

Appendix B

State and Territory Highlights

The following sections were written by each state or territory to highlight the key accomplishments of beach programs in coastal states and territories. EPA has not verified and validated these data. These program descriptions describe recent activities and might include some actions not funded by BEACH Act funds. Readers should note that the summaries for the Gulf Coast area were written before hurricanes Katrina and Rita. These devastating events, which occurred in August and September 2005, will likely have a profound effect on the beach programs administered by the affected states in the short term. In the coming months, EPA and the states will work to reestablish program activities so that the health and safety of beachgoers remain protected.

Alabama

In June 1999, the Alabama Department of Environmental Management (ADEM), in cooperation with the Alabama Department of Public Health (ADPH), initiated a program to routinely monitor bacteria levels at five public recreational beaches along the Gulf Coast. The effort was later expanded to include six additional sites along the Gulf Coast and Mobile Bay. ADEM was designated as the state's lead agency and was awarded grant money by EPA through the BEACH Act to carry out this program. Through the BEACH Act, ADEM and ADPH expanded and enhanced monitoring and notification efforts for Alabama's public recreational waters. The goal of this program is to increase public awareness and provide water quality information to help the public make more informed decisions concerning their recreational use of Alabama's natural coastal waters.

Monitoring and Public Notification

The monitoring program now involves the routine collection of water samples from 25 high-use and/or

potentially high-risk public recreational sites from Perdido Bay to Dauphin Island. The selection of sites and the frequency of sampling have been determined using a risk-based evaluation and ranking process. This process considers a number of factors for a given site, the most important being the amount of use and the amount of risk. Depending on the site rankings, samples are collected twice a week, once a week, or once every other week during the swimming season (June through September) and once a month during the cooler months (October through May). Samples are analyzed for the indicator bacteria enterococci. The indicator bacteria used and the threshold concentration, which triggers an advisory, are based on recommendations provided by EPA in the documents *Ambient Water Quality Criteria for Bacteria* (1986) and *Water Quality Standards Handbook, second edition* (1983). All enterococci analysis is performed by ADPH Laboratory using EPA Standard Method 1600. EPA Method 1600 provides a direct count of bacteria in the water based on the development of colonies on the surface of the membrane filter. The ADPH and EPA whole body water contact standard for enterococci is 104 col/100 mL (single sample maximum).

Trained ADEM and ADPH staff collect samples from the sites, and the ADPH Mobile Laboratory performs enterococcus analyses. ADPH reviews all data and is responsible for issuing advisories. All test results are posted on the ADEM Web site and advisories are publicized through press releases and posted on signs at each of the 25 sampling locations. More than 3,000 samples have been collected since the inception of the Beach Program, resulting in 52 advisories issued. During fiscal year 2004, over 800 samples were collected and analyzed, resulting in 15 beach advisories. Currently ADPH is using YSI Environmental Monitoring Systems, which are

multiparameter, water quality measurement and data collection systems used to collect in situ data. These data are also reported on the ADEM Web site. The in situ data collected includes dissolved oxygen, pH, specific conductivity, salinity, and temperature. Turbidity data are also collected using a field turbidity meter.

American Samoa

Overview of progress

All 143 miles of beaches and lagoon waters surrounding American Samoa are used daily by residents and tourists both for swimming and for family subsistence fishing. Thus, protection of public health by reducing the risk of disease acquired from swimming and recreating in contaminated waters is a great concern for the local community. Prior to 2002, the existing methods for monitoring recreational waters in the territory did not adequately protect public health. Following the receipt of BEACH grant funds in FY 2001, American Samoa EPA (ASEPA) successfully developed a beach monitoring and public notification program by the end of FY 2002. Since that time, ASEPA has continued with full implementation and enhancement of this program.

Background

Prior to receiving BEACH Act grant funds in FY 2001, limited assessment was made of beaches (embayments and open coastal waters). Each week, ASEPA monitored only 12 beach sites spanning 30 beach miles. Although beach samples were analyzed for the detection and quantification of enterococci, no statistical reference work was performed, nor was any attempt made to utilize the information for public notification.

FY 2002 Progress

In FY 2002, ASEPA used grant funds to develop a program consistent with EPA's nine performance criteria for the implementation of monitoring, assessment and notification. The primary objective of the project was continued development of an enhanced coastal recreation water monitoring program for American Samoa. Samples were routinely collected and analyzed from 14 beach sites weekly (Tier 1), 7 beaches monthly (Tier 2), and 14 remote beaches quarterly (Tier 3). Public advisories were issued in print, radio, and

television media for all beach samples that exceeded the American Samoa Water Quality Standards.

FY 2003 Progress

In FY 2003, ASEPA continued with full implementation of the beach monitoring and notification program. ASEPA also submitted an annual performance report, financial report, and monitoring and notification report for each fiscal year. Two Tier 3 beach sites were shifted to a more regular sampling frequency of Tier 1, increasing the number of beaches monitored weekly from 14 to 16 beaches. An additional beach site was added to Tier 3 for monitoring and public notification, bringing the total number of beaches sampled each quarter to 15. The total number of beach miles monitored and assessed for public notification at the end of FY 2003 was 83 miles.

FY 2004 Progress

Increased BEACH Act grant funding awarded in FY 2004 enabled ASEPA to continue with full implementation and to enhance its beach monitoring and notification program. Specifically, ASEPA increased the monitoring frequency for Tier 3 waters from quarterly to weekly monitoring; bringing the total number of beach sites sampled each week from 16 to 31. In addition to increased monitoring, advisories of water quality exceedances at Tier 3 waters were issued weekly for public notification. These data have enabled ASEPA to focus its nonpoint source efforts for improving water quality at beach sites. A fourth tier of 21 new beach sites spanning 60 miles was evaluated and classified using a risk-based approach, increasing the total number of beach miles considered for monitoring and public notification to 143 miles.

California

California has one of the most extensive beach monitoring programs in the country. Monitoring is performed by county health agencies in 18 coastal counties by NPDES permittees that discharge to the coastal zone, environmental groups, and numerous citizen monitoring groups. The BEACH program is helping California turn these programs into a coordinated statewide program.

Monitoring

BEACH Act grant funds have been used to augment beach monitoring in California. The State Department of Health Services (DHS) requires weekly monitoring for three bacterial indicators (total coliform bacteria, fecal coliform bacteria, and enterococcus) during the summer dry-weather period (April 1 to October 31) at all beaches having more than 50,000 visitors each year and near storm drains. Some local governments, especially in southern California, monitor their beaches year-round. Counties have used the BEACH Act grant funds to increase the number of stations sampled at beaches, increase the frequency of sampling, and, where appropriate, extend sampling to year-round.

The State Water Resources Control Board (State Board) has an ongoing Beach Water Quality Task Force consisting of health officials, regulatory agencies, discharge agencies, and environmental groups. The task force developed a three-tiered monitoring framework. Tier 1 beaches are high-use beaches with potential sources of contamination. These are monitored at least weekly; many are monitored daily or five days a week. Tier 2 beaches have moderate usage. These beaches may be monitored less than weekly or not at all during the period from November 1 through March 31 at the discretion of the local health officer. Tier 3 beaches are low-use beaches with little or no known source of contamination. The local health officer and water quality agencies may have monitoring conducted to determine whether these waters should be classified as Tier 1 or 2. Otherwise, the Tier 3 beaches are not monitored.

Quality assurance

The local health agencies collecting data have their own individual Quality Assurance Plans. DHS used the BEACH Act grant funds to develop a Quality Assurance Management Plan for all beach monitoring activities under the BEACH program. The plan describes how the program will develop, implement, and determine the effectiveness of its quality assurance and quality control policies and procedures. Perhaps unique to California, organizations participate in inter-laboratory calibration studies to ensure that results being generated by multiple laboratories are comparable.

Public notification and outreach

The state regulations prescribe bacterial thresholds and procedures for posting advisories and closing beaches. California makes a clear distinction between advisories and closings. Advisories provide the beachgoer with information to make an informed decision. The thresholds for posting an advisory in California are lower than those in other states. In California, beach advisories are mandated when any single sample exceeds a threshold for any one of three indicators. In addition, advisories are routinely posted for beaches 72 hours after a rainstorm. These differences need to be taken into consideration when making state-by-state comparisons.

Coastal counties are required by statute to report monthly to the state the number of beach advisories and closings. EPA BEACH Act grant funds have been used to help develop and support electronic data submittal. In Southern California, the county health agencies have data systems in place that allow them to transmit the water quality and advisory data to the State Board's Beach Watch System. In Northern California, counties are able to submit data to the Beach Watch System through a Web-based interface. The data from the Beach Watch System is used to submit data to EPA.

The Beach Water Quality Work Group refined the Heal-the-Bay Report Card system for consistent statewide application. The beach report card provides information on 430 beaches in California and is updated weekly (www.healthebay.org/brc/statemap.asp). The use of letter grades effectively communicates complex water quality data in a way that most people can understand and allows them to make informed decisions about where they want to swim.

Other highlights

California is a leader in beach monitoring. The state has invested \$78 million in a Clean Beach Initiative to clean up bacterial contamination throughout the state. The state also has invested in the development of techniques for rapid indicators to allow for quicker notification and methods for source tracking to accurately and rapidly identify causes of bacterial impairments. There have been two epidemiological

studies in California (Santa Monica Bay, 1994, and Mission Bay, 2004) to evaluate the relationship between bacterial indicators and incidence of disease. The Mission Bay study is unique in that it provides information on the risks associated with nonpoint sources of bacteria that are not of human origin.

Connecticut

Monitoring and public notification

The 67 regulated coastal bathing areas along the shoreline of Connecticut in contact with the Long Island Sound Estuary fall into two groups. Sixty-three of these beaches are sampled and monitored by 22 municipal local health departments, while the remaining 4 are state park beaches monitored by the Connecticut Department of Environmental Protection (CTDEP). These 67 beaches are monitored and closed in accordance with the *State of Connecticut's Guidelines for Monitoring Bathing Water and Closure Protocol*. From Memorial Day to Labor Day, the shoreline local health departments and CTDEP notify the public when they issue closings or advisories for these beaches.

The Connecticut Department of Public Health (CTDPH) is currently building Web pages for the public beaches in Connecticut. The pages will be accessed through the department's home page, and will include beach lists; a tiered beach monitoring list; the *State of Connecticut's Guidelines for Monitoring Bathing Water and Closure Protocol*; links to Connecticut local health departments and CTDEP for beach closure information, the Centers for Disease Control and Prevention, and EPA; and references to state regulations governing public beaches.

Beach mapping and data management

CTDPH has traversed the entire length of each of the 67 regulated coastal bathing areas along the shoreline adjoining the Long Island Sound Estuary. This survey yielded the latitude and longitude of the beach end points, the beach lengths, and the latitude and longitude of each of the 144 sampling sites at these beaches. The geographic data from this survey have been rendered through geographic information system (GIS) software to create one colored and scaled map for each of the regulated coastal bathing areas. These maps, along with notification and monitoring data, are

contained in an integrated custom relational database reserved for office use. Notification and monitoring data can be displayed on beach maps to quickly visualize seasonal data sets for selected beaches.

This custom database not only tracks notification and monitoring data but also is used to produce a yearly Beach Summary report and the annual Beach Survey that is completed by CTDEP and the local health departments. Sample results produced by CTDPH state laboratory for these beaches are reported seasonally to CTDPH where they are entered into and managed by custom relational database software. Monitoring and notification data collected with the annual Beach Survey is stored in the database and forwarded to EPA as part of a BEACH Act grant requirement.

Laboratory services

The CTDPH state laboratory is an active partner with CTDEP and the local health departments that elect to use the laboratory service for beach monitoring. During a typical bathing season, the state laboratory routinely processes more than 1,000 water samples collected at selected regulated coastal bathing areas. Samples that test positive for elevated levels of enterococcus trigger a telephone call directly to the submitting local health department or CTDEP as soon as the test results are learned. Beach monitoring test results are mailed to the local health departments and to CTDEP.

