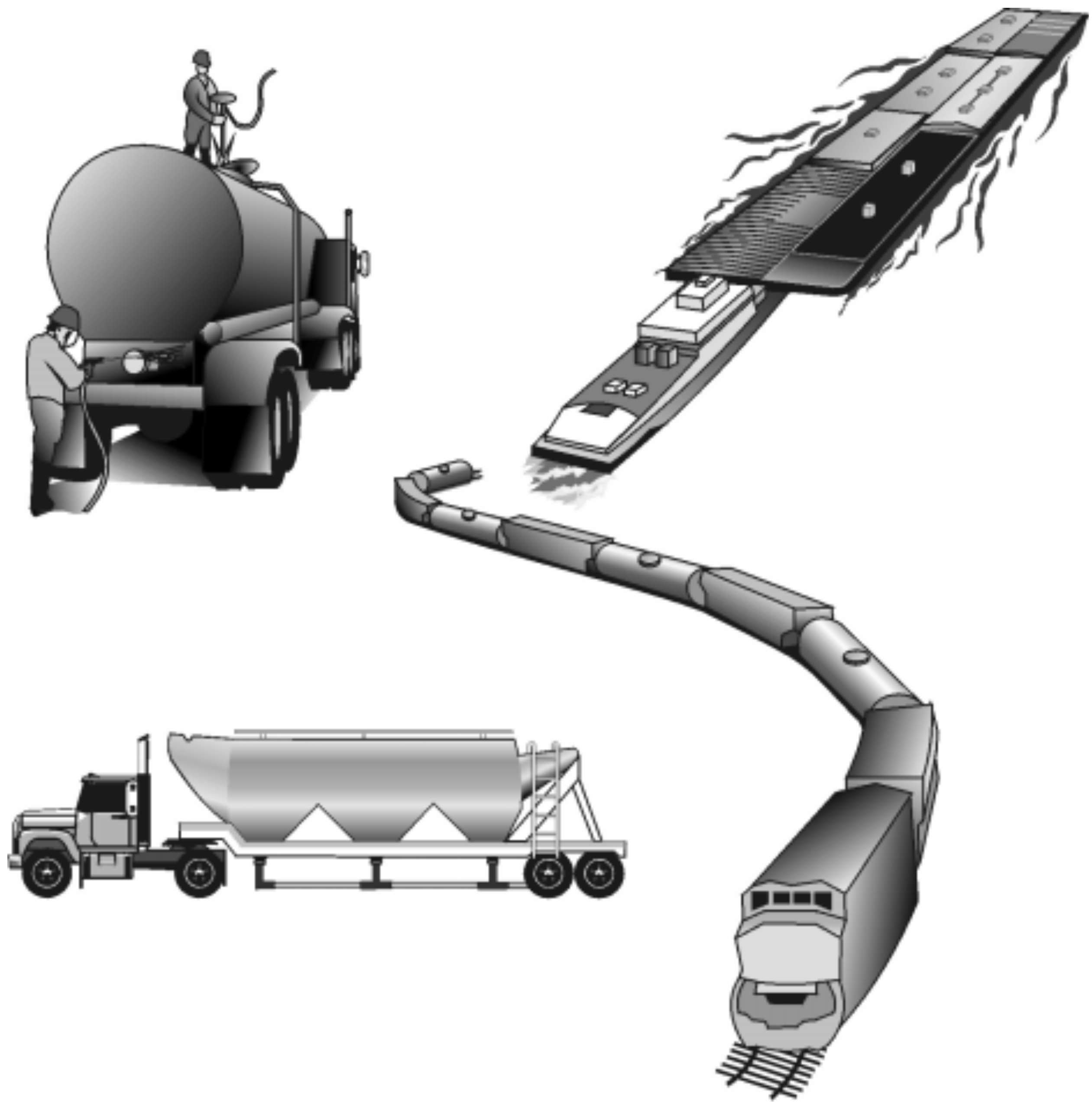
United States Environmental Protection Agency | Office of Water (4303) | EPA-821-R-00-012 June 2000

Final Development Document For Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category



FINAL
DEVELOPMENT DOCUMENT
FOR
EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS
FOR THE
TRANSPORTATION EQUIPMENT CLEANING
POINT SOURCE CATEGORY

Carol M. Browner
Administrator

J. Charles Fox
Assistant Administrator, Office of Water

Geoff Grubbs
Director, Office of Science and Technology

Sheila E. Frace
Director, Engineering and Analysis Division

Ronald Jordan
Acting Chief, Chemicals Branch

John Tinger
Project Manager

June 2000

U.S. Environmental Protection Agency
Office of Water
Washington, DC 20460

Acknowledgments and Disclaimer

This document has been reviewed and approved for publication by the Engineering and Analysis Division, Office of Science and Technology. This document was prepared with the support of Eastern Research Group, Inc. (Contract No. 68-C5-0033), under the direction and review of the Office of Science and Technology.

EPA would like to acknowledge the exceptional efforts and contributions of Eastern Research Group, Inc. in the development of this document. ERG has provided invaluable support for the data collection, data analysis, and engineering assessments and materials contained in this document.

TABLE OF CONTENTS

Page

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

Page

TABLE OF CONTENTS (Continued)

Page

LIST OF TABLES

LIST OF TABLES (Continued)

Page

LIST OF TABLES (Continued)

Page

LIST OF TABLES (Continued)

Page

LIST OF TABLES (Continued)

Page

LIST OF FIGURES

Page

LIST OF FIGURES (Continued)

Page

1.0 LEGAL AUTHORITY

Effluent limitations guidelines and standards for the Transportation Equipment Cleaning Industry (TECI) are being promulgated under the authority of Sections 301, 304, 306, 307, 308, and 501 of the Clean Water Act, 33 U.S.C. 1311, 1314, 1316, 1317, 1318, and 1361.

1.1 Clean Water Act (CWA)

The Federal Water Pollution Control Act Amendments of 1972 established a comprehensive program to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (Section 101(a)). To implement the Act, the United States Environmental Protection Agency (EPA) is to issue effluent limitations guidelines, pretreatment standards, and new source performance standards for industrial dischargers. These guidelines and standards are summarized briefly in the following sections.

1.1.1 Best Practicable Control Technology Currently Available (BPT) (Section 304(b)(1) of the CWA)

In the guidelines for an industry category, EPA defines BPT effluent limits for conventional, priority,[1] and nonconventional pollutants. In specifying BPT, EPA looks at a number of factors. EPA first considers the cost of achieving effluent reductions in relation to the effluent reduction benefits. The Agency also considers: the age of the equipment and facilities; the processes employed and any required process changes; engineering aspects of the control technologies; non-water quality environmental impacts (including energy requirements); and such other factors as the Agency deems appropriate (CWA 304(b)(1)(B)). Traditionally, EPA establishes BPT effluent limitations based on the average of the best performances of facilities

---

[1]In the initial stages of EPA CWA regulation, EPA efforts emphasized the achievement of BPT limitations for control of the "classical" pollutants (e.g., TSS, pH, BOD_5). However, nothing on the face of the statute explicitly restricted BPT limitation to such pollutants. Following passage of the Clean Water Act of 1977 with its requirement for points sources to achieve best available technology limitations to control discharges of toxic pollutants, EPA shifted its focus to address the listed priority pollutants under the guidelines program. BPT guidelines continue to include limitations to address all pollutants.

within the industry of various ages, sizes, processes, or other common characteristics. Where, however, existing performance is uniformly inadequate, EPA may require higher levels of control than currently in place in an industrial category if the Agency determines that the technology can be practically applied.

1.1.2 Best Conventional Pollutant Control Technology (BCT) (Section 304(b)(4) of the CWA)

The 1977 amendments to the CWA required EPA to identify effluent reduction levels for conventional pollutants associated with BCT technology for discharges from existing industrial point sources. In addition to other factors specified in Section 304(b)(4)(B), the CWA requires that EPA establish BCT limitations after consideration of a two part "cost-reasonableness" test. EPA explained its methodology for the development of BCT limitations in July 1986 (51 FR 24974).

Section 304(a)(4) designates the following as conventional pollutants: biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform, pH, and any additional pollutants defined by the Administrator as conventional. The Administrator designated oil and grease as an additional conventional pollutant on July 30, 1979 (44 FR 44501).

1.1.3 Best Available Technology Economically Achievable (BAT) (Section 304(b)(2) of the CWA)

In general, BAT effluent limitations guidelines represent the best economically achievable performance of plants in the industrial subcategory or category. The factors considered in assessing BAT include the cost of achieving BAT effluent reductions, the age of equipment and facilities involved, the process employed, potential process changes, and non-water quality environmental impacts, including energy requirements. The Agency retains considerable discretion in assigning the weight to be accorded these factors. BAT limitations may be based on effluent reductions attainable through changes in a facility's processes and operations. As with

BPT, where existing performance is uniformly inadequate, BAT may require a higher level of performance than is currently being achieved based on technology transferred from a different subcategory or category. BAT may be based upon process changes or internal controls, even when these technologies are not common industry practice.

1.1.4 New Source Performance Standards (NSPS) (Section 306 of the CWA)

NSPS reflect effluent reductions that are achievable based on the best available demonstrated control technology. New facilities have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. As a result, NSPS should represent the most stringent controls attainable through the application of the best available control technology for all pollutants (i.e., conventional, nonconventional, and priority pollutants). In establishing NSPS, EPA is directed to take into consideration the cost of achieving the effluent reduction and any non-water quality environmental impacts and energy requirements.

1.1.5 Pretreatment Standards for Existing Sources (PSES) (Section 307(b) of the CWA)

PSES are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of publicly-owned treatment works (POTWs). The CWA authorizes EPA to establish pretreatment standards for pollutants that pass through POTWs or interfere with treatment processes or sludge disposal methods at POTWs. Pretreatment standards are technology-based and analogous to BAT effluent limitations guidelines.

The General Pretreatment Regulations, which set forth the framework for the implementation of categorical pretreatment standards, are found at 40 CFR Part 403. Those regulations contain a definition of pass-through that addresses localized rather than national instances of pass-through and establish pretreatment standards that apply to all nondomestic dischargers (see 52 FR 1586, January 14, 1987).

1.1.6 Pretreatment Standards for New Sources (PSNS) (Section 307(b) of the CWA)

Like PSES, PSNS are designed to prevent the discharges of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. PSNS are to be issued at the same time as NSPS. New indirect dischargers have the opportunity to incorporate into their plants the best available demonstrated technologies. The Agency considers the same factors in promulgating PSNS as it considers in promulgating NSPS.

1.2 Section 304(m) Requirements

Section 304(m) of the CWA, added by the Water Quality Act of 1987, requires EPA to establish schedules for (1) reviewing and revising existing effluent limitations guidelines and standards ("effluent guidelines") and (2) promulgating new effluent guidelines. On January 2, 1990, EPA published an Effluent Guidelines Plan (55 FR 80) that established schedules for developing new and revised effluent guidelines for several industry categories. One of the industries for which the Agency established a schedule was the TECI.

In 1992, EPA entered into a Consent Decree requiring proposal and final agency action of effluent limitations guidelines and standards final rule for the TECI (NRDC vs. Browner D.D.C. 89-2980). In December of 1997, the Plaintiffs and EPA agreed to modify the deadlines for proposal to May 15, 1998 and a deadline of June 15, 2000 for final action.

1.3 Pollution Prevention Act

In the Pollution Prevention Act (PPA) of 1990 (42 U.S.C. 13101 et seq., Pub. Law 101-508, November 5, 1990), Congress declared pollution prevention a national policy of the United States. The PPA declares that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner whenever feasible; pollution that cannot be prevented or recycled should be treated;

and disposal or other release into the environment should be chosen only as a last resort and should be conducted in an environmentally safe manner. The PPA directs EPA to, among other things, "review regulations of the Agency prior and subsequent to their proposal to determine their effect on source reduction" (Sec. 6604; 42 U.S.C. 13103(b)(2)). This regulation for the TECI was reviewed for its incorporation of pollution prevention as part of the Agency effort.

2.0 SUMMARY AND SCOPE

The final regulations for the Transportation Equipment Cleaning Industry (TECI) include effluent limitations guidelines and standards for the control of pollutants in wastewater. This document presents the information and rationale supporting the final effluent limitations guidelines and standards. Section 2.0 highlights the applicability, subcategorization, and technology bases of the final rule.

2.1 Applicability of the Regulation

Transportation equipment cleaning (TEC) facilities are defined as those facilities that generate wastewater from cleaning the interior of tank trucks, closed-top hopper trucks, rail tank cars, closed-top hopper rail cars, intermodal tank containers, tank barges, closed-top hopper barges, and ocean/sea tankers used to transport materials or cargos that come into direct contact with the tank or container interior. Facilities that do not engage in cleaning the interior of tanks are not within the scope of this rule.

The wastewater flows covered by the final rule include all washwaters that have come into direct contact with the tank or container interior including prerinse cleaning solutions, chemical cleaning solutions, and final rinse solutions. Additionally, the rule covers wastewater generated from washing vehicle exteriors, equipment and floor washings, and TEC-contaminated stormwater for those facilities covered by the guidelines. These wastewater streams are defined as TEC process wastewater.

The TEC rule includes a low flow exclusion that applies to any facility that discharges less than 100,000 gallons per year of TEC process wastewater. Facilities discharging less than 100,000 gallons per year of TEC process wastewater will remain subject to limitations and standards established on a case-by-case basis using Best Professional Judgement by the permitting authority.

The focus of this rule is on TEC facilities that function independently of other industrial activities that generate wastewater. The final TEC limitations do not apply to wastewaters associated with tank cleanings operated in conjunction with other industrial, commercial, or publicly-owned treatment works (POTW) operations so long as the facility only cleans tanks that have contained raw materials, by-products and finished products that are associated with the facility's on-site processes. (On-site means the contiguous and non-contiguous property within the established boundaries of the facility.)

Facilities that clean tank interiors solely for purposes of shipping products (i.e., cleaned for purposes other than maintenance and repair) would be regulated solely under the TEC guideline. On the other hand, wastewater generated from cleaning tank interiors for the purposes of maintenance and repair on the tank is not considered TEC process wastewater. It is possible that some facilities or wastewater generated from some unit operations at these facilities will be subject to the Metals Products & Machinery (MP&M) effluent guidelines currently being developed by EPA. Facilities that clean tank interiors solely for the purposes of repair and maintenance would not be regulated under the TEC guideline. If a facility discharges wastewater from MP&M activities that are subject to the MP&M guideline and also discharges wastewater from cleaning tanks for purposes other than repair and maintenance of those tanks, then that facility may be subject to both guidelines.

If a facility generates TEC process wastewater, but also accepts wastewater generated off site, then that facility may be subject to either the TEC rule or the Centralized Waste Treatment rule, depending on the nature of the off-site wastewater. If the off-site wastewater is solely TEC process wastewater, then the facility would be regulated solely under the TEC rule. If the off-site wastewater is non-TEC process wastewater, or a combination of TEC and non-TEC process wastewater, then the facility may be considered a Centralized Waste Treatment facility and may be subject to the standards established in 40 CFR 437.

EPA has identified an estimated population of 1,239 TEC facilities that are not already covered by other CWA effluent guidelines. EPA estimates that 341 facilities will be affected by this rule.

2.2 Subcategorization

EPA has subcategorized the TEC point source category into 7 subcategories based on types of cargos carried and transportation mode. The subcategories are listed below and are described in Table 2-1 at the end of this section.

- Truck/Chemical & Petroleum;
- Rail/Chemical & Petroleum;
- Barge/Chemical & Petroleum;
- Food;
- Truck/Hopper;
- Rail/Hopper; and
- Barge/Hopper.

2.3 Summary of Rule

The components of the final rules applicable to each subcategory of the TECI are shown in Table 2-2 and are described in the following subsections.

2.3.1 Best Practicable Control Technology Currently Available (BPT)

EPA has promulgated BPT for the three chemical and petroleum subcategories of the TECI to control priority, nonconventional, and conventional pollutants in wastewater from direct dischargers. EPA is also promulgating BPT for the Food Subcategory of the TECI to control conventional pollutants in wastewater from direct dischargers. The specific pollutants controlled vary for each subcategory. Table 2-3 summarizes the technology basis for BPT for each regulated subcategory. Tables 2-4 through 2-7 present the effluent limitations guidelines for each regulated subcategory.

2.3.2 Best Conventional Pollutant Control Technology (BCT)

EPA is promulgating BCT equivalent to BPT for the three chemical and petroleum subcategories and the Food Subcategory of the TECI to control conventional pollutants in wastewater from direct dischargers. Table 2-3 summarizes the technology basis for BCT for each regulated subcategory. Tables 2-4 through 2-7 present the effluent limitations guidelines for each regulated subcategory.

2.3.3 Best Available Technology Economically Achievable (BAT)

EPA is promulgating BAT equivalent to BPT for the three chemical and petroleum subcategories of the TECI to control priority and nonconventional pollutants in wastewater from direct dischargers. EPA is not promulgating BAT for the Food Subcategory because EPA is not regulating any priority pollutants in these subcategories. The specific pollutants controlled vary for each subcategory. Table 2-3 summarizes the technology basis for BAT for each regulated subcategory. Tables 2-4 through 2-6 present the effluent limitations guidelines for each regulated subcategory.

2.3.4 New Source Performance Standards (NSPS)

EPA is promulgating NSPS for the three chemical and petroleum subcategories of the TECI to control priority, nonconventional, and conventional pollutants in wastewater from new direct dischargers. EPA is also promulgating NSPS for the Food Subcategory of the TECI to control conventional pollutants in wastewater from new direct dischargers. The specific pollutants controlled vary for each subcategory. Table 2-3 summarizes the technology basis for NSPS for each regulated subcategory. Tables 2-4 through 2-7 present the effluent limitations guidelines for each regulated subcategory.

2.3.5 Pretreatment Standards for Existing Sources (PSES)

EPA is promulgating PSES for the three chemical and petroleum subcategories of the TECI to control priority and nonconventional pollutants in wastewater from indirect dischargers. The specific pollutants controlled vary for each subcategory. Table 2-8 summarizes the technology basis for PSES for each regulated subcategory. Tables 2-9 through 2-11 present the pretreatment standards for each regulated subcategory for discharges to POTWs.

EPA is also promulgating an enforceable pollution prevention alternative, referred to as the Pollutant Management plan. The requirements of the Pollutant Management Plan are specified in 40 CFR Part 442 and described in section 8.6.6 of this document.

2.3.6 Pretreatment Standards for New Sources (PSNS)

EPA is promulgating PSNS for the three chemical and petroleum subcategories of the TECI to control priority and nonconventional pollutants in wastewater from new indirect dischargers. The specific pollutants controlled vary for each subcategory. Table 2-8 summarizes the technology basis for PSNS for each regulated subcategory. Tables 2-9 through 2-11 present the pretreatment standards for each regulated subcategory for discharges to POTWs.

EPA is also promulgating an enforceable pollution prevention alternative, referred to as the Pollutant Management Plan. The requirements of the Pollutant Management Plan are specified in 40 CFR Part 442 and described in Section 8.6.6 of this document.

Table 2-1

Subcategorization for the Transportation Equipment Cleaning Industry

Subcategory	Subcategory Description
Truck/Chemical & Petroleum	TEC facilities that clean tank trucks and intermodal tank containers that contained chemical and/or petroleum cargos.
Rail/Chemical & Petroleum	TEC facilities that clean rail tank cars that contained chemical and/or petroleum cargos.
Barge/Chemical & Petroleum	TEC facilities that clean tank barges or ocean/sea tankers that contained chemical and/or petroleum cargos.
Food	TEC facilities that clean tank trucks, intermodal tank containers, rail tank cars, tank barges, or ocean/sea tankers that contained food grade cargos.
Truck/Hopper	TEC facilities that clean closed-top hopper trucks.
Rail/Hopper	TEC facilities that clean closed-top hopper rail cars.
Barge/Hopper	TEC facilities that clean closed-top hopper barges.

Table 2-2

Summary of Rules for the Transportation Equipment Cleaning Industry Point Source Category

Subcategory	PSES	BPT	BAT	BCT	PSNS	NSPS
Truck/Chemical & Petroleum	✓	✓	✓	✓	✓	✓
Rail/Chemical & Petroleum	✓	✓	✓	✓	✓	✓
Barge/Chemical & Petroleum	✓	✓	✓	✓	✓	✓
Food		✓		✓		✓
Truck/Hopper	No regulations					
Rail/Hopper						
Barge/Hopper						

Table 2-3

Summary of Technology Basis for BPT, BCT, BAT, and NSPS

Subcategory	Technology Basis	
Truck/Chemical & Petroleum	BPT BCT BAT NSPS	Equalization; Oil/water separation; Turn-key treatment system including chemical oxidation, neutralization, coagulation, and clarification; Biological treatment; Activated carbon adsorption; and Sludge dewatering.
Rail/Chemical & Petroleum	BPT BCT BAT NSPS	Oil/water separation; Equalizaton; Dissolved air flotation; Biological treatment; and Sludge dewatering.
Barge/Chemical & Petroleum	BPT BCT BAT NSPS	Oil/water separation; Dissolved air flotation; Filter press; Biological treatment; and Sludge dewatering.
Food	BPT BCT NSPS	Oil/water separation; Equalization; Biological treatment; and Sludge dewatering.

Table 2-4

Truck/Chemical & Petroleum Subcategory: BPT, BCT, BAT, and NSPS Concentration-Based Limitations for Discharges to Surface Waters

Pollutant or Pollutant Property	[mg/L]							
	BPT		BCT		BAT		NSPS	
	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average
BOD_5 (a)	61	22	61	22	NA	NA	61	22
TSS (b)	58	26	58	26	NA	NA	58	26
Oil and Grease (HEM) (c)	36	16	36	16	36	16	36	16
pH	Within 6 to 9 at all times.				NA	NA	Within 6 to 9 at all times.	
Copper	0.84	NA	NA	NA	0.84	NA	0.84	NA
Mercury	0.0031	NA	NA	NA	0.0031	NA	0.0031	NA

(a) BOD_5 - Biochemical oxygen demand (5-day).
(b) TSS - Total suspended solids.
(c) HEM - Hexane extractable material.
NA - Not applicable.

Table 2-5

Rail/Chemical & Petroleum Subcategory: BPT, BCT, BAT, and NSPS Concentration-Based Limitations for Discharges to Surface Waters

Pollutant or Pollutant Property	[mg/L]							
	BPT		BCT		BAT		NSPS	
	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average
BOD_5 (a)	61	22	61	22	NA	NA	61	22
TSS (b)	58	26	58	26	NA	NA	58	26
Oil and Grease (HEM) (c)	36	16	36	16	36	16	36	16
pH	Within 6 to 9 at all times.				NA	NA	Within 6 to 9 at all times.	
Fluoranthene	0.076	NA	NA	NA	0.076	NA	0.076	NA
Phenanthrene	0.34	NA	NA	NA	0.34	NA	0.34	NA

(a) BOD_5 - Biochemical oxygen demand (5-day).
(b) TSS - Total suspended solids.
(c) HEM - Hexane extractable material.
NA - Not applicable.

Table 2-6

Barge/Chemical & Petroleum Subcategory: BPT, BCT, BAT, and NSPS Concentration-Based Limitations for Discharges to Surface Waters

Pollutant or Pollutant Property	[mg/L]							
	BPT		BCT		BAT		NSPS	
	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average
BOD_5 (a)	61	22	61	22	NA	NA	61	22
TSS (b)	58	26	58	26	NA	NA	58	26
Oil and Grease (HEM) (c)	36	16	36	16	NA	NA	36	16
pH	Within 6 to 9 at all times.				NA	NA	Within 6 to 9 at all times.	
Cadmium	0.020	NA	NA	NA	0.020	NA	0.020	NA
Chromium	0.42	NA	NA	NA	0.42	NA	0.42	NA
Copper	0.10	NA	NA	NA	0.10	NA	0.10	NA
Lead	0.14	NA	NA	NA	0.14	NA	0.14	NA
Mercury	0.0013	NA	NA	NA	0.0013	NA	0.0013	NA
Nickel	0.58	NA	NA	NA	0.58	NA	0.58	NA
Zinc	8.3	NA	NA	NA	8.3	NA	8.3	NA

(a) BOD_5 - Biochemical oxygen demand (5-day).
(b) TSS - Total suspended solids.
(c) HEM - Hexane extractable material.
NA - Not applicable.

Table 2-7

Food Subcategory: BPT, BCT, and NSPS Concentration-Based Limitations for Discharges to Surface Waters

Pollutant or Pollutant Property	[mg/L]					
	BPT		BCT		NSPS	
	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Monthly Average
BOD_5 (a)	56	24	56	24	56	24
TSS (b)	230	86	230	86	230	86
Oil and Grease (HEM) (c)	20	8.8	20	8.8	20	8.8
pH	Within 6 to 9 at all times.					

(a) BOD_5 - Biochemical oxygen demand (5-day).
(b) TSS - Total suspended solids.
(c) HEM - Hexane extractable material.

Table 2-8

Summary of Technology Basis for PSES and PSNS

Subpart	Subcategory	Technology Basis	
A	Truck/Chemical & Petroleum	PSES & PSNS	Equalization; Oil/water separation; Turn-key treatment system including chemical oxidation, neutralization, coagulation, and clarification; and Sludge dewatering.
B	Rail/Chemical & Petroleum	PSES & PSNS	Oil/water separation; Equalization; Dissolved air flotation; and Sludge dewatering.
C	Barge/Chemical & Petroleum	PSES & PSNS	Oil/water separation; Dissolved air flotation; Filter press; Biological treatment; and Sludge dewatering.

Table 2-9

Truck/Chemical & Petroleum Subcategory: PSES and PSNS Concentration-Based Limitations for Discharges to POTWs

Pollutant or Pollutant Property	Daily Maximum [mg/L]	
	PSES	PSNS
Non-polar Material (SGT-HEM) (a)	26	26
Copper	0.84	0.84
Mercury	0.0031	0.0031

(a) SGT-HEM - Silica-gel treated hexane extractable material.

Table 2-10

Rail/Chemical & Petroleum Subcategory: PSES and PSNS Concentration-Based Limitations for Discharges to POTWs

Pollutant or Pollutant Property	Daily Maximum [mg/L]	
	PSES	PSNS
Non-polar Material (SGT-HEM) (a)	26	26
Fluoranthene	0.076	0.076
Phenanthrene	0.34	0.34

(a) SGT-HEM - Silica-gel treated hexane extractable material.

Table 2-11

Barge/Chemical & Petroleum Subcategory: PSES and PSNS Concentration-Based Limitations for Discharges to POTWs

Pollutant or Pollutant Property	Daily Maximum [mg/L]	
	PSES	PSNS
Non-polar Material (SGT-HEM) (a)	26	26
Cadmium	0.020	0.020
Chromium	0.42	0.42
Copper	0.10	0.10
Lead	0.14	0.14
Mercury	0.0013	0.0013
Nickel	0.58	0.58
Zinc	8.3	8.3

(a) SGT-HEM - Silica-gel treated hexane extractable material.

3.0 DATA COLLECTION ACTIVITIES

EPA collected data from a variety of sources including existing data from previous EPA and other governmental data collection efforts, industry provided information, data collected from questionnaire surveys, and field sampling data. Each of these data sources is discussed below, as well as the quality assurance/quality control (QA/QC) and other data editing procedures. Summaries and analyses of the data collected by EPA are presented in Sections 4.0 through 12.0.

3.1 Summary of TECI Information Collected Prior to 1992

Prior to 1992, EPA conducted two studies of the Transportation Equipment Cleaning Industry (TECI). The first study was performed during the 1973-74 period for the Transportation Industry Point Source Category. This broad study of the transportation industry was not specific to transportation equipment cleaning (TEC) processes and wastewaters and did not result in any regulations for the TECI. Information from the first study was obtained from only a few TEC facilities and was limited to conventional pollutants. Because of the age of this study, EPA did not use any data from this study in the development of the rule.

In 1989, EPA published the Preliminary Data Summary for the Transportation Equipment Cleaning Industry (1). This second study was performed in response to the Domestic Sewage Study, which identified TEC facilities as potentially discharging high levels of conventional, toxic, and nonconventional pollutants in raw and treated wastewaters (2). The study was a preliminary investigation to determine the size of the TECI and to estimate the total discharge of priority pollutants. EPA used this data to perform an environmental impact analysis which formed the basis for EPA's decision to develop effluent guidelines specifically for the TECI.

For the second study, the Agency sampled eight TEC facilities between 1986-87, including one aircraft, three tank truck, two rail tank car, and two tank barge cleaning facilities. Raw TEC wastewater, treated effluent, and sludge were collected and analyzed at each facility.

The samples were analyzed for analytes on the 1987 Industrial Technology Division List of Analytes. This list contains conventional pollutants, EPA's priority pollutants (excluding fecal coliform bacteria and asbestos), and 285 additional organic and inorganic nonconventional pollutants or pollutant characteristics.

3.2 Summary of the TECI Questionnaires

A major source of information and data used in developing effluent limitations guidelines and standards was industry responses to technical and economic questionnaires distributed by EPA under the authority of Section 308 of the Clean Water Act. These questionnaires requested information concerning tank cleaning operations and wastewater generation, treatment and discharge, as well as wastewater characterization data. Questionnaires also requested financial and economic information for use in assessing economic impacts and the economic achievability of technology options.

3.2.1 Identification of Potential TECI Population

In order to characterize the TECI, EPA first developed a potential list of TEC facilities by identifying all potential segments within the industry. EPA characterized the TECI into industry segments based on tank type cleaned (truck, rail, barge, etc.) and business operational structure (independents, carriers, shippers, and builder/leasers) as described in Section 4.0. Since transportation facilities may clean a variety of tank types and may perform a variety of business operations, TEC facilities may have been classified under more than one of these tank type and operational structure segments.

The Agency was unaware of any single source or set of sources that specifically identify facilities that perform TEC operations. Likewise, there is no single Standard Industrial Classification (SIC) code or set of SIC codes that specifically identify facilities that perform TEC operations. Therefore, a variety of sources were identified and evaluated including transportation industry directories, Dun and Bradstreet's Information Services, several Agency databases, trade journals, trade associations, and contacts with state and local authorities.

The Agency performed an exhaustive search to identify all available sources listing facilities that potentially perform TEC operations. In addition to obtaining lists of facilities known to perform TEC activities, data sources were also used to identify potential TEC facilities by one or more of the following criteria: (1) they own, operate, or maintain transportation equipment (tank trucks, rail tank cars, tank barges); (2) they own, operate, or maintain equipment used by the transportation segments applicable to the TECI (truck haulage, rail transportation, and water transportation); or (3) they report under an SIC code that includes facilities that have the potential to own, operate, or maintain transportation equipment (e.g., local liquid haulage, marine cargo handling, loading or unloading vessels). Table 3-1 lists the major sources identified by EPA by tank type and business operational structure.

The list of facilities obtained from different sources varied in terms of the probability that the facilities on the list actually perform TEC operations. For example, EPA considered facilities identified through trade association lists or telephone contacts to have a high probability of performing TEC operations, while facilities identified through the various SIC codes had a lower likelihood of actually performing TEC operations. In order to account for the variation in the quality of data sources, each facility in the TECI site identification database was assigned a level of assurance representing the probability that the facility performs TEC operations.

Facilities were assigned level of assurances of either high, medium, or low based upon the Agency's evaluation of information provided by each facility source, including information provided by industry and trade association representatives, research of industrial practices, and information obtained during telephone conversations. In general, a high level of assurance indicated that a facility was specifically identified as performing TEC operations. Facilities assigned a medium level of assurance were identified as either owning, operating, or maintaining transportation equipment or performing cleaning of transportation equipment (not specifically tanks) in the transportation segments applicable to the TECI (e.g., SIC Codes 4789-0402 Railroad Car Repair and 4789-0401 Cleaning Railroad Trailers). A low level of assurance was assigned to facilities identified as owning, operating, or maintaining equipment related to the transportation industry with no indication of whether cleaning operations are performed (e.g., SIC Code 4491-0101 Marine Cargo Handling, Loading Vessels). Table 3-2 includes a complete list of sources and source level of assurance used to identify potential TEC facilities.

EPA identified a total potential industry population of 30,280 facilities by compiling the lists from all sources. EPA then constructed a database, called the TECI site identification database, of 7,940 facilities that potentially clean tank interiors. For some data sources, only a portion (i.e., a statistical sample) of the total available records were entered into the database. Therefore, the 7,940 facilities contained in TECI site identification database represents a total potential industry population of 30,280 facilities. For each potential TEC facility identified, the following data were entered into the database: facility type (e.g., truck, rail), facility name, facility address, facility telephone numbers, primary and secondary facility contacts, source(s) of facility information, and level of assurance.

Since multiple sources were used to identify the TEC population, duplicate searches were performed on the database to ensure that there were no duplicate records in the TECI site identification database. This database served as the initial population for EPA to collect industry provided data.

During identification of the potential TECI population and development of the Screener Questionnaire sample frame (see Section 3.2.2.1), the Agency included facilities that clean the exteriors of aircraft and facilities that deice/anti-ice aircraft and/or pavement in the scope of the TECI. As such, the Agency endeavored to identify the population of facilities that perform these operations and entered information for these facilities into the TECI site identification database. The TECI site identification database includes information for an additional 3,960 facilities that potentially clean the exteriors of aircraft or deice/anti-ice aircraft and/or pavement. These 3,960 facilities represent a total potential industry population of 4,781 facilities. However, the Agency decided to postpone consideration of developing effluent limitations guidelines and standards for this segment. Therefore, references to the aircraft segment in this section are limited to those required to accurately describe the statistical sampling performed to develop the TECI Screener Questionnaire mailing list (see Section 3.2.2.3).

3.2.2 1993 Screener Questionnaire for the Transportation Equipment Cleaning Industry (Screener Questionnaire)

The objectives of the Screener Questionnaire were to:

- Identify facilities that perform TEC operations;
- Evaluate TEC facilities based on wastewater, economic, and/or operational characteristics;
- Develop technical and economic profiles of the TECI;
- Select a statistical sample of screener respondents to receive a Detailed Questionnaire (see Section 3.2.3) such that the sample responses may be used to characterize the TECI; and
- Select facilities for EPA's TECI engineering site visit and sampling program.

3.2.2.1 Development of the Screener Questionnaire Sample Frame

In order to gather all available information on the TECI, the Agency could have mailed Screener Questionnaires to all 11,900 facilities in the TECI site identification database; however, the Agency decided that a sample size of 4,000 would sufficiently represent the variety of technical and economic characteristics of the TECI and meet the objectives of the Screener Questionnaire while minimizing the burden to both industry and government. Therefore, a database containing information on potential TEC facilities was developed from a sample of 4,000 facilities (including both tank interior cleaning and aircraft deicing facilities). Development of the statistical sample frame for the Screener Questionnaire is discussed below.

Facilities were selected from the TECI site identification database to receive a Screener Questionnaire based upon two factors: (1) facility type (i.e., tank truck cleaning, rail tank car cleaning, tank barge cleaning, transfer facilities, and aircraft segment), and (2) probability of performing TEC operations (level of assurance, as discussed in Section 3.2.1). This selection approach divides the TECI into 15 distinct categories or cells (i.e., five facility types times three levels of assurance).

Since facilities that were specifically identified as performing TEC operations were assigned a high level of assurance, all records in the TECI site identification database with a high level of assurance were selected for the mailing list. The initial sample size selected from the remaining cells was calculated using the following equation, which minimizes the statistical variance for a fixed total sample size (3):

$$n_h = n \frac{N_n \sqrt{P_h Q_h}}{\sum N_h \sqrt{P_h Q_h}} \qquad (1)$$

where:

h	=	Cell (e.g., barge-medium)
n	=	Total number of facilities remaining to be allocated [4,000 - 1,211 (high) = 2,789]
n_h	=	Sample size for each cell
N_h	=	Total number of facilities in each cell for which records are available
P_h	=	Probability of performing TEC operations
Q_h	=	$1 - P_h$

The Agency estimated that 15% of facilities with a low level of assurance perform TEC operations, and assigned a P_h value of 0.15 to these facilities. This estimate was based on contacts with a representative sample of facilities in the TECI, contacts with trade associations, and information contained in facility identification sources. Similarly, a P_h value of 0.50 was assigned to the medium level-of-assurance facilities since the Agency estimated that 50% of these facilities perform TEC operations.

The Agency performed statistical precision estimates based on the sample cell sizes determined by equation (1) and the assigned P_h value for the medium and low level-of-assurance cells. These precision estimates predicted unacceptably high statistical variances for cells with a medium level of assurance and less than 400 records in the TECI site identification database (rail-medium, transfer-medium, and barge-medium). Therefore, all records within these cells were selected for the mailing list.

Equation (1) was then reapplied to the remaining cells from which random samples would be selected. The total number of facilities to be allocated, n, was revised from 2,789 to 2,205 after eliminating the three additional census cells (i.e., 4,000 - 1,211 (high) - 218 (rail-medium) - 357 (barge-medium) - 9 (transfer-medium) = 2,205). Table 3-3 summarizes the final distribution of facilities in the TECI Screener Questionnaire mailing list by facility type and level of assurance.

Facilities in the TECI site identification database were then randomly selected for the noncensus cells, with the exceptions of the truck-medium and transfer-low cells. For the truck-medium cell, a "stratified" random selection of facilities, based on source, was required because the truck-medium cell includes facilities identified by several sources from which only a fraction of the potential records available were received, as well as by several sources for which all available records were received (i.e., randomly selecting facilities from this cell, without consideration of source, would bias sources for which a larger percentage of the records available were received). To develop an accurate statistical representation of this cell, the Agency calculated a sample size for each source. Facilities in the truck-medium cell were then selected randomly within each source using the individually calculated, source-specific sample size, with the sum of the source-specific sample sizes equalizing to the total number of facilities to be selected from the truck-medium cell as calculated using equation (1).

Only two facilities were available for selection from the transfer-low cell. Due to the low probability that the transfer-low facilities perform TEC operations, EPA chose only one of the two facilities to receive a questionnaire.

3.2.2.2 Development of the Screener Questionnaire

The Agency requested the following site-specific information for calendar year 1992 in the four-page Screener Questionnaire:

- Facility name and address;
- Contact person;
- Business entity that owns the facility;
- Number of TEC facilities operated by the business entity;
- Whether the facility performs TEC operations;
- Whether the facility generates TEC process wastewater;
- TEC process wastewater discharge information;
- Number of tank interior cleanings performed by tank type;
- Percentage of tank interior cleanings performed by cargo type;
- Types of cleaning processes performed;
- Facility total average daily wastewater discharge;
- Wastewater treatment technologies or disposal methods;
- Facility operational structure (e.g., carrier, independent);
- Number of employees - total and TEC-related; and
- Annual revenues - total and TEC-related.

3.2.2.3 Administration of the Screener Questionnaire

In December 1993, the Agency mailed 3,240 Screener Questionnaires to potential tank interior cleaning facilities. This Screener Questionnaire mail-out comprised the statistical sample frame described in Section 3.2.2.1. Additionally, EPA mailed out Screener Questionnaires to 28 facilities that transport hazardous waste in order to obtain additional data for use in determining their applicability under the TECI guideline. For the same reason, EPA mailed one Screener Questionnaire to a facility that cleans the interiors of ocean/sea tankers. This facility had been identified subsequent to development of the TECI site identification database. Since these 29 facilities were not included in the statistical sample population, responses from these facilities were not used in calculating national estimates for the TECI. Table 3-4 summarizes the Screener Questionnaire mail-out, follow-up, and receipt activities.

EPA established a toll-free helpline to assist Screener Questionnaire recipients in completing the questionnaire. The helpline received calls from 698 questionnaire recipients.

Following receipt of the Screener Questionnaire responses, an initial review was performed to determine whether the facility indicated that TEC operations were performed at their location. Facilities that indicated that TEC operations were performed at their location and that they generated TEC wastewater were preliminarily designated “in-scope” facilities. Facilities that indicated that TEC operations were performed at their location but that they did not generate TEC wastewater were designated “dry” facilities. Facilities that indicated that TEC operations were not performed at their location were designated “out-of-scope” facilities. Responses from a total of 754 in-scope facilities and 24 dry facilities were received by the Agency. An additional 245 Screener Questionnaires for which responses were not received were determined to be either inactive or out-of-scope based on telephone calls or other follow-up activities. Responses for 90 facilities, approximately two percent of the mailing list, were unaccounted for (i.e., certified mail cards not returned, Screener Questionnaire returned as undeliverable, and follow-up phone calls not returned). The remaining responses were from out-of-scope facilities.

Screener Questionnaire responses from in-scope facilities were then entered into the Screener Questionnaire database. The quality of responses in the database was evaluated by performing a number of database range and logic checks. For example, one check verified that the total number of facility employees exceeded the number of employees that perform TEC-related activities. The Agency followed up with facilities that “failed” a prioritized list of range and logic checks to resolve missing or contradictory information.

3.2.2.4 Calculation of National Estimates

Each source used to develop the TECI site identification database was considered a statistical "stratum" during development of the Screener Questionnaire sample frame. Each surveyed facility in a stratum represents a specific number of facilities in the national population. For example, if a surveyed facility falls within stratum "A" and the "weight" of that stratum is 5, the responses received from that facility represent a total of five facilities in the overall TECI population. Following receipt of the Screener Questionnaire responses (to account for nonrespondents), EPA determined a weight associated with each stratum using the following equation:

$$\text{Stratum Weight} = \frac{N_h}{n_h} \qquad (2)$$

where:

N_h = Total number of facilities in stratum
n_h = Number of facilities that responded to the Screener Questionnaire

Subsequent to administration of the Screener Questionnaire, the Agency reviewed the Screener Questionnaire strata and specific facility assignments within the strata and determined that post-stratification of certain sources (strata) and adjustment of certain facility assignments within the strata would improve the statistical confidence of the strata and reduce sample bias within the original sample frame. Post-stratification adjustments made are described below. Additional details concerning post-stratification of the Screener Questionnaire sample frame are included in reference 4.

- Some facilities were identified by multiple sources in multiple transportation types applicable to the TECI (e.g., truck facility in one source and rail facility in another source). For the Screener Questionnaire sample frame, these facilities were classified as "transfer" facilities. During post-stratification, since these facilities are not characteristically different from other facilities in the primary source (facilities identified by multiple sources were assigned a primary source, generally based on the source level of assurance), they were reassigned to the original tank type in the primary source for scale-up purposes.

- Facilities identified as performing TEC operations based on telephone contacts during development of source level-of-assurance assignments had been classified as “high,” regardless of the original source, because EPA knew (i.e., had a high level of assurance) that these facilities performed TEC operations. Classifying these facilities as “high” biased the national estimates; therefore, these facilities were post-stratified to their original source, facility type, and level of assurance group.

- In order to reduce the variability of the national estimates, several Screener Questionnaire strata with similar weighting factors were collapsed into a single strata and assigned a conglomerated weighting factor for the entire collapsed strata. For example, all censused Screener Questionnaire strata (e.g., truck-high, rail-high, barge-medium), with a few exceptions, were collapsed into a single stratum.

After incorporating the post-stratification adjustments described above, the Screener Questionnaire sample frame included 13 strata, which are listed in Table 3-5. EPA recalculated the survey weighting factors for each of the revised Screener Questionnaire strata and estimated that the total number of facilities in the TECI was 2,739 facilities. These data are also listed in Table 3-5.

3.2.3 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry (Detailed Questionnaire)

EPA designed and administered a Detailed Questionnaire to a statistical sample of eligible TEC facilities from the Screener Questionnaire respondents. The objectives of the Detailed Questionnaire were to collect detailed site-specific technical and economic information pertaining to the year 1994 to:

- Develop an industry profile;

- Characterize TEC processes, industry production (i.e., number and type(s) of tanks cleaned), and water usage and wastewater treatment;

- Perform an industry subcategorization analysis;
- Develop pollutant loadings and reductions estimates;
- Develop compliance cost estimates; and
- Determine the impacts of the rulemaking on the TECI.

3.2.3.1 Development of the Detailed Questionnaire Sample Frame

Facilities responding to the Screener Questionnaire were preliminarily identified as “in-scope” if they performed TEC operations that generated wastewater in 1992. As shown in Table 3-4, EPA received Screener Questionnaire responses from 754 in-scope facilities. Twenty-four of these responses were from the second mailing to 29 facilities described in Section 3.2.2.3 that were not part of the statistical sampling effort. Another 16 facilities indicated that although they performed TEC operations in 1992, they would not be performing these operations in the future. Therefore, 40 in-scope respondents were ineligible for selection to receive a Detailed Questionnaire and were not included in the Detailed Questionnaire sample design. The 714 remaining in-scope respondents were then used as a basis for the sample design.

Based on responses to the Screener Questionnaire, four variables were considered in designing the Detailed Questionnaire sample draw. The four variables were tank type, operational structure, number of employees, and wastewater treatment in place. Each of the 714 potential Detailed Questionnaire recipients was classified based on these four variables as listed below. Facilities with multiple classifications were assigned a primary classification based on their predominant tank type cleaned, predominant operational structure, and highest level of wastewater treatment with some exceptions noted below.

Tank Type

Truck
Rail
Barge

Intermodal Tank Container
Intermediate Bulk Container
Tanker
Land-Water (clean barges or tankers and any other tank types)
Water (clean barges and tankers and no other tank types)
Land (clean any combination of trucks, intermodal tank containers, intermediate bulk containers, or rail cars with no predominant tank type cleaned)

Operational Structure

Builder/Leaser
Carrier
Independent
Shipper
Not Elsewhere Classified (i.e., no predominant operational structure or operational structure not provided)

Number of Employees

Small (varies by operational structure)
Large (varies by operational structure)

Level of Wastewater Treatment in Place

None or Pretreatment
Primary
Secondary
Advanced
Recycle/Reuse

Additional details concerning the methodology used to classify facilities within these four variables are included in references 5 and 6.

The following criteria were used to select the 275 Detailed Questionnaire recipients:

- Select a random sample of facilities, stratified by tank type, from the TECI Screener Questionnaire census stratum;

- Select all facilities in the TECI Screener Questionnaire noncensus strata considered to be primarily composed of operational structures other than "shippers";

- Select a random sample of facilities in the TECI Screener Questionnaire noncensus strata considered to be primarily shippers;

- Select all facilities with the tank type "land-water," "tanker," and "water";

- Select a random sample of at least 20 barge facilities; and
- Select all facilities in strata with two or fewer facilities comprising small businesses (i.e., with small number of employees for the operational structure).

The sampling strategy was designed to meet two objectives most effectively: (1) to ensure that at least one facility was sampled from most cells (i.e., combinations of the four variables previously listed), and (2) to ensure that the variance around the national estimates would not be grossly inflated in attempting to meet the first objective. The design sampled relatively fewer facilities in strata primarily composed of shippers than in strata primarily composed of nonshippers, because, in most cases, the TEC wastewater generated by shippers would be covered by other effluent guidelines. The last criterion described above was included to evaluate cost impacts on small businesses.

To achieve the sample draw criteria listed above, the Detailed Questionnaire stratification consisted of 23 strata created from the 13 Screener Questionnaire strata described in Section 3.2.2.4. Table 3-6 lists the 23 Detailed Questionnaire strata and the distribution of facilities in the TECI Detailed Questionnaire mailing list by these strata.

As part of the standard process of developing the Detailed Questionnaire, nine facilities were selected and sent pretest questionnaires. EPA decided that data from the pretest Detailed Questionnaire responses would not be used in national estimates because they represented data from the year 1993 rather than 1994, the baseline year for the Detailed Questionnaire data. The Detailed Questionnaire sample design treated the facilities that received a pretest questionnaire as eligible for sample selection with the understanding that, if selected, a replacement facility would be chosen. Four questionnaire pretest facilities were selected during the sample draw and were replaced. One of the four facilities was a member of a stratum from which all facilities were to receive a Detailed Questionnaire (i.e., a census stratum). For this stratum, the responses of the facilities remaining in the stratum were used to represent responses from the pretest facility (i.e., the survey weight for the census stratum was revised from 1 to a weight of more than 1).

3.2.3.2 Development of the Detailed Questionnaire

The Agency developed the Detailed Questionnaire to collect information necessary to develop effluent limitations guidelines and standards for the TECI. The questionnaire was developed in conjunction with EPA's Office of Pollution Prevention and EPA's Office of Solid Waste. A draft version of the questionnaire was sent to nine pretest facilities to complete and to several industry trade associations and companies for review and comment. Comments from these facilities, trade associations, and companies were incorporated into the final version of the Detailed Questionnaire.

The Detailed Questionnaire included two parts:

1. Part A: Technical Information

   - Section 1: General Facility Information
   - Section 2: TEC Operations
   - Section 3: Wastewater Generation, Treatment, and Discharge
   - Section 4: Wastewater Characterization Data
   - Section 5: Pollution Prevention and Water Conservation
   - Section 6: Questionnaire Certification for Part A - Technical Information

2. Part B: Financial and Economic Information

   - Section 1: Facility Identification
   - Section 2: Facility and TEC Financial Information
   - Section 3: Business Entity Financial Information
   - Section 4: Corporate Parent Financial Information

Part A, Section 1 requested information necessary to identify the facility and to determine wastewater discharge locations. The information collected by this section included facility name, mailing and physical facility address, technical contract person and address, facility layout diagram, age of facility, major modifications made to the facility, environmental permits held by the facility, wastewater discharge location(s), and whether the facility is regulated by any existing or upcoming national categorical limitations or standards.

Part A, Section 2 requested information necessary to develop an industry profile, characterize TEC processes, determine industry production (i.e., number and type(s) of tanks cleaned), and perform an industry subcategorization analysis. The information collected included a TEC process flow diagram, description of TEC processes, TEC operating days per year and hours per day, types and numbers of tanks cleaned, cleaning processes performed, cleaning solutions used and disposition of spent cleaning solutions, general cargo types and specific cargos cleaned, heel generation and disposition, other operations performed (e.g., tank hydrotesting, exterior washing), and air emissions from TEC operations.

Part A, Section 3 requested information regarding wastewater generation, recycle/reuse, and discharge and to determine wastewater treatment in place. This information was used to develop regulatory compliance cost estimates. The information collected in this section included a wastewater generation, treatment, and discharge diagram; wastewater streams generated and volume; wastewater streams discharged, volume, and destination; wastewater recycle/reuse streams and destination; wastewater treatment unit operations; wastewater treatment residuals generated, volume, disposition, and costs; wastewater treatment system capital and annual costs; and space availability at the facility.

Part A, Section 4 requested information concerning the availability of wastewater stream characterization data and/or treatability data. This information was used to determine whether supplemental analytical data requests would be required.

Part A, Section 5 requested information concerning pollution prevention and water conservation activities. This information was used to identify applicable pollution prevention and water conservation technologies for consideration in developing regulatory technology options. The information collected included submittal of any facility pollution prevention policies or plans, wastewater pollution prevention activities performed and their impacts, water conservation practices used and their impacts, solid waste pollution prevention activities performed and their impacts, and air pollution prevention activities performed and their impacts.

Part A, Section 6 included a certification form indicating that information submitted to EPA was true, accurate, and complete; a check box indicating whether any portion of questionnaire responses were considered confidential business information; and a check box indicating whether contract personnel perform TEC operations or whether TEC operations are performed by a mobile facility.

Part B, Section 1 requested information necessary to identify the facility and identify the facility's corporate hierarchy. The information collected by this section included facility name, mailing and physical facility address, county, street names of closest intersection, contact person and address, types of TEC operations performed, corporate hierarchy, corporation type, and facility type.

Part B, Section 2 requested information necessary to develop an industry economic profile and to assess facility-level economic impacts associated with TECI effluent guidelines. The information collected by this section included primary and secondary SIC codes, first month of facility fiscal year, whether the facility performs non-TEC operations and types, purpose of TEC and non-TEC operations, cost increase that would lead to using commercial tank cleaning sources, percentage of commercial tank interior cleanings performed, and how TEC costs are recovered. The section also requested why clients use TEC services, whether the facility rejects cargos, who accepts rejected cargos, factors that affect TEC operations used, number and types of tanks cleaned, impact of 1993 flooding on TEC revenues and costs, distance to nearest commercial TEC facility, sensitivity of clients to price increases, discount rate of borrowed money, balance sheet information including assets and liabilities, TEC revenue and cost information, income statement information, assessed value, number of employees, and financial statements.

Part B, Section 3 requested information necessary to assess business entity-level economic impacts associated with TECI effluent guidelines. The information collected by this section included name and mailing address, primary and secondary SIC codes, business entity type, list of TEC facilities operated by the business entity and TEC operations performed, year the business entity gained control of facility, and first month of fiscal year. The section also requested top revenue-generating activities, discount rate of borrowed money, balance sheet information including assets and liabilities, TEC revenue and cost information, financial statement information, number of employees, and financial statements.

Part B, Section 4 requested information necessary to assess corporate parent-level economic impacts associated with potential TECI effluent guidelines. The information collected by this section included name and mailing address, primary and secondary SIC codes, year the corporate parent gained control of the business entity, corporate parent type, and financial statements.

A blank copy of the Detailed Questionnaire and copies of the Detailed Questionnaire responses (nonconfidential portions) are contained in the administrative record for this rulemaking. Further details on the types of information collected and the potential use of the information are contained in the Information Collection Request for this project (7). Detailed information on Part B is presented in the economic analysis report (8).

3.2.3.3 Administration of the Detailed Questionnaire

In April 1995, the Agency mailed 275 Detailed Questionnaires to in-scope TEC facilities identified from Screener Questionnaire responses. This Detailed Questionnaire mail-out comprised the statistical sample. EPA evaluated the specific facilities selected to receive the

Detailed Questionnaire and determined that the Detailed Questionnaire sample population would not include a sufficient number of facilities that operate potential BAT end-of-pipe treatment technologies. To obtain additional detailed wastewater treatment information for use in developing regulatory options and estimating compliance cost, EPA mailed an additional 12 Detailed Questionnaires to facilities that operate potential BAT end-of-pipe treatment technologies. Since these 12 facilities were not included in the statistical sample population, responses from these facilities were not used in calculating national estimates for the TECI. Table 3-7 summarizes the Detailed Questionnaire mail-out, follow-up, and receipt activities.

EPA established toll-free helplines, one for Part A and one for Part B, to assist Detailed Questionnaire recipients in completing the questionnaire. The Part A helpline received a total of 477 calls from 192 facilities. The Part B helpline received a total of 161 calls.

The Agency completed a detailed engineering review of Part A of the Detailed Questionnaire responses to evaluate the completeness, accuracy, and consistency of information provided by the respondents, and to perform additional response coding to facilitate data entry and analysis of questionnaire responses. The TEC Questionnaire Part A Coding/Review Checklist (9) outlines the processes used by engineering reviewers to evaluate and code the questionnaire responses. The Data Element Dictionary for Part A of the U.S. Environmental Protection Agency 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry Database (10) contains information codes reported either by the respondents or added by the engineering reviewers during questionnaire response evaluation. The Agency contacted respondents by telephone or letter who provided inaccurate, incomplete, or contradictory technical information.

The Agency entered the questionnaire responses into the Detailed Questionnaire database, the structure of which is documented in the Detailed Questionnaire Data Element Dictionary referenced above. The database was developed in FoxPro™; however, the database was converted to SAS® for other users to access. After engineering review and coding, questionnaire responses were double key entered using a data entry and verification system, also developed in FoxPro™. Additional documentation concerning the data entry and verification system is contained in the administrative record for this rulemaking. Inconsistencies in double key entry were verified by the questionnaire reviewers.

After population of the questionnaire database, the Agency performed range and logic checks to ensure that the database was complete and accurate. During questionnaire analysis, additional questionnaire database "cleanup" was performed to identify and resolve any additional data that were questionable based on engineering judgement. Responses not standardized during coding were standardized, where appropriate, to facilitate questionnaire analysis.

3.2.3.4 Calculation of National Estimates

Each surveyed facility in a stratum represents a specific number of facilities in the national population. Therefore, EPA determined a weight associated with each stratum. For example, if a surveyed facility falls within stratum "A" and the weight of that stratum is 5, the responses received from that facility represent a total of five facilities in the overall TECI population. EPA calculated the survey weighting factors for each of the Detailed Questionnaire strata using equation (2) in Section 3.2.2.4. Details concerning calculation of the Detailed Questionnaire survey weights are included in reference 13. Table 3-8 shows the Detailed Questionnaire strata and their associated strata weights. Calculation of survey weighting factors, which account for nonrespondents, is described in reference 11.

During review of the Detailed Questionnaire responses, the Agency classified each facility within one of the following three categories:

1. **Direct and Indirect Discharge Facilities:** TEC facilities that discharge wastewater to surface waters of the United States (direct discharge) or to a publicly-owned treatment works (POTW) (indirect discharge).

2. **Zero Discharge Facilities:** TEC facilities that do not discharge wastewater to surface waters or to a POTW, and may instead haul wastewater off site to a

centralized waste treater, practice total waste water recycle/reuse, or land apply wastewater.

3. **Previously Regulated (also called captive facilities):** TEC facilities that are covered by existing or upcoming effluent guidelines. TEC operations are a very small part of their overall operations. These facilities include facilities regulated under the Organic Chemicals, Plastics, and Synthetic Fibers Effluent Guideline, the Dairies Effluent Guideline, the Centralized Waste Treaters Effluent Guideline, and the Industrial Waste Combustors (Incinerators) Effluent Guideline. These facilities will not be covered by the TECI effluent guideline as long as they commingle and treat the TEC wastewater with their major source wastewater.

National estimates of the total population of these three TEC facility types are listed in the following table:

Facility Type	Number of Sample Population Responses Received	Estimated Number of Facilities in Total Population
Direct and Indirect Discharge Facilities	93	692
Zero Discharge Facilities	49	547
Previously Regulated Facilities	34	1,166

3.3 Summary of EPA's TECI Site Visit Program from 1993 Through 1999

The Agency conducted 44 engineering site visits (13 of which were conducted concurrently with sampling) at 43 facilities to collect information about TEC processes, water use practices, pollution prevention practices, wastewater treatment technologies, and waste disposal methods. These facilities were also visited to evaluate potential sampling locations (as described in Section 3.4). In general, the Agency visited facilities that encompass the range of TEC facilities. The following table summarizes the number of site visits performed by primary tank type cleaned.

Primary Tank Type Cleaned	Number of Facilities Visited
Truck/Intermediate Bulk Container	22
Rail	10
Barge	9 (one facility visited twice)
Tanker	1
Closed-Top Hopper Barge	1

3.3.1 Criteria for Site Selection

The Agency based site selection on information submitted in response to the TECI Screener and Detailed Questionnaires. The Agency also contacted trade association representatives to identify representative TEC facilities for site visits. The Agency used the following five criteria to select facilities that encompassed the range of TEC operations, wastewater characteristics, and wastewater treatment practices within the TECI.

1. Tank Types Cleaned: Truck, Rail, Barge, Intermodal Tank Container, Intermediate Bulk Container, Tanker, Closed-Top Hoppers;
2. Operational Structure: Independent, Carrier, Shipper, Combinations;
3. Treatment: Advanced, Secondary, Primary, None;
4. Cargo Types Cleaned: Chemicals, Food grade, Petroleum, Combinations; and
5. Discharge Status: Direct, Indirect, 100% Wastewater Recycle/Reuse, Contract Haul.

Facility-specific selection criteria are contained in site visit reports (SVRs) prepared for each facility visited by EPA. Exceptions include site visits performed concurrently with sampling in which case facility-specific selection criteria are contained in sampling episode reports (SERs) prepared for each facility sampled by EPA. The SVRs and SERs are contained in the administrative record for this rulemaking.

3.3.2 Information Collected

During the site visits, EPA collected the following types of information:

- General facility information including size and age of facility, number of employees, operating hours per day and days per year, number of cleaning bays or docks, facility clients, and non-TEC operations;
- Types of tanks and cargos cleaned, number of tanks cleaned by cargo type, reasons for tank cleaning, most difficult cargos to clean, whether and why tanks are rejected;
- Typical cleaning processes used by tank and cargo type;
- Types of cleaning equipment used and operating volume and pressure;
- Heel removal, management, volume, and disposition;
- Cleaning solutions used, temperature, whether cleaning solutions are recirculated, and disposition of spent cleaning solutions;
- Types and disposition of wastewater generated;
- Volumes of wastewater generated per tank cleaned by tank and cargo type;
- Types of in-process source reduction and recycling performed;
- Wastewater treatment units and operation including volume, flow rate, and treatment chemicals used, amounts, and purpose;
- Wastewater discharge location and monitoring requirements;
- Types, volume, and disposition of wastewater treatment residuals;
- Identification of potential sampling points and sampling methodologies; and
- Logistical and health and safety information required for sampling.

This information is documented in the SVRs or SERs for each visited facility.

3.4 Summary of EPA's TECI Sampling Program from 1994 through 1996

The Agency conducted 20 sampling episodes at 18 facilities (two facilities were sampled twice). Twelve of these sampling episodes were conducted to obtain untreated TEC process wastewater and treated final effluent characterization data from facilities representative of the variety of TEC facilities. Wastewater treatment sludge was also characterized at two of these twelve facilities to determine whether the sludge was hazardous. Each of these "characterization" sampling episodes encompassed one sampling day. Eight additional sampling episodes were conducted to obtain both untreated TEC process wastewater characterization data and to evaluate the effectiveness and variability of wastewater treatment units used to treat TEC wastewater. Of these 8 sampling episodes, 1 was conducted for 1 day, 2 were conducted for 3 days each, 4 were conducted for 4 days each, and 1 was conducted for 5 days. The following table summarizes the number of sampling episodes performed by primary tank type cleaned.

Primary Tank Type Cleaned	Number of Facilities Sampled
Truck	7
Rail	5
Barge	7 (two facilities sampled twice)
Closed-Top Hopper Barge	1

At several facilities, sampled TEC waste streams were commingled with other wastewater sources including exterior cleaning wastewater, boiler wastewater, and contaminated stormwater. Samples were typically analyzed for volatile organics, semi-volatile organics, organo-halide pesticides, organo-phosphorus pesticides, phenoxy-acid herbicides, dioxins and furans, metals, and classical wet chemistry parameters. The results of this data collection are discussed in Sections 6.0, 7.0, and 12.0.

3.4.1 Criteria for Site Selection

The Agency based site selection on information submitted in response to the TECI Screener and Detailed Questionnaires or information collected during TECI engineering site visits. The Agency used the same five general criteria to select facilities for sampling as that used to select facilities for site visits:

1. Tank Types Cleaned: Truck, Rail, Barge, Closed-Top Hoppers;
2. Operational Structure: Independent, Carrier, Shipper;
3. Cargo Types Cleaned: Chemicals, Food grade, Petroleum;
4. Treatment: Advanced, Secondary, Primary, None; and
5. Discharge Status: Direct, Indirect, 100% Wastewater Recycle/Reuse.

Facilities sampled during the "characterization" sampling episodes were selected primarily based on tank type and cargo type cleaned, for the overall purpose of characterizing wastewater that was typical of the TECI and representative of the variety of technical and economic characteristics of the TECI. Facilities sampled during the wastewater treatment evaluation sampling episodes were selected primarily based on use of potential BAT and PSES control technologies and widest possible coverage of the TECI effluent guidelines subcategories. Facility-specific selection criteria are contained in SERs and/or sampling and analysis plans (SAPs) prepared for each facility sampled by EPA. The SERs and SAPs are contained in the administrative record for this rulemaking.

3.4.2 Information Collected

In addition to wastewater and solid waste samples, the Agency collected the following information during each sampling episode:

- Dates and times of sample collection;
- Flow data corresponding to each sample;
- Production data (i.e., number of tanks cleaned per sampling day) corresponding to each wastewater sample;
- Design and operating parameters for source reduction, recycling, and treatment technologies evaluated during sampling; and

- Temperature, free chlorine, and pH of the sampled waste streams.

All data collected during sampling episodes are documented in the SER prepared for each sampled facility. SERs are included in the administrative record for this rulemaking. The SERs also contain technical analyses of treatment system performance (where applicable).

3.4.3 Sample Collection and Analysis

During the sampling episode, teams of EPA personnel and EPA contractor engineers, scientists, and technicians collected and preserved samples and shipped them to EPA contract laboratories for analysis. Sample collection and preservation were performed according to EPA protocols as specified in the TEC Quality Assurance Project Plan (QAPP) (12) and the EAD Sampling Guide (13).

In general, composite samples were collected from wastewater streams with compositions that were expected to vary over the course of a production period (e.g., untreated TEC process wastewater prior to equalization). Grab samples were collected from streams that were not expected to vary over the course of a production period (e.g., wastewater streams collected subsequent to extended equalization). Composite samples of wastewater treatment sludge were also collected. EPA collected the required types of quality control samples as specified in the TEC QAPP, such as trip blanks, equipment blanks, and duplicate samples, to verify the precision and accuracy of sample analyses. The list of analytes for each waste stream, analytical methods used, and the analytical results, including quality control samples, are included in the SERs prepared for each facility sampled.

3.5 Summary of Post-Proposal Data Collected

EPA received 50 comment submissions on the TEC proposed rule. From these comments, EPA obtained additional data and information from the industry and POTWs, including monitoring data and information related to cost of treatment and pass through of pollutants at POTWs. The monitoring data submitted included 5 days of effluent data from two truck/chemical facilities and 11 days of final effluent data from an indirect discharger than cleans IBCs; however, these data were not used because the following were not provided: paired influent data; specific flow production data for the sampling point; the treatment technologies used at the facility; and the specific waste streams treated. EPA also received five days of SGT-HEM data from a POTW for raw wastewater, primary effluent, and secondary effluent waste streams. EPA acquired additional information regarding IBCs as well as data critiques on the pesticide/herbicide data. The specific data, information, and comments provided to EPA are located in the administrative record for this rulemaking.

The Agency obtained self-monitoring data from two additional Barge/Chemical & Petroleum facilities operating BPT/BAT treatment. The data consisted of effluent data for conventional pollutants over a one-year period from both facilities, and effluent data for priority pollutants over a one-year period from one facility, totaling approximately 190 effluent data points. The facilities also provided self-monitoring data for chemical oxygen demand (COD) at the influent to biological treatment over the same time period. Complete site visit reports, raw data results, and statistical methodology are located in the administrative record for this rulemaking. EPA used these data to calculate effluent limitations for BOD and TSS for the Barge/Chemical & Petroleum Subcategory as discussed in the Final Statistical Support Document (14).

EPA also received 17 comment submissions on the Notice of Availability (NOA). From these comments, EPA obtained additional self-monitoring data for truck/chemical facilities from one commenter. These data were more representative of the effluent levels at a facility over a much longer period than was represented by EPA's original data set. Therefore, these data were used to calculate final limitations. EPA used the data from one Truck/Chemical & Petroleum Subcategory facility for the calculation of variability factors for copper and mercury. The complete data set, including lab reports and certified monitoring reports, can be found in Section 15.2.2 in the administrative record for this rulemaking.

3.6 Existing Data Sources

In developing the TECI effluent guidelines, EPA evaluated the following existing data sources:

- The Office of Research and Development (ORD) Risk Reduction Engineering Laboratory (RREL) treatability database;
- The Fate of Priority Pollutants in Publicly Owned Treatment Works (50 POTW Study) database;
- Lists of potential TEC facilities from state and local agencies;
- EPA's Permit Compliance System and Industrial Facilities Discharge and Databases; and
- U.S. Navy bilge wastewater characterization data.

These data sources and their uses for the development of the TECI effluent guidelines are discussed below.

3.6.1 EPA's Risk Reduction Engineering Laboratory Treatability Database

EPA's Office of Research and Development (ORD) developed the Risk Reduction Engineering Laboratory (RREL) treatability database to provide data on the removal and destruction of chemicals in various types of media, including water, soil, debris, sludge, and sediment. One component of the RREL database is treatability data from POTWs for various pollutants. This database includes physical and chemical data for each pollutant, the types of treatment used to treat the specific pollutants (predominantly activated sludge and aerobic lagoons for POTWs), the type of media treated (domestic wastewater for POTWs), the scale of the treatment system (i.e., full-, pilot-, or bench-scale), treatment concentrations achieved, treatment efficiency, and source of treatment data. EPA used this database to assess removal by POTWs of TECI pollutants of interest and to select pollutants to be regulated (see Section 12.0).

3.6.2 EPA's Fate of Priority Pollutants in Publicly Owned Treatment Works Database

In September 1982, EPA published the Fate of Priority Pollutants in Publicly Owned Treatment Works (15), referred to as the 50 POTW Study. The purpose of this study was to generate, compile, and report data on the occurrence and fate of the 129 priority pollutants in 50 POTWs. The report presents all the data collected, the results of preliminary evaluations of these data, and the results of calculations to determine the following:

- The quantity of priority pollutants in the influent to POTWs;
- The quantity of priority pollutants discharged from POTWs;
- The quantity of priority pollutants in the effluent from intermediate process streams; and
- The quantity of priority pollutants in the POTW sludge streams.

EPA used the data from this study to assess removal by POTWs of TECI pollutants of concern.

3.6.3 State and Local Agencies

A number of state and local agencies provided the Agency with lists of facilities within their jurisdiction that directly discharge wastewaters and were identified as either performing TEC operations or reporting under an SIC code for facilities that own and/or operate transportation equipment. The following agencies supplied lists of potential TEC facilities: Alabama Department of Environmental Management, Baton Rouge Department of Public Works, City of Houston Industrial Wastewater Service, Kentucky Department of Environmental Protection, Metropolitan Water Reclamation District of Chicago, and State of Mississippi Permitted Facilities.

3.6.4 EPA's Permit Compliance System and Industrial Facilities Discharge Databases

The Agency searched the Permit Compliance System (PCS) and the Industrial Facilities Discharge (IFD) databases to identify facilities that potentially perform TEC operations (see Section 3.2.1). These databases identify facilities that discharge wastewater by four-digit SIC code. Facilities in SIC codes potentially applicable to the TECI were entered into the TECI site identification database.

3.6.5 U.S. Navy Bilge Wastewater Characterization Data

Several facilities in the Barge/Chemical & Petroleum Subcategory for which compliance costs were estimated commingle non-TEC wastewater with TEC wastewater prior to treatment. The non-TEC wastewater of concern consists primarily of marine wastewaters such as bilge wastewater and ship-building wastewater. The U.S. Navy published a report titled "The Characterization of Bilge Water Aboard Navy Ships." EPA reviewed the report for bilge wastewater characterization data and determined that these data were appropriate for use in characterizing marine wastewater streams treated by facilities in the Barge/Chemical & Petroleum Subcategory. A detailed description of the source of the bilge wastewater data and EPA's rationale for transfer of the data to the TECI effluent guidelines development effort is provided in reference 16.

3.7 Summary of Publicly Owned Treatment Works Data

In October 1993 the Association of Metropolitan Sewerage Authorities (AMSA) provided EPA with data from POTW members on industrial users that conducted TEC operations in 1992. The POTWs provided the following information: (1) POTW contact, location, and limits; (2) industrial user information including TEC facility contact, location, average wastewater discharged in gallons per day, and the types of TEC operations performed; (3) industrial user sampling point information; (4) industrial user treatment technologies employed; (5) industrial user pollution prevention practices; and (6) industrial user sampling data collected by the POTW or the industrial user.

EPA considered using the AMSA data as a source in developing the TECI site identification database (see Section 3.2.1); however, because the AMSA data were not received until after the TECI site identification database was finalized, EPA decided not to use these data in developing the database. In addition, the sampling data were not used because very little sampling data were provided and because influent and effluent data were not paired, precluding use to determine treatment performance efficiencies. For these reasons, EPA decided not to use the AMSA data in the development of the final rule.

3.8 References[1]

1. U.S. Environmental Protection Agency, Office of Water Regulations and Standards. Preliminary Data Summary for the Transportation Equipment Cleaning Industry. EPA 440/1-89/104, September 1989 (DCN T10201).

2. U.S. Environmental Protection Agency, Office of Water Regulations and Standards, February 1986, Report to Congress on the Discharge of Hazardous Wastes to Publicly-Owned Treatment Works (referred to as the Domestic Sewage Study "DSS").

3. Cochran, W.S. Sampling Techniques. John Wiley & Sons, 1977. p. 108.

4. Eastern Research Group, Inc., Development of Survey Weights for the U.S. Environmental Protection Agency Tank and Container Interior Cleaning Screener Questionnaire. May 15, 1998 (DCN T11000).

5. Radian Corporation. Transportation Equipment Cleaning Industry (TECI) Tank and Aircraft Screener Database Postings. Memorandum from Debbie Falatko, Radian Corp., to Gina Matthews, U.S. EPA, June 30, 1995 (DCN T10269).

6. Science Applications International Corporation (SAIC). Final Transportation Equipment Cleaning Industry Detailed Questionnaire Sample Design Report. May, 1998 (DCN T11100).

[1]For those references included in the administrative record supporting the TECI rulemaking, the document control number (DCN) is included in parentheses at the end of the reference.

7. U.S. Environmental Protection Agency. Information Collection Request, 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry. November 1994 (DCN T09843).

8. U.S. Environmental Protection Agency. Economic Analysis of Final Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category. EPA 821-R-00-013, June 2000.

9. Radian Corporation. TEC Questionnaire Part A Coding/Review Checklist. September 12, 1995 (DCN T10249).

10. Eastern Research Group, Inc. Data Element Dictionary for Part A of the U.S. Environmental Protection Agency 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry. April 4, 1997 (DCN T10271).

11. SAIC. Statistical Methods for Calculating National Estimates. May 1998 (DCN T11101).

12. Radian Corporation. Draft Quality Assurance Project Plan for the Transportation Equipment Cleaning Industry. January 19, 1995 (DCN T10233).

13. Viar and Company. EAD Sampling Guide. June 1991 (DCN T10218).

14. U.S. Environmental Protection Agency. Statistical Support Document of Final Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category. June 2000 (DCN 20636).

15. U.S. Environmental Protection Agency. Fate of Priority Pollutant in Publicly-Owned Treatment Works. EPA 440/1-82/303, September 1982 (DCN T10311).

16. Eastern Research Group, Inc. Development of Transportation Equipment Cleaning Industry Production Normalized Pollutant Loadings. Memorandum from Grace Kitzmiller, Eastern Research Group, Inc. to the TECI Rulemaking Record. May 6, 1998 (DCN T09981).

Table 3-1

Major Sources Used to Identify Potential TEC Facilities by Tank Type and Business Operational Structure

	Tank Trucks, Closed-Top Hopper Trucks, Intermodal Tank Containers, and Intermediate Bulk Containers	Rail Tank Cars and Closed-Top Hopper Rail Cars	Tank Barges, Closed-Top Hopper Barges, and Ocean/Sea Tankers	Transfer Facilities (Multiple Modes of Transportation)
Independent	Modern Bulk Transporter, 1993 Tank Cleaners Directory Modern Bulk Transporter, 1993 Tank Trailer Repair Directory Dun & Bradstreet	1993 Repair Car Directory 1992 Pocket List of Railroad Officials Dun & Bradstreet	1993 Inland River Guide Dun & Bradstreet 1993 American Waterways Shipyard Conference Shipyard Services Directory	Modern Bulk Transporter, 1993 Tank Cleaners Directory 1993 Inland River Guide
Carrier	Dun & Bradstreet 1993 National Motor Carriers Directory Modern Bulk Transporter, 1993 Tank Cleaners Directory Modern Bulk Transporter, 1992 Tank Container Depot Directory	Dun & Bradstreet	Dun & Bradstreet 1993 Inland River Guide 1993 Industrial and Hazardous Waste Transporters	1993 National Motor Carriers Directory Modern Bulk Transporter, 1992 Bulk Transfer Directory
Shipper	TRINC Users File 1993 Private Fleet Directory	1992 Pocket List of Railroad Officials 1993 Private Fleet Directory TRINC Users File	Dun & Bradstreet	TRINC Users File 1992 Pocket List of Railroad Officials 1993 National Motor Carriers Directory
Builder/Leaser	Modern Bulk Transporter, 1993 Tank Trailer Repair Directory	1992 Pocket List of Railroad Officials Union Tank Car List of Facilities	1993 Inland River Guide	Modern Bulk Transporter, 1993 Tank Trailer Repair Directory

Table 3-2

Sources Used to Identify Potential TEC Facilities

Source	Level of Assurance	Source Code
Potential Tank Barge Cleaning Facilities		
Telephone Contacts (All sources)	high	All
1993 Inland River Guide (Tank barge cleaning operations specifically identified)	high	14
1993 American Waterways Shipyard Conference (AWSC) Shipyard Services Directory (Tank barge cleaning operations specifically identified)	high	1
Metropolitan Water Reclamation District of Chicago List	high	25
1993 Inland River Guide (Perform tank barge operations)	medium	14
1993 AWSC Shipyard Services Directory (Perform tank barge operations)	medium	1
Kentucky Department for Environmental Protection List	medium	15
Dun and Bradstreet (Second order of SIC codes) (Assessed based on SIC code descriptions)	medium	12
Dun and Bradstreet (First order of SIC codes) (Assessed based on SIC codes descriptions)	medium	11
1993 Industrial and Hazardous Waste Transporters	medium	13
TRINC Users File	medium	23
Dun and Bradstreet (First order of SIC codes) (Assessed based on SIC code descriptions)	low	11
Dun and Bradstreet (Second order of SIC codes) (Assessed based on SIC code descriptions)	low	12
EPA's Permit Compliance System	low	18
Potential Rail Tank Car Cleaning Facilities		
1992 Pocket List of Railroad Officials	high	19
Telephone Contacts (All sources)	high	All
Union Tank Car List of Facilities	high	24
Repair Car Directory, February, 1993	high	21
Repair Car Directory, February, 1992	high	20
Modern Bulk Transporter, February, 1993, Tank Trailer Repair Directory	high	5
1993 Industrial and Hazardous Waste Transporters	medium	13
Alabama Department of Environmental Management List	medium	3
Kentucky Department for Environmental Protection List	medium	15
Mississippi Permitted Facilities	medium	16

Table 3-2 (Continued)

Source	Level of Assurance	Source Code
Dun and Bradstreet (First order of SIC codes) (Assessed based on SIC code descriptions)	medium	11
Dun and Bradstreet (Second order of SIC codes) (Assessed based on SIC code descriptions)	medium	12
Dun and Bradstreet (First order of SIC codes) (Assessed based on SIC code descriptions)	low	11
Dun and Bradstreet (Second order of SIC codes) (Assessed based on SIC code descriptions)	low	12
EPA's Permit Compliance System	low	18
Potential Transfer Facilities		
1993 Inland River Guide	high	14
Modern Bulk Transporter, December 1992, Bulk Transfer Directory	high	6
Dun and Bradstreet (First order of SIC codes) (Assessed based on SIC code descriptions)	medium	11
Dun and Bradstreet (Second order of SIC codes) (Assessed based on SIC code descriptions)	medium	12
Dun and Bradstreet (First order of SIC codes) (Assessed based on SIC code descriptions)	low	11
Dun and Bradstreet (Second order of SIC codes) (Assessed based on SIC code descriptions)	low	12
EPA's Permit Compliance System	low	18
Potential Tank Truck Cleaning Facilities		
Telephone Contacts (All sources)	high	All
Modern Bulk Transporter, March 1993, Tank Cleaners Directory	high	4
Modern Bulk Transporter, February 1993, Tank Trailer Repair Directory	high	5
Modern Bulk Transporter, December 1992, Tank Container Depot Directory	high	6
Modern Bulk Transporter, March 1992, Tank Cleaners Directory	high	7
Modern Bulk Transporter, January 1992, Advertisement	high	8
Modern Bulk Transporter, September 1992, Advertisement	high	9
City of Houston Industrial Wastewater Service List	high	26
Metropolitan Water Reclamation District of Chicago List	high	25
1993 Industrial and Hazardous Waste Transporters	medium	13
1993 National Motor Carriers Directory	medium	17
TRINC Owners File	medium	22
TRINC Users File (Facilities operate tank trucks)	medium	23

Table 3-2 (Continued)

Source	Level of Assurance	Source Code
Alabama Department of Environmental Management List Mississippi Permitted Facilities	medium	3
Kentucky Department for Environmental Protection List	medium	15
Dun and Bradstreet (Second order of SIC codes) (Assessed by SIC code descriptions)	medium	12
Dun and Bradstreet (First order of SIC codes) (Assessed by SIC code descriptions)	medium	11
1993 Private Fleet Directory	low	2
TRINC Users File (Assessed by SIC code descriptions)	low	23
Dun and Bradstreet (Second order of SIC codes) (Assessed by SIC code descriptions)	low	12
Dun and Bradstreet (First order of SIC codes) (Assessed by SIC code descriptions)	low	11
EPA's Permit Compliance System	low	18

Table 3-3

Original Screener Questionnaire Sample Frame and Distribution of Facilities in the TECI Screener Questionnaire Mailing List by Facility Type and Level of Assurance

Level of Assurance (Probability of Performing TEC Operations)	Facility Type					Total Facilities
	Aircraft Segment (a)	Rail Tank Car Cleaning	Tank Barge Cleaning	Tank Truck Cleaning	Transfer Facilities	
High	266	157	78	604	106	**1,211**
Medium	487	218	357	433	9	**1,504**
Low	7	30	114	1,133	1	**1,285**
TOTAL Facilities	**760**	**405**	**549**	**2,170**	**116**	**4,000**

(a) The Agency has postponed consideration of developing effluent limitations guidelines and standards for the aircraft segment. Data for the aircraft segment are included only to describe the statistical sampling performed to develop the TECI site identification database and the TECI screener mailing list.

