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FINAL

AMENDMENTS TO THE

FINAL BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)

BACKGROUND DOCUMENTS

FOR

WASTES FOR WHICH WASTEWATER TREATMENT STANDARDS WERE DETERMINED BASED ON CONCENTRATIONS IN INCINERATOR SCRUBBER WATER: K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, AND U190

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LIST OF ABBREVIATIONS AND ACRONYMS

Abbreviation/Acronym	Definition
AC	Activated Carbon
ACF	Accuracy Correction Factor
AFF	Aerobic Fixed Film
AirS	Air Stripping
AL	Aerobic Lagoons
AnFF	Anaerobic Fixed Film
APCD	Air Pollution Control Devices
API	American Petroleum Institute
ART	Articles not part of WERL database
AS	Activated Sludge Biological Treatment
BDAT	Best Demonstrated Available Technology
BGAC	Biological Granular Activated Carbon
BT	Biological Treatment
CAC	Chemically Assisted Clarification
CFR	Code of Federal Regulations
ChOx	Chemical Oxidation
Chred	Chemical Reduction
CWA	Clean Water Act
DAF	Dissolved Air Flotation
DNT	Dinitrotoluene
EAD	Engineering and Analysis Division
EPA	Environmental Protection Agency
FIL	Filtration
FR	Federal Register
FWPCA	Federal Water Pollution Control Act

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

Abbreviation/Acronym	Definition
GAC	Granular Activated Carbon
HSWA	Hazardous and Solid Waste Amendments
ITD	Industrial Technology Division
LDR	Land Disposal Restrictions
Leachate	Industry Submitted Leachate Data
LL	Liquid-Liquid Extraction
NPDES	National Pollutant Discharge Elimination System
OCPSF	Organic Chemicals, Plastics, and Synthetic Fibers
OER	Onsite Engineering Report
OSW	Office of Solid Waste
PACT®	Powdered Activated Carbon Addition to Activated Sludge
RBC	Rotating Biological Contactor
RCRA	Resource Conservation and Recovery Act
RO	Reverse Osmosis
SCOx	Super Critical Oxidation
SExt	Solvent Extraction
SS	Steam Stripping
TCLP	Toxicity Characteristic Leaching Procedure
TF	Trickling Filter
TOC	Total Organic Carbon
TSS	Total Suspended Solids
UF	Ultrafiltration
UV	Ultraviolet Radiation

LIST OF ABBREVIATIONS AND ACRONYMS (Continued)

Abbreviation/Acronym	Definition
VF	Variability Factor
WAO	Wet Air Oxidation
WERL	Water Engineering Research Laboratory
WOx	Wet Air Oxidation

1.0 INTRODUCTION

The U.S. Environmental Protection Agency (EPA or Agency) is today revising the best demonstrated available technology (BDAT) treatment standards for organic constituents regulated in wastewater[1] forms of the hazardous wastes listed as K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190. These hazardous wastes, defined in Title 40, Code of Federal Regulations (40 CFR), Sections 261.31, 261.32, or 261.33, are listed in Table 1-1 at the end of this section. This document presents EPA's rationale and technical support for the revision of treatment standards for organic constituents in the wastewater forms of the previously mentioned wastes. In this document, the wastes identified by the aforementioned codes may also be referred to as "the wastes of interest."

BDAT treatment standards were established for the wastes of interest in accordance with the amendments to the Resource Conservation and Recovery Act (RCRA) of 1976, enacted by the Hazardous and Solid Waste Amendments (HSWA) of November 8, 1984. Treatment standards for the wastes of interest became effective on various dates, none later than May 8, 1990. Since the effective dates, compliance with these BDAT treatment standards has been a prerequisite under 40 CFR Part 268 for placement of the wastes in land disposal units.

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[1]Wastewaters are defined as wastes containing less than 1% (weight basis) total suspended solids[2] (TSS) and less than 1% (weight basis) total organic carbon (TOC). Wastes not meeting this definition are classified as nonwastewaters and must comply with the nonwastewater treatment standard.

[2]The term "total suspended solids" (TSS) clarifies EPA's previously used terminology of "total solids" and "filterable solids." Specifically, total suspended solids is measured by Method 209C (total suspended solids dried at 103-105°C) in Standard Method for the Examination of Water and Wastewater, Sixteenth Edition (1).

The Agency's legal authority and promulgated methodology for establishing treatment standards, and the petition process necessary for requesting a variance from the treatment standards, are summarized in EPA's Methodology for Developing BDAT Treatment Standards (2). If the individual concentrations of all of the regulated constituents (organics, inorganics, and metals) in a waste, as generated, are lower than or equal to their respective concentration-based treatment standards, then treatment of that waste is not required prior to land disposal.

The previously promulgated treatment standards for the organic constituents regulated in wastewater forms of K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190 were determined based on constituent concentrations in incinerator scrubber water. This methodology was used for the following reasons:

- EPA was not aware that wastewater forms of the waste, as generated, existed; therefore, it was believed that the only wastewater forms of the waste that might be generated would have been derived from the treatment of the nonwastewater form of the waste by incineration (i.e., scrubber water); and
- Actual wastewater treatment performance data for treatment of the wastes of interest or wastes judged to be similar were not readily available.

The Agency is revising the treatment standards for wastewater forms of the wastes of interest and basing the treatment standards on available wastewater treatment performance data rather than concentrations in incinerator scrubber water. This revision is in accordance with the methodology established by the Agency in the Third Third Final Rule (55 FR 22599). The Agency prefers to use appropriate wastewater treatment performance data from well-designed and well-operated wastewater treatment units to develop wastewater treatment standards whenever possible because they represent the performance of actual wastewater treatment technologies; conversely, concentrations in

incinerator scrubber water represent a residual from treatment of nonwastewaters and do not specifically reflect wastewater treatment.

The revised BDAT treatment standards for organic constituents in wastewater forms of the wastes of interest are based on wastewater treatment performance data from several sources. These sources include the Best Demonstrated Available Technology (BDAT) database, wet air oxidation (WAO) and powdered activated carbon addition to biological treatment (PACT®) data, the Industrial Technology Division (ITD) (now the Engineering and Analysis Division (EAD)) database, the National Pollutant Discharge Elimination System (NPDES) database, the Water Engineering Research Laboratory (WERL) database, industry submitted leachate treatment performance data, data in literature that are not part of the WERL database, and data in literature submitted by industry on the WAO and PACT® treatment processes. Details regarding the development of a wastewater database combining the information in these sources are presented in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A: Wastewater Forms of Organic U and P Wastes and Multi-Source Leachate (F039) For Which There are Concentration-Based Treatment Standards (3).

Two exceptions to these revisions include the treatment standard for benzal chloride in wastewater forms of K015 and the treatment standard for pentachloroethane in wastewater forms of K018, K028, and K030. The previously promulgated treatment standard for benzal chloride in wastewater forms of K015 is not being revised. The K015 treatment standard is based on benzal chloride concentrations in incinerator scrubber water and will continue to be based on incinerator scrubber water data because actual wastewater treatment performance data for benzal chloride are not available at this time. During the development of the Third Third rule, a concentration-based treatment standard for benzal chloride could not be established due to analytical difficulties; a technology-based treatment standard was then established for U017 (benzal

chloride). However, because benzal chloride may be present in K015 in concentrations above 88%, the Agency believes that it is necessary to establish a concentration-based treatment standard for benzal chloride in wastewater forms of K015 to ensure that the waste is substantially treated prior to land disposal. Also during the development of the Third Third rule, the Agency determined that complications arise in the quantification of pentachloroethane, a regulated constituent in K018, K028, and K030 (see 55 FR 22611). As such, the Agency promulgated a method of treatment standard, rather than a concentration-based treatment standard for this constituent. EPA is now removing pentachloroethane from regulation in wastewater forms of K018, K028, and K030. The Agency believes that the treatment of other regulated constituents in K018, K028, and K030 will, in turn, provide treatment of pentachloroethane that is sufficiently protective of human health and the environment.

The revised treatment standards promulgated today for the regulated organic constituents in wastewater forms of K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190 wastes are listed in Table 1-2. These treatment standards reflect the total concentration of each organic constituent regulated in the wastewater forms of the wastes of interest. The units used to report total constituent concentration are mg/L (parts-per-million on a weight-by-volume basis).

Sections 2.0 through 6.0 of this document supplement discussions in the background documents listed in Table 1-3 by discussing applicable and demonstrated treatment technologies, wastewater treatment performance data, determination of the revised BDAT, constituents selected for regulation, and calculation of the revised treatment standards. Section 7.0 contains acknowledgements, and Section 8.0 lists references. Appendix A presents the wastewater treatment performance data, on a constituent-by-constituent basis, that were used to determine the revised BDAT, and to calculate the revised treatment standards promulgated in this regulation.

Table 1-1

Waste Code Definitions

- K015. Still bottoms from the distillation of benzal chloride.
- K016. Heavy ends or distillation residues from the production of carbon tetrachloride.
- K018. Heavy ends from the fractionation column in ethyl chloride production.
- K019. Heavy ends from the distillation of ethylene dichloride in ethylene dichloride production.
- K020. Heavy ends from the distillation of vinyl chloride in vinyl chloride monomer production.
- K023. Distillation light ends from the production of phthalic anhydride from naphthalene.
- K024. Distillation bottoms from the production of phthalic anhydride from naphthalene.
- K028. Spent catalyst from the hydrochlorination reactor in the production of 1,1,1-trichloroethane.
- K030. Column bottoms or heavy ends from the combined production of trichloroethylene and perchloroethylene.
- K048. Dissolved air flotation (DAF) float from the petroleum refining industry.
- K049. Slop soil emulsion solids from the petroleum refining industry.
- K050. Heat exchanger bundle cleaning sludge from the petroleum refining industry.
- K051. API separator sludge from the petroleum refining industry.

Table 1-1

(Continued)

- K052. Tank bottoms (leaded) from the petroleum refining industry.
- K087. Decanter tank tar sludge from coking operations.
- K093. Distillation light ends from the production of phthalic anhydride from ortho-xylene.
- K094. Distillation bottoms from the production of phthalic anhydride from ortho-xylene.

U codes representing discarded commercial chemical products, off-specification species, container residue, and spill residue containing these constituents:

- U028. bis(2-Ethylhexyl) Phthalate.
- U069. Dibutyl Phthalate.
- U088. Diethyl Phthalate.
- U102. Dimethyl Phthalate.
- U107. Di-n-octyl Phthalate.
- U190. Phthalic Anhydride.

Table 1-2

Revised BDAT Treatment Standards for Organic Constituents Regulated in Wastewater Forms of K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190

K015	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
57. Anthracene	0.059
218. Benzal chloride	0.28*
63. Benzo(b)fluoranthene	0.055
65. Benzo(k)fluoranthene	0.059
141. Phenanthrene	0.059
43. Toluene	0.080
K016	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
110. Hexachlorobenzene	0.055
111. Hexachlorobutadiene	0.055
112. Hexachlorocyclopentadiene	0.057
113. Hexachloroethane	0.055
42. Tetrachloroethene	0.056

*The treatment standard for benzal chloride in wastewater forms of K015 is not being revised.

Table 1-2

(Continued)

K018	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
12. Chloroethane	0.27
15. Chloromethane	0.19
22. 1,1-Dichloroethane	0.059
23. 1,2-Dichloroethane	0.21
110. Hexachlorobenzene	0.055
111. Hexachlorobutadiene	0.055
137. Pentachloroethane	NR
45. 1,1,1-Trichloroethane	0.054
113. Hexachloroethane	0.055

NR - Not Regulated.

Table 1-2

(Continued)

K019	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
68. bis(2-Chloroethyl)ether	0.033
9. Chlorobenzene	0.057
14. Chloroform	0.046
88. p-Dichlorobenzene	0.090
23. 1,2-Dichloroethane	0.21
109. Fluorene	0.059
113. Hexachloroethane	0.055
121. Naphthalene	0.059
141. Phenanthrene	0.059
148. 1,2,4,5-Tetrachlorobenzene	0.055
42. Tetrachloroethene	0.056
150. 1,2,4-Trichlorobenzene	0.055
45. 1,1,1-Trichloroethane	0.054

K020	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
23. 1,2-Dichloroethane	0.21
41. 1,1,2,2-Tetrachloroethane	0.057
42. Tetrachloroethene	0.056

K023	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
220. Phthalic Anhydride (measured as phthalic acid)	0.069

Table 1-2

(Continued)

K024	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
220. Phthalic Anhydride (measured as phthalic acid)	0.069

K028	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
22. 1,1-Dichloroethane	0.059
25. trans-1,2-Dichloroethene	0.054
111. Hexachlorobutadiene	0.055
113. Hexachloroethane	0.055
137. Pentachloroethane	NR
40. 1,1,1,2-Tetrachloroethane	0.057
41. 1,1,2,2-Tetrachloroethane	0.057
42. Tetrachloroethene	0.056
45. 1,1,1-Trichloroethane	0.054
46. 1,1,2-Trichloroethane	0.054

NR - Not Regulated.

Table 1-2

(Continued)

K030	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
87. o-Dichlorobenzene	0.088
88. p-Dichlorobenzene	0.090
111. Hexachlorobutadiene	0.055
113. Hexachloroethane	0.055
137. Pentachloroethane	NR
148. 1,2,4,5-Tetrachlorobenzene	0.055
42. Tetrachloroethene	0.056
150. 1,2,4-Trichlorobenzene	0.055

NR - Not Regulated.

Table 1-2

(Continued)

K048	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
4. Benzene	0.14
62. Benzo(a)pyrene	0.061
70. bis(2-Ethylhexyl)phthalate	0.28
80. Chrysene	0.059
98. Di-n-butyl Phthalate	0.057
226. Ethylbenzene	0.057
109. Fluorene	0.059
121. Naphthalene	0.059
141. Phenanthrene	0.059
142. Phenol	0.039
145. Pyrene	0.067
43. Toluene	0.080
215.-217. Xylenes (total)	0.32

Table 1-2

(Continued)

K049	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
57. Anthracene	0.059
4. Benzene	0.14
62. Benzo(a)pyrene	0.061
70. bis(2-Ethylhexyl)phthalate	0.28
8. Carbon Disulfide	0.014
80. Chrysene	0.059
96. 2,4-Dimethylphenol	0.036
226. Ethylbenzene	0.057
121. Naphthalene	0.059
141. Phenanthrene	0.059
142. Phenol	0.039
145. Pyrene	0.067
43. Toluene	0.080
215.-217. Xylenes (total)	0.32

K050	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
62. Benzo(a)pyrene	0.061
142. Phenol	0.039

Table 1-2

(Continued)

K051	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
52. Acenaphthene	0.059
57. Anthracene	0.059
59. Benz(a)anthracene	0.059
4. Benzene	0.14
62. Benzo(a)pyrene	0.061
70. bis(2-Ethylhexyl)phthalate	0.28
80. Chrysene	0.059
98. Di-n-butyl Phthalate	0.057
226. Ethylbenzene	0.057
109. Fluorene	0.059
121. Naphthalene	0.059
141. Phenanthrene	0.059
142. Phenol	0.039
145. Pyrene	0.067
43. Toluene	0.080
215.-217. Xylenes (total)	0.32

Table 1-2

(Continued)

K052	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
4. Benzene	0.14
62. Benzo(a)pyrene	0.061
81. o-Cresol	0.11
82. Cresol (m- and p- isomers)	0.77
96. 2,4-Dimethylphenol	0.036
226. Ethylbenzene	0.057
121. Naphthalene	0.059
141. Phenanthrene	0.059
142. Phenol	0.039
43. Toluene	0.080
215.-217. Xylenes (total)	0.32

Table 1-2

(Continued)

K087	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
51. Acenaphthalene	0.059
4. Benzene	0.14
80. Chrysene	0.059
108. Fluoranthene	0.068
116. Indeno(1,2,3-cd)pyrene	0.0055
121. Naphthalene	0.059
141. Phenanthrene	0.059
43. Toluene	0.080
215.-217. Xylenes (total)	0.32

K093	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
220. Phthalic Anhydride (measured as phthalic acid)	0.069

K094	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
220. Phthalic Anhydride (measured as phthalic acid)	0.069

Table 1-2

(Continued)

U028	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
70. bis(2-Ethylhexyl)phthalate	0.28

U069	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
98. Di-n-butyl Phthalate	0.057

U088	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
92. Diethyl Phthalate	0.20

U102	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
97. Dimethyl Phthalate	0.047

Table 1-2

(Continued)

U107	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
104. Di-n-octyl Phthalate	0.017
U190	
Maximum for Any Single Grab Sample	
BDAT List Constituent	Total Constituent Concentration in Wastewaters (mg/L)
220. Phthalic Anhydride (measured as phthalic acid)	0.069

Table 1-3

Background Documents Which Are Being Amended

- Final Best Demonstrated Available Technology (BDAT) Background Document for K015 (5) (hereinafter referred to as the Background Document for K015).
- Final Best Demonstrated Available Technology (BDAT) Background Document for K016, K018, K019, K020, and K030 (6) (hereinafter referred to as the Background Document for K016, K018, K019, K020, and K030).
- Final Best Demonstrated Available Technology (BDAT) Background Document for Phthalate Wastes: K023, K024, K093, K094, U028, U069, U088, U102, U107, U190 (7) (hereinafter referred to as the Background Document for Phthalate Wastes).
- Final Best Demonstrated Available Technology (BDAT) Background Document for K024 (8) (hereinafter referred to as the Background Document for K024).
- Final Best Demonstrated Available Technology (BDAT) Background Document for Wastes From the Production of 1,1,1-Trichloroethane: K028, K029, K095, and K096 (9) (hereinafter referred to as the Background Document for K028).
- Final Best Demonstrated Available Technology (BDAT) Background Document for K048, K049, K050, K051, and K052 (10) (hereinafter referred to as the Background Document for K048, K049, K050, K051, and K052).
- Final Best Demonstrated Available Technology (BDAT) Background Document for K087 (11) (hereinafter referred to as the Background Document for K087).

2.0 AMENDMENT TO THE "APPLICABLE AND DEMONSTRATED TREATMENT TECHNOLOGIES" SECTION OF THE FINAL BDAT BACKGROUND DOCUMENTS FOR K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190: WASTEWATER ORGANICS

This section supplements the discussion in Section 3.0 (Applicable and Demonstrated Treatment Technologies) concerning the following documents:

- Background Document for K015 (5);
- Background Document for K016, K018, K019, K020, and K030 (6);
- Background Document for Phthalate Wastes (7);
- Background Document for K024 (8);
- Background Document for K028, K029, K095, and K096 (9);
- Background Document for K048, K049, K050, K051, and K052 (10); and
- Background Document for K087 (11).

This section discusses the technologies that are applicable for the treatment of organic constituents in wastewater forms of the wastes of interest and that can be considered demonstrated for the purpose of establishing BDAT.

2.1 Applicable Treatment Technologies

To be considered applicable, a technology must theoretically be usable to treat the waste. Detailed descriptions of technologies that are applicable for treatment

of listed hazardous wastes are provided in EPA's Treatment Technology Background Document (4).

Since wastewater forms of the wastes of interest may contain organic constituents at treatable concentrations, applicable treatment technologies include those that destroy or reduce the total amount of organic compounds in the wastewater. The Agency has identified the following treatment technologies as potentially applicable for treatment of these wastes:

- Biological treatment (including aerobic fixed film, aerobic lagoons, activated sludge, anaerobic fixed film, rotating biological contactors, sequential batch reactors, and trickling filter technologies);
- Carbon adsorption (including activated carbon and granular activated carbon technologies);
- Chemical oxidation;
- Chemically assisted clarification (including chemical precipitation technology);
- Incineration (including fluidized-bed, rotary kiln, and liquid injection incineration);
- PACT® treatment (including powdered activated carbon addition to activated sludge and biological granular activated carbon technologies);
- Reverse osmosis;
- Solvent extraction (including liquid-liquid extraction technology);
- Stripping treatment (including steam stripping and air stripping technologies); and
- Wet air oxidation (including supercritical oxidation technology).

Total recycle or reuse may also be applicable for certain wastes. These treatment technologies were identified based on current waste treatment practices and engineering judgment.

The concentrations and type(s) of constituents present in a waste generally determine which technology is most applicable. For example, wet air oxidation, PACT® treatment, biological treatment, and solvent extraction are applicable for treatment of wastewaters containing a total organic carbon concentration up to 1% and is often used as a polishing step following primary treatment by biological treatment, solvent extraction, or wet air oxidation. Typically, carbon adsorption is applicable for treatment of wastewaters containing a total organic carbon concentration of less than 0.1%. Some of the wastewaters that are the subject of this document may contain constituents that are too toxic to be treated effectively by biological treatment or PACT® treatment.

Brief discussions of each of the technologies identified as applicable for the treatment of organic constituents in wastewater forms of the wastes of interest are given below:

Biological Treatment

Biological treatment is a destruction technology in which hazardous organic constituents in wastewaters are biodegraded. This technology generates two treatment residuals: a treated effluent and a waste biosludge. Waste biosludge may be land disposed without further treatment if it meets the applicable BDAT nonwastewater treatment standards for regulated constituents.

Carbon Adsorption

Carbon adsorption is a separation technology in which hazardous organic constituents in wastewaters are selectively adsorbed onto activated carbon. This

technology generates two treatment residuals: a treated effluent and spent activated carbon. The spent activated carbon can be reactivated, recycled, or incinerated.

Chemical Oxidation

Chemical oxidation is a destruction technology in which inorganic cyanide, some dissolved organic compounds, and sulfides are chemically oxidized to yield carbon dioxide, water, salts, simple organic acids, and sulfates. This technology generates one treatment residual: treated effluent.

Chemically-Assisted Clarification

Chemically-assisted clarification, including chemical precipitation, is a separation technology in which the addition of chemicals during treatment results in the formation of precipitates from the organic or inorganic constituents in wastewater. The solids formed are then separated from the wastewater by settling, clarification, and/or polishing filtration. This technology generates two treatment residuals: treated wastewater effluent and separated solid precipitate. The solid precipitate may be land disposed without further treatment if it meets the applicable BDAT nonwastewater treatment standards.

Incineration

Incineration is a destruction technology in which heat is transferred to a waste to destabilize chemical bonds and destroy organic constituents. In a fluidized-bed incinerator, waste is injected into the fluidized-bed material (generally sand and/or incinerator ash), where it is heated to its ignition temperature. Heat energy from the combustion reactions is then transferred back to the fluidized bed. Ash is removed periodically during operation and during bed change-outs.

In a rotary kiln incinerator, wastes are fed into the elevated end of the kiln. The rotation of the kiln causes the waste to mix with hot gases to heat the waste to its ignition temperature. Combustion gases from the kiln enter an afterburner for complete destruction of organic waste constituents. Other wastes may also be injected into the afterburner. Also, ash is removed from the lower end of the kiln.

In a liquid injection incinerator, liquid wastes are atomized and injected into the incinerator. In general, only wastes with low or negligible ash contents are amenable to liquid injection incineration. Therefore, this technology does not generate an ash residual.