Training

CTDPH administers the BEACH Act grant in Connecticut and provides two meetings annually at the beginning and end of the bathing season for local health departments, CTDEP, and other interested parties. These workshops review the current status of the BEACH Act grant, laboratory methods used to test for the indicator organism enterococcus, sample collection and handling protocol, the courier service provided by CTDPH to collect coastal water samples along the shoreline, and notification and monitoring data collection during and after the bathing season.

Press event

EPA and CTDPH have participated in several press events announcing the award of the BEACH Act grant. In 2004, the city of New London participated

in the Connecticut BEACH Act grant announcement at Ocean Beach. Following the announcement and speaker comments, EPA demonstrated water collection sampling and testing techniques in front of several camera crews and a live audience of swimmers.

Delaware

Delaware's swimming beaches have been sampled since 1979. As part of an ongoing commitment to provide assurances for the state's residents and visitors regarding swimming water quality, Delaware implemented a revised, formalized Recreational Water Program in 1989. It is one of the most comprehensive programs of its kind in the United States.

Approximately 50 miles of coastline, from Slaughter Beach to the state line at Ocean City, Maryland, are sampled for enterococcus bacteria levels, monitored for rainfall, and observed for other factors known to impact water quality, including spills and potentially toxic phytoplankton blooms. Delaware has a total of 25 miles of Atlantic Ocean coast, 50 miles of Delaware Bay Coast, and 115 miles of coastal bay (Inland Bays) shoreline, including Rehoboth Bay, Indian River Bay, and Little Assawoman Bay.

The Delaware Department of Natural Resources and Environmental Control developed the *State of Delaware Guidelines for Monitoring and Assessing the Human Health Risk of Swimming Activities in Fresh and Marine Recreational Waters*. These guidelines were set forth to protect people from incurring an unacceptable health risk due to swimming (primary-contact recreation) in the natural waters of Delaware. These health risks may include, but are not limited to, infections of the ears, nose, eyes, of throat, or gastrointestinal distress.

The principles in the guidelines were developed using health effects relationships determined by the EPA through 10 years of study in the United States and other countries. The guidelines contain a list of definitions, details on the statutory authority, specifications and a discussion on health risks, monitoring parameters, water quality standards, laboratory analytical methodology, and a description of their tiered monitoring plan, site selection criteria, and their public notification policy.

Swimming advisories are issued to recreational water area administrators and are managed collaboratively with the Delaware Department of Natural Resources and Environmental Control. Continuous notification to the public regarding the advisory status of swimming areas is maintained via a toll-free number (1-800-922-WAVE). Information is also available through the Web site www.dnrec.state.de.us.

Florida

In 1998, five of Florida's coastal counties began monitoring for enterococci bacteria under a grant-funded pilot program. By the beginning of 2000, 11 Florida counties were participating in the program, which continued through July 2000.

In August 2000, the beach water sampling program was extended to 34 of Florida's coastal counties through state legislation (Senate Bill 1412 and House Bill 2145) and funding. This funding allowed for biweekly sampling at just over 300 sites throughout the state. In addition, testing under the new program included fecal coliform as well as enterococci. The choice to use these two indicator bacteria was made on the basis of adopted water quality standards of the Florida Department of Environmental Protection for fecal coliform, and recommended standards of EPA for enterococcus. The state delegated authority to county health departments to conduct the sampling and issue health advisories for areas that exceed these standards. The public is notified through an online Web site, local media, and signs posted at the access points to the swimming areas.

In August 2002, the beach water sampling program began collecting water samples weekly with additional funding from EPA. With the increased sampling frequency, the use of enterococcus geometric means became possible. Since then, advisories have been issued if bacteria levels exceed either the single sample standards for enterococcus or fecal coliforms or the geometric mean standard for enterococcus.

The Florida Healthy Beaches Web site (<http://esetappsdoeh/irm00beachwater/default.aspx>) continues to be a valuable asset in notifying the public. The ability for the public to access the information on all beaches in their area allows them to make informed

decisions without tying up county or state staff. Sample locations and risk classifications for beaches in the program are being reviewed to ensure they remain in step with development along the coast of Florida.

Georgia

The Coastal Resources Division (CRD) of the Georgia Department of Natural Resources uses the Web to meet both the monitoring and notification portions of the BEACH Act grant. Beach water quality monitoring data are easily accessible and transferable in the Web-based Coastal Water Quality Database. For public notification, Georgia has partnered with Earth911 to allow easy access to current beach status information.

Water quality database

CDR collects water quality data in the rivers, estuaries, and ocean waters, including beach sites, along the Georgia coast. These data had been stored in a single Water Quality Database housed within CRD. Upon implementation of the beach data reporting requirements, CRD found that the existing database was insufficient for storing and reporting the beach data required by EPA. CRD applied for, and received, an EPA National Environmental Information Exchange Network (NEIEN) grant to develop a method of transmitting the beach data into EPA WebSIM via the Georgia network node. CRD then contracted with Acclaim Systems to develop an Oracle database with a Web-based interface and data transport capabilities.

Prior to the development of the Oracle database, laboratory data were reported to CRD electronically in an Excel spreadsheet. CRD staff would then copy and paste the data into an Access database (a time-consuming and error-prone method). With the new Beach Water Quality Database, the laboratory staff log in to the database using a Web browser, such as Internet Explorer, to access a data input form. Data in this form are held separately in the database until checked for quality assurance and quality control (QA/QC) by CRD. After approval, the data are stored in the main Oracle database, where they can be queried or exported into an XML format for transmission to EPA WebSIM. For bacterial data, the laboratory enters the bacteria count from each single sample.

The Oracle application automatically calculates the rolling 30-day geometric mean. The application highlights the data fields in red when the single sample value or the geometric mean value exceeds the EPA recommended levels. When the EPA-recommended level has been exceeded, the application generates and sends an e-mail to the laboratory manager and to the CRD manager. A “what if” calculator that automatically displays the hypothetical value of the next sample needed to reach the EPA geometric mean threshold is programmed into the geometric mean application. This is useful to beach managers for projecting what might happen with a beach in the near future. If the numbers show that a relatively low single sample value will push the geometric mean above the threshold, the beach manager can do a little advance planning and perhaps conduct a preventive sanitary survey. If a beach is already under a geometric mean-based advisory, the manager can project how much longer the beach might remain under advisory and perhaps increase public notification outreach efforts.

Beach notification

To ensure the widest outreach of public notification, CRD partners with Earth911 to reach the Web-using public. As soon as laboratory results are received, CRD staff log in to an Earth911 Web interface to update the status on each Georgia beach. Changes in status are instantly reflected on the public Earth911 Web site. After clicking the “Beach Water Quality” category, users see a map of the United States. Clicking the “Georgia” portion of the United States map zooms in to Georgia. Users can then select their beach area of interest to see information about it, and the date and time of the last update.

An added benefit to Earth911 users is that they can subscribe to receive e-mail notifications regarding their beach of interest. When the status of that beach is revised, a notification is triggered.

Public outreach

The Georgia Department of Natural Resources (GDNR) and the Georgia Division of Public Health (GDPH) are working together to implement a public outreach component of the Beach Monitoring Notification program. To give cohesion to the message

coming from both agencies, they created an easily identifiable graphic. Because Georgia is known as the “Peach State,” the “Peach on the Beach” was created. This character is used in flyers, ads, and promotional items. The “Peach on the Beach” literature is designed to direct people to the GDNR Web site for additional information. Once there, users can easily find a link to the Earth911 Web site.

FAQ flyer

GDPH and GDNR developed a flyer with frequently asked questions. The flyer, featuring the “Peach on the Beach” character, is distributed to the public by the local Health Department. The flyer also contains contact information directing the public to the GDNR Web site and to the local health department telephone information line.

In addition, permanent metal folding signs were installed at beach access points. The signs are the primary way for visitors to the beach to stay informed of the current beach status. However, GDPH and GDNR wanted to make the information available in various formats, especially for people who want to see the beach status before their beach trip.

Newspaper ads and hotel information sheets

When GDNR began testing for enterococcus bacteria in early 2004, one local beach community began to have short-term advisories occur at one or more of their beaches seemingly on a weekly basis. When GDPH issued a press release issuing a beach swimming advisory, within days another press release was issued lifting the advisory. Eventually, GDNR and GDPH began running a weekly ad in the local newspaper. The ad, entitled “Your Weekly Beach Report,” featured the “Peach on the Beach” and listed which beaches in that county were currently under advisory. The ad also pointed readers to the GDNR Web site for the most current beach advisory information. The newspaper ad ran weekly throughout the swimming season.

In addition to the newspaper ad, the local health department worked with the local visitors bureau to create a customized information sheet for hotels to display or distribute to their guests. The date-stamped

flyer is faxed weekly to a distribution list maintained and updated by the visitor’s bureau.

Promotional items

GDNR holds an annual coastal environment festival, Coastfest, every year in October. The one-day event is very popular, drawing more than 7,000 visitors last year. GDPH set up a booth at Coastfest with information about the Beach Water Quality Monitoring and Notification Program. At the booth, beach buckets imprinted with the “Peach on the Beach” and Web directions were given to the children. Coloring sheets were handed out as well. Pencils imprinted with the Web address were given out to adults. The promotional items remind people to check the Web site before going to the beach.

Guam

Tourists, fishermen, and the public use the beaches of Guam heavily every day. Increased development over the years continues to threaten beach water quality. Improper or failing sewage delivery systems, septic tanks, urban runoff, non-permitted upland clearing, and reverse osmosis discharges are the largest contributors to surface water pollution.

Monitoring

The microbiological and chemical parameters that the Guam EPA currently monitors include: pH, total suspended solids, total dissolved solids, temperature, turbidity, nitrite-nitrogen, nitrate-nitrogen, dissolved oxygen, salinity, total phosphorous, ortho-phosphorous, and enterococci bacteria. Guam EPA conducts weekly monitoring at 38 fixed stations along its most frequently used coastal beaches (Tier 1 beaches) for enterococci bacteria.

Beaches classified as Tier 1 are beaches that are highly frequented have a high number of possible pollution sources, are easily accessible, and require frequent monitoring. Tier 2 beaches are less frequented with restricted accessibility, have few pollution sources, and require less frequent monitoring. Tier 3 beaches are classified as very infrequently visited, remote, or very inaccessible, and are not monitored routinely. Of the 73 beaches, 39 were further classified as Tier 1 beaches and the remaining 34 were classified as Tier 3.

Public notification and outreach

When samples exceed the single sample or geometric mean enterococci bacteria (cfu/100mL) an advisory is released to notify the public that the beach is closed or warn against swimming. These bacteria criteria were updated in FY 2004 in the water quality regulations. Guam uses the local media (newspapers and TV) and their Web site (<http://www.guamepa.govguam.net/programs/emas/beach.html#REPORT>) to provide real time results to the public. The Web site posts the weekly results and historical summaries to communicate potential risks to the public. Further, all reports are accompanied with a press release making them available to the public.

Hawaii

Hawaii's BEACH Act grant, which is managed by the Hawaii Department of Health (HDOH), assists the state in its efforts to monitor a portion of more than 400 beaches, scattered along 297 miles of its coastline, and notify the public when monitoring reveals exceedances of water quality criteria for bacteria. HDOH already had established and maintained a monitoring program for their coastal waters prior to initiation of the BEACH grant program. HDOH's further development of the established beach monitoring program, in response to requirements of EPA's BEACH Act grant, began with identification of all beaches scattered throughout the four major islands of Hawaii (Oahu, Maui, Hawaii, and Kauai). These beaches were identified by name and associated with longitude and latitude coordinates. HDOH then developed and implemented a risk-based evaluation and classification plan for their list of coastal marine waters and prioritized their monitoring schedule using this information.