Table 3-4

Summary of TECI Screener Questionnaire Mail-Out and Follow-Up Activities

Activity	Number of Facilities
Screeners mailed	3,269
Screeners remailed	184
Screeners returned undelivered	244
Follow-up letters mailed	450
Follow-up phone calls completed	755
Number of dry facilities	26
Screener responses received	2,963
In-scope responses	754
Helpline calls	698
Inactive facilities	268
Screeners unaccounted for	60

Table 3-5

Final Screener Questionnaire Sample Frame Strata and Total Population Estimates

Screener Questionnaire Strata	Screener Questionnaire Strata Code (Source) (a)	Number of In-Scope Screener Responses	Survey Weighting Factor	Estimated Total Number of Facilities in TECI
1	Census (multiple)	509	1.049	533.94
2	Barge-Low (1,12)	1	7.400	7.40
3	Truck-Low (2)	38	10.619	403.51
4	Transfer-Low (11,12,18)	1	9.500	9.50
5	Truck-Low (12)	11	8.762	96.38
6	Truck-Medium (12)	13	8.532	110.91
7	Truck-Medium (13); Non-Census	15	6.308	94.62
8	Truck-Medium (17)	23	8.033	184.77
9	Rail-High (19)	63	2.093	131.86
10	Truck-Medium (22)	7	3.074	21.52
11	Truck-Low (23)	25	33.749	843.73
12	Truck-Medium (23)	17	17.272	293.62
13	Truck-Medium (13); Census	7	1.00	7.00
TOTAL				**2,738.76**

(a) Source code listed in Table 3-2.

Table 3-6

Detailed Questionnaire Sample Frame and Distribution of Facilities in the TECI Detailed Questionnaire Mailing List by Strata

Detailed Questionnaire Strata	Detailed Questionnaire Strata Code (Source) (a)	Number of Facilities Selected for Detailed Questionnaire Mailing List
1	Census - Barge; Census	4
2	Census - Barge; Random	16
3	Census - Land-Water; Census	9
4	Census - Rail; Census	9
5	Census - Rail; Random	11
6	Census - Truck-Land; Census	3
7	Census - Truck-Land; Random	75
8	Census - Tanker-Water; Census	6
9	Barge-Low (1,12); Nonshipper	1
10	Truck-Low (2); Nonshipper	8
11	Truck-Low (2); Shipper	12
12	Transfer-Low (11,12,18); Nonshipper	1
13	Truck-Low (12); Nonshipper	11
14	Truck-Medium (12); Nonshipper	12
15	Truck-Medium (13); Nonshipper; Random	15
16	Truck-Medium (13); Nonshipper; Census	7
17	Truck-Medium (17); Nonshipper	22
18	Rail-High (19); Nonshipper	18
19	Rail-High (19); Shipper	8
20	Rail-High (19); Shipper; Land-Water	3
21	Truck-Medium (22); Nonshipper	7
22	Truck-Low (23); Shipper	10
23	Truck-Medium (23); Shipper	7
TOTAL		**275**

(a) Source code listed in Table 3-2.

Table 3-7

Summary of TECI Detailed Questionnaire Mail-Out and Follow-Up Activities

Activity	Number of Facilities
Detailed Questionnaires Mailed	287
Reminder Phone Calls	156
Delinquent Response Phone Calls or Letters	75
Questionnaire Responses Received — Part A — Part B	 200 195
Responses Received, Insufficient for Analyses — Part A — Part B	 1 5
Out-of-Scope Responses	40 (3 Dry Facilities)
Helpline Calls — Part A — Part B	 192 (477 Total Calls) (161 Total Calls)
Follow-up Calls During Questionnaire Review — Part A — Part B	 171 142

Table 3-8

Detailed Questionnaire Sample Frame Strata and Weights

Detailed Questionnaire Strata	Detailed Questionnaire Strata Code (Source) (a)	Survey Weighting Factor
1	Census - Barge; Census	1.31
2	Census - Barge; Random	2.10
3	Census - Land-Water; Census	1.05
4	Census - Rail; Census	1.05
5	Census - Rail; Random	4.86
6	Census - Truck-Land; Census	1.05
7	Census - Truck-Land; Random	5.37
8	Census - Tanker-Water; Census	1.05
9	Barge-Low (1,12); Nonshipper	7.40
10	Truck-Low (2); Nonshipper	10.62
11	Truck-Low (2); Shipper	25.66
12	Transfer-Low (11,12,18); Nonshipper	9.50
13	Truck-Low (12); Nonshipper	8.76
14	Truck-Medium (12); Nonshipper	8.53
15	Truck-Medium (13); Nonshipper; Random	6.31
16	Truck-Medium (13); Nonshipper; Census	1.00
17	Truck-Medium (17); Nonshipper	8.03
18	Rail-High (19); Nonshipper	2.09
19	Rail-High (19); Shipper	10.20
20	Rail-High (19); Shipper; Land-Water	2.09
21	Truck-Medium (22); Nonshipper	3.07
22	Truck-Low (23); Shipper	84.37
23	Truck-Medium (23); Shipper	41.95

4.0 INDUSTRY DESCRIPTION

The Transportation Equipment Cleaning Industry (TECI) includes facilities that use water to clean the interiors of tank trucks, closed-top hopper trucks, intermodal tank containers, rail tank cars, closed-top hopper rail cars, tank barges, closed-top hopper barges, ocean/sea tankers, and other similar tanks (excluding intermediate bulk containers (IBCs) and drums). This section describes and provides a profile of the TECI. Information presented in this section is based on data provided by facilities in response to the Detailed Questionnaire (1) and obtained by EPA's site visit and sampling programs. The Detailed Questionnaire database (2) includes information necessary to develop an industry profile, characterize transportation equipment cleaning (TEC) processes, and perform an industry subcategorization analysis. Note that the data contained in the Detailed Questionnaire database reflect TECI operations in calendar year 1994.

Information presented in this section is based on operations performed by the estimated total TECI population of 1,229[1] facilities. This total includes an estimated 692 discharging facilities and 537[1] zero discharge facilities.

4.1 Operational Structure

The TECI is characterized by four business operational segments: independents, carriers, shippers, and builder/leasers. Independent facilities provide commercial cleaning services, either as a primary or secondary business, for tanks that they do not own or operate. Carrier-operated facilities, or "for-hire facilities," own, operate, and clean tank fleets used to transport cargos for other companies. Shipper-operated facilities transport their own cargos or engage carriers to transport their cargos, and clean the fleets used for such transport. Builder/leaser facilities manufacture and/or lease tanks, and clean the interiors of these tanks after

[1] Does not include an additional estimated 10 facilities represented by a single nonrespondent.

equipment has been placed in service. Since transportation facilities may perform a variety of business operations, TEC facilities may be classified under more than one operational segment.

The TECI is additionally classified based on the relationship between the cleaning facility and the customer: commercial and in-house. The first category, commercial facilities, includes independent tank wash facilities and builder/leaser-operated facilities, at which customers pay a fee for tank cleaning. The second category comprises shipper-operated or carrier-operated facilities that provide tank cleaning facilities to support in-house operations. These facilities are considered private because tank cleaning services may not be offered to nonaffiliated transportation equipment.

Approximately two-thirds of the TECI are shipper-operated or carrier-operated facilities that provide tank cleaning services to support in-house operations. Tank trucks and rail tank cars that last transported food grade products are most likely to be cleaned by in-house facilities because these tanks usually transport the same cargos for the same food processing facility and because quality control measures are more stringent for cleaning food-grade tanks. In contrast, tank and hopper barges are typically cleaned by independent tank wash facilities located on their travel routes, because these carriers usually transport cargos in both directions to maximize their large capacities and minimize the effects of the slower travel.

4.2 Cleaning Purpose

Tank and container interiors are cleaned for two primary purposes: (1) to prevent contamination of materials from one cargo shipment to the next and (2) to facilitate inspection and repair. Facility responses to the Detailed Questionnaire indicate that tanks are used to transport more than 700 unique cargos. Tanks that are not in dedicated service (i.e., tanks that carry a variety of products) are generally cleaned before each product changeover to prevent contamination of the new cargo. Some tanks in dedicated service also require cleaning to prevent contamination of subsequent cargos if product purity is a concern, such as for certain process chemicals and food products, including milk, vegetable oils, molasses, and corn syrup. Sections 4.4 and 4.5 discuss in detail the tank types and cargo types cleaned, respectively.

Tank interiors are also cleaned to facilitate internal inspection of the tank and/or inspection of fittings and valves that may be required as part of a routine inspection and maintenance program. In addition, the interior of the tank must be rendered nonexplosive and nonflammable through a cleaning process called "gas-freeing" to provide a safe environment for manual cleaning and for tank repairs that require "hot work" (e.g., welding or cutting).

4.3 TEC Operations

Although different types of tanks are cleaned in various manners, the basic cleaning process for each tank is similar. A typical sequence is as follows:

- Review shipping manifest forms to determine the cargo last transported in the tank;
- Determine the next cargo to be transported in the tank;
- Drain the tank heel (residual product) and, if necessary, segregate the heel for off-site disposal;
- Rinse the tank with water;
- Wash the tank using one or more cleaning methods and solutions;
- Rinse the tank with water; and
- Dry the tank.

Figure 4-1 illustrates the general TEC processes performed. The following paragraphs further describe these processes.

The cleaning facility determines the cargo last transported in the tank to: (1) assess the facility's ability to clean the tank efficiently; (2) determine the appropriate cleaning sequence and cleaning solutions; (3) evaluate whether the residue cleaned from the tank will be compatible with the facility's wastewater treatment system; and (4) establish an appropriate level of health and safety protection for the employees who will clean the tank. The next cargo to be transported in the tank is identified to determine if the available level of cleaning at the facility is adequate to prevent contamination of the next cargo. The facility may decide to reject a tank based on any of the preceding concerns.

Once a tank has been accepted for cleaning, the facility checks the volume of heel (residual cargo) in the tank and determines an appropriate heel disposal method. Any water-soluble heels that are compatible with the facility's treatment system and the conditions of the facility's wastewater discharge permit are usually combined with other wastewaters for treatment and discharge at the facility. Incompatible heels are segregated into drums or tanks for disposal or reuse by alternative means, which may include reuse on site, return to the consignee, sale to a reclamation facility, landfilling, or incineration. The TEC facility may reuse heels comprising soaps, detergents, solvents, acids, or alkalis as tank cleaning solutions or as neutralizers for future heels and for wastewater treatment. Section 4.6 discusses heel removal and disposal in detail.

Cleaning processes vary among facilities depending on available cleaning equipment and the cargos last transported in the tanks to be cleaned. Certain residual materials (such as sugar) only require a water rinse, while other residual materials (such as latexes or resins) require a detergent or strong caustic solution followed by a final water rinse. Other cleaning processes include presolve (application of solvent or diesel to the tank interior for cargos that are difficult to remove), steam cleaning, and forced air drying. The state of the product last transported in the tank affects the cleaning processes used. For example, hardened or caked-on products sometimes require an extended processing time. Some tanks require manual cleaning with scouring pads, shovels, or razor blades to remove residual materials. The cleaning of tanks used to transport gases or volatile material sometimes requires filling the tank to capacity with water to displace vapors, followed by flushing of the wastewater. Section 4.7 discusses chemical cleaning solutions in detail.

Tanks are typically washed using one of two methods: (1) low- or high-pressure spinner nozzles or (2) hand-held wands and nozzles. Spinner nozzles, which are inserted through the main tank hatch, operate at pressures between 100 pounds per square inch (psi) and 600 psi to deliver hot or cold water rinses and a variety of cleaning solutions. They are designed to rotate around both their vertical and horizontal axes to create an overlapping spray pattern that cleans the entire interior of the tank. Operating cycles range from rinse bursts of a few seconds to recirculating detergent or caustic washes of 20 minutes or longer for caked or crystallized residues. Washing with hand-held wands and nozzles achieves the same result as with high-pressure spinner nozzles, but requires facility personnel to manually direct the wash solution across the interior surface of the tank.

After cleaning, tanks may be dried by applying ambient or heated air using a blower. Cleaning personnel may enter and inspect tank interiors and perform manual cleaning as required. Valves, fittings, and other tank components may be removed and cleaned by hand. Hoses are generally cleaned in a separate hose bath using the same cleaning solutions as those used to clean tank interiors.

4.3.1 Tank and Hopper Truck, IBC, and Intermodal Tank Container Cleaning

Tank trucks, IBCs, and intermodal tank containers are generally considered empty when they arrive at the facility, but may contain between one quart and twenty gallons of heel (typically less than 1% of tank capacity). Closed-top hopper trucks generally contain less than five pounds of residual material. Tank interior cleaning is typically performed in wash racks (or cleaning bays), but may also be performed in designated wash areas that are not constructed specifically for tank interior cleaning. Tank exterior cleaning is often performed in the same wash racks with the wastewater commingled with tank interior cleaning wastewater. Facilities may have separate, dedicated cleaning bays, cleaning solutions, and equipment for cleaning tanks that previously contained chemical and food grade cargos. On average, tank and hopper truck, IBC, or intermodal tank container cleaning requires two hours: one-half hour for equipment handling (i.e., moving the tank in and out of the cleaning bay and preparation for cleaning), and one and one-half hours for cleaning, which includes visual inspection and any manual cleaning.

4.3.2 Rail Tank and Hopper Car Cleaning

Rail tank cars are generally considered empty when they arrive at the facility, but cars typically contain approximately 60 gallons of heel (typically less than 1% of tank capacity). Rail tank and hopper car cleaning processes are similar to the processes used for tank and hopper truck cleaning described above; however, rail cars are more likely to be cleaned using steam rather than caustic or detergent cleaning solutions. Rail car exteriors are less likely to be cleaned. Of particular concern during rail tank car cleaning is the potential to damage the interior tank lining, which is designed to protect the tank wall from corrosion by the tank contents.

4.3.3 Tank and Hopper Barge and Ocean/Sea Tanker Cleaning

Tank barges are generally considered empty when they arrive at the facility, but typically contain approximately 1,000 gallons of heel (typically less than 1% of tank capacity). Tank barge cleaning facilities typically perform six basic operations: strip liquid free, strip and blow, clean for a Marine Chemist's Certificate, cold water manual wash, cold water Butterworth® (low-pressure, high-volume spinner) wash, and hot water Butterworth® wash. Depending on the specifications of the cleaning request, any one of these operations is performed or repeated, and cleaning solutions may be used. The most common cleaning operation involves heel stripping followed by a Butterworth® wash and rinse. Heel, wash, and rinse waters are removed from the tanks using vacuum pumps. The barge is then certified for entry by a Marine Chemist and facility personnel enter the tanks to inspect the interior. If necessary, a manual wash is performed. Cleaning time for tank barges typically ranges from four to eight hours.

Hopper barges require more manual cleaning than tank barges because of the dense nature of the dry bulk cargos last transported. Hopper barges have covers that are easily removed by a crane to facilitate tank entry by personnel and equipment, and eliminate confined-space entry concerns. Typically, a skid loader (e.g., Bobcat®) is lowered by crane into the barge and collects the heel into a large container. The skid loader and container are then removed and personnel manually wash the inside of the barge using a high-pressure, high-volume fire hose. Wash water is continually stripped from the barge using a vacuum pump. The barge may then be inspected by a grain inspector.

The cleaning operations performed for ocean/sea tankers are similar to those of tank barges, although larger in scale. Cargo hold interiors are predominantly cleaned at sea by the tanker crew, with wastewater either discharged shore side at ballast water treatment facilities or at sea within the provisions of the International Convention for the Prevention of Pollution by Ships (MARPOL). A relatively small percentage of cargo hold interiors are cleaned shore side to facilitate inspection and repair and are performed concurrently with ballast tank and bunker (fuel) tank cleanings.

4.3.4 Special Cleaning Processes

Tanks (particularly tank trucks) that last contained food grade products such as corn and sugar sweeteners, juice, and chocolate are typically cleaned using a computer operated and controlled washing system, which regulates the cleaning equipment for each step in the selected cleaning sequence, including flow rate, pressure, temperature, and cleaning sequence duration. The cleaning process is performed in dedicated food grade cleaning bays equipped with stainless steel cleaning equipment. A hot water wash is performed according to standards adopted by the Coca-Cola Company©, which require certification that each tank has been washed and sanitized at a temperature of at least 180°F for a minimum of 15 minutes as measured by the temperature of the wash water exiting the tank. The system includes a temperature chart to continuously record the temperature of the recirculating wash water and generates a cleaning ticket for each tank certifying that the temperature and time requirements have been met. The specification requires tank recleaning if not loaded within 24 hours of certification.

4.4 Tank Types Cleaned

Facilities responding to the TECI Detailed Questionnaire reported cleaning nine primary tank types. These nine tank types can be subdivided into a total of 34 tank classifications by tank capacity; however, only the primary tank type classifications were considered for this discussion. The table below lists each of the nine primary tank types and number cleaned. A definition of these tank types is located in the glossary in Section 15.0.

Tank Type	Number of Cleanings Per Year	Percentage of Total Number of Tank Cleanings (%)
Tank Truck (T)	2,110,000	87
Intermediate Bulk Container (IBC)	84,500	3
Intermodal Tank Container (IM)	81,500	3
Closed-Top Hopper Truck (TH)	65,500	3
Rail Tank Car (R)	49,700	2
Ocean/Sea Tanker (NT)	14,800	<1
Closed-Top Hopper Barge (BH)	12,600	<1
Closed-Top Hopper Rail Car (RH)	8,990	<1
Tank Barge (B)	8,960	<1
TOTAL (a)	**2,440,000**	**100**

(a) Differences occur due to rounding.

The majority of facilities in the TECI reported cleaning only one primary tank type; however, a total of twenty tank types and combinations of tank types were reported to be cleaned by facilities in the TECI. The distribution of tank types cleaned is summarized below.

Facility Group	Total Number of Facilities in Group	Percentage of Total Facilities in the TECI (%)
Facilities that clean only one primary tank type (e.g., T only, R only)	913	74
Facilities that clean both tanks and closed-top hoppers within the same mode of transport only (e.g., T and TH, R and RH)	142	12
Facilities that clean tank types with multiple modes of transport (e.g., T and R, R and B)	13	1
Facilities that clean miscellaneous combinations of tank types (i.e., no apparent tank type trends)	160	13
TOTAL (a)	**1,229**	**100**

(a) Differences occur due to rounding.

This distribution demonstrates that the TECI is mostly characterized by facilities that clean only one primary tank type. Of the 913 facilities that clean only one primary tank type, 73% clean only tank trucks and 11% clean only rail tank cars. The remaining 16% of facilities clean, in descending order by percentage of facilities, intermediate bulk containers, closed-top hopper trucks, tank barges, closed-top hopper barges, and ocean/sea tankers. This distribution corresponds closely to the total number of each type of tank cleaned. The Agency did not identify any facilities that clean only either intermodal tank containers or closed-top hopper rail cars.

For facilities that clean both tanks and closed-top hoppers within the same mode of transport (e.g., T and TH, R and RH, or B and BH), the percentage of tank cleanings performed versus hopper cleanings performed was estimated. At 94% of the facilities that clean both tank trucks and closed-top hopper trucks, tank truck cleanings account for at least 75% of all cleanings performed. For the remaining 6% of facilities, hopper truck cleanings account for more than 99% of all cleanings performed. At 91% of facilities that clean both rail tank cars and closed-top rail hopper cars, rail tank car cleanings typically account for greater than 60% of all cleanings performed. For the remaining 9% of facilities, rail hopper car cleanings account for nearly 86% of all cleanings performed. For facilities that clean both tank barges and closed-top hopper barges, tank barge cleanings comprise less than 1% of all cleanings performed. These distributions suggest that facilities that clean both tanks and closed-top hoppers typically clean either predominantly tanks or predominantly closed-top hoppers.

Only 1% of the TECI consists of facilities that clean tank types within multiple modes of transportation and 13% cleans combinations of tank types. Of the 13%, all of these facilities clean tank trucks and some combination of intermediate bulk containers and/or intermodal tank containers. Some of these facilities also clean a relatively small percentage of closed-top hopper trucks.

4.5 Cargo Types Cleaned

Facilities responding to the TECI detailed questionnaire reported cleaning 15 general cargo types listed below. Appendix A of the Detailed Questionnaire contains a more detailed description of these cargo types.

- Group A - Food Grade Products, Beverages, and Animal and Vegetable Oils;
- Group B - Petroleum and Coal Products;
- Group C - Latex, Rubber, and Resins;
- Group D - Soaps and Detergent;
- Group E - Biodegradable Organic Chemicals;
- Group F - Refractory (Nonbiodegradable) Organic Chemicals;
- Group G - Inorganic Chemicals;
- Group H - Agricultural Chemicals and Fertilizers;
- Group I - Chemical Products;
- Group J - Hazardous Waste (as defined by RCRA in 40 CFR Part 261);
- Group K - Nonhazardous Waste;

- Group L - Dry Bulk Cargos; and
- Group M, N, and O - Other (Not Elsewhere Classified).

Table 4-1 lists the number of tanks cleaned by the industry by cargo type.

Figure 4-2 illustrates the distribution of TEC facilities by the number of cargo types cleaned. As demonstrated by this distribution, the TECI is characterized by facilities that clean either a single cargo type (48%) or a variety of cargo types (52%).

The distribution of the facilities that clean a single cargo type is presented in Table 4-2. Of the facilities that reported cleaning only one cargo type, 81% clean either food grade products, beverages, and animal and vegetable oils (65%) or petroleum and coal products (16%). Facilities that reported cleaning only "other" cargos (Groups M, N, and O) comprise 10% of facilities that clean a single cargo type. Over half of these facilities that clean only "other" cargos clean tanks that last contained drilling mud, drilling fluids, salt water, or frac-sand mix from oil well drilling operations.

A cursory review of the facilities that clean two or more cargo types suggests no apparent trends of cargo types cleaned, but rather a wide variety of combinations of "chemical-type" cargos.

4.6 Heel Removal and Disposal

As noted in Section 4.3, heel is residual cargo remaining in a tank or container following unloading, delivery, or discharge of the transported cargo. The amount of heel removed per tank cleaning depends primarily on the type of tank being cleaned. Other significant factors that impact residual heel volume include cargo viscosity, tank internal construction, tank offloading system design, and consignee tank offloading system design. Table 4-3 provides a detailed analysis of the average volume of heel removed per tank cleaning by cargo group and tank type. (Note that ocean/sea tankers are not included in this analysis because that group of tankers is represented by only one Detailed Questionnaire response and because the facility that responded reported that no heel was removed from tanks cleaned). As shown in the table, tank barges contain the largest amount of heel of all the tank types due to their large capacities. On average, tank trucks, intermediate bulk containers, and intermodal tank containers contain less than 10 gallons of heel and rail cars contain approximately 60 gallons of heel.

Listed below are the 10 discharge or disposal methods for heels reported in responses to the Detailed Questionnaire:

- Discharged with tank cleaning wastewater (WW);
- Discharged or hauled separately from tank cleaning wastewater to a treatment works (ID);
- Evaporation (EV);
- On-site or off-site land disposal (LD);
- On-site or off-site land application (LA);
- On-site or off-site incineration (IN);
- On-site or off-site heat recovery (HR);
- On-site or off-site reuse or recycle (RR);
- Deep well injection (DW); and
- Discharged or hauled separately from tank cleaning wastewater to a hazardous waste treatment, storage, and disposal facility (HD).

Table 4-4 provides a distribution of the total volume of heel discharged or disposed in 1994 by cargo group and by discharge/disposal method. As shown in the table, the largest volume of heel (58%) is reused or recycled on or off site. The largest percentage of reused or recycled heel consists of food grade products, petroleum and coal products, organic and inorganic chemicals, and chemical products. Food grade products heel is often reused as animal feed; petroleum and coal products heel is typically sold for product recovery. The second largest volume of heel (15%) is land disposed; petroleum and coal products heel and dry bulk cargos heel comprise 82% of heel that is land disposed.

Twelve percent of the total heel removed by the TECI is discharged with tank interior cleaning wastewater and comprises primarily inorganic chemical products, food grade products, and latex, rubber, and resin heels. Land application, deep well injection, and incineration are used to dispose less than 2% of the total volume of heel removed.

Many facilities implement measures to reduce the amount of heel received. Of the 1,229 facilities in the TECI, 589 facilities (48% of the population) reported practicing one or more heel minimization measures. The most commonly practiced of these measures is to refuse or reject tanks for cleaning if excessive heel is present. Some facilities charge an extra fee per weight or volume of heel received as an incentive to tank owners to minimize heel. Most TEC facilities maintain good communications with their customers, and drivers are instructed to inspect all tanks to ensure complete product offloading and to eliminate the need to reject tanks for cleaning or to assess extra fees.

4.7 Chemical Cleaning Solutions

As noted in Section 4.3, many cargo types require the use of chemical cleaning solutions in the tank cleaning process. Responses to the Detailed Questionnaire indicate that facilities typically use four types of chemical cleaning solutions: (1) acid solution; (2) caustic solution; (3) detergent solution; and (4) presolve solution. Acid solutions most commonly used by TEC facilities are composed of hydrofluoric and/or phosphoric acid and water. In addition to tank interior cleaning, these acid solutions are used as metal brighteners on aluminum and stainless steel tank exteriors. Caustic solutions typically comprise a mixture of sodium hydroxide and water in different proportions. The most common ingredients in detergent solutions are sodium metasilicate and phosphate-based surfactants. Some facilities use off-the-shelf brands of detergent solutions such as Tide®, Arm & Hammer®, and Pine Power®. Often, concentrated detergents ("boosters") such as glycol ethers or esters are added to acid and caustic solutions to improve their effectiveness. Presolve solutions usually consist of diesel fuel, kerosene, or some other petroleum-based solvent. Other miscellaneous chemical cleaning solutions include passivation agents (oxidation inhibitors), odor controllers such as citrus oils, and sanitizers; these solutions are usually applied on a cargo-specific or tank-specific basis. Responses to the Detailed Questionnaire indicate no obvious trends between the chemical cleaning solutions used and the cargo types cleaned (i.e., each chemical cleaning solution category is reported as being used to clean each cargo type noted in Section 4.5). The choice of chemical cleaning solutions used is more likely a factor of wastewater treatment system compatibility, POTW limitations, facility preference, and/or customer preference.

Of the 1,229 facilities in the TECI, 656 (53% of the population) reported using one or more chemical cleaning solutions. The following table shows the number of facilities that reported using each chemical cleaning solution.

Chemical Cleaning Solution	Number of Facilities That Use Each Chemical Cleaning Solution	Percentage of All Facilities That Use Chemical Cleaning Solutions (%)
Acid Solution	50	8
Caustic Solution	434	66
Detergent Solution	560	85
Presolve Solution	137	21
Other Chemical Cleaning Solution	134	20

As shown in the table, detergent solution is the most commonly used cleaning solution, used by 85% of all facilities that use chemical cleaning solutions. The second most commonly used chemical cleaning solution is caustic solution, which is used by 66% of all facilities that use chemical cleaning solutions. Acid solution is used by only 8% of all facilities that use chemical cleaning solutions.

Chemical cleaning solutions are generally reused until they are no longer effective, as determined by cleaning personnel. Make-up solution is periodically added to replace solution lost in the final rinse or to boost efficacy. Spent cleaning solutions may be hauled off site for disposal or discharged to the on-site wastewater treatment system, if compatible. Of the 656 facilities that reported using chemical cleaning solutions, 84% discharge one or more cleaning solutions to their on-site wastewater treatment systems, 59% of these facilities reuse their cleaning solutions before discharge to wastewater treatment, and 16% send their cleaning solutions off site.

4.8 Non-TEC Operations

In addition to tank interior cleaning, TEC facilities often perform other operations that may generate wastewater. Some of these operations support transportation equipment operations such as tank exterior cleaning, tank hydrostatic testing, and tank repair and maintenance. Other facilities perform processing or manufacturing operations as their primary business and use transportation equipment as a component of their primary business. The following table shows the number of facilities that generate wastewater from each of the non-TEC operations noted above.

Non-TEC Operation	Number of Facilities	Percentage of Total Population (%)	Total Wastewater Generation (gallons per day)
Tank Exterior Cleaning	735	60	1,050,000
Processing and Manufacturing	368	30	62,400,000
Tank Hydrotesting	197	16	900,000
Tank Repair and Maintenance	94	7	6,920

Approximately 60% of facilities generate wastewater from tank exterior cleaning activities. Tank exterior cleaning is usually performed at the same wash rack as tank interior cleaning; therefore, nearly all tank exterior cleaning wastewater is commingled with TEC interior cleaning wastewater prior to treatment. Exterior cleaning wastewater may be contaminated by wastes from a variety of sources, including the cargos last transported in the tank, spent cleaning solutions, exterior surface dirt, soot from engine exhaust, metals from the tank components (including rust), and engine fluids (including fuel, hydraulic fluid, and oil).

Processing and manufacturing operations are performed at nearly one third of facilities and generate relatively large volumes of wastewater. These wastewaters are usually treated and/or discharged together with tank interior cleaning wastewater due to their similar composition.

Tank hydrotesting (i.e., hydrostatic pressure testing), a DOT requirement, is performed to determine the integrity of a tank and is a component of routine tank inspection. Since tanks are usually cleaned before hydrotesting, hydrotesting wastewater contains minimal contaminants and is easily reused or recycled.

Seven percent of facilities in the TECI reported generating wastewater from repair and maintenance activities.

4.9 Geographic Profile

EPA performed a geographical mapping analysis of the Detailed Questionnaire sample population of 142 facilities (discharging facilities plus zero discharge facilities). Note that a simple geographical mapping of these facilities may not accurately represent the TECI because each facility in the sample population has a unique statistical survey weight, ranging from 1.0489 to 87.6106, which is not reflected in the maps. The mapping analysis, however, may be appropriate to identify geographic trends within the TECI. Figures 4-3 through 4-9 illustrate the following facility geographic distributions:

- Figure 4-3: All Facilities;
- Figure 4-4: Truck Facilities;
- Figure 4-5: Rail Facilities;
- Figure 4-6: Barge Facilities;
- Figure 4-7: Chemical Facilities;

- Figure 4-8: Food Grade Facilities; and
- Figure 4-9: Petroleum Facilities.

As illustrated in Figure 4-3, TEC facilities are distributed primarily within the industrial portions of the United States, with relatively high concentrations in the area between Houston and New Orleans and within specific urban areas such as Los Angeles, Chicago, and St. Louis. The distribution of truck facilities illustrated in Figure 4-4 mirrors the distribution of all facilities illustrated in Figure 4-3. The distribution of rail facilities (illustrated in Figure 4-5) shows lower concentrations in the area between Houston and New Orleans and higher concentrations across eastern Texas as compared to Figure 4-3. As illustrated in Figure 4-6, barge facilities are located along inland waterways of the United States (note the location of an ocean/sea tanker cleaning facility in Florida). Presumably, differences among the geographical distributions illustrated in Figures 4-4 through 4-6 indicate major thoroughfares by road, rail, and inland waterway, respectively.

The distribution of chemical facilities illustrated in Figure 4-7 resembles the distribution of all facilities illustrated in Figure 4-3 except for a relatively lower concentration of facilities in the northwestern region of the United States. As illustrated in Figure 4-8, food grade facilities are specifically not located within the area between Houston and New Orleans, and appear to be located primarily within agricultural areas of the United States. The distribution of petroleum facilities does not include a concentration of facilities within the area between Houston and New Orleans, an area typically associated with the petroleum industry. A possible explanation is that petroleum tanks are loaded in the Houston/New Orleans area for transport to other regions of the United States; the tanks may then be cleaned in the local area of the consignee. Another possible explanation is that pipelines rather than tanks are the primary mode of petroleum product transportation in this area.

4.10 References[2]

1. U.S. Environmental Protection Agency. Information Collection Request, 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry. November 1994 (DCN T09843).

2. Eastern Research Group, Inc. Data Element Dictionary for Part A of the U.S. Environmental Protection Agency 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry Database. April 4, 1997 (DCN T10271).

[2]For those references included in the administrative record supporting the TECI rulemaking, the document control number (DCN) is included in parentheses at the end of the reference.

Table 4-1

Number of Tanks Cleaned by Cargo Type – Discharging and Zero Discharge Facilities

Cargo Type Cleaned	Number of Cleanings Per Year	Percentage of Total Number of Tank Cleanings (%)
Food Grade Products, Beverages, and Animal and Vegetable Oils (A)	908,000	37
Petroleum and Coal Products (B)	214,000	9
Latex, Rubber, and Resin (C)	299,000	12
Soaps and Detergents (D)	87,100	4
Biodegradable Organic Chemicals (E)	137,000	6
Refractory (Nonbiodegradable) Organic Chemicals (F)	15,500	1
Inorganic Chemicals (G)	106,000	4
Agricultural Chemicals and Fertilizers (H)	14,000	1
Chemical Products (I)	218,000	9
Hazardous Waste (J)	6,330	<1
Nonhazardous Waste (K)	12,100	<1
Dry Bulk Cargos (L)	36,900	2
Other (M, N, or O)	80,300	3
Not specified	305,000	13
TOTAL (a)	**2,440,000**	**100**

(a) Differences occur due to rounding.

Table 4-2

Distribution of Facilities That Clean a Single Cargo Type – Discharging and Zero Discharge Facilities

Cargo Type Cleaned	Number of Facilities	Percentage of Facilities That Clean Only This Cargo Type (%)
Food Grade Products, Beverages, and Animal and Vegetable Oils (A)	385	65
Petroleum and Coal Products (B)	96	16
Latex, Rubber, and Resins (C)	(a)	(a)
Soaps and Detergents (D)	NC	NC
Biodegradable Organic Chemicals (E)	NC	NC
Refractory (Nonbiodegradable) Organic Chemicals (F)	NC	NC
Inorganic Chemicals (G)	11	2
Agricultural Chemicals and Fertilizers (H)	20	3
Chemical Products (I)	NC	NC
Hazardous Waste (J)	NC	NC
Nonhazardous Waste (K)	NC	NC
Dry Bulk Cargos (L)	22	4
Other (M, N, or O)	60	10
TOTAL (b)	**596**	**100**

(a) The data in this cell represents three or fewer facilities and therefore is not shown here due to confidential business information and/or other data disclosure considerations.
(b) Differences occur due to rounding.
NC - Facilities with this characteristic were not identified by responses to the Detailed Questionnaire. Therefore, data for these facilities, if facilities with these characteristics do indeed exist, are not available for this analysis.

Table 4-3

Average Volume of Heel Removed per Tank Cleaning by Cargo Group and Tank Type – Discharging and Zero Discharge Facilities

Cargo Group	Tank Type (gallons of heel/tank)							
	Truck Tank	Rail Tank	Tank Barge	Truck Hopper	Rail Hopper	Barge Hopper	Intermediate Bulk Container	Intermodal Tank Container
Food Grade Products (A)	20	58	924	6	165	13	NC	2
Petroleum and Coal Products (B)	2	128	1050	1	(a)	166	<1	<1
Latex, Rubber, and Resin (C)	3	29	(a)	<1	(a)	NC	2	2
Soaps and Detergent (D)	2	51	NC	<1	(a)	NC	1	<1
Biodegradable Organic Chemicals (E)	2	27	868	<1	7	NC	0	<1
Refractory Organic Chemicals (F)	<1	22	683	<1	NC	NC	NC	0
Inorganic Chemicals (G)	1	19	562	<1	337	NC	<1	0
Agricultural Chemicals and Fertilizers (H)	<1	49	364	<1	15	112	NC	0
Chemical Products (I)	<1	35	616	NC	(a)	NC	0	<1
Hazardous Waste (J)	<1	(a)	NC	NC	NC	NC	NC	NC
Nonhazardous Waste (K)	9	23	(a)	NC	NC	NC	NC	0
Dry Bulk Cargos (L)	<1	6	NC	2	90	446	NC	NC

(a) The data in this cell represents three or fewer facilities and therefore is not shown here due to confidential business information and/or other data disclosure considerations.

NC - Facilities with this characteristic were not identified by responses to the Detailed Questionnaire. Therefore, data for these facilities, if facilities with these characteristics do indeed exist, are not available for this analysis.

Table 4-4

Total Volume of Heel Discharged/Disposed by Cargo Group and Discharge/Disposal Method – Discharging and Zero Discharge Facilities

Cargo Group	Heel Discharge/Disposal Method Code (gallons/year)									
	WW	ID	EV	LD	LA	IN	HR	RR	DW	HD
Food Grade Products (A)	591,000	109,000	NC	212,000	NC	NC	16,200	4,510,000	NC	7,000
Petroleum and Coal Products (B)	206,000	45,900	NC	2,100,000	659	67,000	1,300,000	5,420,000	3,450	91,500
Latex, Rubber, and Resin (C)	320,000	40,100	NC	216,000	(a)	66,900	26,200	36,500	239	44,100
Soaps and Detergent (D)	35,400	37,200	NC	42,200	2,230	3,660	13,200	2,020	3,450	181,000
Biodegradable Organic Chemicals (E)	193,000	15,600	15,900	12,100	2,790	66,100	15,700	1,470,000	11,700	247,000
Refractory Organic Chemicals (F)	2,340	12,500	NC	NC	NC	26,800	(a)	166,000	NC	67,000
Inorganic Chemicals (G)	951,000	168,000	NC	27,800	(a)	717	NC	569,000	31,200	73,800
Agricultural Chemicals and Fertilizers (H)	222,000	NC	NC	16,100	138	807	NC	150,000	NC	285
Chemical Products (I)	41,600	(a)	NC	53,400	(a)	29,900	9,360	542,000	634	36,100
Hazardous Waste (J)	NC	NC	NC	NC	NC	344	NC	NC	NC	22,200
Nonhazardous Waste (K)	15,000	NC	NC	2,050	(a)	NC	NC	NC	96	10,600
Dry Bulk Cargos (L)	2,160	64,400	NC	561,000	NC	NC	NC	1,360	96	(a)

(a) The data in this cell represents three or fewer facilities and therefore is not shown here due to confidential business information and/or other data disclosure considerations.
NC - Facilities with this characteristic were not identified by responses to the Detailed Questionnaire. Therefore, data for these facilities, if facilities with these characteristics do indeed exist, are not available for this analysis.

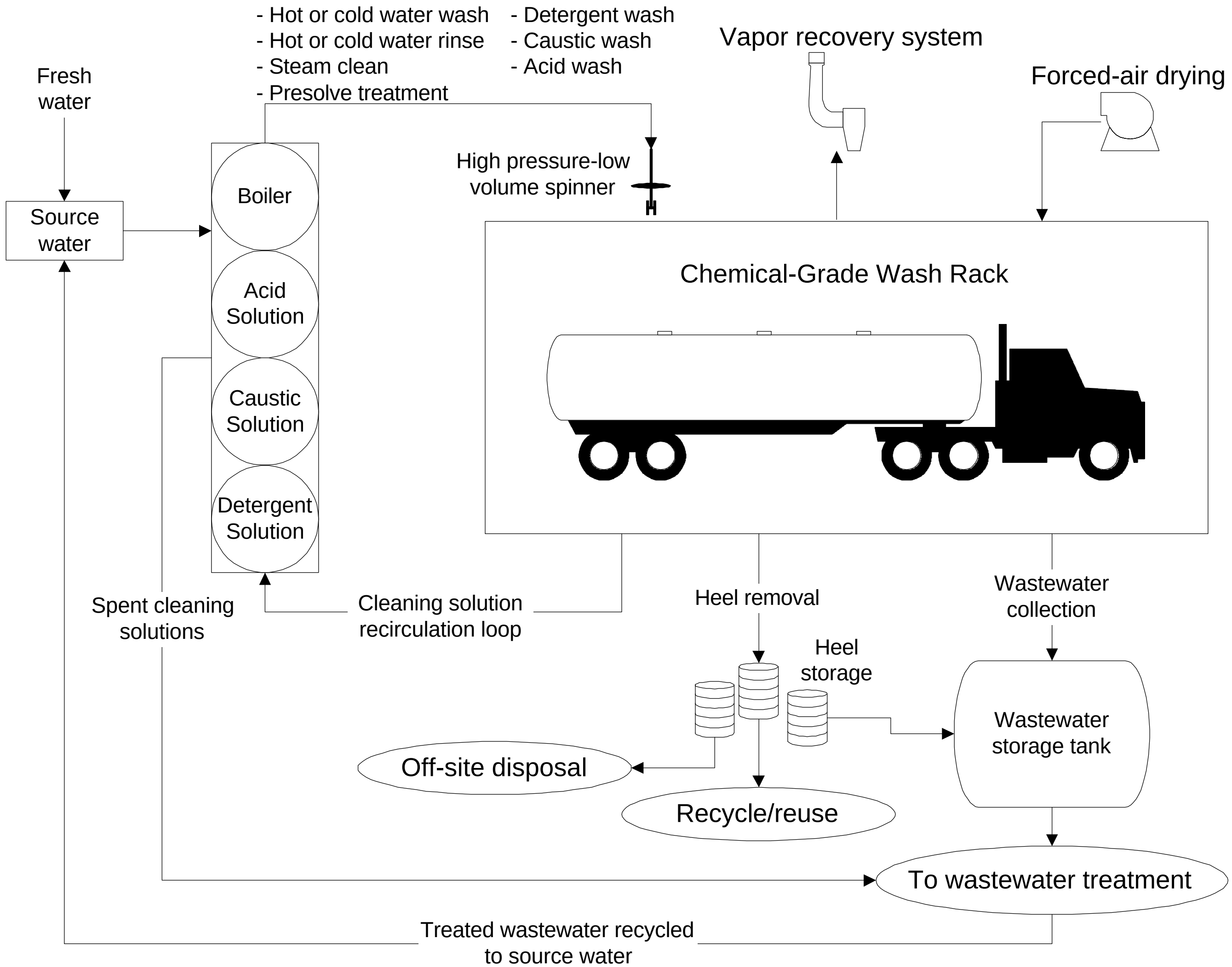


Figure 4-1. Diagram of General TEC Operations

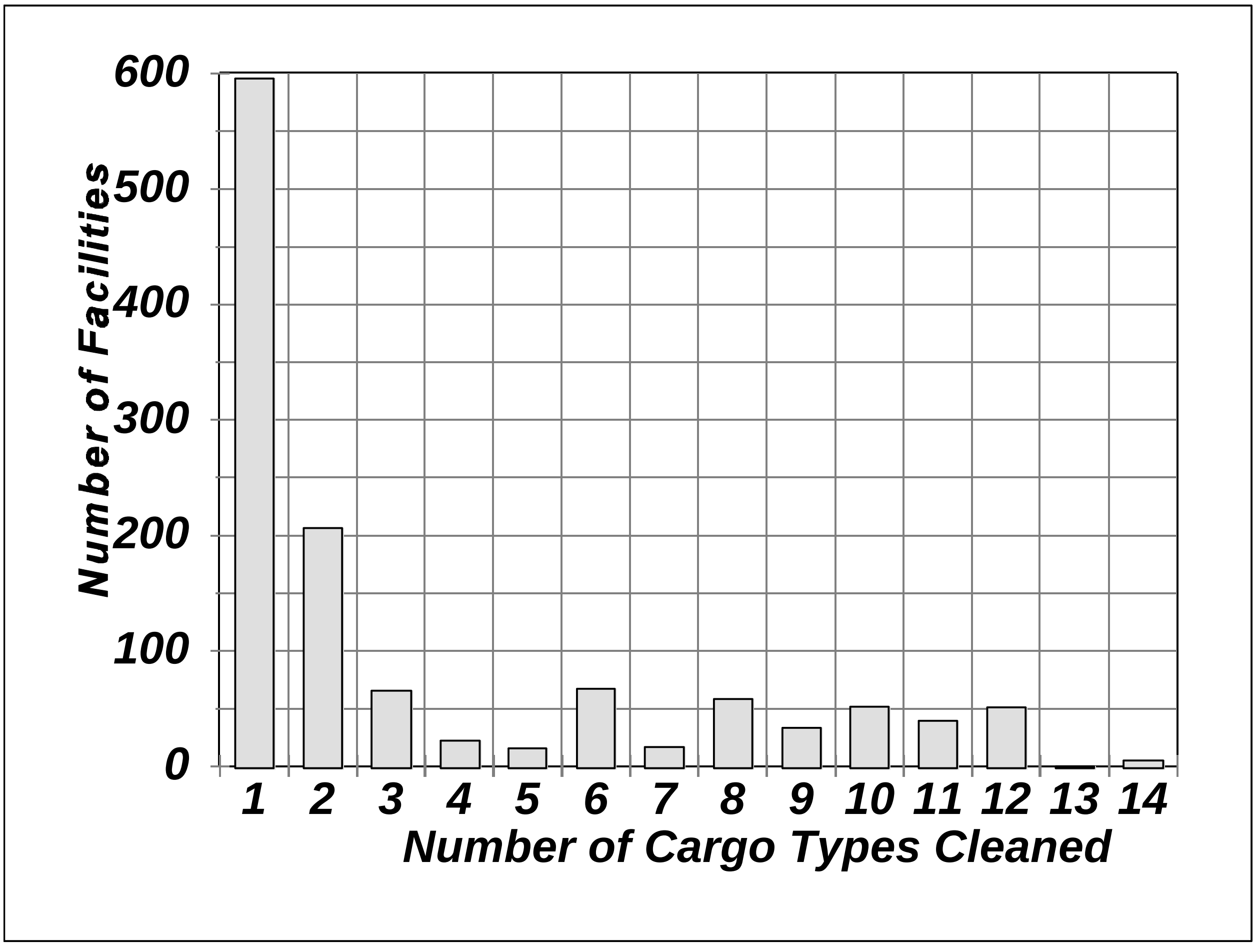


Figure 4-2. Distribution of TEC Facilities by Number of Cargo Types Cleaned – Discharging and Zero Discharge Facilities

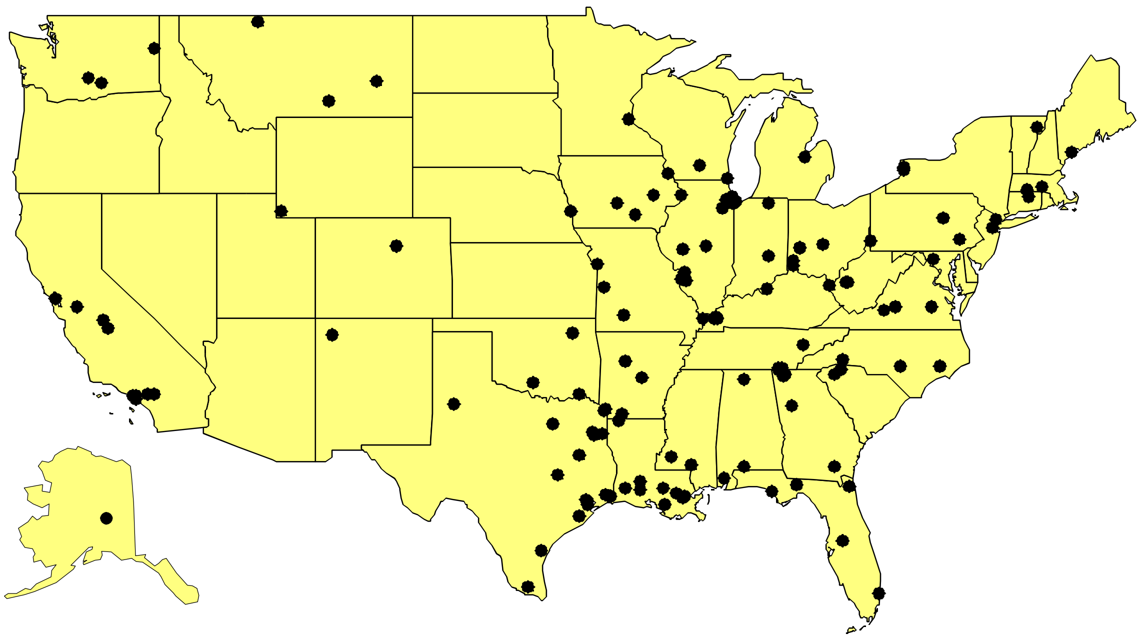


Figure 4-3. Geographic Profile of Discharging and Zero Discharge Facilities in the TECI Detailed Questionnaire Sample Population

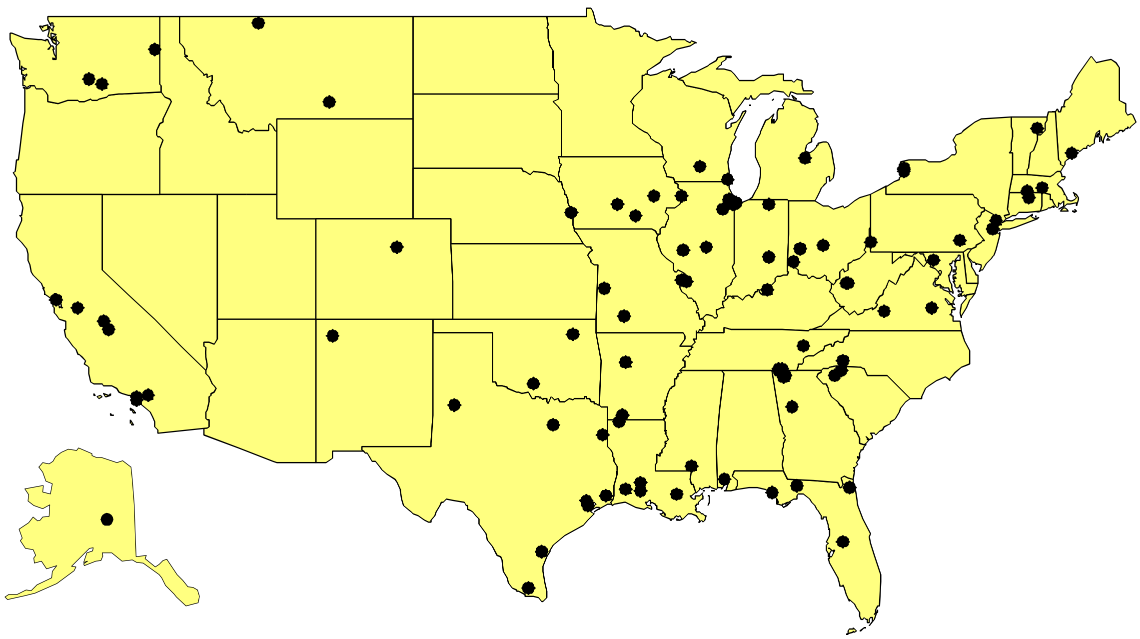


Figure 4-4. Geographic Profile of Discharging and Zero Discharge Truck Facilities in the TECI Detailed Questionnaire Sample Population

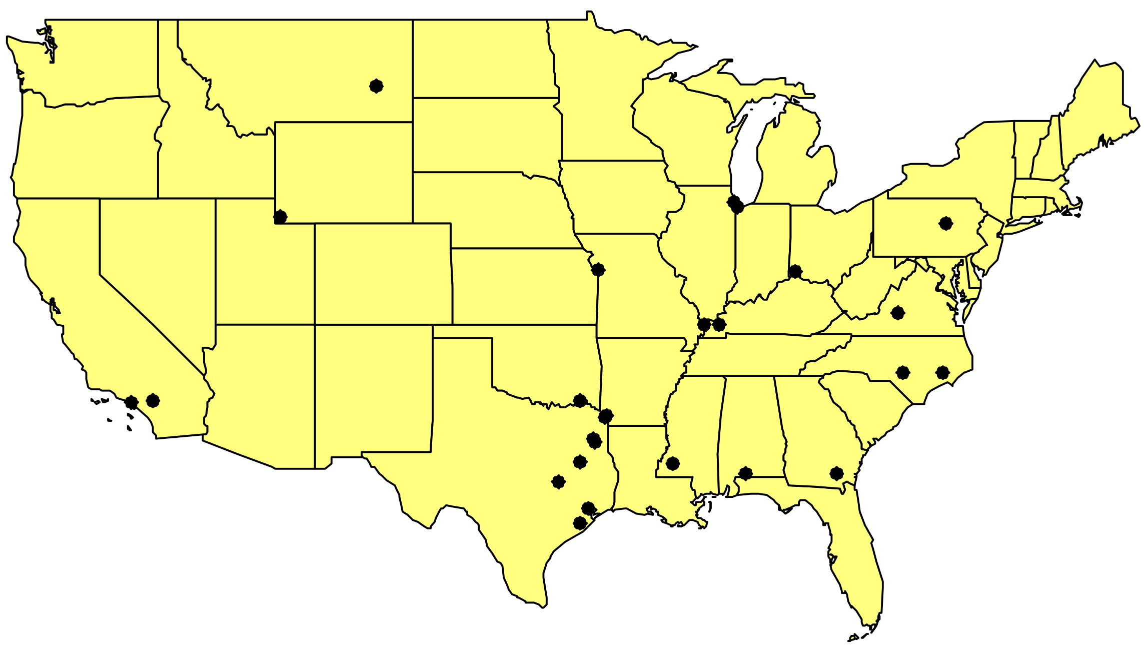


Figure 4-5. Geographic Profile of Discharging and Zero Discharge Rail Facilities in the TECI Detailed Questionnaire Sample Population

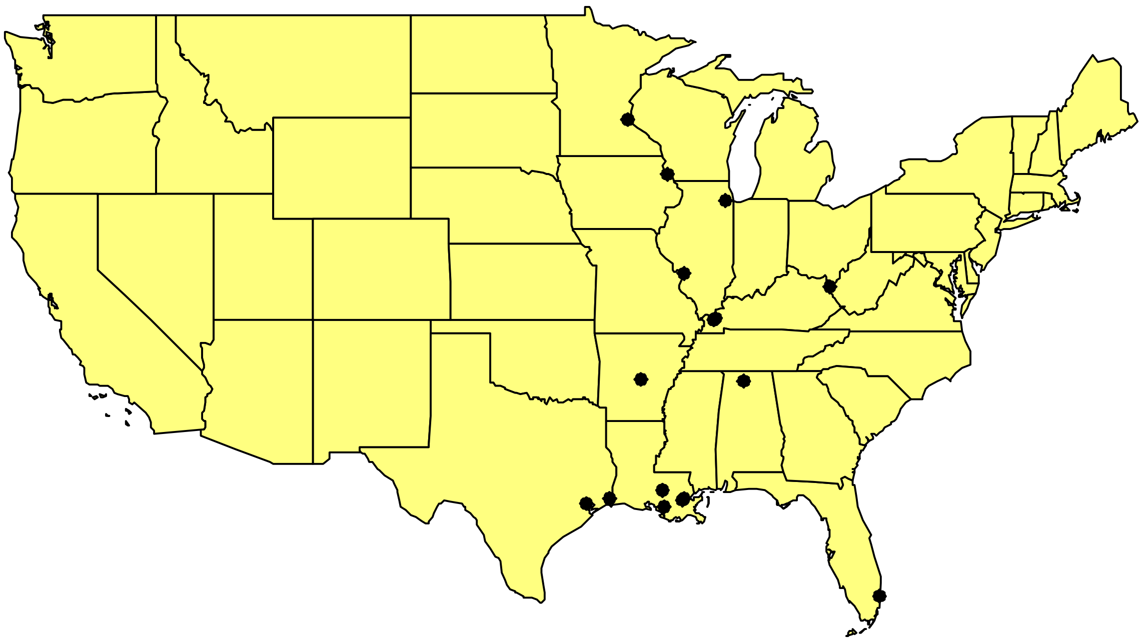


Figure 4-6. Geographic Profile of Discharging and Zero Discharge Barge Facilities in the TECI Detailed Questionnaire Sample Population

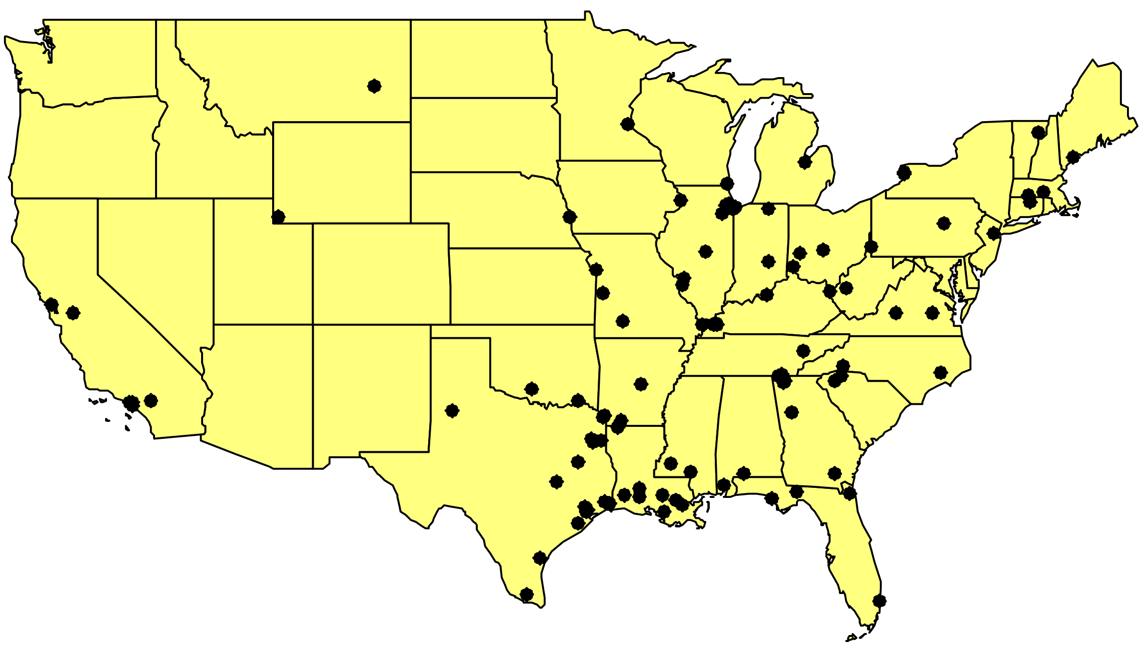


Figure 4-7. Geographic Profile of Discharging and Zero Discharge Facilities in the TECI Detailed Questionnaire Sample Population that Clean Chemical Cargos

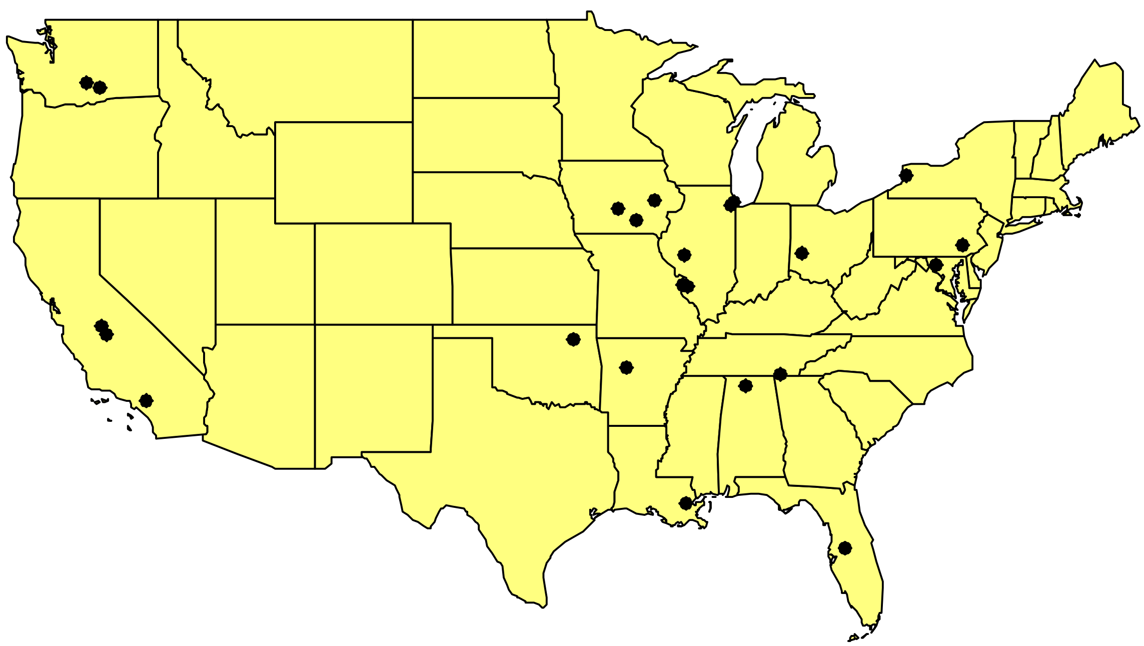


Figure 4-8. Geographic Profile of Discharging and Zero Discharge Facilities in the TECI Detailed Questionnaire Sample Population that Clean Food Grade Cargos

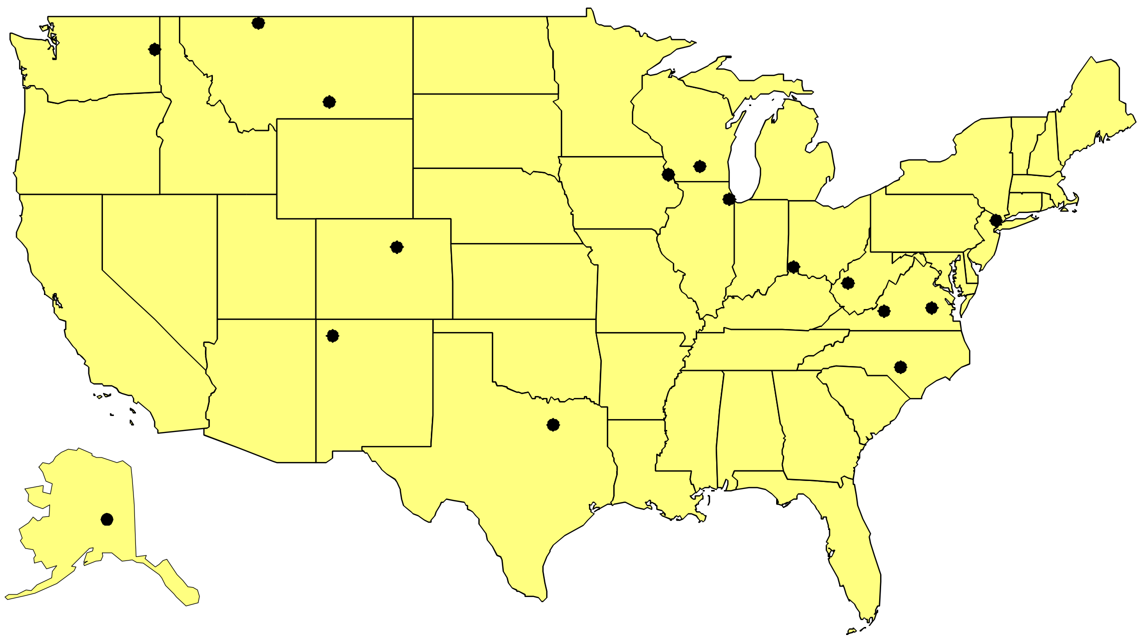


Figure 4-9. Geographic Profile of Discharging and Zero Discharge Facilities in the TECI Detailed Questionnaire Sample Population that Clean Petroleum Cargos

5.0 INDUSTRY SUBCATEGORIZATION

The division of a point source category into groups called "subcategories" provides a mechanism for addressing variations among products, raw materials, processes, and other parameters that can result in distinct effluent characteristics. This provides each subcategory with a uniform set of effluent limitations guidelines that take into account technology achievability and economic impacts unique to that subcategory. In developing effluent limitations, EPA assesses several factors including manufacturing processes, products, the size and age of the facility, water use, and wastewater characteristics. The Transportation Equipment Cleaning Industry (TECI), however, is not typical of many of the other industries regulated under the Clean Water Act (CWA) because it does not produce a product. Therefore, EPA developed additional factors that specifically address the characteristics of transportation equipment cleaning (TEC) operations. Similarly, several factors typically considered for subcategorization of manufacturing facilities were not considered applicable to this industry. For this rulemaking, EPA considered the following factors:

- Cleaning processes (production processes);
- Tank type cleaned;
- Cargo type cleaned;
- Water use practices;
- Wastewater characteristics;
- Facility age;
- Facility size;
- Geographical location;
- Water pollution control technologies;
- Treatment costs; and
- Non-water quality environmental impacts.

After evaluating the above factors, EPA determined that subcategorization of the TECI is necessary.

5.1 Factors Considered for Basis of Subcategorization

EPA considered a number of potential subcategorization approaches for the TECI. EPA used information collected during 44 engineering site visits, the Screener Questionnaire for the TECI (1), and the Detailed Questionnaire for the TECI (2) to develop potential subcategorization approaches. EPA considered eleven factors in developing its subcategorization scheme for the TECI. A discussion of each is presented below, and a detailed analysis can be found in the Subcategorization Analysis for the Transportation Equipment Cleaning Industry (3).

Consistent with other effluent guidelines subcategorization efforts, information presented in this section is based on operations performed by the estimated total TECI population of 1,229 facilities. This total includes an estimated 692 discharging facilities and 537 zero discharge facilities. Section 3.2.3.4 further discusses these facilities.

5.1.1 Cleaning Processes (Production Processes)

EPA interpreted "production processes" to be the cleaning processes used by TEC facilities. Section 4.3 describes TEC operations and the various methods used to clean tank interiors. In summary, the cleaning process descriptions provided in Section 4.3 show the following characteristics within the TECI:

1. Fundamental cleaning processes are the same for all tanks;
2. Use of chemical cleaning solutions versus solely water washes is dependent upon the type of cargo cleaned;
3. Cleaning equipment includes either low- or high-pressure spinner nozzles or hand-held wands and nozzles;
4. Heel volumes vary significantly depending on the type of tank cleaned;
5. Time required for tank cleaning varies significantly depending on the tank type and cargo type cleaned;

6. Rail car cleaning processes are more likely to include steam cleaning than truck or barge cleaning processes;

7. Hopper barge cleaning processes differ significantly from tank barge cleaning processes; and

8. Cleaning processes for food grade cargos differ significantly from cleaning processes for other cargo types.

Characteristics 1 and 3 were not considered bases for industry subcategorization and were not evaluated further.

Characteristics 2 and 8 suggest potential subcategorization of the TECI based on use of chemical solutions and/or type of cargo cleaned. EPA analyzed the use of chemical cleaning solutions in the TECI and the relationship between the use of chemical cleaning solutions and type of cargo cleaned in the TECI. Approximately 56% of TEC facilities use chemical cleaning solutions in one or more of their cleaning processes. Facilities that clean a variety of cargo types (i.e., five or greater) are more likely to use chemical cleaning solutions than facilities that clean four or fewer cargo types. EPA further evaluated facilities that clean four or fewer cargo types to identify trends based on specific cargo types cleaned. Significantly, only 4% of facilities that clean only petroleum and coal products use chemical cleaning solutions. For the remaining facilities grouped by cargo types cleaned, the use of chemical cleaning solutions is not a distinguishing factor.

Characteristics 4, 5, 6, and 7 suggest potential subcategorization of the TECI based on the type of tank cleaned. However, characteristics 4 and 5 were not analyzed further because these characteristics are not anticipated to result in distinct effluent characteristics. For example, the volume of heel removed is primarily an indication of product offloading efficiency by the consignee rather than an indication of the efficiency of heel removal (an associated water pollution prevention practice) by the cleaning facility. The time required for cleaning is often an indication of the duration of recirculating wash cycles, which generally do not generate wastewater.

EPA evaluated the relationship between the predominant type of tank cleaned and the use of chemical cleaning solutions. This analysis revealed that none of the facilities that clean predominantly closed-top hoppers uses chemical cleaning solutions, indicating that these facilities use significantly different cleaning processes than tank truck, rail tank car, and tank barge cleaning facilities. As determined from Detailed Questionnaire responses, typical cargos cleaned by closed-top hopper facilities include dry bulk products such as agricultural chemicals, fertilizers, and coal cargos not typically hauled in tank trucks, rail tank cars, and tank barges. Therefore, closed-top hopper cleaning facilities are unique from other facilities based on both cleaning processes used and cargo types transported.

In summary, these results indicate differences between certain types of facilities based on cleaning processes used. Unique facility types include facilities that clean a wide variety of cargo types, facilities that clean only food grade products, facilities that clean only petroleum and coal products, and facilities that clean predominantly closed-top hoppers. However, these differences are primarily related to cargo types and tank types cleaned. Further subcategorization analyses related to cargo types and tank types cleaned are described below. Therefore, cleaning processes alone were not considered an appropriate basis for subcategorization.

5.1.2 Tank Type Cleaned

EPA analyzed the distribution of TEC facilities by tank type and combinations of tank types cleaned. Section 4.4 of this document discusses in detail the various tank types cleaned. In general, facilities responding to the Detailed Questionnaire reported cleaning the nine primary tank types listed below:

- Tank Truck (T);
- Rail Tank Car (R);
- Tank Barge (B);
- Intermediate Bulk Container (IBC);
- Intermodal Tank Container (IM);
- Ocean/Sea Tanker (NT);
- Closed-Top Hopper Truck (TH);

- Closed-Top Hopper Rail Car (RH); and
- Closed-Top Hopper Barge (BH).

The majority of facilities in the TECI (913 of 1,229 facilities) reported cleaning only one primary tank type, indicating that the TECI is mostly characterized by facilities that clean only one primary tank type. Of these 913 facilities, 73% clean only tank trucks and 11% clean only rail tank cars. The remaining 16% of facilities clean, in descending order by percentage of facilities, only intermediate bulk containers, closed-top hopper trucks, tank barges, closed-top hopper barges, or ocean/sea tankers. None of the facilities (as represented by the Detailed Questionnaire sample population) clean only either intermodal tank containers or closed-top hopper rail cars.

EPA conducted 44 engineering site visits at facilities that clean tank trucks, rail tank cars, or tank barges. Information collected during these visits suggests many distinct physical and operational characteristics among these three facility types that warrant distinct subcategories for these three facility types. First, although all three facility types use chemical cleaning solutions in tank cleaning processes as discussed above, rail tank car cleaning facilities are more likely than other facility types to use steam in place of, or in addition to, chemical cleaning solutions in the cleaning process. Second, the specific cargos cleaned by the three facility types vary significantly. Tank trucks are used to transport refined end-use products. This contrasts with tank barges, which are used to transport predominantly crude, unrefined cargos and major manufacturing feedstock cargos such as petrochemicals and bulk oils (including foodgrade oils). Cargos transported by rail tank car include products primarily in the middle of this cargo type range, between crude, unrefined products and refined end-use products. Third, volume and characteristics of wastewater generated by these facility types differ significantly, as described in Section 6.0. Finally, as a result of differences in the volume and characteristics of wastewater generated, average wastewater treatment costs currently incurred by facilities differ significantly for these facility types.

Facilities that clean ocean/sea tankers represent less than one percent of facilities within the TECI. Cleaning operations performed and specific commodities cleaned are similar to those of tank barges, although different in scale. Based on the size of the ocean/sea tanker cleaning segment and its similarity to the tank barge segment, development of a separate subcategory within the TECI for ocean/sea tankers is not warranted.

Thirteen percent of facilities clean combinations of tank types; all of these facilities clean tank trucks and some combination of intermediate bulk containers and/or intermodal tank containers. Information collected during engineering site visits at these facilities indicates that the cargo types cleaned and cleaning operations performed are identical for tanks and containers, with minor modifications for cleaning intermediate bulk containers due to their relatively small capacity. Therefore, development of a separate subcategory within the TECI for intermediate bulk and/or intermodal tank containers is not warranted.

An additional 12% of facilities clean both tanks and closed-top hoppers within the same mode of transportation (i.e., T and TH, R and RH, or B and BH). An analysis of these facilities indicates that they clean either predominantly tanks or predominantly closed-top hoppers. Based on this characterization, development of a separate subcategory within the TECI for these facilities is not warranted. These facilities are best characterized and regulated as facilities with operations in multiple subcategories.

In summary, these results indicate significant differences between facilities based on tank types cleaned. Therefore, EPA determined that subcategorization based, in part, on tank types cleaned is appropriate.

5.1.3 Cargo Type Cleaned

EPA considered subcategorizing the TECI based on the cargo type cleaned. Respondents to the Detailed Questionnaire reported cleaning tanks which transported 15 general cargo types. The reported cargo types are listed below:

- Group A - Food Grade Products, Beverages, and Animal and Vegetable Oils;
- Group B - Petroleum and Coal Products;
- Group C - Latex, Rubber, and Resins;
- Group D - Soaps and Detergents;
- Group E - Biodegradable Organic Chemicals;
- Group F - Refractory (Nonbiodegradable) Organic Chemicals;
- Group G - Inorganic Chemicals;
- Group H - Agricultural Chemicals and Fertilizers;
- Group I - Chemical Products;
- Group J - Hazardous Waste (as defined by RCRA in 40 CFR Part 261);
- Group K - Nonhazardous Waste;
- Group L - Dry Bulk Cargos (i.e., hopper cars); and
- Group M, N, and O - Other (Not Elsewhere Classified).

Forty-eight percent of facilities in the TECI clean only one cargo type, while 52% clean a variety of cargo types. Of the facilities that reported cleaning only one cargo type, 65% reported cleaning food grade products, beverages, and animal and vegetable oils (Group A), 16% reported cleaning petroleum and coal products (Group B), and 10% reported cleaning "other cargos" (Groups M, N and O). A review of the data for facilities that clean two or more cargos suggests no apparent trend in cargo types cleaned, but rather a wide variety of combinations of "chemical-type" cargos.

EPA was not able to identify any other distinct segments of the TECI among the remaining groups, which included Latex, Rubber, and Resins (Group C), Soaps and Detergents (Group D), Biodegradable Organic Chemicals (Group E), Refractory (Nonbiodegradable)

Organic Chemicals (Group F), Inorganic Chemicals (Group G), Agricultural Chemicals and Fertilizers (Group H), Chemical Products (Group I), Hazardous Waste (Group J), Nonhazardous Waste (Group K), and Groups M, N, and O consisting of cargos not elsewhere classified.

There are several reasons to consider subcategorization based on type of cargo. Facilities that clean tanks which contained only food grade products (Group A), petroleum grade products (Group B), or dry bulk goods (Group L) represent distinct and relatively large segments of the TECI that differ significantly from facilities that clean tanks containing a wide variety of cargos. The type of cargo transported and the type of cleaning processes utilized influences wastewater characteristics. EPA therefore concluded that subcategorization of the TECI based, in part, on cargo type is an appropriate means of subcategorization.

Specifically, EPA developed a separate subcategory for facilities that clean tanks that contained food grade cargos. EPA also developed separate subcategories for facilities that clean closed-top hoppers (i.e., vessels that contained dry bulk goods).

EPA considered developing separate subcategories for facilities that clean tanks that contained "chemical" cargos and for facilities that clean tanks that contained "petroleum" cargos. EPA compared raw wastewater characterization data collected for wastewaters generated from barge/chemical and barge/petroleum facilities and concluded the wastewater characteristics and treatability were similar. Therefore, EPA decided to combine these subcategories.

EPA also compared raw wastewater characterization data for the truck/chemical and truck/petroleum facilities, but found fewer similarities. For example, fewer pollutants were detected at the truck/petroleum facility than at the truck/chemical facilities, and similarly detected pollutants were found at lower concentrations at the truck/petroleum facility. However, EPA is concerned that its wastewater characterization data for truck/petroleum facilities does not capture all pollutant loadings attributable to these facilities (see discussion in Section 6.5) and that apparent differences in wastewaters for these facilities are incorrect.

In addition, EPA found it difficult to clearly define “chemical” versus “petroleum” cargos and was concerned that the rule incorporating separate subcategories would be difficult to implement. EPA instead decided to develop combined “chemical and petroleum” subcategories in order to provide unambiguous, straightforward definitions which provide clear direction for implementation.

5.1.4 Water Use and Wastewater Reuse Practices

TEC facilities use water for cleaning and rinsing as well as for a number of ancillary purposes such as hydrotesting, air pollution control, and process cooling water. Water use varies based on a number of factors including type of tank cleaned, type of cleaning solution utilized, type of cargo last contained in the tank, type of cargo to be transported, and tank capacity. Significant observations of distinctions in water use include:

- Rail facilities use significantly larger volumes of water for tank hydrotesting than truck facilities, presumably because rail tanks have larger capacities; barge cleaning facilities do not report performing hydrotesting.

- Truck facilities use significantly larger volumes of water for tank exterior cleaning operations, presumably because tank exterior appearance is more important for trucks, which are highly visible to the public.

- Rail facilities use significantly larger volumes of boiler water, presumably because of their more extensive use of steam cleaning. (Virtually all facilities, regardless of tank type, use boilers to heat cleaning solutions and rinses and to heat air for tank drying.)

- Food grade facilities use significant volumes of cooling water, both for TEC operations and for other on-site processes (e.g., juice processing, rendering).

- Petroleum facilities use significantly larger volumes of tank hydrotesting water, presumably because petroleum tanks are often in dedicated service and are cleaned primarily to facilitate inspection, which typically includes tank hydrotesting.

These observations indicate differences among facilities based on water use practices; however, these differences are primarily related to types of tanks and cargos cleaned.

EPA also investigated facilities that do not discharge TEC process wastewater to surface waters or to POTWs (i.e., zero discharge facilities) to determine whether they exhibited any unique water use characteristics that might represent a distinct subcategory. Of the estimated 537 zero discharge facilities, 46% achieved zero discharge by hauling their wastewater off site for treatment and/or disposal. Facilities may haul wastewater off site because it is less expensive than on-site treatment. An estimated 46% of zero discharge facilities disposed of their wastewater by on-site land application, land disposal, deep-well injection, or evaporation. These alternative disposal options are available to some facilities because of site-specific conditions which may include being situated on land suitable for land-application, or being located close to an off-site waste treatment facility.

Only 8% of zero discharge facilities recycled or reused 100% of their TEC process wastewater. Of these, 70% clean predominantly (i.e., 95% or greater) tanks that last contained petroleum and coal products. As noted in Section 6.0, facilities that clean tanks containing petroleum and coal products discharge significantly less wastewater per tank cleaned than other types of facilities.

In summary, the variations in water use practices among different types of facilities demonstrate that the most appropriate method of subcategorization that encompasses water use practices is based on the type of tank cleaned and type of cargo cleaned at a facility.

5.1.5 Wastewater Characteristics

EPA evaluated two wastewater characteristics for this subcategorization analysis: volume of tank interior cleaning wastewater generated per tank cleaned and concentration and types of pollutants in TEC process wastewater. Section 6.0 provides additional information concerning these two wastewater characteristics.

In order to evaluate wastewater volumes, EPA calculated the median wastewater volume generated per tank cleaned from several different tank and cargo classifications. The classifications selected represented cleaning processes performed, tank type cleaned, cargo type cleaned, and water use and wastewater reuse practices described earlier in this section.

The median tank interior cleaning wastewater volumes generated by tank type (gallons per tank) indicate significant differences, particularly for tank trucks (452) versus rail tank cars (1,229) and tank barges (1,669); and for tanks (452 to 1,669) versus closed-top hoppers (144 to 712). The median tank interior cleaning wastewater volumes generated by tank type and cargo type (gallons per tank) also indicate significant differences, particularly for truck/chemical (449) versus rail/chemical (1,701) versus barge/chemical (2,365); and for chemical (449 to 2,365) versus petroleum (11 to 150).

