

DELAWARE

1st in beachwater quality (1% of samples exceeded national standards)

Delaware has about 25 miles of Delaware Bay coastline, 26 miles of Atlantic Ocean coastline, and 115 miles of inland bay shoreline. All three of the state's counties (Newcastle, Kent, and Sussex) have coastline.

The state's marine beachwater monitoring program is administered by the Delaware Department of Natural Resources and Environmental Control (DNREC). The DNREC conducts monitoring activities and issues swimming advisories to local recreational water area administrators so they can regulate access to swimming waters.¹ The local administrators always follow state recommendations.² Delaware also monitors freshwater beaches; this summary only includes information about the state's coastal monitoring.

In 2008, the monitoring season stretched from May 12 to September 19. A few coastal sites were sampled in the off-season by the DNREC and the Delaware Surfrider Chapter and analyzed by the University of Delaware's College of Marine and Earth Studies.¹

The state's monitoring data are used to determine which watersheds should be assessed for placement of nutrient/bacteria buffers that reduce the introduction of pollutants.² These buffers consist of setbacks or vegetation that reduce the amount of nutrients and bacteria that get carried to surface waters in runoff. The recreational water program notifies the DNREC's groundwater discharge section when a violation of recreational water quality standards is found.¹ This section is responsible for providing regulatory oversight over the installation of septic systems, underground injection wells, spray irrigation wastewater systems, and other systems associated with wastewater treatment.

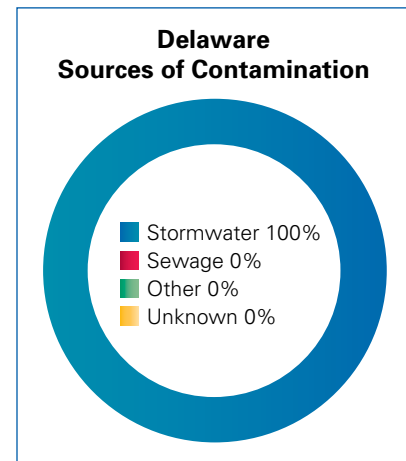
Delaware's Recreational Water Program has initiated a beach shoreline survey program to identify existing sources of pollution. Sanitary surveys of shorelines and marinas adjacent to recreational beaches are conducted in order to identify existing and potential sources of pollution.¹

Regression analyses revealed no relationship between rainfall and total enterococcus levels at Atlantic Ocean and Delaware Bay beaches, with the exception of Rehoboth Beach.² This finding triggered extensive monitoring of Rehoboth Beach's stormwater and sanitary sewers in order to discover whether they were combined. The monitoring revealed that the sewers are uncombined,² so there is another source of fecal indicator bacteria that is contaminating stormwater in this area.

Delaware has several programs that promote public participation in water quality improvements: Coast Day, Adopt-a-Beach, a Clean Marina Program, an annual coastal cleanup event, and Beach Grass Planting.² In 2008, the recreational water program provided funding to the Inland Bays Citizens Monitoring Program in order to promote this volunteer-based organization.¹ The program also supports the University of Delaware's Citizen Monitoring program, which conducts and reports on investigations of fish kills, harmful algal blooms, and other water quality problems.¹

The recreational water program is providing support for research into analysis of marine and inland bay waters for the presence of pathogenic and pathogen-like bacteria, including *Helicobacter pylori* and *Campylobacter jejuni*. The goal is to be able to quickly identify harmful bacteria and improve the safety of recreational waters.¹ The program plans to provide support for research to test marine and inland bay waters for the presence of pathogenic and pathogen-like *Epsilonproteobacteria*, which are associated with human gastric disease and gastroenteritis. Results will be compared to standard methods for indicators of fecal contamination.²

The DNREC samples water and/or shellfish for harmful algal bloom species and toxins and issues swimming advisories at freshwater beaches because of harmful algal blooms. The state discovered its first known occurrence of a *Karenia brevis* bloom during routine beach observations in late August of 2007. The toxins produced by this species of harmful algae can aerosolize and cause respiratory symptoms. Because of the 2007 *K. brevis* bloom, Delaware enhanced its surveillance analyses, response, and public notification capability for marine toxins and harmful algal blooms in 2008.