HDOH categorized the list of beaches into tiers on the basis of potential risk of illness to swimmers and frequency of use. Monitoring frequency is done according to tier level. Tier 1 beaches are composed of coastal recreational waters with a high frequency of primary contact recreation use, including waters with a potential for contamination by pollution. Presently, 50 Tier 1 beaches are monitored twice a week throughout the year. Tier 2 beaches are used less frequently and, therefore, are monitored once a week on a rotating schedule for six months at a time. Thirty-four Tier

2 beaches are being monitored once a week for a six-month period. Tier 3 beaches are designated by very low visitation and are monitored as needed. HDOH compiled data about beach locations and sources of potential contamination into a GIS map, which identifies beaches by name, latitude and longitude coordinates, and indicates the locations and types of potential sources of microbial contamination.

All beaches are resampled when water quality standards for bacteria are exceeded. In 2003, HDOH refined its decision rule for resampling and posting advisories on beaches where adjacent coastal waters exceeded water quality criteria for bacteria. By 2004, Hawaii's practice of posting advisories was well established and extended to add advisories for possible contamination from storm water after rain events. In addition to posting advisories at beaches, HDOH also alerts the public of high bacterial indicator counts or sewage spills through announcements on radio stations and in newspapers. HDOH is in the final stages of developing its own Web site for reporting data to the public. They have established a practice of sharing monitoring data with a local chapter of the Surfrider Foundation, an environmental organization. Surfrider displays HDOH's monitoring data on its own Web site. HDOH also sends monitoring data to EPA quarterly and reports a summary of notifications to EPA annually.

HDOH keeps the public informed of the beach program by attending meetings of community environmental organizations, hosting public presentations of grant awards, and encouraging comments about the monitoring and notification program from the public, local agencies, recreational clubs, and environmental organizations.

Illinois

Monitoring

Illinois' Lake Michigan beaches are monitored five to seven times a week during the swimming season. They are among the most frequently monitored beaches in the country. To augment beach water quality monitoring conducted at coastal beaches, the Illinois Department of Public Health (IDPH) continues to validate and implement working models to predict *E. coli* levels in Lake Michigan because health warnings are generally issued

on the basis of *E. coli* concentrations from samples taken the previous day. Predictive models created using continuously measured hydro-meteorological variables provide a good alternative to monitoring because they can predict, with a good degree of accuracy, when bacteria levels will be high. For example, in the summer of 2004, predictive modeling equipment was installed by the Lake County Health Department to predict *E. coli* levels at two Lake Michigan beaches: Illinois Beach State Park–South Beach in Zion, Illinois, and Forest Park Beach in Lake Forest, Illinois. The models, which measure a number of variables, such as wind speed and direction, sunlight, rainfall, air and water temperature, humidity, wave height, dissolved solids, clarity, and acidity, accurately predicted whether *E. coli* concentrations were above or below the 235 cfu/100 mL threshold for full body contact 85 percent and 86 percent of the time, respectively, during the 2004 swimming season.

Public notification and outreach

All of the Lake Michigan beaches in Illinois use standard postings at the beach indicating that swimming is prohibited when *E. coli* levels are above 235 cfu/100 mL. IDPH continues to develop and distribute educational resources to the public on the potential risks associated with swimming in contaminated water. “Don’t Feed the Waterfowl” signs have been posted at Lake Michigan beaches to discourage visitors from feeding birds, which has the potential to contribute significant fecal loads to beach water, leading to beach closings. To obtain beach closure information, the public can visit IDPH’s bathing beaches Web site at www.idph.state.il.us/envhealth/beachhome.htm or the Chicago Park District’s Swim Report at www.chicagoparkdistrict.com/index.cfm/fuseaction/swim_report.home.cfm. Information on keeping the beaches clean is available at www.lakemichigan.org. The Lake County Health Department, Wilmette Park District, Winnetka beaches, and the City of Evanston post their beach closure information at the EARTH911 beach notification Web site at www.earth911.org/WaterQuality/default.asp?cluster=17.

Indiana

Under the BEACH Act, Indiana has used grant dollars to develop the Lake Michigan Beaches Program.

Indiana’s 45 miles of Lake Michigan shoreline is on the northern edge of Lake, Porter, and LaPorte counties. Funding has helped to increase the frequency of *E. coli* monitoring at Indiana’s Lake Michigan beaches.

Before the development of the Lake Michigan Beaches Program, Indiana’s coastal beaches were monitored one or two days a week. The funding has allowed partner communities to increase the frequency of sampling and analysis of water samples for *E. coli* to five to seven days a week. IDEM has also used a portion of the resources to keep the public informed. Beach managers, the park department, or both now notify the public by posting beach advisory and beach water closure signs. In the spring of 2005, IDEM will have fixed signage or kiosks installed at several coastal beaches for the 2005 beach season. The kiosks will provide beachgoers with current information about the status of beach waters and additional information about the possible sources and causes of *E. coli* contamination. Recommendations will also be provided as to how beachgoers and watercraft owners and operators can reduce the likelihood of causing an *E. coli* release.

In 2002, IDEM began developing the Beach Monitoring and Notification Plan (BMNP) as required by EPA for Indiana’s portion of the Lake Michigan shoreline. This work was completed in 2003, and the plan has met the performance criteria established by the BEACH Act.

The summer of 2004 was the first beach season in which IDEM was able to provide funds to coastal communities to increase the frequency of monitoring. The funding provided multiple resources to local communities, which were able to upgrade equipment, purchase supplies, and pay for additional summer staff to collect and analyze samples.

As part of Indiana’s efforts to fulfill the requirement of the BEACH Act performance criteria, four pilot projects were funded and implemented during the 2004 beach season:

1. Indiana University: Developing a prototypical model of *E. coli*-induced closings at Indiana’s Lake Michigan beaches in close proximity to the outfall of Dunes Creek into Lake Michigan

2. Gary Sanitary District: Characterizing the *E. coli* distribution of beaches down-current from Burns Ditch, which flows into Lake Michigan
3. LaPorte County Health Department: Working with state and local stakeholders to enhance public notification of Lake Michigan beach closings in LaPorte County
4. Indiana University: Assessing and evaluating communication about Lake Michigan beach closings and health information provided to Lake and Porter County stakeholders

In addition, IDEM has funded 3 pilot projects for the 2005 beach season:

1. Environment, Law, and Economics Institute (ELEI): Protecting the health of our coastal communities through education by developing and distributing an educational brochure on “beach health”
2. Gary Sanitary District: Developing a ‘SwimCast’ predictive model system for Buffington Harbor Beach in the City of Gary, Indiana
3. Gary Sanitary District: Validating and operationally testing predictive model for *E. coli* concentrations on swimming beaches of Ogden Dunes, Wells Street, Marquette, and Lake Street

Time-relevant water quality data for Indiana’s beaches are posted on the Earth911 Web site. The site also includes pollution information, project information, and links to other water quality sites. During 2004, a partnership between IDEM and Earth911 facilitated the development of the submittal, reporting, and notification system for Indiana’s Lake Michigan Beaches Program. The information posted on the Earth911 Web site allows partner communities, beachgoers, and other interested parties to access the current status of the beaches that have been monitored for *E. coli*.

Louisiana

(Note: This information was updated after Hurricanes Katrina and Rita hit the Gulf Coast in 2005)

Risk-based beach classification system

Since initial Beach Act grants were awarded in 2001, the Louisiana Beach Monitoring Program has been developed and successfully implemented under the guidance of the Center for Environmental Health Services within the Office of Public Health (OPH). Before the implementation of the Louisiana Beach Monitoring Program, OPH and its contractor completed a systematic process to identify and rank Louisiana’s beaches according to risk. The analysis process consisted of four major steps:

1. Identifying and defining coastal recreation waters
2. Identifying beaches or similar points of access used by the public for swimming, bathing, surfing, or similar water contact activities
3. Reviewing available information on levels of potential fecal contamination at beaches and their intensity of use
4. Ranking beaches to decide which beaches would be included in Louisiana’s BEACH program

The results of this evaluation are presented in *Louisiana’s BEACH Act grant Report, Grant Year 2001* and are available online at www.ophbeachmonitoring.com. They reflect a model approach for identifying and prioritizing beaches in a state for monitoring under the BEACH program.

OPH initiated the process by defining coastal recreation waters within the state. Waterbodies designated as “estuarine” or designated for oyster propagation in the state’s surface water quality standards and water quality assessments, waters adjacent to estuarine waters containing at least one sample station with a mean salinity of 3 parts per trillion (ppt), and waters lying between an isolated estuarine waterbody and the estuarine water’s connection to the Gulf of Mexico were identified as coastal recreation waters.

Next, coastal recreation waters were examined to determine whether beaches or similar points of access used by the public for swimming, bathing, surfing, or similar water contact activities were present. Parish sheriff’s offices were contacted to identify the areas

meeting OPH's definition of a beach in each parish where coastal recreation waters occur. Using the resulting list of beaches, OPH delineated each beach on digital aerial photography in a GIS and began the process of evaluating exposure risk at each beach using two factors: the relative densities of pathogen indicators in beach waters and the number of people using each beach.

OPH used fecal coliform data collected under the state's Molluscan Shellfish Program to identify areas where the state's fecal coliform criteria were being exceeded. They also evaluated general information gleaned from the state's existing fish consumption and swimming advisories, water quality inventory, and impaired waters list. To obtain estimates of beach use, OPH surveyed local parish officials. The officials provided estimates of the number of beach visitors on a typical weekday, weekend, and holiday during the peak swimming season, along with the percentage of beach users entering the water. Estimates were then generalized into broad categories for relative comparison.

Using fecal coliform levels and levels of beach use, a qualitative ranking scheme was devised and used to assign each beach to a monitoring tier. Because water quality was good for the majority of beaches considered, the level of beach use was the primary criterion used to assign beaches to monitoring tiers. Beaches classified as having very high, high, or moderate to high use were assigned to Tier 1 and received the most monitoring attention. Beaches classified as having moderate use were assigned to Tier 2. Beaches with low or very low use and a water quality ranking based on fecal coliform data that were not collected in close proximity to the beach were assigned to Tier 3 and targeted for additional bacterial indicator monitoring to better characterize risk. Beaches on private land or with existing swimming advisories posted by the state and with very low public use were excluded from further consideration.

Prior to the landfall of Hurricanes Katrina and Rita in 2005, OPH was implementing its beach monitoring program at high-priority beaches consistent with its beach classification scheme. OPH had developed a high-quality public notification program that

efficiently used beach signs, the department's Web site, press releases, and direct contact of partner agencies and local officials to communicate to the public when beach advisories were warranted by the monitoring data collected at these beaches. Due to extensive damage to the state's beaches and associated infrastructure by Hurricanes Katrina and Rita, LDHH expects to reevaluate the state's existing list of beaches to determine whether adjustments to the list and associated monitoring schedule are necessary.

Maine Background

Although beach monitoring was not a priority in Maine in the past, there is growing interest in monitoring ocean beaches to protect public health. Although relatively few people swim in the cold water in the eastern part of the state, the sandy beach areas in the mid-coast and southern regions experience a high volume of visitors and intense recreational usage during the 3-month beach season.

With EPA funding through the BEACH Act grants, Maine's Healthy Coastal Beaches Program was established in 2002 as part of the larger statewide Healthy Beaches Program. Prior to then, the state monitored a few state parks monthly and the Maine Department of Environmental Protection (DEP) focused on ensuring that licensed discharges did not threaten swimmers' health. Monitoring and public notification for public beaches was (and still is) primarily under the jurisdiction of the municipalities, and private beaches are responsible for monitoring their own beaches (although most do not). With three towns recruited in 2004, 37 beaches in 18 towns are currently monitored weekly, Memorial Day through Labor Day, as part of the Program.

