

# **Guidance Document for the Discharge of Petroleum Distribution Terminal Effluents to Publicly Owned Treatment Works**

API PUBLICATION 1612  
FIRST EDITION, NOVEMBER 1996

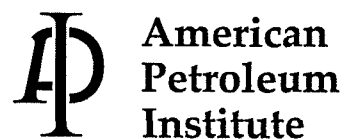




# **Guidance Document for the Discharge of Petroleum Distribution Terminal Effluents to Publicly Owned Treatment Works**

**Manufacturing, Distribution and Marketing Department**

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## FOREWORD

Petroleum product terminals receive bulk shipments of gasoline, middle distillates, aviation gas, lube oil, and specialty products from pipelines, tankers, barges, railcars, and trucks. The products are stored in tanks and warehouses and distributed to service stations, truck stops, and other points of use. There are approximately 1700 pipeline and petroleum product terminals in the United States.

Terminals generate wastewaters consisting primarily of tank bottom water and stormwater runoff from product transfer areas. The various wastewaters are treated by an oil/water separator to recover any free product, and the treated wastewater is discharged as terminal effluent. Often, because of geographic location, low effluent volume, or operating limitations, the most practical disposal option for terminal effluent will be discharge to the local publicly owned treatment works (POTW). Effluent discharge to a POTW usually requires a permit or agreement from the POTW, specifying conditions under which the discharge is acceptable.

In some cases, POTWs may have significant concerns regarding the acceptance of terminal effluent. Concerns include the following:

- a. Terminal effluent may contain flammable liquids, creating an explosion hazard in the sewers or wastewater treatment plant.
- b. Treatment effluent contaminants may harm the treatment process, hindering the treatment plant's ability to function effectively.
- c. Terminal effluent contaminants may not be treatable by the treatment plant and may thus be discharged to the environment in excessive quantities.
- d. Terminal effluent discharges may not be adequately controlled, leading to slugs of oil, contaminants, or volume entering the sewers.
- e. Terminal effluent contaminants may expose POTW operators to health hazards.

These are important concerns for POTWs, but terminals can successfully address them. The concerns are more logically associated with major industrial dischargers, as opposed to petroleum product terminals, which typically generate only small volumes of terminal effluents, have systems in place to prevent flammable liquid discharges, and can readily implement effective discharge controls.

This guidance document is written to assist the terminal through the negotiations of a pretreatment discharge permit or agreement with the local POTW. The document describes key systems at POTWs and terminals, explains POTW concerns, and presents reasonable methods for addressing the concerns.

This document is organized into seven sections addressing key issues involved in obtaining a pretreatment discharge permit. The sections are as follows:

- a. Section 1—POTW Characteristics—Explains the main components of POTWs—the sewer system and the treatment plant. POTW performance requirements are described, as well as operating limits, giving the terminal an understanding of the sources of POTW concerns regarding the acceptance of terminal effluents.
- b. Section 2—Pretreatment Requirements—Discusses the pretreatment program, which is the framework for regulating industrial discharges to POTWs. It describes the constraints POTWs may impose on terminal effluent discharges.
- c. Section 3—Characteristics of Terminal Effluent—Describes sources of terminal effluent and typical effluent compositions. Factors affecting effluent volume and contaminant loading are addressed.
- d. Section 4—POTW Concerns—Discusses specific concerns POTWs may have about accepting terminal effluents. Measures for mitigating the concerns are described.
- e. Section 5—Relations with POTW Management—Guides the reader through the discharge application process, from initial contact to securing the permit to maintaining good relations with the POTW after discharge commences.

- f. Section 6—Terminal Pretreatment Options—Addresses methods to reduce terminal effluent volume and to treat the effluent to reduce contaminant levels.
- g. Section 7—Associated Costs—Outlines costs associated with discharging terminal effluent to a POTW.

Two appendixes provide information that may be useful in preparing for a pretreatment permit negotiation:

- a. Appendix A—Mass Balance Calculations: This appendix shows how to calculate contaminant concentrations in terminal effluent and demonstrate the insignificant impact of the contaminants on a POTW.
- b. Appendix B—Petroleum Product Terminal Wastewater Characterization Data: This appendix summarizes available data on specific terminal wastewaters and composite terminal effluents.

