Appendix A

Treatment Performance Data Base and Methodology for Identifying Universal Treatment Standards for Constituents in Nonwastewater Forms of F032, F034, and F035

TABLE OF CONTENTS

LIST OF TABLES

EPA is promulgating universal treatment standards (UST) for the regulation of specific hazardous constituents in nonwastewater forms of F032, F034, and F035. This Appendix presents the methodology for establishing nonwastewater universal standards. Section A.1 presents the methodology for determining nonwastewater Best Demonstrated Available Technology (BDAT) Universal Treatment Standards. Section A.2 presents a constituent-by-constituent discussion of the determination of the universal standards for each regulated constituent.

A.1 Methodology for Determining BDAT Universal Treatment Standards

The performance data presented in Appendix A represent the universal standards data for the constituents regulated in F032, F034, and F035.

The Agency chose which treatment standards to transfer as the universal standard on a constituent-by-constituent basis. Six factors were considered in selecting the "best" standard from the available treatment standard performance data:

(1) Where possible, the Agency preferred performance data (i.e., the matrix spike recovery data, detection limit, and variability factor (according to Table A-1)) for the same constituent.

(2) The matrix spike recovery data were evaluated to determine whether acceptable recoveries were obtained according to EPA's quality assurance/quality control guidelines.

(3) When performance data from the same constituent were unavailable, the Agency used performance data from a constituent with similar composition and functional groups.

(4) When evaluating the matrix spike recovery data, the Agency preferred to use a matrix spike recovery for a specific constituent instead of a value averaged over a group of constituents (e.g., volatile organics).

(5) The method detection limit was examined to determine if it could be met routinely by industry.

(6) The treatment standard corresponding to the "best" data was compared to the detection limits used to calculate other treatment standards to determine if the constituent could be treated to similar levels in similar waste codes.

A.2 Determination of Treatment Standards for Nonwastewater Forms of F032, F034, and F035

Treatment standard data for the constituents regulated in nonwastewater forms of F032, F034, and F035 are presented in Table A-1 and Table A-2. A constituent-by-constituent discussion of the determination of the universal treatment standard for each of these constituents is given below. A more detailed discussion of the determination of the universal treatment standards is provided in EPA's Final Best Demonstrated Available Technology (BDAT) Background Document for Universal Standards, Volume A: Universal Standards for Nonwastewater Forms of Listed Hazardous Wastes (4).

A.2.1 Phenols

Phenol:

The universal standard for phenol was determined to be 6.2 mg/kg, based upon the F039, K083, and U188 treatment standard data. The Agency chose to use these data because they represent the transfer of an accuracy correction factor and detection limit from the same constituent as the constituent of concern and the use of an actual matrix spike recovery. The Agency did not use the K022 treatment standard data because the treatment standard was considered to be an outlier compared to the magnitude of the detection limits from other incineration tests. The Agency believes that a universal standard of 6.2 mg/kg may be reasonably achieved based on detection limits reported for phenol in other waste codes.

2,4-Dichlorophenol:

The universal standard for 2,4-dichlorophenol was determined to be 14 mg/kg, based upon the F039 and U081 treatment standards, which represent the only concentration-based standards promulgated to date for this constituent.

2,4,6-Trichlorophenol:

The universal standard for 2,4,6-trichlorophenol was determined to be 7.4 mg/kg, based upon the F039 treatment standard data. The Agency chose not to use the K105 data because it believes that the K105 standard of 4.4 mg/kg is not reasonable for a universal standard based on other incineration test detection limits.

2,3,4,6-Tetrachlorophenol:

The universal standard for 2,3,4,6-trichlorophenol was determined to be 7.4 mg/kg, based upon the F039 treatment standard, which represents the only concentration-based standards promulgated to date for this constituent.

Pentachlorophenol:

The universal standard for pentachlorophenol was determined to be 7.4 mg/kg, based upon the F039, K001, and U051 treatment standards, which represent the only concentration-based standards promulgated to date for this constituent.

A.2.2 PAHs

Acenaphthene:

The universal standard for acenaphthene was determined to be 3.4 mg/kg, based upon the K035 treatment standard data. The Agency chose to use the K035 treatment standard data rather than the F039 treatment standard data because the F039 treatment standard was promulgated incorrectly as 4.0 mg/kg instead of 0.8 mg/kg. The Agency believes that a standard of 0.8 mg/kg may not be reasonably achieved based on detection limits reported for acenaphthene in other incineration tests.

Anthracene:

The universal standard for anthracene was determined to be 3.4 mg/kg, based upon the K015 and K035 treatment standard data. The universal standard for anthracene was not based upon the F039 treatment standard data because the F039 standard was promulgated incorrectly as 4.0 mg/kg instead of 0.8 mg/kg. The Agency believes that a standard of 0.8 mg/kg may not be reasonably achieved based on detection limits reported for anthracene in other incineration tests.

Benz(a)anthracene:

The treatment standard for benz(a)anthracene was determined to be 3.4 mg/kg, based upon the K035 treatment standard. The Agency chose to use the K035 treatment standard data because these data represent the use of an accuracy correction factor and detection limit from the same constituent as the constituent of concern. The Agency believes that a treatment standard of 3.4 mg/kg may be reasonably achieved based on detection limits reported for benz(a)anthracene in other waste codes.

<u>Benzo(a)pyrene</u>:

The treatment standard for benzo(a)pyrene was determined to be 3.4 mg/kg, based upon the K035 and K060 treatment standards. The Agency chose to use the K035 and K060 treatment standard data because these data represent the use of both an accuracy correction factor and detection limit from the same constituent as the constituent of concern. The Agency believes that a treatment standard of 3.4 mg/kg may be reasonably achieved based on the detection limits reported for benzo(a)pyrene in other waste codes.

<u>Benzo(k)fluoranthene</u>:

The treatment standard for benzo(k)fluoranthene was determined to be 6.8 mg/kg, based upon the F039 treatment standards for benzo(k)fluoranthene. This constituent is regulated as a Sum/2 to account for analytical problems in distinguishing between the two compounds in nonwastewater matrices.

<u>Chrysene</u>:

The universal standard for chrysene was determined to be 3.4 mg/kg, based upon the K087 and K035 treatment standards data. The Agency chose to use the K087 and K035 treatment standard data because these data represent the use of both an accuracy correction factor and detection limit from the same constituent as the constituent of concern. The Agency believes that a universal standard of 3.4 mg/kg may be reasonably achieved based upon detection limits reported for chrysene in other waste codes.

<u>Dibenz(a,h)anthracene</u>:

The treatment standard for dibenz(a,h)anthracene was determined to be 8.2 mg/kg, based upon the F039 and U063 treatment standards. The Agency chose to use the F039 and U063 treatment standard data because these data represent the use of an actual matrix spike recovery. The Agency believes that a treatment standard of 8.2 mg/kg may be reasonably achieved based on detection limits reported for dibenz(a,h)anthracene in other waste codes.

<u>Fluorene</u>:

The universal treatment standard for fluorene was determined to be 3.4 mg/kg, based upon the K035 treatment standard data. The Agency chose to use these data rather than the F039 treatment standard data. The F039 standard was promulgated incorrectly as 4.0 mg/kg instead of 0.8 mg/kg. The Agency believes that a standard of 0.8 mg/kg may not be reasonably achieved based on detection limits for fluorene from other incineration tests.

<u>Indeno(1,2,3-cd)pyrene</u>:

The treatment standard for indeno(1,2,3-cd)pyrene was determined to be 3.4 mg/kg, based upon the K035 and K087 treatment standards. The Agency chose to use the K035 and K087 treatment standard data standard data because these data represent the use of both an accuracy correction factor and detection limit from the same constituent. The Agency believes that a treatment standard of 3.4 mg/kg may be reasonably achieved based on detection limits reported for indeno(1,2,3-cd)pyrene in other waste codes.

<u>Naphthalene</u>:

The treatment standard for naphthalene was determined to be 5.6 mg/kg, based upon the K019 treatment standard. The Agency chose to use the K019 treatment standard data because these data represent the use of an accuracy correction factor and detection limit from the same constituent. The Agency believes that a treatment standard of 5.6 mg/kg may be reasonably achieved based on detection limits reported for naphthalene in other waste codes.

<u>Phenanthrene</u>:

The universal standard for phenanthrene was determined to be 5.6 mg/kg, based upon the K019 treatment standard. The Agency chose to use these data because they represent the use of an accuracy correction factor and detection limit from the same constituent as the constituent of concern. The Agency chose a universal standard of 5.6 mg/kg to account for regulatory flexibility based on variations in treatment of this constituent.

<u>Pyrene</u>:

The universal standard for pyrene was determined to be 8.2 mg/kg, based upon the K035 and F039 treatment standard data. The Agency chose to use these data because they represent the use of an accuracy correction factor and detection limit from the same constituent as the constituent of concern. The Agency believes that transfer of data from K001 and U051, with a treatment standard of 1.5 mg/kg, is not reasonable for a universal standard based on detection limits from other incineration tests.

A.2.3 Dioxins and Furans

<u>Tetrachlorodibenzo-p-dioxins</u>:

The universal standard for tetrachlorodibenzo-p-dioxins was determined to be 0.001 mg/kg, based upon the F039 treatment standard, which represents only concentration-based standard promulgated to date for this constituent.

Pentachlorodibenzo-p-dioxins:

The universal standard for pentachlorodibenzo-p-dioxins was determined to be 0.001 mg/kg, based upon the F039 treatment standard, which represents only concentration-based standard promulgated to date for this constituent.

Hexachlorodibenzo-p-dioxins:

The universal standard for hexachlorodibenzo-p-dioxins was determined to be 0.001 mg/kg, based upon the F039 treatment standard, which represents only concentration-based standard promulgated to date for this constituent.

Tetrachlorodibenzofurans:

The universal standard for tetrachlorodibenzofurans was determined to be 0.001 mg/kg, based upon the F039 treatment standard, which represents only concentration-based standard promulgated to date for this constituent.

Pentachlorodibenzofurans:

The universal standard for pentachlorodibenzofurans was determined to be 0.001 mg/kg, based upon the F039 treatment standard, which represents only concentration-based standard promulgated to date for this constituent.

Hexachlorodibenzofurans:

The universal standard for hexachlorodibenzofurans was determined to be 0.001 mg/kg, based upon the F039 treatment standard, which represents only concentration-based standard promulgated to date for this constituent.

A.2.4 Metals

Arsenic:

The universal standard for arsenic was determined to be 5.0 mg/L in the TCLP extract based upon the F034 treatment standard. The F039 treatment standard was established as equivalent to the toxicity characteristic (TC) regulatory level for arsenic (D004). Table A-2 summarizes the determination of universal standards for arsenic in nonwastewater forms of wastes. The table includes the waste code, treatment performance data, and technology from which the universal standard was transferred.

The Agency established BDAT for arsenic as slag vitrification. The universal standard was not based upon K061-HTMR data because the Agency believes that this technology is not "best" for treatment of arsenic in universal standards wastes. The available slag vitrification treatment standard data (K031, K084, K101, K102, P010, P036, P038, and U136) show treatment to a leachate concentration of 1.8 mg/L (using the Extraction Procedure (EP) toxicity test). The universal standard based on this value would yield a standard of 5.6 mg/L using the EP toxicity test. Because the characteristic level for arsenic of 5.0 mg/L in the toxicity characteristic leachate procedure (TCLP) extract is similar in magnitude to the standard calculated from slag vitrification, the Agency believes that it is valid to default to the characteristic level for the universal standard for arsenic.

Chromium:

EPA evaluated waste characterization and treatment performance data for chromium for several sources, including data on the performance to high-temperature metal recovery (HTMR) and stabilization technologies for treatment chromium. EPA selected the stabilization data to develop the universal standard for chromium because these data represent treatment of chromium in difficult to treat wastes, including stripping liquids, plating and pelletizing operation wastes, and cleanout wastes from plating tanks. The Agency believes that these data represent effluent values that can be routinely achieved by industry.

Table A-2 summarizes the determination of the universal standard for chromium in nonwastewater forms of wastes. The table includes the waste code, treatment performance data, and technology from which the universal standard was transferred. The universal standard for chromium was determined to be 0.86 mg/L in the TCLP extract based upon the treatment standard developed form the stabilization treatment performance data.

Table A-1

Determination of Universal Treatment Standards for Organic Constituents (Nonwastewaters)

Constituent Selected for Regulation	Waste Code from Which Universal Standard Data Were Transferred	Treatment Test from Which Performance Data[a] Were Transferred	Constituent from Which the Concentration in Treated Waste Was Transferred	Concentration in Treated Waste (mg/kg)	Constituent from Which the Accuracy Correction Data Were Transferred	Accuracy Correction Factor (Matrix Spike % Recovery)	Variability Factor	Universal Treatment Standard (mg/kg)
PHENOLS								
Phenol	F039, U188, K083	K019	Phenol	<2.0	Phenol	1.11 (90)[b]	2.8	6.2
2,4-Dimethylphenol	F039, U101	K019	2,4-Dimethylphenol	<5.0	p-Chloro-m-cresol	1 (110)[b]	2.8	14
2,4,6-Trichlorophenol	F039	K001-PCP	Pentachlorophenol	<12.5	Pentachlorophenol	1.05 (95)[b]	2.8	7.4
2,3,4,6-Tetrachlorophenol	F039	K001-PCP	Pentachlorophenol	<12.5	Pentachlorophenol	1.05 (95)[b]	2.8	7.4
Pentachlorophenol	F039, K001, U051	K001-PCP	Pentachlorophenol	<2.5	Pentachlorophenol	1.05 (95)[b]	2.8	7.4
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHS)								
Acenaphthene	K035	K087	Fluorene	<1.0	Flourene	1.22 (82)	2.8	3.4
Anthracene	K015, K035	K087	Anthracene	<1.0	Anthracene	1.22 (82)	2.8	3.4
Benz(a)anthracene	K035	K087	Benz(a)anthracene	<1.0	Benz(a)anthracene	1.22 (82)	2.8	3.4
Benzo(a)pyrene	K035, K060	K087	Benzo(a)pyrene	<1.0	Benzo(a)pyrene	1.22 (82)	2.8	3.4
Benzo(b)fluoranthene and Benzo(k)fluoranthene	K039	K087	Benzo(b)fluoranthene and Benzo(k)fluoranthene	<1.0 + <1.0 = <2.0	Benzo(b)fluoranthene and Benzo(k)fluoranthene	1.22 (82)	2.8	6.8 (sum)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

TABLE A-1 (continued)

Constituent Selected for Regulation	Waste Code from Which Universal Standard Data Were Transferred	Treatment Test from Which Performance Data[a] Were Transferred	Constituent from Which the Concentration in Treated Waste Was Transferred	Concentration in Treated Waste (mg/kg)	Constituent from Which the Accuracy Correction Data Were Transferred	Accuracy Correction Factor (Matrix Spike % Recovery)	Variability Factor	Universal Treatment Standard (mg/kg)
Chrysene	K035, K087	K087	Chrysene	<1.0	Chrysene	1.22 (82)	2.8	3.4
Dibenz(a,h)anthracene	F039, U063	K087	Dibenz(a,h)anthracene	<1.0	Pyrene	2.94 (34)[b]	2.8	8.2
Fluorene	K035	K087	Fluorene	<1.0	Fluorene	1.22 (82)	2.8	3.4
Indeno(1,2,3-c,d)pyrene	K034, K087	K087	Indeno(1,2,3-c,d)pyrene	<1.0	Indeno(1,2,3-c,d)pyrene	1.22 (82)	2.8	3.4
Naphthalene	K019	K019	Naphthalene	<2.0	Naphthalene	1 (103)	2.8	5.6
Phenanthrene	K019	K019	Phenanthrene	<2.0	Phenanthrene	1 (103)	2.8	5.6
Pyrene	K035, F039	K087	Pyrene	<1.0	Pyrene	2.94 (34)[b]	2.8	8.2
DIOXINS AND FURANS								
Tetrachlorodibenzo-p-dioxins	F039	Dioxins Rule	-	<0.001	-	-	-	0.001
Pentachlorodibenzo-p-dioxins	F039	Dioxins Rule	-	<0.001	-	-	-	0.001
Hexachlorodibenzo-p-dioxins	F039	Dioxins Rule	-	<0.001	-	-	-	0.001
Tetrachlorodibenzofurans	F039	Dioxins Rule	-	<0.001	-	-	-	0.001
Pentachlorodibenzofurans	F039	Dioxins Rule	-	<0.001	-	-	-	0.001
Hexachlorodibenzofurans	F039	Dioxins Rule	-	<0.001	-	-	-	0.001

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table A-2

Determination of Universal Treatment Standards for Metal Constituents (Nonwastewaters)

Constituent Selected for Regulation	Waste Code from Which the Universal Standard Data Were Transferred	Treatment Test from Which the Performance Data[a] Were Transferred	Constituent from Which the Concentration in Treated Waste Was Transferred	Average Concentration in Treated Waste (mg/L)	Constituent from Which the Accuracy Correction Data Were Transferred	Accuracy Correction Factor (Matrix Spike % Recovery)	Variability Factor	Universal Treatment Standard (mg/L)
Metal Constituents								
Arsenic	D004	-	Arsenic	-	Arsenic	-	-	5.0
Chromium (total)	-	D007-Cyanokem	Chromium	0.16	Chromium	1 (105)[b]	5.4	0.86

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Appendix B

Treatment Performance Data Base and Methodology for Identifying Universal Treatment Standards for Constituents in Wastewater Forms of F032, F034, and F034

TABLE OF CONTENTS

Page

LIST OF TABLES

EPA is promulgating universal treatment standards to regulate specific hazardous constituents in wastewater forms of F032, F034, and F035. This appendix presents the methodology for establishing universal treatment standards for the constituents promulgated for regulation in wastewater forms of F032, F034, and F035. Section B.1 presents the methodology for determining the wastewater universal standards. Section B.2 presents a constituent-by-constituent discussion of the determination of the universal standards for each regulated constituent. The data presented in this Appendix are those that supported the development of univeral treatment standards. New data submitted by industry during the public comment period for the Phase 4 proposed rule (60 FR 43654, August 22, 1995) are presented in Appendix K and are discussed by the EPA in the document entitled *Treatability of Dioxin/Furan in F032 Wastewater.*

B.1 Methodology for Determining Wastewater BDAT Universal Treatment Standards

The promulgated universal standards for regulated constituents in wastewater forms of F032, F034, and F035 are based on treatment performance data from several sources, including the Best Demonstrated Available Treatment (BDAT) performance data, the National Pollutant Discharge Elimination System (NPDES) data, the Water Engineering Research Laboratory (WERL) data, EPA-collected Wet Air Oxidation/Powdered Activated Carbon (WAO/PACT®) data, the Engineering and Analysis Division (EAD) data, industry-submitted leachate treatment performance data, data in literature that were not already part of the WERL data, and data in literature submitted by industry on the WAO and PACT® treatment process. This appendix presents the wastewater treatment performance data and discusses use of the data to determine BDAT and to calculate the universal treatment standards for the constituents proposed for regulation in wastewater forms of F032, F034, and F035. Table B-1 presents a summary of the data used.

Table B-2 and Table B-3 are data source and treatment technology keys, respectively, for the data tables presented in this appendix. Tables B-4 through B-29 in this appendix present the available wastewater treatment performance data for each constituent regulated in F032, F034, and F035. The data used to determine the universal treatment standards are indicated with a footnote. A discussion of the determination of the universal standards for each of the constituents regulated in F032, F034, and F035 is presented in Section B.2.

The calculation of the universal treatment standards involved three steps. These were: (1) identification of best demonstrated technologies and treatment performance data; (2) determination of a variability factor specific to each constituent in a treatment performance data set to correct for normal variation in the performance of a particular technology, over time; and (3) calculation of the treatment standard, which is equal to the average effluent concentration multiplied by the variability factor. The universal standards and specific treatment performance data used to determine the treatment standards for each regulated constituent in wastewater forms of F032, F034, and F035 are presented in Tables B-1 and B-4 through B-29.

B.1.1 Identification of Best Demonstrated Technologies and Treatment Performance Data

To determine the best demonstrated technology for each BDAT List organic constituent, the Agency examined the universal standards wastewater treatment performance data base. To determine "best," a hierarchy was established to evaluate the wastewater treatment performance data. The following outlines the methodology used to determine "best" for wastewater constituents that are included in this document:

(1) For any organics with EAD performance data and a promulgated EAD effluent limitation, the EAD data were used to calculate the BDAT treatment standard for that constituent. The data representing EAD Option 1 were used in all cases (5).

(2) For any constituent for which promulgated EAD standards (based on actual treatment performance data) do not exist, data from an Agency-sponsored BDAT wastewater treatment test were used to determine the BDAT treatment standard for that constituent (when it was available).

(3) For any constituent with industry-submitted leachate treatment performance data, where the data showed substantial treatment and the data were considered better or

more representative of treatment performance than Agency data, the Agency used the industry-submitted leachate data to calculate the BDAT concentration-based standard.

