

TESTING THE WATERS

24TH EDITION



Sources of Beach Water Pollution

Most beach closings and advisories are issued because beach water monitoring has detected the presence of pathogens—microscopic organisms from human and animal wastes that pose a threat to human health. Key contributors of these contaminants include stormwater runoff, untreated or partially treated discharges from sewage treatment systems, discharges from sanitary sewers and septic systems, and wildlife.

STORMWATER RUNOFF

Stormwater runoff starts as rain or snowmelt. As it washes over roads, rooftops, parking lots, construction sites, and lawns, it becomes contaminated with oil and grease, pesticides, litter, and pollutants from vehicles. On its way to storm drains, it also can pick up fecal matter from dogs, cats, pigeons, other urban animals, and even humans. Human waste may also find its way into storm drain systems from leaking sewage pipes or from businesses or residences that have illegally connected their sewage discharge to the storm drains. Illicit discharges also occur when people empty holding tanks from recreational vehicles and trailers into storm drains.

The amount of pollution present in urban runoff tends to correlate with the amount of impervious cover, such as roads, sidewalks, parking lots, and buildings. A study conducted in North Carolina found that a watershed that was 22 percent covered by impervious surfaces had an average fecal coliform count more than seven times higher than a watershed that was 7 percent covered by impervious surfaces.¹ However, even in less developed areas, uncontrolled runoff can foul beaches.



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As the population along the U.S. coast grows and sprawling development continues, more land is converted to impervious surfaces that deflect rather than absorb falling rain. More than half of the people in the United States live in coastal counties, which occupy only 17 percent of the nation's land mass (excluding Alaska). Between 1970 and 2010, the coastal population grew by 50.9 million, and it is expected to increase by nearly 15 million more by 2020.² At the current rate, by 2025 more than one-fourth of all of our coastal acreage will be developed.³

HUMAN WASTE FROM SEWAGE SYSTEMS

Sewage overflows from aging sanitary and combined sewer systems, leaking sewage pipes, and malfunctioning sewage treatment plants and pump stations have always been a major cause of pollution at ocean, bay, and Great Lakes beaches. Malfunctions at a wastewater plant can quickly spill millions of gallons of partially treated sewage into coastal waters and result in no-swimming advisories along miles of beaches. In Florida's Miami-Dade County, for instance, at least 65 ruptures spewed more than 47 million gallons of untreated human waste into county waterways and streets from 2009 to 2011.⁴ Fixing these aging and malfunctioning sewage systems comes at a hefty cost. Repairing and rebuilding its wastewater and stormwater systems could cost Miami-Dade County more than \$12 billion over the next 15 years.⁵ On the national level, it is estimated that \$298 billion in capital investments will be needed to repair our wastewater and stormwater systems over the next 20 years.⁶

Combined Sewer Overflows

Combined sewer systems, concentrated in the Great Lakes region and the northeastern United States, carry both raw sewage from homes and businesses and stormwater runoff from streets to sewage treatment plants. Although they are most prevalent in urban areas, combined sewer systems serve around 40 million people in 772 communities nationwide.⁷

Treating stormwater before releasing it to surface waters is desirable, but during periods of heavy rainfall or snowmelt, the volume of the combined wastewater can become too great for the treatment plant to handle. In such circumstances, the excess flow is diverted to outfall points that discharge it—and the pollutants it carries, including raw sewage, trash, and toxic industrial waste—into the nearest stream or coastal waterway. This is known as a combined sewer overflow, or CSO.

CSOs are a major cause of pathogen contamination in marine and Great Lakes waters near urban areas. In 2002 it was estimated that some 43,000 CSO events were occurring per year nationwide, discharging 850 billion gallons of raw sewage and stormwater annually.⁸ Although an EPA policy that aims to reduce these overflows has been in effect since 1994, virtually all combined sewer systems continue to overflow in storms. A significant number of communities with CSOs still have not submitted plans for controlling them, and even where plans are in place, it will be years before they are fully implemented.

Sanitary Sewer Overflows and Discharges from Sewer Line Breaks

Sanitary sewer systems carry human and industrial waste from buildings to sewage treatment plants for treatment. These sewer systems can discharge untreated sewage when the treatment plants malfunction or are overwhelmed or when sewer lines break, posing a threat to bathing beach safety. Separate sanitary sewers serve approximately 164 million people nationwide.⁹

Although most of these systems were built more recently than combined sewer systems, they are aging and deteriorating rapidly. A nationwide survey of 42 treatment plants found some system components that have been in use for as long as 117 years; the average is 33 years.¹⁰ As populations and sewer loads increase and rehabilitation and maintenance schedules lag, pipes can deteriorate and break, spilling sewage directly onto streets or into waterways.