EPA also evaluated available raw wastewater characterization data by tank type and cargo classification. Significant observations from these analyses include:

- The number and types of pollutants detected at truck/chemical, rail/chemical, and barge/chemical facilities were similar.
- Fewer pollutants were detected at the truck/petroleum facilities than at the truck/chemical facilities, and similarly detected pollutants were found at lower concentrations at the truck/petroleum facilities.
- The majority of pollutants detected at barge/chemical facilities were also detected at the barge/petroleum facility.
- The number and types of pollutants detected in the truck/food, rail/food, and barge/food facilities were similar.
- The one closed-top hopper barge facility sampled was significantly different from the other facility types in terms of the number of priority pollutants detected, the total number of pollutants detected, and the specific pollutants detected.

In conclusion, the distribution of median wastewater volume generated supports the development of distinct subcategories within the TECI based on tank type and cargo type cleaned. Analysis of raw wastewater characterization data collected during EPA's sampling program also supports development of distinct subcategories within the TECI.

5.1.6 Facility Age

EPA evaluated the age of facilities as a possible means of subcategorization because older facilities may have different processes and equipment that result in different wastewater characteristics, and which therefore may require significantly greater or more costly control technologies to comply with regulations.

EPA evaluated the treatment technologies in place as related to the year in which the facility first conducted TEC operations. For this analysis, EPA characterized older facilities as those that began TEC operations prior to 1980, and compared their wastewater treatment-in-place to that of facilities that began TEC operations after 1980. Treatment-in-place was evaluated by whether facilities use treatment technologies classified as follows: no treatment, pretreatment, primary treatment, secondary treatment, and advanced treatment. The specific treatment technologies included within these technology classifications are listed in the Detailed Questionnaire Data Element Dictionary (4). These analyses indicated that older facilities are as likely to be currently operating treatment in place for each wastewater treatment classification as are newer facilities. In addition, many older facilities have improved, replaced, or modified equipment over time.

As described in Section 6.0, wastewater characteristics are predominantly dependent on the type of cargos being cleaned, the type of tank being cleaned, and the types of cleaning operations performed. The age of a facility does not have an appreciable impact on wastewater characteristics and was not considered as a basis for subcategorization.

5.1.7 Facility Size

EPA considered subcategorization of the TECI on the basis of facility size. Three parameters were identified as relative measures of facility size: number of employees, number of tanks cleaned, and wastewater flow. EPA found that facilities of varying sizes generate similar wastewaters and use similar treatment technologies within the subcategorization approach. A detailed discussion of the pollutant loadings associated with small facilities can be found in the "Final Cost-Effectiveness Analysis of Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category" (5). EPA determined that the industry should not be subcategorized based on facility size. However, EPA is promulgating an exclusion for facilities that discharge less than 100,000 gallons per year of TEC process wastewater to provide relief and flexibility for facilities that perform a relatively small number of TEC operations and for permit authorities.

5.1.8 Geographical Location

EPA performed a geographical mapping analysis of the Detailed Questionnaire sample population of 142 facilities (discharging facilities plus zero discharge facilities). Note that a simple geographical mapping of these 142 facilities may not accurately represent the TECI because each facility in the sample population has a unique statistical survey weight, ranging from 1 to 87.6, which is not reflected in the maps; however, the mapping analysis may be appropriate to identify potential geographic trends within the TECI. Maps were prepared to reflect all surveyed facilities and to reflect facilities classified by tank type and by cargo type (these maps are also presented and discussed in Section 4.9). The following geographic trends were observed:

- TEC facilities are located primarily within the industrial portions of the United States, with relatively high concentrations in the area between Houston and New Orleans and within specific urban areas, such as Los Angeles, Chicago, and St. Louis;
- The distribution of truck facilities mirrors the distribution of all facilities;

- The distribution of rail facilities shows lower concentrations in the area between Houston and New Orleans and higher concentrations across eastern Texas as compared to all TEC facilities;

- Barge facilities are located along inland waterways of the United States;

- The distribution of chemical facilities resembles the distribution of all TEC facilities except for a relatively lower concentration of facilities in the northwestern region of the United States;

- Food grade facilities are specifically not located within the area between Houston and New Orleans, and appear to be located primarily within agricultural areas of the United States; and

- Petroleum facilities are not concentrated in the area between Houston and New Orleans, an area typically associated with the petroleum industry.

These trends suggest differences among facilities based on geographic distribution; however, these differences are primarily related to types of tanks and cargos cleaned. Therefore, geographic location alone is not an appropriate basis for subcategorization.

Geographic location may impact costs if additional land is required to install treatment systems, since the cost of land will vary depending on whether the site is located in an urban or rural location. The treatment systems used to treat TEC wastewaters typically do not have large land requirements; therefore, subcategorization based on land availability is not appropriate. Water availability is also a function of geographic location. However, limited water supply encourages conservation by efficient use of water, including recycling and reuse, and encourages the early installation of practices advisable for the entire category to reduce treatment costs and improve pollutant removals. For this reason also, geographic location alone is not an appropriate basis for subcategorization.

5.1.9 Water Pollution Control Technologies

EPA evaluated water pollution control technologies currently being used by the industry as a basis for establishing regulations. The technologies are appropriate for the wastewater characteristics typical of the TECI. As discussed in Section 5.1.5, TEC wastewater characteristics (including wastewater volume generated and pollutant concentrations) are dependent upon tank type and cargo type cleaned. Sections 5.1.2 and 5.1.3 discuss subcategorization of the TECI based on tank type and cargo type cleaned, respectively. Therefore, water pollution control technologies alone are not considered an appropriate basis for subcategorization.

5.1.10 Treatment Costs

Treatment costs vary significantly among facilities and are primarily dependent upon water pollution control technologies being used and on facility wastewater flow rates. As discussed in Section 5.1.9, water pollution control technologies used are based upon the facility wastewater characteristics, which are dependent upon tank type and cargo type cleaned. Therefore, treatment costs alone are not considered an appropriate basis for subcategorization.

5.1.11 Non-Water Quality Environmental Impacts

Non-water quality environmental impacts from the TECI result from solid waste disposal, transportation of wastes to off-site locations for treatment and disposal, and emissions of volatile organic compounds to the air. However, as these impacts are a result of individual facility practices and do not apply uniformly across different industry segments, non-water quality environmental impacts are not an appropriate basis for subcategorization. Section 11.0 provides further information concerning non-water quality environmental impacts of the TECI.

5.2 Selection of Subcategorization Approach

Based on its evaluation of the above factors, EPA determined that subcategorization of the TECI is necessary and that different effluent limitations and pretreatment standards should be developed for subcategories of the industry. EPA concluded that the most appropriate basis for subcategorization of the industry be based on tank type and cargo type cleaned.

The tank type classifications for this rule include: (1) tank trucks and intermodal tank containers; (2) rail tank cars; (3) tank barges and ocean/sea tankers; (4) closed-top hopper trucks; (5) closed-top hopper rail cars; and (6) closed-top hopper barges. A description of each of these tank type classifications is presented in Section 15.0. Containers defined as drums or intermediate bulk containers (IBCs) are not covered by this guideline.

The cargo type classifications used as a basis for subcategorization include: (1) food grade; (2) dry bulk; and (3) chemical and petroleum. A description of the cargo type classifications is provided below.

> **Food Grade** - "Food grade" cargos include edible and non-edible food products. Specific examples of food grade products include, but are not limited to, the following cargos: alcoholic beverages, animal by-products, animal fats, animal oils, caramel, caramel coloring, chocolate, corn syrup and other corn products, dairy products, dietary supplements, eggs, flavorings, food preservatives, food products that are not suitable for human consumption, fruit juices, honey, lard, molasses, non-alcoholic beverages, salt, sugars, sweeteners, tallow, vegetable oils, vinegar, and pool water.
>
> **Dry Bulk** - The dry bulk classification includes cargos containing dry bulk products such as grain, soybeans, soy meal, soda ash, lime, fertilizer, plastic pellets, flour, sugar, and similar commodities or cargos.
>
> **Chemical** - Chemical cargos include, but are not limited to, the following cargos: latex; rubber; plastic; plasticizers; resins; soaps; detergents; surfactants; agricultural chemicals and pesticides; hazardous waste; organic chemicals including: alcohols, aldehydes, formaldehydes, phenols, peroxides, organic salts, amines, amides, other

nitrogen compounds, other aromatic compounds, aliphatic organic chemicals, glycols, glycerines, and organic polymers; refractory organic compounds including: ketones, nitriles, organo-metallic compounds containing chromium, cadmium, mercury, copper, zinc; and inorganic chemicals including: aluminum sulfate, ammonia, ammonium nitrate, ammonium sulfate, and bleach. Cargos which are not considered to be food grade, petroleum, or dry bulk goods are considered to be chemical cargos.

Petroleum - Petroleum cargos include the products of the fractionation or straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking, or other refining processes. For purposes of this rule, petroleum cargos also include products obtained from the refining or processing of natural gas and coal. Specific examples of petroleum products include, but are not limited to: asphalt; benzene; coal tar; crude oil; cutting oil; ethyl benzene; diesel fuel; fuel additives; fuel oils; gasoline; greases; heavy, medium, and light oils; hydraulic fluids; jet fuel; kerosene; liquid petroleum gases (LPG) including butane and propane; lubrication oils; mineral spirits; naphtha; olefin, paraffin, and other waxes; tall oil; tar; toluene; xylene; and waste oil.

Facilities that clean petroleum and/or chemical cargos are further subcategorized by tank type as follows:

- Truck/Chemical & Petroleum;
- Rail/Chemical & Petroleum; and
- Barge/Chemical & Petroleum.

Definitions of these subcategories are provided at the end of this section.

Facilities that clean food grade cargos are combined into a single Food Subcategory (definition provided at the end of this section). EPA determined that further subcategorization of these facilities by tank type was not warranted for several reasons. First, the pollutants of concern (i.e., conventional pollutants as discussed in Section 6.5) and achievable effluent quality are identical for all three facility types. Second, large differences in wastewater volumes generated are not significant because EPA has promulgated concentration-based rather than mass-based effluent limitations. Note that EPA is regulating Food Subcategory wastewater that is directly discharged but is not regulating wastewater that is indirectly discharged.

Facilities that clean closed-top hoppers (used to transport dry bulk cargos) are further subcategorized by transportation mode as follows:

- Truck/Hopper;
- Rail/Hopper; and
- Barge/Hopper.

Definitions of these subcategories are provided at the end of this section. Note that EPA is not regulating wastewater discharges from cleaning closed-top hoppers.

In summary, EPA has divided the TECI into the following 7 subcategories. Definitions of these subcategories are provided below:

Truck/Chemical & Petroleum

This subcategory applies to TEC facilities that clean tank trucks and intermodal tank containers which have been used to transport chemical or petroleum cargos.

Rail/Chemical & Petroleum

This subcategory applies to TEC facilities that clean rail tank cars which have been used to transport chemical or petroleum cargos.

Barge/Chemical & Petroleum

This subcategory applies to TEC facilities that clean tank barges or ocean/sea tankers which have been used to transport chemical or petroleum cargos.

Food

This subcategory applies to TEC facilities that clean tank trucks, intermodal tank containers, rail tank cars, tank barges, or ocean/sea tankers which have been used to transport food grade cargos.

Truck/Hopper

This subcategory applies to TEC facilities that clean closed-top hopper trucks.

Rail/Hopper

This subcategory applies to TEC facilities that clean closed-top hopper rail cars.

Barge/Hopper

This subcategory applies to TEC facilities that clean closed-top hopper barges.

5.3 References[1]

1. U.S. Environmental Protection Agency. Information Collection Request, Tank and Container Interior Cleaning Screener Questionnaire. December 1993 (DCN T00312).

2. U.S. Environmental Protection Agency. Information Collection Request, 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry. November 1994 (DCN T09843).

3. Eastern Research Group, Inc. Subcategorization Analysis for the Transportation Equipment Cleaning Industry. May 5, 1998 (DCN T04653).

[1]For those references included in the administrative record supporting the TECI rulemaking, the document control number (DCN) is included in parentheses at the end of the reference.

4. Eastern Research Group, Inc. Data Element Dictionary for Part A of the U.S. Environmental Protection Agency 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry. April 4, 1997 (DCN T10271).

5. U.S. Environmental Protection Agency. Final Cost-Effective Analysis of Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category. EPA 821-R-00-014, June 2000.

6.0 WATER USE, WASTEWATER CHARACTERIZATION, AND POLLUTANTS OF INTEREST

As part of the characterization of the Transportation Equipment Cleaning Industry (TECI), EPA determined water use and wastewater generation practices associated with transportation equipment cleaning (TEC) operations and assessed what constituents are typically found in TEC wastewater. Information presented in this section is based on data provided by facilities in response to the Detailed Questionnaire and obtained by EPA's site visit and sampling programs. The Detailed Questionnaire database includes information regarding each facility's water use, wastewater discharge, and disposal practices. The following topics are discussed in this section:

- Section 6.1: An overview of water use and wastewater generation in the TECI;
- Section 6.2: The sources of wastewater identified in the TECI;
- Section 6.3: A discussion of the wastewater discharge practices within the TECI;
- Section 6.4: An overview of water reuse and recycling in the TECI;
- Section 6.5: Wastewater characterization data collected during EPA's sampling program; and
- Section 6.6: The pollutants of interest for the TECI.

Sections 6.1, 6.2, and 6.3 discuss water use and wastewater generation, sources of wastewater, and wastewater discharge practices at only the estimated total TECI population of 692 discharging facilities. Section 6.4 includes water reuse and recycling information on the discharging facilities as well as the zero discharge facilities. Section 6.5 presents EPA wastewater characterization data collected from 20 sampling episodes, and Section 6.6 lists the pollutants of interest, by subcategory, for the TECI.

Some data summaries included in this section are presented by tank type and cargo type cleaned. The combination of tank type and cargo type cleaned is referred to as the "facility type." To simplify data analyses by facility type, EPA assigned facilities that clean multiple cargo types to a single, predominant cargo group. Therefore, for these facilities, facility characteristics for all facility operations are attributed to the single predominant cargo group.

6.1 Water Use and Wastewater Generation

This section describes water use and wastewater generation practices of discharging facilities which, by definition, use water or water-based cleaning solutions to clean or rinse tank interiors. The amount of water required and wastewater generated to clean each tank depends upon the cleaning process, as well as the tank type, tank size, and commodity last transported. In addition, the TECI uses water and generates wastewater during other processes related to TEC operations. The most significant uses of water associated with TEC operations include:

- Tank interior prerinse, prior to cleaning;
- Tank interior cleaning hot or cold water washes and/or rinses;
- Tank exterior washing;
- Boiler feed water for conversion to steam for steam cleaning, for heating cleaning solutions, or heating or drying tank interiors; and
- Formulation of cleaning solutions.

Following removal of the transported commodity from the tank, a residue or heel remains, which is generally removed prior to tank cleaning. During or after heel removal, TEC facilities may perform a rinse prior to commencing cleaning consisting of a short burst of water applied to the tank interior to remove additional heel that adheres to the tank's interior. Purposes of the prerinse include (1) enhancing heel removal; (2) minimizing the amount of heel ultimately contained in tank cleaning wastewater (pollution prevention); (3) extending the service life of tank cleaning solutions by reducing solution contamination from tank heel; and (4) protecting the wastewater treatment system, which may not be acclimated or designed to treat residual heel. Prerinse wastewater is typically segregated from, rather than commingled with, subsequent TEC wastewater.

TEC facilities perform hot or cold water washes and rinses to clean tank interiors. Water-soluble cargos and petroleum and coal products are typically cleaned using only hot or cold water washes without chemical cleaning solutions. Virtually all cleaning sequences include a final water rinse to remove cleaning solution residue, particularly when recirculated cleaning solutions or water are used during the cleaning process. Steam cleaning is also performed, particularly by rail tank car cleaning facilities. Tank interior cleaning is typically the largest use of water at TEC facilities.

Large volumes of water are typically used to clean tank exteriors, particularly at tank truck cleaning facilities where appearance is important due to the high visibility on roadways. Soaps and hydrofluoric acid-based aluminum brighteners may also be used in this process. On-site boilers may use significant volumes of water both as a feed stream and for maintenance, such as during boiler blowdown. Finally, since cleaning solutions are often received in concentrated form, water is used to formulate the cleaning solutions to appropriate concentrations. Water is also used to “make up” cleaning solutions, due to loss by evaporation and solution carry-over into subsequent tank rinse wastewater.

Table 6-1 summarizes the total annual volume of wastewater generated by the TECI. Since many facilities perform both TEC and non-TEC operations, this table includes both the amount of wastewater generated by TEC operations (total TEC wastewater) and the total amount of wastewater reported to be generated by the TECI (total TEC and non-TEC wastewater). Approximately 5.5 billion gallons of wastewater (both TEC and non-TEC wastewater) is generated annually by the TECI. Facilities that clean tank trucks last containing food cargos account for 70% of this volume, due to the large number of tanks cleaned, relatively greater use of exterior cleaning as part of the routine tank cleaning procedures, and wastewater generated by food processing operations at many truck/food facilities. Truck/chemical facilities, having the next largest volume, account for 17% of all wastewater generated by the TECI, while 13% of the total volume of wastewater generated is divided among the remaining nine facility types.

Approximately 1.3 billion gallons of wastewater from interior cleaning operations is generated annually, as shown in Table 6-1. Truck/chemical facilities account for 56% of the total TEC wastewater volume, while truck/food facilities account for 19% of the total TEC wastewater volume. These percentages differ significantly from those based on wastewater generation volume. These differences indicate that truck/chemical facilities generate the majority of their wastewater from cleaning the interiors of tanks, while truck/food facilities generate the majority of their wastewater from cleaning tank exteriors and other processes.

Table 6-2 provides a more detailed analysis of the average volume of TEC wastewater generated per tank cleaning by commodity type and tank type. Truck tank, rail tankcar, tank barge, truck hopper, rail hopper, barge hopper, intermediate bulk container (IBC), and intermodal tank container (ITC) are the eight major tank types listed. In general, the tank capacity decreases in the following order by tank type: tank barge, barge hopper, rail tank, rail hopper, truck tank, truck hopper, ITC, and IBC. This decrease in tank size corresponds to a decrease in the amount of wastewater generated per tank cleaning. The volume of wastewater generated per tank cleaning for tank trucks is relatively similar for all commodity groups except for the Latex, Rubber, and Resins Group; the Chemical Products Group; and the Hazardous Waste Group. Facility personnel at facilities visited during engineering site visits and sampling episodes indicated that resins are the most difficult commodity to clean. Chemical products such as water treatment chemicals were also identified as difficult commodities to clean by facility personnel.

6.2 Sources of Wastewater

EPA has identified the following operations as primary sources of wastewater within the TECI:

- Tank interior cleaning;
- Tank exterior cleaning;
- Boiler blowdown;
- Tank hydrotesting;
- Safety equipment cleaning; and
- TEC-contaminated stormwater.

Tank interior cleaning wastewater includes water and steam condensate generated by tank cleaning operations, prerinse solutions, chemical cleaning solutions, and final rinse solutions. Tank exterior cleaning wastewater includes water and cleaning solutions generated by tank exterior cleaning operations. Boiler blowdown is wastewater generated during maintenance of on-site boilers used to heat tank cleaning solutions and rinses and to generate steam. Tank hydrotesting (i.e., hydrostatic pressure testing) is performed by completely filling the tank with water and applying a pressure of at least 150% of the maximum allowable working pressure. The water is then typically discharged as a waste stream. Wastewater is also generated by cleaning safety equipment. TEC-contaminated stormwater is commonly generated when rain water blows or runs into the tank cleaning bay (most cleaning bays are enclosed or covered). In addition, many wastewater treatment systems are not enclosed or covered resulting in generation of TEC-contaminated stormwater from these areas.

Additional wastewater sources reported in responses to the Detailed Questionnaire include air pollution control devices, maintenance and repair operations, laboratory wastewater, TEC noncontact cooling water, and flare condensate; however, these sources were reported by relatively few facilities and were generated in relatively small volumes.

Some facilities generate large volumes of non-TEC wastewater from food processing or other manufacturing operations and from non-TEC process equipment cleaning.

Other facilities accept wastewater for treatment on site such as TEC wastewater from other facilities or marine wastewater (e.g., bilge and ballast water). In these cases, wastewater generated off site may comprise 50% or more of the total wastewater volume generated.

Table 6-3 summarizes the average volume of wastewater generated per day for the six wastewater streams listed above. Average wastewater generation volumes were calculated based on data from all the facilities within a specific cargo group. If a facility did not report generating a wastestream, then that facility was assumed to generate zero gallons per day of that wastestream.

Tank interior cleaning wastewater comprises the largest wastewater stream generated by facilities in eight of the eleven facility types (data for some facilities is not shown to protect data confidentiality). For the remaining three facility types (rail/chemical, truck/petroleum, and rail/food), either tank hydrotesting wastewater or tank exterior cleaning wastewater comprise the largest wastewater stream.

Table 6-4 presents the total volume of wastewater generated per day by wastewater stream type and facility type. This value is obtained by multiplying the average volume of wastewater generated per facility per day (Table 6-3) by the total number of facilities within each respective facility type. Truck/chemical and truck/food facilities generate the largest volumes of interior wastewater and exterior wastewater because the largest number of tanks are cleaned by facilities in these facility types.

Although barge/hopper and barge/chemical & petroleum facilities generate the largest volume of TEC interior cleaning wastewater per facility as shown in Table 6-3, the total volume of wastewater generated by these two facility types is significantly less than that generated by truck/chemical and truck/food facilities. Although barge cleaning generates significantly more wastewater per tank cleaning than truck cleaning, the total number of tank trucks cleaned is much greater than the total number of tank barges cleaned.

6.3 Wastewater Discharge Practices

EPA estimates that 692 facilities discharge TEC wastewater either directly or indirectly. Table 6-5 summarizes the TECI discharge status by facility type. Approximately 97% of the discharging facilities discharge wastewater indirectly, while only 3% discharge wastewater directly. However, the majority of barge (tank and closed-top hopper) facilities (69%) discharge directly to U.S. surface waters because these facilities are usually located on major waterways. In addition, subsequent to 1994, the basis year of the detailed questionnaire, EPA learned of 4 barge/chemical and petroleum facilities that changed discharge status from direct to indirect. Where possible, EPA's analyses reflect this change. EPA has identified direct discharging facilities in addition to those shown in Table 6-5 (see Section 9.1.2); however, EPA has not identified any direct discharging facilities of the following five facility types: truck/petroleum, rail/petroleum, rail/food, truck/hopper, and rail/hopper.

Table 6-6 summarizes the total annual volume of wastewater discharged by the TECI. Approximately 2.2 billion gallons of wastewater is discharged annually by TEC facilities. This volume includes all wastewater sources such as TEC and non-TEC wastewaters, but excludes wastewaters that are not commingled with TEC wastewater such as sanitary wastewater and noncontaminated stormwater. Truck/food facilities account for 41% of this volume, due to the large number of tanks cleaned, relatively greater use of exterior cleaning as part of the routine tank cleaning operations, and wastewater generated by food processing operations at many truck/food facilities. Truck/chemical facilities, having the next largest volume, account for 39% of all wastewater generated by the TECI, while 20% of the total volume of wastewater generated is divided among the remaining nine facility groups.

EPA estimates that 547 facilities generate TEC wastewater but do not discharge wastewater directly to surface waters or indirectly to POTWs. The majority of these facilities achieve zero discharge of TEC wastewater by hauling the wastewater to a treatment, storage, and disposal facility (TSDF), ballast water treatment facility, privately owned treatment works, or centralized waste treatment (CWT) facility, or disposing of the wastewater by land application, land disposal, or evaporation. An estimated 44 TEC facilities achieve zero discharge of TEC wastewater by recycling or reusing 100% of TEC wastewater.

6.4 Water Reuse and Recycling

Water reuse and recycle activities commonly performed by discharging and zero discharge facilities include:

- Recirculation of cleaning solutions, including chemical cleaning solutions and water washes;
- Reuse of final rinse wastewater as initial rinse water; and
- Reuse of treated TEC wastewater as source water for TEC operations.

Other water reuse and recycle activities reported in responses to the Detailed Questionnaire include:

- Reuse of hydrotest wastewater as source water for TEC operations;
- Use of TEC contaminated stormwater as source water for TEC operations; and
- Reuse of final tank rinse wastewater as cleaning solution “make-up” water.

Additional information concerning water conservation and water recycle and reuse technologies applicable to the TECI is included in Section 7.2.

Approximately 10% of facilities, including discharging and zero discharging facilities, reuse all or part of treated TEC wastewater as source water for TEC operations. The majority of these facilities are zero discharging facilities, as shown in Table 6-7. The highest percentage of facilities that reuse wastewater in TEC operations are the truck/petroleum facilities.

For these facilities, 52 zero dischargers out of the total 104 truck/petroleum facilities reuse TEC wastewater as source water for TEC operations.

Wastewater streams that are recycled or reused for TEC operations include tank interior cleaning wastewater and hydrotesting wastewater. Hydrotesting wastewater is typically clean and does not require extensive treatment prior to recycle or reuse. Tank interior cleaning wastewater generated by truck/petroleum or rail/petroleum facilities can typically be reused for cleaning after treatment by simple oil/water separation. Tank interior cleaning wastewater generated by facilities cleaning chemical cargos generally requires more extensive treatment prior to reuse as source water in TEC operations. Accordingly, few facilities that clean chemical cargos reuse treated TEC wastewater as source water for TEC operations. Finally, sanitation requirements at many food grade facilities preclude the reuse of TEC wastewater as source water for TEC operations at these facilities.

The Agency analyzed wastewater generation, treatment, and discharge diagrams submitted in response to the Detailed Questionnaire to evaluate typical TEC wastewater management practices and common wastewater recycle and reuse practices. Figure 6-1 illustrates common wastewater management practices. The figure shows wastewater recycling that was reported to be performed by one or more facilities within the Detailed Questionnaire sample population. Review of the water flow diagrams submitted by facilities in responses to the Detailed Questionnaire resulted in the following observations:

- Facilities that recycle one wastewater stream type do not necessarily recycle additional wastewater stream types;
- Facilities that recycle wastewater streams generally segregate these streams for treatment and recycle; and
- Wastewater stream recycle and reuse activities performed are dependent upon the type of cargo cleaned.

6.5 Wastewater Characterization

EPA conducted a study of TECI wastewaters to determine the presence or absence of priority, conventional, and nonconventional pollutant parameters. Priority pollutants parameters are defined in Section 307(a)(1) of the Clean Water Act (CWA). The list of priority pollutant parameters, presented in Table 6-8, consists of 126 specific priority pollutants listed in 40 CFR Part 423, Appendix A. Section 301(b)(2) of the CWA obligates EPA to regulate priority pollutants if they are determined to be present at significant concentrations and it is technically and economically feasible. Section 304(a)(4) of the CWA defines conventional pollutant parameters, which include biochemical oxygen demand (BOD_5), total suspended solids (TSS), pH, fecal coliform, and any additional pollutants defined by the administrator as conventional. The administrator designated oil and grease (referred to as hexane extractable material or HEM) as an additional conventional pollutant on July 30, 1979 (44 FR 44501). These pollutant parameters are subject to regulation as specified in Sections 304(b)(1)(A), 304(a)(4), 301(b)(2)(E), and 306 of the CWA. Nonconventional pollutant parameters are those that are neither priority nor conventional pollutant parameters. Sections 301(b)(2)(F) and 301(g) of the CWA give EPA the authority to regulate nonconventional pollutant parameters, as appropriate, based on technical and economic considerations.

As discussed in Section 3.4, EPA conducted 20 sampling episodes at 18 facilities representative of the variety of facilities in the TECI (2 facilities were sampled twice). As part of this sampling program, EPA routinely analyzed wastewater samples for 4 conventional, 125 priority, and 348 nonconventional pollutant parameters, for a total of 477 pollutants analyzed. The nonconventional pollutants include organics, metals, pesticides, herbicides, dioxins, furans, and classical wet chemistry parameters (classical pollutants) that do not appear on the list of conventional or priority pollutants.

Subsequent to sampling, wastewater characterization data from four facilities were determined to not represent TEC wastewater, either because the facility was covered by another effluent guideline or because the sampled waste stream was determined to not represent TEC wastewater. Tables 6-9 through 6-16 present available wastewater characterization data by tank and cargo type cleaned. Data are available for the following:

- Truck/chemical facilities (Table 6-9);
- Rail/chemical facilities (Table 6-10);
- Barge/chemical & petroleum facilities (Table 6-11);
- Truck/food facilities (Table 6-12);
- Rail/food facilities (Table 6-13);
- Barge/food facilities (Table 6-14);
- Truck/petroleum facilities (Table 6-15); and
- Barge/hopper facilities (Table 6-16).

Raw wastewater characterization data for truck/hopper, rail/hopper, and rail/petroleum facilities were not collected during EPA's sampling program. EPA believes that characterization data from barge/hopper facilities represent truck/hopper and rail/hopper facilities since these facilities clean similar cargos; however, the volume of TEC wastewater generated during tank cleaning differs significantly among these facilities. EPA believes that characterization data from truck/petroleum facilities represent rail/petroleum facilities since these facilities also clean similar cargos.

However, in its analysis of the industry, EPA sampled one truck/petroleum facility. This facility treated only final rinse wastewater on site. Initial rinses and other TEC wastewaters were contract hauled for off-site treatment and were consequently not included in the sampling performed by EPA. Therefore, EPA did not use the data collected from this facility in further analyses because the data are not considered to be representative of the Truck/Chemical & Petroleum and Rail/Chemical & Petroleum Subcategories.

Tables 6-9 through 6-16 also present a statistical summary of the raw wastewater characterization data, including the mean, minimum, and maximum concentration values for each pollutant or parameter detected at least once in any raw wastewater characterization sample. For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration. The methodology used to calculate the mean concentration involved first calculating a mean concentration for each facility characterized and then calculating a subcategory mean concentration using applicable mean facility concentrations. In addition, for those samples in which individual pollutants were not detected, the sample detection limit is reported as the minimum concentration. Also listed in these tables is the number of times each pollutant or parameter was analyzed and detected in raw wastewater samples.

The summaries shown in Table 6-17 are derived from Tables 6-9 through 6-16. As expected, facilities cleaning chemical cargos have the highest number of priority pollutants detected. In addition, the range of concentrations for the classical pollutants is highest for barge/chemical & petroleum and truck/chemical facilities.

6.6 Pollutants of Interest

As discussed in Section 5.2, EPA subcategorized the TECI into 7 subcategories:

- Truck/Chemical & Petroleum Subcategory;
- Rail/Chemical & Petroleum Subcategory;
- Barge/Chemical & Petroleum Subcategory;
- Food Subcategory;
- Truck/Hopper Subcategory;
- Rail/Hopper Subcategory; and
- Barge/Hopper Subcategory.

Using the raw wastewater characterization data presented in Tables 6-9 through 6-16, EPA determined those pollutants commonly present in TECI wastewater for each subcategory and identified these pollutants as "pollutants of interest." EPA considered a separate list of pollutants of interest for each subcategory. EPA considered the following two general criteria to identify pollutants of interest:

1. The frequency of detection in subcategory wastewater characterization samples; and

2. The average raw wastewater concentration at those facilities sampled for treatment performance.

The first criterion indicates that the presence of the pollutant is representative of the subcategory, rather than an isolated occurrence. The second criterion ensures that the pollutant was present at treatable levels where EPA evaluated treatment performance. Application of these two general criteria is described in Sections 6.6.1 through 6.6.3.

If wastewater characterization samples were collected at two or more facilities within a subcategory, then pollutants detected at least two times in wastewater characterization samples were considered as pollutants of interest for that subcategory. If wastewater characterization samples were collected at only one facility within a subcategory, then only one detect was required for consideration as a pollutant of interest. Where EPA sampling data show that a pollutant concentration is below the detection limit at all sampled facilities within a subcategory, that pollutant is excluded from consideration as a pollutant of interest in that subcategory.

EPA considered an average pollutant concentration of at least five times the pollutant method detection limit to be a treatable level for all pollutants. To determine the average pollutant concentration within each subcategory, EPA averaged both the detected and the nondetected concentrations (nondetected concentrations were assumed to be equal to the pollutant detection limit). For subcategories with treatment performance data from more than one facility, pollutants present at treatable levels in the wastewater of at least one facility were considered pollutants of interest for that subcategory. Table 6-18 shows pollutants of interest by subcategory.

6.6.1 Truck/Chemical & Petroleum, Rail/Chemical & Petroleum, and Barge/Chemical & Petroleum Subcategories

Wastewater characterization samples were analyzed for all 477 pollutants for these subcategories. As discussed in Section 5.2, facilities that clean petroleum and/or chemical cargos are subcategorized by tank type (e.g., Truck/Chemical & Petroleum). However, for the purpose of determining pollutants of interest for the Truck/Chemical & Petroleum Subcategory, EPA excluded wastewater characterization data from the truck/petroleum facilities for the reasons discussed in Section 6.5. Therefore, raw wastewater characterization data from only truck/chemical facilities are used to identify pollutants of interest in the Truck/Chemical & Petroleum Subcategory.

The same selection criteria were applied separately to the analytical data available for the Truck/Chemical & Petroleum, Rail/Chemical & Petroleum, and Barge/Chemical & Petroleum Subcategories to identify pollutants of interest. These include:

- The pollutant was detected in at least two TEC wastewater characterization samples.
- The average raw wastewater concentration was at least five times the method detection limit from at least one facility sampled for treatment performance.

EPA conducted a rigorous analytical data review of all detects in Sampling Episode 4676 and 4677 (Truck/Chemical & Petroleum Subcategory). Based on this review, EPA determined that the presence of disulfoton and EPN are questionable in Truck/Chemical & Petroleum Subcategory raw wastewater. These pesticides are not further considered in EPA's analyses for the Truck/Chemical & Petroleum Subcategory.

6.6.2 Food Subcategory

Wastewater characterization samples were analyzed for all 477 pollutants. Available characterization data for the Food Subcategory include five days of sampling at a barge/food facility, one day of sampling at a truck/food facility, and one day of sampling at a rail/food facility.

EPA used wastewater treatment system performance data collected at one barge/food facility to represent the Food Subcategory. Samples collected at this one facility were analyzed for 190 pollutants including all 176 semivolatile organics and 14 classical pollutants. Volatile organics, pesticides, herbicides, dioxins, furans, metals, and six classical pollutants (adsorbable organic halides, total cyanide, amenable cyanide, surfactants, total sulfide, and volatile residue) were not analyzed because these analytes were not detected at significant levels in wastewater characterization samples. The following selection criteria were applied to identify pollutants of interest for the Food Subcategory. These include:

- The pollutant was detected in at least one TEC wastewater characterization sample at any Food facility.
- The average raw wastewater concentration was at least five times the method detection limit at the facility sampled for treatment performance.

6.6.3 Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories

The Agency used the sampling data collected at one barge/hopper facility to represent all three hopper subcategories. Samples collected during this sampling episode were analyzed for 453 pollutants, 24 fewer than the usual 477 pollutants. These 24 pollutants include the 17 dioxins and furans, 5 classical wet chemistry parameters (adsorbable organic halides, surfactants, total phenols, total sulfide, and volatile residue), and 2 volatile organics (m-xylene and o- + p-xylene). Except for xylenes, these pollutants were not analyzed because they were not expected to be present in TEC wastewater based on an assessment of the cargos cleaned and the cleaning processes used by facilities in these subcategories. M-xylene and o- + p-xylene were not analyzed because the laboratory inadvertently analyzed for m- + p-xylene and o-xylene instead, both of which were not detected. The same selection criteria were applied to the Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories to identify pollutants of interest. These include:

- The pollutant was detected in the single TEC wastewater characterization sample.
- The average raw wastewater concentration was at least five times the method detection limit at the facility sampled for treatment performance.

Table 6-1

Estimates of Total Annual Volume of Wastewater Generated by Facility Type – Discharging Facilities Only

Facility Type	Total Wastewater Generated		Wastewater Generated from Interior Cleaning Operations	
	Amount (gal/yr)	Percentage of Industry Total (%)	Amount (gal/yr)	Percentage of Industry Total (%)
Truck/Chemical	929,000,000	17	716,000,000	56
Rail/Chemical	262,000,000	5	91,900,000	7
Barge/Chemical & Petroleum	194,000,000	4	94,100,000	7
Truck/Petroleum	35,400,000	<1	2,500,000	<1
Rail/Petroleum	2,800	<<1	2,830	<<1
Truck/Food	3,850,000,000	70	245,000,000	19
Rail/Food	88,200,000	2	6,920,000	<1
Barge/Food	21,700	<<1	21,700	<<1
Truck/Hopper	23,900,000	<1	14,300,000	1
Rail/Hopper	208,000	<<1	17,500	<<1
Barge/Hopper	112,000,000	2	103,000,000	8
TOTAL (a)	**5,490,000,000**	**100**	**1,270,000,000**	**100**

(a) Differences occur due to rounding.

Table 6-2

Average Volume of Interior Cleaning Wastewater Generated per Tank Cleaning by Cargo Group and Tank Type – Discharging Facilities Only

Cargo Group	Average Volume of Interior Cleaning Wastewater Generated (gallons/tank)							
	Truck Tank	Rail Tank	Tank Barge	Truck Hopper	Rail Hopper	Barge Hopper	Intermediate Bulk Container	Intermodal Tank Container
Food Grade Products	360	1,200	19,000	520	1,800	17,000	NC	430
Petroleum and Coal Products	410	990	13,000	(a)	(a)	(a)	87	430
Latex, Rubber, and Resins	610	1,600	(a)	(a)	(a)	NC	50	230
Soaps and Detergents	440	620	NC	(a)	(a)	NC	(a)	550
Biodegradable Organic Chemicals	330	1,200	9,100	(a)	(a)	NC	(a)	(a)
Refractory Organic Chemicals	400	1,200	11,000	NC	NC	NC	NC	NC
Inorganic Chemicals	410	1,300	12,000	(a)	(a)	NC	(a)	NC
Agricultural Chemicals and Fertilizers	330	1,700	3,600	(a)	(a)	850	NC	NC
Chemical Products	640	1,700	3,700	NC	(a)	NC	(a)	810
Hazardous Waste	170	NC	NC	NC	NC	NC	NC	NC
Nonhazardous Waste	280	530	(a)	NC	NC	NC	NC	NC
Dry Bulk Commodities or Cargos	580	(a)	NC	470	1,900	(a)	NC	NC

(a) Not disclosed to prevent compromising confidential business information.
NC - Not characterized by the Detailed Questionnaire sample population.

Table 6-3

Average Volume of Wastewater Generated per Facility per Day by Wastewater Stream Type and Facility Type – Discharging Facilities Only

Facility Type	TEC Interior Cleaning (gallons/day)	TEC Exterior Washing (gallons/day)	Boiler Blowdown (gallons/day)	Hydrotesting Wastewater (gallons/day)	Safety Equipment Rinsate (gallons/day)	TEC-Contaminated Stormwater (gallons/day)
Truck/Chemical	8,400	1,200	15	270	7.8	18
Rail/Chemical	8,700	870	250	8,900	4.8	240
Barge/Chemical & Petroleum	20,000	(a)	(a)	NC	(a)	(a)
Truck/Petroleum	420	37	NC	1,800	NC	(a)
Rail/Petroleum	(a)	NC	NC	NC	NC	NC
Truck/Food	4,600	640	(a)	NC	NC	(a)
Rail/Food	(a)	(a)	NC	NC	NC	NC
Barge/Food	(a)	NC	NC	NC	NC	NC
Truck/Hopper	1,400	500	NC	NC	NC	NC
Rail/Hopper	(a)	NC	NC	(a)	(a)	NC
Barge/Hopper	34,000	NC	NC	NC	NC	(a)

(a) Not disclosed to prevent compromising confidential business information.
NC - Not characterized by the Detailed Questionnaire sample population.

Table 6-4

Total Volume of Wastewater Generated per Day by Wastewater Stream Type and Facility Type – Discharging Facilities Only

Facility Type	TEC Interior Cleaning (gallons/day)	TEC Exterior Washing (gallons/day)	Boiler Blowdown (gallons/day)	Hydrotesting Wastewater (gallons/day)	Safety Equipment Rinsate (gallons/day)	TEC-Contaminated Stormwater (gallons/day)
Truck/Chemical	2,400,000	340,000	4,400	77,000	2,200	5,300
Rail/Chemical	330,000	33,000	9,400	340,000	180	9100
Barge/Chemical & Petroleum	300,000	(a)	(a)	NC	(a)	(a)
Truck/Petroleum	15,000	1,300	NC	62,000	NC	(a)
Rail/Petroleum	(a)	NC	NC	NC	NC	NC
Truck/Food	800,000	110,000	(a)	NC	NC	(a)
Rail/Food	(a)	(a)	NC	NC	NC	NC
Barge/Food	(a)	NC	NC	NC	NC	NC
Truck/Hopper	46,000	17,000	NC	NC	NC	NC
Rail/Hopper	(a)	NC	NC	(a)	(a)	NC
Barge/Hopper	430,000	NC	NC	NC	NC	(a)

(a) Not disclosed to prevent compromising confidential business information.
NC - Not characterized by the Detailed Questionnaire sample population.

Table 6-5

Discharge Status by Facility Type

Facility Type	Indirect Discharge		Direct Discharge	
	Number of Facilities	**Percentage of Industry Total (%)**	**Number of Facilities**	**Percentage of Industry Total (%)**
Truck/Chemical	288	43	0	0
Rail/Chemical	38	6	0	0
Barge/Chemical & Petroleum (a)	5	<1	10	53
Truck/Petroleum	34	5	0	0
Rail/Petroleum	3	<1	0	0
Truck/Food	173	26	0	0
Rail/Food	86	13	0	0
Barge/Food	2	<1	0	0
Truck/Hopper	34	5	0	0
Rail/Hopper	5	<1	0	0
Barge/Hopper	3	<1	9	47
TOTAL (b)	**673**	**100**	**19**	**100**

(a) Subsequent to 1994, the basis year of the detailed questionnaire, EPA learned of 4 barge/chemical and petroleum facilities that changed discharge status from direct to indirect.
(b) Differences occur due to rounding.

Table 6-6

Estimates of Total Annual Volume of Wastewater Discharged By Facility Type and Discharge Status

Facility Type	Discharge Status	Total Interior Cleaning Wastewater Discharged		Total Commingled Wastewater Discharged	
		Amount (gal/yr)	Percentage of Industry Total (%)	Amount (gal/yr)	Percentage of Industry Total (%)
Truck/Chemical	Indirect	708,000,000	57	845,000,000	39
Rail/Chemical	Indirect	91,300,000	7	130,000,000	6
Barge/Chemical & Petroleum	Direct	30,300,000	2	42,800,000	2
Barge/Chemical & Petroleum	Indirect	28,100,000	2	28,700,000	1
Truck/Petroleum	Indirect	2,500,000	<1	3,100,000	<1
Rail/Petroleum	Indirect	2,830	<<1	2,830	<<1
Truck/Food	Indirect	243,000,000	20	889,000,000	41
Rail/Food	Indirect	19,500,000	2	131,000,000	6
Barge/Food	Indirect	21,700	<<1	21,700	<<1
Truck/Hopper	Indirect	14,300,000	1	19,500,000	<1
Rail/Hopper	Indirect	17,400	<<1	80,200	<<1
Barge/Hopper	Direct	100,000,000	8	100,000,000	5
Barge/Hopper	Indirect	2,610,000	<1	2,610,000	<1
TOTAL (a)		**1,240,000,000**	**100**	**2,190,000,000**	**100**

(a) Differences occur due to rounding.

Table 6-7

Number of Facilities That Reuse All or Part of TEC Wastewater as Source Water for TEC Operations

Facility Type	Number of Facilities that Reuse TEC Wastewater		Total Number of Discharging and Zero Discharge Facilities
	Discharging Facilities	Zero Discharge Facilities	
Truck/Chemical	14	33	556
Rail/Chemical	1	15	67
Barge/Chemical & Petroleum	3	1	31
Truck/Petroleum	0	52	104
Rail/Petroleum	0	1	4
Truck/Food	0	0	318
Rail/Food	0	0	86
Barge/Food	0	0	2
Truck/Hopper	5	0	39
Rail/Hopper	0	0	5
Barge/Hopper	0	0	14

Table 6-8
Priority Pollutant List (a)

1 Acenaphthene	66 Bis (2-ethylhexyl) Phthalate
2 Acrolein	67 Butyl Benzyl Phthalate
3 Acrylonitrile	68 Di-n-butyl Phthalate
4 Benzene	69 Di-n-octyl Phthalate
5 Benzidine	70 Diethyl Phthalate
6 Carbon Tetrachloride (Tetrachloromethane)	71 Dimethyl Phthalate
7 Chlorobenzene	72 Benzo(a)anthracene (1,2-Benzanthracene)
8 1,2,4-Trichlorobenzene	73 Benzo(a)pyrene (3,4-Benzopyrene)
9 Hexachlorobenzene	74 Benzo(b)fluoranthene (3,4-Benzo fluoranthene)
10 1,2-Dichloroethane	75 Benzo(k)fluoranthene (11,12-Benzofluoranthene)
11 1,1,1-Trichloroethane	76 Chrysene
12 Hexachloroethane	77 Acenaphthylene
13 1,1-Dichloroethane	78 Anthracene
14 1,1,2-Trichloroethane	79 Benzo(ghi)perylene (1,12-Benzoperylene)
15 1,1,2,2-Tetrachloroethane	80 Fluorene
16 Chloroethane	81 Phenanthrene
17 Removed	82 Dibenzo(a,h)anthracene (1,2,5,6-Dibenzanthracene)
18 Bis (2-chloroethyl) Ether	83 Indeno(1,2,3-cd)pyrene (2,3-o-Phenylenepyrene)
19 2-Chloroethyl Vinyl Ether (mixed)	84 Pyrene
20 2-Chloronaphthalene	85 Tetrachloroethylene (Tetrachloroethene)
21 2,4,6-Trichlorophenol	86 Toluene
22 Parachlorometa Cresol (4-Chloro-3-Methylphenol)	87 Trichloroethylene (Trichloroethene)
23 Chloroform (Trichloromethane)	88 Vinyl Chloride (Chloroethylene)
24 2-Chlorophenol	89 Aldrin
25 1,2-Dichlorobenzene	90 Dieldrin
26 1,3-Dichlorobenzene	91 Chlordane (Technical Mixture & Metabolites)
27 1,4-Dichlorobenzene	92 4,4'-DDT (p,p'-DDT)
28 3,3'-Dichlorobenzidine	93 4,4'-DDE (p,p'-DDX)
29 1,1-Dichloroethene	94 4,4'-DDD (p,p'-TDE)
30 1,2-Trans-Dichloroethene	95 Alpha-endosulfan
31 2,4-Dichlorophenol	96 Beta-endosulfan
32 1,2-Dichloropropane	97 Endosulfan Sulfate
33 1,3-Dichloropropylene (Trans-1,3-Dichloropropene)	98 Endrin
34 2,4-Dimethylphenol	99 Endrin Aldehyde
35 2,4-Dinitrotoluene	100 Heptachlor
36 2,6-Dinitrotoluene	101 Heptachlor Epoxide
37 1,2-Diphenylhydrazine	102 Alpha-BHC
38 Ethylbenzene	103 Beta-BHC
39 Fluoranthene	104 Gamma-BHC (Lindane)
40 4-Chlorophenyl Phenyl Ether	105 Delta-BHC
41 4-Bromophenyl Phenyl Ether	106 PCB-1242 (Arochlor 1242)
42 Bis (2-chloroisopropyl) Ether	107 PCB-1254 (Arochlor 1254)
43 Bis (2-chloroethoxy) Methane	108 PCB-1221 (Arochlor 1221)
44 Methylene Chloride (Dichloromethane)	109 PCB-1232 (Arochlor 1232)
45 Methyl Chloride (Chloromethane)	110 PCB-1248 (Arochlor 1248)
46 Methyl Bromide (Bromomethane)	111 PCB-1260 (Arochlor 1260)
47 Bromoform (Tribromomethane)	112 PCB-1016 (Arochlor 1016)
48 Dichlorobromomethane (Bromodichloromethane)	113 Toxaphene
49 Removed	114 Antimony (total)
50 Removed	115 Arsenic (total)
51 Chlorodibromomethane (Dibromochloromethane)	116 Asbestos (fibrous)
52 Hexachlorobutadiene	117 Beryllium (total)
53 Hexachlorocyclopentadiene	118 Cadmium (total)
54 Isophorone	119 Chromium (total)
55 Naphthalene	120 Copper (total)
56 Nitrobenzene	121 Cyanide (total)
57 2-Nitrophenol	122 Lead (total)
58 4-Nitrophenol	123 Mercury (total)
59 2,4-Dinitrophenol	124 Nickel (total)
60 4,6-Dinitro-o-Cresol (Phenol, 2-methyl-4,6-dinitro)	125 Selenium (total)
61 N-Nitrosodimethylamine	126 Silver (total)
62 N-Nitrosodiphenylamine	127 Thallium (total)
63 N-Nitrosodi-n-propylamine (Di-n-propylnitrosamine)	128 Zinc (total)
64 Pentachlorophenol	129 2,3,7,8-Tetrachlorodibenzo-p-Dioxin
65 Phenol	

Source: Clean Water Act
(a) Priority pollutants are numbered 1 through 129 but include 126 pollutants since EPA removed three pollutants from the list (Numbers 17, 49, and 50).

Table 6-9

Summary of Raw Wastewater Characterization Data for Truck/Chemical Facilities

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Volatile Organics							
P011	1,1,1-Trichloroethane	µg/L	710	10	2,700	9	10
P013	1,1-Dichloroethane	µg/L	12	9.9	36	2	10
P029	1,1-Dichloroethene	µg/L	14	10	40	2	10
	1,2-Dibromoethane	µg/L	17	10	86	2	10
P010	1,2-Dichloroethane	µg/L	400	10	1,700	4	10
P032	1,2-Dichloropropane	µg/L	11	9.9	19	1	10
	1,4-Dioxane	µg/L	19	9.9	150	1	10
	Acetone	µg/L	24,000	57	67,000	10	10
P004	Benzene	µg/L	35	10	270	3	10
P048	Bromodichloromethane	µg/L	10	9.9	12	1	10
P007	Chlorobenzene	µg/L	16	10	29	4	10
P023	Chloroform	µg/L	65	10	420	6	10
	Diethyl Ether	µg/L	110	50	900	1	10
P038	Ethylbenzene	µg/L	440	10	3,900	6	10
	m-Xylene	µg/L	1,700	10	7,100	6	10
	Methyl Ethyl Ketone	µg/L	5,200	50	28,000	6	10
	Methyl Isobutyl Ketone	µg/L	1,600	50	8,200	7	10
P044	Methylene Chloride	µg/L	12,000	29	63,000	10	10
	o- + p-Xylene	µg/L	860	10	3,600	6	10
P085	Tetrachloroethene	µg/L	1,100	10	6,500	8	10
P006	Tetrachloromethane	µg/L	14	9.9	49	1	10

Table 6-9 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P086	Toluene	µg/L	1,600	10	7,000	7	10
P047	Tribromomethane	µg/L	10	9.9	14	1	10
P087	Trichloroethene	µg/L	26	10	81	4	10
Semivolatile Organics							
P025	1,2-Dichlorobenzene	µg/L	190	10	1,000	2	10
	1-Methylphenanthrene	µg/L	140	10	1,000	2	10
	2,3-Dichloroaniline	µg/L	3,600	10	34,000	2	10
P021	2,4,6-Trichlorophenol	µg/L	180	10	1,500	2	10
P031	2,4-Dichlorophenol	µg/L	57	10	160	2	10
	2,6-Dichlorophenol	µg/L	56	10	160	1	10
P024	2-Chlorophenol	µg/L	67	10	160	3	10
	2-Isopropylnaphthalene	µg/L	240	10	1,000	3	10
	2-Methylnaphthalene	µg/L	150	10	1,000	7	10
P057	2-Nitrophenol	µg/L	110	20	320	1	10
	3,6-Dimethylphenanthrene	µg/L	160	10	1,000	2	10
P058	4-Nitrophenol	µg/L	270	50	800	1	10
P001	Acenaphthene	µg/L	130	10	1,000	1	10
	alpha-Terpineol	µg/L	340	10	2,000	4	10
	Aniline	µg/L	130	10	1,000	1	10
	Benzoic Acid	µg/L	24,000	1,500	110,000	10	10
	Benzyl Alcohol	µg/L	410	28	1,900	9	10
	Biphenyl	µg/L	140	10	1,000	2	10
P066	Bis (2-ethylhexyl) Phthalate	µg/L	900	12	4,200	9	10
P069	Di-n-Octyl Phthalate	µg/L	350	10	2,200	5	10
P063	Di-n-Propylnitrosamine	µg/L	270	20	2,000	1	10

Table 6-9 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Dimethyl Sulfone	µg/L	150	10	1,000	2	10
	Diphenylamine	µg/L	140	10	1,000	1	10
P080	Fluorene	µg/L	140	10	1,000	1	10
	Hexanoic Acid	µg/L	77	10	200	2	10
P054	Isophorone	µg/L	140	10	1,000	1	10
	n-Decane	µg/L	350	10	1,100	2	10
	n-Docosane	µg/L	330	10	2,600	8	10
	n-Dodecane	µg/L	1,100	10	3,200	4	10
	n-Eicosane	µg/L	410	10	1,900	8	10
	n-Hexacosane	µg/L	810	10	7,600	8	10
	n-Hexadecane	µg/L	640	10	1,800	8	10
P062	n-Nitrosodiphenylamine	µg/L	270	20	2,000	1	10
	n-Octacosane	µg/L	940	10	9,000	6	10
	n-Octadecane	µg/L	450	10	1,700	8	10
	n-Tetracosane	µg/L	640	10	5,400	9	10
	n-Tetradecane	µg/L	560	10	2,100	7	10
	n-Triacontane	µg/L	1,200	10	11,000	3	10
P055	Naphthalene	µg/L	330	10	1,000	7	10
	o-Cresol	µg/L	160	10	1,000	2	10
	p-Cresol	µg/L	130	10	670	4	10
	p-Cymene	µg/L	150	10	1,000	2	10
P081	Phenanthrene	µg/L	180	10	1,000	2	10
P065	Phenol	µg/L	2,000	100	6,400	9	10
	Styrene	µg/L	3,300	10	27,000	7	10
	Tripropyleneglycol Methyl Ether	µg/L	1,300	99	9,900	1	10

Table 6-9 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Phenoxy-Acid Herbicides							
	2,4,5-T	µg/L	0.85	0.20	4.4	4	10
	2,4,5-TP	µg/L	0.59	0.20	3.2	3	10
	2,4-D	µg/L	2.5	1.0	10	2	10
	2,4-DB (Butoxon)	µg/L	6.6	2.0	31	2	10
	Dalapon	µg/L	0.81	0.20	5.7	2	10
	Dichloroprop	µg/L	2.8	1.0	10	2	10
	Dinoseb	µg/L	2.3	0.50	18	3	10
	MCPA	µg/L	680	50	3,500	7	10
	MCPP	µg/L	130	50	740	1	10
	Picloram	µg/L	1.2	0.50	5.0	2	10
Organo-Phosphorous Pesticides							
	Azinphos Methyl	µg/L	4.4	1.0	22	3	10
	Demeton B	µg/L	5.4	2.0	35	1	10
	Diazinon	µg/L	3.9	2.0	16	2	10
	Dichlofenthion	µg/L	2.8	2.0	9.0	3	10
	Dimethoate	µg/L	2.3	1.0	6.8	1	10
	Ethion	µg/L	2.4	2.0	4.3	1	10
	Leptophos	µg/L	5.6	2.0	34	3	10
	Merphos	µg/L	2.5	2.0	5.4	1	10
	Methyl Chlorpyrifos	µg/L	3.3	2.0	14	1	10
	Methyl Parathion	µg/L	2.3	2.0	4.0	1	10
	Tetrachlorvinphos	µg/L	2.7	2.0	7.1	3	10
Organo-Halide Pesticides							
P094	4,4'-DDD	µg/L	0.59	0.20	2.0	1	10

Table 6-9 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P092	4,4'-DDT	µg/L	0.29	0.10	1.0	1	10
P103	beta-BHC	µg/L	0.35	0.10	1.0	3	10
	Bromoxynil Octanoate	µg/L	1.5	0.50	5.0	1	10
	Chlorobenzilate	µg/L	3.5	1.0	10	4	10
	Diallate A	µg/L	6.9	2.0	20	2	10
	Diallate B	µg/L	10	2.0	62	2	10
P090	Dieldrin (d)	µg/L	0.13	0.040	0.40	3	10
P096	Endosulfan II	µg/L	2.9	1.0	10	1	10
P097	Endosulfan Sulfate	µg/L	0.30	0.10	1.0	2	10
P099	Endrin Aldehyde	µg/L	3.3	0.10	15	2	10
P104	gamma-BHC	µg/L	0.20	0.050	0.50	2	10
P091	gamma-Chlordane	µg/L	0.16	0.050	0.50	1	10
	Nitrofen	µg/L	0.60	0.20	2.0	1	10
	Pentachloronitrobenzene (PCNB)	µg/L	7.9	0.050	77	3	10
	Propachlor	µg/L	2.3	0.10	11	1	10
	Simazine	µg/L	28	8.0	84	1	10
	Terbuthylazine	µg/L	15	5.0	50	1	10
Metals							
	Aluminum	µg/L	6,100	48	30,000	10	10
P114	Antimony	µg/L	57	3.4	240	6	10
P115	Arsenic	µg/L	15	4.6	28	9	10
	Barium	µg/L	530	73	1,200	10	10
P117	Beryllium	µg/L	0.92	0.30	1.4	2	10
	Bismuth	µg/L	110	0.10	650	1	10
	Boron	µg/L	4,700	140	26,000	10	10

Table 6-9 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P118	Cadmium	µg/L	18	1.0	49	9	10
	Calcium	µg/L	300,000	71,000	540,000	10	10
P119	Chromium	µg/L	2,400	3.1	19,000	9	10
	Cobalt	µg/L	85	6.0	330	8	10
P120	Copper	µg/L	1,100	40	9,200	10	10
	Dysprosium	µg/L	46	26	100	2	10
	Europium	µg/L	24	2.9	100	3	10
	Gadolinium	µg/L	98	28	300	2	10
	Gallium	µg/L	280	8.6	1,100	2	10
	Germanium	µg/L	200	72	500	3	10
	Gold	µg/L	68	11	200	3	10
	Hafnium	µg/L	160	1.0	500	1	10
	Hexavalent Chromium	mg/L	0.29	0.010	3.3	3	9
	Holmium	µg/L	140	0.50	500	1	10
	Iridium	µg/L	580	42	4,400	4	10
	Iron	µg/L	30,000	270	150,000	10	10
	Lanthanum	µg/L	35	0.10	100	1	10
P122	Lead	µg/L	25	2.8	76	3	10
	Lithium	µg/L	96	31	180	7	10
	Lutetium	µg/L	22	0.58	100	2	10
	Magnesium	µg/L	72,000	10,000	270,000	10	10
	Manganese	µg/L	800	2.3	6,300	10	10
P123	Mercury	µg/L	1.8	0.20	5.0	8	10
	Molybdenum	µg/L	100	18	370	10	10
	Neodymium	µg/L	52	0.50	200	1	10

Table 6-9 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P124	Nickel	µg/L	360	9.0	2,100	10	10
	Niobium	µg/L	170	32	500	6	10
	Osmium	µg/L	91	0.10	490	1	10
	Palladium	µg/L	190	0.50	500	1	10
	Phosphorus	µg/L	42,000	1,300	190,000	8	8
	Platinum	µg/L	570	66	3,700	5	10
	Potassium	µg/L	19,000	6,100	34,000	8	8
	Praseodymium	µg/L	140	1.0	500	2	10
	Rhenium	µg/L	160	19	500	3	10
	Rhodium	µg/L	1,200	1.0	6,700	4	10
	Ruthenium	µg/L	320	62	590	6	10
	Samarium	µg/L	150	0.50	500	1	10
	Scandium	µg/L	21	0.10	100	4	10
P125	Selenium	µg/L	11	1.0	23	3	10
	Silicon	µg/L	14,000	2,800	51,000	9	10
P126	Silver	µg/L	3.5	2.2	6.4	3	10
	Sodium	µg/L	1,000,000	140,000	2,800,000	10	10
	Strontium	µg/L	2,300	140	5,500	10	10
	Sulfur	µg/L	360,000	68,000	780,000	8	8
	Tantalum	µg/L	200	0.50	500	4	10
	Tellurium	µg/L	270	1.0	1,000	3	10
	Terbium	µg/L	140	8.3	500	2	10
P127	Thallium	µg/L	3.7	1.0	24	2	10
	Thorium	µg/L	170	1.0	500	1	10
	Thulium	µg/L	110	0.50	500	1	10

Table 6-9 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Tin	µg/L	12,000	23	85,000	7	10
	Titanium	µg/L	190	6.1	1,000	10	10
	Tungsten	µg/L	220	1.0	500	3	10
	Uranium	µg/L	610	1.0	1,000	1	10
	Vanadium	µg/L	31	1.9	150	7	10
	Ytterbium	µg/L	22	0.10	100	4	10
	Yttrium	µg/L	2.1	0.30	5.0	1	10
P128	Zinc	µg/L	830	35	3,500	10	10
	Zirconium	µg/L	27	0.10	100	1	10
Dioxins and Furans							
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	pg/L	690	50	2,400	7	10
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/L	220	50	1,100	5	10
	1,2,3,6,7,8-Hexachlorodibenzofuran	pg/L	120	50	500	3	10
	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	pg/L	97	50	500	1	10
	Octachlorodibenzo-p-dioxin	pg/L	6,100	200	21,000	10	10
	Octachlorodibenzofuran	pg/L	560	99	1,900	2	10
Classical Pollutants							
	Adsorbable Organic Halides (AOX)	µg/L	5,100	1,200	19,000	10	10
	Amenable Cyanide	mg/L	0.0033	5.0×10^{-6}	0.010	1	17
	Ammonia as Nitrogen	mg/L	79	0.29	650	10	10
	BOD 5-day	mg/L	2,300	320	6,000	10	10
	Chemical Oxygen Demand (COD)	mg/L	6,600	830	16,000	10	10
	Chloride	mg/L	900	83	4,800	10	10
	Fluoride	mg/L	21	0.30	180	10	10
	Hexane Extractable Material	mg/L	1,300	6.0	5,300	38	38

Table 6-9 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Nitrate/Nitrite	mg/L	2.6	0.26	9.5	10	10
	SGT-HEM	mg/L	150	5.0	450	29	38
	Surfactants (MBAS)	mg/L	16	0.85	33	10	10
P121	Total Cyanide	mg/L	0.020	0.0050	0.077	13	29
	Total Dissolved Solids	mg/L	5,000	1,700	11,000	10	10
	Total Organic Carbon (TOC)	mg/L	1,500	160	3,200	10	10
	Total Phenols	mg/L	2.6	0.0059	6.8	9	10
	Total Phosphorus	mg/L	22	0.37	53	10	10
	Total Sulfide (Iodometric)	mg/L	0.92	0.83	1.0	1	3
	Total Suspended Solids	mg/L	1,600	38	4,800	10	10
	Volatile Residue	mg/L	2,900	1,900	6,400	4	4

(a) For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration.
(b) Minimum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(c) Maximum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(d) EPA conducted a rigorous analytical data review of all detects in Sampling Episodes 4676 and 4677. Based on this review, EPA determined that the two of the detected dieldrin samples are questionable.

Table 6-10

Summary of Raw Wastewater Characterization Data for Rail/Chemical Facilities

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Volatile Organics							
	Acetone	µg/L	390	50	930	4	5
P004	Benzene	µg/L	27	10	44	1	5
	Carbon Disulfide	µg/L	10	10	11	1	5
P038	Ethylbenzene	µg/L	70	10	180	4	5
	m-Xylene	µg/L	120	10	390	4	5
	Methyl Ethyl Ketone	µg/L	130	50	310	4	5
	Methyl Isobutyl Ketone	µg/L	51	50	58	1	5
	o- + p-Xylene	µg/L	87	10	240	4	5
P086	Toluene	µg/L	97	19	170	5	5
Semivolatile Organics							
P008	1,2,4-Trichlorobenzene	µg/L	80	10	130	1	5
	1-Methylfluorene	µg/L	37	10	230	1	5
	1-Methylphenanthrene	µg/L	61	10	350	2	5
	2,3-Benzofluorene	µg/L	23	10	110	1	5
	2,4-Diaminotoluene	µg/L	1,100	99	6,200	3	5
P031	2,4-Dichlorophenol	µg/L	310	10	590	1	5
P034	2,4-Dimethylphenol	µg/L	25	10	100	3	5
P035	2,4-Dinitrotoluene	µg/L	3,400	10	27,000	1	5
P036	2,6-Dinitrotoluene	µg/L	940	10	7,300	1	5
	2-Isopropylnaphthalene	µg/L	87	10	140	1	5
	2-Methylnaphthalene	µg/L	59	10	400	1	5

Table 6-10 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	5-Nitro-o-toluidine	µg/L	430	10	3,300	1	5
	7,12-Dimethylbenz(a)anthracene	µg/L	24	10	120	1	5
P001	Acenaphthene	µg/L	41	10	260	1	5
P078	Anthracene	µg/L	82	10	500	3	5
P072	Benzo(a)anthracene	µg/L	22	10	100	1	5
	Benzoic Acid	µg/L	1,700	50	6,500	3	5
	Biphenyl	µg/L	51	10	330	1	5
P018	Bis (2-chloroethyl) Ether	µg/L	25	10	100	1	5
P066	Bis (2-ethylhexyl) Phthalate	µg/L	22	10	100	1	5
	Carbazole	µg/L	69	20	370	3	5
P076	Chrysene	µg/L	27	10	150	1	5
	Dimethyl Sulfone	µg/L	50	10	170	2	5
	Diphenyl Ether	µg/L	28	10	100	1	5
P039	Fluoranthene	µg/L	69	10	480	2	5
P080	Fluorene	µg/L	46	10	300	1	5
	Hexanoic Acid	µg/L	2,300	10	9,300	4	5
	n-Decane	µg/L	31	10	100	2	5
	n-Docosane	µg/L	170	10	1,200	3	5
	n-Dodecane	µg/L	260	10	1,400	4	5
	n-Eicosane	µg/L	740	17	4,800	5	5
	n-Hexacosane	µg/L	130	10	420	3	5
	n-Hexadecane	µg/L	1,500	10	8,300	4	5
	n-Octacosane	µg/L	55	10	330	2	5
	n-Octadecane	µg/L	790	15	5,700	5	5
	n-Tetracosane	µg/L	180	10	780	4	5

Table 6-10 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	n-Tetradecane	µg/L	940	10	6,400	4	5
	n-Triacontane	µg/L	75	10	270	2	5
P055	Naphthalene	µg/L	47	10	290	4	5
	p-Cresol	µg/L	35	10	110	2	5
	Perylene	µg/L	35	10	210	1	5
	Phenacetin	µg/L	21	10	100	1	5
P081	Phenanthrene	µg/L	150	10	1,100	3	5
P065	Phenol	µg/L	370	10	1,900	4	5
P084	Pyrene	µg/L	56	10	380	2	5
	Styrene	µg/L	32	10	100	2	5
Phenoxy-Acid Herbicides							
	2,4,5-T	µg/L	13	0.20	20	2	5
	2,4,5-TP	µg/L	13	0.20	20	2	5
	2,4-D	µg/L	73	1.0	180	1	5
	2,4-DB (Butoxon)	µg/L	130	2.2	200	3	5
	Dalapon	µg/L	17	0.20	53	1	5
	Dicamba	µg/L	630	0.54	1,300	4	5
	Dichloroprop	µg/L	70	8.4	100	3	5
	Dinoseb	µg/L	32	0.50	52	3	5
	MCPP	µg/L	42,000	50	82,000	2	5
Organo-Phosphorous Pesticides							
	Chlorpyrifos	µg/L	2.0	2.0	2.0	1	5
	Dioxathion	µg/L	5.8	5.0	8.0	1	4
	Disulfoton	µg/L	2.0	2.0	2.0	1	5
	Tetrachlorvinphos	µg/L	2.1	2.0	3.0	1	5

Table 6-10 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Tokuthion	µg/L	2.5	2.0	4.0	1	4
	Trichlorfon	µg/L	7.2	5.0	18	1	4
	Trichloronate	µg/L	2.1	2.0	2.4	1	5
	Trimethylphosphate	µg/L	2.8	2.0	5.0	2	4
Organo-Halide Pesticides							
P094	4,4'-DDD	µg/L	0.21	0.050	0.44	1	5
P092	4,4'-DDT	µg/L	0.25	0.10	1.3	1	5
	Acephate	µg/L	730	20	5,500	2	5
	Alachlor	µg/L	0.25	0.20	0.60	1	5
P102	alpha-BHC	µg/L	0.19	0.050	0.27	2	5
P091	alpha-Chlordane	µg/L	0.099	0.080	0.11	1	5
	Atrazine	µg/L	84	1.0	630	1	5
	Benefluralin	µg/L	2.2	0.20	12	2	5
P103	beta-BHC	µg/L	26	0.10	200	3	5
	Butachlor	µg/L	0.48	0.30	0.53	1	5
	Captafol	µg/L	1.9	1.2	2.0	1	5
	Carbophenothion	µg/L	1.0	0.50	1.2	1	5
	Chlorobenzilate	µg/L	1.1	0.25	2.7	1	5
	Chloroneb	µg/L	22	0.30	170	1	5
	Dacthal (DCPA)	µg/L	0.40	0.050	1.8	2	5
P105	delta-BHC	µg/L	0.46	0.050	3.0	4	5
	Diallate	µg/L	77	2.2	580	3	5
	Dicofol	µg/L	1.4	1.0	3.4	1	4
P090	Dieldrin	µg/L	1.7	0.040	12	3	5
P095	Endosulfan I	µg/L	0.11	0.10	0.14	1	5

Table 6-10 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P097	Endosulfan Sulfate	µg/L	0.26	0.070	1.3	2	5
P099	Endrin Aldehyde	µg/L	0.28	0.10	1.6	1	5
	Endrin Ketone	µg/L	0.13	0.080	0.33	1	5
	Ethalfluralin	µg/L	4.2	0.050	33	1	5
P104	gamma-BHC	µg/L	0.28	0.050	1.9	1	5
P091	gamma-Chlordane	µg/L	0.085	0.050	0.26	2	5
	Isodrin	µg/L	0.16	0.10	0.52	1	5
	Isopropalin	µg/L	0.56	0.20	3.1	1	5
	Metribuzin	µg/L	0.15	0.050	0.20	1	5
	Mirex	µg/L	0.69	0.20	4.0	1	5
	Nitrofen	µg/L	0.92	0.20	6.0	1	5
	Pendimethalin	µg/L	0.71	0.30	2.4	1	5
	Pentachloronitrobenzene (PCNB)	µg/L	0.10	0.050	0.46	2	5
	Perthane	µg/L	41	10	250	1	5
	Propachlor	µg/L	13	0.10	100	3	5
	Propazine	µg/L	18	1.0	39	3	5
	Simazine	µg/L	24,000	0.80	190,000	1	5
	Strobane	µg/L	46	5.0	170	1	4
	Terbacil	µg/L	19	2.0	140	2	5
	Terbuthylazine	µg/L	2,100	5.0	13,000	3	5
	Triadimefon	µg/L	1.0	0.50	1.6	1	5
	Trifluralin	µg/L	1.6	0.10	12	1	5
Metals							
	Aluminum	µg/L	12,000	2,200	64,000	5	5
P114	Antimony	µg/L	16	4.7	61	3	5

Table 6-10 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P115	Arsenic	µg/L	39	12	120	5	5
	Barium	µg/L	590	100	1,800	5	5
P117	Beryllium	µg/L	0.64	0.20	1.3	1	5
	Bismuth	µg/L	84	67	100	1	5
	Boron	µg/L	2,100	460	5,500	5	5
	Calcium	µg/L	31,000	18,000	56,000	5	5
	Cerium	µg/L	390	280	500	1	5
P119	Chromium	µg/L	50	28	150	5	5
	Cobalt	µg/L	28	18	60	5	5
P120	Copper	µg/L	110	81	180	5	5
	Europium	µg/L	52	3.8	100	1	5
	Gold	µg/L	120	46	200	1	5
	Iron	µg/L	16,000	6,700	26,000	5	5
	Lanthanum	µg/L	98	96	100	1	5
P122	Lead	µg/L	32	12	59	2	5
	Lithium	µg/L	76	39	150	2	5
	Magnesium	µg/L	14,000	6,200	28,000	5	5
	Manganese	µg/L	750	540	1,400	5	5
P123	Mercury	µg/L	0.24	0.20	0.38	2	5
	Molybdenum	µg/L	33	10	72	4	5
P124	Nickel	µg/L	81	36	120	5	5
	Niobium	µg/L	290	71	500	1	5
	Phosphorus	µg/L	8,200	2,100	33,000	5	5
	Platinum	µg/L	300	110	500	1	5
	Potassium	µg/L	970,000	4,500	2,800,000	5	5

Table 6-10 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P125	Selenium	µg/L	11	1.6	20	1	5
	Silicon	µg/L	13,000	5,500	26,000	5	5
	Sodium	µg/L	1,700,000	290,000	6,100,000	5	5
	Strontium	µg/L	340	210	600	5	5
	Sulfur	µg/L	440,000	53,000	1,200,000	5	5
	Tantalum	µg/L	310	110	500	1	5
P127	Thallium	µg/L	7.9	1.3	28	1	5
	Tin	µg/L	28	25	34	1	5
	Titanium	µg/L	67	8.3	400	5	5
	Tungsten	µg/L	310	130	500	1	5
	Uranium	µg/L	880	760	1,000	1	5
	Vanadium	µg/L	48	10	80	3	5
	Ytterbium	µg/L	51	2.7	100	1	5
	Yttrium	µg/L	2.2	0.50	6.4	1	5
P128	Zinc	µg/L	550	77	1,200	5	5
	Zirconium	µg/L	60	19	100	1	5
Dioxins and Furans							
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	pg/L	2,600	50	20,000	1	5
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/L	330	50	1,800	1	5
	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	pg/L	190	50	720	1	5
	2,3,7,8-Tetrachlorodibenzofuran	pg/L	21	10	100	1	5
	Octachlorodibenzo-p-dioxin	pg/L	8,200	100	61,000	3	5
	Octachlorodibenzofuran	pg/L	1,500	100	7,500	3	5
Classical Pollutants							
	Adsorbable Organic Halides (AOX)	µg/L	1,400	150	1,900	5	5

Table 6-10 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Ammonia as Nitrogen	mg/L	25	8.0	48	5	5
	BOD 5-day	mg/L	1,700	260	4,200	5	5
	Chemical Oxygen Demand (COD)	mg/L	4,000	810	20,000	5	5
	Chloride	mg/L	1,200	280	3,900	5	5
	Fluoride	mg/L	1.8	0.90	2.2	5	5
	Hexane Extractable Material	mg/L	810	56	5,200	14	14
	Nitrate/Nitrite	mg/L	5.8	0.050	40	4	5
	SGT-HEM	mg/L	210	18	750	14	14
	Surfactants (MBAS)	mg/L	2.5	1.7	5.0	5	5
P121	Total Cyanide	mg/L	0.019	0.0050	0.10	1	6
	Total Dissolved Solids	mg/L	7,900	980	26,000	5	5
	Total Organic Carbon (TOC)	mg/L	970	150	3,300	5	5
	Total Phenols	mg/L	0.43	0.021	1.5	5	5
	Total Phosphorus	mg/L	9.5	1.4	45	5	5
	Total Suspended Solids	mg/L	530	230	1,400	5	5
	Volatile Residue	mg/L	480	480	480	1	1

(a) For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration.
(b) Minimum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(c) Maximum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.