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Suggested revisions are invited and should be submitted to the director of the Manufacturing, Distribution and Marketing Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

# CONTENTS

|                                                                        | Page |
|------------------------------------------------------------------------|------|
| SECTION 1—POTW CHARACTERISTICS .....                                   | 1    |
| 1.1 Introduction .....                                                 | 1    |
| 1.2 Components of a POTW System .....                                  | 1    |
| 1.2.1 POTW Sewer System Components .....                               | 1    |
| 1.2.2 Typical Wastewater Treatment System Components .....             | 1    |
| 1.3 Performance Requirements of POTWs .....                            | 4    |
| 1.3.1 Concentration Limits .....                                       | 4    |
| 1.3.2 Flow Limits .....                                                | 4    |
| 1.4 Operating Limits of POTWs .....                                    | 4    |
| 1.4.1 Flow Limitations .....                                           | 4    |
| 1.4.2 Mass Loading Limitations .....                                   | 4    |
| 1.5 Referenced Publications .....                                      | 4    |
| SECTION 2—PRETREATMENT REQUIREMENTS .....                              | 5    |
| 2.1 Introduction .....                                                 | 5    |
| 2.2 Pretreatment Programs .....                                        | 5    |
| 2.2.1 EPA Regulations .....                                            | 5    |
| 2.2.2 Objectives .....                                                 | 5    |
| 2.3 Industrial User Classifications .....                              | 6    |
| 2.3.1 SIU Definition .....                                             | 6    |
| 2.3.2 Typical Requirements for Nonsignificant Industrial Users .....   | 6    |
| 2.3.3 Typical SIU Requirements .....                                   | 8    |
| 2.4 Development of Local Limits .....                                  | 8    |
| 2.5 Typical Pretreatment Requirements Likely to Affect Terminals ..... | 9    |
| 2.5.1 POTW Connection .....                                            | 9    |
| 2.5.2 Self-Monitoring .....                                            | 9    |
| 2.5.3 Flow Control .....                                               | 9    |
| 2.5.4 Waste Disposal .....                                             | 9    |
| 2.5.5 Spill Prevention .....                                           | 9    |
| 2.5.6 Pretreatment/Waste Minimization .....                            | 9    |
| 2.5.7 Fees .....                                                       | 9    |
| SECTION 3—CHARACTERISTICS OF TERMINAL EFFLUENT .....                   | 10   |
| 3.1 Introduction .....                                                 | 10   |
| 3.2 Background on Petroleum Product Terminals .....                    | 10   |
| 3.3 Terminal Effluent Sources .....                                    | 10   |
| 3.3.1 Tank Bottom Water .....                                          | 10   |
| 3.3.2 Stormwater .....                                                 | 10   |
| 3.3.3 Other Effluent Sources .....                                     | 10   |
| 3.4 Terminal Effluent Volumes .....                                    | 11   |
| 3.4.1 Tank Bottom Water .....                                          | 11   |
| 3.4.2 Stormwater .....                                                 | 11   |
| 3.4.3 Other Effluent Sources .....                                     | 11   |
| 3.5 Terminal Effluent Contaminants .....                               | 12   |
| 3.6 Typical Terminal Effluent Composition .....                        | 12   |
| SECTION 4—POTW CONCERNS .....                                          | 13   |
| 4.1 Introduction .....                                                 | 13   |
| 4.2 Flammable Discharges .....                                         | 13   |

|                                                            | Page |
|------------------------------------------------------------|------|
| 4.3 Contaminants.....                                      | 14   |
| 4.3.1 Interference.....                                    | 14   |
| 4.3.2 Pass-Through.....                                    | 14   |
| 4.3.3 Sludge Contamination.....                            | 15   |
| 4.4 Flow Loading.....                                      | 15   |
| 4.4.1 Slug Loading.....                                    | 15   |
| 4.4.2 Stormwater Discharge.....                            | 16   |
| 4.4.3 Timing of Discharge.....                             | 16   |
| 4.5 Worker Exposure.....                                   | 16   |
| SECTION 5—RELATIONS WITH POTW MANAGEMENT.....              | 17   |
| 5.1 Introduction.....                                      | 17   |
| 5.2 Preparing for Permit Application.....                  | 17   |
| 5.2.1 Preliminary Steps.....                               | 17   |
| 5.2.2 Characterize Terminal Effluent.....                  | 17   |
| 5.3 Applying for the Permit.....                           | 18   |
| 5.3.1 SIU Applications.....                                | 18   |
| 5.3.2 Requirements of Nonsignificant Industrial Users..... | 18   |
| 5.3.3 Discussions With POTW.....                           | 18   |
| 5.3.4 Legal Requirements.....                              | 18   |
| 5.4 Connecting to the System.....                          | 18   |
| 5.5 Maintaining the Relationship.....                      | 18   |
| 5.5.1 Permit Compliance.....                               | 18   |
| 5.5.2 Sampling and Analysis.....                           | 19   |
| 5.5.3 Reporting Changes in Discharge.....                  | 19   |
| SECTION 6—TERMINAL PRETREATMENT OPTIONS.....               | 20   |
| 6.1 Introduction.....                                      | 20   |
| 6.2 Effluent Minimization.....                             | 20   |
| 6.3 Discharge Control Methods.....                         | 20   |
| 6.3.1 Industrial Discharge Flow Control.....               | 20   |
| 6.3.2 Flammable Liquid Discharge Safeguards.....           | 20   |
| 6.4 Monitoring Discharges.....                             | 20   |
| 6.5 Effluent Treatment.....                                | 21   |
| SECTION 7—ASSOCIATED COSTS.....                            | 21   |
| 7.1 Introduction.....                                      | 21   |
| 7.2 Permit Compliance Costs.....                           | 21   |
| 7.2.1 Sampling and Laboratory Analysis.....                | 21   |
| 7.2.2 Recordkeeping.....                                   | 22   |
| 7.3 User Costs.....                                        | 22   |
| 7.3.1 Connection Fees.....                                 | 22   |
| 7.3.2 Flow-Specific Fees.....                              | 22   |
| 7.3.3 Contaminant-Specific Fees.....                       | 22   |
| 7.3.4 High-Strength Surcharge.....                         | 22   |
| 7.4 Pretreatment Costs.....                                | 22   |
| 7.4.1 Capital Costs.....                                   | 22   |
| 7.4.2 Operating Costs.....                                 | 23   |