(4) For any constituent without EAD data, BDAT wastewater treatment test data, or industry-submitted leachate treatment performance data showing substantial treatment, other available treatment performance data were evaluated to determine BDAT and were used to calculate the BDAT concentration-based standard. Considered in this evaluation were the treatment technology for which data were available, whether the data represented a full-, pilot-, or bench-scale technology, the concentration of the constituent of interest in the influent to treatment, the average concentration of the constituent of interest in the effluent from treatment, and the removal efficiency of the treatment technology. Full-scale treatment data with an influent concentration range greater than 100 ppb were preferred over pilot- or bench-scale data and preferred over data with a low (i.e., 0-100 ppb) influent concentration range. If several sets of data met these criteria (i.e., full-scale available technologies with high influent concentrations), they were compared by examination of their average effluent values and percent removals to determine the data set(s) which had the lowest effluent values and the technology with the highest percent removal.

(5) For any constituent where treatment performance data were not available from any of the examined sources, data were transferred for calculation of a BDAT treatment standard from a similar constituent in a waste judged to be similar.

Details regarding the development of BDAT for the constituents proposed for regulation in the wastewater forms of F032, F034, and F035 are presented in the EPA's Proposed Best Demonstrated Available Technology (BDAT) Background Document for Universal Standards, Volume B: Universal Standards for Wastewater Forms of Listed Hazardous Wastes (5).

For most constituents proposed for regulation in F032, F034, and F035, the Agency had treatment performance data from the EAD (formerly ITD) data base. The Agency believes that these data represent the best demonstrated treatment performance for the following reasons:

- EAD data are comprised of treatment performance data from Organic Chemical Plastics and Synthetic Fiber (OCPSF) sampling episodes. These episodes included long-term sampling episodes of several industries. The data are, therefore, a good reflection of the treatment of organics in industrial wastewaters.

- EAD data were carefully screened prior to inclusion in the OCPSF data base and were used in determining an EAD promulgated limit.

- A promulgated EAD limit represents data that have undergone both EPA and industry review and acceptance.

B.1.2 Variability Factors

A variability factor accounts for the variability inherent in the 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 (7).

Due to the nature of the data gathered from various data sources presented in this appendix, variability factors for most of the constituents proposed for regulation in F032, F034, and F035 are not calculated as described in Reference 7. In many cases, original effluent points were not available.

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 organic constituents).

For constituents where a variability factor was unknown or could not be calculated, an average variability factor was used. The average variability factors were generated from the EAD variability factors and are specific to the type of constituent under consideration (i.e., volatile organic or semivolatile organic). The average variability factor for semivolatile organics is the average of the variability factors shown in Table B-1. Determination of these average variability factors is similar to the procedure used by EPA in previous BDAT rulemakings to determine average accuracy correction factors.

For all constituents proposed for regulation in F032, F034, and F035, an EAD variability factor was used in the determination of the treatment standard. In these cases, an accuracy correction factor was not used because it would lead to over-correcting the data.

B.1.3 Treatment Standard Calculation

A constituent-by-constituent discussion of the determination of the universal treatment standards for wastewaters is presented in Section B.2.

B.2 Determination of Treatment Standards for Wastewater Forms of F032, F034, and F035 (Phenols, PAHs, Dioxins and Furans, and Metals)

Wastewater treatment performance data for the constituents regulated in F032, F034, and F035 are presented in Tables B-4 through B-29. A constituent-by-constituent discussion of the data used to calculate the universal treatment standards for each constituent regulated in wastewater forms of F032, F034, and F035 is given below.

B.2.1 Phenols

Phenol:

BDAT for phenol is biological treatment (BT). Biological treatment was selected as BDAT for two reasons: (1) the industry-submitted leachate data for BT showed substantial treatment of phenol and (2) the Agency believes that these data are representative of effluent values that can be routinely achieved by industry. The effluent concentration value reported for phenol in the industry-submitted leachate data is supported by the effluent concentration data from the EAD data base.

The universal standard for phenol was calculated using an effluent concentration of 10 μg/L and the appropriate variability factor and accuracy correction factor. The calculation of the resulting universal standard for phenol in wastewaters is 0.039 mg/L (Table B-1).

2,4-Dimethylphenol:

BDAT for 2,4-dimethylphenol is biological treatment (BT). The universal standard was calculated using the EAD median long-term average of 10.794 μg/L and the EAD Option 1 variability factor. The calculation of the resulting universal standard for 2,4-dimethylphenol in wastewaters is 0.036 mg/L (Table B-1).

2,4,6-Trichlorophenol:

BDAT for 2,4,6-trichlorophenol is biological treatment (BT). Biological treatment was selected as BDAT for two reasons: (1) the industry-submitted leachate data for biological treatment showed substantial treatment of 2,4,6-trichlorophenol and (2) the Agency believes that these data are representative of effluent values that can be routinely achieved by industry.

The universal standard for 2,4,6-trichlorophenol was calculated using an effluent concentration of 10 μg/L and the appropriate variability factor and accuracy correction factor. The calculation of the resulting universal standard for 2,4,6-trichlorophenol in wastewaters is 0.035 mg/L (Table B-1).

2,3,4,6-Tetrachlorophenol:

BDAT for 2,3,4,6-tetrachlorophenol is biological treatment (BT). Biological treatment technologies include trickling filter systems (TF) and activated sludge biological treatment (AS).

The universal standard for 2,3,4,6-tetrachlorophenol was calculated using its detection limit of 6.8 μg/L and the appropriate variability factor and accuracy correction factor. The Agency used the method detection limit because the effluent concentration of 2,3,4,6-tetrachlorophenol was below the detection level routinely achievable using EPA-approved methods. The calculation of the resulting universal standard for 2,3,4,6-tetrachlorophenol in wastewaters is 0.030 mg/L (Table B-1).

Pentachlorophenol:

BDAT for pentachlorophenol is filtration followed by granular activated carbon (Fil+GAC). Fil+GAC was selected as BDAT because this technology represents treatment performance data with a high influent concentration and a high removal efficiency. The effluent concentration achievable by Fil+GAC is supported by the effluent concentration data from the biological treatment technologies.

The universal standard for pentachlorophenol was calculated using an effluent concentration of 20 μg/L and the appropriate variability factor and accuracy correction factor. The calculation of the resulting universal standard for pentachlorophenol wastewaters is 0.089 mg/L (Table B-1).

B.2.2 PAHs

Acenaphthene:

BDAT for acenaphthene is biological treatment (BT). The universal standard was calculated using the EAD median long-term average of 10 μg/L and the EAD Option 1 variability factor. The calculation of the resulting universal standard for acenaphthene in wastewaters is 0.059 mg/L (Table B-1).

Anthracene:

BDAT for anthracene is biological treatment (BT). The universal standard was calculated using the EAD median long-term average of 10 μg/L and the EAD Option 1 variability factor. The calculation of the resulting universal standard for anthracene in wastewaters is 0.059 mg/L (Table B-1).

Benz(a)anthracene:

BDAT for benz(a)anthracene was identified as biological treatment (BT). Biological treatment was selected as BDAT because it represents treatment performance data from the EAD data base. The BDAT treatment standard was calculated using the EAD median long-term average of 10 ppb and the EAD variability factor for benz(a)anthracene. The determination of the resulting BDAT treatment standard for benz(a)anthracene is 0.059 mg/L (Table B-1).

<u>Benzo(a)pyrene</u>:

BDAT for benzo(a)pyrene was identified as biological treatment (BT). The biological treatment was selected as BDAT because it represents treatment performance data from the EAD data base. BDAT treatment standard was calculated using the EAD median long-term average of 10.3 ppb and the EAD variability factor for benzo(a)pyrene. The determination of the resulting BDAT treatment standard for benzo(a)pyrene is 0.061 mg/L (Table B-1).

<u>Benzo(b)fluoranthene and Benzo(k)fluoranthene</u>:

The Agency's existing UTS limits for benzo(b)fluoranthene and benzo(k)fluoranthene were promulgated as the sum of these two constituents in coking wastes, because these two constituents may not be accurately quantified separately in wastewater forms of wastes. EPA proposed to adopt for benzo(k)fluoranthene in F032 and F034 the same UTS limit EPA is promulgating the treatment standard for the sum of benzo(b)fluoranthene and benzo(k)fluoranthene.

BDAT for benzo(b)fluoranthene was identified as activated sludge biological treatment (AS). Activated sludge was selected as BDAT because it represents full-scale data with a high influent concentration range and a high removal efficiency. The concentration limit for benzo(b)fluoranthene (0.055 mg/L) was calculated using the effluent concentration of 10 ppb and the average of the EAD variability factors for semivolatile constituents. BDAT for benzo(k)fluoranthene was identified as BT. BT was selected as BDAT because it represents treatment performance data from the EAD data base. The concentration limit for benzo(k)fluoranthene (0.059 mg/L) was calculated using the EAD median long-term average of 10 ppb and the EAD variability factor for benzo(k)fluoranthene.

The treatment standard promulgated for benzo(b)fluoranthene is the sum of benzo(b)fluoranthene and benzo(k)fluoranthene which was calculated as 0.11 mg/L (based upon the sum of the individually-determined concentration limits for these constituents, and is shown in Table B-1).

Chrysene:

BDAT for chrysene was identified as biological treatment (BT). BT was selected as BDAT because it represents treatment performance data from the EAD data base. The BDAT treatment standard was calculated using the EAD median long-term average of 10 ppb and the EAD variability factor for chrysene. The determination of the resulting BDAT treatment standard for chrysene is 0.059 mg/L (Table B-1.)

Dibenz(a,h)anthracene:

BDAT for dibenz(a,h)anthracene was identified as chemically-assisted clarification (CAC). CAC was selected as BDAT because it represents a demonstrated technology with high influent concentrations and a high removal efficiency. The BDAT treatment standard for dibenz(a,h)anthracene was calculated using an effluent concentration of 10 ppb and the average of the EAD variability factors for semivolatile constituents. The determination of the resulting BDAT treatment standard for dibenz(a,h)anthracene is 0.055 mg/L (Table B-1).

Fluorene:

BDAT for fluorene is biological treatment (BT). The universal standard was calculated using the EAD median long-term average of 10 μg/L and the EAD Option 1 variability factor. The calculation of the resulting universal standard for fluorene in wastewaters (0.059 mg/L) is shown in Table B-1.

Indeno(1,2,3-cd)pyrene:

BDAT for indeno(1,2,3-cd)pyrene was identified as activated sludge biological treatment (AS). Activated sludge was selected as BDAT because it represents full-scale treatment performance with a high removal efficiency. The 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 average of the EAD variability factors for semivolatile constituents. The determination of the resulting BDAT treatment standard for indeno(1,2,3-cd) pyrene (0.0055 mg/L) is shown in Table B-1.

Naphthalene:

BDAT for naphthalene was identified as biological treatment (BT). Biological treatment was selected as BDAT because it represents treatment performance data from the EAD data base. The BDAT treatment standard was calculated using the EAD median long-term average of 10.0 ppb and the EAD variability factor for naphthalene. The determination of the resulting BDAT treatment standard for naphthalene (0.059 mg/L) is shown in Table B-1.

Phenanthrene:

BDAT for phenanthrene is biological treatment (BT). The universal standard was calculated using the EAD median long-term average of 10 μg/L and the EAD Option 1 variability factor. The calculation of the resulting universal standard for phenanthrene in wastewaters is 0.059 mg/L (Table B-1).

<u>Pyrene</u>:

BDAT for pyrene is biological treatment (BT). The universal standard was calculated using the EAD median long-term average of 11.33 μg/L and the EAD Option 1 variability factor. The calculation of the resulting universal standard for pyrene in wastewaters is 0.067 mg/L (Table B-1).

B.2.3 Dioxins and Furans

<u>Tetrachlorodibenzo-p-dioxins</u>:

BDAT for tetrachlorodibenzo-p-dioxins is biological treatment (BT). Biological treatment was selected as BDAT for two reasons: (1) the industry-submitted leachate data showed substantial treatment of tetrachlorodibenzo-p-dioxins by a demonstrated treatment technology and (2) the Agency believes that these data are representative of effluent values that can be routinely achieved by industry.

The universal standard for tetrachlorodibenzo-p-dioxins was calculated using an effluent concentration of 0.0045 μg/L and the appropriate variability factor and accuracy correction factor. The calculation of the resulting universal standard for tetrachlorodibenzo-p-dioxins in wastewaters is 0.000063 mg/L (Table B-1).

<u>Pentachlorodibenzo-p-dioxins</u>:

Treatment performance data were transferred to pentachlorodibenzo-p-dioxins from a constituent judged to be similar with respect to elemental composition and functional groups. The Agency believes that the tetrachlorodibenzo-p-dioxins are the most appropriate constituents from which to transfer performance data to pentachlorodibenzo-p-dioxins. The transfer of treatment performance data from this constituent results in a BDAT for pentachlorodibenzo-p-dioxins of biological treatment (BT). The universal standard for pentachlorodibenzo-p-dioxins wastewaters is 0.000063 mg/L (Table B-1).

<u>Hexachlorodibenzo-p-dioxins</u>:

Treatment performance data were transferred to hexachlorodibenzo-p-dioxins from a constituent judged to be similar with respect to elemental composition and functional groups. The Agency believes that the tetrachlorodibenzo-p-dioxins are the most appropriate constituents from which to transfer performance data to hexachlorodibenzo-p-dioxins. The transfer of treatment performance data from these constituents results in a BDAT for hexachlorodibenzo-p-dioxins of biological treatment (BT). The universal standard for hexachlorodibenzo-p-dioxins wastewaters is 0.000063 mg/L (Table B-1).

<u>Tetrachlorodibenzofurans</u>:

Treatment performance data were transferred to tetrachlorodibenzofurans from a constituent judged to be similar with respect to elemental composition and functional groups. The Agency believes that the tetrachlorodibenzo-p-dioxins are the most appropriate constituents from which to transfer performance data to tetrachlorodibenzofurans. The transfer of treatment performance data from these constituents results in a BDAT for tetrachlorodibenzofurans of biological treatment (BT). The universal standard for tetrachlorodibenzofurans wastewaters is 0.000063 mg/L (Table B-1).

<u>Pentachlorodibenzofurans</u>:

BDAT for pentachlorodibenzofurans is biological treatment (BT). Biological treatment was selected as BDAT for two reasons: (1) the industry-submitted leachate data showed substantial treatment of pentachlorodibenzofurans by a demonstrated treatment technology and (2) the Agency believes that these data are representative of effluent values that can be routinely achieved by industry.

The universal standard for pentachlorodibenzofurans was calculated using an effluent concentration of 0.0025 μg/L (the average of the biological treatment effluent concentrations) and the appropriate variability factor and accuracy correction factor. The calculation of the resulting universal standard for pentachlorodibenzofurans in wastewaters is 0.000035 mg/L (Table B-1).

<u>Hexachlorodibenzofurans</u>:

Treatment performance data were transferred to hexachlorodibenzofurans from a constituent judged to be similar with respect to elemental composition and functional groups. The Agency believes that the tetrachlorodibenzo-p-dioxins are the most appropriate constituents from which to transfer performance data to hexachlorodibenzofurans. The transfer of treatment performance data from these constituents results in a BDAT for hexachlorodibenzofurans of biological treatment (BT). The universal standard for hexachlorodibenzofurans wastewaters is 0.000063 mg/L (Table B-30).

B.2.4 Metals

<u>Arsenic</u>:

BDAT for arsenic is lime conditioning followed by sedimentation and filtration (L+Sed+Fil). Lime conditioning followed by sedimentation and filtration was selected as BDAT because this treatment train represents treatment performance data from the EAD-CMDB that showed substantial treatment of arsenic and a lower effluent concentration value than the other EAD data. The Agency preferred the use of the EAD data base rather than other data sources because the EAD data base represents a comprehensive source of wastewater treatment performance data with longer-term sampling and a greater number of sample sets than other wastewater treatment data bases.

The universal standard for arsenic was calculated using the EAD mean long-term average of 340 μg/L and the EAD-CMDB variability factor. The calculation of the resulting universal standard for arsenic in wastewaters is 1.4 mg/L (Table B-1).

Chromium (Total):

BDAT for chromium (total) is chemical precipitation followed by sedimentation (ChPt+Sed). Although lime conditioning followed by sedimentation and filtration (L+Sed+Fil), lime conditioning followed by sedimentation (L+Sed), and sedimentation followed by filtration (Sed+Fil) data were available from the EAD-CMDB, the Agency believes that the chemical precipitation followed by sedimentation data from the EAD-MF data base are representative of effluent values that can be routinely achieved by industry.

The universal standard for chromium (total) was calculated using the EAD mean effluent concentration of 572 μg/L and the EAD-MF variability factor. The calculation of the resulting universal standard for chromium (total) in wastewaters is 2.77 mg/L (Table B-1).

Table B-1
Determination of Universal Treatment Standards for Organic Constituents (Wastewaters)

Constituent Selected For Regulation	BDAT Treatment Technology	Source of Treatment Performance Data	Average Effluent Concentration (mg/L)	Accuracy Correction Factor	Variability Factor	Universal Treatment Standard (mg/L)
PHENOLS						
Phenol	BT	LEACHATE	<0.010	1.4	2.8	0.039
2,4-Dimethylphenol	BT	EAD-OCPSF	0.011	-	3.3	0.036
2,4,6-Trichlorophenol	BT	LEACHATE	<0.010	1.3	2.8	0.035
2,3,4,6-Tetrachlorophenol	TF+AS	WERL	<0.0068	-	4.4	0.030
Pentachlorophenol	Fil+GAC	WERL	0.020	-	4.4	0.089
POLYNUCLEAR AROMATIC HYDROCARBONS (PAHS)						
Acenaphthene	BT	EAD-OCPSF	0.010	-	5.9	0.059
Anthracene	BT	EAD-OCPSF	0.010	-	5.9	0.059
Benz(a)anthracene	BT	EAD-OCPSF	0.010	-	5.9	0.059
Benzo(a)pyrene	BT	EAD-OCPSF	0.010	-	5.9	0.061
Benzo(b)fluoranthene	AS	WERL	0.010	-	5.5	0.55[b]
Benzo(k)fluoranthene	BT	EAD-OCPSF	-	-	5.9	0.59[b]
Sum of benzo(b)fluoranthene and benzo(k)fluoranthene	-	-	-	-	-	0.11[a]
Chrysene	BT	EAD-OCPSF	0.010	-	5.9	0.059
2,4-Dimethylphenol	BT	EAD-OCPSF	0.011	-	3.3	0.036
Fluorene	BT	EAD-OCPSF	0.010	-	5.9	0.059
Indeno(1,2,3-cd)pyrene	AS	WERL	<0.0010	-	5.5	0.0055
Naphthalene	BT	EAD-OCPSF	0.010	-	5.9	0.059
Phenanthrene	BT	EAD-OCPSF	0.010	-	5.9	0.059
Pyrene	BT	EAD-OCPSF	0.011	-	5.9	0.067

Constituent Selected For Regulation	BDAT Treatment Technology	Source of Treatment Performance Data	Average Effluent Concentration (mg/L)	Accuracy Correction Factor	Variability Factor	Universal Treatment Standard (mg/L)
DIOXINS AND FURANS						
Tetrachlorodibenzo-p-dioxins	BT	LEACHATE	0.0000045	5.0	2.8	0.000063
Pentachlorodibenzo-p-dioxins	BT	Transferred from Tetrachlorodibenzo-p-dioxin	0.0000045	5.0	2.8	0.000063
Hexachlorodibenzo-p-dioxins	BT	Transferred from Tetrachlorodibenzo-p-dioxin	0.0000045	5.0	2.8	0.000063
Tetrachlorodibenzofurans	BT	Transferred from Tetrachlorodibenzo-p-dioxin	0.0000045	5.0	2.8	0.000063
Pentachlorodibenzofurans	BT	LEACHATE	0.0000025	5.0	2.8	0.000035
Hexachlorodibenzofurans	BT	Transferred from Tetrachlorodibenzo-p-dioxin	0.0000045	5.0	2.8	0.000063

< - Indicated a detection limit value.
[a]Benzo(b)fluoranthene and benzo(k)fluoranthene are regulated as a sum under universal standards.

Source: (5)

Determination of Universal Treatment Standards for Metal Constituents (Wastewaters)

Constituent Selected For Regulation	BDAT Treatment Technology	Source of Treatment Performance Data	Average Effluent Concentration (mg/L)	Accuracy Correction Factor	Variability Factor	Universal Treatment Standard (mg/L)
Arsenic	L+Sed+Fil	EAD-CMDB	0.34	-	4.1	1.4
Chromium (total)	ChPt+Sed	EAD-MF	0.57	-	4.9	2.77

Source: (5)

Table B-2
Key to Data Sources for Wastewaters

Code	Data Base
BDAT	Best Demonstrated Available Technology
WAO	EPA Wet Air Oxidation/PACT® Test Data
EAD	Engineering and Analysis Division
OCPSF	Organic Chemicals, Plastics, and Synthetic Fibers (EAD)
CMDB	Combined Metals Database (EAD)
MF	Metal Finishing (EAD)
NPDES	National Pollutant Discharge Elimination System
WERL	Water Engineering Research Laboratory
LEACHATE	Leachate Treatment Performance Data Submitted by Industry
CMA	Data Submitted in Comments to the Proposed Rule by the Chemical Manufacturers Association's Carbon Disulfide Task Force
TSCD	Data Submitted by the California TSCD
ART	Data from Published Articles
WAO (LIT)	Wet Air Oxidation/PACT® Data in Literature Submitted by Industry

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-3
Key to Treatment Technologies

Code	Technology
AAS	Activated Alumina Sorption
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
AnL	Anaerobic Lagoons
BGAC	Biological Granular Activated Carbon
BT	Biological Treatment
CA	Carbon Adsorption
CAC	Chemically Assisted Clarification
Chem/Cond	Chemical Conditioning
ChOx	Chemical Oxidation [parentheses indicate the oxidation chemical, i.e., ChOx(ozone)]
ChOx/Pt	Chemical Oxidation/Precipitation
ChPt	Chemical Precipitation
Chred	Chemical Reduction
CN/Ox	Cyanide Oxidation
COAG	Coagulation
DAF	Dissolved Air Flotation
EC	Electrochemical Treatment

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-3 (continued)

Code	Technology
Fil	Filtration
FLOAT	Flotation
GAC	Granular Activated Carbon
Gr/Rem	Grease/Oil Removal
IE	Ion Exchange
KPEG	Dechlorination Using Alkoxide
L	Lime
LL	Liquid-Liquid Extraction
Neut	Neutralization
PACT®	Powdered Activated Carbon Addition to Activated Sludge
RBC	Rotating Biological Contactor
RO	Reverse Osmosis
SBR	Sequential Batch Reactor
SCOx	Super Critical Oxidation
Sed	Sedimentation
SExt	Solvent Extraction
SS	Steam Stripping
TF	Trickling Filter
UF	Ultrafiltration
UV	Ultraviolet Radiation
WOx	Wet Air Oxidation

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-3 (continued)

Addition codes included in tables of respective constituents:

"_ + _" -	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.

