

Compliance Tips for Small, Mechanical Wastewater Treatment Plants

Background on this Compliance Advisory

This advisory is directed to owners and operators of small publicly owned wastewater treatment works (POTWs) and small private wastewater treatment plants, both commonly referred to as wastewater treatment plants (WWTPs). It is intended to provide small WWTPs with information that will help them comply with their National Pollutant Discharge Elimination System (NPDES) permit effluent limits. Smaller WWTPs are a particular focus of an EPA National Initiative to reduce significant non-compliance (SNC) because 60% of recent NPDES SNC violations occurred at these facilities. EPA reminds WWTP operators of their responsibility to fully comply with their NPDES permits, and that compliance assistance is available. As a result of EPA's focus in this important area, NPDES permittees, regardless of facility size or type, will see EPA and states putting increased emphasis on identifying, addressing and resolving SNC violations using enforcement and other compliance tools. Note that, while this alert focuses on operational issues, some operators of small mechanical WWTPs are also failing to submit required discharge monitoring reports (DMRs), or are submitting incomplete or inaccurate DMRs that can mask serious violations. If you are having trouble completing or submitting your DMRs, contact your permitting authority and request assistance. Increased compliance will improve surface water quality and reduce potential impacts on drinking water supplies. For more information about EPA's efforts to reduce SNC,



+see: [Reducing Significant Non-Compliance with National Pollutant Discharge Elimination System \(NPDES\) Permits.](#)

Surface Water Pollution from Small WWTPs

Pollutants commonly discharged by small WWTPs at SNC violation levels include oxygen-demanding substances (e.g., biochemical oxygen demand (BOD), chemical oxygen demand (COD)), total suspended solids (TSS), pathogens (i.e., fecal coliform/E. coli), nutrients, and total residual chlorine. The tables included below provide information on violation causes and potential solutions. Table 1 (below) starts by outlining some common issues experienced at WWTPs that can cause serious permit limit exceedances.

Table 1. WWTP Processes and Common Issues

WWTP Process	Common Issues That Can Lead to Noncompliance
Primary Treatment (solids settling and sludge removal)	<ul style="list-style-type: none"> ➤ Bar screen broken ➤ Clarifier/sedimentation tanks out of service ➤ Short circuiting of wastewater flow ➤ Broken/uncalibrated process controls
Secondary Treatment	<ul style="list-style-type: none"> ➤ Inadequate retention time and pH buffering (alkalinity), low food to mass ratio, low soluble BOD (low influent loading) ➤ Insufficient aeration/dissolved oxygen ➤ Inadequate process control tools and methods ➤ Clarifiers out of service

(conversion of pollutants into less noxious substances)	<ul style="list-style-type: none"> ➤ Solids loss from clarifiers
Tertiary Treatment (filtration)	<ul style="list-style-type: none"> ➤ Filters (clogged) bound by sludge ➤ Hydrogen sulfide generation in the carbon contactor
Disinfection Chlorine	<ul style="list-style-type: none"> ➤ No chlorine ➤ No dechlorination ➤ Chlorine contact tank full of biological solids
UV	<ul style="list-style-type: none"> ➤ Poor effluent transmittance ➤ Build-up of scale on bulbs ➤ Electricity is off

Common Underlying Causes of Effluent Violations at Small WWTPs

Small systems often have difficulty keeping trained operators and obtaining adequate funding for operations, maintenance, and system upgrades needed to achieve and maintain compliance. Table 2 can serve as a critical starting point for identifying solutions to common causes of effluent violations. (Before making any major process or operation and maintenance changes, operators are advised to check with their permitting authority.)

Table 2. Effluent Violations at Small WWTPs: Root Causes and Potential Solutions

Topic	Common Root Causes	Recommended Potential Solutions
Resource scarcity	<p>Resource scarcity may involve one or more of the following conditions:</p> <ul style="list-style-type: none"> ➤ Inadequate funding or community commitment to make resources available for infrastructure upgrades and/or maintenance. ➤ Inadequate funds or ability to hire and retain certified operators. ➤ Inadequate funds to hire contract wastewater engineers to provide operational oversight. ➤ Lack of public awareness of the need to invest in infrastructure upgrades and/or maintenance. ➤ Operators are not given the resources needed to: purchase process control testing equipment, treatment chemicals or haul sludge. 	<ul style="list-style-type: none"> ➤ For help and information on funding sources, such as loans, grants, accessing State Revolving Funds, bonds, etc., contact your local Environmental Finance Center. ➤ Determine if user fees need to be increased to cover operation, maintenance, and replacement costs of treatment equipment. ➤ Use asset management to pursue and achieve sustainable infrastructure. Draft a wastewater budget based upon proper operations and maintenance: Asset Management for Water and Wastewater Utilities. ➤ Encourage best planning and management practices by implementing Capacity, Management, Operation and Maintenance (CMOM) programs. ➤ Explore the Water Finance Clearinghouse. ➤ Educate municipal leadership. ➤ Engage the public by conducting public outreach and education on benefits and true costs of wastewater collection, transmission, and treatment. Develop an insert for the wastewater billing or post information on the utility's website.
Operation Problems	<ul style="list-style-type: none"> ➤ Operator error is often due to lack of training or being over-extended. ➤ Errors may also occur when written standard 	<ul style="list-style-type: none"> ➤ Seek training among the many low or no cost online sources, such as WaterOperator.org - Process Control Resources. ➤ Join listservs and organizations that conduct training such as U.S. EPA NPDES Training, your state permitting