Combustion gases from the incinerators are fed to scrubber systems for cooling and removal of entrained particulates and acid gases, if present. In general, with the exception of liquid injection incineration, two residuals are generated by incineration processes: ash and scrubber water.

PACT® Treatment

PACT® treatment is a combination of carbon adsorption and biological treatment. It is a destruction technology in which hazardous organic constituents are biodegraded and selectively adsorbed onto powdered activated carbon. This technology generates two treatment residuals: a treated effluent and spent carbon/biosludge. The spent carbon may be regenerated and recycled to the process or incinerated.

Reverse Osmosis

Reverse osmosis is a separation technology in which dissolved organics (usually salts) are removed from a wastewater by filtering the wastewater through a semipermeable membrane at a pressure greater than the osmotic pressure caused by the dissolved organic constituents. This technology generates two residuals: the treated

effluent and the concentrated organic salt materials that do not pass through the membrane.

Solvent Extraction

Solvent extraction is a separation technology in which hazardous organic constituents are removed from a waste due to greater solubility in the solvent phase than in the waste phase. This technology generates two residuals: a treated waste residual and an extract. The extract may be recycled or treated by incineration.

Stripping Treatment

Stripping treatment is a separation technology in which volatile organic constituents in a liquid waste are physically transferred to a flowing gas or vapor. In steam stripping, steam contacts the waste, strips the volatile organics, and carries them to a condenser where the mixture of organic vapors and steam is condensed and collected in an accumulator tank. In air stripping, air contacts the waste and strips the volatile organic constituents. Air stripping generates one treatment residual: treated effluent. Emissions generated from air stripping may require further treatment.

Wet Air Oxidation

Wet air oxidation is a destruction technology in which hazardous organic constituents in wastes are oxidized and destroyed under pressure at elevated temperatures in the presence of dissolved oxygen. This technology is applicable for wastes comprised primarily of water and containing a total organic carbon concentration of up to 10%. Wet air oxidation generates one treatment residual: treated effluent. The treated effluent may require further treatment for hazardous organic constituents by carbon adsorption or PACT® treatment. Emissions from wet air oxidation may also require further treatment.

2.2 Demonstrated Treatment Technologies

The performance data presented in Appendix A of this document include full-scale treatment performance data for all of these technologies. Therefore, all of the technologies identified as applicable for the treatment of organic constituents in wastewater forms of the wastes of interest have been "demonstrated" in full-scale operation for treatment of wastewaters containing these constituents or constituents determined to be similar. The Agency believes that all of these wastewater treatment technologies deserved further consideration as potential Best Demonstrated Available Technologies for the constituents in the wastes of interest.

3.0 AMENDMENT TO THE "TREATMENT PERFORMANCE DATABASE" SECTION OF THE FINAL BDAT BACKGROUND DOCUMENTS FOR K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190: WASTEWATER ORGANICS

This section supplements the discussion in Section 4.0 (Treatment Performance Database) of the following documents, unless stated otherwise:

- Background Document for K015 (5);
- Background Document for K016, K018, K019, K020, and K030 (6);
- Background Document for Phthalate Wastes (7);
- Background Document for K024 (8);
- Background Document for K028, K029, K095, and K096 (9);
- Background Document for K048, K049, K050, K051, and K052 (10); and
- Background Document for K087 (11).

Since the Agency does not have any treatment performance data for organic constituents in wastewater forms of K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190, wastewater treatment performance data from several other data sources were examined. Details regarding the development of the wastewater treatment performance database using these sources are presented in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A: Wastewater Forms of Organic U and P Wastes and Multi-Source Leachate (F039) For Which There Are Concentration-Based Treatment Standards (3).

This section presents the wastewater treatment performance data available to the Agency for each BDAT List organic constituent regulated in the wastes of interest. Section 3.1 gives a brief description of each data source examined for applicable wastewater treatment performance data. Section 3.2 discusses the wastewater treatment performance data considered in determining BDAT. The actual treatment performance data available to EPA for each constituent regulated in the wastes of interest are presented on a constituent-by-constituent basis in the tables of Appendix A.

3.1 Sources of Treatment Performance Data

The sources examined for applicable wastewater treatment performance data included:

- The BDAT database;
- WAO/PACT® data;
- The EAD database;
- The NPDES database;
- The WERL database;
- Industry submitted leachate treatment performance data;
- Data in literature that were not already part of the WERL database; and
- Data in literature submitted by industry on the WAO and PACT® treatment processes.

The treatment performance data from these sources were used to determine BDAT for organic constituents in the wastewater forms of K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190.

3.1.1 BDAT Database

The BDAT database consists of treatment performance data collected to establish treatment standards for wastes regulated in the First, Second, and Third Third BDAT Land Disposal Restrictions rulemakings.

Extensive sampling of incineration systems has been conducted under the BDAT program. As part of these sampling efforts, incinerator scrubber water data were collected to determine BDAT treatment standards for wastewater forms of various hazardous wastes. As discussed in Section 1.0, however, the Agency prefers to use appropriate wastewater treatment performance data from well-designed and well-operated wastewater treatment units rather than constituent concentrations in scrubber water to develop wastewater treatment standards. (This does not, however, preclude the Agency from establishing treatment standards for wastes based on constituent concentrations in incinerator scrubber waters on a case-by-case basis.) Therefore, only treatment performance data from the BDAT database that represent a specific technology amenable to wastewater treatment, such as biological treatment or chemical precipitation, were examined as potential treatment performance data for determination of treatment standards for the constituents regulated in the wastes of interest.

BDAT wastewater treatment performance data were available for K103, K104, and K062 from the First and Second Third groups of wastes. The wastewater treatment technologies represented by the data for these waste codes include liquid/liquid extraction, steam stripping, and activated carbon adsorption for organic constituents.

Additionally, as part of the development of the final rule restricting the land disposal of solvent wastes F001-F005, the Agency examined data from EAD sampling episodes, which are presented in the F001-F005 background document (12). The technologies represented by the data for these waste codes include biological

treatment, activated carbon adsorption, steam stripping, air stripping, and wet air oxidation. The wastewater treatment performance data for constituents regulated in F001-F005 were incorporated into the wastewater treatment database.

3.1.2 WAO/PACT® Data

For specific Third Third U and P waste codes, a wastewater treatment test was conducted using wet air oxidation (WAO) and PACT® treatment technologies. The treatment performance data from this test were incorporated into the wastewater treatment database.

3.1.3 EAD Database--Promulgated Limits

In response to the Federal Water Pollution Control Act (FWPCA) of 1972 and the Clean Water Act (CWA) of 1977, EPA promulgated regulations to reduce the levels of pollutants in wastewaters discharged from industrial point sources using the "Best Available Technology Economically Achievable." The responsibility for developing and promulgating effluent limitations guidelines was assigned to the Industrial Technology Division (ITD), now the Engineering and Analysis Division (EAD), within EPA's Office of Water Regulations and Standards. To date, EPA has promulgated effluent regulations for 27 industrial categories.

The treatment performance data used in promulgation efforts have been summarized by category in specific effluent limitations guidelines and standards development documents. The treatment performance data from the Final Development Document for Effluent Limitations Guidelines and Standards for the Organic Chemicals, Plastics, and Synthetic Fibers Point Source Category for BDAT List organic constituents for which effluent limitations exist were incorporated into the wastewater treatment database.

3.1.4 NPDES Database.

Under the Clean Water Act, the discharge of pollutants into the waters of the United States is prohibited unless a permit is issued by EPA or a state under the National Pollutant Discharge Elimination System (NPDES). An NPDES permit establishes effluent limitations for specific pollutants that a facility may discharge. The permit also establishes monitoring and reporting requirements for a facility to determine whether the effluent limitations are being met. The monitoring data submitted to the Agency by facilities as part of the NPDES permit program is summarized in the NPDES database.

The NPDES database was searched to identify facilities that have monitoring data for 90 BDAT List constituents. Data from this search, representing constituent concentrations in effluents from wastewater treatment, have been incorporated into the wastewater treatment database. However, EPA was unable to evaluate whether substantial treatment occurred because the corresponding influent concentrations of the constituents were not available. Also, the treatment technologies or treatment trains represented by the NPDES data were identified in some, but not all cases. Therefore, NPDES data were used to calculate treatment standards only when other data were unavailable.

3.1.5 WERL Database

EPA's Risk Reduction Engineering Laboratory, which now includes the former Water Engineering Research Laboratory (WERL), has developed and is continuing to expand a database on the treatability of chemicals in various types of waters and wastewaters. This WERL database has been compiled from wastewater treatment performance data available in literature. The treatment performance data for BDAT List constituents in this database were included in the wastewater treatment database.

3.1.6 Leachate Treatment Performance Data

Leachate treatment performance data were submitted to the Agency prior to the proposal of the Third Third Land Disposal Restrictions rule. The data were developed and compiled by a committee comprised of representatives of several major domestic corporations. This leachate committee was formed in April 1989 following the stay by the U.S. Court of Appeals, D.C. Circuit, of the Land Disposal Restrictions for the First Third group of wastes as it applied to hazardous waste leachate. (Waste Management Inc. vs. EPA CADC, No. 88-1581, 8/9/88.)

The data submitted included waste characterization data and full- and bench-scale treatment performance data for multi-source leachate. For those constituents with little or no wastewater treatment performance data but for which industry-submitted leachate treatment performance data were available and showed substantial treatment, the Agency used the leachate treatment performance data as the basis for calculating concentration-based treatment standards. The leachate treatment performance data that were used to recalculate BDAT treatment standards proposed in the Third Third Final Rule have been included in the wastewater treatment database.

3.1.7 Other Sources

Other sources of wastewater treatment performance data for BDAT List constituents include data in literature that were not already part of the WERL database and data in literature submitted by industry on the WAO and PACT® treatment processes.

3.2 Treatment Performance Database

All of the treatment performance data that were considered in the development of the treatment standards for organic constituents in wastewater forms of

the wastes of interest are summarized in the tables of Appendix A. (The data that were used to calculate each of the revised BDAT treatment standards are shown in these tables with an asterisk.) These data are discussed in greater detail in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A: Wastewater Forms of Organic U and P Wastes and Multi-Source Leachate (F039) For Which There Are Concentration-Based Treatment Standards (3).

The discussions that precede each of the data tables in Appendix A present any additional data that may have been considered in determining the final concentration-based treatment standards. The Agency prefers, whenever possible, to use appropriate wastewater treatment performance data from well-designed and well-operated wastewater treatment units rather than data from incinerator scrubber water. The wastewater treatment performance data in Appendix A were accumulated from wastes that exhibited similar characteristics to the wastes of interest - in terms of treatment performance and treatment selection. Furthermore, the Agency believes that the wastewater treatment performance data presented in Appendix A represent the best sources of treatment performance data for organic constituents in wastewater forms of the wastes of interest.

4.0 AMENDMENT TO THE "IDENTIFICATION OF BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT)" SECTION OF THE FINAL BDAT BACKGROUND DOCUMENTS FOR K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, AND U190: WASTEWATER ORGANICS

This section supplements the discussion in Section 5.0 (Identification of Best Demonstrated and Available Technology (BDAT)) of the following documents:

- Background Document for K015 (5);
- Background Document for K016, K018, K019, K020, and K030 (6);
- Background Document for Phthalate Wastes (7);
- Background Document for K024 (8);
- Background Document for K028, K029, K095, and K096 (9);
- Background Document for K048, K049, K050, K051, and K052 (10); and
- Background Document for K087 (11).

The best demonstrated available technology (BDAT) is determined based on a thorough review of all the treatment performance data available to EPA for the wastes of concern or wastes judged to be similar. The treatment performance data that were evaluated for these wastes are presented in Appendix A.

As described in EPA's Methodology Document for Developing BDAT Treatment Standards (2), after all applicable and demonstrated treatment technologies are identified for the wastes of interest, treatment performance data are examined to

identify the technologies that perform "best." The treatment performance data are evaluated to determine:

- Whether the data represent operation of a well-designed and well-operated treatment system;
- Whether sufficient analytical quality assurance/quality control measures were employed to ensure the accuracy of the data; and
- Whether the appropriate measure of performance was used to assess the performance of the particular treatment technology.

The Agency then determines whether the best demonstrated technology is "available." An available treatment technology is one that (1) is not a proprietary or patented process that cannot be purchased or licensed from the proprietor (i.e., it must be commercially available), and (2) substantially diminishes the toxicity of the waste or substantially reduces the likelihood of migration of hazardous constituents from the waste.

The Agency determines the "best" demonstrated technology for each constituent by a thorough review of all the treatment performance data available for each constituent. The best demonstrated technology selected for each constituent is described in Appendix A, along with the presentation of treatment performance data.

To determine the best demonstrated technology for specific constituents in wastewaters, a hierarchy was established to evaluate the data presented in Section 3.0. These data came from a variety of sources as identified in Section 3.2. In general, the Agency believes that data from the EAD and BDAT programs are superior data than those from other sources. The EAD database, described in Section 3.1.3, is a comprehensive source of wastewater treatment performance data and usually represents longer term sampling with a greater number of sample sets than the other wastewater

treatment databases, and data generated as part of the BDAT program follow EPA protocols for sampling and analysis procedures.

The following is an outline of the data source hierarchy used to determine the best demonstrated technology for wastewater constituents included in this document. All data used in determining BDAT for a constituent came from the highest level in the hierarchy in which they were available for a particular constituent.

(1) EAD treatment performance data that were used to promulgate an EAD effluent-based limitation standard. The data representing EAD Option I were used in all cases (13).

(2) Agency-sponsored BDAT wastewater treatment test data.

(3) Industry-submitted multi-source leachate treatment performance data, where the data showed substantial treatment.

(4) Other available treatment performance data. Evaluation of these data were based on:

  (a) The treatment technology for which data where available;

  (b) Whether the data represented full-, pilot-, or bench-scale treatment;

  (c) The concentration of the constituent of interest in the effluent from treatment;

  (d) The average concentration of the constituent of interest in the effluent from treatment; and

  (e) The removal efficiency of the treatment technology.

  Full-scale treatment performance data with an influent constituent concentration range greater than 100 ppb were preferred over data from pilot- or bench-scale operations, or from operations with a low (i.e., 0-100 ppb) influent constituent concentration range. If several sets of data met these criteria (i.e., full-scale available technologies with high influent constituent concentrations), they were compared by examination of their average effluent values and percent

removals to determine the data set(s) with the lowest effluent values and the technology with the highest percent removal.

(5) If treatment performance data were not available from any of the examined sources, data were transferred from a structurally similar constituent.

The applicable and demonstrated technologies identified in Sections 2.1 and 2.2 that were determined to be best for each constituent, as identified in Appendix A, are all commercially available. In addition, the treatment performance data included in Appendix A show substantial treatment of each constituent by the corresponding technologies selected as BDAT. Therefore, the best demonstrated technology for each constituent is also considered to be "available," and is BDAT for that constituent.

In some cases, deviations from the above data source hierarchy were necessary based on the data available for specific constituents. These deviations are addressed in the relevant constituent discussions of Appendix A.

5.0 AMENDMENT TO THE "SELECTION OF REGULATED CONSTITUENTS" SECTION OF THE FINAL BDAT BACKGROUND DOCUMENTS FOR K018, K028, AND K030: WASTEWATER ORGANICS

This section supplements the discussion in Section 6.0 (Selection of Regulated Constituents) in the following documents:

- Background Document for K016, K018, K019, K020, and K030 (6); and
- Background Document for K028, K029, K095, and K096 (9).

As discussed in EPA's Methodology for Developing BDAT Treatment Standards (2), constituents selected for regulation must satisfy the following criteria:

1. The constituent must be on the BDAT List of constituents. Presence on the BDAT List means that EPA-approved methods exist for analysis of the constituent in treated waste matrices.

2. The constituent must be present in, or be suspected of being present in, the untreated waste. Analytical difficulties may prevent a constituent from being identified in the untreated waste, but its identification in a treatment residual may lead the Agency to conclude that it is present in the untreated waste.

From a group of constituents that are eligible for regulation because they meet the above criteria, EPA may select a subset of constituents that represents the broader group. For example, from a group of constituents that react similarly to treatment, the Agency may select for regulation those constituents that (1) are the most difficult to treat, based on waste characteristics affecting treatment performance; (2) are representative of other constituents in the waste, based on structural similarities; or (3) are present in the untreated waste in the highest concentrations. Selecting a subset of

constituents for regulation is done to facilitate implementation of the compliance and enforcement program.

The Agency acknowledges that in certain instances, compliance with the BDAT treatment standards cannot be demonstrated due to analytical difficulties in the analysis of certain wastes. In such instances, if the waste has been treated with a combustion BDAT process and an analytical sensitivity (i.e., detection limit) within an order of magnitude of the treatment standard has been achieved, the Agency will consider that compliance with the treatment standard for the respective constituents in the waste has been demonstrated (14).

5.1 BDAT List Constituent Deleted from Further Consideration for Regulation (Pentachloroethane)

Initially, all organic constituents in the waste codes addressed in this document which were regulated during the First, Second, or Third Third rulemakings were considered by the Agency for regulation. However, during the development of the Third Third rule, pentachloroethane (a regulated constituent in K018, K028, and K030 which was originally included on the BDAT List of constituents) was removed from the BDAT List of constituents due to analytical concerns. Therefore, the Agency is deleting pentachloroethane from further regulation in wastewater forms of K018, K028, and K030.

5.2 BDAT List Constituents Selected for Regulation

The Agency is revising the regulations for all of the organic constituents in the wastewater forms of each waste selected for regulation during the First, Second, or Third Third rules with the exceptions of pentachloroethane (discussed above) and benzal chloride. As discussed in Section 1.0, the promulgated treatment standard for benzal

chloride in wastewater forms of K015 is not being revised. The constituents in the wastes of concern selected for regulation are presented in Table 5-1.

Table 5-1

Regulated Constituents in K015, K016, K018, K019, K020, K023 K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, and U190: Wastewater Organics

BDAT List Number	BDAT List Constituent	BDAT List Number	BDAT List Constituent
Wastewater Forms of K015		**Wastewater Forms of K016**	
57.	Anthracene	110.	Hexachlorobenzene
218.	Benzal Chloride	111.	Hexachlorobutadiene
63.	Benzo(b)fluoranthene	112.	Hexachlorocyclopentadiene
65.	Benzo(k)fluoranthene	113.	Hexachloroethane
141.	Phenanthrene	42.	Tetrachloroethene
43.	Toluene		
Wastewater Forms of K018		**Wastewater Forms of K019**	
12.	Chloroethane	68.	bis(2-Chloroethyl)ether
15.	Chloromethane	9.	Chlorobenzene
22.	1,1-Dichloroethane	14.	Chloroform
23.	1,2-Dichloroethane	88.	p-Dichlorobenzene
110.	Hexachlorobenzene	23.	1,2-Dichloroethane
111.	Hexachlorobutadiene	109.	Fluorene
45.	1,1,1-Trichloroethane	113.	Hexachloroethane
113.	Hexachloroethane	121.	Naphthalene
		141.	Phenanthrene
		148.	1,2,4,5-Tetrachlorobenzene
		42.	Tetrachloroethene
		150.	1,2,4-Trichlorobenzene
		45.	1,1,1-Trichloroethane
Wastewater Forms of K020		**Wastewater Forms of K023**	
23.	1,2-Dichloroethane	220.	Phthalic Anhydride (measured as phthalic acid)
41.	1,1,2,2-Tetrachloroethane		
42.	Tetrachloroethene		

Table 5-1

(Continued)

BDAT List Number	BDAT List Constituent	BDAT List Number	BDAT List Constituent
Wastewater Forms of K024		Wastewater Forms of K028	
220.	Phthalic Anhydride (measured as phthalic acid)	22.	1,1-Dichloroethane
		25.	trans-1,2-Dichloroethene
		111.	Hexachlorobutadiene
		113.	Hexachloroethane
		40.	1,1,1,2-Tetrachloroethane
		41.	1,1,2,2-Tetrachloroethane
		42.	Tetrachloroethene
		45.	1,1,1-Trichloroethane
		46.	1,1,2-Trichloroethane
Wastewater Forms of K030		Wastewater Forms of K048	
87.	o-Dichlorobenzene	4.	Benzene
88.	p-Dichlorobenzene	62.	Benzo(a)pyrene
111.	Hexachlorobutadiene	70.	bis(2-Ethylhexyl) Phthalate
113.	Hexachloroethane	80.	Chrysene
148.	1,2,4,5-Tetrachlorobenzene	98.	Di-n-butyl Phthalate
42.	Tetrachloroethene	226.	Ethylbenzene
150.	1,2,4-Trichlorobenzene	109.	Fluorene
		121.	Naphthalene
		141.	Phenanthrene
		142.	Phenol
		145.	Pyrene
		43.	Toluene
		215-217.	Xylenes (total)

Table 5-1

(Continued)

BDAT List Number	BDAT List Constituent	BDAT List Number	BDAT List Constituent
Wastewater Forms of K049		**Wastewater Forms of K050**	
57.	Anthracene	62.	Benzo(a)pyrene
4.	Benzene	142.	Phenol
62.	Benzo(a)pyrene		
70.	bis(2-Ethylhexyl) Phthalate		
8.	Carbon Disulfide		
80.	Chrysene		
96.	2,4-Dimethylphenol		
226.	Ethylbenzene		
121.	Naphthalene		
141.	Phenanthrene		
142.	Phenol		
145.	Pyrene		
43.	Toluene		
215-217.	Xylenes (total)		
Wastewater Forms of K051		**Wastewater Forms of K052**	
52.	Acenaphthene	4.	Benzene
57.	Anthracene	62.	Benzo(a)pyrene
59.	Benz(a)anthracene	81.	o-Cresol
4.	Benzene	82.	Cresol (m- and p-isomers)
62.	Benzo(a)pyrene	96.	2,4-Dimethylphenol
70.	bis(2-Ethylhexyl) Phthalate	226.	Ethylbenzene
80.	Chrysene	121.	Naphthalene
98.	Di-n-butyl Phthalate	141.	Phenanthrene
226.	Ethylbenzene	142.	Phenol
109.	Fluorene	43.	Toluene
121.	Naphthalene	215-217.	Xylenes (total)
141.	Phenanthrene		
142.	Phenol		
145.	Pyrene		
43.	Toluene		
215-217.	Xylenes (total)		

Table 5-1

(Continued)

BDAT List Number	BDAT List Constituent	BDAT List Number	BDAT List Constituent
Wastewater Forms of K087		**Wastewater Forms of K093**	
51.	Acenaphthalene	220.	Phthalic Anhydride (measured as phthalic acid)
4.	Benzene		
80.	Chrysene		
108.	Fluoranthene		
116.	Indeno(1,2,3-cd)pyrene		
121.	Naphthalene		
141.	Phenanthrene		
43.	Toluene		
215-217.	Xylenes (total)		
Wastewater Forms of K094		**Wastewater Forms of U028**	
220.	Phthalic Anhydride (measured as phthalic acid)	70.	bis(2-Ethylhexyl) Phthalate
Wastewater Forms of U069		**Wastewater Forms of U088**	
98.	Di-n-butyl Phthalate	92.	Diethyl Phthalate
Wastewater Forms of U102		**Wastewater Forms of U107**	
97.	Dimethyl Phthalate	104.	Di-n-octyl Phthalate
Wastewater Forms of U190			
220.	Phthalic Anhydride (measured as phthalic acid)		

6.0 AMENDMENT TO THE "CALCULATION OF BDAT TREATMENT STANDARDS" SECTION OF THE FINAL BDAT BACKGROUND DOCUMENTS FOR K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, AND U190: WASTEWATER ORGANICS

This section supplements the discussion in Section 7.0 (Calculation of BDAT Treatment Standards) of the following documents, unless stated otherwise:

- Background Document for K015 (5);
- Background Document for K016, K018, K019, K020, and K030 (6);
- Background Document for Phthalate Waste (7);
- Background Document for K024 (8);
- Background Document for K028, K029, K095, and K096 (9);
- Background Document for K048, K049, K050, K051, and K052 (10); and
- Background Document for K087 (11).