The Program is a community-based, voluntary program with no current legislation and none proposed. Although this approach has its challenges, the communities have accepted it, and they are supportive of the assessment and remediation of pollution sources that impair water quality at coastal beaches. The Program is advised by an Advisory Committee composed of representatives from the University of Maine Cooperative Extension and Sea Grant; Maine

Coastal Program/Maine State Planning Office; Maine Departments of Environmental Protection, Marine Resources, Human Services, and Conservation and Bureau of Health; Casco Bay Estuary Project; Wells National Estuarine Research Reserve; Mount Desert Island Water Quality Coalition; Northern New England Chapter of the Surfrider Foundation, local municipalities, and water districts. The Advisory Committee has developed and implemented a pilot program including:

1. Surveys of towns and beach users
2. Outreach and education to community groups, municipal officials, data managers and citizens
3. Development and implementation of standards and protocols for swimming beach monitoring
4. Notification of the public of water quality conditions at public beaches

Assessment

The program created and updated a risk assessment matrix to classify beaches into tiers as required by the BEACH Act. Using results of the assessment and monitoring, recent additional investigations and sanitary surveys have been conducted to identify sources of pathogens at Lincolnville Beach and the neighboring Frohock Brook; Goosefare Brook in Saco, where a study of coastal currents was conducted; and Goose Rocks Beach in Kennebunkport.

Training and public notification

In 2004, program staff trained all town and state park beach personnel, and personnel from three regional labs. Microbac Laboratories provided analysis to 12 towns and state parks, including the scheduling and transportation for the samples. The lab worked closely with several towns when water quality exceedances occurred. The program received a fair amount of media attention this past year, including television, newspapers, radio, and newsletters. Advisory signs were placed at all participating beaches in 2004.

Database management and Web site

The program has been working steadily on improving the online database. It functioned very well in 2004 as an in-house tool; the latest functions include automatic

e-mail alert to managers when a water quality value is in exceedance, geometric mean, and simple graphing capability. The public interface to the data portion of the program's Web site (developed by the program's database consultant, Relyon Media) is at <http://www.maineoastdata.org/public/> and went live in March 2005.

GIS maps have been developed for all beaches and have been verified for accuracy. Beach monitoring and notification data for 2003 and 2004 were submitted to EPA in 2005.

In addition to protecting public health, beach monitoring data collected by the program have been used by scientists investigating harbor seal mortality, by a student preparing a master's thesis, and by journalists for articles for the local press.

Education, outreach, and public involvement

The program developed a 2-year marketing plan, using professional marketing expertise to develop educational and outreach materials such as print materials (brochure, posters, community resource guide, and advisory signs), a Web site (www.mainehealthybeaches.org), radio commercials and public service announcements, and television weather sponsorship. The state conducted a direct user survey to determine the extent of the outreach for the Maine Healthy Beach campaign. The goal of this effort was to inform visitors to Maine beaches of the monitoring program, the risks of waterborne illness, and the measures being taken to ensure a safe experience in the form of written and visual materials.

Community examples of partnerships

The Health Coastal Beaches Program has created successful partnerships in Maine. This was evident in 2004 in Mount Desert Island and southern Maine after the Natural Resources Defense Council annual *Testing the Waters Report* singled out the two communities in Maine (out of four nationally) as "Beach Bums." Although the report and ensuing articles may have accelerated the process of recruiting one of the "Bums," much time was spent redirecting the attitudes created by the bad press. In the other "bum" community, the report had the opposite effect, though monitoring has continued. Maine believed that its Healthy Coastal

Beaches Program was still in the developing and recruiting phase and that this was simply a detour for the work that needed to be done in soliciting towns' participation. It was a test of the community-based process, reaffirming the importance of community support in protecting public health.

The community partnerships are exemplified by the Mount Desert Island Water Quality Coalition (MDIWQC), which monitors, with the high school, water quality at Seal Harbor Beach, a popular swimming spot. The MDIWQC confirmed that at times swimmers were at risk at Seal Harbor Beach, given the enterococci counts. In fact, two outbreaks of swimming illness were reported to the MDIWQC during the pilot project. The town of Mount Desert Island has been proactive in posting swimming advisories, has closed the beach on two occasions, set up its own laboratory, and continues to work closely with the MDIWQC to solve the pollution problem at Seal Harbor Beach. In addition, a group of Seal Harbor residents raised funds to conduct a shoreline and watershed survey to track down potential pollution sources, which will be conducted in 2005. The combined data of the town and the MDIWQC have helped to develop a more complete picture of when and where pollution events are occurring. Healthy Coastal Beaches Program staff has provided the training and resources necessary to implement the monitoring, data entry, and notification for Mount Desert Island beaches.

Maryland

The Maryland Department of the Environment (MDE) adopted revised beach regulations for all of Maryland's beaches. Key points include:

- Adoption of *E. coli* and enterococci as the only bacteriological indicators for beach monitoring and public notification purposes
- Tiered monitoring design, prioritizing beaches based on risk
- All beaches, permitted or not, receive the same protection (in the past, only permitted beaches required monitoring)

- New amendments reflecting EPA's comments and concerns to the beach regulations (adopted by Maryland in July 2004) are in the final promulgation stages

Sixteen of the 23 counties in Maryland have recognized beaches and monitoring programs. Seven counties claim to have no beaches. Each year, memorandums of understanding (MOUs) with Maryland Department of Health and Mental Hygiene (DHMH) have provided the Laboratories Administration with the personnel, equipment, and materials to evaluate the increase in samples.

Working closely with St. Mary's County, and providing grant money to them, has helped a poorly managed beach program that was nearly defunct to become the most improved county program in Maryland. Increased monitoring has exposed potential fecal contamination sources. The county has developed its own Web site to convey each beach's status. Thorough sanitary surveys and increased monitoring have resulted in a better-protected public.

MOUs with several other counties have provided a much needed benefit to the beach monitoring and public notification efforts of those counties. Along with St. Mary's County, Kent, Cecil, and Anne Arundel Counties have used grant money to upgrade their programs. Many projects revolve around source identification. Anne Arundel County is working on developing a predictive model. (See below for Sandy Point project description).

The number of samples taken by the counties has more than tripled in the past two years due to the following factors:

- Replicate sampling is required for quality assurance purposes
- The number of beaches monitored has increased by more than 50 percent
- The frequency of monitoring has increased from most beaches being monitored monthly to the higher priority beaches now being monitored weekly or biweekly

Data submission to EPA and the methods for data transfer are still evolving. MDE and sister agencies in other states are working closely with EPA in data sharing. MDE was one of the first states to transmit the 2003 beach monitoring data. This was mainly due to MDE's use of STORET, which greatly simplified the process. As more efficient means of data sharing have become possible, EPA's STORET group has provided the technical assistance to the Beach Program. Beach advisory data (a.k.a. "Notification Data") sharing has been more challenging due to the requirement to use EPA's Central Data Exchange (CDX) node. In the near future, MDE hopes to use its node to transfer all of the required data to EPA.

"Digital Health Department"

MDE chose to acquire a Web-based product that can manage all aspects of the beach program. MDE contracted with Garrison Enterprises, Inc. to develop a customized version of the Digital Health Department application for Maryland's Beach program. This Web-based product allows them to:

- Record data collected in the field directly into an online database
- Receive results directly from the lab as the lab personnel enter data and test results directly into the online database
- Analyze and track data, including water sample results, illness data, or any search or report of data as needed
- Notify the public and all interested parties automatically via e-mail, phone center, blast fax, and Web site
- Export data to EPA in compliance with BEACH Act grant performance criteria

Field samplers will use laptop or tablet PC instead of a paper form when collecting samples. Scheduling of field sampling and preparing labels for bottles will be done online using the application. In the field, all the information and data that the sampler wishes to collect (time, station, salinity, temp, etc.) will be entered directly into the device, real time via a wireless Web connection. The labs will enter the bacterial indicator sample result directly into the database. Transcription

errors will be eliminated or minimized, creating higher quality data. Results will be available to the local health department immediately, without having to fax, mail, or phone, allowing more timely public notifications if necessary. All the local health departments who monitor beaches will have access to this data via the Web. They will be able to download data, run queries and reports, among other things. This application also comes with a state beach Web site and a variety of methods for notifying the public of water quality results and exceedences (fax, e-mail, phone, Web page). MDE planned to fully implement the system prior to the 2005 beach season.

North Beach—Calvert County, Maryland

North Beach is a high use beach on the Chesapeake Bay in northern Calvert County Maryland. The Town of North Beach invested millions of dollars in creating a boardwalk, building a fishing pier, and attracting businesses and vendors. The boardwalk and pier is a centerpiece in the town's plan to attract more visitors and help the town's economy by increasing tourism dollars. Overlooked in the town's planning were the possible effects of a stormwater outfall, which is in the center of the swimming area. The town assumed that any runoff would be rainfall alone and impacts would be minimal.

With Beach Act grant money, MDE implemented a tiered sampling design, and required more frequent monitoring by the local health departments of the state's higher use beaches. During the summer of 2003, the increased monitoring at North Beach revealed poor water quality results during the bathing season, resulting, ultimately, in beach advisories. A thorough sanitary review of the area and discussions between MDE, the Calvert County Health Department, and the North Beach town engineer revealed the likely source of high fecal counts to be the storm water outfall. The town engineer provided blueprints that showed that the stormwater system shared a common conduit with the aging, terra cotta sanitary sewer system. During periods of drought, a minimal flow still was evident from the stormwater outfall.

A sampling plan was developed to identify the area(s) of the sewer system that may be damaged and to

follow up with camera inspections of the pipes. One week later, Hurricane Isabel disrupted those plans, damaging much of the boardwalk, pier, and the stormwater outfall. However, one very positive result of the storm occurred. The town, when rebuilding the pier and boardwalk area, decided to extend the stormwater outfall past the end of the pier and outside of the bathing area. The 2004 beach season sampling, during a similarly rainy summer as 2003, revealed significantly better water quality in the beach area with no advisories or closings required. The town still plans to investigate and repair, if necessary, the suspect sewer system. Without the BEACH Act and Beach Act grant funding, the more proactive monitoring and public notification effort by the State may not have occurred, thus, perhaps not revealing a potential public health risk to the bathers at North Beach.

Sandy Point State Park Project

A major problem in determining whether a swim area is safe for human contact is the lag time between water sampling and receipt of water quality monitoring results. Under current practices, decisions concerning swim advisories and beach closings are made using results that are between one and four days old, depending on communication with the labs. Consequently, bathers may be exposed to fecal-contaminated water and may be at increased risk of contracting gastroenteritis and other swimming related illnesses.

The Anne Arundel County Department of Health, in partnership with the Maryland Department of Natural Resources and MDE, are using Beach Grant funds to assess water quality conditions at Sandy Point State Park and to more appropriately determine beach advisories using real time water quality data. Daily fecal indicator sampling, along with real time measurements of wind speed, wind direction, rainfall, temperature, solar radiation, as well as nutrient and other water quality parameters are being collected during this project. Two shallow-water monitoring sites and a weather station are strategically placed at public swim areas within Sandy Point State Park. Over 1 million visitors bathe, recreate or attend special event activities each year at Sandy Point State Park. At the completion of the project, decisions concerning beach advisories and management of swim and recreational

areas will be enhanced so that a bather's exposure to fecal contaminated water and risk of contracting gastroenteritis and other swimming related illnesses is reduced.

Real time and near real time data from Sandy Point can be seen at the following Web site: http://mddnr.chesapeakebay.net/newmontech/contmonetb_results_graphs.cfm?station=SandyPointSouth.

A proposal to develop a regression or predictive model under a future grant application will be made to closely correlate physical, nutrient, and meteorological data with bacterial concentrations in bathing and recreational waters. The outcome of this project will help to further MDE's efforts in better protection of the public who bathe in natural areas by giving more timely notifications of possible increased risk due to fecal contamination impacts.