Table 2. Effluent Violations at Small WWTPs: Root Causes and Potential Solutions

Topic	Common Root Causes	Recommended Potential Solutions
	<p>operating procedures (SOPs) and documented operational data are not available or are not implemented.</p> <ul style="list-style-type: none"> ➤ Plant configuration may lack operational flexibility. ➤ Operational issues, such as manifold blower(s) used to run all air components and cycled on and off to optimize biological treatment; airlift return activated sludge (RAS) pumps are out of service. ➤ Operators may need more training on activated sludge process control and troubleshooting, which is critical to compliance. 	<p>agency, professional associations such as Association of Clean Water Administrators (ACWA), Water Environment Federation (WEF), National Association of Clean Water Agencies (NACWA), American Water Works Association (AWWA) or your local technical assistance providers like Rural Community Assistance Partnership (RCAP) and the National Rural Water Association (NRWA),</p> <ul style="list-style-type: none"> ➤ Seek collaboration with neighboring operators with similar conditions or process units. Consult with your state or EPA Region, who can use an ECHO-gov CWA NPDES National POTW Pairing Dashboard to help put you in touch with operators at similarly sized plants that are successfully meeting their effluent limits. ➤ Develop written SOPs using resources at WEF.org or EPA Guidance for Preparing SOPs. ➤ Seek training on troubleshooting: Troubleshooting Noncompliance at the Smallest Wastewater Treatment Plants: Part I and Troubleshooting Noncompliance at the Smallest Wastewater Treatment Plants: Part II.
Equipment failure	<ul style="list-style-type: none"> ➤ Lack of operator training on its use, failure to follow best management practices, or lack of preventative maintenance planning and/or implementation. ➤ Improper design, installation, and/or construction. 	<ul style="list-style-type: none"> ➤ Seek lessons learned from other operators of new systems. ➤ Find training on best practices for operating and maintaining treatment systems with new technology. ➤ Develop an asset management system that incorporates operation and maintenance plans and tracks equipment that may be nearing end of life and will require capital investment: Developing an Asset Management Program. ➤ Encourage best planning and management practices by implementing Capacity, Management, Operation and Maintenance (CMOM) programs.
Significant changes in system influent volume or strength	<ul style="list-style-type: none"> ➤ Changes to the influent volume and strength are influenced by increased or decreased population, new or fewer industrial users, or excessive wet or dry weather. ➤ Widespread implementation of low-flow fixtures can also contribute to reduced influent volume. 	<p>For communities that have a decreased population:</p> <ul style="list-style-type: none"> ➤ Seek technical assistance and evaluate how current system can be modified to effectively treat the current influent level and strength. ➤ Hire an engineer: http://wateroperator.org/Portals/1/Documents/10112.pdf ➤ Provide education about regionalization: Consolidation of Water and Wastewater Systems: Options and Considerations.