The calculation of the revised treatment standards for each BDAT List constituent regulated in the wastes of interest are shown in Table 6-1. The BDAT treatment standards were calculated by multiplying the average long-term effluent concentration for each constituent by an accuracy correction factor (ACF) and a variability factor (VF), if applicable. The long term effluent concentration values are those shown in the appropriate tables in Appendix A. The accuracy correction factors and variability factors for each constituent were determined as described below.

6.1 Accuracy Correction Factors

Accuracy correction factors account for analytical interferences associated with the chemical matrices of the samples. The accuracy correction factor is incorporated into the determination of treatment standards by multiplying it (and a variability factor when appropriate) by the constituent's detection limit. An accuracy correction factor was determined for each of the constituents by dividing 100 by the matrix spike recovery (percent) for each constituent.

The matrix spike recoveries are developed by analyzing a sample of a treated waste for a constituent and then re-analyzing the sample after the addition of a known amount of the same constituent (i.e., spike) to the sample. The matrix spike recovery represents the total amount of constituent recovered after spiking, minus the initial concentration of the constituent in the sample, and the result divided by the spike concentration of the constituent. Duplicate matrix spikes were performed for some BDAT List constituents. If a duplicate matrix spike was performed for a constituent, the matrix spike recovery used for that constituent was the lower of the two values between the first matrix spike and the duplicate spike.

An accuracy correction factor of 1.00 was used when both the matrix spike and duplicate matrix spike recoveries exceeded 100 percent, so that the data were not adjusted to concentrations below the detection limits. Matrix spike values of less than 20 percent are not acceptable and were not used to correct detection limits, nor included in calculating average matrix spike recoveries.

EAD variability factors already contain accuracy correction measures. Therefore, to avoid over-correcting the data, accuracy correction factors were not used in cases where EAD variability factors were used. In cases where an EAD variability factor was not used, an accuracy correction factor was determined as described above and included in the treatment standard calculation.

As described above, matrix spike recovery data are routinely used in determining accuracy correction factors; however, these data were not available for most of the treatment performance data examined. Consequently, matrix spike data were pooled from BDAT and leachate data sources. Leachate matrix spike data were used to determine an accuracy correction factor in cases where leachate treatment performance data were used to establish a treatment standard; BDAT matrix spike data were used in all other cases. Where an accuracy correction factor was not available for a specific constituent, an average accuracy correction factor was determined, as presented in Tables 6-4 through 6-8.

6.2 Variability Factors

A variability factor accounts for the variability inherent in treatment system performance, treatment residual collection, and analysis of the treated waste samples. Variability factors are calculated as described in EPA's Methodology for Developing BDAT Treatment Standards (2).

Original effluent data points were not always available. Therefore, variability factors for some constituents were not calculated as described in Reference 2. For example, effluent data in the WERL database were presented as averages; since actual effluent data points were not available, it was not possible to calculate a variability factor specific to each of these constituents.

The variability factor calculated during the EAD regulation effort was used for those constituents for which a treatment standard was based on an EAD effluent limitation (i.e., selected volatile and semivolatile organics).

One of two options was used for constituents where a variability factor was unknown or could not be calculated:

(1) Use of average variability factors that were generated from the EAD variability factors and were specific to the type of constituent under consideration. The average volatile organic variability factor is an average of the volatile organic variability factors from EAD data as presented in Table 6-2. The average semivolatile organic variability factors are averages of the semivolatile organic variability factors from EAD data as presented in Table 6-3. The procedure for determination of these average variability factors was similar to the procedures used by EPA in previous Land Disposal Restrictions rulemakings to determine average accuracy correction factors.

(2) Use of a variability factor of 2.8 for constituents that were not volatile or semivolatile organics. A variability factor of 2.8 was used to calculate treatment standards for constituents for which the long-term average effluent concentration was based on detection limits only. This variability factor has been used by EPA in past Land Disposal Restrictions rulemakings where variability factors could not be calculated.

6.3 Calculation of Revised BDAT Treatment Standards

The calculation of BDAT treatment standards involves three steps: (1) accuracy correction of the treatment performance data to account for analytical interferences with the chemical make-up of the samples; (2) determination of a variability factor, specific to each constituent, to correct for normal variations in the performance of a treatment technology; and (3) calculation of the treatment standard, which is equal to the average effluent concentration multiplied by the accuracy correction factor and the variability factor.

Table 6-1

CALCULATION OF BDAT TREATMENT STANDARDS FOR ORGANIC CONSTITUENTS REGULATED IN WASTEWATER FORMS OF: K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, AND U190

BDAT List Number	BDAT List Constituents	Long-Term Average Effluent Concentration (ppm) x	Variability Factor x	Accuracy Correction Factor =	BDAT Treatment Standard (ppm)
51.	Acenaphthalene	0.010	5.9	NA	0.059
52.	Acenaphthene	0.010	5.9	NA	0.059
57.	Anthracene	0.010	5.9	NA	0.059
59.	Benz(a)anthracene	0.010	5.9	NA	0.059
4.	Benzene	0.010	14	NA	0.14
62.	Benzo(a)pyrene	0.0103	5.9	NA	0.061
63.	Benzo(b)fluoranthene	0.010	5.5	NA	0.055
65.	Benzo(k)fluoranthene	0.010	5.9	NA	0.059
68.	Bis(2-chloroethyl)ether	0.006	5.5	NA	0.033
70.	Bis(2-ethylhexyl)phthalate	0.047	5.9		0.28
8.	Carbon Disulfide	0.0050	2.8	1.0	0.014
9.	Chlorobenzene	0.010	5.7	NA	0.057
12.	Chloroethane	0.050	5.3	NA	0.27
14.	Chloroform	0.0122	3.7	NA	0.046
15.	Chloromethane	0.050	3.8	NA	0.19
80.	Chrysene	0.010	5.9	NA	0.059
81.	o-Cresol	0.025	4.4	NA	0.11
82.	m/p-Cresol	0.174	4.4	NA	0.77
87.	o-Dichlorobenzene	0.016	5.5	NA	0.088
88.	p-Dichlorobenzene	0.01633	5.5	NA	0.090
22.	1,1-Dichloroethane	0.010	5.9	NA	0.059
23.	1,2-Dichloroethane	0.0256	8.2	NA	0.21
25.	trans-1,2-Dichloroethene	0.010	5.3	NA	0.054
92.	Diethyl Phthalate	0.0425	4.8	NA	0.20
96.	2,4-Dimethylphenol	0.010794	3.3	NA	0.036
97.	Dimethyl Phthalate	0.010	4.6	NA	0.047
98.	Di-n-butyl Phthalate	0.017606	3.2	NA	0.057
104.	Di-n-octyl Phthalate	0.0030	5.5	NA	0.017
226.	Ethyl Benzene	0.010	5.7	NA	0.057
108.	Fluoranthene	0.011533	5.9	NA	0.068
109.	Fluorene	0.010	5.9	NA	0.059
110.	Hexachlorobenzene	0.010	5.5	NA	0.055
111.	Hexachlorobutadiene	0.010	5.5	NA	0.055

NA - Not Applicable.

Table 6-1

(Continued)

BDAT List Number	BDAT List Constituents	Long-Term Average Effluent Concentration (ppm)	x	Variability Factor	x	Accuracy Correction Factor	=	BDAT Treatment Standard (ppm)
112.	Hexachlorocyclopentadiene	0.01026		5.5		NA		0.057
113.	Hexachloroethane	0.010		5.5		NA		0.055
116.	Indeno(1,2,3-cd)pyrene	0.0010		5.5		NA		0.0055
121.	Naphthalene	0.010		5.9		NA		0.059
141.	Phenanthrene	0.010		5.9		NA		0.059
142.	Phenol	0.010		2.8		1.4		0.039
220.	Phthalic Anhydride	0.015		2.8		1.6		0.069
145.	Pyrene	0.01133		5.9		NA		0.067
148.	1,2,4,5-Tetrachlorobenzene	0.010		5.5		NA		0.055
40.	1,1,1,2-Tetrachloroethane	0.010		5.7		NA		0.057
41.	1,1,2,2-Tetrachloroethane	0.010		5.7		NA		0.057
42.	Tetrachloroethene	0.0104		5.3		NA		0.056
43.	Toluene	0.010		8.0		NA		0.080
150.	1,2,4-Trichlorobenzene	0.010		5.5		NA		0.055
45.	1,1,1-Trichloroethane	0.010		5.3		NA		0.054
46.	1,1,2-Trichloroethane	0.010		5.3		NA		0.054
215.	Xylenes (total)	0.056		5.7		NA		0.32

NA - Not Applicable.

Note: Due to space constraints, variability factors were expressed here with only two significant figures. For more detailed values, see Tables 6.2 and 6.3 of this document.

Table 6-2

Variability Factors for Volatile Organics

Constituent	EAD Variability Factor
Acrylonitrile	4.83045
Benzene	13.5252
Chloroethane	5.34808
Chloroform	3.71334
Chloromethane	3.79125
1,1-Dichloroethane	5.88383
1,2-Dichloroethane	8.22387
1,1-Dichloroethene	2.4723
trans-1,2-Dichloroethene	5.34808
Methylene Chloride	3.86915
Tetrachloroethylene	5.34808
Toluene	7.9506
1,1,1-Trichloroethane	5.34808
1,1,2-Trichloroethane	5.34808
Trichloroethylene	5.34808
Vinyl Chloride	5.34808
Average Variability Factor (Volatile Organics)	5.7310

Table 6-3

Variability Factors for Semivolatile Organics

Constituent	EAD Variability Factor
ACID EXTRACTABLES	
2,4-Dimethylphenol	3.2565
2,4-Dinitro-o-cresol	11.5417
2,4-Dinitrophenol	2.45842
4-Nitrophenol	2.47783
Phenol	2.49705
Average Variability Factor (Acid Extractable Semivolatiles)	4.4463
BASE/NEUTRAL EXTRACTABLES	
Acenaphthalene	5.89125
Acenaphthene	5.89125
Anthracene	5.89125
Benzo(a)anthracene	5.89125
Benzo(a)pyrene	5.89125
Benzo(k)fluoranthene	5.89125
bis(2-Ethylhexyl) Phthalate	5.91768
Chrysene	5.89125
Diethyl Phthalate	4.75961
Dimethyl Phthalate	4.63833
Di-n-butyl Phthalate	3.23768
Fluoranthene	5.89125
Fluorene	5.89125
Naphthalene	5.89125
Nitrobenzene	4.83045
Phenanthrene	5.89125
Pyrene	5.89125
Average Variability Factor (Base/Neutral Extractable Semivolatiles)	5.5340

Table 6-4

Determination of Accuracy Correction Factors for Volatile Organics - EPA Data

Volatile Organic Constituent	Percent Recovery						Low Value	ACF[b]
	WAO A		WAO B		K103/K104			
n-Butanol	82	94	84	93			82	1.2
Isobutanol	97	92	102	89			89	1.1
Methanol	93	88	99	85			85	1.2
3-Chloropropionitrile	159	171	162	182			159	1.0
1,4-Dioxane	152	153	155	153			152	1.0
2-Ethoxyethanol	157	172	161	161			157	1.0
Ethylene Oxide	103	37	50	22			22	4.6
Methacrylonitrile	150	158	165	169			150	1.0
Trichloroethene	87	89	87	88			87	1.2
1,1-Dichloroethene	108	110	120	120			108	1.0
Benzene	165	190	110	120	76	74	76	1.3
Chlorobenzene	98	110	88	90			88	1.1
Toluene			87	90			87	1.2
						Average Percent Recovery =	103.23	
						Use	100%[a]	

ACF for Volatile Organics = 100/100 = 1.0[b]

Notes:

If Percent Recovery is less than 20%, that value is dropped from consideration.

[a]If Percent Recovery is greater than 100%, then the recovery used is set at 100, to prevent adjustment of data below detection limits.

[b]To determine an Accuracy Correction Factor (ACF), the average of the lowest values for each volatile organic constituent is calculated. ACF = 100/avg. low value.

WAO A = Percent recovery data from the wet air oxidation test on waste mixture A.
WAO B = Percent recovery data from the wet air oxidation test on waste mixture B.

K103/K104 = Percent recovery data from the K103/K104 treatment performance test.

Table 6-5

Determination of Accuracy Correction Factors for Semivolatile Organics - EPA Data

Semivolatile Organic Constituent	Percent Recovery					Low Value	ACF*
	WAO A		WAO B	K103/K104			
Acid Extractables							
p-Chloro-m-cresol	21	12	58			21	4.8
2-Chlorophenol	55	55	55			55	1.8
Pentachlorophenol	68	82	0			68	1.5
4-Nitrophenol	20	13	43			20	5.0
Phenol	94	82	42	21	26	21	4.8
			Average Percent Recovery			37	
Acid Neutral Semivolatiles ACF = 100/37 = 2.7*							
Base Neutral Extractables							
Acenaphthene	72	86	79			72	1.4
1,4-Dichlorobenzene	65	74	52			52	1.9
2,4-Dinitrotoluene	78	112	69			69	1.5
N-Nitroso-di-n-propylamine	79	92	51			51	2.0
Pyrene	68	67	84			67	1.5
1,2,4-Trichlorobenzene	73	87	61			61	1.6
Nitrobenzene				115	116	115	1.0
Aniline				91	97	91	1.1
Base Neutral Extractable Semivolatiles ACF = 100/72.3 = 1.38*							

Notes:

If Percent Recovery is less than 20%, that value is dropped from consideration.

If Percent Recovery is greater than 100%, then the recovery used is 100, to prevent adjustment of data below detection limits.

*To determine an Accuracy Correction Factor (ACF), the average of the lowest values for each semivolatile organic constituent is calculated. ACF = 100/avg. low value.

WAO A = Percent recovery data from the wet air oxidation test on waste mixture A.
WAO B = Percent recovery data from the wet air oxidation test on waste mixture B.

K103/K104 = Percent recovery data from the K103/K104 treatment performance test.

Table 6-6

Determination of Accuracy Correction Factors for Volatile Organics - Industry-Submitted (Dow) Leachate Data

Volatile Constituent	Percent Recovery			ACF[b]
	Matrix Spike	Matrix Spike Duplicate	Low Value	
Methanol	100	100	100	1.0
Isobutyl Alcohol	101	101	101	1.0
n-Butyl Alcohol	105	99	99	1.01
1,1-Dichloroethene	130	132	130	1.0
Trichloroethene	94	94	94	1.06
Chlorobenzene	98	96	96	1.04
Toluene	100	100	100	1.0
Benzene	94	94	94	1.06
		Average	101.75	
		Set At	100[a]	

Volatile ACF = 100/100 = 1.00[b]

Notes:

If Percent Recovery is less than 20%, that value is dropped from consideration.

[a]If Percent Recovery is greater than 100%, then the recovery used is 100, to prevent adjustment of data below detection limits.

[b]To determine an Accuracy Correction Factor (ACF), the average of the lowest values for each volatile organic constituent is calculated. ACF = 100/avg. low value.

Table 6-7

Determination of Accuracy Correction Factors for Volatile Organics - Industry-Submitted (CWM) Leachate Data

Volatile Constituent	Percent Recovery	ACF[b]
Acetone	99	1.01
n-Butyl Alcohol	112	1.0
Isobutyl Alcohol	112	1.0
Methyl Ethyl Ketone	99	1.01
Methanol	112	1.0
Methyl Isobutyl Ketone	99	1.01
Average Percent Recovery Set At	105.5 100[a]	
Volatile ACF = 100/100 = 1.00[b]		

Notes:

If Percent Recovery is less than 20%, that value is dropped from consideration.

[a]If Percent Recovery is greater than 100%, then the recovery used is 100, to prevent adjustment of data below detection limits.

[b]To determine an Accuracy Correction Factor (ACF), the average of the lowest values for each volatile organic constituent is calculated. ACF = 100/avg. low value.

Table 6-8

Determination of Accuracy Correction Factors for Semivolatile Organics - Industry-Submitted (Dow) Leachate Data

Semivolatile Constituent	Percent Recovery: Matrix Spike	Matrix Spike Duplicate	Low Value	ACF[a]
Acid Extractables				
Pentachlorophenol	79	83	79	1.3
Phenol	71	74	71	1.4
2-Chlorophenol	72	73	72	1.4
p-Chloro-m-cresol	79	84	79	1.3
4-Nitrophenol	109	100	100	1.0
		Average	80.2	
Acid Extractable Semivolatiles ACF = 100/80.2 = 1.25[a]				
Base Neutral Extractables				
	80	89	80	1.3
1,2,4-Trichlorobenzene	81	86	81	1.2
Acenaphthene	84	83	83	1.2
2,4-Dinitrotoluene	87	105	87	1.1
Pyrene	60	65	60	1.7
N-Nitroso-n-propylamine	74	82	74	1.4
1,4-Dichlorobenzene				
		Average	77.5	
Base Neutral Extractable Semivolatiles ACF = 100/77.5 = 1.29[a]				

Notes:

If Percent Recovery is less than 20%, that value is dropped from consideration.

If Percent Recovery is greater than 100%, then the recovery used is 100, to prevent adjustment of data below detection limits.

[a]To determine an Accuracy Correction Factor (ACF), the average of the lowest values for each semivolatile organic constituent is calculated. ACF = 100/avg. low value.

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8.0 REFERENCES

1. American Public Health Association, American Water Works Association, and Water Pollution Control Federation. Standard Methods for Examination of Water and Wastewater (Sixteenth Edition). Washington, DC, 1985.

2. U.S. Environmental Protection Agency, Office of Solid Waste. Methodology for Developing BDAT Treatment Standards. Washington, DC, June 1989.

3. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for U and P Wastes and Multi-Source Leachate (F039), Volume A: Wastewater Forms of Organic U and P Wastes and Multi-Source Leachate (F039) for which there are Concentration-Based Treatment Standards. Washington, DC, 1990.

4. U.S. Environmental Protection Agency, Office of Solid Waste. Treatment Technology Background Document. Washington, DC, June 1989.

5. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for K015. Washington, DC, August 1988.

6. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for K016, K018, K019, K020, and K030. Washington, DC, August 1988.

7. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for Phthalate Wastes. Washington, DC, May 1989.

8. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for K024. Washington, DC, August 1988.

9. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for Wastes from the Production of 1,1,1-Trichloroethane: K028, K029, K095, and K096. Washington, DC, May 1989.

10. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for K048, K049, K050, K051, and K052. Washington, DC, August 1988.

11. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for K087. Washington, DC, August 1988.

12. U.S. Environmental Protection Agency, Office of Solid Waste. Final Best Demonstrated Available Technology (BDAT) Background Document for F001-F005 Spent Solvents, Volume 2. Washington, DC, 1986.

13. U.S. Environmental Protection Agency, Office of Water Regulations and Standards. Development Document for Effluent Limitations Guidelines New Source Performance Standards and Pretreatment Standards for the Organic Chemicals and the Plastics and Synthetic Fibers Point Source Category (Volumes I and II). Washington, DC, 1987.

14. U.S. Environmental Protection Agency. Federal Register (Volume 55). U.S. Environmental Protection Agency. Washington, D.C.: June 1, 1990. p. 22541.

Appendix A

TREATMENT PERFORMANCE DATA FOR CONSTITUENTS REGULATED IN K015, K016, K018, K019, K020, K023, K024, K028, K030, K048, K049, K050, K051, K052, K087, K093, K094, U028, U069, U088, U102, U107, AND U190

Table A-1

Index for Appendix A

Table A-1 (Continued)

Index for Appendix A

Table A-2

Database Key

Code	Database
BDAT	Best Demonstrated Available Technology
EAD	Engineering and Analysis Division (formerly Industrial Technology Division)
NPDES	National Pollutant Discharge Elimination System
WAO	Wet Air Oxidation
WERL	Water Engineering Research Laboratory
OCPSF	Organic Chemicals, Plastics, and Synthetic Fibers
LEACHATE	Data Submitted by Industry

Table A-3

Key to Treatment Technologies

Code	Technology
AC	Activated Carbon
AFF	Aerobic Fixed Film
AL	Aerobic Lagoons
API	API Oil/Water Separator
AS	Activated Sludge
AirS	Air Stripping
AnFF	Anaerobic Fixed Film
BGAC	Biological Granular Activated Carbon
BT	Biological Treatment
CAC	Chemically Assisted Clarification
ChOx	Chemical Oxidation
Chred	Chemical Reduction
DAF	Dissolved Air Flotation
Fil	Filtration
GAC	Granular Activated Carbon
KPEG	Dechlorination Using Alkoxide
LL	Liquid-Liquid Extraction
PACT	Powdered Activated Carbon Addition to Activated Sludge
RBC	Rotating Biological Contactor
RO	Reverse Osmosis
SCOx	Super Critical Oxidation
SExt	Solvent Extraction
SS	Steam Stripping

Table A-3 (Continued)

Key to Treatment Technologies

Code	Technology
TF	Trickling Filter
UF	Ultrafiltration
UV	Ultraviolet Radiation
WOx	Wet Air Oxidation

"__ + __" - Indicates that the first process unit is followed in the process train by the second, i.e., AS + Fil - Activated Sludge followed by Filtration.

"__w + __" - Indicates that the two units are used together, i.e., UFwPAC - Ultrafiltration using Powdered Activated Carbon.

"__[B]" - Indicates batch instead of continuous flow.

Acenaphthalene. The data available for acenaphthalene were compiled from the EAD and WERL databases. These data are presented in Table A-4. Technologies for which treatment performance data are available include AL, AS, AS+Fil, and BT. All of the treatment performance data represent full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for acenaphthalene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for acenaphthalene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-4

WASTEWATER TREATMENT PERFORMANCE DATA
FOR ACENAPHTHALENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	6B		100-1000	3	10.000		98.4	WERL
AS	Full	6B		100-1000	13	10.000		97.9	WERL
AS+Fil	Full	6B		1000-10000	3	13.000		99.87	WERL
* BT	Full	1293	10	191-699	15	10.000			EAD *

* Data used in developing revised standard.

