United States Environmental Protection Agency
Office of Water (4606)
EPA 916-F-01-032
July 2001

Source Water Protection Practices Bulletin

Managing Sanitary Sewer Overflows and Combined Sewer Overflows to Prevent Contamination of Drinking Water

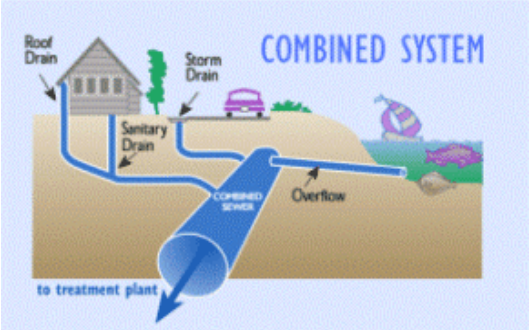
Sanitary sewer overflows (SSOs) are discharges of untreated sewage from municipal sanitary sewer systems as a result of broken pipes, equipment failure, or system overload. Combined sewer overflows (CSOs) are discharges of untreated sewage and storm water from municipal sewer systems or treatment plants when the volume of wastewater exceeds the system's capacity due to periods of heavy rainfall or snow melt. The untreated sewage can be discharged directly into basements, streets, parks, and surface waters including streams, lakes, rivers, or estuaries. This fact sheet focuses on the management of SSOs and CSOs to prevent contamination of drinking water sources; see also the fact sheet on storm water runoff.

Sanitary sewer overflow

OVERVIEW OF SSO AND CSO OCCURRENCE

Most cities and towns started building sewer collection systems over 100 years ago and many of these systems have not received adequate upgrades, maintenance, and repairs over time. In addition, cities use a wide variety of materials, designs, and installation practices to construct sewer collection systems. Even well-operated systems may be subject to occasional blockages or structural, mechanical, or electrical failures.

Sanitary sewer collection systems collect sewage and other wastewater and transport it to a facility for proper treatment and disposal. Sanitary sewer overflows occur when untreated sewage is discharged from the collection system due to pipe blockages, pipe breaks, infiltration and inflow from leaky pipes, equipment failures, and insufficient system capacity.



Combined sewer systems are designed to carry sanitary wastewater and storm water in the same pipe to a sewage treatment plant during "dry weather." In periods of rainfall or snow melt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, lakes, or estuaries.

WHY IS IT IMPORTANT TO MANAGE SSOs AND CSOs NEAR THE SOURCES OF YOUR DRINKING WATER?

Combined sewer overflow

EPA estimates that there are at least 40,000 SSOs and thousands of CSOs each year. The untreated sewage and wastewater from these overflows can contaminate our waters, causing serious water quality problems and threatening drinking water supplies. It can also back up into basements, causing property damage, and create threats to public health for those who come in contact with the raw sewage and wastewater.

SSOs and CSOs can carry bacteria, viruses, protozoa, helminths (intestinal worms), and inhaled molds and fungi directly into source water, and can cause diseases that range in severity from mild gastroenteritis to life-threatening ailments such as cholera, dysentery, infectious hepatitis, and severe gastroenteritis. People can be exposed to the contaminant from sewage in drinking water sources, and through direct contact in areas of high public access such as basements, lawns or streets, or water used for recreation.

When sewage floods basements, the damaged area must be thoroughly cleaned and disinfected to reduce the risk of disease. Local health officials should be consulted to identify measures to be taken to remove the sewage and reduce health risks. Pesticides and other chemicals tend to be stored in basements. Where water from flooded basements that contain spilled chemicals is pumped or released to the ground outside the building, it may percolate through the soil and contaminate the ground water.

Under the Clean Water Act, discharges from point sources into waterways are prohibited unless authorized by a National Pollutant Discharge Elimination System (NPDES) permit. NPDES permit requirements for municipal wastewater treatment plants must include limitations based on secondary treatment, including limits on oxygen-demanding pollutants and suspended solids, as well as any other more stringent requirements (such as disinfection) necessary to meet state water quality standards. Although CSOs are considered point sources, they are not subject to secondary treatment requirements; instead, NPDES permits for combined sewer systems are based on the provisions of EPA's 1994 CSO Control Policy, which provides for implementation of minimum technology-based controls and long-term control plans to meet water quality standards. SSOs, on the other hand, typically are not permitted and are generally prohibited. EPA is considering how to better standardize NPDES permit conditions to clarify this prohibition and provide for better operation and maintenance of sanitary sewers, increased attention to system planning, and better notification to the public in the event of an overflow.

AVAILABLE PREVENTION MEASURES TO ADDRESS SSOs AND CSOs

A variety of nonstructural and structural prevention measures are available to address SSOs and CSOs. Nonstructural activities tend to be more general and applicable to most sewer collection systems. They include, but are not limited to, visual inspections, monitoring and maintenance programs, employee training, and public education. Structural activities tend to be more site-specific and can be very expensive to incorporate. They involve upgrading the collection system, constructing wet weather storage facilities, or building a new sewer collection system. The most effective prevention plans encompass both structural and nonstructural activities.

Please keep in mind that individual prevention measures may or may not be adequate to prevent contamination of source waters. Most likely, individual measures should be combined in an

overall prevention approach that considers the nature of the potential source of contamination, the purpose, cost, operational, and maintenance requirements of the measures, the vulnerability of the source waters, the public's acceptance of the measures, and the community's desired degree of risk reduction. Some of the more conventional prevention measures are described below.