|                                                                                 | Page |
|---------------------------------------------------------------------------------|------|
| APPENDIX A—MASS BALANCE CALCULATIONS .....                                      | 25   |
| APPENDIX B—PETROLEUM PRODUCT TERMINAL WASTEWATER<br>CHARACTERIZATION DATA ..... | 31   |

#### Figures

|                                                                                                         |   |
|---------------------------------------------------------------------------------------------------------|---|
| 1—Typical Municipal Wastewater Treatment Plant Process (With Issues<br>Related to Terminals Noted)..... | 2 |
| 2—Typical Treatment Plant Inflow Curves (Weekday,<br>Residential, Conditions) .....                     | 2 |
| 3—EPA-Approved State Pretreatment Program .....                                                         | 5 |
| 4—Determination of Industrial User Classification.....                                                  | 7 |

#### Tables

|                                                                                              |    |
|----------------------------------------------------------------------------------------------|----|
| 1—Examples of Terminal Effluent Contaminant Loadings.....                                    | 13 |
| 2—Safeguards Against Flammable Liquid Discharge .....                                        | 14 |
| 3—Steps to Alleviate Interference Concerns .....                                             | 15 |
| 4—Steps to Alleviate Pass-Through Concerns .....                                             | 15 |
| 5—Steps to Alleviate Sludge Contamination Concerns .....                                     | 15 |
| 6—Steps to Alleviate Slug Loading Concerns .....                                             | 16 |
| 7—Steps to Alleviate Stormwater Discharge Concerns.....                                      | 16 |
| 8—Steps to Alleviate Timing of Discharge Concerns .....                                      | 16 |
| 9—Steps to Alleviate Worker Exposure Concerns.....                                           | 17 |
| 10—Oil-Contamination Reduction Techniques Reference .....                                    | 20 |
| 11—Treatment Process Selection.....                                                          | 21 |
| 12—Representative Analytical Costs .....                                                     | 22 |
| B-1—Marketing Terminal Wastewater Concentrations From Tank Bottom Draws .....                | 32 |
| B-2—Marketing Terminal Wastewater Concentrations for Loading Rack Water.....                 | 33 |
| B-3—Marketing Terminal Wastewater Concentrations for Tank Containment<br>Water .....         | 33 |
| B-4—Marketing Terminal Wastewater Concentrations From Oil/Water Separator<br>Effluents ..... | 34 |



# Guidance Document for the Discharge of Petroleum Distribution Terminal Effluents to Publicly Owned Treatment Works

## SECTION 1—POTW CHARACTERISTICS

### 1.1 Introduction

A publicly owned treatment works (POTW) collects and treats wastewater. Its two main components are a wastewater conveyance (sewer) system and a wastewater treatment system. Terminals may be more successful negotiating and implementing a program to discharge effluents to a POTW when they understand POTW components and limitations.

This section discusses the POTW conveyance system, treatment system processes, typical requirements of a POTW's operating permit, and operating limitations of POTWs. The information is the basis for the POTW concerns described in Section 4.