Acenaphthene. The data available for acenaphthene were compiled from the EAD and WERL databases, as well as WAO data from literature. These data are presented in Table A-5. Technologies for which treatment performance data are available include AS, AS+Fil, CAC, BT, PACT®, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for acenaphthene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for acenaphthene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-5

WASTEWATER TREATMENT PERFORMANCE DATA
FOR ACENAPHTHENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	975B		0-100		4.800		77	WERL
AS	Pilot	204A		0-100	8	1.200		97	WERL
AS	Full	6B		0-100	7	10.000		90	WERL
AS	Full	201B		100-1000	3	1.000		99.44	WERL
AS	Full	6B		100-1000	13	10.000		98.9	WERL
AS+Fil	Full	6B		1000-10000	3	13.000		99.66	WERL
CAC	Pilot	195B		0-100	8	10.000		67	WERL
Fil	Full	792E		0-100	4	2.000		83	WERL
* BT	Full	1293	10	513-1516	15	10.000			EAD *
PACT	Bench	975B		0-100		4.000		90	WERL
TF	Full	1B		0-100	4	6.000		86	WERL
WOx	Bench	Zimpro		7000000	1	500.000		99.99	WAO
WOx [B]	Bench	236A		>1000000	1	2800.000		99.96	WERL

* Data used in developing revised standard.

Anthracene. The data available for anthracene were compiled from the EAD and WERL databases. These data are presented in Table A-6. Technologies for which treatment performance data are available include AS, AS+Fil, BT, and TF. The treatment performance data represent pilot- and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for anthracene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for anthracene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-6

WASTEWATER TREATMENT PERFORMANCE DATA
FOR ANTHRACENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	6B		100-1000	14	10.000		98.6	WERL
AS	Full	1B		0-100	4	13.000		82	WERL
AS	Pilot	204A		0-100	8	0.900		97.4	WERL
AS+Fil	Full	6B		1000-10000	3	10.000		99.52	WERL
Fil	Full	782E		0-100	3	1.000		97.2	WERL
* BT	Full	1293	10	418-643	15	10.000			EAD *
TF	Full	1B		100-1000	6	17.000		92.3	WERL

* Data used in developing revised standard.

Benz(a)anthracene. The data available for benz(a)anthracene were compiled from the EAD and WERL databases. These data are presented in Table A-7. Technologies for which treatment performance data are available include AS, AS+Fil, and BT. The treatment performance data represent pilot- and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for benz(a)anthracene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for benz(a)anthracene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-7

WASTEWATER TREATMENT PERFORMANCE DATA
FOR BENZ(a)ANTHRACENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	201B		0-100	1	1.000		98.3	WERL
AS	Pilot	204A		0-100	8	0.600		97.5	WERL
AS	Full	6B		100-1000	12	10.000		97	WERL
AS+Fil	Full	6B		1000-10000	3	56.000		96.5	WERL
Fil	Full	792E		1000-10000	4	3.000		99.75	WERL
* BT	Full	1293	10	10-614	15	10.000			EAD *

* Data used in developing revised standard.

Benzene. The data available for benzene were compiled from the EAD, BDAT, and WERL databases, as well as PACT® data from literature. These data are presented in Table A-8. Technologies for which treatment performance data are available include AL, AL+AS, API+DAF+AS, AS, AS+Fil, AirS, AirS+GAC, GAC, LL, LL+SS+AC, PACT®, RO, SS, TF, TF+AS, and WOx. The treatment performance data represent bench- and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for benzene is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for benzene (0.14 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-8

WASTEWATER TREATMENT PERFORMANCE DATA
FOR BENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Bench	371D		1000-10000		60.000		98	WERL
AL	Full	6B		100-1000	2	10.000		98.9	WERL
AL	Full	1B		100-1000	6	10.000		94.4	WERL
AL	Full	6B		100-1000	2	10.000		92.3	WERL
AL+AS	Full	233D		10000-100000	21	13.000		99.9	WERL
API+DAF+AS	Full	1482D		1000-10000	4	3.700		99.96	WERL
AS	Full	6B		100-1000	7	10.000		98.8	WERL
AS	Bench	200B		100-1000	16	0.800		99.3	WERL
AS	Bench	200B		100-1000	6	1.000		99.83	WERL
AS	Full	1B		100-1000	6	2.000		99	WERL
AS	Full	6B		100-1000	22	30.000		91.7	WERL
AS	Full	1B		100-1000	6	1.000		99.55	WERL
AS	Full	6B		100-1000	14	10.000		95.7	WERL
AS	Full	6B		100-1000	3	10.000		95.6	WERL
AS	Full	1B		100-1000	6	2.000		98.9	WERL
AS	Bench	202D		100000-1000000		40.000		99.97	WERL
AS	Full	6B		1000-10000	3	10.000		99.09	WERL
AS	Full	6B		1000-10000	27	11.000		99.8	WERL
AS	Full	6B		1000-10000	3	10.000		99.71	WERL
AS	Full	6B		0-100	28	10.000		89.6	WERL
AS	Bench	200B		0-100	16	0.500		97.8	WERL
AS	Full	6B		10000-100000	15	10.000		99.97	WERL
AS	Full	234A		100-1000		0.600		99.83	WERL
AS	Full	201B		0-100	10	6.000		81	WERL
AS	Full	1B		0-100	6	16.000		84	WERL
AS	Pilot	206B		0-100	20	0.200		99.73	WERL
AS	Full	234A		0-100		0.700		97.4	WERL
AS+Fil	Full	6B		100000-1000000	3	20.000		99.99	WERL
AirS	Bench	1328E		10000-100000	5	9300.000		90	WERL
AirS	Full	322B		100-1000	22	0.440		99.74	WERL
AirS	Pilot	224B		100-1000	1	0.500		99.67	WERL
AirS	Full	322B		1000-10000	19	52.000		98.7	WERL
AirS	Pilot	1362E		100-1000	3	1.000		99.09	WERL
AirS+GAC	Full	229A		0-100	19	1.000		90.9	WERL

TABLE A-8 (Continued)

WASTEWATER TREATMENT PERFORMANCE DATA
FOR BENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
GAC	Full	245B		1000-10000	1	10.000		99.28	WERL
LL	Full	K104	5	4500-320000	5	35600.000	76.0		BDAT
LL	Full	K103	5	32000-81000	5	3560.000	76.0		BDAT
LL+SS	Full	K103/K104	5	4500-320000	5	5.600	76.0		BDAT
LL+SS+AC	Full	K103/K104	5	4500-320000	4	19.000	76.0		BDAT
PACT	Bench	242E		0-100		5.000		83	WERL
PACT	Bench	200B		100-1000	12	0.700		99.34	WERL
PACT	Bench	Zimpro		290	1	1.000		99.7	WAO
PACT	Bench	Zimpro		29	1	5.000		83	WAO
RO	Full	250B		1000-10000		140.000		92.2	WERL
RO	Full	250B		0-100		3.800		95.1	WERL
RO	Pilot	323B		0-100	1	32.000		19	WERL
RO	Pilot	250B		100-1000		50.000		78	WERL
RO	Full	250B		100-1000		67.000		82.7	WERL
* SS	Full	0415	10	22300-48100	4	38.800			EAD *
* SS	Full	2680	10	34693-147212	10	10.000			EAD *
* SS	Full	1494	10	239-2006310	13	44.800			EAD *
* SS	Full	0415	10	274000-412000	3	200.300			EAD *
SS	Full	6B		100000-1000000	3	200.000		99.94	WERL
SS	Full	6B		100000-1000000	12	48.000		99.99	WERL
SS	Full	6B		10000-100000	2	10.000		99.97	WERL
SS	Full	6B		10000-100000	10	10.000		99.99	WERL
SS	Full	251B		100-1000	10	10.000		98.3	WERL
[illegible]	Full	1B		0-100	5	1.000		97.5	WERL
[illegible]S	Full	6B		10000-100000	3	10.000		99.97	WERL
	Pilot	250B		1000-10000		230.000		78	WERL
WOx	Full	242E		1000-10000		29.000		99.64	WERL
WOx [B]	Bench	1054E		1000-10000		500.000		53	WERL
WOx [B]	Bench	1054E		100000-1000000		180000.000		82	WERL

* Data used in developing revised standard.

Benzo(a)pyrene. The data available for benzo(a)pyrene were compiled from the EAD and WERL databases. These data are presented in Table A-9. Technologies for which treatment performance data are available include AS, CAC, ChOx, GAC, BT, and TF. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for benzo(a)pyrene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10.3 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for benzo(a)pyrene (0.061 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-9

WASTEWATER TREATMENT PERFORMANCE DATA
FOR BENZO(a)PYRENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	375E		0-100	7	0.027		86	WERL
AS	Full	375E		0-100	7	0.028		88	WERL
AS	Full	375E		0-100	7	0.016		97.4	WERL
AS	Full	375E		0-100	7	0.021		86	WERL
AS	Full	6B		100-1000	10	10.000		95.2	WERL
CAC	Pilot	195B		1000-10000	8	20.000		98.2	WERL
ChOx(Oz)	Bench	153D		0-100		1.000		76	WERL
Fil	Full	792E		100-1000	4	1.000		99.81	WERL
Fil	Pilot	195D		0-100	8	10.000		50	WERL
GAC	Pilot	195D		1000-10000	8	20.000		98.2	WERL
* BT	Full	1293	10	10-426	15	10.300			EAD *
Sed	Bench	153D		0-100		4.200		37	WERL
TF	Full	126E		0-100		0.120		25	WERL
TF	Full	375E		0-100	7	0.016		93.6	WERL
TF	Full	375E		0-100	7	0.035		89	WERL

* Data used in developing revised standard.

Benzo(b)fluoranthene. The treatment performance data available for benzo(b)fluoranthene were compiled from the NPDES and WERL databases and are presented in Table A-10. Technologies for which treatment performance data are available include AS, BT, RO, and TF. The treatment performance data represent pilot- and full-scale studies and the resulting effluent concentrations ranged from 0.001 ppb to 10 ppb.

The revised BDAT for benzo(b)fluoranthene is AS (activated sludge biological treatment). AS was selected as BDAT because it represents full-scale data with a high influent concentration range and a high removal efficiency. The revised BDAT treatment standard for benzo(b)fluoranthene was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and the variability factor. The calculation of the resulting BDAT treatment standard for benzo(b)fluoranthene (0.055 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-10

WASTEWATER TREATMENT PERFORMANCE DATA
FOR BENZO(b)FLUORANTHENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
		LA0066214			15	10.000			NPDES
		MD0000345			1	10.000			NPDES
		NY0000281			1	5.000			NPDES
		NY0000281			9	4.844			NPDES
		IL0001627			9	10.111			NPDES
		MD0000345			1	10.000			NPDES
		KY0003603			1	10.000			NPDES
		KY0003514			1	10.000			NPDES
		WV0004740			1	10.000			NPDES
		LA0065501			6	10.000			NPDES
* AS	Full	6B		100-1000	10	10.000		95.4	WERL *
AS	Full	375E		0-100	7	0.023		88	WERL
AS	Full	375E		0-100	7	0.014		97.8	WERL
AS	Full	375E		0-100	7	0.023		89.6	WERL
AS	Full	375E		0-100	7	0.017		89	WERL
BT	Full	LA0038245			38	10.126			NPDES
BT	Full	KY0002119			1	10.000			NPDES
RO	Pilot	1634E		0-100		0.001		92.1	WERL
TF	Full	375E		0-100	7	0.033		89.7	WERL
TF	Full	375E		0-100	7	0.017		93.2	WERL

* Data used in developing revised standard.

Benzo(k)fluoranthene. The data available for benzo(k)fluoranthene were compiled from the EAD and WERL databases. These data are presented in Table A-11. Technologies for which treatment performance data are available include AS, BT, RO, and TF, and the treatment performance data represent pilot- and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for benzo(k)fluoranthene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for benzo(k)fluoranthene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

WASTEWATER TREATMENT PERFORMANCE DATA
FOR BENZO(k)FLUORANTHENE

NOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	6B		100-1000	10	10.000		94.7	WERL
AS	Full	375E		0-100	7	0.012		89	WERL
AS	Full	375E		0-100	7	0.010		96.6	WERL
AS	Full	375E		0-100	7	0.013		89	WERL
* BT	Full	1293	10	10-352	15	10.000			EAD *
RO	Pilot	1634E		0-100		0.001		94	WERL
TF	Full	375E		0-100	7	0.015		90.6	WERL
TF	Full	375E		0-100	7	0.014		90	WERL

* Data used in developing revised standard.

Bis(2-chloroethyl)ether. The treatment performance data available for bis(2-chloroethyl)ether were compiled from the NPDES and WERL databases and are presented in Table A-12. Technologies for which treatment performance data are available include AL, AS, BT, CAC, ChOx, and TF. The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 1 ppb to 430 ppb.

The revised BDAT for bis(2-chloroethyl)ether is AS (activated sludge biological treatment). AS was selected as BDAT because the data represent full-scale treatment performance with a high influent concentration and high removal efficiency. The revised BDAT treatment standard for bis(2-chloroethyl)ether was calculated using the effluent concentration of 6 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for bis(2-chloroethyl)ether (0.033 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-12

WASTEWATER TREATMENT PERFORMANCE DATA
FOR BIS(2-CHLOROETHYL)ETHER

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
		LA0065501			6	10.000			NPDES
		PA0012777			38	3.014			NPDES
		NY0107174			8	25.875			NPDES
		MI0000868			8	2.750			NPDES
		LA0066214			15	10.000			NPDES
AL	Pilot	203A		100-1000	11	102.000		29	WERL
AL	Pilot	203A		100-1000	11	78.000		46	WERL
AS	Full	1B		100-1000	11	13.000		98.3	WERL
AS	Pilot	240A		0-100	9	29.000		67	WERL
AS	Full	6B		1000-10000	3	430.000		73	WERL
AS	Pilot	203A		100-1000	11	30.000		79	WERL
* AS	Full	975B		1000-10000		6.000		99.87	WERL *
BT	Full	KY0002119			13	12.080			NPDES
BT	Full	LA0036245			36	12.492			NPDES
BT	Full	PA0026247			25	10.880			NPDES
BT	Full	PA0026689			2	2.500			NPDES
BT	Full	MI0029173			15	1.000			NPDES
BT	Full	MI0029173			15	1.000			NPDES
CAC	Pilot	203A		100-1000	11	114.000		20	WERL
ChOx	Bench	975B		1000-10000		6.000		99.74	WERL
TF	Pilot	203A		100-1000	11	132.000		8	WERL
TF	Pilot	240A		0-100	8	65.000		32	WERL

* Data used in developing revised standard.

Bis(2-ethylhexyl)phthalate. The data available for bis(2-ethylhexyl)phthalate were compiled from the EAD and WERL databases and literature WAO and PACT® data. These data are presented in Table A-13. Technologies for which treatment performance data are available include AL, AS, CAC, BT, PACT®, RO, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for bis(2-ethylhexyl)phthalate is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 47.1 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for bis(2-ethylhexyl)phthalate (0.28 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-13

WASTEWATER TREATMENT PERFORMANCE DATA
FOR BIS(2-ETHYLHEXYL)PHTHALATE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	11	34.000		80	WERL
AL	Full	1B		100-1000	6	73.000		39	WERL
AL	Bench	371D		1000-10000		190.000		90.5	WERL
AL	Pilot	203A		100-1000	11	30.000		82	WERL
AS	Full	1B		0-100	6	8.000		79	WERL
AS	Full	1B		0-100	4	18.000		47	WERL
AS	Full	1B		0-100	4	5.000		81	WERL
AS	Pilot	241B		100-1000	5	7.000		93.7	WERL
AS	Pilot	203A		100-1000	11	18.000		89	WERL
AS	Full	1B		0-100	6	10.000		84	WERL
AS	Bench	202D		100-1000		60.000		77	WERL
AS	Full	1B		0-100	3	10.000		66	WERL
AS	Pilot	241B		1000-10000	4	390.000		64	WERL
AS	Full	1B		100-1000	6	90.000		59	WERL
AS	Full	1B		0-100	6	11.000		64	WERL
AS	Full	1B		100-1000	5	31.000		72	WERL
AS	Full	1B		0-100	5	9.000		67	WERL
AS	Full	1B		0-100	6	20.000		73	WERL
AS	Full	1B		0-100	4	67.000		33	WERL
AS	Full	6B		1000-10000	37	47.000		97.1	WERL
AS	Full	1B		0-100	4	11.000		76	WERL
AS	Full	1B		100-1000	6	40.000		86	WERL
AS	Full	201B		0-100	3	5.000		93.8	WERL
AS	Full	1B		0-100	4	16.000		70	WERL
AS	Pilot	204A		0-100	8	11.000		79	WERL
AS	Pilot	240A		100-1000	10	46.000		73	WERL
AS	Full	1B		100-1000	6	48.000		83	WERL
AS	Full	1B		0-100	6	51.000		39	WERL
AS	Bench	1050E		100-1000	5	35.000		91.2	WERL
AS	Full	1B		0-100	6	10.000		81	WERL
AS	Full	1B		0-100	3	6.000		86	WERL
AS	Full	1B		100-1000	6	190.000		57	WERL
CAC	Pilot	203A		100-1000	11	15.000		91.1	WERL
* BT	Full	948	10	11-11740	33	43.300			EAD *
PACT	Bench	975B		100-1000		3.000		99.46	WERL
PACT	Bench	Zimpro		561	1	2.000		99.6	WAO
RO	Full	250B		0-100		8.000		90	WERL
TF	Full	1B		0-100	5	60.000		3	WERL
TF	Pilot	203A		100-1000	11	39.000		77	WERL
TF	Full	1B		0-100	5	5.000		81	WERL
TF	Full	1B		0-100	4	22.000		24	WERL
TF	Full	1B		0-100	6	26.000		32	WERL
TF	Full	1B		0-100	5	33.000		56	WERL
TF	Pilot	240A		100-1000	8	43.000		79	WERL
WOx	Full	Zimpro	2	4800	1	10.000			WAO
WOx	Full	Zimpro	11	1800	1	0.000			WAO
WOx [B]	Bench	1054E		100000-1000000		100.000		99.99	WERL

* Data used in developing revised standard.

Carbon Disulfide. The treatment performance data available for carbon disulfide were compiled from the NPDES data for one facility and are presented in Table A-14A. The revised BDAT treatment standard was based on the average effluent concentration from this facility and leachate treatment performance data submitted by industry (presented in Table A-14B). The technology for which data are available was BT with a resulting effluent concentration of 5 ppb.

The revised BDAT for carbon disulfide is BT (biological treatment). BT was selected as BDAT because the data showed substantial treatment of carbon disulfide. The revised BDAT treatment standard for carbon disulfide was calculated using the effluent concentration of 5 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for carbon disulfide (0.014 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-14A

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CARBON DISULFIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
*		NY0000345			2	85.000			NPDES *

* Data used in developing revised standard.

TABLE A-14B

INDUSTRY-SUBMITTED LEACHATE TREATMENT PERFORMANCE
DATA FOR CARBON DISULFIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT		EMELLE	5	10	1	5		50	LEACHATE
BT		BFI	5	260	1	5		98.07	LEACHATE

Chlorobenzene. The treatment performance data available for chlorobenzene were compiled from the WERL database, BDAT Solvents Rule data, and PACT® and WAO data from literature. These data are presented in Table A-15. Technologies for which treatment performance data are available include AFF, AL, AS, AirS, BGAC, BT, GAC, PACT®, RO, SS, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 0.250 ppb to 1,550,000 ppb.

The revised BDAT for chlorobenzene is BT (biological treatment). BT was selected as BDAT because it is represented by full-scale data developed from EAD sampling and was used as part of the BDAT Solvents Rule. Furthermore, the effluent concentrations achievable by this technology are supported by similar effluent concentrations from the AS and PACT® treatment performance data. The revised BDAT treatment standard for chlorobenzene was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for chlorobenzene (0.057 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-15

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHLOROBENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AFF	Bench	501A		0-100	9	1.000		90.7	WERL
AL	Bench	371D		1000-10000		160.000		94.7	WERL
AS	Bench	200B		100-1000	12	1.100		99.17	WERL
AS	Bench	200B		100-1000	6	1.300		99.81	WERL
AS	Full	975B		100-1000		6.000		94.6	WERL
AS	Full	6B		100-1000	4	10.000		98.9	WERL
AS	Bench	200B		0-100	6	0.200		99.23	WERL
AS	Full	975B		100-1000		10.000		94.6	WERL
AS	Full	975B		0-100		6.000		84	WERL
AS	Full	1B		100-1000	6	3.000		98.9	WERL
AS	Pilot	206B		100-1000	20	1.300		99.34	WERL
AS	Pilot	241B		100-1000	5	4.000		98.6	WERL
AS	Full	975B		100-1000		12.000		97.8	WERL
AirS	Bench	1328E		1000-10000	5	1600.000		77	WERL
AirS	Bench	1328E		10000-100000	5	3300.000		89	WERL
BGAC	Bench	501A		0-100	23	0.290		97.6	WERL
BT	Full	P206		929-49775	8	841.000			BDAT #
BT	Full	P246		10-3040	13	101.000			BDAT #
BT	Full	P263		443-832	3	504.000			BDAT #
BT	Full	REF4		1900	1	12.000			BDAT #
* BT	Full	P202		79-429	20	10.000			BDAT # *
BT+AC	Full	P246		10-7200	16	30.000			BDAT #
GAC	Full	245B		100-1000	1	10.000		96.6	WERL
GAC	Full	245B		1000-10000	1	10.000		99.7	WERL
GAC	Full	237A		1000-10000	1	10.000		99.17	WERL
[redacted]	Full	1421D		0-100		0.250		56	WERL
[redacted]	Full	6B		1000-10000	4	10.000		99.38	WERL
PACT	Bench	200B		100-1000	11	0.800		99.37	WERL
PACT	Bench	242E		0-100		5.000		84	WERL
PACT	Bench	Zimpro		31	1	5.000		84	WAO
RO	Pilot	323B		0-100	1	12.000		50	WERL
RO	Full	250B		0-100		4.000		53	WERL
RO	Full	250B		1000-10000		120.000		91.6	WERL
SS	Full	251B		100-1000	10	10.000		97.4	WERL
WOx	Bench	Zimpro		5535000	1	1550000.000		72	WAO
WOx	Bench	Zimpro		792000	1	61000.000		92.3	WAO

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.
* Data used in developing revised standard.

Chloroethane. The data available for chloroethane were compiled from the EAD and WERL databases. These data are presented in Table A-16. Technologies for which treatment performance data are available include AL, AS, PACT®, and SS, with all of the treatment performance data representing full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for chloroethane is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 50 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for chloroethane (0.27 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-16

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	1B		100-1000	5	260.000		30	WERL
AS	Full	1B		100-1000	5	250.000		0	WERL
AS	Full	1B		100-1000	5	640.000		0	WERL
AS	Full	6B		100-1000	4	50.000		87	WERL
PACT	Full	6B		1000-10000	3	63.000		96.8	WERL
* SS	Full	913	50	50-47700	14	50.000			EAD *
* SS	Full	415T	50	690-42000	15	50.000			EAD *
SS	Full	6B		10000-100000	2	50.000		99.88	WERL
SS	Full	99.75		10000-100000	15	50.000		99.75	WERL

* Data used in developing revised standard.