Table 6-11

Summary of Raw Wastewater Characterization Data for Barge/Chemical & Petroleum Facilities

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Volatile Organics							
P013	1,1-Dichloroethane	µg/L	11	10	20	1	10
P010	1,2-Dichloroethane	µg/L	450	10	11,000	1	10
	Acetone	µg/L	87,000	780	500,000	10	10
P003	Acrylonitrile	µg/L	41,000	50	120,000	3	10
P004	Benzene	µg/L	11,000	45	110,000	10	10
	Carbon Disulfide	µg/L	12	10	31	1	10
P023	Chloroform	µg/L	55	10	1,100	2	10
P038	Ethylbenzene	µg/L	4,500	89	16,000	10	10
	Isobutyl Alcohol	µg/L	180	10	2,100	1	10
	m-Xylene	µg/L	3,200	10	25,000	9	10
	Methyl Ethyl Ketone	µg/L	110,000	50	600,000	8	10
	Methyl Isobutyl Ketone	µg/L	48,000	50	1,100,000	8	10
	Methyl Methacrylate	µg/L	47	10	910	1	10
P044	Methylene Chloride	µg/L	38	10	570	5	10
	o- + p-Xylene	µg/L	2,500	150	21,000	10	10
P085	Tetrachloroethene	µg/L	120	10	1,400	1	10
P086	Toluene	µg/L	13,000	410	51,000	10	10
P087	Trichloroethene	µg/L	13	10	55	4	10
P088	Vinyl Chloride	µg/L	13	10	77	1	10
Semivolatile Organics							
P025	1,2-Dichlorobenzene	µg/L	9,400	10	56,000	1	10

Table 6-11 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	1-Methylfluorene	µg/L	360	10	1,300	4	10
	1-Methylphenanthrene	µg/L	1,400	17	13,000	9	10
	1-Phenylnaphthalene	µg/L	63	10	200	1	10
	2,3-Benzofluorene	µg/L	100	10	580	3	10
P034	2,4-Dimethylphenol	µg/L	98	10	470	1	10
	2-Methylnaphthalene	µg/L	7,800	130	81,000	10	10
	2-Phenylnaphthalene	µg/L	80	10	590	1	10
	3,6-Dimethylphenanthrene	µg/L	200	10	870	5	10
P001	Acenaphthene	µg/L	660	10	9,500	6	10
P077	Acenaphthylene	µg/L	610	10	13,000	3	10
	Aniline	µg/L	59	10	200	1	10
P078	Anthracene	µg/L	390	10	7,400	2	10
	Benzoic Acid	µg/L	800	50	1,900	4	10
	Benzyl Alcohol	µg/L	66	10	200	1	10
	Biphenyl	µg/L	2,500	29	26,000	9	10
P066	Bis (2-ethylhexyl) Phthalate	µg/L	700	12	7,500	8	10
P069	Di-n-Octyl Phthalate	µg/L	790	10	12,000	4	10
P039	Fluoranthene	µg/L	62	10	200	1	10
P080	Fluorene	µg/L	970	10	13,000	6	10
P009	Hexachlorobenzene	µg/L	67	10	390	1	10
P012	Hexachloroethane	µg/L	65	10	200	1	10
	Hexanoic Acid	µg/L	130	10	570	1	10
	n-Decane	µg/L	75,000	10	1,200,000	9	10
	n-Docosane	µg/L	2,600	34	49,000	10	10
	n-Dodecane	µg/L	34,000	450	360,000	10	10

Table 6-11 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	n-Eicosane	µg/L	7,700	93	110,000	10	10
	n-Hexacosane	µg/L	140	10	550	7	10
	n-Hexadecane	µg/L	34,000	110	370,000	10	10
	n-Octacosane	µg/L	82	10	290	5	10
	n-Octadecane	µg/L	14,000	95	170,000	10	10
	n-Tetracosane	µg/L	1,400	33	15,000	9	10
	n-Tetradecane	µg/L	84,000	630	1,100,000	10	10
	n-Triacontane	µg/L	340	10	1,500	2	10
P055	Naphthalene	µg/L	74,000	530	1,100,000	10	10
	o-Cresol	µg/L	110	10	620	1	10
	p-Cresol	µg/L	120	10	740	1	10
	p-Cymene	µg/L	6,400	11	150,000	5	10
	Pentachloroethane	µg/L	120	20	400	1	10
	Pentamethylbenzene	µg/L	1,600	10	6,700	4	10
P081	Phenanthrene	µg/L	1,500	10	16,000	7	10
P065	Phenol	µg/L	170	10	990	3	10
P084	Pyrene	µg/L	520	10	4,200	7	10
	Styrene	µg/L	96,000	570	630,000	10	10
	Thianaphthene	µg/L	60	10	200	1	10
Phenoxy-Acid Herbicides							
	2,4-D	µg/L	150	1.9	1,000	1	6
	Dalapon	µg/L	33	0.20	200	2	6
	MCPA	µg/L	9,700	1,200	50,000	2	6
Organo-Phosphorous Pesticides							
	Malathion	µg/L	3.6	2.2	5.1	2	2

Table 6-11 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Parathion (Ethyl)	µg/L	6.6	2.2	11	2	2
	Sulfotep	µg/L	2.2	2.0	2.3	1	2
	Trichlorfon	µg/L	7.1	5.0	9.2	1	2
Organo-Halide Pesticides							
P094	4,4'-DDD	µg/L	1.2	0.45	2.0	1	2
P089	Aldrin	µg/L	1.4	0.20	2.6	1	2
P102	alpha-BHC	µg/L	0.30	0.10	0.50	1	2
	Chlorobenzilate	µg/L	7.8	5.6	10	1	2
P090	Dieldrin	µg/L	0.37	0.040	0.70	1	2
	Ethalfluralin	µg/L	2.7	0.10	5.3	1	2
P091	gamma-Chlordane	µg/L	0.28	0.050	0.50	1	2
	Metribuzin	µg/L	1.6	1.1	2.0	1	2
	Propachlor	µg/L	2.1	1.0	3.3	1	2
Metals							
	Aluminum	µg/L	25,000	100	360,000	6	6
P114	Antimony	µg/L	9.8	1.6	30	4	6
P115	Arsenic	µg/L	11	1.1	94	3	6
	Barium	µg/L	260	66	1,400	6	6
P117	Beryllium	µg/L	1.4	0.20	15	2	6
	Bismuth	µg/L	120	46	900	1	6
	Boron	µg/L	910	550	1,500	6	6
P118	Cadmium	µg/L	43	1.0	390	5	6
	Calcium	µg/L	140,000	60,000	320,000	6	6
	Cerium	µg/L	400	170	1,700	2	6
P119	Chromium	µg/L	330	2.6	2,600	4	6

Table 6-11 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Cobalt	µg/L	37	2.1	280	2	6
P120	Copper	µg/L	880	76	6,000	6	6
	Europium	µg/L	18	2.9	200	1	6
	Germanium	µg/L	280	78	1,000	2	6
	Gold	µg/L	100	34	400	2	6
	Hafnium	µg/L	240	100	1,000	1	6
	Hexavalent Chromium	mg/L	0.19	0.070	0.27	3	3
	Iodine	µg/L	39,000	2,000	210,000	1	6
	Iridium	µg/L	390	42	2,400	4	6
	Iron	µg/L	610,000	3,000	6,600,000	6	6
	Lanthanum	µg/L	170	24	2,000	1	6
P122	Lead	µg/L	370	12	1,800	4	6
	Lithium	µg/L	170	31	390	4	6
	Lutetium	µg/L	23	3.2	200	2	6
	Magnesium	µg/L	70,000	19,000	240,000	6	6
	Manganese	µg/L	4,100	140	38,000	6	6
P123	Mercury	µg/L	5.4	0.10	81	3	6
	Molybdenum	µg/L	330	20	860	5	6
	Neodymium	µg/L	59	19	400	1	6
P124	Nickel	µg/L	1,900	58	14,000	6	6
	Niobium	µg/L	210	32	1,600	3	6
	Osmium	µg/L	800	36	12,000	2	6
	Phosphorus	µg/L	15,000	690	56,000	5	6
	Platinum	µg/L	380	66	1,000	3	6
	Potassium	µg/L	31,000	22,000	65,000	6	6

Table 6-11 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Praseodymium	µg/L	160	38	1,000	3	6
	Rhenium	µg/L	97	19	1,000	1	6
	Ruthenium	µg/L	3,400	110	40,000	4	6
	Scandium	µg/L	14	0.80	200	1	6
P125	Selenium	µg/L	4.0	1.0	20	1	6
	Silicon	µg/L	21,000	28	130,000	4	6
P126	Silver	µg/L	5.7	1.8	34	3	6
	Sodium	µg/L	1,700,000	990,000	5,800,000	6	6
	Strontium	µg/L	4,700	980	12,000	6	6
	Sulfur	µg/L	460,000	96,000	2,100,000	6	6
	Tantalum	µg/L	300	50	1,700	4	6
	Thorium	µg/L	440	120	3,400	2	6
	Tin	µg/L	56	22	220	1	6
	Titanium	µg/L	38	1.6	300	5	6
	Tungsten	µg/L	300	120	1,200	2	6
	Uranium	µg/L	1,200	610	6,100	1	6
	Vanadium	µg/L	43	1.7	410	3	6
	Ytterbium	µg/L	22	1.1	200	5	6
	Yttrium	µg/L	5.5	0.40	56	2	6
P128	Zinc	µg/L	19,000	630	79,000	6	6
	Zirconium	µg/L	35	11	260	2	6
Dioxins and Furans							
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/L	320	50	4,100	1	10
	Octachlorodibenzo-p-dioxin	pg/L	9,400	100	100,000	4	10
	Octachlorodibenzofuran	pg/L	960	100	8,200	3	10

Table 6-11 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Classical Pollutants							
	Adsorbable Organic Halides (AOX)	µg/L	940	82	3,500	10	10
	Amenable Cyanide	mg/L	0.092	0.0020	0.18	1	8
	Ammonia as Nitrogen	mg/L	54	0.60	150	10	10
	BOD 5-day	mg/L	5,700	120	26,000	10	10
	Chemical Oxygen Demand (COD)	mg/L	44,000	130	200,000	10	10
	Chloride	mg/L	1,100	40	2,800	10	10
	Fluoride	mg/L	1.4	0.74	3.9	9	9
	Hexane Extractable Material	mg/L	14,000	37	220,000	27	27
	Nitrate/nitrite	mg/L	22	0.16	55	10	10
	SGT-HEM	mg/L	6,300	21	98,000	25	25
	Surfactants (MBAS)	mg/L	9.0	0.12	13	6	6
P121	Total Cyanide	mg/L	0.11	0.0040	0.21	5	8
	Total Dissolved Solids	mg/L	3,100	1.0	17,000	9	10
	Total Organic Carbon (TOC)	mg/L	10,000	30	53,000	10	10
	Total Phenols	mg/L	0.48	0.018	2.5	10	10
	Total Phosphorus	mg/L	6.4	0.080	31	10	10
	Total Sulfide (Iodometric)	mg/L	4.6	4.6	4.6	1	1
	Total Suspended Solids	mg/L	2,200	55	15,000	10	10
	Volatile Residue	mg/L	350	1.0	710	1	2

(a) For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration.
(b) Minimum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(c) Maximum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.

Table 6-12

Summary of Raw Wastewater Characterization Data for Truck/Food Facilities

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Volatile Organics							
	Acetone	µg/L	97	50	140	1	2
P023	Chloroform	µg/L	93	10	180	1	2
	Methyl Ethyl Ketone	µg/L	55	50	60	1	2
	Trichlorofluoromethane	µg/L	1,500	10	2,900	1	2
Semivolatile Organics							
	Benzoic Acid	µg/L	210	180	230	2	2
	Dimethyl Sulfone	µg/L	21	10	33	1	2
	Hexanoic Acid	µg/L	380	110	660	2	2
	n-Hexacosane	µg/L	85	10	160	1	2
	n-Octacosane	µg/L	74	10	140	1	2
	n-Tetracosane	µg/L	53	10	96	1	2
	n-Triacontane	µg/L	88	10	170	1	2
Phenoxy-Acid Herbicides							
	MCPA	µg/L	170	50	300	1	2
Organo-Halide Pesticides							
	Diallate A	µg/L	2.9	2.4	3.5	1	2
Metals							
	Aluminum	µg/L	190	28	360	1	2
P114	Antimony	µg/L	21	18	25	1	2
	Barium	µg/L	12	6.3	18	2	2
	Bismuth	µg/L	1.5	0.10	2.8	1	2
	Boron	µg/L	300	170	420	2	2

Table 6-12 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Calcium	µg/L	2,900	1,300	4,400	2	2
P120	Copper	µg/L	170	34	300	2	2
	Erbium	µg/L	4.5	0.10	8.9	1	2
	Europium	µg/L	4.8	0.10	9.5	1	2
	Gadolinium	µg/L	1.9	0.50	3.2	1	2
	Gallium	µg/L	2.0	0.50	3.5	1	2
	Germanium	µg/L	46	0.50	91	1	2
	Hafnium	µg/L	7.6	1.0	14	1	2
	Hexavalent Chromium	mg/L	0.020	0.010	0.030	1	2
	Indium	µg/L	20	1.0	38	1	2
	Iridium	µg/L	24	1.0	46	1	2
	Iron	µg/L	670	7.0	1,300	2	2
	Lanthanum	µg/L	1.4	0.10	2.7	1	2
	Lithium	µg/L	4.7	0.10	9.2	1	2
	Magnesium	µg/L	2,900	370	5,400	2	2
	Manganese	µg/L	26	2.0	50	2	2
P123	Mercury	µg/L	1.8	0.71	2.8	2	2
	Neodymium	µg/L	6.7	0.50	13	1	2
	Niobium	µg/L	150	150	150	2	2
	Palladium	µg/L	1.3	0.50	2.0	1	2
	Platinum	µg/L	67	35	98	2	2
	Praseodymium	µg/L	10	1.0	20	1	2
	Rhenium	µg/L	1.1	1.0	1.2	1	2
	Ruthenium	µg/L	6.6	1.0	12	1	2
	Samarium	µg/L	16	7.2	25	2	2
P125	Selenium	µg/L	18	4.6	31	1	2

Table 6-12 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Silicon	µg/L	9,500	2,900	16,000	2	2
	Sodium	µg/L	280,000	220,000	340,000	2	2
	Strontium	µg/L	19	4.5	33	2	2
	Tantalum	µg/L	17	10	25	2	2
	Tellurium	µg/L	6.3	1.0	12	1	2
	Terbium	µg/L	18	16	21	2	2
	Thorium	µg/L	3.4	1.0	5.8	1	2
	Titanium	µg/L	11	10	12	2	2
	Tungsten	µg/L	7.9	1.0	15	1	2
	Uranium	µg/L	270	1.0	540	1	2
P128	Zinc	µg/L	66	18	120	2	2
	Zirconium	µg/L	3.8	0.10	7.4	1	2
Dioxins and Furans							
	Octachlorodibenzo-p-dioxin	pg/L	380	100	650	1	2
Classical Pollutants							
	Adsorbable Organic Halides (AOX)	µg/L	2,000	190	3,900	2	2
	Amenable Cyanide	mg/L	0.0068	0.0050	0.016	1	7
	Ammonia as Nitrogen	mg/L	0.035	0.010	0.060	1	2
	BOD 5-day	mg/L	2,700	160	5,200	2	2
	Chemical Oxygen Demand (COD)	mg/L	3,000	380	5,600	2	2
	Chloride	mg/L	76	68	83	2	2
	Fluoride	mg/L	0.57	0.28	0.85	2	2
	SGT-HEM	mg/L	9.0	5.0	26	2	7
	Nitrate/Nitrite	mg/L	1.9	0.050	3.7	1	2
	Hexane Extractable Material	mg/L	130	5.2	270	7	7
	Surfactants (MBAS)	mg/L	10	0.49	20	2	2

Table 6-12 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P121	Total Cyanide	mg/L	0.0068	0.0050	0.016	1	7
	Total Dissolved Solids	mg/L	3,400	810	6,000	2	2
	Total Organic Carbon (TOC)	mg/L	1,300	86	2,500	2	2
	Total Phenols	mg/L	0.038	0.0050	0.070	1	2
	Total Phosphorus	mg/L	67	11	120	2	2
	Total Sulfide (Iodometric)	mg/L	3.5	1.0	6.0	1	2
	Total Suspended Solids	mg/L	420	28	800	2	2
	Volatile Residue	mg/L	4,300	310	8,300	2	2

(a) For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration.
(b) Minimum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(c) Maximum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.

Table 6-13

Summary of Raw Wastewater Characterization Data for Rail/Food Facilities

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Semivolatile Organics							
	Benzoic Acid	µg/L	78	78	78	1	1
P065	Phenol	µg/L	58	58	58	1	1
Organo-Phosphorous Pesticides							
	Diazinon	µg/L	31	31	31	1	1
Metals							
	Aluminum	µg/L	150	150	150	1	1
	Barium	µg/L	18	18	18	1	1
	Boron	µg/L	39	39	39	1	1
P118	Cadmium	µg/L	2.4	2.4	2.4	1	1
	Calcium	µg/L	31,000	31,000	31,000	1	1
	Europium	µg/L	10	10	10	1	1
	Gadolinium	µg/L	54	54	54	1	1
	Holmium	µg/L	140	140	140	1	1
	Iridium	µg/L	81	81	81	1	1
	Iron	µg/L	270	270	270	1	1
	Lutetium	µg/L	4.5	4.5	4.5	1	1
	Magnesium	µg/L	10,000	10,000	10,000	1	1
	Manganese	µg/L	4.8	4.8	4.8	1	1
	Molybdenum	µg/L	34	34	34	1	1
	Neodymium	µg/L	61	61	61	1	1
P124	Nickel	µg/L	9.8	9.8	9.8	1	1

Table 6-13 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Niobium	µg/L	81	81	81	1	1
	Phosphorus	µg/L	1,800	1,800	1,800	1	1
	Rhenium	µg/L	26	26	26	1	1
	Silicon	µg/L	680	680	680	1	1
	Sodium	µg/L	6,400	6,400	6,400	1	1
	Strontium	µg/L	110	110	110	1	1
	Sulfur	µg/L	6,700	6,700	6,700	1	1
	Tantalum	µg/L	50	50	50	1	1
	Thulium	µg/L	23	23	23	1	1
	Tungsten	µg/L	320	320	320	1	1
Dioxins and Furans							
	1,2,3,4,6,7,8-Heptachlorodibenzofuran	pg/L	300	300	300	1	1
	Octachlorodibenzofuran	pg/L	490	490	490	1	1
Classical Pollutants							
	Adsorbable Organic Halides (AOX)	µg/L	15	15	15	1	1
	Ammonia as Nitrogen	mg/L	0.040	0.040	0.040	1	1
	Chemical Oxygen Demand (COD)	mg/L	34,000	34,000	34,000	1	1
	Chloride	mg/L	10	10	10	1	1
	Fluoride	mg/L	0.39	0.39	0.39	1	1
	Nitrate/nitrite	mg/L	0.16	0.16	0.16	1	1
	Surfactants (MBAS)	mg/L	0.011	0.011	0.011	1	1
P121	Total Cyanide	mg/L	0.0043	0.0026	0.0061	2	4
	Total Dissolved Solids	mg/L	25,000	25,000	25,000	1	1
	Total Organic Carbon (TOC)	mg/L	13,000	13,000	13,000	1	1
	Total Phenols	mg/L	0.018	0.018	0.018	1	1

Table 6-13 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Total Phosphorus	mg/L	1.8	1.8	1.8	1	1
	Total Sulfide (Iodometric)	mg/L	11	11	11	1	1
	Total Suspended Solids	mg/L	27	27	27	1	1

(a) For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration.
(b) Minimum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(c) Maximum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.

Table 6-14

Summary of Raw Wastewater Characterization Data for Barge/Food Facilities

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Volatile Organics							
	Acetone	µg/L	180	180	180	1	1
	Methyl Ethyl Ketone	µg/L	130	130	130	1	1
Semivolatile Organics							
	1,3,5-Trithiane	µg/L	280	50	500	1	5
	Benzoic Acid	µg/L	2,200	50	4,100	3	5
	Hexanoic Acid	µg/L	64,000	2,000	150,000	5	5
	n-Tetradecane	µg/L	55	10	100	1	5
	o-Cresol	µg/L	79	10	200	1	5
P065	Phenol	µg/L	200	10	540	3	5
Phenoxy-Acid Herbicides							
	2,4-D	µg/L	7.5	7.5	7.5	1	1
Organo-Halide Pesticides							
	Diallate A	µg/L	21	21	21	1	1
Metals							
	Aluminum	µg/L	1,700	1,700	1,700	1	1
	Barium	µg/L	88	88	88	1	1
P118	Cadmium	µg/L	4.6	4.6	4.6	1	1
	Calcium	µg/L	21,000	21,000	21,000	1	1
P119	Chromium	µg/L	47	47	47	1	1
	Cobalt	µg/L	19	19	19	1	1
P120	Copper	µg/L	100	100	100	1	1

Table 6-14 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Europium	µg/L	12	12	12	1	1
	Gadolinium	µg/L	36	36	36	1	1
	Gallium	µg/L	170	170	170	1	1
	Germanium	µg/L	290	290	290	1	1
	Hafnium	µg/L	29	29	29	1	1
	Hexavalent Chromium	mg/L	0.31	0.31	0.31	1	1
	Iron	µg/L	42,000	42,000	42,000	1	1
P122	Lead	µg/L	150	150	150	1	1
	Lithium	µg/L	8.5	8.5	8.5	1	1
	Lutetium	µg/L	1.8	1.8	1.8	1	1
	Magnesium	µg/L	17,000	17,000	17,000	1	1
	Manganese	µg/L	410	410	410	1	1
P123	Mercury	µg/L	0.41	0.41	0.41	1	1
	Molybdenum	µg/L	18	18	18	1	1
	Neodymium	µg/L	5.4	5.4	5.4	1	1
P124	Nickel	µg/L	210	210	210	1	1
	Niobium	µg/L	150	150	150	1	1
	Osmium	µg/L	12	12	12	1	1
	Palladium	µg/L	9.4	9.4	9.4	1	1
	Platinum	µg/L	520	520	520	1	1
	Rhenium	µg/L	18	18	18	1	1
	Ruthenium	µg/L	120	120	120	1	1
	Samarium	µg/L	29	29	29	1	1
	Scandium	µg/L	0.26	0.26	0.26	1	1
	Silicon	µg/L	7,400	7,400	7,400	1	1

Table 6-14 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P126	Silver	µg/L	20	20	20	1	1
	Sodium	µg/L	550,000	550,000	550,000	1	1
	Strontium	µg/L	110	110	110	1	1
	Terbium	µg/L	5.6	5.6	5.6	1	1
	Thulium	µg/L	17	17	17	1	1
	Uranium	µg/L	940	940	940	1	1
	Vanadium	µg/L	12	12	12	1	1
P128	Zinc	µg/L	330	330	330	1	1
Dioxins and Furans							
	2,3,7,8-Tetrachlorodibenzofuran	pg/L	11	11	11	1	1
	Octachlorodibenzo-p-dioxin	pg/L	110	110	110	1	1
Classical Pollutants							
	Ammonia as Nitrogen	mg/L	3.0	0.77	9.3	5	5
	BOD 5-day	mg/L	4,600	890	6,800	5	5
	Chemical Oxygen Demand (COD)	mg/L	7,300	540	12,000	5	5
	Chloride	mg/L	150	88	180	5	5
	Fluoride	mg/L	0.34	0.28	0.46	5	5
	Hexane Extractable Material	mg/L	720	75	1,100	5	5
	Nitrate/Nitrite	mg/L	0.093	0.050	0.30	3	5
	SGT-HEM	mg/L	52	5.0	140	3	5
	Surfactants (MBAS)	mg/L	2.8	2.8	2.8	1	1
	Total Dissolved Solids	mg/L	3,000	1,800	3,700	5	5
	Total Organic Carbon (TOC)	mg/L	2,500	1,600	3,300	5	5
	Total Phenols	mg/L	0.50	0.26	1.2	5	5
	Total Phosphorus	mg/L	92	51	180	5	5

Table 6-14 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Total Sulfide (Iodometric)	mg/L	16	16	16	1	1
	Total Suspended Solids	mg/L	1,300	260	2,000	5	5
	Volatile Residue	mg/L	2,500	2,500	2,500	1	1

(a) For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration.
(b) Minimum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(c) Maximum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.

Table 6-15

Summary of Raw Wastewater Characterization Data for Truck/Petroleum Facilities

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Volatile Organics							
	Acetone	µg/L	180	99	310	5	5
	m-Xylene	µg/L	10	10	12	1	5
P086	Toluene	µg/L	20	10	43	2	5
Semivolatile Organics							
	Biphenyl	µg/L	410	10	2,000	1	5
P066	Bis (2-ethylhexyl) Phthalate	µg/L	110	68	150	5	5
	Diphenyl Ether	µg/L	11	10	16	1	5
	n-Decane	µg/L	10	10	11	1	5
	n-Docosane	µg/L	26	10	47	4	5
	n-Dodecane	µg/L	20	10	34	3	5
	n-Eicosane	µg/L	53	22	87	5	5
	n-Hexacosane	µg/L	26	10	37	3	5
	n-Hexadecane	µg/L	36	10	79	4	5
	n-Octacosane	µg/L	64	43	110	5	5
	n-Octadecane	µg/L	45	21	94	5	5
	n-Tetracosane	µg/L	40	10	100	3	5
	n-Tetradecane	µg/L	40	12	69	5	5
	n-Triacontane	µg/L	93	10	140	4	5
P065	Phenol	µg/L	18	10	35	2	5
Metals							
	Aluminum	µg/L	500	180	850	5	5

Table 6-15 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P114	Antimony	µg/L	4.2	3.8	5.9	1	5
P115	Arsenic	µg/L	4.9	3.3	11	1	5
	Barium	µg/L	73	42	96	5	5
	Bismuth	µg/L	81	46	120	4	5
	Boron	µg/L	430	320	540	5	5
P118	Cadmium	µg/L	2.0	1.6	3.0	2	5
	Calcium	µg/L	30,000	12,000	58,000	5	5
	Cerium	µg/L	210	170	320	2	5
P119	Chromium	µg/L	9.1	4.4	28	2	5
P120	Copper	µg/L	5.8	2.8	18	1	5
	Erbium	µg/L	25	24	28	1	5
	Europium	µg/L	6.3	2.9	16	4	5
	Holmium	µg/L	60	39	78	5	5
	Iron	µg/L	1,400	860	2,200	5	5
	Lanthanum	µg/L	27	24	38	1	5
	Lutetium	µg/L	3.3	3.2	3.8	1	5
	Magnesium	µg/L	2,900	1,300	4,900	5	5
	Manganese	µg/L	150	65	280	5	5
P123	Mercury	µg/L	0.29	0.20	0.63	1	5
	Molybdenum	µg/L	110	68	200	5	5
	Neodymium	µg/L	21	19	26	2	5
	Phosphorus	µg/L	2,500	1,500	5,900	5	5
	Potassium	µg/L	5,200	4,100	7,200	5	5
	Praseodymium	µg/L	44	38	52	3	5
	Samarium	µg/L	96	87	130	1	5

Table 6-15 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Silicon	µg/L	8,800	4,100	13,000	5	5
	Sodium	µg/L	500,000	380,000	730,000	5	5
	Strontium	µg/L	100	59	140	5	5
	Sulfur	µg/L	6,700	3,300	17,000	5	5
	Tantalum	µg/L	72	57	98	5	5
	Titanium	µg/L	6.4	1.2	18	3	5
	Tungsten	µg/L	190	130	440	2	5
	Uranium	µg/L	640	610	750	1	5
	Vanadium	µg/L	3.8	3.3	6.0	1	5
	Ytterbium	µg/L	1.1	0.90	1.8	1	5
P128	Zinc	µg/L	350	190	490	5	5
	Zirconium	µg/L	11	11	14	1	5
Classical Pollutants							
	Ammonia as Nitrogen	mg/L	0.30	0.16	0.48	5	5
	BOD 5-day	mg/L	67	48	110	5	5
	Chemical Oxygen Demand (COD)	mg/L	660	580	740	5	5
	Chloride	mg/L	530	400	800	5	5
	Fluoride	mg/L	1.5	1.1	2.0	5	5
	Hexane Extractable Material	mg/L	260	22	1,200	60	60
	SGT-HEM	mg/L	130	5.0	410	59	60
	Total Dissolved Solids	mg/L	1,300	950	1,900	5	5
	Total Organic Carbon (TOC)	mg/L	110	28	210	5	5

Table 6-15 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Total Phosphorus	mg/L	2.9	2.0	6.5	5	5
	Total Suspended Solids	mg/L	230	130	360	5	5

(a) For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration.
(b) Minimum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(c) Maximum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.

Table 6-16

Summary of Raw Wastewater Characterization Data for Barge/Hopper Facilities

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
Semivolatile Organics							
P066	Bis (2-ethylhexyl) Phthalate	µg/L	43	43	43	1	1
Metals							
	Aluminum	µg/L	15,000	15,000	15,000	1	1
P115	Arsenic	µg/L	51	51	51	1	1
	Barium	µg/L	150	150	150	1	1
P117	Beryllium	µg/L	4.9	4.9	4.9	1	1
	Bismuth	µg/L	46	46	46	1	1
	Boron	µg/L	160	160	160	1	1
P118	Cadmium	µg/L	11	11	11	1	1
	Calcium	µg/L	280,000	280,000	280,000	1	1
	Cerium	µg/L	380	380	380	1	1
P119	Chromium	µg/L	130	130	130	1	1
P120	Copper	µg/L	62	62	62	1	1
	Erbium	µg/L	27	27	27	1	1
	Europium	µg/L	2.9	2.9	2.9	1	1
	Gadolinium	µg/L	67	67	67	1	1
	Gold	µg/L	54	54	54	1	1
	Hexavalent Chromium	mg/L	0.046	0.046	0.046	1	1
	Holmium	µg/L	45	45	45	1	1
	Iridium	µg/L	240	240	240	1	1
	Iron	µg/L	87,000	87,000	87,000	1	1

Table 6-16 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
	Lanthanum	µg/L	50	50	50	1	1
	Lithium	µg/L	50	50	50	1	1
	Lutetium	µg/L	3.6	3.6	3.6	1	1
	Magnesium	µg/L	31,000	31,000	31,000	1	1
	Manganese	µg/L	2,900	2,900	2,900	1	1
	Molybdenum	µg/L	54	54	54	1	1
P124	Nickel	µg/L	110	110	110	1	1
	Osmium	µg/L	440	440	440	1	1
	Phosphorus	µg/L	610,000	610,000	610,000	1	1
	Platinum	µg/L	66	66	66	1	1
	Potassium	µg/L	31,000	31,000	31,000	1	1
	Praseodymium	µg/L	79	79	79	1	1
	Ruthenium	µg/L	1,300	1,300	1,300	1	1
	Samarium	µg/L	87	87	87	1	1
	Silicon	µg/L	2,800	2,800	2,800	1	1
P126	Silver	µg/L	6.9	6.9	6.9	1	1
	Sodium	µg/L	150,000	150,000	150,000	1	1
	Strontium	µg/L	380	380	380	1	1
	Sulfur	µg/L	150,000	150,000	150,000	1	1
	Tantalum	µg/L	65	65	65	1	1
	Titanium	µg/L	450	450	450	1	1
	Tungsten	µg/L	130	130	130	1	1
	Vanadium	µg/L	180	180	180	1	1
	Ytterbium	µg/L	7.2	7.2	7.2	1	1
	Yttrium	µg/L	72	72	72	1	1

Table 6-16 (Continued)

Priority Pollutant Code	Analyte	Units	Mean Concentration (a)	Minimum Concentration (b)	Maximum Concentration (c)	Number of Times Detected	Number of Times Analyzed
P128	Zinc	µg/L	250	250	250	1	1
	Zirconium	µg/L	33	33	33	1	1
Classical Pollutants							
	Ammonia as Nitrogen	mg/L	520	520	520	1	1
	BOD 5-day	mg/L	17	17	17	1	1
	Chemical Oxygen Demand (COD)	mg/L	640	640	640	1	1
	Chloride	mg/L	190	190	190	1	1
	Fluoride	mg/L	20	20	20	1	1
	Nitrate/Nitrite	mg/L	3.0	3.0	3.0	1	1
	Total Dissolved Solids	mg/L	2,900	2,900	2,900	1	1
	Total Organic Carbon (TOC)	mg/L	61	61	61	1	1
	Total Phosphorus	mg/L	540	540	540	1	1
	Total Suspended Solids	mg/L	1,400	1,400	1,400	1	1

(a) For samples in which individual pollutants were not detected, the sample detection limit was used in calculating the mean concentration.
(b) Minimum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.
(c) Maximum value of detected amounts or detection limits (for samples in which individual pollutants were not detected) from all analyses.

Table 6-17

Summaries of the Raw Wastewater Characterization Data for Each Facility Type

Facility Type	Number of Priority Pollutants Detected	Number of Pollutants Detected
Truck/Chemical	55	202
Rail/Chemical	43	180
Barge/Chemical & Petroleum	45	159
Truck/Petroleum	10	67
Truck/Food	7	76
Rail/Food	4	45
Barge/Food	9	68
Barge/Hopper	9	57

Facility Type	Range of Pollutant Concentrations (mg/L)					
	BOD_5	COD	TOC	TSS	HEM	SGT-HEM
Truck/Chemical	320 to 6,000	830 to 16,000	160 to 3,200	38 to 4,800	6.0 to 5,300	5.0 to 450
Rail/Chemical	260 to 4,200	810 to 20,000	150 to 3,300	230 to 1,400	56 to 5,200	18 to 750
Barge/Chemical & Petroleum	120 to 26,000	130 to 200,000	30 to 53,000	55 to 15,000	37 to 220,000	21 to 98,000
Truck/Petroleum	48 to 110	580 to 740	28 to 210	130 to 360	22 to 1,200	5.0 to 410
Truck/Food	160 to 5,200	380 to 5,600	86 to 2,500	28 to 800	5.2 to 270	5.0 to 26
Rail/Food	NQ	34,000	13,000	27	ND	ND
Barge/Food	890 to 6,800	540 to 12,000	1,600 to 3,300	260 to 2,000	75 to 1,100	5.0 to 140
Barge/Hopper	17	640	61	1,400	ND	ND

ND - Not detected.
NQ - Not quantitated due to matrix interference.
BOD_5 - Biochemical oxygen demand (5-day).
COD - Chemical oxygen demand.
TOC - Total organic carbon.
TSS - Total suspended solids.
HEM - Hexane extractable material.
SGT-HEM - Silica-gel treated hexane extractable material.

Table 6-18

Pollutants Of Interest By Subcategory

Analyte	Subcategory				
	Truck/Chemical & Petroleum	Rail/Chemical & Petroleum	Barge/Chemical & Petroleum	Food	Truck/Hopper, Rail/Hopper, and Barge/Hopper
Volatile Organics					
1,1,1-Trichloroethane	✓				
1,2-Dichloroethane	✓				
Acetone	✓	✓	✓		
Acrylonitrile			✓		
Benzene	✓		✓		
Chloroform	✓		✓		
Ethylbenzene	✓	✓	✓		
M-Xylene	✓	✓	✓		
Methyl Ethyl Ketone	✓		✓		
Methyl Isobutyl Ketone	✓		✓		
Methylene Chloride	✓		✓		
O- + P-Xylene	✓	✓	✓		
Tetrachloroethene	✓				
Toluene	✓		✓		
Tricloroethene	✓				
Semivolatile Organics					
1-Methylfluorene			✓		
1-Methylphenanthrene		✓	✓		
1,2-Dichlorobenzene	✓				

Table 6-18 (Continued)

Analyte	Subcategory				
	Truck/Chemical & Petroleum	Rail/Chemical & Petroleum	Barge/Chemical & Petroleum	Food	Truck/Hopper, Rail/Hopper, and Barge/Hopper
2-Chlorophenol	✓				
2-Isopropylnaphthalene	✓				
2-Methylnaphthalene	✓		✓		
2,3-Benzofluorene			✓		
2,4-Diaminotoluene		✓			
2,4,6-Trichlorophenol	✓				
3,6-Dimethylphenanthrene			✓		
Acenaphthene			✓		
Acenaphthylene			✓		
Alpha-terpineol	✓				
Anthracene		✓	✓		
Benzoic Acid	✓	✓	✓		
Benzyl Alcohol	✓				
Biphenyl			✓		
Bis(2-ethylhexyl) Phthalate	✓		✓		
Carbazole		✓			
Di-n-octyl Phthalate	✓		✓		
Dimethyl Sulfone	✓	✓			
Fluoranthene		✓			
Fluorene			✓		
Hexanoic Acid		✓		✓	
N-Decane	✓		✓		
N-Docosane	✓	✓	✓		

Table 6-18 (Continued)

Analyte	Subcategory				
	Truck/Chemical & Petroleum	Rail/Chemical & Petroleum	Barge/Chemical & Petroleum	Food	Truck/Hopper, Rail/Hopper, and Barge/Hopper
N-Dodecane	✓	✓	✓		
N-Eicosane	✓	✓	✓		
N-Hexacosane	✓	✓	✓		
N-Hexadecane	✓	✓	✓		
N-Octacosane		✓	✓		
N-Octadecane	✓	✓	✓		
N-Tetracosane	✓	✓	✓		
N-Tetradecane	✓	✓	✓		
N-Triacontane	✓	✓			
Napthalene	✓	✓	✓		
O-Cresol	✓			✓	
P-Cresol	✓	✓			
P-Cymene	✓		✓		
Pentamethylbenzene			✓		
Phenanthrene		✓	✓		
Phenol	✓	✓	✓	✓	
Pyrene		✓	✓		
Styrene	✓	✓	✓		
Phenoxy-Acid Herbicides					
2,4,5-T	✓	✓			
2,4,5-TP	✓	✓			
2,4-D	✓			✓	
2,4-DB (Butoxon)	✓	✓			

Table 6-18 (Continued)

Analyte	Subcategory				
	Truck/Chemical & Petroleum	Rail/Chemical & Petroleum	Barge/Chemical & Petroleum	Food	Truck/Hopper, Rail/Hopper, and Barge/Hopper
Dalapon	✓		✓		
Dicamba		✓			
Dichlorprop		✓			
Dinoseb	✓	✓			
MCPA	✓				
MCPP		✓			
Organo-Phosphorous Pesticides					
Azinophos Methyl	✓				
Leptophos	✓				
Organo-Halide Pesticides					
Acephate		✓			
alpha-BHC		✓			
Benefluralin		✓			
beta-BHC	✓	✓			
Dacthal (DCPA)		✓			
delta-BHC		✓			
Diallate (a)	✓	✓		✓	
Dieldrin		✓			
Endosulfan Sulfate		✓			
Endrin Aldehyde	✓				
gamma-BHC	✓				
gamma-Chlordane		✓			
Pentachoronitrobenzene (PCNB)	✓	✓			

Table 6-18 (Continued)

Analyte	Subcategory				
	Truck/Chemical & Petroleum	Rail/Chemical & Petroleum	Barge/Chemical & Petroleum	Food	Truck/Hopper, Rail/Hopper, and Barge/Hopper
Propachlor		✓			
Propazine		✓			
Terbacil		✓			
Terbuthylazine		✓			
Metals					
Aluminum	✓	✓	✓	✓	✓
Arsenic		✓			✓
Barium		✓			
Boron	✓	✓	✓		
Cadmium	✓		✓		
Calcium	✓	✓	✓		✓
Chromium	✓	✓	✓		✓
Copper	✓	✓	✓		
Hexavalent Chromium			✓		✓
Iron	✓	✓	✓	✓	✓
Lead			✓		
Magnesium	✓	✓	✓		✓
Manganese	✓	✓	✓	✓	✓
Mercury	✓		✓		
Molybdenum	✓		✓		✓
Nickel	✓		✓	✓	
Osmium			✓		
Phosphorus	✓	✓	✓		✓

Table 6-18 (Continued)

Analyte	Subcategory				
	Truck/Chemical & Petroleum	Rail/Chemical & Petroleum	Barge/Chemical & Petroleum	Food	Truck/Hopper, Rail/Hopper, and Barge/Hopper
Potassium	✓	✓	✓		✓
Ruthenium			✓		
Silicon	✓	✓	✓	✓	✓
Sodium	✓	✓	✓	✓	✓
Strontium	✓		✓		
Sulfur	✓	✓	✓		✓
Tin	✓				
Titanium	✓	✓	✓		✓
Yttrium					✓
Zinc	✓	✓	✓	✓	✓
Dioxins and Furans					
1,2,3,4,6,7,8-Heptachorodibenzo-p-dioxin	✓				
1,2,3,4,6,7,8-Heptachlorodibenzo-furan	✓				
Octachlrodibenzo-p-dioxin	✓	✓	✓		
Octachlrodibenzofuran		✓			
Classical Pollutants					
Adsorbable Organic Halides (AOX)	✓	✓	✓		
Ammonia as Nitrogen	✓	✓	✓	✓	✓
BOD 5-day	✓	✓	✓	✓	✓
Chemical Oxygen Demand (COD)	✓	✓	✓	✓	✓
Chloride	✓	✓	✓	✓	✓
Fluoride	✓	✓	✓		✓
Hexane Extractable Material	✓	✓	✓	✓	

Table 6-18 (Continued)

Analyte	Subcategory				
	Truck/Chemical & Petroleum	Rail/Chemical & Petroleum	Barge/Chemical & Petroleum	Food	Truck/Hopper, Rail/Hopper, and Barge/Hopper
Nitrate/Nitrite	✓	✓	✓		✓
SGT-HEM	(b)	✓	✓	✓	
Surfactants (MBAS)	✓	✓	✓	✓	
Total Dissolved Solids	✓	✓	✓	✓	✓
Total Organic Carbon (TOC)	✓	✓	✓	✓	✓
Total Phenols	✓	✓	✓	✓	
Total Phosphorus	✓	✓	✓	✓	✓
Total Sulfide (Iodometric)				✓	
Total Suspended Solids	✓	✓	✓	✓	✓

(a) Diallate represents diallate and/or diallate A and/or diallate B.
(b) EPA does not believe the SGT-HEM treatment performance data to be representative of the subcategory. EPA considers SGT-HEM a pollutant of interest for this subcategory based on the average raw wastewater concentration for this subcategory.

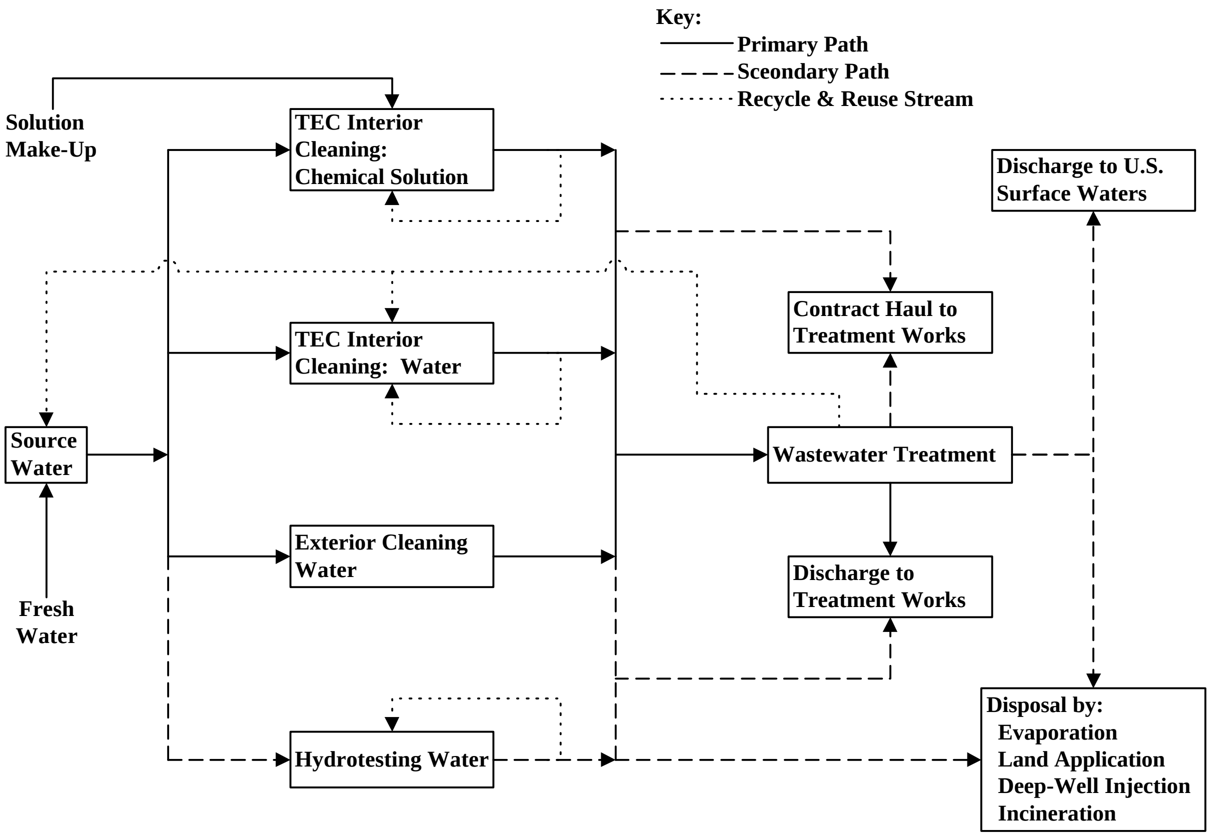


Figure 6-1. Water Use Diagram for TEC Operations

7.0 POLLUTION PREVENTION AND WASTEWATER TREATMENT TECHNOLOGIES

This section describes technologies that are used by the Transportation Equipment Cleaning Industry (TECI) to prevent the generation of wastewater pollutants or reduce the discharge of wastewater pollutants. Various combinations of these technologies were considered as the basis for the effluent limitations guidelines and standards for the industry (see Section 8.0).

Three major approaches are used by the TECI to improve effluent quality: (1) cleaning process technology changes and controls to prevent or reduce the generation of wastewater pollutants; (2) flow reduction technologies to decrease wastewater generation and increase pollutant concentrations, thereby improving the efficiency of treatment system pollutant removals; and (3) end-of-pipe wastewater treatment technologies to remove pollutants from transportation equipment cleaning (TEC) wastewater prior to discharge. These approaches are discussed in the following sections:

- Section 7.1: Pollution prevention controls used by the TECI;
- Section 7.2: Flow reduction technologies used by the TECI;
- Section 7.3: End-of-pipe wastewater treatment technologies used by the TECI; and
- Section 7.4: References used in this section.

7.1 Pollution Prevention Controls

EPA has defined pollution prevention as source reduction and other practices that reduce or eliminate pollution at the source. Source reduction includes any practices that reduce the amount of any hazardous substance or pollutant entering any waste stream or otherwise released into the environment, or any practice that reduces the hazards to public health and the environment associated with the release of such pollutants. Data gathered from the Detailed

Questionnaire shows that approximately 27% of TEC facilities currently practice water pollution prevention, and approximately 61% of TEC facilities currently practice heel pollution prevention. The principal pollution prevention controls applicable to the TECI are the use of dedicated tanks, heel reduction, and reduction in the amount or toxicity of chemical cleaning solutions. These pollution prevention controls are discussed in the following subsections.

7.1.1 Use of Dedicated Tanks

Tank cleanings are performed for two primary purposes: (1) to prevent contamination of materials from one cargo shipment to the next and (2) to facilitate inspection and repair. Certain segments of the TECI , such as shippers and carriers, frequently use tanks dedicated to hauling a single cargo (e.g., gasoline) that require no, or less frequent, cleaning between loads. Most TEC facilities cannot implement the use of dedicated tanks since it is only the shipper or carrier offering the container for cleaning that can exercise the use of dedicated tanks. Benefits from the use of dedicated tanks include:

- Reduced costs as a result of fewer tank cleanings;
- Reduced waste management and disposal costs because heel removal and disposal are not required;
- Elimination of the generation of tank cleaning wastewater and associated pollutant discharges; and
- Reduced tank cleaning wastewater treatment costs and/or sewerage fees.

Impediments to the use of dedicated tanks include:

- Product purity concerns that necessitate cleaning to prevent contamination of subsequent cargos; and
- Financial loss due to inefficient equipment allocation (i.e., dedicated tanks are precluded from use to transport other cargos).

7.1.2 Heel Reduction

Heel is the residual cargo remaining in a tank or container following unloading, delivery, or discharge of the transported cargo and is the primary source of pollutants in TEC wastewater. Measures may be taken before, during, and after the tank cleaning process to reduce the amount of heel that enters the wastewater stream. These heel reduction measures are described later in this section.

Excessive heels are also an important economic consideration for the TECI. For example, many cargos are valuable, and any product waste represents a significant loss. In addition, profits from transporting product and/or cleaning tanks can be offset by large heel disposal costs. As a result, the TECI has a strong economic incentive to minimize heels.

Heel generation occurs during the unloading of a tank. Since tank unloading frequently does not occur at the TEC facility, the carrier, shipper, or consignee may have a more direct control over heel generation than the TEC facility that will ultimately clean the tank and dispose the heel. TEC facilities can develop a heel minimization program that identifies the sources of heels and institutes practices that discourage heel generation by carriers, shippers, and consignees.

Tank cleaning facility personnel cite education of, and communication among, the carrier, shipper, and consignee as critical components of an effective heel minimization program. Carriers, shippers, and consignees may not be aware of the problems associated with excess heels and may not understand how heel minimization best serves their interests. An effective heel minimization program is best implemented as a partnership among the carrier, shipper, consignee, and tank cleaning facility and may include the following components:

- Drivers should be trained to identify excess heels;
- Drivers should perform pre- and post-trip inspections and discuss with the consignee methods for reducing excess heels;

- If excess heel is not resolved with the consignee, the driver should report excess heel to the driver's manager. Drivers should document heel issues or problems including offloading conditions which may have caused excess heel;

- Carriers should provide data to the shipper on amounts of heels;

- Facilities should consider heel management options other than disposal, such as redelivering the product to the consignee or drumming the heel and returning it to the shipper or consignee;

- Facilities should evaluate any company policies that punish or fine drivers for excess heel to ensure that the policies do not encourage illicit heel disposal;

- Drivers should consider inviting shippers to accompany them during product delivery to gain a first hand perspective and understanding of factors impacting heel volumes;

- Facilities may refuse or reject tanks for cleaning if excessive heel is present;

- Facilities may charge an extra fee per amount of heel received as an incentive to minimize heel;

- Facilities may refuse to accept particular cargos for one or more of the following reasons: federal, state, local, or other environmental permit limitations; safety considerations; facility cleaning capabilities; and/or facility wastewater treatment system capabilities;

- The heel minimization programs, pollution prevention plans, and tank cleaning standard operational procedures should be written and carefully followed by all personnel involved in heel generation and management; and

- Personnel should undergo ongoing training so that changes in the heel minimization program and new procedures and policies will not be overlooked.

Implementation of an effective heel program can provide significant environmental and economic benefits. In order to achieve the environmental and economic benefits associated with heel reduction, TEC facilities should employ appropriate heel reduction techniques in addition to implementing an effective heel minimization program. Heel reduction techniques are discussed in the following paragraphs.

During tank cleaning operations, some TEC facilities incorporate procedures to remove as much heel as possible so that it can be segregated from the tank cleaning wastewater. One procedure, used particularly for tanks that last transported petroleum products, is to steam the inside of the tank to lower the viscosity of the heel to facilitate draining. The steamed tank is then drained to remove additional heel. Similarly, tanks, drains, and fittings may be preheated with steam or hot water to facilitate product draining. Another procedure applicable to certain cargos is for tank cleaning personnel to enter the tank and manually squeegee heel toward the valve openings. (Physically entering a tank may not be advisable in many circumstances. Personnel must be trained in health and safety procedures and a confined space entry permit may be required.)

A third procedure is to perform a hot or cold water prerinse (subsequent to primary heel removal via draining) to enhance heel removal. This procedure uses a short burst of water (e.g. 5 to 10 seconds) to remove heel from the tank interior. The prerinse wastewater (containing residual heel) is drained and managed separately from tank cleaning wastewater. Note that some facilities perform tank prerinses solely as a means to increase the useful life of tank cleaning solutions (by minimizing solution contamination with heel) rather than as a TEC wastewater pollution prevention procedure. These facilities do not manage the prerinse wastewater separately from the other tank interior cleaning wastewaters.

After tank cleaning is complete, facilities employ various heel management practices (such as reuse, recycle, or disposal) so that heel is managed separately from tank interior cleaning wastewater. Reuse and recycle may be accomplished by any one of several methods. One method is to return the heel to the consignee. Some heels can be reused at the TEC facility. For example, fuel and fuel oil heels can be used in TEC facilities' on-site boilers or in their own transportation equipment. Heels comprised of soaps, detergents, solvents, acids, or alkalis may be reused by TEC facilities for tank cleaning, neutralization, or wastewater treatment. Many food grade heels can be recycled as animal feed. Some heels, such as fertilizers, can be segregated, stored, and sold as product.

Heel that cannot be recycled or reused can be managed separately from tank interior cleaning wastewater. The most common method of heel disposal is land disposal. This practice is most often performed with petroleum and coal product heels and dry-bulk cargo heels. Heels may also be hauled to a privately owned treatment works, federally owned treatment works, centralized waste treatment works, ballast water treatment facility, or hazardous waste treatment, storage, and disposal facility, all of which are frequently better equipped to treat these wastes.

7.1.3 Reduction in the Amount and Toxicity of Chemical Cleaning Solutions

Many cargo types require the use of chemical cleaning solutions in the tank cleaning process. In addition to the contaminants contained in the heel removed by chemical cleaning solutions, the chemicals used in the solutions may themselves be toxic. These chemical cleaning solutions are a significant source of pollutants in TEC wastewater. By reducing the amount and toxicity of chemical cleaning solutions used in the tank cleaning process, tank cleaning facilities can reduce the contribution of cleaning solutions to the total wastewater pollutant concentrations. These pollution prevention procedures include recirculating and reusing cleaning solutions, disposing cleaning solutions separately from tank interior cleaning wastewater, and using less toxic cleaning solutions. These measures are described further in the following paragraphs.

The majority of TEC facilities that discharge chemical cleaning solutions with their tank cleaning wastewater recycle and reuse the solutions at least once prior to discharge. Recycle and reuse is usually achieved through the use of automated cleaning systems or cleaning solution recirculation loops that allow reuse of the cleaning solutions until their efficacy diminishes below acceptable levels. This reduces the amount of additional chemical cleaning solution required for each tank cleaned; instead, smaller amounts of make-up solution are periodically added to replace solution lost in the final rinse or to boost efficacy. As previously mentioned, a hot or cold water prerinse may also be used to extend the useful life of a chemical cleaning solution, thereby reducing the total amount of chemical cleaning solution needed for tank cleaning.

Another method of reducing the introduction of chemical cleaning solutions to the wastewater streams is to capture the spent solutions (both interior and exterior cleaning solutions) and dispose them off site at a treatment facility that is better equipped to treat these concentrated chemical wastes than on-site wastewater treatment systems. Off-site disposal can be combined with the recirculation and reuse of cleaning solutions (described above) to reduce the need for fresh cleaning solution and to minimize the amount of cleaning solutions that enter the facility wastewater treatment system.

Many facilities in the TECI substitute less toxic cleaning solutions, where appropriate, to reduce the amount of toxic pollutants that are introduced to the wastewater stream. Typically, presolve solutions are the most toxic chemical cleaning solutions and are least compatible with facility wastewater treatment systems. Presolve usually consists of diesel fuel, kerosene, or some other petroleum-based solvent and is used to clean hardened or caked-on products that are not easily removed by other cleaning processes. In many cases, presolve may be substituted by acidic or caustic solutions to which detergent “boosters” (e.g., glycol ethers or esters) are added to improve their effectiveness. At some facilities, chemical cleaning solutions may be eliminated by using steam cleaning or hot or cold water washes for water-soluble cargos or by extending the process time of cleaning steps that do not use toxic cleaning solutions.

As in the case of heel reduction, these methods to reduce the amount and toxicity of chemical cleaning solutions benefit from written cleaning process standard operating procedures and pollution prevention plans that are carefully followed by cleaning personnel. Facilities should also conduct ongoing training for cleaning personnel to insure that the procedures contained in these resources will be practiced at all times.

7.2 Flow Reduction Technologies

This section describes technologies that can reduce the volume of wastewater discharges from TEC facilities. Flow reduction offers the following benefits: (1) increased pollutant concentrations which increase the efficiency of the wastewater treatment system; (2) decreased wastewater treatment system equipment sizes, resulting in reduced treatment system capital and operating and maintenance costs; and (3) decreased water and energy usage. Data gathered from the Detailed Questionnaire show that approximately 45% of TEC facilities currently practice flow reduction/water conservation. Flow reduction technologies applicable to the TECI serve to reduce the amount of fresh water required for tank cleaning through cleaning process modifications and/or recycling and reusing process wastewaters in TEC or other operations. These flow reduction technologies are presented in the following subsections.

7.2.1 High-Pressure, Low-Volume Cleaning Equipment

The use of high-pressure, low-volume cleaning equipment is one of the most effective tools for reducing water use. The most common type of this equipment is spinner nozzles, which are nozzles designed to rotate around both vertical and horizontal axes to create an overlapping spray pattern that cleans the entire interior of the tank. Spinner nozzles are inserted through the main tank hatch and operated at pressures between 100 pounds per square inch (psi) and 600 psi to deliver hot or cold water rinses and a variety of cleaning solutions for tank cleaning final rinses. Spinners can be operated using pulsing pump technology where water is delivered in bursts of a few seconds, further reducing the volume of water. Washing with high-pressure, hand-held wands with stationary nozzles achieves the same result as washing with high pressure spinner nozzles but requires facility personnel to manually direct the wash solution across the interior surface of the tank.

7.2.2 Monitoring TEC Water Use

Cleaning personnel can monitor the amount of water required for tank cleaning so that the minimum amount of water is used to clean each specific tank and cargo type. One approach is to inspect each tank to determine the state and amount of residual cargo remaining and thereby determine the duration and amount of water required for cleaning. A more general approach is to have a predetermined water use and cleaning time for each tank type and cargo combination based on previous tank cleaning experience.

7.2.3 Equipment Monitoring Program

The implementation of an equipment monitoring program can significantly reduce fresh water requirements by eliminating water waste. Pumps, hoses, nozzles, water storage tanks, and cleaning solution tanks may develop leaks and require prompt attention by facility personnel. Preventative maintenance, periodic inspection, and prompt repair of leaks can help ensure that no unnecessary water waste occurs.

7.2.4 Cleaning Without Use of Water

Dry cleaning processes (i.e., cleaning processes that do not require water) are effective for removing some cargos, particularly dry-bulk goods and viscous liquids. Mechanical devices may be used to vibrate hoppers to improve heel removal. Some dry cleaning processes, particularly applicable to hopper or tank barges, include manual operations to shovel or sweep dry-bulk cargos, or mop or squeegee liquid cargos to remove as much residual material as possible. (Physically entering a tank may not be advisable in many circumstances. Personnel must be trained in health and safety procedures and a confined entry space entry permit may be required.) Depending on the effectiveness of these dry cleaning processes, the need for subsequent tank cleaning with water may be eliminated. At a minimum, these techniques will reduce the amount of water and cleaning solution required for tank cleaning.

7.2.5 Cascade Tank Cleaning

Facilities that primarily clean tanks used to transport the same cargos (e.g., petroleum facilities) often operate "cascading" tank cleaning processes. In these processes, the most contaminated TEC process wastewater is used for initial tank rinses, with initial tank rinse wastewater routed to disposal. Clean water, or relatively clean TEC process wastewater, is used for final tank rinses, with final tank rinse water reused as an initial tank rinse when cleaning subsequent tanks. Through this process, wash water is used at least twice prior to discharge or disposal.

7.2.6 Wastewater Recycle and Reuse

In addition to cascading tank cleaning processes, TEC facilities may incorporate other methods of water recycle and reuse to reduce or eliminate the need for fresh process water. Wastewater streams most commonly recycled and reused for TEC operations include tank interior cleaning wastewater, hydrotesting water, uncontaminated stormwater, and noncontact cooling water. If hydrotesting water, uncontaminated stormwater, and noncontact cooling water are segregated from tank interior cleaning wastewater, these wastewaters do not require extensive treatment prior to recycle and reuse.

Tank interior cleaning wastewater generated by cleaning tanks used to transport petroleum products can typically be reused as tank interior cleaning water after treatment by oil/water separation and activated carbon treatment. Wastewater generated by cleaning tanks that last transported chemical products generally requires more extensive treatment prior to reuse as source water in TEC operations. Final tank rinse water may also be used as cleaning solution make-up water.

Tank hydrotesting wastewater may be reused as future hydrotesting water by pumping to a storage tank between tests. Because hydrotesting usually requires that the entire tank be filled (approximately 5,000 gallons for an intermediate sized tank truck), the reuse of hydrotest wastewater can save substantial volumes of fresh water.

7.3 End-of-Pipe Wastewater Treatment Technologies

End-of-pipe wastewater treatment includes physical, chemical, and biological processes that remove pollutants from TEC wastewater prior to discharge to a receiving stream or POTW. Many TEC facilities use pretreatment, primary treatment, biological treatment, and/or advanced treatment for end-of-pipe treatment of wastewater. [See Table C-6 of the Data Element Dictionary for the Detailed Questionnaire (1) for the specific technologies included within these technology classifications.] Typical end-of-pipe treatment currently used by the TECI includes pretreatment and primary treatment. TEC facilities that operate biological and/or advanced treatment units are commonly those that practice extensive water and wastewater recycle and reuse or discharge directly to U.S. surface waters.

The following subsections describe the major wastewater treatment technologies used by the TECI. Each subsection includes a general description of how the technology works and what types of pollutants the technology treats. The number of TEC facilities that use each treatment technology is presented in the following table. The numbers of facilities presented in this table have been adjusted using statistical scaling factors and therefore represent the entire industry rather than only the surveyed facilities. The following subsections describe each of these technologies in the order that they appear in the table.

Treatment Technology	Number of Facilities (% of Discharging Facilities) That Utilize the Treatment Technology
Gravity Settling	393 (57%)
pH Adjustment	303 (44%)
Equalization	289 (42%)
Oil/Water Separation	251 (36%)
Sludge Dewatering	195 (28%)
Dissolved Air Flotation	175 (25%)

Treatment Technology	Number of Facilities (% of Discharging Facilities) That Utilize the Treatment Technology
Coagulation/Flocculation	169 (24%)
Filtration	166 (24%)
Clarification	157 (23%)
Biological Oxidation	60 (9%)
Chemical Precipitation/Separation	43 (6%)
Grit Removal	30 (4%)
Chemical Oxidation	16 (2%)
Activated Carbon Adsorption	4 (<1%)
Membrane Filtration	1 (<1%)

7.3.1 Gravity Settling

Gravity settling, or sedimentation, removes suspended solids from TEC process wastewater by maintaining wastewater in a quiescent state so that contaminants can separate by density. Gravity settling is utilized by more than half of the TEC facilities (57%). During gravity settling, wastewater is typically collected in a tank or catch basin, where it is detained for a period of time, allowing solids with a specific gravity higher than water to settle to the bottom of the tank and solids with a specific gravity lower than water to float to the surface. The effectiveness of gravity separation depends upon the characteristics of the TEC wastewater and the length of time the wastewater is held in the treatment unit. Properly designed and operated gravity separation units are capable of achieving significant reductions of suspended solids and 5-day biochemical oxygen demand in many TEC wastewaters.

Some facilities add chemicals, such as lime or polymers, to aid in the settling of solids. The solids that settle out or float to the surface may be removed from the unit continuously using automatic scrapers or skimmers. Alternatively, the units may be periodically shut down and the solids removed manually.

7.3.2 pH Adjustment

Adjustment of pH is a process in which chemicals are added to a wastewater to make it acidic or basic or to neutralize acidic or basic wastewaters. Of the total TEC facilities, 44% utilize pH adjustment. A pH adjustment system normally consists of a small tank in which the wastewater pH is adjusted by mixing and chemical addition under the control of a pH meter. To adjust the pH of the wastewater, either caustic or acidic chemicals are added to the mixing tank. Because many treatment technologies used in the TECI are sensitive to pH fluctuations, pH adjustment may be required as part of an effective treatment system. Some treatment technologies require a high pH (e.g., chemical precipitation), while others require a neutral pH (e.g., biological oxidation). In addition, the pH of the final effluent from these technologies must often be adjusted prior to discharge to meet permit conditions for wastewater discharge.

7.3.3 Equalization

Equalization involves homogenizing variable wastewaters over time to control fluctuations in flow and pollutant characteristics, thereby reducing the size and cost and improving the efficiency of subsequent treatment units. Approximately 42% of TEC facilities incorporate equalization in their wastewater treatment processes. Equalization units include tanks which are often equipped with agitators (e.g., impeller mixers and air spargers) to mix the wastewater and to prevent solids from settling at the bottom of the unit. Chemicals may also be added to the equalization units to adjust pH, as necessary, for further treatment.

Equalization units can allow downstream treatment units to be sized and operated on a continuous-flow basis, because they can minimize the variation in the characteristics of untreated wastewaters. This reduces the probability of treatment system upsets and allows treatment systems to be optimized for a narrower range of influent wastewater characteristics. The amount of residence time required by an equalization unit to achieve optimum effects is dependent upon the specific characteristics and daily flow patterns of the wastewater.

7.3.4 Oil/Water Separation

Oil/water separation uses the difference in specific gravity between oil and water to remove free or floating oil from wastewater. More than one-third of TEC facilities (36%) use oil/water separation as a method of removing varying levels of oil and grease.

The most common mechanism for oil removal is an oil skimmer. Some skimming devices work by continuously contacting the oil with a material, such a belt or rope, onto which the oil readily adheres. As the material passes through the floating oil layer, the oil coats the surface of the material. The oil-coated material then passes through a mechanism that scrapes the oil from the material into an oil collection unit. Another type of skimming device uses overflow and underflow baffles to skim the floating oil layer from the surface of the wastewater. An underflow baffle allows the oil layer to flow over into a trough for disposal or reuse while most of the water flows underneath the baffle. This is followed by an overflow baffle, which is set at a height relative to the first baffle such that only the oil-bearing portion will flow over the first baffle during normal operation.

A standard oil/water separator utilized by the TECI is an American Petroleum Institute (API) oil/water separator. A typical API oil/water separator is rectangular and constructed with surface skimmers for oil removal and a bottom sludge rake or sludge auger for solids removal. It is designed such that lighter floating matter rises and remains on the surface of the water until removed, while the liquid flows out continuously under partitions or through deep outlets. Figure 7-1 presents a diagram of an API oil/water separator.

Another common type of oil/water separator used by the TECI is a coalescing oil/water separator, which is used to remove oil droplets too finely dispersed for conventional gravity separation and skimming technology. These units are comprised of a series of corrugated and/or inclined plates or tubes arranged parallel to one another and transverse to the flow of water. The plates and tubes are often built of materials that attract oil away from the water, such as polypropylene, ceramic, or glass. As the oil droplets impinge on the surfaces of the plates or tubes, they coalesce into a layer of oil that flows or is pumped from the unit. Figure 7-2 presents a diagram of a coalescing oil/water separator.

Due to the complex nature of TEC wastewater and the presence of detergents and high-pH chemicals, oils may form a stable emulsion which does not separate well in a gravity or coalescing separator. Stable emulsions require pH adjustment, the addition of chemicals, and/or heat to break the emulsion. The method most commonly used by the TECI to perform oil/water separation on stable emulsions is acid cracking. Acid cracking entails the addition of sulfuric or hydrochloric acid to the tank containing the oil mixture until the pH reaches 1 or 2. A coagulant may also be added during acid cracking to aid in oil/water separation. After the emulsion bond is broken, the free oil floats to the top of the tank where it is removed by a skimming device.

7.3.5 Sludge Dewatering

Sludge dewatering reduces sludge volume by decreasing its water content. Various methods of this particular process are employed by 28% of the TECI. Sludge dewatering may involve simple techniques such as the use of sludge drying beds, or it may be accomplished through more complicated mechanical techniques, including filter presses, rotary vacuum filters, and centrifuges. The decrease in sludge volume achieved through sludge dewatering substantially reduces the cost for sludge disposal and allows for easier sludge handling.

7.3.5.1 Sludge Drying Bed

The sludge drying bed process involves applying sludge to land, collecting the supernatant after solids settle, and allowing the sludge to dry. The sludge cake may then be scraped manually or by a front-end loader and dumped into a truck. Disadvantages to using a sludge drying bed are potential odor problems, large land area requirements, and the cost of labor to remove the dried cake. The main components of a sludge drying bed include watertight walls extending above the surface of the bed; an opening in the wall for entrance of a front-end loader to scrape up the sludge cake; drainage trenches filled with a coarse sand bed supported on a gravel filter with a perforated pipe underdrain; paved areas on both sides of the trenches with a slope for gravity drainage; and a sludge inlet and supernatant draw-off (2). The supernatant collected from the sludge may be returned as influent to wastewater treatment. Depending on sludge content and climate conditions for evaporation, sludge drying times may range from several days to weeks.

7.3.5.2 Plate-and-Frame Filter Press

The most widely used filter press is referred to as the plate-and-frame filter press. A filter press uses positive pressure provided by a mechanical device, such as a hydraulic ram, to drive water contained in the sludge through a filter medium. This type of unit comprises a series of recessed plates that are affixed with a filter medium (e.g., filter cloth) and are stacked together on a horizontal shaft. The plates form a series of spaces separated by the filter media and are otherwise sealed to withstand the internal pressures created during the filtration cycle. As the sludge is forced through the system, the water passes through the filter medium and is discharged through the filtrate port while the solids become trapped within the spaces, forming a dewatered cake against the filter medium.

When the cycle is over, the plates are separated, and the dewatered cake is released from the spaces into a collection bin. Removing the cake from the filter media is often performed manually by an operator. The filter press filtrate that results from the dewatering is usually piped back to the beginning of the treatment system. Figure 7-3 presents a diagram of a plate-and-frame filter press.

7.3.5.3 Rotary Vacuum Filter

A rotary vacuum filter consists of a cylindrical drum with a filter medium, such as cloth or wire mesh, around its perimeter. The drum is horizontally suspended within a vessel and is partially submerged in the sludge. The drum is rotated and the filter surface contacts the sludge within the vessel while a vacuum is drawn from within the drum. This draws the water through the filter medium toward the axis of rotation and discharges it through a filtrate port. The solids become trapped against the filter medium, forming a dewatered cake around the outside of the drum. The dewatered cake is continuously scraped from the drum into a collection bin. Figure 7-4 presents a diagram of a rotary vacuum filter.

7.3.5.4 Centrifuge

Another method of sludge dewatering is centrifuging. Centrifuge designs are based on the principal of centrifugal force. To settle and separate higher density solids from wastewater, sludge is spun or rotated in the centrifuge, collected on the inner wall of the mechanism, and then scraped from the walls of the centrifuge. Certain wastewater treatment chemicals may be added to sludge in the centrifuge to bring additional pollutants out of solution and form an insoluble floc (e.g., as in chemical precipitation) that is also separated by the centrifugal forces.

7.3.6 Dissolved Air Flotation

Flotation is the process of influencing suspended particles to rise to the wastewater surface where they can be collected and removed. Dissolved air flotation is utilized by approximately 25% of TEC facilities in their treatment systems. During flotation, gas bubbles introduced into the wastewater attach themselves to suspended particles, thereby reducing their specific gravity and causing them to float. Flotation processes are utilized because they can remove suspended solids that have a specific gravity slightly greater than 1.0 more quickly than sedimentation.

Dissolved air flotation (DAF) is one of several flotation techniques used for wastewater treatment to extract free and dispersed oil and grease, suspended solids, and some dissolved pollutants from process wastewater. In DAF, two modes of operation may be employed to pressurize wastewater. In recycle pressurization, air is injected into a portion of recycled, clarified effluent and dissolved into a wastewater stream in an enclosed tank or pipe, pressurizing the wastewater. In full flow pressurization, all of the influent wastewater is injected with air in a surge tank and is pumped to a retention tank under pressure to dissolve the air into the wastewater.

When the wastewater enters the flotation tank, the pressure is reduced, which causes fine air bubbles to be released. These bubbles make contact with the suspended particles via two separate mechanisms. The first mechanism involves the use of a flocculant, which causes rising air bubbles to be trapped inside flocculated masses as they increase in size. The second mechanism involves the intermolecular attraction between the solid particle and the air bubble, which causes the solid to adhere to the bubble. In either mechanism, the low density of the air bubble causes it to rise to the surface of the flotation tank with the flocculated or adhered solids attached.

DAF units are equipped with rakes that scrape the floc from the surface and into a sludge collection vessel, where it is subsequently pumped to a dewatering unit and later disposed. A sludge auger may be included in the DAF unit to remove solids that have settled to the bottom of the tank. Units are typically operated on a continuous basis and incorporate chemical mix tanks (if flocculants are used), flotation vessels, and sludge collection tanks in a single enclosed unit. Figure 7-5 presents a diagram of a DAF unit with pressurized recycle.

7.3.7 Coagulation/Flocculation

Coagulation and flocculation are processes that cause suspended solids in wastewater to coalesce. The coalesced particles tend to settle out of the wastewater more quickly than particles that have not undergone coagulation/flocculation. Approximately 24% of TEC facilities use coagulation/flocculation.

Coagulation consists of the addition and rapid mixing of a “coagulant,” the destabilization of colloidal and fine suspended solids, and the initial aggregation of those particles. Flocculation is the slow stirring to complete aggregation of those particles and form a floc which will in turn settle by gravity (3). After rapid mixing, coagulant aids, such as polyelectrolytes, are often added to reduce the repulsive forces between the charged particles. Flocculation may also be accomplished by adding such materials as lime or sodium silicate to form loose agglomerates that carry the fine particles down with them. These settled solids form a sludge; therefore, coagulation/flocculation is typically followed by clarification to remove solids (see Section 7.3.9).

7.3.8 Filtration

Filtration is used to remove solids from wastewater by passing the wastewater through a material that retains the solids on, or within, itself. The percentage of TEC facilities that use filtration (excluding membrane filtration, which is discussed separately in Section 7.3.15) is 24 percent. A wide variety of filter types are used by the TECI including media filters (e.g., sand, gravel, charcoal), bag filters, and cartridge filters. A filter press (see Section 7.3.5) may be used for in-line wastewater filtration. The flow pattern of filters is usually top-to-bottom; however, upflow filters, horizontal filters, and biflow filters are also used.

The complete filtration process typically involves two phases: filtration and backwashing. As the filter becomes saturated with trapped solids, the efficiency of the filtration process decreases. As the head loss across the filter bed (i.e., measure of solids trapped in the filter) increases to a limiting value, the end of the filter run is reached, and the filter must be backwashed to remove the suspended solids in the bed. During backwashing, the flow through the filter is reversed so that the solids trapped in the media are dislodged and can exit the filter. The bed may also be agitated with air in order to aid in solids removal. The backwash water is then recycled back into the wastewater feed stream.

The type of filter used depends on various factors such as the operating cycle (i.e., whether the wastewater is being filtered continuously or in batches) or the nature of the solids passing through the filter. The filter type can also be determined by the filtration mechanism (i.e., whether the filtered solids are stopped at the surface of the medium and accumulate to form a filter cake or are trapped within the pores or body of the filter).

7.3.9 Clarification

Clarification involves holding wastewater in a quiescent state so that contaminants can separate by density. Clarification uses the same principles for treatment as gravity settling but differs from gravity settling in that it is typically used after coagulation/flocculation and/or biological treatment. Approximately 23% of the TECI use clarification in their wastewater treatment systems.

Clarifiers consist of settling tanks and are commonly equipped with a sludge scraper mounted on the floor of the clarifier to rake sludge into a sump for removal. The bottom of the clarifier may also be sloped to facilitate sludge removal. Clarification can be used as either a pre-or post-treatment step for various operations to aid in removing settleable solids, free oil and grease, and other floating material. Clarifiers are often referred to as primary or secondary sedimentation tanks. Primary clarification is used to remove settleable solids from raw wastewater or wastewater treated by coagulation/flocculation. Secondary clarification is normally used in activated sludge systems to remove biomass. A portion of the sludge biomass is often recycled from the secondary clarifier back to the activated sludge biological oxidation unit (see Section 7.3.10). Secondary clarification may include the addition of chemicals to aid in the coagulation and agglomeration of suspended solids following biological treatment. Polymers are typically used as coagulant aids, but other coagulants (e.g., alum) may also be used. Figure 7-6 presents a diagram of a clarifier.

7.3.10 Biological Oxidation

Biological oxidation is a reaction caused by biological activity which results in a chemical combination of oxygen with organic matter to yield relatively stable end products such as carbon dioxide and water (3). Approximately 9% of the TECI uses biological oxidation to treat wastewater. In wastewater treatment, this is most commonly accomplished with an activated sludge treatment system, but aerated lagoons, trickling filters, and rotating biological contactors (RBCs) can also be used to perform biological oxidation of wastewater.

An activated sludge treatment system normally consists of an aeration basin, a secondary clarifier, and a sludge recycle line. Equalization of flow, pH, temperature, and pollutant loading is necessary to obtain consistent, adequate treatment. A settling tank may be used to remove settleable solids prior to aeration. An aerobic bacterial population is maintained in the aeration basin where oxygen, recycled sludge, and nutrients (usually nitrogen and phosphorus) are added to the system. Prior to the aeration basin, oxygen may also be added to wastewater in preaeration tanks. Oxygen is normally supplied by aerators that also provide mixing to help keep microorganisms in suspension. The activated sludge-wastewater mixture, or “mixed liquor,” is then sent to a secondary clarifier that controls the amount of suspended solids discharged and provides recycled sludge back to the aeration basin to keep an optimal concentration of acclimated microorganisms in suspension.

Sludge produced by these systems generally consists of biological waste products and expired microorganisms and is typically discharged from the clarifier. However, under certain operating conditions, this sludge may accumulate in the aeration basin and may require periodic removal. Figure 7-7 presents a diagram of an activated sludge system.

7.3.11 Chemical Precipitation/Separation

Chemical precipitation/separation is a process that renders dissolved pollutants insoluble and uses the resulting phase differential to separate pollutants from wastewater. Approximately 6% of TEC facilities use chemical precipitation/separation. During chemical precipitation processes typical in the TECI, insoluble solid precipitates are formed from the organic or inorganic compounds in the wastewater through the addition of chemicals and/or pH adjustment. Sedimentation or filtration then separates out the solids from the wastewater. Chemical precipitation is generally carried out in four phases:

1. Addition of the chemical to the wastewater;
2. Rapid (flash) mixing to homogeneously distribute the chemical;
3. Slow mixing to promote particle growth by flocculation; and
4. Sedimentation or filtration to remove the flocculated solid particles.

Chemical precipitation systems normally consist of a rapid mixer, a chemical feed system to add the precipitation agent, a flocculation tank, and a sedimentation tank. In batch chemical precipitation systems, the treated wastewater is held in the unit long enough to allow the solids to settle out. The water is then pumped from the unit, and the resulting sludge is removed for further dewatering and subsequent disposal.

Precipitation agents, such as polyaluminum chloride, ferric chloride, and lime, work by reacting with pollutant cations (e.g., metals) and some anions to convert them into an insoluble form for subsequent removal by gravity settling. The pH of the wastewater also affects how much pollutant mass is precipitated, as pollutants precipitate more efficiently in different pH ranges. Figure 7-8 presents a diagram of a batch chemical precipitation unit.

7.3.12 Grit Removal

Grit removal is the process of eliminating heavy, suspended material from wastewater. Grit removal is only used by 4% of TEC facilities. Grit removal differs from gravity settling/clarification in that it is typically performed in a smaller tank and has a shorter retention time. Removal is accomplished using a settling chamber and a collection mechanism, such as a rake. Grit chambers may also be aerated to remove floatable solids. This unit operation is performed to prevent excess wear on pumps, accumulations in aeration tanks and clarifiers, and clogging of sludge piping (3).

7.3.13 Chemical Oxidation

Chemical oxidation is used in wastewater treatment to destroy priority pollutants or other organic pollutants by oxidizing them with an oxidizing agent. Approximately 2% of TEC facilities use chemical oxidation. Chemical oxidation systems consist of a tank, a mixer, and a chemical feed system to add the oxidizing agent. During the chemical oxidation reaction, one or more electrons are transferred from the oxidizing chemical (electron donor) to the targeted pollutants (electron acceptor), causing their destruction. An oxidant often used by the TECI is hydrogen peroxide. Other oxidants used in industry include chlorine, ozone, and potassium permanganate.

7.3.14 Activated Carbon Adsorption

Activated carbon removes organic constituents from wastewater by physical and chemical forces that bind the constituents to the carbon surface and internal pores. Activated carbon adsorption is widely used in the treatment of industrial wastewaters because it adsorbs an extensive variety of organic compounds. However, less than 1% of TEC facilities currently use activated carbon adsorption. The term “activated carbon” refers to carbon materials, such as coal or wood, that are processed through dehydration, carbonization, and oxidation to yield a material that is highly adsorbent due to a large surface area and a high number of internal pores per unit of mass. In general, organic constituents possessing certain properties (e.g., low water solubility and high molecular weight) and certain chemical structures (e.g., aromatic functional groups) are amenable to treatment by activated carbon adsorption.

An activated carbon adsorption system usually consists of a column of bed containing the activated carbon. The most common form of activated carbon for wastewater treatment is granular. Powdered activated carbon is used less frequently for wastewater treatment due to the difficulty of regeneration, reactor system design considerations, and its tendency to plug more easily than granular activated carbon, although it may be used in conjunction with biological treatment systems.

The carbon adsorption capacity (i.e., the mass of the contaminant adsorbed per mass of carbon) for specific organic contaminants is related in part to the characteristics of each compound. Competitive adsorption of mixed compounds has a major effect on adsorption (i.e., the carbon may begin preferentially adsorbing one compound over another compound and may even begin desorbing the other compound). Process conditions, process design factors, and carbon characteristics also affect adsorption capacity.

When the adsorption capacity of the carbon is exhausted, the spent carbon is either disposed or regenerated; the choice is generally determined by cost. Carbon may be regenerated by removing the adsorbed organic compounds from the carbon through steam regeneration, thermal regeneration, or physical/chemical regeneration. The most common methods to regenerate carbon used for wastewater treatment are thermal and steam regeneration. These methods volatilize the organic compounds that were adsorbed onto the carbon. Afterburners are required to ensure destruction of the organic vapors. A scrubber may also be necessary to remove particulates from the air stream. Physical/chemical regeneration uses a solvent, which can be a water solution, to remove the organic compounds.

7.3.15 Membrane Filtration

Membrane filtration is a term applied to a group of processes that use a pressure-driven, semipermeable membrane to separate suspended, colloidal, and dissolved solutes from a process wastewater. Less than 1% of TEC facilities use membrane filtration. During operation, the feed solution flows across the surface of the membrane. “Clean” water permeates the membrane by passing through pores in the membrane, leaving the contaminants and a portion of the feed behind. The clean or treated water is referred to as the permeate or product water stream, while the stream containing the contaminants is called the concentrate, brine, or reject stream. The size of the pores in the membrane is selected based on the type of contaminant to be removed. The pore size will be relatively large for the removal of precipitates or suspended materials, or very small for the removal of inorganic salts or organic molecules. Figure 7-9 presents a diagram of membrane filtration unit.

For industrial applications, the product water stream will either be discharged or, more likely, recycled or reused. The reject stream is normally disposed, but if the reject is of suitable quality, it can also be recycled or reused. Types of membrane filtration systems available include microfiltration, ultrafiltration (UF), and reverse osmosis (RO). The applicability of each of these membrane filtration technologies to the TECI is discussed below.

7.3.15.1 Microfiltration

Microfilters are generally capable of removing suspended solids and colloidal matter with diameters of greater than 0.1 microns and are commonly made from woven polyester or ceramic materials. The systems can be operated at feed pressures of less than 50 pounds per square inch gauge (psig). The feed stream does not require extensive pretreatment, and the membrane is relatively resistant to fouling and easily cleaned. Microfilters are capable of recovering up to 95% of the feed stream as product water.

7.3.15.2 Ultrafiltration

Ultrafiltration is similar to microfiltration except that a UF membrane has smaller pores. The “tightest” UF membrane is typically capable of rejecting molecules having diameters of greater than 0.001 microns. The system operates at a feed pressure of 50 to 200 psig. UF systems are capable of recovering from 90 to 95% of the feed as product water.

7.3.15.3 Reverse Osmosis

Reverse osmosis systems differ from microfiltration and ultrafiltration systems in that they have the ability to reject dissolved organic and inorganic molecules. RO systems are generally capable of removing particles with diameters less than 0.001 microns. RO membranes are commonly made from cellulose acetate; however, polysulfone, polyamide, or other polymeric materials may also be used. Reverse osmosis systems can be operated at feed pressures of 250 to 600 psig. RO membranes are very susceptible to fouling and may require extensive pretreatment of wastewater to remove wastewater constituents that can cause fouling. Oxidants (which may attack the membrane), particulates, oil, grease, and other materials that could cause a film or scale to form, plugging the membrane, must be removed by pretreatment. Reverse osmosis systems are capable of recovering up to 50 to 90% of the feed stream as product water. The dissolved solids concentration in the feed determines the percent recovery that can be obtained as well as the required feed pressure to operate the system.