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

PHENOLS

Table B-4
Treatment Performance Data
for Phenol in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
AL	Pilot	203A	NR	100-1000	11	84.000	NR	33	WERL
AL	Pilot	203A	NR	100-1000	11	18.000	NR	86	WERL
AL	Full	6B	NR	100-1000	3	11.000	NR	90.8	WERL
AL	Pilot	192D	NR	100-1000	NR	10.000	NR	98.99	WERL
API+DAF+AS	Full	1482D	NR	100-1000	4	85.000	NR	89.5	WERL
AS	Full	1B	NR	100-1000	5	2.000	NR	98.6	WERL
AS	Full	1B	NR	0-100	6	26.000	NR	63	WERL
AS	Bench	202D	NR	100000-1000000	NR	0.010	NR	99.99	WERL
AS	Full	6B	NR	100-1000	39	10.000	NR	96.4	WERL
AS	Full	1B	NR	100-1000	5	8.000	NR	97.2	WERL
AS	Pilot	203A	NR	100-1000	11	14.000	NR	89	WERL
AS	Full	201B	NR	100-1000	31	20.000	NR	92.6	WERL
AS	Full	1B	NR	100-1000	6	1.000	NR	99.89	WERL
AS	Full	6B	NR	10000-100000	3	10.000	NR	99.94	WERL
AS	Full	1B	NR	100-1000	6	61.000	NR	92.4	WERL
AS	Full	1B	NR	0-100	3	1.000	NR	96.4	WERL
AS	Full	975B	NR	1000-10000	NR	6.6000	NR	99.87	WERL
AS	Full	1B	NR	100-1000	5	1.000	NR	99.33	WERL
AS	Bench	1054E	NR	100000-1000000	NR	0.250	NR	99.88	WERL
AS	Pilot	240A	NR	0-100	11	10.000	NR	90	WERL
AS	Full	6B	NR	100-1000	7	15.000	NR	98	WERL
AS	Full	1122E	NR	10000-100000	NR	4000.000	NR	95.2	WERL
AS	Full	6B	NR	100-1000	3	120.000	NR	97.9	WERL
AS	Pilot	241B	NR	100-1000	4	8.000	NR	97.2	WERL
AS	Full	6B	NR	1000-10000	10	21.000	NR	99.64	WERL
AS	Full	975B	NR	100-1000	NR	20.000	NR	87	WERL
AS	Full	6B	NR	100-1000	11	10.000	NR	96.3	WERL
AS	Full	1B	NR	100-1000	6	1.000	NR	99.44	WERL
AS	Full	1B	NR	0-100	6	1.000	NR	98.3	WERL

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-4 (continued)

Technology	Technology Scale	Facility	Detection Limit (µg/L)	Range of Influent Concentrations (µg/L)	No. of Data Points	Average Effluent Concentration (µg/L)	Recovery (%)	Removal (%)	Reference
AS	Full	6B	NR	100-1000	3	10.000	NR	98.6	WERL
AS	Pilot	226B	NR	100000-1000000	6	500.000	NR	99.95	WERL
AS	Full	975B	NR	1000-10000	NR	160.000	NR	95	WERL
AS	Full	6B	NR	100000-1000000	2	10.000	NR	99.99	WERL
AS	Pilot	204A	NR	100-1000	8	14.000	NR	94.6	WERL
AS	Pilot	192D	NR	100-1000	NR	10.000	NR	98.99	WERL
AS	Full	6B	NR	1000-10000	4	56.000	NR	96.9	WERL
AS	Bench	1054E	NR	10000-100000	NR	1000.000	NR	95	WERL
AS	Full	6B	NR	100000-1000000	13	10.000	NR	99.99	WERL
AS	Full	1B	NR	100-1000	6	25.000	NR	94.4	WERL
AS+Fil	Full	6B	NR	10000-100000	3	13.000	NR	99.98	WERL
AS+Fil	Full	6B	NR	100-1000	15	10.000	NR	98	WERL
AnFF	Pilot	231A	NR	1000000	NR	700.000	NR	99.98	WERL
AnFF	Pilot	231A	NR	1000000	NR	30.000	NR	99.99	WERL
AnFF	Bench	230A	NR	100000-1000000	NR	10.000	NR	98.97	WERL
AnFF	Pilot	231A	NR	100000-1000000	NR	10.000	NR	99.99	WERL
AnFF	Pilot	231A	NR	100000-1000000	NR	70.000	NR	99.98	WERL
AnFF	Bench	230A	NR	>1000000	NR	1000.000	NR	99.95	WERL
AnFF	Pilot	235D	NR	100000-1000000	NR	240.000	NR	99.86	WERL
AnFFw GAC	Pilot	249D	NR	1000000	NR	50.000	NR	99.99	WERL
CAC	Pilot	203A	NR	100-1000	11	99.000	NR	21	WERL
ChOx	Bench	975B	NR	100-1000	NR	16.000	NR	93.3	WERL
ChOx	Bench	975B	NR	100-1000	NR	2.000	NR	98.3	WERL
ChOx	Bench	975B	NR	1000-10000	NR	12.000	NR	99.37	WERL
GAC	Bench	1054E	NR	100-1000	NR	10.000	NR	99	WERL
GAC	Full	245B	NR	100-1000[b]	1	10.000	NR	92.6	WERL
GAC	Full	237A	NR	1000-10000[b]	1	5.000	NR	99.89	WERL
BT[a]	Full	DOW	10	715-2500	3	10.000	NR	99.32	LEACHATE[a]
BT	Full	1293	10	698564-978672	15	10.000	NR	NR	EAD-OCPSF
LL	Full	K104	30	150000-300000	5	165000.000	21	NR	BDAT

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-4 (continued)

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
LL	Full	K103	30	1500000-3000000	5	84000.000	21	NR	BDAT
LL+SS	Full	K103/ K104	30	150000-3000000	5	2400.000	21	NR	BDAT
LL+SS+AC	Full	K103/ K104	30	150000-3000000	4	60.000	21	NR	BDAT
PACT®	Bench	190E	NR	10000-100000	NR	1.800	NR	99.99	WERL
PACT®	Bench	975B	NR	1000-10000	NR	2.000	NR	99.96	WERL
PACT®	Full	6B	NR	1000-10000	3	30.000	NR	98.6	WERL
PACT®	Bench	975B	NR	1000-10000	NR	8.000	NR	99.85	WERL
RBC	Pilot	603E	NR	100000-1000000	NR	1700.000	NR	99.6	WERL
RBC	Pilot	192D	NR	100-1000	NR	10.000	NR	98.99	WERL
RO	Full	250B	NR	1000-10000	NR	120.000	NR	93.6	WERL
SBR	Pilot	1433D	NR	10000-100000	16	1000.000	NR	97.7	WERL
SBR	Pilot	227D	NR	100000-1000000[b]	1	1000.000	NR	99.81	WERL
SBR	Bench	64D	NR	100000-1000000	NR	3000.000	NR	99.63	WERL
SBRwPACT®	Bench	64D	NR	100000-1000000	NR	1000.000	NR	99.88	WERL
SExt	Pilot	1082E	NR	>1000000	NR	210000.000	NR	95.4	WERL
SS	Pilot	1082E	NR	100000-1000000	NR	160.000	NR	24	WERL
TF	Pilot	203A	NR	100-1000	11	64.000	NR	49	WERL
TF	Full	1B	NR	100-1000	6	47.000	NR	82	WERL
TF	Pilot	240A	NR	0-100	10	8.000	NR	91.3	WERL
TF	Full	1B	NR	0-100	6	1.000	NR	98.2	WERL
WO_X	Bench	Zimpro	NR	10000000	1	20000.000	NR	99.8	WAO (LIT)
WO_X [B]	Bench	1054E	NR	100000-1000000	NR	27000.000	NR	97.3	WERL
WO_X [B]	Bench	1101D	NR	>1000000	NR	3600.000	NR	99.92	WERL
WO_X [B]	Bench	236A	NR	>1000000	1	3000.000	NR	99.97	WERL

[a]Data used in developing universal standard.
NR = Not reported

[b]The influent concentration was reported as between this range.
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-5
Treatment Performance Data
for 2,4-Dimethylphenol in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AL	Pilot	192D	NR	1000-10000	NR	10.000	99.81	WERL
AS	Full	6B	NR	100-1000	7	13.000	98.1	WERL
AS	Pilot	192D	NR	1000-10000	NR	10.000	99.81	WERL
AS	Full	6B	NR	10000-100000	14	10.000	99.97	WERL
AS	Pilot	204A	NR	0-100	8	0.900	99.06	WERL
AS+Fil	Full	6B	NR	1000-10000	3	10.000	99.9	WERL
AnFF	Pilot	235D	NR	1000-10000	NR	0.400	99.99	WERL
AnFFwGAC	Pilot	249D	NR	10000-100000	NR	0.050	99.93	WERL
BT[a]	Full	1293	10	16216-73537	15	10.000	NR	EAD-OCPSF[a]
RBC	Pilot	192D	NR	1000-10000	NR	10.000	99.81	WERL
RO	Full	250B	NR	100-1000	NR	16.000	98.4	WERL
TF	Full	1B	NR	0-100	2	25.000	38	WERL
WO_X	Bench	Zimpro	NR	8220000	1	100.000	99.99	WAO (LIT)
WO_X+PACT	Pilot	Zimpro	33	530000-790000	3	75.330	NR	WAO
WO_X [B]	Bench	236A	NR	>1000000	1	820.000	99.99	WERL

[a]Data used in developing universal standard.
NR = Not reported
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-6
Treatment Performance Data
for 2,4,6-Trichlorophenol in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
NR	NR	PA0033367	NR	NR	1	10.000	NR	NPDES
NR	NR	PA0036650	NR	NR	6	5.170	NR	NPDES
NR	NR	AR0038512	NR	NR	25	3083.510	NR	NPDES
NR	NR	PA0008231	NR	NR	7	7150.000	NR	NPDES
NR	NR	LA0065501	NR	NR	6	10.000	NR	NPDES
NR	NR	AR0038512	NR	NR	20	1294.810	NR	NPDES
NR	NR	CT0001341	NR	NR	30	398.000	NR	NPDES
NR	NR	MI0000868	NR	NR	8	2.000	NR	NPDES
NR	NR	PA0008231	NR	NR	1	10.000	NR	NPDES
NR	NR	LA0066214	NR	NR	15	10.000	NR	NPDES
NR	NR	NJ0005134	NR	NR	18	37.647	NR	NPDES
AS	Full	375E	NR	0-100	7	0.070	42	WERL
AS	Full	375E	NR	0-100	7	0.040	60	WERL
BT[a]	NR	DOW	10	26-200	3	10.000	90.49	LEACHATE[a]
BT	Full	PA0026247	NR	NR	25	11.520	NR	NPDES
BT	Full	LA0038245	NR	NR	38	10.466	NR	NPDES
BT	Full	NY0026042	NR	NR	3	5.000	NR	NPDES
BT	Full	MI0022276	NR	NR	22	0.635	NR	NPDES
RO	Pilot	180A	NR	0-100		0.010	98	WERL

[a]Data used in developing universal standard.
NR = Not reported
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-7
Treatment Performance Data
for 2,3,4,6-Tetrachlorophenol in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AS[a]	Full	375E	NR	0-100	7	0.060	62	WERL[a]
AS[a]	Full	375E	NR	0-100	7	0.210	16	WERL[a]
AS[a]	Full	375E	NR	0-100	7	0.180	5	WERL[a]
AS[a]	Full	375E	NR	0-100	7	0.110	15	WERL[a]
TF[a]	Full	375E	NR	0-100	7	0.100	28	WERL[a]
TF[a]	Full	375E	NR	0-100	7	0.060	45	WERL[a]

[a]Data used in developing universal standard.
NR = Not reported
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-8
Treatment Performance Data
for Pentachlorophenol in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
NR	NR	LA0066214	NR	NR	15	10.000	NR	NPDES
NR	NR	TX0001201	NR	NR	9	29.400	NR	NPDES
NR	NR	OH0058874	NR	NR	5	7624.000	NR	NPDES
NR	NR	MS0044580	NR	NR	1	3.000	NR	NPDES
NR	NR	TX0001201	NR	NR	59	41.900	NR	NPDES
NR	NR	M00103349	NR	NR	14	3.700	NR	NPDES
NR	NR	MW0049786	NR	NR	40	3.148	NR	NPDES
NR	NR	NJ0050750	NR	NR	5	18.775	NR	NPDES
NR	NR	LA0065501	NR	NR	6	5.000	NR	NPDES
NR	NR	OH0004961	NR	NR	1	16200.000	NR	NPDES
NR	NR	CT0003751	NR	NR	1	10.000	NR	NPDES
NR	NR	WI0025739	NR	NR	1	40.000	NR	NPDES
NR	NR	WY0032590	NR	NR	34	1.000	NR	NPDES
NR	NR	PA0026531	NR	NR	29	23103.400	NR	NPDES
NR	NR	WY0032590	NR	NR	1	1.000	NR	NPDES
NR	NR	CT0001341	NR	NR	24	64.600	NR	NPDES
NR	NR	NY0001210	NR	NR	1	0.010	NR	NPDES
AL	Pilot	203A	NR	0-100	11	57.000	32	WERL
AL	Pilot	203A	NR	0-100	11	20.000	76	WERL
AL	Pilot	192D	NR	100-1000	NR	10.000	98	WERL
AS	Bench	1050E	NR	100-1000	5	2.800	99.3	WERL
AS	Pilot	192D	NR	100-1000	NR	70.000	86	WERL
AS	Pilot	240A	NR	0-100	9	20.000	60	WERL
AS	Full	673B	NR	1000-10000	29	3600.000	57	WERL
AS	Bench	1691A	NR	100-1000	NR	1.000	99.66	WERL
AS	Bench	202D	NR	1000-10000	NR	170.000	97.9	WERL
AS	Bench	960E	NR	10000-100000	4	5400.000	74	WERL
AS	Full	375E	NR	0-100	7	0.620	15	WERL
AS	Pilot	204A	NR	0-100	8	6.300	17	WERL

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-8 (continued)

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AS	Full	375E	NR	0-100	7	0.650	14	WERL
AS	Pilot	203A	NR	0-100	11	3.000	96.4	WERL
AS	Bench	1691A	NR	10000-100000	NR	2.000	99.98	WERL
AS	Full	375E	NR	0-100	7	0.190	63	WERL
AS	Bench	40D	NR	10000-100000	30	68.000	99.66	WERL
AS	Bench	1691A	NR	1000-10000	NR	2.000	99.94	WERL
AS	Full	375E	NR	0-100	7	0.410	39	WERL
BT	Full	PA0008800	NR	NR	6	585.200	NR	NPDES
BT	Full	PA0026247	NR	NR	25	28.600	NR	NPDES
BT	Full	LA0038245	NR	NR	41	44.624	NR	NPDES
CAC	Pilot	203A	NR	0-100	11	50.000	40	WERL
COAG+Sed+BT+Fil	Full	MI0024023	NR	NR	18	20.444	NR	NPDES
Fil	Pilot	673B	NR	1000-10000	28	3400.000	6	WERL
Fil+GAC[a]	Pilot	673B	NR	100-1000	9	20.000	95.6	WERL[a]
GAC	Pilot	673B	NR	1000-10000	28	30.000	99.12	WERL
RBC	Pilot	192D	NR	100-1000	NR	90.000	82	WERL
RO	Pilot	180A	NR	0-100	NR	0.100	86	WERL
TF	Pilot	240A	NR	0-100	10	25.000	39	WERL
TF	Full	375E	NR	0-100	7	0.430	6	WERL
TF	Full	1B	NR	100-1000	6	220.000	35	WERL
TF	Full	1B	NR	0-100	6	14.000	69	WERL
TF	Pilot	203A	NR	0-100	11	82.000	2	WERL
TF	Full	375E	NR	0-100	7	0.500	33	WERL
TF	Full	M00023264	NR	NR	10	12.100	NR	NPDES
WOx	Bench	Zimpro	NR	5000000	1	135000.000	97.3	WAO (LIT)
WOx [B]	Bench	236A	NR	>1000000	1	6000.000	99.88	WERL

[a]Data used in developing universal standard
NR = Not reported
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

PAHs

Table B-9
Treatment Performance Data
for Acenaphthene in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AS	Full	975B	NR	0-100	NR	4.800	77	WERL
AS	Pilot	204A	NR	0-100	8	1.200	97	WERL
AS	Full	6B	NR	0-100	7	10.000	90	WERL
AS	Full	201B	NR	100-1000	3	1.000	99.44	WERL
AS	Full	6B	NR	100-1000	13	10.000	98.9	WERL
AS+Fil	Full	6B	NR	1000-10000	3	13.000	99.66	WERL
CAC	Pilot	195B	NR	0-100	8	10.000	67	WERL
Fil	Full	792E	NR	0-100	4	2.000	83	WERL
BT[a]	Full	1293	10	513-1516	15	10.000	NR	EAD-OCPSF[a]
PACT	Bench	975B	NR	0-100	NR	4.000	90	WERL
TF	Full	1B	NR	0-100	4	6.000	86	WERL
WO_X	Bench	Zimpro	NR	7000000	1	500.000	99.99	WAO (LIT)
WO_X [B]	Bench	236A	NR	>1000000	1	2800.000	99.96	WERL

[a]Data used in developing universal standard.
NR = Not reported
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-10
Treatment Performance Data
for Anthracene in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AS	Full	6B	NR	100-1000	14	10.000	96.6	WERL
AS	Full	1B	NR	0-100	4	13.000	82	WERL
AS	Pilot	204A	NR	0-100	8	0.900	97.4	WERL
AS+Fil	Full	6B	NR	1000-10000	3	10.000	99.52	WERL
Fil	Full	792E	NR	0-100	3	1.000	97.2	WERL
BT[a]	Full	1293	10	418-943	15	10.000	NR	EAD-OCPSF[a]
TF	Full	1B	NR	100-1000	6	17.000	92.3	WERL

[a]Data used in developing universal standard.
NR = Not reported
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-11
Treatment Performance Data
for Benz(a)anthracene in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AS	Full	201B	NR	0-100	1	1.000	98.3	WERL
AS	Pilot	204A	NR	0-100	8	0.600	97.5	WERL
AS	Full	6B	NR	100-1000	12	10.000	97	WERL
AS+Fil	Full	6B	NR	1000-10000	3	56.000	96.5	WERL
Fil	Full	792E	NR	1000-10000	4	3.000	99.75	WERL
BT[a]	Full	1293	10	10-614	15	10.000	NR	EAD[a]

[a]Data used in developing universal standard.
NR = Not reported
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-12
Treatment Performance Data for Benzo(a)pyrene in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AS	Full	375E	NR	0-100	7	0.027	86	WERL
AS	Full	375E	NR	0-100	7	0.028	88	WERL
AS	Full	375E	NR	0-100	7	0.016	97.4	WERL
AS	Full	375E	NR	0-100	7	0.021	86	WERL
AS	Full	6B	NR	100-1000	10	10.000	95.2	WERL
CAC	Pilot	195B	NR	1000-10000	8	20.000	98.2	WERL
ChOx(ozone)	Bench	153D	NR	0-100	NR	1.000	76	WERL
Fil	Full	792E	NR	100-1000	4	1.000	99.81	WERL
Fil	Pilot	195D	NR	0-100	8	10.000	50	WERL
GAC	Pilot	195D	NR	1000-10000	8	20.000	98.2	WERL
BT[a]	Full	1293	10	10-426	15	10.300	NR	EAD[a]
Sed	Bench	153D	NR	0-100	NR	4.200	37	WERL
TF	Full	126E	NR	0-100	NR	0.120	25	WERL
TF	Full	375E	NR	0-100	7	0.016	93.6	WERL
TF	Full	375E	NR	0-100	7	0.035	89	WERL