Chloroform. The data available for chloroform were compiled from the EAD and WERL databases and WAO and PACT® data from literature. These data are presented in Table A-17. Technologies for which treatment performance data are available include AL, AS, AS+Fil, AirS, CAC, CAC+AirS, ChOx, GAC, PACT®, RO, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale data.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for chloroform is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 12.2 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for chloroform (0.046 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-17

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHLOROFORM

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	1607B		0-100	3	9.000		90.1	WERL
AL	Full	1B		100-1000	6	26.000		96.8	WERL
AL	Pilot	203A		100-1000	14	53.000		61	WERL
AL	Full	141A		100-1000		16.000		92.3	WERL
AL	Full	1607B		100-1000	2	10.000		97.4	WERL
AL	Full	1607B		100-1000	3	130.000		86	WERL
AL	Pilot	203A		100-1000	14	31.000		77	WERL
AS	Full	1B		0-100	3	20.000		80	WERL
AS	Full	6B		100-1000	7	30.000		77	WERL
AS	Full	1B		0-100	5	6.000		86	WERL
AS	Full	6B		100-1000	3	10.000		97.7	WERL
AS	Bench	202D		10000-100000		200.000		99.43	WERL
AS	Full	234A		0-100		1.200		61	WERL
AS	Full	1B		0-100	6	21.000		62	WERL
AS	Full	375E		0-100	7	1.000		75	WERL
AS	Full	1B		100-1000	6	59.000		51	WERL
AS	Full	975B		0-100		2.000		93.8	WERL
AS	Full	234A		0-100		2.300		72	WERL
AS	Full	234A		0-100		0.500		96.4	WERL
AS	Full	6B		100-1000	3	10.000		96.2	WERL
AS	Full	238A		0-100	3	2.400		46	WERL
AS	Full	1607B		100-1000	3	50.000		86	WERL
AS	Full	1607B		1000-10000	2	40.000		96.9	WERL
AS	Pilot	206B		100-1000	20	3.600		97.4	WERL
AS	Full	375E		0-100	7	20.000		78	WERL
AS	Full	1587E		0-100		1.600		65	WERL
AS	Pilot	241B		100-1000	5	44.000		85	WERL
AS	Full	234A		0-100		1.300		84	WERL
AS	Pilot	203A		100-1000	14	18.000		87	WERL
AS	Full	6B		1000-10000	27	19.000		96.7	WERL
AS	Full	201B		0-100	29	36.000		53	WERL
AS	Full	234A		0-100		1.300		65	WERL
AS	Pilot	240A		0-100	14	2.000		96	WERL
AS+Fil	Full	6B		1000-10000	3	10.000		99.41	WERL
AS+Fil	Full	6B		100-1000	14	10.000		95.8	WERL
AirS	Bench	1326E		100000-1000000	5	16000.000		93.1	WERL
AirS	Pilot	369A		0-100		1.400		96.2	WERL
AirS	Pilot	213B		0-100	1	13.000		77	WERL
AirS	Bench	1326E		10000-100000	5	4400.000		63	WERL

TABLE A-17 (Continued)

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHLOROFORM

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AirS	Pilot	225B		0-100	1	0.130		98.9	WERL
AirS	Bench	17A		0-100		2.600		96.9	WERL
AirS	Bench	17A		1000-10000		110.000		91.7	WERL
AirS	Bench	17A		0-100		3.900		88	WERL
AirS	Bench	17A		100-1000		4.200		96.6	WERL
AirS	Pilot	210B		100-1000	1	1.000		99.2	WERL
AirS	Bench	17A		100-1000		3.700		96.6	WERL
AirS	Bench	1328E		100-1000	5	34.000		84	WERL
AirS	Pilot	434B		1000-10000	4	41.000		96	WERL
CAC	Pilot	203A		100-1000	14	106.000		22	WERL
CAC+AirS	Full	1633D		0-100	25	0.200		89	WERL
ChOx	Bench	640E		100-1000	2	7.000		96	WERL
ChOx	Bench	640E		100-1000	1	3.000		99	WERL
ChOx (Oz)	Pilot	331D		0-100		46.000		37	WERL
ChOx (Oz)	Pilot	331D		0-100		2.800		35	WERL
GAC	Full	1264B		0-100		1.000		67	WERL
GAC	Pilot	331D		0-100		1.000		96.6	WERL
GAC	Full	245B		100-1000	1	10.000		97.6	WERL
GAC	Full	237A		100-1000	1	10.000		96.1	WERL
GAC	Full	245B		100-1000	1	10.000		96.2	WERL
PACT	Bench	242E		0-100		20.000		47	WERL
PACT	Bench	Zimpro		1470	1	1.000		99.9	WAO
PACT	Bench	Zimpro		38	1	20.000		47	WAO
RO	Pilot	180A		0-100		0.890		71	WERL
RO	Full	250B		1000-10000		110.000		94.5	WERL
RO	Full	250B		100-1000		53.000		67	WERL
SCOx	Pilot	65D		100-1000		1.700		99.83	WERL
* SS	Full	415T	10	7330-1066000	15	10.500			EAD *
* SS	Full	913	10	28700-200000	14	129.200			EAD *
SS	Full	6B		100000-1000000	15	10.000		99.99	WERL
SS	Full	6B		10000-100000	2	120.000		99.88	WERL
SS	Full	251B		1000000	10	6000.000		99.99	WERL
SS	Full	251B		100000-1000000	10	9600.000		96.4	WERL
TF	Pilot	240A		0-100	14	11.000		89	WERL
TF	Full	1B		0-100	4	14.000		86	WERL
TF	Pilot	203A		100-1000	14	102.000		24	WERL
WOx	Bench	Zimpro		4450000	1	3000.000		99.9	WAO
WOx	Bench	Zimpro		270000	1	1000.000		99	WAO

* Data used in developing revised standard.

Chloromethane. The data available for chloromethane were compiled from the EAD, WERL, and NPDES databases. These data are presented in Table A-18. Technologies for which treatment performance data are available include AS, AS+Fil, BT, and SS. All of the treatment performance data represent full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for chloromethane is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 50 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for chloromethane (0.19 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-18

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHLOROMETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
		CT0000434			5	22.600			NPDES
		KY0003514			1	6.000			NPDES
		PA0011371			9	1.000			NPDES
		LA0004057			22	12.300			NPDES
		MA0005304			21	10.048			NPDES
		IL0001627			9	9.333			NPDES
		NY0202061			29	1.000			NPDES
		NY0075957			13	20.769			NPDES
		NY0006605			15	6.400			NPDES
		NJ0028291			2	1.000			NPDES
		MD0000345			1	10.000			NPDES
		KY0003603			1	10.000			NPDES
		WV0004740			1	10.000			NPDES
		OH0025461			2	21.700			NPDES
		SC0001180			40	8.974			NPDES
		LA0066214			15	11.786			NPDES
		LA0066435			12	6.500			NPDES
		LA0065501			6	10.000			NPDES
		TX0007439			42	3.500			NPDES
AS	Full	1B		100-1000	6	110.000		66	WERL
AS	Full	1B		100-1000	5	11.000		96.3	WERL
AS	Full	1B		100-1000	5	91.000		75	WERL
AS+Fil	Full	6B		0-100	7	50.000		39	WERL
BT	Full	KY0002119			1	10.000			WERL
BT	Full	LA0036245			38	10.263			WERL
BT	Full	PA0026689			2	12.100			WERL
BT	Full	WV0023116			18	16.111			WERL
Sed+Fil	Full	PA0010502			26	1.308			WERL
* SS	Full	725	50	9440-1290000	13	923.100			EAD *
SS	Full	6B		100000-1000000	11	50.000		99.96	WERL
SS	Full	251B		10000-100000	10	5.000		99.99	WERL

* Data used in developing reivsed standard.

Chrysene. The data available for chrysene were compiled from the EAD and WERL databases. These data are presented in Table A-19. Technologies for which treatment performance data are available include AS, AS+Fil, and BT. The treatment performance data represent pilot- and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for chrysene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for chrysene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-19

WASTEWATER TREATMENT PERFORMANCE DATA
FOR CHRYSENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Pilot	204A		0-100	8	1.200		96.9	WERL
AS	Full	6B		100-1000	4	10.000		99	WERL
AS	Full	6B		100-1000	11	10.000		96.8	WERL
AS+FII	Full	6B		1000-10000	3	10.000		99.09	WERL
FII	Full	792E		100-1000	4	1.000		99.76	WERL
* BT	Full	1293	10	10-677	15	10.000			EAD *

* Data used in developing revised standard.

ortho-Cresol. The treatment performance data available for ortho-cresol were compiled from the WERL database and the BDAT Solvents Rule data. These data are presented in Table A-20. Technologies for which data are available include Anff, AnFFwGAC, BT, and RO. The treatment performance data represent bench-, pilot-, and full-scale studies and the resulting effluent concentrations ranged from 14 ppb to 26,000 ppb.

The revised BDAT for ortho-cresol is BT (biological treatment). BT was selected as BDAT because it represents full-scale data developed from EAD sampling and was used as part of the BDAT Solvents Rule. The revised BDAT treatment standard for ortho-cresol was calculated using the effluent concentration of 25 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for ortho-cresol (0.11 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-20

WASTEWATER TREATMENT PERFORMANCE DATA
FOR ortho-CRESOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AnFF	Bench	230A		100000-1000000		26000.000		78	WERL
AnFF	Pilot	235D		10000-100000		7800.000		85	WERL
AnFFwGAC	Pilot	249D		100000-1000000		8800.000		98.7	WERL
* BT	Full	REF5		1886-2536	2	25.000			BDAT # *
RO	Full	250B		100-1000		14.000		98.5	WERL

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.
* Data used in developing revised standard.

meta/para-Cresol. Currently, reliable analytical methods for the separation and subsequent measurement of meta-cresol and para-cresol do not exist. Therefore, the Agency believes it is appropriate to measure and regulate both isomers under one combined listing. The treatment performance data available for meta/para-cresol were compiled from the WERL database and are presented in Table A-21. Technologies for which treatment performance data are available include API+DAF+AS, AS, AnFF, RO, and SExt. The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 72 ppb to 17,000 ppb.

The revised BDAT for meta/para-cresol is AS (activated sludge biological treatment). AS was selected as BDAT because it represents a demonstrated technology with a high removal efficiency and was the BDAT chosen for ortho-cresol. The revised BDAT treatment standard for meta/para-cresol was calculated using the effluent concentration of 174 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for meta/para-cresol (0.77 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-21

WASTEWATER TREATMENT PERFORMANCE DATA
FOR meta/para-CRESOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
API+DAF+AS	Full	1482D		1000-10000	4	160.000		87	WERL
* AS	Pilot	241B		100-1000	9	174.000		68	WERL *
AnFF	Bench	230A		100000-1000000		17000.000		90.7	WERL
RO	Full	250B		1000-10000		72.000		97.7	WERL
SExt	Pilot	1062E		100000-1000000		3000.000		99.66	WERL

* Data used in developing revised standard.

o-Dichlorobenzene. The treatment performance data available for o-dichlorobenzene were compiled from the WERL database, BDAT Solvents Rule data, and WAO data from literature . These data are presented in Table A-22. Technologies for which treatment performance data are available include AFF, AL, AS, AirS, BGAC, BT, GAC, PACT®, RBC, RO, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 0.09 ppb to 2,017,000 ppb.

The revised BDAT for o-dichlorobenzene is BT (biological treatment). BT was selected as BDAT because it represents full-scale data developed from EAD sampling and was used as part of the BDAT Solvents Rule. Furthermore, the effluent concentration achieved by this technology is similar to effluent concentrations reported from the WERL activated sludge treatment performance data. The revised BDAT treatment standard for o-dichlorobenzene was calculated using the effluent concentration of 16 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for o-dichlorobenzene (0.088 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-22

WASTEWATER TREATMENT PERFORMANCE DATA
FOR o-DICHLOROBENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AFF	Bench	501A		0-100	25	0.380		98	WERL
AL	Pilot	192D		100-1000		10.000		97.7	WERL
AL	Pilot	192D		1000-10000		100.000		94.8	WERL
AL	Bench	371D		1000-10000		72.000		97.6	WERL
AS	Full	1B		100-1000	4	6.000		96	WERL
AS	Full	6B		1000-10000	3	52.000		96.5	WERL
AS	Pilot	192D		1000-10000		110.000		94.3	WERL
AS	Pilot	192D		100-1000		270.000		37	WERL
AS	Full	6B		100-1000	330	35.000		96.2	WERL
AS	Full	1B		100-1000	2	5.000		96.2	WERL
AS	Full	1B		0-100	3	2.000		94.3	WERL
AS	Full	6B		1000-10000	4	16.000		99.33	WERL
AS	Bench	200B		100-1000	14	8.000		92.7	WERL
AS	Full	1B		100-1000	5	10.000		91.7	WERL
AS	Full	1587E		0-100		1.200		79	WERL
AS	Bench	202D		10000-100000		50.000		99.94	WERL
AS	Pilot	241B		100-1000	10	25.000		93.2	WERL
AS	Bench	1050E		100-1000	5	1.600		99.6	WERL
AS	Full	375E		0-100	7	5.000		67	WERL
AS	Full	6B		100-1000	3	10.000		92.9	WERL
AS	Bench	1054E		100-1000		8.000		96.4	WERL
AirS	Bench	1328E		10000-100000	5	6200.000		74	WERL
AirS	Pilot	222B		0-100	1	0.500		83	WERL
BGAC	Bench	501A		0-100	34	0.310		96.8	WERL
BT	Full	P246		768-2801	14	596.000			BDAT #
* BT	Full	P202		1350-4387	4	16.000			BDA
BT	Full	P206		233-2333	10	88.000			BDA
BT+AC	Full	P246		768-3275	17	176.000			BDAT #
GAC	Full	245B		100-1000	1	10.000		98.9	WERL
GAC	Full	1421D		0-100		0.270		90	WERL
PACT	Bench	242E		0-100		5.000		83	WERL
PACT	Bench	200B		100-1000	14	2.900		97.5	WERL
PACT	Full	6B		1000-10000	10	88.000		96.5	WERL
PACT	Full	6B		100-1000	4	64.000		90	WERL
RBC	Pilot	192D		100-1000		10.000		97.7	WERL
RO	Pilot	323B		0-100	1	11.000		70	WERL
RO	Pilot	180A		0-100		0.090		92.5	WERL
WOx	Bench	Zimpro		590000	1	150000.000		74.6	WAO
WOx	Bench	Zimpro		6530000	1	2017000.000		69.1	WAO
WOx	Pilot	78D		>1000000		29000.000		98.7	WERL

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.
* Data used in developing revised standard.

p-Dichlorobenzene. The treatment performance data available for p-dichlorobenzene were compiled from the WERL database and WAO data from literature. These data are presented in Table A-23. Technologies for which treatment performance data are available include AFF, AL, AS, AirS, BGAC, CAC, ChOx, GAC, PACT®, RBC, RO, and TF. The treatment performance data represent bench-, pilot, and full-scale studies. The resulting effluent concentrations ranged from 0.004 ppb to 3,600 ppb.

The revised BDAT for p-dichlorobenzene is AS (activated sludge biological treatment). AS was selected as BDAT because it represents full-scale data with high influent concentrations and high removal efficiencies. The revised BDAT treatment standard for p-dichlorobenzene was calculated using an effluent concentration of 16.33 ppb (which represents an average of the data presented for the activated sludge technology in the high influent concentration ranges) and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for p-dichlorobenzene (0.090 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-23

WASTEWATER TREATMENT PERFORMANCE DATA
FOR p-DICHLOROBENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AFF	Bench	501A		0-100	27	0.200		96.1	WERL
AL	Pilot	192D		0-100		10.000		88	WERL
AL	Pilot	203A		0-100	11	31.000		67	WERL
AL	Pilot	203A		0-100	11	12.000		87	WERL
AL	Pilot	192D		100-1000		10.000		90.5	WERL
AS	Full	1B		0-100	2	10.000		76	WERL
AS	Full	234A		0-100		0.500		81	WERL
AS	Pilot	241B		100-1000	4	10.000		90.7	WERL
* AS	Full	975B		1000-10000		12.000		99.63	WERL *
AS	Pilot	192D		100-1000		10.000		90.5	WERL
AS	Pilot	631D		0-100		0.004		99	WERL
AS	Pilot	631D		0-100		0.004		99	WERL
AS	Pilot	240A		100-1000	12	8.000		93.8	WERL
AS	Pilot	192D		0-100		10.000		88	WERL
AS	Full	234A		0-100		0.500		90	WERL
AS	Pilot	241B		100-1000	11	19.000		95.1	WERL
AS	Full	201B		0-100	2	6.000		79	WERL
AS	Full	1B		0-100	1	5.000		93.1	WERL
AS	Full	1B		0-100	1	8.000		83	WERL
AS	Pilot	203A		0-100	11	5.000		94.6	WERL
AS	Full	234A		0-100		0.500		91.7	WERL
* AS	Full	6B		100-1000	4	10.000		97	WERL *
AS	Full	975B		0-100		4.900		92.8	WERL
* AS	Full	975B		100-1000		27.000		96.6	WERL
AirS	Bench	1328E		10000-100000	5	3600.000		90	WERL
BGAC	Bench	501A		0-100	34	0.270		97.5	WERL
CAC	Pilot	203A		0-100	11	66.000		29	WERL
ChOx	Bench	975B		0-100		5.000		91.1	WERL
GAC	Full	245B		100-1000	1	10.000		96	WERL
GAC	Full	1421D		0-100		0.200		92	WERL
PACT	Bench	975B		0-100		5.000		93.5	WERL
PACT	Bench	975B		0-100		5.000		92.3	WERL
PACT	Bench	Zimpro		36.6	1	0.015		99.96	WAO
RBC	Pilot	192D		0-100		10.000		88	WERL
RO	Pilot	180A		0-100		0.670		61	WERL
TF	Pilot	240A		100-1000	11	16.000		88	WERL
TF	Pilot	203A		0-100	11	58.000		36	WERL

* Data used in developing revised standard.

1,1-Dichloroethane. The data available for 1,1-dichloroethane were compiled from the EAD and WERL databases. These data are presented in Table A-24. Technologies for which treatment performance data are available include AL, AS, AirS, AirS+GAC, CAC, GAC, PACT®, RO, SS, and TF. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for 1,1-dichloroethane is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for 1,1-dichloroethane (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-24

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,1-DICHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	14	19.000		87	WERL
AL	Pilot	203A		100-1000	14	45.000		69	WERL
AL	Full	1B		0-100	2	10.000		68	WERL
AS	Pilot	203A		100-1000	14	8.000		94.4	WERL
AS	Pilot	240A		0-100	14	2.000		97.5	WERL
AirS	Pilot	222B		0-100	1	0.300		97.5	WERL
AirS	Pilot	1362E		1000-10000	3	630.000		75	WERL
AirS+GAC	Full	229A		0-100	19	1.000		97.4	WERL
CAC	Pilot	203A		100-1000	14	111.000		23	WERL
GAC	Bench	1362E		1000-10000		1.000		99.97	WERL
GAC	Full	1264B		0-100		1.000		80	WERL
PACT	Bench	Zimpro		640	1	1.000		99.8	WAO
RO	Full	250B		1000-10000		84.000		92.4	WERL
RO	Full	250B		100-1000		64.000		89	WERL
RO	Full	250B		0-100		3.000		95.4	WERL
* SS	Full	913	10	3400-13900	14	10.000			EAD *
SS	Full	251B		10000-100000	10	10.000		99.9	WERL
SS	Full	6B		1000-10000	2	10.000		99.9	WERL
TF	Pilot	240A		0-100	14	7.000		91.3	WERL
TF	Pilot	203A		100-1000	14	94.000		35	WERL

* Data used in developing revised standard.

1,2-Dichloroethane. The data available for 1,2-dichloroethane were compiled from the EAD and WERL databases and WAO data from literature. These data are presented in Table A-25. Technologies for which treatment performance data are available include AL, AL+AS, AS, AS+Fil, AirS, CAC, PACT®, RO, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for 1,2-dichloroethane is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 25.6 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for 1,2-dichloroethane (0.21 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-25

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,2-DICHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	14	15.000		90.2	WERL
AL	Full	1B		1000-10000	6	10.000		99.75	WERL
AL	Pilot	203A		100-1000	14	45.000		71	WERL
AL+AS	Full	233D		1000-10000	21	8.000		99.67	WERL
AS	Pilot	203A		100-1000	14	22.000		86	WERL
AS	Pilot	241B		100-1000	3	140.000		57	WERL
AS	Full	1B		1000-10000	6	4400.000		33	WERL
AS	Full	6B		100-1000	3	12.000		98.1	WERL
AS	Pilot	240A		0-100	13	5.000		94.3	WERL
AS	Full	6B		1000-10000	25	29.000		98.6	WERL
AS	Full	375E		100-1000	7	74.000		82	WERL
AS	Bench	202D		100000-1000000		3700.000		98.6	WERL
AS	Full	1B		10000-100000	6	1800.000		89	WERL
AS	Full	6B		100-1000	13	94.000		64	WERL
AS	Full	6B		100-1000	12	15.000		96.5	WERL
AS+Fil	Full	6B		10000-100000	3	1200.000		96.5	WERL
AirS	Full	322B		100-1000	5	55.000		89	WERL
AirS	Full	322B		1000-10000	5	189.000		91.8	WERL
CAC	Pilot	203A		100-1000	14	109.000		29	WERL
PACT	Bench	Zimpro		210	1	1.000		99.5	WAO
RO	Full	250B		1000-10000		350.000		84	WERL
RO	Full	250B		0-100		13.000		79	WERL
RO	Pilot	323B		0-100	1	32.000		37	WERL
RO	Full	250B		100-1000		43.000		76	WERL
* SS	Full	415T	10	2339900-23476000	15	56.100			EAD
* SS	Full	913	10	172000-327000	14	73.300			EAD
SS	Full	251B		1000000	10	97.000		99.99	WERL
SS	Full	6B		1000000	15	56.000		99.99	WERL
SS	Full	6B		100000-1000000	2	50.000		99.98	WERL
TF	Pilot	240A		0-100	13	12.000		86	WERL
TF	Full	375E		100-1000	7	45.000		65	WERL
TF	Pilot	203A		100-1000	14	93.000		39	WERL
WOx	Bench	Zimpro		6280000	1	13000.000		99.8	WAO
WOx(B)	Bench	1054E		1000000		230000.000		93.6	WERL

* Data used in developing revised standard.

trans-1,2-Dichloroethene. The data available for trans-1,2-dichloroethene were compiled from the EAD and WERL databases. These data are presented in Table A-26. Technologies for which treatment performance data are available include AS, AS+Fil, AirS, GAC, RO, SS, and TF. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for trans-1,2-dichloroethene is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for trans-1,2-dichloroethene (0.054 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-26
WASTEWATER TREATMENT PERFORMANCE DATA
FOR TRANS-1,2-DICHLOROETHYLENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVA (%)	REFERENCE
AS	Full	1B		0-100	3	7.000		88	WERL
AS	Full	1B		0-100	4	3.000		93.5	WERL
AS	Full	1B		0-100	5	8.000		71	WERL
AS+Fil	Full	6B		100-1000	3	78.000		81	WERL
AirS	Bench	1328E		1000-10000	5	1500.000		80	WERL
AirS	Pilot	1362E		1000-10000	3	1.300		99.9	WERL
AirS	Pilot	71D		100-1000	1	5.000		98.1	WERL
AirS	Pilot	1363E		100-1000		5.000		95.2	WERL
AirS	Bench	1328E		100000-1000000	5	17000.000		84	WERL
GAC	Full	245B		100-1000	1	10.000		92.5	WERL
RO	Full	250B		10000-100000		8000.000		64	WERL
* SS	Full	415T	10	4860-43000	15	14.100			ITD-L *
* SS	Full	913	10	14100-70300	14	10.000			ITD-L *
SS	Full	6B		10000-100000	15	14.000		99.9	WERL
SS	Full	6B		10000-100000	2	10.000		100	WERL
TF	Full	1B		0-100	5	1.000		97.9	WERL

* Data used in developing proposed standard.