7.4 References[1]

1. Eastern Research Group, Inc. Data Element Dictionary for Part A of the U.S. Environmental Protection Agency 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry, April 4, 1997 (DCN T10271).

2. Viessman, Warren, Jr. and Mark J. Hammer. Water Supply and Pollution Control, Fifth Edition. Harper Collins College Publishers. New York, NY, 1993.

3. Reynolds, Tom and Paul Richards. Unit Operations and Processes in Environmental Engineering. PWS Publishing. Boston, MA, 1996.

[1]For those references included in the administrative record supporting the TECI rulemaking, the document control number (DCN) is included in parentheses at the end of the reference.

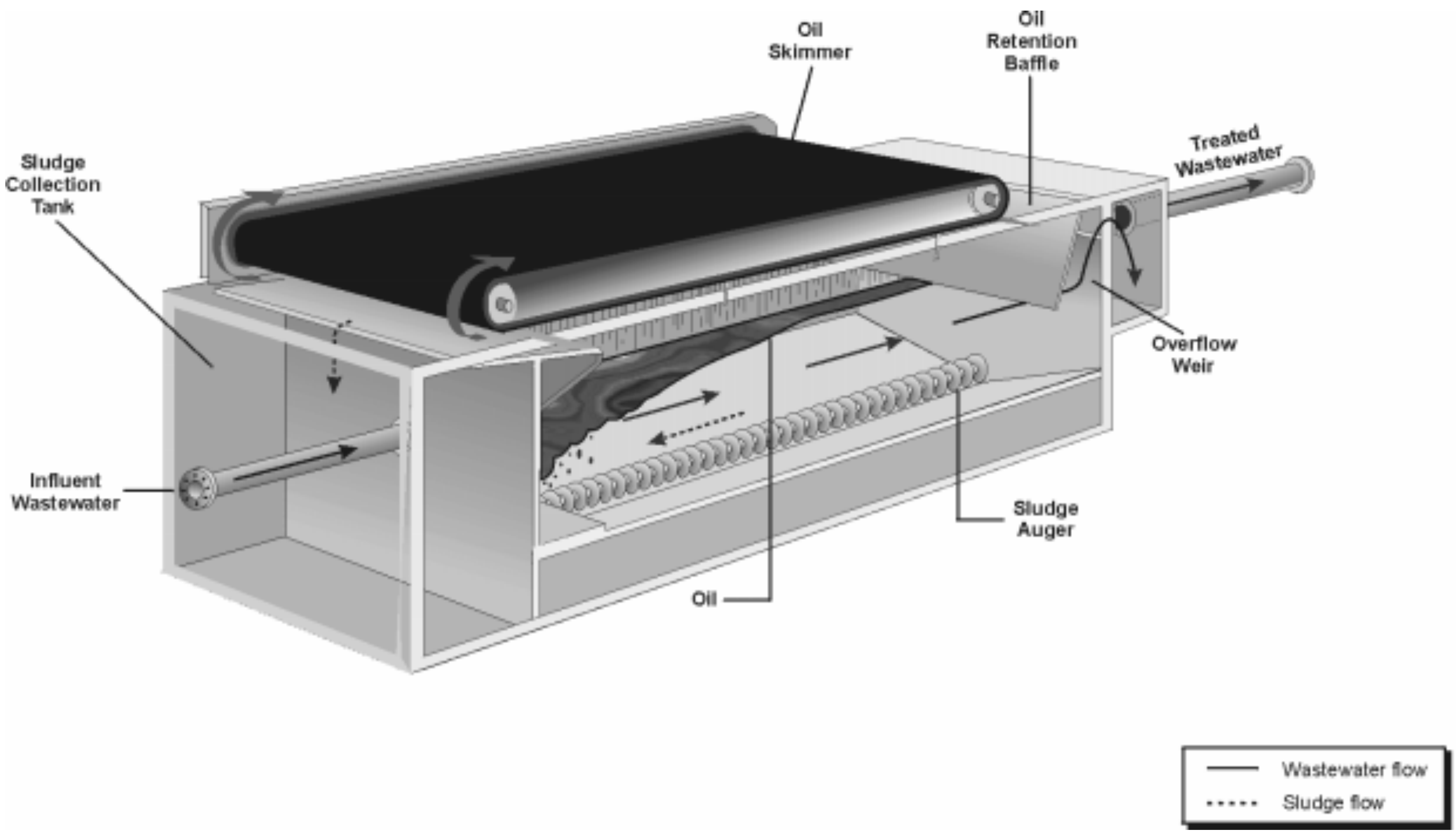


Figure 7-1. API Oil/Water Separator

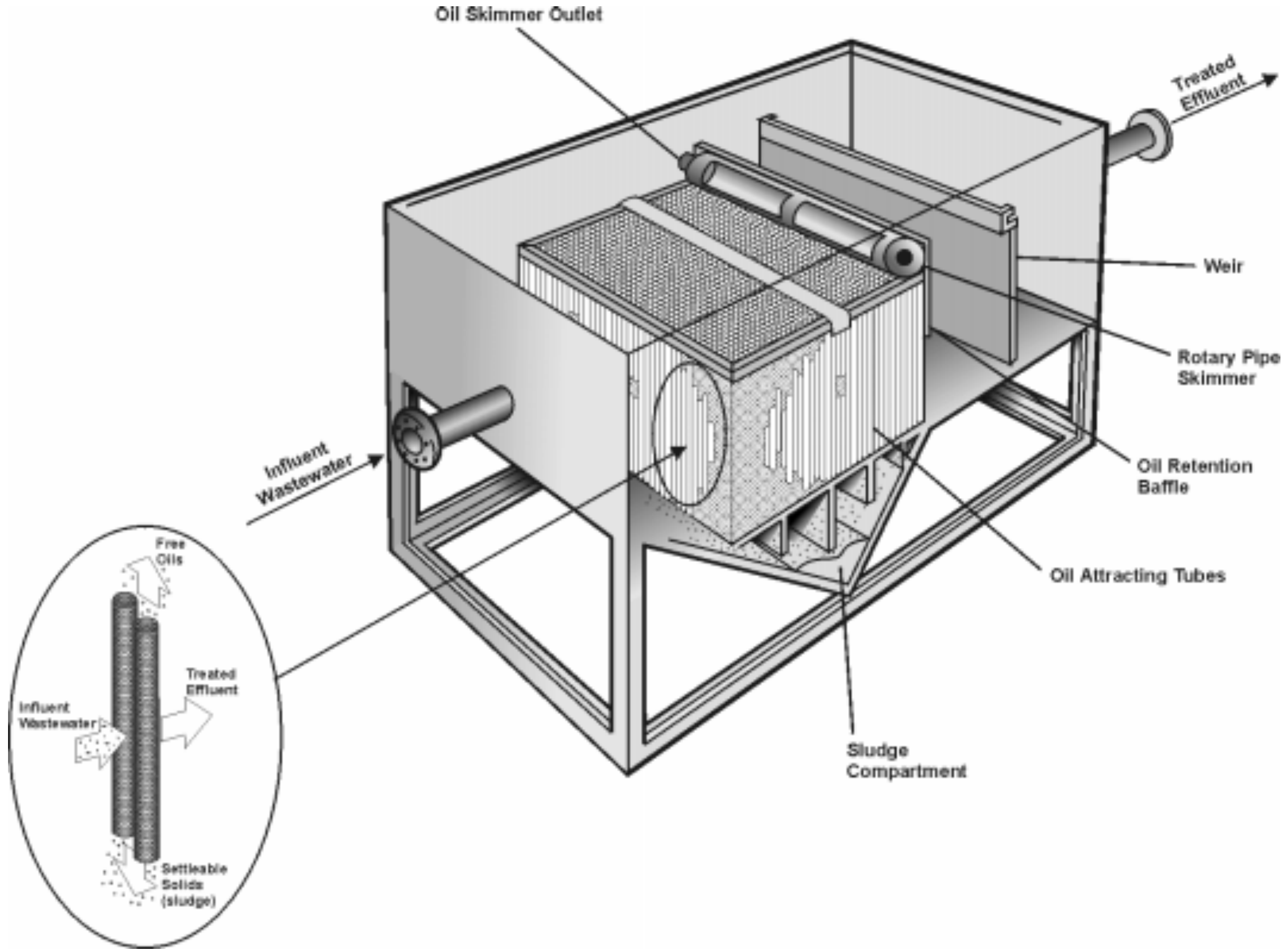


Figure 7-2. Coalescing Oil/Water Separator

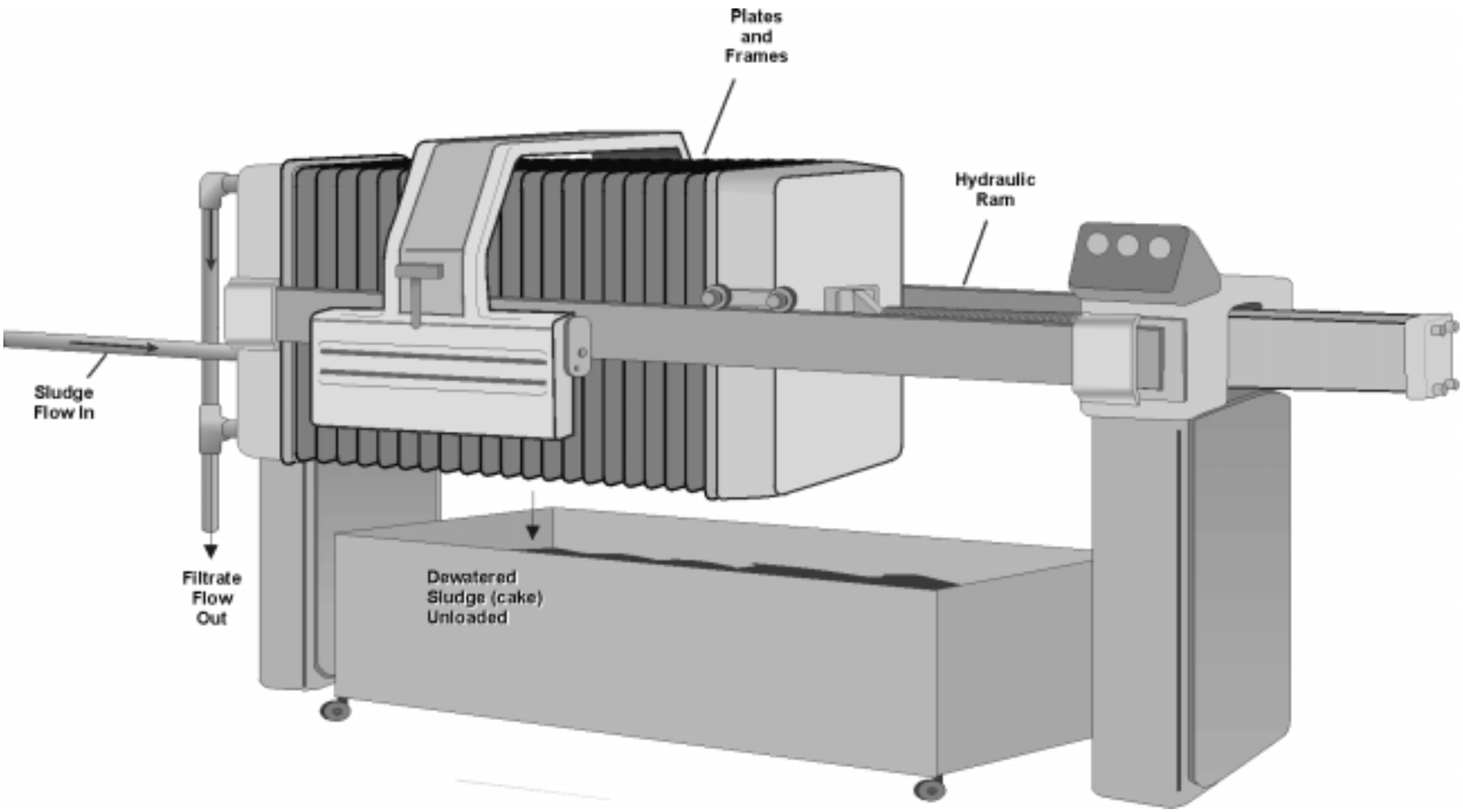


Figure 7-3. Plate-and-Frame Filter Press

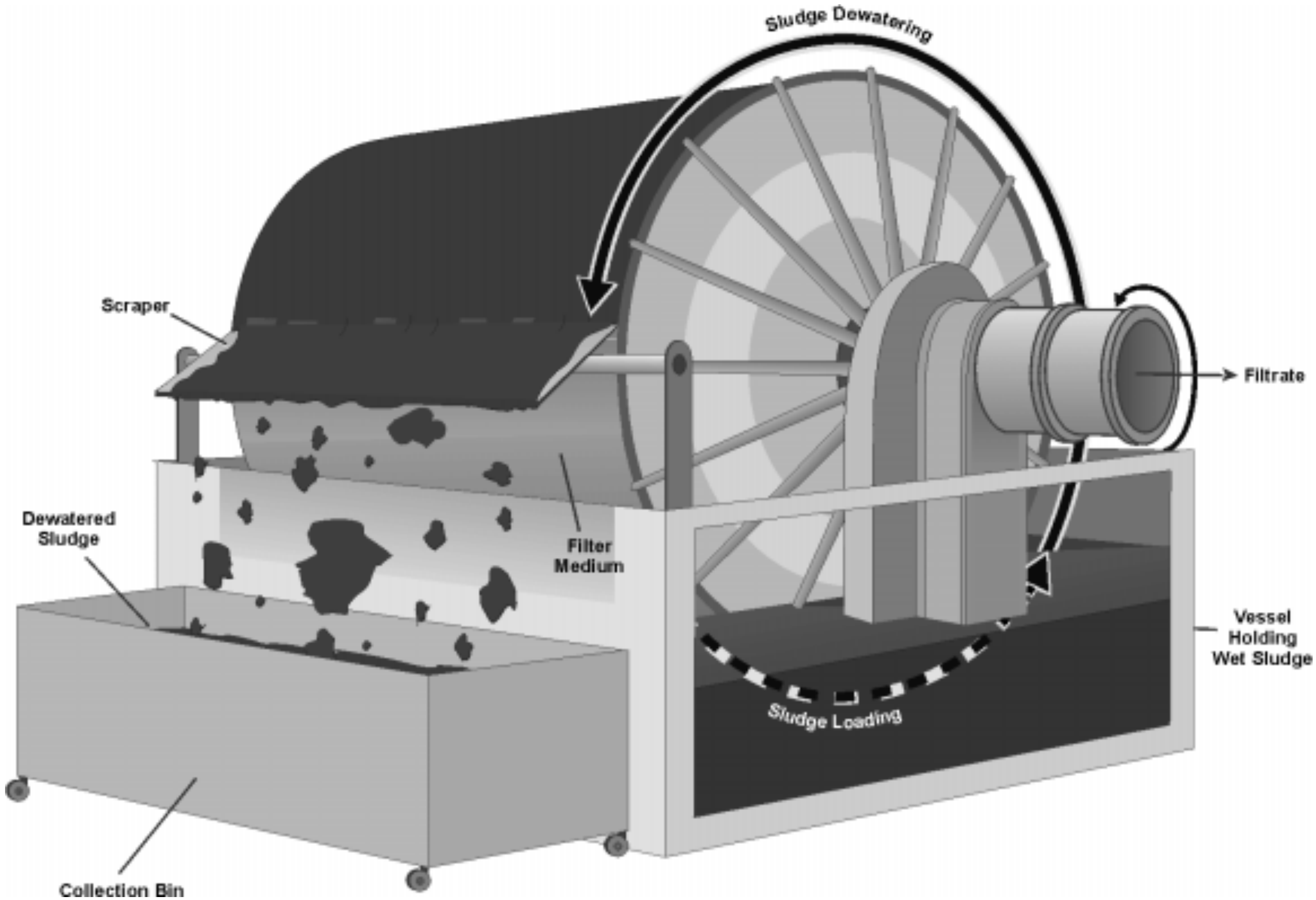


Figure 7-4. Rotary Vacuum Filter

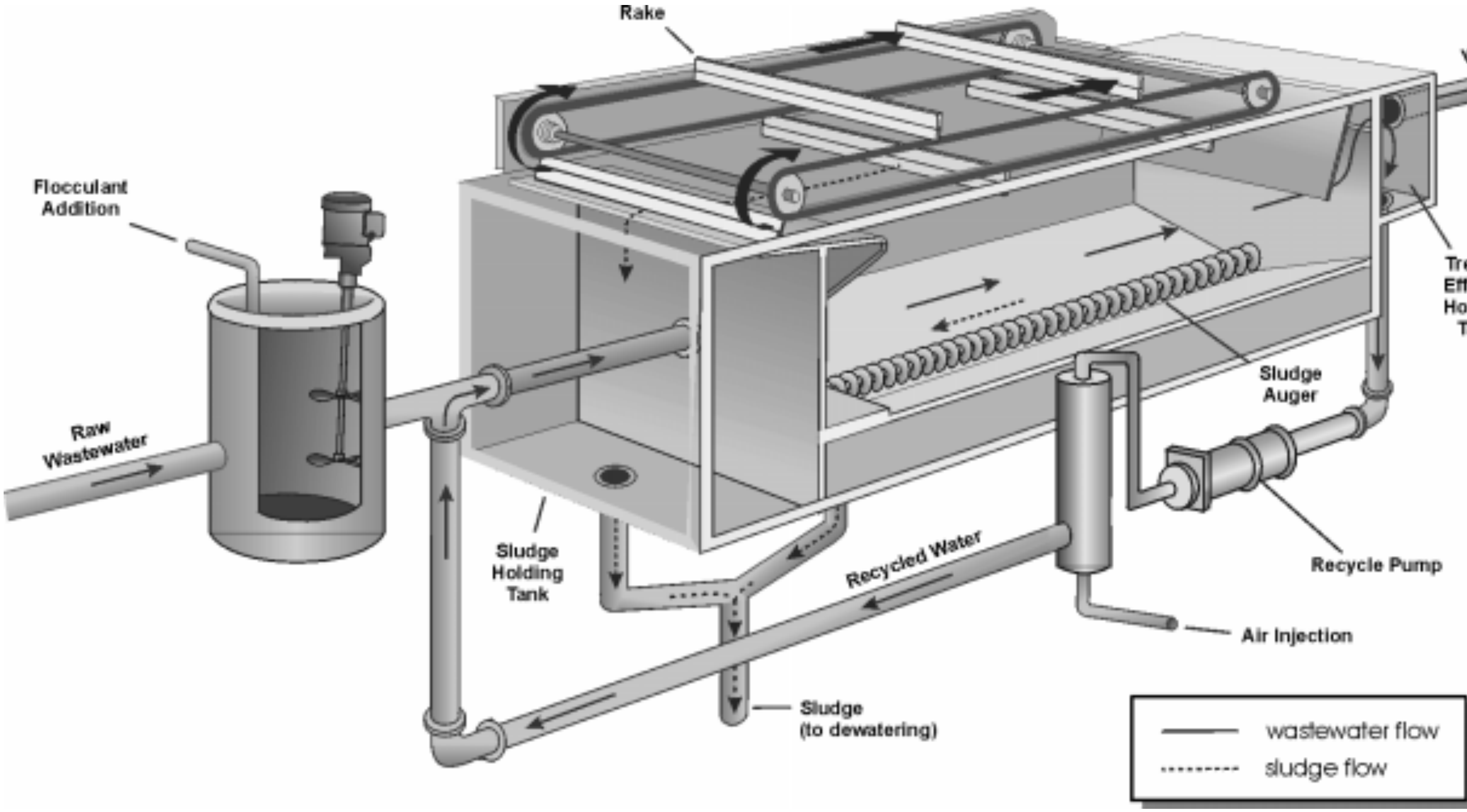


Figure 7-5. Dissolved Air Flotation Unit with Pressurized Recycle

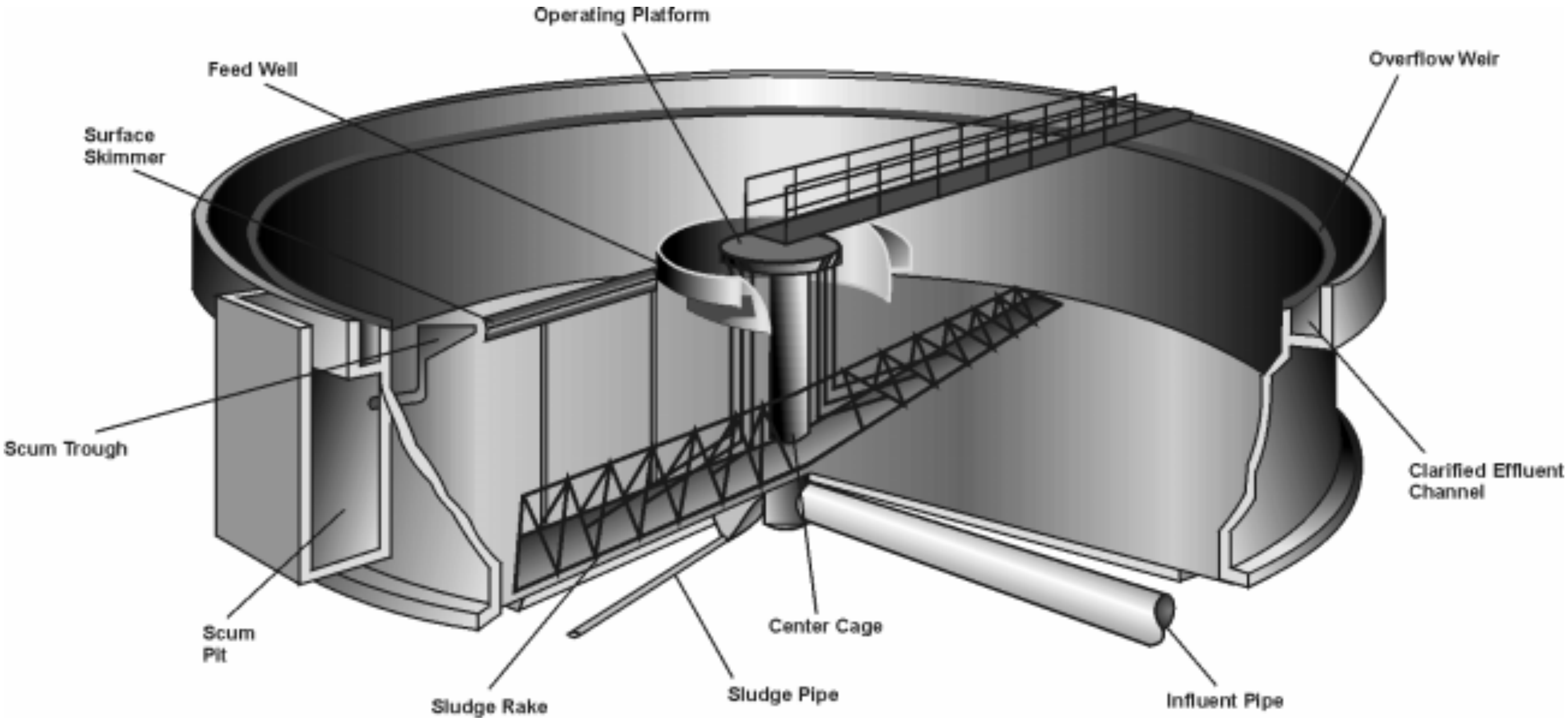


Figure 7-6. Clarifier

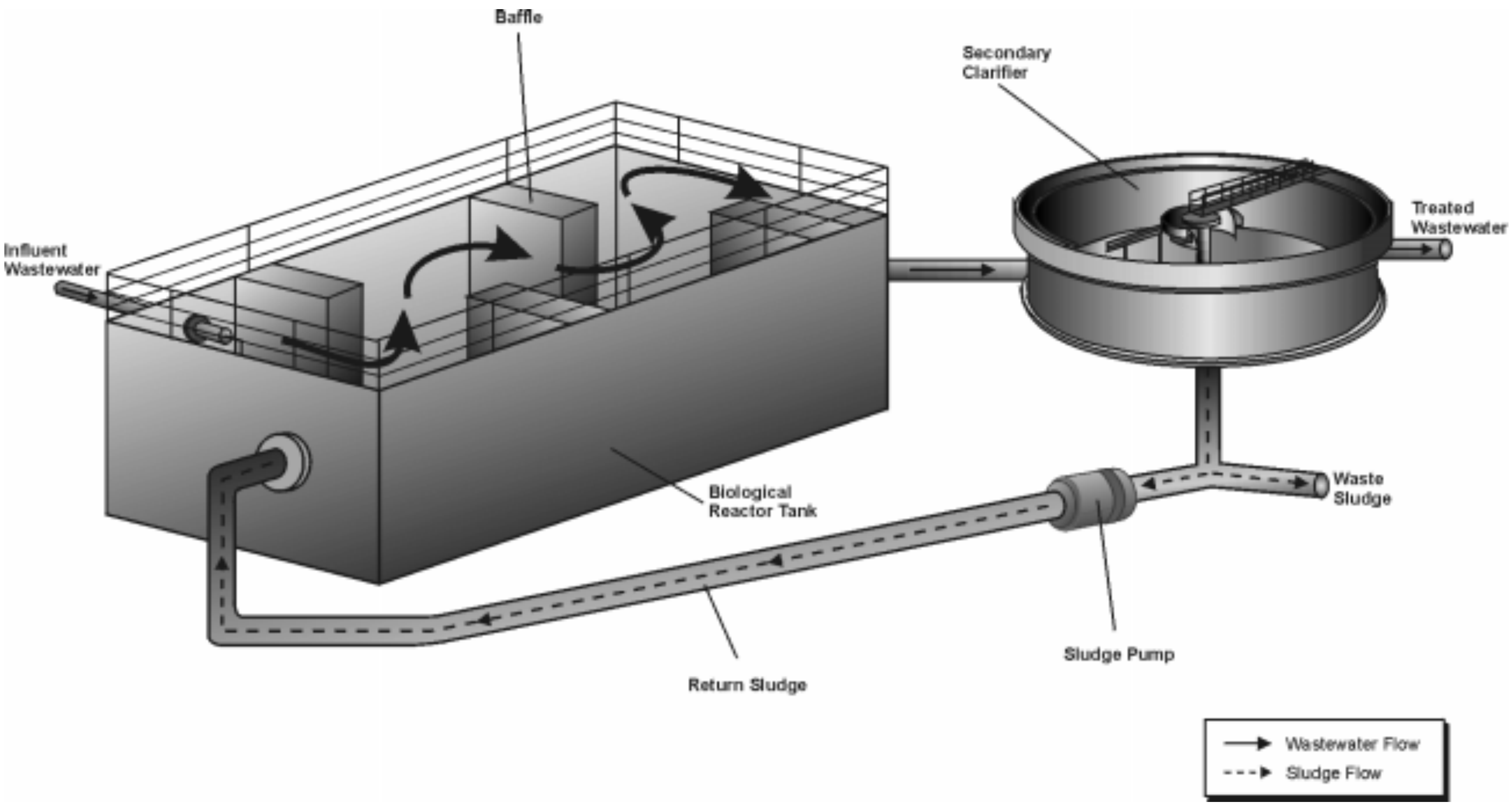


Figure 7-7. Activated Sludge System

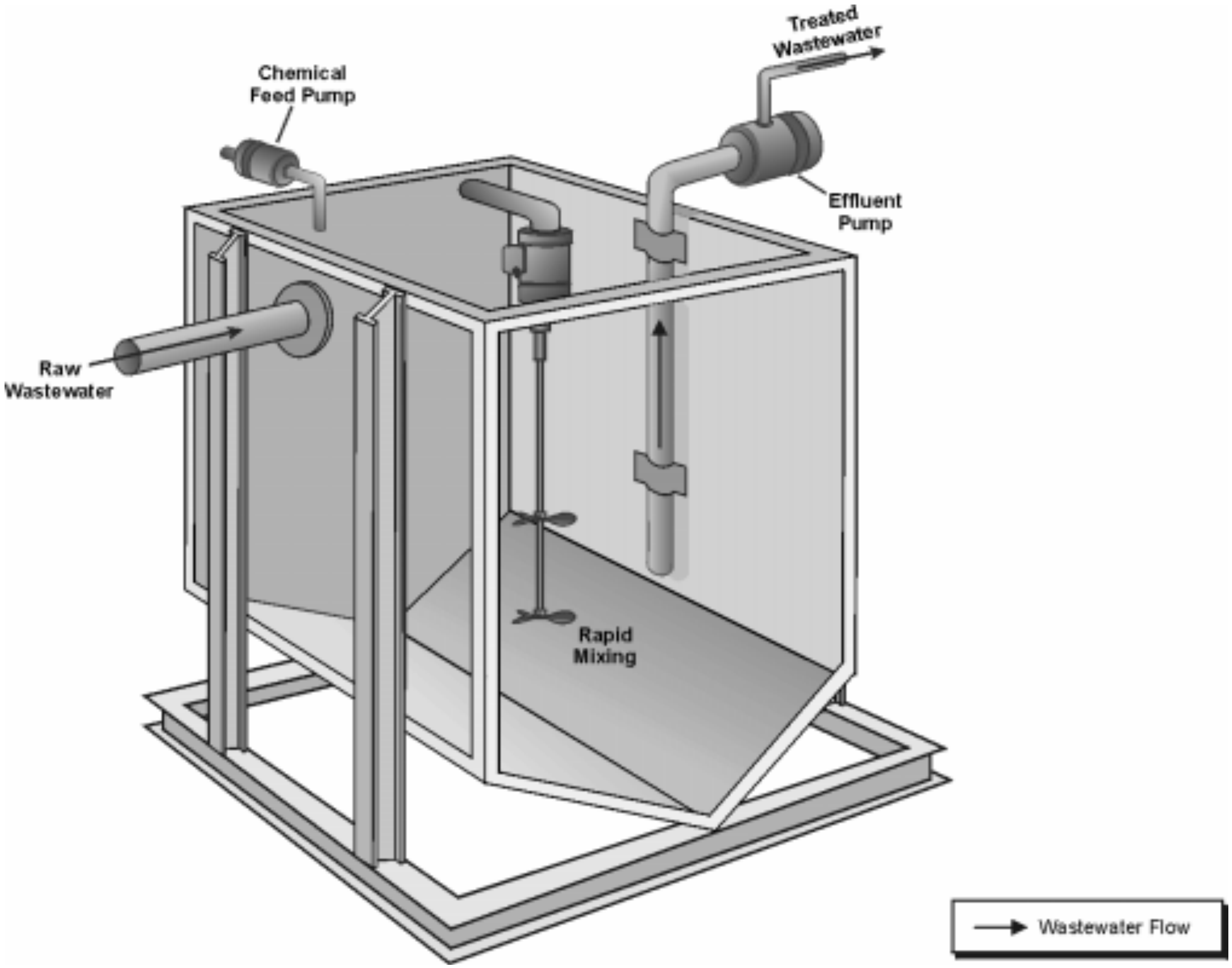


Figure 7-8. Batch Chemical Precipitation Unit

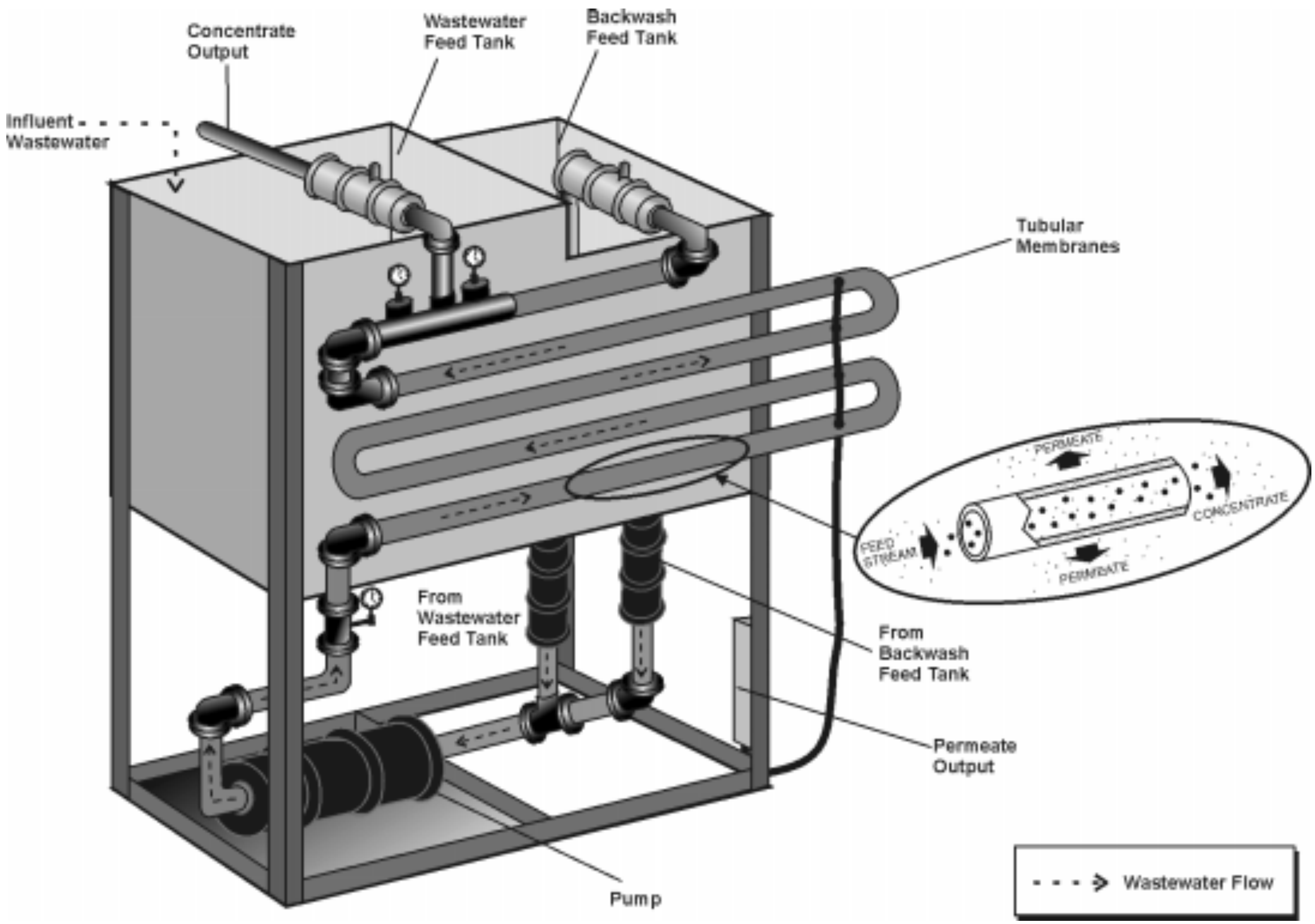


Figure 7-9. Membrane Filtration Unit

8.0 DEVELOPMENT OF CONTROL AND TREATMENT OPTIONS

This section describes the combinations of pollution prevention practices and end-of-pipe wastewater treatment that EPA configured as technology options for consideration as bases for the Transportation Equipment Cleaning Industry (TECI) effluent limitations guidelines and standards. (Note that water conservation practices, which are not part of EPA's technology bases, are incorporated into EPA's costing methodology for several subcategories. See Section 9.2.7 for additional information.) EPA developed technology options for the following:

- Best practicable control technology currently available (BPT);
- Best conventional pollutant control technology (BCT);
- Best available technology economically achievable (BAT);
- New source performance standards (NSPS);
- Pretreatment standards for existing sources (PSES); and
- Pretreatment standards for new sources (PSNS).

Technology bases for each option for each regulation were selected from the pollution prevention and wastewater treatment technologies described in Section 7.0. Sections 8.2 through 8.7 discuss the regulatory options that were considered for each of the regulations listed above.

8.1 Introduction

The final regulations establish quantitative limits on the discharge of pollutants from industrial point sources. The applicability of the various limitations for the TECI is summarized below:

	Direct Discharge	Indirect Discharge	Existing Source	New Source	Conventional Pollutants	Priority and Nonconventional Pollutants
BPT	✔		✔		✔	✔
BAT	✔		✔			✔
BCT	✔		✔		✔	
NSPS	✔			✔	✔	✔
PSES		✔	✔			✔
PSNS		✔		✔		✔

All of these regulations are based upon the performance of specific technologies but do not require the use of any specific technology. The regulations applicable to direct dischargers are effluent limitations guidelines which are applied to individual facilities through National Pollutant Discharge Elimination System (NPDES) permits issued by EPA or authorized states under Section 402 of the Clean Water Act (CWA). The regulations applicable to indirect dischargers are standards and are administered by local permitting authorities (i.e., the government entity controlling the publicly-owned treatment works (POTW) to which the industrial wastewater is discharged). The pretreatment standards control pollutants that pass through or interfere with POTWs.

EPA incorporated the following pollution prevention element into all technology options.

- Good Heel Removal and Management Practices. The benefits of good heel removal and management practices include the following:

  — Prevention of pollutants from entering the wastewater stream (i.e., maximum removal of heel prior to tank cleaning minimizes the pollutant loading in the tank interior cleaning wastewater stream);

  — Potential to recover/reuse valuable product; and

  — Reduced wastewater treatment system capital and annual costs due to reduced wastewater pollutant loadings.

The components of good heel removal and management practices are discussed in detail in Section 7.1.2.

Based on responses to the Detailed Questionnaire, the majority of transportation equipment cleaning (TEC) facilities currently operate good heel removal and management practices. Because of the many benefits of these practices, and a demonstrated trend in the TECI to implement these practices, EPA believes that the TECI will have universally implemented good heel removal and management practices prior to implementation of TECI effluent guidelines. Therefore, EPA is allocating no costs or pollutant reductions for this component of the technology option bases.

8.2 Best Practicable Control Technology Currently Available (BPT)

The BPT effluent limitations control identified conventional, priority, and nonconventional pollutants when discharged from TEC facilities to surface waters of the U.S. Generally, EPA determines BPT effluent levels based upon the average of the best existing performances by plants of various sizes, ages, and unit processes within each industrial category or subcategory. In industrial categories where present practices are uniformly inadequate, however, EPA may determine that BPT requires higher levels of control than any currently in place if the technology to achieve those levels can be practicably applied.

In addition, CWA Section 304(b)(1)(B) requires a cost assessment for BPT limitations. In determining the BPT limits, EPA must consider the total cost of treatment technologies in relation to the effluent reduction benefits achieved. This inquiry does not limit EPA's broad discretion to adopt BPT limitations that are achievable with available technology unless the required additional reductions are "wholly out of proportion to the costs of achieving such marginal level of reduction." See Legislative History, op. cit. p. 170. Moreover, the inquiry does not require the Agency to quantify benefits in monetary terms. See e.g. American Iron and Steel Institute v. EPA, 526 F. 2d 1027 (3rd Cir., 1975).

In balancing costs against the benefits of effluent reduction, EPA considers the volume and nature of expected discharges after application of BPT, the general environmental effects of pollutants, and the cost and economic impacts of the required level of pollution control. In developing guidelines, the CWA does not require or permit consideration of water quality problems attributable to particular point sources, or water quality improvements in particular bodies of water. Therefore, EPA has not considered these factors in developing the final limitations. See Weyerhaeuser Company v. Costle, 590 F. 2d 1011 (D.C. Cir. 1978).

EPA identified relatively few direct discharging facilities for most subcategories in the TECI as compared to the number of indirect discharging facilities. However, the Agency concluded that direct discharging facilities are similar to indirect discharging facilities in terms of types of tanks cleaned, types of commodities cleaned, water use, and wastewater characteristics. With respect to existing end-of-pipe wastewater treatment in place, direct discharging facilities typically operate biological treatment in addition to physical/chemical treatment technologies typically operated by indirect discharging facilities.

8.2.1 BPT Options for the Truck/Chemical & Petroleum Subcategory

BPT options for the Truck/Chemical & Petroleum Subcategory include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Equalization, Oil/Water Separation, Chemical Oxidation, Neutralization, Coagulation, Clarification, Biological Treatment, and Sludge Dewatering

Option 2: Equalization, Oil/Water Separation, Chemical Oxidation, Neutralization, Coagulation, Clarification, Biological Treatment, Activated Carbon Adsorption, and Sludge Dewatering

The purpose and design bases of the components of these technology options are described below. These technologies are also described in further detail in Section 7.3.

Equalization

Purpose: Reduce wastewater variability and accumulate wastewater to optimize subsequent treatment system size and operating costs.

Design Basis: Minimum of 24-hour residence time. Includes aerators/mixers to homogenize wastewater.

Oil/Water Separation

Purpose: Removal of entrained oil and grease.

Design Basis: Vertical tube coalescing separator with rotary oil skimmer. Includes demulsifier chemical additive, oil storage tank, and sludge storage tank.

Chemical Oxidation, Neutralization, Coagulation, and Clarification

Purpose: Chemical Oxidation - chemically oxidize pollutants using oxidants such as hydrogen peroxide.

Neutralization - adjust wastewater pH.

Coagulation - destabilize (reduce repulsive interaction) particle suspension using electrolytes to aggregate suspended matter.

Clarification - settle and remove agglomerated coagulated solids.

Design Basis: Turn-key treatment system consisting of four reaction tanks in series plus a clearwell. Includes chemical feed systems, mixers, control system, and sludge storage tanks.

Biological Treatment

Purpose: Biologically decompose organic constituents.

Design Basis: Activated sludge biological treatment system with a 4.6-day residence time. Includes two preaeration tanks in series and a sludge storage tank.

Activated Carbon Adsorption

Purpose: Wastewater polishing.

Design Basis: Two carbon columns in series with nominal carbon change-out frequency of once per month. Includes carbon charge of 250 lb/gpm/vessel.

Sludge Dewatering

Purpose: Reduce sludge volume by removing water.

Design Basis: Plate-and-frame filter press. Generates dewatered sludge at 32.5% solids.

All existing direct discharging facilities in this subcategory currently employ equalization, coagulation/clarification, biological treatment, and activated carbon adsorption. All existing direct discharging facilities also operate simple oil/water separators, such as gravity separators or oil skimmers, followed by chemical/physical treatment (e.g., coagulation/ clarification).

8.2.2 BPT Options for the Rail/Chemical & Petroleum Subcategory

BPT options for the Rail/Chemical & Petroleum Subcategory include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Oil/Water Separation, Equalization, Biological Treatment, and Sludge Dewatering

Option 2: Oil/Water Separation, Equalization, Dissolved Air Flotation (with Flocculation and pH Adjustment), Biological Treatment, and Sludge Dewatering

Option 3: Oil/Water Separation, Equalization, Dissolved Air Flotation (with Flocculation and pH Adjustment), Biological Treatment, Organo-Clay/Activated Carbon Adsorption, and Sludge Dewatering

The purpose and design bases of the components of these technology options are described below. These technologies are also described in further detail in Section 7.3.

Oil/Water Separation

Purpose: Removal of entrained oil and grease.

Design Basis: API separator with slotted pipe surface oil skimmer, fabric belt skimmer for entrained thin oils, and bottom sludge rake. Includes oil storage tank and sludge storage tank.

Equalization

Purpose: Reduce wastewater variability and accumulate wastewater to optimize subsequent treatment system size and operating costs.

Design Basis: Two tanks in parallel, each with minimum 24-hour residence time. Includes aerators to homogenize wastewater.

Dissolved Air Flotation

Purpose: Removal of entrained solid or liquid particles.

Design Basis: Dissolved air flotation unit with recycle pressurization system. Includes chemical addition systems for polymers (coagulants and flocculant) and pH adjustment, sludge collection tank, and pre-fabricated building.

Biological Treatment

Purpose: Biologically decompose organic constituents.

Design Basis: Activated sludge biological treatment system with a 4.6-day residence time. Includes two preaeration tanks in series and a sludge storage tank.

Organo-Clay/Activated Carbon Adsorption

Purpose: Wastewater polishing.

Design Basis: Two columns in series - organo-clay followed by carbon - with nominal carbon change-out frequency of one vessel per month and nominal organo-clay change-out frequency of one vessel every two months. Includes organo-clay charge of 1.44 ft^3/gpm/vessel and carbon charge of 1.44 ft^3/gpm/vessel.

Sludge Dewatering

Purpose: Reduce sludge volume by removing water.

Design Basis: Plate-and-frame filter press. Generates dewatered sludge at 32.5% solids. Includes sludge storage tank.

All existing direct discharging facilities in this subcategory currently employ equalization, pH adjustment, biological treatment and sludge dewatering. All existing direct discharging facilities also operate simple oil/water separators such as gravity separators or oil skimmers.

8.2.3 BPT Options for the Barge/Chemical & Petroleum Subcategory

BPT options for the Barge/Chemical & Petroleum Subcategory include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Oil/Water Separation, Dissolved Air Flotation, Filter Press, Biological Treatment, and Sludge Dewatering

Option 2: Oil/Water Separation, Dissolved Air Flotation, Filter Press, Biological Treatment, Reverse Osmosis, and Sludge Dewatering

The purpose and design bases of the components of these technology options are described below. These technologies are also described in further detail in Section 7.3.

Oil/Water Separation

Purpose: Removal of low to moderate amounts of insoluble oil.

Design Basis: Gravity separator with 6.4-day residence time for wastewater equalization and oil, water, and solids separation. Includes two separation tanks in series with an oil removal pump and an oil storage tank.

Dissolved Air Flotation

Purpose: Removal of entrained solid or liquid particles.

Design Basis: Dissolved air flotation unit with influent pressurization system. Includes sludge storage tank.

Filter Press

Purpose: Wastewater filtration.

Design Basis: In-line plate-and-frame filter press for wastewater filtration. Generates dewatered sludge at 32.0% solids. Includes diatomaceous earth mix tank and wastewater effluent storage tank.

Biological Treatment

Purpose: Biologically decompose organic constituents.

Design Basis: Activated sludge biological treatment system with a 4.6-day residence time. Includes two preaeration tanks in series, a clarifier with polymer addition for additional solids removal, and a sludge storage tank.

Reverse Osmosis

Purpose: Wastewater polishing.

Design Basis: Reverse osmosis system including unit with membranes, influent wastewater storage tanks, and flooded suction tank.

Sludge Dewatering

Purpose: Reduce biological treatment sludge volume by removing water.

Design Basis: Sludge is dewatered in in-line wastewater plate-and-frame filter press described above.

Note that following the proposed rule, EPA obtained additional treatment performance data for conventional pollutants from two facilities that EPA determined also operated BPT treatment. The technologies operated by these facilities include:

Facility 1: Gravity separation (1.25-day residence time), equalization and solids settling (1.85-day residence time), sand filtration (2-hour residence time), biological treatment with chemically assisted clarification (4-day residence time), and batch flocculation (1.8-day residence time).

Facility 2: Gravity separation (61-day residence time), equalization (30-day residence time), biological treatment with chemically assisted clarification (21-day residence time), and sand filtration (less than 10-minute residence time).

EPA considers the level of pollutant control demonstrated by these facilities to be equivalent to Option 1.

8.2.4 BPT Options for the Food Subcategory

BPT options for the Food Subcategory include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Oil/Water Separation

Option 2: Oil/Water Separation, Equalization, Biological Treatment, and Sludge Dewatering

The purpose and design bases of the components of these technology options are described below. These technologies are also described in further detail in Section 7.3.

Oil/Water Separation

Purpose: Removal of low to moderate amounts of insoluble oil.

Design Basis: Gravity separator with 6.4-day residence time for wastewater equalization and oil, water, and solids separation. Includes two separation tanks in series with an oil removal pump and an oil storage tank.

Equalization

Purpose: Reduce wastewater variability and accumulate wastewater to optimize subsequent treatment system size and operating costs.

Design Basis: Eight-day residence time. Includes aerators/mixers to homogenize wastewater.

Biological Treatment

Purpose: Biologically decompose organic constituents.

Design Basis: Activated sludge biological treatment system with a 4.6-day residence time. Includes two preaeration tanks in series and a sludge storage tank.

Sludge Dewatering

Purpose: Reduce biological treatment sludge volume by removing water.

Design Basis: Plate-and-frame filter press for wastewater filtration. Generates dewatered sludge at 32.0% solids. Includes diatomaceous earth mix tank.

Based on Screener Questionnaire results, EPA estimates that there are 19 direct discharging facilities in the Food Subcategory. However, EPA's survey of the TECI did not identify any direct discharging facilities through the Detailed Questionnaire sample population.

The wastewater generated by the Food Subcategory contains high loadings of biodegradable organics, and few toxic pollutants. EPA conducted sampling at a direct discharging barge/food facility which EPA believes to be representative of the entire subcategory population.

8.2.5 BPT Options for the Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories

BPT options for the Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Gravity Separation

The purpose and design bases of the components of this technology option are described below. This technology is also described in further detail in Section 7.3.

Gravity Separation

Purpose: Removal of suspended solids.

Design Basis: Gravity separator with 4-day residence time for wastewater equalization and solids separation. Includes two separation tanks in series.

8.3 Best Conventional Pollutant Control Technology (BCT)

BCT limitations control the discharge of conventional pollutants from direct dischargers. Conventional pollutants include BOD, TSS, oil and grease, and pH. BCT is not an additional limitation, but rather replaces BAT for the control of conventional pollutants. To develop BCT limitations, EPA conducts a cost reasonableness evaluation, which consists of a two-part cost test: 1) the POTW test, and 2) the industry cost-effectiveness test.

In the POTW test, EPA calculates the cost per pound of conventional pollutants removed by industrial dischargers in upgrading from BPT to a BCT candidate technology and then compares this to the cost per pound of conventional pollutants removed in upgrading POTWs from secondary to tertiary treatment. The upgrade cost to industry, which is represented in dollars per pound of conventional pollutants removed, must be less than the POTW benchmark of $0.25 per pound (in 1976 dollars). In the industry cost-effectiveness test, the ratio of the incremental BPT to BCT cost, divided by the BPT cost for the industry, must be less that 1.29 (i.e. the cost increase must be less than 29 percent).

In developing BCT limits, EPA considered whether there are technologies that achieve greater removals of conventional pollutants than for BPT, and whether those technologies are cost-reasonable according to the BCT Cost Test. In each subcategory, EPA considered the same technologies and technology options when developing BCT options as were developed for BPT.

8.4 Best Available Technology Economically Achievable (BAT)

The factors considered in establishing a BAT level of control include: the age of process equipment and facilities, the processes employed, process changes, the engineering aspects of applying various types of control techniques to the costs of applying the control technology, non-water quality environmental impacts such as energy requirements, air pollution and solid waste generation, and such other factors as the Administrator deems appropriate (Section 304(b)(2)(B) of the Act). In general, the BAT technology level represents the best existing economically achievable performance among facilities with shared characteristics. BAT may include process changes or internal plant controls which are not common in the industry. BAT may also be transferred from a different subcategory or industrial category.

In each subcategory, EPA considered the same technologies and technology options when developing BAT options as were developed for BPT.

8.5 New Source Performance Standards (NSPS)

New Source Performance Standards under Section 306 of the CWA represent the greatest degree of effluent reduction achievable through the application of the best available demonstrated control technology for all pollutants (i.e., conventional, nonconventional, and toxic pollutants). NSPS are applicable to new industrial direct discharging facilities. Congress envisioned that new treatment systems could meet tighter controls than existing sources because of the opportunity to incorporate the most efficient processes and treatment systems into plant design. Therefore, Congress directed EPA, in establishing NSPS, to consider the best demonstrated process changes, in-plant controls, operating methods, and end-of-pipe treatment technologies that reduce pollution to the maximum extent feasible.

In each subcategory, EPA considered the same technologies and technology options when developing NSPS options as were developed for BPT.

8.6 Pretreatment Standards for Existing Sources (PSES)

Pretreatment standards are designed to prevent the discharge of toxic pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs, as specified in Section 307(b) of the CWA. PSES are technology-based and analogous to BAT limitations for direct dischargers.

8.6.1 PSES Options for the Truck/Chemical & Petroleum Subcategory

PSES options for the Truck/Chemical & Petroleum Subcategory include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option A: Equalization and Oil/Water Separation

Option 1: Equalization, Oil/Water Separation, Chemical Oxidation, Neutralization, Coagulation, Clarification, and Sludge Dewatering

Option 2: Equalization, Oil/Water Separation, Chemical Oxidation, Neutralization, Coagulation, Clarification, Activated Carbon Adsorption, and Sludge Dewatering

The purpose and design bases of the components of these technology options are described below. These technologies are also described in further detail in Section 7.3.

Equalization

Purpose: Reduce wastewater variability and accumulate wastewater to optimize subsequent treatment system size and operating costs.

Design Basis: Minimum 24-hour residence time. Includes aerators/mixers to homogenize wastewater.

Oil/Water Separation

Purpose: Removal of entrained oil and grease.

Design Basis: Vertical tube coalescing separator with rotary oil skimmer. Includes demulsifier chemical additive, and oil storage tank.

Chemical Oxidation, Neutralization, Coagulation, and Clarification

Purpose: Chemical Oxidation - chemically oxidize pollutants using oxidants such as hydrogen peroxide.

Neutralization - adjust wastewater pH.

Coagulation - destabilize (reduce repulsive interaction) particle suspension using electrolytes to aggregate suspended matter.

Clarification - settle and remove agglomerated coagulated solids.

Design Basis: Turn-key treatment system consisting of four reaction tanks in series plus a clearwell. Includes chemical feed systems, mixers, control system, and sludge storage tanks.

Carbon Adsorption

Purpose: Wastewater polishing.

Design Basis: Two carbon columns in series with nominal carbon change-out frequency of once per month. Includes carbon charge of 250 lb/gpm/vessel.

Sludge Dewatering

Purpose: Reduce sludge volume by removing water.

Design Basis: Plate-and-frame filter press. Generates dewatered sludge at 32.5% solids.

8.6.2 PSES Options for the Rail/Chemical & Petroleum Subcategory

PSES options for the Rail/Chemical & Petroleum Subcategory include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Oil/Water Separation

Option 2: Oil/Water Separation, Equalization, Dissolved Air Flotation (with Flocculation and pH Adjustment), and Sludge Dewatering

Option 3: Oil/Water Separation, Equalization, Dissolved Air Flotation (with Flocculation and pH Adjustment), Organo-Clay/Activated Carbon Adsorption, and Sludge Dewatering

The purpose and design bases of the components of these technology options are described below. These technologies are also described in further detail in Section 7.3.

Oil/Water Separation

Purpose: Removal of entrained oil and grease.

Design Basis: API separator with slotted pipe surface oil skimmer, fabric belt skimmer for entrained thin oils, and bottom sludge rake. Includes oil storage tank and sludge storage tank.

Equalization

Purpose: Reduce wastewater variability and accumulate wastewater to optimize subsequent treatment system size and operating costs.

Design Basis: Two tanks in parallel, each with minimum 24-hour residence time. Includes aerators to homogenize wastewater.

Dissolved Air Flotation

Purpose: Removal of entrained solid or liquid particles.

Design Basis: Dissolved air flotation unit with recycle pressurization system. Includes chemical addition systems for polymers (coagulants and flocculant) and pH adjustment, sludge collection tank, and pre-fabricated building.

Organo-Clay/Activated Carbon Adsorption

Purpose: Wastewater polishing.

Design Basis: Two columns in series - organo-clay followed by carbon - with nominal carbon change-out frequency of one vessel per month and nominal organo-clay change-out frequency of one vessel every two months. Includes organo-clay charge of 1.44 ft^3/gpm/vessel and carbon charge of 1.44 ft^3/gpm/vessel.

Sludge Dewatering

Purpose: Reduce sludge volume by removing water.

Design Basis: Plate-and-frame filter press. Generates dewatered sludge at 32.5% solids. Includes sludge storage tank.

8.6.3 PSES Options for the Barge/Chemical & Petroleum Subcategory

PSES options for the Barge/Chemical & Petroleum Subcategory include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Oil/Water Separation, Dissolved Air Flotation, and Filter Press

Option 2: Oil/Water Separation, Dissolved Air Flotation, Filter Press, Biological Treatment, and Sludge Dewatering

Option 3: Oil/Water Separation, Dissolved Air Flotation, Filter Press, Biological Treatment, Reverse Osmosis, and Sludge Dewatering

The purpose and design bases of the components of these technology options are described below. These technologies are also described in further detail in Section 7.3.

<u>Oil/Water Separation</u>

Purpose: Removal of low to moderate amounts of insoluble oil.

Design Basis: Gravity separator with 6.4-day residence time for wastewater equalization and oil, water, and solids preparation. Includes two separation tanks in series with an oil removal pump and an oil storage tank.

<u>Dissolved Air Flotation</u>

Purpose: Removal of entrailed solid or liquid particles.

Design Basis: Dissolved air flotation unit with influent pressurization system. Includes sludge storage tank.

<u>Filter Press</u>

Purpose: Wastewater filtration.

Design Basis: In-line plate-and-frame filter press for wastewater filtration. Generates dewatered sludge at 32.0% solids. Includes diatomaceous earth mix tank and wastewater effluent storage tank.

Biological Treatment

Purpose: Biologically decompose organic constituents.

Design Basis: Activated sludge biological treatment system with a 4.6-day residence time. Includes two preaeration tanks in series, a clarifier with polymer addition for additional solids removal, and a sludge storage tank.

Reverse Osmosis

Purpose: Wastewater polishing.

Design Basis: Reverse osmosis system including unit with membranes, influent wastewater storage tanks, and flooded suction tank.

Sludge Dewatering

Purpose: Reduce biological treatment sludge volume by removing water.

Design Basis: Sludge is dewatered in in-line wastewater plate-and-frame filter press described above.

8.6.4 PSES Options for the Food Subcategory

PSES options for the Food Subcategory include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Oil/Water Separation

Option 2: Oil/Water Separation, Equalization, Biological Treatment, and Sludge Dewatering

The purpose and design bases of the components of these technology options are described below. These technologies are also described in further detail in Section 7.3.

Oil/Water Separation

Purpose: Removal of low to moderate amounts of insoluble oil.

Design Basis: Gravity separator with 6.4-day residence time for wastewater equalization and oil, water, and solids separation. Includes two separation tanks in series with an oil removal pump and an oil storage tank.

Equalization

Purpose: Reduce wastewater variability and accumulate wastewater to optimize subsequent treatment system size and operating costs.

Design Basis: Eight-day residence time. Includes aerators/mixers to homogenize wastewater.

Biological Treatment

Purpose: Biologically decompose organic constituents.

Design Basis: Activated sludge biological treatment system with a 4.6-day residence time. Includes two preaeration tanks in series and a sludge storage tank.

Sludge Dewatering

Purpose: Reduce biological treatment sludge volume by removing water.

Design Basis: Plate-and-frame filter press for wastewater filtration. Generates dewatered sludge at 32.0% solids. Includes diatomaceous earth mix tank.

8.6.5 PSES Options for the Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories

PSES options for the Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories include the following technology bases in addition to good heel removal as discussed in Section 8.1.

Option 1: Gravity Separation

The purpose and design bases of the components of this technology option are described below. This technology is also described in further detail in Section 7.3.

Gravity Separation

Purpose: Removal of suspended solids.

Design Basis: Gravity separator with 4-day residence time for wastewater equalization and solids separation. Includes two separation tanks in series.

8.6.6 Pollution Prevention Alternative

EPA also considered an enforceable pollution prevention alternative, referred to as the Pollutants Management Plan. The ten components of this plan include:

(i) procedures for identifying cargos, the cleaning of which is likely to result in discharges of pollutants that would be incompatible with treatment at the POTW;

(ii) for cargos identified as being incompatible with treament at the POTW, the plan shall provide that heels be fully drained, segregated from other wastewaters, and handled in an appropriate manner;

(iii) for cargos identified as being incompatible with treatment at the POTW, the Plan shall provide that the tank be prerinsed or presteamed as appropriate and the wastewater segregated from wastewaters to be discharged to the POTW and handled in an appropriate manner, where necessary to ensure that they do not cause or contribute to a discharge that would be incompatible with treatment at the POTW;

(iv) all spent cleaning solutions, including interior caustic washes, interior presolve washes, interior detergent washes, interior acid washes, and exterior acid brightener washes shall be segregated from other wastewaters and handled in an appropriate manner, where necessary to ensure that they do not cause or contribute to a discharge that would be incompatible with treatment at the POTW;

(v) provisions for appropriate recycling or reuse of cleaning agents;

(vi) provisions for minimizing the use of toxic cleaning agents (solvents, detergents, or other cleaning or brightening solutions);

(vii) provisions for appropriate recycling or reuse of segregated wastewaters (including heels and prerinse/pre-steam wastes);

(viii) provisions for off-site treatment or disposal, or effective pre-treatment of segregated wastewaters (including heels, prerinse/pre-steam wastes, spent cleaning solutions);

(ix) information on the volumes, content, and chemical characteristics of cleaning agents used in cleaning or brightening operations; and

(x) provisions for maintaining appropriate records of heel management procedures, prerinse/pre-steam management procedures, cleaning agent management procedures, operator training, and proper operation and maintenance of any pre-treatment system.

8.7 Pretreatment Standards for New Sources (PSNS)

Section 307 of the CWA requires EPA to promulgate both pretreatment standards for new sources and new source performance standards. New indirect discharging facilities, like new direct discharging facilities, have the opportunity to incorporate the best available demonstrated technologies including: process changes, in-facility controls, and end-of-pipe treatment technologies.

In each subcategory, EPA considered the same technologies and technology options when developing PSNS options as were developed for PSES.

9.0 COSTS OF TECHNOLOGY BASES FOR REGULATIONS

This section describes the methodology used to estimate the implementation costs associated with each of the regulatory options under consideration for the Transportation Equipment Cleaning Industry (TECI). Section 8.0 describes in detail the regulatory options and the technologies used as the bases for those options. The cost estimates presented in this section, together with the pollutant reduction estimates described in Section 10.0, provide a basis for evaluating the regulatory options and determining the economic impact of the final regulation on the TECI. The results of the economic impact assessment for the regulation are found in the Economic Assessment (EA) for the TECI final rulemaking (1).

EPA used the following approach to estimate compliance costs for the TECI:

- EPA mailed Detailed Questionnaires to a statistical sample of transportation equipment cleaning (TEC) facilities (discussed in Section 3.2.3). Information from the 81 facilities that responded to the questionnaire was used to characterize industry-wide TEC operations, operating status, and pollutant control technologies in place for the baseline year (1994). EPA also used information from Screener Questionnaire responses (discussed in Section 3.2.2) and other sources for four direct discharging facilities to characterize the baseline for direct dischargers in two industry subcategories (see Section 9.1.2).

- EPA collected and analyzed field sampling data to determine the pollutant concentrations in untreated TEC-process wastewater (discussed in Section 6.0).

- EPA identified candidate pollution prevention and wastewater treatment technologies and grouped appropriate technologies into regulatory options (discussed in Section 8.0). The regulatory options serve as the bases of compliance cost and pollutant loading calculations.

- EPA performed sampling episodes at best performing facilities to determine pollutant removal performance for the identified technologies (see Section 10.0).

- EPA developed cost equations for capital and operating and maintenance (O&M) costs for water conservation practices (discussed in Section 9.2.7) and each technology included in the regulatory options (discussed in Section 9.2.4) based on information gathered from TEC facilities, wastewater treatment system vendors, technical literature, and on engineering judgement.

- EPA developed and used an electronic cost model to estimate compliance costs (discussed in Section 9.3) and pollutant loadings (discussed in Section 10.0) for each regulatory option.

- EPA used output from the cost model to estimate total annualized costs, cost-effectiveness values, and the economic impact of each regulatory option on the TECI (presented in the EA).

EPA estimated facility compliance costs for 19 unique technology options. Table 9-1 at the end of this section lists the number of technology options for which EPA estimated facility compliance costs.

The following information is discussed in this section:

- Section 9.1: Development of model sites;

- Section 9.2: Methodology used to estimate compliance costs;

- Section 9.3: Design and cost elements for pollutant control technologies;

- Section 9.4: Summary of estimated compliance costs by regulatory option; and

- Section 9.5: References.

EPA also evaluated a pollution prevention alternative as discussed in Section 8.6.6. Because EPA is considering the pollution prevention plan as an alternative to meeting the numeric standards, EPA believes that the costs of this plan will be less than the costs of any of EPA's selected options because a facility will choose to adopt the most cost effective option available to it.

9.1 Development of Cost Model Inputs

This section describes the development of the key inputs to the TECI cost model: model sites and pollutant control technologies.

9.1.1 Model Site Development

The Agency used a model site approach to estimate regulatory compliance costs for the TECI. A model site is an operating TEC facility whose data were used as input to the TECI cost model. A total of 81 facilities were used as model sites for the cost analysis because each meets the following criteria:

- The facility discharges 100,000 gallons or more per year of TEC process wastewater either directly to surface waters or indirectly to a publicly-owned treatment works (POTW); and
- The facility supplied sufficient economic and technical data to estimate compliance costs and assess the economic impacts of these costs. Such data include daily flow rate, operating schedules, tank cleaning production and types of tanks cleaned, existing treatment in place, and economic status for the base year 1994.

As discussed in Section 3.2.3, EPA mailed Detailed Questionnaires to a statistical sample of TEC facilities. EPA evaluated each of the 176 respondents to determine whether the facility would be potentially affected by the regulatory options considered by the Agency and would therefore incur costs as a result of potential regulations. Ninety-five facilities would not incur costs because:

- The facility is subject to other Clean Water Act final or proposed categorical standards and, therefore, meets EPA's exclusion for industrial and commercial facilities (34 facilities);
- The facility discharges less than 100,000 gallons per year of TEC process wastewater (12 facilities); or

- The facility is a zero or alternative discharging facility (i.e., does not discharge TEC wastewater either directly or indirectly to a surface water) and thus would not be subject to the limitations and standards for this guideline (49 facilities).

Each of the 81 facilities is considered a "model" facility since it represents a larger number of facilities in the overall industry population as determined by its statistical survey weight. The Statistical Support Document (2) discusses in detail the development of the survey weights. These facilities represent an estimated industry population of 692 facilities that discharge either directly to surface waters or indirectly to a POTW. EPA selected a facility-by-facility model approach to estimate compliance costs, as opposed to a more general modeling approach, to better characterize the variability of processes and resultant wastewaters among TEC facilities.

Although EPA estimated regulatory compliance costs on a facility-by-facility basis, EPA made certain engineering assumptions based on information from standard engineering costing publications, equipment vendors, and industry-wide data. Thus, for any given model facility (or facilities represented by the model facility), the estimated costs may deviate from those that the facility would actually incur. However, EPA considers the compliance costs to be accurate when evaluated on an industry-wide, aggregate basis.

9.1.2 Supplemental Model Site Development

EPA reviewed the 81 model facilities and identified direct dischargers in two subcategories (Barge/Chemical & Petroleum and Barge/Hopper), but none in the remaining subcategories. To assess the need to develop limitations and standards for direct dischargers for the remaining subcategories, EPA reviewed the Screener Questionnaire sample population to identify direct discharging facilities that would be subject to these regulations. This review identified the following direct dischargers by subcategory:

- Truck/Chemical & Petroleum (three facilities in sample population);
- Rail/Chemical & Petroleum (one facility in sample population); and

- Food (three facilities in sample population).

EPA decided to estimate compliance costs for direct dischargers in the Truck/Chemical & Petroleum and Rail/Chemical & Petroleum Subcategories for the following reasons:

- Regulatory options considered for direct and indirect dischargers differ (i.e., regulatory options for direct dischargers include biological treatment while those for indirect dischargers do not); and

- Dissimilar regulatory options may result in significantly different estimated compliance costs.

Technical information required to estimate compliance costs for these facilities was obtained from the Screener Questionnaire responses, telephone conversations with facility personnel, and facility NPDES permits.

Note that the estimated compliance costs for these direct dischargers are not added to the costs estimated for the 81 model sites (described in Section 9.1) to obtain industry-wide cost estimates. Statistically, compliance costs for these direct dischargers are included within the industry-wide cost estimates based on the 81 model facilities. Therefore, EPA used estimated compliance costs for these direct dischargers only to assess in greater detail the impact of the limitations on these facilities.

EPA estimates that the compliance costs for direct dischargers in the Food Subcategory will be zero or insignificant for the following reasons:

- All of these facilities identified by EPA currently operate biological treatment and are believed to currently achieve the final limitations; and

- EPA assumes that current NPDES permits for these facilities require frequent monitoring for pollutant parameters regulated by this guideline (i.e., BOD_5, TSS, and oil and grease). Therefore, these facilities will not incur additional monitoring costs as a result of this rulemaking.

Based on this assessment, EPA believes that developing model sites in the TECI cost model for direct discharging food grade facilities is not necessary.

9.1.3 Pollutant Control Technology Development

EPA evaluated Screener and Detailed Questionnaire responses to identify applicable pollution prevention and wastewater treatment technologies for the TECI and to select facilities for EPA's TECI site visit and sampling program. EPA conducted 44 engineering site visits at 43 facilities to collect information about TEC processes, water use practices, pollution prevention practices, wastewater treatment technologies, and waste disposal methods. Based on the information gathered from these site visits, EPA sampled untreated and/or treated wastewater streams at 18 facilities. EPA also collected treatment performance data from two additional Barge/Chemical & Petroleum facilities operating BAT/BPT treatment (see Section 3.5). Sections 3.3 and 3.4 discuss in more detail the engineering site visit and sampling program conducted as part of the TECI rulemaking.

In most cases, the specific pollutant control technologies costed, including equipment, chemical additives and dosage rates, and other O&M components, are the same as those operated by the facilities whose sampling data are used to represent the performance options, with adjustments made to reflect differences in wastewater flow rates or other facility-specific conditions. For example, BPT and PSES Options 1 and 2 for the Truck/Chemical & Petroleum Subcategory include chemical oxidation, neutralization, coagulation, and clarification and are specifically based on a turn-key system characterized during wastewater sampling. Therefore, EPA's estimated compliance costs are based upon implementation of a turn-key chemical oxidation, neutralization, coagulation, clarification system. EPA chose this approach to ensure that the technology bases of the regulatory options can achieve the limitations and standards, and that the estimated compliance costs reflect implementation of these technology bases. EPA believes this approach overestimates the compliance costs because many facilities can likely achieve the limitations and standards by implementing less expensive pollution prevention practices, substituting less expensive alternative equipment, or utilizing equipment in place that EPA did not assess as equivalent to the technology basis (see Section 9.2.5 for more detail on treatment-in-place credits).

EPA emphasizes that the regulations do not require that a facility install or possess these technologies, but only that the facility comply with the appropriate effluent limitations and standards.

9.1.4 Model Sites with Production in Multiple Subcategories

Some model facilities have production in more than one subcategory. For example, a facility that cleans both tank trucks and rail tank cars that last transported chemical cargos has production in both the Truck/Chemical & Petroleum and Rail/Chemical & Petroleum Subcategories. To simplify compliance costs and pollutant reduction estimates, EPA assigned each multiple-subcategory facility a primary subcategory. For these facilities, compliance costs and pollutant reduction estimates for all facility production are assigned to the primary subcategory. This methodology may bias the subcategory cost and pollutant reduction estimates on a facility-by-facility basis; however, EPA believes that subcategory costs and pollutant reduction estimates are accurate on an aggregate basis (i.e., individual facility biases are offset within each subcategory in aggregate).

This simplification is necessary because the technology bases of the regulatory options differ for each subcategory. EPA considered an alternative approach that included designing separate treatment systems for subcategory-specific wastewater based on the subcategory regulatory options. However, to comply with the regulations, a facility can implement any technology it chooses, provided it achieves the effluent limitations. Installation of two (or more) separate treatment systems is not a practical or cost-effective solution to comply with the regulations. Therefore, EPA rejected this alternative approach.

Compliance costs and pollutant reduction estimates for individual facilities that clean multiple tank types are based on the assumption that facilities will install and operate the technologies chosen as the technology basis for each facility's primary subcategory. EPA does not have data available demonstrating that the technologies costed to treat each primary subcategory will effectively treat wastewaters from all potential secondary subcategories. For example, EPA does not have data available on the performance of the Truck/Chemical & Petroleum Subcategory technology bases in treating Rail/Chemical & Petroleum Subcategory wastewater. However, EPA believes that the costed technology for the Truck/Chemical & Petroleum Subcategory option will control all pollutants of interest in all TEC wastewaters generated by each facility because the control technologies included in the different technology bases use similar pollutant removal mechanisms (e.g., chemical/physical treatment, secondary biological treatment, and advanced treatment for wastewater polishing).

For these reasons, EPA believes that its costing methodology for multiple-subcategory facilities is appropriate and adequately represents the compliance costs and pollutant reductions for these facilities.

9.2 Costing Methodology

To accurately determine the impact of the effluent limitations guidelines and standards on the TECI, EPA estimated costs associated with regulatory compliance. The Agency developed a cost model to estimate compliance costs for each of the regulatory options under BPT, BCT, BAT, PSES, PSNS, and NSPS. EPA, used the cost model to estimate costs associated with implementation of the pollutant control technologies used as the basis for each option. However, EPA did not use the cost model to estimate compliance costs for the Barge/Chemical & Petroleum Subcategory, rather EPA used a site-specific approach to assign compliance costs (see Section 9.2.9). Again, the regulations do not require that a facility install and possess these technologies but only that the appropriate facility effluent limitations and standards be achieved.

In addition, EPA included water conservation in its costing methodology. Although water conservation technologies are not included in EPA's technology options, EPA retained these technologies as a cost-effective compliance strategy for several subcategories (see Section 9.2.7).

9.2.1 Wastewater Streams Costed

Based on information provided by the sites in their Detailed Questionnaire (or Screener Questionnaire in the case of the four direct dischargers without a Detailed Questionnaire), follow-up letters, and telephone calls, EPA classified each wastewater stream at each site as TEC interior cleaning wastewater, other TEC commingled wastewater stream, or non-TEC wastewater. The following additional questionnaire data were used to characterize wastewater streams:

- Flow rate;
- Production rate (i.e., types and number of tanks cleaned); and
- Operating schedule.

EPA first reviewed wastewater streams discharged by each facility and classified these streams as interior cleaning wastewater or other commingled wastewater stream. Facilities that clean tanks representing multiple modes of transportation (e.g., road, rail, or waterway) or that clean both tanks and closed-top hoppers are considered to have multiple wastewater streams. However, as discussed in Section 9.1.4, these facilities are assigned a primary subcategory, and the TECI cost model costs the flow contribution of wastewater from any secondary subcategory as primary subcategory wastewater.

Wastewater considered in developing compliance costs consists of tank interior cleaning wastewater and other commingled wastewater streams not easily segregated. Examples of interior cleaning wastewater are water, condensed steam, prerinse cleaning solutions, chemical cleaning solutions, and final rinse solutions generated from cleaning tank and container interiors. Examples of other commingled waste streams not easily segregated are tank or trailer exterior cleaning wastewater, equipment and floor washings, TEC-contaminated stormwater, boiler blowdown, bilge and ballast waters, and other non-TEC wastewater streams that are commingled with TEC wastewaters. Incidental and non-TEC wastewater streams are included in developing the compliance costs because these streams are difficult or costly to segregate and treat separately from TEC wastewater.

Wastewater streams not considered in developing compliance costs include sanitary wastewater; tank hydrotesting wastewater; and repair, rebuilding, and maintenance wastewater. These wastewater streams are not costed for treatment because they do not fall within the scope of the TECI rulemaking (e.g., they fall under the scope of another rulemaking) and they are generally easily segregated from TEC wastewaters.

9.2.2 Influent Pollutant Concentrations

The concentration of each pollutant in each model site TEC wastewater stream was estimated using field sampling pollutant loadings data for wastewater discharged by tank type. Section 3.4 discusses the field sampling program. These data are used with Detailed or Screener Questionnaire flow, tank cleaning production, and operating data to calculate the influent concentrations. Section 10.0 describes these calculations in more detail.

9.2.3 Cost Model Development

EPA developed a computerized design and cost model to estimate compliance costs and pollutant reductions for the TECI technology options for the following subcategories:

- Truck/Chemical & Petroleum;
- Rail/Chemical & Petroleum;
- Barge/Chemical & Petroleum (indirect dischargers only);
- Food;
- Truck/Hopper;
- Rail/Hopper; and
- Barge/Hopper.

(The costing methodology developed for direct dischargers in the Barge/Chemical & Petroleum Subcategory is discussed in Section 9.2.9.)

EPA evaluated the following existing cost models from other EPA effluent guidelines development efforts to be used as the basis for the TECI cost model:

- Metal Products and Machinery (MP&M) Phase I Industries Design and Cost Model; and

- Pharmaceuticals Industry Cost Model.

EPA incorporated modified components of both models in the TECI cost model.

The TECI cost model contains technology “modules,” or subroutines; each module calculates direct capital and annual costs for installing and operating a particular wastewater treatment or pollution reduction technology. In general, each module is exclusive to one control technology. For each regulatory option, the TECI cost model combines a series of technology modules. There are also module-specific “drivers” (technology drivers) that operate in conjunction with the technology modules. These drivers access input data, run the corresponding modules, and populate output databases. The technology drivers are bound together by primary drivers, which run the technology drivers in the appropriate order for each regulatory option.

EPA adapted the MP&M cost model drivers for the TECI cost model with the following modifications:

- Costs are tracked by subcategory. The MP&M cost model was not designed to develop separate costs and loads by subcategory.

- All data values calculated by the cost model are stored in an output database file. This allows the cost model user to examine the importance of each calculated value for each technology module.

The input data to the cost model include production data (i.e., types and number of tanks cleaned), wastewater flow, existing technology in place, operational hours per day, and operational days per year. EPA obtained the flow rates, operating schedules, production data, and existing treatment-in-place data from Detailed Questionnaire responses from each facility (and other data sources for supplemental facilities, as discussed in Section 9.1.2). These data comprise the input data for the technology modules. Each module manipulates the input data (stored in data storage files) to generate output data (stored in different data storage files), which represent costs incurred by implementing the costed technology. The output data storage files become the input data storage files for subsequent technology modules, enabling the cost model to track operating hours per day and days per year, flows, and costs for use in subsequent modules.

9.2.4 Components of Compliance Costs

EPA used the TECI cost model to calculate capital costs and annual O&M costs for each technology and to sum the capital and O&M costs for all technologies at each facility. Capital costs comprise direct and indirect costs associated with the purchase, delivery, and installation of pollutant control technologies. Annual O&M costs comprise all costs related to operating and maintaining the treatment system for a period of one year, including the estimated costs for compliance monitoring of wastewater discharges. These compliance costs components are described in detail in the following subsections.

9.2.4.1 Capital Costs

The TECI cost model uses the cost equations listed in Table 9-2 to estimate the direct capital costs for purchasing, delivering, and installing equipment included in the technology bases for each regulatory option. Where possible, cost sources (i.e., vendors) provide all three cost components for varying sized equipment. Where a vendor quote is not available, literary references or estimates based on engineering judgement are used to estimate direct capital cost. Direct capital costs consist of the following:

- Purchase of treatment equipment and any accessories;
- Purchase of treatment equipment instrumentation (e.g., pH probes and control systems);
- Installation costs (e.g., labor and rental fees for equipment such as cranes);
- Delivery cost based on transporting the treatment system an average of 500 miles;
- Construction of buildings or other structures to house major treatment units (e.g., foundation slab, enclosure, containment, and lighting and electricity hook-ups); and
- Purchase of necessary pumps (e.g., for wastewater transfer, chemical addition, and sludge handling).

Indirect capital costs are not technology-specific and are instead represented as a factor that is applied to the direct capital costs in the post-processing portions of the TECI cost model. Indirect capital costs typically include the following:

- Purchase and installation of necessary piping to interconnect treatment system units (e.g., pipe, pipe hangers, fittings, valves, insulation, similar equipment);
- Secondary containment and land costs;
- Excavation and site work (e.g., site clearing, landscaping, fences, walkways, roads, parking areas);
- Engineering costs (e.g., administrative, process design and general engineering, communications, consultant fees, legal fees, travel, supervision, and inspection of installed equipment);
- Construction expenses (e.g., construction tools and equipment, construction supervision, permits, taxes, insurance, interest);
- Contractors’ fees; and
- Contingency (e.g., allocation for unpredictable events such as foul weather, price changes, small design changes, and errors in estimates).

