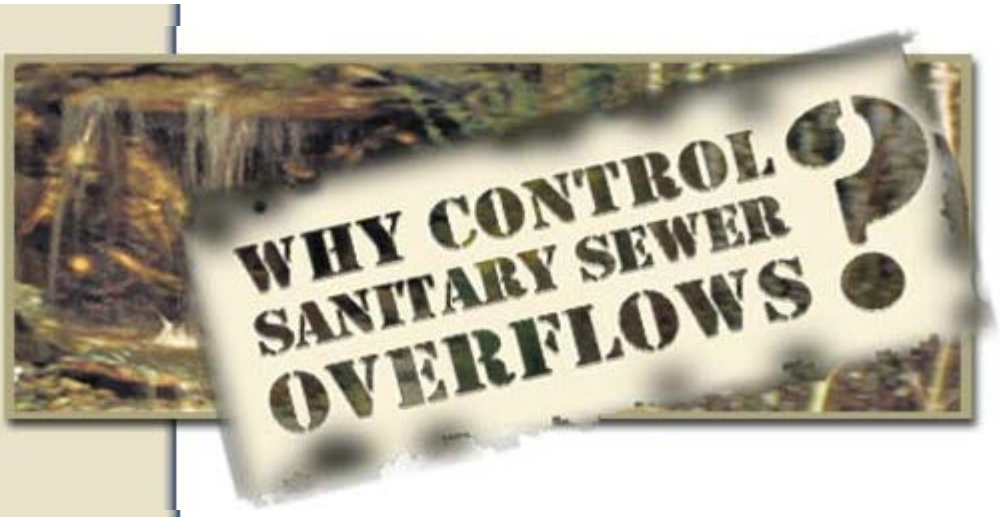

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Overview

Sanitary sewer overflows (SSOs) are releases of untreated sewage into the environment. They have always been illegal under the Clean Water Act, but EPA's proposed SSO Control Rule will clarify the prohibition and provide a program for helping municipalities track and report activities undertaken to control SSOs.

Why Control Sanitary Sewer Overflows?

Sewer infrastructure represents an enormous public asset that accounts for trillions of dollars worth of local, state, and federal investment over the last century. Most collection system projects were spurred by a strong public demand for relief from unsanitary, unsightly, and smelly sewage problems that plagued many areas of the country, contaminating water and causing deadly disease outbreaks.

Much of the nation's sewage collection infrastructure is between 30 and 100 years old, placing them at increased risk for leaks, blockages and malfunctions due to deterioration. The longer sewer collection system problems go unresolved, the more serious they become, placing vital public assets at risk of further degradation, posing an unacceptable risk to human health and the environment, damaging public and private property, and impacting state and local economies.

For some communities, implementation of the proposed SSO Rule will require significant additional investment to replace, repair, or expand parts of the system. For others, better operation and maintenance practices will resolve many of the problems that lead to SSOs.

Causes of SSOs

When an SSO occurs, the cause is usually listed as a recent, immediately traceable condition, such as a pipe break or pump failure. However, merely

repairing the ruptured pipe without understanding the underlying cause of its failure may not protect against future SSOs. The major causes leading to SSOs include age, lack of maintenance, poor operational procedures, and inadequate flow capacity.

Many sewer system failures are attributable to natural aging processes, such as:

- Years of wear and tear on system equipment such as pumps, lift stations, check valves, and other moveable parts that can lead to mechanical or electrical failure;
- Freeze/thaw cycles, groundwater flow, and subsurface seismic activity that can result in pipe movement, warping, brittleness, misalignment, and breakage; and
- Deterioration of pipes and joints due to exposure to saltwater or other corrosive substances.

Lack of maintenance exacerbates age-related deterioration. Systems that are not routinely cleaned and repaired experience more frequent clogged and collapsed lines due to root growth and accumulation of debris, sediment, oil and grease. Similarly, the condition and function of mechanical equipment depreciates much faster without regular maintenance. Regular inspection and cleaning can eliminate many of these problems and keep the system functioning smoothly.

Not only do collection system bottlenecks and pipe breaks lead directly to SSOs, but they also exert hydraulic stress on other parts of the system, resulting in an expanding web of failures.

Operational procedures that lead to SSOs include mistakes, such as accidentally activating a pump without ensuring that all necessary check valves are in position, and disregarding or disconnecting available warning mechanisms, such as warning bells and lights.