Table 2. Effluent Violations at Small WWTPs: Root Causes and Potential Solutions

Topic	Common Root Causes	Recommended Potential Solutions
		<p>For communities that have increased population:</p> <ul style="list-style-type: none"> ➤ Seek education on financing for expansion and new technology: contact your local Environmental Finance Center. <p>If the plant design includes flexibility, there are operation techniques that can expand capacity to treat high strength flow and wet weather flow such as step feeding for high strength waste streams and contact stabilization for wet weather flows.</p> <p>For systems that have new or increased flow from industrial users:</p> <ul style="list-style-type: none"> ➤ Establish a pretreatment program and revise the sewer use ordinance. ➤ Reduce influent strength by implementing septic hauling for a portion of the wastewater.
<p>Pass-through and interference</p>	<ul style="list-style-type: none"> ➤ Pass-through and interference from industrial users and institutions (high strength or non-compatible influent) can cause or contribute to effluent violations. ➤ Small plants that accept septage may experience resultant effluent violations. 	<ul style="list-style-type: none"> ➤ In municipalities without a pretreatment program, consider establishing a program pretreatment program. ➤ Revise and enforce the sewer use ordinance. ➤ Seek training for states and municipalities on pretreatment program implementation, including handling of slug loads. ➤ Conduct outreach on effective municipal level Enforcement Response Plans (escalation of enforcement response against non-complying Industrial Users). ➤ Conduct an inventory of WWTPs and industrial users to target likely impacts. ➤ Implement best practices for sampling and treating septage: Septage Management. 
<p>Design flaws</p>	<p>Plants may have design issues:</p> <ul style="list-style-type: none"> ➤ With parallel treatment trains, the flow splitting may be poor. ➤ Plant was designed using a textbook number for raw sewage composition, which may lead to unnecessarily high capacity. ➤ Lack of operational flexibility such as airlift pumps that cannot be turned down; insufficiently sized sludge holding tanks. 	<ul style="list-style-type: none"> ➤ Promote the use of operations manuals rather than engineering manuals (e.g., Design Standards: Wastewater Treatment Plants & Collection Systems < 100,000 gpd). ➤ Adjust valves to improve splitting. ➤ Explore operational changes to limit the effects of the design flaws. ➤ Take treatment units out of service during periods of low loading.

Compliance and Financing Assistance Resources

In addition to the resources listed in Table 2, the following resources can help you correct violations and achieve compliance.

Compliance Assistance Resources

- [Reducing Significant Non-Compliance \(SNC\) with NPDES Permits - Resources for NPDES Permittees and Other Organizations](https://www.epa.gov/enforcement/national-compliance-initiative-reducing-significant-non-compliance-snc-npdes-permits) (<https://www.epa.gov/enforcement/national-compliance-initiative-reducing-significant-non-compliance-snc-npdes-permits>)
- [EPA Small and Rural Wastewater Systems Website and Tools](https://www.epa.gov/small-and-rural-wastewater-systems/tools-training-and-technical-assistance-small-and-rural) (<https://www.epa.gov/small-and-rural-wastewater-systems/tools-training-and-technical-assistance-small-and-rural>)
- WaterOperator.org is a free training resource portal for operators of small systems
- [Rural Community Assistance Partnership Website](https://www.rcap.org/) (<https://www.rcap.org/>)
- [National Rural Water Association Website](http://nrwa.org) (nrwa.org)
- [EPA National Pollutant Discharge Elimination System Website](https://www.epa.gov/npdes/national-pretreatment-program-events-training-and-publications) (<https://www.epa.gov/npdes/national-pretreatment-program-events-training-and-publications>)
- [Activated Sludge Process Control and Troubleshooting Training Manual and Chart Methodology](https://epa.ohio.gov/Portals/29/documents/CAU/Activated%20Sludge%20Process%20Control%20and%20Troubleshooting%20Manual.pdf) (<https://epa.ohio.gov/Portals/29/documents/CAU/Activated%20Sludge%20Process%20Control%20and%20Troubleshooting%20Manual.pdf>)
- [NetDMR Support Portal](https://netdmr.zendesk.com/hc/en-us) (<https://netdmr.zendesk.com/hc/en-us>)



Potential Funding and Financing Sources

- [Funding Sources for Small and Rural Wastewater Systems](https://www.epa.gov/small-and-rural-wastewater-systems/funding-sources-small-and-rural-wastewater-systems) (<https://www.epa.gov/small-and-rural-wastewater-systems/funding-sources-small-and-rural-wastewater-systems>)
- [EPA Water Infrastructure and Resiliency Finance Center](https://www.epa.gov/waterfinancecenter/efcn) (<https://www.epa.gov/waterfinancecenter/efcn>)
- [Clean Water State Revolving Funds](http://www.epa.gov/cwsrf) (www.epa.gov/cwsrf)

General References

- U.S. EPA, 1998, [How Wastewater Treatment Works... The Basics](https://www3.epa.gov/npdes/pubs/bastre.pdf) (EPA/833/F-98/002). Office of Water, Washington, D.C. (<https://www3.epa.gov/npdes/pubs/bastre.pdf>)
- U.S. EPA, 2004, [Primer for Municipal Wastewater Treatment Systems](https://www3.epa.gov/npdes/pubs/primer.pdf) (EPA/832/R-048/001). Office of Water, Washington, D.C. (<https://www3.epa.gov/npdes/pubs/primer.pdf>)

Disclaimer

This Compliance Advisory addresses select provisions of EPA regulatory requirements using plain language. Nothing in this Compliance Advisory is meant to replace or revise any NPDES permit, any EPA regulatory provision, or any other part of the Code of Federal Regulations, the Federal Register, or the Clean Water Act. EPA recommends that operators consult with their permitting agency prior to making major changes to their systems.