Diethyl Phthalate. The data available for diethyl phthalate were compiled from the EAD and WERL databases and PACT® data from literature. These data are presented in Table A-27. Technologies for which treatment performance data are available include AS, BT, and PACT®. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for diethyl phthalate is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 42.5 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for diethyl phthalate (0.20 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-27

WASTEWATER TREATMENT PERFORMANCE DATA
FOR DIETHYL PHTHALATE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AS	Pilot	204A		0-100	8	1.200		97.4	WERL
AS	Full	6B		1000-10000	36	28.000		97.7	WERL
AS	Pilot	241B		100-1000	11	12.000		97.6	WERL
AS	Full	1B		0-100	4	1.000		96.7	WERL
AS	Full	1B		0-100	3	3.000		88	WERL
* BT	Full	948	10	14-15000	33	23.500			EAD *
PACT	Bench	Zimpro		88	1	1.000		98.9	WAO

* Data used in developing revised standard.

2,4-Dimethylphenol. The data available for 2,4-dimethylphenol were compiled from the EAD and WERL databases, WAO data from literature, and EPA WAO test data. These data are presented in Table A-28. Technologies for which treatment performance data are available include AL, AS, AS+Fil, AnFF, AnFFwGAC, BT, RBC, RO, TF, WOx, and WOx+PACT®. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for 2,4-dimethylphenol is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10.794 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for 2,4-dimethyl phenol (0.036 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-28

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 2,4-DIMETHYLPHENOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AL	Pilot	192D		1000-10000		10.000		99.81	WERL
AS	Full	6B		100-1000	7	13.000		98.1	WERL
AS	Pilot	192D		1000-10000		10.000		99.81	WERL
AS	Full	6B		10000-100000	14	10.000		99.97	WERL
AS	Pilot	204A		0-100	8	0.900		99.06	WERL
AS+Fil	Full	6B		1000-10000	3	10.000		99.9	WERL
AnFF	Pilot	235D		1000-10000		0.400		99.99	WERL
AnFFwGAC	Pilot	249D		10000-100000		0.050		99.93	WERL
* BT	Full	1293	10	16216-73537	15	10.000			EAD *
RBC	Pilot	192D		1000-10000		10.000		99.81	WERL
RO	Full	250B		100-1000		16.000		98.4	WERL
TF	Full	1B		0-100	2	25.000		38	WERL
WOx	Bench	Zimpro		8220000	1	100.000		99.99	WAO
WOx+PACT	Pilot	Zimpro	33	530000-780000	3	75.330			WAO
WOx[B]	Bench	236A		>1000000	1	820.000		99.99	WERL

* Data used in developing revised standard.

Dimethyl Phthalate. The data available for dimethyl phthalate were compiled from the EAD and WERL databases and PACT® and WAO data from literature. These data are presented in Table A-29. Technologies for which treatment performance data are available include AS, BT, PACT®, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for dimethyl phthalate is being proposed revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for dimethyl phthalate (0.047 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-29

WASTEWATER TREATMENT PERFORMANCE DATA
FOR DIMETHYL PHTHALATE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AS	Full	1B		100-1000	1	2.000		98.2	WERL
AS	Full	6B		100-1000	16	20.000		92.6	WERL
AS	Pilot	241B		100-1000	10	13.000		97.7	WERL
AS	Pilot	204A		0-100	8	0.800		98.3	WERL
AS	Full	1B		0-100	1	30.000		12	WERL
* BT	Full	948	10	10-625	22	10.000			EAD *
PACT	Bench	Zimpro		332	1	1.000		99.7	WAO
WOx	Full	Zimpro	1	61000	1	0.000			WAO

* Data used in developing revised standard.

Di-n-butyl Phthalate. The data available for di-n-butyl phthalate were compiled from the EAD and WERL databases. These data are presented in Table A-30. Technologies for which treatment performance data are available include AL, AS, CAC, ChOx, BT, and TF. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for di-n-butyl phthalate is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 17.606 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for di-n-butyl phthalate (0.057 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-30

WASTEWATER TREATMENT PERFORMANCE DATA
FOR DI-n-BUTYL PHTHALATE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AL	Bench	371D		100-1000		5.000		99.5	WERL
AL	Pilot	203A		0-100	11	14.000		81	WERL
AL	Pilot	203A		0-100	11	44.000		40	WERL
AS	Pilot	240A		0-100	12	8.000		91.4	WERL
AS	Full	1B		0-100	6	4.000		91.7	WERL
AS	Full	975B		0-100		3.000		87	WERL
AS	Full	1B		0-100	4	5.000		94.4	WERL
AS	Full	201B		0-100	2	3.000		93.5	WERL
AS	Full	1B		0-100	5	5.000		93.8	WERL
AS	Full	1B		0-100	3	10.000		87	WERL
AS	Pilot	204A		0-100	8	2.700		93.9	WERL
AS	Pilot	203A		0-100	11	7.000		90.4	WERL
AS	Full	6B		100-1000	31	13.000		96.8	WERL
AS	Pilot	241B		100-1000	11	17.000		96	WERL
AS	Bench	1050E		100-1000	5	2.400		99.4	WERL
AS	Full	6B		1000-10000	6	30.000		98.7	WERL
CAC	Pilot	203A		0-100	11	47.000		36	WERL
ChOx	Bench	975B		0-100		3.000		87	WERL
* BT	Full	948	10	19-2000	33	13.000			EAD *
TF	Full	1B		0-100	5	6.000		92.6	WERL
TF	Full	1B		0-100	3	20.000		70	WERL
TF	Pilot	203A		0-100	11	52.000		29	WERL
TF	Pilot	240A		0-100	11	16.000		81	WERL

* Data used in developing revised standard.

Di-n-octyl Phthalate. The treatment performance data available for di-n-octyl phthalate were compiled from the NPDES and WERL databases and are presented in Table A-31. Technologies for which treatment performance data are available include AL, AS, BT, ChOx, and PACT®. The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 3 ppb to 47,000 ppb.

The revised BDAT for di-n-octyl phthalate is AS (activated sludge biological treatment). AS was selected as BDAT because it represents full-scale treatment with a high influent concentration and a high removal efficiency. The revised BDAT treatment standard for di-n-octyl phthalate was calculated using the effluent concentration of 3 ppb and the appropriate variability factor and accuracy correction factor. The calculation of the resulting BDAT treatment standard for di-n-octyl phthalate (0.017 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-91

WASTEWATER TREATMENT PERFORMANCE DATA
FOR DI-n-OCTYL PHTHALATE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
		MA0005304			21	9.810			NPDES
		LA0065501			6	10.000			NPDES
		LA0066214			15	10.000			NPDES
		MS0001970			1	110.000			NPDES
		OH0002445			6	5.717			NPDES
		WI0044636			1	47000.000			NPDES
		NY0004138			5	48.000			NPDES
		OH0002445			1	4.000			NPDES
AL	Bench	371D		1000-10000		48.000		97.6	WERL
AS	Full	1B		0-100	2	12.000		79	WERL
AS	Pilot	204A		0-100	5	4.800		83	WERL
* AS	Full	1B		100-1000	1	3.000		98.6	WERL *
BT	Full	LA0036245			38	9.961			NPDES
ChOx	Bench	975B		1000-10000		360.000		80	WERL
PACT	Bench	975B		1000-10000		3.000		99.75	WERL

* Data used in developing revised standard.

Ethylbenzene. The treatment performance data available for ethylbenzene were compiled from the WERL database, BDAT Solvents Rule data, and PACT® and WAO data from literature. These data are presented in Table A-32. Technologies for which treatment performance data are available include AL, AL + AS, AS, API + DAF + AS, AS + Fil, Airs, Airs + GAC, BT, CAC, GAC, PACT®, RO, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies with resulting effluent concentrations ranging from 0.100 ppb to 30,000 ppb.

The revised BDAT for ethylbenzene is BT (biological treatment). BT was selected as BDAT because it represents full-scale data developed from EAD sampling and was used as part of the BDAT Solvents Rule. Furthermore, the effluent concentration achieved by this technology is supported by similar effluent concentrations reported from the WERL activated sludge treatment performance data. The proposed revised BDAT treatment standard for ethylbenzene was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for ethylbenzene (0.057 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-32

WASTEWATER TREATMENT PERFORMANCE DATA
FOR ETHYL BENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	14	12.000		89	WERL
AL	Pilot	203A		100-1000	14	27.000		76	WERL
AL	Full	1B		0-100	4	10.000		89	WERL
AL+AS	Full	233D		1000-10000	21	4.000		99.93	WERL
API+DAF+AS	Full	1482D		10000-100000	4	3.300		99.98	WERL
AS	Bench	200B		100-1000	6	0.700		99.89	WERL
AS	Full	201B		0-100	16	6.000		92.8	WERL
AS	Pilot	206B		0-100	20	0.200		99.76	WERL
AS	Full	6B		100-1000	3	10.000		98.2	WERL
AS	Full	238A		0-100	3	0.500		97.2	WERL
AS	Pilot	240A		0-100	14	1.000		98.4	WERL
AS	Full	6B		100-1000	24	10.000		94.4	WERL
AS	Full	234A		0-100		0.200		99.14	WERL
AS	Full	234A		0-100		0.200		99.22	WERL
AS	Bench	202D		10000-100000		80.000		99.87	WERL
AS	Full	6B		1000-10000	4	10.000		99.47	WERL
AS	Full	975B		1000-10000		8.000		99.6	WERL
AS	Full	1B		0-100	6	9.000		90.7	WERL
AS	Full	975B		100-1000		10.000		96.4	WERL
AS	Full	1B		0-100	4	3.000		89	WERL
AS	Pilot	241B		100-1000	5	5.000		97.6	WERL
AS	Full	1B		0-100	3	5.000		89	WERL
AS	Full	1B		0-100	5	1.000		96.1	WERL
AS	Full	1B		0-100	4	1.000		97.7	WERL
AS	Full	1B		0-100	5	5.000		79	WERL
AS	Full	6B		1000-10000	3	25.000		98.7	WERL
AS	Full	1B		0-100	3	3.000		95.4	WERL
AS	Full	975B		0-100		8.000		87	WERL
AS	Pilot	203A		100-1000	14	6.000		94.6	WERL
AS	Pilot	REF2		23500	6	366.000			BDAT #
AS	Full	1B		100-1000	6	4.000		97.5	WERL
AS	Full	1B		100-1000	3	2.000		99.26	WERL
AS	Full	1B		100-1000	4	1.000		99.17	WERL
AS	Bench	200B		0-100	9	0.500		99.5	WERL
AS	Full	6B		100-1000	7	10.000		97.9	WERL
AS	Full	6B		100-1000	15	10.000		98.9	WERL
AS	Full	6B		100-1000	29	10.000		97.4	WERL
AS	Full	1B		0-100	4	8.000		89	WERL
AS	Full	6B		10000-100000	7	10.000		99.97	WERL
AS	Bench	200B		100-1000	12	0.600		99.5	WERL

EAD Data presented in the BDAT Solvents Rule F001-F005 Background Document.

TABLE A-32 (Continued)

WASTEWATER TREATMENT PERFORMANCE DATA
FOR ETHYL BENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AS+Fil	Full	6B		0-100	15	10.000		90	WERL
AirS	Pilot	224B		0-100	1	0.500		91.9	WERL
AirS	Full	69A		0-100		0.300		94.1	WERL
AirS+GAC	Full	229A		0-100	19	1.000		80	WERL
* BT	Full	P211		12923-80000	7	10.000			BDAT # *
* BT	Full	P234		10-3850	33	10.000			BDAT # *
* BT	Full	P221		10-140	3	10.000			BDAT # *
* BT	Full	P293		2287-3565	2	10.000			BDAT # *
* BT	Full	P238		220-3350	2	10.000			BDAT # *
* BT	Full	P215		564-4150	3	10.000			BDAT # *
* BT	Full	P242		190-553	2	10.000			BDAT # *
* BT	Full	P244		608	1	10.000			BDAT # *
BT	Full	P257		63-3648	27	12.000			BDAT #
* BT	Full	P202		96-596	20	10.000			BDAT # *
* BT	Full	P230		101-3040	15	10.000			BDAT # *
* BT	Full	P299		22-230	16	10.000			BDAT # *
* BT	Full	P251		1235-1360	3	10.000			BDAT # *
* BT	Full	P253		10-144	2	10.000			BDAT # *
CAC	Pilot	203A		100-1000	14	73.000		34	WERL
GAC	Full	1421D		0-100		0.100		97	WERL
PACT	Bench	242E		0-100		5.000		76	WERL
PACT	Bench	Zimpro		185	1	1.000		99.5	WAO
PACT	Bench	200B		0-100	11	0.400		99.57	WERL
PACT	Bench	Zimpro		21	1	5.000		76	WAO
RO	Pilot	180A		0-100		0.020		71	WERL
RO	Pilot	250B		0-100		5.000		92.9	WERL
RO	Full	250B		1000-10000		170.000		97	WERL
SS	Pilot	REF2		23500	5	206.000			BDAT
TF	Pilot	240A		0-100	14	1.000		98.4	WERL
TF	Pilot	203A		100-1000	14	31.000		72	WERL
TF	Full	1B		100-1000	4	11.000		90.8	WERL
TF	Full	1B		0-100	4	4.000		90.9	WERL
UF	Pilot	250B		100-1000		70.000		59	WERL
WOx	Full	Zimpro	50	19000-27000	2	3550.000			WAO
WOx	Full	242E		1000-10000		21.000		99.65	WERL
WOx[B]	Bench	1054E		1000-10000		500.000		94.6	WERL
WOx[B]	Bench	1054E		100000-1000000		30000.000		97	WERL

EAD Data presented in the BDAT Solvents Rule F001-F005 Background Document.
* Data used in developing revised standard.

Fluoranthene. The data available for fluoranthene were compiled from the EAD and WERL databases. These data are presented in Table A-33. Technologies for which treatment performance data are available include AL, AS, AS+Fil, CAC, ChOx, BT, PACT®, RO, and TF. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for fluoranthene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 11.533 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for fluoranthene (0.068 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-33

WASTEWATER TREATMENT PERFORMANCE DATA
FOR FLUORANTHENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	11	36.000		65	WERL
AL	Pilot	203A		100-1000	11	23.000		78	WERL
AS	Full	375E		0-100	7	0.041		96.1	WERL
AS	Full	375E		0-100	7	0.048		93.3	WERL
AS	Pilot	204A		0-100	8	1.900		93.9	WERL
AS	Full	375E		0-100	7	0.038		94.1	WERL
AS	Full	6B		1000-10000	14	12.000		99.25	WERL
AS	Pilot	240A		0-100	12	8.000		91.8	WERL
AS	Full	375E		0-100	7	0.029		96.8	WERL
AS	Pilot	203A		100-1000	11	5.000		95.2	WERL
AS+Fil	Full	6B		1000-10000	3	16.000		99.69	WERL
CAC	Pilot	195B		1000-10000	8	170.000		93.7	WERL
CAC	Pilot	203A		100-1000	11	13.000		88	WERL
ChOx(Cl)	Full	1081D		0-100		0.045		44	WERL
Fil	Pilot	195B		100-1000	8	110.000		35	WERL
Fil	Pilot	577E		0-100		0.001		99.92	WERL
Fil	Full	1081D		0-100		0.081		42	WERL
Fil	Full	792E		1000-10000	4	8.000		99.56	WERL
* BT	Full	1293	10	966-2141	15	11.500			EAD *
PACT	Bench	975B		0-100		3.000		77	WERL
RO	Pilot	1634E		0-100		0.007		88	WERL
TF	Pilot	203A		100-1000	11	49.000		53	WERL
TF	Full	375E		0-100	7	0.029		97.1	WERL
TF	Full	375E		0-100	7	0.044		96.3	WERL
TF	Full	1B		0-100	4	12.000		69	WERL
TF	Pilot	240A		0-100	11	14.000		85	WERL

* [illegible]sed in developing revised standard.

Fluorene. The data available for fluorene were compiled from the EAD and WERL databases. These data are presented in Table A-34. Technologies for which treatment performance data are available include AL, AS, BT, and TF and the treatment performance data represent pilot- and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for fluorene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for fluorene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-34

WASTEWATER TREATMENT PERFORMANCE DATA
FOR FLUORENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AL	Full	6B		100-1000	3	10.000		94.1	WERL
AS	Full	6B		1000-10000	13	10.000		99.17	WERL
AS	Pilot	204A		0-100	8	0.700		96.2	WERL
* BT	Full	1293	10	678-1873	15	10.000			EAD *
TF	Full	1B		0-100	4	20.000		54	WERL

* Data used in developing revised standard.

Hexachlorobenzene. The treatment performance data available for hexachlorobenzene were compiled from the WERL database. These data are presented in Table A-35. Technologies for which treatment performance data are available include AS, AS+Fil, and GAC. The treatment performance data represent full-scale studies. The resulting effluent concentrations ranged from 0.01 ppb to 20 ppb.

The revised BDAT for hexachlorobenzene is AS+Fil (activated sludge followed by filtration). AS+Fil was selected as BDAT because it represents full-scale data with a high influent concentration and a high removal efficiency. The proposed revised BDAT treatment standard for hexachlorobenzene was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for hexachlorobenzene (0.055 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-35

WASTEWATER TREATMENT PERFORMANCE DATA
FOR HEXACHLOROBENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AS	Full	375E		0-100	7	0.010		83	WERL
AS	Full	375E		0-100	7	0.010		94.4	WERL
* AS+FII	Full	6B		100-1000	14	10.000		96.7	WERL *
GAC	Full	237A		0-100	1	20.000		38	WERL

* Data used in developing revised standard.

Hexachlorobutadiene. The treatment performance data available for hexachlorobutadiene were compiled from the WERL database. These data are presented in Table A-36. Technologies for which treatment performance data are available include AS, AS+Fil, and GAC. The treatment performance data represent pilot-scale and full-scale studies. The resulting effluent concentrations ranged from 10 ppb to 20 ppb.

The revised BDAT for hexachlorobutadiene is AS+Fil (activated sludge followed by filtration). AS+Fil was selected as BDAT because it represents full-scale data with a high influent concentration and a high removal efficiency. The revised BDAT treatment standard for hexachlorobutadiene was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for hexachlorobutadiene (0.055 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-36

WASTEWATER TREATMENT PERFORMANCE DATA
FOR HEXACHLOROBUTADIENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AS	Pilot	241B		100-1000	11	15.000		96.2	WERL
* AS+Fil	Full	6B		100-1000	2	10.000		92.8	WERL *
* AS+Fil	Full	6B		1000-10000	14	10.000		99.6	WERL *
GAC	Full	237A		100-1000	1	20.000		82	WERL

* Data used in developing revised standard.

Hexachlorocyclopentadiene. The treatment performance data available for hexachlorocyclopentadiene were compiled from the NPDES database and WAO data from literature. These data are presented in Table A-37. Technologies for which treatment performance data are available include bench-scale and full-scale studies. The effluent concentrations of all the data documented ranged from 0.2 ppb to 15,000 ppb.

The revised BDAT for hexachlorocyclopentadiene is BT (biological treatment). BT was selected as BDAT because it represents full-scale treatment performance. The proposed revised BDAT treatment standard for hexachlorocyclopentadiene was calculated using the effluent concentration of 10.263 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for hexachlorocyclopentadiene (0.057 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-37

WASTEWATER TREATMENT PERFORMANCE DATA
FOR HEXACHLOROCYCLOPENTADIENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
		LA0065501			6	10.000			NPDES
		MI0025739			1	0.200			NPDES
		LA0066214			15	10.000			NPDES
		NY0107174			24	1.000			NPDES
* BT	Full	LA0038245			38	10.263			NPDES *
WOx	Bench	Zimpro		>10000000	1	15000.000		99.9	WAO

* Data used in developing revised standard.

Hexachloroethane. The treatment performance data available for hexachloroethane were compiled from the WERL database. These data are presented in Table A-38. Technologies for which treatment performance data are available include AS and AS+Fil. Data are available from pilot and full-scale studies. The resulting effluent concentration for both studies was 10 ppb.

The revised BDAT for hexachloroethane is AS+FiL (activated sludge followed by filtration). AS+Fil was selected as BDAT because it represents full-scale treatment performance with a high removal efficiency. The proposed revised BDAT treatment standard for hexachloroethane was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for hexachloroethane (0.055 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-38

WASTEWATER TREATMENT PERFORMANCE DATA
FOR HEXACHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AS	Pilot	241B		100-1000	11	10.000		97.1	WERL
* AS+Fil	Full	6B		100-1000	14	10.000		93.8	WERL *

* Data used in developing revised standard.

Indeno(1,2,3-cd)pyrene. The treatment performance data available for indeno(1,2,3-cd)pyrene were compiled from the NPDES and WERL databases. These data are presented in Table A-39. Technologies for which treatment performance data are available include AS, BT, chlorination, and TF. All of the treatment performance data represent full-scale studies. The resulting effluent concentrations ranged from 0.009 ppb to 28 ppb.