Ongoing and near-future efforts

- Statewide public outreach and information campaign to better educate the public regarding beaches, water quality, risk, etc. Beach Web site, brochures are planned. This may include enhancing our notification methods with Earth911.org cooperation—Spring and Summer 2005.
- Continue to select and fund local programs and projects.
- Develop predictive model for Sandy Point State Park.
- Continue urging counties to perform post rain-event sampling to allow for more protective preemptive advisories where appropriate.
- Continue to upgrade and improve data management techniques, quality, sharing, etc. between state and county agencies and EPA.
- Explore the use of NOAA radar rainfall data for predicting water quality and for developing preemptive advisory protocols.

Massachusetts

Public notification and outreach

In 2001, the Massachusetts Department of Public Health (MDPH) initiated the development of a system that would enable the public to see which beaches were open or closed on specific day or week, to see the reason behind any closure, and to keep track of a beach's water quality history. A working electronic, Web-based system for public notification of marine beach postings and water quality monitoring data went online in 2003. It was developed by MDPH in conjunction with Garrison Enterprises. The Web site was developed with funding support from the EPA BEACH Act grant and can be reached from the home page of the MDPH Web site (www.mass.gov/dph) or directly at www.mass.gov/dph/beha/tox/reports/beach/beaches.htm.

The Web site supports reporting routine water quality monitoring data through a series of password-protected data entry pages. The Web-based system allows MDPH contract laboratories to enter sampling test results directly to the site. These laboratories are required under contract to enter field sampling data and laboratory results into the MDPH public notification Web site as results become available. Data entered on the site provide as near real time public notification as possible, after which the Web site automatically generates postings for those samples that exceed single-sample or geometric mean regulatory limits. Display of postings on the public pages occurs twice a day, at 9:30 AM and 12:30 PM. Additional enhancements allow for local health officials to view postings shortly before public notification to give them an opportunity to post advisories at beaches and prepare for public inquiries.

Beach mapping

A detailed GIS layer for Massachusetts's marine bathing beaches was developed by MDPH with assistance from Applied Geographics, Inc. (AGI), and with considerable information from local health officials. AGI prepared detailed color aerial photomaps for all 60 coastal communities with marine bathing beach polygons highlighted. AGI also calculated the miles of sandy coastline (approximately 727 miles) in Massachusetts. State health officials worked with local health officials to identify the locations and specific

boundaries of each known beach, the designation of each beach—public or semi-public (and private, if known), the location or locations where the water samples are taken for routine monitoring, the location at each beach where posting (i.e., posting/closure due to bathing water quality violation) would occur if it is necessary, and the locations of normal access points and parking lots. MDPH staff validated all information by site visits to all marine beaches. The completed Massachusetts marine bathing beach GIS point layers were added to the state Web site (www.mass.gov/mgis/). These layers represent the linear extent of each beach and points marking their boundaries and access, sampling, and other locations. The beach layers display information for 510 marine bathing beaches, including 419 public beaches and 91 semi-public beaches, as well as the estimated mileage of public (153.1 miles), semi-public (50.7 miles), and private beaches (522.4 miles) in Massachusetts.

Monitoring

MDPH has been successful at monitoring every marine and semi-public beach in Massachusetts weekly during the past three beach seasons. This includes 578 sampling locations at more than 500 beaches. The bathing beach season in Massachusetts usually runs from as early as Memorial Day, in some areas, through Labor Day.

The Public Health-Based Beach Evaluation, Classification, and Tiered Monitoring Plan has been developed to ultimately direct water quality monitoring resources to the beaches that pose the greatest health concern. The plan is intended to facilitate the identification and cleanup of pollution problems, while those beaches with more pristine records can be monitored less often than the required weekly routine monitoring through a variance process pursuant to both the Massachusetts and federal beach acts. In this system, every beach was classified into three "tiers." Tier 1 includes heavily used beaches that have pollution problems. EPA believes that these beaches should be tested at least twice a week. Because of the ongoing pollution concerns and violations, these beaches are generally sampled more than once a week. Tier 2 includes beaches with some pollution. These beaches must be tested once a week. Tier 3 includes

beaches with no known pollution problems. These beaches are required to be tested once every 2 weeks or sometimes less, as determined by MDPH through the variance process.

Training and sanitary surveys

MDPH has held numerous training sessions for local health officials during the life of the BEACH Act grant. Topics discussed have included health concerns related to polluted bathing water, sampling methodology and use of standardized field sampling forms, current federal and state regulations, MDPH's new public notification Web site, and an overview of MDPH's global positioning system (GPS) survey of marine beaches in Massachusetts. MDPH training sessions have also presented information on identifying actual or potential sources of contamination and use of the MDPH standardized sanitary survey form. Additional technical guidance has been provided in subsequent mailings to local health officials.

MDPH developed a sanitary survey form for beaches. The development of this form allows communities to apply for sampling variances according to Massachusetts regulations (105 CMR 445.100) and will help MDPH comply with EPA BEACH Act grant requirements for a tiered monitoring approach to sampling. In addition, MDPH conducted three sanitary survey training sessions for local health officials to further these goals.

Laboratory programs and quality assurance

MDPH used the federal beach funds to provide partial contract laboratory support for routine water quality compliance and monitoring for marine beaches required under federal and Massachusetts regulations to local communities that qualified. These laboratories have analyzed more than 12,000 samples from 48 marine beach communities that took part in the contract laboratory program. The laboratories will be audited in 2005 to ensure compliance with the quality assurance project plan (QAPP) and standard operating procedures.

The QAPP for routine monitoring activities and related beach project implementation was submitted to, and approved, by EPA. The QAPP describes

quality assurance, quality control, and related activities, including enforcement aspects that are in place to ensure that the results of the project meet EPA's published performance criteria. The state finalized a Quality Management Plan (QMP) for all activities under the EPA BEACH Act grant and other activities specific to bathing beach regulations. The QMP is a required document that describes how the program will develop, implement, and determine the effectiveness of its quality assurance and quality control policies and procedures.

Database management

The Data Submission Plan for Routine Monitoring under the BEACH Act grant and other activities specific to bathing beach regulations was developed, submitted to, and approved by EPA. The Plan is a required document that describes Massachusetts' plan for submitting the beach data it collects from coastal municipalities to EPA. Massachusetts submitted all its monitoring and notification data for 2003 and 2004 to EPA in 2004.

Michigan

The Michigan Department of Environmental Quality's (MDEQ) beach monitoring program is summarized below, and more details can be found at www.deq.state.mi.us/documents/deq-wb-beach-2003annualreport.pdf.

MDEQ's beach monitoring program is a part of the surface water quality monitoring program summarized in the January 1997 report titled *A Strategic Environmental Quality Monitoring Program for Michigan's Surface Waters*. The objectives of the beach monitoring component of the Strategy are listed below:

1. Assist local health departments to implement and strengthen beach monitoring programs
2. Determine whether waters of the state are safe for total body contact recreation
3. Create and maintain a statewide database
4. Compile data to determine overall water quality
5. Evaluate the effectiveness of MDEQ programs in attaining water quality standards (WQS) for pathogen indicators

The following examples from the report contain detailed information about the beach monitoring program, as well as water quality data for 2003.

Beach monitoring

The monitoring of beaches in Michigan is voluntary and is conducted by the local health departments. Health departments are required to comply with Michigan's water quality standards according to R 333.12544 of the Public Health Code, 1978 PA 368, which states,

Funding for beach monitoring

Prior to 2000, health departments relied on local funding to conduct beach monitoring programs. Local funding is often not sufficient to execute a comprehensive monitoring program. MDEQ now provides Clean Michigan Initiative-Clean Water Fund (CMI-CWF) and BEACH Act grants to local health departments to aid in the implementation or enhancement of their beach monitoring programs.

MDEQ awards CMI-CWF and BEACH Act grant monies to local units of government and nonprofit entities. Eligible entities include county, city, township, and village agencies; watershed and environmental action councils; universities; regional planning agencies; and incorporated nonprofit organizations. The majority of grants are awarded to local health departments. If a group other than a local health department is awarded a grant, MDEQ requires the group to work closely with the local health department. The CMI-CWF and BEACH Act grants are designed to fund proposals that determine and report levels of *E. coli* in the swimming areas of public beaches. In selecting recipients for grant awards, MDEQ considers the following:

- Location and frequency of beach use
- History of beach monitoring and bacterial contamination
- Ability to communicate results to the public efficiently
- Ability to respond and take appropriate action in the event of beach contamination

In 1998, only 20 counties monitored their beaches. Since MDEQ began providing grants for beach monitoring, the number of counties with a beach monitoring program has risen steadily. Twenty-four counties monitored at least one of their beaches in 2000, 36 counties monitored in 2001, and 38 counties monitored in 2003 and 2004. Although no grant funding was available in 2002, monitoring was conducted in 26 counties.

Minnesota

The Minnesota Pollution Control Agency (MPCA) operates Minnesota's Beach Monitoring Program. The program addresses fecal contamination of Lake Superior's recreational waters by implementing a comprehensive beach monitoring and public notification plan for beaches adjacent to Lake Superior.

Collaboration of beach program with external parties to identify source problems

MPCA is working to identify beach pollution sources so that measures can be taken to reduce beach water pollution. For example, the City of Duluth and the Western Lake Superior Sanitary District (the District) have conducted die testing in the sewer lines and stormwater pump tanks and have been able to eliminate them as potential sources of bacteria at the New Duluth Boat Club site. The District has also been pursuing DNA fingerprinting to try to determine whether the source of the bacteria is animal or human waste.

MPCA is also working toward eliminating sewer overflows. In many areas of Duluth, the sanitary sewers that carry sewage also receive rainwater or groundwater that does not normally require treatment. Much of this "clear" water enters the sewers from roof drains and from footing drains that remove groundwater from around houses. The connection of these sources to the sanitary sewers over the years has led to overloading of the sewers during wet weather. As a result, the sewers sometimes overflow during rainy weather, and untreated sewage flows into Lake Superior. Because of the heavy precipitation in the summer of 2003, there were over 40 overflows from 10 different locations. EPA has been working with MPCA, the City of Duluth, and the District to resolve the problem. Each organization submitted a Plan of Action describing its proposed

actions to eliminate the overflows. Among other things, these plans propose preventing excessive amounts of rainwater and groundwater from entering the sewers, by such means as construction of storage basins to hold some of the water during wet weather until it can be sent to the wastewater treatment plant for proper treatments.

Monitoring

All the beaches along Lake Superior within state jurisdiction are monitored for *E. coli* regularly during the swimming season. If a beach has unsafe levels of bacteria, it is posted with a “Water Contact Not Recommended” sign until the bacteria levels decrease. The Beach Monitoring Program’s goal is to ensure a safe and healthy aquatic recreational environment by informing the public about the risk of contracting waterborne diseases from exposure to contaminated waters. It will work toward this goal during 2005 by:

- Collecting samples from 39 Lake Superior beaches
- Analyzing those samples for waterborne diseases and human health risks
- Working with researchers to try to determine the source of contamination at beaches with continuous advisories
- Actively promoting safe water- and beach-related recreation
- Encouraging the beachgoing public to become more active stewards of the state’s precious water resources

The 2004 monitoring season brought windier and rainier days than 2003’s pilot monitoring season and precipitated more advisories along Minnesota’s North Shore. During 2004, 38 beaches were monitored for *E. coli* and fecal coliform bacteria; 26 advisories were posted at 17 of the sites. Of the 17 beaches with advisories, 5 were repeats from the 2003 monitoring season.

Public notification and outreach

MPCA developed beach advisory and closure signs that show when risk is present to swimmers. The signs contain a “no-swim” icon, information about causes of water contamination, advice on what the public can

do to help reduce beach water pollution, and contact information. MPCA also developed an informational brochure and beach health fact sheets for distribution to the public. It has also partnered with local mass media outlets to communicate beach health risk information to the public through newspapers, radio, and television. MPCA Beach Monitoring Program staff developed a user-friendly Web page that offers specific beach information and has an easy-to-remember URL—MNBeaches.org. The Minnesota program also has a local phone number (218-725-7724) with a beach advisory voice message and access to advisory information via the MPCA 800 number (1-800-657-3864).