Rapid development has also caused sewage flows to exceed system capacity in a number of communities. Some have tried to be proactive, imposing growth restrictions or building moratoriums until sewer capacity catches up. Many more are uncertain of the actual design capacity of their sewer systems, or do not adequately consider it in their planning process. Capacity-constrained areas may need additional miles of sewer pipe, bigger interceptors, more underground storage, or additional treatment capacity to control their overflows.

Any of these causes, by itself or in combination, can set the stage for an SSO.

How Big is the Problem?

There are about 19,500 sewer systems nationwide designed to handle an average daily flow of roughly 50 billion gallons of raw sewage.

SSO reporting requirements vary from state to state, and many go unreported. However, based on a sampling of news reports during 2000, 59 SSOs in 18 states resulted in the release of an estimated 1.2 billion gallons of sewage. Of these reported SSOs, one of the most serious was an estimated 72-million-gallon release into Florida's Indian River that resulted in drinking water advisories and beach closures throughout most of the state.

A number of states did participate in voluntary monitoring and reporting of SSOs. In 1999, 122 separate SSO events were reported in 13 states and the U.S. Virgin Islands. In another 36 events, SSO was listed as one of the elements leading to beach contamination and closure (NRDC 2000). Several states, including California and Texas, have passed laws mandating reporting of SSOs.

Impacts of SSOs

Human Health

Raw sewage contains disease-causing pathogens, including viruses, bacteria, worms, and protozoa. Diseases resulting from enteric pathogens range from stomach flu and upper respiratory infections to potentially life-threatening illnesses such as cholera, dysentery, Hepatitis B, and cryptosporidiosis. Children, the elderly, and people with suppressed immune systems face added risk of contracting serious illnesses. When SSOs contaminate public places and waters of the U.S., people can be at risk of exposure to the untreated sewage when:

- **Swimming in open water**. Between 1997 and 1998, the CDC recorded 1,387 cases of enteric illness contracted during nine outbreaks among swimmers in lakes, ponds, rivers, and canals. Although the source of the pathogens wasn't listed in the CDC survey, the disease-causing organisms were consistent with those found in human sewage, including E. coli, Cryptosporidium, and a Norwalk-like virus (CDC 2000). Health professionals suspect that the actual number of outbreaks resulting from open-water swimming is many times this number, but most cases go unreported.
- **Drinking from a contaminated community water supply**. In June, 1998, 1,300 people in Austin, Texas fell ill with cryptosporidiosis after an SSO in Brushy Creek flowed through underground fissures into an aquifer supplying five municipal wells (CDC 2000). In September 2000, drinking water alerts were issued to residents of Springfield, Missouri and several neighboring communities when a million-gallon SSO entered Goodwin Hollow Creek, an underground stream that feeds several springs and private water wells (MSNBC 2000).
- **Eating contaminated fish or shellfish**. Shellfish are bottom-dwelling filter feeders that pass large quantities of water through their systems. They accumulate diseases, bacteria, and biotoxins and pass them on to humans that eat them. Fish that prey on

contaminated shellfish or contract diseases themselves can also make people ill.

Recreation

Every year, vacationers take 1.8 billion trips to a public waterfront. About a fourth of them, or 45 million, come to boat, swim, or fish - activities that can include primary and secondary contact with the water (NRDC 1998). Each year, tourism dollars are lost because hundreds of coastal beaches are closed due to SSO contamination, often repeatedly or for extended periods. In 1999, 7,214 beach closings and advisories were issued, 20% due to SSOs. Beach closings took place in 13 states, affecting the Pacific, Atlantic, and Gulf Coasts; the Great Lakes; and many smaller inland streams, lakes, and reservoirs. (NRDC 2000).

Sport fishing, which also benefits local economies, is impacted by SSOs when fisheries become less productive due to poor water quality. Nearly 17 million marine sport anglers took 68 million fishing trips in 1997 and caught 366 million fish, 50% of which were released. In some fisheries, recreational anglers harvest as much, if not more, fish than commercial fisherman (CERI 1999).

Natural Resource Impacts

According to EPA's National Water Quality Inventory: 1998 Report to Congress (EPA 2000), 40% of U.S. waterways monitored by states during 1998 were found to be impaired. In rivers, streams, and estuaries, the major contaminants contributing to the impairment were pathogens, nutrients, and metals - all contaminants typically found in sewage. Although it is hard to gauge the importance of SSOs in the overall problem, they are suspected as a contributing factor.

