

hydraulic concerns, wastewater associated with peak flows may have low concentrations of oxygen demanding pollutants, which can also decrease treatment efficiencies.

Generally, biological treatment units are designed and operated to maintain a relatively stable population of microorganisms. See 48 FR 52258, 52275 (November 16, 1983). This means that biological treatment units generally cannot be designed to accommodate wide variations in flow volumes and influent strength. Primary clarification units are less sensitive to variations in flow volumes and influent strength. In addition, primary clarification units can be brought into operation and taken out of operation to respond to changes in flow volume.

Many POTW treatment plants have been designed with primary treatment capacity that is significantly greater than the biological treatment capacity. These treatment plants often have multiple primary clarification units that are operated in parallel, with one or more primary clarification units not operating during low flow conditions, and brought into service during high flow conditions. These POTWs typically provide screening and primary clarification of all flows entering the plant, and, in order to protect their biological treatment units, route flows in excess of full capacity of the biological treatment unit around the biological treatment units. In some cases, chemicals are added to the portion of the flow that is routed around the biological treatment units to enhance solids and/or pathogen removal. Another option is to provide other forms of enhanced physical/chemical treatment for the portion of the flow that is routed around the biological units. Some POTWs discharge flows routed around biological treatment units directly to a surface water, while others blend the flows routed around the biological treatment units with flows that have gone through the biological treatment unit (e.g., for disinfection or other advanced treatment) prior to discharge.

Other design and operational options routinely employed to enhance treatment of wet weather flows without damaging biological treatment capabilities include:

- Increasing the size of secondary clarifiers to accommodate a pre-determined amount of peak wet weather flow;
- Providing alternative feed patterns in the aeration basin(s);
- Increasing the returned activated sludge capacities relative to those needed for steady flow;

- Providing flow equalization (*i.e.* short term storage) prior to the biological unit either at the plant or before flows get to the plant; and
- Decreasing peak flow volumes through I/I removal, sewer separation or rerouting flows to a different treatment plant.

See Design of Municipal Wastewater Treatment Plants Fourth Edition, 1998, Water Environment Federal Manual of Practice 8, ASCE Manual and Report of Engineering Practice No. 76, Volume 2, page 11–5; Prevention and Control of Sewer System Overflows Second Edition, 1999, Water Environment Federation Manual of Practice FD–17.

Other facilities may employ other modifications to manage peak wet weather flows. For example, some facilities divert dilute wet weather flows around primary clarifiers to the biological treatment units in order to ensure adequate organic loadings in the biological units. Given the complexity and site-specific nature of collection systems and treatment facilities, site-specific planning processes are necessary to identify the optimal mix of peak wet weather management measures.

Many States have developed detailed design criteria and/or operating practices for municipal wastewater treatment facilities. EPA has also developed guidance on design considerations and operation of POTWs, including guidance on the composite correction program approach to identify and address performance limitations and to obtain improved performance at POTWs. EPA Technology Transfer Handbook: Retrofitting POTWs, 1989, Hegg, B.A., L.D. DeMers, and J.B. Barber. This guidance identifies specific low cost modifications that can be used to optimize an existing facility's performance which can result in significant improvements of performance at many wastewater treatment facilities without major capital improvements. Hegg, B.A., K.L. Rakness, and J.R. Schultz, 1979, *A Demonstration Approach for Improving Performance and Reliability of Biological Wastewater Treatment Plants* EPA 600/2–79–035, NTIS No. PB–300476, USEPA, Cincinnati, OH.

C. NPDES Requirements for POTWs

The CWA requires that most POTWs achieve effluent limitations based upon secondary treatment as defined by EPA and any more stringent limitations necessary to meet water quality standards prior to discharging to waters of the United States. NPDES permits are issued by EPA or States, U.S. Territories, or Tribes authorized by EPA

to do so. Currently, 45 States and one U.S. Territory administer the NPDES permit program. EPA issues NPDES permits in the remaining States and Territories, and in Indian country.

1. Secondary Treatment Regulations

Section 301(b)(1)(B) of the Clean Water Act, 33 U.S.C. 1311(b)(1)(B), requires that publicly owned treatment works (POTWs) achieve effluent limitations based upon secondary treatment as defined by the Administrator of EPA pursuant to section 304(d)(1) of the Act. Section 304(d)(1) of the Act directed EPA to publish information, in terms of amounts of constituents and chemical, physical, and biological characteristics of pollutants, on the degree of effluent reduction attainable through the application of secondary treatment. Section 304(d)(4) of the Act, 33 U.S.C. 1314(d)(4), deems treatment facilities such as oxidation ponds, lagoons, ditches and trickling filters to be the “equivalent” of secondary treatment. That section directed the Administrator to provide guidance on design criteria for such facilities, taking into account pollutant removal efficiencies. Section 304(d)(4) further requires that water quality not be adversely affected by deeming such facilities to be the equivalent of secondary treatment.

EPA promulgated the secondary treatment information regulations at 40 CFR part 133 to define minimum levels of effluent quality for publicly owned treatment works (POTWs) prior to discharge. The secondary treatment regulations were based on performance data for a sample of well-designed and well-operated secondary treatment plants. The 30-day average effluent limitations in the secondary treatment regulations were based on the 95th-percentile value of data representing well-operated POTWs, excluding values attributable to upsets, bypasses, operational errors, or other unusual conditions. With the exception of section 304(d)(4) facilities eligible for treatment equivalent to secondary treatment, the secondary treatment regulations do not otherwise specify the type of treatment process to be used to meet secondary treatment requirements nor do they preclude the use of non-biological facilities. Rather, the basic decisions on the choice of a technology or alternative waste management technique were left to a case-by-case cost-effectiveness analysis. See 48 FR 52258, 52260 (November 16, 1983).

The requirements of the secondary treatment regulations are expressed as concentration limitations (seven-day and 30-day average effluent