Total capital investment (direct and indirect capital costs) is obtained by multiplying the direct capital cost by various indirect capital cost factors, summing them, and then adding start-up costs as shown in Table 9-3.

Capital cost equations relate direct capital cost to equipment design parameters, such as wastewater flow. Equipment component designs are generally based upon the equipment operated by the facilities whose sampling data are used as the basis for the technology options. To relate the design of the equipment operated by the sampled facility to that required by the costed facilities, the TECI cost model typically uses a “design equation.” For example, a sampled facility with a nominal wastewater flow rate of 50 gpm operates a 65-gpm dissolved air flotation (DAF) unit. The design equation developed for the DAF unit is:

$$\text{DAFGPM} = \text{INFGPM} \times \left(\frac{65}{50}\right) = \text{INFGPM} \times 1.3 \qquad (1)$$

where:

DAFGPM	=	DAF unit nominal capacity (gpm)
INFGPM	=	Influent flow rate (gpm)

In this example, the equipment design parameter for the DAF unit is the facility’s wastewater flow rate, and the equipment costing parameter is the DAF unit’s nominal capacity.

Cost equations are used throughout the TECI cost model to determine direct capital costs. For a given equipment component, a cost curve is developed by plotting different equipment sizes versus direct capital costs. Equipment sizes used to develop the cost equations correspond to the range of sizes required by the costed facilities based on an influent flow rate or volume requirement. The cost/size data point pairs are plotted and an equation for the curve that provides the best curve fit for the plotted points with the least standard error is calculated. The equations calculated to fit the cost curves are most commonly polynomial, but may be linear, exponential, or logarithmic.

Because of the variability in wastewater flow rates at TEC facilities, equipment design equations estimate that some facilities would require very small pieces of equipment. In some instances, EPA determined that very small equipment is either not commercially available or not technically feasible. In these cases, the facility is costed for the smallest equipment size that is both commercially available and technically feasible. For wastewater streams requiring equipment with a capacity above the maximum-sized unit commercially available and technically feasible, multiple units of equal capacity are designed to operate in parallel.

9.2.4.2 Annual Costs

Annual cost components include costs for operational labor, maintenance and repair labor, operating and maintenance materials, electricity, treatment chemicals, filter replacements, disposal of treatment system residuals, and monitoring.

Annual costs typically are not estimated using cost curves. Operational, maintenance, and repair labor are estimated as a labor time requirement per equipment component or a fraction of the total operational hours per day and operational days per year for the costed facility. Labor time is converted to a constant labor cost used throughout the TECI cost model. The TECI cost model uses the wage rate specified in The Richardson Rapid System Process Plant Construction Estimating Standards (3) for installation workers in 1994 ($25.90 per hour) for all required labor to install, operate, and maintain the systems associated with the technology bases. Electricity costs are based on operating time and required horsepower, which are converted to electricity costs using a standard rate used throughout the TECI cost model. The TECI cost model uses the average cost for electricity of $0.047 per KW-hr from the MP&M cost model (4). Chemical addition feed rates, filter replacements, and wastewater treatment residual generation rates are generally based on wastewater flow rate. These rates are converted to costs using unit cost data (e.g., $/weight) provided by chemical vendors and waste disposal facilities. The TECI cost model uses water rates from the 1992 Rate Survey of Water and Wastewater conducted by Ernst and Young (5). The water rate is adjusted from the 1992 rate of $2.90 per 1,000 gallons to the 1994 rate of $2.98 per 1,000 gallons using the capital investment index discussed later in this section.

Table 9-4 presents the O&M unit costs used by the cost model and includes references for the origin of each cost.

EPA adjusted water fees and monitoring costs calculated by the cost model to 1994 dollars because all facility-specific information in the questionnaire database is from 1994. This adjustment allows direct comparison between financial data reported in the Detailed Questionnaire and calculated compliance costs for each facility. Costs are adjusted based on the Chemical Engineering (CE) Plant Cost 1994 annual index and the index value for the year in which costs were originally reported using the following formula (6):

$$AC = OC \left(\frac{368.1}{OCI} \right) \tag{2}$$

where:

AC	=	Adjusted cost, 1994 dollars
OC	=	Original cost, dollars
OCI	=	Original cost year index

9.2.5 Treatment-in-Place Credit

EPA evaluated facility responses to the Detailed Questionnaire to determine whether pollutant control technologies are currently in place. These facilities are given credit for having "treatment in place" to ensure that EPA accurately assesses the baseline (1994) costs and pollutant loadings. Where appropriate, these treatment credits are used to develop cost estimates for system upgrades instead of costing for new systems. No costs beyond necessary additional compliance monitoring are estimated for facilities currently using pollutant control technologies with sufficient capacity equivalent to a regulatory option.

EPA reviewed questionnaire data for each model facility to assess the types of end-of-pipe technologies in place at each site (e.g., oil/water separation, biological oxidation). EPA identified end-of-pipe technologies on site that, based on technical consideration, are considered equivalent to technologies included in the TECI technology options. For example, belt filter presses are considered equivalent to plate-and-frame filter presses for sludge dewatering. EPA also identified technologies that are not considered equivalent, and for which no credit for treatment in place is given. For example, bag filters are not considered equivalent to activated carbon adsorption. Site-specific determinations regarding treatment in place at model sites are included in the administrative record for this rulemaking.

In some cases, EPA evaluated facility treatment-in-place to determine whether existing technologies, although not identical to EPA's technology bases, may be sufficient to meet EPA's effluent limitations. For example, Option 1 for the Truck/Chemical & Petroleum Subcategory includes oil/water separation (coalescing-type) and chemical/physical treatment (coagulation/clarification). Several model facilities currently operate simple oil/water separators such as gravity separators or oil skimmers, followed by chemical/physical treatment (coagulation or dissolved air flotation). EPA believes both treatment approaches can achieve equivalent performance; therefore, the Agency assessed treatment-in-place credit for these facilities. This belief is based on two assumptions. First, EPA assumes that facilities are operating oil/water separation technologies that are appropriate for the specific amount and type of oils and greases generated by their facility. Second, EPA assumes that subsequent chemical/physical treatment will be adequate to handle any minor aberrations in anticipated oil and grease characteristics. EPA used this same approach for assigning oil/water separation (API) treatment-in-place credit for the Rail/Chemical & Petroleum Subcategory.

EPA used operating schedule data and site-specific technology specifications from the Detailed Questionnaire responses to assess the capacity of the end-of-pipe technologies in place at the model sites. EPA assumed that each model site operates the technologies in place at full capacity at baseline (i.e., currently). Therefore, EPA used the operating schedule and capacity of each technology as reported in the questionnaire to define its maximum operating capacity.

EPA uses the maximum operating capacity to assign facilities full or partial treatment-in-place credit. Partial treatment-in-place credit is assigned to facilities determined to not have enough treatment capacity in place.

Facilities receiving full treatment-in-place credit for a given technology are not expected to incur additional capital or O&M costs. However, the facility may incur additional costs for items not directly associated with the unit, such as monitoring costs. Facilities receiving partial treatment-in-place credit incur additional capital and O&M costs under the regulatory options for an additional unit to treat the wastewater flow that is above the existing unit's capacity.

EPA also analyzed technologies that are not considered equivalent, and for which no credit for treatment in place is given, to see if these facilities currently generate significant volumes of settled sludge that are disposed off site. Although operation of these units is not considered equivalent treatment, the sludge currently generated by these units is considered similar to the sludge that would be generated by the technology bases if the non-equivalent technology were not operated. If these treatment units continue to be operated after implementation of the technology bases, they will significantly reduce the amount of sludge that would be generated by the technology bases. Therefore, EPA credited baseline sludge generation and disposal from non-equivalent equipment.

9.2.6 Calculation of Baseline Parameters

As discussed in the previous section, EPA determined the treatment in place for the costed facilities. Before running the cost model for any of the technology options, a baseline run of the model is performed to determine the following:

- Baseline (1994) annual costs incurred by each model site;
- Baseline non-water quality impacts, such as electricity usage, sludge and solid waste generation, and waste oil generation; and

- Baseline pollutant loadings.

The baseline values for annual costs, non-water quality impacts, and pollutant loadings are subtracted from the costs calculated for each technology option to estimate the incremental costs of compliance with each regulatory option. EPA uses the incremental costs, non-water quality impacts, and pollutant loadings to represent economic and environmental impacts of the rulemaking.

9.2.7 Good Water Conservation Practices and Flow Reduction

As discussed in Section 7.2, the reduction in the volume of wastewater discharged from TEC facilities offers several benefits, including the following:

- Reduced water usage and sewage fees;
- Improved wastewater treatment efficiency because influent wastewater pollutant concentrations will be higher; and
- Reduced wastewater treatment system capital and annual operating and maintenance (O&M) costs due to reduced wastewater flows.

End-of-pipe wastewater treatment cannot achieve complete removal of pollutants. There is a lowest concentration that wastewater treatment technologies have been demonstrated to achieve. As shown in the equation below, pollutant loadings in wastewater are dependent upon wastewater pollutant concentration and on wastewater flow.

$$PNPL = \frac{C \times PNF}{264{,}170} \qquad (3)$$

where:

PNPL = Production normalized pollutant load, g/tank
C = Concentration, µg/L
PNF = Production normalized flow, gallons/tank

Equation (3) demonstrates that optimal pollutant reductions are achieved using a combination of good water conservation practices and end-of-pipe wastewater treatment.

In developing effluent guidelines limitations and standards for the TECI, EPA included good water conservation practices as a cost-effective compliance strategy for most subcategories. Although EPA did not include flow reduction in the technology bases for all subcategories, EPA retained flow reduction in the cost model for most subcategories. Flow reduction results in significant compliance cost savings and consequently EPA assumed facilities will incorporate flow reduction in their compliance strategy.

The Agency considered good water conservation practices to be represented by the median tank interior cleaning wastewater volume discharged per tank cleaning (including non-TEC wastewater streams not easily segregated) for each facility type. This wastewater volume is referred to as the "target flow" for each facility type. Table 9-5 presents target flows for existing facilities by facility type. Development of the target flows is described in Section 9.2.7.2.

EPA did not include water conservation practices as a costing strategy for the Barge/Chemical & Petroleum Subcategory because of the high variability in wastewater volumes required for barge cleaning. For example, tanks with an interior frame require more water to clean, and some barges are only cleaned every few years and may accumulate significant amounts of residue which require greater volumes of water to clean.

9.2.7.1 Flow Reduction Control Technologies

Since good water conservation practices are defined by median wastewater volumes per tank cleaned, 50% of existing TEC facilities currently operate good water conservation practices. For the remaining 50% of TEC facilities, EPA considered a variety of control technologies depending upon the extent of flow reduction required at a given facility to achieve the applicable target flow. For the truck and rail subcategories, except for hoppers, the control technologies include the following:

- <u>For facilities with current flow to target flow ratios greater than 1 and less than or equal to 1.5:</u>

  — Facility water use monitoring, and
  — Personnel training in water conservation.

- <u>For facilities with current flow to target flow ratios greater than 1.5 and less than or equal to 2:</u>

  — Facility water use monitoring,
  — Personnel training in water conservation, and
  — Two new spinners and spinner covers.

- <u>For facilities with current flow to target flow ratios greater than 2:</u>

  — Facility water use monitoring,
  — Personnel training in water conservation, and
  — New tank interior cleaning system(s)[1].

For the hopper subcategories, the control technologies include the following:

- <u>For facilities with current flow to target flow ratios greater than 1:</u>

  — Facility water use monitoring, and
  — Personnel training in water conservation.

In calculating compliance cost estimates (see Section 9.3.2), EPA assumed that the flow reduction technologies are sufficient to achieve the target flow for all facilities based on the selection criteria described above. Additional details concerning EPA's flow reduction methodology, the flow reduction control technologies, and application of the flow technologies are included in the TECI cost model documentation contained in the rulemaking record.

---

[1]New tank interior cleaning system(s) include(s) solution tanks, controls, pumps, piping, catwalks, stairways, rails, and spinners.

9.2.7.2 Development of Target Flows

Waste streams considered in developing the target flows include TEC process wastewater. TEC process wastewater includes the following waste streams:

- Water and steam used to clean tank and container interiors;
- Prerinse cleaning solutions;
- Chemical cleaning solutions;
- Final rinses;
- Tank or trailer exterior cleaning wastewater;
- Equipment and floor washings; and
- TEC-contaminated stormwater.

The following waste streams were not considered in developing the target flows:

- Bilge and ballast waters;
- Non-TEC process wastewaters;
- Sanitary wastewater;
- Tank hydrotesting water; and
- Wastewater generated from rebuilding or maintenance activities.

Target flows were calculated based on responses to the Detailed Questionnaire. EPA first reviewed wastewater streams discharged by each facility and classified these streams as described above. EPA then calculated a facility-specific production-normalized flow expressed in gallons of wastewater discharged per tank cleaned based on the TEC process wastewater flow rate and the annual number of tanks cleaned. Facilities that clean tanks representing multiple modes of transportation (e.g., road, rail, or inland waterway) or that clean both tanks and closed-top hoppers are considered multi-subcategory facilities. For the purpose of developing the target flows, these facilities were assigned a primary subcategory, and the flow contribution of any secondary subcategory was not considered in the analysis.

For each facility type, using the facility-specific production-normalized flows and the corresponding facility-specific survey weighting factors, EPA performed a statistical analysis to determine the median wastewater volume generated per tank cleaned. Detailed information concerning calculation of the target flows is included in the Statistical Support Document for the final rule (2).

9.2.8 Contract Haul in Lieu of Treatment

For some facilities, particularly those with lower flow rates, contract hauling is less expensive than performing on-site treatment. For those facilities, EPA estimates compliance costs based on contract hauling wastewater for off-site treatment instead of the technology bases for the particular regulatory option.

To assess contract hauling in lieu of treatment, EPA compares the net present cost of contract hauling the wastewater for off-site treatment to the net present cost of treating that wastewater on site for each regulatory option (assuming 7% interest and a 15-year equipment life span for all capital equipment). Capital and annual costs estimated for contract hauling wastewater include a wastewater storage tank, repair labor, O&M materials, and transport and off-site disposal of the wastewater.

9.2.9 Costing Methodology for Direct Dischargers in the Barge/Chemical & Petroleum Subcategory

EPA did not use the cost model to estimate compliance costs for direct dischargers in the Barge/Chemical & Petroleum Subcategory. Due to the small number of model facilities, the fact that all of the direct dischargers currently operate biological treatment, and the addition of new wastewater characterization data for the subcategory, EPA believed that it would be more appropriate to consider each model facility on an individual basis rather than use the cost model. EPA gathered information from the Detailed Questionnaire to determine technologies currently in place (Table L) and current discharge limits (Table P) for each model facility. In general, facilities supplied discharge data for only conventional and classical pollutants, and some metals; however, there are several semi-volatile pollutants that are considered pollutants of interest for the subcategory. EPA used BOD and/or COD data to assess current treatment performance for these facilities and to determine if the semi-volatile limitations are currently achieved. For model facilities whose effluent data do not meet the BOD and/or COD long term averages, additional capacity was added to existing biological treatment systems to increase the residence time and/or aeration of biological treatment. Additional capacity and additional aeration are also assumed to achieve the long-term averages for BOD and COD as well as organics. For model facilities whose effluent data do not meet the TSS long term averages, polymer-assisted clarification costs and additional sludge handling costs were added. Additional operator training costs were also included in any costed upgrade.

9.3 Design and Cost Elements for Pollutant Control Technologies

This section presents detailed information regarding cost model components and specific technologies modeled in the cost model.

9.3.1 Cost Model Components

The TECI cost model consists of several programming components, which can be grouped into four major categories:

- Model shell programs;
- Primary model drivers;
- Data storage files; and
- Technology drivers and modules.

The model shell includes programs that create the various menus and user interfaces that accept user inputs and pass them to the appropriate memory storage areas. The primary model drivers are programs that access technology drivers in the appropriate order for each option and process the model-generated data. Data storage files are databases that contain cost model input and output data. Information typically stored in data storage files includes:

- Flow, production, and operating data associated with each wastewater stream;
- Pollutant concentrations associated with each wastewater stream; and
- Facility-specific data regarding existing technologies in place (discussed in Section 9.2.5).

Technology drivers and modules are programs that calculate costs and pollutant loadings for a particular pollutant control technology. EPA developed cost modules for the water conservation practices and wastewater treatment technologies included in the regulatory options for the TECI.

The technology drivers perform the following functions, as applicable, for each technology costed for a facility:

- Locate and open all necessary input data files;
- Store input data entered by the user of the model;
- Open and run the appropriate technology modules; and
- Calculate and track the following types of information generated by each technology module:
    - Total direct capital costs,
    - Total direct annual costs,
    - Electricity use and associated cost,
    - Water use and associated cost,
    - Sludge generation and associated disposal costs,
    - Solid waste generation and associated disposal costs,
    - Waste oil generation and associated disposal costs,
    - Effluent flow rate, and
    - Effluent pollutant concentrations.

The following table lists the treatment technologies that are modeled in the cost model. Sections 9.3.2 through 9.3.20 discuss the technology modules.

Cost Module	Section Number
Flow Reduction	9.3.2
Equalization	9.3.3
Oil/Water Separation (Vertical Tube Coalescing)	9.3.4
Oil/Water Separation (API)	9.3.5
Oil/Water Separation (Gravity)	9.3.6
Gravity Separation	9.3.7
Chemical Oxidation, Neutralization, Coagulation, Clarification	9.3.8
Dissolved Air Flotation (DAF) (with pH Adjustment and Chemical Addition)	9.3.9
DAF (No Chemical Addition)	9.3.10
Filter Press (For Wastewater Clarification and Sludge Dewatering)	9.3.11
Biological Treatment	9.3.12
Biological Treatment with Extended Aeration and Polymer-Assisted Clarification	9.3.13
Activated Carbon Adsorption (Vessels)	9.3.14
Organo-Clay/Activated Carbon Adsorption	9.3.15
Reverse Osmosis	9.3.16
Sludge Dewatering	9.3.17
Contract Haul of Wastewater in Lieu of Treatment	9.3.18
Compliance Monitoring	9.3.19
Waste Hauling	9.3.20

9.3.2 Flow Reduction

In this module, EPA estimates costs for a facility to install wastewater reduction technologies in order to reduce the volume of wastewater generated per tank cleaned. The flow reduction module design is based on the ratio of the current volume of wastewater generated per tank cleaned to the target volume of wastewater generated per tank cleaned. The target volume of wastewater generated per tank cleaned is discussed in Section 9.2.7. The module compares the target flow to the current flow and costs facilities for different flow reduction technologies based on their subcategory and/or the magnitude of their ratio of target flow to current flow (the "flow ratio"). Facilities with a flow ratio less than or equal to 1 (i.e., facilities generating less than the target flow of wastewater per tank cleaned) are not costed in the flow reduction module.

Where the TECI cost model reduces facility wastewater flow rates through volume reduction, specific capital and O&M costs are estimated to account for the costs those facilities would incur to implement flow reduction technologies and practices. Because of the variation in tank types and cleaning practices between subcategories, the costs for implementing flow reduction technologies are different for each subcategory. EPA did not include flow reduction costs for the Barge/Chemical & Petroleum Subcategory due to the wide variation in wastewater volumes generated per cleaning.

EPA bases the implementation costs for flow reduction on data received in response to the TECI Detailed Questionnaire, technologies and practices observed during site visits and sampling episodes at TEC facilities, information received from vendors on the flow reduction technologies, and technical literature. However, EPA does not have information available for every costed facility to determine the extent to which flow reduction is achievable and the exact equipment components and changes in standard operating procedures necessary to achieve the flow reductions estimated by the cost model. Although the cost model estimates costs incurred and wastewater volume reduction achieved by flow reduction, the costs and flow reductions may not be completely accurate for every costed facility due to limitations in the available data. However, EPA believes that the cost model accurately estimates the flow reduction and associated costs for the industry as a whole.

Capital and annual costs for the following equipment and practices listed below are included in the flow reduction module:

- Replacement tank cleaning system (Truck/Chemical & Petroleum, Rail/Chemical & Petroleum, and Food Subcategories (except barge/food facilities));
- Two spinners - one high flow for cleaning solution and one low flow for rinse (Truck/Chemical & Petroleum, Rail/Chemical & Petroleum, and Food Subcategories (except barge/food facilities)); and
- Cleaning crew training and wastewater flow rate monitoring for all subcategories (except Barge/Chemical & Petroleum facilities).

Annual costs include tank cleaning crew training and wastewater flow rate monitoring. Annual costs for operating a replacement tank cleaning system and spinners are assumed to equal baseline costs for operating existing tank cleaning systems; therefore, no additional annual costs are calculated in the cost module for implementing these technologies.

The flow reduction module uses information from responses to the Detailed Questionnaire on current wastewater generation per tank and the number of tanks cleaned along with the target flow (described in Section 9.2.7) to estimate the annual cost credits (i.e., negative annual costs) for savings from reduced water usage. The total volume of water saved is shown by the following equation:

$$WS = (CWG \times NT) - (RFWG \times NT) \tag{3}$$

where:

WS	=	Water savings (gallons/year)
CWG	=	Current wastewater generated per tank cleaned (gallons)
NT	=	Number of tanks cleaned per year
RFWG	=	Target flow wastewater generated per tank cleaned (gallons) (see Table 9-5 for specific target flows)

The volume of water saved is then multiplied by the cost of fresh water (as described in Section 9.2.4.2) to estimate monetary savings from reductions in wastewater use.

9.3.3 Equalization

In this module, EPA estimates costs for a facility to install and operate an equalization tank(s) to accumulate wastewater in order to reduce wastewater variability and to optimize the size, effectiveness, and operating costs for the subsequent treatment units. The required equalization tank size depends on a minimum wastewater residence time. Minimum residence times vary by subcategory (details provided in Section 8.0) based on the ratio of equalization tank size to total wastewater flow rate as observed during EPA sampling episodes and site visits. The equalization module calculates the costs necessary to operate an equalization unit as well as to adequately mix wastewater.

Capital and annual costs for the following equipment are included in the equalization module:

- Equalization tank(s); and
- Aerators/mixer(s).

Annual costs include operational labor, maintenance and repair labor, O&M materials, and electricity. The costs associated with the equalization tank(s) are based on tank volume necessary to perform adequate equalization of TEC wastewater, as observed during EPA site visits and sampling episodes. The costs associated with the aerator/mixer(s) are based on the motor horsepower required to adequately mix the wastewater in the equalization tank, as observed during EPA site visits and sampling episodes.

9.3.4 Oil/Water Separation (Vertical Tube Coalescing)

In this module, EPA estimates costs for a facility to install and operate a vertical tube coalescing oil/water separator to remove entrained oil and grease. The oil/water separation module calculates the costs necessary to treat wastewater using a vertical tube coalescing separator and a demulsifier that is added to the wastewater to aid in oil separation. The module also calculates the costs for removing, storing, and disposing of floating oil and settled solids.

Capital and annual costs for the following equipment are included in the vertical tube coalescing oil/water separator module:

- A demulsifier feed system (including a metered-flow pump and demulsifier);

- An influent wastewater transfer pump;
- An oil/water separator unit (including a water level probe and control system);
- An oil storage tank;
- A sludge transfer pump; and
- A sludge storage tank.

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, raw materials (i.e., demulsifier), and oil and settled solids disposal. The oil/water separator observed during EPA site visits and sampling episodes at TEC facilities is sized with 25% excess capacity due to fluctuations in daily wastewater flows. EPA likewise estimates vertical tube coalescing oil/water separator costs based on a unit with a capacity that exceeds average daily wastewater flow rates by 25%.

The demulsifier feed system costs are based on the feed rate of demulsifier observed during EPA site visits and sampling episodes. The costs associated with the wastewater transfer and sludge transfer pumps are based on the horsepower necessary to pump wastewater and sludge at the flow rates estimated by the oil/water separator module.

The waste oil storage tank and sludge storage tank costs are based on tank volume. The oil storage tank and sludge storage tank are sized to hold the volume of oil and sludge, respectively, collected over a period of one month.

EPA assumes that floating oils and settled solids will be disposed off site once per month, based on observations made during site visits and sampling episodes. Waste disposal costs are calculated separately in the waste haul module (see Section 9.3.20). The oil/water separator module calculates the amount of oil to be disposed using the difference between the influent and effluent average total oil and grease concentrations. The oil/water separator module calculates the amount of sludge to be disposed using the difference between the influent and effluent average total suspended solids concentrations. EPA assumes that the waste oil stream comprises 95% oil and the settled solids stream comprises 4% solids, based on assumptions used in the MP&M cost model.

9.3.5 Oil/Water Separation (American Petroleum Institute [API] Separator)

In this module, EPA estimates costs for a facility to install and operate an API oil/water separator to remove entrained oil and grease. The module calculates costs necessary to operate an API separator with a slotted pipe surface oil skimmer, a fabric belt skimmer for entrained thin oils, and a bottom sludge rake. The module also calculates the costs to remove, store, and dispose of skimmed oils and settled solids.

Capital and annual costs for the following equipment are included in the API oil/water separator module:

- An API oil/water separator;
- A wastewater transfer pump;
- An oil storage tank; and
- A sludge storage tank.

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, and disposal of residual oil and settled solids. The API oil/water separator costs are based on the ratio of API oil/water separator nominal capacity to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities. The unit nominal capacity is four times that needed to accommodate facility average daily wastewater flow rates to account for fluctuations in daily wastewater flow and to allow for ample wastewater residence. The unit uses two motors, a scraper/skimmer motor, and an oil collection belt skimmer motor. Electricity costs are based on motor horsepower necessary to operate the scraper/skimmer and oil collection belt skimmer.

The wastewater transfer pump costs are based on the influent wastewater flow rate for each facility. The pump is designed to operate at a flow rate of one-half the stated maximum capacity of the pump. Electricity costs are based on motor horsepower necessary to transfer wastewater at the flow rates estimated by the oil/water separator module.

The waste oil storage tank and sludge storage tank costs are based on tank volume. The oil storage tank and the sludge storage tank are sized to hold the volume of oil and the volume of sludge, respectively, collected over a period of one month.

EPA assumes that floating oils and settled solids will be disposed off site once per month (provided sludge dewatering is not costed as part of the regulatory option) based on observations made during site visits and sampling episodes. Waste disposal costs are calculated separately in the waste haul module (see Section 9.3.20). The API oil/water separator module calculates the amounts of oil and sludge to be disposed based on the ratios of the oil and sludge generation rates to the facility wastewater flow rates observed during EPA site visits and sampling episodes at TEC facilities. If sludge dewatering is costed, the sludge is costed to be pumped from the sludge storage tank to the filter press (the costs for the sludge pump are included in the sludge dewatering module (see Section 9.3.17)). EPA assumes that the waste oil stream comprises 95% oil and the settled solids stream comprises 4% solids, based on assumptions used in the MP&M cost model.

9.3.6 Oil/Water Separation (Gravity)

In this module, EPA estimates costs for a facility to install and operate a gravity oil/water separator to remove floating oils from raw wastewater. The module also calculates the costs necessary to remove, store, and dispose of floating oils. For the Food Subcategory, no oil disposal costs are incurred because EPA assumes oil will be recycled to animal feed and/or soap manufacturing based on practices observed during EPA site visits and sampling episodes at TEC facilities. The module calculates the costs for removing, storing, and disposing of settled solids for the Food Subcategory but not for the Barge/Chemical & Petroleum Subcategory because EPA assumes gravity oil/water separators at Barge/Chemical & Petroleum facilities will generate a negligible amount of settled solids based on observations made during EPA site visits and sampling episodes.

Capital and annual costs for the following equipment are included in the gravity oil/water separation module:

- A gravity oil/water separator;
- Two wastewater transfer pumps (only one for Barge/Chemical & Petroleum);
- An oil transfer pump;
- An oil storage tank (Barge/Chemical & Petroleum only);
- A sludge transfer pump (Food only); and
- An oil/water separator effluent pump (Barge/Chemical & Petroleum only).

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, and residual disposal costs. The gravity oil/water separator costs are based on tank volume designed to provide a wastewater residence time of 6.4 days, as observed during EPA site visits and sampling episodes at TEC facilities.

The wastewater transfer pumps and oil transfer pump costs are based on the respective wastewater and oil flow rates estimated by the oil/water separator module. The pumps are designed to operate at an average flow rate of one-half the stated maximum flow-rate capacity of the pump. Electricity costs are based on the pump motor horsepower necessary to transfer wastewater and oil at the flow rates estimated by the oil/water separator module. The sludge transfer pump costs are based on the horsepower necessary to pump sludge at the flow rates estimated by the oil/water separator module. The effluent wastewater pump costs are based on effluent wastewater flow rate. Electricity costs are based on the motor horsepower necessary to pump wastewater to the subsequent treatment unit.

Oil and sludge management practices are based on practices observed during EPA site visits and sampling episodes at TEC facilities. For the Barge/Chemical & Petroleum Subcategory, oil is collected in a tank and assumed to be hauled off site every 5 days. Oil storage tank costs are based on the tank volume necessary to hold the oil generated over a 5-day period. For the Food Subcategory, oil is pumped directly from the gravity oil/water separator tank for off-site disposal twice per year. Sludge is collected either directly from the gravity oil/water separator tank and hauled off site for disposal once per month or pumped to a sludge storage tank (included in the biological treatment module) for subsequent on-site sludge dewatering. Waste disposal costs are calculated separately in the waste haul module (see Section 9.3.20). The oil and sludge volumes generated (where applicable) are calculated based on the ratios of the oil and sludge generation rates to the facility wastewater flow rates observed during EPA site visits and sampling episodes at TEC facilities. EPA assumes that the waste oil stream comprises 95% oil and the settled solids stream comprises 4% solids, based on assumptions used in the MP&M cost model.

9.3.7 Gravity Separation

In this module, EPA estimates costs for a facility to install and operate a gravity separator to remove suspended solids from raw wastewater by settling to the bottom of the unit. The module also calculates the costs for removing, storing, and disposing of settled solids.

Capital and annual costs for the following equipment are included in the gravity separation module:

- A gravity separator tank;
- Two wastewater transfer pumps; and
- A sludge transfer pump (if sludge generation is less than 1,265 gallons per month).

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, and residual disposal costs. The gravity separator tank costs are based on a tank volume designed to provide a wastewater residence time of 4 days, as observed during EPA site visits and sampling episodes at TEC facilities.

The wastewater transfer pump costs are based on influent wastewater flow rate. The pumps are designed to operate at a flow rate of one-half the stated maximum flow rate capacity of the pumps. Electricity costs are based on motor horsepower necessary to transfer wastewater at the flow rates estimated by the gravity separator module. The sludge transfer pump costs are based on motor horsepower necessary to transfer sludge at the flow rates estimated by the gravity separator module.

EPA assumes that settled solids will be disposed off site once per month based on observations made during site visits and sampling episodes at TEC facilities. Waste disposal costs are calculated separately in the waste haul module (see Section 9.3.20). The sludge volume generated by the gravity separator is calculated based on the ratios of the sludge generation rates to the facility wastewater flow rates observed during EPA site visits and sampling episodes at TEC facilities. Sludge is assumed to accumulate in the bottom of the gravity separator tank. If the monthly sludge generation is less than 1,265 gallons, it is more economical for a facility to pump the sludge into drums for disposal. Otherwise, a vacuum truck (provided by the sludge disposal company) would be used to remove the sludge. EPA assumes the settled solids stream comprises 4% solids, based on engineering literature.

9.3.8 Chemical Oxidation, Neutralization, Coagulation, and Clarification

In this module, EPA estimates costs for a facility to install and operate a turn-key treatment system consisting of four reaction tanks in series and a clearwell. Treatment steps include: chemical oxidation to oxidize organic pollutants using hydrogen peroxide; neutralization to adjust wastewater pH; coagulation to destabilize suspended matter using polyalum chloride (an electrolyte); and clarification to settle and remove agglomerated solids using a polymer flocculant.

The module calculates costs necessary for the turn-key treatment system, including the reaction tanks, clearwell, chemical feed systems, mixers, control system, and two sludge storage tanks. The module also calculates the costs to collect solids from the bottom of the clarifier and pump the sludge into a sludge storage tank for subsequent dewatering.

Capital and annual costs for the following equipment are included in the chemical oxidation, neutralization, coagulation, and clarification module:

- Four reaction tanks;
- Two sludge storage tanks;
- A clearwell;
- Five chemical feed systems;
- Two mixers;
- An influent wastewater pump;
- A sludge pump (sized at 20 gpm); and
- A control system.

Annual costs include operational labor, maintenance and repair labor, O&M materials, and electricity. The turn-key package system costs are based on the nominal wastewater flow rate capacity of the unit. The turn-key package system observed during EPA sites visits and sampling episodes at TEC facilities is sized with 25% excess capacity due to fluctuations in daily wastewater flows. EPA likewise estimates turn-key package system costs based on a unit with a capacity that exceeds daily wastewater flow rates by 25%. Electricity costs for the mixers, chemical feed systems, and sludge pump are based on motor horsepower necessary to operate the turn-key unit.

9.3.9 DAF (with pH Adjustment and Chemical Addition)

In this module, EPA estimates costs for a facility to install and operate a DAF unit designed to remove entrained solid or liquid particles. The module calculates the costs necessary to operate a DAF unit with a recycle pressurization system, chemical addition systems for polymers (coagulants and flocculant) and pH adjustment, and a sludge collection tank. The module also calculates costs for a pre-engineered building to enclose the treatment unit.

Capital and annual costs for the following equipment are included in the DAF module:

- A wastewater transfer pump;
- A chemical treatment tank system;
- A polymer mixing tank system;
- A polymer dilution tank system;
- A DAF unit;
- An air compressor;
- A sludge storage tank; and
- A pre-engineered building.

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, and chemical costs. The DAF unit observed during EPA site visits and sampling episodes at TEC facilities is sized with 30% excess capacity due to fluctuations in daily wastewater flows. EPA likewise estimates DAF unit costs based on a unit with a capacity that exceeds daily wastewater flow rates by 30%. The unit uses two motors: a surface skimmer motor and a pressurization motor pump. Electricity costs are based on motor horsepower necessary to operate the surface skimmer motor and pressurization pump.

The wastewater transfer pump costs are based on influent wastewater flow rate. Pumps are designed to operate at a flow rate of one-half the stated maximum capacity of the pump. Electricity costs are based on motor horsepower necessary to transfer wastewater at the influent wastewater flow rates.

The chemical treatment tank system consists of a treatment tank, mixer, pH probe, acid metering pump, and caustic metering pump. The treatment tank costs are based on the ratio of tank volume to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities. The mixer costs are based on tank volume and motor horsepower necessary to operate the mixer. The pH probe and acid metering pump costs are the same for every facility. The caustic metering pump costs are based on tank volume. Sulfuric acid (93%) and sodium hydroxide (50%) are added to the wastewater. The volume of chemicals added is based on the ratio of chemical addition to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

The polymer mixing tank system consists of a mixing tank, a mixer, and two metering pumps. The tank costs are based on the ratio of mixing tank volume to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities. The mixer costs are based on tank volume and motor horsepower necessary to operate the mixer. The metering pump cost is the same for every facility. The polymer dilution tank system consists of the same components as the polymer mixing tank system except it includes only one metering pump. Polymer addition rates are based on the ratio of polymer addition to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

The sludge storage tank costs are based on the ratio of sludge storage tank volume to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities. Sludge is collected in the storage tank before being dewatered. (Costs for a sludge storage tank designed to collect sludge over the period of a month were estimated for facilities currently operating a DAF unit without sludge dewatering.) Costs for sludge dewatering are estimated in the sludge dewatering module (see Section 9.3.17). The DAF unit sludge generation rates are based on information gathered from the Detailed Questionnaire from facilities operating DAF units with chemical addition.

The pH adjustment and DAF units are housed in the pre-engineered building to provide protection from poor weather conditions. The pre-engineered building costs are based on the square footage of building space needed to house the DAF unit and associated equipment. Since differences in the sizes of equipment housed in the pre-engineered building are minor, costs for all facilities are estimated for the same building size.

9.3.10 DAF (without Chemical Addition)

In this module, EPA estimates costs for a facility to install and operate a DAF unit designed to remove entrained solid or liquid particles. The module calculates the costs necessary to operate a DAF unit and collect solids for disposal off site (for facilities with treatment in place but no sludge dewatering on site) or for on-site sludge dewatering.

Capital and annual costs for the following equipment are included in this DAF module:

- A DAF unit; and
- A sludge storage tank.

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, and residual disposal (if sludge dewatering costs are not included). The DAF unit costs are based on the ratio of DAF unit capacity to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities. Electricity costs are based on the motor horsepower necessary to operate the DAF unit.

A sludge storage tank is only included in baseline options where a facility does not operate sludge dewatering on site. A sludge storage tank is sized to hold the volume of sludge collected over a period of one month. Waste disposal costs are calculated separately in the waste haul module (see Section 9.3.20). The sludge storage tank costs are based on volume. The DAF module calculates the amount of sludge to be disposed based on the ratio of DAF sludge generation rate to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities. EPA assumes that the DAF sludge comprises 4% solids, based on assumptions used in the MP&M cost model.

9.3.11 Filter Press (for Wastewater Clarification and Biological Treatment Sludge Dewatering)

In this module, EPA estimates costs for a facility to install and operate a single filter press for two operations: wastewater clarification and biological treatment sludge dewatering. During wastewater treatment operating hours, the filter press functions as a wastewater clarifier. Following wastewater treatment operating hours, the filter press dewaters sludge from biological treatment. The module calculates the costs necessary to filter and store wastewater before being discharged or pumped to subsequent treatment units. The module also calculates annual costs associated with sludge dewatering. The filter press is designed to treat one batch of wastewater per day and one batch of biological treatment sludge per day.

Capital and annual costs for the following equipment are included in the filter press module:

- An influent pump and compressor;
- A diatomaceous earth precoat tank;
- A diatomaceous earth precoat pump and compressor;
- A filter press; and
- An effluent storage tank.

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, and residual disposal. Based on observations made during EPA site visits and sampling episodes, EPA assumes that both operations generate equal daily volumes of dewatered sludge. Dewatered sludge volumes are based on the ratio of dewatered sludge generation rate to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities. The filter press volume is based on and equal to the volume of dewatered sludge from either one of the operations (since they are assumed to generate equal volumes). Waste disposal costs are calculated separately in the waste haul module (see Section 9.3.20) and are based on the total volume of dewatered sludge from both filter press operations. EPA assumes the dewatered filter cake volume comprises 32% solids, based on engineering literature.

The influent pump and precoat transfer pump costs are based on influent wastewater flow rate. Electricity costs for the pumps are based on motor horsepower necessary to transfer wastewater and polymer at the flow rates estimated by the filter press module.

The diatomaceous earth precoat tank costs and effluent storage tank costs are based on tank volumes recommended by filter press vendors. The amount of diatomaceous earth necessary to treat wastewater and biological treatment sludge is based on the ratio of diatomaceous earth usage rate to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

9.3.12 Biological Treatment

In this module, EPA estimates costs for a facility to install and operate a biological oxidation unit used to decompose organic constituents. The module calculates costs necessary for operating an aerobic biological treatment unit consisting of two preaeration tanks, a post-treatment clarifier, and a sludge storage tank. A portion of the sludge is recycled by pumping the sludge from the clarifier to the second preaeration tank. Sludge is also pumped from the clarifier into a sludge storage tank for subsequent dewatering.

Capital and annual costs for the following equipment are included in the biological treatment module:

- Wastewater transfer pumps;
- Two preaeration tanks;
- Diffusers/blowers;
- A biological reactor tank;
- A clarifier;
- A sludge storage tank;
- A sludge pump; and
- A biological treatment effluent discharge pump.

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, and residual disposal. The biological reactor capital and annual costs are based on a tank volume designed to provide a wastewater residence time of 4.6 days, as observed during EPA site visits and sampling episodes at TEC facilities. Annual additions of microorganisms to the biotreatment unit is based on the ratio of microorganism addition rate to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

The wastewater transfer pump costs are based on influent wastewater flow rate. Electricity costs for the pumps are based on motor horsepower necessary to transfer wastewater at the influent flow rate. The diffuser/blower costs are based on the ratio of air flow rate to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

The preaeration and sludge storage tank volumes are based on the ratio of tank volume to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities. The sludge and effluent discharge pump costs are based on motor horsepower necessary to transfer sludge and wastewater at the flow rates estimated by the biological treatment module.

The clarifier is used to settle sludge following the biological digestion in the biological reactor. Clarifier costs are based on the ratio of clarified volume to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

9.3.13 Biological Treatment with Extended Aeration and/or Polymer-Assisted Clarification

These treatment technologies only apply to the Barge/Chemical & Petroleum Subcategory; therefore, no electronic cost module was developed. EPA estimates costs for a facility to install and operate additional aerators and polymer-assisted clarification for those facilities not currently meeting the BOD, COD, and/or TSS long term averages. These technologies are applicable to waste streams following primary treatment, such as oil/water separation or equalization.

Capital and annual costs for the following equipment are included in the treatment technology estimates:

- Polymer addition system (e.g., feed pump); and
- Aeration diffusers and blowers.

Annual costs include operational labor, maintenance and repair labor, O&M materials, chemical costs, electricity, and residual disposal. The polymer feed pump capital and annual costs are based on a Garratt-Callahan Polymer 7622 metering pump which can accommodate 0.02 to 0.6 gallons per hour of polymer. The aeration diffusers and blowers capital and annual costs are based on the additional oxygen requirement at each facility.

The polymer metering pump cost is the same for every facility. Polymer addition rates are based on the ratio of polymer addition to wastewater flow rate based on data from the Pharmaceutical Manufacturing Industry cost model. Residual disposal costs are based on the incremental volume of solids removed by subtracting the TSS treatment effectiveness concentration from the current effluent TSS concentration and converting the difference to either an incremental filter cake volume or raw sludge volume.

Aeration diffusers and blowers costs are based on the additional volume of oxygen required based on a facility's influent BOD concentration and assuming the treatment effectiveness concentration is achieved. In addition to operational and repair labor, costs for materials, electricity, and labor training are included to optimize biological treatment performance.

9.3.14 Activated Carbon Adsorption (Vessels)

In this module, EPA estimates costs for a facility to install and operate an activated carbon adsorption system used as a tertiary treatment technology applicable to waste streams following treatment by chemical oxidation, neutralization, coagulation, and clarification. The module calculates costs necessary for operating two activated carbon columns in series. Spent carbon is assumed to require off-site regeneration once per month.

Capital and annual costs for the following equipment are included in the granular activated carbon module:

- Two wastewater transfer pumps;
- Two bag filters operated in series;
- A backwash tank; and
- Two carbon adsorption filters.

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, chemicals (media changeout), weekly COD monitoring, and residual disposal. The capital and annual costs associated with the carbon adsorption filters are based on the ratios of activated carbon system size and carbon usage rate to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

The costs associated with the wastewater transfer pumps are based on influent wastewater flow rate. Electricity costs are based on motor horsepower necessary to operate the carbon adsorption system.

The costs associated with the bag filters are based on two carbon steel 2-inch housings with 5-micron bag filters. Bag costs are based on using one bag per operating day, and labor costs are based on operating days per year. The backwash tank volume is based on the volume required to hold 30 minutes worth of daily wastewater flow at the facility. Operational labor to backwash the system is included.

EPA assumes that one column of spent activated carbon is changed out once per month. Media change-out costs include costs for labor and fresh media. Weekly COD monitoring of influent and effluent from the carbon vessels is included to test the effectiveness of the carbon. Spent carbon is assumed to be sent off site for regeneration. Media change-out costs include costs for labor and fresh media. For cost estimating purposes, EPA assumes that TEC facilities typically operate an average of 265 days per year. Costs are adjusted for facilities operating less than 265 days per year by multiplying "typical" residual regeneration costs by a factor consisting of actual operating days divided by 265.

9.3.15 Organo-Clay/Activated Carbon Adsorption

In this module, EPA estimates costs for a facility to install and operate an organo-clay adsorption unit followed by a granular activated carbon unit for wastewater polishing. The module calculates costs to operate two columns in series (organo-clay followed by activated carbon) with nominal carbon change-out frequency of one vessel per month and nominal organo-clay change-out frequency of one vessel per two months.

Capital and annual costs for the following equipment are included in the organo-clay/activated carbon adsorption module:

- A wastewater transfer pump;
- An organo-clay vessel; and
- A granular activated carbon vessel.

Annual costs include operational labor, maintenance and repair labor, electricity, chemicals (media), and residual disposal. The costs associated with the organo-clay vessel and granular activated carbon vessels are based on the ratio of filter media volume to influent flow rate observed during EPA site visits and sampling episodes at TEC facilities.

The costs associated with the wastewater transfer pump are based on influent wastewater flow rate. The pump is designed to operate at a flow rate of one-half the stated maximum capacity of the pump. Electricity costs are based on motor horsepower necessary to transfer influent wastewater.

The design media change-out frequency is once per month for granular activated carbon, and once every two months for organo-clay, based on information provided by treatment system vendors. Spent carbon is assumed to be sent off site for regeneration or disposal and spent clay is assumed to be sent off site for incineration. Media change-out costs include costs for labor and fresh media. Residual disposal costs include costs for waste shipping and media disposal.

9.3.16 Reverse Osmosis

In this module, EPA estimates costs for a facility to install and operate a reverse osmosis unit for wastewater polishing. The module calculates costs necessary for wastewater storage prior to entering the reverse osmosis unit, and the reverse osmosis unit itself. The reverse osmosis unit is operated as a double pass unit. After the first pass through the reverse osmosis unit, the wastewater is transferred to a storage tank. When the storage tank is nearly full, the wastewater is pumped for a second pass through the reverse osmosis unit prior to discharge. Concentrate from the reverse osmosis unit is recycled to the first biological treatment preaeration tank.

Capital and annual costs for the following equipment are included in the reverse osmosis module:

- Two reverse osmosis wastewater storage tanks;
- A reverse osmosis flooded suction tank; and
- A reverse osmosis unit.

Annual costs include operational labor, maintenance and repair labor, electricity, and membrane and pretreatment filter replacement costs. The reverse osmosis unit capital costs are based on influent wastewater flow rate. Electricity costs are based on motor horsepower necessary to operate the unit at the flow rate estimated by the reverse osmosis module. Membrane and filter replacement costs are based on influent wastewater flow rate and information provided by treatment technology vendors. EPA estimates that membranes require replacement every five years, and the pretreatment filter cartridges must be replaced every two months.

The reverse osmosis wastewater storage tanks and flooded suction tank costs are based on the ratio of tank volume to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

9.3.17 Sludge Dewatering (Plate-and-Frame Filter Press)

In this module, EPA estimates costs for a facility to install and operate a plate-and-frame filter press. The module calculates costs necessary to operate a plate-and-frame filter press to dewater sludge that is generated by wastewater treatment units.

For the Truck/Chemical & Petroleum Subcategory, EPA assumes that facilities will use a portable pump to pump sludge from the sludge storage tanks into the filter press. Because EPA includes a portable pump in the oil/water separator module (see Section 9.3.4), costs are not included for an additional pump in the sludge dewatering module for the Truck/Chemical & Petroleum Subcategory.

Capital and annual costs for the following equipment are included in the plate-and-frame filter press module:

- A plate-and-frame filter press;
- Sludge transfer pumps (Rail/Chemical & Petroleum and Food Subcategory);
- Sludge storage tank (PSES Option 1 for the Rail/Chemical & Petroleum Subcategory);

- Precoat (diatomaceous earth) tank (for dewatering biological treatment sludge); and
- Precoat transfer pump and compressor (for dewatering biological treatment sludge).

Annual costs include operational labor, maintenance and repair labor, O&M materials, electricity, chemical costs (diatomaceous earth), and residual disposal costs. Materials costs include annual replacement of filter press cloths. The filter press capital and annual costs are calculated using the ratio of sludge generation rate to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities, as well as technical literature on sludge and filter cake solids contents. In general EPA assumes that the press operates one batch per day; therefore, the press volume generally equals the estimated daily volume of filter cake generation. However, for the Truck/Chemical & Petroleum and Rail/Chemical & Petroleum Subcategories, EPA performed an optimization analysis to determine filter press volume versus the number of batches per day based on the filter cake generation rate and operational days per year. EPA assumes that the filter press will operate no more than two batches per day. The cost for hauling dewatered sludge is estimated separately in the waste haul module (see Section 9.3.20) and is based on the calculated volume of dewatered sludge generated. EPA assumes that the dewatered sludge comprises 32 to 33% solids, based on engineering literature. A one-time sludge profile fee and roll-off box delivery fee are also included.

The sludge transfer pump costs are based on motor horsepower necessary to transfer sludge at flow rates estimated by the sludge dewatering module. The precoat transfer pump costs are based on influent wastewater flow rate. Electricity costs are based on motor horsepower necessary to transfer polymer at flow rates estimated by the sludge dewatering module.

The diatomaceous earth precoat tank costs are based on tank volumes recommended by filter press vendors. The amount of diatomaceous earth necessary is based on the ratio of diatomaceous earth usage rate to wastewater flow rate observed during EPA site visits and sampling episodes at TEC facilities.

9.3.18 Contract Hauling of Wastewater in Lieu of Treatment

In this module, if contract hauling in lieu of treatment is appropriate, capital and annual costs for a wastewater holding tank are included in the module. Annual costs include maintenance and repair labor, O&M materials, transportation, and disposal of wastewater. EPA assumes that wastewater would be accumulated in a holding tank and then disposed off site every three months. Holding tank costs are based on the tank volume needed to contain all of the wastewater generated by a facility over a three-month period.

Transportation disposal costs are based on gallons of wastewater to be disposed. EPA uses quotes from nation-wide vendors to estimate costs for contract hauling wastewater off site. EPA estimates a cost of $0.44/gallon (7) to contract haul wastewater off site.

9.3.19 Compliance Monitoring

Compliance monitoring costs are included in all of the regulatory options for all subcategories.

In this module, EPA estimates annual compliance monitoring costs for all TEC facilities. The annual cost calculated by the model for compliance monitoring includes laboratory costs to analyze wastewater semivolatile organics, metals, and classical pollutants. For indirect dischargers, EPA estimates costs for facilities to monitor monthly for all regulated pollutants (see Section 12.3). For direct dischargers, EPA estimates costs for facilities to monitor weekly for classical pollutants and monthly for semivolatile organics and metals. However, for direct dischargers in the Food Subcategory, EPA estimates costs for facilities to monitor weekly for only classical pollutants because EPA is regulating only these pollutants in the Food Subcategory. Costs for each type of analysis per sample were obtained from a laboratory contracted by EPA on past wastewater sampling efforts. The table below shows the monitoring costs used in the cost model.

Analytical Method	Laboratory Fee ($1994)	Reference
Method 625 - Semi-Volatile Organic Compounds	$350	(39)
Method 1620 - Metals	$598	(8)
Method 1664 - HEM	$35	(8)
Method 1664 - SGT-HEM	$56.67	(39)
Method 401.5 - BOD	$16	(8)
Method 410.4 - COD	$20	(8)
Method 160.2 - TSS	$6.50	(40)

9.3.20 Waste Hauling

In this module, where applicable, EPA estimates annual waste hauling costs for oil (95% oil), undewatered sludge (approximately 4% solids), and dewatered sludge (approximately 32% solids) for all TEC facilities. The cost model calculates annual costs for waste hauling, including labor and transportation. Cost rates are obtained from national vendors. Undewatered sludge disposal costs are based on using either a vacuum-truck or multiple drums, depending on the volume to be disposed. Dewatered sludge costs include an annual roll-off box rental.

9.4 Summary of Costs by Regulatory Option

Table 9-6 summarizes estimated BPT, BCT, and BAT compliance costs by regulatory option. Table 9-7 summarizes estimated PSES compliance costs by regulatory option. Costs shown include capital and O&M costs (including energy usage) totaled for each subcategory for all discharging facilities. All costs represent the estimated incremental compliance costs to the industry. The capital costs shown in Tables 9-6 and 9-7 represent the direct capital costs estimated by the technology modules plus the indirect capital costs discussed in Section 9.2.4.1. The annual costs shown in Tables 9-6 and 9-7 represent the direct annual costs estimated by the technology modules plus the compliance monitoring and waste hauling costs discussed in Sections 9.3.19 and 9.3.20, respectively.

9.5 References[2]

1. U.S. Environmental Protection Agency, Office of Water. Economic Analysis for the Final Effluent Limitations Guidelines for the Transportation Equipment Cleaning Industry. EPA 821-R-00-013, June 2000.

2. U.S. Environmental Protection Agency, Office of Water. Statistical Support Document for the Final Effluent Limitations Guidelines for the Transportation Equipment Cleaning Industry. EPA-821-B-98-014, May 1998.

3. The Richardson Rapid System Process Plant Construction Estimating Standards. Volume 4: Process Equipment, 1994.

4. Eastern Research Group, Inc. Standard Annual Cost Rates Used in the TECI Cost Model. Memorandum from Melissa Cantor, Eastern Research Group, Inc. to the TECI Rulemaking Record, April 22, 1998 (DCN T09977).

5. Eastern Research Group, Inc. Flow Reduction Cost Module Documentation for the Transportation Equipment Cleaning Cost Model. May 1998 (DCN T09753).

6. "Economic Indicators." Chemical Engineering. September 1995, page 168.

7. Eastern Research Group, Inc. Contract Haul Cost Module Documentation for the Transportation Equipment Cleaning Cost Model. May 1998 (DCN T09754).

8. Eastern Research Group, Inc. Monitoring Cost Module Documentation for the Transportation Equipment Cleaning Cost Model. May 1998 (DCN T09852).

9. Eastern Research Group, Inc. Equalization Cost Module Documentation Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory. May 1998 (DCN T09730).

10. Eastern Research Group, Inc. Oil/Water Separation Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory (Direct Dischargers). May 1998 (DCN T09734).

11. Eastern Research Group, Inc. Oil/Water Separation Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory (Indirect Dischargers). May 1998 (DCN T09731).

[2]For those references included in the administrative record supporting the TECI rulemaking, the document control number (DCN) is included in parentheses at the end of the reference.

12. Eastern Research Group, Inc. Chemical Oxidation/Neutralization/Coagulation/ Clarification Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory (Direct Dischargers). May 1998 (DCN T09735).

13. Eastern Research Group, Inc. Chemical Oxidation/Neutralization/Coagulation/ Clarification Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory (Indirect Dischargers). May 1998 (DCN T09732).

14. Eastern Research Group, Inc. Sludge Dewatering Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory (Direct Dischargers). May 1998 (DCN T09726).

15. Eastern Research Group, Inc. Sludge Dewatering Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory (Indirect Dischargers). May 1998 (DCN T09723).

16. Eastern Research Group, Inc. Biological Treatment Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory (Direct Dischargers). May 1998 (DCN T09736).

17. Eastern Research Group, Inc. Activated Carbon Adsorption Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Truck/Chemical Subcategory. May 1998 (DCN T09733).

18. Eastern Research Group, Inc. Oil/Water Separation Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory (Direct Dischargers). May 1998 (DCN T09741).

19. Eastern Research Group, Inc. Oil/Water Separation Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory (Indirect Dischargers). May 1998 (DCN T09737).

20. Eastern Research Group, Inc. Equalization Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory. May 1998 (DCN T09738).

21. Eastern Research Group, Inc. pH Adjustment/Dissolved Air Flotation Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory (Direct Dischargers). May 1998 (DCN T09742).

22. Eastern Research Group, Inc. pH Adjustment/Dissolved Air Flotation Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory (Indirect Dischargers). May 1998 (DCN T09739).

23. Eastern Research Group, Inc. Sludge Dewatering Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory (Direct Dischargers). May 1998 (DCN T09727).

24. Eastern Research Group, Inc. Sludge Dewatering Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory (Indirect Dischargers). May 1998 (DCN T09724).

25. Eastern Research Group, Inc. Biological Treatment Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory (Direct Dischargers). May 1998 (DCN T09743).

26. Eastern Research Group, Inc. Organo-Clay/Granular Activated Carbon Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Rail/Chemical Subcategory. May 1998 (DCN T09740).

27. Eastern Research Group, Inc. Primary Oil/Water Separation and Dissolved Air Flotation Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Barge/Chemical Subcategory. May 1998 (DCN T09744).

28. Eastern Research Group, Inc. Filter Press Cost Module: Sludge Dewatering Documentation for the Transportation Equipment Cleaning Cost Model Barge/Chemical Subcategory (Baseline). May 1998 (DCN T09851).

29. Eastern Research Group, Inc. Filter Press Cost Module: Wastewater and Sludge Documentation for the Transportation Equipment Cleaning Cost Model Barge/Chemical Subcategory (Indirect Dischargers). May 1998 (DCN T09725).

30. Eastern Research Group, Inc. Biological Treatment Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Barge/Chemical Subcategory. May 1998 (DCN T09745).

31. Eastern Research Group, Inc. Reverse Osmosis Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Barge/Chemical Subcategory. May 1998 (DCN T09746).

32. Eastern Research Group, Inc. Equalization Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Food Subcategories. May 1998 (DCN T09748).

33. Eastern Research Group, Inc. Oil/Water Separation Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Food Subcategories. May 1998 (DCN T09749).

34. Eastern Research Group, Inc. Biological Treatment Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Food Subcategories. May 1998 (DCN T09750).

35. Eastern Research Group, Inc. Sludge Dewatering Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Food Subcategories. May 1998 (DCN T09729).

36. Eastern Research Group, Inc. Gravity Separator Cost Module Documentation for the Transportation Equipment Cleaning Cost Model Hopper Subcategories. May 1998 (DCN T09747).

37. Eastern Research Group, Inc. TECI Cost Model Annual Cost Factors for Pumps. Memorandum from Melissa Cantor, Eastern Research Group, Inc. to the TECI Rulemaking Record, October 10, 1997 (DCN T04654).

38. Eastern Research Group, Inc. TECI Cost Model Annual Cost Factors for Tanks. Memorandum from Melissa Cantor, Eastern Research Group, Inc. to the TECI Rulemaking Record, March 27, 1998 (DCN T09976).

39. Eastern Research Group, Inc. TECI Cost Model Revision Documentation. June 1999 (DCN T20322).

40. Eastern Research Group, Inc. Barge/Chemical & Petroleum (Direct Dischargers) Costing Calculation Sheets. May 1999 (DCN T20379).

41. Eastern Research Group, Inc. Costs for Filter Press Cloths. July 1998 (DCN T20487).

Table 9-1

Number of Costed Technology Options for Each TECI Subcategory

Subcategory	Number of Unique Technology Options	Number of BPT/BCT/BAT/ NSPS Options	Number of PSES/PSNS Options
Truck/Chemical & Petroleum	5	2	3
Rail/Chemical & Petroleum	6	3	3
Barge/Chemical & Petroleum	3	2	3
Food	2	2	2
Truck/Hopper	1	NA	1
Rail/Hopper	1	NA	1
Barge/Hopper	1	1	1

NA - Not Applicable

Table 9-2

Direct Capital Costs Used by the TECI Cost Model

Capital Costs				
Item	**Cost Equation ($1994)**	**Subcategory(ies)**	**Technology(ies)**	**Reference**
Cleaning bays	C = 65,000 - 74,928 for 1 bay (based on tank type) C = 80,000 - 82,798 for 2 bays (based on tank type) C = 150,000 - 165,596 for 4 bays (based on tank type)	Truck/Chemical & Petroleum Rail/Chemical & Petroleum	Flow Reduction	(5)
Spinners and covers (2)	C = 10,000	Truck/Chemical & Petroleum Rail/Chemical & Petroleum	Flow Reduction	(5)
Equalization tank	C = 1.002(V) + 4,159.944	Truck/Chemical & Petroleum Food	Equalization	(9, 32)
Equalization tank mixer/aerator	C = 463 for V <16,667 C = 573 for V <33,333 C = 804 for V ≥33,333	Truck/Chemical & Petroleum Food	Equalization	(9, 32)
Demulsifier pump	C = 1,634	Truck/Chemical & Petroleum	Oil/Water Separator	(10, 11)
Oil/water separator (vertical tube coalescing)	$C = -0.926(GPM)^2 + 247.9(GPM) + 6,209$	Truck/Chemical & Petroleum	Oil/Water Separator	(10, 11)
Oil storage tank	C = 0.874(V) + 202.45	Truck/Chemical & Petroleum Barge/Chemical & Petroleum	Oil/Water Separator	(10, 11, 27)
Sludge transfer pump	C = 2,102 for GPM ≤ 2 C = 1,602 for GPM >2	Truck/Chemical & Petroleum Truck/Hopper Rail/Hopper Barge/Hopper Food	Oil/Water Separator, Gravity Separation	(10, 11, 33, 36)
Sludge storage tank	C = 0.846(V) + 355.163	Truck/Chemical & Petroleum	Oil/Water Separator	(10, 11)
Chemical oxidation/coagulation/ clarification system	$C = -3.885(GPM)^2 + 1,374.588(GPM) + 49,978.01$	Truck/Chemical & Petroleum	Chemical Oxidation, Neutralization, Coagulation, Clarification	(12, 13)

Table 9-2 (Continued)

Capital Costs				
Item	**Cost Equation ($1994)**	**Subcategory(ies)**	**Technology(ies)**	**Reference**
Polyalum chloride storage tank	C = 6,698	Truck/Chemical & Petroleum	Chemical Oxidation, Neutralization, Coagulation, Clarification	(12, 13)
Plate-and-frame filter press	$C = -6.244(FCV)^2 + 1{,}527.685(FCV) + 10{,}379.655$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Filter Press, Sludge Dewatering	(14, 15, 23, 24, 28, 29, 35)
Dewatered sludge profile fee and roll-off box drop-off fee	C = 487	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Sludge Dewatering, Filter Press	(7)
Un-dewatered sludge profile fee	C = 200	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food Truck/Hopper Rail/Hopper Barge/Hopper	Oil/Water Separation, Dissolved Air Flotation, Chemical Oxidation, Neutralization, Coagulation, Clarification Biological Treatment, Gravity Separation	(7)
Wastewater pumps (for carbon adsorption system)	$C = -0.11(GPM)^2 + 31.706(GPM) + 562.079$	Truck/Chemical & Petroleum	Activated Carbon Adsorption	(17)
Activated carbon adsorption vessels (2 vessels)	$C = 12.237(ACV)^{1.026}$	Truck/Chemical & Petroleum	Activated Carbon Adsorption	(17)
Bag filters	C = 649.69	Truck/Chemical & Petroleum	Activated Carbon Adsorption	(39)
Backwash tank	$C = 0.9047(V) + 328.65$	Truck/Chemical & Petroleum	Activated Carbon Adsorption	(39)

Table 9-2 (Continued)

Capital Costs				
Item	**Cost Equation ($1994)**	**Subcategory(ies)**	**Technology(ies)**	**Reference**
Wastewater transfer pump	$C = 0.0124(GPM)^3 - 0.985(GPM)^2 + 23.352(GPM) + 847.032$	Rail/Chemical & Petroleum Barge/Chemical & Petroleum Truck/Hopper Rail/Hopper Barge/Hopper	Oil/Water Separation, pH Adjustment, Gravity Separation, Organo-Clay/Activated Carbon Adsorption	(18, 19, 21, 22, 26, 36)
Oil transfer pump	$C = 0.0124(GPM)^3 - 0.985(GPM)^2 + 23.352(GPM) + 847.032$	Rail/Chemical & Petroleum Barge/Chemical & Petroleum	Oil/Water Separation	(18, 19, 27)
Oil/water separator (API)	$C = -0.312(GPM)^2 + 277.123(GPM) + 38{,}266.407$	Rail/Chemical & Petroleum	Oil/Water Separation	(18, 19)
Oil storage tank	$C = 1.949(V) + 573.468$ for V>185 gallons $C = 970$ for $V \leq 185$ gallons	Rail/Chemical & Petroleum	Oil/Water Separation	(18, 19)
Sludge storage tank	$C = 2.668(V) + 154.792$ for V>55 gallons $C = 193$ for $V \leq 55$ gallons	Rail/Chemical & Petroleum	Oil/Water Separation	(18, 19)
Equalization tank	$C = -0.000017(V)^2 + 1.185(V) + 673.73$	Rail/Chemical & Petroleum	Equalization	(20)
Equalization tank agitator	$C = 2827.932LOG_{10}(HP) + 4{,}604.077$	Rail/Chemical & Petroleum	Equalization	(20)
Chemical addition tank and polymer mixing tank	$C = 4.27(V) + 684.194$	Rail/Chemical & Petroleum	pH Adjustment, DAF	(21, 22)
Chemical addition tank mixer	$C = 1.162(V) + 622.232$	Rail/Chemical & Petroleum	pH Adjustment	(21, 22)
pH probe	C = 1,177.70	Rail/Chemical & Petroleum	pH Adjustment	(21, 22)
Acid addition pump	C = 316.8	Rail/Chemical & Petroleum	pH Adjustment	(21, 22)
Caustic addition pump	C = 316.8 for $V \leq 450$ gallons C = 371.8 for V >450 gallons	Rail/Chemical & Petroleum	pH Adjustment	(21, 22)
Polymer mixing tank mixer	$C = 1.071(V) + 610.915$	Rail/Chemical & Petroleum	DAF	(21, 22)
Polymer pump	C = 697.2 for polymers 7622 and 7181 C = 686 for polymer 7032	Rail/Chemical & Petroleum Barge/Chemical & Petroleum	DAF Polymer-Assisted Coagulation	(21, 22, 39)
Polymer dilution tank	$C = 0.00038(V)^3 - 0.18828(V)^2 + 32.308(V) - 554.286$	Rail/Chemical & Petroleum	DAF	(21, 22)
Polymer dilution tank mixer	$C = 3.38(V) + 566.510$	Rail/Chemical & Petroleum	DAF	(21, 22)

Table 9-2 (Continued)

Capital Costs				
Item	**Cost Equation ($1994)**	**Subcategory(ies)**	**Technology(ies)**	**Reference**
DAF unit	C = -1.357(GPM)^2 + 291.471(GPM) + 68,163.591	Rail/Chemical & Petroleum	DAF	(21, 22)
DAF compressor	C = 245.317(HP) + 1,998.279	Rail/Chemical & Petroleum	DAF	(21, 22)
Sludge storage tank	C = 2.587(V) + 159.528	Rail/Chemical & Petroleum	DAF	(21, 22)
Pre-engineered building	C = 19,450.08	Rail/Chemical & Petroleum	DAF	(21, 22)
Sludge transfer pump	C = -22.288(HP)^2 + 327.219(HP) + 1,827.999	Rail/Chemical & Petroleum	Oil/Water Separation, Sludge Dewatering	(18, 23, 24)
Sludge storage tank	C = 15,678.49LOG$_{10}$(V) - 40,333.095	Rail/Chemical & Petroleum	Sludge Dewatering	(24)
Organo-clay/activated carbon vessels	C = 2.922(FMC)^2 + 169.642(FMC) + 3,825.433	Rail/Chemical & Petroleum	Organo-Clay/Granular Activated Carbon	(26)
Oil/water separator(gravity separation)	C = 0.234(V) + 16,153	Barge/Chemical & Petroleum	Oil/Water Separation	(27)
Oil/water separator effluent pump, precoat pump, and filter press influent pump	C = 1,928.46 for GPM<2 C = 2,015.98 for GPM<4 C = 2,226.1 for GPM<7.5 C = 3,371.21 for GPM<15 C = 4,784.05 for GPM<30 C = 6,696.73 for GPM≥30	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Oil/Water Separator, Filter Press, Sludge Dewatering	(14, 23, 27, 28, 29, 35)
DAF unit	C = 46,000 for GPM<53 C = 68,500 for GPM≥53	Barge/Chemical & Petroleum	DAF	(27)
Sludge storage tank	C = 0.917(V) + 322.7	Barge/Chemical & Petroleum	DAF	(27)
Filter press wastewater effluent storage tank	C = 0.526(V) + 3,246.142	Barge/Chemical & Petroleum	Filter Press	(29)
Precoat storage tank	C = 4,160 for FPV <10 C = 4,544 for FPV <30 C = 5,078 for FPV <50 C = 6,980 FPV <100 C = 10,284 for FPV ≥100	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Filter Press, Sludge Dewatering	(14, 23, 28, 29, 35)

Table 9-2 (Continued)

Capital Costs				
Item	**Cost Equation ($1994)**	**Subcategory(ies)**	**Technology(ies)**	**Reference**
Wastewater transfer pump/oil transfer pump (operating at maximum capacity)	$C = 0.0015(GPM)^3 - 0.2463(GPM)^2 + 11.6758(GPM) + 847.0323$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Oil/Water Separation, Biological Treatment	(16, 25, 30, 33, 34)
Preaeration tank	$C = 0.578(V) + 2,142.109$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Biological Treatment	(16, 25, 30, 34)
Diffusers/blowers	$C = 23.443(FT3M) + 787.24$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Biological Treatment	(16, 25, 30, 34)
Biological reactor tank	$C = -0.371(V/1,000)^2 + 475.133(V/1,000) + 2,3000.696$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Biological Treatment	(16, 25, 30, 34)
Clarifier	$C = 0.331(GPM)^2 + 143.329(GPM) + 21,838.385$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Biological Treatment	(16, 25, 30, 34)
Biological treatment optimization labor	$C = 1,036$	Barge/Chemical & Petroleum	Biological Treatment	(40)
Sludge storage and reverse osmosis storage tank	$C = 0.733(V) + 12,170.856$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Biological Treatment, Reverse Osmosis	(16, 25, 30, 31, 34)
Sludge transfer pump	$C = 209.82(HP) + 1,888.2$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Biological Treatment, Sludge Dewatering	(16, 25, 30, 34, 35)

Table 9-2 (Continued)

Capital Costs				
Item	**Cost Equation ($1994)**	**Subcategory(ies)**	**Technology(ies)**	**Reference**
Wastewater pump (effluent from biological treatment)	$C = 3.383(HP)^2 + 64.263(HP) + 1,024.711$	Truck/Chemical & Petroleum Rail/Chemical & Petroleum Barge/Chemical & Petroleum Food	Biological Treatment	(16, 25, 30, 34)
Flooded suction tank	$C = -0.0003(V)^2 + 2.9356(V) + 118.68$ for $V \geq 55$ $C = 193$ for $V<55$	Barge/Chemical & Petroleum	Reverse Osmosis	(31)
Reverse osmosis unit	$C = -13.578(GPM)^2 + 2,600.9(GPM) + 4,773.9$	Barge/Chemical & Petroleum	Reverse Osmosis	(31)
Gravity separator	$C = -0.00002(V)^2 + 1.165(V) + 4748.36$ for $V<21,808$ $C = 0.00000006(V)^2 + 0.2849(V) + 10,738$ for $V \geq 21,808$	Truck/Hopper Rail/Hopper Barge/Hopper Food	Oil/Water Separator, Gravity Separation	(33, 36)

ACV - Activated carbon vessel volume (cubic feet).
API - American Petroleum Institute.
C - Direct capital equipment costs ($1994).
DAF - Dissolved Air Flotation.
FCV - Filter cake volume (cubic feet per day).
FMC - Filter media vessel volume (cubic feet).
FT3M - Flow rate (cubic feet per minute).
GPM - Flow rate (gallons per minute).
HP - Motor horsepower (hp).
FPV - Filter press volume (cubic feet).
V - Tank volume (gallons).

Table 9-3

Components of Total Capital Investment

Item	Component	Cost
1	Equipment capital costs (including required accessories), installation, delivery, electrical and instrumentation, enclosure, and pumping	Direct Capital Cost
2	Piping	10% of item 1
3	Secondary containment/land costs	10% of item 1
4	Excavation and site work	3.5% of item 6
5	Indirect costs including: engineering and supervision, construction expenses, contractor's fee, and contingency	30% of item 6
6	Direct + Indirect Costs	Sum of items 1 through 5 = 1.80 × Direct Capital Cost
7	Start-up costs	$207.2
8	**Total Capital Investment**	**Sum of items 6 and 7 = (1.80 x Direct Capital Cost) + 207.2**

Source: Reference (39).

Table 9-4

Operation and Maintenance Unit Costs Used by the TECI Cost Model

Item	Cost ($1994)/ Cost Equation ($1994)	Practice/ Technology	Reference
Activity			
Contract hauling of bulk wastewater	$0.44/gallon	Contract Haul	(7)
Disposal of waste oil (95% oil, 5% water)	$0.37/gallon	Contract Haul	(7)
Nonhazardous dewatered sludge disposal	$141.01/yd^3 + $4,176/yr for roll-off box rental	Contract Haul	(7)
Nonhazardous undewatered sludge disposal	$0.53-$3.58/gallon (based on volume)	Contract Haul	(7)
Laboratory fee for volatile organic compounds	$459/analysis	Compliance Monitoring	(8)
Laboratory fee for semivolatile organic compounds	$350/analysis	Compliance Monitoring	(39)
Laboratory fee for metals	$598/analysis	Compliance Monitoring	(8)
Laboratory fee for HEM	$35/analysis	Compliance Monitoring	(8)
Laboratory fee for SGT-HEM	$56.67/analysis	Compliance Monitoring	(39)
Laboratory fee for BOD_5	$16/analysis	Compliance Monitoring	(8)
Laboratory fee for COD	$20/analysis	Compliance Monitoring	(8)
Laboratory fee for TSS	$6/analysis	Compliance Monitoring	(40)
Chemicals			
Activated carbon (annual media change-out and regeneration)	$A = 0.00112(ACV)^2 + 11.663(ACV) + 11058.543$	Activated Carbon Adsorption	(17)
Biological treatment microbes	$2.84/lb	Biological Treatment	(16, 25, 30, 34)
Demulsifier	$33.36/gallon	Oil/Water Separator	(10, 11)
Diatomaceous earth	$0.76/lb	Filter Press, Sludge Dewatering	(14, 23, 28, 29, 35)
Organo-clay/activated carbon adsorption (annual media change-out)	$A = -1.785(FMV)^2 + 946.009(FMV) - 450.496$	Organo-Clay/Activated Carbon Adsorption	(25)
Organo-clay/activated carbon disposal (organo-clay incineration and activated carbon regeneration)	$A = 161.429(FMV) + 8464.083$	Organo-Clay/Activated Carbon Adsorption	(26)
Hydrogen peroxide	$0.45-$0.69/lb	Chemical Oxidation, Neutralization, Coagulation, Clarification	(12, 13)

Table 9-4 (Continued)

Item	Cost ($1994)/ Cost Equation ($1994)	Practice/ Technology	Reference
Magnesium hydroxide	$0.26-$0.36/lb	Chemical Oxidation, Neutralization, Coagulation, Clarification	(12, 13)
Polyalum chloride	$2.53-$4.28/gallon	Chemical Oxidation, Neutralization, Coagulation, Clarification	(12, 13)
Polymer	$2.44-$3.00/lb	Chemical Oxidation, Neutralization, Coagulation, Clarification, Biological Treatment	(12, 13, 40)
Polymer 7032	$1.10/lb	DAF	(21, 22)
Polymer 7181	$4.45/lb	DAF	(21, 22)
Polymer 7622	$1.25/lb	DAF	(21, 22)
Sodium hydroxide (50%)	$1.689/gallon	pH Adjustment	(21, 22)
Sulfuric acid (93%)	$0.095-$0.28/lb $1.091/gallon	Chemical Oxidation, Neutralization, Coagulation, Clarification, and pH Adjustment	(12, 13, 21, 22)
Labor Costs			
Flow reduction training	A = (FPT-REG)(0.5)(25.9) for truck tank type A=(FPT-REG)(0.5)(25.9)/(1.7) for rail tank type	Flow Reduction	(5)
Pump operational labor	A = (0.05)(DPY)(25.9)	All	(37)
Pump maintenance labor	A = (0.005)(DPY)(HPD)(25.9)	All	(37)
Oil/water separator (vertical tube coalescing) operational labor	A = (0.05)(DPY)(25.9)	Oil/Water Separator	(10, 11)
Oil/water separator (vertical tube coalescing) maintenance labor	A = (0.005)(HPD)(DPY)(25.9) + ((48)(25.9))	Oil/Water Separator	(10, 11)
Tanks with mixers maintenance labor	A = 103.6 -207.2 (based on tank volume)	Equalization, pH Adjustment, Filter Press, DAF, Biological Treatment, Sludge Dewatering	(9, 14, 20, 21, 22, 23, 28, 29, 30, 32, 35, 38)
Tanks without mixers maintenance labor	A = 414.4 - 828.8 (based on tank volume)	All	(38)
Tank(all) repair labor	A = (0.01)(C)	All	(38)

Table 9-4 (Continued)

Item	Cost ($1994)/ Cost Equation ($1994)	Practice/ Technology	Reference
Filter press operational labor	A = (BPY)(12.95) - (BPY)(25.9) (based on filter press volume)	Filter Press, Sludge Dewatering	(14, 15, 23, 24, 28, 29, 35)
DAF operational labor	A = (1)(DPY)(25.9) - (2)(DPY)(25.9) (based on chemical addition)	DAF	(21, 22, 27)
DAF maintenance and repair labor	A = (0.01)(C) - (0.02)(C) (based on chemical addition)	DAF	(21, 22, 27)
Chemical oxidation, neutralization, coagulation, clarification operational labor	A = (HPD)(DPY)(25.9)	Chemical Oxidation, Neutralization, Coagulation, Clarification	(12, 13)
Chemical oxidation, neutralization, coagulation, clarification maintenance and repair labor	A = (32)(25.9)	Chemical Oxidation, Neutralization, Coagulation, Clarification	(12, 13)
Activated carbon unit repair labor	A = (0.01)(C)	Activated Carbon Adsorption	(17)
Activated carbon operational labor	A = (0.5)(DPY)(25.9) + 1,295	Activated Carbon Adsorption	(39)
Bag filter operational labor	A = (0.5)(DPY)(25.9)	Activated Carbon Adsorption	(39)
Bag filter maintenance and repair labor	A = (0.01)(C)	Activated Carbon Adsorption	(39)
pH probe maintenance and repair labor	A = (2)(0.01)(C)	pH Adjustment	(21, 22)
Organo-clay/granular activated carbon unit repair labor	A = (0.01)(C)	Organo-Clay/Activated Carbon Adsorption	(25)
Reverse osmosis operational labor	A = (DPY)(25.9)	Reverse Osmosis	(31)
Reverse osmosis maintenance labor	A = 414.4	Reverse Osmosis	(31)
Oil/water separation (API) maintenance labor	A = 414.4	Oil/Water Separation	(18, 19)
Material and Replacement Costs			
Pump materials	A = (0.01)(C)	All	(37)
Chemical oxidation/ neutralization/coagulation/ clarification materials	A = (0.01)(C)	Chemical Oxidation, Neutralization, Coagulation, Clarification	(12, 13)
Demulsifier pump materials	A = 15	Oil/Water Separation	(10, 11)
Oil/water separator (vertical tube coalescing) materials	A = 8-25 (based on wastewater flow)	Oil/Water Separation	(10, 11)
Bag filters	A = (2.30)(DPY)	Activated Carbon Adsorption	(39)

Table 9-4 (Continued)

Item	Cost ($1994)/ Cost Equation ($1994)	Practice/ Technology	Reference
Filter press cloths	A = 245-8,100 (based on filter press volume)	Filter Press Sludge Dewatering	(41)
Filter press materials	A = (0.01)(C)	Filter Press Sludge Dewatering	(14, 15, 23, 24, 28, 29, 35)
DAF (with chemical addition) materials	A = (0.01)(C)	DAF	(21, 22)
Annual costs for a building	A = (0.035)(C)	DAF	(21, 22)
pH probe materials	A = 185/0.75	pH Adjustment	(21, 22)
Filter press precoat storage tank materials	A = (0.01)(C)	Filter Press, Sludge Dewatering	(14, 23, 28, 29, 35)
Reverse osmosis membrane replacement	$A = -1.409(GPM)^2 + 142.64(GPM) + 707.27$	Reverse Osmosis	(31)
General Costs			
Electricity usage fee	$0.047/ kilowatt-hour	All	(4)
O&M labor rate	$25.90/hour	All	(3)
Water usage fee	$2.98/1,000 gal of water	Flow Reduction	(5)

A - Annual costs ($1994/year).
ACV - Activated carbon vessel volume (cubic feet).
BPY - Filter press batches per year.
C - Direct capital equipment costs ($1994).
DPY - Operating days per year.
DAF - Dissolved Air Flotation.
FMV - Filter media vessel volume (cubic feet).
FPT - Flow per tank (gallons).
GPM - Flow rate (gallons per minute).
HPD - Operating hours per day.
REG - Subcategory median flow per tank (gallons).