Cities estimate that 60 percent of SSOs come from leaking service lines, and ***monitoring and maintenance programs*** are a key component in preventing them. Sanitary sewer collection system operators should monitor their sewer lines, service connections, and sewer line joints regularly to detect cracks and misalignments between joints that can cause leaks of untreated sewage. Service connections must remain tightly sealed to prevent additional leaks from occurring. Properly maintaining the sewer collection system allows parts of the sewer system to be repaired or replaced, if necessary, before they break and cause more serious and expensive problems.


Storm drain

Maintenance programs should also include cleaning sewer lines, connections, and pumps. If trash and sediments build up in the sewer lines, they will block the sewage from flowing to the collection system or treatment plant. As the flow becomes blocked, the pressure on the lines increases and the system becomes surcharged leading to overflow of sewage out of manholes and into the street. Surcharging can also cause sewage backup into basements of homes connected to the line. In some cases, the lines may break and collapse, causing raw sewage and wastewater to percolate through the soil to ground water.

Employee training is an important tool for preventing contamination from sewer overflows. Employees should be trained on how to run the equipment, and shut it down, if necessary, to prevent overflows. Employees should have access to and knowledge of contingency and emergency response plans. They should be aware of any potential for overflow events and be prepared to take appropriate action to prevent sewage from entering the source water.

Public education involves informing developers and the public of how sewer overflows occur, and what they can do to prevent them. Developers should be aware of the sewer collection design capacity, and plan accordingly. As new communities are developed, the additional sewage can overload the collection system. Developers should check to make sure the new sewer lines are compatible with the existing sewer system. If the lines do not fit the joints, then the sewage can leak out of the system, or rain water or snow melt can infiltrate the cracked lines and cause overflows. Developers should also make sure that sewer lines are not placed near trees; the roots can grow into the sewer lines and crack them. The community can help prevent overflows by conserving water and flushing only appropriate items. Citizens should also be aware that hazardous substances, pesticides, and fertilizers could be carried off in storm sewers and increase the deleterious effects of CSOs.

Visual inspections of the surface and internal areas (pipelines and manholes) ensure that the equipment is running properly and efficiently. Operators should pay specific attention to sunken areas in the groundcover above a sewer line and areas with ponding water. Operators should perform these inspections on a daily or weekly basis at low flow times (e.g., overnight), depending on the system size or frequency of overflows, and log their findings. Inspection reports provide managers with pertinent information and keep them informed on how the system is running. This will help avoid equipment failure and resulting overflows.

Incorporating system upgrades is another viable option, but this can be very expensive. As sewer systems become older, sewer lines and connections have to be repaired or replaced. Equipment also has to be replaced or updated as new technology becomes available. As new communities are developed, new sewer lines will be added to the collection system. Eventually the sewer system will reach its design capacity and will have to expand or a new collection system will have to be built.

Adding a wet weather storage facility such as an overflow retention basin to a sewer collection system will reduce SSOs and CSOs by capturing and storing excess flow. The stored volumes of sewage and storm water are released to the wastewater treatment plant after the wet weather event has subsided and the treatment plant capacity has been restored. Retention basins are designed to control both flow rate and water quality. These basins can remove sediment and grit from the effluent before being released to the treatment plant. Retention basins can be constructed either on- or off-line from the sewer collection system. On-line basins are connected to the sewer system and retain excess flows when the inlet flow surpasses the outlet capacity. Off-line basins are connected in parallel to the sewer system and receive flows only during wet weather periods. Retention basins are typically earthen basins or covered or uncovered concrete tanks. Covered basins are more widely used because they are safer and provide better odor control and safety conditions.

Eliminating direct pathways of sewage overflows to source water is an effective measure to prevent contamination. Regrading areas around pump stations and "vulnerable" manholes can divert overflow sewage from entering surface water directly. In addition, plugging storm water drainage wells (i.e., drywells used to discharge storm water underground) in the vicinity of pump stations and manholes would eliminate conduits for sewage overflow to enter the ground water.

CSO control technologies include a number of engineering methods such as deep tunnel storage, in-system control/in-line storage, off-line near-surface storage/sedimentation (mentioned earlier), vortex technologies, and disinfection. In urban areas, where space constraints are severe, deep tunnel storage can be a viable option for managing CSOs. Large volumes of combined sewage can be diverted and stored in deep tunnels during a storm event. The stored combined sewage is then pumped out from the tunnel and conveyed to sewage treatment plants after the storm event subsides. Vortex separators regulate flow and cause solids to separate out from the combined flow, therefore allowing clarified flow to be discharged to surface water. Disinfection using liquid hypochlorite is the most common practice in controlling CSOs, and alternatives such as ultraviolet light, ozone, or gaseous chlorine are also available.

FOR ADDITIONAL INFORMATION

These sources contain information on sanitary sewer overflows and combined sewer overflows. All of the documents listed are available for free on the Internet.

Earth Day Indiana Handbook 1997-98. *Combined Sewer Overflows...what you should know*. Retrieved February 15, 2001, from the World Wide Web: http://www.k12.in.us/earthdayind/handbook2.html.

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U.S. EPA, Office of Wastewater Management. *Wet Weather*. Retrieved February 14, 2001, from the World Wide Web: http://www.epa.gov/owm/wet.htm.