The EPA has estimated that 23,000 to 75,000 sanitary sewer overflows (SSOs) occur annually, discharging a total of 3 billion to 10 billion gallons per year. Nearly 70 percent of sewage overflows from lines carrying human waste are due to obstructions such as tree roots or grease clogs, line breaks, and mechanical failures.¹¹

Wet weather places demands on sanitary sewer systems even though these systems do not carry stormwater runoff. Rainwater can enter the system by seeping through manholes and by falling onto the surface of the treatment units during

rain events; this can lead to the discharge of raw sewage from manholes, overflowing pipes, and treatment plant bypasses. According to an EPA report, although only 26 percent of sanitary sewer overflows nationwide were caused by wet weather events and related inflow and infiltration between January 2001 and December 2003, these events accounted for nearly 75 percent of the total SSO volume discharged.¹²

In January 2001, the EPA proposed SSO regulations that would have required improved capacity, operation, and maintenance as well as public notification when overflows occur. The Bush administration shelved this initiative, but the Obama administration's EPA announced in June 2010 that it would consider a suite of actions to address SSOs. During several "listening sessions," participants encouraged the EPA to update regulations with respect to SSOs. However, staff and budget limitations kept the agency from doing so.¹³

Inadequately Treated Sewage

Sewage plants near coastal waters tend to serve densely populated, rapidly growing urban areas. When too many homes and businesses are hooked up to a sewage treatment plant, the plant is prone to more frequent bypasses and inadequate treatment. Moreover, sewage treatment plants can and do malfunction as the result of human error, failure of old equipment, or unusual conditions in the raw sewage. When that happens, raw or partially treated sewage may be discharged into coastal waterways and their tributaries. Some sewage systems also bypass all or a portion of their treatment plants when flows exceed capacity during rain events.

HUMAN SEWAGE FROM SEPTIC SYSTEMS AND BOATING WASTE

Septic Systems

About one-third of new construction and 23 percent of U.S. dwellings overall use some kind of septic tank or on-site waste disposal system.¹⁴ If not sited, built, and maintained properly, septic systems near the coast can leach wastewater into recreational waters, contaminating bathing beaches. Malfunctioning septic systems at just a few nearshore properties can result in beach water contamination that is significant enough to trigger a beach closure. Even when a failing septic system is located inland, runoff can carry bacteria into streams that empty into recreational waters. Unfortunately, homeowners often do not adequately maintain their septic systems. Studies reviewed by the EPA cited failure rates of 10 percent to 20 percent.¹⁵ Despite this, there is no federal regulatory program to control waste from septic systems, and local governments and states rarely inspect these systems sufficiently to prevent failures.

Boating Waste

Marinas are generally located in areas that are naturally sheltered or where a breakwater has been constructed. This shelter results in reduced circulation of clean water around the docks, which allows boating waste to accumulate and

pose a serious health threat. Waste may also be discharged improperly from boats that are in use, posing a health and aesthetic threat to bathing beaches.

Federal law requires boats with onboard toilets either to treat the waste with chemicals before discharging it or to hold the waste and later pump it out into a sewage treatment plant. Also, the federal Clean Vessel Act (CVA) of 1992 provides federal grant money to states for building pump-out and dump stations in marinas so boaters can dispose of human waste in an environmentally sound manner. However, a government watchdog report from 2004 found limited oversight of the adequacy of pump-out facilities in many areas.¹⁶

AGRICULTURAL DISCHARGES AND AGRICULTURAL RUNOFF

Agricultural pollution affects nearly 40 percent of the country's tainted rivers and streams.¹⁷ The production of farm animals has increasingly shifted toward huge, industrial-scale operations where large numbers of animals are confined together. These concentrated animal feeding operations (CAFOs) can produce vast quantities of manure that far exceed the assimilation capacity of crops and pastures. Runoff from farms and animal feeding operations may contain high concentrations of pathogenic animal waste.