Table 9-5

Target Wastewater Flow by Facility Type

Facility Type	Target Flow (gallons/tank)
Truck/Chemical & Petroleum	605
Rail/Chemical & Petroleum	2,091
Truck/Food	790
Rail/Food	4,500
Barge/Food	4,500
Truck/Hopper	144
Rail/Hopper	267
Barge/Hopper	712

Source: Reference (2).

Table 9-6

Cost Summary of Regulatory Options for BPT/BAT/BCT (a)

Subcategory	Option	Capital Cost (Thousand $1994)	O&M Cost (Thousand $/yr (in $1994))
Barge/Chemical & Petroleum	1	$85	$126
Barge/Chemical & Petroleum	2	$1,800	$316
Rail/Chemical & Petroleum	1	$0	$7
Rail/Chemical & Petroleum	2	$184	$35
Rail/Chemical & Petroleum	3	$199	$61
Truck/Chemical & Petroleum	1	$77	$(28)
Truck/Chemical & Petroleum	2	$77	$(28)
Food (b)	1	$0	$0
Food (b)	2	$0	$0
Barge/Hopper (c)	1	$160	$480

Source: Output from the Transportation Equipment Cleaning Industry Design and Cost Model.

(a) Costs are based on monthly monitoring for regulated toxic pollutants and weekly monitoring for regulated conventional pollutants.
(b) All direct dischargers in these subcategories currently operate oil/water separation, equalization, and biological treatment and are expected to meet the pollutant discharge long-term averages without incurring any additional capital or annual costs.
(c) Costs are based on only monthly monitoring for all pollutants.

Table 9-7

Cost Summary of Regulatory Options for PSES (a)

Subcategory	Option	Capital Cost (Thousand $1994)	O&M Cost (Thousand $/yr (in $1994))
Barge/Chemical & Petroleum	1	$0	$61
Barge/Chemical & Petroleum	2	$0	$61
Barge/Chemical & Petroleum	3	$430 (b)	$220 (b)
Rail/Chemical & Petroleum	1	$3,190	$496
Rail/Chemical & Petroleum	2	$7,040	$659
Rail/Chemical & Petroleum	3	$7,540	$1,500
Truck/Chemical & Petroleum	A	$19,300	$5,480
Truck/Chemical & Petroleum	1	$51,400	$8,030
Truck/Chemical & Petroleum	2	$65,400	$23,600
Food	1	$18,100 (c)	$30.6 (c)
Food	2	$96,400 (c)	$61.6 (c)
Barge/Hopper	1	$0 (c)	$26 (c)
Rail/Hopper	1	$0 (c)	$28 (c)
Truck/Hopper	1	$310 (c)	$390 (c)

Source: Output from the Transportation Equipment Cleaning Design and Cost Model.

(a) Costs are based on monthly monitoring of all regulated pollutants.
(b) Costs are based on one facility; however, since proposal, EPA has identified four facilities that previously discharged directly to surface waters and have since either switched or plan to switch discharge status. EPA did not consider Option 3 for PSES or PSNS at proposal; therefore, EPA did not revise compliance costs for this option for the final rule.
(c) EPA did not consider these options for PSES or PSNS at proposal; therefore, EPA did not revise compliance costs for these options for the final rule.

10.0 POLLUTANT REDUCTION ESTIMATES

This section describes EPA's estimates of industry pollutant loadings and pollutant reductions for each of the Transportation Equipment Cleaning Industry (TECI) technology options described in Section 8.0. The Agency estimated pollutant loadings and pollutant reductions at TEC facilities in order to evaluate the impact of pollutant loadings currently released to surface waters and publicly-owned treatment works (POTWs), to evaluate the impact of pollutant loadings released to surface waters and POTWs following implementation of each TECI regulatory option, and to assess the cost-effectiveness of each TECI regulatory option in achieving these pollutant loading reductions. Untreated, baseline, and post-compliance pollutant loadings and pollutant reductions were estimated for pollutants of interest that were treated by the technology bases. The selection of pollutants included in the load removal estimates is discussed below. Untreated, baseline, and post-compliance pollutant loadings are defined as follows:

- Untreated loadings - pollutant loadings in raw transportation equipment cleaning (TEC) wastewater. These loadings represent pollutant loadings generated by the TECI, and do not account for wastewater treatment currently in place at TEC facilities.

- Baseline loadings - pollutant loadings in TEC wastewater currently being discharged to POTWs or U.S. surface waters. These loadings account for wastewater treatment currently in place at TEC facilities.

- Post-compliance loadings - pollutant loadings in TEC wastewater that would be discharged following implementation of each regulatory option. These loadings are calculated assuming that all TEC facilities would operate wastewater treatment technologies equivalent to the technology bases for the regulatory options evaluated.

The following information is presented in this remainder of this chapter:

- Section 10.1 presents the methodology used to identify pollutants included in the load removal estimates;

- Section 10.2 presents the general methodology used to calculate TECI pollutant loadings and pollutant reductions;
- Section 10.3 presents the general methodology used to estimate untreated pollutant loadings in TEC wastewaters;
- Section 10.4 presents the methodology used to estimate untreated production normalized pollutant loadings (PNPLs) in TEC wastewaters for multiple subcategory facilities;
- Section 10.5 presents the estimated untreated pollutant loadings for the TECI;
- Section 10.6 presents the estimated baseline pollutant loadings for the TECI;
- Section 10.7 presents the estimated post-compliance pollutant loadings for the TECI;
- Section 10.8 presents the estimated pollutant loading reductions achieved by the TECI following implementation of each regulatory option; and
- Section 10.9 presents references for this section.

EPA has not directly evaluated pollutant removals for the pollution prevention alternative. EPA believes that pollutant reductions would be equivalent to or exceed the load removals from EPA's regulatory options.

10.1 Methodology Used to Identify Pollutants Included in the Load Removal Estimates

After determining pollutants of interest for each subcategory (discussed in Section 6.6), EPA selected treatment technologies and composed technology options that control the pollutants of interest for each subcategory. Next, EPA gathered influent and effluent sampling data to characterize treatment performance for the options. EPA evaluated the sampling data and determined if a pollutant of interest was treated by one or more of the wastewater treatment technology options evaluated for each subcategory and discharge type (i.e., indirect or direct) by analyzing the percent reduction achieved by the technology option. (The technology options considered for each subcategory are discussed in Section 8.0.) EPA included all pollutants of interest in the load removal estimates that had a removal efficiency greater than 0% by at least one technology option considered by the Agency. The criterion was applied to the base technology option and to each incremental technology option individually. This criterion insures that EPA does not select for regulation pollutants that are not removed or controlled by the technology options considered by the Agency.

If a given pollutant of interest met this criterion, treatment effectiveness concentrations and/or percent removal efficiencies were also calculated. Additional information on identifying pollutants included in the load removal estimates and their corresponding removal rates for each TECI subcategory can be found in reference 1 and reference 2.

10.2 General Methodology Used to Calculate Pollutant Loadings and Pollutant Reductions

In general, pollutant loadings and pollutant reductions were calculated for the TECI using the following methodology:

1. Field sampling data were analyzed to determine pollutant concentrations in untreated TEC wastewaters.

2. These concentrations were converted to untreated PNPLs for each TECI subcategory using the sampled facility production data (i.e., the number of tanks cleaned), wastewater flow rates, and operating data.

3. Untreated PNPLs were used in the TECI cost model (see Section 9.0) to estimate the loading of each pollutant in each model facility untreated TEC wastewater stream.

4. Model facility daily untreated pollutant loadings were converted to untreated influent concentrations using facility flow data and a conversion factor.

5. Model facility untreated pollutant loadings and statistically generated weighting factors were used to calculate untreated wastewater pollutant loadings for the TECI and each TECI subcategory.

6. For each pollutant of interest (see Section 6.6), pollutant removal efficiencies achieved by the treatment technologies that comprise each TECI regulatory option were developed using analytical data collected during EPA's TECI sampling program.

7. Treated effluent concentrations, or treatment effectiveness concentrations, that are achieved by treatment technologies that comprise each TECI regulatory option were developed using analytical data collected during EPA's TECI sampling program.

8. The TECI cost model calculated the pollutant loadings and pollutant loading reductions achieved at baseline. For facilities that have existing treatment, the cost model compared the untreated TEC wastewater influent concentrations to the treatment effectiveness concentrations and percent removal efficiency achieved by existing treatment, and determined the pollutant reductions achieved by the existing treatment.

9. The baseline pollutant concentrations were converted to baseline pollutant loadings using facility flow rates and a conversion factor.

10. TECI and TECI subcategory baseline pollutant loadings were calculated for each regulatory option using the model facility baseline pollutant loadings and statistically generated weighting factors.

11. The TECI cost model calculated the post-compliance pollutant loadings and pollutant reductions achieved by each regulatory option. As discussed in Section 8.0, each TECI regulatory option is comprised of a set of pollutant control technologies. For each facility and for each treatment unit, the cost model compared the pollutant concentrations in the wastewater influent to the treatment effectiveness concentration and/or the pollutant percent removal efficiency achieved by the treatment unit, and then determined the pollutant reductions achieved.

12. The post-compliance pollutant concentrations were converted to post-compliance pollutant loadings using facility flow rates and a conversion factor.

13. TECI and TECI subcategory post-compliance pollutant loadings were calculated for each regulatory option using the model facility post-compliance pollutant loadings and statistically generated weighting factors.

14. For each model facility, the pollutant reductions achieved by each regulatory option were calculated by subtracting the post-compliance pollutant loadings from the baseline pollutant loadings.

15. TECI and TECI subcategory pollutant reductions achieved by each regulatory option were calculated using the model facility pollutant reductions and statistically generated weighting factors.

10.3 General Methodology Used to Estimate Untreated Pollutant Loadings

The Agency used analytical data collected during EPA's TECI sampling program to calculate untreated PNPLs for pollutants of interest that were removed by the regulatory options evaluated for each TECI subcategory. The following table lists the number of untreated wastewater characterization samples collected and analyzed for each TECI subcategory:

Subcategory	Number of Untreated Wastewater Characterization Samples Collected	Number of Facilities Sampled
Truck/Chemical & Petroleum	10	5
Rail/Chemical & Petroleum	5	2
Barge/Chemical & Petroleum	10	3
Food	7	3
Truck/Hopper	0	0
Rail/Hopper	0	0
Barge/Hopper	1	1

Note that although some analytical data were available from facility responses to the Detailed Questionnaire, these data were not useable for one or more of the following reasons: (1) the data provided represented samples collected at a variety of treatment system influent/effluent points that may not correspond to the technology options considered as the bases for regulation; (2) the data provided were an average estimated by the facility over one or more sampling days, rather than individual analytical results as required for statistical analyses; and (3) analytical quality assurance/quality control (QA/QC) data were not provided, prohibiting an assessment of the data quality. No untreated wastewater characterization data were submitted in comments on the proposed rule and notice of availability.

For each facility sampled, data on facility production (i.e., number of tanks cleaned per day), cargo types cleaned, TEC wastewater flow rate, operating hours per day, and operating days per year were collected. These data were used in conjunction with the untreated wastewater analytical data to calculate PNPLs for each subcategory using the methodology described below.

EPA first calculated PNPLs for each untreated wastewater sample collected at each facility using the following equation:

$$L_i = \frac{C_i \times cf \times F}{T} \qquad (1)$$

where:

i	=	Pollutant *i* in waste stream
L_i	=	Pollutant loading generated per tank cleaned (milligram/tank or microgram/tank, depending on the pollutant)
C_i	=	Pollutant concentration in TEC wastewater characterization sample (milligram/liter or microgram/liter, depending on the pollutant)
cf	=	Conversion factor (liters per gallon)
F	=	Daily flow rate (gallons/day); gallons per year calculated by multiplying the flow in gallons per day by the number of operating days per year
T	=	Number of tanks cleaned per day; the number of tanks cleaned per year was calculated by multiplying the number of tanks cleaned per day by the number of operating days per year

Certain pollutants were not detected above the sample detection limits in some wastewater samples. Because both nondetect and detect results represent the variability of pollutant concentrations in TEC wastewater, both results were included in calculating PNPLs. For nondetect results, EPA assumed the pollutant concentration was equal to the sample detection limit for that pollutant. EPA based this assumption on the expectation that the pollutant was present in TEC wastewater, albeit at a concentration less than the sample detection limit.

If duplicate samples or multiple grab samples (e.g., for HEM and SGT-HEM analyses) of untreated wastewater were collected at a facility, EPA calculated the daily average PNPL for each pollutant at that facility using the following equation:

$$DL_i = \frac{\sum_{j=\text{Sample 1}}^{N} L_{i,j}}{N} \tag{2}$$

where:

DL_i	=	Daily average pollutant loading generated per tank cleaned (milligram/tank or microgram/tank, depending on the pollutant)
i	=	Pollutant *i* in waste stream
$L_{i,j}$	=	Pollutant loading generated per tank cleaned for sample (milligram/tank or microgram/tank, depending on the pollutant)
j	=	Counter for number of duplicate or grab samples collected
N	=	Number of duplicate or grab samples collected

In cases where EPA collected samples from the same sampling point at the same facility over multiple sampling days, EPA calculated a facility average PNPL using the following equation:

$$FL_i = \frac{\sum_{j=\text{Day 1}}^{\text{Day N}} L_{i,j} \text{ (or } DL_{i,j}\text{)}}{N} \tag{3}$$

where:

FL_i	=	Facility-specific average pollutant loading generated per tank cleaned (milligram/tank or microgram/tank, depending on the pollutant)
i	=	Pollutant *i* in waste stream
$L_{i,j}$	=	Pollutant loading generated per tank cleaned on Day j (milligram/tank or microgram/tank, depending on the pollutant)

$DL_{i,j}$ = Daily average pollutant loading generated per tank cleaned on Day j (milligram/tank or microgram/tank, depending on the pollutant)

j = Counter for number of days of sampling at a specific facility

N = Number of sampling days at a specific facility

Finally, EPA calculated subcategory PNPLs by averaging the applicable average facility-specific PNPLs as shown in the equation below. This methodology ensured that pollutant data from each sampled facility were weighted equally in calculating the subcategory PNPLs, regardless of the number of wastewater samples collected at each facility.

$$PNPL_i = \frac{\sum_{j=\text{Facility 1}}^{\text{Facility N}} FL_{i,j}}{N} \qquad (4)$$

where:

$PNPL_i$ = Subcategory average production normalized pollutant loading generated per tank cleaned (milligram/tank or microgram/tank, depending on the pollutant)

i = Pollutant *i* in waste stream

$FL_{i,j}$ = Facility-specific average pollutant loading generated per tank cleaned (milligram/tank or microgram/tank, depending on the pollutant)

j = Counter for number of facilities sampled for a specific subcategory

N = Number of facilities sampled for a specific subcategory

Additional information on the calculation of untreated PNPLs for each TECI subcategory can be found in reference 3.

10.4 Multiple Subcategory Facility PNPLs

Some modeled facilities have production in more than one subcategory. For example, a facility that cleans both tank trucks and rail tank cars that last transported chemical cargos has production in both the Truck/Chemical & Petroleum and the Rail/Chemical & Petroleum Subcategories. To simplify compliance cost and pollutant reduction estimates, EPA assigned each multiple subcategory facility to a single primary subcategory. As a result of this simplification, EPA modeled control of all TEC wastewater generated by multiple subcategory facilities using the technology options evaluated for the facility's primary subcategory (rather than segregating and treating the waste streams in separate wastewater treatment systems). EPA accounted for untreated TEC wastewater pollutant loadings from other secondary subcategories by using the PNPLs from secondary subcategory wastewater for those pollutants that were also pollutants of interest for the primary subcategory. Estimation of pollutant reductions for multiple subcategory facilities is described in greater detail in the rulemaking record.

10.5 TECI Untreated Pollutant Loadings

TECI untreated pollutant loadings represent the industry pollutant loadings before accounting for pollutant removal by treatment technologies already in place at TEC facilities. The Agency estimated untreated pollutant loadings generated by model facilities using the untreated PNPLs developed for each stream type (i.e., PNPLs for tank trucks cleaned at Truck/Chemical & Petroleum Subcategory facilities, etc.) and the number of tanks cleaned per year at each model facility.

The model facility untreated wastewater pollutant loadings were then weighted using statistically derived weighting factors for each model facility. The weighted model facility loadings were then summed to estimate untreated pollutant loadings for each subcategory and the entire TECI. Tables 10-1 through 10-10 present total industry untreated pollutant loadings by pollutant and discharge status for each subcategory.

10.6 TECI Baseline Pollutant Loadings

TECI baseline loadings represent the pollutant loadings currently discharged by TEC facilities to U.S. surface waters or to POTWs after accounting for removal of pollutants by existing on-site treatment. Section 9.2.5 describes the assessment of the treatment in place at each model TEC facility. The model facility baseline pollutant loadings were calculated as the difference between the model facility untreated wastewater pollutant loadings calculated as described in Section 10.5 and the pollutant reductions achieved by treatment in place at each TECI model facility.

The model facility baseline pollutant loadings were then weighted using the statistically derived weighting factors for each model facility. The weighted model facility baseline loadings were then summed to estimate the baseline pollutant loadings for the entire TECI. Tables 10-1 through 10-10 present the total industry baseline pollutant loadings by pollutant and discharge status for each subcategory.

10.7 TECI Post-Compliance Pollutant Loadings by Regulatory Option

TECI post-compliance pollutant loadings represent the pollutant loadings that would be discharged following implementation of the regulatory options. Model facility post-compliance pollutant loadings were calculated using the following steps. First, model facility baseline pollutant loadings were calculated as described in Section 10.6. Second, these loadings were converted to baseline pollutant effluent concentrations for each model facility using the baseline pollutant loadings, the facility process wastewater flow, and a conversion factor. Third, the baseline pollutant effluent concentrations were compared to the effluent concentrations achieved by each regulatory option. Finally, the lower of these concentrations was used along with the facility flow and an appropriate conversion factor to determine the model facility post-compliance pollutant loadings for each regulatory option.

The model facility post-compliance pollutant loadings were then weighted using the statistically derived weighting factors for each model facility. The weighted model facility post-compliance pollutant loadings were then summed to estimate the post-compliance pollutant loadings for the entire TECI. Tables 10-1 through 10-10 present the total industry post-compliance pollutant loadings by pollutant and discharge status for each subcategory.

10.8 TECI Pollutant Loading Reduction Estimates

The pollutant loading reductions represent the pollutant removal achieved through implementation of the regulatory options. Therefore, the pollutant loading reductions are the difference between the post-compliance pollutant loadings and the baseline pollutant loadings for each regulatory option considered. Estimated pollutant loading reductions achieved by each regulatory option are described below by regulation and are shown in Tables 10-1 through 10-10.

10.8.1 BPT

Table 10-11 summarizes pollutant loading reductions for each TECI regulatory option considered for BPT. Although EPA developed a BPT option for the Truck/Hopper and Rail/Hopper Subcategories, pollutant reductions for this option were not estimated for these subcategories because none of the model facilities in these subcategories are direct dischargers.

Tables 10-1 through 10-4 present the BPT pollutant loading reduction estimates for all pollutants and regulatory options for the following subcategories:

- Truck/Chemical & Petroleum Subcategory (Table 10-1);
- Rail/Chemical & Petroleum Subcategory (Table 10-2);
- Barge/Chemical & Petroleum Subcategory (Table 10-3); and
- Barge/Hopper Subcategory (Table 10-4).

As discussed in Section 9.2.9, EPA did not use the cost model to estimate compliance costs for direct dischargers in the Barge/Chemical & Petroleum Subcategory. In addition, EPA did not use the cost model to estimate pollutant loadings and reductions for this subcategory for the same reasons discussed in Section 9.2.9. Because EPA used BOD and/or COD baseline concentrations as indicators for treatment of other pollutants of interest, EPA did not estimate baseline loadings and removals for other pollutants of interest.

Furthermore, EPA did not re-evaluate Option 2 pollutant loadings and removals for the Barge/Chemical & Petroleum Subcategory because this option was determined to not represent the average of the best treatment (because it is not commonly used in the industry) for the proposed rule. The Proposed Technical Development Document presents baseline and option loadings and removals for all options considered at proposal, including Option 2 (4). Note that these loadings are not representative of the current state of the industry (because several facilities have changed discharge status) and EPA's available sampling data; however, the loadings demonstrate the pollutant reduction capacity of Option 2.

10.8.2 BCT

BCT options developed and evaluated by EPA are identical to those developed and evaluated for BPT. Therefore, BCT pollutant loading reductions are identical to the BPT pollutant loading reductions for conventional pollutants discussed in Section 10.8.1.

10.8.3 BAT

BAT options developed and evaluated by EPA are identical to those developed and evaluated for BPT. Therefore, BAT pollutant loading reductions are identical to the BPT pollutant loading reductions for priority and nonconventional pollutants discussed in Section 10.8.1.

10.8.4 PSES

Table 10-12 summarizes pollutant loading reductions for each TECI regulatory option considered for PSES.

Tables 10-5 through 10-10 present the PSES pollutant loading reduction estimates for all pollutants and regulatory options for the following subcategories:

- Truck/Chemical & Petroleum Subcategory (Table 10-5);
- Rail/Chemical & Petroleum Subcategory (Table 10-6);
- Food Subcategory (Table 10-7);
- Truck/Hopper Subcategory (Table 10-8);
- Rail/Hopper Subcategory (Table 10-9); and
- Barge/Hopper Subcategory (Table 10-10).

As discussed in Section 9.2.9, based on a review of current operating and discharge monitoring data (e.g., BOD and/or COD) for EPA's model facilities in the Barge/Chemical & Petroleum Subcategory, EPA believes that all model indirect discharging facilities are meeting levels of control that would be established under PSES Options 1 and 2. Consequently, EPA estimates zero load reductions associated with these options. EPA believes there may be some additional removals associated with PSES Option 3; however, EPA believes that this option would not result in a significant reduction of toxic pollutants because most pollutants are already treated to very low levels based on the Option 2 level of control. EPA did not re-evaluate Option 3 pollutant loadings and removals for this subcategory because this option was rejected for the proposed rule because of small incremental removals achieved by this option. The Proposed Development Document presents baseline and option loadings and removals for all options considered at the proposal, including Option 3 (4). Note that these loadings are not representative of the current state of the industry (because several facilities have changed discharge status) and EPA's available sampling data; however, the loadings demonstrate the pollutant reduction capacity of Option 2 and Option 3.

10.9 References[1]

1. Eastern Research Group, Inc. Development of Final Removal Efficiencies and Treatment Effectiveness Concentrations for Regulated Subcategories. Memorandum from Melissa Cantor, Eastern Research Group, Inc. to the TECI Rulemaking Record. March 28, 2000 (DCN T20513).

2. Eastern Research Group, Inc. Development of Treatment Effectiveness Concentrations and Percent Removals. Memorandum from Grace Kitzmiller, Eastern Research Group, Inc. to the TECI Rulemaking Record. April 29, 1998 (DCN T09764).

3. Eastern Research Group, Inc. Development of Transportation Equipment Cleaning Industry Production Normalized Pollutant Loadings. Memorandum from Grace Kitzmiller, Eastern Research Group, Inc. to the TECI Rulemaking Record. May 6, 1998 (DCN T09981).

4. U.S. Environmental Protection Agency, Office of Water. Development Document for Proposed Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category. EPA-821-B-98-011, May 1998.

[1]For those references included in the administrative record supporting the TECI rulemaking, the document control number (DCN) is included in parentheses at the end of the reference.

Table 10-1

Truck/Chemical & Petroleum Subcategory – Direct Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals							
5-Day Biochemical Oxygen Demand	NA	420,000	930	920	920	8.6	8.6
Oil and Grease (HEM)	NA	250,000	700	700	700	6.5	6.5
Total Suspended Solids	NA	230,000	3,400	3,400	3,400	32	32
Bulk Nonconventionals							
Chemical Oxygen Demand	NA	1,000,000	36,000	35,000	35,000	330	330
Total Organic Carbon	NA	240,000	27,000	27,000	27,000	250	250
Total Petroleum Hydrocarbons (SGT-HEM)	NA	23,000	640	640	640	6.0	6.0
Nonconventional Metals							
Aluminum	7429905	1,100	25	25	25	<1	< 1
Boron	7440428	580	35	35	35	<1	< 1
Iron	7439896	3,300	120	120	120	1.1	1.1
Manganese	7439965	170	27	27	27	<1	< 1
Phosphorus	7723140	9,800	2,800	2,700	2,700	26	26
Silicon	7440213	2,300	660	660	660	6.2	6.2
Tin	7440315	2,100	830	820	820	7.7	7.7
Titanium	7440326	34	2.5	2.4	2.4	<1	< 1
TOTAL Nonconventional Metals		**19,000**	**4,500**	**4,400**	**4,400**	**41**	**41**

Table 10-1 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Nonconventional Organics							
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	< 1	< 1	< 1	< 1	< 1	< 1
2,4,5-T	93765	< 1	< 1	< 1	< 1	< 1	< 1
2-Methylnaphthalene	91576	13	1.3	1.3	1.3	< 1	< 1
2-Isopropylnaphthalene	2027170	33	1.3	1.3	1.3	< 1	< 1
2,4-DB (Butoxon)	94826	1.3	1.2	1.2	1.2	< 1	< 1
2,4,5-TP	93721	< 1	< 1	< 1	< 1	< 1	< 1
Acetone	67641	5,100	300	300	300	< 1	< 1
Adsorbable Organic Halides (AOX)	59473040	810	79	79	79	< 1	< 1
alpha-Terpineol	98555	45	1.3	1.3	1.3	< 1	< 1
Azinphos Methyl	86500	< 1	< 1	< 1	< 1	< 1	< 1
Benzoic Acid	65850	4,300	270	270	270	< 1	< 1
Benzyl Alcohol	100516	49	2.5	2.5	2.5	< 1	< 1
Dalapon	75990	< 1	< 1	< 1	< 1	< 1	< 1
Diallate	2303164	3.8	< 1	< 1	< 1	< 1	< 1
Dimethyl Sulfone	67710	1,300	1.3	1.3	1.3	< 1	< 1
Leptophos	21609905	1.0	< 1	< 1	< 1	< 1	< 1
m-Xylene	108383	360	1.3	1.3	1.3	< 1	< 1
MCPA	94746	100	34	34	34	< 1	< 1
Methyl Ethyl Ketone	78933	920	18	18	18	< 1	< 1
Methyl Isobutyl Ketone	108101	350	21	21	21	< 1	< 1

Table 10-1 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
n-Octadecane	593453	71	1.3	1.3	1.3	< 1	< 1
n-Triacontane	638686	39	1.3	1.3	1.3	< 1	< 1
n-Tetradecane	629594	89	1.3	1.3	1.3	< 1	< 1
n-Decane	124185	63	1.3	1.3	1.3	< 1	< 1
n-Docosane	629970	19	1.3	1.3	1.3	< 1	< 1
n-Dodecane	112403	200	1.3	1.3	1.3	< 1	< 1
n-Eicosane	112958	55	1.3	1.3	1.3	< 1	< 1
n-Hexacosane	630013	26	1.3	1.3	1.3	< 1	< 1
n-Hexadecane	544763	130	1.3	1.3	1.3	< 1	< 1
n-Tetracosane	646311	33	1.3	1.3	1.3	< 1	< 1
o-Cresol	95487	13	1.7	1.7	1.7	< 1	< 1
o+p-Xylene	136777612	180	1.3	1.3	1.3	< 1	< 1
Octachlorodibenzo-p-dioxin	3268879	< 1	< 1	< 1	< 1	< 1	< 1
p-Cresol	106445	13	1.7	1.7	1.7	< 1	< 1
p-Cymene	99876	10	1.3	1.3	1.3	< 1	< 1
Pentachloronitrobenzene	82688	1.4	< 1	< 1	< 1	< 1	< 1
Styrene	100425	570	1.7	1.7	1.7	< 1	< 1
Total Phenols	NA	390	230	230	230	2.2	2.2
TOTAL Nonconventional Organics		**15,000**	**990**	**990**	**990**	**3.7**	**3.7**

Table 10-1 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Other Nonconventionals							
Fluoride	16984488	3,600	2,400	2,300	2,300	22	22
Nitrate/Nitrite	NA	320	90	89	89	< 1	< 1
Total Phosphorus	14265442	4,600	1,200	1,200	1,200	12	12
Surfactants (MBAS)	NA	3,000	130	130	130	1.2	1.2
TOTAL Other Nonconventionals		**12,000**	**3,800**	**3,800**	**3,800**	**35**	**35**
Priority Metals							
Chromium	7440473	350	2.5	2.5	2.5	< 1	< 1
Copper	7440508	43	11	11	11	< 1	< 1
Mercury	7439976	< 1	< 1	< 1	< 1	< 1	< 1
Zinc	7440666	100	2.6	2.5	2.5	< 1	< 1
TOTAL Priority Metals		**490**	**16**	**16**	**16**	**< 1**	**< 1**
Priority Organics							
1,2-Dichloroethane	107062	98	1.6	1.6	1.6	< 1	< 1
1,1,1-Trichloroethane	71556	130	1.3	1.3	1.3	< 1	< 1
1,2-Dichlorobenzene	95501	18	1.3	1.3	1.3	< 1	< 1
2-Chlorophenol	95578	11	1.7	1.7	1.7	< 1	< 1
Benzene	71432	6.4	1.3	1.3	1.3	< 1	< 1
beta-BHC	319857	< 1	< 1	< 1	< 1	< 1	< 1
Bis (2-ethylhexyl) Phthalate	117817	92	1.3	1.3	1.3	< 1	< 1
Chloroform	67663	12	1.3	1.3	1.3	< 1	< 1

Table 10-1 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Di-n-Octyl Phthalate	117840	30	1.3	1.3	1.3	< 1	< 1
Ethylbenzene	100414	81	1.3	1.3	1.3	< 1	< 1
Methylene Chloride	75092	2,000	220	210	210	2.0	2.0
Naphthalene	91203	55	1.3	1.3	1.3	< 1	< 1
Tetrachloroethylene	127184	200	1.3	1.3	1.3	< 1	< 1
Toluene	108883	310	1.3	1.3	1.3	< 1	< 1
Trichloroethylene	79016	3.6	1.8	1.8	1.8	< 1	< 1
TOTAL Priority Organics		**3,100**	**230**	**230**	**230**	**2.2**	**2.2**

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.
Note: EPA did not revise the pollutant loadings and reductions to include 18 additional pollutants of interest and the final pollutant removal methodology because these additional pollutant removals would have an insignificant impact on the total load removals.

Table 10-2

Rail/Chemical & Petroleum Subcategory – Direct Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals									
5-Day Biochemical Oxygen Demand	NA	8,200	62	62	62	55	0	0	7.5
Oil and Grease (HEM)	NA	3,600	50	50	28	28	0	22	22
Total Suspended Solids	NA	2,400	85	85	85	23	0	0	62
Bulk Nonconventionals									
Chemical Oxygen Demand	NA	19,000	770	770	770	760	0	0	15
Total Dissolved Solids	NA	37,000	34,000	34,000	25,000	21,000	0	9,200	13,000
Total Organic Carbon	NA	4,500	770	770	540	510	0	230	260
Total Petroleum Hydrocarbons (SGT-HEM)	NA	860	87	87	28	28	0	59	59
Nonconventional Metals									
Aluminum	7429905	55	23	23	12	< 1	0	10	22
Barium	7440393	3.4	3.3	3.3	1.1	1.1	0	2.2	2.2
Boron	7440428	8.6	7.6	7.6	6.3	5.5	0	1.4	2.1
Calcium	7440702	170	130	130	130	130	0	2.7	2.7
Iron	7439896	70	70	70	< 1	< 1	0	69	69
Magnesium	7439954	69	57	57	55	55	0	1.7	1.7
Manganese	7439965	3.5	2.9	2.9	1.9	1.9	0	< 1	< 1
Phosphorus	7723140	56	45	45	8.5	5.7	0	36	39
Potassium	7440097	4,500	4,200	4,200	3,300	3,100	0	890	1,100
Silicon	7440213	57	57	57	39	39	0	18	18

Table 10-2 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Sodium	7440235	7,800	6,900	6,900	4,900	4,800	0	1,900	2,100
Sulfur	7704349	2,200	2,000	2,000	1,500	1,300	0	450	620
Titanium	7440326	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
TOTAL Nonconventional Metals		**15,000**	**13,000**	**13,000**	**10,000**	**9,500**	**0**	**3,400**	**3,900**
Nonconventional Organics									
1-Methylphenanthrene	832699	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
2,4-Diaminotoluene	95807	7.3	7.3	7.3	6.9	< 1	0	< 1	6.7
2,4,5-TP	93721	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
2,4,5-T	93765	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
2,4-DB (Butoxon)	94826	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Acephate	30560191	3.0	2.9	2.9	2.5	< 1	0	< 1	2.8
Acetone	67641	2.1	< 1	< 1	< 1	< 1	0	0	0
Adsorbable Organic Halides (AIX)	59473040	5.3	1.7	1.7	1.6	1.2	0	< 1	< 1
Benefluralin	1861401	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Benzoic Acid	65850	7.8	< 1	< 1	< 1	< 1	0	0	< 1
Carbazole	86748	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Dacthal (DCPA)	1861321	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Diallate	2303164	1.3	< 1	< 1	< 1	< 1	0	< 1	< 1
Dicamba	1918009	2.0	1.9	1.9	< 1	< 1	0	1.9	1.9
Dichloroprop	120365	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Dimethyl Sulfone	67710	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Dinoseb	88857	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Gamma-chlordane	5103742	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Hexanoic Acid	142621	11	11	11	6.0	6.0	0	4.9	4.9

Table 10-2 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
m-Xylene	108383	< 1	< 1	< 1	< 1	< 1	0	0	0
MCPP	7085190	130	130	130	15	< 1	0	110	130
Methyl Ethyl Ketone	78933	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
n-Triacontane	638686	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
n-Tetracosane	646311	1.0	< 1	< 1	< 1	< 1	0	< 1	< 1
n-Tetradecane	629594	6.5	< 1	< 1	< 1	< 1	0	0	0
n-Octadecane	593453	5.7	< 1	< 1	< 1	< 1	0	0	0
n-Docosane	629970	1.2	< 1	< 1	< 1	< 1	0	0	0
n-Octacosane	630024	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
n-Dodecane	112403	1.7	< 1	< 1	< 1	< 1	0	0	0
n-Eicosane	112958	4.9	< 1	< 1	< 1	< 1	0	0	0
n-Hexadecane	544763	9.4	< 1	< 1	< 1	< 1	0	0	0
n-Hexacosane	630013	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
o+p-Xylene	136777612	< 1	< 1	< 1	< 1	< 1	0	0	0
Octachlorodibenzo-p-dioxin	3268879	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Octachlorodibenzofuran	39001020	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
p-Cresol	106445	< 1	< 1	< 1	< 1	< 1	0	0	< 1
Pentachloronitrobenzene	82688	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Propachlor	1918167	< 1	< 1	< 1	< 1	< 1	0	0	0
Propazine	139402	< 1	< 1	< 1	< 1	< 1	0	0	< 1
Styrene	100425	< 1	< 1	< 1	< 1	< 1	0	0	0
Terbacil	5902512	< 1	< 1	< 1	< 1	< 1	0	0	0
Terbuthylazine	5915413	9.4	9.3	9.3	6.7	< 1	0	2.6	9.3

Table 10-2 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Total Phenols	NA	2.5	1.8	1.8	1.2	< 1	0	< 1	1.6
TOTAL Nonconventional Organics		**220**	**170**	**170**	**43**	**11**	**0**	**130**	**160**
Other Nonconventionals									
Ammonia as Nitrogen	7664417	180	33	33	33	28	0	0	4.6
Chloride	16887006	5,700	5,400	5,400	3,900	3,900	0	1,500	1,500
Fluoride	16984488	10	10	10	6.9	3.1	0	3.4	7.2
Nitrate/Nitrite	NA	27	9.7	9.7	9.7	5.3	0	0	4.5
Surfactants (MBAS)	NA	11	11	11	4.2	2.0	0	6.8	8.9
Total Phosphorus	14265442	57	41	41	7.8	3.0	0	33	38
TOTAL Other Nonconventionals		**6,000**	**5,500**	**5,500**	**4,000**	**4,000**	**0**	**1,500**	**1,500**
Priority Metals									
Arsenic	7440382	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Chromium	7440473	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Copper	7440508	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Zinc	7440666	2.1	1.5	1.5	< 1	< 1	0	1.4	1.4
TOTAL Priority Metals		**3.0**	**2.4**	**2.4**	**< 1**	**< 1**	**0**	**1.9**	**2.0**
Priority Organics									
alpha-BHC	319846	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Anthracene	120127	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
beta-BHC	319857	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
delta-BHC	319868	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Dieldrin	60571	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Endosulfan Sulfate	1031078	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Ethylbenzene	100414	< 1	< 1	< 1	< 1	< 1	0	0	0

Table 10-2 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Fluoranthene	206440	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
Naphthalene	91203	< 1	< 1	< 1	< 1	< 1	0	0	0
Phenanthrene	85018	1.1	< 1	< 1	< 1	< 1	0	< 1	< 1
Phenol	108952	1.8	< 1	< 1	< 1	< 1	0	< 1	< 1
Pyrene	129000	< 1	< 1	< 1	< 1	< 1	0	< 1	< 1
TOTAL Priority Organics		**5.0**	**< 1**	**< 1**	**< 1**	**< 1**	**0**	**< 1**	**< 1**

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.

Table 10-3

Barge/Chemical & Petroleum Subcategory – Direct Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals							
5-Day Biochemical Oxygen Demand	NA	2,300,000	22,000	6,200	< 6,200	16,000	> 16,000
Total Suspended Solids	NA	760,000	5,400	2,100	< 2,100	3,300	> 3,300
Bulk Nonconventionals							
Chemical Oxygen Demand	NA	14,000,000	150,000	77,000	< 77,000	69,000	> 69,000

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.

Table 10-4

Barge/Hopper Subcategory – Direct Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals					
Total Suspended Solids	NA	28,000	19,000	10,000	8,600
Bulk Nonconventionals					
Chemical Oxygen Demand	NA	44,000	8,700	6,000	2,700
Nonconventional Metals					
Aluminum	7429905	300	210	95	110
Calcium	7440702	5,400	3,800	2,100	1,700
Iron	7439896	1,800	1,200	500	670
Manganese	7439965	55	38	18	20
Titanium	7440326	8.6	6.0	1.8	4.2
TOTAL Nonconventional Metals		**7,600**	**5,200**	**2,700**	**2,500**
Priority Metals					
Beryllium	7440417	< 1	< 1	< 1	< 1
Chromium	7440473	2.5	1.7	1.5	< 1
Zinc	7440666	15	3.4	1.8	1.6
TOTAL Priority Metals		**18**	**5.2**	**3.4**	**1.8**

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.
Note: Load reductions include a high bias because some facilities included in the pollutant reduction analysis would be excluded because of low flow. In addition, EPA did not revise the pollutant loadings to include additional pollutants of interest and the final pollutant removal methodology because these additional pollutant removals would have an insignificant impact on the total load removals.

Table 10-5

Truck/Chemical & Petroleum Subcategory – Indirect Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option A Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option A Pollutant Reductions from Baseline (lbs/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals									
5-Day Biochemical Oxygen Demand	NA	18,000,000	9,900,000	8,200,000	790,000	790,000	1,800,000	9,100,000	9,100,000
Oil and Grease (HEM)	NA	11,000,000	6,400,000	190,000	170,000	170,000	6,200,000	6,300,000	6,300,000
Total Suspended Solids	NA	9,800,000	5,300,000	4,000,000	350,000	130,000	1,300,000	5,000,000	5,200,000
Bulk Nonconventionals									
Chemical Oxygen Demand	NA	45,000,000	29,000,000	28,000,000	12,000,000	5,000,000	1,600,000	17,000,000	24,000,000
Total Dissolved Solids	NA	30,000,000	30,000,000	30,000,000	30,000,000	20,000,000	73,000	73,000	10,000,000
Total Organic Carbon	NA	11,000,000	9,100,000	8,900,000	7,600,000	1,200,000	250,000	1,500,000	8,000,000
Total Petroleum Hydrocarbons (SGT-HEM)	NA	1,000,000	620,000	63,000	60,000	60,000	560,000	560,000	560,000
Nonconventional Metals									
Aluminum	7429905	48,000	27,000	15,000	2,600	550	12,000	25,000	27,000
Boron	7440428	25,000	22,000	21,000	18,000	1,500	66	3,500	20,000
Calcium	7440702	1,900,000	1,700,000	1,700,000	1,500,000	1,200,000	22,000	240,000	520,000
Iron	7439896	140,000	81,000	41,000	5,100	1,000	40,000	76,000	80,000
Magnesium	7439954	450,000	270,000	180,000	58,000	56,000	92,000	210,000	210,000
Manganese	7439965	4,000	1,900	920	570	570	970	1,300	1,300
Molybdenum	7439987	600	530	510	450	450	24	81	81
Phosphorus	7723140	430,000	260,000	210,000	79,000	54,000	52,000	180,000	210,000
Potassium	7440097	200,000	180,000	180,000	160,000	160,000	470	17,000	17,000
Silicon	7440213	100,000	62,000	51,000	20,000	16,000	11,000	42,000	46,000

Table 10-5 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option A Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option A Pollutant Reductions from Baseline (lbs/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Sodium	7440235	6,600,000	6,400,000	6,300,000	6,100,000	4,200,000	16,000	210,000	2,200,000
Strontium	7440246	15,000	13,000	12,000	11,000	11,000	680	1,900	1,900
Sulfur	7704349	3,000,000	3,000,000	3,000,000	3,000,000	2,200,000	7,300	7,300	850,000
Tin	7440315	93,000	69,000	64,000	43,000	6,400	4,700	26,000	62,000
Titanium	7440326	1,500	840	430	91	52	410	750	790
TOTAL Nonconventional Metals		**13,000,000**	**12,000,000**	**12,000,000**	**11,000,000**	**7,800,000**	**260,000**	**1,000,000**	**4,200,000**
Nonconventional Organics									
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	35822469	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
1,2,3,4,6,7,8-Heptachlorodibenzofuran	67562394	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
2,4-D	94757	22	18	18	15	15	< 1	3.3	3.3
2,4,5-T	93765	6.8	3.8	3.8	1.1	< 1	< 1	2.7	3.1
2-Methylnaphthalene	91576	550	330	160	55	55	170	280	280
2-Isopropylnaphthalene	2027170	1,400	790	540	55	55	240	730	730
2,4-DB (Butoxon)	94826	50	39	39	30	14	< 1	9.3	25
2,4,5-TP	93721	4.8	3.2	3.2	1.8	1.8	< 1	1.4	1.4
Acetone	67641	220,000	190,000	190,000	160,000	40,000	590	34,000	150,000
Adsorbable Organic Halides (AOX)	59473040	35,000	21,000	20,000	6,600	3,000	1,300	15,000	18,000
alpha-Terpineol	98555	2,000	1,400	1,300	770	55	33	610	1,300
Azinphos Methyl	86500	33	19	19	5.9	5.9	< 1	14	14
Benzoic Acid	65850	190,000	170,000	170,000	150,000	64,000	470	16,000	100,000
Benzyl Alcohol	100516	2,100	1,200	940	110	84	230	1,100	1,100
Dalapon	75990	7.1	7.1	7.1	7.1	2.5	< 1	< 1	4.6
Diallate	2303164	150	87	86	29	13	< 1	58	73

Table 10-5 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option A Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option A Pollutant Reductions from Baseline (lbs/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Dimethyl Sulfone	67710	58,000	31,000	19,000	55	55	11,000	31,000	31,000
Dinoseb	88857	17	15	15	13	13	< 1	1.9	1.9
Leptophos	21609905	45	29	28	11	11	< 1	18	18
m-Xylene	108383	16,000	8,100	8,000	720	55	48	7,300	8,000
MCPA	94746	4,500	2,900	950	790	570	2,000	2,200	2,400
Methyl Ethyl Ketone	78933	40,000	35,000	35,000	30,000	3,600	100	5,000	31,000
Methyl Isobutyl Ketone	108101	15,000	11,000	11,000	7,400	1,700	38	3,700	9,500
n-Octadecane	593453	3,000	1,600	1,000	55	55	610	1,600	1,600
n-Triacontane	638686	1,700	900	730	55	55	170	850	850
n-Tetradecane	629594	3,800	2,100	940	55	55	1,200	2,000	2,000
n-Decane	124185	2,800	1,400	1,400	55	55	8.7	1,300	1,300
n-Docosane	629970	830	470	310	55	55	160	420	420
n-Dodecane	112403	8,800	4,400	4,300	55	55	28	4,300	4,300
n-Eicosane	112958	2,300	1,300	910	140	55	400	1,200	1,200
n-Hexacosane	630013	1,100	620	460	55	55	170	570	570
n-Hexadecane	544763	5,600	3,100	1,400	55	55	1,600	3,000	3,000
n-Tetracosane	646311	1,400	780	500	55	55	280	720	720
Octachlorodibenzo-p-dioxin	3268879	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
o-Cresol	95487	580	320	310	56	55	1.9	260	260
o+p-Xylene	136777612	8,000	4,200	4,200	450	55	25	3,700	4,100
p-Cresol	106445	550	510	510	470	57	1.4	39	460
p-Cymene	99876	450	270	260	81	55	8.9	190	220
Pentachloronitrobenzene	82688	60	30	30	< 1	< 1	< 1	30	30
Styrene	100425	25,000	15,000	13,000	4,400	150	1,600	11,000	15,000

Table 10-5 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option A Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option A Pollutant Reductions from Baseline (lbs/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Total Phenols	NA	17,000	13,000	13,000	8,800	6,900	53	4,000	6,000
TOTAL Nonconventional Organics		**660,000**	**520,000**	**500,000**	**370,000**	**120,000**	**23,000**	**150,000**	**400,000**
Other Nonconventionals									
Ammonia as Nitrogen	7664417	800,000	730,000	630,000	630,000	450,000	100,000	100,000	280,000
Chloride	16887006	4,500,000	4,500,000	4,500,000	4,500,000	3,000,000	11,000	11,000	1,500,000
Fluoride	16984488	160,000	120,000	110,000	79,000	43,000	14,000	42,000	78,000
Nitrate/Nitrite	NA	14,000	13,000	13,000	13,000	3,700	34	570	9,400
Total Phosphorus	14265442	200,000	120,000	120,000	46,000	24,000	4,900	79,000	100,000
Surfactants (MBAS)	NA	130,000	89,000	79,000	44,000	5,400	10,000	45,000	84,000
TOTAL Other Nonconventionals		**5,800,000**	**5,600,000**	**5,500,000**	**5,300,000**	**3,600,000**	**140,000**	**280,000**	**2,100,000**
Priority Metals									
Cadmium	7440439	140	98	92	54	53	5.5	44	45
Chromium	7440473	15,000	7,800	6,800	110	74	1,000	7,700	7,700
Copper	7440508	1,900	1,200	790	420	300	420	800	910
Mercury	7439976	12	6.6	6.5	1.1	1.1	< 1	5.5	5.5
Nickel	7440020	1,800	1,500	1,400	1,100	880	110	380	620
Zinc	7440666	4,500	2,500	1,500	110	110	930	2,400	2,400
TOTAL Priority Metals		**23,000**	**13,000**	**11,000**	**1,800**	**1,400**	**2,500**	**11,000**	**12,000**
Priority Organics									
1,2-Dichloroethane	107062	4,300	2,400	2,400	620	66	14	1,800	2,400
1,1,1-Trichloroethane	71556	5,500	3,000	3,000	500	55	18	2,500	3,000
1,2-Dichlorobenzene	95501	780	410	410	55	55	2.5	360	360
2-Chlorophenol	95578	480	280	250	63	55	29	220	220
2,4,6-Trichlorophenol	88062	1,500	1,100	980	780	420	160	360	730

Table 10-5 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option A Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option A Pollutant Reductions from Baseline (lbs/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Benzene	71432	280	170	170	58	55	< 1	110	110
beta-BHC	319857	3.9	1.9	1.9	< 1	< 1	< 1	1.4	1.4
Bis (2-ethylhexyl) Phthalate	117817	4,000	2,100	1,900	84	55	160	2,000	2,000
Chloroform	67663	530	350	330	170	85	24	180	270
Di-n-Octyl Phthalate	117840	1,300	690	680	55	55	4.2	630	630
Endosulfan Sulfate	1031078	2.8	2.6	2.6	2.5	2.5	< 1	< 1	< 1
Endrin Aldehyde	7421934	35	35	35	35	35	< 1	< 1	< 1
Ethylbenzene	100414	3,500	1,900	1,800	210	55	77	1,700	1,800
gamma-BHC	58899	1.8	1.8	1.8	1.8	1.0	< 1	< 1	< 1
Methylene Chloride	75092	88,000	65,000	58,000	39,000	6,300	6,800	25,000	58,000
Naphthalene	91203	2,400	1,300	1,000	110	55	270	1,200	1,200
Phenol	108952	12,000	11,000	9,800	9,200	7,300	800	1,400	3,400
Tetrachloroethylene	127184	8,800	5,200	130	55	55	5,000	5,100	5,100
Toluene	108883	14,000	8,200	8,100	2,700	55	46	5,900	8,100
Trichloroethylene	79016	160	110	110	57	55	< 1	56	58
TOTAL Priority Organics		**150,000**	**100,000**	**89,000**	**54,000**	**15,000**	**14,000**	**48,000**	**88,000**

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.

Table 10-6

Rail/Chemical & Petroleum Subcategory – Indirect Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals									
Biochemical Oxygen Demand	NA	1,300,000	990,000	970,000	800,000	700,000	23,000	190,000	290,000
Oil and Grease (HEM)	NA	590,000	440,000	19,000	8,200	6,600	420,000	430,000	430,000
Total Suspended Solids	NA	370,000	360,000	130,000	25,000	4,600	230,000	340,000	360,000
Bulk Nonconventionals									
Chemical Oxygen Demand	NA	3,000,000	2,700,000	1,400,000	1,200,000	1,200,000	1,300,000	1,500,000	1,500,000
Total Dissolved Solids	NA	5,700,000	5,600,000	4,300,000	3,800,000	3,200,000	1,300,000	1,800,000	2,400,000
Total Organic Carbon	NA	710,000	700,000	530,000	460,000	430,000	170,000	240,000	270,000
Total Petroleum Hydrocarbons (SGT-HEM)	NA	130,000	100,000	6,800	2,500	2,500	95,000	100,000	100,000
Nonconventional Metals									
Aluminum	7429905	8,300	6,600	2,100	1,700	46	4,600	5,000	6,600
Barium	7440393	540	320	240	92	92	76	220	220
Boron	7440428	1,400	1,400	1,100	1,000	890	270	340	460
Calcium	7440702	30,000	29,000	24,000	24,000	24,000	4,900	5,100	5,100
Iron	7439896	11,000	4,000	3,600	98	46	390	3,900	4,000
Magnesium	7439954	12,000	12,000	9,900	9,800	9,800	1,800	1,900	1,900
Manganese	7439965	510	490	330	290	290	160	200	200
Phosphorus	7723140	7,600	7,200	2,800	920	580	4,400	6,300	6,600
Potassium	7440097	680,000	670,000	550,000	510,000	480,000	120,000	160,000	190,000
Silicon	7440213	9,000	7,300	7,100	6,200	6,200	140	1,100	1,100

Table 10-6 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Sodium	7440235	1,200,000	1,200,000	860,000	760,000	740,000	300,000	400,000	420,000
Sulfur	7704349	340,000	330,000	260,000	230,000	210,000	70,000	94,000	120,000
Titanium	7440326	75	67	17	2.3	2.3	50	65	65
TOTAL Nonconventional Metals		**2,300,000**	**2,200,000**	**1,700,000**	**1,500,000**	**1,500,000**	**500,000**	**680,000**	**760,000**
Nonconventional Organics									
1-Methylphenanthrene	832699	61	47	4.8	4.6	4.6	43	43	43
2,4-Diaminotoluene	95807	1,100	1,100	1,100	1,000	46	8.1	30	1,000
2,4,5-TP	93721	6.8	2.8	2.5	< 1	< 1	< 1	2.5	2.5
2,4,5-T	93765	6.8	6.7	2.6	< 1	< 1	4.1	6.1	6.3
2,4-DB (Butoxon)	94826	68	31	29	8.6	3.0	1.9	22	28
Acephate	30560191	460	450	400	380	21	53	76	430
Acetone	67641	1,100	1,000	660	660	570	360	360	460
Adsorbable Organic Halides	59473040	920	880	750	730	540	140	160	340
Benefluralin	1861401	1.4	1.3	< 1	< 1	< 1	< 1	1.1	1.3
Benzoic Acid	65850	1,800	1,700	1,200	1,200	37	500	500	1,600
Carbazole	86748	68	56	21	20	11	35	35	45
Dacthal (DCPA)	1861321	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Diallate	2303164	200	180	58	23	23	120	150	150
Dicamba	1918009	300	110	100	< 1	< 1	9.7	110	110
Dichloroprop	38120365	38	35	14	6.2	1.6	22	29	34
Dimethyl Sulfone	67710	40	33	12	11	11	21	22	22
Dinoseb	88857	17	17	6.0	< 1	< 1	11	16	16
gamma-Chlordane	5103742	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

Table 10-6 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Hexanoic Acid	142621	1,700	1,200	1,200	910	910	29	280	280
m-Xylene	108383	140	110	100	73	4.6	5.5	33	100
MCPP	7085190	20,000	8,900	7,500	1,200	62	1,400	7,700	8,900
Methyl Ethyl Ketone	78933	240	240	210	210	26	23	23	210
n-Hexacosane	630013	96	74	5.7	5.1	5.1	68	69	69
n-Triacontane	638686	63	50	6.1	4.8	4.8	44	45	45
n-Docosane	629970	180	140	6.8	4.8	4.8	130	130	130
n-Hexadecane	544763	1,400	1,000	7.0	4.7	4.7	1,000	1,000	1,000
n-Octadecane	593453	880	640	10	4.6	4.6	630	630	630
n-Tetradecane	629594	1,000	730	10	4.6	4.6	720	730	730
n-Dodecane	112403	280	220	15	4.6	4.6	200	210	210
n-Tetracosane	646311	160	120	7.3	4.8	4.8	110	110	110
n-Eicosane	112958	750	550	12	4.6	4.6	540	540	540
n-Octacosane	630024	59	46	5.5	4.6	4.6	41	42	42
o+p-Xylene	136777612	95	75	72	59	4.6	2.6	16	70
Octachlorodibenzo-p-dioxin	3268879	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Octachlorodibenzofuran	39001020	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
p-Cresol	106445	30	30	30	30	4.6	< 1	< 1	26
Pentachloronitrobenzene	82688	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Propachlor	1918167	8.7	6.4	< 1	< 1	< 1	6.0	6.0	6.0
Propazine	139402	9.3	7.2	2.3	2.3	1.6	5.0	5.0	5.7
Styrene	100425	110	110	4.7	4.6	4.6	100	100	100
Terbacil	5902512	14	10	< 1	< 1	< 1	9.5	9.5	9.5

Table 10-6 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Terbuthylazine	5915413	1,400	1,200	1,100	1,000	2.3	18	150	1,200
Total Phenols	NA	430	400	250	210	42	150	190	360
TOTAL Nonconventional Organics		**35,000**	**22,000**	**15,000**	**7,900**	**2,400**	**6,600**	**14,000**	**19,000**
Other Nonconventionals									
Ammonia as Nitrogen	7664417	19,000	19,000	19,000	19,000	16,000	110	110	2,800
Chloride	16887006	880,000	870,000	680,000	610,000	610,000	180,000	260,000	260,000
Fluoride	16984488	1,700	1,400	1,400	1,100	340	44	260	1,100
Nitrate/Nitrite	NA	4,100	3,800	3,000	3,000	1,600	750	750	2,100
Total Phosphorus	142654462	7,400	6,800	2,400	900	350	4,400	5,900	6,500
Surfactants (MBAS)	NA	2,100	1,300	1,200	680	330	110	670	1,000
TOTAL Other Nonconventionals		**910,000**	**900,000**	**710,000**	**630,000**	**620,000**	**190,000**	**270,000**	**270,000**
Priority Metals									
Arsenic	7440382	34	32	21	19	13	10	13	19
Chromium	7440473	83	83	37	4.6	4.6	46	78	78
Copper	7440508	79	45	35	12	12	10	34	34
Zinc	7440666	330	310	88	9.2	9.2	220	300	300
TOTAL Priority Metals		**530**	**470**	**180**	**44**	**38**	**290**	**420**	**420**
Priority Organics									
alpha-BHC	319846	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Anthracene	120127	80	62	8.8	4.7	4.7	53	57	57
beta-BHC	319857	18	13	< 1	< 1	< 1	13	13	13
delta-BHC	319868	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Dieldrin	60571	1.1	< 1	< 1	< 1	< 1	< 1	< 1	< 1

Table 10-6 (Continued)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 3 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)	Option 3 Pollutant Reduction from Baseline (lb/yr)
Endosulfan Sulfate	1031078	< 1	< 1	< 1	< 1	< 1	< 1	< 1	< 1
Ethylbenzene	100414	64	47	46	35	4.6	1.7	12	43
Fluoranthene	206440	74	57	5.7	4.9	4.9	51	52	52
Naphthalene	91203	55	50	20	11	5.0	30	39	45
Phenanthrene	85018	160	120	9.0	5.3	4.9	110	120	120
Phenol	108952	310	310	230	190	4.6	76	110	300
Pyrene	129000	58	45	5.5	4.9	4.9	39	40	40
TOTAL Priority Organics		**830**	**710**	**330**	**260**	**34**	**380**	**440**	**670**

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.

Table 10-7

Food Subcategory – Indirect Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 2 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)	Option 2 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals							
5-Day Biochemical Oxygen Demand	NA	22,000,000,000	22,000,000,000	22,000,000,000	29,000	3,000,000	22,000,000,000
Oil and Grease (HEM)	NA	2,200,000,000	68,000,000	360,000	11,000	67,000,000	68,000,000
Total Suspended Solids	NA	4,900,000,000	4,900,000,000	4,900,000,000	81,000	670,000	4,900,000,000
Bulk Nonconventionals							
Chemical Oxygen Demand	NA	110,000,000,000	110,000,000,000	110,000,000,000	95,000	15,000,000	110,000,000,000
Total Dissolved Solids	NA	78,000,000,000	78,000,000,000	78,000,000,000	740,000	11,000,000	78,000,000,000
Total Organic Carbon	NA	41,000,000,000	41,000,000,000	41,000,000,000	110,000	5,600,000	41,000,000,000
Total Petroleum Hydrocarbons (SGT-HEM)	NA	140,000,000	140,000,000	140,000,000	11,000	19,000	140,000,000
Nonconventional Organics							
Benzoic Acid	65850	5,900,000	5,900,000	5,900,000	110	52	5,900,000
Hexanoic Acid	142621	140,000,000	140,000,000	140,000,000	51	1,200	140,000,000
TOTAL Nonconventional Organics		**140,000,000**	**140,000,000**	**140,000,000**	**160**	**1,200**	**140,000,000**
Other Nonconventionals							
Ammonia as Nitrogen	7664417	7,900,000	7,800,000	7,800,000	580	1,100	7,800,000
Priority Organics							
Phenol	108952	600,000	600,000	600,000	22	5.4	600,000

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.
Note: EPA did not revise the pollutant loadings to include additional pollutants of interest and the final pollutant removal methodology because these additional pollutant removals would have an insignificant impact on the total load removals.

Table 10-8

Truck/Hopper Subcategory – Indirect Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals					
Total Suspended Solids	NA	17,000	15,000	8,200	6,700
Bulk Nonconventionals					
Chemical Oxygen Demand	NA	7,600	6,800	4,800	2,000
Nonconventional Metals					
Aluminum	7429905	180	160	76	88
Calcium	7440702	3,300	3,000	1,700	1,300
Iron	7439896	1,000	920	400	520
Manganese	7439965	34	30	15	16
Titanium	7440326	5.4	4.8	1.5	3.3
TOTAL Nonconventional Metals		**4,600**	**4,100**	**2,200**	**2,000**
Priority Metals					
Beryllium	7440417	< 1	< 1	< 1	< 1
Chromium	7440473	1.5	1.3	1.2	< 1
Zinc	7440666	3.0	2.7	1.5	1.2
TOTAL Priority Metals		**4.5**	**4.1**	**2.7**	**1.4**

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.
Note: Load reductions include a high bias because some facilities included in the pollutant reduction analysis would be excluded because of low flow. In addition, EPA did not revise the pollutant loadings to include additional pollutants of interest and the final pollutant removal methodology because these additional pollutant removals would have an insignificant impact on the total load removals.

Table 10-9

Rail/Hopper Subcategory – Indirect Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals					
Total Suspended Solids	NA	890	160	160	0
Bulk Nonconventionals					
Chemical Oxygen Demand	NA	5,100	96	96	0
Nonconventional Metals					
Aluminum	7429905	17	1.5	1.5	0
Calcium	7440702	100	33	33	0
Iron	7439896	36	8.0	8.0	0
Manganese	7439965	1.5	< 1	< 1	0
Titanium	7440326	< 1	< 1	< 1	0
TOTAL Nonconventional Metals		**160**	**43**	**43**	**0**
Priority Metals					
Beryllium	7440417	< 1	< 1	< 1	0
Chromium	7440473	< 1	< 1	< 1	0
Zinc	7440666	< 1	< 1	< 1	0
TOTAL Priority Metals		**1**	**< 1**	**< 1**	**0**

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.
Note: Load reductions include a high bias because some facilities included in the pollutant reduction analysis would be excluded because of low flow. In addition, EPA did not revise the pollutant loadings to include additional pollutants of interest and the final pollutant removal methodology because these additional pollutant removals would have an insignificant impact on the total load removals.

Table 10-10

Barge/Hopper Subcategory – Indirect Dischargers
Summary of Pollutant Loadings and Reductions by Technology Option (a)

Pollutant Name	CAS Number	Untreated Wastewater Pollutant Loading (lb/yr)	Baseline Wastewater Pollutant Loading (lb/yr)	Option 1 Wastewater Pollutant Loading (lb/yr)	Option 1 Pollutant Reduction from Baseline (lb/yr)
Bulk Conventionals					
Total Suspended Solids	NA	8,500	5,500	4,500	940
Bulk Nonconventionals					
Chemical Oxygen Demand	NA	3,900	3,200	2,700	550
Nonconventional Metals					
Aluminum	7429905	94	51	42	8.7
Calcium	7440702	1,700	1,100	920	190
Iron	7439896	530	270	220	46
Manganese	7439965	17	9.7	8.1	1.7
Titanium	7440326	2.7	< 1	< 1	< 1
TOTAL Nonconventional Metals		**2,400**	**1,400**	**1,200**	**250**
Priority Metals					
Beryllium	7440417	< 1	< 1	< 1	< 1
Chromium	7440473	< 1	< 1	< 1	< 1
Zinc	7440666	1.5	< 1	< 1	< 1
TOTAL Priority Metals		**2**	**2**	**1**	**< 1**

(a) All data are presented with two significant digits. Apparent inconsistencies in sums and differences are due to rounding.
NA - Not applicable.
Note: EPA did not revise the pollutant loadings to include additional pollutants of interest and the final pollutant removal methodology because these additional pollutant removals would have an insignificant impact on the total load removals.

Table 10-11

BPT Pollutant Loading Reductions

Subcategory	Option	BOD_5 Loading Reduction (pounds/year)	TSS Loading Reduction (pounds/year)	Oil and Grease (HEM) Loading Reduction (pounds/year)	Priority Pollutant Loading Reduction (pounds/year)	Nonconventional Pollutant Loading Reduction (pounds/year) (a)
Truck/Chemical & Petroleum	1	8.6	32	6.5	2.3	81
	2	8.6	32	6.5	2.3	81
Rail/Chemical & Petroleum	1	0	0	0	0	0
	2	0	0	22	2.2	5,000
	3	7.5	62	22	2.3	5,600
Barge/Chemical & Petroleum	1	16,000	3,300	NA	NA	NA
	2	NC	NC	NC	NC	NC
Food	1	0 (b)	0 (b)	0 (b)	0 (b)	0 (b)
	2	0 (b)	0 (b)	0 (b)	0 (b)	0 (b)
Barge/Hopper (c)	1	NR	8,600	NR	1.8	2,500

(a) The loading reductions presented exclude reduction of COD, TDS, TOC, and SGT-HEM.
(b) Pollutant reductions determined to be zero because all facilities identified by EPA currently meet the regulatory option.
(c) Load reductions include a high bias because some facilities included in the pollutant reduction analysis would be excluded because of low flow.
BOD_5 - Biochemical oxygen demand (five-day).
TSS - Total suspended solids.
HEM - Hexane extractable material.
NR - Pollutant loading reductions not calculated because pollutant is not removed by this regulatory option.
NC - Not calculated because the regulatory option was not fully evaluated by EPA following the proposed rule.
NA - Not available because EPA did not have sufficient data to fully evaluate these pollutant removals.

Table 10-12

PSES Pollutant Loading Reductions

Subcategory	Option	Priority Pollutant Loading Reduction (pounds/year)	Nonconventional Pollutant Loading Reduction (pounds/year) (a)
Truck/Chemical & Petroleum	A	16,000	420,000
	1	60,000	1,500,000
	2	99,000	6,700,000
Rail/Chemical & Petroleum	1	670	700,000
	2	870	960,000
	3	1,100	1,100,000
Barge/Chemical & Petroleum	1	0	0
	2	0	0
	3	NC	NC
Food	1	5.5	2,300
	2	600,000	150,000,000
Truck/Hopper (b)	1	1.4	2,200
Barge/Hopper (b)	1	< 1	250

(a) The loading reductions presented exclude reduction of COD, TDS, TOC, and SGT-HEM.
(b) Load reduction include a high bias because some facilities included in the pollutant reduction analysis would be excluded because of low flow.
NC - Not calculated because the regulatory option was not fully evaluated by EPA following the proposed rule.

11.0 NON-WATER QUALITY ENVIRONMENTAL IMPACTS

Sections 304(b) and 306 of the Clean Water Act require EPA to consider the non-water quality environmental impacts of effluent limitations guidelines and standards. Therefore, EPA evaluated the effects of the Transportation Equipment Cleaning Industry (TECI) final regulatory options on energy consumption, air pollution, and solid waste generation. Sections 11.1 through 11.3 discuss these impacts and Section 11.4 lists references for this section. Reference 1 summarizes the results of these analyses. In addition to these non-water quality environmental impacts, EPA considered the impacts of the final rule on noise pollution and water and chemical use and determined these impacts to be negligible.

EPA did not directly evaluate non-water quality environmental impacts of the pollution prevention alternative. However, considering pollution prevention and source reduction techniques in the alternative, EPA believes that the non-water quality environmental impacts will be less than estimated from the technology options.

11.1 Energy Impacts

Energy impacts resulting from the regulatory options include energy requirements to operate wastewater treatment equipment such as aerators, pumps, and mixers. The Agency evaluated the annual increase in electrical power consumption for each regulatory option relative to the estimated current industry consumption for wastewater treatment.

Flow reduction technologies (a component of all regulatory options for most subcategories) reduce energy requirements by reducing the number of operating hours per day and/or operating days per year for wastewater treatment equipment currently operated by the TECI. For some regulatory options, energy savings resulting from flow reduction exceed requirements for operation of additional wastewater treatment equipment, resulting in a net energy savings for these options.

Based on EPA's regulatory options (see Section 8.0), the Agency estimates a net increase in electricity use for the TECI as a result of the final rule would be approximately 5 million kilowatt hours per year. In 1990, the total U.S. industrial electrical energy purchase was approximately 756 billion kilowatt hours (2). EPA's technology options would increase U.S. industrial electrical energy purchase by 0.0007 percent. Therefore, the Agency concludes that the effluent pollutant reduction benefits from the technology options exceed the potential adverse effects from the estimated increase in energy consumption.

11.2 Air Emission Impacts

Transportation equipment cleaning (TEC) facilities generate volatile and semivolatile organic pollutants, some of which are also on the list of Hazardous Air Pollutants in Title 3 of the Clean Air Act Amendments of 1990. Air emissions from TEC facilities occur at several stages of the equipment cleaning process. Prior to cleaning, tanks which have transported volatile materials may be opened and vented with or without steam in a process called gas freeing. At some facilities, tanks are filled to capacity with water to displace vapors to the atmosphere or to a combustion device. Tanks are then cleaned, typically using either heated cleaning solutions or hot water. For recirculated cleaning solutions, pollutants may be volatilized from heated cleaning solution storage tanks. For TEC wastewater, pollutants may volatilize as the wastewater falls onto the cleaning bay floor, flows to floor drains and collection sumps, and conveys to wastewater treatment. TEC wastewater typically passes through treatment units open to the atmosphere where further pollutant volatilization may occur.

In order to quantify the impact of the regulation on air emissions at proposal, EPA performed a WATER8 (3) model analysis to determine the quantity of air emissions that would result from the treatment technology options. Reference 4 describes EPA's model analysis in detail. EPA estimated that the maximum increase in air emissions would be 153,000 kilograms per year of organic pollutants (volatile and semivolatile organics), which represented approximately 35 percent of the total organic pollutant wastewater load of raw TEC wastewater.

Since the final technology options are fairly similar to the proposed technology options, EPA estimates that these estimates would not change significantly.

EPA's estimate of air emissions reflects the increase in emissions at TEC facilities, and does not account for baseline air emissions that are currently being released to the atmosphere at the POTW or as the wastewater is conveyed to the POTW. It is expected that much of the increased emissions at indirect TEC facilities calculated for this rule are currently being released at POTWs or during conveyance to the POTW. To a large degree, this rule will merely shift the location at which the air emissions are released, rather than increasing the total air emissions from TEC wastewater. As a result, air emission from TEC wastewater at POTWs are expected to be reduced somewhat following implementation of this rule. EPA's model analysis was performed based on the most stringent regulatory options considered for each subcategory in order to create a "worst case scenario" (i.e., the more treatment technologies used, the more chance of volatilization of compounds to the air). For some subcategories, air emission impacts are overestimated (see Section 12.0).

In addition, to the extent that facilities currently operate treatment in place, the results overestimate air emission impacts from the regulatory options. Additional details concerning EPA's model analysis to estimate air emission impacts are included in "Estimated Air Emission Impacts of TEC Industry Regulatory Options" in the rulemaking record.

Based on the sources of air emissions in the TEC industry and limited data concerning air pollutant emissions from TEC operations provided in response to the 1994 Detailed Questionnaire (most facilities did not provide air pollutant emissions estimates), EPA estimates that the incremental air emissions resulting from the regulatory options are a small percentage of air emissions generated by TEC operations.

11.3 Solid Waste Impacts

Solid waste impacts resulting from the regulatory options include additional solid wastes generated by wastewater treatment technologies. These solid wastes consist of wastewater treatment residuals, including sludge, and waste oil. These impacts are discussed below in Sections 11.3.1 through 11.3.2 respectively.

EPA also analyzed options containing activated carbon adsorption and organo clay. EPA did not select any options containing these technologies, with the exception of BPT Option 2 for the Truck/Chemical & Petroleum Subcategory (see Section 12.1.1). EPA does not expect any incremental solid waste impacts from selecting this option because all known facilities in this subcategory currently operate activated carbon adsorption.

11.3.1 Wastewater Treatment Sludge

Wastewater treatment sludge is generated in two forms: dewatered sludge (or filter cake) generated by a filter press and/or wet sludge generated by treatment units such as oil/water separators, dissolved air flotation, and biological treatment. The Agency evaluated impacts of the increased sludge generation for each regulatory option relative to the estimated current industry wastewater treatment sludge generation.

Many facilities that currently operate wastewater treatment systems do not dewater wastewater treatment sludge. Storage, transportation, and disposal of relatively large volumes of undewatered sludge that would be generated after implementing the TECI regulatory options is less cost-effective than dewatering sludge on site and disposing the greatly reduced volume of resulting filter cake. However, following implementation of these regulations, EPA believes TEC facilities would install sludge dewatering equipment to handle increases in sludge generation. For these reasons, EPA estimates net decreases in the volume of wet sludge generated by the industry and net increases in the volume of dry sludge generated by the industry.

EPA estimates that the rule will result in a decrease in wet sludge generation of approximately 17 million gallons per year, which represents an estimated 98 percent decrease from current wet sludge generation. In addition, EPA estimates that the rule will result in an increase in dewatered sludge generation of approximately 35 thousand cubic yards per year, which represents an estimated 120 percent increase from current dewatered sludge generation.

Based on responses to the Detailed Questionnaire, most TEC facilities currently dispose wastewater treatment sludge in nonhazardous landfills. Sludge characterization data provided by industry and collected during EPA's TECI sampling program confirm that wastewater treatment sludge generated by the TECI is nonhazardous as determined by the Toxicity Characteristic Rule under the Resource Conservation and Recovery Act. Compliance cost estimates for the TECI regulatory options are based on disposal of wastewater treatment sludge in nonhazardous waste landfills.

The Agency concludes that the effluent benefits and the reductions in wet sludge from the technology options exceed the potential adverse effects from the estimated increase in wastewater treatment sludge generation.

11.3.2 Waste Oil

EPA estimates that compliance with this regulation will result in an increase in waste oil generation at TEC sites based on removal of oil from wastewater via oil/water separation. EPA estimates that this increase in waste oil generation will be approximately 667,000 gallons per year, which represents no more than an estimated 330 percent increase from current waste oil generation. The Agency evaluated the impacts of the increased waste oil generation for each regulatory option relative to the estimated current industry waste oil generation. The increase in waste oil generation is attributed to the removal of oil from TEC wastewaters prior to discharge to publicly owned treatment works or surface waters. This increase reflects a transfer of oil from the wastewater to a more concentrated waste oil, and does not reflect an increase in overall oil generation at TEC sites.

EPA assumes, based on responses to the Detailed Questionnaire, that waste oil will be disposed via oil reclamation or fuels blending on or off site. Therefore, the Agency does not estimate any adverse effects from increased waste oil generation.

11.4 References[1]

1. Eastern Research Group, Inc. Summary of the Results of Non-Water Quality Impacts Analyses. April 2000 (DCN T20537).

2. U.S. Department of Commerce. 1990 Annual Survey of Manufacturers, Statistics for Industry Groups and Industries. M90 (AS)-1, March 1992.

3. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Wastewater Treatment Compound Property Processor and Air Emissions Estimator (WATER8), Version 4.0. U.S. Environmental Protection Agency, Research Triangle Park, NC, May 1, 1995.

4. Eastern Research Group, Inc. WATER8 Analysis of Air Emission Impacts of TECI Regulatory Options. May 1998 (DCN T04660).

[1]For those references included in the administrative record supporting the TECI rulemaking, the document control number (DCN) is included in parentheses at the end of the reference.

12.0 OPTION SELECTION AND REGULATED POLLUTANTS

After EPA established technology options for each subcategory (see Section 8.0), EPA estimated the cost of compliance for each option (see Section 9.0); the priority, conventional, and non-conventional pollutant removals associated with each option (see Section 10.0); and the non-water quality environmental impacts associated with each option (see Section 11.0). EPA used the results of these analyses along with other factors identified in the Clean Water Act to select the technology bases from which to base the final effluent limitations guidelines and standards. This section discusses the factors considered and EPA's rationale in selecting technology options for BPT, BAT, BCT, NSPS, PSES, and PSNS. Owners or operators of facilities subject to these regulations are not required to use the specific pollution prevention and wastewater treatment technologies selected by EPA to establish effluent limitations. Rather, a facility can choose to use any combination of pollution prevention and wastewater treatment to comply with the limitations provided they are not achieved through dilution.

All supporting economic and financial analyses can be found in the Final Economic Analysis of Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category (1). Cost-effectiveness analyses can be found in the Final Cost-Effectiveness Analysis of Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category (2).

EPA selected pollutants to regulate from the list of pollutants of interest that are removed by each selected regulatory option (see Section 6.6). EPA also considered publicly-owned treatment works (POTW) pass through when selecting regulated pollutants for indirect dischargers. The following topics are discussed in this section:

- Section 12.1: Option Selection for Direct Dischargers;
- Section 12.2: Option Selection for Indirect Dischargers;

- Section 12.3: Rationale for Selecting Regulated Pollutants;
- Section 12.4: Regulated Pollutants for Direct Dischargers;
- Section 12.5: Regulated Pollutants for Indirect Dischargers (Including the POTW Pass-Through Analysis); and
- Section 12.6: References.

12.1 Option Selection for Direct Dischargers

EPA analyzed BPT, BCT, BAT, and NSPS options for all subcategories. EPA's option selection rationale is provided in the following subsections. Note that all costs are presented in 1998 dollars.

12.1.1 Truck/Chemical & Petroleum

EPA evaluated two options for the Truck/Chemical & Petroleum Subcategory as discussed in Section 8.2.1. EPA established BPT limits for the Truck/Chemical & Petroleum Subcategory based on Option 2. EPA's decision to base BPT limitations on Option 2 treatment primarily reflects on two factors: 1) the degree of effluent reductions attainable, and 2) the total cost of the treatment technologies in relation to the effluent reductions achieved.

Agency data indicate that a treatment train consisting of physical/chemical treatment for the removal of metals and toxics, biological treatment for the removal of decomposable organic material, and activated carbon adsorption for the removal of residual organics represents the average of the best treatment in the industry. EPA also selected Option 2 because all of the model facilities have equalization, coagulation/clarification, biological treatment, and activated carbon adsorption in place. Two of the three model facilities in the cost model have sufficient treatment in place; therefore, compliance costs for these facilities include only additional monitoring. The third facility was costed for flow reduction, sludge dewatering, and monitoring, which results in a net cost savings for the facility's entire treatment train. These net cost savings for the third facility are greater than the monitoring costs incurred by the other two facilities.

No basis could be found for identifying different BPT limitations based on age, size, process, or other engineering factors. Neither the age nor the size of the TEC facility will directly affect the treatability of the TEC wastewaters.

EPA determined that Option 2 is economically achievable because it will result in a net cost savings to the industry, and will not cause any facility closures, revenue impacts, or employment impacts. Therefore, EPA based BAT on Option 2.

EPA did not identify any technologies beyond BPT/BAT that can achieve greater removals of conventional or toxic pollutants. Therefore, EPA established BCT and NSPS equivalent to BPT and BAT.

12.1.2 Rail/Chemical & Petroleum

EPA evaluated three options for the Rail/Chemical & Petroleum Subcategory as discussed in Section 8.2.2. EPA established BPT limits for the Rail/Chemical & Petroleum Subcategory based on Option 2. EPA's decision to base BPT limitations on Option 2 treatment primarily reflects on two factors: 1) the degree of effluent reductions attainable, and 2) the total cost of the treatment technologies in relation to the effluent reductions achieved.

EPA evaluated the costs, loads, and impacts of the one model direct discharging facility which currently operates oil/water separation, equalization, pH adjustment, biological treatment, and a filter press. EPA estimates that the cost of implementing Option 1 is for monitoring costs only (i.e., zero capital costs), totaling approximately $4,900 annually post-tax ($7,600 pre-tax). Option 2 costs $40,800 annualized post-tax ($59,000 pre-tax), and Option 3 costs $60,600 annualized post-tax ($89,000 pre-tax).

EPA did not have sampling data for direct dischargers in this subcategory. EPA has therefore relied on treatment data transferred from the Barge/Chemical & Petroleum Subcategory to establish limits for conventionals (see Section 12.4.2), and treatment data from indirect dischargers in the Rail/Chemical & Petroleum Subcategory to establish limits for toxic pollutants (see Section 12.4.2). Furthermore, all toxic parameters considered for regulation were treated to the same level at Options 1, 2, and 3. Although EPA believes that the treatment in place at the one rail direct discharging facility identified by EPA is sufficient to meet the final limitations (see Section 2.0), EPA has decided to establish BPT based on Option 2, which includes dissolved air flotation (DAF). EPA believes that this is the most appropriate technology because the data set used to transfer limits (from both the rail indirect discharging facilities and the barge direct discharging facilities) includes DAF treatment.

No basis could be found for identifying different BPT limitations based on age, size, process, or other engineering factors. Neither the age nor the size of the TEC facility will directly affect the treatability of the TEC wastewaters.

EPA determined that Option 2 is economically achievable because it will not cause the facility to close or any revenue or employment impacts. Therefore, EPA based BAT on Option 2.

EPA evaluated Option 3 as a BCT candidate technology to determine whether it was cost-reasonable according to the BCT Cost Test. The option did not pass the BCT Cost Test; therefore, EPA established BCT equivalent to BPT.