The revised BDAT for indeno(1,2,3-cd)pyrene is AS (activated sludge - biological treatment). AS was selected as BDAT because it represents full-scale treatment performance with a high removal efficiency. The revised BDAT treatment standard for indeno(1,2,3-cd)pyrene was calculated using an effluent concentration of 1 ppb (which represents the detection limit for indeno(1,2,3-cd)pyrene) and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for indeno(1,3,3-cd)pyrene (0.0055 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-39

WASTEWATER TREATMENT PERFORMANCE DATA
FOR INDENO(1,2,3-cd)PYRENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
		LA0065501			6	10.000			NPDES
		LA0066214			15	28.000			NPDES
* AS	Full	375E		0-100	7	0.013		92.6	WERL *
* AS	Full	375E		0-100	7	0.011		97	WERL *
* AS	Full	375E		0-100	7	0.017		84	WERL *
* AS	Full	375E		0-100	7	0.015		86	WERL *
BT	Full	LA0036245			38	10.097			NPDES
ChOx(Cl)	Full	1061D		0-100		0.009		67	WERL
FII	Full	1061D		0-100		0.027		59	WERL
TF	Full	375E		0-100	7	0.012		92.5	WERL
TF	Full	375E		0-100	7	0.019		89	WERL

* Data used in developing revised standard.

Naphthalene. The data available for naphthalene were compiled from the EAD and WERL databases as well as WAO data from literature. These data are presented in Table A-40. Technologies for which treatment performance data are available include AL, AS, AirS, CAC, ChOx, BT, PACT®, RBC, RO, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for naphthalene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for naphthalene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-40

WASTEWATER TREATMENT PERFORMANCE DATA
FOR NAPHTHALENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVER (%)	REMOVAL (%)	REFERENCE
AL	Pilot	192D		0-100		10.000		82	WERL
AL	Bench	371D		100-1000		23.000		97.7	WERL
AL	Pilot	192D		100-1000		25.000		96.5	WERL
AL	Pilot	203A		100-1000	11	13.000		88	WERL
AL	Pilot	203A		100-1000	11	36.000		67	WERL
AL+AL	Full	233D		100-1000	21	18.000		98.3	WERL
AS	Full	201B		0-100	11	5.000		89	WERL
AS	Full	6B		100-1000	2	14.000		95.9	WERL
AS	Bench	1050E		100-1000	5	2.000		99.5	WERL
AS	Pilot	241B		100-1000	11	8.900		97.9	WERL
AS	Pilot	241B		100-1000	5	10.000		93	WERL
AS	Full	975B		100-1000		1.000		99.17	WERL
AS	Pilot	204A		0-100	8	0.700		99.09	WERL
AS	Bench	202D		1000-10000		10.000		99.86	WERL
AS	Pilot	203A		100-1000	11	4.000		96.3	WERL
AS	Pilot	240A		100-1000	12	6.000		95	WERL
AS	Full	1B		0-100	5	9.000		86	WERL
AS	Full	1B		100-1000	5	10.000		95.4	WERL
AS	Full	6B		10000-100000	14	10.000		99.95	WERL
AS	Full	6B		100-1000	13	10.000		99	WERL
AS	Pilot	192D		0-100		10.000		82	WERL
AS	Full	1B		0-100	4	3.000		91.9	WERL
AS	Full	6B		1000-10000	7	10.000		99.56	WERL
AS	Full	6B		100-1000	3	10.000		96	WERL
AS	Pilot	192D		100-1000		25.000		96.5	WERL
AS	Bench	1328E		10000-100000	5	6200.000		74	WERL
CAC	Pilot	203A		100-1000	11	79.000		27	WERL
ChOx	Bench	975B		0-100		2.000		88	WERL
* BT	Full	1293	10	11227-37145	15	10.000			EAD *
PACT	Bench	Zimpro		191	1	1.000		99.9	WAO
RBC	Pilot	192D		0-100		10.000		82	WERL
RO	Pilot	180A		0-100		0.020		80	WERL
TF	Pilot	240A		100-1000	11	14.000		88	WERL
TF	Full	1B		0-100	6	3.000		89	WERL
TF	Pilot	203A		100-1000	11	74.000		32	WERL
WOx	Full	Zimpro	6	1200	1	210.000			WAO

* Data used in developing revised standard.

Phenanthrene. The data available for phenanthrene were compiled from the EAD and WERL databases. These data are presented in Table A-41. Technologies for which treatment performance data are available include AL, AS, AS+Fil, CAC, BT, PACT®, and TF. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for phenanthrene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for phenanthrene (0.059 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-41

WASTEWATER TREATMENT PERFORMANCE DATA
FOR PHENANTHRENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	6B		100-1000	5	10.000		92.9	WERL
AL	Pilot	203A		0-100	11	40.000		58	WERL
AL	Pilot	203A		0-100	11	16.000		83	WERL
AL	Bench	371D		100-1000		15.000		96.5	WERL
AS	Pilot	204A		0-100	8	1.100		97.2	WERL
AS	Pilot	240A		0-100	12	6.000		93	WERL
AS	Full	6B		1000-10000	14	10.000		99.7	WERL
AS	Pilot	203A		0-100	11	4.000		95.8	WERL
AS	Full	1B		0-100	4	13.000		82	WERL
AS	Bench	202D		100-1000		10.000		96.2	WERL
AS	Bench	1050E		100-1000	5	2.000		99.5	WERL
AS+Fil	Full	6B		1000-10000	3	17.000		99.8	WERL
CAC	Pilot	203A		0-100	11	24.000		75	WERL
Fil	Full	792E		0-100	4	10.000		85	WERL
* BT	Full	1293	10	2035-4711	15	10.000			EAD *
PACT	Full	6B		100-1000	10	25.000		95.9	WERL
TF	Pilot	240A		0-100	10	9.000		90	WERL
TF	Pilot	203A		0-100	11	51.000		46	WERL
TF	Full	1B		100-1000	6	17.000		91.5	WERL

* Data used in developing revised standard.

Phenol. Treatment performance data for phenol were compiled from the EAD, BDAT, and WERL databases as well as WAO data from literature. These data are presented in Table A-42A. In addition, leachate treatment performance data was submitted by industry and are presented in Table A-42B. Technologies for which treatment performance data are available include AL, API+DAF+AS, AS, ChOx, GAC, BT, LL, LL+SS, LL+SS+AC, PACT®, RBC, RO, SBR, SS, TF, WOx, AS+Fil, and Anff. The treatment performance data represent bench-, pilot-, and full-scale studies.

The revised BDAT for phenol is BT (biological treatment). BT was selected as BDAT because it resulted in substantial treatment of phenol. The revised BDAT treatment standard for phenol was calculated using the effluent concentration of 10 ppb and the appropriate variability factor and accuracy correction factor. The calculation of the resulting BDAT treatment standard for phenol (0.039 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-42A

WASTEWATER TREATMENT PERFORMANCE DATA
FOR PHENOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Pilot	203A		100-1000	11	84.000		33	WERL
AL	Pilot	203A		100-1000	11	18.000		86	WERL
AL	Full	6B		100-1000	3	11.000		90.8	WERL
AL	Pilot	192D		100-1000		10.000		96.99	WERL
API+DAF+AS	Full	1482D		100-1000	4	65.000		89.5	WERL
AS	Full	1B		100-1000	5	2.000		98.6	WERL
AS	Full	1B		0-100	6	26.000		63	WERL
AS	Bench	202D		100000-1000000		0.010		99.99	WERL
AS	Full	6B		100-1000	39	10.000		96.4	WERL
AS	Full	1B		100-1000	5	8.000		97.2	WERL
AS	Pilot	203A		100-1000	11	14.000		89	WERL
AS	Full	201B		100-1000	31	20.000		92.6	WERL
AS	Full	1B		100-1000	6	1.000		99.89	WERL
AS	Full	6B		10000-100000	3	10.000		99.94	WERL
AS	Full	1B		100-1000	6	61.000		92.4	WERL
AS	Full	1B		0-100	3	1.000		96.4	WERL
AS	Full	975B		1000-10000		6.600		99.87	WERL
AS	Full	1B		100-1000	5	1.000		99.33	WERL
AS	Bench	1054E		100000-1000000		0.250		99.88	WERL
AS	Pilot	240A		0-100	11	10.000		90	WERL
AS	Full	6B		100-1000	7	15.000		98	WERL
AS	Full	1122E		10000-100000		4000.000		95.2	WERL
AS	Full	6B		100-1000	3	120.000		97.9	WERL
AS	Pilot	241B		100-1000	4	8.000		97.2	WERL
AS	Full	6B		1000-10000	10	21.000		99.64	WERL
AS	Full	975B		100-1000		20.000		87	WERL
AS	Full	6B		100-1000	11	10.000		96.3	WERL
AS	Full	1B		100-1000	6	1.000		99.44	WERL
AS	Full	1B		0-100	6	1.000		96.3	WERL
AS	Full	6B		100-1000	3	10.000		96.6	WERL
AS	Pilot	226B		100000-1000000	6	500.000		99.95	WERL
AS	Full	975B		1000-10000		160.000		95	WERL
AS	Full	6B		100000-1000000	2	10.000		99.99	WERL
AS	Pilot	204A		100-1000	8	14.000		94.6	WERL
AS	Pilot	192D		100-1000		10.000		96.99	WERL
AS	Full	6B		1000-10000	4	56.000		96.9	WERL
AS	Bench	1054E		10000-100000		1000.000		95	WERL
AS	Full	6B		100000-1000000	13	10.000		99.99	WERL
AS	Full	1B		100-1000	6	25.000		94.4	WERL
AS+Fil	Full	6B		10000-100000	3	13.000		99.96	WERL
AS+Fil	Full	6B		100-1000	15	10.000		98	WERL

TABLE A-42A (Continued)

WASTEWATER TREATMENT PERFORMANCE DATA
FOR PHENOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AnFF	Pilot	231A		1000000		700.000		99.98	WERL
AnFF	Pilot	231A		1000000		30.000		99.99	WERL
AnFF	Bench	230A		100000-1000000		10.000		99.97	WERL
AnFF	Pilot	231A		100000-1000000		10.000		99.99	WERL
AnFF	Pilot	231A		100000-1000000		70.000		99.98	WERL
AnFF	Bench	230A		>1000000		1000.000		99.95	WERL
AnFF	Pilot	235D		100000-1000000		240.000		99.86	WERL
AnFFwGAC	Pilot	249D		1000000		60.000		99.99	WERL
CAC	Pilot	203A		100-1000	11	99.000		21	WERL
ChOx	Bench	975B		100-1000		16.000		93.3	WERL
ChOx	Bench	975B		100-1000		2.000		98.3	WERL
ChOx	Bench	975B		1000-10000		12.000		99.37	WERL
GAC	Bench	1054E		100-1000		10.000		99	WERL
GAC	Full	245B		100-1000	1	10.000		92.6	WERL
GAC	Full	237A		1000-10000	1	5.000		99.89	WERL
* BT	Full	1293	10	698564-978672	15	10.000			EAD *
LL	Full	K104	30	150000-300000	5	165000.000	21		BDAT
LL	Full	K103	30	1500000-3000000	5	84000.000	21		BDAT
LL+SS	Full	K103/K104	30	150000-3000000	5	2400.000	21		BDAT
LL+SS+AC	Full	K103/K104	30	150000-3000000	4	60.000	21		BDAT
PACT	Bench	190E		10000-100000		1.800		99.99	WERL
PACT	Bench	975B		1000-10000		2.000		99.96	WERL
PACT	Full	6B		1000-10000	3	30.000		98.6	WERL
PACT	Bench	975B		1000-10000		8.000		99.85	WERL
RBC	Pilot	603E		100000-1000000		1700.000		99.6	WERL
RBC	Pilot	192D		100-1000		10.000		98.99	WERL
RO	Full	250B		1000-10000		120.000		93.6	WERL
SBR	Pilot	1433D		10000-100000	16	1000.000		97.7	WERL
SBR	Pilot	227D		100000-1000000	1	1000.000		99.81	WERL
SBR	Bench	64D		100000-1000000		3000.000		99.63	WERL
SBRwPACT	Bench	64D		100000-1000000		1000.000		99.88	WERL
SExt	Pilot	1082E		>1000000		210000.000		95.4	WERL
SS	Pilot	1082E		100000-1000000		180.000		24	WERL
TF	Pilot	203A		100-1000	11	64.000		49	WERL
TF	Full	1B		100-1000	6	47.000		82	WERL
TF	Pilot	240A		0-100	10	8.000		91.3	WERL
TF	Full	1B		0-100	6	1.000		98.2	WERL
WOx	Bench	Zimpro		10000000	1	20000.000		99.8	WAO
WOx [B]	Bench	1054E		100000-1000000		27000.000		97.3	WERL
WOx [B]	Bench	1101D		>1000000		3600.000		99.92	WERL
WOx [B]	Bench	236A		>1000000	1	3000.000		99.97	WERL

* Data used in developing revised standard.

TABLE A-42B

INDUSTRY-SUBMITTED LEACHATE TREATMENT PERFORMANCE DATA FOR PHENOL

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT		DOW	10	715-2500	3	10.000		99.32	LEACHATE

Phthalic Anhydride. No wastewater treatment performance data are available for phthalic anhydride from any of the examined sources. However, leachate treatment performance data representing biological treatment were submitted by industry and are presented in Table A-43.

The revised BDAT for phthalic anhydride is BT (biological treatment). BT was selected because it showed substantial treatment of phthalic anhydride and showed average leachate effluent values greater than that of PACT®. The revised BDAT treatment standard for phthalic anhydride was calculated using the effluent concentration of 15 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for phthalic anhydride (0.069 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-43

INDUSTRY-SUBMITTED LEACHATE TREATMENT PERFORMANCE DATA FOR PHTHALIC ANHYDRIDE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT	Bench	CWM		~26633	3	15.000		99.94	LEACHATE

Pyrene. The data available for pyrene were compiled from the EAD and WERL databases as well as WAO data from literature. These data are presented in Table A-44. Technologies for which treatment performance data are available include AL, AS, AS+Fil, CAC, ChOx, GAC, BT, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for pyrene is being revised to BT (biological treatment). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 11.33 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for pyrene (0.067 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-44

WASTEWATER TREATMENT PERFORMANCE DATA
FOR PYRENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Bench	371D		100-1000	11	15.000		97	WERL
AL	Pilot	203A		100-1000	11	36.000		65	WERL
AL	Pilot	203A		100-1000	11	25.000		76	WERL
AS	Pilot	203A		100-1000	11	5.000		95.2	WERL
AS	Full	1B		0-100	1	5.000		80	WERL
AS	Pilot	204A		0-100	8	2.000		93.3	WERL
AS	Pilot	204A		0-100	12	10.000		90	WERL
AS	Full	6B		100-1000	14	10.000		99	WERL
AS+Fil	Full	6B		1000-10000	3	16.000		99.48	WERL
CAC	Pilot	195B		1000-10000	8	110.000		94.5	WERL
CAC	Pilot	203A		100-1000	11	12.000		88	WERL
ChOx(Cl)	Full	1061D		0-100		0.018		80	WERL
Fil	Pilot	195B		100-1000	8	80.000		27	WERL
Fil	Pilot	577E		0-100		0.001		99.96	WERL
Fil	Full	1061D		0-100		0.045		40	WERL
Fil	Full	792E		1000-10000	4	6.000		99.5	WERL
GAC	Pilot	195D		0-100	6	10.000		79	WERL
* BT	Full	1293	10	641-1436	15	10.300			EAD *
TF	Pilot	203A		100-1000	11	46.000		54	WERL
TF	Pilot	240A		0-100	10	17.000		83	WERL
WOx	Bench	Zimpro		500000	1	260.000		99.95	WAO

* Data used in devloping revised standard.

1,2,4,5-Tetrachlorobenzene. The treatment performance data available for 1,2,4,5-tetrachlorobenzene were compiled from the NPDES database and are presented in Table A-45. Influent values were not available for the NPDES data and the NPDES average effluent value was below the compound detection limit of 1.5 ppb. Therefore, it cannot be determined if this data represents treatment.

Treatment performance data were therefore transferred to this constituent from the constituent judged to be most similar in elemental composition and functional groups within the structure of the chemical. The constituent judged to be most similar to 1,2,4,5-tetrachlorobenzene (and used to transfer treatment performance data) was hexachlorobenzene. The treatment performance data for hexachlorobenzene is presented in Table A-36. The resulting BDAT for 1,2,4,5-tetrachlorobenzene is AS+Fil (activated sludge followed by filtration) and the BDAT treatment standard is 0.055 ppm as described in Section 6.0 and shown in Table 6-1.

TABLE A-45

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,2,4,5-TETRACHLOROBENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
		MI0000868			9	1.111			NPDES

1,1,1,2-Tetrachloroethane. The treatment performance data available for 1,1,1,2-tetrachloroethane were compiled from WAO data from literature and are presented in Table A-46. The technology for which data were available was bench-scale PACT®.

The revised BDAT for 1,1,1,2-Tetrachloroethane is PACT® (powdered activated carbon treatment). PACT® was selected as BDAT because it represents data with a high removal efficiency and the lowest achievable effluent. The revised BDAT treatment standard for 1,1,1,2-tetrachloroethane was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for 1,1,1,2-tetrachloroethane (0.057 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-46

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,1,1,2-TETRACHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
* PACT	Bench	Zimpro		36	1	10.000		72	WAO *

* Data used in developing proposed revised standard.

1,1,2,2-Tetrachloroethane. The treatment performance data available for 1,1,2,2-tetrachloroethane were compiled from the WERL and NPDES databases and are presented in Table A-47. Technologies for which treatment performance data are available include AS, AirS, BT, and GAC. The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 0.0005 ppb to 11,000 ppb.

The revised BDAT for 1,1,2,2-tetrachloroethane is GAC (granular activated carbon). GAC was selected as BDAT because of its full-scale treatment performance with high influent concentrations and a high removal efficiency. The revised BDAT treatment standard for 1,1,2,2-tetrachloroethane was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for 1,1,2,2-tetrachloroethane (0.057 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-47

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,1,2,2-TETRACHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
		NY0007048			9	1.560			NPDES
		NJ0028291			2	1.000			NPDES
		LA0066435			13	7.570			NPDES
		LA0066214			15	5.000			NPDES
		LA0065501			6	5.000			NPDES
		NJ0030392			4	0.005			NPDES
AS	Bench	202D		100000-1000000		11000.000		94.5	WERL
AS	Full	1B		0-100	2	3.000		93.5	WERL
AirS	Pilot	1363E		100-1000		4.600		99	WERL
AirS	Pilot	71D		100-1000	1	41.000		95.5	WERL
BT	Full	LA0038245			38	5.313			NPDES
* GAC	Full	245B		1000-10000	1	10.000		99.1	WERL *

* Data used in developing revised standard.

Tetrachloroethene. The data available for tetrachloroethylene were compiled from the EAD and WERL databases, BDAT Solvents Rule data, and PACT® data from literature. These data are presented in Table A-48. Technologies for which treatment performance data are available include AL, AS, AS+Fil, Airs, AnFF, BT, CAC+AirS, ChOX, Chred, GAC, PACT®, RO, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for tetrachloroethene is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10.4 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for tetrachloroethylene (0.056 ppm) is described in Section 6.0 and is shown in Table 6-1.

TABLE A-48

WASTEWATER TREATMENT PERFORMANCE DATA
FOR TETRACHLOROETHYLENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	1B		0-100	6	10.000		90	WERL
AS	Full	1B		0-100	3	10.000		83	WERL
AS	Full	1B		0-100	5	2.000		97.5	WERL
AS	Full	1B		0-100	4	8.000		85	WERL
AS	Full	238A		0-100	3	2.100		87	WERL
AS	Full	1587E		0-100		0.870		97.8	WERL
AS	Full	234A		0-100		22.000		49	WERL
AS	Full	238A		0-100	3	1.600		87	WERL
AS	Full	1B		0-100	4	1.000		96	WERL
AS	Full	234A		100-1000		3.900		96.7	WERL
AS	Full	1B		0-100	5	8.000		75	WERL
AS	Full	1B		100-1000	5	5.000		96.7	WERL
AS	Full	1B		0-100	3	22.000		45	WERL
AS	Full	1B		0-100	6	28.000		71	WERL
AS	Pilot	241B		100-1000	5	11.000		95.3	WERL
AS	Full	1B		1000-10000	6	440.000		85	WERL
AS	Full	201B		0-100	22	6.000		89.5	WERL
AS	Full	1B		0-100	4	6.000		93	WERL
AS	Full	1B		100-1000	6	48.000		79	WERL
AS	Full	1B		100-1000	6	26.000		78	WERL
AS	Full	234A		0-100		0.600		95.9	WERL
AS	Full	1B		0-100	6	8.000		85	WERL
AS	Full	1B		0-100	5	14.000		74	WERL
AS	Full	1B		100-1000	4	100.000		83	WERL
AS+Fil	Full	6B		10000-100000	3	230.000		99.04	WERL
[illegible]	Full	6B		100-1000	15	11.000		97.7	WERL
[illegible]	Pilot	221B		0-100	1	0.500		95.8	WERL
AirS	Pilot	71D		0-100	1	0.200		98.7	WERL
AirS	Full	223B		100-1000	1	0.800		99.43	WERL
AirS	Pilot	222B		0-100	1	0.200		94.3	WERL
AirS	Pilot	217B		100-1000	1	0.300		99.73	WERL
AirS	Pilot	207B		0-100	1	0.500		98.3	WERL
AirS	Full	69A		0-100		0.960		96.4	WERL
AirS	Pilot	220B		0-100	1	0.200		99.76	WERL
AirS	Pilot	208B		0-100	1	0.200		99.17	WERL
AirS	Pilot	1363E		0-100		0.200		97.1	WERL
AirS	Pilot	214B		100-1000	1	0.900		99.31	WERL
AirS	Full	1042E		100-1000		0.500		99.71	WERL
AirS	Full	322B		100-1000	9	1.200		99.75	WERL
AirS	Pilot	1362E		1000-10000	3	5.000		99.74	WERL
AnFF	Bench	724D		10000-100000		4.400		99.99	WERL

TABLE A-48 (Continued)

WASTEWATER TREATMENT PERFORMANCE DATA
FOR TETRACHLOROETHYLENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT	Full	P225		95-31500	18	47.000			BDAT 1
BT	Full	P280		110-1748	12	10.000			BDAT 1
BT	Full	REF4		82	1	7.300			BDAT 1
CAC+AirS	Full	1833D		0-100	7	0.100		89	WERL
ChOx	Pilot	2026A		0-100	4	2.000		86	WERL
ChOx	Pilot	2026A		0-100	4	1.700		84	WERL
Chred	Bench			250	1	5.000			ART
GAC	Full	1264B		0-100		1.000		95.2	WERL
GAC	Full	245B		1000-10000	1	10.000		99.13	WERL
GAC	Full	237A		100-1000	1	10.000		96.3	WERL
PACT	Bench	242E		100-1000		10.000		92.6	WERL
PACT	Bench	Zimpro		304		1.000		99.7	WAO
PACT	Bench	Zimpro		136	1	10.000		93	WAO
RO	Pilot	323B		0-100	1	30.000		68	WERL
RO	Pilot	180A		0-100		0.250		81	WERL
* SS	Full	913	10	10800-241000	14	18.400			EAD *
SS	Full	251B		1000-10000	10	10.000		99.29	WERL
SS	Full	6B		10000-100000	2	10.000		99.95	WERL
TF	Full	1B		0-100	5	12.000		81	WERL
TF	Full	1B		100-1000	5	26.000		83	WERL
TF	Full	1B		0-100	3	16.000		54	WERL
TF	Full	1B		0-100	4	1.000		96.9	WERL
TF	Full	1B		0-100	6	6.000		92.7	WERL
TF	Full	1B		0-100	5	3.000		94.3	WERL
UV [B]	Bench	1136E		0-100	1	7.500		85	WERL
WOx		REF10		41000	1	1000.000			BDAT
WOx	Pilot	78D		1000000		900.000		99.98	WERL

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.
* Data used in developing revised standard.