[a]Data used in developing proposed treatment standard
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-13
Treatment Performance Data for Benzo(b)fluoranthene
in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
NR	NR	LA0066214	NR	NR	15	10.000	NR	NR	NPDES
NR	NR	MD0000345	NR	NR	1	10.000	NR	NR	NPDES
NR	NR	NY0000281	NR	NR	1	5.000	NR	NR	NPDES
NR	NR	NY0000281	NR	NR	9	4.844	NR	NR	NPDES
NR	NR	IL0001627	NR	NR	9	10.111	NR	NR	NPDES
NR	NR	MD0000345	NR	NR	1	10.000	NR	NR	NPDES
NR	NR	KY0003603	NR	NR	1	10.000	NR	NR	NPDES
NR	NR	KY0003514	NR	NR	1	10.000	NR	NR	NPDES
NR	NR	WV0004740	NR	NR	1	10.000	NR	NR	NPDES
NR	NR	LA0065501	NR	NR	6	10.000	NR	NR	NPDES
AS[a]	Full	6B	NR	100-1000	10	10.000	NR	95.4	WERL[a]
AS	Full	375E	NR	0-100	7	0.023	NR	88	WERL
AS	Full	375E	NR	0-100	7	0.014	NR	97.8	WERL
AS	Full	375E	NR	0-100	7	0.023	NR	89.6	WERL
AS	Full	375E	NR	0-100	7	0.017	NR	89	WERL
BT	Full	LA0038245	NR	NR	38	10.126	NR	NR	NPDES
BT	Full	KY0002119	NR		1	10.000	NR	NR	NPDES
RO	Pilot	1634E	NR	0-100	NR	0.001	NR	92.1	WERL
TF	Full	375E	NR	0-100	7	0.033	NR	89.7	WERL
TF	Full	375E	NR	0-100	7	0.017	NR	93.2	WERL

[a]Data used in developing proposed treatment standard
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-14
Treatment Performance Data for Benzo(k)fluoranthene
in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
AS	Full	6B	NR	100-1000	10	10.000	NR	94.7	WERL
AS	Full	375E	NR	0-100	7	0.012	NR	89	WERL
AS	Full	375E	NR	0-100	7	0.010	NR	96.6	WERL
AS	Full	375E	NR	0-100	7	0.013	NR	89	WERL
BT[a]	Full	1293	10	10-352	15	10.000	NR	NR	EAD[a]
RO	Pilot	1634E	NR	0-100	NR	0.001	NR	94	WERL
TF	Full	375E	NR	0-100	7	0.015	NR	90.6	WERL
TF	Full	375E	NR	0-100	7	0.014	NR	90	WERL

[a]Data used in developing proposed treatment standard
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-15
Treatment Performance Data for Chrysene
in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
AS	Pilot	204A	NR	0-100	8	1.200	NR	96.9	WERL
AS	Full	6B	NR	100-1000	4	10.000	NR	99	WERL
AS	Full	6B	NR	100-1000	11	10.000	NR	96.8	WERL
AS+Fil	Full	6B	NR	1000-10000	3	10.000	NR	99.09	WERL
Fil	Full	792E	NR	100-1000	4	1.000	NR	99.76	WERL
BT[a]	Full	1293	10	10-67	15	10.000	NR		EAD[a]

[a]Data used in developing proposed treatment standard
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-16
Treatment Performance Data for Dibenz(a,h)anthracene
in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
NR	NR	LA0066214	NR	NR	15	10.000	NR	NR	NPDES
NR	NR	LA0065501	NR	NR	6	10.000	NR	NR	NPDES
BT	Full	LA0038245	NR	NR	38	10.066	NR	NR	NPDES
CAC[a]	Pilot	195B	NR	100-1000	8	10.000	NR	92.8	WERL[a]

[a]Data used in developing proposed treatment standard
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-17
Treatment Performance Data for Fluorene in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (µg/L)	Range of Influent Concentrations (µg/L)	No. of Data Points	Average Effluent Concentrations (µg/L)	Removal (%)	Reference
AL	Full	6B	NR	100-1000	3	10.000	94.1	WERL
AS	Full	6B	NR	1000-10000	13	10.000	99.17	WERL
AS	Pilot	204A	NR	0-100	8	0.700	98.2	WERL
BT[a]	Full	1293	10	678-1873	15	10.000	NR	EAD-OCPSF[a]
TF	Full	1B	NR	0-100	4	20.000	54	WERL

[a]Data used in developing universal standard.
NR = Not reported
Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-18
Treatment Performance Data for Indeno(1,2,3-cd)pyrene
in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
NR	NR	LA0065501	NR	NR	6	10.000	NR	NR	NPDES
NR	NR	LA0066214	NR	NR	15	28.000	NR	NR	NPDES
AS[a]	Full	375E	NR	0-100	7	0.013	NR	92.8	WERL[a]
AS[a]	Full	375E	NR	0-100	7	0.011	NR	97	WERL[a]
AS[a]	Full	375E	NR	0-100	7	0.017	NR	84	WERL[a]
AS[a]	Full	375E	NR	0-100	7	0.015	NR	86	WERL[a]
BT	Full	LA0038245	NR	NR	38	10.097	NR	NR	NPDES
ChOx(Cl)	Full	1081D	NR	0-100	NR	0.009	NR	67	WERL
Fil	Full	1081D	NR	0-100	NR	0.027	NR	59	WERL
TF	Full	375E	NR	0-100	7	0.012	NR	92.5	WERL
TF	Full	375E	NR	0-100	7	0.019	NR	89	WERL

[a]Data used in developing proposed treatment standard
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-19
Treatment Performance Data
for Naphthalene in Wastewaters

Technology	Technology Size	Facility	Detection Limit (µg/L)	Range of Influent Concentrations (µg/L)	No. of Data Points	Average Effluent Concentration (µg/L)	Removal (%)	Reference
AL	Pilot	192D	NR	0-100	NR	10.000	82	WERL
AL	Bench	371D	NR	100-1000	NR	23.000	97.7	WERL
AL	Pilot	192D	NR	100-1000	NR	25.000	96.5	WERL
AL	Pilot	203A	NR	100-1000	11	13.000	88	WERL
AL	Pilot	203A	NR	100-1000	11	36.000	67	WERL
AL+AL	Full	233D	NR	100-1000	21	16.000	98.3	WERL
AS	Full	201B	NR	0-100	11	5.000	89	WERL
AS	Full	6B	NR	100-1000	2	14.000	95.9	WERL
AS	Bench	1050E	NR	100-1000	5	2.000	99.5	WERL
AS	Pilot	241B	NR	100-1000	11	8.900	97.9	WERL
AS	Pilot	241B	NR	100-1000	5	10.000	93	WERL
AS	Full	975B	NR	100-1000	NR	1.000	99.17	WERL
AS	Pilot	204A	NR	0-100	8	0.700	99.09	WERL
AS	Bench	202D	NR	1000-10000	NR	10.000	99.86	WERL
AS	Pilot	203A	NR	100-1000	11	4.000	96.3	WERL
AS	Pilot	240A	NR	100-1000	12	6.000	95	WERL
AS	Full	1B	NR	0-100	5	9.000	86	WERL
AS	Full	1B	NR	100-1000	5	10.000	95.4	WERL
AS	Full	6B	NR	10000-100000	14	10.000	99.95	WERL
AS	Full	6B	NR	100-1000	13	10.000	99	WERL
AS	Pilot	192D	NR	0-100	NR	10.000	82	WERL
AS	Full	1B	NR	0-100	4	3.000	91.9	WERL
AS	Full	6B	NR	1000-10000	7	10.000	99.56	WERL
AS	Full	6B	NR	100-1000	3	10.000	96	WERL
AS	Pilot	192D	NR	100-1000	NR	25.000	96.5	WERL
AirS	Bench	1328E	NR	10000-100000	5	6200.000	74	WERL
BT[a]	Full	1293	10	11227-37145	15	10.000	NR	EAD[a]
CAC	Pilot	203A	NR	100-1000	11	79.000	27	WERL
ChOx	Bench	975B	NR	0-100	NR	2.000	88	WERL

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-19 (continued)

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
PACT®	Bench	Zimpro	NR	191	1	1.000	99.9	WAO
RBC	Pilot	192D	NR	0-100	NR	10.000	82	WERL
RO	Pilot	180A	NR	0-100	NR	0.020	80	WERL
TF	Pilot	240A	NR	100-1000	11	14.000	88	WERL
TF	Full	1B	NR	0-100	6	3.00	89	WERL
TF	Pilot	203A	NR	100-1000	11	74.000	32	WERL
WOx	Full	Zimpro	6	1200	1	210.000	NR	WAO

[a]Data used in developing proposed treatment standard
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-20
Treatment Performance Data
for Phenanthrene in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AL	Full	6B	NR	100-1000	5	10.000	92.9	WERL
AL	Pilot	203A	NR	0-100	11	40.000	58	WERL
AL	Pilot	203A	NR	0-100	11	16.000	83	WERL
AL	Bench	371D	NR	100-1000	NR	15.000	98.5	WERL
AS	Pilot	204A	NR	0-100	8	1.100	97.2	WERL
AS	Pilot	240A	NR	0-100	12	6.000	93	WERL
AS	Full	6B	NR	1000-10000	14	10.000	99.7	WERL
AS	Pilot	203A	NR	0-100	11	4.000	95.8	WERL
AS	Full	1B	NR	0-100	4	13.000	82	WERL
AS	Bench	202D	NR	100-1000	NR	10.000	98.2	WERL
AS	Bench	1050E	NR	100-1000	5	2.000	99.5	WERL
AS+Fil	Full	6B	NR	1000-10000	3	17.000	99.8	WERL
CAC	Pilot	203A	NR	0-100	11	24.000	75	WERL
Fil	Full	792E	NR	0-100	4	10.000	85	WERL
BT[a]	Full	1293	10	2035-4711	15	10.000	NR	EAD-OCPSF[a]
PACT®	Full	6B	NR	100-1000	10	25.000	95.9	WERL
TF	Pilot	240A	NR	0-100	10	9.000	90	WERL
TF	Pilot	203A	NR	0-100	11	51.000	46	WERL
TF	Full	1B	NR	100-1000	6	17.000	91.5	WERL

[a]Data used in developing universal standard.
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-21
Treatment Performance Data
for Pyrene in Wastewaters

Technology	Technology Scale	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AL	Bench	371D	NR	100-1000	11	15.000	97	WERL
AL	Pilot	203A	NR	100-1000	11	36.000	65	WERL
AL	Pilot	203A	NR	100-1000	11	25.000	76	WERL
AS	Pilot	203A	NR	100-1000	11	5.000	95.2	WERL
AS	Full	1B	NR	25	1	5.000	80	WERL
AS	Pilot	204A	NR	0-100	8	2.000	93.3	WERL
AS	Pilot	204A	NR	0-100	12	10.000	90	WERL
AS	Full	6B	NR	100-1000	14	10.000	99	WERL
AS+Fil	Full	6B	NR	1000-10000	3	16.000	99.48	WERL
CAC	Pilot	195B	NR	1000-10000	8	110.000	94.5	WERL
CAC	Pilot	203A	NR	100-1000	11	12.000	88	WERL
ChOx(Cl)	Full	1081D	NR	0-100	NR	0.018	60	WERL
Fil	Pilot	195B	NR	100-1000	8	80.000	27	WERL
Fil	Pilot	577E	NR	0-100	NR	0.001	99.96	WERL
Fil	Full	1081D	NR	0-100	NR	0.045	40	WERL
Fil	Full	792E	NR	1000-10000	4	6.000	99.5	WERL
GAC	Pilot	195D	NR	0-100	6	10.000	79	WERL
BT[a]	Full	1293	10	641-1438	15	10.300	NR	EAD-OCPSF[a]
TF	Pilot	203A	NR	100-1000	11	48.000	54	WERL
TF	Pilot	240A	NR	0-100	10	17.000	83	WERL
WO_x	Bench	Zimpro	NR	500000	1	260.000	99.95	WAO (LIT)

[a]Data used in developing universal standard.
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

DIOXINS AND FURANS

Table B-22
Treatment Performance Data
for Tetrachlorodibenzo-p-dioxins in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AS	Full	253B	NR	0.00014	1	0.00012	14	WERL
AS	Full	253B	NR	0.00004	1	0.00001	75	WERL
BT[a]	NR	CWM	NR	0.0021-0.0039	3	0.00500	NR	LEACHATE[a]
BT[a]	Bench	CWM	NR	0.0176	3	0.00400	78.79	LEACHATE[a]
GAC	Full	245B	NR	0-100	NR	0.00087	93.6	WERL
KPEG (B)	Bench	244B	NR	28	1	0.65000	97.7	WERL
KPEG (B)	Bench	244B	NR	400	1	0.37000	99.91	WERL

[a]Data used in developing universal standard.
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-23
Treatment Performance Data
for Pentachlorodibenzo-p-dioxins in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
KPEG (B)	Bench	244B	NR	500	1	0.36000	99.93	WERL

NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-24
Treatment Performance Data
for Hexachlorodibenzo-p-dioxins in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
KPEG (B)	Bench	244B	NR	3000	1	2.10000	99.93	WERL

NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-25
Treatment Performance Data
for Tetrachlorodibenzofurans in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
KPEG (B)	Bench	244B	NR	145	1	0.35000	99.76	WERL

NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-26
Treatment Performance Data
for Pentachlorodibenzofurans in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
BT[a]	NR	CWM	NR	0.0001-0.0027	3	0.002	NR	LEACHATE[a]
BT[a]	Bench	CWM	NR	0.0118	3	0.003	77.68	LEACHATE[a]
KPEG (B)	Bench	244B	NR	800	1	0.71000	99.91	WERL

[a]Data used in developing universal standard.
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-27
Treatment Performance Data
for Hexachlorodibenzofurans in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
KPEG (B)	Bench	244B	NR	3800	1	0.76000	99.98	WERL

NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

METALS

Table B-28
Treatment Performance Data
for Arsenic in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Removal (%)	Reference
AL	Full	1B	NR	0-100	4	8.000	0.00	WERL
AS	Full	234A	NR	0-100	7	3.000	50.00	WERL
AS	Full	234A	NR	0-100	7	6.000	40.00	WERL
AS	Full	234A	NR	0-100	7	6.000	50.00	WERL
AS	Full	234A	NR	0-100	7	1.000	75.00	WERL
AS	Full	234A	NR	0-100	7	1.000	89.00	WERL
AS	Full	201B	NR	0-100	6	4.000	50.00	WERL
AS	Full	1B	NR	0-100	6	4.000	50.00	WERL
AS	Full	1B	NR	0-100	6	2.000	50.00	WERL
AS	Full	1B	NR	0-100	6	2.000	50.00	WERL
AS	Full	1B	NR	0-100	6	3.000	0.00	WERL
AS	Full	1B	NR	0-100	5	2.000	33.00	WERL
AS	Full	975B	NR	100-1000	NR	83.000	27.00	WERL
CAC	Full	393A	NR	0-100	NR	6.300	34.00	WERL
CAC (B)	Bench	638B	NR	0-100[b]	1	8.000	67.00	WERL
CAC (B)	Bench	638B	NR	100-1000[b]	1	2.000	99.69	WERL
Chred/Pt+Sed+Fil	Full	K062	NR	<100-3000	11	180.000	NR	BDAT
L+Sed	Full	NR	NR	4200	NR	510.000	NR	EAD-CMDB
L+Sed+Fil[a]	Full	NR	NR	4200	NR	340.000	NR	EAD-CMDB[a]
TF	Full	1B	NR	0-100	6	32.000	0.00	WERL

[a]Data used in developing universal standard.
[b]The influent concentration was reported as between this range.
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-29
Treatment Performance Data
for Chromium (Total) in Wastewaters

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
AL	Full	1B	NR	100-10000	6	130.000	NR	89.00	WERL
AS	Full	234A	NR	0-100	7	7.000	NR	84.00	WERL
AS	Full	1B	NR	0-100	6	29.000	NR	64.00	WERL
AS	Full	167E	NR	0-100	NR	9.000	NR	72.00	WERL
AS	Full	1B	NR	0-100	6	5.000	NR	90.90	WERL
AS	Full	1B	NR	0-100	7	22.000	NR	69.00	WERL
AS	Full	234A	NR	0-100	7	16.000	NR	82.00	WERL
AS	Full	1B	NR	0-100	6	6.000	NR	85.00	WERL
AS	Full	167E	NR	0-100	NR	3.000	NR	96.10	WERL
AS	Full	1B	NR	0-100	6	12.000	NR	76.00	WERL
AS	Full	243A	NR	0-100	NR	12.000	NR	83.00	WERL
AS	Full	1B	NR	0-100	6	36.000	NR	62.00	WERL
AS	Full	1B	NR	0-100	6	35.000	NR	65.00	WERL
AS	Full	1B	NR	0-100	6	6.000	NR	89.00	WERL
AS	Full	1B	NR	0-100	6	11.000	NR	78.00	WERL
AS	Full	234A	NR	0-100	7	34.000	NR	58.00	WERL
AS	Full	1B	NR	0-100	6	36.000	NR	64.00	WERL
AS	Full	1B	NR	0-100	6	24.000	NR	70.00	WERL
AS	Full	198E	NR	0-100	33	40.000	NR	79.00	WERL
AS	Full	234A	NR	0-100	7	3.000	NR	94.60	WERL
AS	Full	234A	NR	100-1000	7	14.000	NR	89.00	WERL
AS	Full	1B	NR	100-1000	6	16.000	NR	87.00	WERL
AS	Full	1B	NR	100-1000	6	40.000	NR	76.00	WERL
AS	Full	243A	NR	100-1000	NR	28.000	NR	77.00	WERL
AS	Full	1B	NR	1000-10000	6	62.000	NR	95.60	WERL
AS	Full	1B	NR	100-1000	6	59.000	NR	86.00	WERL
AS	Full	1B	NR	100-1000	6	19.000	NR	89.00	WERL
AS	Full	1B	NR	100-1000	6	38.000	NR	84.00	WERL
AS	Full	167E	NR	100-1000	NR	6.000	NR	98.50	WERL

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-29 (continued)

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
AS	Full	1B	NR	100-1000	6	16.000	NR	90.00	WERL
AS	Full	167E	NR	100-1000	NR	12.000	NR	92.30	WERL
AS	Full	1B	NR	100-1000	6	48.000	NR	88.00	WERL
AS	Pilot	1294B	NR	1000-10000	3	390.000	NR	64.00	WERL
AS	Full	1B	NR	100-1000	6	26.000	NR	80.000	WERL
AS	Full	1B	NR	1000-10000	6	110.000	NR	97.40	WERL
AS	Full	1B	NR	100-1000	6	52.000	NR	82.000	WERL
AS	Full	1B	NR	1000-10000	96	140.000	NR	90.00	WERL
AS	Full	1B	NR	100-1000	6	19.000	NR	83.00	WERL
AS	Full	201B	NR	100-1000	35	51.000	NR	77.00	WERL
AS	Full	234A	NR	100-1000	7	20.000	NR	82.00	WERL
AS	Full	1B	NR	100-1000	7	46.000	NR	89.00	WERL
AS	Full	1B	NR	100-1000	6	28.000	NR	93.50	WERL
AS	Full	1B	NR	100-1000	6	35.000	NR	68.00	WERL
AS	Full	1B	NR	100-1000	6	50.000	NR	54.00	WERL
AS	Full	1B	NR	100-1000	6	19.000	NR	88.00	WERL
CAC	Full	393A	NR	100-1000	NR	40.000	NR	94.10	WERL
CAC (B)	Bench	638B	NR	100-1000[b]	1	50.000	NR	62.00	WERL
ChOx/Pt (B)	Bench	248A	NR	1000-10000[b]	1	0.500	NR	74.00	WERL
ChPt	Full	245B	NR	10000-100000[b]	1	34.000	NR	99.95	WERL
ChPt (B)	Pilot	254B	NR	100-1000	16	77.000	NR	76.00	WERL
ChPt (B)	Pilot	254B	NR	10000-100000	14	170.000	NR	99.66	WERL
ChPt+Fil (B)	Pilot	254B	NR	10000-100000	14	47.000	NR	99.91	WERL
ChPt+Fil (B)	Pilot	254B	NR	100-1000	16	75.000	NR	77.00	WERL
ChPt+Sed[a]	Full	NR	50	0-35400	38	572.000	NR	NR	EAD-MF[a]
Chred/Pt+ Sed+Fil	Full	K062	NR	70-917000	9	57.000	NR	NR	BDAT
Chred/Pt+ Sed+Fil	Full	K062	NR	6000-7000000	11	135.000	68.0	NR	BDAT
Fil	Pilot	254B	NR	100-1000	14	39.000	NR	90.20	WERL
L+Sed	Full	NR	NR	100-116000	NR	84.000	NR	NR	EAD-CMDB

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-29 (continued)

Technology	Technology Size	Facility	Detection Limit (μg/L)	Range of Influent Concentrations (μg/L)	No. of Data Points	Average Effluent Concentration (μg/L)	Recovery (%)	Removal (%)	Reference
L+Sed+Fil	Full	NR	NR	2800-9150	NR	70.000	NR	NR	EAD-CMDB
PACT®	Pilot	1294B	NR	1000-10000	3	320.000	NR	71.00	WERL
Sed	Pilot	1294B	NR	1000-10000	3	1100.000	NR	66.00	WERL
Sed+Fil	Full	NR	NR	100-116000	NR	80.000	NR	NR	EAD-CMDB
TF	Full	1B	NR	100-1000	6	57.000	NR	56.00	WERL
TF	Full	1B	NR	100-1000	6	34.000	NR	69.00	WERL
TF	Full	1B	NR	0-100	6	15.000	NR	67.00	WERL
TF	Full	1B	NR	100-1000	6	92.000	NR	23.00	WERL
TF	Full	1B	NR	100-1000	6	180.000	NR	25.00	WERL
TF	Full	1B	NR	100-1000	6	44.000	NR	71.00	WERL
TF	Full	1B	NR	0-100	6	17.000	NR	48.00	WERL

[a]Data used in developing universal standard.
[b]The influent concentration was reported as between this range.
NR = Not reported

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-30
Variability Factor Calculation for Base/Neutral
Extractable Semivolatile Organic Constituents

Semivolatiles	**EAD Variability Factor**
Acenaphthalene	5.89125
Acenaphthene	5.89125
Anthracene	5.89125
Benz(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 =	5.5340
Semivolatiles VF = 5.5340	

Source: (5)

< - indicates a detection limit value.
[a]Performance data consist of the concentration in treated waste, accuracy correction factor, and variability factor.
[b]This number represents a constituent-specific matrix spike.