Due to the incremental economic impacts projected at Option 3 (see reference 1 for additional information), EPA believes that Option 3 may create a barrier to entry for new sources. In addition, few additional pollutant removals are achieved by Option 3. Therefore, EPA decided to establish NSPS equivalent to BPT, BAT, and BCT.

12.1.3 Barge/Chemical & Petroleum

EPA evaluated two options for the Barge/Chemical & Petroleum Subcategory as discussed in Section 8.2.3. EPA established BPT limits for the Barge/Chemical & Petroleum Subcategory based on Option 1. EPA's decision to base BPT limitations on Option 1 treatment primarily reflects on two factors: 1) the degree of effluent reductions attainable, and 2) the total cost of the treatment technologies in relation to the effluent reductions achieved.

EPA estimates that the annualized costs for Option 1 are $89,500 ($146,300 pre-tax) and Option 2 are $345,700 ($540,900 pre-tax). EPA estimates that both Option 1 and Option 2 remove 19,300 pounds of BOD and TSS. Based on the treatment technologies in place at the model facilities, coupled with the biological treatment system upgrades estimated by EPA to achieve Option 1 performance levels (see Section 9.2.9), EPA predicts that Option 2 would not result in any additional removal of toxic pounds because most pollutants are already treated to very low levels, often approaching or below non-detect levels.

Additionally, the Agency concluded that reverse osmosis is not commonly used in the industry. Therefore, Option 2 does not represent the average of the best treatment.

No basis could be found for identifying BPT limitations based on age, size, process, or other engineering factors. Neither the age nor the size of the TEC facility will directly affect the treatability of TEC wastewaters.

EPA also analyzed the costs of all options to determine the economic impact that this regulation would have on the TECI. EPA's assessment showed that implementation of Option 1 is projected to result in no facility closures and no employment losses (see reference 1 for additional information). Therefore, EPA based BAT on Option 1.

EPA evaluated Option 2 as a BCT candidate technology to determine whether it was cost-reasonable according to the BCT Cost Test. The option did not pass the BCT Cost Test; therefore, EPA established BCT equivalent to BPT.

EPA also established NSPS equivalent to BPT, BAT, and BCT because few additional pollutant removals are achieved by Option 2.

12.1.4 Food

EPA evaluated two options for the Food Subcategory as discussed in Section 8.2.4. EPA established BPT limitations for the Food Subcategory based on Option 2. EPA's decision to base BPT limitations on Option 2 treatment primarily reflects on two factors: 1) the degree of effluent reductions attainable, and 2) the total cost of the treatment technologies in relation to the effluent reductions achieved.

The wastewater generated by the Food Subcategory contains high loadings of biodegradable organics and few toxic pollutants. Based on the data collected by EPA, raw wastewater contained significant levels of organic material, exhibiting an average BOD_5 concentration of 3,500 mg/L. Therefore, EPA concluded that some form of biological treatment is necessary to reduce potential impacts to receiving waters from direct discharging facilities. All existing facilities that responded to the Screener Questionnaire indicated that they have a biological treatment system in place. Accordingly, EPA considers Option 2 to represent the average of the best treatment and based BPT on Option 2.

EPA projects no additional pollutant removals and no additional costs to the industry based on EPA's selection of Option 2 because all facilities identified by EPA currently have the selected technology in place.

EPA did not establish BAT for the Food Subcategory because EPA found that food grade facilities discharge very few pounds of toxic pollutants not amenable to treatment by a biological treatment system.

EPA did not identify any technologies beyond BPT that can achieve greater removals of conventional pollutants. Therefore, EPA established BCT equivalent to BPT.

Finally, for the same reasons EPA established BCT equivalent to BPT, and did not establish BAT for this subcategory, EPA established NSPS equivalent to BPT.

12.1.5 Truck/Hopper and Rail/Hopper

EPA was not able to identify any direct discharging facilities in the Truck/Hopper and Rail/Hopper subcategories; therefore, EPA has not established effluent limitations for direct dischargers for these subcategories. Permit writers can more appropriately control discharges from these facilities, if any, using best professional judgement.

12.1.6 Barge/Hopper

EPA evaluated one option for the Barge/Hopper Subcategory as discussed in Section 8.2.5. EPA did not establish BPT, BCT, BAT, or NSPS regulations for this subcategory because hopper facilities discharge very few pounds of conventional or toxic pollutants. EPA sampling data showed that very little wastewater is generated from cleaning the interiors of hopper tanks due to the dry nature of bulk materials transported. Therefore, EPA determined that nationally applicable regulations are unnecessary for this subcategory. Direct dischargers will remain subject to limitations established by permit writers on a case-by-case basis using best professional judgement.

12.2 <u>Indirect Discharging Options</u>

EPA analyzed PSES and PSNS options for all subcategories. EPA's option selection rationale is provided in the following subsections. Note that all costs are presented in 1998 dollars.

12.2.1 Truck/Chemical & Petroleum

EPA evaluated three options for the Truck/Chemical & Petroleum Subcategory as discussed in Section 8.6.1. EPA also considered a pollution prevention approach as a compliance option as discussed in Section 8.6.6. EPA established PSES for the Truck/Chemical & Petroleum Subcategory based on a pollution prevention compliance option as well as a traditional compliance option (i.e., a set of numeric pretreatment standards) based on Option 1. EPA believes that pollution prevention and effective pollutant management is an appropriate and effective way of reducing pollutant discharges from this subcategory. Further, the Agency believes that providing a pollution prevention compliance option may be less costly than the technology options considered for regulation. Therefore, EPA provided both a pollution prevention option based on development and implementation of a Pollutant Management Plan (PMP) and a set of numeric limits allowing facility owners and operators to choose the less expensive compliance alternative. For the portion of the industry that already has extensive treatment in place, it may be more cost effective to comply with the numeric limits. Conversely, for those facilities already utilizing good pollution prevention practices and/or operating in accordance with a PMP, it may be more cost effective to use the pollution prevention compliance alternative.

For establishing numeric pretreatment standards, EPA's decision to base PSES limitations on Option 1 treatment primarily reflects on three factors: 1) the degree of effluent reductions attainable, 2) the total cost of the treatment technologies in relation to the effluent reductions achieved, and 3) economic impacts.

Option A would have a post-tax annualized cost of $5.2 million ($8.1 million pre-tax) for 286 facilities. Option 1 would cost $9.2 million ($14.4 million pre-tax) and Option 2 would cost $20.9 million ($32.9 million pre-tax) annualized. Option A is projected to remove 1,500 toxic pound-equivalents, while Option 1 removes 11,700 and Option 2 removes 20,900 toxic pound-equivalents. EPA predicts that, if selected, Option 2 would not result in any significant additional benefits incremental to Option 1 because the additional toxic pound-equivalents removed by Option 2 are mainly due to pollutants that would not be selected for regulation (see Section 12.5).

These toxic pound-equivalents estimates do not include any credit for reductions of a number of pesticides, herbicides, or other toxic agents that may be present in TEC wastewater at some facilities but that were not found at the time of EPA's sampling. According to the detailed questionnaire responses, EPA found that over 3,000 types of cargos are cleaned at tank truck facilities. However, absent better estimates, EPA based its analysis on those toxic substances that were confirmed present by its sampling protocols.

EPA projects that there will be no adverse economic impacts for any option when a positive cost pass through assumption is made. However, EPA has also looked at the assumption of no cost pass through, which indicated that 14 facilities may experience financial stress at Option 1, and that 22 facilities may experience financial stress at Option 2. At Option 1, none of the 14 facilities experiencing financial stress are small businesses; at Option 2, 7 of the 22 facilities are small businesses (see reference 1 for additional information).

EPA does not believe that the lower cost of Option A demonstrated significant removals of toxics to justify its selection as a regulatory option. Option A was considerably less cost effective than Option 1 (see reference 2 for additional information). Additionally, EPA agrees with a pretreatment authority that accepts TEC wastewater who has argued that oil/water separation alone is not effective for achieving concentration standards for the pollutants that may be discharged by tank cleaning operations. The pretreatment authority also indicated its support for effective pollution prevention practices as an alternative to numeric limits for these facilities.

EPA believes that a dual approach, which offers facilities a choice between pollution prevention and compliance with numeric limits based on Option 1, is economically achievable and will significantly reduce pollutant loadings. EPA has also made a finding of no barrier to entry associated with Option 1 level of control for new sources; therefore, EPA established PSES and PSNS based on a dual approach involving a pollution prevention compliance option and traditional limits based on Option 1 technologies.

12.2.2 Rail/Chemical & Petroleum

EPA evaluated three options for the Rail/Chemical & Petroleum Subcategory as discussed in Section 8.6.2. EPA also considered a pollution prevention approach as a compliance option as discussed in Section 8.6.6. EPA established PSES for the Rail/Chemical & Petroleum Subcategory based a pollution prevention compliance option as well as a traditional compliance option based on Option 2. EPA has determined that a Pollutant Management Plan is an appropriate compliance alternative to the numerical pretreatment standards for the Rail/Chemical and Petroleum Subcategory. EPA believes this Pollutant Management Plan alternative is consistent with the CWA and the Pollution Prevention Act of 1990; it is comparable to the numerical standards in terms of pollutant removal and costs incurred by facilities; is economically achievable; and will allow an appropriate level of flexibility to facility owners and operators on how to best achieve a reduction in pollutants being discharged to the POTW. For establishing numeric pretreatment standards, EPA's decision to base PSES limitations on Option 2 treatment primarily reflects on three factors: 1) the degree of effluent reductions attainable, 2) the total cost of the treatment technologies in relation to the effluent reductions achieved, and 3) economic impacts.

EPA estimates that Option 1 would have an annualized cost of $0.60 million ($0.90 million pre-tax), Option 2 would cost $1.0 million ($1.5 million pre-tax), and Option 3 would cost $1.6 million ($2.5 million pre-tax). EPA also considered the cost effectiveness to evaluate the relative efficiency of each option in removing toxic pollutants. Option 1 is projected to remove 6,600 toxic-pound equivalents, Option 2 removes 7,300 toxic-pound equivalents, and

Option 3 removes 7,800 toxic-pound equivalents. EPA predicts that, if selected, Option 3 would not result in significant additional benefits incremental to Option 2 because the additional toxic pound-equivalents removed by Option 3 are due to pollutants that would not be selected for regulation (see Section 12.5).

EPA considered selecting Option 1; however, EPA shares the concerns of a pretreatment authority that accepts TEC wastewater that oil/water separation alone is not sufficient pretreatment for the pollutants in Rail/Chemical & Petroleum Subcategory wastewaters. Additionally, EPA is concerned about any discrepancy in selected options for the rail and truck facilities because treatment options should be similar for facilities that potentially compete with each other.

Option 2, which is analogous to PSES Option 1 in the Truck/Chemical & Petroleum Subcategory, achieves a significant reduction in toxic loadings and results in no closures, financial stress, or revenue impacts.

EPA established PSNS equivalent to PSES because EPA does not predict significant additional pollutant removals by Option 3, and EPA does not believe that the higher costs for Option 3 justify its selection for pretreatment standards for new sources.

12.2.3 Barge/Chemical & Petroleum

EPA evaluated three options for the Barge/Chemical & Petroleum Subcategory as discussed in Section 8.6.3. EPA did not propose PSES for this subcategory, but is promulgating PSES for the Barge/Chemical & Petroleum Subcategory based on Option 2 for the reasons discussed below.

EPA proposed Option 2 for PSNS. EPA did not propose PSES for the Barge/Chemical & Petroleum Subcategory because EPA identified only one facility discharging to a POTW. However, since the proposal, EPA has identified four facilities that previously discharged directly to surface waters and have since either switched or plan to switch discharge status. EPA now estimates that there are five facilities that discharge wastewater to a POTW.

EPA evaluated the treatment in place and levels of control currently achieved by the model indirect discharging Barge/Chemical & Petroleum facilities. EPA was able to evaluate effluent discharge concentrations of BOD and oil & grease from all of these model facilities and TSS from two model facilities (EPA did not have the data to evaluate the discharge concentrations of other parameters). Based on the discharge concentrations of these conventional pollutants, EPA believes that all model indirect discharging facilities are meeting the levels of control that would be established under PSES at Option 2. Although EPA does not establish technology-based pretreatment standards for conventional pollutants, EPA believes that these parameters demonstrate a level of control similar to the technology options for PSES at Option 2, and that the effluent concentrations of other pollutants of interest also would be controlled similarly.

Therefore, EPA estimates that the cost of implementing PSES standards equivalent to Option 2 would be solely for increased monitoring costs, totaling approximately $67,000 annually. EPA believes that all indirect discharging facilities have sufficient treatment in place to prevent pass through or interference and are predicted to meet standards that would be established under PSES. EPA predicts that there would be no incremental removals or benefits associated with establishing PSES standards.

In addition, EPA evaluated the pass through of pollutants regulated under BAT. As was discussed at proposal for establishment of PSNS, and in the Notice of Availability for SGT-HEM, EPA found that a number of pollutants would in fact pass through a POTW based on BAT treatment. Due to the pass through of a number of pollutants, and due to the number of facilities that have switched discharge status since proposal, EPA concluded that it should establish PSES based on Option 2. EPA believes that PSES is necessary in order to establish similar levels of control for direct and indirect dischargers, and especially to establish similar levels of control for those facilities that may decide to switch discharge status.

As noted under NSPS for the Barge/Chemical & Petroleum Subcategory, EPA believes that Option 3, which includes reverse osmosis treatment, would not result in a significant reduction of toxic pollutants because most pollutants are already treated to very low levels based on Option 2 level of control. Option 2 was demonstrated to treat many regulated pollutants to effluent levels approaching the detection limit. EPA has therefore decided to establish PSNS based on Option 2.

12.2.4 Food

EPA evaluated two options for PSES for the Food Subcategory as discussed in Section 8.6.4. This evaluation also considered the types and concentrations of pollutants found in raw wastewaters in this subcategory. As expected, food grade facilities do not discharge significant quantities of toxic pollutants to POTWs. In addition, conventional pollutants present in the wastewater were found at concentrations that are amenable to treatment at a POTW. As a result, EPA did not establish PSES or PSNS for the Food Subcategory due to the low levels of toxic pollutants discharged by facilities in this subcategory.

12.2.5 Truck/Hopper, Rail/Hopper, and Barge/Hopper

EPA evaluated one option for PSES for the Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories as discussed in Section 8.6.5. This evaluation also considered the types and concentrations of pollutants found in raw wastewaters for these subcategories. EPA estimates that 42 indirect discharging hopper facilities discharge a total of 3.5 toxic-pound equivalents to the nation's waterways, or less than one toxic-pound equivalent per facility. Additionally, EPA estimates that the total cost to the industry to implement PSES would be greater than $350,000 annually. EPA did not consider the estimated costs to control the discharge of these small amounts of pound equivalents to be reasonable.

EPA also evaluated the levels of pollutants in raw wastewaters and determined that none were present at levels expected to cause inhibition of the receiving POTW.

Based on these factors, EPA did not establish PSES or PSNS for the Truck/Hopper, Rail/Hopper, or Barge/Hopper Subcategories.

12.3 Rationale for Selecting Regulated Pollutants

EPA selected a subset of pollutants for which to establish numerical effluent limitations from the list of pollutants of interest for each regulated subcategory (see Section 6.6 for details on the pollutants of interest). Due to the wide range of cargos transported in tanks cleaned by TEC facilities it would be very difficult to establish numerical limitations for all of the pollutants that may be found in TECI wastewaters. Additionally, monitoring for all pollutants of interest is not necessary to ensure that TECI wastewater pollution is adequately controlled, since many of the pollutants originate from similar sources, have similar treatabilities, and are expected to be removed by the same mechanisms and treated to similar levels.

Therefore, rather than set effluent limitations for all pollutants detected in EPA's wastewater characterization and wastewater treatment effectiveness sampling episodes, EPA attempted to select a group of pollutants that were frequently detected in TECI wastewater and whose control through a combination of physical and chemical treatment processes would lead to the control of a wide range of pollutants with similar properties. Compounds selected for regulation were chosen to be representative of the various groups of compounds found to be effectively treated in each of the regulated subcategories. Specific compounds selected vary for each of the subcategories, but include compounds from various groups including metals, conventionals, and organics. Organic compounds were selected to be representative of the various groups of organic compounds detected (hydrocarbons, organohalogens, carboxylic acid derivatives, phthalic acid esters, etc.). In addition, special consideration was given to priority pollutants that were detected at treatable levels and were demonstrated to be effectively removed were selected for regulation.

Pollutants were selected for regulation based on the following criteria:

- EPA selected pollutants that were detected most frequently in TECI wastewater. Generally, this meant that a pollutant had to be detected at least four times in wastewater characterization samples for the Truck/Chemical & Petroleum and Barge/Chemical & Petroleum Subcategories, and at least three times in the Rail/Chemical & Petroleum Subcategory. Priority pollutants that were effectively removed and were present at significant concentrations in wastewaters, but were not detected at the frequencies described above, were also considered for regulation.

- EPA selected pollutants that were detected at significant concentrations in raw wastewater at those facilities sampled for treatment performance. Generally, the average pollutant concentration in raw wastewater had to be at least 10 times the method detection limit (MDL) to be considered for regulation. Priority pollutants that were effectively removed and that were detected frequently in the industry, but whose average concentration was less than 10 times the MDL, were also considered for regulation.

- EPA did not select pesticides or herbicides for regulation.

- EPA did not select dioxins or furans for regulation.

- EPA did not select chemicals that are used in wastewater treatment operations of the selected treatment technology option.

- EPA did not select pollutant parameters that were not considered toxic.

- EPA selected pollutants that were removed by the selected treatment technology option by at least 50 percent.

EPA did not select pesticides, herbicides, dioxins, or furans for regulation in any subcategory for three reasons. First, these pollutants were generally found at very low levels in raw wastewater. Second, the treatment technologies sampled by EPA were found to remove these pollutants from the wastewater. The treatment technologies in each subcategory treated most pesticides, herbicides, dioxins, and furans to low levels in the effluent. Third, compliance monitoring costs for these pollutants are prohibitively expensive for the TECI. Therefore, EPA has determined that it is unnecessary to set nationally-applicable discharge standards for specific pesticides, herbicides, dioxins, and furans.

EPA also did not establish limits for phenol in any subcategory. Based on the small number of direct dischargers present in the industry, EPA feels that local permitting authorities can decide whether establishing discharge limitations based on water quality considerations is appropriate. For indirect dischargers, phenol is readily biodegradable and is not expected to pass through a POTW.

EPA determined that COD from TEC wastewater is adequately treated in a POTW and does not pass through. Therefore, EPA did not select COD for regulation for indirect dischargers. EPA also believes that COD regulation is unnecessary for direct dischargers due to the control of other conventionals, including BOD, TSS, and oil and grease.

For direct discharging facilities, EPA is regulating the conventional pollutant oil and grease (HEM) but is not regulating the nonconventional pollutant non-polar material (SGT-HEM). The analysis for HEM quantifies both petroleum-based oils and greases as well as edible oils from vegetables or fish. SGT-HEM, however, quantifies only the petroleum-based fraction. EPA believes it is unnecessary to select both HEM and SGT-HEM for regulation because the petroleum component present in the wastewater is a subset of the total oil and grease measurement. EPA therefore concluded that establishing effluent limitations for both oil and grease and SGT-HEM would be redundant for direct discharging facilities.

Based on the methodology described above, EPA feels that it has selected pollutants for regulation in each subcategory that will provide adequate control of the wide range of pollutants that may be found in TECI wastewaters.

12.4 <u>Regulated Pollutants for Direct Dischargers</u>

EPA selected regulated pollutants for the Truck/Chemical & Petroleum Subcategory, Rail/Chemical & Petroleum Subcategory, Barge/Chemical & Petroleum Subcategory, and Food Subcategory. The specific regulated pollutants for each subcategory are discussed in the following subsections.

12.4.1 Truck/Chemical & Petroleum

EPA established BPT, BCT, BAT, and NSPS limitations for the Truck/Chemical & Petroleum Subcategory. The following pollutants and pollutant parameters were not selected for regulation because they are not present at treatable concentrations or are not likely to cause toxic effects: adsorbable organic halides (AOX), fluoride, nitrate/nitrite, total phosphorus, total phenols, surfacants (MBAS), total organic carbon (TOC), total dissolved solids (TDS), alpha-terpineol, benzene, benzoic acid, benzyl alcohol, chloroform, 1,2-dichlorobenzene, dimethyl sulfone, n-decane, n-triacontane, o-cresol, p-cresol, p-cymene, trichloroethene, 2-methylnaphthalene, 2-chlorophenol, 2-isopropylnaphthalene, boron, phosphorus, silicon, tin, and titanium.

The following pollutants were not selected for regulation because they are commonly used in the industry as wastewater treatment chemicals: aluminum, iron, and manganese.

The following pollutants were not selected for regulation because they are likely to be volatilized in the treatment system and are therefore not considered to be treated by the selected technology: acetone, 1,2-dichloroethane, ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, tetrachloroethene, toluene, 1,1,1-trichloroethane, m-xylene, o-+p-xylene, and naphthalene.

The following pollutant was determined to be present in TEC wastewater due to source water contamination, and was therefore not selected as a pollutant to regulate: zinc.

The following pollutant was not selected for regulation because EPA believes that its sampling data is not representative of the practices that may be performed by tank truck facilities and because EPA has insufficient data to evaluate the effectiveness of industry-supplied sampling data: chromium.

The following pollutants were not selected for regulation because they are controlled through the regulation of other pollutants: bis(2-ethylhexyl)phthalate, di-n-octyl phthalate, n-docosane, n-dodecane, n-eicosane, n-hexacosane, n-hexadecane, n-octadecane, n-tetracosane, n-tetradecane, and styrene.

The following pollutants were not selected for regulation because the treatment system did not demonstrate removals of at least 50%: 2,4,6-trichlorophenol, cadmium, calcium, magnesium, molybdenum, nickel, potassium, sodium, strontium, sulfur, ammonia as nitrogen, and chloride.

EPA is regulating BOD_5, TSS, oil and grease (HEM), pH, copper, and mercury.

12.4.2 Rail/Chemical & Petroleum

EPA established BPT, BCT, BAT, and NSPS limitations for the Rail/Chemical & Petroleum Subcategory. The following pollutants and pollutant parameters were not selected for regulation because they are not present at treatable concentrations or are not likely to cause toxic effects: adsorbable organic halides (AOX), ammonia as nitrogen, nitrate/nitrite, surfactants (MBAS), total dissolved solids (TDS), total organic carbon (TOC), total phenols, total phosphorus, acetone, anthracene, barium, benzoic acid, carbazole, chromium, copper, dimethyl sulfone, ethylbenzene, fluoride, o-+p-xylene, 1-methylphenanthrene, naphthalene, n-octacosane, p-cresol, phosphorus, pyrene, styrene, titanium, n-triacontane, zinc, and 2,4-diaminotoluene.

The following pollutants were not selected for regulation because they are commonly used in the industry as wastewater treatment chemicals: aluminum and iron.

The following pollutant was not selected for regulation because it is likely to be volatilized in the treatment system and is therefore not considered to be treated by the selected technology: m-xylene.

The following pollutants were not selected for regulation because they are controlled through the regulation of other pollutants: n-docosane, n-dodecane, n-eicosane, n-hexacosane, n-hexadecane, n-octadecane, n-tetracosane, and n-tetradecane.

The following pollutants were not selected for regulation because the treatment systems did not demonstrate removals of at least 50%: arsenic, boron, calcium, chloride, hexanoic acid, magnesium, manganese, potassium, silicon, sodium, and sulfur.

EPA is regulating BOD_5, TSS, oil and grease (HEM), pH, fluoranthene, and phenanthrene.

12.4.3 Barge/Chemical & Petroleum

EPA established BPT, BCT, BAT, and NSPS limitations for the Barge/Chemical & Petroleum Subcategory. The following pollutants and pollutant parameters were not selected for regulation because they were present only in trace amounts, are not present at treatable concentrations, or are not likely to cause toxic effects: adsorbable organic halides (AOX), ammonia as nitrogen, nitrate/nitrite, surfacants (MBAS), total dissolved solids, total organic carbon (TOC), total phenols, total phosphorus, acenaphthylene, acrylonitrile, anthracene, benzoic acid, calcium, chloride, chloroform, fluoride, hexavalent chromium, methylene chloride, molybdenum, 2,3-benzofluorene, n-octacosane, osmium, ruthenium, phosphorus, potassium, silicon, sodium, strontium, sulfur, and titanium.

The following pollutants were not selected for regulation because they are commonly used in the industry as wastewater treatment chemicals: aluminum, iron, magnesium, and manganese.

The following pollutants were not selected for regulation because they are likely to be volatilized in the treatment system and are therefore not considered to be treated by the selected technology: acetone, benzene, ethylbenzene, methyl ethyl ketone, methyl isobutyl ketone, toluene, m-xylene, o-+p-xylene, acenaphthene, biphenyl, fluorene, naphthalene, phenanthrene, and styrene.

The following pollutants were not selected for regulation because they are controlled through the regulation of other pollutants: bis(2-ethylhexyl)phthalate, 3,6-dimethylphenanthrene, n-hexacosane, n-hexadecane, 1-methylfluorene, 2-methylnaphthalene, 1-methylphenanthrene, pentamethylbenzene, di-n-octyl phthalate, n-decane, n-docosane, n-dodecane, n-eicosane, n-octadecane, n-tetracosane, n-tetradecane, p-cymene, and pyrene.

The following pollutant was not selected for regulation because the treatment system did not demonstrate removals of at least 50%: boron.

EPA is regulating BOD_5, TSS, oil and grease (HEM), pH, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

12.4.4 Food

EPA established BPT, BCT, and NSPS limitations for the Food Subcategory for BOD_5, TSS, oil and grease (HEM), and pH.

12.5 Regulated Pollutants for Indirect Dischargers

Section 307(b) of the CWA requires the Agency to promulgate pretreatment standards for existing sources (PSES) and new sources (PSNS). To establish pretreatment standards, EPA must first determine whether each BAT pollutant under consideration passes through a POTW, or interferes with the POTW's operation or sludge disposal practices.

The Agency evaluated POTW pass through for the TEC pollutants of interest for all subcategories where EPA is regulating priority and nonconventional pollutants. In determining whether a pollutant is expected to pass through a POTW, the Agency compared the nation-wide average percentage of a pollutant removed by well-operated POTWs with secondary treatment to the percentage of a pollutant removed by BAT treatment systems. A pollutant is determined to “pass through” a POTW when the average percentage removal achieved by a well-operated POTW (i.e., those meeting secondary treatment standards) is less than the percentage removed by the industry’s direct dischargers that are using the selected BAT technology.

The approach to the definition of pass-through satisfies two competing objectives set by Congress: 1) the wastewater treatment performance for indirect dischargers be equivalent to that for direct dischargers, and 2) that the treatment capability and performance of the POTW be recognized and taken into account in regulating the discharge of pollutants from indirect dischargers. Rather than compare the mass or concentration of pollutants discharged by the POTW with the mass or concentration of pollutants discharged by a BAT facility, EPA compares the percentage of the pollutants removed by the BAT treatment system with the POTW removal. EPA takes this approach because a comparison of mass or concentration of pollutants in a POTW effluent to pollutants in a BAT facility’s effluent would not take into account the mass of pollutants discharged to the POTW from non-industrial sources, nor the dilution of the pollutants in the POTW effluent to lower concentrations from the addition of large amounts of non-industrial wastewater.

To establish the performance of well-operated POTWs, EPA primarily compiled POTW percent-removal data from previous effluent guidelines rulemaking efforts, which have established national POTW percent-removal averages for a broad list of pollutants. These guidelines have used the information provided in “The Fate of Priority Pollutants in Publicly Owned Treatment Works,” commonly referred to as the 50 POTW Study. For those pollutants not found in the 50 POTW Study, EPA used data from EPA’s National Risk Management Research Laboratory’s (RREL) treatability database. These studies were discussed previously in Section 3.0.

To perform the TEC pass-through analysis, EPA used percent removal rates generated for the rulemaking efforts from the Metal Products and Machinery (MP&M) Industry

(3), the Centralized Waste Treatment (CWT) Industry (4), the Industrial Laundries Industry (5), and the Pesticide Manufacturing Industry (6). EPA used POTW removal data from the 50 POTW study, the RREL database, and the rulemaking efforts listed above to compile the POTW removals used for the TECI (7).

For indirect dischargers, EPA did not conduct the pass through analysis on the conventional pollutant oil and grease because of a POTW's ability to treat the non-petroleum based oils and greases, such as animal fats and vegetable oils. EPA instead conducted the pass-through analysis only on SGT-HEM. SGT-HEM quantifies the petroleum-based fraction of oil and grease which may not be treated as effectively in a POTW as with the BAT treatment technology. In order to determine removal rates for SGT-HEM, EPA used data submitted by the County Sanitation Districts of Los Angeles County resulting in a percent removal estimate of 74 percent (8). EPA established pretreatment standards for SGT-HEM in cases where EPA demonstrated that the selected BAT treatment technology will achieve greater removals of SGT-HEM than a POTW. In these cases, EPA believes that SGT-HEM has been demonstrated to pass through and that it is a good indicator parameter for a number of nonconventional pollutants.

Based on the criteria described above, EPA selected pollutants for regulation for indirect dischargers for each of the regulated subcategories. Note that the Agency has chosen not to regulate indirect dischargers in the Food, Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories.

The following sections give the results of the pass-through analysis for each subcategory. The pass-through analysis was not conducted for the conventional pollutants (BOD_5, TSS, pH, and oil and grease) that are regulated for direct dischargers because conventional pollutants are not regulated under PSES and PSNS. Pollutants in each subcategory and technology option that were demonstrated to pass through a POTW were selected for regulation. The results of the pass-through analysis for the Truck/Chemical & Petroleum, Rail/Chemical & Petroleum, and Barge/Chemical & Petroleum Subcategories are listed in Tables 12-1, 12-2, and 12-3.

12.5.1 Truck/Chemical & Petroleum

EPA established PSES and PSNS limitations for the Truck/Chemical & Petroleum Subcategory. Based on the pass-through analysis, EPA determined that the following pollutants passed through a POTW and were therefore selected for regulation: copper, mercury, and SGT-HEM.

12.5.2 Rail/Chemical & Petroleum

EPA established PSES and PSNS limitations for the Rail/Chemical & Petroleum Subcategory. Based on the pass-through analysis, EPA determined that the following pollutants passed through a POTW and were therefore selected for regulation: SGT-HEM, phenanthrene, and fluoranthene.

12.5.3 Barge/Chemical & Petroleum

EPA established PSES and PSNS limitations for the Barge/Chemical & Petroleum Subcategory. Based on the pass-through analysis, EPA determined that the following pollutants passed through a POTW and were therefore selected for regulation: SGT-HEM, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

12.6 References

1. U.S. Environmental Protection Agency. Final Economic Analysis of Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category. EPA 821-R-00-013, June 2000.

2. U.S. Environmental Protection Agency. Final Cost-Effectiveness Analysis of Effluent Limitations Guidelines and Standards for the Transportation Equipment Cleaning Category. EPA 821-R-00-014, June 2000.

3. U.S. Environmental Protection Agency. Development Document for Proposed Effluent Limitations Guidelines and Standards for the Metals Products and Machinery Phase I Point Source Category. EPA 821-R-95-021, April 1995.

4. U.S. Environmental Protection Agency. Development Document for Proposed Effluent Limitations Guidelines and Standards for the Centralized Waste Treatment Industry. EPA 821-R-95-006, January 1995.

5. U.S. Environmental Protection Agency. Development Document for Proposed Pretreatment Standards for Existing and New Sources for Industrial Laundries Point Source Category. EPA 821-R-97-007, November, 1997.

6. U.S. Environmental Protection Agency. Development Document for Effluent Limitations Guidelines and New Source Performance Standards for Pesticide Chemical Manufacturers. EPA 821-R-93-016, September 1993.

7. U.S. Environmental Protection Agency. Final POTW Pass-Through Analysis for the TECI. April 2000 (DCN T20534).

8. 64 FR 38870 (DCN 20477).

Table 12-1

Pass-Through Analysis for the Truck/Chemical & Petroleum Subcategory

Pollutant	Average BAT Percent Removal	Average POTW Percent Removal	Pass Through
Copper	87	84	Yes
Mercury	94	90	Yes

Table 12-2

Pass-Through Analysis for the Rail/Chemical & Petroleum Subcategory

Pollutant	Average BAT Percent Removal	Average POTW Percent Removal	Pass Through
Fluoranthene	92	42	Yes
Phenanthrene	97	95	Yes

Table 12-3

Pass-Through Analysis for the Barge/Chemical & Petroleum Subcategory

Pollutant	Average BAT Percent Removal	Average POTW Percent Removal	Pass Through
Cadmium	97	90	Yes
Chromium	98	80	Yes
Copper	98	84	Yes
Lead	95	77	Yes
Mercury	98	90	Yes
Nickel	96	51	Yes
Zinc	93	80	Yes

13.0 IMPLEMENTATION OF EFFLUENT LIMITATIONS GUIDELINES AND STANDARDS

A permit writer must first determine if a facility is subject to the Transportation Equipment Cleaning (TEC) regulation by evaluating its tank cleaning operations, including the tank types cleaned, cargo types cleaned, and annual wastewater discharge volume. This section is intended to provide guidance to permit writers and TEC facilities on how the TEC rule will be applied and implemented.

Indirect discharging facilities in the Truck/Chemical and Petroleum and Rail/Chemical and Petroleum subcategories subject to the TECI regulation will need to make an initial choice on how to comply with the regulation. They will need to choose to either comply with numerical effluent limitations guidelines and standards or agree to develop and comply with an enforceable pollution prevention alternative, referred to as the Pollutant Management Plan. Direct discharging facilities must comply with numerical effluent limitations guidelines and standards.

Section 13.1 discusses and provides examples of facilities that are excluded from the TEC rule. Section 13.2 discusses implementation of numerical effluent limitations and pretreatment standards and provides examples of how these are applied. Section 13.3 discusses implementation of the Toxics Management Plan.

In addition, EPA is preparing a Permit Guidance Document to provide further assistance to the industry and the permitting/control authorities implementing this rule. (A copy may be obtained by writing to the EPA Office of Water Resource Center (RC-4100), 401 M Street, SW, Washington, DC, 20460, or by calling 202-260-7786.)

13.1 Facilities Excluded from the TECI Regulation

EPA has provided in the rule a low-flow exclusion for facilities that generate less than 100,000 gallons per year of TEC process wastewater (§442.1(b)(3)). Section 13.1.1 provides an example of how the low flow exclusion is applied. Note that the definition of TEC process wastewater (§442.2) specifically excludes wastewater generated from cleaning tank interiors for the purposes of maintenance and repair.

EPA has provided an exclusion for wastewaters associated with tank cleanings operated in conjunction with other industrial, commercial, or publicly-owned treatment works (POTW) operations, provided that the cleaning is limited to tanks that previously contained raw materials, by-products and finished products that are associated with the facility's on-site processes. On-site means the contiguous and non-contiguous established boundaries of a facility. Sections 13.1.2 and 13.1.3 provide examples of application of this exclusion.

A TEC facility may accept wastewater from off site and still be considered a TEC facility as long as the wastewater from off site also meets the definition of TEC process wastewater. If a TEC facility accepts wastewater from off site that is not generated from other tank cleaning activities, that facility may be considered a centralized waste treater (CWT) and may have to meet limitations applicable to the CWT industry.

The TEC effluent limitations are not applicable to wastewater generated from cleaning drums and intermediate bulk containers; however, EPA recognizes that many facilities that will be subject to the TEC effluent limitations also clean these types of containers. Section 13.1.4 provides guidance in applying the TEC effluent limitations for these facilities.

13.1.1 Low Flow Exclusion - Unregulated Wastewater

Example 1: An indirect discharging TEC facility cleans rail tank cars for both shipping products and repair. The facility discharges an average of 360,000 gallons of wastewater per year and performs an average of 360 cleanings per year. All tanks last transported chemical and petroleum cargos. According to facility records, approximately 75% of all cleanings are performed for the purpose of maintenance and repair on the tank, with the remainder performed for the purpose of shipping. The facility operates year round.

By definition, only 25% of the facility's total average annual wastewater flow, 90,000 gallons per year, is considered TEC process wastewater. This facility qualifies for the low flow exclusion because it discharges less than 100,000 gallons per year of TEC process wastewater, and is therefore not subject to TEC effluent limitations. Facilities discharging less than 100,000 gallons per year of TEC process wastewater will remain subject to limitations and standards established on a case-by-case basis using Best Professional Judgement by the permitting authority.

13.1.2 Manufacturing Facility Covered by Another Point Source Category

Example 2: A chemical manufacturer, subject to the Organic Chemicals, Plastics, and Synthetic Fibers (OCPSF) effluent guideline (40 CFR 414), manufacturers bulk organic chemicals for sale and distribution. The facility holds a NPDES permit with limitations based on 40 CFR 414.71 and 414.73. In addition to manufacturing chemicals, the facility transports chemicals in tank trucks and occasionally cleans the interiors of tank trucks when changing cargos for delivery. Based on data collected over the previous five years, the greatest number of tank trucks cleaned in a given year is 200 tanks, and the average is 178 tanks. The average annual volume of tank cleaning wastewater discharged is 140,000 gallons. Tank cleaning wastewater is combined with chemical manufacturing wastewater (14 millions gallons per year) for treatment in the facility's on-site treatment facility. The facility operates 365 days per year.

As specified in §442.1(b)(1), the TECI effluent guidelines do not apply to "wastewater associated with tank cleanings operated in conjunction with other industrial...operations, provided that the cleaning is limited to tanks that previously contained raw materials, by-products, or finished products that are associated with the facility's on-site processes." Although this facility is not subject to 40 CFR 442, wastewater discharges from tank truck cleaning may be permitted under 40 CFR 414 or any other applicable point source category.

13.1.3 Manufacturing Facility Not Covered by Another Point Source Category

Example 3: A grape juice processing facility cleans tank trucks that contained processed juice. The facility discharges to a local POTW and is not required to monitor their effluent discharges. The facility cleans (on average) 350 tank trucks per year and discharges 1,000 gallons of wastewater per tank cleaning. Wastewater is generated from interior, exterior, and equipment and floor washings. The facility also discharges over 5,000 gallons per day of wastewater from juice processing. All waste streams are commingled prior to discharge, without pretreatment. The facility operates 350 days per year.

This facility is not currently subject to another point source category, but generates a significant volume of tank cleaning wastewater, 350,000 gallons per year. However, as described in §442.1(b)(1), the TECI effluent guidelines do not apply to "wastewater associated with tank cleanings operated in conjunction with other industrial...operations, provided that the cleaning is limited to tanks that previously contained raw materials, by-products, or finished products that are associated with the facility's on-site processes." Therefore, this facility is not subject to 40 CFR 442. The facility may be subject to local pretreatment limits as necessary to prevent pass-through or interference.

Example 4: An inorganic chemical manufacturer operates a distribution center 100 miles from its main facility where all chemicals are manufactured. The facility mainly operates as a chemical distributor (e.g., unloading and loading products), but it also cleans tank trucks for change of cargo. The wastewater generated from tank cleaning is not currently covered by a point source category, and is discharged to a local POTW without pretreatment. The distributor cleans an average of 600 tank trucks per year and discharges 210,000 gallons of tank cleaning wastewater per year. The facility has no other significant sources of process wastewater. The distributor operates 180 days per year.

As described in §442.1(b)(1), the TECI effluent guidelines do not apply to "wastewater associated with tank cleanings operated in conjunction with other industrial, commercial, or POTW operations, provided that the cleaning is limited to tanks that previously contained raw materials, by-products, or finished products that are associated with the facility's on-site processes." EPA has provided a revised definition for "on-site" that includes contiguous and non-contiguous property within the established boundary of a facility.

EPA believes its exclusion for other industrial, commercial, or POTW facilities allows the permitting authority a considerable amount of discretion in determining if the tank cleanings are performed as part of, or in addition to, the facilities on-site processes. In this example, the permit writer may exercise flexibility in setting local limitations and may determine that the TEC effluent limitations would be appropriate for use as the basis of the permit.

13.1.4 Facility That Cleans Tanks and IBCs

Example 5: A direct discharging TEC facility cleans tank trucks and intermediate bulk containers (IBCs) last containing chemical or petroleum cargos. The facility cleans 4,500 tank trucks per year and 1,800 IBCs per year. The facility discharges an average of 270 gallons of wastewater per tank truck or IBC cleaned. The facility operates 350 days per year.

Discharges from this facility are subject to §442.11, §442.12, and §442.13 for the Truck/Chemical & Petroleum Subcategory. As stated under §442.1(b)(2), wastewater resulting from the cleaning of IBCs is not covered by 40 CFR 442; however, permit writers, using Best Professional Judgement, may provide a pollutant discharge allowance for non-categorical wastewater discharges such as IBC cleaning. EPA assumes that a permit writer would give this facility an allowance for the IBC cleanings since the facility cleans a significant number of IBCs each day and they may contribute significant pollutant loadings in the raw and treated wastewater. As a conservative estimate, a permit writer could assume that the wastewater characteristics from cleaning a tank truck are similar to that of cleaning an IBC.

13.2 Numerical Effluent Limitations

Using the effluent limitations guidelines and standards, the permitting authority will establish numerical discharge limitations for the facility and specify monitoring and reporting requirements. For direct discharging facilities, the effluent limitation guidelines are applicable to the final effluent discharged to U.S. surface waters. For indirect discharging facilities, pretreatment standards are applicable to the final effluent discharged to a POTW. This section provides guidance and examples on how the TECI effluent guidelines will be implemented.

Compliance monitoring should be performed on a frequency basis established by the permitting authority. EPA's monitoring costs for this regulation assumed compliance monitoring for conventional pollutants four times per month, and for priority and non-conventional pollutants once per month.

13.2.1 Single Subcategory Facility

Example 6: An indirect discharging TEC facility cleans rail tank cars that last transported fuel oil, lube oil, and sulfuric acid. The facility cleans 20 tanks per day and discharges an average of 10.4 million gallons of TEC process wastewater per year. The facility operates 260 days per year.

This facility's wastewater discharges are subject to Subpart B - Rail Tank Cars Transporting Chemical & Petroleum Cargos, Pretreatment Standards for Existing Sources (PSES) (§442.25). This facility would be required to monitor for SGT-HEM, fluoranthene, and phenanthrene and must comply with the following end-of-pipe discharge limitations:

Pollutant	Maximum Daily Concentration (mg/L)
SGT-HEM	26
Fluoranthene	0.076
Phenanthrene	0.34

13.2.2 Multiple Subcategory Facility

Example 7: An indirect discharging TEC facility cleans the interiors of tank trucks and rail tank cars. A wide range of cargos is cleaned, but all cargos are classified as chemical or petroleum (as defined in §442.2). The facility cleans, on average, 10 tank trucks and 3 rail cars per day. On average, the facility discharges 500 gallons of TEC process wastewater per tank truck cleaned and 2,000 gallons of TEC process wastewater per rail tank car cleaned. The facility also commingles into its treatment system 20 gallons per day of boiler blowdown. The facility operates 300 days per year.

This facility's wastewater discharge is subject to both Subpart A - Tank Trucks and Intermodal Tank Containers Transporting Chemical & Petroleum Cargos, PSES (§442.15) and Subpart B - Rail Tank Cars Transporting Chemical & Petroleum Cargos, PSES (§442.25). A permit writer would use the combined waste stream formula in Equation 1, set forth in 40 CFR 403.6(e), to establish effluent limitations. Note that the boiler blowdown waste stream is the only dilute waste stream at this facility.

$$C_T = \left(\frac{\sum_{i=1}^{N} C_i F_i}{\sum_{i=1}^{N} F_i} \right) \left(\frac{F_T - F_D}{F_T} \right) \qquad (1)$$

where:

C_T = Alternative concentration limit for the combined wastestream, (mg/L)
C_i = Concentration limit for a pollutant in the regulated stream i, (mg/L)
F_i = Average daily flow (at least a 30-day average) of regulated stream i, (gallons/day)
F_D = Average daily flow (at least 30-day average) of dilute waste stream(s), (gallons/day)

F_T = Average daily flow (at least a 30-day average) through the combined treatment facility (including regulated, unregulated, and dilute waste streams), (gallons/day)

N = Total number of regulated streams

An example for calculating the copper limit is provided:

Average daily Subpart A flow:

$$F_A = TPD_A * GPT = 10 * 500 = 5{,}000 \ gallons/day$$

Average daily Subpart B flow:

$$F_B = TPD_B * GPT = 3 * 2{,}000 = 6{,}000 \ gallons/day$$

where:

F = Average daily flow (at least a 30-day average) of regulated stream, (gallons/day)

TPD = Number of tanks cleaned per day, (tanks/day)

GPT = Gallons of TEC process wastewater generated per tank cleaned, (gallons/tank)

The average daily flow through the combined treatment system is the sum of F_A and F_B plus the boiler blowdown flow, or 11,020 gallons/ day. The maximum daily concentration limitation for copper for Subpart A is 0.84 mg/L (from §442.15). Copper is not regulated for Subpart B and this flow is considered an unregulated process flow. C_T for copper is calculated as:

$$C_T = \left(\frac{0.84 * 5{,}000}{5{,}000} \right) \left(\frac{11{,}020 - 20}{11{,}020} \right) = 0.84 \ mg/L$$

The same methodology would be used to establish pretreatment standards for all pollutants regulated under §442.15 and/or §442.25 (SGT-HEM, mercury, fluoranthene, and phenanthrene). SGT-HEM is the only pollutant regulated under both Subparts A and B. Because the SGT-HEM limitation is the same in both subparts (26 mg/L), C_T for SGT-HEM for this example facility is calculated as:

$$C_T = \left(\frac{(26 * 5{,}000) + (26 * 6{,}000)}{11{,}000} \right) \left(\frac{11{,}020 - 20}{11{,}020} \right) = 26 \ mg/L$$

13.2.3 Regulated and Unregulated Wastewater at a Facility

Example 8: An indirect discharging TEC facility cleans tank barges containing a variety of cargos, including petroleum and products such as gasoline, mineral spirits and xylene. The facility also cleans barge hoppers containing dry bulk cargos. The facility cleans a total of 165 tank barges per year and 1,120 hoppers per year. The facility discharges an average of 700 gallons of wastewater per barge hopper cleaned and 4,700 gallons of wastewater per chemical and petroleum barge cleaned. The facility operates 280 days per year.

This facility’s wastewater discharge is subject to Subpart C - Tank Barges and Ocean/Sea Tankers Transporting Chemical & Petroleum Cargos, PSES (§442.35). EPA has not established PSES for the cleaning of barge hoppers. By definition, wastewater generated from cleaning closed-top hoppers is not considered TEC process wastewater and is not covered by 40 CFR 442. This flow will remain subject to limitations and standards established on a case-by-case basis using Best Professional Judgement by the permitting authority.

EPA found that hopper wastewater contains low levels of conventional and toxic pollutants. Permit writers should evaluate unregulated streams to determine whether they actually are acting as dilution. A local or state control authority can use its own legal authority to establish a limit more stringent than would be derived using the combined waste stream formula. In this example, EPA assumes that a permit writer would not give this facility an allowance for hopper cleanings and would consider it a dilution flow.

The annual volume of TEC process wastewater discharged by this facility is calculated as follows:

$$ANN = TPY * GPT = 165 * 4{,}700 = 775{,}500 \ gallons/year$$

where:

ANN	=	Annual TEC process wastewater flow, (gallons/year)
TPY	=	Number of tank barges cleaned per year (chemical and petroleum only), (tanks/year)
GPT	=	Gallons of TEC process wastewater generated per tank cleaned, (gallons/tank)

This facility does not qualify for the low flow exclusion because it discharges more than 100,000 gallons per year of TEC process wastewater.

The annual volume of wastewater generated from cleaning hoppers is:

$$ANN = TPY * GPT = 1{,}120 * 700 = 784{,}000 \ gallons/year$$

A permit writer would use the combined waste stream formula (see Equation (1)) to establish PSES since only a portion of the facility's discharge is subject to this rule. An example for calculating C_T for zinc is provided below. The maximum daily concentration limitation for zinc for Subpart C is 8.3 mg/L (from §442.35).

Average daily Subpart C flow:

$$F_i = \frac{ANN}{DPY} = \frac{775{,}500}{280} = 2{,}770 \ gallons/day$$

Average daily hopper flow (considered a dilution waste stream in this example):

$$F_D = \frac{ANN}{DPY} = \frac{784{,}000}{280} = 2{,}800 \ \ gallons/day$$

where:

F	=	Average daily flow (at least a 30-day average) of stream, (gallons/day)
ANN	=	Annual wastewater flow, (gallons/year)
DPY	=	Number of operating days per year

The average daily flow through the combined treatment facility:

$$F_T = \left(\frac{(165 \ * \ 4{,}700) \ + \ (1{,}120 \ * \ 700)}{280} \right) = 5{,}570 \ \ gallons/day$$

Alternative concentration limit:

$$C_T = \left(\frac{8.3 \ * \ 2{,}770}{2{,}770} \right) \left(\frac{5{,}570 \ - \ 2{,}800}{5{,}570} \right) = 4.1 \ \ mg/L$$

The same methodology would be used to establish pretreatment standards for all pollutants regulated under §442.35 (SGT-HEM, cadmium, chromium, copper, lead, mercury, nickel, and zinc).

13.3 Pollutant Management Plan

The permitting authority will establish a pollution prevention allowable discharge of wastewater pollutants, as defined in §442.2, if the facility agrees to a control mechanism or pretreatment agreement as specified in the applicable subpart(s).

14.0 ANALYTICAL METHODS

Section 304(h) of the Clean Water Act directs EPA to promulgate guidelines establishing test procedures (analytical methods) for analyzing pollutants. These test procedures are used to determine the presence and concentration of pollutants in wastewater, and are used for submitting applications and for compliance monitoring under the National Pollutant Discharge Elimination System (NPDES) found at 40 CFR Parts 122.41(j)(4) and 122.21(g)(7), and for the pretreatment program found at 40 CFR 403.7(d). Promulgation of these methods is intended to standardize analytical methods within specific industrial categories and across industries.

EPA has promulgated analytical methods for monitoring pollutant discharges at 40 CFR Part 136, and has promulgated methods for analytes specific to given industrial categories at 40 CFR Parts 400 to 480. In addition to the methods developed by EPA and promulgated at 40 CFR Part 136, certain methods developed by others[1] have been incorporated by reference into 40 CFR Part 136.

EPA promulgated Method 1664, the analytical method for HEM and SGT-HEM, on May 14, 1999 (see 64 FR 26315) to support phaseout of use of CFC-113. This rulemaking revised 40 CFR 136 to list Method 1664 as an approved method to analyze oil and grease and non-polar material (i.e., HEM and SGT-HEM). Note that EPA will allow continued use of methods that use CFC-113 through the extension to the laboratory use exemption of CFC-113 through 2005; however, EPA strongly encourages dischargers/generators/industrial users and permit authorities to substitute use of Method 1664 for CFC-113 methods. Method 1664 will be used in EPA's wastewater program for regulation development, permit applications, and compliance monitoring. In anticipation of promulgation of Method 1664, data collected by EPA in support of the TECI effluent guideline utilized Method 1664. Therefore, all effluent limitations

[1]For example, the American Public Health Association publishes *Standard Methods for the Examination of Water and Wastewater*.

promulgated for oil and grease (HEM) and non-polar material (SGT-HEM) in this effluent guideline are to be measured by Method 1664.

For this final rule, EPA is regulating certain conventional, priority, and nonconventional pollutants as identified in Section 12.0. The methods proposed for monitoring the regulated pollutants are briefly discussed in the following sections:

- Section 14.1: Semivolatile Organic Compounds;
- Section 14.2: Metals;
- Section 14.3: Hexane Extractable Material and Silica-Gel Treated Hexane Extractable Material;
- Section 14.4: Biochemical Oxygen Demand; and
- Section 14.5: Total Suspended Solids.

Section 14.6 lists the references used in this section.

14.1 Semivolatile Organic Compounds

Semivolatile organic compounds are analyzed by EPA Method 1625, Revision C (1). In this method, samples are prepared by liquid-liquid extraction with methylene chloride in a separatory funnel or continuous liquid-liquid extractor. Separate acid and base/neutral extracts are concentrated and analyzed by high resolution gas chromatography (HRGC) combined with low resolution mass spectrometry (LRMS). The detection limit of the method is usually dependent upon interferences rather than instrument limitations. With no interferences present, minimum levels of 10, 20, or 50 µg/L (ppb) can be achieved, depending upon the specific compound.

14.2 Metals

Metals are analyzed by EPA Method 1620 (2). This method is a consolidation of the EPA 200 series methods for the quantitative determination of 27 trace elements by inductively coupled plasma (ICP) and graphite furnace atomic adsorption (GFAA), and determination of mercury by cold vapor atomic absorption (CVAA). The method also provides a semiquantitative ICP screen for 42 additional elements. The ICP technique measures atomic emissions by optical spectroscopy. GFAA measures the atomic absorption of a vaporized sample, and CVAA measures the atomic absorption of mercury vapor. Method detection limits (MDLs) are influenced by the sample matrix and interferences. With no interferences present, compound-specific MDLs ranging from 0.1 to 75 μg/L (ppb) can be achieved.

14.3 Hexane Extractable Material and Silica-Gel Treated Hexane Extractable Material

Hexane Extractable Material (HEM; formerly known as oil and grease) and Silica-Gel Treated Hexane Extractable Material (SGT-HEM) are analyzed by EPA Method 1664 (3). In this method, a 1-L sample is acidified and serially extracted three times with n-hexane. The solvent is evaporated from the extract and the HEM is weighed. For SGT-HEM analysis, the HEM is redissolved in n-hexane and an amount of silica gel proportionate to the amount of HEM is added to the HEM solution to remove adsorbable materials. The solution is filtered to remove the silica gel, the solvent is evaporated, and the SGT-HEM is weighed. This method is capable of measuring HEM and SGT-HEM in the range of 5 to 1,000 mg/L (ppm), and may be extended to higher concentrations by analysis of a smaller sample volume.

14.4 Biochemical Oxygen Demand

Biochemical oxygen demand (BOD_5) is a measure of the relative oxygen requirements of wastewaters, effluents, and polluted waters. BOD_5 is measured by EPA Method 405.1 (4). The BOD_5 test specified in this method is an empirical bioassay-type procedure that measures dissolved oxygen consumed by microbial life while assimilating and oxidizing the organic matter present. The standard test conditions include dark incubation at 20°C for a five-day period, and the reduction in dissolved oxygen concentration during this period yields a measure of the biological oxygen demand. The practical minimum level of determination is 2 mg/L (ppm).

14.5 Total Suspended Solids

Total suspended solids (TSS) is measured using EPA Method 160.2 (4). In this method, a well-mixed sample is filtered through a pre-weighed glass fiber filter. The filter is dried to constant weight at 103 -105°C. The weight of material on the filter divided by the sample volume is the amount of TSS. The practical range of the determination is 4 - 20,000 mg/L (ppm).

14.6 References[2]

1. U.S. Environmental Protection Agency. Method 1625, Revision C: Semivolatile Organic Compounds by Isotope Dilution GCMS, June 1989 (DCN T10220).

2. U.S. Environmental Protection Agency. Method 1620: Metals by Inductively Coupled Plasma Atomic Emission Spectroscopy and Atomic Absorption Spectroscopy, September 1989 (DCN T10224).

3. U.S. Environmental Protection Agency. Method 1664, Revision A: n-Hexane Extractable Material (HEM: Oil and Grease) and Silica Gel Treated n-Hexane Extractable Material (SGT-HEM; Non-polar Material) by Extraction and Gravimetry, EPA-821-R-98-002, February 1999. (DCN T20485).

4. U.S. Environmental Protection Agency. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1983. (DCN T10228).

[2] For those references included in the administrative record supporting the TECI rulemaking, the document control number (DCN) is included in parentheses at the end of the reference.

15.0 GLOSSARY

Administrator - The Administrator of the U.S. Environmental Protection Agency.

Agency - The U.S. Environmental Protection Agency.

Ballast Water Treatment Facility - A facility which accepts for treatment ballast water or any water which has contacted the interior of cargo spaces or tanks in an ocean/sea tanker.

Baseline Loadings - Pollutant loadings in TEC wastewater currently being discharged to POTWs or U.S. surface waters. These loadings take into account wastewater treatment currently in place at TEC facilities.

BAT - The best available technology economically achievable, as described in Sec. 304(b)(2) of the Clean Water Act.

BCT - The best conventional pollutant control technology, as described in Sec. 304(b)(4) of the Clean Water Act.

BMP - Best management practice. Section 304(e) of the Clean Water Act gives the Administrator the authority to publish regulations to control plant site runoff, spills, or leaks, sludge or waste disposal, and drainage from raw material storage.

BOD_5 - Five day biochemical oxygen demand. A measure of biochemical decomposition of organic matter in a water sample. It is determined by measuring the dissolved oxygen consumed by microorganisms to oxidize the organic matter in a water sample under standard laboratory conditions of five days and 20° C, see Method 405.1. BOD_5 is not related to the oxygen requirements in chemical combustion.

BPT - The best practicable control technology currently available, as described in Sec. 304(b)(1) of the Clean Water Act.

Builder/Leaser - A facility that manufactures and/or leases tank trucks, closed-top hopper tank trucks, intermodal tank containers, rail tank cars, closed-top hopper rank tank cars, tank barges, closed-top hopper barges, and/or ocean/sea tankers, and that cleans the interiors of these tank after equipment has been placed in service.

CAA - Clean Air Act. The Air Pollution Prevention and Control Act (42 U.S.C. 7401 et. seq.), as amended, inter alia, by the Clean Air Act Amendments of 1990 (Public Law 101-549, 104 Stat. 2399).

Cargo - Any chemical, material, or substance transported in a tank truck, closed-top hopper truck, intermodal tank container, rail tank car, closed-top hopper rail car, tank barge, closed-top hopper barge, ocean/sea tanker, or a similar tank that comes in direct contact with the chemical, material, or substance. A cargo may also be referred to as a commodity.

Carrier-Operated (Carrier) - A facility that owns, operates, and cleans a tank fleet used to transport commodities or cargos for other companies.

Centralized Waste Treater (CWT) - A facility that recycles, reclaims, or treats any hazardous or nonhazardous industrial wastes received from off site.

Centralized Waste Treaters Effluent Guideline - see proposed 40 CFR Part 437, 60 FR 5464, January 27, 1995.

CFR - Code of Federal Regulations, published by the U.S. Government Printing Office. A codification of the general and permanent rules published in the Federal Register by the Executive departments and agencies of the federal government.

Chemical Cargo - Chemical cargos include, but are not limited to, the following cargos: latex; rubber; plastic; plasticizers; resins; soaps; detergents; surfactants; agricultural chemicals and pesticides; hazardous waste; organic chemicals including: alcohols, aldehydes, formaldehydes, phenols, peroxides, organic salts, amines, amides, other nitrogen compounds, other aromatic compounds, aliphatic organic chemicals, glycols, glycerines, and organic polymers; refractory organic compounds including: ketones, nitriles, organo-metallic compounds containing chromium, cadmium, mercury, copper, zinc; and inorganic chemicals including: aluminum sulfate, ammonia, ammonium nitrate, ammonium sulfate, and bleach. Cargos which are not considered to be foodgrade, petroleum, or dry bulk goods are considered to be chemical cargos.

Classical Pollutants - A general term for parameters, including conventional pollutants, that are commonly analyzed by a wet chemistry laboratory. Classical pollutants may also be referred to as classical wet chemistry parameters.

Classical Wet Chemistry Parameters- A general term for parameters, including conventional pollutants, that are commonly analyzed by a wet chemistry laboratory. Classical wet chemistry parameters may also be referred to as classical pollutants.

Closed-Top Hopper Rail Car - A completely enclosed storage vessel pulled by a locomotive that is used to transport dry bulk commodities or cargos over railway access lines. Closed-top hopper rail cars are not designed or contracted to carry liquid commodities or cargos and are typically used to transport grain, soybeans, soy meal, soda ash, lime, fertilizer, plastic pellets, flour, sugar, and similar commodities or cargos. The commodities or cargos transported come in direct contact with the hopper interior. Closed-top hopper rail cars are typically divided into three compartments, carry the same commodity or cargo in each compartment, and are generally top loaded and bottom unloaded. The hatch covers on closed-top hopper rail cars are typically longitudinal hatch covers or round manhole covers.

Closed-Top Hopper Truck - A motor-driven vehicle with a completely enclosed storage vessel used to transport dry bulk commodities or cargos over roads and highways. Closed-top hopper trucks are not designed or constructed to carry liquid commodities or cargos and are typically used to transport grain, soybeans, soy meal, soda ash, lime, fertilizer, plastic pellets, flour, sugar, and similar commodities or cargos. The commodities or cargos transported come in direct contact with the hopper interior. Closed-top hopper trucks are typically divided into three compartments, carry the same commodity or cargo in each compartment, and are generally top loaded and bottom unloaded. The hatch covers used on closed-top hopper trucks are typically longitudinal hatch covers or round manhole covers. Closed-top hopper trucks are also commonly referred to as dry bulk hoppers.

Closed-Top Hopper Barge - A non-self-propelled vessel constructed or adapted primarily to carry dry commodities or cargos in bulk through rivers and inland waterways, and may occasionally carry commodities or cargos through oceans and seas when in transit from one inland waterway to another. Closed-top hopper barges are not designed to carry liquid commodities or cargos and are typically used to transport corn, wheat, soy beans, oats, soy meal, animal pellets, and similar commodities or cargos. The commodities or cargos transported come in direct contact with the hopper interior. The basic types of tops on closed-top hopper barges are telescoping rolls, steel lift covers, and fiberglass lift covers.

COD - Chemical oxygen demand. A nonconventional, bulk parameter that measures the oxygen-consuming capacity of refractory organic and inorganic matter present in water or wastewater. COD is expressed as the amount of oxygen consumed from a chemical oxidant in a specific test, see Methods 410.1 through 401.4.

Commercial TEC Facility - A TEC facility that performs 50 percent of their cleanings for commercial customers. Many of these facilities perform 90 percent or more commercial cleanings.

Commodity - Any chemical, material, or substance transported in a tank truck, closed-top hopper truck, intermodal tank container, rail tank car, closed-top hopper rail car, tank barge, closed-top hopper barge, ocean/sea tanker, or similar tank that comes in direct contact with the chemical, material, or substance. A commodity may also be referred to as a cargo.

Consignee - Customer or agent to whom commodities or cargos are delivered.

Contract Hauling - The removal of any waste stream from the facility by a company authorized to transport and dispose of the waste, excluding discharges to sewers of surface waters.

Conventional Pollutants - The pollutants identified in Sec. 304(a)(4) of the Clean Water Act and the regulations thereunder (i.e., biochemical oxygen demand (BOD_5), total suspended solids (TSS), oil and grease, fecal coliform, and pH).

CWA - Clean Water Act. The Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 1251 et seq.), as amended, inter alia, by the Clean Water Act of 1977 (Public Law 95-217) and the Water Quality Act of 1987 (Public Law 100-4).

Daily Discharge - The discharge of a pollutant measured during any calendar day or any 24-hour period that reasonably represents a calendar day.

Dairy Products Processing Effluent Guideline - see 40 CFR Part 405.

Detailed Questionnaire - The 1994 Detailed Questionnaire for the Transportation Equipment Cleaning Industry.

Direct Capital Costs - One-time capital costs associated with the purchase, installation, and delivery of a specific technology. Direct capital costs are estimated by the TECI cost model.

Direct Discharger - A facility that conveys or may convey untreated or facility-treated process wastewater or nonprocess wastewater directly into surface waters of the United States, such as rivers, lakes, or oceans. (See Surface Waters definition.)

Discharge - The conveyance of wastewater to: (1) United States surface waters such as rivers, lakes, and oceans, or (2) a publicly-owned, privately-owned, federally-owned, centralized, or other treatment works.

Drum - A metal or plastic cylindrical container with either an open-head or a tight-head (also known as bung-type top) used to hold liquid, solid, or gaseous commodities or cargos which are in direct contact with the container interior. Drums typically range in capacity from 30 to 55 gallons.

Dry Bulk Cargo - A cargo which includes dry bulk products such as fertilizers, grain, and coal grain, soybeans, soy meal, soda ash, lime, fertilizer, plastic pellets, flour, sugar, and similar commodities or cargos.

EA - Economic assessment. An analysis which estimates the economic impacts of compliance costs on facilities, firms, employment, domestic and international market, inflation, distribution, environmental justice, and transportation equipment cleaning customers.

Effluent - Wastewater discharges.

Effluent Limitation - Any restriction, including schedules of compliance, established by a State or the Administrator on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources into navigable waters, the waters of the contiguous zone, or the ocean. (CWA Sections 301(b) and 304(b).)

Emission - Passage of air pollutants into the atmosphere via a gas stream or other means.

EPA - The U.S. Environmental Protection Agency.

Facility - A facility is all contiguous and non-contiguous property within established boundaries owned, operated, leased, or under the control of the same corporation or business entity. The property may be divided by public or private right-of-way.

Federally-Owned Treatment Works (FOTW) - Any device or system owned and/or operated by a United States Federal Agency to recycle, reclaim, or treat liquid sewage or liquid industrial wastes.

Food Grade Cargo - Food grade cargos include edible and non-edible food products. Specific examples of food grade products include but are not limited to: alcoholic beverages, animal by-products, animal fats, animal oils, caramel, caramel coloring, chocolate, corn syrup and other corn products, dairy products, dietary supplements, eggs, flavorings, food preservatives, food products that are not suitable for human consumption, fruit juices, honey, lard, molasses, non-alcoholic beverages, salt, sugars, sweeteners, tallow, vegetable oils, vinegar, and pool water.

FR - Federal Register, published by the U.S. Government Printing Office, Washington, D.C. A publication making available to the public regulations and legal notices issued by federal agencies.

Hazardous Air Pollutants (HAPs) - Substances listed by EPA as air toxics under Section 112 of the Clean Air Act.

Heel - Any material remaining in a tank or container following unloading, delivery, or discharge of the transported cargo. Heels may also be referred to as container residue, residual materials or residuals.

Hexane Extractable Material (HEM) - A method-defined parameter that measures the presence of relatively nonvolatile hydrocarbons, vegetable oils, animal fats, waxes, soaps, greases, and related materials that are extractable in the solvent n-hexane. See Method 1664. HEM is also referred to as oil and grease.

Independent - A facility that provides cleaning services on a commercial basis, either as a primary or secondary business, for tanks which they do not own or operate.

Indirect Capital Costs - One-time capital costs that are not technology-specific and are represented as a multiplication factor that is applied to the direct capital costs estimated by the TECI cost model.

Indirect Discharger - A facility that discharges or may discharge pollutants into a publicly-owned treatment works (POTW).

Industrial Waste Combusters Effluent Guidelines - see 40 CFR Part 444, FR 6518, January 27, 2000.

In-house TEC Facility - A TEC facility that performs less than 50 percent of their cleanings for commercial clients. In-house TEC facilities primarily clean their own transportation equipment and have very few commercial clients. Most of these facilities perform less than 10 percent of their total cleanings for commercial clients.

Inorganic Chemicals Manufacturing Effluent Guidelines - see 40 CFR Part 415.

Intermediate Bulk Container (IBC or Tote) - A completely enclosed storage vessel used to hold liquid, solid, or gaseous commodities or cargos which are in direct contact with the tank interior. Intermediate bulk containers may be loaded onto flat beds for either truck or rail transport, or onto ship decks for water transport. IBCs are portable containers with 450 liters (119 gallons) to 3,000 liters (793 gallons) capacity. IBCs are also commonly referred to as totes.

Intermodal Tank Container - A completely enclosed storage vessel used to hold liquid, solid, or gaseous commodities or cargos which come in direct contact with the tank interior. Intermodal tank containers may be loaded onto flat beds for either truck or rail transport, or onto ship decks for water transport. Containers larger than 3,000 liters capacity are considered intermodal tank containers. Containers smaller than 3,000 liters capacity are considered IBCs.

MP&M - Metal Products & Machinery Effluent Guidelines, new regulation to be proposed in 2000 (designated as 40 CFR Part 438).

New Source - As defined in 40 CFR 122.2 and 122.29, and 403.3(k), a new source is any building, structure, facility, or installation from which there is or may be a discharge of pollutants, the construction of which commenced (1) for purposes of compliance with New Source Performance Standards, after the promulgation of such standards under CWA Section 306; or (2) for the purposes of compliance with Pretreatment Standards for New Sources, after the publication of proposed standards under CWA Section 307(c), if such standards are thereafter promulgated in accordance with that section.

Nonconventional Pollutant - Pollutants other than those specifically defined as conventional pollutants (identified in Section 304(a)(4) of the Clean Water Act) or priority pollutants (identified in 40 CFR Part 423, Appendix A).

Nondetect Value - A concentration-based measurement reported below the sample-specific detection limit that can reliably be measured by the analytical method for the pollutant.

Non-Polar Material - A method-defined parameter that measures the presence of mineral oils that are extractable in the solvent n-hexane and not adsorbed by silica gel. See Method 1664. Non-polar material is also referred to as SGT-HEM.

Nonprocess Wastewater - Wastewater that is not generated from industrial processes or that does not come into contact with process wastewater. Nonprocess wastewater includes, but is not limited to, wastewater generated from restrooms, cafeterias, and showers.

Non-Water Quality Environmental Impact - An environmental impact of a control or treatment technology, other than to surface waters.

NPDES - The National Pollutant Discharge Elimination System authorized under Sec. 402 of the CWA. NPDES requires permits for discharge of pollutants from any point source into waters of the United States.

NRDC - Natural Resources Defense Council.

NSPS - New source performance standards, under Sec. 306 of the CWA.

Ocean/Sea Tanker - A self- or non-self-propelled vessel constructed or adapted to transport commodities or cargos in bulk in cargo spaces (or tanks) through oceans and seas, where the commodity or cargo carried comes in direct contact with the tank interior. There are no maximum or minimum vessel or tank volumes.

OCPSF - Organic Chemicals, Plastics, and Synthetic Fibers Manufacturing Effluent Guideline, see 40 CFR Part 414.

Off Site - “Off site” means outside the established boundaries of the facility.

Oil and Grease (O&G) - A method-defined parameter that measures the presence of relatively nonvolatile hydrocarbons, vegetable oils, animal fats, waxes, soaps, greases, and related materials that are extractable in either n-hexane (referred to as HEM, see Method 1664) or Freon 113 (1,1,2-trichloro-1,2,2-trifluoroethane, see Method 413.1). Data collected by EPA in support of the TECI effluent guideline utilized Method 1664.

On Site - “On site” means within the established boundaries of the facility.

Operating and Maintenance (O&M) Costs - All costs related to operating and maintaining a treatment system for a period of one year, including the estimated costs for compliance wastewater monitoring of the effluent.

Petroleum Cargo - Petroleum cargos include the products of the fractionation or straight distillation of crude oil, redistillation of unfinished petroleum derivatives, cracking, or other refining processes. For purposes of this rule, petroleum cargos also include products obtained from the refining or processing of natural gas and coal. Specific examples of petroleum products include, but are not limited to: asphalt; benzene; coal tar; crude oil; cutting oil; ethyl benzene; diesel fuel; fuel additives; fuel oils; gasoline; greases; heavy, medium, and light oils; hydraulic fluids, jet fuel; kerosene; liquid petroleum gases (LPG) including butane and propane; lubrication oils; mineral spirits; naphtha; olefin, paraffin, and other waxes; tall oil; tar; toluene; xylene; and waste oil.

Petroleum Refining Effluent Guidelines - see 40 CFR Part 415.

PNPL - Production Normalized Pollutant Loading. Untreated wastewater pollutant loading generated per tank cleaning.

Point Source Category - A category of sources of water pollutants.

Pollutants of Interest - Pollutants that meet the following criteria are considered pollutants of interest: detected two or more times in the subcategory raw wastewater characterization data or one time for the Food, Truck/Hopper, Rail/Hopper, and Barge/Hopper Subcategories, and an average treatment technology option influent concentration greater than or equal to five times their analytical method detection limit. All pollutants of interest that were removed by the technology bases were used in the environmental assessment and cost effectiveness analyses.

Pollution Prevention - The use of materials, processes, or practices that reduce or eliminate the creation of pollutants or wastes. It includes practices that reduce the use of hazardous and nonhazardous materials, energy, water, or other resources, as well as those practices that protect natural resources through conversation or more efficient use. Pollution prevention consists of source reduction, in-process recycle and reuse, and water conservation practices.

Post-Compliance Loadings - Pollutant loadings in TEC wastewater following implementation of each regulatory option. These loadings are calculated assuming that all TEC facilities would operate wastewater treatment technologies equivalent to the technology bases for the selected regulatory options.

POTW - Publicly-owned treatment works, as defined at 40 CFR 403.3(o).

PPA - Pollution Prevention Act. The Pollution Prevention Act of 1990 (42 U.S.C. 13101 et. seq., Pub. Law 101-508), November 5, 1990.

Prerinse - Within a TEC cleaning process, a rinse, typically with hot or cold water, performed at the beginning of the cleaning sequence to remove residual material (i.e., heel) from the tank interior.

Presolve Wash - Use of diesel, kerosene, gasoline, or any other type of fuel or solvent as a tank interior cleaning solution.

Pretreatment Standard - A regulation that establishes industrial wastewater effluent quality required for discharge to a POTW. (CWA Section 307(b).)

Priority Pollutants - The pollutants designated by EPA as priority in 40 CFR Part 423, Appendix A.

Privately-Owned Treatment Works - Any device or system owned and operated by a private company that is used to recycle, reclaim, or treat liquid industrial wastes not generated by that company.

Process Wastewater - Any water which, during manufacturing or processing, comes into direct contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

PSES - Pretreatment standards for existing sources, under Sec. 307(b) of the CWA.

PSNS - Pretreatment standards for new sources, under Sec. 307(b) and (c) of the CWA.

Rail Tank Car - A completely enclosed storage vessel pulled by a locomotive that is used to transport liquid, solid, or gaseous commodities or cargos over railway access lines. A rail tank car storage vessel may have one or more storage compartments, and the stored commodities or cargos come in direct contact with the tank interior. There are no maximum or minimum vessel or tank volumes.

RCRA - Resource Conservation and Recovery Act (PL 94-580) of 1976, as amended (42 U.S.C. 6901, et. seq.).

RREL - U. S. Environmental Protection Agency, Office of Research and Development, Risk Reduction Engineering Laboratory.

Screener Questionnaire - The 1993 Screener Questionnaire for the Transportation Equipment Cleaning Industry.

Shipper-Operated (Shipper) - A facility that transports or engages a carrier for transport of their own commodities or cargos and cleans the fleet used for such transport. Also included in the scope of this definition are facilities which provide tank cleaning services to fleets that transport raw materials to their location.

SIC - Standard industrial classification. A numerical categorization system used by the U.S. Department of Commerce to catalogue economic activity. SIC codes refer to the products, or group of products, produced or distributed, or to services rendered by an operating establishment. SIC codes are used to group establishments by the economic activities in which they are engaged. SIC codes often denote a facility's primary, secondary, tertiary, etc. economic activities.

Silica Gel Treated Hexane Extractable Material (SGT-HEM) - A method-defined parameter that measures the presence of mineral oils that are extractable in the solvent n-hexane and not adsorbed by silica gel. See Method 1664. SGT-HEM is also referred to as non-polar material.

Source Reduction - Any practice which reduces the amount of any hazardous substance, pollutant, or contaminant entering any waste stream or otherwise released into the environment prior to recycling, treatment, or disposal. Source reduction can include equipment or technology modifications, process or procedure modifications, substitution of raw materials, and improvements in housekeeping, maintenance, training, or inventory control.

Surface Waters - Waters including, but not limited to, oceans and all interstate and intrastate lakes, rivers, streams, mudflats, sand flats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, and natural ponds.

Tank - A generic term used to describe any closed container used to transport commodities or cargos. The commodities or cargos transported come in direct contact with the container interior, which is cleaned by TEC facilities. Examples of containers which are considered tanks include: tank trucks, closed-top hopper trucks, intermodal tank containers, rail tank cars, closed-top hopper rail cars, tank barges, closed-top hopper barges, ocean/sea tankers, and similar tanks. Containers used to transport pre-packaged materials are not considered tanks, nor are 55-gallon drums or pails or intermediate bulk containers.

Tank Barge - A non-self-propelled vessel constructed or adapted primarily to carry commodities or cargos in bulk in cargo spaces (or tanks) through rivers and inland waterways, and may occasionally carry commodities or cargos through oceans and seas when in transit from one inland waterway to another. The commodities or cargos transported are in direct contact with the tank interior. There are no maximum or minimum vessel or tank volumes.

Tank Truck - A motor-driven vehicle with a completely enclosed storage vessel used to transport liquid, solid or gaseous materials over roads and highways. The storage vessel or tank may be detachable, as with tank trailers, or permanently attached. The commodities or cargos transported come in direct contact with the tank interior. A tank truck may have one or more storage compartments. There are no maximum or minimum vessel or tank volumes. Tank trucks are also commonly referred to as cargo tanks or tankers.

TECI - Transportation Equipment Cleaning Industry.

TEC Process Wastewater - All wastewaters associated with cleaning the interiors of tanks including: tank trucks; tank rail cars; intermodal tank containers; tank barges; and ocean/sea tankers used to transport commodities or cargoes that come into direct contact with the interior of the tank or container. At those facilities that clean tank interiors, TEC process wastewater includes wastewater generated from washing vehicle exteriors, equipment and floor washings, TEC-contaminated stormwater, wastewater pre-rinse cleaning solutions, chemical cleaning solutions, and final rinse solutions. TEC process wastewater is defined to include only wasterwater generated from a regulated TEC subcategory. Therefore, TEC process wastewater does not include wastewater generated from cleaning hopper cars, or from food grade facilities discharging to a POTW. Wastewater generated from cleaning tank interiors for purposes of shipping products (i.e., cleaned for purposes other than maintenance and repair) is considered TEC process wastewater. Wastewater generated from cleaning tank interiors for the purposes of maintenance and repair on the tank is not considered TEC process wastewater. Facilities that clean tank interiors solely for the purposes of repair and maintenance are not regulated under the TEC rule.

Total Annualized Cost - The sum of annualized total capital investment and O&M costs. Total capital investment costs are annualized by spreading them over the life of the project. These annualized costs are then added to the annual O&M costs.

Total Capital Investment - Total one-time capital costs required to build a treatment system (i.e., sum of direct and indirect capital costs).

Tote - A completely enclosed storage vessel used to hold liquid, solid, or gaseous commodities or cargos which come in direct contact with the vessel interior. Totes may be loaded onto flat beds for either truck or rail transport, or onto ship decks for water transport. There are no maximum or minimum values for tote volumes, although larger containers are generally considered to be intermodal tank containers. Totes are also referred to as intermediate bulk containers or IBCs. Fifty-five gallon drums and pails are not considered totes.

Transportation Equipment Cleaning Facility - Any facility that generates wastewater from cleaning the interior of tank trucks, closed-top hopper trucks, rail tank cars, closed-top hopper rail cars, intermodal tank containers, tank barges, closed-top hopper barges, ocean/sea tankers, and (excluding drums and intermediate bulk containers).

Treatment Effectiveness Concentration - Treated effluent pollutant concentration that can be achieved by each treatment technology that is part of a TECI regulatory option. Treatment effectiveness concentrations for each pollutant were developed for each treatment technology that removed the pollutant by 50 percent or greater.

Treatment, Storage, and Disposal Facility (TSDF) - A facility that treats, stores, or disposes hazardous waste in compliance with the applicable standards and permit requirements set forth in 40 CFR Parts 264, 265, 266, and 270.

TSS - Total suspended solids. A measure of the amount of particulate matter that is suspended in a water sample. The measure is obtained by filtering a water sample of known volume. The particulate material retained on the filter is then dried and weighed, see Method 160.2.

Untreated Loadings - Pollutant loadings in raw TEC wastewater. These loadings represent pollutant loadings generated by the TECI, and do no account for wastewater treatment currently in place at TEC facilities.

U.S.C. - The United States Code.

Zero Discharge Facility - A facility that does not discharge pollutants to waters of the United States or to a POTW. Also included in this definition are discharge or disposal of pollutants by way of evaporation, deep-well injection, off-site transfer to a treatment facility, and land application.