



---

## News Release

U.S. Department of the Interior  
U.S. Geological Survey

**Address**  
Ohio District  
6480 Doubletree Ave  
Columbus, OH 43229-1111

**Release**  
March 17, 2003

**Contact**  
Donna Francy

**Email**  
[dsfrancy@usgs.gov](mailto:dsfrancy@usgs.gov)

**Phone**  
614-430-7769

**Fax**  
614-430-7777

---

# Forecasting Bacteria Levels at Ohio Beaches

## *USGS Research Gives Health Officials a Tool for Predicting Water Safety*

Before you hit the beach, it may soon be possible to check the bacteria beach forecast.

U.S. Geological Survey scientists have found a quick method to predict bacteria levels at three Lake Erie urban beaches and one inland lake beach in Ohio. A computer model takes into account current weather and environmental conditions and is used to forecast *Escherichia coli* (*E. coli*) bacteria concentrations. Results could be provided within 2 hours of data collection, and the beachgoer would have access to timely information on current water-quality conditions before leaving for the beach.

"Our method and model could be customized for other beaches across the nation as long as unique environmental factors are considered and tested for each beach," said Donna Francy, USGS research hydrologist for the study.

Beach advisories or closings in the United States are issued when concentrations of indicator organisms, such as *E. coli*, exceed safety standards. *E. coli* is a bacterium found in the intestines and feces of warm-blooded animals. Indicator organisms do not necessarily cause disease, but they are present in sewage and waste and indicate the possible presence of pathogens (disease-causing organisms). If the concentration of *E. coli* exceeds the standard established by the state, the risk of illness is considered too high for some recreational use.

Unfortunately, current methods to determine levels (concentrations) of *E. coli* take at least 18 hours to complete. During this period, *E. coli* concentrations may change dramatically; therefore, a beach may be posted with an advisory when the bacterial water quality has already returned to safe levels. Also, an advisory may not be posted on a day when the risk of pathogen exposure is high; for example, after a heavy overnight rain.

"We collected weather and environmental data to develop statistical models to predict *E. coli* concentrations," said Francy. "Instead of waiting 18 hours for *E. coli* to grow in the laboratory, we can quickly measure factors that explain changes in *E. coli* concentrations, enter them into a computer program, and obtain a prediction of recreational water quality in less than 2 hours."

"Our model allows state, city, and county health officials to make decisions based on current information, not yesterday's information," said Francy

The scientists determined that the best model for each beach was based on a unique combination of weather and environmental factors. For the Lake Erie beaches (Edgewater Park, Huntington Reservation, and Villa Angela), these factors included wave height, number of birds on the beach at the time of sampling, lake-current direction, rainfall, turbidity, and streamflow of a

nearby river. For Mosquito Lake, an inland lake about 40 miles south of Lake Erie, the factors included time of year, wind direction and speed, number of birds, and rainfall.

The models can be used like weather forecasts to predict the probability that the Ohio single-sample bathing-water standard for *E. coli* (235 colonies per 100 milliliters) will be exceeded. Threshold probabilities for each model were established. Computed probabilities that are less than the threshold probability indicates that bacterial water quality is most likely acceptable. Computed probabilities equal to or above the threshold probability indicate that the water quality is most likely unacceptable and that a water-quality advisory may be needed.

"We are very pleased with the USGS models," said Jill Lis, Program Manager for the Cuyahoga County Board of Health. "These tools could help officials protect and inform the public in a timely manner."

The models' ability to predict recreational water quality could be further tested by measuring *E. coli* concentrations in subsequent years to assess whether the threshold probabilities are valid from one year to the next. Each year the model is tested, new information can be added and model variables can be recalculated to see if the predictions improve with additional data. If, over time, the probability-based models correctly predict impairment of recreational water quality as well as or better than current methods, beach managers may consider using the models to aid or direct decisions on posting beach advisories.

"We found the models for Huntington Reservation and Villa Angela were good at predicting recreational water quality in 2002, but the results at Edgewater and Mosquito Lake were less reliable," Francy said. "Perhaps the sources of fecal contamination at Edgewater and Mosquito Lake are from localized activity that cannot be measured or predicted."

USGS scientists took their investigation a step further and looked at the distribution of *E. coli* in water and sands collected from near the swash zone. The swash zone is the area that is alternately covered and exposed by waves and is where children often play in the sand. The investigators found that concentrations of *E. coli* in water and sands collected from near the swash zone were often higher than those collected from within the bathing area. For example, *E. coli* concentrations were considerably higher than recreational standards in some waters from the swash zone. Although there are no standards for *E. coli* in swash-zone materials, the high concentrations found at some locations may warrant concern for public health.

Three reports from this study are available on the web at <http://oh.water.usgs.gov/beaches/>. The technical report, "Distribution, sources, wastewater indicators, and predictive modeling for *Escherichia coli* at Ohio bathing beaches," USGS Water-Resources Investigation Report 02-4285 provides detailed methods, results, and water-quality data. More concise summaries of the study are available in two fact sheets titled, "Forecasting bacteria levels at bathing beaches" and "*Escherichia coli* in the swash zone at four Ohio bathing beaches".

USGS completed this study in cooperation with the Ohio Water Development Authority, Northeast Ohio Regional Sewer District, Ohio Lake Erie Office, Cuyahoga County Board of Health, Cuyahoga County Sanitary Engineers, and the Cuyahoga River Community Planning Organization.

The USGS serves the nation by providing reliable scientific information to describe and understand the Earth; minimize loss of life and property from natural disasters; manage water, biological, energy, and mineral resources; and enhance and protect our quality of life.

\*\*\* USGS \*\*\*

This news release can be viewed online at <http://oh.water.usgs.gov/beaches/>. Photos can be downloaded from this website. Electronic copies of the text are available by request.