Source: (4)

Table B-31
Proposed BDAT Standards for F032, F034, and F035 (Wastewaters and Nonwastewaters)

Constituent	**Wastewaters Maximum for any 24-Hour Composite Total Composition (mg/l)**	**Nonwastewaters Maximum for Any Grab Sample Composition (mg/kg)**	**Constituents Proposed for Regulation**		
			F032	F034	F034
PHENOLS					
Phenol	0.039	6.2	X		
2,4-Diemethylphenol	0.035	14.0	X		
2,4,6-Trichlorophenol	0.035	7.4	X		
2,3,4,6-Tetrachlorophenol	0.035	7.4	X		
Pentachlorophenol	0.089	7.4	X		
PAHs					
Acenaphthene	0.059	3.4	X	X	
Anthracene	0.059	3.4	X	X	
Benz(a)anthracene	0.059	3.4	X	X	
Benzo(a)pyrene	0.061	3.4	X	X	
Benzo(k)fluoranthene	0.11	6.8	X	X	
Chrysene	0.059	3.4	X	X	
Dibenz(a,h)anthracene	0.055	8.2	X	X	

Table B-32 (Continued)

Constituent	Wastewaters Maximum for any 24-Hour Composite Total Composition (mg/l)	Nonwastewaters Maximum for Any Grab Sample Composition (mg/kg)	Constituents Proposed for Regulation		
			F032	F034	F034
Fluorene	0.059	3.4	X	X	
Indeno(1,2,3-cd)pyrene	0.0055	3.4	X	X	
Naphthalene	0.059	5.6	X	X	
Phenanthrene	0.059	5.6	X	X	
Pyrene	0.067	8.2	X	X	
Dioxins and Furans					
Tetrachlorodibenzo-p-dioxins	0.000063	0.001	X		
Pentachlorodibenzo-p-dioxins	0.000063	0.001	X		
Hexachlorodibenzo-p-dioxins	0.000063	0.001	X		
Tetrachlorodibenzofurans	0.000063	0.001	X		
Pentachlorodibenzofurans	0.000035	0.001	X		
Hexachlorodibenzofurans	0.000063	0.001	X		
INORGANICS					
Arsenic	1.4	5.0	X	X	X
Chromium (total)	2.77	0.86	X	X	X

APPENDIX C

SUMMARY OF SUBMITTED AND OTHER AVAILABLE TREATMENT PERFORMANCE DATA FOR WOOD PRESERVING AND RELATED WASTES

Table C-1
Wood Preserving Process Waste or Related Data That Meet EPA QA/QC Criteria

Source Document	Technology	Scale of Tests	Wastewater (WW) or Nonwastewater (NWW)	Wood Treatment Data Points Complying With Proposed Treatment Standards		Matrix/Media
				Number of Data Points Complying	Number of Data Points Not Complying	
Volume I, Waste Characterization and Treatment Report for F035, SAIC, September 30, 1992	Stabilization	Full Scale	NWW	2	6	Process Sludge
Treatability Testing of Inorganic WPW, F035 EPA, May 10, 1991	Chemical Precipitation	Bench Scale	WW	15	1	Simulated Process Wastewater
Draft Waste Characterization and Treatability Report for Inorganic WPW, F035, Chemical Waste Management, February 1992	Stabilization	Full Scale	NWW	2	0	Process Sludge
Koppers Wastewater Treatment Data, January-September 1991	Oil/Water Separator plus Biotreatment/Biotreatment and Activated Carbon	Full Scale	WW	113	28	Process Wastewater
Marathon Oil Delisting Petition for K048 and K051 Wastes, June/ July 1991	Thermal Desorption	Pilot Scale	NWW	75	45	Process Wastes

Table C-2
Available Wood Preserving Process Waste or Related Data That Do Not Meet EPA or QA/QC Criteria*

Source Document	Technology	Scale of Tests	Wastewater (WW) or Nonwastewater (NWW)	Wood Treatment Data Points Complying With Proposed Treatment Standards		Matrix/ Media	Data Deficiencies
				Number of Data Points Complying	Number of Data Points Not Complying		
Regulatory Data Review, November-December 1994	Biotreatment	Full Scale	WW	17	0	Process Wastewater	No Analytical Methods, No Blanks, or Matrix Spikes
Abstracts of Proceedings of Arsenic/Mercury Symposium, EPA, August 1992	Stabilization	Bench and Full Scale	NWW	9	0	Various Process Wastes, Ash, Sludge, and Soils	No Blanks or Matrix Spikes, Incomplete Data Sets
Develop Document for ELGs and Standards for the Timber Products Point Source Category, EPA, January 1981	Biotreatment	Full Scale	WW	15	26	Process Wastewater	No Analytical Methods, No Blanks or Matrix Spikes, No Influent Data
Activated Sludge and Activated Carbon Treatment of a WP Effluent, PCP, 19809	Biotreatment and Biotreatment plus Carbon Adsorption	Full Scale	WW	33	112	Process Wastewater	No Analytical Methods, No Blanks or Matrix Spikes
APEG Treatment of Dioxin/ Furan at WP Site in Butte, Montana	APEG/KPEG	Pilot Scale	NWW (Oil)	30	0	Waste Oil	No Blanks or Matrix Spikes

*Did not list analytical methods, did not include "blank" analysis, did not include matrix spike data, did not have untreated waste analysis.

Table C-3
Wood Preserving Soils or Related Soils
Data That Meet EPA QA/QC Criteria

Source Document	Technology	Scale of Tests	Wood Treatment Constituents Complying With Proposed Treatment Standards	
			Number of Constituents Complying	Number of Constituents Not Complying
Thermal Desorption/UV Photolysis Process Technology Research at the Naval Construction Battalion Center, for USAF IRP, Volume I, May-July 1995	Thermal Desorption	Pilot Scale	5	0
Comments of Blazer East, Inc., in Response to EPA's ANPRM of October 24, 1991	Bioremediation	Pilot Scale	0	13

Table C-4
Available Wood Preserving Soils or Related Soils
Data That Do Not Meet EPA QA/QC Criteria*

Source Document	Technology	Scale of Tests	Wood Treatment Constituents Complying With Proposed Treatment Standards		Data Deficiencies
			Number of Constituents Complying	Number of Constituents Not Complying	
Evaluation of Full-Scale In-Situ and Ex-Situ Bioremediation of Creosote Wastes, EPA	Biotreatment	Full Scale	1	2	No Data Pairs, No Blanks or Matrix Spikes, No Analytical Methods
Attachment A, Literature Review (Case Study 4)	Biotreatment	Full Scale	1	10	No Blanks or Matrix Spikes, No Analytical Methods
Engineering Bulletin: Chemical Dehalogenation Treatment: APEG Treatment, EPA, September 1990	APEG	Full Scale	1	0	Only Data Averages/Ranges, No Blanks or Matrix Spikes, No Analytical Methods
Engineering Bulletin: Slurry Biodegradation, EPA, September 1990	Biotreatment	Full Scale	1	3	No Blanks or Matrix Spikes, No Analytical Methods
Comments From James G. Brown Foundation In Response to EPA's October 24, 1991 ANPRM	Bioremediation	Full Scale	0	6	No Blanks or Matrix Spikes, No Analytical Methods
Dioxin Treatment Technologies, Office of Technological Assessment, 1993	Thermal Desorption, APEG/KPEG, Biotreatment, Soil Washing	Various	No tabulated treatment data. Data are for dioxin/furans only. Much of data presented as averages, ranges, or not isomer specific.		No Blanks or Matrix Spikes, No Influent Data, No Analytical Methods

Table C-4 (continued)

Source Document	Technology	Scale of Tests	Wood Treatment Constituents Complying With Proposed Treatment Standards		Data Deficiencies
			Number of Constituents Complying	Number of Constituents Not Complying	
Workshop on Removal, Recovery, Treatment, Disposal, Abstract Proceedings, Arsenic and Mercury, EPA, August 1992	Acid Leaching	Bench and Pilot Scale	2	0	No Blanks or Matrix Spikes, No Analytical Methods
An Evaluation of Stabilization/ Solidification of an Inorganic WPW, USEPA, April 1993	Stabilization	Bench Scale	0	2	No Untreated Soil Characteristic Data

*Did not list analytical methods, did not include "blank" analysis, did not include matrix spike data, did not have untreated soils analysis.

TABLE C-5
WOOD PROCESSING WASTE, AND SIMILAR WASTE, TREATED CONSTITUENT CONCENTRATIONS FROM VARIOUS DATA SOURCES

Source Document	Arsenic		Chromium		Phenol		2,4-Dimethylphenol		2,4,6-Trichlorophenol	
	mg/l Wste Wtr	mg/l (TCLP) Non WW	mg/l Wste Wtr	mg/l (TCLP) Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW
Ref 2 (Biotreatment)										
Ref 11 (Stabilization)		< 12 - 32.13		0.74 - 20.0						
Ref 15 (not WPW)(Stabil)		0.03 - 2.0								
Ref 23 (no inf. data)(Biotr)										
Ref 25 (Biotreatment) (Biotreat. + Act. Car.)					1 - 3000					
Ref 36 (Biotreatment)	This data set is a duplicate of data set Ref 81.									
Ref 44 (oil)(KPEG/APEG)										
Ref 65 (SynCCA)(ChemPt)	0.02 - 1.58		0.05 - 0.56							
Ref 66 (Stabilization)		< 5.0		< 0.50						
Ref 81 (Biotreatment)										
Ref 116 (Thermal Desorption) (K048/51 Wastes)						< 660 - < 5000				
Total Number of Data Points:	13	14	3	5	81					
No. of Points Meeting UTS:	12	11	3	2	8					
Prcnt of Data Meeting UTS:	92	79	100	40	10					
Univer. Treatment Standrds:	1.40	5.00	2.77	0.86	39.00	6200.00	36.00	14000.00	35.00	7400.00

TABLE C-5
WOOD PROCESSING WASTE, AND SIMILAR WASTE, TREATED CONSTITUENT CONCENTRATIONS FROM VARIOUS DATA SOURCES

Source Document	2,3,4,6-Tetrachlorophenol		Pentachlorophenol		Acenaphthene		Anthracene		Benz(a)anthrachene	
	mg/l Wste Wtr	mg/l (TCLP) Non WW	mg/l Wste Wtr	mg/l (TCLP) Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW
Ref 2 (Biotreatment)			< 50 - < 56		< 10					
Ref 11 (Stabilization)										
Ref 15 (not WPW)(Stabil)										
Ref 23 (no inf. data)(Biotr)			30 - 8270		4 - 370		37 - 1400		10 - 440	
Ref 25 (Biotreatment) (Biotreat. + Act. Car.)			10 - 8600							
Ref 36 (Biotreatment)			This data set is a duplicate of data set Ref 81.							
Ref 44 (oil)(KPEG/APEG)										
Ref 65 (SynCCA)(ChemPt)										
Ref 66 (Stabilization)										
Ref 81 (Biotreatment)			302 - 62		10 - 1400		0.20 - 420		0.50 - 170	
Ref 116 (Thermal Desorption) (K048/51 Wastes)								< 330 - < 5000		< 330 - < 10000
Total Number of Data Points:			83		18		14	15	13	15
No. of Points Meeting UTS:			41		6		11	5	10	3
Prcnt of Data Meeting UTS:			49		33		79	33	77	20
Univer. Treatment Standrds:	30.00	7400.00	89.00	7400.00	59.00	3400.00	59.00	3400.00	59.00	3400.00

TABLE C-5
WOOD PROCESSING WASTE, AND SIMILAR WASTE, TREATED CONSTITUENT CONCENTRATIONS FROM VARIOUS DATA SOURCES

Source Document	Arsenic		Chromium		Phenol		2,4-Dimethylphenol		2,4,6-Trichlorophenol	
	mg/l Wste Wtr	mg/l (TCLP) Non WW	mg/l Wste Wtr	mg/l (TCLP) Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW
Ref 2 (Biotreatment)										
Ref 11 (Stabilization)		< 12 - 32.13		0.74 - 20.0						
Ref 15 (not WPW)(Stabil)		0.03 - 2.0								
Ref 23 (no inf. data)(Biotr)										
Ref 25 (Biotreatment) (Biotreat. + Act. Car.)					1 - 3000					
Ref 36 (Biotreatment)	This data set is a duplicate of data set Ref 81.									
Ref 44 (oil)(KPEG/APEG)										
Ref 65 (SynCCA)(ChemPt)	0.02 - 1.58		0.05 - 0.56							
Ref 66 (Stabilization)		< 5.0		< 0.50						
Ref 81 (Biotreatment)										
Ref 116 (Thermal Desorption) (K048/51 Wastes)						< 660 - < 5000				
Total Number of Data Points:	13	14	3	5	81					
No. of Points Meeting UTS:	12	11	3	2	8					
Prcnt of Data Meeting UTS:	92	79	100	40	10					
Univer. Treatment Standrds:	1.40	5.00	2.77	0.86	39.00	6200.00	36.00	14000.00	35.00	7400.00

TABLE C-5
WOOD PROCESSING WASTE, AND SIMILAR WASTE, TREATED CONSTITUENT CONCENTRATIONS FROM VARIOUS DATA SOURCES

Source Document	2,3,4,6-Tetrachlorophenol		Pentachlorophenol		Acenaphthene		Anthracene		Benz(a)anthrachene	
	mg/l Wste Wtr	mg/l (TCLP) Non WW	mg/l Wste Wtr	mg/l (TCLP) Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW
Ref 2 (Biotreatment)			< 50 - < 56		< 10					
Ref 11 (Stabilization)										
Ref 15 (not WPW)(Stabil)										
Ref 23 (no inf. data)(Biotr)			30 - 8270		4 - 370		37 - 1400		10 - 440	
Ref 25 (Biotreatment) (Biotreat. + Act. Car.)			10 - 8600							
Ref 36 (Biotreatment)	This data set is a duplicate of data set Ref 81.									
Ref 44 (oil)(KPEG/APEG)										
Ref 65 (SynCCA)(ChemPt)										
Ref 66 (Stabilization)										
Ref 81 (Biotreatment)			302 - 62		10 - 1400		0.20 - 420		0.50 - 170	
Ref 116 (Thermal Desorption) (K048/51 Wastes)								< 330 - < 5000		< 330 - < 10000
Total Number of Data Points:			83		18		14	15	13	15
No. of Points Meeting UTS:			41		6		11	5	10	3
Prcnt of Data Meeting UTS:			49		33		79	33	77	20
Univer. Treatment Standrds:	30.00	7400.00	89.00	7400.00	59.00	3400.00	59.00	3400.00	59.00	3400.00

TABLE C-5
WOOD PROCESSING WASTE, AND SIMILAR WASTE, TREATED CONSTITUENT CONCENTRATIONS FROM VARIOUS DATA SOURCES

Source Document	Benzo(a)pyrene		Benzo(k)fluoranthene		Chrysene		Dibenz(a,h)anthracene		Fluorene	
	mg/l Wste Wtr	mg/l (TCLP) Non WW	mg/l Wste Wtr	mg/l (TCLP) Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW
Ref 2 (Biotreatment)									< 10- < 11	
Ref 11 (Stabilization)										
Ref 15 (not WPW)(Stabil)										
Ref 23 (no inf. data)(Biotr)	20-290		40-210		19-270				50-280	
Ref 25 (Biotreatment) (Biotreat. + Act. Car.)										
Ref 36 (Biotreatment)										
Ref 44 (oil)(KPEG/APEG)										
Ref 65 (SynCCA)(ChemPt)										
Ref 66 (Stabilization)										
Ref 81 (Biotreatment)	1.3-100		0.37-44		0.50-170		2.0-200		1.0-1200	
Ref 116 (Thermal Desorption) (K048/51 Wastes)		< 330- < 10000				< 330 - < 5000				

Total Number of Data Points:	13	15	13		12	15	10		16	
No. of Points Meeting UTS:	10	3	12		10	5	9		16	
Prcnt of Data Meeting UTS:	77	20	92		83	33	90		75	
Univer. Treatment Standrds:	61.00	3400.00	110.00	6800.00	59.00	3400.00	55.00	8200.00	58.00	3400.00

TABLE C-5
WOOD PROCESSING WASTE, AND SIMILAR WASTE, TREATED CONSTITUENT CONCENTRATIONS FROM VARIOUS DATA SOURCES

Source Document	Indeno(1,2,3-c,d)pyrene		Naphthalene		Phenanthrene		Pyrene		TCDD	
	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW	mcg/l Wste Wtr	mcg/kg Non WW	pcg/l Wste Wtr	pcg/kg Non WW
Ref 2 (Biotreatment)			< 10		< 10- < 11					
Ref 11 (Stabilization)										
Ref 15 (not WPW)(Stabil)										
Ref 23 (no inf. data)(Biotr)	40 - 110		2 - 140				13 - 1200			
Ref 25 (Biotreatment) (Biotreat. + Act. Car.)										
Ref 36 (Biotreatment)										
Ref 44 (oil)(KPEG/APEG)										640 - 820
Ref 65 (SynCCA)(ChemPt)										
Ref 66 (Stabilization)										
Ref 81 (Biotreatment)	1.9 - 50		5.0 - 500		0.4 - 3000		1.0 - 510		8.0 - 18	
Ref 116 (Thermal Desorption) (K048/51 Wastes)				< 330 - < 5000		< 330 - 6300		< 330 - < 5000		
Total Number of Data Points:	13		17	15	12	15	17	15	2	5
No. of Points Meeting UTS:	3		14	15	10	14	11	15	2	5
Prcnt of Data Meeting UTS:	23		82	100	83	93	65	100	100	100
Univer. Treatment Standrds:	5.50	3400.00	59.00	5600.00	59.00	5600.00	67.00	8200.00	63000.00	1000000.00

TABLE C-5
WOOD PROCESSING WASTE, AND SIMILAR WASTE, TREATED CONSTITUENT CONCENTRATIONS
FROM VARIOUS DATA SOURCES

Source Document	PeCDD		HxCDD		TCDF		PeCDF		HxCDF	
	pcg/l Wste Wtr	pcg/kg Non WW	pcg/l Wste Wtr	pcg/kg Non WW	pcg/l Wste Wtr	pcg/kg Non WW	pcg/l Wste Wtr	pcg/kg Non WW	pcg/l Wste Wtr	pcg/kg Non WW
Ref 2 (Biotreatment)										
Ref 11 (Stabilization)										
Ref 15 (not WPW)(Stabil)										
Ref 23 (no inf. data)(Biotr)										
Ref 25 (Biotreatment) (Biotreat. + Act. Car.)										
Ref 36 (Biotreatment)										
Ref 44 (oil)(KPEG/APEG)		490 - 970		430 - 920		590 - 1500		580 - 1300		530 - 2200
Ref 65 (SynCCA)(ChemPt)										
Ref 66 (Stabilization)										
Ref 81 (Biotreatment)	150 - 400		3300 - 9400		9.8 - 93		110 - 160		2000 - 4800	
Ref 116 (Thermal Desorption) (K048/51 Wastes)						< 660 - < 5000				

Total Number of Data Points:	2	5	2	5	2	5	2	5	2	5
No. of Points Meeting UTS:	2	5	2	5	2	5	2	5	2	5
Prcnt of Data Meeting UTS:	100	100	100	100	100	100	100	100	100	100
Univer. Treatment Standrds:	63000.40	1000000.00	63000.00	1000000.00	63000.00	1000000.00	63000.00	1000000.00	63000.00	1000000.00

APPENDIX D

COMMENTS SUMMARY AND COMMENTORS TO OCTOBER 24, 1991 ADVANCED NOTICE OF PROPOSED RULEMAKING, POTENTIAL BDAT FOR NEWLY LISTED WASTES FROM WOOD PRESERVING OPERATIONS

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APPENDIX E

EXAMPLES OF ALTERNATIVE TECHNOLOGIES POTENTIALLY APPLICABLE FOR THE TREATMENT OF WOOD PRESERVING AND RELATED WASTES

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APPENDIX F

FEDERAL REGISTER NOTICES CONCERNING THE DELISTING OF PETROLEUM WASTES FOR MARATHON OIL

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APPENDIX G

GUIDANCE MEMORANDUM: ASSURING PROTECTIVE OPERATION OF INCINERATORS BURNING DIOXIN-LISTED WASTES

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APPENDIX H

OSWER GUIDANCE FOR OBTAINING VARIANCES FROM THE LDRs FOR SOIL AND DEBRIS

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APPENDIX I

ENVIRONMENTAL FACT SHEET: EPA ISSUES FINAL RULES FOR CORRECTIVE ACTION MANAGEMENT UNITS AND TEMPORARY UNITS

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APPENDIX J

OTHER PUBLICATIONS WITH INFORMATION RELATED TO THE TREATMENT OF WOOD PRESERVING OR RELATED WASTES

The following publications were prepared by WASTECH, a multiorganization cooperative project managed by the American Academy of Environmental Engineers with grant assistance from the U.S. Environmental Protection Agency, the U.S. Department of Defense, and the U.S. Department of Energy.