Mississippi

(Note: This information was not updated after Hurricanes Katrina and Rita hit the Gulf Coast in 2005)

Monitoring

Mississippi’s Department of Environmental Quality (MDEQ) implemented an intensive beach water quality monitoring and public notification program in 1998 through its inter-agency Beach Monitoring Task Force. From 1998 through 2004 water samples were collected from twenty-one beaches and tested for fecal coliform and enterococci along with several chemical parameters. If bacteria levels reached unsafe levels, advisories were placed on the beach stating that swimming was not recommended until bacterial levels returned to safe levels. The advisories remained in place until the monitoring data indicated that the water was safe for swimming and water contact.

Under the BEACH Act, the Mississippi Beach Monitoring Program was expanded in 2005 to include 22 beaches, and the frequency of sampling was increased for seven beaches. Sixteen of the 22 beaches were classified as Tier 1 Beaches and they are monitored 10 times per month during the recreational season, which is from May through October. The six Tier II beaches are monitored four times per month. All beaches are monitored four times per month during the non-recreational season.

Water samples from the beaches are tested for enterococci bacteria, and if the bacteria levels exceed

EPA recommended levels, a no swimming advisory sign is posted on the beach section. Additional water samples are tested from the site, and the no-swim advisory remains posted at the site until bacteria levels return to safe levels. In addition to signage, MDEQ provides public notification of beach water quality conditions through press releases and by posting near real time information on the state's Beach Monitoring Web site

Public Notification

During 2000, MDEQ developed a Beach Monitoring Web page to provide public notification of the water quality at the Mississippi beaches and to provide historical beach monitoring bacteria data. The public can view the Web site at <http://www.usm.edu/gcrl/msbeach/index>. This Web site provides near real time data from all the monitoring locations, current beach advisories, beach locations, pictures, and maps locating the sampling sites. Also, information is provided about the history of beach advisories for all beach locations. Data from Mississippi's Beach Monitoring Program is routinely uploaded to EPA's Beach Monitoring STORET database. EPA uploads these data to the EPA National STORET database.

New Hampshire Monitoring

The New Hampshire Department of Environmental Services (NHDES) manages New Hampshire's Beach Program. The Beach Program monitors and inspects 16 coastal public beaches weekly or twice a month based on their status. Currently, 11 beaches are monitored weekly and 5 beaches are monitored twice a month. In addition, potential pollution sources are monitored regularly during the swim season to identify potential public health threats. Monitoring and assessment reports are available on the program's Web site at www.des.state.nh.us/beaches/beach_reports/index.html.

Assessment

The assessment of all beaches and designation of tiers were completed in 2003. On the basis of these assessments, NHDES performed microbial source tracking studies to better identify the host source species that contribute to elevated bacteria observations in coastal streams that discharge to or near three

coastal beaches. The sites included Little River, North Hampton, which discharges to State Beach; Chapel Brook, Rye, which discharges to Bass Beach; and Parson's Creek, Rye, which discharges to Pirate's Cove Beach. The study found that wildlife and humans were the most prevalent source species identified at each site. Wild animals present included coyote, deer, fox, otter, raccoon, and sparrow. At two sites, the state has plans for remediation of human fecal contamination, including repair of failed septic systems. At another site, they will study restoring a salt marsh by removing tidal restrictions.

Public notification

On the beach program Web site at www.des.state.nh.us/beaches/index.html, NHDES has provided the public with information about coastal beach water quality status. NHDES has also published a brochure informing the public about the program. In addition, NHDES has produced signage for the public when advisories are posted.

Data management

NHDES developed a beach database to allow for ease of data transfer between the state and federal levels. NHDES's Environmental Monitoring Database houses the department's environmental data. All New Hampshire beach stations, activities, and sampling results can be found in the database. The database also houses a beach-specific module for the program that went live in December 2003. Beach-specific information, such as beach contacts, inspections, and beach advisory data are accessible through this module.

The objective of the module is to enhance current beach data and make the data reportable to EPA via XML. Data are reported to EPA via uploads to the National STORET database for the water quality database and via XML to the PRAWN database for beach advisory and contact information. New Hampshire met the BEACH Act grant requirements on March 12, 2004, and was the second state in the nation to submit notification data via XML. To date, both coastal and freshwater beach data dating back to 1985 have been uploaded into the national version of STORET.

New Jersey

Beginning in May 2004, the New Jersey Department of Health and Senior Services and the New Jersey Department of Environmental Protection's (NJDEP) Cooperative Coastal Monitoring Program required that the sanitary quality of its marine bathing beach waters be determined using EPA Method 1600 enterococcus test (September 2002 version.) In this test, all bacterial colonies with a blue halo, regardless of colony size, are counted as enterococcus. The method states that there is a 6 percent false-positive rate and a 6.5 percent false-negative rate.

New Jersey coastal county and local health departments sample 325 ocean and bay bathing beach locations weekly and test the samples for enterococcus organisms. The concentration of enterococcus may not exceed 104 per 100 mL. Exceeding this value requires immediate resampling of the beach water and a sanitary survey of the sampled area. Two consecutive violations result in closure of the beach to primary contact recreational activities. Daily monitoring is continued until an acceptable enterococcus value and sanitary survey result is obtained, and the beach is then reopened.

In June 2004, enterococcus concentrations in samples from several ocean and bay bathing beaches were unusually high (>1000 per 100 mL), often in the absence of high concentrations at adjacent or nearby beaches and, in at least one case, in the absence of fecal coliform and *E. coli* bacteria. These results were unusual and unexpected because there are no known sources of bacteria to those beaches, and years of past fecal coliform data have been well within the standard for bathing beaches.

NJDEP's Water Monitoring and Standards marine water laboratory began work to isolate and identify the bacteria. Ten colonies isolated from one of these high-concentration sample petri plates were subjected to enterococcus confirmatory testing as specified in the method. None of these colonies were *Enterococcus spp.* All colonies on this plate appeared near the end of the 24 h incubation period, were less than 0.5 mm in diameter, and created lighter-blue halos than colonies that confirm as *Enterococcus spp.*

Nine similar colonies (< 0.5 mm diameter, excluding halo) were randomly selected from high-concentration sample plates from four bathing beach sites from two counties and subjected to identification procedures ("API 20 Strep" test, bioMerieux, Inc., Durham, NC). Six colonies were identified as *Aerococcus viridans* and three could not be classified.

Aerococcus viridans and a few other non-enterococcus lactic acid bacteria are known to possess the enzyme that causes the blue color halo in the enterococcus test and interference by *A. viridans* has been observed by researchers in commercial enterococcus detection tests that rely on the presence of this enzyme.

Aerococcus viridans was first described in 1953. It is a well-known pathogen of lobsters and other crustaceans and is an occasional opportunistic pathogen in humans and animals. *A. viridans* has been observed in many non-fecal environments and is "by no means common in [human] faeces" (Williams et al. 1953. *J. Gen. Microbiol.* 8: 475). Thus, the presence of *A. viridans* in marine water appears to have little sanitary significance.

In early July 2004, the NJDEP requested guidance from EPA regarding the counting of small-diameter colonies. The NJDEP received written guidance from EPA recommending that colonies less than 0.5 mm diameter no longer be counted as enterococcus, further stating their intention to revise Method 1600 to this effect by the end of 2005. The NJDEP immediately instituted the revised counting procedure resulting in a reduction of some sample counts and the need for closures at several beach locations. (Note: occasional high-concentration "true" enterococcus samples continue to be observed at some beach sampling locations, typically associated with wet-weather conditions.)

For more detailed information on New Jersey's Cooperative Coastal Monitoring Program, visit the NJDEP beach Web site: www.njbeaches.org.

North Carolina

North Carolina's recreational water quality monitoring program began as a state-funded mandate in 1997. The program tests both ocean and estuarine waters in deference to North Carolina's barrier island system,

which offers recreational areas on both the ocean and sound sides. North Carolina boasts 320 miles of ocean shoreline and another approximately 4,000 miles of estuarine shore. The program had previously tested between 275 and 300 sites for *E. coli* and fecal coliform bacteria and posted swimming advisories on the basis of a running monthly average or geometric mean.

The changes to beach water quality monitoring dictated by the BEACH Act guidance led North Carolina Recreational Water Quality (RWQ) staff to expect a higher number of swimming advisories for the 2003 season. The new single-sample advisory requirement would increase the number of advisories because previously, the single-count “spikes” were moderated in the geometric mean calculation. However, it was questionable whether the number of beach days sites were under advisory would also increase. This is a more accurate indicator of overall water quality, and if people did not clearly understand this difference, a potential public perception problem could develop. The state sought to address the issue before it occurred.

RWQ staff developed an extensive outreach and education plan, targeted to different audiences both internal and external to state government. Their audiences included state agency employees; state-level legislative representatives from coastal counties; local government officials and boards of health; interest groups, including tourism, environmental, pier, and camp owners; and local business interests near sampling sites. They created brochures and fact sheets and the beginnings of a Web-based data system that would allow the public to access water quality data for their chosen beaches. The public can access beach water quality data that is updated weekly, as well as information about the program and downloadable brochures on the program’s Web site, www.deh.enr.state.nc.us/shellfish/Water_Monitoring/RWQweb/home.htm. They also entered into a partnership with a national environmental nonprofit to display their swimming advisories on the nonprofit’s Web site while they developed their own capacity. Most importantly, they instigated a series of face-to-face talks and meetings—their most valuable outreach tool.

The personal contact facet of the plan was critical, especially for introducing the state and local

government officials. The Recreational Water Quality Program is not housed within the state Division of Water Quality, which, to the public, might seem a logical place for it. Because the program is focused on public health protection, it falls under the auspices of the state’s Division of Environmental Health, along with the Shellfish Sanitation Program.

State and local government employees receive high volumes of notices, e-mails, and other information, so the likelihood of their closely reading the material received from an unknown agency representative, much less retaining any of it, was slim. With personal contact, however, a face is connected to a name and a program. Although people might not retain all the information they receive at a meeting, they have a contact and back-up material with memories attached to them.

With the goal of reaching as many concerned parties as they could, the program staff also performed a snowball sample for the first round of a total of 49 meetings, ending the discussion by asking those present who else they thought they should contact. This yielded other groups and individuals, which were also approached.

Another key component of the outreach program involved eliciting the concerns of officials and citizens about aspects of the program, and feedback about how those concerns might be addressed. One of the most common issues raised by officials was the media’s handling of swimming advisories, especially in light of the likely increase. Early in the program, reporters had mistakenly stated that an entire county’s beaches were “closed.” The state program does not have the statutory authority to close beaches; they issue swimming advisories that recommend against swimming in a specific area within 200 feet in any direction of a sampling site. This caused considerable concern about misperceptions regarding an area’s waters and possible loss of tourism revenues.

As a result, the program offered a modified version of its educational program to key environmental media representatives. Again, the most important component of the program involved personal contact, and this was augmented by presentations and the other informational materials. Several prominent reporters

were given tours of the program and supplied with data and background, resulting in three positive front page stories in major newspapers in Raleigh, Charlotte, and Wilmington. Throughout the season, media coverage was consistently strong and accurate, and no “closings” were reported. This approach gave the program increased credibility and showed that state and local governments can work together, which has led to increased cooperation.

Outreach efforts continue on a smaller scale—refresher talks are offered for local government and health officials and citizen groups, as well as orientation for newly elected or appointed members. The program checks in with interested parties before the new season begins to determine whether they are the notification contact for the coming season and whether they would like anyone else added to the notification list for their areas. The program has received substantial positive feedback for its responsiveness and hopes to continue to improve outreach in the coming seasons.

Northern Mariana Islands

The beaches and lagoon waters of the Commonwealth of Northern Mariana Islands (CNMI) are heavily used daily by tourists, fishermen, and the public. Increased development over the years continues to threaten beach water quality. Improper or failing sewage delivery systems, septic tanks, urban runoff, non-permitted upland clearing, and reverse osmosis discharges are the largest contributors to waterbody pollution.