The DNREC's Comprehensive Algal Bloom Monitoring Program was implemented in cooperation with the University of Delaware Sea Grant Marine Advisory Service. This included follow-up monitoring of harmful algal blooms at the Indian River Inlet, a beach site that is used by surfers. The recreational water program also provided funding for university research into identifying harmful algal bloom species.¹

Delaware received a \$207,730 federal BEACH Act grant in 2008 and was eligible for a \$211,000 grant in 2009. The full cost of Delaware's coastal beach monitoring and notification program is approximately double the amount of the BEACH Act grant.³

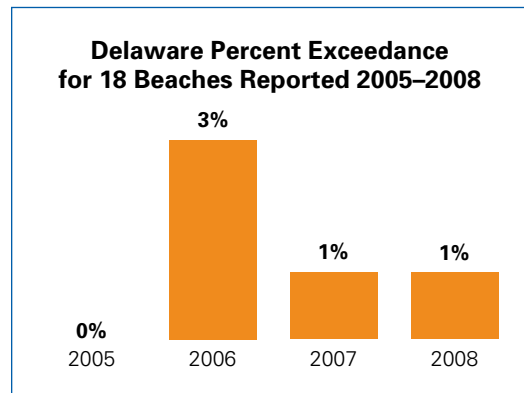
Standards

Indicator Organism: Enterococcus

Standards: Delaware standards for beachwater quality are an enterococcus single-sample maximum of 104 cfu/100 ml and a geometric mean of 35 cfu/100 ml. Delaware also monitors its coastal waters for temperature, pH, dissolved oxygen, and salinity.

DNA analyses to track the source of bacteria at Slaughter Beach and Prime Hook Beach have shown that non-human sources contribute to indicator bacteria counts at these beaches. Monitoring results at these beaches are adjusted downwards to account for non-human sources at these beaches before the water quality standard is applied. (Monitoring data are reported before this adjustment is made.) For Slaughter Beach, the correction factor is 0.49 multiplied by the raw count. This was calculated based on a microbial source tracking study at this beach that found that 77% of fecal bacteria came from wildlife sources, with a 26% margin of error. At Prime Hook, microbial source tracking found that 70% of fecal bacteria came from wildlife, with a 24% margin of error, resulting in a correction factor of 0.54 for this beach.⁴

Delaware issues preemptive rainfall advisories. For marine waters, the DNREC has determined that 3.5 inches of rainfall within 24 hours or three inches within 12 hours may trigger a closing.² Preemptive closings would be issued in the case of a known sewage spill.²



Monitoring

Determination of Monitoring Locations and Frequency: Marine beaches that are lifeguarded are monitored.

Practice: Samples are taken in knee-deep water, generally on Mondays and Tuesdays, with Wednesdays and Thursdays as backup days.² Results are available 24 hours after sampling. Multiple samples are sometimes taken.¹

Results: In 2008, Delaware reported 24 coastal beaches, all in Sussex County and all monitored once a week. For the fourth consecutive year, NRDC looked at the percent of monitoring samples that exceeded the state's daily maximum bacterial standards (all reported samples were used to calculate the 2008 percent exceedance values, including duplicate samples and samples taken outside the official beach season, if any). In 2008, 1 percent of all reported beach monitoring samples exceeded the state's daily maximum bacterial standards. The beaches with the highest percent exceedance rate in 2008 were Holts Landing Beach (15%) and Delaware Seashore State Park, Tower Road Bayside in Sussex County (14%).

Comparing percent exceedance values to previous years, NRDC includes only those beaches monitored and reported each year between 2005 and 2008. For this consistent set of 18 beaches, the percent of samples exceeding the standard remained steady at 1 percent in 2008 from 2007 levels, a decrease from 3 percent in 2006. There were less than 1 percent exceedances in 2005.

2008 Delaware Monitoring Frequency and Results by Beach					
County	Beach	Tier	Monitoring Frequency	Total Samples	Percent Exceedance
Sussex	Holts Landing Beach	No data	1/wk	20	15%
Sussex	Delaware Seashore State Park, Tower Road Bayside	2	1/wk	22	14%
Sussex	Rehoboth-Delaware Ave	No data	1/wk	13	0%
Sussex	Delaware/Maryland Line Beach	2	1/wk	21	0%
Sussex	Cape Henlopen State Park - Herring Point	2	1/wk	32	0%
Sussex	Fenwick Island State Park Beach	2	1/wk	21	0%
Sussex	Rehoboth-Rehoboth Ave Beach	1	1/wk	34	0%
Sussex	Prime Hook Beach	2	1/wk	22	0%
Sussex	Broadkill Beach	1	1/wk	20	0%
Sussex	Delaware Seashore State Park, Tower Road Ocean Site	1	1/wk	31	0%
Sussex	Slaughter Beach	1	1/wk	22	0%
Sussex	Lewes Beach South	1	1/wk	20	0%
Sussex	Rehoboth-Queen St Beach	1	1/wk	21	0%
Sussex	Lewes Beach	No data	1/wk	20	0%
Sussex	South Indian River Inlet Beach	1	1/wk	20	0%
Sussex	Bethany Beach	1	1/wk	27	0%
Sussex	Rehoboth-Virginia Ave Beach	1	1/wk	34	0%
Sussex	Lewes Beach North	1	1/wk	20	0%
Sussex	South Bethany Beach	1	1/wk	21	0%
Sussex	North Indian River Inlet Beach, Delaware Seashore State Park	1	1/wk	27	0%
Sussex	Cape Henlopen Beach	1	1/wk	20	0%
Sussex	Dewey Beach	1	1/wk	21	0%
Sussex	Atlantic Beach Near Gordons Pond	1	1/wk	21	0%
Sussex	Fenwick Island - Town	1	1/wk	0	N/A