### 1.2 Components of a POTW System

This section discusses the sewer and treatment systems. These systems are typically designed for managing residential wastewater (domestic sewage). Depending on the community, however, the POTW may also anticipate receiving a contribution of wastewater from industrial and commercial sources.

#### 1.2.1 POTW SEWER SYSTEM COMPONENTS

Wastewater flows through a network of sewers and pump stations that deliver wastewater to a treatment plant. The sewers typically convey wastewater by gravity and thus flow only partially full. Consequently, there is an air space in the pipe above the wastewater surface. If flammable gases such as hydrogen sulfide collect in this airspace or in a manhole, an explosion hazard can result.

Pump stations are used to transfer wastewater over long distances or to "lift" wastewater so it can flow by gravity again. Pump station wetwells hold wastewater until the level activates the pumps. While the wastewater accumulates in the wetwell, gases can volatilize and collect in the air space. Pump stations have moving metal parts that can cause sparking. While the moving parts are usually kept in a separate drywell compartment, gases such as hydrogen sulfide can migrate into this area, posing an explosion hazard.

Sewer workers need to access the conveyance system via manholes for routine maintenance and emergency work. Manholes and pump stations require confined space entry because gases exist in all municipal wastewater conveyance systems receiving domestic sewage. Many gases, such as hydrogen sulfide, are toxic; however, nontoxic gases are also of concern to the POTW, as they displace air from the sewer system. Likewise, POTW operators are also concerned about

exposure to volatile and possibly toxic contaminants discharged by industrial users.

#### 1.2.2 TYPICAL WASTEWATER TREATMENT SYSTEM COMPONENTS

Wastewater treatment plants typically purify wastewater using a combination of solids settling, biological degradation of dissolved contaminants, and disinfection of pathogenic organisms. Plant complexity, configuration, and process selection vary from POTW to POTW. Most plants are constructed for liquid and sludge treatment. However, some plants now include air and odor treatment as well. Key processes are described below, with POTW concerns noted. Figure 1 shows a typical arrangement of many of these processes at a wastewater treatment plant.

##### 1.2.2.1 Influent Pumping

At some plants, an influent pumping station lifts wastewater to a higher elevation so wastewater can flow by gravity through the plant. These pumps have hydraulic limitations. Overloading can result in sewer backups and possible wastewater overflows. Since an influent pumping chamber is the low point in the conveyance system and the treatment plant, vapors heavier than air can collect here. Therefore, a POTW may be concerned about explosion hazards at the influent pumping chamber.

##### 1.2.2.2 Equalization Basin

Treatment processes work better with stable inputs of flow and waste. Wastewater flows to POTWs tend to follow a "diurnal curve," as shown in Figure 2. Typically this diurnal curve has high sewer flows at somewhat predictable times of day related to the workday. Peaks normally occur after the morning and afternoon commute hours. Low flows occur at normally inactive times such as after midnight. This variation between peak and low flows is more pronounced in smaller POTWs; larger POTWs serve larger communities and tend to have a wider variety of water use patterns that buffer the peak and low periods. Treatment plants receiving a high variation in flow or waste strength may use an equalization basin to dampen out effects it might have on the rest of the treatment system.

##### 1.2.2.3 Headworks

The headworks, located early in the process train, screen out large debris that can clog or otherwise damage equipment downstream. Equipment may include a bar screen, which acts