For information on how to obtain these publications, contact the American Academy of Environmental Engineers, 130 Holiday Court, Suite 100, Annapolis, MD 21401.

Innovative Site Remediation Technology: Chemical Treatment, Volume 2. EPA 542-B-94-004, September 1994.

Innovative Site Remediation Technology: Soil Washing/Soil Flushing, Volume 3. EPA 542-B-93-012, November 1993.

Innovative Site Remediation Technology: Solidification/stabilization, Volume 4. EPA 542-B-94-001, June 1994.

Innovative Site Remediation Technology: Thermal Desorption, Volume 6. EPA 542-B-93-011, November 1993.

Innovative Site Remediation Technology: Thermal Destruction, Volume 7. EPA 542-B-94-003, October 1994.

The following technical support documents can be obtained from the State of California Department of Toxic Substances Control Alternative Technology Division.

Staff Report Treatment Standards For Organic Containing Petroleum Hazardous Waste. December 1989.

Technical Support Document for Treatment Standards for non-RCRA Organic Containing Petroleum Hazardous Waste. April 1, 1992.

APPENDIX K

SUMMARY OF NEWLY SUBMITTED AND PROPOSED RULE DATA FOR WOOD PRESERVING RAW MATERIALS AND WASTEWATER AND NONWASTEWATER FORMS OF F032, F034, AND F035

APPENDIX K

This document presents data received since publication of the proposed Phase 4 rulemaking (60 FR 43654, August 22, 1995) relative to wood preserving product and waste characterization, treatability data for wastewater and nonwastewater forms of F032, F034, and F035, and information on non-combustion and soil treatment technologies.

Summary of New Data in Response to Phase 4 Proposal or in Support of the Promulgated UTS Treatment Standards

Type of Information	Source or Commenter/Comment No., Date	Summary	EPA's Review of Such Information or the Effect of Such Data/Study on the Proposed Treatment Standard
Characterization studies on current Pentachloro-phenol commercial grade formulations & F032 wastes	Convington and Burling (for the Penta Task Force)/PH4P-00032, 11/20/95	Concentrations of PCDD/PCDF in PCP formulations (See Table K-1 in Appendix K)	See [1], [5], & [6]. EPA has promulgated a Compliance Treatment Alternative of CMBST.
	American Wood Preservers Institute/PH4P-00039, 11/20/95	Concentrations of PCDD/PCDF in PCP formulations (See Table K-1 in Appendix K)	See [1], [5], & [6]. EPA has promulgated a Compliance Treatment Alternative of CMBST.
	Vulcan Chemicals/PH4P-00023.I, 2/23/96	Characterization of F032 (See Table K-2 in Appendix K)	See [1], [5], & [6]. EPA has promulgated a Compliance Treatment Alternative of CMBST.
Wastewater Treatment Data	Remediation Technologies (RETEC)/ PH4P-00062, 11/17/95	Two data points on the performance of carbon adsorption on groundwater contaminated with PCDD/ PCDF and PAH. RETEC states that, based on these treatment data EPA should withdraw the proposed regulation of PCDD and PCDF since, presumably by regulating PAH, PCDD and PCDF would also be regulated. (See Table K-3 in Appendix K)	See [2], [5], & [6]. RETEC effluent data show that the treatment standards for PCDD/PCDF may be achieveable using carbon adsorption as a polishing step. EPA is promulagting UTS limits for PCDD and PCDF in wastewater forms of F032 as proposed.

Type of Information	Source or Commenter/Comment No., Date	Summary	EPA's Review of Such Information or the Effect of Such Data/Study on the Proposed Treatment Standard
Wastewater Treatment Data	EPA's Study [2]	Several commenters (AWPI/PH4P-00039; Covington and Burling for The Penta Task Force/PH4P-00023) raised concerns that F032 wastewaters, as generated, cannot achieve the UTS limits EPA proposed for the regulation of PCDD and PCDF. (See Table K-2 in Appendix K for summary of Penta Task Force Data.) The commenters argued that the performance destruction efficiency of the selected BDAT model technology, namely biological treatment, cannot treat to those levels. This study examined prevailing wastewater treatment practices in the Wood Preserving industry (see Table K-4 in Appendix K) which shows that existing primary, secondary, and tertiary treatment processes can be optimized to meet the UTS limits promulgated for the regulated PCDD and PCDF constituents in wastewater forms of F032.	See [2]. EPA is finalizing the proposed treatment standards for PCDD/PCDF in F032 wastewaters as proposed. Facilities may use any technologies to achieve this standard, and current data indicate that existing wastewater treatment systems at wood preserving facilities or contaminated sites are either capable of meeting the standard, by proper optimization, or within the context of a treatability variance under the 40 CFR 268.44 (h). Further, ROD examined by EPA indicate that activated carbon adsorption is used widely for the remediation of surface and ground waters contaminated with PNAs, PCP, PCDD, and PCDF. Activated carbon adsorption is often used as an effective polishing step of wastewaters prior to a NPDES discharge or as a groundwater abatement technology.
Incineration Studies	Convington and Burling (for the Penta Task Force)/PH4P-00032, 11/20/95 AND 2/23/96	An incinerator required to meet a RCRA Destruction and Removal Efficiency (DRE) of 99.99% cannot meet the proposed UTS limits for proposed PCDD and PCDF in F032. (See Table K-5 in Appendix K for summary of data.)	See [3]. EPA believes that the submitted treatment study is not representative of well designed and operated incineration treatment system. EPA also believes that this bench-scale incineration study is not representative of other typical incinerators.
	EPA's Study [3]	EPA's review of Vulcan's Incineration Study.	See [3]. Based on treatment data from the incineration of F024 and in the combustion MACT rule, EPA believs that proper design and operation of combsution devices and their temperature controls for offgases can minimize the reformation of PCDD and PCDF in a treated gas stream.

Type of Information	Source or Commenter/Comment No., Date	Summary	EPA's Review of Such Information or the Effect of Such Data/Study on the Proposed Treatment Standard
Analytical Test Method Issues	Convington and Burling (for the Penta Task Force)/PH4P-00032, 11/20/95 EPA's Study [3]	The commenter submitted a report entitled "Chemical Analysis of F032 Wastes for Polychlorinated Dibenzo-*p*-dioxins, Polychlorinated Dibenzofurans, and Pentachlorophenols," prepared by the University of Dayton Research Institute. This report describes the analyses of 23 samples of F032 wastes that were analyzed for PCDDs/PCDFs. The report notes that the analyses were "extremely difficult" and that recoveries of labelled compounds were "typically only 30 to 50%, with some recoveries as low as 5%." EPA's review of Vulcan's analytical testing methods issues.	See [4], [5], and [6]. EPA believes that potential difficulties can be properly addressed by following appropriate steps for sample preparation, extraction or digestion, and clean up procedures , and determi-native procedures recommended in either one of two recommended SW 846 Test Methods. EPA is specifically recommending either SW-846 Method (December 1994, Update II) 8280A or SW-846 Method (July 1995, Upadte III - Proposed) 8290. See [4].
Noncombustion Treatment Alternatives	Beazer East/PH4P-00023; Covington and Burling for the Penta Task Force/PH4P-00032; AWPI/PH4P-00039	Commenters stated that EPA identification of Noncombustion Treatment Alternatives relied heavily on emerging technologies and not on fully commercialized treatment technology alternatives that can meet the proposed UTS treatment limits. (See Table K-6 in this Appendix K.)	See [5] & [6].

Type of Information	Source or Commenter/Comment No., Date	Summary	EPA's Review of Such Information or the Effect of Such Data/Study on the Proposed Treatment Standard
EPA's Guidance Documents on Treatment Options and Selection at Wood Preserving Sites	Presumptive Remedies for Soils, Sediments, and Sludges at Wood Treater Sites (Directive 9200.5-162, also published under NTIS No. PB-95-963410) Technology Selection Guide for Wood Treater Sites (EPA 540-F-93-020, also published as Pub. No. 9360-0-46FS) Contaminants and Remedial Options at Wood Preserving Sites (EPA/600/R-92/182)	Several commenters (Beazer East/PH4P-00023; AWPI/PH4P-00039) stated that the selection of incineration as BDAT for F032 is contrary to EPA's presumptive remedies for contaminated media at wood preserving sites, which includes bioremediation, stabilization for metals, and incineration for limited hot spots.	See [5] & [6]. The treatment standards are techno-logy based and EPA is relying on the established BDAT criteria to set such treatment levels. EPA has examined, therefore, these suggested documents within the context of the BDAT criteria that define when the performance of a given treatment techno-logy or of several technologies may be deemed as "best". In accordance with EPA's BDAT criteria, EPA believes that these documents support EPA promulgation of the treatment standards. EPA believes that the treatment standards promulagted today can be met, generally, by the BDAT model technologies supporting the UTS treatment standards. For wastewaters or contaminated ground- & surface-waters, EPA found that appropriate physical/chemical treatment followed by activated carbon adsorption can meet, generally, the UTS limits promulagted today for PNAs, PCP, PCDD,a nd PCDF. Further, EPA believes that energy and chemical intensive technologies can be optimized to meet the promulagted treatment standards for gene-rated wastes or within the context of a treatability variance (under the 40 CFR 268.44 (h)) for media or debris contaminated with F032, F034, and F035. As a result, EPA is promulagting UTS limits as proposed.

Data/Studies/Literature Cited: [1] Notice of Data Availability 61 FR21418 (May 10, 1996); [2] "Treatability of Dioxin/Furan in F032 Wastewater", SAIC, 9/6/96; [3] "Review of the Incineration (Comment No. PH4P-00023.I)", SAIC, 9/6/96 ; [4] "Draft Background Paper Addressing Technical Issues Related to Analysis of F032 Wood Preserving Wastes for Dioxins and Furans", SAIC, 6/28/96; [5] *Final BDAT Background Document for Wood Preserving Wastes, F032, F034, and F035*, EPA, April 15, 1997. [6] *Phase 4 Response to Comments Document*, EPA, April 15, 1997.

Table K-1: Constituents in Pentachlorophenol Product (in ppb)

Constituent	Historical[1]	Covington and Burling[2]			AWPI[3]	Vulcan Chemicals[4]
		min	max	avg. (# of data pts.)[5]		
TCDD	<3-<1,800	<1	<1	<1 (67)	<1	<50
PeCDD	<3-10,000	<1	<1	<1 (67)	<5	<50
HxCDD	<3-100,000	970[6]	2,310	1,580 (67)	1,500-1,800	1,550
HpCDD	<3-100,000					94,000
OCDD	60-360,000					
TCDF	1-1,000	<1	<1	<1 (67)	<1	
PeCDF	3-4,000	<1	<1	<1 (67)	<5	
HxCDF	3-9,000	<100	13,400	1.57 (67)	<1-13,400	
HpCDF	10-40,000					
OCDF	10-30,000					

[1]Source: Table 3-2, Proposed Best Demonstrated Available Technology (BDAT) Background Document for Wood Preserving Wastes F032, F034, and F035, November, 1995.

[2]Source: Covington and Burling on behalf of The Penta Task Force, Comment No. PH4P-00032, 11/20/95.

[3]Source: American Wood Preservers Institute, Comment No. PH4P-00039, 11/20/95.

[4]Source: Vulcan Chemicals (see page 3-4 in Final BDAT Background Document for Wood Preserving Wastes- F032, F034, and F035).

[5]Where nondetect data were reported, the detection limit was used for the purposes of averaging.

[6]Data shown are for analysis by HPLC. Data from analysis by GC/MS show a minimum of 610 ppb, maximum of 2570 ppb, and an average of 1610 ppb based on 67 data points.

Table K-2: Summary of F032 Wastewater Data from Covington and Burling for the Penta Task Force

Constituent/ Parameter	Plant A (ppb)	Plant B (ppb)	Plant C (ppb)	Plant D (ppb)	Plant E (ppb)	Plant F (ppb)	Mean (ppb)
Work Tank Solution							
TCDD	ND	ND	<0.28	<0.8	<0.41	ND	<0.5
PeCDD	<0.25	ND	<0.2	<1.3	<0.83	<0.8	<0.69
HxCDD	320	410	36	520	450	340	346
TCDF	<0.97	<0.61	<0.57	<0.91	<0.6	<0.38	<0.68
PeCDF	<0.19	<0.59	<0.53	<0.72	<0.29	<0.76	<0.52
HxCDF	380	650	420	250	280	160	357
Retort Sludge							
TCDD	<0.4[a]	NA	ND	<0.11	<0.56	<0.41	<0.38
PeCDD	<0.49	NA	<0.15	<0.16	<0.89	<0.46	<0.44
HxCDD	120	NA	33	81	240	130	121
TCDF	<0.45	NA	ND	<0.094	<0.42	<0.35	<0.34
PeCDF	<0.4	NA	<0.054	<0.092	<0.45	<0.22	<0.24
HxCDF	200	NA	660	140	450[b]	160	322
Drip Pad Waste							
TCDD	<0.72	<0.72	ND	<0.067	<0.35	4.3[b]	1.2
PeCDD	<1.1	<0.85	<0.67	<0.11	ND	ND	<0.70
HxCDD	240	270	180	110	28	220	175
TCDF	<0.71	<0.88	<0.31	<0.064	<0.38	<0.14	<0.42
PeCDF	78[b]	17	3	<0.18	1[b]	17	19
HxCDF	1000[b]	1500[b]	1200	210	79	180	692

Constituent/ Parameter	Plant A (ppb)	Plant B (ppb)	Plant C (ppb)	Plant D (ppb)	Plant E (ppb)	Plant F (ppb)	Mean (ppb)
Oil-Water Separator Sludge							
TCDD	<0.43	ND	NA	ND	<0.41	<0.7	<0.56
PeCDD	<0.53	<0.92	NA	<0.15	<0.83	<0.71	<0.97
HxCDD	590	130	NA	260	450	160	280
TCDF	<0.46	<0.52	NA	ND	<0.6	<0.69	<0.62
PeCDF	ND	<1.8	NA	<0.37	<0.29	<0.42	<0.82
HxCDF	660	550	NA	660	280	360	574
Filter Press Cake							
TCDD	2[b]	NA	NA	NA	NA	NA	2
PeCDD	ND	NA	NA	NA	NA	NA	ND
HxCDD	190	NA	NA	NA	NA	NA	190
TCDF	ND	NA	NA	NA	NA	NA	ND
PeCDF	<0.34	NA	NA	NA	NA	NA	<0.34
HxCDF	560	NA	NA	NA	NA	NA	560

Source: "Chemical Analysis of F032 Wastes for Polychlorinated Dibenzo-p-dioxins, Polychlorinated Dibenzofurans, and Pentachlorophenols," Covington and Burling for The Penta Task Force, Comment Number PH4P-00032.J, April 1, 1996.

ND - Not detected; detection limit could not be calculated due t the presence of interfering false positives.

NA - Not analyzed.

[a] Value is below detection limit.

[b] Value estimated due to the presence of interfering false positives.

Table K-3: Summary of F032 Wastewater Data From Remediation Technologies Following Treatment by Carbon Adsorption Polishing (ppb)

Constituent/Parameter	Site 1 (ppb)	Site 2 (ppb)
TCDD	<0.048	<0.00078
PeCDD	<0.0011	<0.0014
HxCDD	<0.0012	<0.0023
HpCDD	<0.0014	<0.0023
OCDD		
TCDF	<0.0005	<0.00065
PeCDF	<0.0007	<0.00093
HxCDF	<0.0029	<0.0022
HpCDF	<0.00084	<0.0022
OCDF		
Acenaphthene	<10	<10
Anthracene	<10	<10
Benz(a)anthracene	<10	<10
Benzo(a)pyrene	<10	<10
Benzo(k)fluoranthene	<10	<10
Chyrsene	<10	<10
Dibenz(a,h)fluoranthene	<10	<10
Fluroene	<10	<10
Indeno(1,2,3-cd)pyrene	<10	<10
Naphthalene	<10	<10
Phenanthrene	<10	<10
Pyrene	<10	<10
Pentachlorophenol	<0.25	0.7

Source: Remediation Technologies, Comment No. PH4P-00062, 11/17/95.

Table K-4: Summary of F032 Wastewater Data from "Preliminary Data for Wood Preserving Segment"

Constituent	Facility A (ppb)				Facility B (ppb)	Facility C (ppb)	Facility E (ppb)			UTS (ppb)
	Point 1	Point 2	Point 3	Point 4			Point 1	Point3	Point4	
TCDD	<0.000065	<0.00024	<0.000176	<0.000013		<0.000044	0.00037	0.000091	0.00034	0.067
PeCDD	0.000241	0.000096	0.000216	0.000159			0.008	ND	0.0057	0.067
HxCDD	0.0243	0.0268	0.0173	0.00988	0.101	0.000471	0.29	0.0052	0.34	0.067
HpCDD	0.205	0.169	>0.0821	>0.0608	>0.436	0.00347	5	0.21	2.3	
OCDD	0.85	1.37	>0.6	>0.194	>1.59	0.0173	15	1.1	3.9	
TCDF	0.0013	0.000518	<0.000165	0.000099	0.000637	<0.000009	0.007	ND	0.0014	0.067
PeCDF	0.00186	0.00127	0.000877	0.000767		0.000047	0.044	0.00014	0.0023	0.035
HxCDF	0.045	0.0414	0.0122	0.0175	0.0515	0.000643	2.2	0.034	0.05	0.067
HpCDF	0.127	0.136	>0.0667	>0.0518	>0.184	0.00362	5.2	0.37	0.27	
OCDF	0.52	0.83	>0.38	>0.11	>0.947	0.00439	10	0.54	0.27	
BOD	340	370	380	220	>42,000	47	5000	3200	3600	
Oil & Grease	120	95	66	28	160	5.4	150	90	51	
TSS	18	55	35	26	2,000	39	480	49	1,800	
Ammonia	0.54	0.5	0.66	0.5	5.7	130	27	19	150	
Chloride	13	11	29	22	750	35	370	430	400	
COD	820	1,100	650	570	16,000	350	16,000	12000	10,000	
Cyanide					290		<20	34	<20	
Corrosivity	13	11	<10	<10		12				
Flash Point	65	>65	>65	>65	65	>65				

Constituent	Facility A (ppb)				Facility B (ppb)	Facility C (ppb)	Facility E (ppb)			UTS (ppb)
	Point 1	Point 2	Point 3	Point 4			Point 1	Point3	Point4	
Fluoride					0.34		0.4	0.4	0.48	
Nitrogen	0.58	1.1	1.1	1.8	55	160	72	43	270	
Nitrate + Nitrile	0.078	0.12	0.11	0.05	1.3	110	1.3	<0.05	<0.05	
Phosphorus	0.42	1.1	1.8	0.92	5.3	1.4	26	7.3	110	
Spec. Conduct.	140	170	200	120	20,000		2800	3000	6,000	
Sulfate	2.2	4.2	8.1	16	1,100	120	94	160	4	
Sulfide					8.4		<1	<1		
TOC							5200	4500		
TDS	97	140	230	180	5,200	690	9200	7000	6,000	

Source: "Preliminary Data for Wood Preserving Segment of the Timber Products Processing Point Source Category," EPA, September, 1991
Facilities and stream sampled:
A - oil/water separator effluent (wood treated with pentachlorophenol)
Point 1 - After 1st oil/water separator, day 1
Point 2 - After 1st oil/water separator, day 2
Point 3 - After 2nd oil/water separator, day 1
Point 4 - After 2nd oil/water separator, day 2
B- cooling tower condensate (wood treated with pentachlorophenol and/or creosote)
C- treated water (wood treated with pentachlorophenol and/or creosote)
D - final effluent (wood treated with creosote, therefore concentrations are not included)
E - wood treated with pentachlorophenol
Point 1 - holding tank effluent
Point 3 - bioreactor influent
Point 4 - bioreactor effluent

Table K-5: Summary of Data Characterizing F032 Nonwastewaters from Covington and Burling for the Penta Task Force

Constituent/ Parameter	E1 Retort Sludge (ppb)	E2: Drip Pad Wastes (ppb)	F1: Retort Sludge (ppb)	B2: Drip Pad Sweepings (ppb)	E1: Retort Sludge Ash (ppb) T=1600°F	E1: Retort Sludge Ash (ppb) T=1680°F
TCDD	0.56	0.72	<0.41*	0.72	<1.1*	<0.71*
PeCDD	0.89	1.1	1.2	0.85	<1.7*	<1.3*
HxCDD	24	240	160	270	4.3	8.4
TCDF	0.42	0.71	<0.41*	0.88	<0.88*	<0.56*
PeCDF	0.45	7.8	0.66	17	<0.83*	2.6
HxCDF	1500	2000	800	3300	3.5	14

Source: Covington and Burling for the Penta Task Force, Comment No. PH4P-00032, 2/23/96.