Monitoring

The microbiological and chemical parameters that the CNMI Division of Environmental Surveillance Laboratory currently monitors are salinity, dissolved oxygen, phosphates, nitrates, temperature, pH, turbidity, and enterococci bacteria. The Department of Environmental Quality (DEQ) monitors 38 fixed stations along Saipan’s most frequently used west coast beaches for microbiological and chemical parameters weekly (Tier 1 beaches). On Managaha Island (11 sites), Tinian (11 sites), and Rota (12 sites), beaches are monitored at least twice a year for 8-week continuous periods during the rainy and dry seasons (Tier 2 beaches). At all Tier 2 beaches, after the 8-week

continuous monitoring periods, monthly sampling is continued.

Beaches that have a high potential risk for harmful pathogens and are heavily used by the public are all considered Tier 1 beaches. Beaches that do not have a high potential risk for harmful pathogens but may or may not be heavily used by the public are considered Tier 2 beaches. Tier 2 beaches also include the most isolated beaches, which cannot feasibly be sampled on a weekly basis. Tier 1 beaches are easily accessible, commonly used by the public, and represent the majority of impaired waters throughout CNMI. Tier 2 beaches are less accessible and represented more supportive waterbodies. In the case of Managaha Island, Tier 2 classification is used because historical data sets show few violations despite a growing tourist population visiting the island.

Public notification and outreach

When samples exceed the single sample or geometric mean enterococci bacteria limits in the water quality regulations, the beach is “red flagged,” meaning a warning is provided to the public not to swim there. These bacteria criteria were updated in FY 2004 in the water quality regulations. DEQ uses the local media (two newspapers) and their Web site to provide real time results to the public. The Web site posts the weekly results and historical summaries to communicate potential risks to the public (www.deq.gov.mp/beach%20monitoring%20web/Map%20Choice.htm). Further, all reports are accompanied with a press release making them available to any member of the public. Additionally, signs are posted at six frequently used beaches regarding the most recent testing results, and are being installed at all other locations.

Ohio

Ohio has developed and continues to conduct a program for monitoring the bacteria content at the majority of recreational waters that are designated for swimming, bathing, scuba diving, or similar water contact activities. The partnership effort between the Ohio Department of Health (ODH), the Ohio Department of Natural Resources, local health departments with public bathing beaches within their jurisdictions, and private or public organizations along

the Lake Erie border provides the citizens of Ohio with specific information regarding the most recent water quality conditions at most public beach areas throughout the state.

Monitoring

The monitoring program analyzes water from selected public beaches along the Lake Erie border during the summer, generating data for evaluating the risks of adverse health effects to bathers. The program provides for prompt notification whenever the water at public beaches becomes contaminated, thereby helping to better inform the bathing public and ultimately prevent illness. The program also highly encourages the development of localized beach water monitoring efforts, predictive models for assessing recreational water quality, preemptive warning systems to inform the public more effectively, and aquatic sanitation programs for identifying and eliminating potential pollution sources.

Collaboration of beach program with external parties to identify source problems

In Ohio, much work is being done along the Lake Erie shoreline to ensure biologically safe swimming areas. Many agencies and organizations (both public and private) are involved in identifying factors that adversely affect beach water. Some local health departments have instituted programs to locate and eliminate failed septic systems that might contribute to high bacteria counts at public beaches. Other organizations are concentrating on controlling the migratory habits of numerous waterfowl to minimize their effects on beach water quality. Two projects funded by Ohio's Lake Erie Commission, one at Maumee Bay State Park in the western Lake Erie basin and one in the Cleveland area, are working to identify and eliminate sources of potentially harmful pathogens. By employing intense sampling surveys and sophisticated DNA fingerprinting technologies, researchers are seeking the sources of illness-causing bacteria on Lake Erie beaches.

Public notification and outreach

In recent years, high levels of *E. coli* bacteria have resulted in Lake Erie beach postings, warning the public of the potential health hazards. ODH will use

BEACH Act grant funds to improve advisory signs for use at monitored beaches, offering the public credible data for making informed decisions about their aquatic activity. Monitoring results are distributed to all monitored beaches, all local health departments along the lake, and various major newspaper and media outlets in the Lake Erie basin.

Oregon Monitoring

Using an EPA BEACH Act grant, the Oregon Beach Monitoring Program (OBMP) began developing its monitoring and notification program in 2002 by prioritizing and selecting an initial list of beaches for sampling. During the first sampling season in 2003, the program sampled 99 sites at 52 beaches in all 7 counties along the Oregon coast. Six percent of these sites were monitored weekly, 44 percent were monitored every two weeks, and 50 percent were monitored monthly.

In 2004, Oregon reduced the number of sites and beaches monitored to 60 and 19, respectively. Using EPA's recommendation for adaptive sampling, Oregon targeted those beaches that had the highest use and bacteria levels as indicated by the monitoring data collected the preceding year. While reducing the number of sites monitored, Oregon nearly doubled its sampling frequency from the previous season—in 2004, 16 percent of the sites were monitored weekly, 74 percent were monitored every 2 weeks, and 10 percent were monitored monthly.

For the 2005 sampling season, Oregon again used an adaptive approach to prioritize its list and identified more than 70 sites at 21 beaches for sampling. This way, the program can ensure that each season it is using federal BEACH dollars to monitor the most important Oregon beaches from a public health perspective.

In addition, Oregon is one of the few states to monitor beach waters during the winter, when surfers are the primary beach users. To identify the beaches where surfing occurs most frequently, the OBMP has worked with the Oregon chapter of the Surfrider Foundation and local surf shops. At the time of this writing, Oregon monitors 42 winter sampling sites at 12 beaches in 6 counties along the coast. The program has doubled

its sampling frequency from last winter, from once per month to every other week, and will try to maintain this frequency for subsequent monitoring seasons.

Public notification and outreach

As of January 2005, Oregon has issued 20 beach advisories at 12 beaches along the coast. Until recently, the process for notifying the public of these water quality advisories consisted of e-mail messages to stakeholders and local government officials, press releases to media outlets throughout the state, and signage at beach access points. Although this system continues to be effective, Oregon has taken important steps to improve and expand public access to advisory information and monitoring data.

To expand the reach of public notifications and to make data accessible to the public, Oregon focused its notification system improvements on Internet resources. For example, Oregon partnered with Earth911 to disseminate beach advisory information online. The Earth911 system maps all monitored beaches and allows program staff to enter advisory information as it is retrieved from the field. The public can then access this information for any monitored beach in real time from both the OBMP Web site (<http://oregon.gov/DHS/ph/beaches/beaches.shtml>) and the Earth911 Web site (www.earth911.org/waterquality/default.asp?cluster=41).

To provide the public with access to monitoring results, the program is collaborating with the Oregon Ocean-Coastal Management Program's Coastal Atlas. The Coastal Atlas is one of the nation's most comprehensive coastal-area information systems, and it provides the public with access to interactive maps and data sets related to the Oregon coast. The program's partnership with the Coastal Atlas will enable users to view monitoring data by beach or by sampling station and will provide photographs and maps for each station. That system is expected to be available on both the Coastal Atlas and OBMP Web sites by May 2005.

For more information, contact the Oregon Beach Monitoring Program at 503-731-4012 or visit <http://egov.oregon.gov/DHS/ph/beaches/>.

Rhode Island

Monitoring and assessment

Through routine water quality monitoring, supported through the BEACH Act grant and conducted by the Rhode Island Department of Health (HEALTH) in 2003 and 2004, three beaches were identified for additional attention because of high bacteria densities and frequent closings. Sanitary surveys at these beaches Warren Town Beach, Easton Beach, and Scarborough State Beach helped to reveal problems with storm drains, sewer lines, and septic systems.

At Warren Town Beach, through sampling and inspections conducted by HEALTH, the Rhode Island Department of Environmental Management (RIDEM), and the Warren Department of Public works, it was shown that sewage from a broken sewer line was penetrating a brick stormwater catch basin and being discharged into the bathing area. The town repaired the sewer line, and routine sampling during the 2004 bathing season showed bacteria levels well below the standard; no closings were necessary. HEALTH will conduct additional wet weather sampling to ensure that all local pollution sources have been addressed.

In Newport, HEALTH, RIDEM, Rhode Island Department of Transportation (RIDOT), EPA, the City of Newport, and the Town of Middletown have been working to identify sources of pollution causing closings at Easton's Beach. More than 350 water quality samples have been collected in the area surrounding the beach. Test results were modeled using GIS techniques. This information was used to investigate and eliminate pollution sources in the drainage system. Smoke testing has revealed several possible cross-connections between the sewer and stormwater system. It was discovered that a pump station approximately 500 feet from the bathing area, in Middletown, Rhode Island, was discharging untreated sewage during high-flow events. RIDEM issued a Notice of Violation (NOV) to the municipality. Short-term measures were put into place to avoid discharge, except in the case of extreme rainfall. Residents passed a \$2.5 million bond, which will fund the mandated reconstruction of the defective pump station, as well as aid in correcting the structural integrity of faulty segments of the wastewater infrastructure. In addition, Middletown has an ongoing

inflow and infiltration abatement project that will reduce pump station volumes and lower the risk to public health.

At Scarborough State Beach, routine monitoring in the summer of 2003 identified high bacteria counts following rain events. Through sanitary surveys, HEALTH identified three stormwater discharges at this beach. The stormwater outfalls drain surface runoff from high-density residential development and several wetland areas. HEALTH, RIDEM, and EPA conducted extensive water quality sampling and inspected private septic systems in the surrounding area. Intensive sampling did not reveal a direct cause for the bacterial contamination, but several septic system violations were identified. RIDEM has issued citations to several facilities, including a vacation campground with more than 100 units and an inadequate sewage disposal system. Short-term corrections are in place at the campground; the owner has entered into a consent decree and will install sewers in the facility by the 2007 bathing season. RIDOT contracted with a private engineering firm to develop and construct a treatment system for the three outfalls. The engineering firm decided to use new, innovative media technology to filter out bacteria before they are discharged into the bathing area.

HEALTH will continue to monitor for bacteria at all these sites to monitor improvements and notify the public if unsafe conditions exist.

Public notification and outreach

HEALTH's active and visible role in mitigating public health risks at beaches through the reduction of pollutants has spurred much interest. Media channels are reporting beach-related environmental and health concerns; the public has focused on beach closings; and, most important, there is the political will to correct these problems. Local communities have formed committees, municipalities have passed bonds, and nongovernmental organizations have turned a watchful eye to Rhode Island's beaches. The governor has formed a commission to reduce beach closings and fish kills, the legislature has authorized a permanent commission to provide recommendations for correcting

the problem, and a \$19 million bond fund was just passed to help clean up Narragansett bay.

Data management

HEALTH has worked with a vendor, Garrison Enterprises, Inc., to develop a Web-based beach monitoring and public notification database. The database will allow for the improved collection of data and transmission to EPA. It will also give HEALTH the ability to more effectively and quickly notify the public when opening or closing a bathing beach. A listing of all of Rhode Island's beaches, sample stations, facility information, facility contacts, monitoring data, open/closed information, season reports, and other environmental information can be accessed through this database from any Web connection. Much of this data is also available through a public portal available on HEALTH's Beach Monitoring Web site at www.ribeaches.org. This real time access to data better equips managers and the public to make informed decisions about their recreational opportunities. HEALTH met the BEACH Act grant requirements in 2004 when it electronically submitted to EPA (via XML) the 2003 and 2004 monitoring and notification data for the national beach database.