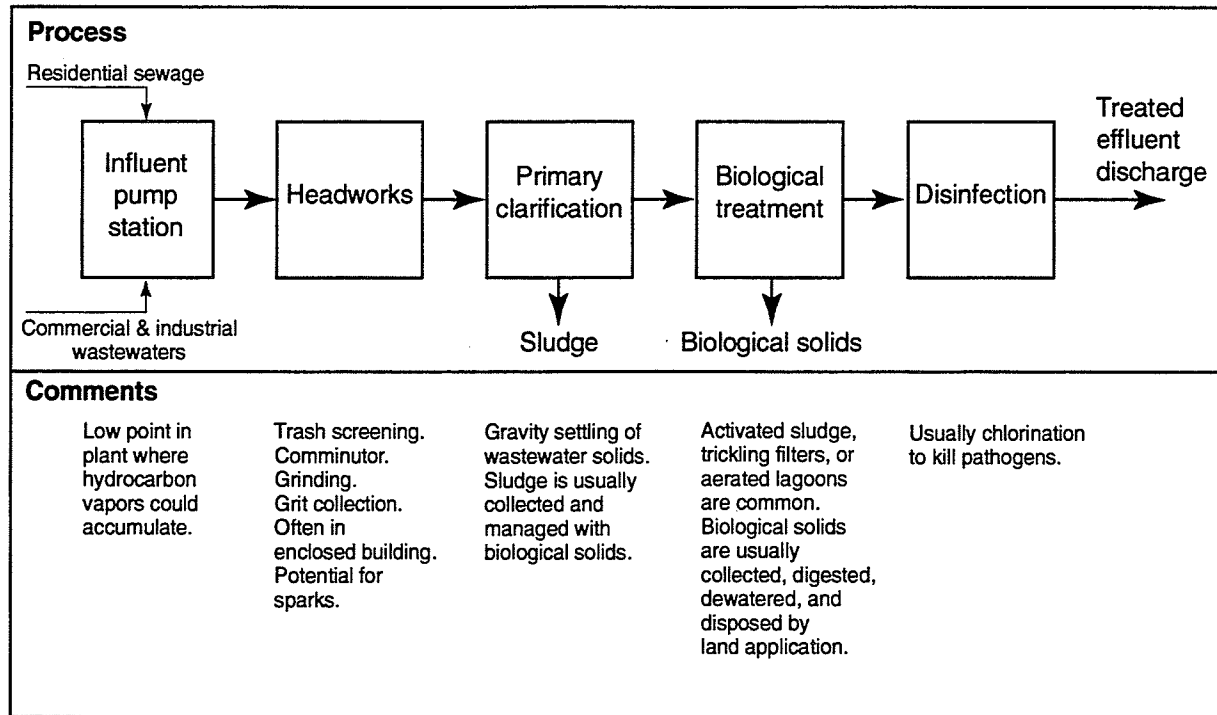


Figure 1—Typical Municipal Wastewater Treatment Plant Process  
(With Issues Related to Terminals Noted)

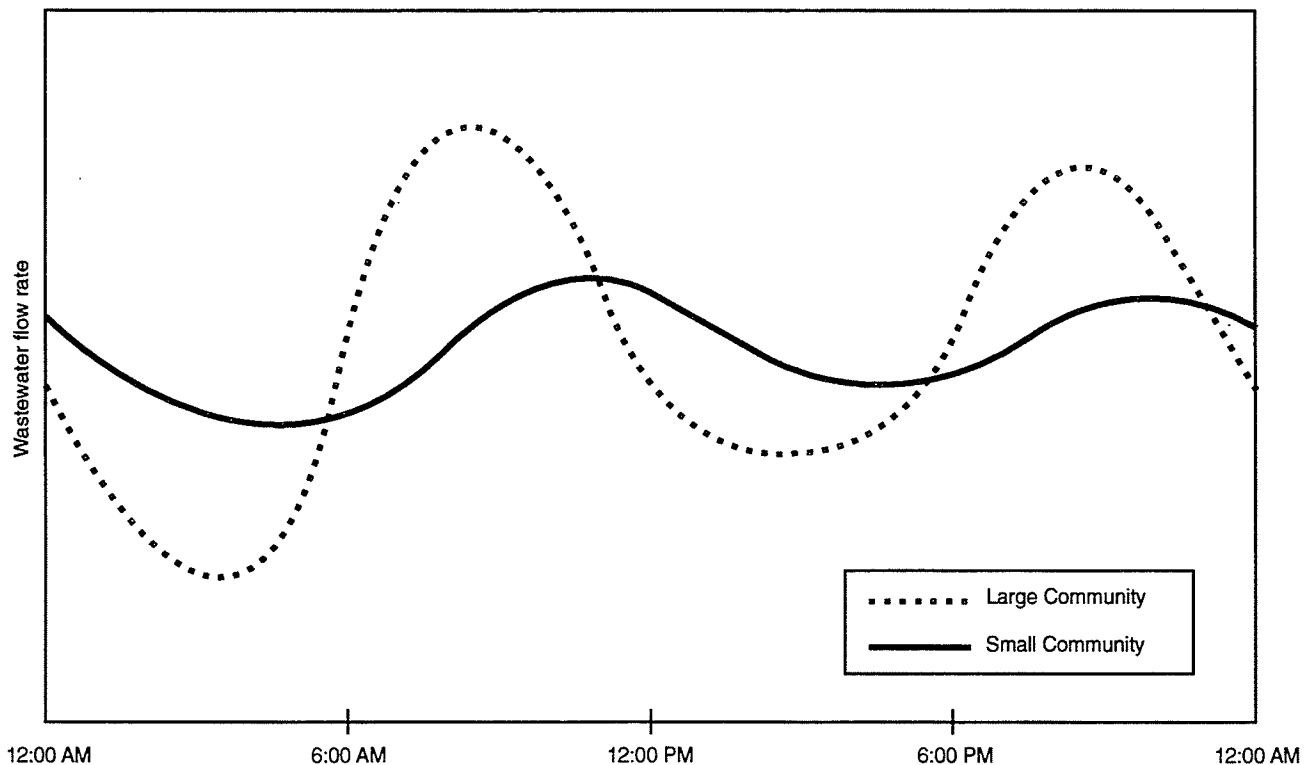


Figure 2—Typical Treatment Plant Inflow Curves  
(Weekday, Residential, Conditions)