CLIMATE CHANGE AND ITS EFFECT ON WATER QUALITY

Beach water quality is generally adversely affected by increased rainfall. Scientists agree that in many regions of the United States, climate change will increase the frequency and magnitude of rain and large storms; will cause more runoff, coastal flooding, and coastal erosion; and will bring warmer water and air temperatures. These changes will exacerbate the existing causes of beach water pollution that threaten public health. In fact, the Intergovernmental Panel on Climate Change found that "[w]aterborne diseases and degraded water quality are very likely to increase with more heavy precipitation."¹⁸

In particular, global climate change is expected to increase the amount of rainfall in some regions where combined sewer systems are concentrated. In the Great Lakes region, climate modeling predicts that the regional average annual CSO frequency between 2060 and 2099 will increase by 13 percent to 70 percent.¹⁹

Even in areas that have separate sewer systems, like much of the West, an increase in extreme rainfall events can lead to more pollution in coastal waters via increased stormwater runoff. For instance, in California, warmer temperatures can mean more winter precipitation that falls as rain and less that falls as snow, leading to more winter runoff. More winter runoff over saturated soils will result in larger sediment flows and more bacteria in beach water.

In the Great Lakes region, warmer temperatures can lead to another source of pollution: algal blooms. *Cladophora*, a green alga that grows on the bottom of the Great Lakes, thrives in warmer temperatures.²⁰ Filter-feeding invasive species, such as quagga mussels, also contribute to the proliferation of algae by clearing the normally murky waters of phytoplankton and other microorganisms. Sunlight that is able to penetrate to the lake floor encourages the growth of large mats of algae.²¹ These foul-smelling mats can break free and eventually accumulate on beaches, becoming breeding grounds for *E. coli* and enterococci.²² As temperatures increase, the Great Lakes states are seeing an abundance of algae growth and subsequent beach closings earlier in the year.²³

Nitrogen and phosphorus pollution from stormwater runoff, agricultural runoff, water treatment plants, and CSOs also spur the growth of algae. Large, harmful algal blooms (HABs), such as blooms of cyanobacteria (blue-green algae), produce toxins that accumulate in the body and pose a health threat to humans and wildlife.²⁴ Acute exposure to the hepatotoxin microcystin can lead to skin irritation and gastrointestinal illness, and chronic exposure can result in increased liver disease and even death.²⁵

BEACHGOERS

In the 2005 study “Outbreaks Associated with Recreational Water in the United States,” researchers found that bathers themselves are an important localized source of contamination leading to illness outbreaks.²⁶ All swimmers release fecal organisms when they enter the water in a process called bather shedding. Fecal accidents are also a source of pathogens, as are diaper-age children if care isn’t taken to ensure that their wastes are kept from entering the water. The presence of *E. coli* and coliform bacteria has been shown to correlate with the number of visitors and periods of high recreational use (generally the summer and weekends).²⁷

WILDLIFE AND PET WASTE

Municipalities sometimes list waterfowl as the cause of beach closings or advisories. During migration season, excessive populations of waterfowl can gather at beaches or in suburban areas where their waste can be carried by runoff into recreational waters. Pet waste deposited on or near the beach also contains pathogens that can wind up in beach water when pet owners do not pick up and properly dispose of it. The fecal matter from these animals can overload the capacity of a beach to absorb wastes, particularly if there is no vegetation around the beach.



MARINE DEBRIS AND PLASTIC POLLUTION

Although not monitored as part of the BEACH Act, solid waste, particularly plastic items, can heavily affect beaches and beach water quality. Waste litters the landscape, and much of it ends up on our shores and in our lakes, rivers, and oceans, where it kills marine life, poses navigational hazards, and impacts local economies and potentially human health. While marine debris includes a range of man-made waste, the vast majority of marine debris is plastic.²⁸ In August 2013, NRDC published *Waste in Our Waterways*,²⁹ which reported data received from 95 local governments in California. The report showed that cities, towns, and taxpayers are shouldering significant costs to stop litter from becoming pollution that harms the environment as well as tourism and other economic activity.

The most effective way to stop plastic pollution in our oceans is to make sure it never reaches the water in the first place. NRDC is helping to stop plastic pollution³⁰ by advancing policies that encourage the switch to reusable or recyclable packaging, especially phasing out the use of single-use plastic bags. NRDC is also working to incentivize producers to use less plastic packaging or design fully recyclable packaging, helping to improve recycling infrastructure, and supporting other activities that prevent plastic waste from polluting our oceans and beaches.

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