* - Value is below detection limit.

Table K-6. Technologies for Treating Dioxin/Furans in F032 Nonwastewaters (Soils)

Technology	Public Comments			EPA Response	Docket Supporting Materials
	Technology Availability	Soil/Waste Characteristics Limit Applicability	Status of Technology Demonstration		
			DEMONSTRATED		
APEG and KPEG Processes			• Soils spiked with PCDD/F @ 2000 ppb were treated to below 1 ppb using KPEG for treatment time of 1-2 hours. TCDD in a 2,4-D/2,4,5-T waste was reduced from 1300 ppb to ND using KPEG and a 2 day reaction time. (DB) • No demonstration that technology dechlorinates PCBs. The technology has not been pursued. (BE) APEG reagents only partially dechlorinate organic wastes. (CB)	This technology is commercially available. It can be purchased or licensed. It has being demonstrated full-scale at wood preserving and PCB contaminated sites. Soil limitations associated with the soil moisture content can be minimized by dewatering technologies. Also, comments emphasizing the kinetic limitations are common concerns with other chemical technologies which are often addressed by proper optimization of reaction times that may involve the addition of excess agents, better temperature controls, and appropriate mixing.	[1], section 4.16; [4] vendor name: SDTX Technologies

Technology	Public Comments			EPA Response	Docket Supporting Materials
	Technology Availability	Soil/Waste Characteristics Limit Applicability	Status of Technology Demonstration		
Shirco Infrared Thermal Process	• The Dioxin Treatability Document indicates that this technology is commerciall y available in Germany, hoever, there are no permitted facilities in the U.S. yet. (BE)	• Sludge and treatment solution wastes have high liquid content and are not suitable condidates for this technology. High moisture content wastes slow the system require dewatering and will slow the treatment system. (CB)	• No data are available in the SITE database regarding the use of this technology for D/F. (BE) • Proposed UTS achieved at 2 of 4 site where used, however, in these two cases, PCDD/F concentra-tion in the waste was 10-100 ppb, which is much lower than expected in F032. (CB) • Adding a drying system is not a demonstrated technology.	This technology is a patented process that can be purchased or liscensed abroad. It is also being marketed for onsite full-scale treat-ment in Europe. Often, physical/chemical separation technolo-gies are employed at remediation sites and commercial hazardous waste treatment facilities to pretreat or condition wastes/ soils/debris such that they can undergo thermal treatment. Water content/solid content can be modi-fied in order to impro-ve the amenability of the stream to treatment.	CB

Technology	Public Comments			EPA Response	Docket Supporting Materials
	Technology Availability	**Soil/Waste Characteristics Limit Applicability**	**Status of Technology Demonstration**		
Biotreat-ment			• Zimpro, a leading manufacturer of a WW biotreatment unit, had no data to support removal of D/F to proposed UTS. (BE) • EPA should provide performance data to confirm the assertion made that biotreatment can meet BDAT. (BE)	Bioremediation has been demonstrated at several wood preserving facilities. Bioremediation of soils often fails the treatment standards promulgated today. However, the biotreatment of wastewaters can be achieved by the use of pretreatment or post-treatment technologies. Pretreatment include physical/chemical processes to reduce the loadings of D/F (and PCP oils and metals) to bioreactors. Post-treatment is often accomplished by treating with activated carbon adsorption wastewater effluents from the bio-reactors.	[7]; [8]
EMERGING					

Technology	Public Comments			EPA Response	Docket Supporting Materials
	Technology Availability	**Soil/Waste Characteristics Limit Applicability**	**Status of Technology Demonstration**		
Hubber Supercritical Oxidation Process	• Used widely for destruction of nerve agents and rocket fuels that are non-chlorinated. (CB)	• According to the Dioxin Treatability Document, this technology can only treat liquid wastes and finely ground, thin slurries. It has not been tested on a commercial scale for any solid wastes. (BE)	• The waste material must be preheated in a pressure sealed line prior to introduction into the supercritical reactor. Corrosion is a severe problem. Also, insolubility of inorganic salts in supercritical water can result in build up in reactor. (CB) • Treatability data for show treatment of a sample containing 0.674 ppb PCDD/Fs to 0.09 ppb @ 450°C and 0.011 ppb @ 500°C. Not clear that similar results will be achieved for higher initial concentrations in F032. (CB)	Although the feasa-bility of using this technology is most promissing for wood preserving wastes, EPA believes that this technology may still be classified as an emer-ging technology.	[9]

Technology	Public Comments			EPA Response	Docket Supporting Materials
	Technology Availability	Soil/Waste Characteristics Limit Applicability	Status of Technology Demonstration		
Pyrolitic Destruction[7]	• Only one company is pursuing the technology and it is not demonstrated at commercial scale. (BE)	• Can only treat liquid wastes and, perhaps, finely ground, thin slurries. (BE) Pretreatment needed. (CB)	• Total PCDD/Fs of 0.42 ng/m3 were observed in the produced syngas, which is indicative of PCDD/Fs in the slag residue. Slag data are not available. (CB)	EPA concurrs with the commenters that additional performance data are needed to asssess the treatment potential of the technology at wood preserving sites. However, pyrolitycal processes are widely used for the manufac-turing or recovery of valuable hydrocarbons from wastewater treatment sludges, coals, tars, crude oils, slop oils in the petroleum and coal refining industries.	[1], section 4.26; 4] vendor name: Texaco; [10]; [11]

[7]CB comments focus on Syngas Inc. Entrained-Bed Gasification System.

Technology	Public Comments			EPA Response	Docket Supporting Materials
	Technology Availability	**Soil/Waste Characteristics Limit Applicability**	**Status of Technology Demonstration**		
Ultraviolet Photolysis	Not commer-cially available (BE)	Wood preserving waastes do not transmit light. It is a highly turbid, opaque waste that contains dirt and wood fiber and will likely require high dilution prior to treatment. (DB)	Some processes are reasonably efficient for destruction of chlorinated hydrocarbons. Ceratin D/F isomers are photochemica-lly labile. (CB) This technology requires the dissolution of D/F from the soil inot the solvent extract and subsequent destruction of the D/F in the liquid solvent, There are difficuklties similar to those for critical fluid extraction (materails handling and agglomeration) and BCD (destrution of the dissolved D/F in the solvent extract to level low enough to allow recycle of the solvent). (BE)	Although this techno-logy is commercially available, generally, for the treatment of drin-king water, EPA believes it still under development for the treatment of hazardous wastewaters.	[5], [6]

Technology	Public Comments			EPA Response	Docket Supporting Materials
	Technology Availability	**Soil/Waste Characteristics Limit Applicability**	**Status of Technology Demonstration**		
BCD		• Pentachlorophenol will negatively affect treatability of the waste an require treatment in conjuction with another technology. (CB)	• As of 1995, EPA/RREL data indicate that the dechlorination process in the "liquid reactor" is not successfully dechlorinating dioxin/furan. (BE) • D/F is removed from soil, but the off-gas stream could not be evaluated due to analytical interferences. (BE) • An EPA Region X test was terminated due to the inability of the system to meet D/F air emissions requirements. (BE) • Soils spiked with PCDD/F @ 2000 ppb were treated to below 1 ppb using K)H/DMSO reagent for 1-7 days. (CB) • Proprietary mixtures have failed, resulting in a 12-45% reduction in a 7-28 day time. (CB)	EPA agrees with the commenters that this technology is still under development. EPA believes,however, that the technology short-comings identifed by the commenters with regard to EPA conducted field studies can be overcome by better engineering design and controls.	[1], section 4.15; [2]; [3]

ABBREVIATIONS: D/F: Dioxin/Furan ; BE: Beazer East; CB: Covington and Burling (The Penta Group)
BDAT: Best Demonstrated Available Technology

Sources Cited:

[1] Remediation Technologies Screening Matrix and Reference Guide, DOD Environmental Transfer Committee, October 1994.
[2] Base-Catalyzed Dechlorination (BCD) Process, from http://www.nttc.edu/env/site95/demo/complete/nrmlbase.html
[3] Dechlorination and Immobilization Process, Funderbunk and Associates, from http://www.nttc.edu/env/site95/demo/complete/fund_ass.html
[4] VISITT 5.0 (a database providing technology and vendor information on treatment technologies)
[5] UV Radiation and Oxidation System (Isometric View), Ultrox, a Division of Zimpro Environmental Inc., from http://www.nttc.edu/env/site95/demo/complete/ultrox.html
[6] Photolytic Degradation Process Using UV Lights, IT Corporation, from http://www.nttc.edu/env/site95/demo/complete/itphoto.html
[7] DRAMENDO Bioremediation Technology, Grace Dearborn, Inc., from http://www.nttc.edu/env/site95/demo/complete/gracedea.html

[8] Membrane Filtration and Bioremediation, SBP Technologies, Inc., from http://www.nttc.edu/env/site95/demo/complete/sbp.html
[9] United Nations Industrial Development Org.; Supercritical Oxidation, from http://www.unido.org/services/environment/envtech/envtech3.html#Chapter 32
[10] Tech Trends, Gasification Treatment for Soils, from http://clu-in/ttgasifi.html
[11] Texaco Gasification Process, from http://www.nttc.edu/env/site95/demo/complete/texaco.html

APPENDIX L

OVERVIEW OF DATA REVIEWED OR CITED BY EPA FOR THE PROMULGATION OF ALTERNATIVE TREATMENT STANDARD OF CMBST

EPA Citations:

Final Best Demonstrated Available Technology (BDAT) Background Document For Wastes From the Production of Chlorinated Aliphatic Hydrocarbons, F024, EPA OSW, (EPA/530-SW-89-048M, May, 1989.

This background document provides the Agency's rationale and technical support for selecting the constituents to be regulated in F024 and for developing treatment standards for these constituents. For both F024 nonwastewaters and wastewaters, the BDAT treatment standards for organic constitutents are based on treatment performance data from rotary kiln incineration of F024. The BDAT treatment standards for metal constituents in F024 wastewaters are based on a transfer of treatment performance data from chemical precipitation followed by vacuum filtration treatment of K062 mixed with metal-bearing characteristic wastes. The BDAT treatment standards for dioxin and furan constitutents in both F024 nonwastewaters and wastewaters are set at the analytical detection limit that can be routinely achieved for these constitutents, consistent with the dioxins rule promulgated on November 8, 1986 (51 FR 40572, 40638).

Onsite Engineering Report of Treatment Technology Performance and Operation for ENSCO, El Dorado, Arkansas, EPA OSW, December, 1988 (located in the docket for the Second Third LDR Proposed Rule, F-89-LD10-FFFFP, Docket Item No. LD10-S0195).

ENSCO's El Dorado facility was sampled for the purpose of collecting data to characterize incineration treatment of the listed hazardous waste F024. The data were collected as part of EPA's program to develop treatment standards for listed hazardous wastes that are subject to land disposal restrictions. Results of the sampling visit are presented in this report.

An Experimental Evaluation of the Incinerability of Pentachlorophenol Wood Treating Wastes, Covington and Burling for the Penta Task Force, Comment No. PH4P-00032.I, February 23, 1996

As part of the study conducted by the University of Dayton Research Institute on the incinerability of F032 wastes, Vulcan Chemicals, and Covington & Burling, on behalf of the Penta Task Force, submitted a report entitled "Chemical Analysis of F032 Wastes for Polychlorinated Dibenzo-*p*-dioxins, Polychlorinated Dibenzofurans, and Pentachlorophenols". This report describes the analyses of 23 samples of F032 wastes that were analyzed for PCDDs/PCDFs. The report notes that the analyses were "extremely difficult" and that recoveries of labelled compounds were "typically only 30 to 50%, with some recoveries as low as 5%." The Penta Task Force also submitted data characterizing four samples of F032 wastes, including retort sludge (2 samples), drip pad wastes (1 sample), and drip pad sweepings (1 sample). Also submitted were data characterizing PCDD/PCDF concentrations in ash resulting from the incineration of one of the retort sludge samples at various temperatures.

<u>EPA Review of the Incineration Study</u> (Comment No. PH4P-0023.I)

The U.S. Environmental Protection Agency (EPA) reviewed a report entitled "An Experimental Evaluation of the Incinerability of Pentachlorophenol Wood Treating Wastes" prepared by the University of Dayton Research Institute (UDRI) for Vulcan Chemicals. UDRI analyzed four waste samples from three facilities, then selected one of the samples for a laboratory evaluation of its incinerability study because of its high octa-CDD concentration.

A well-design and well-operated bench-scale incineration system can indicate if the waste material can meet goals for DREs and residue limits. The bench-scale system was designed to simulate a two-stage thermal treatment unit (e.g., rotary kiln and afterburner); the most common arrangement for hazardous waste combustion. The primary chamber operated at 1600°F and 1680°F. A difference of 200°F to 400°F would better represent the range of rotary kiln temperatures and provide greater experimental variance in study results. The secondary chamber operated at 1292°F and 1472°F; UDRI indicated that these temperatures usually achieve 99.99 percent DRE. The report stated that octa-CDD and pentachlorophenol (PCP) were selected as POHCs to demonstrate the 99.99% DRE requirement. DREs >99.99% were only achieved when the secondary chamber operated at the higher temperature (1472°F). These temperatures are lower than typical afterburner temperatures and PCDD/F destruction requires temperatures greater than 1800°F. Increasing the secondary chamber temperature would result in higher DREs, since higher temperature increases the combustion reaction rates (i.e., DREs). The design of this study could be improved by selecting appropriate temperatures.
.

The residue from the bench-scale treatment system was analyzed to determine if the test condition could achieve the 1 ppb limit for each congener class of CDD/F. However, the detection limits for tetra- and penta-CDD and penta-CDF were above 1 ppb. UDRI stated that the formation of hexa-CDD/F from PCP causes the residue to exceed the 1 ppb limit. They conclude that increased residence time, increased oxygen concentration or modest increased temperature will have little effect on the PCDD/F concentration in the residue. However, with detection limits higher than design objectives, the results are not conclusive.

<u>EPA Combustion Emission Technical Resource Document (CETRED),</u> (OSW:EPA 530-R-94-014), May, 1994.

The Draft Combustion Emissions Technical Resource Document (CETRED) contains the initial technical analysis by the U.S. EPA concerning emissions of dioxins/furans and particulate matter from certain types of devices that burn hazardous waste: cement kilns, light weight aggregate kilns, incinerators, and industrial boilers. Activated carbon control systems used in duct injection, fixed bed, and fluidized bed processes are stated to enhance the removal of mercury and organics in combustion system flue gas.

<u>EPA Memorandum from Shiva Garg</u>, EPA- OSW (Docket # F-96-RCSP-FFFFF), February 23, 1996.

The memorandum discusses the performance of activated carbon injection (ACI) on dioxin/furan and mercury emissions. Test and analysis of ACI at an incinerator in East Liverpool, Ohio showed that a 98% reduction in dioxin/furan and a 90% reduction in Mercury emissions were achieved. The air pollution control system operates at a system removal efficiency of 97% for mercury.

<u>MACT Combustion Act Support Document, Vol III</u>, EPA, March, 1996. (Internet http://www.epa.gov/epapower/cobust.html)

Section 5 of Volume III of the MACT document discusses techniques for achieving beyond-the-floor (B-T-F) control levels. Good operating practices, carbon injection techniques, and carbon beds are described as B-T-F control techniques for incinerators and cement kilns. All of the air pollution control techniques discussed are described in detail in the *Technical Support Document for HWC MACT Standards, Volume I: Description of Source Categories*.

<u>EXPANDED LIST OF REFERENCES EVALUATED FOR WOOD PRESERVING WASTES</u>

EPA examined the following additional sources of data regarding combustion of wood preserving wastes. All of these additional data sources are included as attachments to public comments submitted by the Cement Kiln Recycling Coalition. EPA has determined that the establishment of MACT emission limits for PCDD/F and TCDD/F will be addressed through the Hazardous Waste Combustors proposed rule (61 *FR* 17358, April 19, 1996). As a result, EPA deferred action on the data/studies summarized below.

<u>Comments on Land Disposal Restrictions Phase IV Rule - Issues Associated with Clean Water Act Treatment Equivalency, and Treatment Standards for Wood Preserving Wastes and Toxicity Characteristic Metal Wastes; Notice of Data Availability</u>, Cement Kiln Recycling Coalition, June 1996.

<u>Dioxin Emission Results from Recent Testing,</u> Rigo & Rigo Associates Inc. in Association with Schreiber, Grana & Yonley, Inc. for CKRC, February, 1995. (CKRC Attachment)

The report presents dioxin testing data compiled from tests conducted in 1994 by CKRC member companies. A general test protocol was developed to establish basline parameters, assess the effect of exit temperature and metal concentration in the feed, and identify a relationship between kiln temperature and stack gas dioxin concentration. The report includes 8 tables and 17 figures that characterize the dioxin emissions and compare them to proposed American and European limits. The report indicates that regardless of the amount of hazardous waste burned, the cement kilns should be able to meet the new limits when APCS temperatures are kept below 350 °F. Since much of the data was compiled at higher temperatures, the report recommends a kiln-by-kiln determination of the prudent operating temperature to assure compliance.

Metals Controls Evaluation on Selected Hazardous Waste Incinerators, Schreiber, Grana & Yonley, Inc. for CKRC, October 1993. (CKRC Attachment 2)

The report evaluated RCRA permit status and permit conditions applicable to metals controls on incinerators, and compared them to the Boiler and Industrial Furnace (BIF) regulations in 40 CFR 266, Subpart H. The permit term, metals feed limits, and the metals emissions limits were examined. No specific emission limits were provided in the study of six different incinerators.

Toxic Metals Emissions from Hazardous Waste Thermal Treatment Systems, Gossman Consulting, Inc. for CKRC, January 1994. (CKRC Attachment)

The purpose of this study was to analyze the available metals emissions data, and to propose a technology-based standard which truly represents best available technology and is protective of human health and the environment. 12 Tables and Graphs and four Graph sets were included in this study. Average emissions concentrations for lead, mercury, thallium, arsenic, beryllium, cadmium, and hexavalent chromium were proposed as technology based emission standards for emission controls of toxic metals. The report proposes that each facility be required to demonstrate that for its gas flow rates, oxygen levels, and site specific dispersion coefficients, the technology based standard is more protective than existing health based limits. The report includes a justification to delete barium and silver from BIF compliance testing requirements.

A Comparison of Metal Emissions from Cement Kilns Utilizing Hazardous Waste Fuels with Commercial Hazardous Waste Incinerators, Proceedings, 29th International Cement Seminar, Gossman Consulting, Inc. (CKRC Attachment)

The study compiles emissions data collected from 33 cement kiln and 20 commercial incinerators. The concentration of toxic material in emitted particulate is one or more orders of magnitude less in cement kilns than in commercial incinerators. Based on the data presented, the report suggests that it would be unsound to use a single particulate emission standard as a surrogate for toxic metal control. According to the report, a large body of emission data on cement kilns and incinerators should be used by the EPA to understand the clear differences so that the focus can be on protecting the human health and the environment rather than purposely biasing the regulations in favor of one technology or the other.

Evaluation of the Origin, Emissions and Control of Organic and Metal Compounds from Cement Kilns Co-fired with Hazardous Wastes, Scientific Advisory Board on Cement Kiln Recycling, June, 1993. (CKRC Attachment)

The objectives of the report are to address pertinent scientific issues regarding the recycling of hazardous waste in cement kilns and to analyze their scientific implications. The study also aims to provide a basis for recommendations regarding the improved kiln performance in respect to organic and metals emissions. The data base on burning hazardous waste cement kiln is extensive and demonstrates that cement kilns burning waste-derived fuels can employ existing technology to meet and in some cases exceed current emissions regulations.

Risk Assessment Studies, Texas Natural Resource Conservation Commission, October 1995 & January, 1996. (CKRC Attachment)

Region 6 conducted risk assessment studies as part of the National Combustion Strategy to evaluate burning hazardous waste in the Midlothian, TX area. The risk assessments were conducted to determine the risk of cancer or other adverse effects to the area based on lifetime exposure to contaminants expected to be released by the facilities. The TNRCC concluded that the emissions from industrial activity in Midlothian pose no health threat to the area residents.

APPENDIX M

EXPANDED LIST OF REFERENCES EVALUATED FOR WOOD PRESERVING WASTES

APPENDIX M

27-Jul-95

ID #: 1
DOCKET #:
TITLE: PHONE LOGS

ID #: 2
DOCKET #:
TITLE: PRELIMINARY DATA SUMMARY FOR THE WOOD PRESERVING SEGMENT OF THE TIMBER PRODUCTS PROCESSING POINT SOURCE CATEGORY

ID #: 3
DOCKET #:
TITLE: TREATMENT STANDARDS

ID #: 4
DOCKET #:
TITLE: VERSAR'S MEMORANDUM (1990-1992)

ID #: 5
DOCKET #:
TITLE: WOOD LISTING (F032, F034, F035 PROPOSED/FINAL RULES)

ID #: 6
DOCKET #:
TITLE: POLICY ACTION MEMO

ID #: 7
DOCKET #:
TITLE: RADIAN'S MEMORANDUM

APPENDIX M

27-Jul-95

ID #: 8
DOCKET #:
TITLE: SUMMARY OF GENERATION, DISPOSAL, TREATMENT OF F032,34,35. APPENDICES - SAIC/ORD.

