clark Parks and Recreation, City of Vancouver, Clark County Public Works).
4. Integrate the results into the CCHD's public notification system for swimming beaches (press release issued and post advisory at several locations at Vancouver Lake).

Sampling frequency

Bi-weekly samples will be collected (generally on Monday or Tuesday). Additional follow-up samples will be collected if the levels are above the acceptable limits (above 100,000 cells). The following week samples will be collected and continue on a weekly basis if any sample exceeds 100,000 cells. When levels exceed 100,000 cells, samples will also be collected for toxin testing (Two samples will be analyzed for hepatotoxin and neurotoxin when necessary). When test results are below action levels sampling frequency will revert back to bi-weekly.

Sampling Design

Representativeness

The sample sites have been selected to represent conditions in the swimming area. Data is applicable to near-shore conditions along the western side of the lake. Water sampling will consist of a near surface measurement (approximately six inches below the surface). Two samples will be collected on each day. One sample will be at the Northernmost (location code VAN067) end of the swimming area. The sample will be taken where the water depth is approximately three feet. The second sample will be at the Southernmost (location code VAN063) end of the Swimming area at a depth of three feet.

Comparability

This project will generate data that are comparable to local and regional lake monitoring projects, as well as guidelines developed to protect public health. Procedures and sampling design that follow international guidelines facilitate the comparison. Furthermore, using standard techniques ensures comparability with past and future datasets. Bi-weekly samples will be collected(generally on Monday or Tuesday). Additional follow-up samples will be collected if the levels are above the allowable limits (above 100,000 cells). The following week samples will be collected and continue on a weekly basis if any of the samples exceed 100,000 cells. When levels exceed 100,000 cells samples will also be collected for toxin testing.

Cost

Each analytical test (identification and enumeration) for Cyanobacteria cells will cost $120.00. If only bi-weekly testing is done (no samples above 100,000 cells) a total of 18 samples will be analyzed on 9 days and will total $2160.00. If samples are above 100,000 cells then the highest cost would be $4320.00. In addition, if the counts are above 100,000 cells, the toxin testing commences and the following costs will be incurred (weekly testing includes toxin tests). Microcystin toxin test (ELISA) will cost $30.00 - $50.00. Other toxin testing varies and neurotoxin tests using GC/MS and HPLC can range from $80.00 - $200.00 per sample. Total cost for toxin testing is hard to determine but should be less than $3000.00 (including shipping costs).

Field Procedures

Water samples are collected for cyanobacteria in standard liter bottles provided by the contracted lab. The samples will immediately be put into a cooler with ice packs.
When all the samples have been collected, they will be labeled with the location and date. All samples will be taken to the laboratory on the same day as collected.

Lab Procedures

The contracted lab will follow the procedures detailed in its own QA manual for analyzing samples and performing QC procedures. QC data, including results from duplicate and blank analyses, will be submitted to the CCHD by the lab with the analytical report.

Parameter	Sample Matrix	Number of Samples	Analytical Method	Expected Range of Results
Cyanobacteria	Lake Water	18	Variable	0-100,000+ cells/ml

Data Management Procedures

Field, lab and QC data will be compiled and entered into a spreadsheet for analysis. Data will be submitted to Water Resources for entry into the County's centralized water quality database.

Data Review, Verification, and Validation

Once the measurement results have been recorded into the spreadsheet, they will be examined to ensure:

- The data are consistent, correct, and complete according to the data recording sheets filled out in the field.
- Any qualifiers with the data are identified.

Data Quality Assessment

After the data have been validated, the following steps will be conducted to assess the data quality:

- Review the data quality objectives and the sampling design
- Conduct a preliminary data review
- Draw conclusions from the data

Summarize data results and summarize QC and QA results. Assess the usability of the data (and whether any of the data are suspect or need to be qualified) by comparing QC result to MQO's (Measurement Quality Objectives). Discuss any discrepancies between a program's MQO's and the data collected.

Postings/Closure

Action Levels

Cyanobacteria is now being used as an indicator of potential health risk by the World Health Organization(WHO) The bathing standards established by the WHO will be used to determine action levels. Warning notices shall be posted if a single sample exceeds the WHO guideline for Cyanobacteria of 100,000 cells per ml. Vancouver Lake will be posted "Closed to Swimming" if this level is exceeded and there is a scum formation on the beach in the bathing area. The notices will be posted at the gatehouse to the Park and on the three beach billboards. If the standards are exceeded an additional sample will be collected until the levels are back within guidelines (determined by the next scheduled sample). The lake will then be re-opened to swimming.

References

WHO Guidelines, Chorus and Bartram, 1999; Table 5.2 Guidelines for safe practice in managing bathing waters which may contain cyanobacterial cells and or toxins.

Diamond Lake, Oregon; US Forest Service and Douglas County Health Department, Mikeal Jones.

Pacific Lutheran University Biology Department, Dr. Michael Crayton,