The environmental impacts of sewage include hypoxia, harmful algal blooms, habitat degradation, floating debris, and impacts to threatened or endangered species (CERI 1999). According to the U.S. Fish and Wildlife Service, more than 50% of threatened and endangered species are water-dependent (USFS 2000).

Public and Private Property Damage

An untold number of private basement backups occur each year. In addition to the problem of human exposure, these spills can cause structural damage to building frames and foundations as well as water damage to electrical and gas appliances that are typically located in the basement. They can also damage or destroy floor and wallcoverings and personal property. The cost of cleaning up a

sewage spill has been estimated at between $700 and $4,000 (EPA 1999). SSOs frequently spill into homeowner yards, damaging landscaping, driveways, and outside possessions.

Municipal property damage from a major SSO can be severe. Communities pay billions per year to clean up and repair overflow damage to sewer infrastructure, roads and other transportation assets, parks and recreation areas, and municipal water supplies and treatment facilities.

Other Economic Impacts

Shellfish Beds and Fisheries

In 1995, 6.7 million acres of shellfish beds were restricted, 72% of them due to water pollution. The primary basis for harvest restriction is the concentration of bacteria typically found in sewage. Bed closures can have a devastating impact on local economies that rely on commercial shellfishing. Demand for shellfish has roughly doubled since 1966 and continues to grow, placing pressure on coastal states to improve water quality to open up more shellfish nurseries to harvest (NMFS 1999).

Commercial and recreational fishing suffers when SSOs impact fishing waters. Polluted water creates lowered fishery productivity, reduced and more costly harvests, and weakened consumer confidence. These impacts on the fishing industry also impact local economies in coastal regions. Each year, commercial fishing enterprises spend millions on boats, motors, docking fees, fuel, etc. Industry cutbacks mean loss of income to local service providers in small fishing communities that have grown up around the fishing industry and have few replacement options. They also lead to a reduction in the food supply, which leads to higher prices for consumers and more imports. (NMFS 2000).

Manufacturing.

Manufacturers need access to adequate wastewater collection and treatment facilities to sustain or increase production. In communities that are experiencing capacity problems and/or SSOs, manufacturers may not be able to obtain increased POTW discharge limits needed to expand, forcing them to relocate. Loss of major manufacturers can cripple a local economy (WIN 2000).

Property Values

Property with access to surface water is worth more to homeowners and businesses if the water is perceived to be of high quality. Conversely, neighborhoods that experience chronic SSOs or perceived impairments to water quality drop in value (WIN 2000).

Implications for Small Communities

Many small towns have limited resources for public works projects and limited access to technical resources needed to fully implement the measures of the proposed SSO Control Rule. If SSOs are occurring and

posing a threat to human health or the environment, all requirements of the rule must be followed as written. However, in many communities, SSOs are limited or nonexistent and do not impact human health or the environment. In this situation, each of the program requirements must be addressed, but elements that would otherwise be cost-prohibitive and may not be directly applicable to the local collection system may be modified as appropriate.

For Additional Information

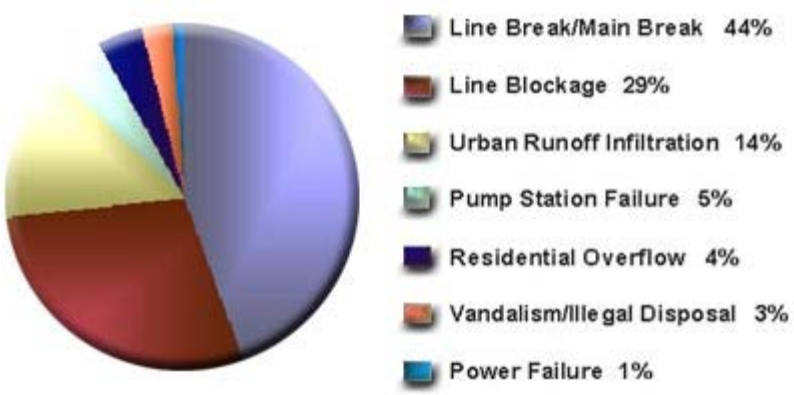
Contact the U.S. EPA Office of Wastewater Management at:

- Phone : 202-564-9545
- Internet: www.epa.gov/npdes/sso

Or, contact your NPDES Permitting Authority. (A list of names and telephone numbers for each U.S. EPA Region and many state contacts is available through the SSO home page.