like a trash rack, and a comminutor, which acts like a garbage disposal grinding up debris. Often, headworks equipment is located in an enclosed building. The mechanical moving parts and the enclosed space both create explosion concerns.

#### 1.2.2.4 Grit Chamber

The grit chamber follows the headworks and settles out inorganic solids such as stones that find their way into the conveyance system. Grit removal functions to protect downstream equipment from abrasive materials.

#### 1.2.2.5 Primary Settling or Clarification

Gravity settling of wastewater solids provides primary treatment by removing readily settleable organic material. Liquid overflows to the next process, the biological treatment unit. The sludge collected from the clarifier bottom is pumped to sludge processing units.

#### 1.2.2.6 Biological Treatment

This process, also referred to as secondary treatment, removes the majority of organic contaminants. Biological treatment involves the use of living microorganisms (bacteria) to consume organic matter as their food. The microorganisms in POTWs normally get the overwhelming bulk of their food from organic contaminants of domestic origin (household sewage), so that the microorganisms that evolve in a biological treatment process acclimate primarily to these domestic contaminants. POTWs are concerned that nondomestic wastewater discharges may contain unusual contaminants that can harm (kill or inhibit the growth of) the microorganisms or contain contaminants that the microorganisms cannot degrade. Harming the microorganisms is called *interference*; sending untreated contaminants through the treatment plant is called *pass-through*. These two terms are discussed further in Section 2.

Several process configurations are commonly used in POTWs: activated sludge, trickling filters, rotating biological contactors, and lagoons. Each configuration provides a way of contacting the microorganisms with the wastewater, supplying air (oxygen) to the microorganisms, and controlling the microorganism population to maintain effective treatment capability.

Activated sludge, one of the most common biological treatment processes, uses continuous-flow aeration basins for mixing the wastewater, microorganisms, and air together. Microorganism communities (flocs) grow in the basins as they consume the wastewater contaminants, reaching macroscopic levels and becoming the primary component of the solids in the basin. The mixed, solids-containing contents of the basin flow into a clarifier, where the microorganism solids (sludge) settle out, and the treated, clarified liquid overflows to a downstream treatment process. Some of the settled microorganism solids are returned to the aeration basin to treat additional incoming wastewater, while some are

removed from the process and managed for disposal. Careful process control is necessary to maintain proper aeration basin conditions and to provide optimal growth conditions for the microorganisms.

Trickling filters use a stationary media—such as plastic or stones—to support microorganism growth. The wastewater is distributed over the media, and the microorganisms, growing as a slime layer on the media, degrade the contaminants as the wastewater flows past. The treated wastewater is directed to a clarifier to settle out portions of the slime layer that slough off the media.

Rotating biological contactors also use a plastic framework to support microorganism growth. In this case, the microorganisms grow on discs that contact the wastewater by rotating, partially submerged in a basin. The microorganisms are exposed to air as they rotate out of the wastewater. Again, a clarifier follows the aeration portion of the process.

Lagoons are the simplest biological treatment configuration, consisting of ponds, normally mixed and aerated with splash-type mechanical devices. Solids are not removed by a clarifier; instead, solids are allowed to settle either to the bottom of an unmixed portion of the pond or to the bottom of a separate, unmixed pond. Lagoons are normally larger than the basins associated with activated sludge, trickling filters, or rotating biological contactors; however, the concentration of microorganisms is normally lower. Lagoon systems require minimal operator attention and are more typical of smaller POTWs.

#### 1.2.2.7 Nutrient Removal/Advanced Treatment

Some POTWs are required to remove ammonia, a plant growth nutrient. Ammonia removal can be integrated into the biological phase of treatment or can involve a process after biological treatment. Biological ammonia removal, called nitrification, is accomplished by a very small number of bacteria species within the overall microorganism community, and these nitrifying species have a relatively slow growth rate. Interference is a concern with nitrification, because the nitrifying bacteria might be susceptible to adverse impacts from certain contaminants of industrial origin.