South Carolina

Data management

Grant funds provided to the South Carolina Department of Health and Environmental Control (DHEC) through the BEACH Act have allowed for many upgrades and improvements to the state's beach monitoring and notification program. One of the largest of these accomplishments is electronic storage and management of monitoring and advisory data. Previously, all records were maintained as paper copies. These records were quickly reviewed and then filed. The data were not used in any constructive way, other than to issue and rescind advisories. With the need for electronic data arising from the requirements of the BEACH Act grant, this system was changed dramatically. South Carolina's existing Environmental Facility Information System (EFIS) is used to manage monitoring and advisory data. All monitoring data is manually entered into EFIS or uploaded from the Laboratory Information System (LIMS). The program coordinator enters advisory

information into EFIS. This improvement has allowed for easy dissemination of monitoring and advisory data to interested individuals through e-mail or printed reports. The electronic format also makes it possible to analyze monitoring data. In past years, gathering data for analysis or to respond to a citizen's request was a tedious process requiring a lot of time; now it is much simpler.

Mini-grant program

The award of BEACH Act grant funds has allowed South Carolina to establish a mini-grant program. A portion of South Carolina's total grant award is set aside to award monitoring and notification grants to coastal municipalities. Municipalities apply for grant awards through a competitive process. A committee reviews and ranks grant applications. The grants are then awarded on the basis of ranking and available funding. For the 2003 and 2004 cycles, all municipalities that applied were awarded grant funds. These monies can be used for collecting and analyzing samples, purchasing advisory signs, and employing staff to post and remove advisory signs.

The benefits of this program are multifaceted. The municipalities benefit by becoming more involved in a program that greatly affects their community. The local state university benefits because currently, all funded municipalities employ a local university to perform sampling and analysis. This gives the university an opportunity for student involvement and instruction, as well as monetary support of the laboratory. The state benefits from this process by building stronger working relationships with the communities involved in the beach monitoring program. Municipalities' involvement also assists the state in rapid public notification of advisories. Local municipal employees are able to post and remove advisory signs more quickly than a state employee, who must travel to the site. The state plans to continue the mini-grant program as grant funds are available. In coming years, the state hopes to expand the program by encouraging more local governments to apply for grant funding.

GPS data

Before receiving the BEACH Act grant, South Carolina had very little locational information regarding

sampling sites. Descriptions of site locations used only nearby streets or landmarks. The length of each beach was also imprecise and was estimated using maps. Through the grant, South Carolina has collected GPS data for each beach monitoring site. Use of these data, in conjunction with GIS capabilities, has allowed South Carolina to:

- Determine the location of each site with respect to county lines
- More accurately determine beach lengths
- View beach monitoring stations in relation to other information layers, such as shellfish monitoring stations
- Create location-specific maps for display in public areas, such as community information kiosks or state park camping areas

Compilation of locational data also allowed South Carolina to participate in Earth911's beach advisory notification Web site. Earth911 works in conjunction with coastal states to provide advisory information on the Internet. The Web site provides maps of the state's beaches with the sample sites, marked by green dots that become red when an advisory is issued for the area. This Web site has added another avenue for dissemination of advisory information.

Tier III project

In August 2005, DHEC's Bureau of Water will issue a contract for continued surveying at sites identified previously as Tier III. This contractor will verify the site locations, develop necessary survey forms, document public access and use, and determine sources of pollution.

Texas

The Texas General Land Office (GLO) administers the Texas Beach Watch Program in conjunction with various contracted entities, including county health and parks departments, universities, state parks, and municipalities. GLO oversees monitoring and public notification on approximately 144 miles of beaches in Texas. GLO has received \$1.23 million in BEACH Act grants since 2000 to develop and implement its program.

Beach segment classification

During the development phase of the Texas Beach Watch Program, GLO used information from its own *Texas Beach & Bay Access Guide* to identify beaches within each of the coastal counties that may be eligible for implementation of a beach monitoring program. Beach segments were initially evaluated to determine whether swimming activities occurred at each beach. For those beaches at which swimming activities were occurring, the level of beach use was evaluated using GLO's observations and those provided by local entities with intimate knowledge about local beach usage. Beach segments identified with the highest frequency of use were then ranked and prioritized for monitoring under the BEACH Act. This classification system has provided a useful framework in which to prioritize funds for the implementation of the Beach Watch Program.

Monitoring

Prior to the passage of the BEACH Act, Texas was sampling at 13 of the most popular beaches on the Texas Gulf coast using National Oceanic and Atmospheric Administration Coastal Management Program funds. Using the BEACH Act grants, Texas expanded sampling to approximately 59 beaches in 7 counties. Sampling using the BEACH Act funds began in 2003 following a 2-year period of program development. From January 1, 2003, through October 31, 2004, GLO performed more than 7,000 sampling events at 59 coastal beaches in Texas.

Public notification and outreach

When beach water quality samples exceed the applicable water quality criteria for enterococcus, officials with jurisdiction over local beaches, as well as other interested citizens and citizens' groups, are immediately notified by e-mail. In most areas, local officials have agreed to post beach advisory signs to notify the public of potentially unsafe swimming conditions. Additionally, GLO maintains an interactive mapping tool on its Web site that allows the public to select individual beaches or stations and get information about current bacteria levels and recommended beach advisories. This GIS mapping tool provides real time water quality updates using the information entered into the Texas Beach Watch

database. For a link to this interactive mapping tool see www.glo.state.tx.us/coastal/beachwatch/index.html. From January 1, 2003, through October 31, 2004, 392 criterion exceedances were noted out of approximately 7,000 sampling events. Local governments were notified, and advisories were posted at local beaches at their discretion.

Since the Beach Act was passed, the Texas Beach Watch Program has greatly expanded its monitoring and notification capabilities and the number of partners with which it works to implement the program. This has resulted in a much more visible beach monitoring program and an increased level of interest in beach water quality by the public.

Virginia

A new component to the program in 2004 included collaboration with Virginia Tech researcher Dr. Charles Hagedorn to conduct source tracking at beaches that exceeded the standard for bacteria. Two source-tracking techniques were used on Virginia's beaches during the 2004 swimming season. One method provided information on whether a human waste stream was present at the beaches; the second method provided greater detail into the source of contamination as identification of the bacteria were linked to more specific sources such as pets, wildlife, human, or waterfowl. The source tracking techniques have proved valuable to the cities of Hampton and Newport News in providing information to help them identify where to target mitigation efforts in an attempt to control wastewater contamination of beaches in their localities.

The Virginia Department of Health Beach Monitoring Program has the potential to prevent public exposure to waterborne pathogens when they are at levels that pose a greater than normal risk at the locations in Virginia where the greatest number of people may be affected.

Virgin Islands

The United States Virgin Islands (USVI) consists of four main islands—St. Thomas, St. John, Water Island, and St. Croix. These islands harbor some of the most fascinating and beautiful marine environments in the world. These aquatic resources have contributed to

drawing an average of two million divers, beachcombers and sightseers per year spending nearly \$100 million since 1997. The USVI also has a coastline greater than 185 nautical miles, allowing for public access at hundreds of locations during a year-round swimming season. These unique factors led to the development and implementation of the United States Virgin Islands Beach Water Quality Monitoring Program (the Program), which is essential for the protection of both beachgoers and the marine resources.

Before the implementation of the Program, the Department of Planning and Natural Resources (DPNR), Division of Environmental Protection (DEP) sampled only a fixed network of coastal and offshore waters quarterly through the Ambient Monitoring Program. The frequency and sampling locations did not sufficiently inform the community of the potential health hazards in nearshore waters. This promoted DPNR-DEP to apply for its first year of BEACH Act grant funds in 2001. First-year funds were used to develop the program's Quality Assurance Project Plan (QAPP). Second-year funds were directed to implementation of the program. A total of 43 beaches were selected—20 on St. Croix, 15 on St. Thomas and 8 on St. John. The selected beaches are monitored weekly. Two state-approved labs were selected to perform the analysis, one on St. Croix and one on St. Thomas, and both use EPA method 1600 for enterococci analysis. A Web site and a toll-free number are being established to ensure that the public has access to the data collected and the public advisory status of each beach. Temporary beach water quality warning signs are being used until the permanent signs are completely assembled. The Program has conducted public outreach to several local public schools, and several interviews with the local media have been held.

The Program officially began sampling in the St. Thomas and St. John districts in July 2004 and in the St. Croix district in August 2004. Since the program began, several press releases have been issued. Using field research, DPNR-DEP has found that the common sources of bacterial contamination in the nearshore waters at the designated beaches are soil runoff after heavy rain events and occasional municipal sewer overflows. However, other suspected contributing

factors are the garbage dumpsters that have been placed in close proximity to the shoreline.

The Program, one of the newest programs within DPNR-DEP, is also one of the most popular. Future plans include conducting additional pollution source investigations throughout the territory and continuing public education sessions.

Wisconsin Monitoring

The Wisconsin Department of Natural Resources (WDNR) operates Wisconsin's Beach Program. Under this program, WDNR gives grants to communities along Lake Michigan and Lake Superior to monitor beach water for elevated bacteria levels. To design its beach monitoring and notification program, WDNR formed a workgroup composed of state-level environmental and public health officials, local health officials, and other interested parties. They identified 190 beaches along Lake Michigan and Lake Superior using GPS technologies. This allowed WDNR to create additional GPS data layers that included the location of all wastewater treatment outfalls along with their proximity to the beaches. WDNR collected additional information for each beach, evaluating the potential for impacts from stormwater runoff, bather and waterfowl loads, and the location of outfalls and farms. WDNR used this information to rank and classify beaches as "high," "medium" or "low" priority. These rankings indicate how often the beaches should be monitored to ensure that water quality conditions are safe for swimming. Passage of the BEACH Act has enabled WDNR to substantially increase the number of beaches it monitors, from 6 to 110 coastal beaches.

Public notification and outreach

WDNR's public notification and risk communication measures were developed in collaboration with the workgroup and other stakeholders, including the public. These efforts included developing signs at beaches to give notice to the public that the coastal recreational waters are not meeting, or are not expected to meet, water quality standards. These signs, which are also in Spanish and Hmong, were designed using feedback from a beach user survey and public meetings

held around the state. Other products that were developed include:

- A statewide toll-free telephone service to make beach condition information available to the public
- An automatic e-mail service to which the public can subscribe to receive daily updates on beach conditions
- A statewide informational brochure, approximately 70,000 copies of which were distributed at local beaches, parks, and health departments
- A statewide Beach Health Web page (www.wibeaches.us) for collecting monitoring and advisory data and reporting up-to-date conditions at all coastal beaches
- An internal Web site for local health departments to report their daily advisory and monitoring data in the format required for EPA reporting at the end of the beach season

Collaboration of beach program with external parties to identify source problems

Phytoremediation project in Racine, Wisconsin

The Racine County Health Department collaborated with staff from federal, state, and local health and environmental agencies; nongovernmental organizations; academia; and students to plant native indigenous wetland plants upland of a beach to filter stormwater runoff and thereby reduce nonpoint source pollution into Lake Michigan. The plan is to reroute the flow of water from a stormwater outfall to infiltration beds upland of the beach using the native plants to filter the flow and reduce beach water pollution. The project should improve water quality, reduce the number of beach closings, and increase protection of public health.

Microbial source tracking in Door County, Wisconsin

Door County has more than 250 miles of shoreline and a large number of public beaches that are frequented by many tourists during the summer season. The BEACH Act grant was used to monitor 27 Great Lakes beaches

in the county in the summer of 2004. Although there was not enough funding to allow for identification of sources of detected microbial contamination, steps had to be taken to find out where the contamination source was and whether it was safe to swim at the beach. The Door County Soil and Water Conservation Department acquired funding to pay samplers and analysts to monitor *E. coli* concentrations at selected beaches, near outfalls, and after rain events. Funds were also used to monitor avian waste concentrations; to isolate *E. coli* from beach water, avian waste, and human waste in Door County; and to conduct DNA fingerprinting and antibiotic sensitivity profiling of these isolates. These data are to be used to further characterize the indicator organism used to monitor beach water quality and help to identify the source of contamination. Approximately 1,000 *E. coli* isolates from water and waste, and the majority has been DNA fingerprinted and tested for antibiotic sensitivity.