Causes of SSOs

A high percentage of SSOs occur as a result of system deterioration and/or lack of maintenance. The chart below summarizes the events that caused 105 SSOs that led to beach closures in 1999 (NRDC 2000). As the chart shows, more than 70% of the SSOs were attributed to line/main breaks or line blockages.



Most of the line and main breaks were reported in old pipes - many that were already identified as unstable or that had experienced failures in the recent past.

Of the line blockages reported, the most common cause was buildup of oil and grease. The second-most important cause was tree root intrusion into the line.

Studying beach closure data, which is tracked via survey by the Natural Resources Defense Council and EPA, is one of the best ways to understand the impacts of urban wet weather pollution resulting from SSOs, combined sewer overflows, storm water runoff, and other causes. If you want to read more about beach closures (due to SSOs and other causes), check the following sites:

- EPA's Beach Watch
- NRDC's Testing the Waters 2000: A Guide to Water Quality at Vacation Beaches

Diseases Associated With Sewage

It is critical to keep raw sewage out of the environment and away from people. Sewage pathogens have been linked to many illnesses, ranging from mild flu-like symptoms to serious disease, organ failure, and sometimes even death. The types of organisms that may be present in sewage, and the potential health effects associated with each, are described in the table below.

Organism	Health Effects
Viruses, such as Norwalk Virus	• Diarrhea • Gastroenteritis • Hepatitis • Meningitis • Pneumonia • Paralysis • Respiratory infections
Protozoa, such as Cryptosporidium	• Abdominal cramps • Intestinal parasites • Severe diarrhea • Ulcers
Bacteria, such as *Escherischia coli*	• Abdominal pain • Cholera • Food poisoning • Severe diarrhea • Typhoid fever
Helminths (worms)	• Anemia • Chest pain • Digestive problems • Fever • Insomnia • Muscle aches • Vomiting

People get exposed to pathogens by ingesting them, sometimes by accidentally swallowing contaminated water while swimming or drinking it from the tap. Pathogens can also be ingested via contaminated food, such as fish and shellfish that are caught in contaminated water. Once some people contract a pathogen-borne disease, they become carriers of the disease and can infect others through the fecal to oral route. Many healthy adults can fight off the milder forms of sewage-born illness, experiencing flu-like symptoms for a few days and then recovering completely. Others, including elderly people, children, and people with suppressed immune systems, are at greater risk for more severe disease.

Viruses are believed to be the major cause of disease contracted through direct contact with sewage, and are responsible for gastroenteritis, hepatitis, respiratory illness, and other health problems. One of the most common, the Norwalk Virus, is representative of a heterogenous group of viruses, also called small round structured viruses (SRSVs) or the Norwalk-like family of

agents. Common names of the illness caused by the Norwalk and Norwalk-like viruses are viral gastroenteritis, acute nonbacterial gastroenteritis, food poisoning, and food infection.

The protozoan Cryptosporidium parvum causes cryptosporidiosis, a gastrointestinal disease that affects people and animals.Upon infection, this protozoan resides principally in the gastrointestinal tract and goes through its life stages as an intracellular parasite. In the intestines, it forms oocysts (similar to parasite eggs) that are shed in feces and which are the source of infection for new susceptible people.

Bacteria in sewage, such as *Escherischia coli* and enterococci, can cause many diseases and illnesses. Enterococci are bacteria that normally live in the bowel, intestines and digestive tracts of humans.The bacteria help to break down wastes in the body, but can cause urinary tract infections, wound infections and blood infections if they get out of their normal environment. Today, new strains of the bacteria, called VRE (Vancomycin Resistant Enterococcus), have developed a resistance gene to most antibiotics. Since enterococci are found normally in the intestines, every time an antibiotic is taken, the bacteria are exposed. This resistance gene makes it very difficult for doctors to treat a VRE patient. Those most at risk from VRE are people who are already seriously ill.

If you want to learn more about sewage-borne pathogens, here some good internet sites ( ):

- Massachusetts Water Reclamation Authority's informative page on water and germs

Centers for Disease Control Fact Sheets on:

- Swimming Pools/Recreational Water: Information for Parents and Swimmers
- Cryptosporidiosis
- Diarrheageneic Escherichia coli
- Norwalk-like Viruses