#### 1.2.2.8 Disinfection

Pathogens, including bacteria and viruses, exist in wastewater due to the discharge of human waste, and may cause an assortment of highly infectious diseases. Disinfection is used to kill pathogens common in human wastewater. Chlorination is currently the most common disinfection method. A key operating factor is the amount of time the wastewater stays in contact with the disinfecting process. Hydraulic overloads can impact the effectiveness of this process.

#### 1.2.2.9 Effluent Disposal

POTWs discharge final effluent to surface waters—a stream, lake, or ocean—in accordance with permit conditions, discussed in 1.3.

### 1.2.2.10 Sludge Handling

The solid by-product of the treatment system is sludge, or biosolids, from the clarifiers. All POTWs generate sludge and need to dispose of it in some way, normally by land application. EPA regulations have tightened the maximum concentrations of certain contaminants that can be applied to land. The regulations focus on metals and polynuclear aromatic hydrocarbons (PAHs), because these contaminants tend to associate with the sludge during biological treatment. POTW compliance with these regulations requires careful control of the sludge quality. Depending on which contaminants are found in the sludge, the POTW may not be able to pursue certain sludge disposal options.

### 1.2.2.11 Air Emission Control

This issue addresses the control and treatment of air toxics and odors. With the Clean Air Act Amendments of 1990, POTWs are now beginning to review their treatment plants with regard to air emissions from open channels and basins, such as tanks, lagoons, and conveyance systems. Volatile organics (VOCs) can escape to the atmosphere, creating air emissions from the wastewater system. Basins associated with enhanced biological treatment, such as activated sludge aeration tanks, have fewer VOC emissions than lagoons, for example, because of the high concentration of microorganisms that metabolize the VOCs in solution before they volatilize.

## 1.3 Performance Requirements of POTWs

POTWs, like terminals, are part of the regulated community. Treatment plant discharges must comply with National Pollutant Discharge Elimination System (NPDES) permit conditions. Permit violations can lead to regulatory agency intervention, fines, and enforcement actions. Environmental lawsuits initiated by third parties can also result from violations of the NPDES permit. NPDES permits include a variety of requirements, categorized as flow limits and concentration limits.

### 1.3.1 CONCENTRATION LIMITS

NPDES permits stipulate maximum concentrations for specific contaminants. The basis for determining concentration limits is either technology or water quality. Technology based limits are intended to reflect the capabilities of treatment processes; for example, biological treatment might be expected to remove approximately 85 percent of influent organic contaminants. Water quality based limits are intended to ensure that discharged contaminants do not impair the health or designated use of the receiving water; for example, limits may represent the maximum allowable contaminant load that does not create toxic conditions for aquatic life.

The POTW's discharge is routinely analyzed for regulated contaminants. Any exceedences associated with industrial

discharges indicate that the POTW may not be effectively treating the industrial contaminant, meaning that pass-through is creating permit violations for the POTW.

### 1.3.2 FLOW LIMITS

An NPDES permit specifies the maximum flow rate that a POTW may discharge. Wastewater flow rates approaching this limit trigger requirements for the POTW to investigate a treatment plant expansion. Thus, POTWs monitor the residential and industrial hook-ups, stormwater discharge, and groundwater infiltration into sewers. POTWs are becoming increasingly unwilling to accept stormwater, because it is considered a nonwastewater stream that could push the POTW toward a hydraulic expansion.

## 1.4 Operating Limits of POTWs

Sustained successful performance of the wastewater treatment plant requires control of the two primary operating constraints: hydraulic (flow) loading and mass (contaminant) loading.

### 1.4.1 FLOW LIMITATIONS

Flow limitations may apply to the sewer system and the treatment plant. Pumps and process units located at the treatment plant are designed to handle specified hydraulic capacities. Hydraulic overloading of pumps or sewers can cause overflows. High flows prevent sufficient hydraulic detention in disinfection processes, leading to insufficient pathogen destruction. Terminal effluent volumes are very low, as described in 3.4, and should have a negligible impact on a POTW influent flow rate. It is unlikely that terminal effluents have a high enough volume to create hydraulic problems at a POTW.

### 1.4.2 MASS LOADING LIMITATIONS

Treatment plant process units are designed for an expected influent loading—pounds per day—of contaminants. Higher loadings can upset the processes. Terminal effluent mass loadings are very low, as shown in the example mass balance in Appendix A, and should have a negligible impact on a POTW influent composition. It is unlikely that terminal effluents have a high enough loading to upset a POTW process.

## 1.5 Referenced Publications

Unless otherwise noted, the latest edition or revision of the following publications shall, to the extent specified herein, form a part of this publication. When specific parts (for example, numbered paragraphs or tables) of other documents are referenced in this text, the edition current when this publication was issued shall apply.