ID #: 9
DOCKET #:
TITLE: SUMMARY OF GENERATION, DISPOSAL TREATMENT DATA OF F035 - SAIC/ORD

ID #: 10
DOCKET #:
TITLE: SUMMARY OF GENERATION, DISPOSAL, TREATMENT FOR F032,33,34 - SAIC/ORD

ID #: 11
DOCKET #:
TITLE: VOL. I, WASTE CHARACTERISTICS & TREATMENT REPORTS FOR F035 - SAIC

ID #: 12
DOCKET #:
TITLE: PHYSICS RELATIVITY

ID #: 13
DOCKET #:
TITLE: LETTER TO CLYDE DIAL-SAIC

ID #: 14
DOCKET #:
TITLE: WEST STABILIZATION OF F035

APPENDIX M

27-Jul-95

ID #: 15
DOCKET #:
TITLE: ARSENIC & MERCURY - ABSTRACT PROCEEDINGS

ID #: 16
DOCKET #:
TITLE: BACKGROUND DOC LISTING OF WOOD PRESERVING WASTES (FINAL) USEPA

ID #: 17
DOCKET #:
TITLE: CHARACTERIZATION DOCUMENT-F035

ID #: 18
DOCKET #:
TITLE: ARSENIC IN NATURAL WASTE-ENVIRONMENTAL SCIENCE & TECHNOLOGY

ID #: 19
DOCKET #:
TITLE: WOOD TREATMENT NESHAP

ID #: 20
DOCKET #:
TITLE: WOOD PRESERVATION STATISTICS

ID #: 21
DOCKET #:
TITLE: PRELIMINARY DATA SUMMARY FOR WP SEGMENT OF TIMBER PRODUCTS PROCESSING POINT SOURCE CATEGORY.

APPENDIX M

27-Jul-95

ID #: 22
DOCKET #:
TITLE: PLYWOOD, HARDBOARD & WOOD PRESERVING-USEPA

ID #: 23
DOCKET #:
TITLE: DEVELOP DOCUMENT FOR EFFLUENT LIMITATIONS GUIDELINES & STANDARDS FOR THE TIMBER PRODUCTS POINT SOURCE CATEGORY-EPA

ID #: 24
DOCKET #:
TITLE: TREATABILITY TESTING OF INORGANIC WOOD PRESERVING WASTE F035-GESSNER, A.W. - FOR EPA (SYNOPSIS)

ID #: 25
DOCKET #:
TITLE: ACTIVATED SLUDGE & ACTIVATED CARBON TREATMENT OF A WP EFFLUENT PCP

ID #: 26
DOCKET #:
TITLE: NATO REPORT # 174, INTERNATIONAL FORM EXCHANGE ON DIOXINS

ID #: 27
DOCKET #:
TITLE: DIOXINS TREATMENT TECHNOLOGIES-OFFICE OF TECHNOLOGY ASSESSMENT; CONGRESS OF THE UNITED STATES.

ID #: 28
DOCKET #:
TITLE: INCINERATION OF DIOXIN WASTES FROM SEVESO

APPENDIX M

27-Jul-95

ID #: 29
DOCKET #:
TITLE: ADVANCES IN DIOXIN RISK MANAGEMENT CONTROL TECHNOLOGIES

ID #: 30
DOCKET #:
TITLE: ARTICLES SCRUBBER SYSTEMS, MINIMIZE DIOXIN/MERCURY EMISSIONS

ID #: 31
DOCKET #:
TITLE: COMBUSTION EMISSIONS TECHNICAL RESOURCE DOCUMENT MAY '84

ID #: 32
DOCKET #:
TITLE: VARIOUS LISTS OF WOOD PRESERVING FACILITIES

ID #: 33
DOCKET #:
TITLE: BACKGROUND DOCUMENT FOR PROPOSED LISTING OF WOOD PRESERVING & SURFACE PROTECTION PRESERVATION PROCESS, VOLUME I & II-RADIAN

ID #: 34
DOCKET #:
TITLE: COMMENTS OF WOOD PRESERVING WASTE SOIL TREATER (BEAER EAST INC.) TO EPA'S 24 OCT 91 ANPR FOR NEWLY LISTED WASTE & CONTAMINATED SOILS

APPENDIX M

27-Jul-95

ID #: 35
DOCKET #:
TITLE: COMMENTS BY VULCAN IN RESPONSE TO EPAs 28 OCT 1991 ANPR

ID #: 36
DOCKET #:
TITLE: COMMENTS OF KOPPERS, TO EPA'S 24 OCT '91 ANPR

ID #: 37
DOCKET #:
TITLE: COMMENTS FROM HWTC TO EPA JULY 91- 21 OCT 92 ANPR

ID #: 38
DOCKET #:
TITLE: COMMENTS FROM JAMES BROWN FOUNDATION ON EPAs 24 OCT 91 ANPR

ID #: 39
DOCKET #:
TITLE: SAIC REPORT-VOLUME 2 ONLY-30 SEPTEMBER 92 -WASTE CHARACTERIZATION AND TREATABILITY REPORT FOR INORGANIC WOOD PRESERVING WASTE F035.

ID #: 40
DOCKET #:
TITLE: FINAL AND PROPOSED BDAT BACKGROUND DOCUMENT FOR K001-AUG 88 (PROPOSED BACKGROUND DOCUMENT MAY 88).

APPENDIX M

27-Jul-95

ID #: 41
DOCKET #:
TITLE: K001 BDAT BACKGROUND DOCUMENT ADDENDUM-MAY '90 (SEE DOCUMENT 40)

ID #: 42
DOCKET #:
TITLE: LISTING BACKGROUND DOCUMENT FOR WOOD PRESERVING WASTE-RADIAN-NOV 90, VOLUME II. SEE DOCUMENT 16 FOR VOLUME 1

ID #: 43
DOCKET #:
TITLE: RESPONSE TO COMMENTS ON LISTING OF WOOD PRESERVING WASTES

ID #: 44
DOCKET #:
TITLE: APEG TREATMENT OF DIOXINS/FURANS @ A WOOD PRESERVING SITE IN BUTTE, MONTANA (NOTE: THIS SAME SITE IS DISCUSSED IN OTHER DOCUMENTS)

ID #: 45
DOCKET #:
TITLE: ADVANCED DIOXIN RISK MANAGEMENT-CONTROL TECHNOLOGY CHEMO SPHERE-1989. DUPLICATE OF DOCUMENT # 29

ID #: 46
DOCKET #:
TITLE: THERMAL DESORPTION UV/PHOTOLYSIS, NCBC, GULFPORT, MS, VOLUME 1 -MAY -JULY '85

APPENDIX M

27-Jul-95

ID #: 47
DOCKET #:
TITLE: NATIONAL DIOXIN STUDY

ID #: 48
DOCKET #:
TITLE: METHOD FOR DEGRADATION/DESTRUCTION & DE TOXIFICATION OF DIOXINS & RELATED COMPOUNDS-1992 (THIS IS A DUPLICATE)

ID #: 49
DOCKET #:
TITLE: DIOXIN STRATEGY

ID #: 50
DOCKET #:
TITLE: DIOXIN-CONTAMINATED WASTE STREAMS-JULY '85

ID #: 51
DOCKET #:
TITLE: INTERIM PROCEDURES FOR ESTIMATING RISKS ASSOCIATED WITH EXPOSURE TO MIXTURE OF DIOXIN/FURANS-USEPA-MAR '89

ID #: 52
DOCKET #:
TITLE: ABSTRACTS FROM RODs FOR WOOD PRESERVING SITES

ID #: 53
DOCKET #:
TITLE: TREATABILITY TESTING (LAB SCALE) OF INORGANIC WOOD PRESERVING WASTE-F035; NOV '90. SEE DOCUMENT #65 FOR FINAL REPORT.

APPENDIX M

27-Jul-95

ID #: 54
DOCKET #:
TITLE: REGULATORY ANALYSIS OF RESTRICTIONS ON LAND DISPOSAL OF CERTAIN DIOXIN WASTES

ID #: 55
DOCKET #:
TITLE: BACKGROUND DOCUMENT FOR DIOXIN CONTAINING WASTES F020 ,23, 26-28-LDRs-JAN '86. INCOMPLETE ONLY EXECUTIVE SUMMARY.

ID #: 56
DOCKET #:
TITLE: OTHER DIOXIN CONTAINING WASTES/F024; EXCERPTS FROM FEDERAL REGULATIONS-22 NOV 89

ID #: 57
DOCKET #:
TITLE: WOOD PRESERVING RULE SATELLITE TRAINING COURSE-AUG- '91

ID #: 58
DOCKET #:
TITLE: F024 BDAT BACKGROUND DOCUMENT-USEPA-MAY '89

ID #: 59
DOCKET #:
TITLE: PHONE FILES - F032,34 & 35 - NOV '91-JUNE '92

APPENDIX M

27-Jul-95

ID #: 60
DOCKET #:
TITLE: INDEX TO RULEMAKING RECORDS ON WOOD PRESERVING WASTE, NOT DATED BUT CLEARLY AFTER JUNE '92

ID #: 61
DOCKET #:
TITLE: ONSITE ENGINEERING REPORT (OER) : F035 @ MARYLAND WOOD PRESERVING CORP., ROCKVILLE, MD, JULY 91-DRAFT

ID #: 62
DOCKET #:
TITLE: WASTE CHARACTERISTIC & TREATABILITY OF INORGANIC WOOD PRESERVING WASTE F035 A SUMMARY-UNTREATED-SAIC

ID #: 63
DOCKET #:
TITLE: SITES WITH SOIL CONTAMINATED WITH CONSTITUENTS WHICH ARE REGULATED IN WPW

ID #: 64
DOCKET #:
TITLE: NETAC-DEC 1990-A TECHNOLOGY OVERVIEW OF EXIST & EMERGING ENVIRONMENT SOLUTIONS FOR WOOD TREATING CHEMICALS. DUPLICATED IN DOCUMENT # 34.

ID #: 65
DOCKET #:
TITLE: TREATABILITY TESTING (LAB SCALE) OF INORGANIC WPW F035-EPA-10 MAY '95. FINALIZED VERSION OF DOCUMENT # 53.

APPENDIX M

27-Jul-95

ID #: 66
DOCKET #:
TITLE: WASTE CHARACTERISTICS & TREATABILITY REPORT FOR INORGANIC WPW - F035-DRAFT-CHEMICAL WASTE MANAGEMENT-EMELLE, ALA-FEB-92

ID #: 67
DOCKET #:
TITLE: DRAFT REPORT ON THE CHARACTERISTICS OF SELECTED WASTE STREAMS-USEPA-AUG '84

ID #:68
DOCKET #:
TITLE: MEMOS WPW (AUG 89-SEP 92)

ID #: 69
DOCKET #:
TITLE: DRAFT OF BDAT FOR WOOD PRESERVING WASTES; DUPLICATED IN OTHER DOCUMENTS

ID #: 70
DOCKET #:
TITLE: IN-HOUSE STUDIES

ID #: 71
DOCKET #:
TITLE: MEETINGS NOTES - FROM A MEETING BETWEEN EPA AND AMERICAN WOOD PRESERVING INSTITUTE REGARDING WPW

APPENDIX M

27-Jul-95

ID #: 72
DOCKET #:
TITLE: BDAT BACKGROUND DOCUMENT K087 - AUG '88

ID #: 73
DOCKET #:
TITLE: BDAT BACKGROUND DOCUMENT FOR K031, 84, 101, 102, ETC. (ARSENIC CONTAINING WASTES)

ID #: 74
DOCKET #:
TITLE: BDAT BACKGROUND DOCUMENT FOR K061-STEEL INDUSTRY PROFILE LIQUOR-AUG '83

ID #: 75
DOCKET #:
TITLE: BDAT BACKGROUND DOCUMENT FOR U/P WASTES & F039 (MULTISOURCE LEACHATE)-USEPA-MAY '90

ID #: 76
DOCKET #:
TITLE: BDAT BACKGROUND DOCUMENT FOR U/P WASTES & F039 (MULTISOURCE LEACHATE)-USEPA-MAY '90; VOLUME B-WASTEWATERS/NONWASTEWATERS; W/METHODS OF TREATMENT -As TREATMENT STANDARDS

ID #: 77
DOCKET #:
TITLE: BDAT BACKGROUND FOR U/P WASTES & F039-USEPA-MAY 1990; VOLUME C-NONWASTEWATERS ORGANICS

ID #: 78
DOCKET #:
TITLE: BDAT BACKGROUND DOCUMENT U/P WASTES & F039-USEPA-MAY '90- VOLUME D-REACTIVE U/P WASTEWATERS & NONWASTEWATERS

ID #: 79
DOCKET #:
TITLE: BDAT BACKGROUND DOCUMENT FOR U/P & F039-USEPA-MAY '90-VOLUME-E-GASEOUS U&P

ID #: 80
DOCKET #:
TITLE: KOPPERS INDUSTRIES - 24 OCT '91 - ANPR COMMENTS - 3 DEC '91. THIS IS PROBABLY A DUPLICATE

ID #: 81
DOCKET #:
TITLE: KOPPERS WASTEWATER TREATMENT DATA

ID #: 82
DOCKET #:
TITLE: COMMENTS OF AWPI (AMBER WOOD PRESERVING INSTITUTE) TO 24 OCT '91 ANPR

ID #: 83
DOCKET #:
TITLE: ENGINEERING BULLETIN ON SLURRY BIODEGRADATION

APPENDIX M

27-Jul-95

ID #: 84
DOCKET #:
TITLE: ENGINEERING BULLETIN-CHEMICAL DEHALOGENATION (APEG)

ID #: 85
DOCKET #:
TITLE: DRAFT REPORT-HORSEHEAD RESOURCE DEVELOPMENT FOR K061; USEPA

ID #: 86
DOCKET #:
TITLE: OPTIONS FOR DISPOSAL OF DIOXIN-CONTAMINATED HERBICIDES IN THE BYERS WAREHOUSE, ST. JOSEPH, MO; USEPA-RREL BENCH SCALE TESTING)

ID #: 87
DOCKET #:
TITLE: PROPOSED RULE F032,34,35 BDAT REGULATION; 24 OCT 91-56FR 55160

ID #: 88
DOCKET #:
TITLE: VERSAR-ANALYTICAL DIFFICULTIES IN DETERMINING DIOXIN/FURAN IN SAMPLES CONTAMINATED WITH F032

ID #: 89
DOCKET #:
TITLE: SUPERFUND WP SITES-UNIDENTIFIED-SEVERAL LOCATIONS-NO DATA

ID #: 90
DOCKET #:
TITLE: INMETCO HISTORY ON SLAG DEVELOPMENT

APPENDIX M

27-Jul-95

ID #: 91
DOCKET #:
TITLE: ARSENIC CHEMICAL BEHAVIOR & TREATMENT. NATIONAL ENVIRONMENTAL JOURNAL

ID #: 92
DOCKET #:
TITLE: SUPERCRITICAL WATER: POWERFUL OXIDATION FOR TOXIC ORGANICS-ENVIRONMENTAL ENGINEERING WORLD

ID #: 93
DOCKET #:
TITLE: PRESUMPTIVE REMEDY-WOOD SITES

ID #: 94
DOCKET #:
TITLE: PRESUMPTIVE REMEDIES OSWER-SUPP-RREL; (CONTAM., & REMEDIAL OPTIONS @ WP SITES)

ID #: 95
DOCKET #:
TITLE: WASTE MINIMIZATION PRACTICES @ TWO CCA WOOD TREATMENT PLANTS - USEPA

ID #: 96
DOCKET #:
TITLE: GUIDES TO POLLUTION PREVENTION - WP INDUSTRY EPA

ID #: 97
DOCKET #:
TITLE: RECYCLING & REUSE OF MATERIAL FOUND ON SUPERFUND SITES - USEPA

APPENDIX M

27-Jul-95

ID #: 98
DOCKET #:
TITLE: WASTE MINIMIZATION ASSESSMENT FOR A MANUFACTURER PRODUCING TREATED WOOD PRODUCTS-EPA MAY '92

ID #: 99
DOCKET #:
TITLE: CHEMICAL STABILIZATION OF MIXED ORGANIC AND METAL COMPOUNDS - EPA SITE PROGRAM DEMONSTRATION OF SILICATE TECHNOLOGY CORPORATION PROCESS

ID #: 100
DOCKET #:
TITLE: 1) ENHANCED BIOREMEDIATION FOR ON-SITE REMEDIATION OF CONTAMINATED SOILS AND GROUNDWATER 2) BIOREMEDIATION IN THE FIELD (EPA/540/N-92/004 NO 7; OCTOBER 1992).

ID #: 101
DOCKET #:
TITLE: MONSANTO; DIOXIN ANALYSIS

ID #: 102
DOCKET #:
TITLE: DIOXINS-DATA CALL IN & REGULATORY EFFORTS IN EPA

ID #: 103
DOCKET #:
TITLE: 40 CFR 262.34 "90 DAY GENERATOR RULE"; FR VOL 51; NO 56

APPENDIX M

27-Jul-95

ID #: 104
DOCKET #:
TITLE: SUMMARY EVALUATION OF FULL-SCALE IN SITE AND EX SITU BIOREMEDIATION OF CREOSOTE WASTES; CHAMPION INTERNATIONAL'S SUPERFUND SITE IN LIBBY, MONTANA

ID #: 105
DOCKET #:
TITLE: ARTICLE ON DESTRUCTION OF DIOXINS AND FURANS ADSORBED ON FLY ASH IN A ROTARY KILN FURNACE

ID #: 106
DOCKET #:
TITLE: LEFT INTENTIONALLY BLANK.

ID #: 107
DOCKET #:
TITLE: DRAFT TECHNOLOGY PROFILE-TEXACO GASIFICATION PROCESS

ID #: 108
DOCKET #:
TITLE: INNOVATIVE TREATMENT TECHNOLOGIES - OVERVIEW & GUIDE TO INFORMATION SOURCES-USEPA

ID #: 109
DOCKET #:
TITLE: SUPERFUND INNOVATIVE ECOLOGY PROGRAM-TECHNOLOGY PROFILES, 7TH EDITION, EPA

APPENDIX M

27-Jul-95

ID #: 110
DOCKET #:
TITLE: CHAPTER 3, NONTHERMAL TREATMENT TECHNOLOGIES, FROM DIOXIN TREATMENT TECHNOLOGIES TEXT

ID #: 111
DOCKET #:
TITLE: MICROTERRA, INC. PROMOTIONAL DOCUMENTS

ID #: 112
DOCKET #:
TITLE: VARIOUS ARTICLES FROM OHM CORP. SENT TO RICHARD KINCH, ON BIOSLURRY TREATMENT

ID #: 113
DOCKET #:
TITLE: EVALUATING ACQ AS AN ALTERNATIVE WOOD PRESERVING SYSTEM, USEPA

ID #: 114
DOCKET #:
TITLE: LEFT INTENTIONALLY BLANK.

ID #: 115
DOCKET #:
TITLE: DEVELOPMENT DOCUMENT FOR PROPOSED EFFLUENT LIMITATIONS GUIDELINES & STANDARDS FOR THE PAPER, & PAPERBOARD POINT SOURCE CATEGORY, EPA

APPENDIX M

27-Jul-95

ID #: 116
DOCKET #:
TITLE: MARATHON OIL PETITION FOR DELISTING OF K048 & K051 WASTES. ALSO ADDITIONAL DATA RESPONDING TO EPA QUESTIONS

ID #: 117
DOCKET #:
TITLE: SEVERAL PUBLICATIONS ON BIOREMEDIATION-WHY IT SOMETIMES DOESN'T WORK

ID #: 118
DOCKET #:
TITLE: ENVIRONMENTAL FACT SHEET: EPA ISSUES TRIAL RULES FOR CORRECTIVE ACTION MANAGEMENT UNITS AND TEMPORARY UNITS

ID #: 119
DOCKET #:
TITLE: FINAL PROPOSED BEST DEMONSTRATED AVAILABLE TECHNOLOGY (BDAT) BACKGROUND DOCUMENT FOR WOOD PRESERVING WASTES, F032, F034-F035, JULY 26, 1995.

ID #: 120
DOCKET #:
TITLE: PRELIMINARY DATA SUMMARY FOR THE WOOD PRESERVING SEGMENT OF THE TIMBER PRODUCTS PROCESSING POINT SOURCE CATEGORY, SEPTEMBER 1991 (EPA 440/1-91/023).

ID #: 121
DOCKET #:
TITLE: TECHNOLOGY SELECTION GUIDE FOR WOOD TREATER SITES, MARCH 1993 (EPA 540-F-93-020 OR PUB. 9360.0-46FS).

APPENDIX M

27-Jul-95

ID #: 122
DOCKET #:
TITLE: PRESUMPTIVE REMEDIES FOR SOILS, SEDIMENTS, & SLUDGES AT WOOD TREATED SITES, NOVEMBER 1995 (OSWER DIRECTIVE: 9200.5-162; EPA 540/R-95/128; OR PB 95-963410).

ID #: 123
DOCKET #:
TITLE: IN-SITU REMEDIATION TECHNOLOGY STATUS REPORT: THERMAL ENHANCEMENTS, APRIL 1995 (EPA 542-K-94-009).