Toluene. The data available for toluene were compiled from the EAD and WERL databases, BDAT Solvents Rule data, WAO and PACT® data from literature, and EPA WAO test data. These data are presented in Table A-49. Technologies for which treatment performance data are available include AL, AL+AS, API+DAF+AS, AS, AS+Fil, AirS, AirS+GAC, BT, BT+AC, GAC, PACT®, RO, SS, SS+AC, TF, WOx+PACT®, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for toluene is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for toluene (0.080 ppm) is described in Section 6.0 and is shown in Table 6-1.

Table A-49

WASTEWATER TREATMENT PERFORMANCE DATA FOR TOLUENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	6B		100-1000	3	10.000		96.2	WERL
AL	Bench	371D		1000-10000		90.000		97	WERL
AL	Full	1B		100-1000	6	32.000		96.1	WERL
AL+AS	Full	233D		1000-10000	21	4.000		99.85	WERL
API+DAF+AS	Full	1482D		10000-100000	4	11.000		99.93	WERL
AS	Bench	202D		10000-100000		10.000		99.96	WERL
AS	Full	6B		10000-100000	3	73.000		99.84	WERL
AS	Full	6B		1000-10000	3	10.000		99.57	WERL
AS	Full	975B		1000-10000		12.000		99.66	WERL
AS	Full	6B		10000-100000	3	76.000		99.90	WERL
AS	Bench	200B		100-1000	10	0.800		99.3	WERL
AS	Full	6B		1000-10000	24	10.000		99.73	WERL
AS	Full	1B		1000-10000	6	9.000		99.81	WERL
AS	Full	6B		1000-10000	15	10.000		99.86	WERL
AS	Full	6B		1000-10000	3	24.000		99.76	WERL
AS	Full	975B		1000-10000		280.000		96.3	WERL
AS	Full	6B		1000-10000	7	10.000		99.5	WERL
AS	Full	975B		100-1000		23.000		86	WERL
AS	Full	6B		1000-10000	33	20.000		99.8	WERL
AS	Pilot	226B		100000-1000000	7	300.000		99.85	WERL
AS	Full	6B		100-1000	14	10.000		97.8	WERL
AS	Full	6B		100-1000	4	10.000		97.6	WERL
AS	Full	1B		0-100	5	4.000		88	WERL
AS	Full	975B		100-1000		7.600		99.04	WERL
AS	Full	1B		100-1000	6	4.000		99.46	WERL
AS	Full	234A		0-100		0.700		97.1	WERL
AS	Full	1B		0-100	4	3.000		90.6	WERL
AS	Full	1587E		0-100		0.100		99	WERL
AS	Full	201B		100-1000	32	57.000		87	WERL
AS	Full	1B		100-1000	5	12.000		96.8	WERL
AS	Full	1B		0-100	4	1.000		98	WERL
AS	Full	234A		0-100		0.200		96.2	WERL
AS	Full	1B		100-1000	4	4.000		96.4	WERL
AS	Full	1B		0-100	5	2.000		97.6	WERL
AS	Full	238A		0-100	3	6.200		92.7	WERL
AS	Full	6B		100-1000	3	10.000		94.4	WERL
AS	Full	1B		0-100	5	2.000		97.1	WERL
AS	Full	1B		0-100	4	4.000		86	WERL
AS	Pilot	241B		100-1000	5	4.000		96.6	WERL

Table A-49 Continued

WASTEWATER TREATMENT PERFORMANCE DATA
FOR TOLUENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	234A		0-100		0.200		98.9	WERL
AS	Full	1B		0-100	5	3.000		94	WERL
AS	Full	1B		100-1000	6	20.000		89	WERL
AS	Full	1B		0-100	6	1.000		97.3	WERL
AS	Full	1B		0-100	5	1.000		97.4	WERL
AS	Full	234A		0-100		0.200		97.7	WERL
AS	Full	1B		0-100	6	2.000		96.3	WERL
AS	Full	1B		100-1000	5	56.000		93.6	WERL
AS	Pilot	206B		100-1000	20	0.600		99.76	WERL
AS	Full	1B		100-1000	6	10.000		96.4	WERL
AS	Full	234A		100-1000		0.200		99.9	WERL
AS	Full	1B		100-1000	6	31.000		95.4	WERL
AS	Pilot	REF2		92000	6	23467.000			BDAT #
AS + Fil	Full	6B		10000-100000	3	10.000		99.96	WERL
AirS	Full	322B		100-1000	24	0.660		99.77	WERL
AirS	Pilot	1362E		0-100	3	1.700		95.3	WERL
AirS	Bench	1328E		10000-100000	5	2800.000		92.4	WERL
AirS	Full	69A		0-100		0.940		97	WERL
AirS	Full	322B		0-100	5	2.000		97.4	WERL
AirS	Pilot	224B		0-100	1	0.500		98.9	WERL
AirS	Full	322B		1000-10000	6	34.000		99.18	WERL
AirS	Full	322B		10000-100000	3	114.000		99.33	WERL
AirS+GAC	Full	229A		0-100	19	1.000		90	WERL
[illegible]	Full	P206		834-57475	10	1491.000			BDAT #
[illegible]	Full	P211		1154-4000	7	10.000			BDAT #
[illegible]	Full	P202		60-155	20	10.000			BDAT #
BT	Full	P244		1109	1	10.000			BDAT #
BT	Full	P210		135-5805	2	10.000			BDAT #
BT	Full	P223		99-265	3	10.000			BDAT #
BT	Full	P217		34400-60000	3	73.000			BDAT #
BT	Full	P234		2350-35000	32	21.000			BDAT #
BT	Full	P242		1200-1533	2	10.000			BDAT #
BT	Full	P221		10-323	3	10.000			BDAT #
BT	Full	P208		140-640	14	10.000			BDAT #
BT	Full	P240		22700	1	10.000			BDAT #
BT	Full	P246		77-12938	9	630.000			BDAT #
BT	Full	P251		15840-26060	3	10.000			BDAT #
BT	Full	P253		66-230	3	103.000			BDAT #
BT	Full	P257		1730-12900	27	12.000			BDAT #
BT	Full	P265		37750-50000	3	10.000			BDAT #

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.

Table A-49 Continued

WASTEWATER TREATMENT PERFORMANCE DATA FOR TOLUENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
BT	Full	P286		24000-160000	3	76.000			BDAT #
BT	Full	P215		3300-4550	3	10.000			BDAT #
BT	Full	P230		3503-30347	15	10.000			BDAT #
BT	Full	REF4		680	1	4.000			BDAT #
BT+AC	Full	P246		77-12938	10	113.000			BDAT #
GAC	Pilot	435B		10000-100000		10.000		99.96	WERL
GAC	Full	245B		10000-100000	1	10.000		99.94	WERL
GAC	Pilot	REF7		120	1	0.300			BDAT #
PACT	Bench	200B		100-1000	13	0.300		99.75	WERL
PACT	Bench	242E		0-100		5.000		91.2	WERL
PACT	Bench	Zimpro		2730	1	1.000		99.9	WAO
PACT	Bench	Zimpro		57	1	5.000		91	WAO
RO	Full	250B		100-1000		20.000		92.5	WERL
RO	Pilot	250B		0-100		12.000		86	WERL
RO	Full	250B		1000-10000		420.000		94.7	WERL
* SS		0415 2	10	19300-29000	3	12.000			EAD *
SS	Full	6B		1000-10000	2	10.000		99.71	WERL
SS	Full	6B		10000-100000	3	12.000		99.95	WERL
* SS		0415 1	10	2570-4230	4	22.300			EAD *
SS	Pilot	REF4		92000	5	42.000			BDAT #
SS	Full	P246		57-98	4	10.000			BDAT #
SS+AC	Full	P297		640-8650	3	11.000			BDAT #
TF	Full	6B		100-1000	3	10.000		96.3	WERL
TF	Full	1B		0-100	5	10.000		88	WERL
TF	Full	1B		0-100	6	7.000		86	WERL
TF	Full	1B		0-100	5	2.000		97.2	WERL
TF	Full	1B		0-100	6	1.000		98.2	WERL
TF	Full	1B		100-1000	4	7.000		97.8	WERL
UF	Pilot	250B		100-1000		84.000		35	WERL
WOx		REF10		8500000	1	200000.000			BDAT #
WOx	Bench	Zimpro		4330000	1	12000.000		99.7	WAO
WOx	Bench	Zimpro		5000	1	500.000		90	WAO
WOx	Pilot	Zimpro		30000	1	500.000		98.3	WAO
WOx	Full	Zimpro	50	82000-82000	2	10950.000			WAO
WOx	Full	242E		100-1000		57.000		72	WERL
WOx	Pilot	78D		10000-100000		500.000		96.3	WERL
WOx + PACT	Pilot	Zimpro	5	130000-180000	3	5.000		99.9	WAO
WOx [b]	Bench	78D		1000-10000		500.000		90	WERL
WOx [b]	Bench	78D		10000-100000		1000.000		96.8	WERL
WOx [b]	Bench	1054E		10000-100000		500.000		96.9	WERL
WOx [b]	Bench	1054E		1000000		220000.000		95.7	WERL

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.
* Data used in developing revised standard.

1,2,4-Trichlorobenzene. The treatment performance data available for 1,2,4-trichlorobenzene were compiled from the WERL database and are presented in Table A-50. Technologies for which treatment performance data are available include AFF, AS, BGAC, GAC, PACT®, RO, and TF. The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 0.02 ppb to 89 ppb.

The revised BDAT for 1,2,4-trichlorobenzene is PACT® (powdered activated carbon treatment). PACT® was selected as BDAT because this technology represents full-scale treatment with a high influent concentration and a high removal efficiency. The revised BDAT treatment standard for 1,2,4-trichlorobenzene was calculated using the effluent concentration of 10 ppb and the appropriate accuracy correction factor and variability factor. The calculation of the resulting BDAT treatment standard for 1,2,4-trichlorobenzene (0.055 ppm) is described in Section 6.0 and is shown in Table 6-1.

Table A-50

WASTEWATER TREATMENT PERFORMANCE DATA FOR 1,2,4-TRICHLOROBENZENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AFF	Bench	501A		0-100	23	0.570		90.5	WERL
AS	Full	6B		100-1000	330	71.000		88	WERL
AS	Pilot	241B		100-1000	9	89.000		86	WERL
AS	Full	1B		0-100	6	8.000		92	WERL
AS	Full	201B		0-100	13	14.000		80	WERL
AS	Full	1B		1000-10000	4	89.000		91.9	WERL
AS	Full	975B		100-1000		36.000		64	WERL
AS	Bench	200B		100-1000	14	12.000		90	WERL
BGAC	Bench	501A		0-100	34	0.280		96.9	WERL
GAC	Full	245B		1000-10000	1	10.000		99.74	WERL
GAC	Full	1421D		0-100		0.830		90	WERL
PACT	Bench	200B		100-1000	12	2.100		98	WERL
* PACT	Full	6B		100-1000	10	10.000		98	WERL *
RO	Pilot	180A		0-100		0.020		95.7	WERL
TF	Full	1B		0-100	3	5.000		91.7	WERL

* Data used in developing revised standard.

1,1,1-Trichloroethane. The data available for 1,1,1-trichloroethane were compiled from the EAD and WERL databases, BDAT Solvents Rule data, and WAO data from literature. These data are presented in Table A-51. Technologies for which treatment performance data are available include AL, AS, AirS, BT, GAC, PACT®, RO, SS, TF, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for 1,1,1-trichloroethane is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for 1,1,1-trichloroethane (0.054 ppm) is described in Section 6.0 and is shown in Table 6-1.

Table A-51

WASTEWATER TREATMENT PERFORMANCE DATA FOR 1,1,1-TRICHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AL	Full	1B		0-100	5	10.000		90	WERL
AS	Full	201B		0-100	6	21.000		79	WERL
AS	Full	1B		0-100000	4	10.000		89	WERL
AS	Full	234A		1000-10000		1.300		99.68	WERL
AS	Full	1B		1000-10000	6	850.000		67	WERL
AS	Full	1B		0-100	5	9.000		84	WERL
AS	Full	1B		0-100	4	10.000		84	WERL
AS	Full	1B		0-100	5	10.000		61	WERL
AS	Full	1B		100-1000	6	12.000		90	WERL
AS	Full	6B		100-1000	3	10.000		98.9	WERL
AS	Full	375E		0-100	7	1.000		92.3	WERL
AS	Full	1B		0-100	4	12.000		87	WERL
AS	Full	975B		100-1000		4.000		98.1	WERL
AS	Full	234A		0-100		1.000		97.6	WERL
AS	Pilot	206B		100-1000	20	0.300		99.77	WERL
AS	Full	1B		100-1000	5	54.000		89	WERL
AS	Full	1B		100-1000	6	5.000		96.2	WERL
AS	Full	1B		0-100	6	30.000		39	WERL
AS	Full	1B		0-100	4	5.000		95	WERL
AS	Full	1B		100-1000	6	28.000		94.3	WERL
AS	Full	234A		0-100		1.300		76	WERL
AS	Full	238A		0-100	3	2.200		85	WERL
AS	Full	234A		0-100		1.300		73	WERL
AS	Full	1B		0-100	3	2.000		95.8	WERL
AS	Full	238A		0-100	3	2.900		77	WERL
AS	Full	1587E		100-1000		0.270		99.73	WERL
AS	Full	1B		100-1000	5	100.000		70	WERL
AS	Full	375E		0-100	7	1.000		92.3	WERL
AS	Full	1B		0-100	3	7.000		83	WERL
AS	Full	1B		0-100	3	8.000		84	WERL
AS	Full	1B		0-100	3	2.000		95.8	WERL
AS	Pilot	241B		100-1000	5	8.000		97.2	WERL
AS	Full	1B		0-100	5	1.000		98.4	WERL
AS	Full	1B		0-100	3	4.000		88	WERL
AS	Full	234A		0-100		1.300		88	WERL
AS	Bench	202D		100000-1000000		1600.000		98.6	WERL
AS	Pilot	REF6		237	1	23.000			BDAT #
AS	Pilot	REF2		150000	6	48683.000			BDAT #

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.

Table A-51 Continued

WASTEWATER TREATMENT PERFORMANCE DATA FOR 1,1,1-TRICHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AirS	Pilot	211B		0-100	1	1.000		96.8	WERL
AirS	Pilot	207B		0-100	1	0.500		97.5	WERL
AirS	Pilot	812E		1000-10000		49.000		96.9	WERL
AirS	Pilot	222B		100-1000	1	1.100		99.75	WERL
AirS	Pilot	812E		0-100		3.000		92.9	WERL
AirS	Pilot	211B		100-1000	1	1.700		99.5	WERL
AirS	Pilot	1362E		1000-10000	3	130.000		97.8	WERL
AirS	Pilot	812E		100-1000		12.000		89	WERL
AirS	Pilot	217B		0-100	1	0.300		97	WERL
AirS	Pilot	205E		100-1000		7.000		96.8	WERL
AirS	Full	1344E		100-1000		0.200		99.96	WERL
AirS	Pilot	219B		0-100	1	0.500		96.7	WERL
BT	Full	P240		10-215	3	10.000			BDAT #
GAC	Bench	1362E		10-100		1.000		99.99	WERL
GAC	Full	1264B		0-100		1.000		96.6	WERL
GAC	Full	1264B		100-1000		1.000		99.35	WERL
GAC	Pilot	812E		100-1000		1.000		99.05	WERL
PACT	Bench	242E		100-1000		25.000		93.8	WERL
PACT	Bench	Zimpro		4970	1	1.000		99.9	WAO
PACT	Bench	Zimpro		405	1	25.000		93.8	WAO
RO	Pilot	180A		0-100		0.050		98.2	WERL
RO	Full	250B		100-1000		36.000		96.6	WERL
RO	Pilot	323B		0-100	1	2.000		97.8	WERL
RO	Full	250B		100-1000		10.000		93.8	WERL
[illegible]	Full	6B		10000-100000		10.000		99.94	WERL
[illegible]	Full	913	10	11900-35000	14	10.000			EAD *
SS	Pilot	REF2		150000	5	463.000			BDAT #
TF	Full	375E		0-100	7	1.000		50	WERL
TF	Full	1B		0-100	5	2.000		92.6	WERL
TF	Full	1B		100-1000	6	2.000		98.3	WERL
TF	Full	1B		0-100	5	5.000		92.2	WERL
UV [B]	Bench	1138E		0-100		30.000		40	WERL
WOx		REF10		370000	1	1000.000			BDAT #
WOx	Full	Zimpro	50	6900-9600	2				WAO
WOx	Full	242E		100000-1000000		400.000		99.96	WERL

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.
* Data used in developing revised standard.

1,1,2-Trichloroethane. The data available for 1,1,2-trichloroethane were compiled from the EAD and WERL databases and PACT® data from literature. These data are presented in Table A-52. Technologies for which treatment performance data are available include AS, PACT®, SS, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies.

The treatment performance data available from the EAD database were used to determine the revised BDAT treatment standard for this constituent for the following reasons:

(1) The EAD data represent treatment performance data from the OCPSF sampling episodes. The data collected by EAD include long-term sampling of several industries; therefore, the Agency believes these data are representative of the total organic chemical industry and can adequately represent a wastewater of unknown characteristics.

(2) The EAD data were carefully screened prior to inclusion in the OCPSF database. These data were used in determining a promulgated EAD limit.

(3) A promulgated EAD limit represents data that have undergone further review, and have received acceptance by both EPA and industry.

BDAT for 1,1,2-trichloroethane is being revised to SS (steam stripping). The revised BDAT treatment standard was calculated using the EAD median long-term average effluent value of 10 ppb and the EAD Option 1 variability factor. The calculation of the resulting BDAT treatment standard for 1,1,2-trichloroethane (0.054 ppm) is described in Section 6.0 and is shown in Table 6-1.

Table A-52

WASTEWATER TREATMENT PERFORMANCE DATA FOR 1,1,2-TRICHLOROETHANE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
AS	Full	6B		100-1000	3	18.000		97.1	WERL
AS	Pilot	206B		100-1000	20	28.000		79	WERL
AS	Full	6B		0-100	3	10.000		80	WERL
AS	Full	1B		0-100	3	5.000		88	WERL
AS	Pilot	241B		100-1000	5	110.000		54	WERL
PACT	Bench	242E		0-100		5.000		83	WERL
PACT	Bench	190E		1000-10000		4.200		99.68	WERL
PACT	Bench	Zimpro		30	1	5.000		83	WAO
SCOx	Pilot	65D		100000-1000000		36.000		99.96	WERL
* SS	Full	913	10	416-26400	14	11.200			EAD *
* SS	Full	415T	10	220-14500	15	10.000			EAD *
SS	Full	6B		10000-100000	2	10.000		99.96	WERL
SS	Full	6B		1000-10000	8	10.000		99.85	WERL
SS	Full	251B		1000-10000	10	10.000		99.87	WERL
SS	Full	251B		1000-10000	10	5.000		99.91	WERL
WOx	Full	242E		10000-100000		30.000		99.91	WERL

* Data used in developing revised standard.

Xylenes. The revised BDAT treatment standard for xylenes was determined using the combined data of all three isomers. The treatment performance data available for xylenes were compiled from the NPDES and WERL database, BDAT Solvents Rule data, and WAO and PACT® data from literature. These data are presented in Tables A-53, A-54, A-55, and A-56. Technologies for which treatment performance data are available include AS, AirS, PACT®, RO, GAC, and WOx. The treatment performance data represent bench-, pilot-, and full-scale studies. The resulting effluent concentrations ranged from 0.1 ppb to 20,000 ppb, with a detection limit established at 0.5 ppb.

The revised BDAT for xylenes is WOx (wet air oxidation). WOx was selected as BDAT because the WOx and RO data were the only full-scale data available at the higher concentration ranges. Further examination of the available data revealed that RO was not able to achieve the low effluent concentrations observed with the use of WOx technology. The revised BDAT treatment standard for xylenes was calculated using the average effluent concentrations of all data available from WOx full-scale studies. This effluent concentration was determined to be 56 ppb. The resulting BDAT treatment standard for xylenes is 0.32 ppm as shown in Table 6-1.

TABLE A-53

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,2-XYLENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
		NY0183628			3	196.330			NPDES
AS	Full	1587E		0-100		0.100		96.6	WERL
AS	Bench	200B		100-1000	15	0.900		99.2	WERL
AirS	Pilot	224B		0-100	1	0.500		93	WERL
PACT	Bench	242E		0-100		5.000		93.7	WERL
PACT	Bench	Zimpro		79	1	5.000		94	WAO
RO	Full	250B		10000-100000		300.000		97.8	WERL
* WOx	Full	242E		10000-100000		79.000		99.92	WERL *

* Data used in developing revised standard.

TABLE A-54

WASTEWATER TREATMENT PERFORMANCE DATA
FOR 1,3-XYLENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
		NY0183628			3	193.330			NPDES
AS	Full	1567E		0-100		0.100		98.3	WERL
AirS	Pilot	224B		0-100	1	0.500		72	WERL
GAC	Full	1421D		0-100		0.130		20	WERL
PACT	Bench	242E		0-100		10.000		70	WERL
PACT	Bench	Zimpro		33	1	10.000		70	WAO
* WOx	Full	242E		10000-100000		33.000		99.7	WERL *

* Data used in developing revised standard.

TABLE A-55

WASTEWATER TREATMENT PERFORMANE DATA
FOR 1,4-XYLENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
		NY0183628			3	198.330			NPDES
AirS	Pilot	224B		0-100	1	0.500		90	WERL
GAC	Full	1421D		0-100		0.040		37	WERL

TABLE A-56

WASTEWATER TREATMENT PERFORMANCE DATA
FOR XYLENE

TECHNOLOGY	TECHNOLOGY SIZE	FACILITY	DETECTION LIMIT (ppb)	RANGE INFLUENT CONCENTRATION (ppb)	NO. OF DATA POINTS	AVERAGE EFFLUENT CONCENTRATION (ppb)	RECOVERY (%)	REMOVAL (%)	REFERENCE
GAC	Pilot	REF7		140	1	0.100			BDAT #
WOx		REF10		21200	1	500.000			BDAT #
WOx	Pilot	Zimpro		8385000	1	20000.000		99.8	WAO

EAD data presented in the BDAT Solvents Rule F001-F005 Background Document.