## API

Publ 4602 *Minimization, Handling, Treatment, and Disposal of the Petroleum Products Terminal Wastewater*

Brown and Caldwell<sup>1</sup>

*Treatment of Petroleum Marketing Effluent in a Publicly Owned Treatment Facility*

EPA<sup>2</sup>

440/1-82/303 *Fate of Priority Pollutants in Publicly Owned Treatment Works*

40 *Code of Federal Regulations*, Parts 122, 303, and 403  
*Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program*  
*Industrial User Permitting Guidance Manual*

## SECTION 2—PRETREATMENT REQUIREMENTS

### 2.1 Introduction

POTWs must ensure that their systems can effectively manage and treat complex wastewaters consisting of domestic and industrial discharges. With most system components designed for domestic wastewaters, POTWs need a way to control industrial discharges. Control is achieved by the pretreatment program, which authorizes and, in fact, requires the POTW to regulate the quality and quantity of discharges from industries. This section describes the pretreatment programs, industrial user classifications, and typical pretreatment requirements likely to affect petroleum terminals, and the development of local limits.

### 2.2 Pretreatment Programs

#### 2.2.1 EPA REGULATIONS

EPA's National Pretreatment Program was established to regulate the introduction of contaminants from nondomestic sources into POTWs. The program is intended to be implemented on a local level, by the POTW itself, according to guidelines set forth in federal EPA regulations (40 CFR Part 403). Many states are approved to administer the POTWs' programs, keeping the regulatory oversight closer to home, where local interests receive their proper attention. Figure 3 identifies which states have EPA-approved pretreatment programs. States without approved programs must adhere to the national program.

The normal procedure for implementing the program is for the POTW to prepare the pretreatment program (the elements of which are described in this section) and submit it for approval to either the state or EPA. In unusual cases, the state or EPA takes responsibility for program preparation from the POTW. The terminal should identify the agency having authority for implementing the program.

#### 2.2.2 OBJECTIVES

There are a number of objectives that the pretreatment program attempts to achieve, including the following:

a. To prevent contaminants that interfere with the POTW's normal operation from entering the sewer system. Such *inter-*

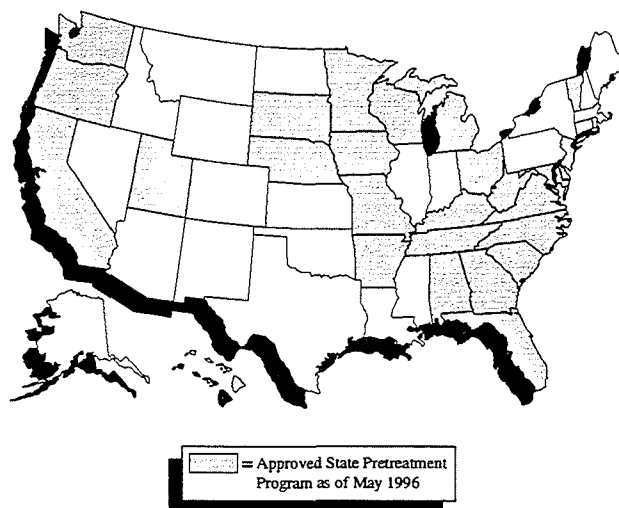


Figure 3—EPA-Approved State Pretreatment Program

*ference* can result in plant upsets by harming the treatment process microorganisms.

b. To prevent inadequate treatment of contaminants that *pass through* into the environment. Pass-through occurs when the treatment plant is unable to remove a contaminant effectively, and either the contaminant has an effluent concentration exceeding the POTW's permit limit or the contaminant causes an exceedance of water quality standards applicable to the POTW's receiving stream.

c. To ensure sewer worker safety and health, preventing explosive and toxic working conditions in the sewer system and at the treatment plant. The discharge to the sewers of flammable and/or noxious materials is prohibited.

d. To prevent restriction or limitation of the POTW's sludge disposal options, owing to contaminant concentrations in the sludge.

e. To reduce the introduction of clean water into the sewer system, preserving the hydraulic capacity of the sewer system and the plant for wastewater.

f. To ensure that oily or viscous discharges do not damage the POTW by clogging pipes or coating equipment.

<sup>1</sup>Brown and Caldwell, P.O.Box 8045, Walnut Creek, California 94596-1220.

<sup>2</sup>Environmental Protection Agency. The *Code of Federal Regulations* (CFR) is available from the U.S. Government Printing Office, Washington, D.C. 20402.