N/A: Not applicable

Closings and Advisories

Because of concerns about water quality, there is a permanent caution regarding swimming in Rehoboth Bay, Indian River Bay, and Little Assawoman Bay. This permanent advisory includes Tower Road Bayside in Rehoboth Bay and Holts Landing Beach in Indian River Bay. Contaminants in these bays come from many sources in the watershed, including failing septic systems, farm and lawn fertilizers, and runoff from poultry operations. In addition, the sewage treatment plants in Lewes and Rehoboth discharge treated effluent into the Lewes and Rehoboth Canal, which feeds into the bays. Poor flushing of the shallow waters in these bays allows pollutants to linger; it takes 120 days for water to move out of the inland bays.² Signs are posted at popular access points around Rehoboth Bay, Indian River Bay, and Little Assawoman Bay to warn potential swimmers of the risks associated with swimming in these bodies of water, particularly after a heavy rain.¹

Closing/Advisory Issuance: State policy is to issue advisories for indicator exceedances. However, circumstances that would trigger an imminent health threat result in a closing. An exceedance of either the single-sample maximum standard or the geometric mean standard triggers an advisory.¹ There are limited overriding factors, such as leaking

sampling containers, excessive sediment in samples, etc., which can be taken into account before issuing an advisory when a sample exceeds standards, but these are rare exceptions. Along with issuing an advisory, resampling to confirm exceedances of bacteriological standards is conducted immediately following a report of elevated sample results.² All ocean resamples taken to verify exceedances, without exception, have been below the single-sample maximum standard.¹ The DNREC provides beach advisory information via a telephone hotline, signs, a website, and e-mail. Whether advisories are issued for an entire beach or for a section of beach is determined on a case-by-case basis.

Reopening Procedures: Once an advisory or closing is issued, the beach is monitored more frequently until the advisory can be lifted.¹ States that monitor more frequently after an exceedance is found will tend to have higher percent exceedance rates and lower total closing/advisory days than they would have had if their sampling frequency did not increase after an exceedance was found.

Number of Closings and Advisories: Delaware had 2 closing/advisory events in 2008. Total closing/advisory days for two events lasting six consecutive weeks or less increased 10% to 11 days in 2008 from 10 days in 2007, 0 days in 2006, and 0 days in 2005. In addition, there were no extended or permanent events in 2008 or 2007. Extended events are those in effect more than six consecutive weeks but not more than 13 consecutive weeks; permanent events are in effect for more than 13 consecutive weeks.

Causes of Closings and Advisories: All closing and advisory days in 2008 were preemptive (i.e. without waiting for monitoring results) due to heavy rainfall.

The reported sources of beachwater contamination for 2008 are as follows: All closing and advisory days in 2008 were from stormwater runoff.

2008 Delaware Beach Closings and Advisories					
County	Beach	Start Date	End Date	Reason	Source
Sussex	Delaware Seashore State Park, Tower Road Bayside	6/3/08	6/11/08	Bacteria	Stormwater
Sussex	Holts Landing Beach	6/24/08	6/27/08	Bacteria	Stormwater

Notes

1 Delaware Department of Natural Resources and Environmental Control. 2008 Recreational Water Year-End Report. Not dated.

2 Debbie Rouse, Delaware Department of Natural Resources and Environmental Control, personal communication, June 2009.

3 Jack Pingree, Environmental Program Manager, Delaware Department of Natural Resources and Environmental Control, personal communication, May 2007.

4 Michael Bott, Delaware Department of Natural Resources and Environmental Control, personal communication, July 2009.